

DEVELOPMENT OF ROAD MAINTENANCE EXPERTISE

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ABSTRACT

This paper describes an ongoing research and development (R&D) project in Norway, the purpose of which is to develop expertise in and raise the status of maintenance work, both in the Norwegian Public Roads Administration (NPRA) and in the road maintenance sector generally.

The project focuses on 5 areas:

- Increasing awareness of maintenance tasks to raise the status of this field of work and increase recruitment
- Training and education, to increase technical knowledge at all levels
- Specialization, to provide more specialists and better research facilities
- Research and development, to initiate and incorporate more R&D in contracts
- Transfer of experience, to exchange more experience among maintenance players

A list of proposed measures for improving expertise has been prepared and the measures are now being introduced as part of the project or planned for the future. The system also involves establishing systems and routines to ensure that development of expertise is a continuous process.

KEYWORDS

MAINTENANCE, EXPERTISE, TRAINING, EDUCATION, RESEARCH, EXPERIENCE

1. INTRODUCTION

"Development of road maintenance expertise" is a 4-year public roads project that started in 2007 [1] [2]. Its purpose is to preserve and develop expertise and raise the status of maintenance in the NPRA and in the road maintenance sector generally by establishing systems and routines for developing know-how.

The project is being directed by NPRA's Technology Department and involves cooperation with the road maintenance sector, i.e. local government, contractors, suppliers, consultants and research and educational institutions.

The background to the project is the high risk of losing expertise to which the NPRA and the sector generally are exposed, for several reasons:

- NPRA lost a great deal of expertise when its own production was spun off into a state-owned limited company in 2003
- Since 2003, when all road work was made subject to tender, the focus has shifted from maintenance expertise to contractual procedures
- Extensive age-related retirement over the next few years will mean the loss of a great deal of experience

- 5-year function contracts result in rapid turnover of contractors and an urgent need for training
- Experience shows that long-term R&D work is called for

A planning phase involving various players in the sector, to discuss needs and project content, has resulted in a list of proposed measures for improving expertise. The project also involves establishing systems and routines to ensure continuous development of expertise.

2. PROJECT DESCRIPTION

Through the project “Development of road maintenance expertise”, the NPRA wishes to increase expertise in and raise the status of road maintenance and also to establish systems for preserving and adding to this expertise in the future.

2.1. Analysis of future needs for expertise

As part of the project, an independent consultant has analysed future needs for road maintenance expertise. The report describes maintenance as an area with many players in the production chain and many different customers [3].

Road maintenance comprises many different tasks and interdisciplinary areas which require both wide-ranging and cutting-edge expertise. The report concludes that expertise in the following areas is in particular danger of degenerating:

- Local knowledge
- Production know-how
- Cost overview

The reasons are that the expertise is scattered and not readily available, and some of it is a business secret. With today’s tender system, we find that the contractor in a particular geographical area may be replaced every five years, so that there is little continuity among those who direct and perform the daily maintenance work. A great deal of historical knowledge may be lost as a result.

The report does not point to new tasks in the future, but the players must be prepared to adapt rapidly to changes both in organisation and in demands from the general public. Expertise is dispersed among many players who come and go, which means that the NPRA must either possess full expertise in all segments or know where it is to be found. The NPRA must be responsible for and maintain and develop broad-based road maintenance expertise.

2.2. Focal areas

The project is intended to concentrate on technical expertise and does not include organization, procurement, contract negotiation or administration, which are also important for the maintenance of the road network. As a result of dialogue with the industry, it has been decided to concentrate on five important areas in this project:

- Raising awareness of maintenance tasks
Maintenance is seldom noticed as long as tasks are performed correctly at the right time and without obstructing the traffic. When difficult driving conditions, delays and accidents occur, however, there are often negative headlines in the media, and undeserved criticism is often levelled at maintenance workers. We therefore wish to

highlight the importance and variety of road maintenance tasks, in order to achieve positive media coverage. The purpose is to raise the status of and interest in this field and improve recruitment.

