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Walking for life

Norway forms a new national strategy

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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.

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Noise from Electric Vehicles

A 'state-of-the-art' literature survey

As a part of the COMPETT project about electric vehicles and the promotion of the use of these, an international 'state-of-the-art' literature survey on noise has been done. It investigated how much is already known about the noise from electric vehicles and discovered where more research is needed.

The findings in the literature survey show, that there is a potential for noise reduction by replacement of ICE (internal combustion engine) vehicles with electric vehicles. But the finding also shows that there is a great deal of uncertainty about how large this potential is. The reductions of noise found in the references differ greatly and seem to depend very much on how the comparison between noise from ICE vehicles and electric vehicles is done. Most references do however find that it is only at low speeds that a noise reduction can be expected.

The report is concluded with recommendations for how future measurements of noise from electric vehicles could be performed and what aspects of this noise need further investigations. In the next step (in the noise investigations in the COMPETT project) measurements of the noise from electric vehicles will be carried out.

Text: Lykke Møller Iversen

COMPETT: Competitive Electric Town Transport.

Read the report on www.compett.org/results.html

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New EU Project on Automated Driving

PhD students will carry out research on prerequisites, design and driver conduct

A new PhD project in the EU's Marie Curie Programme will investigate the human factors and road safety in the sphere of automated driving. VTI is a project partner and will employ two PhD students with particular expertise in the sphere of cognitive science.

The research project has received financial support from the EU Marie Curie Programme and has been created by a total of seven involved partners*. The research will focus on highly automated driving, i.e. when the direction and speed of the vehicle is taken care of without the person at the wheel having to monitor the system continuously. One of the project's aims is to train and bring together people from different disciplines, for example, psychologists and engineers and to build bridges between the academic world and the vehicle industry.

The interface, an area of research

Altogether 14 PhD students will be employed in the projects, two of whom will be recruited by VTI. VTI's PhD students will focus on the actual interface for automated vehicles but also on driver conduct and the fact that people differ from one another and use and perceive the systems in different ways. Many of the other 12 areas are focused on human factors but one area will be the legal aspects of automation.

Focus on international exchanges

According to the design of the Marie Curie programme, the PhD students should not come from the country where they are employed, the aim being to promote the creation of an international network. The PhD students from the different countries will have a continuous exchange of information with one another during the project as well as visiting and working together with the project partners to obtain broad and applicable knowledge on vehicle innovation and automation. The project was initiated in September 2013 and will continue until August 2017. At present, VTI is focusing its efforts on finding the right people for its PhD fellowships.

*The main partners involved in the project are TU Delft, TUM, SOTON, Chalmers, UTwente, IFSTTAR and VTI.

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High Educated Middle Aged Men Are Early Adopters of Electric Vehicles

Early adopters of electric vehicles (EVs) are middle aged, between 30 and 50 years of age; a majority are men, they have high education and income, live in the vicinity of cities and belong to households with more than one car.

This is according to a literature review carried out by Institute of Transport Economics as a part of the Competitive Electric Town Transport project (COMPETT) funded by ERA-net transport.

Early adopters of hybrid EVs are also men, but in the age range 50-60 years.

Studies of early adopters of electric vehicles indicate a large number of common socio-demographic characteristics across countries. Travelling from one's home to place of work is the most often cited reason for using EVs in most countries. Some studies show that EV drivers are, for the most part, former public transport commuters.

The EV is used by commuters mostly as a complement to the conventional car, especially in Norway where favourable incentives include: no VAT, free parking, permitted driving in bus lanes, free driving on toll roads, reduced annual road tax and reduced tax on company cars.

Adjustments drivers have to make when driving an EV include better planning of journeys – due to battery limitations – and adoption of a smooth (non-erratic) driving style. Motives behind the purchase are the special regulatory advantages (such as in Norway), environmental considerations, lower operation costs and simply the convenience and fun it is to drive these vehicles.

Since electric vehicles are a relatively new technology under continuous development and with greatly reduced greenhouse gas emissions, studies have been carried out to evaluate the potential ownership and to promote initiatives that would increase their number on the roads. The methods and data used to calculate or evaluate this potential are very different, and so the results cannot be compared directly, although in Paris and Birmingham a potential of about 10 percent has been estimated.

In the USA (California), the share of owners who could recharge at home has been estimated at about one-third. Surveys of people's interest in buying an EV also vary between countries, i.e. between those with and without knowledge of the technology and survey method.

Photo: Michael Wøhlk Jæger Sørensen

From the electric vehicle parade in Oslo in September 2013.

Reduced taxes, other benefits (parking), appreciated convenience over public transport and environmental benefits were areas of interest. Knowledge of the technology and practical experience of driving an EV are likely to raise one's interest in buying.

Attitudes towards and perception of EVs, both positive and negative, vary by experience, knowledge and the everyday context. In many of the surveys and studies of people's opinions of different aspects of EVs, there is little or no information about the respondent's level of knowledge and experience.

Two negative aspects of the EV mentioned in many studies are: range and battery charging. "Range anxiety", i.e. the fear of being stranded due to a depleted battery, is not uncommon. Size, price, security and distrust of the technology are also mentioned as negative factors. Praiseworthy aspects of the EV found in several studies are that it is environmentally friendly, easy to park, low on noise, is well regarded and economically advantageous

Text: Randi Hjorthol

Report: Electric Vehicles – a review of literature. TØI Report 1261/2013. Author: Randi Hjorthol
Full report in English: http://bit.ly/attitudeevs

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Photo: Risto Kulmala

The Effect of Traffic Management on Road, Railway and Maritime Traffic

The effects of some road traffic management practices are fairly well known, whereas few studies have been conducted on the effects of other traffic management practices. Most evaluations merely cover the safety effects of different systems and services.

