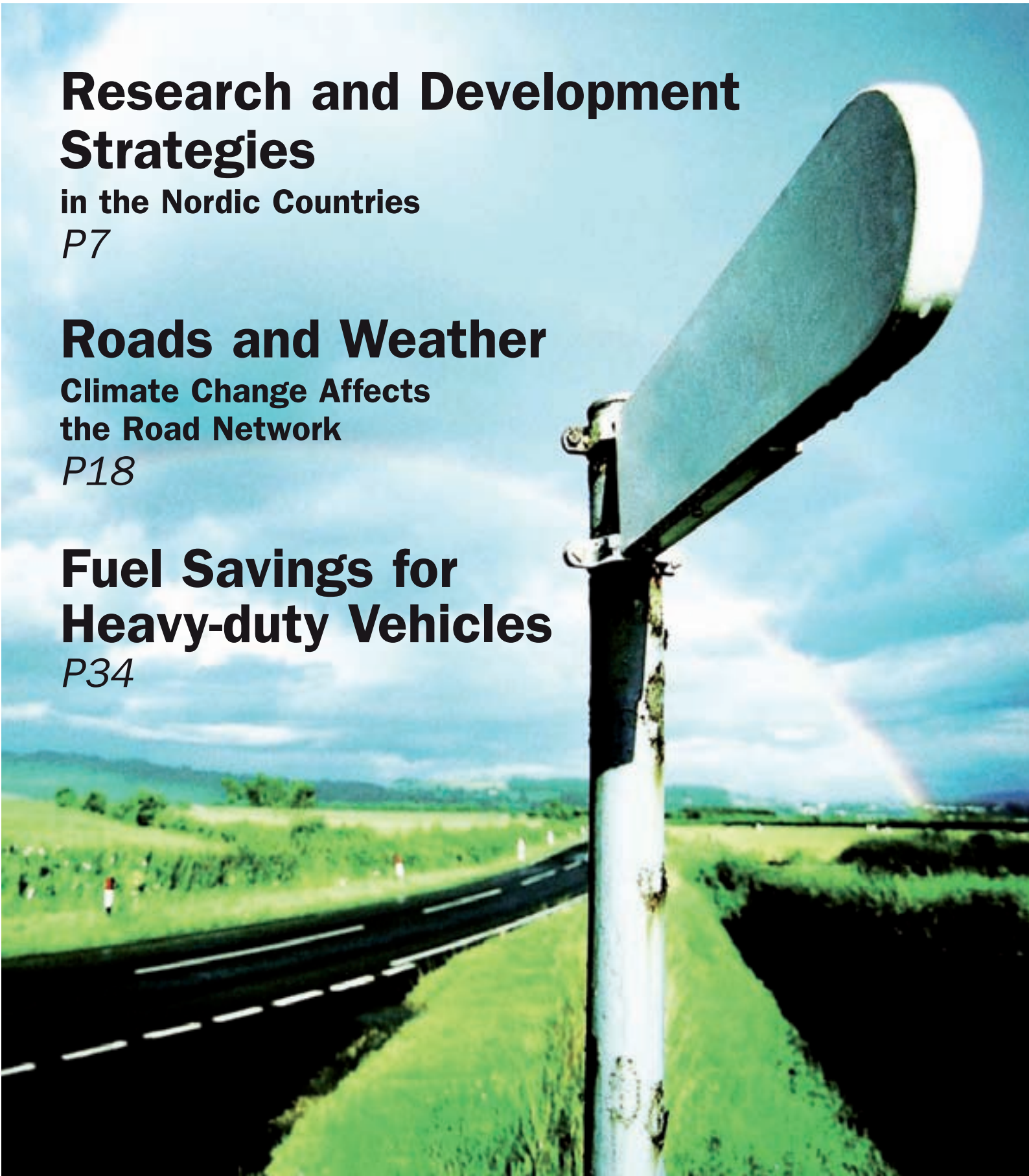
NORDIC

ROAD AND TRANSPORT RESEARCH | NO.1 | 2007



Research and Development Strategies

in the Nordic Countries

P7

Roads and Weather

Climate Change Affects the Road Network

P18

Fuel Savings for Heavy-duty Vehicles

P34

News from

VTI, Sweden

VTI is an independent, internationally established research institute which is engaged in the transport sector. Our work covers all modes, and our core competence is in the fields of safety, economy, environment, traffic and transport analysis, public transport, behaviour and the man-vehicle-transport system interaction, and in road design, operation and maintenance. VTI is a world leader in several areas, for instance in simulator technology.

Icelandic Road Administration (ICERA)

The ICERA's mission is to provide the Icelandic society with a road system in accordance with its needs and to provide a service with the aim of smooth and safe traffic. The number of employees is about 340. Applied research and development and to some extent also basic research concerning road construction, maintenance, traffic and safety is performed or directed by the ICERA. Development division is responsible for road research in Iceland.

Danish Road Directorate (DRD) Danish Road Institute (DRI)

The Road Directorate, which is a part of The Ministry of Transport & Energy, Denmark, is responsible for development and management of the national highways and for servicing and facilitating traffic on the network. As part of this responsibility, the Directorate conducts R&D, the aim of which is to contribute to efficient road management and to the safe use of the network. The materials research component is carried out by the Danish Road Institute.

Norwegian Public Roads Administration (NPRA)

The Norwegian Public Roads Administration is one of the administrative agencies under the Ministry of Transport and Communications in Norway. The NPRA is responsible for the development and management of public roads and road traffic, as well as the Vehicle Department. This responsibility includes research and development of all areas related to road transport and the implementation of R&D results.

Technical Research Centre of Finland (VTT)

VTT Technical Research Centre of Finland is a contract research organisation with a staff of 2,800. In this joint publication, the VTT expertise areas cover research and development of transportation, logistics and road structures. The work is carried out in five research groups employing a staff of 60.

Institute of Transport Economics (TØI), Norway

The Institute of Transport Economics is the national institution for transport research and development in Norway. The main objectives of the Institute are to carry out applied research and promote the application and use of results through consultative assistance to public authorities, the transport industry and others. The Institute is an independent research foundation employing about one hundred persons.

Editorial notes

Nordic Road & Transport Research is a joint publication of six public road and transport research organisations in the Nordic countries, Denmark, Finland, Iceland, Norway, and Sweden. The main objective of the publication is to disseminate research results and news from the institutions, especially to researchers and decision makers. Each institution is responsible for the selection and presentation of the material from its own scope of activities.

Nordic Road & Transport Research is published three times a year. It is regularly sent out, free of charge, to recipients selected by the six joint publishers. Free sample copies are also sent out on special request.

Correspondence about the contents of the publication:

Please write to the author or to the respective publishing organisation.

Requests for back issues, and notification of address changes:

Readers outside the Nordic countries: please write to the Editor-in-chief at the VTI in Sweden.

Readers in the Nordic countries: please contact the publishing institution of your country.

Addresses: see back cover.

Graphic Design
Johnny Dahlgren Grafisk produktion AB, Linköping, Sweden

Issue 3,500

ISSN 1101-5179

Cover
Photos.com

Contents

Annual Meeting Held in Sweden

Every year, VTI arranges the largest conference for the transport sector in the Nordic countries – Transportforum®. For many people, this is a symbol of the start of a new business year, and there are many delegates who attend year after year. The conference was held in Linköping on 10–11 January, and attracted more than 1600 delegates. One of these delegates was the new Swedish Minister of Infrastructure, Åsa Torstensson, who visited the conference for the first time.


PHOTO: VTI/HEJDLÖSA BILDER

Sweden's Minister of Infrastructure Åsa Torstensson (left) visited Transportforum for the first time.

– Transportforum is an impressive meeting place for all the people, companies and public bodies who want to contribute to the development of the transport sector, she said.

During the two days in Linköping, there was a full programme. 52 sessions dealt with everything from new methods of infrastructure maintenance to alternative clean fuels and work on gender equality in the transport sector. The conference is a natural meeting place where those working in the transport sector have the opportunity to exchange information and knowledge and to make new contacts.

– What is most important is the meeting between researchers and those in operational roles in the transport sector, says VTI Director General Urban Karlström. We hope that the conference will benefit both groups. For researchers, it is essential to develop a sound knowledge of the problems and challenges of the sector, and for those who work actively on several issues, new research based knowledge may be a decisive factor in how problems are solved.

New Profile at the Danish Road Institute

In connection with the administrative changes of the local administration made in Denmark from 1 January 2007, a large number of employees from the county administrations were transferred to the Danish Road Directorate. One such person is Dr. Michael Larsen, from the county of Storstrøm where he worked with hydrology, catchment run off, river discharge, fine grained sediment transport and transport of dissolved matter, especially nitrate and phosphorus coming from the agriculture part of the catchment area. All data collected was stored in databases, administrated and maintained by him. Hydrology is an up-coming area of research at the Danish Road Institute and it fits well into other environmental research carried out at the Institute.

Contact: Michael Larsen, mil@vd.dk, telephone +45 72447120

57th UITP World Congress and Exhibition

From 21 to 24 of May 2007 the 57th World Congress and Exhibition of the International Association of Public Transport (UITP) will gather the international public transport community in Helsinki around the theme "Public transport: moving people, moving cities". This theme underlines that cities and regions can only be sustainable if they have dynamic and efficient public transport systems and reciprocally public transport systems can only be dynamic and efficient if they are fully integrated with urban policies. The congress programme will examine the major current issues for the public transport world from the operational point of view: efficient financing models, successful management strategies, security, information technologies and technical innovations. It will also include an important part of reflexion on future trends: How to develop a public transport oriented urban development, how to favour social integration thanks to public transport and the crucial role played by public transport in combating climate change.

The exhibition is complementary to the congress as it will enable practitioners to witness innovative products and to find tangible solutions for their expansion plans. During this edition, the major bus manufacturers will provide live demonstrations of their latest vehicles.

More information and on-line registration is available on www.uitp.com.

International Cooperation: A Visit to Chile

PHOTO: ARILD EGGEN, NPRA

From a district road with Otta Seal Pavement in Region 11. Regional Director Rolando Toloza, CPRA, in the middle, and Arild Eggen, NPRA, to the left.

A five years framework cooperation agreement was signed in December 2005 between Chilean Public Roads Administration (CPRA) and Norwegian Public Roads Administration (NPRA). The agreement also gives possibilities for cooperation between public sectors in the two countries.

As a part of the agreement Arild Eggen and Kjell Levik, both NPRA, carried out an excursion to Chile in November 2005 . The intension of the tour was to:

- Make a rough annual plan for the cooperation for 2007
- Inspect roads with Otta Seal pavement, assess experiences so far and discuss the use of the method on other roads
- Visit Region 10 and 11 with The Cacao channel and the ferry connection to Chile
- Learn about the Chilean strategy for infrastructure
- Be informed about plans for The Austral Route – a new main road with a total length of 70 km – between Region 10 and 11 and possible use of Norwegian expertise
- Work out a program for a possible seminar in Chile in 2007 with experts from CPRA, NPRA, Ministry of Public Works and private sector
- Meet Chilean experts, both from public and private sector, interested in cooperation with Norway
- Investigate a possible visit of Chilean experts to Norway in 2007.

PHOTO: ARILD EGGEN, NPRA

Not only Norway has mountains. Close to the boarder of Argentina in region 11.

In March this year the Director Generals of CPRA and NPRA signed an agreement about "Technical Assistance to the Austral Route Project". That gives Norwegian experts, both from public as well as private sector, the possibility to do a job in a country with almost the same topography and weather conditions as in Norway. As an effect of the cooperation, among other things, the Otta Seal Method will this year be in use in six regions in Chile.

Contact: Arild Eggen, arild.eggen@vegvesen.no
For more information: Go to the English version of www.vegvesen.no, click Facts/International activity/ Partner countries/Chile

Road Engineering Expert Appointed VTI Professor

PHOTO: VTI

Sigurdur Erlingsson, a well known profile and frequently consulted expert in the field of road engineering, both in Sweden and internationally, has taken up the chair in road design and infrastructure maintenance which VTI has established.

– This is a recruitment of key importance for VTI. Sigurdur Erlingsson reinforces our competence in road and rail engineering and makes us more attractive in the market, both nationally and internationally. We are now engaged in long term and forceful marketing, and expect that one of the results this will have is that we will receive an even greater share of European research funds, says Marianne Grauers, Head of Infrastructure at VTI.

Sigurdur Erlingsson received his degree in geophysics at the University of Iceland and also has a degree in civil engineering from the Royal Institute of Technology, KTH, in Sweden. In the beginning of the nineties he was awarded a doctorate in soil mechanics by KTH. In recent years he has held a chair in civil and environmental engineering at the University of Iceland. He will now hold this chair on a part time basis, parallel with his chair at VTI.

