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FINNISH ROAD ADMINISTRATION

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FINNRA AND MINNESOTA DEPARTMENT OF TRANSPORTATION HAVE A LONG TRADITION IN TECHNOLOGY EXCHANGE

COOPERATION BETWEEN THE FINNISH ROAD ADMINISTRATION (FINNRA) AND THE MINNESOTA DEPARTMENT OF TRANSPORTATION (MN/DOT) OF THE USA BEGAN ALREADY IN THE1970'S. BY THE LATE 1980'S IT BECAME MORE FORMAL, AND THE FIRST MEMORANDUM OF UNDERSTANDING (MOU) ON MUTUAL COOPERATION WAS SIGNED. IT IS ENVISIONED THAT THE MOU WILL ASSIST IN MAKING MN/DOT AND FINNRA WORLDWIDE LEADERS IN THE EXCHANGE OF TRANSPORTATION KNOWLEDGE AND ROAD SECTOR INNOVATIONS AND THUS IMPROVE THE QUALITY OF LIFE FOR CITIZENS IN BOTH COUNTRIES.

The exchange of knowledge has been a challenge for both road administrations. Even if the organisations are situated in different continents, it is very clear that the problems which the transportation agencies face are similar in nature and thus wish to continue to share their related experiences.

The cooperation that has become a tradition strengthens core competences within Mn/DOT and Finnra, and provides a framework for the exchange of professionals, a realisation of specific projects as well as an exchange of data bases and program reports. This helps to benchmark each other's transportation technology where applicable.

Minnesotan guests and Finnish hosts listenning to Eero Karjaluoto, Director General of Finnra, in Helsinki in August, 2001.

The program coordinators are responsible for prioritising mutual projects, selecting agency representatives for them and deciding economic framework and cost sharing. Annually, the program coordinators review and evaluate program progress and make any needed adjustments and re-prioritisations.

Early in August, 2001, a high-level expert group, led by Elvyn Tinklenberg, who is a Commisioner, from the Minnesota Department of Transportation visited Finland. The purpose of this visit by the top managers of Mn/DOT and Finnra, was to consummate the previously executed Memorandum of Understanding and to enter specific areas of cooperation into discussion. Other members of the delegation were Doug Weiszhaar, Deputy Commissioner; Jim Swanson, Assistant Commissioner; Marthand Nookala, Assistant Director; Gary Thompson, Office Director; Dan Krom, Director; and Robert Busch, District Engineer (Brainerd, MN).

Also In This Issue:

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The most fruitful discussion topics during the visit were:

- New organisational concept of Finnra: owner/enterprise management
- Intergovernmental coordination: policy and funding
- Infrastructure Technology Program and Procurement Project
- Digi Road Project
- Organisation, management and future development plans of Civil Aviation Administration
- Coordination of public transportation services in capital city area.

Following its visit to Finland, the Minnesotan delegation visited the Estonian Road Administration, the Swedish Road Administration and the Norwegian Road Administration in their respective countries.

Mr. OLLI NORDENSWAN, Finnra

FINANCING TRANSPORT INFRASTRUCTURE

The Ministry of Transport and Communications of Finland published in May, 2000, a report on the possibilities of carrying out road and railway projects in Finland using different kinds of financing methods. This report has been given to interest groups for their opinions, which were summarized by the Ministry. What remains now, is to draw conclusions.