The aim of traffic management is to improve the safety and fluency of traffic, to cut emissions, and to exploit the existing capacity more efficiently. The main aim of this study was to investigate current knowledge on the effectiveness of traffic management, especially on safety but also on the fluency of traffic, the environment such as CO_2 emissions, and energy consumption.

This study covered road, railway and maritime traffic. Only traffic management practices considered relevant to Finnish circumstances were considered; thus only the relevant results are presented here. The main research method used was literature review. Additionally, two group discussions (one on railway traffic and one on maritime traffic) were conducted.

Not a lot of information is available on the effects of traffic management on safety, fluency and environment in railway traffic. The only exception is the management of encounters between railway and road traffic. The research in this field chiefly includes studies on the safety effects of measures implemented for level crossings.

Few if any quantitative results can be found on the effects of traffic management practices on maritime traffic. The results of available studies vary significantly and are mostly based on risk analysis conducted prior to the implementation of specific traffic management practices. International studies cannot be directly applied to Finland because of differences in the operational environment and prevalent circumstances.

The obtained results are presented in this publication by transport mode. In addition, some recommendations and proposals for future study are suggested; however, this is not prioritised by the authors since the final selection of future studies should be evaluated and decided by the relevant authorities.

Text: Anna Schirokoff

Full report with English summary:
VTT Technology 111 http://bit.ly/vtt111

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Blue Spot Analysis

A key element in climate adaptation of major Danish roads

In Denmark, climate change entails an altered precipitation pattern with more frequent and extreme rainfall. Such occurrences can cause floods on road sections compromising safety and passability. Therefore, a model is developed at the Danish Road Directorate to map risk areas in the pursuit of a proactive climate change strategy.

Photo: Hans Bendtsen

A recent flood on a main road in Copenhagen causing a total traffic stop.

In the pursuit of fulfilling the top-listed strategy of the Danish Road Directorate in achieving the highest degree of climate adaptation by the allocated resources, the Blue Spot analysis is valued a central agent. The result of the Blue Spot analysis enables a proactive approach to prepare for the impacts of climate change and sustain road safety and passability.

Predictions in climate change

The first and foremost task of the Danish Road Directorate, as a road owner and manager, is to maintain constant road safety and passability. Predictions in climate change, particularly within the foretold increase in extreme rainfall intensity and frequency, constitute a need for proactivity and adaptation for road owners, especially in order to prevent increasing flooding occurrences.

Therefore, a method to assess flooding risks is developed in the Danish Road Directorate to pinpoint sections of the Danish national road network which are particularly vulnerable to an increase in heavy rainfall. In a combination with consequence evaluations of given flooding, these sections are termed Blue Spots.

The former is chiefly determined by precipitation return patterns and the latter is primarily quantified by socioeconomic factors, such as safety, traffic management systems, and most imperatively; traffic intensity.

The GIS model

On a more technical note, the Blue Spot-mapping is generated in a GIS-model employing various input-data. The model is comprised of three levels; initially, level 1 provides a screening of all terrain depressions which are computed based on a hydrologically adapted digital terrain model. Hereafter, level 2 produces a risk map by incorporating the amount of rainfall needed to fill a given depression alongside the integration of the imperviousness of the catchment area. Lastly, level 3 couples terrain characteristics with drainage system specifications in order to determine depths and retention time of a flooding scenario.

Blue Spots are defined as: Identified stretches of roads where the likelihood of flooding is relatively high and consequences hereof are significant

Furthermore, an important aspect of level three is the incorporation of climate factors, in terms of changing precipitation pattern, to enable model outcomes from the present time and from the year 2050 and 2100.

Hence, the model is able to identify Blue Spots in 2100 which may not exist in present day identifications due to the forecasted increase in extreme precipitation scenarios embedded in climate factors. By the knowledge of both current and future challenges associated with flooded road sections, cost benefit analyses can be conducted on the basis hereof which enables the Danish Road Directorate to streamline climate strategies.

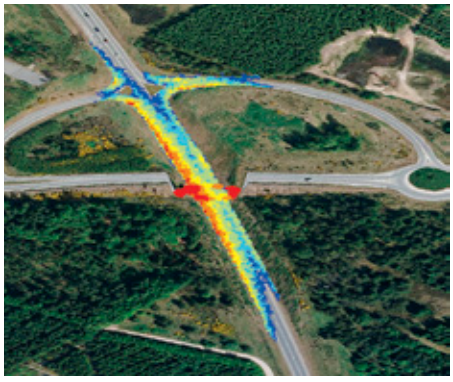

Figure of an identified Blue Spot with color scheme representing depth of the flood.

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Illustration: Norwegian Public Roads Administration

Norwegian Coastal Highway Route E39

The Norwegian Coastal Highway Route E39 Feasibility Study project is commissioned by the Ministry of Transport and Communications. This project has since April 2011 been investigating the potential for trade and industry, regional employment and settlement patterns of eliminating all ferries along the western corridor (E39) between Kristiansand and Trondheim. Further, this project is exploring the technology required for the remaining fjord crossings, and will also consider how the road and bridge infrastructure can be utilised to generate power from solar energy, currents, waves and wind. Implementation strategies and suitable types of contracts are also included in the studies.