– With his solid competence and experience, Sigurdur Erlingsson will both expand and deepen this subject area. One of his strongest points is that he has the theoretical foundations and has also, during his entire career, been applying the results of his research. He will be a very great asset for VTI and Sweden in the field of road and rail engineering, says Marianne Grauers.

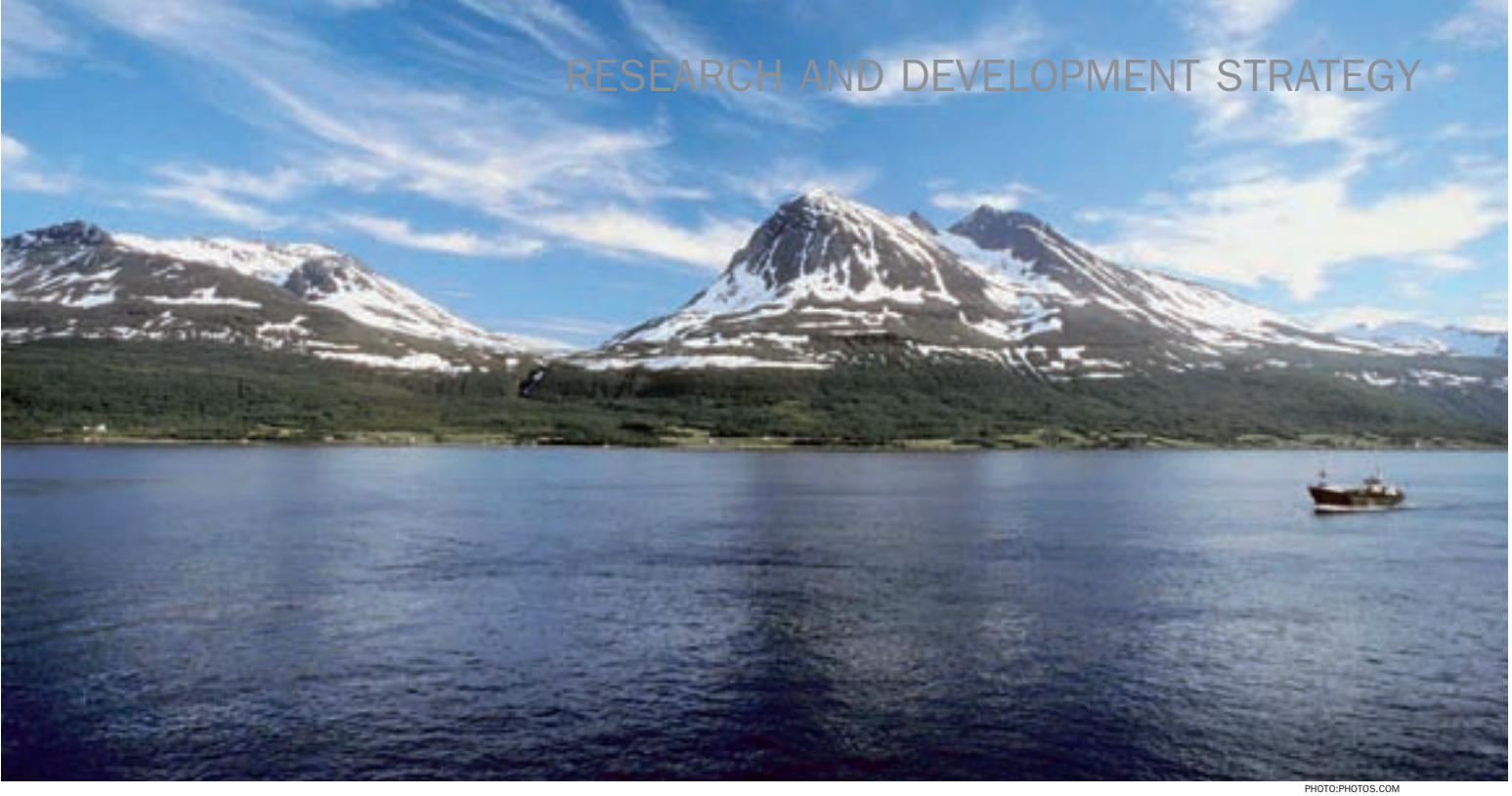


PHOTO:PHOTOS.COM

NordFoU – Nordic Cooperation on R&D

Research, development and realistic testing of new solutions on roads are necessary if the challenges with increased traffic, traffic safety, viability etc. are to be solved in the future. In order to manage utilization of the resources spent on R&D more effectively, the Public Roads Administrations in Finland, Iceland, Norway, Sweden and Denmark have established a common R&D cooperation on road and traffic sections.

The Director Generals of road administrations in the Nordic countries signed the NordFoU cooperation agreement at a meeting held in Helsinki on 10th of December 2004.

Even before the arrangement from 2004 there had been cooperation among the research communities in the Nordic countries. The NordFoU initiative, however, is about strengthening this cooperation with a higher coordination and funding level for the common need for R&D in the Nordic road administrations. In this way economies of scale for the buyer is achieved and the Nordic research community gets a better possibility to specialise and develop.

The NordFoU teamwork implies that projects where at least two countries agree about the need and the funding should meet to get the task solved. The projects are realized through common funding among the participating countries, and subsequently the projects are conducted with assistance from the professional top competence necessary to achieve the best results. Consequently the cooperation increases the efficiency whereupon new knowledge through top competence utilization of every country involved is created.

The NordFou cooperation is organised with a Steering Committee, which has the supervisory responsibility for adaptation and prioritizing within the cooperation. Furthermore the Preparatory Group coordinates remaining smaller initiatives which can facilitate a larger common research effort including for example exchange of information about national R&D initiatives and relevant seminars, conferences etc.

The managerial responsibility of the Steering Committee and the Preparatory Group alternates when it comes to hosting and planning meetings and activities for the cooperating countries. Currently Norway has the responsibility of leading the cooperation program.

Thorbjørn Chr. Risan, NPRA, Norway

Contact: john.krokeborg@vegvesen.no
For more information: www.vejdirektoratet.dk/nordisk/om_nordfou.asp (only in Danish)

Cooperation – a Core Value of VTI

The task of Swedish VTI is to conduct research and development in the transport sector. One of the keywords for the work is co-operation, and the Institute cooperates with both other research environments and players in the business sector. Director General Urban Karlström says that cooperation is essential for successful research.

PHOTO: PHOTOS.COM

VTI has a very well developed international cooperation. An important part of the strategic work at VTI is based on the endeavour to achieve greater cooperation with the important players of the transport sector and other knowledge producers. Cooperation is a fundamental core value which permeates the work of the Institute.

– Cooperation with other research organisations is of key importance to us, says Urban Karlström. We do not have all the competence at VTI, and through co-operation with other research groups outside the Institute we can work on a more interdisciplinary basis and in projects that demand very broad competence.

EU cooperation

VTI has positioned itself as an important player in the European and international research arena. Thanks to its sound reputation and some unique core competence and equipment, the Institute is a sought-after partner, mainly in cooperative projects within EU. Participation in the EU research programmes is one of the best opportunities the Institute has for greater international project cooperation. At the same time, it is an important instrument for the development of other forms of co-operation among the parties who take part in the projects. The EU projects in which VTI participates are mostly driven within the framework programmes of the EU Commission. Just now, VTI is participating in over 20 research projects in the sixth EU framework programme. (Read about one of these projects on page 28).

In European cooperation, the Nordic dimension still creates a special position for VTI, and contacts between VTI and other Nordic environments for transport research are maintained both among researchers and at management level.

Cooperation with universities and institutes of technology

To utilise the limited resources in research as optimally as possible, it is the constant endeavour of VTI to develop cooperation with universities and institutes of technology. This comprises several areas: cooperation in research centres, joint professorial posts, postgraduate programmes and direct cooperation in projects.

Overall, VTI is engaged in six national centres for transport research, for two of which VTI acts as coordinator – CELEST and Road Technology. These are virtual research centres which are financed by the Swedish Road Administration and carry on research, development and demonstration activity – CELEST within transport policy and Road Technology within the construction, maintenance and operation of roads.

– Through cooperation in centres, it is possible to run coordinated projects in which those involved complement one another, instead of small and overlapping projects, says Safwat Said of VTI, coordinator for Road Technology. This also provides greater opportunities to submit strong applications for EU project funds.

Greater cooperation with universities and institutes of technology has many advantages. VTI has access to the educational system, and at the same time the higher education environments have access to VTI's broad and long range competence in the transport sector and to a network with the other players in the sector.

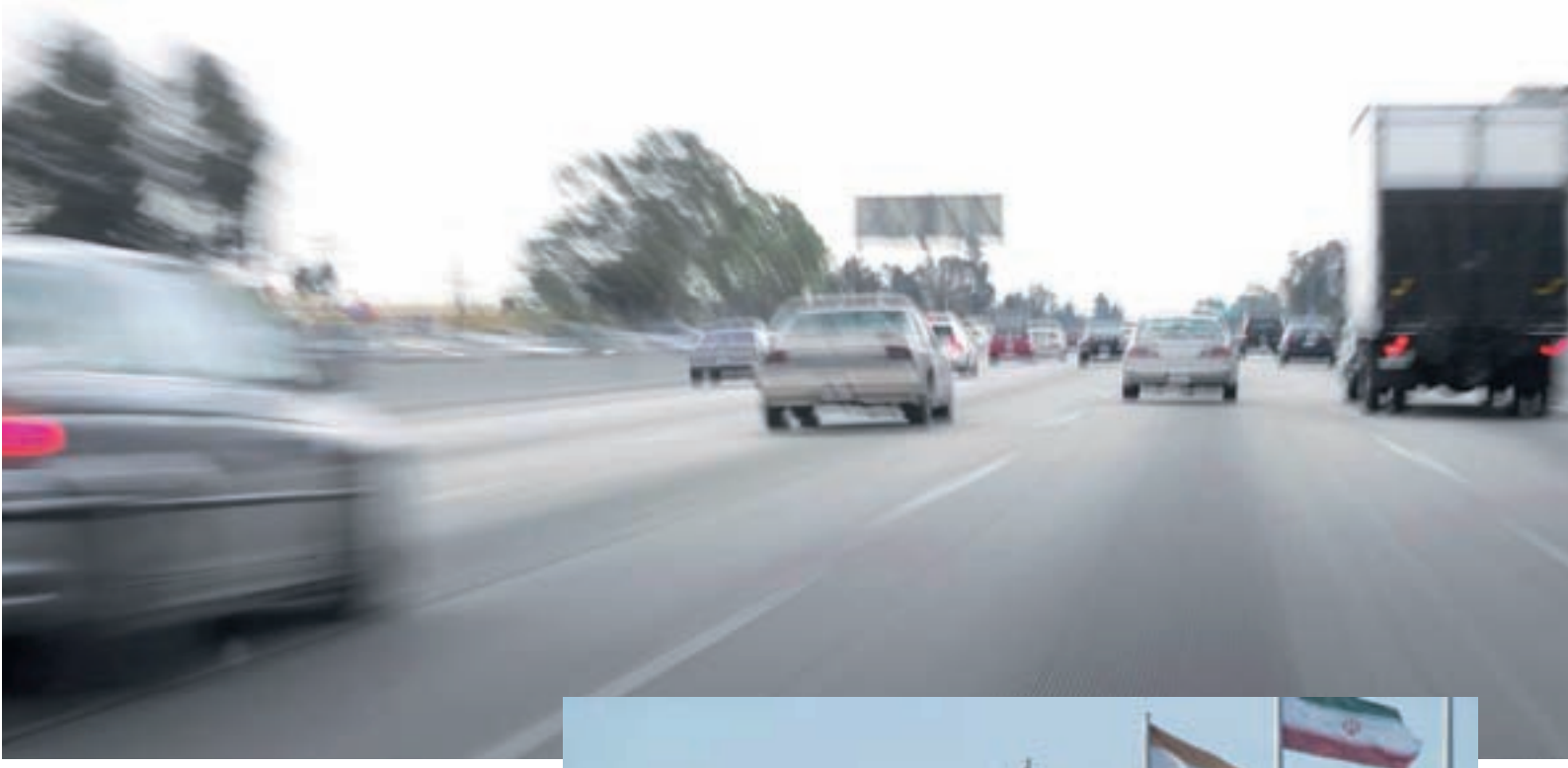


PHOTO: PHOTOS.COM

Good research is based on good cooperation, says VTI Director General Urban Karlström.

Cooperation with the business sector

One important change in the environment in which VTI operates is the increased presence of the business sector in research funding. This takes concrete form in the growing importance of centres with industrial partners and through research funding via programmes financed by industry groups. Development has been rapid. While previously research almost exclusively focused on research motivated by transport policy, it is now essential for VTI to develop its ability to make its competence available and useful also for fund providers in the business sector.