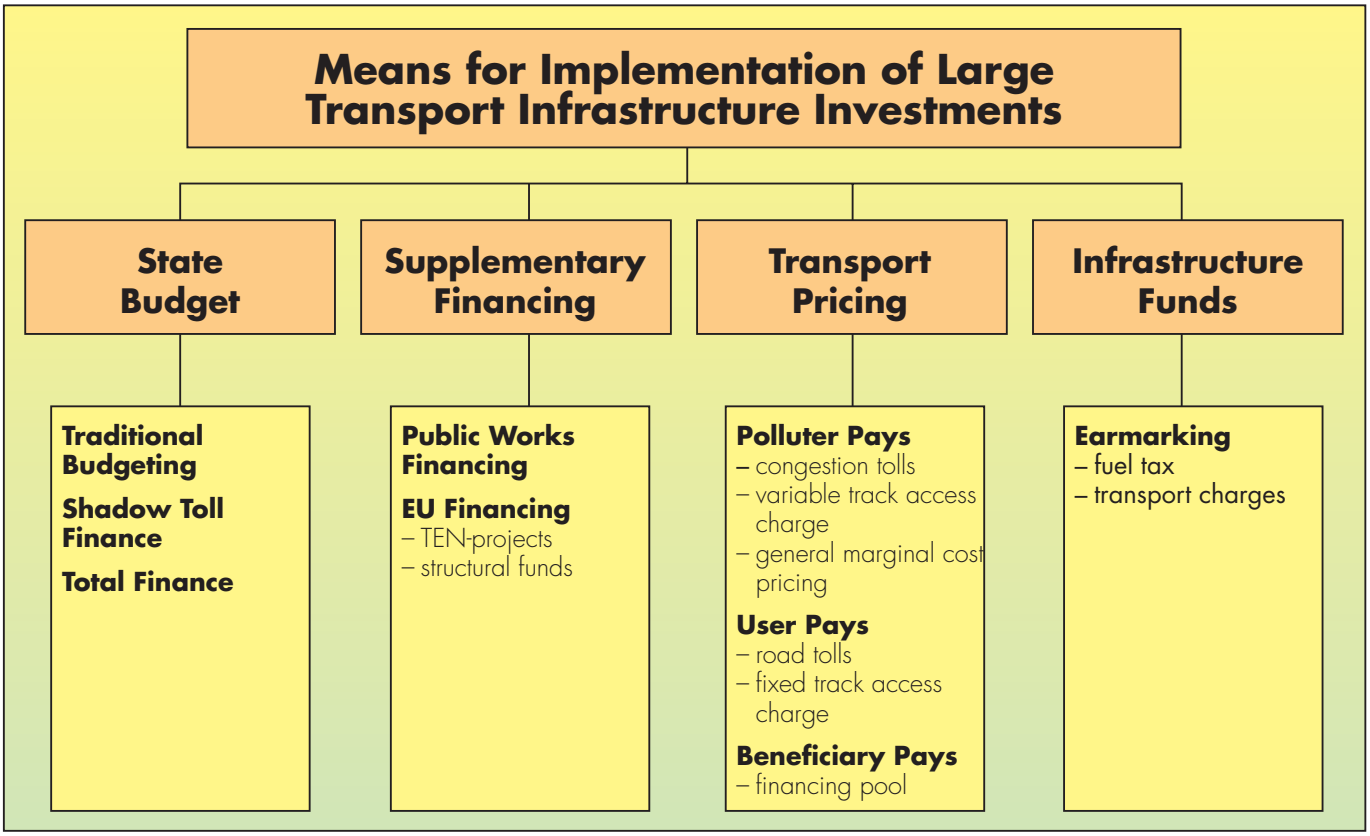
1. BACKGROUND

At the end of last year the Ministry of Transport and Communications set up a working-group, which the author of this article is the chairman of, to continue clarifying the financing questions and to give a proposal on how to finance transportation projects.

The political agenda of Finland's present Government states that the condition and the value of our national road network must remain at its present level. It also states that our Government prepares to finance transportation infrastructure projects by special financing means.

So what does this mean ?

Since the 1990's it has been more and more difficult to find money, especially for larger projects. One idea has been to financially separate the maintenance of roads and railways from the actual construction.



Various alternatives in financing infrastructure projects.

The construction work can be carried out quickly and much closer to its optimal timetable by using a principle of financing where the whole project fully is in one budget allocation instead of financing the project in parts. In Finland we call it the **Total Finance Method**. A good example of this is the Helsinki-Tampere motorway which was under construction for several decades. If the financing costs of this project would have been paid from the budget of the Road Administration, the project would certainly be still going on.