The very deep, wide and long Sognefjord has been used as a pilot site for developing and customising crossing technologies. Studies have confirmed the feasibility of crossing the fjord with either a suspension bridge with a main span of 3,700 m, a floating bridge or a submerged floating tunnel.

The following link will take you to a video animation that shows the technical options:

http://bit.ly/roadE39

There is much suppressed north-south bound traffic along the corridor, resulting in many vehicles using substantially longer routes with lower direct costs in order to avoid the ferry links and narrow roads along the E39 itself. As a "game changing" project it will significantly change traffic patterns in Western Norway, making the E39 the shortest and most attractive western north-south route. A reduction of travel time in the corridor from Kristiansand to Trondheim from the current 20 hours to some 11-12 hours will result in direct transport cost savings of about 1 billion Euros per year. But the most interesting effects seem to be the long term structural and productivity increases coming from new and enlarged residential and employment areas. Further studies have been commissioned for impacts on the national and regional economy, and on the value of traditional exports.

Studies have revealed that bridge-related installations for producing power from renewable energy sources looks interesting, particularly related to dry conditions installations in the pontoons of floating bridges. An implementation period of some 20 years including planning is considered possible, provided some changes in the current planning and contracting system.

The Government's National Transport Plan for the next period (2014-2023) launched in April 2013, proposed the project implemented at a cost of 20 billion Euros over 20 years for completely upgrading the corridor to a modern standard without any ferry connections. The proposal passed the Stortinget on Tuesday 18th of June, and even though there are some different opinions related to financing options, a large political majority is in favour of the project.

Within the cost frame of 20 billion Euros, about half is for the fjord crossings and the other half is for upgrading the roads in between.

The E39 project was among other challenging projects in the world presented at the Strait Crossings 2013 symposium in Bergen 16th-19th of June, attended by about 250 participants from 27 countries.

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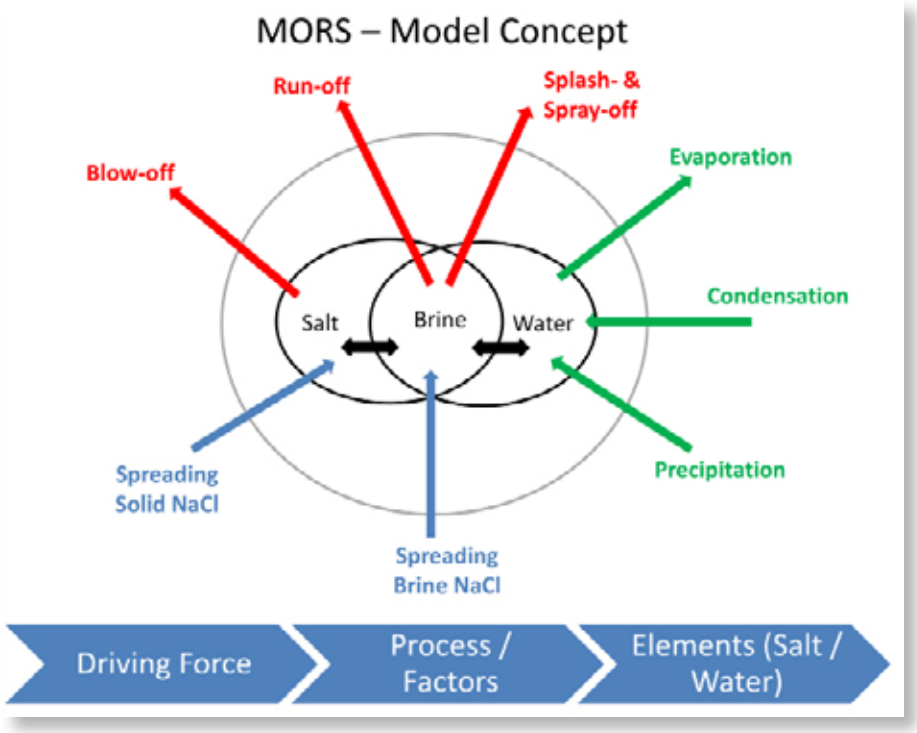

Figure 1 MORS - Model Concept (Source: Skuli Thordarson).

The purpose is to develop a model for residual salt to be implemented. The model will be capable of calculating the residual salt in real time or predicting the development of residual salt on the road after spreading, by taking traffic, road and weather parameters into consideration.

DEFINING THE CONCEPTUAL MODEL

Once the salt is spread on a road, it is influenced by many processes and factors. Figure 1 shows a principal sketch of a model describing the processes.

