

MINNESOTA DEPARTMENT OF TRANSPORTATION /FINNISH NATIONAL ROAD ADMINISTRATION—MAINTENANCE TECHNOLOGY EXCHANGE PARTNERSHIP

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ABSTRACT

The Minnesota Department of Transportation (Mn/DOT) and the Finnish National Road Administration (Finnra) conducted a maintenance worker exchange during the winter of 1995-96. The intent of this exchange was for both agencies to get detailed knowledge of each other's winter road maintenance operations, equipment and materials through hands-on involvement. The exchange program is of obvious benefit to both parties. Finnra has many equipment and operational innovations of interest to Mn/DOT. Some of the more interesting equipment innovations are automatic greasing systems for graders and other equipment, automated grader mold board control systems to obtain precise vertical and horizontal control, a floating system for grader attachments to obtain better control of the front plow, wings and blades, and employs various toothed blades and rubber slush cutting edges. From an operational perspective, Finnra's use of self-directed work teams, and the emphasis Finnra places on local managers and operators working toward reducing costs enables them to compete effectively with private industry.

Similarly, Finnra's exchange worker will return to Finland with new equipment, operation and training ideas for possible implementation. These include zero-velocity salt/sand spreading technology, fiber optic lighting for snow plows, mechanical icebusters, and carbide cutting edge technology. Operational items include the greater use of snow blowers, side wing plows and siping of truck tires for greater traction.

In summary, both agencies have found innovative and cost-effective ways to deliver their service to the road user. From this first worker exchange experience, Mn/DOT will examine similar opportunities with other agencies.

PROGRAM HISTORY

The Minnesota Department of Transportation (Mn/DOT) has a long history of partnering with other agencies in transportation related projects, especially in winter maintenance research. Mn/DOT also has facilitated

various technology transfer and employee training programs throughout Minnesota and the US. As part of its Maintenance Technology Exchange Program, Mn/DOT sent John Scharffbillig, a Highway Maintenance Supervisor to work with Finnra for three months during the winter season of 1995-96. He was stationed at the Raisio Roadmaster Area on the southwestern coast of Finland. In turn, Mn/DOT hosted Marko Kolattu, a Senior Highway Maintenance Operator from Finnra for the same period. Marko was stationed in Mn/DOT's Nopeming Maintenance Subarea in District 1, Duluth, which borders Lake Superior. These locations are illustrated in Figure 1.

Finnra and Mn/DOT have a long history of cooperative efforts and personnel exchange dating back to the early 1970's. Finnra and Mn/DOT have an on-going joint research program with two active projects—Salt Usage Comparison Study and the Maintenance Technology Exchange Partnership.

PROGRAM GOALS

The purpose of the worker exchange was for each agency to get first-hand knowledge of the other's road maintenance (particularly winter maintenance) equipment, materials and methods of operation to improve their own related technologies through research, innovation, implementation, technology transfer and employee training. This knowledge was gathered by observing the host agency's field operations including actual hands-on involvement in those operations, and participating in the daily work activities according to a detailed work program approved by Mn/DOT and Finnra. The exchange also included visits to local maintenance equipment manufacturers to obtain the latest knowledge on the host country's designs and innovations.

Through this exchange, each agency received significant benefits. First, the exchange workers toured various maintenance areas giving field personnel a chance to learn from them and their reactions relating to the differences between the two agencies' maintenance operations. Following the exchange, each agency has had



FIGURE 1 Minnesota Department of Transportation-partnering-Finnish National Road Administration.

their exchange worker as a resource for field research and personnel training.

PROGRAM FUNDING

Both operators remained full-time employees of their own respective agencies throughout the three-month exchange period. Funding for the related costs was provided by each agency for their own operator. However, to limit the need for actual money transfers between agencies, an agreement was prepared to address the exchanging of costs and expenditures accumulated during the Program. In addition, a formal Partnership Agreement was signed to specify issues relating to liability in the case of an accident during the exchange involving motor vehicle/personal injury claims.

INNOVATIVE METHODS AND EQUIPMENT FROM FINLAND

John Scharffbillig's experience in Finland has shown that the Finnra uses innovations in equipment and methods that are of immediate interest to Mn/DOT, as explained in detail in his monthly reports (2, 3). A few of the more important ones are described in the following paragraphs.

Equipment

The principal working parts of the *automatic safeguard greasing system* are the air-operated piston type pump and lines to the grease fittings. This system works similar to a

conventional grease gun. A spring pushing on a plunger maintains a constant pressure to the fittings. The system runs both on an automatic timer or via a manual switch. When the unit is started, a solenoid opens letting the air pump power the grease flow to the fittings. Warning lights on the system let the operator know when it is out of grease, clogged or other problems. Use of the safeguard greasing system has significantly reduced equipment maintenance costs in Finnra.