Financing by loans is not used in Finland concerning infrastructure projects. In Sweden this is quite an ordinary way to finance them.

The public sector in Finland is now at a parting of the ways: whether we let our infrastructure fall into dispair or we, without prejudise, look after new financing methods.

2. EXPERIENCES FROM PRIVATE FINANCING PROJECTS ON THE LAHTI-ROAD; SHADOW TOLL FINANCE.

From the view of the public economy, it is important to be able to prove that the chosen model of financing saves costs and also brings other benefits sufficiently.

The biggest benefit of this financing method was that the project was completed and the road was opened for traffic several years earlier than compared to the traditional budget financing. All construction works were done effectively, thanks in part to the favourable weather conditions and all purchases were made in large entities, which means that significant savings in the construction costs accumulated.

The large financing cost is a clear drawback in this method. For instance, the total cost of the Lahti-road will be FIM 1,200 million, of which only less than 550 million was the cost of the investment, the daily maintenance will be less than 200 million and the rest, more than 450 million, are interest costs, provisions and profits. But the target was not necessarily the saving of public money, but the fact that one could get better value for public money and investment. Nevertheless this project has, in any case, been a good experience for all.

So what could be done better? The agreement period could be a little longer than it was in the case of the Lahti-road; 12 years from the completion of the project, which the project company made even longer into 13 years by speeding up construction. The project company could be in this case more willing to innovative solutions. Also the pricing of traffic performance should be done so that the additional traffic would have a higher unit price than at present. The business risk of the Lahti-road for the project company is, in my mind, relatively small. Also the usability of the road could be a ground for compensation, e.g. how often the route is available for traffic.

In order to have adequate competition, the project should be big enough to attract tenderers from abroad as well. But public-private-partnership-projects (ppp-projects) are models not only for large projects. In the United Kingdom there are succesfully carried out ppp-projects with less than one million pounds value.

In principle it is possible to combine **the Total Finance Model** with **a Shadow Toll Finance Model**. In that case it could be possible to pay a single payment for construction and then a continuous compensation for maintenance. We have also discussed whether construction and financing should both have their own tendering processes.

We have to examine very carefully how many ppp-projects can be financed at the same time. That is why it is of great importance that only such projects are carried out that are profitable and socially economic. Money in the state's budget for infrastructure can not be considerably increased, so we have to find financing from other sources.

3. FINANCING ALTERNATIVES UNDER CONSIDERATION

A fairly new idea for our traffic policy is one where **the Beneficiary Pays**. This alternative may cause a share of financing costs for municipalities, trade or industry. Until now the financier of all major national routes has been the state. It is an other question if a municipality or some other party insists on getting a route and voluntarily is willing to pay for it. Examples of this are the harbour of Vuosaari and the station of Mäntsälä. I am sure that there will not be any parties willing to participate in the financing of a project, if they do not feel that they will benefit in some way from it.

An Infrastructure Fund could be a good means to develop methods for starting up big projects. Money could be collected from various sources by earmarking e.g. different kinds of taxes, from fuel or cars and waterway charges; from privatisation of state owned companies; bonds; or in the beginning directly from the state budget. In many other countries this is not a new idea at all. For us it is not something that we have wanted to discuss seriously about. However, it is high-time to start these discussions.

In the European Union (EU) we have a so called **User Pays** principle, which in most cases means **Tollroads**. Another means, that the EU has introduced, is marginal cost pricing (MCP). This principle means in practice that all users of the infrastructure should pay for the marginal costs they cause for the infrastructure, wear and tear and external costs for other users. In other words, **Polluter Pays** the costs caused by an additional vehicle entering the system. Although it is very complicated to implement pricing by the marginal cost principle, it is important to know the marginal costs, because they form the basis for more effective and fair pricing. Firstly, when a new pricing method is used, there must be an alternative route available. Secondly, the passenger must have a feeling of getting value for money, otherwise the pricing is experienced only as a new tax. We should progress in this direction also in Finland.