The model assumes that there might be mass in the form of three elements on road:

1. Water
2. Brine
3. Undissolved salt.

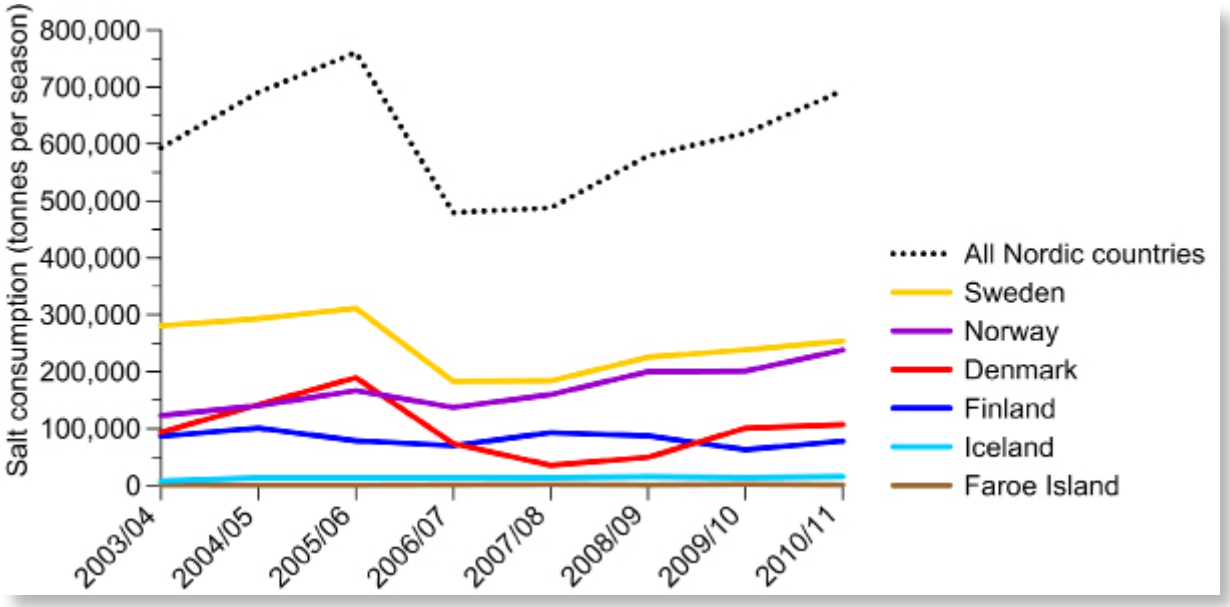

Table 1 Annual salt consumption in the Nordic countries - Source: Winter service in the Nordic countries in 2011.

Researches Residual Salt

The following processes are identified that may bring mass in and out of the system:

1. Spread of dry salt
2. Spread of brine
3. Blow-off
4. Run-off
5. Splash + spray-off
6. Evaporation of liquid
7. Condensation of moisture
8. Precipitation in the form of rain, sleet or snow

In addition, two processes have been identified which change the mass of the various types of elements within the system, i.e. the water, brine or undissolved salt:

9. Dissolution
10. Crystallization

The project team has identified all the factors and are well known with all the processes occurring on road surface.

BENEFITS OF RESIDUAL SALT MODEL

When the researchers succeed in finding a solid model of residual salt amount after a given time or traffic crossing, the possibilities are considerable excessive, including reducing pollution along the road, financial gain and effective workflow for winter crew.

ENVIRONMENTAL CONDITIONS

In season 2010/11, the salt consumption on the Nordic roads was over 690,000 tonnes. The amounts vary depending on winter's harshness. Previous environmental assessments have concluded that large quantities of the salt ends up in verges. Part of the salt also adheres to vehicles and surrounding structures such as bridges, besides being very harmful to the environment.

Furthermore, road salt cause increased chloride concentration in groundwater.

The same studies, also confirmed by the transport sector, indicate that road salt is very aggressive against constructions, and in particular, corrosive safety features of vehicles such as the braking system. Knowledge of the "residual salt" will help winter crew to salt only where it is needed.

ECONOMIC BENEFITS

Road salt is traded today to a market of approx. 55-65 €/tonnes (source: Danish Road Directorate). The price is virtually the same on the Nordic market. Using table 1, the Nordic road authorities uses somewhere between 34-40 M€/year on road salt.

An estimate by Danish Road Directorate reveals that a callout for preventive salting on Danish roads will cost road authorities about 533 K€. In Denmark, the average call-outs/year is about 100. Multiply with the cost of salting, this summing up to 53 M€/year nationwide. The amount is in addition to costs associated with operation and maintenance of equipment and crew.

It is obvious that if the parameter "residual salt amount" can help winter crew to prevent even one single salting, thus the society has saved 533 K€.

The project MORS II will continue in the second period during 2013-2015.

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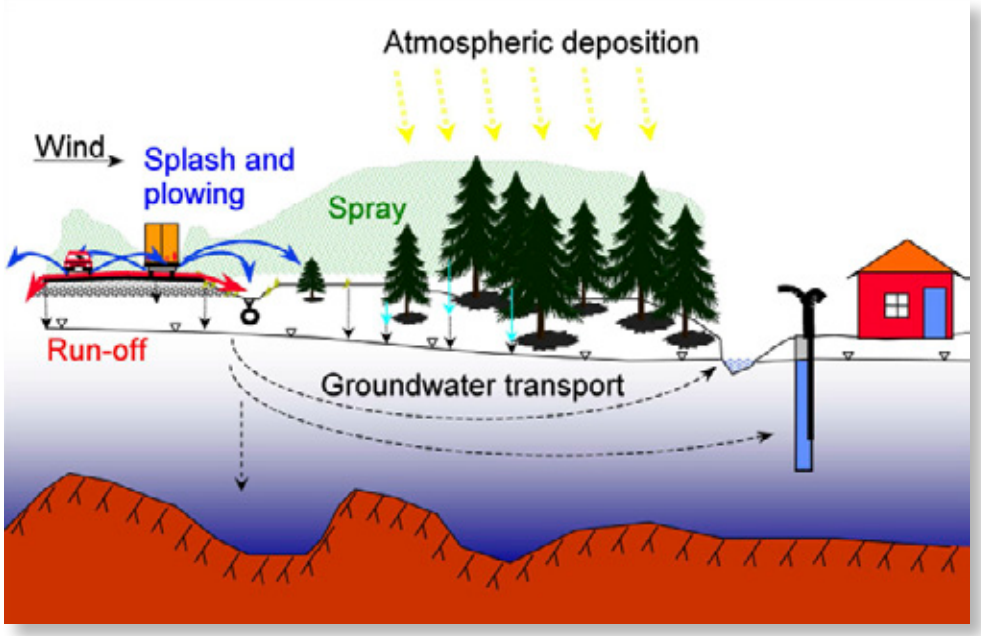