- **Training**
The need for training has increased since all road maintenance in Norway became subject to tendering in 2003. As a result, there is a constant influx of new contractors and sub-contractors who do not have adequate knowledge of the field. The NPRA also needs technical training for its site supervisors. Improved training should heighten expertise at all levels, and training in winter maintenance is a priority area.
- **Specialization**
Road maintenance comprises many different disciplines, and requires broad-based expertise. Many of the subject areas are complex, and in-depth insight is required in order to achieve professional development and quality. To ensure future research and teaching qualifications, it is important to train more specialists right up to doctorate level. This will contribute to more rapid development and also raise the status of the field. Research facilities such as laboratories and test sites must be improved and made available for both teaching and research. This applies in particular to winter research, where traffic and shifting weather conditions pose special challenges for safety and reproducibility.
- **Research and development**
Norwegian experience indicates that the private sector is unwilling to invest in long-term research that does not yield rapid results or returns. To secure forward-looking research, the NPRA must therefore finance and conduct research in collaboration with the private sector. R&D projects must be incorporated in contracts in order to involve contractors in development work, and we therefore aim to include more R&D in contracts.
- **Transfer of experience**
The road maintenance production chain involves many players who come and go, and it is therefore important to ensure exchange of experience between the different players. Road maintenance in Norway is also undergoing a generation change, with many experts on the point of retiring. Road maintenance expertise is largely based on experience that cannot be acquired at university. It is therefore extra important that this expertise is preserved and transferred to new, younger employees. This applies in particular to local knowledge, which is one of the key prerequisites for good winter maintenance. It is therefore important to collect, systematise and disseminate know-how from experienced to new employees and between the various players in the business.

2.3. Organization and involvement of the road maintenance sector

The project is organized in 4 sub-projects which reflect the focal areas:

- Sub-project 1 Heightened visibility
- Sub-project 2 Training
- Sub-project 3 Specialization and R&D
- Sub-project 4 Transfer of experience

Within each sub-project there are project groups with participants from different parts of the road maintenance sector. They contribute input and advice on the planning and

execution of the project. Consultants have also been engaged to assist in drawing up plans and carrying out activities.

A reference group has been established to ensure the necessary contact between the project and NPRA's own organisation and the rest of the sector. The reference group is invited to annual meetings to receive information about projects and to provide input. The reference group now has 47 participants from the following players:

- 16 NPRA
- 6 municipalities and airports
- 8 contractors and sub-contractors
- 8 teaching
- 6 consultants and research
- 3 suppliers of equipment

3. ACTIVITIES IN THE PROJECT

3.1. Sub-project 1 – Heightened visibility

A public relations officer has been taken on in a part-time position to provide a more professional approach to the information function. Various measures have been implemented to positively heighten the visibility of road maintenance in order to improve the status and reputation of this sub-sector.

- Video
A short video has been made to demonstrate the diversity and challenges. The video is used to arouse interest in the area among students and youngsters and as an introduction to lecture programmes.
- More news material on road maintenance
Active work is in progress to get more positive media coverage of road maintenance, for example of roadworks in progress and what winter standard road users can expect.
- PR measures
Various means of promotion are being considered, such as inviting politicians to open conferences, inviting students to professional arrangements, marking of positive events, award of maintenance prizes.

3.2. Sub-project 2 – Training

The NPRA is responsible for the roads and traffic sector, and the project therefore wishes to upgrade the training of the whole sector. This is a wide-ranging task, and contingent on good cooperation with all those who undergo or need the training.

The following work is in progress:

- Collecting information about and evaluating existing training programmes
A preliminary review shows that little is taught about road maintenance at upper secondary schools, colleges or university. Some internal training takes place in companies and trade organisations, but little on the technical aspects of road maintenance. However, the best parts of existing training courses can be extracted, coordinated and developed further.
- Clarification of roles and responsibility for training
To avoid conflicts between those who conduct training, it is important to clarify roles and responsibility for different types of training. This also presupposes that those in need of training are interested in collaborating on a joint programme. The project aims to initiate cooperation of this type in the sector.

- Requirements relating to expertise and training
As the client for maintenance services, the NPRA can make demands regarding the competencies and qualifications of those who are to manage and perform the contracts. However, this presupposes that relevant training programmes exist. One important aspect of the project is therefore to identify what expertise is needed, and what training is required to meet the competency requirements.
- Structure, planning and teaching material
On the basis of the above points, a training structure and plan and training material must be developed. A modular system is planned, where different players with different needs can choose modules adapted to their training requirements. In such a system it will be possible to choose between different levels and specialisations and different subject areas that cover the most important aspects of road maintenance.