The purpose in the EU is not to add taxes and other payments. The purpose is that the old payments will be abolished out of the way for new and better ones. As a member country of the EU Finland wants to follow these principles.

The tollroads are not suitable in

User pays -principle may be a pricing model in Finland in the future.

Finland because of our low traffic density and also because of the large amount of junction points. Another question is whether a road toll is collected by a new wireless technique or by the old technique of driving through tollgates. Using satellite technique we could collect information on driven distances and on what price category of a road the car has used. All this would be charged afterwards like the use of a telephone. However, this could be carried out only after 10 years in practice.

I think that the development of the user pays principle into a Finnish pricing model will be the proposal of our working group. The model ought to be simple and easily understandable, taking into consideration different vehicle types, their characteristics, taxes paid for them and also the different parts of our sparsely populated country.

4. SUMMARY

The main purpose of our working group is not to lobby money for transportation infrastructure, but to look for new opportunities in an unprejudiced way where all sides would benefit. Some may consider this naive.

I anticipate that not one of the methods which I have described will alone solve the problem. The final solution will be an appropriate combination of the methods I have mentioned.

Mr. LASSE WECKSTRÖM, Finnra

FERRY TRAFFIC IN PUBLIC ROAD NETWORK IN FINLAND

THE PRESENT SITUATION

The number of ferry connections in the public road network in Finland has decreased year by year. At the end of 2000 there were 47 ferry connections, while the figure was 139 in 1955, and 64 still in 1995.

In 1997, the management of the then Finnish National Road Administration arranged a seminar on ferry issues. A strategic decision was made in that seminar to replace the short ferry connections (less than 500 m) with bridges in the forthcoming years. The arguments were, on the one hand the ageing of the ferries, and on the other

hand the socio-economic profitability of bridge-building.

About FIM 50 million per year was reserved for implementing the programme, which enabled building a couple of bridges annually. The bridge-programme still continues. It is intended that the management group of the Finnish Road Administration will annually decide on any new bridge projects. We estimate, however, that some 35-40 ferry connections will remain in Finland even in the long term.

The traffic volumes are very low, except for a few connections. There are only five ferry connections where the average amount of traffic exceeds 500 cars per day. Even during the peak season in the summer the traffic volumes are low on many ferries. In spite of that the road users are provided with a very good level of service around the year. The ferries usually operate in both daytime and nighttime. It is also worth noting that the service is completely free of charge for road users in Finland.

It was decided in connection with the recent organisational restructuring (in 2001) that the ferries (80 pcs) – whose new acquisition price is about FIM 500 million – would be transferred to ownership of the Finnish Road Enterprise and its Ferry Services Unit . Nevertheless, it was specifically decided that "The Finnish Road Enterprise must agree on any investments that raise the value of the ferries or refurbishing with Finnish Road Administration in advance". The cable ferries are mainly from the 1970's and the ferry vessels from the 1980's and 90's.

The ferry connections themselves are a part of the public road network, and therefore, the Finnish Road Administration is responsible for them. It could be mentioned as a Finnish special characteristic that we have a large amount of cable ferries that cross rivers and lakes.

FERRY TRAFFIC AGREEMENT FROM THE BUYER'S POINT OF VIEW

The Finnish Road Administration has made one national agreement with the Ferry Services Unit of the Finnish Road Enterprise, with which the ferry traffic services are produced as per the desired service level on each ferry. The duration of the agreement is one calendar year with an option of three more years, and its value for the current year, 2001, excluding VAT, is FIM 127 million. For the time being the Ferry Unit has a monopoly in this field.

From the buyer's point of view this means buying an overall service. In other words, the supplier assumes the overall responsibility on managing the traffic. In addition to actual transportation, the service includes care-taking and maintenance work as well as a great deal of expert tasks (of authorities). The buyer will input less than one man-year in managing the agreement.