Figure 2 Road salts cycle in nature along the road network - source: VTI.

Photo: Hans Bendtsen

Danish Road Directorate performing texture measurements at the PERS surface at the Arnakke test site.

Poroelastic Road Surface – a Pilot Test Section at Arnakke in Denmark

The PERSUADE project aims at developing the experimental concept of poroelastic road surfacing (PERS) into a feasible noise-abatement measure as an alternative to, for example, noise barriers.

The project comprises an extensive investigation and testing in the laboratory to develop a durable mixture, the construction of seven test sections in five partner countries, a monitoring effort for the test sections (noise, rolling resistance, skid resistance, durability, winter behaviour, etc.), and a study of all conceivable environmental and economic aspects. The laboratory development is led by VTI in Sweden. The project has been scheduled for a duration of six years.

The Arnakke test site – Denmark

A small size field test of the PERS material, called test "zero", was carried out in October 2011 preceding the construction of full scale test sections. A 10 m^2 test section was constructed by the project partner NCC Roads. It is situated at the Arnakke rest area located alongside the Holbæk motorway in Denmark, about 60 km west of Copenhagen. The test site consists of a ramp from a parking area for passenger cars only. The ramp leads the traffic to the motorway. The traffic volume and the driving speed (typically 30 km/h) are low.

The purpose of this "zero test" was to:

- gain experience with mixing and laying the PERS material outside the laboratory on a real road
- monitor the performance of the surface during a winter period and see its behavior with frost, snow and ice
- obtain a first indication of the durability of the developed PERS mix
- assess skidding resistance, permeability, acoustical absorption, texture, mechanical impedance, surface temperature and drainability.

A small mixer for cement concrete and a short mixing time of 3 minutes were used when the PERS surface was constructed.

Results

Drainability, absorption, texture and mechanical impedance measurements on the zero test track all indicate that the developed PERS mix has a good potential for noise reduction. However, sometime after the construction mushroom shaped bumps appeared on the PERS surface and at the edge of the test track a pothole started to develop.

Close examination by the PERSUADE team revealed that the bumps were caused by pockets of uncured polyurethane, due to an insufficient mixing and a subsequent reaction with rainwater. The pothole can be attributed to the heterogeneous mixture as well.

An important lesson drawn from this test track in Arnakke is that the mixing is crucial and has to be carried out thoroughly. A very positive result was that PERS does not compromise safety: both the skidding resistance measurements with the VTI developed "portable friction tester" and with the classical skidding resistance tester (SRT) pendulum yielded higher values than the ones measured on the existing asphalt pavement on the Arnakke site.

Text: Hans Bendtsen, Erik Olesen

PERSUADE is the acronym for PoroElastic Road SUrface: an innovation to Avoid Damage to the Environment. The work presented in this article is financed by the European commission as well as by the concerned Danish, Swedish and French PERSUADE partners.
Twelve partners from eight European countries are cooperating in this project, including research institutes, universities and companies representing the involved industry sectors. The three partners from the Nordic countries are the Danish Road Directorate, VTI in Sweden and NCC Roads in Denmark. See also the PERSUADE website at http://persuade.fehrl.org
More information can be found in the report on the PERSUADE homepage: Bendtsen, Olesen, Pigasse, Andersen, Raaberg, Kalman and Cesbron "Measurements at the Arnakke test site with small PERS sections". Persuade Report 2012.