– It is extremely important for VTI to understand the needs of those involved with the problems of the industry, that is those actively engaged in the transport sector, says Urban Karlström. The knowledge that VTI develops can play an important role in transport-related innovation systems. In a project just now in progress, called DROWSI, the giant Swedish car producer Volvo is also involved apart from VTI and several other partners. DROWSI focuses on fatigue-related transport research, and Volvo is in charge of the project. One of Volvo's tasks in the project is to conduct tests on tired drivers.

International cooperative networks

Another form of international cooperation that has grown in importance in recent years is membership and active participation, under institutionalised forms, in international umbrella organisations. There are chiefly three such cooperations that are of special importance: FEHRL (Forum of European National Highway Research Laboratories) in the field of infrastructure, FERSI (Forum of European Road Safety Research Institutes) in road safety, and ECTRI (European Conference of Transport Research Institutes) which covers the entire field of land transport. VTI is represented on the boards of all these. Umbrella organisations also provide VTI with good opportunities for knowledge import, part of the national knowledge provision that can increase in importance over the next years.

As far as the Director General of VTI is concerned, cooperation is essential for the work of VTI.

– Good research is based on good cooperation and interaction between research environments, both nationally and internationally.

Sandra Johansson, VTI, Sweden

The Danish Road Directorate's RD&D-strategy 2006–2014

Last year the Danish Road Directorate established a new strategy for research, development and demonstration, covering the period 2006–2014. The research strategy is aimed at meeting knowledge needs, for the entire Danish road sector, that are expected to arise within the next four to eight years. The actual volume of RD&D-projects in the coming years will be dependant on available research funds.

The annual turnover of the Danish road sector amounts to approximately 13 billion DKK, of which some 5 billion are employed to maintain the whole road network. A turnover of this magnitude in a highly important area of society implies that society must have access to the best and most effective methods, materials and processes. A strategy for the collection and use of new knowledge is presently adopted in other Nordic countries, where separate funding for the procurement of special research programmes has been set apart for certain areas of research.

Danish road and traffic research is, compared to other areas of research, of very limited magnitude. There are only a few small research institutes, and it is becoming increasingly difficult to recruit new researchers. Thus, it is neither possible nor rational to have expert knowledge within the areas of road and traffic related issues where we are able to point to specific knowledge needs. It is, therefore a core element in the Danish RD&D-strategy that international cooperation must be strengthened, since here there is potentially a vast source of new important knowledge to be harvested. But, the effective use of new knowledge requires a minimum of research activities nationally.

One of the most significant EU initiatives is the establishment of the ERA-NET structure to strengthen further cross-border cooperation among national research programmes. Under this programme, the ERA-NET Transport has been established as cooperation between the European Ministries of Transport. Furthermore, the ERA-NET Road has been established between the national road authorities. The Danish Road Directorate is now a partner in ERA-NET Road. On a Nordic level cooperation has been established among the Nordic national road administrations, the so-called NordFoU cooperation. (Read more about NordFoU on pages 7 and 30.)

Road and traffic challenges

Denmark faces new, great challenges in the area of road and traffic in coming years. In recent years, there has been an increase in traffic volume on the main road network, with a substantial reduction in traffic flow quality as a consequence. This increase is expected to continue, and already traffic growth rates of up to four percent per year on the motorway network are not uncommon. The demographic development suggests that more and more people will be moving to areas with less expensive housing compared to the big city areas.

At the same time, work places all over the country are concentrating in these big city areas. This in turn, will result in longer commuting distances and an increasing demand for transportation. Furthermore, Denmark has a relatively low car density, which, added to the expected positive development of the economy over the future years, will bring about a larger growth in the number of motor vehicles than in similar countries. This situation is already causing significant traffic problems with massive queues in and around large cities, especially in the Greater Copenhagen Area.

Also, the large growth in traffic and changes in motor park composition generate negative consequences for the environment; especially the problem with noise is growing rapidly. More than 700,000 residences in Denmark are affected by traffic noise in excess of the recommended maximum limit. Road traffic noise places an increasing strain on citizens, financially and health wise, as shown by the fact that people are generally willing to pay more in

Traffic flow quality is one of the challenges that the Danish Road Directorate will have to face in the coming years.

order to avoid noise nuisances.

From a political point of view, there is great willingness to reduce the number of traffic accidents. The substantial decrease in the number of serious accidents achieved over the last couple of years has shown that efforts in this area do have a positive effect. However, it is becoming increasingly difficult to further reduce the number of traffic accidents. There is a need for a wide use of new methods, including new technology, as a way to develop a modern and safe road infrastructure. Achieving the established goals in the area of road safety therefore requires systematic and dedicated research efforts.

In the light of a growing number of tasks being transferred from the public to the private sector, it is no longer enough to focus on internal rationalisation of the public administrations. The whole process of cooperation between public and private companies will itself be a focal point.

In conclusion, the most important challenges that the Road Directorate will have to face in the next four to eight years are:

- Traffic flow quality
- Road safety
- Noise
- Environmental protection – recycling and clean technologies
- Specific service needs of people and businesses
- Road construction techniques and technological improvements
- Contracting strategies; public-private cooperation.

Management and organisation

Overall responsibility for formulating and reviewing the RD&D strategy lies with the Road Directorate's board of directors. The board has established a coordinating group for the actual implementation of processes. An essential element in RD&D strategy implementation is creating and collecting new, relevant knowledge and identifying when new professional know-how is needed. Also, the establishment and continuous updating of a road sector scenario, reaching four to eight years into the future is essential. The scenario is based on forecasts and development trends in the road sector and key-persons in the sector are meant to contribute to the identification of new knowledge needs.

In addition to formulating knowledge needs, specific needs for demonstration activities should also be formulated. A demonstration activity can be characterised as being a project that demonstrates or tries a theory or a method in practice. It could be laboratory tests of some new materials: more frequently, however, it will be full-scale experiments on the roads.

The RD&D strategy is reported in Report 317, 2006, from the Danish Road Directorate. This article presents selected parts of the strategy.

Carsten B. Nielsen and Maria Meiner, Danish Road Institute, Denmark

Contact: Carsten B. Nielsen, can@vd.dk or Maria Meiner, mm@vd.dk

Norwegian Public Roads Administration (NPRA): Research and Development – Philosophy and Strategic Goals

The Ministry of Transport and Communications has overall responsibility for research and development, R&D, in the transport sector in Norway. This responsibility concerns, among other things, financing, balancing short-term and long-term knowledge building, and responsibility for maintaining an overview of the need for knowledge at all times. It is defined as the sector responsibility.

The organisation of the administrative system in the sector gives the agencies great professional responsibility. For the Norwegian Public Roads Administration, the sector responsibility for roads and road transport lies within limits established by the overall authority entrusted to the agency as part of the "Instructions for the Norwegian Public Roads Administration" approved by the Council of State on May 27, 2005. This gives the Norwegian Public Roads Administration independent responsibility for developing the knowledge and skills required to administer its tasks.

Fundament for R&D

The research and development work is rooted in the NPRA's vision, objective and values. Research and development are actually part of the "development" focus area associated with the agency's result-oriented management processes, and the basis for the development of project areas and individual projects can be found in the National Transport Plan and other governing documents adopted by the authorities.

R&D goals

Research and development activities are to contribute to the development and maintenance of a safe, environmentally friendly and efficient transport system. This means that the agency must focus research and development activities on both doing the right things and doing things right. Research and development activities are to develop and secure the agency's specialist knowledge and skills and ensure that decisions are made on the basis of professionalism, skill and knowledge. The results of research and development activities provide the basis for revision of standards and guidelines and will, as such, benefit the entire transport sector. Research and development at the Norwegian Public Roads Administration make a major contribution to the development and administration of its sector responsibility.

Definitions of R&D

In accordance with the OECD definition, research and development are defined on three levels:

1. Basic research. Experimental or theoretical activities that are carried out primarily to acquire new knowledge about the basis of phenomena and observations, with no view to special practical objectives or applications.

2. Applied research. Activities of an original nature to acquire new knowledge, directed primarily at practical objectives or applications.

3. Development work. Systematic work that applies existing knowledge with the aim of producing new materials and products and introducing new processes, methods, systems or services, or improving those that exist.

In the research and development work it can be hard to distinguish between what is research and what is development because, in a large number of cases, the tasks will overlap and most projects will comprise tasks in both definition II and definition III. The agency contributes to some extent to supporting basic research at universities, colleges and research institutes when the activity is assumed particularly to enhance skills within specialist areas that are very important to the agency.

Main target areas the coming 4–5 years

The main target areas in the R&D activities 4–5 years ahead are based on the National Transport Plan and other steering documents. For the period 2006–2009 the target areas are agreed in "Strategic Plan 2006–2009" and are placed within the following main topics (a long list of suggested sub-

PHOTO: GAUTE LARSEN, GRAPHIC CENTRE, NPRA

projects is not mentioned here):

Mobility of People and Transport of Goods

- Trade and industry transport
- Intelligent transport systems and services – ITS
- Environmentally friendly urban transport

Safety and Security

- Traffic safety
- Risk and vulnerability

Environment, Energy and Resources

- Impact calculations

Competitive Design and Production Systems

- Road tunnels
- Road technology
- Social effects of operation and maintenance.

Agency projects 2007–2010

Agency projects are an indication of the big R&D project which is conducted by the NPRA. The projects shall be placed within the agreed main target areas, and normally they have a timeframe of 3–5 years with total budget limits of approximately 2.5 million Euros.

During the period of 2007–2010 the following agency projects are suggested to be carried out:

- High-risk Groups in Road Traffic
- Protection of Privacy and Traffic Safety
- Trade and Industry Transports
- Environmentally Friendly Urban Transportation
- Climate and Transportation
- The Development of Road Management and Maintenance
- Road for the Future
- SMART Salting (Strategy, Environmental Impacts, Alternatives, Reduction, Measures)
- Development of Tunnels (phase 1)
- Environmentally Friendly Pavements.

Thorbjørn Chr. Risan, NPRA, Norway

For more information: www.vegvesen.no
Contact: John Krokeborg, john.krokeborg@vegvesen.no

Toward Better Roads
– The Icelandic Road Administration's Research Policy

The role of the Icelandic Road Administration (ICERA) is to oversee the country's highway system in the best way possible with a view to society's needs, the safety of road users and environmental considerations.

According to the Road Act, ICERA shall use 1 per cent of the earmarked sources of income for research activities, and this will increase to 1.5 per cent in the year 2009. To use this money in the most effective way, ICERA has set its research policy. The research policy is decided by the Administration's role and objectives, its chief aim being to work systematically towards defining the need in the different sectors, to prioritize the projects and make the research work more efficient.

The chief factors in the Icelandic Road Administration's research and development are as follows:

- To initiate research and development work which enables the Icelandic Road Administration to meet the objectives set at any given time
- To acquire new technology in matters of roads and communications, by participating in foreign research projects, and to utilize domestic and foreign know-how
- To ensure that the results of research and development regarding methods, the use of materials and better work procedures are incorporated into standards and changed work procedures so as to improve the quality of the highway system and the service which the Icelandic Road Administration provides at any given time