The work of developing courses on winter operations is commenced in parallel with the development of the training system. The first phase of this work is revision of a mandatory course for both owner-supervisor and contractor personnel who are responsible for winter maintenance. It comprises the following parts:

- Standard requirements and planning of winter maintenance
- Traffic safety and environmental considerations in winter maintenance
- Monitoring and documentation, of condition and friction, among other things
- Meteorology as basis for decisions to implement measures
- Methods, equipment and execution of various tasks:
 - snow ploughing, sanding, salting, snow/ice clearing, other specialised tasks

In addition special courses will be held locally for crews responsible for mountain roads and roads that are at risk of avalanches. A special PC-based mini-course has been prepared for training drivers of snow-clearing and sanding vehicles.

In the next phase, more specific modules will be developed for the various winter tasks.

3.3. Sub-project 3 – Specialization and R&D

Within these focal areas it has been necessary to restrict activities to a few high priority tasks:

- Collecting and scanning of reports
A review has been made of relevant R&D projects that have been conducted in the course of the last 20 years. Reports available only on paper have been scanned to enable them to be stored and retrieved electronically, and all reports have been assembled in a separate database. This will provide a good overview when new R&D projects are planned.
- More R&D into road maintenance contracts
A number of R&D projects have been incorporated into some contracts in collaboration with the contractors. For the present this applies to monitoring of winter conditions and development and testing of winter maintenance equipment. Experience gathered from these contracts will form the basis for more systematic execution of R&D in contracts.
- Development of specialised road maintenance equipment
Steps have been taken in collaboration with the sector to determine which types of maintenance equipment need to be improved. The project is also supporting the testing of a 3-dimensional georadar system for planning and documentation of maintenance work.
- More PhD students
The project has made an assessment of which subject areas need to be strengthened through a PhD programme. Important areas are winter maintenance, in particular

salting, bearing capacity, rehabilitation and friction. Work has started in collaboration with the University in Trondheim to recruit students for these programmes.

- **Laboratories and test sites**

The project has given a subsidy to the University in Trondheim to build up a climate laboratory which is appropriate for research on winter maintenance. In addition equipment, including a microscope and heat camera, has been purchased for use in research and teaching and to increase the basic understanding of winter problems. Further needs for laboratories and test sites will be assessed.

3.4. Sub-project 4 – Transfer of experience

In today's competitive and rapidly changing society, preserving and passing on experience is a major challenge. It can be achieved by developing systems and routines that pave the way for transfer of experience, but it also requires trust and willingness to cooperate.

- **Cooperation and trust – Course on working together**

A mini-course/video on working together is being produced. The course is designed to help NPRA supervisors and contractors to prevent conflicts and create a better atmosphere of cooperation as a basis for transfer of experience.

- **Arenas for transfer of experience**

The project is determining which arenas are most appropriate for disseminating road maintenance experience, and how best they can be used. Conferences, seminars, courses and various networks are examples of such arenas.

- **Transfer back of experience to road standards for new roads**

It is important that road maintenance experience be taken into account when guidelines are laid down for road planning and construction. The aim of the project is to improve systems and establish fixed routines for bringing such experience to the planners and constructors of new roads.

- **Databank-based transfer of local knowledge**

Systems are to be developed to pick up events associated with maintenance of the road network and present them in a user-friendly way to new contractors. The intention is that the existing reporting system and road data bank be used for storage and presentation of maps.

- **Transfer of silent knowledge**

The project is intended to facilitate the transfer of the know-how that is not written down, but exists in the heads of experienced maintenance people, to young, inexperienced employees. This can take place through mentor schemes where experienced and inexperienced work together, or through experience being collected and preserved before maintenance people retire.

4. FURTHER WORK

The work of developing expertise is a continuous process, and this project will not be able to meet all needs in the course of the project period. There will be an extensive need for development and updating of teaching material after the conclusion of the project at the end of 2010.

We hope, however, to lay a solid foundation by means of the project for the further development of expertise in this important area.

You can read more about the project on the NPRA's website: www.vegvesen.no/kdv

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