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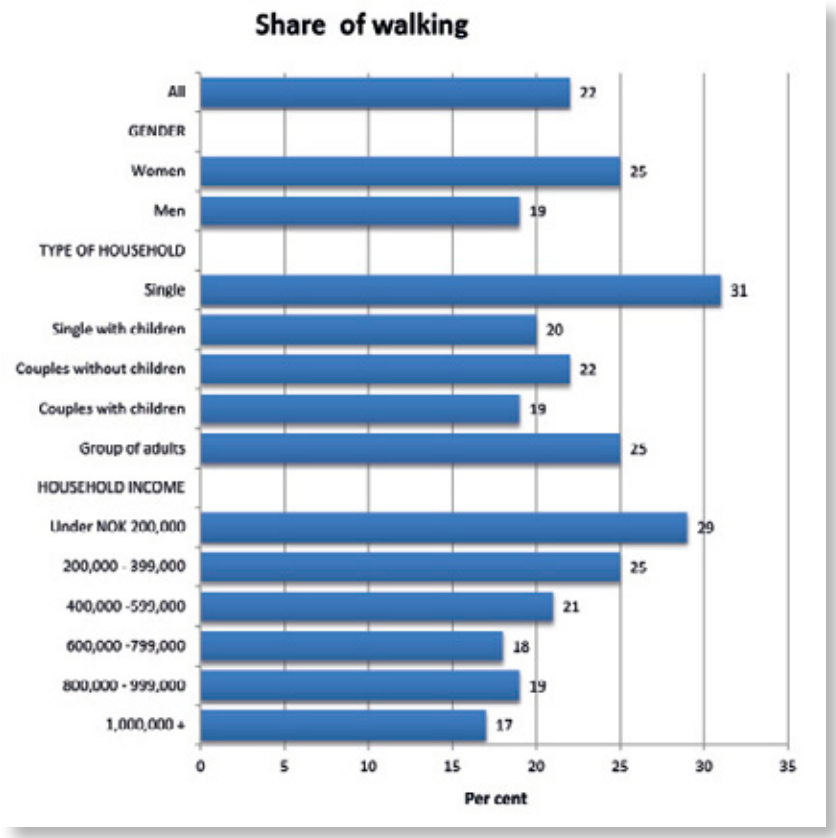
Walking for Life

"Walking for life" is the slogan for the National Walking Strategy that is now being formulated in Norway. The main idea is to get more people to leave their cars at home, and instead use their feet to reach their destination.

The Norwegian Public Roads Administration (NPRA) was commissioned by the Norwegian Government through the previous National Transport Plan to produce a National Walking Strategy. All the regions of the NPRA have been involved in this work, along with representatives from the Directorate of Health and some selected towns and county authorities.

The strategy has two main objectives:

- Walking should appeal to everyone.
  This objective implies that all population groups should find walking appealing, and that it is made easier for them to walk more on a daily basis.
- More people should walk more.
  This objective implies that more of the total journeys made by the inhabitants should be made on foot, and that all population groups should walk more on a daily basis.



Illustration/Tabular picture: Guro Berge

Percentage of traveling on foot from the start point to end point in different population groups. Source: 2009 Norwegian Travel Survey, Brechan and Vågane et al (2011).

Arguments for the strategy

There are many arguments in favour of making it appealing to walk, and for getting more people to walk more. For example, it is good for the climate that more people leave their cars at home in favour of walking or using public transport. In terms of air quality and noise, this is also good for the local community. Where there are more walkers, there is also more social control, and this in turn contributes to creating safe and attractive local communities where more people want to live and spend time. The presence of many people in an area also makes it attractive for businesses to set up there. We as consumers want safe and visually appealing shopping areas, preferably within walking distance of our homes. If we are able to provide such areas with workplaces as well as residential housing, there will be people there both in the daytime and evening.

Design of physical surroundings

The objective is to develop the structures of urban and built-up areas to make them more suitable for walking, to build attractive surroundings based upon the requirements and needs of pedestrians, and to develop coherent and closely interwoven pedestrian networks with an emphasis on accessibility, safety, attractiveness and universal design. In order to achieve this, public authorities must ensure that pedestrians are given adequate priority in national guidelines for land and transport planning and in the design of infrastructure and traffic installations.

An active walking culture

There is a need to acquire more knowledge about pedestrians and develop better tools and methods to make provision for them. And even if these provisions are made, it is not self-evident that more people will walk. We must influence people directly to walk more. The aim is to raise the status of walking as a form of transport and physical activity. The NPRA will draw up a national communication strategy for a more active walking culture and encourage the implementation of local actions and measures to influence different population groups.

Local walking strategies

In order to succeed, the public authorities are dependent on the implementation of local walking strategies or other types of comprehensive efforts on behalf of pedestrians locally. In addition to working to influence local walking culture, the framework conditions for pedestrians must be addressed: land development, the infrastructure, the surrounding environment, operation and maintenance, and the interplay between pedestrians and other road users.

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Finding Success Factors for Transport Corridor Management Structure

The Bothnian corridor is a strategically important link for freight transport connecting Finland and Sweden to Norway, Russia and Northern Central Europe. The Bothnian Green Logistic Corridor project, part-financed by the EU, aims at developing the corridor towards a more efficient, sustainable and cost effective logistical system. This includes establishing a strategy with a corridor management structure.

VTT conducted a study on transport corridor management structure for Luleå University of Technology, Sweden, representing the Bothnian Green Logistic Corridor project. The study was based on a literature review of previous research projects of the project group, on a case study on the Brenner Corridor management structure and a Green Transport Corridor Management Workshop. As a result examples from other countries and projects, ideas and success factors related to corridor management structure were presented.

Photo: BGLC

Success factors

Successful corridor management structure requires agreements that set up clear targets, roles and responsibilities of different actors and stakeholders. Also key performance indicators or service level agreements may be used in a business driven corridor development.

Relevant stakeholders and committed individuals are in the key role regarding the implementation of the targets. Public-lead geographical-based transport corridors usually have infrastructure managers, regional, national and EU-level actors involved. Academia/consultants may be involved for conducting analysis and research projects. On a business based corridor, railway undertakings, combined/intermodal transport operators and terminal operators are the main actors. Sometimes industrial lobbies are initiating corridor development projects.

For the implementation of the plans, regular meetings and follow-ups are needed for all the stakeholders, as well as for different working groups, advisory boards, or task forces. A comprehensive management structure could include for example the following task forces: research and development, regions and policy, industry, and logistics business. What is the most important is that a logical management structure is found. Communication is vital for social acceptance and gaining public trust. A dedicated secretariat could assist in communication and facilitation of stakeholder and working group meetings.