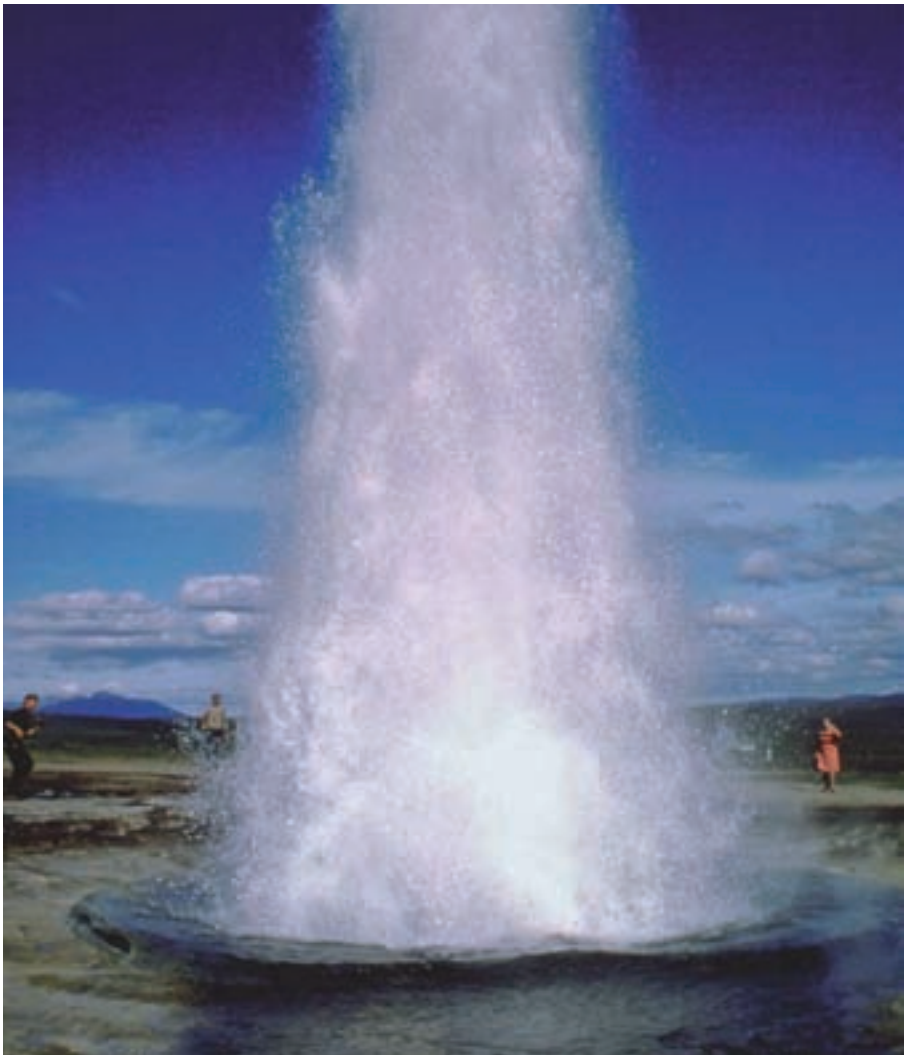


PHOTO: PHOTOS.COM

PHOTO: VIKTOR A. INGOLFSSON, ICERA

- To ensure that the results of research and development regarding traffic safety lead to safer traffic on the country's roads for the benefit of all road users
- To ensure that the results of research and development regarding the environment and society as a whole lead to a positive cohabitation of the road system and traffic with the environment and the population
- To promote the cooperation of those who undertake responsibility and carry out research in this sector
- To provide information on these activities and the results of research
- To assess the results of research and development and use them as the basis for improvement.

Research under the auspices of the Icelandic Road Administration is divided into four chief categories:

- Infrastructure
- Traffic
- Environment
- Society.

Three professional committees serve as advisers for the research categories: one for infrastructure, another for traffic and the third for the environment and society. The committees consist of selected employees of the Icelandic Road Administration. Prior to the allocation of research appropriations, which is carried out during the first month of each year, each professional committee presents the areas of emphasis within its sector to the supervisors of the research work. The committees will invite bodies outside the Administration to meetings, to discuss and have their views on the areas of emphasis. The definitions of the projects are called for accordingly. Also, appropriations are made for projects which are not covered by the areas of emphasis. Emphasis is put on specific categories for the long term, for the period 2006–2010 on environmental topics and information technology.

A Research Board, appointed by the Director General of the Icelandic Road Administration, presents him with proposals for the appropriation to individual projects. The Research Board processes the proposals in cooperation with the supervisors of the research work with a view to the emphases of the professional committees.

In the research policy, emphasis is on practical research and the utilization of the acquisition of knowledge and data for the activities of the Icelandic Road Administration, while also utilizing part of the research appropriations for supporting projects which count as basic research involving the Administration's activities.

It is emphasized that in most instances, at the start of each research project, it should be defined who are to use the results of the specific research project and those should be offered the opportunity to formulate the project in question and implement the results.

The research work, funded by the Icelandic Road Administration, is partly carried out by the employees of the Administration, but also by others, for example universities, various consulting companies and institutions and even individuals.

ICERA also participates in various international research and development projects. The primary aims are to acquire knowledge and experience from other countries, keep up-to-date with ongoing developments and implement them in Iceland when appropriate, to introduce our experience and knowledge in the international arena and rise financing for research projects from outside bodies.

The Icelandic Road Administration's Research Policy is kept under constant review with a view to the changed emphases and the needs of society which are revealed when the professional committees present their areas of emphasis for each year, as mentioned above.

Hreinn Haraldsson and Thorir Ingason, ICERA, Iceland

Strategy for Noise Research at the Danish Road Institute during the Next Four to Eight Years

Based on the Road Directorate's strategy for Research, Development and Demonstration for 2006–2014, noise is one of the main challenges in the next four to eight years.

The problem of noise is an increasing strain on the population, both physically and economically. This can be seen by a greater willingness to pay for less noise nuisance when buying housing. The economic costs for society due to road traffic noise are calculated in Denmark to be between 5.9 and 8.7 billion DKK per year. There is an increasing requirement to reduce noise from roads in connection with ordinary traffic flow, new construction work, road extensions and road maintenance. The road network is expanding and thus the proportion of housing that is exposed to noise nuisance along the road network will correspondingly increase.

Technical framework for the theme of road traffic noise

When cars drive on a road, they generate noise. The level of noise is determined by the construction of the vehicle, tyres, and the road pavement as well as the speed and the manner of driving. When approving vehicles and tyres, the EU regulates the motor noise and the noise from tyres. However, the choice of road pavement is made by the local administration. The total traffic volume and the proportion of heavy traffic and speed have great influence on noise. By traffic planning and various types of traffic regulations and speed control, etc. it is possible to influence these conditions. Noise can also be influenced by noise barriers and covering etc. Near housing and recreational areas, noise can be reduced by barriers and façade insulation, etc. The effect of these measures can be calculated by use of the Nordic model, NORD2000. The EU directive on noise means that in the coming years major noise mapping and Action Plans for noise will be carried out in Denmark and solutions will be proposed.

The aims of the noise theme

In order to strengthen noise research, the Danish Road Institute has collected all noise research in a thematic project on noise. The noise theme should contribute by means of research, development and demonstration to fulfil the following technical noise goals. However, it cannot be expected that all goals will be able to be fulfilled within a short time frame.

- **Noise goal 1: Better noise reducing pavements**
  Development and testing of noise reducing road pavements, which fulfil the functional requirements on road pavements such as friction, low rolling resistance (energy consumption) and good durability, etc. This work covers many technical areas at the Danish Road Institute including acoustics, materials technology, surface properties, etc. It is a challenge to work with more futuristic concepts, where noise reduction can be reduced further.
- **Noise goal 2: Improved knowledge on tyre noise**
  Examination of the importance of tyres on noise, including optimization of rethreaded tyres.
- **Noise goal 3: Reduction of noise by use of traffic management**
  Development and testing of various types of IT, information technology, and traffic management which can influence the amount of traffic and the speed/manner of driving and therefore noise levels.

Noise barrier in Copenhagen.

PHOTO: HANS BENDTSEN

- **Noise goal 4: Optimization of noise barriers**
  There is a need to develop and test new and optimized noise barriers in order to achieve increased noise reduction and an improved design.
- **Noise goal 5: Improved calculation and prioritizing tools**
  A central element in planning and handling the efforts against noise is use of reliable calculation models and prioritizing tools. There is a need to make an effort in this area, including the use of the calculation method NORD2000 in Denmark.
- **Noise goal 6: Better knowledge about the effects of noise**
  There is a need for further knowledge on the effects of noise on human beings and society. It is relevant to study the effect from noise reducing initiatives such as road pavements, barriers, etc. The results can be used to evaluate the effect of the investment in noise reductions and to improve the methods used for noise reductions.
- **Noise goal 7: Integration of noise considerations in planning tools**
  Development of methods to integrate noise in road, traffic and town planning and as a factor in systems which are used for controlling and planning road management (PM- systems).
- **Noise goal 8: Development of acoustical measuring methods**
  The Danish Road Institute should develop expertise and instruments to enable them to use major acoustic measuring methods. It is necessary to develop existing methods or develop new methods. It is natural to participate in international ISO or CEN working groups.

An effort should be made to establish full-scale demonstration projects in cooperation with road authorities.

In addition to these technical goals, further goals have been drawn up for technical networks, communication and financing of Research, Development and Demonstration as well as increased competence for project participants, etc.

Hans Bendtsen, Danish Road Institute, Denmark

Contact: Hans Bendtsen, hbe@vd.dk

Investigating Roads and Weather

The change of climate affects the road network. In January this year the Norwegian Public Roads Administration started a research project with the purpose of getting an overview of the consequences connected to climate change and the necessary measures. The project is called Climate and Transportation.

– Through increased precipitation, higher temperature, less frost and more bad weather we are getting milder winters, warm and dry summers in the southeast of Norway, more rain especially along the coast of Western Norway and higher storm and wind frequency. This will cause more landslides and flood which will have an impact on the road network and the traffic and subsequently become a threat to the safety of the population, especially the road users. And we have to do something with this new situation, says Project Manager Gordana Petkovic, NPRA.

Temporarily the research project Climate and Transportation is divided in eight sub-projects:

1. The effect of climate change on transportation in Norway
2. Data – gathering, saving and processing
3. Protection against flood and erosion
4. Avalanches, rock- and landslides, and rock fall
5. Readiness and warning
6. Consequences for winter operation
7. Bearing capacity of roads
8. Susceptibility and emergency systems.

The specialist environment around the leader of the project board, Jan Otto Larsen, Department of Technology, Road Directorate, has already worked with climate change for some years. The task is continued through the implementation of the project Climate and Transportation. An important aspect of the project is to bring together top competence which already exists in the research community.

According to Gordana Petkovic there are many specialist environments in Norway which conduct research on climate and the consequences of climate change. Norwegian National Rail Administration, Norwegian Meteorological Institute, Norwegian Water Resources and Energy Directorate (NVE), Norwegian Geotechnical Institute (NGI) and Norwegian Geological Survey (NGU) are among the institutes that want to participate in NPRA's project.

– The objective is to make NPRA better on areas the project so far has worked at. We have already gained better knowledge about how the road network is to be built to stand climate change, better basis to consider danger of an avalanche and risks, and better emergency preparedness. All these factors are already incorporated in the guidelines and standards, tells Gordana Petkovic. There are many issues to get down to, but a good professional foundation has already been made by the NPRA.

In order to make it easy for the employees of the agency to follow the project, an intranet project website is established. On this intranet website the employees can pass on comments and suggest measures for the project. More information about Climate and Transportation will be published on the websites and elsewhere when the project has made further progress.

Thorbjørn Chr. Risan, NPRA, Norway

PHOTO: PHOTOS.COM

Safety measures being built against snow- and rock-slides on highway 91 Ura in Lyngen, County of Troms, Northern Norway.

PHOTO: EIVIND BERGLUND, NPRA

Contact: Gordana Petkovic, NPRA,
gordana.petkovic@vegvesen.no and
Jan Otto Larsen, NPRA, jan-otto.larsen@vegvesen.no

R&D on Winter Maintenance:
Current Report on New Salting Method

Norway is a winter land and the winter maintenance is of great significance for traffic flow and traffic safety on the roads. For the Norwegian Public Roads Administration it is of vital importance to focus on professional development on issues regarding winter conditions. A new report (Department of Technology, report no. 2472) has the latest information about a new salting method. The report is summarised in this article.

PHOTO: TORGEIR VAA, SINTEF

Testing the new salting method.

The development of spreader equipment for the new sanding method Fixed sand (mixing sand and hot water) has made it possible to try a completely new salting method by adding hot water to dry salt (sodium chloride).

The winter seasons 2003/2004–2005/2006 a project has been carried out in Lyngdal in Region South in Norway with salt trials on both thin ice and a thicker ice layer. As preventive measures prewetting salt with hot water (95˚C) has been compared with the traditional way of prewetting salt by adding salt brine.

The tests that have been conducted confirm that prewetting salt with hot water is an adequate alternative to using brine as prewetting agent, and so far there are not any negative aspects revealed with the method. The results from trials with anti-icing measures in week 4/2006 showed that prewetting with hot water is equivalent to prewetting with brine when it comes to residual salt measured on the roadway. Earlier trials have shown that de-icing on thick ice with the two methods gives almost identical effect regarding friction development. On thin ice, however, a difference has been proven in favour of the new method with prewetting salt with hot water both with regards to a more rapid effect and a higher level of friction compared to the traditional salting method by adding brine as prewetting agent.

Against the background of the tests carried out, prewetting salt with hot water is recommended to be taken into use as a salting method where Fixed sand equipment is available. There is, however, still a need for documentation of experience with the new method in daily operations with regards amongst other things, firstly, to the amount of water under different conditions, secondly, how much the amount of salt can be reduced, and thirdly, the consequences for traffic and temperature limits for salting.

The plan is to look more thoroughly into these aspects the winter season 2006/2007 by documenting experience with a new unit with heater system adapted to the volume of water needed for prewetting salt.