The highest costs that affect the contract price incur from traffic itself, which in practice means personnel and fuel expenses. With regard to the fuel costs, the risk has been evened out by binding the agreement to a certain price. The contract price will be adjusted, if the market price of fuel deviates more than 5% of the agreed level.

The quality of service is monitored with a customer feedback system, audits, random tests, and contract meetings held three times per year. In contract meetings, the supplier's summary will be presented which includes e.g. the following:

- the improvements made
- changes in trafficking
- trafficking interruptions, safety and environmental issues

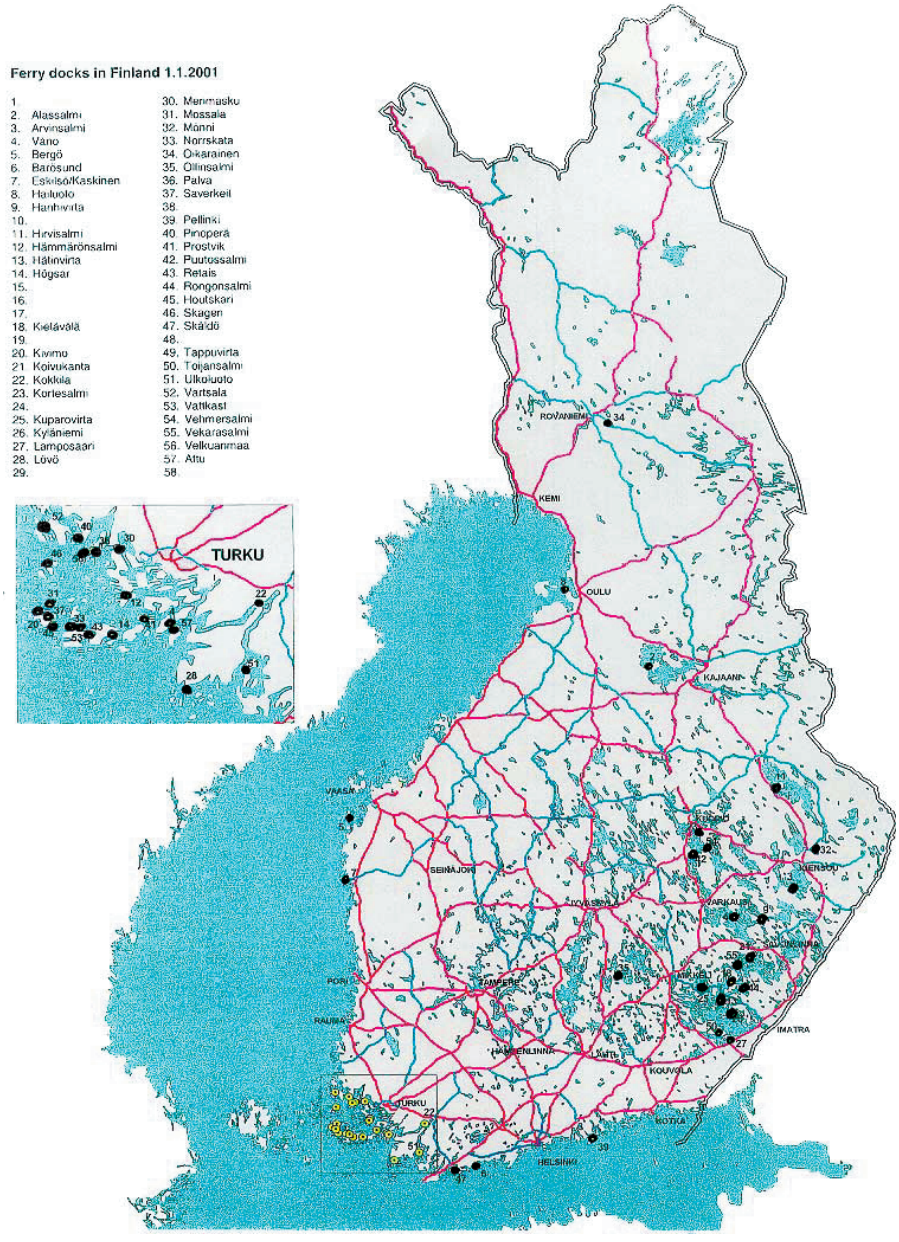


Figure 1. All present ferry connections on the map of Finland.