Corridors are different

The corridor development depends on the maturity of the corridor and identified bottlenecks. In the beginning a corridor development is usually public-lead project concentrating on infrastructure and political issues, followed by analysis on business potential and markets, resulting on a mature business-lead corridor. Bottlenecks on a corridor may be related to infrastructure or business side. Thus, development targets depend on bottlenecks, and the leadership of the development is the main actor related to the target.

Politics influence corridor development

Infrastructure based corridor development derives from larger political issues, such as transport route prioritization both inside and outside Europe (connections to ports) and modal shift. Rail transportation can be supported by common regulation related to cross-financing rail infrastructure from motorway tolls, subsidies (RoLa and unaccompanied combined transport), the access on terminals, security systems, driver licence, infrastructure planning etc. In order to succeed in the development, political support and business actor involvement are needed, and international cooperation, treaties and regulations are a prerequisite.

Text: Jenni Eckhardt

Full report in English:
http://bit.ly/transportcorridor

More information on the BGLC project:
www.bothniangreen.se

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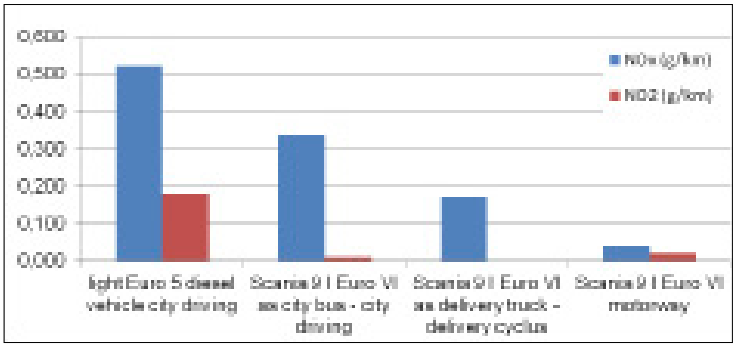
Photo: VTT

Measuring real-world exhaust emissions in the VTT laboratory in Finland.

Low Emissions Possible from Euro 6 Vehicles

The emissions of NO_x and NO_2 from heavy duty vehicles with Euro VI engines in real traffic may be so low that these vehicles emit less of these exhaust components than today's diesel engine passenger cars with Euro 5 technology.



Real life emissions of NO_x and NO_2 from a heavy duty vehicle with a 9 l Euro VI engine, in comparison with a typical Euro 5 car with diesel engine.

Institute of Transport Economics in Norway and VTT in Finland has performed emission testing of Euro 6 vehicles and vehicles with new engine technology commissioned by the Norwegian Public Roads Administration. The results show that advanced technology makes it possible to produce heavy duty vehicles with very low emissions.

In several major Norwegian cities exhaust emissions from vehicles is a problem and standards for air quality standard are expected to be exceeded in the years to come, if measures to reduce NO_x and NO_2 emissions are not implemented. Modern particulate traps effectively decrease particulate emissions from diesel exhaust, but with these traps and oxidising catalysts Euro 5 vehicles emit 5–10 times more NO_2 than without.

It is important to investigate to what extent the Euro 6/VI regulations, which will be mandatory from 2014-2016, will reduce the emissions and if new exhaust cleaning technology will create new problems.

Six light vehicles and two heavy duty vehicles with new and interesting engine technology have been tested. Results from these tests indicate that the emissions of NO_x from new Euro 6 light vehicles may be significantly lower than from corresponding Euro 5 light vehicles, but that the they still at 23 °C in real life traffic may be about 2–4 times higher than the Euro 6 approval limits, and about 5–8 times higher at -7 °C (Nordic winter).

Emission of unregulated emission components from Euro 6 cars and new engine concepts may be higher and different compared with what you traditionally have measured from diesel engine cars.

The new knowledge about real life exhaust emissions from new vehicles with Euro 6 indicates that authorities should be careful in taking actions based on emission figures from legislation or experience with Euro 5 vehicles and yesterdays engine technology. There is a strong need for additional emission testing and cooperation between independent research institutes, authorities and vehicle producers. More knowledge is essential for authorities to be able to make the right decisions about vehicles, emissions and air quality.

Real life emissions of NO_x and NO_2 from a heavy duty vehicle with a 9 l Euro 6 engine, in comparison with a typical Euro 5 car with diesel engine.

Text: Rolf Hagman

Report: Exhaust emissions from vehicles with Euro 6/VI technology. TØI Report 1259/2013.
Authors: Rolf Hagman and Astrid H. Amundsen

Link to report with English summary:
http://bit.ly/emissioneuro6

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Photo: Anne Mari Norheim

Employing a Driving Simulator for Road Planning

This project was cooperation between the project organisation designing a new road project and the simulator group at the Norwegian Public Roads Administration. The aim of the project was to explore the use of a driving simulator in the early stages of planning for a 20 kilometre stretch of road in the southern part of Norway.

A total of 29 alternatives were being evaluated for the roadway project. Taking on all these alternatives was never an option because meeting schedule deadlines were critical for the model to be useful for the planning department. Due to constraints in time and manpower it was decided to make models of three routes which represented three important corridors. The routes were also the options more likely to go further in the evaluation process. The finished result was shown to politicians, planners and the public over three days at two separate locations near the stretch where the road was going to be built. In addition, video of the three alternative routes was made public.