Project Manager Torgeir Vaa, SINTEF, Norway

Contact: Torgeir Vaa, torgeir.vaa@sintef.no, Oeystein Larsen, NPRA, oystein.larsen@vegvesen.no and Roar Stoetterud, NPRA, roar.stotterud@vegvesen.no

For more information:
www.vegvesen.no/Fagstoff/Teknologi/Drift av vegnettet/FoU i vinterdriften (Reports mainly in Norwegian, but some summaries in English)

Motorcycles – the Mode that Poses the Greatest Risk in Road Traffic

Both in Sweden and in other countries, motorcyclists run a high accident and injury risk. A recently completed study at VTI shows that the greatest risks are associated with young riders and with motorcycles in the lowest and highest insurance classes. The risk of being injured is, in relative terms, lower for motorcycles in the intermediate insurance classes.

– The risk of being killed in traffic is approximately 20 times higher for motorcyclists than for motorists, but there are significant differences in the risks run by different groups of motorcyclists, says Urban Björketun at VTI.

PHOTO: PHOTOS.COM

Young riders are a risk group as regards accidents and injuries. In the highest insurance class, comprising the most powerful motorcycles, riders younger than 30 account for ca 60 per cent of injuries.

– Their risk of injury is about twice that of other age classes, says Urban Björketun. The outcome of an injury in this insurance class is more serious than in other insurance classes, something that may indicate that the speed at the time of the accident is higher.

Many motorcycles in the highest insurance class have been developed for track racing. The acceleration and speed resources of these motorcycles place stringent demands on riders who use them in traffic on public roads, both as regards observation of speed limits and consideration of other road users. At the same time, it may be argued that these motorcycles demand extra great attention on the part of motorists because of the extreme changes in speed that are possible with these motorcycles. It is also possible that young riders, in particular, do not always understand how the approach of a motorcycle is detected by drivers who have no experience of powerful motorcycles. The markedly higher risks of injury for young motorcyclists who are riding powerful motorcycles may also be due to a combination of the driving behaviour of the motorcyclists and, to some extent, to a lack of understanding between motorists and motorcyclists.

– These and similar arguments appear in the debate about motorcycles. Our published results do not permit such conclusions, and must be complemented with well reasoned arguments concerning the reasons why the risks of injury are as set out in our report, says Urban Björketun.

– We want however to draw particular attention to our results that young people often ride motorcycles owned by older people, at least when an accident occurs. We have no knowledge to what extent such loans are temporary or of a more long term character. In the first case, the lack of familiarity of a young rider with a temporarily loaned motorcycle may be a contributory cause of an accident. In the second case, it may be that changes for example in the insurance system, which will prevent long term loans, mainly of powerful motorcycles to primarily young riders, will have an effect in enhancing road safety if, in such a case, these young people will instead ride a less powerful motorcycle.

It should however be borne in mind that it is the attitudes of motorcyclists which, to some extent, govern the choice of a motorcycle, and that these attitudes will not necessarily be changed because the person concerned is riding another motorcycle.

Tarja Magnusson, VTI, Sweden

Author and contact: Urban Björketun, urban.bjorketun@vti.se
Title: The risk of injury to motorcycles
Series: R566

International Cooperation:
Botswana Road Maintenance Manual

For more than 30 years Norwegian road experts have had a co-operation with Roads Department in Botswana. The country is of the size of France, and has only 1.7 million inhabitants. Two thirds of the land consist of the Kalahari Desert. So what can Norwegians do in a country so different from Norway?

Botswana gained independence in 1966 after being a British protectorate, and had at that time few resources. Since then Botswana has had stable, democratic development. Traditionally production of meat has been Botswana's main source of income, but after finding minerals and diamonds shortly after the British left, Botswana has achieved a steady economic growth, quite unique in Africa. It is now assessed to be a middle income country, and therefore too prosperous to receive further Norwegian development aid. Cooperation after 2002 continues today under a new agreement where Botswana carries most of the costs.

Norwegian experts have been working for about 30 years with road related projects in Botswana. Among these projects are:

- Application of local material in building of roads
- Adaptation of local versions of Otta seal
- Development of manuals, handbooks and guidelines
- Road planning and impact analysis, as well as maintenance projects
- Traffic data collection
- Training programmes.

The main road network is close to 9,000 km, and nearly 70 per cent are paved. The paved roads appear to be quite modern and with very good capacity.

Traditionally road maintenance has been done as in house work. Like in many other countries Botswana also has started tendering maintenance work. Some years ago they therefore started to work on a manual which could be used for this purpose. The Norwegian Public Roads Administration became involved in this project on the bases of the Institutional Cooperation concept. This involves the Road Administrations in both Botswana and Norway, and regional and Norwegian consultancy. The idea is to transfer both knowledge and working methods. It is the purpose of the project that the maintenance manual shall be used when finished early in 2007.

The Botswana Road Maintenance Manual is divided into three different parts:

Performance Standard

Botswana has not had any common standard requirements for maintenance works. There have been local standards in each of the three regions. Common standard requirements will simplify the process of tendering out maintenance work.

Standard Specification for Maintenance Works

Standard specification for construction work has been in place for many years, but that is not the case for maintenance work. So in cases where jobs have been tendered out, local systems have been used. A common way of describing maintenance activities will make it easier for all parties involved, in other words clients, contractors and consultants.

Operational Procedures

This part of the project describes the different maintenance activities and the resources needed to do the job when it comes to manpower, equipment and materials. It will be described with both labour intensive methods and machine based methods.

John Dahlen, NPRA, Norway

Contact: john.dahlen@vegvesen.no

PHOTO: JON DAHLEN, NPRA

Typical main road in Botszwana.

Watch out!

Main Office – Roads Department Headquarters.

International Cooperation:
Equipment Management in Tanzania

Norway has supported the road sector in Tanzania since 1972. The support included road equipment. It started with support to purchase of plant, equipment and vehicles for construction work, supply of spare parts and education of mechanics, operators and other personnel. The support has gradually changed until today's situation.

The Manager of the Equipment Pool in Lindi in front of some of his vehicles. The tippers are 30 years old but still in operation.

PHOTO: JON BERG, NPRA

Tanzania is a United Republic on the east coast of Africa. It covers an area of 945,087 m² and has about 37 million inhabitants. The country is divided into 20 regions and Swahili is the national language. The Ministry of Infrastructure Development is responsible for the nation's roads. The daily operation of roads is handled by the Tanzania Road Agency (TANROADS) which contracts out most of the road works.

TANROADS has Equipment Pools in many of the regions. These pools hire out equipment to private contractors who are working on the road sector. The biggest pool, Mbeya, has 90 employees and 75 units in operation. The pools are self-financed and are operating on non profit basis. The money from hiring out equipment covers operation costs and investment in renewal of equipment. The pools have been operating from their own income without any external funding for more than 10 years. They have managed to renew som equipment, but not enough to keep it as young as it should be. There is not so much road equipment available on the market and road maintenance activities depend very much on the Equipment Pools. In 1994 an Equipment Management System was introduced to help in the daily operations. The system was computerised in 1999.

PHOTO: JON BERG, NPRA

The Accountant in Mbeya and the Team Leader are discussing the reports produced with the Scala software.

The Equipment Management System

The Management System is vital to make the roads sustainable. The system is both a management and a business accounting one. It has been developed continuously together with the users. According to experience gained the present system report is the 10th edition.

The system gives the managers the overall picture of the business. It lets them follow all revenues, costs, stock values and assets, so they can ensure that sufficient funds are set aside for renewal of equipment. Each month the income goes to the bank account for the daily operation and future investments.

The computerized system uses Scala software and special reports for monitoring the operation have been designed. The system describes methods for budgeting and calculation of hire charge rates, workshop rate, value of plant and equipment and depreciation etc. The budget includes scrapping and renewal plan and annual investments.

Follow-up of performance

There are three main units within the Equipment Pool: Store, mechanical workshop and plant hire. There is one report for each unit which reports the cash flow for the day to day running of the business. The reports compare performance with budget and give key figures that simplify comparison between equipment and other similar businesses.

The annual reports are designed according to international and Tanzanian standards with profit and loss accounts and balance sheet. This makes it easy for outsiders to evaluate the business.

Plans for the next five years:

- Upgrading of software and hardware
- Implementation of new modules for payroll, stock control and service management
- Computers in a local area network including store, mechanical workshop, plant hire unit and accounts and management
- Expansion from two installations in Mbeya and Tanga Equipment Pools to Morogoro, Lindi/Mtwara and Kibaha
- Having all installations in a wide area network working against a central server.

The programme includes training of personnel in general use of computers, double entry accounting and on job training. As soon as procurement of soft and hardware is done there will be training in the use of Scala and in the management system. Then the managers will be trained in business management.

Jon Berg, NPRA, Norway

Contact: jon.berg@vegvesen.no
For more information: Go to the English version of www.vegvesen.no, click Facts/International activity/Partner countries/Tanzania

Road Traffic Noise from Railway Crossings

Different types and designs of rail and tramway crossings are used on urban roads. When cars cross the rail, the tyre-road noise may increase. Noise measurements have been carried out in the SILENCE project.

This article summarises a report produced by the Danish Road Institute/Road Directorate (DRI) as part of the work carried out by the Forum of European Highway Research Laboratories (FEHRL) in Task F1 of the EU project SILENCE started in February 2005. The Swedish National Road and Transport Research Institute (VTI) is the task leader. Investigations of road traffic noise from rail and tramway crossings have been carried out. The objective was to produce a ranking in relation to road traffic noise of commonly used existing types of rail/tramway crossings and to find solutions, which are as silent as possible.

There are four main sources of noise in situations where a rail/tramway crosses a road:

1. The noise from a train or a tram passing by
2. The noise from acoustical horns onboard trains to warn people travelling on the road that a train will soon be passing
3. The noise from the vehicles passing by on the road
4. The noise from acoustical warning systems (if there are any) prior to and during trains or trams cross the road.

In this project the noise from the road traffic is in focus. Increased noise normally occurs when tyres roll over the rails. This excites vibrations in the tyre and these vibrations are transmitted to the surrounding air as noise. Six railway crossings in North Zeeland have been selected for noise measurements:

- One rail crossing has asphalt concrete on both sides of the rails. The pavement was very uneven and with holes caused by wear and tear
- One rail crossing has worn down concrete blocks between the rails
- Two rail crossings have asphalt concrete beside the rails and rubber plates between the rails. One crosses the road at an angle of 90° the other at around 45°
- Two rail crossings have rubber plates beside the rails and rubber plates between the rails. One crosses the road at an angle of 90° the other at around 45°.

The results showed that the angle at which the vehicles crossed the rails was of importance to the noise levels. Rail crossings at an angle of approximately 45° relative to the road generally were less noisy than rail crossings at 90°. The results for passenger cars at 50 km/h are summarized in the table below.

The least noisy (with rubber on both sides) and the most noisy rail crossing with worn down asphalt gave rise to a vehicle noise level of 70.9 dB and 78.5 dB, respectively, a difference of 7.6 dB. This highlights that the design of rail/tram crossings significantly affects the noise from road traffic.

Against the background of this study the following tentative recommendations for the design of rail and tramway crossings with as low a noise emission from passenger cars as possible can be derived:

- The noise is reduced by around 4 dB when the angle between the road and the rails is around 45°
- Using rubber plates next to the rails reduces the road traffic noise in relation to using asphalt or cement concrete

Rail crossing	Asphalt/ asphalt-old-90°	Rubber/ rubber-new-90°	Asphalt/ rubber-new-90°	Rubber/ rubber-new-45°	Asphalt/ concrete-old-45°	Asphalt/ rubber-new-45°
Noise level L_{AFmax} [dB]	78.5	76.2	74.4	72.1	71.1	70.9

Rubber plates next to the rail and the angle at which a vehicle crosses the rails is of importance to the noise levels.

PHOTO: VTI/HEJDLÖSA BILDER

- Using rubber plates only between the rails seem to reduce the noise level by 1–2 dB in relation to using rubber on both sides of the rails. This is difficult to explain and may be caused by features not noted
- The noise levels from dual-axle heavy vehicles at two crossings, a new rubber/rubber at 90° and a new rubber/rubber at 45°, showed the same trends as the noise levels from passenger cars. However, no conclusions can be drawn on heavy vehicle noise because at most of the investigated railway crossings too few truck pass-by noise levels were recorded.

The surface texture at the rail crossings was also measured but no unique relation with the measured noise levels could be seen. The least noisy rail crossing (a new asphalt/rubber at 45°) had the lowest peak to peak range in surface texture.

There is a need for further investigations in relation to noise from dual-axle and multi-axle heavy vehicles and further optimization of the noise reduction.