- summary of customer feedback
- fining and invoicing.

Failure to meet the agreed service level and quality is sanctioned. Fining is directed at defects that concern the smooth flow of traffic, safety, environmental hazards, quality system and customer service.

For example in case of stoppage that exceeds the maximum time allowed, a fine will be imposed for each two-hour period as follows:

- Class I (> 450 ADT) ferry places FIM 25,000 (time allowed 2 hours)
- Class II (150-450 ADT) ferry places FIM 15,000 (time allowed 4 hours)
- Class III (< 150 ADT)ferry places FIM 5,000 (time allowed 6 hours).

A fine will also be imposed for an accident resulting in bodily injury, accident resulting in environmental damage, failure of the quality system, or inappropriate treatment of customers.

Nevertheless, it must be emphasised that the Ferry Services Unit has at least so far performed very well in implementing the agreement. Only few sanctions have been imposed.

One still unresolved question is what to do with the capital costs of the ferries? Although the ferries are owned by the Finnish Road Enterprise, it is the responsibility of the Finnish Road Administration to decide on any investments. Hence the share of capital costs has not as of yet been included as a part of the service agreement. The question is always there and causes a fair amount of arguing between the parties.

CO-OPERATION OF PUBLIC ADMINISTRATION

The Finnish Maritime Administration takes care of and develops the waterways that are the State's responsibility, nautical charts, as well as ice-breaker and pilot services. Additionally, the Finnish Maritime Administration is responsible for the ferry operations in the archipelago and the official vessel safety measures.

We have had informal discussions with the Finnish Road Administration and the Ferry Services Unit about whether it would be possible to shift the ferry operations, at least in the longer connections in the archipelago to the Finnish Maritime Administration. The biggest question mark is how the services with charge/free services could be solved. At the moment the ferry connections in connection with roads under the Finnish Road Administration are free of charge, while the ferries operating in the archipelago under the responsibility of the Finnish Maritime Administration are subject to a charge.

The Finnish Road Administration has proposed that the Finnish Road Administration, Finnish Maritime Administration and the provincial government of Åland would together investigate how the gradually opening markets could be utilised in the purchasing of services. It should also be investigated how the buyer could affect the simplification of provision of the traffic services.

These issues are also largely linked with the incorporation of the Finnish Maritime Administration, which has been underway for years. In spring 2001, however, the Government abandoned or at least postponed the incorporation.

Figure 2. A ferry in the beautiful Finnish archipelago.

SUMMARY

The Finnish Road Administration is now a buyer body completely isolated from production. In this respect we are in international comparison a so-called advanced organisation.

According to road experts, the financing level of road maintenance in Finland, like in nearly all countries, is too low. In Finland we invest in safety in traffic, environmental issues and day-to-day driveability, which means road maintenance around the year. This includes ferry services, the quality of which can probably be kept at a high level also in the future. Instead, we will have to compromise over repairing of lower grade road network and new road investments.

Time will tell whether there are new financing models – such as road tolls and a road fund – to ease road maintenance in Finland. If that would happen, the question of ferry charges would also have to be solved. We are doubtful, however, about any reforms taking place regarding these issues over the next few years. It is a political decision after all.

As decided by the Finnish Parliament, road maintenance is intended to be fully opened for competition by the year 2005. Whether a profitable competition can be arranged regarding ferry services remains to be seen. At the moment the Ferry Services Unit is almost in a monopoly position. The issue cannot be decided on by the Finnish Road Administration alone – trade unions and party politics are also closely linked thereto.