The simulator used for this effort was made by Oktal, and runs on the SCANeR Studio software. It is a compact driving simulator designed to be portable. At the time there were three internal and one external contributor to the project. The finished result was fully drivable models of the three selected routes.

"The public seemed generally very impressed with the quality of the simulation."

The feedback from the public viewings was very positive. The head of planning for the road project felt the model gave an excellent impression of the routes. It was seen as having the potential to provide a considerable advantage in the early phase of planning both in terms of informing the public, who are not used to reading plans and maps, and for the planners. In addition, the presence of the simulator generated added interest for the project, resulting in more attendees to the public viewings. A planner on the project noticed that the curvature and layout of the road at one location seemed different when driving as compared to the plans, and found room for improvement based on the simulation. The public seemed generally very impressed with the quality of the simulation. It was evident that they easily familiarised themselves with the virtual surroundings and several of the visitors displayed strong positive and negative emotional responses to seeing the planned roadway.

This project highlighted the visual benefits a driving simulator has compared to a fly-through using a planning tool. The visual impact from driving on the actual road is an advantage in assessing the roadway's alignment, curvature, banking, sight distance, signage, etc. It also provides an innovative method of presenting to the public different alternatives for new roadways. The process of developing the model was quite time consuming, and changes made in the planning would require significant effort with the current procedure. We are currently looking into reducing the development time by exporting terrain models and road structures directly from other software used in the planning process. If successful we envision using the driving simulator further in road planning.

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The Roads of the Future May Be Ground

A test carried out by VTI shows that ground asphalt produces less noise and reduced emissions.

It has been known for a long time that grinding a concrete floor leads to reduced wear by trucks and other vehicles. But is it also possible to grind roads to make the asphalt smoother, with reduced noise and decreased fuel consumption without a deterioration in friction? It seems as if this question can be answered in the affirmative, at least that was the case in a recent test.

Ulf Sandberg, a researcher at VTI, has carried out a test on the section of the E4 highway around the city of Huskvarna which now has a surface coating of noise-dampening asphalt.

A 65-metre long and just under a metre broad strip was ground with the type of grinding machine manufactured by the company HTC Sweden and sold for grinding concrete floors. When a concrete floor is to be ground, the whole surface is to be made smooth, while here it is a matter of just a few millimetres which are to be ground away to even the surface of the asphalt's hard stones. The surface must still be a bit rough to avoid increasing the risk of aquaplaning.

Asphalt surface coatings function so that rolling resistance increases when there are large stones in the mixture and accordingly the noise. If the mixture contains small stones, the wear increases. The aim is to find a surface coating that is durable but as even as possible in order to reduce noise and fuel consumption, but which still allows water to drain off. This is particularly important along the damp shore of Lake Vättern near Huskvarna.

In this first test, grinding of the road surface has produced exactly the positive effects that were sought after. Despite the asphalt already being noise-dampening on this section, the noise decreased in the first measurements by 1–3 dB and rolling resistance decreased by 4–7 per cent.

– This is a promising result, which we want to continue to work on, says Ulf Sandberg, at VTI.

Mattias Lindahl, university lecturer at the Department of Environmental Technology and Management at Linköping University, Sweden, is also involved in the project:

– This is a very interesting result, which shows the potential of this technology. We hope now to make further progress and investigate life cycle costs, both financial and environmental, and make additional tests, both at VTI and in the field, he says.

Photo: Ulf Sandberg

The ground surface completed test on the section of the E4 highway around Huskvarna.

Photo: Ulf Sandberg

Close view along the ground DPAC surface.

Many questions remain to be dealt with. It is quite clear that grinding is a relatively cheap measure in comparison to the alternatives, but how durable are the positive effects? According to VTI's initial tests on the heavily trafficked E4 highway, the effect had disappeared after a year. Is there a difference between roads with high wear and those with less traffic? And what happens to road signs when the surface is ground?

– We know that roads in densely populated areas such as the Netherlands are ground to reduce the noise levels. Here in Sweden, it would probably be economic to grind certain roads regularly, not least to avoid rut formation, says Mattias Lindahl.

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NORDIC

ROAD AND TRANSPORT RESEARCH

A joint publication with the latest research findings of six public research organisations in Denmark, Finland, Iceland, Norway and Sweden.

SWEDEN

SWEDISH NATIONAL ROAD AND TRANSPORT RESEARCH INSTITUTE (VTI)

The Swedish National Road and Transport Research Institute (VTI), is an independent and internationally prominent research institute in the transport sector. Its principal task is to conduct research and development related to infrastructure, traffic and transport. The institute holds the quality management systems certificate ISO 9001 and the environmental management systems certificate ISO 14001. Some of its test methods are also certified by Swedac. VTI has about 200 employees and is located in Linköping (head office), Stockholm, Gothenburg, Borlänge and Lund.

DENMARK

DANISH ROAD DIRECTORATE (DRD)

DANISH ROAD INSTITUTE (DRI)

The Road Directorate, which is a part of The Ministry of Transport, 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.

FINLAND

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.

ICELAND

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 290. 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.

NORWAY

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. 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.

INSTITUTE OF TRANSPORT ECONOMICS (TØI)

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. TØI is an independent research foundation employing about one hundred persons.

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