Senior Researcher Hans Bendtsen and Sigurd Thomsen, Danish Road Institute, Denmark

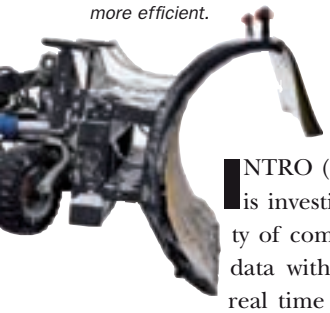
PHOTO: HANS BENDTSEN

Report: Noise measurements at railway crossings. Danish Road Institute/Road Directorate, Note 49, 2007. To be published.
Contact: Hans Bendtsen, hbe@vd.dk and Sigurd Thomsen, snt@vd.dk
For more information: Go to the SILENCE homepage at http://www.silence-ip.org

Intelligent Roads in the Service of Road Safety

The increasing number of accidents and the needs for greater comfort and capacity on the European road network impose new demands on the road infrastructure. The aim of the EU project INTRO is to improve both road safety and transport capacity on the road network by using information from data sources that are already available.

Information as to which roads are in need of maintenance would make winter road management more efficient.



INTRO (INTelligent ROads) is investigating the feasibility of combining sensors and data with road databases in real time to give drivers and road management authorities "instant" information on the risk of skidding, the structural state of the road as well as traffic flows and safety risks.

– The dominant idea underlying INTRO is to link up existing sensor technologies so as to make maximum use of their capacity to provide us with information, says coordinator Bengt Wälivaara, VTI.

VTI is one of ten partners in the project that is financed within the sixth EU framework programme. The project commenced in March 2005 and finishes in February 2008.

Assessment of skidding risk on roads

In order that drivers may plan their driving in relation to the skidding risk, the ideal would be to know in advance which sections of the road are slippery. Drivers could then be prepared before entering the slippery sections or even choose a completely different route. Road management authorities would also greatly benefit from a system that provides information as to which roads need salting. Obviously, more effective winter road management also improves road safety.

This part of the INTRO project evaluates an existing system for assessing skidding resistance using an ordinary passenger car (probe vehicle) equipped with a system estimating the friction between the tyre and the road surface. The system comprises software using sensor data from the vehicle's electronic stability programme ESP and ABS.

– The advantage of the system is, according to the manufacturer, that it requires data from sensors already present in ordinary cars today, says Bengt Wälivaara. This corresponds well with the INTRO concept of using existing sensor systems in new applications.

The system is evaluated in Austria, France and Sweden using different reference systems for road and tyre friction measurements. The tests aim to compare how well estimated friction data agree with reference data.

Simulator study

One critical aspect of this is driver behaviour. During the autumn, a number of researchers made use of the VTI driving simulator to optimise driver response to a new type of information. How is a warning about skidding received by different drivers? How should the warning be formulated to have the desired effect? When should the information reach the driver? During the simulation study, three types of skid detectors were tested; all warn the driver via a display integrated into the speedometer.

– A system that recommends a certain speed depending on road friction is judged the best by the test participants, says Katja Kircher who was in charge of the simulator study at VTI. It was also the system that made people drive more slowly.

The objective of the simulator study is to find whether a skid warning system would increase road safety in practice, or whether it might even be a hazard.

– Yes, there is a risk that drivers might rely too much on the system and might stop using their own judgment of the road conditions. A system may after all give the wrong indication or fail completely, and in such a case it is dangerous if the driver is no longer fully in the loop.

The structural condition of the road

The next phase of the project deals with the effects of combining fixed sensor and mobile vehicle sensors in pavements and bridges. The intention is to find new methods to predict and evaluate the strength of the road and detect surface irregularities such as rutting, pot-holes and similar defects in real-time.

The technical scope of the first part using "in-situ" or fixed sensors is to use and combine already existing sensor technologies such as strain gauges, temperature sensors and humidity sensors permanently mounted in the pavements in order to assess pavement strength in real time. In

Test subjects in the simulator study preferred a system which recommends a certain speed depending on road friction, says Katja Kircher, VTI.

the second part using mobile vehicle sensors, passenger cars will be used as probe vehicles for pavement assessment during 2006–2007. Cars will be equipped with a CAN reader interface collecting information from the standard car sensors (steering wheel movements, vibrations, wheel speeds, etc.) as well as vehicle position and transmit these data to a server. Data from probe vehicles will then be correlated to reference vehicle measurements made in Sweden and UK in order to build models for road surface estimation.

Together, the methods above are meant to provide useful and objective real-time information on the state of the road. At present, most damage to roads is reported by private persons and professional drivers who, on their own initiative, tell the road management authority that a road needs maintenance.

Traffic flows and safety risks

Today, "floating cars" or probe vehicles such as taxis or delivery vehicles, equipped with GPS receivers and modems, are already used in traffic. These vehicles regularly report data in the form of speed and position to traffic centers which can then calculate the travel times on certain routes in cities and can, for instance, predict congestion before it actually occurs.

Information may be given by identified probe vehicles, i e a vehicle can be monitored during its journey in traffic. Another way, which protects the identity of the person providing the information, is the use of unidentified probe vehicles where the journey of the vehicle cannot be followed or traced. The latter method proves a greater challenge since the history of the vehicle is lost after each reading. The INTRO project evaluates and develops new methods of journey time predictions aimed to increase the capacity of both methods. One method to solve the problem above consists of "fusing" traffic data (magnetic loops, traffic cameras, probe cars, etc.) in order to increase the data quality and decrease uncertainties.

Help in choosing a route

The hope with INTRO is that existing sensor technologies in combination will be able to generate more information than each technology on its own. The third subproject of INTRO is investigating the feasibility of linking up dynamic traffic data with for example weather information and accident statistics. This is expected to result in improved forecasts of traffic situations and identification of safety hazards, such as shunting accidents, with the help of traffic data.

– This creates completely new methods for estimating travel times, says Bengt Wälivaara. He believes that companies that design navigation systems will be especially interested.

– With access to better traffic information, they can propose better routes for their customers. At present they do not have access to information on future traffic situations, for instance when congestion on a road will clear. They have to direct their drivers to new routes which may in the long run take longer.

Bengt Wälivaara believes that, as the technology is already available, it is only a matter of time before we see it in application.

– Sooner or later, these systems will be used on the roads.

Sandra Johansson, VTI, Sweden

INTRO is cooperating with the project SRIS (Slippery Road Information System), a project within the framework of IVSS (Intelligent Vehicle Safety System) in which VTI participates as a partner. The aim of SRIS is to use the information that is already available in the data network of cars (e.g. from the ABS and ESP systems) in assessing the winter standard of the road network. The information from several cars is transmitted in real time to a central database where it can be appraised in combination with information from weather stations.

For more information:
Bengt Wälivaara, bengt.walivaara@vti.se
Katja Kircher, katja.kircher@vti.se
www.vti.se/intro

NordFoU: A State-of-the-art Report

Performance Prediction Models for Flexible Pavements

The NordFoU research and development program was formally established in December 2004. One of the research projects initiated at the beginning deals with development of deterioration/performance models for flexible pavements and was named Pavement Performance Models. Below you can read the summary of the first stage report from this project.

PHOTO: TORLEIF HAUGØDEGÅRD, NPRA

E6 by Dal in the county of Akershus north of Oslo.

One of the activities of the preparatory phase of the NordFoU project – Pavement Performance Models, was to conduct a review of available performance prediction models. The purpose of the review was to find out the strengths and the weaknesses of available models in order to provide basis for more detailed evaluations, selection and improvement of models. Accordingly, models that are in use in Nordic countries as well as relevant models from other countries were reviewed, based on expert evaluations of the Nordic models and available literature. This state-of-the-art report contains the results of this review. The following conclusions were made based on the review.

1. Performance prediction models represent a key element of road infrastructure asset management systems or pavement management systems. Thus successful implementation of these systems depends heavily on the performance prediction model used, as the accuracy of the predictions determines the reasonableness of the decisions
2. Several pavement performance prediction models have been proposed over the years. Many of these models are developed for application in a particular region or country under specific traffic and climatic conditions. Therefore they can not be directly applied in other countries or conditions
3. Although much research has been devoted to performance modelling of pavements, a comprehensive model that can predict pavement performance accurately has yet to be developed
4. The available models can be broadly classified into three groups; empirical, mechanistic-empirical and subjective models. Various empirical models are proposed for application at network and project levels. The mechanistic-empirical models are often developed in connection to design systems and therefore have not been widely applied in pavement management systems (PMS), but have the potential to be applied at a network level. The subjective models are mostly developed for strategic (investment) planning at the network level
5. Almost all Nordic countries use simple performance prediction models, based on linear extrapolation of historic data, in their pavement management systems. Denmark uses a slightly different approach in which pavement roughness is predicted as a function of pavement age using non-linear models (curves). Denmark and Sweden have implemented more advanced performance prediction models in their design systems. In Sweden research is underway to further develop the performance models in connection with development of a new design method known as "active design"
6. The simple models currently in use in PMS in Nordic countries are not suitable for prediction of pavement condition over long periods of time. Further, they can not be used for evaluation of the effect of different maintenance measures and material qualities. Thus there is a need for better performance prediction models for PMS applications
7. As the current trend is to move from purely empirical design methods to mechanistic-empirical methods, it is important to further develop performance prediction models that are suitable for these methods. Furthermore there is a need to evaluate the possibility of using the mechanistic-empirical models for prediction of the condition of the road network.

Thus, the review showed that there is a need to develop improved models for use both at the network level and the project level. In order to develop such improved models, it is recommended to take the following steps in the NordFoU project Pavement Performance Models.

1. Pool available data and resources. Development of performance prediction models require large amount of data on real pavements. There are test sections or reference sections in most of the Nordic countries for which data of various levels of detail are available. It is therefore important to pool these data to obtain a good basis for improvement of performance models
2. Use the available data from test sections, heavy vehicle simulator and other sources to evaluate existing performance prediction models
3. Select suitable models based on the evaluation and identify areas that need improvement
4. Improve the selected models especially with regard to climatic effects and studded tire use to make it suitable for Nordic conditions
5. Implement the improved models in each country
6. Agree on recommended test methods so that material evaluations can be conducted using the same procedure in each country
7. Agree on a uniform procedure for traffic data collection and processing.

Rabbira Garba Saba, NPRA, Norway

For more information: Contact Project Manager Rabbira Garba Saba, rabbira.saba@vegvesen.no

Start Walking – a Solution to Many Problems

We are witnessing increasing interest in non-motorised transport modes, mostly as a result of the disquiet about the negative side effects of car use. Owing to the increased traffic volumes, many cities are now facing serious problems in the fields of traffic safety, congestion and air pollution. Some of these problems can be eliminated if short car journeys are replaced by walking.

If people can be persuaded to leave the car at home and instead start walking regularly, this will have a favourable effect on both our planet and our quality of life. Research findings have shown that the attitudes to walking are generally positive, provided that conditions are right. One important factor is distance, since there are not so many of us who can visualise regularly walking long distances. Other factors that influence walking are comfort, traffic, the feeling of safety, security and aesthetic values. All-round programmes must therefore be used to persuade people to walk more, comprising a number of approaches ranging from improvements of the physical environment, via new social structures, to educational inputs.

PHOTO: PHOTODISC

Increased car ownership

Car ownership has seen a staggering increase over the past 50 years, and the negative impacts of the increased use of motorised transport are becoming very palpable. We have environmental problems such as air and water pollution, thinning of the ozone layer and noise. Vehicular traffic is also beginning to occupy increasing space in our cities – a lorry takes up 50 times as much space as a pedestrian.

Quality of life

Health and wellbeing are intimately connected with what we call "quality of life". This is a multidimensional concept and embraces social, mental and physical health, as well as the absence of stress, the capacity to deal with life, self confidence, happiness, physical strength and membership of a social network. An increasing number of research findings show that motorised transport has a negative effect on our physical and psychological health. Many are dying prematurely because of airborne pollutants from vehicles, and noise is also contributing to various forms of mental and physical ill-health. Infrastructure also impacts on our social networks – on a street with light traffic there is much more social contact among neighbours than on a street with intensive and heavy traffic.

PHOTO: PHOTOS.COM

Because of increased car ownership, people today are far more sedentary, and there are studies that show that more than 25 per cent of the Swedish population is passive today. Being in good physical condition not only helps to increase the quality of life but is also related to the actual length of life. Too little exercise and too much fat food often result in weight problems, with the risk of developing a number of diseases. Half a million people are estimated to be overweight in Sweden today. The problem due to obesity is so serious that the World Health Organisation (WHO) now describes it as the fastest growing epidemic in the world.

Walking as a means of transport

Over short distances, walking is the ideal form of movement and, if it is done regularly, also the most effective form of exercise. Some of the factors that influence walking are accessibility, comfort, heavy traffic, aesthetic values, safety and security.