So at least in the near future, ferry traffic services will be purchased from the Ferry Services Unit by one or at most a few national agreements. It may well be that in the future the

contracting party of the Finnish Road Administration would no longer be the central administration, but a road region, e.g. the Turku Road Region. The agreement period would most likely continue to be one year, or a few at the most. The presently applied contract structure has proved to function so well, that there will probably be no need to change it particularly.

The Finnish Road Administration will probably continue replacing ferries with bridges, but maybe at a slower pace than thus far. Of course it all depends on which level road funding will settle at in the future.

The Finnish Road Administration's understanding is that the Ferry Services Unit of the Finnish Road Enterprise has succeeded in building an image of a good and reliable service provider for the actual customers i.e. the road users. In the buyer's opinion, the Ferry Services Unit has also positively carried out the service agreement. The co-operation between the buyer and the supplier has been particularly successful. The Ferry Services Unit has also invested in national and international co-operation with the actors in the field.

Mr. TAPANI MÄÄTTÄ, Finnra and
Mr. PEKKA HIRVONEN, Finnra

GPR TECHNIQUE IN ASPHALT QUALITY CONTROL

A new survey technique, applying Ground Penetrating Radar (GPR) air coupled antennae, to measure dielectric value and thickness of new asphalt pavement has been introduced, tested and accepted in Finland in the 1990´s. Dielectric value of asphalt, measured using a GPR surface reflection method, provides information about the fluctuations in void content in newly paved asphalt pavements.

GENERAL

In Finland asphalt concrete pavement is the most popular bound pavement type on roads and highways. Air void content and asphalt thickness are the most important factors when estimating the quality of asphalt pavements. Previously, air void content for paving quality control was assessed by means of drill core samples and radioactive testing. These methods proved to be relatively slow and expensive, and have not always provided reliable results.

The basic idea behind dielectric measurements by the GPR method is that compaction of the pavement reduces the relative void content of the material and increases the relative proportion of other components. Since the dielectric value for a pavement can be assumed to be a function of the values for its components, changes in their proportions (e.g. in void content) can be measured by recording overall dielectric values for the pavement. The calculations also set out from the assumption that the bitumen and filler content of the material will remain almost constant.

The Ground Penetrating Radar method for asphalt quality surveys was introduced and initially tested in Rovaniemi, Finland, in the summer of 1993. Research work continued at the Texas Transportation Institute (TTI) at Texas A&M University in the United States in 1994-1995 as part of a research programme examining the dielectric properties of road materials. Since 1996 the development work continued as research and development projects in cooperation with the Finnish National Road Administration, University of Oulu and Roadscanners Ltd. These projects involved laboratory tests, software development and field testing at actual paving project sites in Southern and Northern Finland. In 2000, the method was described in the Finnish Asphalt Specifications as the standard quality control method of asphalt pavements in Finland and it was routinely used in several paving projects. The GPR method has also been published in the method descriptions of the Finnish Pavement Technology Advisory Council (PANK).

THEORY

The term dielectric value or "relative dielectric permittivity" refers to the capacity of a material to store, and then allow the passage of electromagnetic energy when an electrical field is imposed upon it. It can also be described as a measure of the ability of a material within an electromagnetic field to become polarized, and therefore respond to electromagnetic waves.

The dielectric value for dry asphalt concrete is a function of the volumetric ratios of bitumen, air and rock and their individual dielectric values (2.6, 1, and 5 - 7 respectively). The fundamental assumption of the GPR method is that when compacting asphalt mix the volumetric proportion of low-dielectric air is decreasing and thus the measured dielectric value of an asphalt mix increases. In other words, the compaction of asphalt increases the dielectric value of the mixture. Small changes in bitumen content will not have a significant influence on composite dielectrics.