If social and other services moved nearer to housing areas, more people would decide to walk. The trend for municipalities and cities to spread out over ever larger areas must therefore be broken, and unnecessary detours for pedestrians must be avoided. An attractive and contiguous infrastructure for pedestrians, with stops for public transport, should be the aim to make conditions more pleasant for pedestrians. There is no doubt that heavy traffic is a deterrent that discourages people from walking, and some forms of vehicle-free zones are therefore preferable.

Along with cyclists, pedestrians are the most vulnerable of all road users, and it is therefore essential that they should feel safe. Pedestrian underpasses and dark conditions are often found frightening, and street lighting in public places should therefore have high priority. Safe routes to school are also very important, since many people dare not let their children go to school on their own but take them by car, something that makes children more dependent and less active.

Aesthetically attractive environments enhance the perception of walking and in such a case the time aspect is of less importance; it is therefore important to place great value on aesthetic aspects in urban planning.

Action is needed

Increased use of motorised transport modes has had such negative effects, both on our external environment and our quality of life, that strong action should be taken without delay. Many of our activities that are preceded by planning, including the choice of transport mode, are of behavioural character. To promote a more environmentally friendly option, it is therefore essential that a better understanding is gained of how people arrive at decisions.

Magdalena Green, VTI, Sweden

For more information: Sonja Forward, sonja.forward@vti.se

Fuel Savings for Heavy-duty Vehicles

In 2003–2005 the Technical Research Centre of Finland (VTT) carried out an extensive research programme aimed at reducing the energy consumption of heavy-duty vehicles. The goal of the programme was to achieve a permanent fuel saving of 5–10 per cent. The results from 2003–2005 indicate that significant savings in fuel consumption can be achieved by a good number of independent technical improvements.

For heavy-duty vehicle operators, fuel is the second biggest cost item after drivers' wages. Transport companies are therefore highly motivated to achieve fuel savings. As fuel consumption is proportional to carbon dioxide emissions, authorities are also looking to save on fuel.

The programme brought together six research parties and some 20 sponsors in a successful cooperation. The research programme covered 12 technical sub-projects. The themes for the sub-projects were broken up into vehicle technology and transport system research. They included the specific fuel consumption of different types of vehicles, modelling the fuel consumption of vehicles, technical aids for drivers, minimising the rolling resistance of tires, the impact of the road surface on that resistance, lubricants, the influence of maintenance and after-market equipment on fuel consumption, transport business monitoring systems, intelligent driver aids, and automated load detection for trucks.

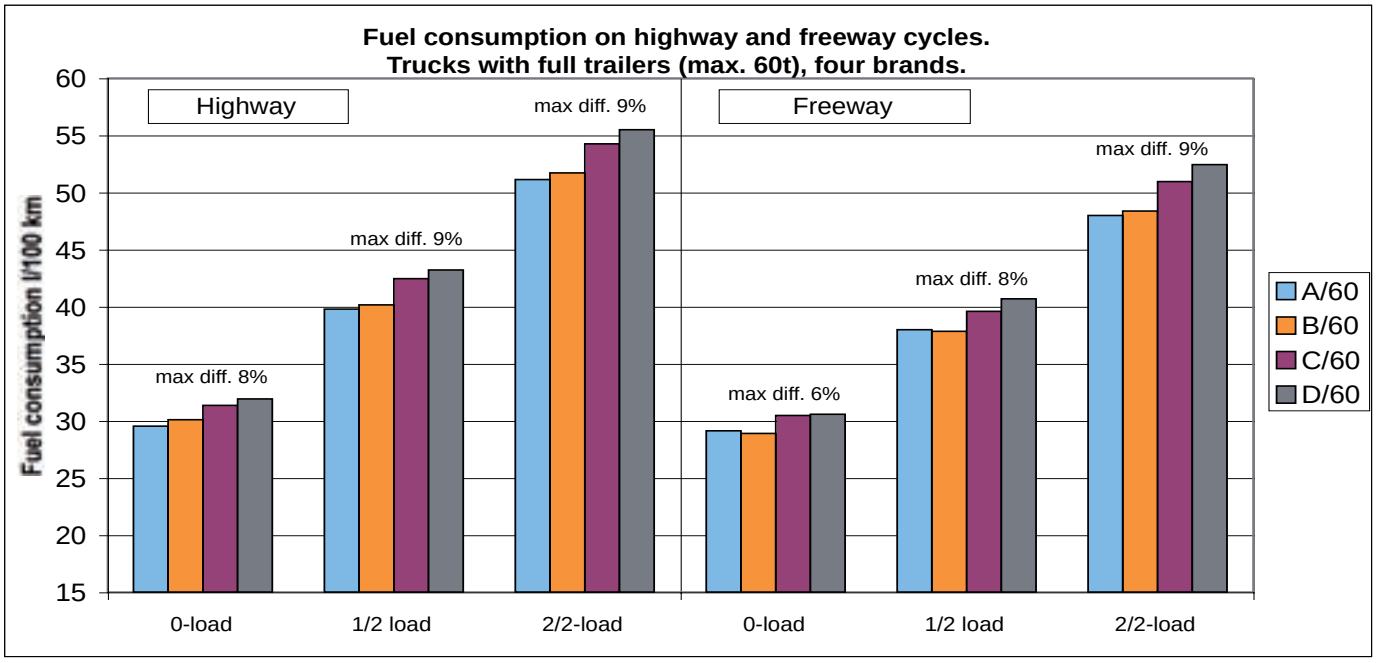
Excellent results

Significant savings in fuel consumption can be achieved by a good number of independent technical improvements. Some of the key findings regarding vehicles and vehicle technology are listed here:

- The vehicle should always be dimensioned based on actual usage-/capacity demand. An oversized vehicle consumes more fuel and increases expenses overall.
- Weight is one of the most essential factors affecting fuel consumption. The dead weight of trailers and vehicles should be minimised. An extra 1,000 kg in weight, either as dead weight or as load, adds some 0.7 l/100 km in fuel consumption for a truck-trailer combination during highway driving. During dynamic urban driving the comparable value for buses is some 2 l/100 km per 1,000 kg.
- The efficiency of the engine depends on the level of load, so that the efficiency is best at a rather high level of load. Therefore the principle for dimensioning the engine should be that the vehicle can cope reasonably with its normal tasks. An excess reservoir of power can easily add 5 per cent to fuel consumption.
- Manual transmission is clearly more efficient than traditional automatic transmission equipped with a torque converter. A robotised manual transmission could be a good compromise between fuel economy and comfort.
- Differences in fuel economy between different vehicle makes might be remarkable, even up to 10–15 per cent. The retailer should provide reliable data on typical fuel consumption values for the vehicle in l/100 km. The minimum specific consumption of the engine, given in g/kWh, does not in any way represent the fuel consumption of the whole vehicle. The actual fuel consumption is also affected by, among other things, the transmission and gear ratio, the mass of the vehicle and the aerodynamics.
- Attention should be paid to the vehicle's aerodynamics. An air deflector installed on the roof of the truck could reduce the fuel consumption by over 5 per cent.
- There are differences between tractive resistances of truck trailers. Based on preliminary results, a five-axle (single wheels) trailer travels more lightly than a four-axle (twin wheels) trailer. The fuel consumption of a combination with a five-axle trailer is roughly 5 per cent less than with a four-axle trailer. A semi-trailer truck of the same weight as a full trailer combination truck consumes less fuel.

Going forward

The research is continuing within the new "RASTU" research consortium. Naturally, this includes studies on reduced fuel consumption. Emission-focused activities for buses and trucks, previously carried out as separate tasks, have been merged into the new research group. In addition, the new project also covers safety issues such as the development of ITS applications for improved safety.



Difference in fuel consumption between the truck brands is significant - up to 9 per cent.

The objectives of the new project can be summarised as follows:

- To ascertain the true performance of new types of vehicles (Euro 4/5 certified vehicles, fuel efficiency and real-life exhaust emissions)
- To develop ITS technology to reduce energy consumption and improve safety and service levels for heavy-duty vehicles
- To make improvements in vehicle technology for reduced fuel consumption
- To verify measures to reduce fuel consumption and information transfer to transport companies, development of various monitoring systems, support for national energy saving programmes in the transport sector
- To establish interconnectedness between urban air quality (NO_2/PM) and new vehicle technology.

Information (in English) on both the 2003–2005 and the 2006–2008 programmes can be found at www.rastu.fi. For the 2003–2005 research project, a summary report in English has been produced (downloadable on the website).

Nils-Olof Nylund, TransEnergy Consulting, Finland

Contact: Nils-Olof Nylund, nils-olof.nylund@teconsunting.fi and Kimmo Erkkila, kimmo.erkkila@vtt.fi

PHOTO: VTT

VTT's facilities enable accurate full consumption and emission measurements of heavy vehicles by simulating driving in real-world conditions, testing the complete vehicle.

The infrastructure damages animals and nature

Title: Habitat fragmentation due to transportation infrastructure – COST 341 national state of the art report, Sweden.
Authors: Lennart Folkeson, VTI and Andreas Seiler
Series: R530A
Language: English with Swedish abstract
Contact: lennart.folkeson@vti.se

Biodiversity is decreasing in Europe. One of the most important causes of this is fragmentation of landscapes and biotopes. Many factors contribute to this fragmentation, but the transport infrastructure, primarily roads and railways, plays a major role.

The European transport network is expanding rapidly. More and more land is taken up by roads and railways. This destroys the habitats of wild animals and plants. Roads and railways are barriers which prevent the movement of animals and the spread of plants in the landscape. Fragmentation is a complex problem; ecosystems are split up into smaller units that are increasingly isolated. In addition, infrastructure in a landscape causes changes in local climatic conditions, the availability of food and growing conditions. Traffic also gives rise to contamination and increases the risk of accidents involving wildlife.

When new investments are made in infrastructure, roads and railways are to be located so that the ecological relationships in the landscape are maintained. If it is not possible to avoid susceptible areas, measures taken to adapt the infrastructure to the ecology can alleviate damage. Such a measure may be to construct ecoducts or other types of animal crossings. An ecoduct is an installation that enables animals to cross above or below a road or railway. Culverts and bridges must also be designed so that animals can move without interruption along the entire watercourse.


PHOTO: LENNART FOLKESON, VTI

This state-of-the-art report describes these and other measures to ensure that ecological relationships in nature are maintained. It also discusses ongoing research regarding the effects of landscape fragmentation, as well as planning approaches and methods.

Joint action against alcohol and drugs in traffic evaluated

Title: SMADIT – Joint Action against Alcohol and Drugs in Traffic. Evaluation of a trial scheme in Stockholm County, 2003–2005
Author: Susanne Gustafsson, VTI
Series: R555
Language: Swedish with English abstract
Contact: susanne.gustafsson@vti.se

SMADIT – Joint Action against Alcohol and Drugs in Traffic – is a collaborative project in Stockholm County involving the Swedish Road Administration, the Police Authority, Stockholm County Council, the Association of Local Authorities in Stockholm County, Stockholm City, the Swedish Prison and Probation Service, and the County Administrative Board. The aim of the project is to set up fast procedures so that drivers under the influence of alcohol or drugs who are resident in Stockholm County are offered, within 24 hours, a consultation regarding the chances of receiving treatment for alcohol or drug dependence. The offer of help is given at an early stage, in the knowledge that drivers who are apprehended by the police are much more ready to undergo treatment if the offer is made immediately after they have been caught. This model has been found successful in different areas of Sweden.

This report is an evaluation of the trial scheme in Stockholm County over the period 2003–2005. The trial scheme has been evaluated using statistics concerning the entire project, a questionnaire study and an interview study.


PHOTO: VTI/HEJDLÖSA BILDER

It is found from answers to the questionnaire and from interviews that almost all those who are taking part in the investigation have a positive attitude to SMADIT, both because of the concept and aims of the project, and because of the cooperation and involvement which the project engenders. There is however scope for improvement, for instance in relation to good and continuous information on the development of the project and in relation to the effect which SMADIT has on the work of the participants as regards their motivation, involvement and actions concerning the problem of alcohol and drugs in traffic.

Bus drivers' working environment

Title: Bus driver's working environment
Author: Selina Mård, VTI
Series: R557
Language: Swedish with english abstract
Contact: selina.mard@vti.se

Bus drivers have a sedentary occupation while their workplace is in constant motion. This places stringent demands on the workplace with regard to both the physical and the psychosocial working environment. In an attempt to improve conditions for bus drivers with respect to their working environment, VTI has collected the views of both bus drivers and their managers. Bus drivers themselves consider that there is still a lot of room for improvement as regards the driver's cab; a space which, for obvious reasons, must be as small as possible and, at the same time, comfortable, safe and functional. One example of what needs to be improved is the placing of the equipment for handling tickets. There is also a wish for greater access to information from meters, navigation systems and other equipment during the entire driving pass. Improvements to safety equipment such as access to belts, alarm buttons and surveillance cameras in the bus are however of particular importance. Most drivers do not regard threats and violence as a major problem, but would rather be safe than unsafe.