Ground penetrating radar, equipped with different types of antennae systems, transmits electromagnetic pulses into the medium under survey and records reflections of the pulses from electrical interfaces. In the GPR technique, pavement surface dielectric value is measured using a reflection

Figure 1. A Finnra GPR van used in asphalt quality control.

technique adapted for use with a horn antenna. Layer-specific dielectric values can be obtained by calculating reflection coefficients from the reflection amplitudes of the interfaces and comparing these with reflections obtained from a metal plate.

DATA COLLECTION AND PROCESSING

During GPR data collection the sampling interval of a minimum 4 samples/m is used. The fastest data collection speed has been 50-60 kmph. GPR surveys are performed as continuous data collection over the whole road section under survey and normally the outer wheelpath of each lane is measured. In figure1, a Finnra GPR survey van with 1.0 GHz horn antenna system is presented. The measured dielectric values are calculated to void content using a laboratory formula and a calibration core result. The void content of the calibration samples are measured in the laboratory. Figure 2 presents the correlation between void content measured using GPR technique and the void content measured in the laboratory, the standards error was 0.9 %. The pavement thickness is determined by using calculated dielectric value and GPR signal two-way travel time through the pavement.

When performing asphalt quality control surveys using the GPR technique, a few important factors should be noted. The method has high requirements on the GPR hardware quality and these systems must pass annually the system specification tests published by Scullion, Lau & Saarenketo in 1996. Because water may distort measurement results, GPR data collection cannot be performed during or immediately after a rainfall and the pavement surface has to be dry. Metal and air pulse data collection, to calibrate the measurement data, has to be carefully performed. In addition, normally two samples are taken to calibrate the measurement data and the sampling points are defined using the GPR data. Sampling and laboratory tests must also be performed using accepted testing procedures.

BENEFITS OF THE GPR METHOD

One of the greatest benefits of the GPR method in pavement quality control is its speed, a survey can be performed without causing major problems for the traffic on the road. There are a number of other benefits. The data collection covers the entire survey section and as such there are no "blind spots" in the survey. If the contractor wishes, the same GPR survey results can be used to determine the thickness of different pavement structures and as such ensure that structures meet thickness criteria. The GPR data can also reveal soft subgrade sections, such as peat under road, where it is not possible to obtain the required asphalt density.

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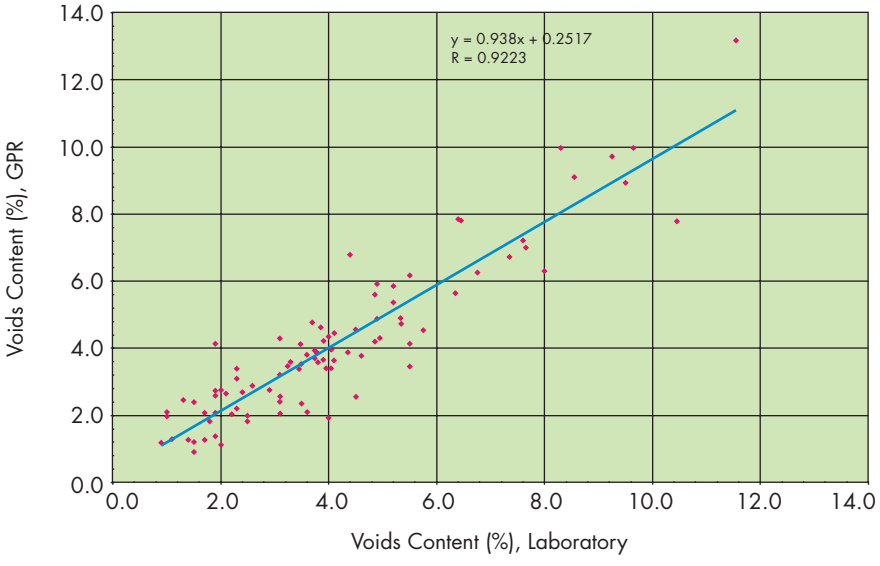

Figure 2. The correlation between air void content measured in the laboratory and air void content measured using GPR technique.