In a job that is characterised by prescribed running times and service schedules, it is important to pay attention to stress factors. The surrounding traffic environment such as road conditions, roadworks and road humps have a great effect on drivers' stress levels. Road humps are considered a problem both by the drivers themselves and also by their managers since the humps appreciably slow down bus traffic. This can cause difficulties in keeping to the prescribed running times. Passengers may not be in time for connecting traffic, and this also causes stress for the drivers. Bad road conditions, handling of tickets and service schedules are the factors generally considered by drivers to cause most stress in their work.


PHOTO: VTI/HEJDLÖSA BILDER

There is a lot to develop and improve with regard to bus drivers' working environment. In order to develop a working environment that is optimal for bus drivers, it is essential to create a consensus among all the players (drivers, employers, trade unions, researchers, bus manufacturers).

Measuring driving style and its possible safety effects

Title: Measuring driving style and its possible safety effects
Authors: Virpi Anttila, Riikka Rajamäki, Harri Peltola and Mikko Kallio
Series: AINO publications 38/2006
Language: Finnish with English abstract
Available on http://www.aino.info/julkaisut/4_kuljtuki/aino38_2006.pdf

The main aim of this research was to study the possibility of measuring driving style in normal traffic in order to define driver-specific driving style with safety related measures. This was done by measuring the speed and accelerations of four taxi vehicles in normal traffic over seven months in the Helsinki area. In the project, some relevant, easily measurable safety measures such as speeding and sudden braking called jerk (often related to near-accident situations) were used when defining and comparing the driving styles. In addition, the suitability of the system as a basis for feedback on speeding was studied.


PHOTO: VTI/HEJDLÖSA BILDER

The results suggest that there are clear differences in driving style between drivers. Drivers speeding more often also had near-accident related jerks, but also strong braking, more often than average drivers did in the same company and vehicle. These drivers often drove during the evening and at night. In general, the percentage of near-accident related jerks was clearly higher at night than in daytime. The results also suggest that an employer is pretty well aware of which drivers have low-risk driving styles, but has difficulty separating between average and risky-style drivers. Therefore measuring and recording driving styles could form a strong basis for a company's driver feedback, training and rewarding (bonus system). Development of driving style measurement will also be important in the future. In addition, measuring driving style (location-based speeding and jerks) would offer valuable information for both public traffic planning and monitoring.

Near-accident related jerks were found to be very interesting measurements. The jerks occurred in normal traffic even more often than expected, and they could give valuable additional information not only regarding individual drivers, but also in relation to traffic research and planning. Future work describing actual traffic situations related to jerks will be very important and could open new possibilities in the field of traffic behaviour.

Medium-sized public transport city of the future

Title: Medium-sized public transport city of the future
Authors: Marja Rosenberg, VTT, and Henriika Weiste, Liidea Oy
Series: Publications of the Ministry of Transport and communications 4/2007
Language: Finnish with English abstract
Available on www.mintc.fi/oliver/upl580-LVM0407.pdf

The aim of the study was to draft a vision of a future medium-sized public transport city, and form strategies to achieve it. One of the starting points of the study was to prepare a national application of the proposed new EU regulation on public passenger transport services. Although the review was done nationally, the medium-sized cities of Oulu, Jyväskylä and Kuopio served as examples. The research methods used were workshops and expert interviews in the core cities.

The long-term vision of a future medium-sized public transport city is derived from the views of passengers, operators, service providers, the economy, cooperation and traffic management. The public transport city of the future will be an active city that offers good quality public transport services for both citizens and business life. It needs the long-term cooperation of all stakeholders in the city area, municipalities, public transport operators and other actors in different fields to achieve this goal.

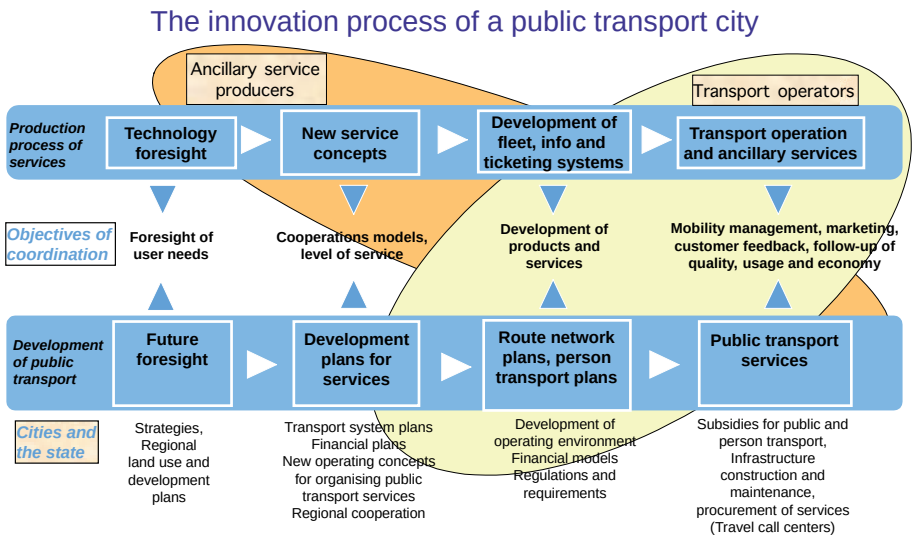
To fulfil the vision at national level we need concrete strategic decisions and new funding schemes. At county and municipality level we need new concepts for organising public transport planning, development and management processes. In addition, we need to adopt a new procedure for land use and transport decision-making that is based on evaluation against the criteria of the new public transport strategy. From the cities' side continuous cooperation with all parties involved is required as well as financial investments. It is the responsibility of the cities, together with the surrounding municipalities, to guarantee an innovative operational environment for public transport operators and other suppliers so they can concentrate on efficient production of present services and development of new service concepts.

In a medium-sized city, a comprehensive way of thinking, new ideas and measures, and general good-will are needed to further develop the public transport system and improve its competitiveness against the car. The renewal process must be based on commonly approved targets and extensive development work to achieve those targets. At national level the most challenging need for change is the reorganisation of funding and management of the public transport and other passenger transport systems. The financing system should be transparent, uniform and simple. There should also be a follow-up system for the impacts of finance. Finance should be used to ensure basic services but also to motivate target-oriented development of the public transport services.

A common, responsible authority managing the public passenger transport and other passenger transport systems should be established. According to the alternatives presented in the study, this authority could be an office either within the central city of cooperation, federation of municipalities, or the county. Fundamentally, this authority should manage all passenger transport in the area, not only public transport, and adequate resources should be ensured.

Further research is needed on new financing and organisation models, and issues concerning alternatives, requirements and impacts related to competitive tendering for public service contracts.

A medium-sized public transport city will promote a car-free urban lifestyle. Rather than the car holding the dominant position, the public transport city will be developed on conditions set by its inhabitants and directed by its cultural life and tourism. Its vitality will be derived from creative cooperation between people, culture and commerce.



The innovation process of a public transport city.

Noise reducing thin pavements – urban roads

Authors: Sigurd Thomsen, Hans Bendtsen and Bent Andersen
Series: Report 149
Language: English
Available on: www.vejdirektoratet.dk/publikationer/Vlrap149/index.htm

Thin pavements optimised for noise reduction are being developed as a promising tool for noise abatement. The Danish Road Institute (DRI) and Road and Hydraulic Engineering Institute in the Netherlands (DWW) are cooperating on the DRI-DWW noise abatement programme. A test section with six types of thin layers including a reference pavement was established on a Danish highway in 2004. The purpose of this experiment is to document the noise reducing effect, and on the long term the acoustical and the structural lifetime. Noise measurements were performed according to the international standard ISO 11819-1 characterizing road surface influence on traffic noise, the so called SPB method, when the pavements were a few months old and one year old. Furthermore, a series of CPX measurements were performed in year 0. To describe the surface texture detailed texture measurements has been performed by laser equipment. The friction has also been measured. The noise increased 0 to 1 dB from year 0 to 1. At the reference pavement there was no increase. Relative to the reference there was a noise reduction for the thin layers of 1 to 3 dB in both years. The tendency was a slightly lower noise reduction in year 1. The uncertainty for the SPB measurements was 0.4 dB.

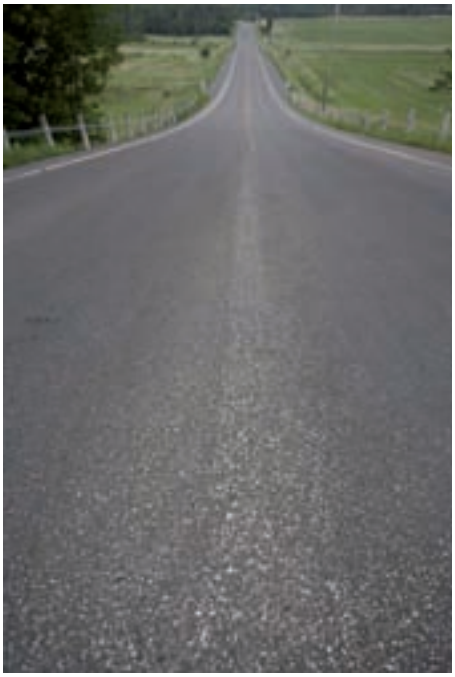


PHOTO: PHOTOS.COM

Acoustic performance – low noise road pavements

Authors: Bent Andersen, Jørgen Kragh and Hans Bendtsen
Series: Technical note 44
Language: English
Available on: www.vejdirektoratet.dk/publikationer/Vlnote044/index.htm

The report on the acoustic performance of low noise road pavements has been produced by the Danish Road Institute/Road Directorate as a part of the EU project SILVIA, a collaborative RTD project supported by the European Commission under its Competitive and Sustainable Growth (GROWTH) programme. Results from noise measurements in different European countries have been collected from partners of the SILVIA project and analysed in order to establish typical average vehicle noise levels for different pavement types used in Europe with a special focus on the low noise solutions.

Noise levels at surfaces like hot rolled asphalt (HRA), cement concrete (CC) or burlap structured cement concrete (CCb) and surface dressing (SD) tend to be 2 or 3 dB higher than noise levels at average dense asphalt concrete (DAC) or stone mastic asphalt (SMA).

On the other hand, noise levels at thin-surface layers (TSF) tend to be 3 dB lower for cars and 1 dB lower for heavy vehicles than at average DAC/SMA. Porous pavements on the average yield noise reductions of 3 or 4 dB. The potential noise reduction as reflected by the lowest noise levels measured for a family of pavements is of 5–10 dB for thin-layer surfaces and porous asphalt. Also burlap structured cement concrete (CCb) and cement concrete with exposed aggregate (EACC) occasionally could be seen to provide noise reduction of 3 dB.

NORDIC

SWEDEN

VTI
Sandra Johansson
SE-581 95 Linköping
Phone +46 13 20 42 26
Fax +46 13 14 14 36
Orderphone +46 13 20 42 69
Email nordic@vti.se
Web www.vti.se

DENMARK

Danish Road Institute
Helen Hasz-Singh
Guldalderen 12
DK-2640 Hedehusene
Phone +45 72 44 70 00
Fax +45 72 44 71 05
Email hhz@vd.dk
Web www.roaddirectorate.dk

FINLAND

VTT Technical Research Centre of Finland
Kari Mäkelä
P.O.Box 1000
FI-02044 VTT
Phone +358 20 722 4586
Fax +358 20 722 7056
Email kari.makela@vtt.fi
Web www.vtt.fi

ICELAND

Icelandic Road Administration
G. Pétur Matthiasson
Borgartún 7
IS-105 Reykjavik
Phone +354 522 1000
Fax +354 522 1009
Email gpm@vegagerdin.is
Web www.vegagerdin.is

NORWAY

Institute of Transport Economics
Nils Fearnley
Gaustadalléen 21
NO-0349 Oslo
Phone +47 22 57 38 00
Fax +47 22 60 92 00
Email toi@toi.no
Web www.toi.no

NORWAY

Norwegian Public Roads Administration
Thorbjørn Chr. Risan
P.O. Box 8142 Dep
NO-0033 Oslo
Phone +47 22 07 35 00
Fax +47 22 07 37 68
Email thorbjorn.risan@vegvesen.no
Web www.vegvesen.no

Questions
concerning the content of the articles, or orders for the publications referred to, should be directed to the publishing institution, see addressed above.

Requests
for back issues, and notification of address changes. Readers outside the Nordic countries: see Swedish address. Readers in the Nordic countries: see adresses above.

Web
www.vti.se/nordic