Automatic slopper control is used when doing final grading of a surface. It is set to the angle wanted and it automatically keeps the grader blade at the selected level and angle. This function is controlled by sensors mounted on the turntable and the body of the grader. When the grader goes up or down, this system makes the needed corrections automatically, instead of the operator having to guess at the modified setting.

Super Kellunta floating system is installed on Finnra graders to obtain better control of the snow removal attachments including front plow, side wing, main blade and rear drag blade. This system permits the attachments to be either fixed in place or floating with a capacity to add down pressure on the attachments when needed. The system allows the front plow to be angled up or down, sideways, etc. The grader controls are configured for grading with the main blade controlled to a finer degree than the other attachments.

The Finnra uses advanced *blade cutting edge technologies*. Included are the Olofsfors P-300 "Swiss Cheese" blade, carbide-tipped pin blades, rubber slush blades, and a quick-attach system to mount these cutting edges. The Swedish P-300 blade has proven effective in removing compacted snow and ice, and it leaves a grooved surface for detention of deicing chemical or brine. The adjustable rubber blade mounted behind the front plow or the underbody blade is widely used for the removal of soft snow and slush. This eliminates the need for more chemical to melt the snow or slush. The quick-attach mounting system for the various cutting edges is a unique and time saving innovation.

Mn/DOT has already tried two sets of the P-300 system. There is a big difference in the principal behind the operation of the P-300 blade compared with the standard Mn/DOT blades, specifically in the mounting angle. It is now expected that with John's practical experience, Mn/DOT will implement the use of this new cutting edge technology.

Operations

As for operational procedures there are many features that were highlighted in John's reports (2, 3). The local Roadmasters are very aware of operational costs and how

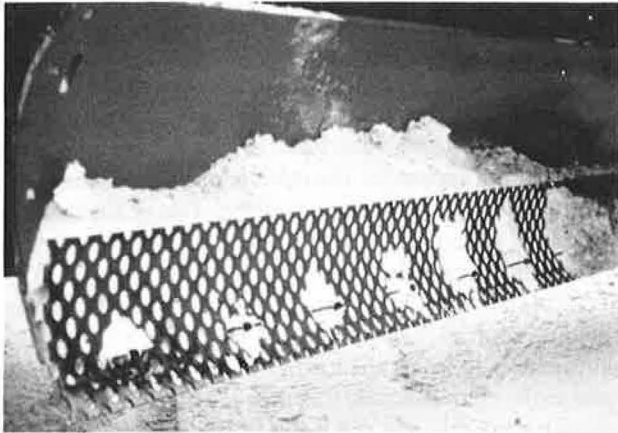


FIGURE 2 Olofsfors P-300 cutting edge, manufactured in Sweden.

they compare with the private sector. With Finnra's drive to reduce operational costs, all the managers and workers are aware of activity costs and are attempting to reduce those costs further. Maintenance forces in Finland compete with private industry for maintenance work.

The Finnra maintenance workers operate in self-directed work teams. Each employee is asked to contribute ideas to improve maintenance and the maintenance program, and is aware of the goals for efficiency, and generally has a strong sense of personal responsibility to help meet these goals.

INNOVATIVE METHODS AND EQUIPMENT FROM MINNESOTA

During his stay in Minnesota, Marko Kolattu visited six of the fourteen maintenance areas within Mn/DOT and two county highway departments. He received the Minnesota Commercial Driver's License (CDL) and operated very diverse equipment. Marko concentrated on issues of concern to maintenance operators, and described his findings in monthly reports (4, 5). Marko's overall impression was good, and he was impressed with Mn/DOT's Traffic Management Center (TMC) in Minneapolis and the Highway Helper Program. He also was interested in the way Mn/DOT set up its operator training in units, covering topics such as hazardous materials, truck operating training, etc. and requiring its maintenance field personnel participate in the training in regular intervals.

At the end of Marko's visit he identified the zero-velocity spreader idea, fiber optic warning lights and some specific snow removal equipment as the things with most potential for successful implementation within Finnra. These ideas are briefly described below.



FIGURE 3 Tyler zero-velocity spreader.

Zero-Velocity Spreader Concept

Zero-velocity spreading of salt and/or abrasives is a technology under development in Minnesota and several other states. This technology, as developed through the Tyler spreader in Minnesota, can substantially reduce salt and/or sand use and increase the maximum speed of the application. It is also considered that the technology has a direct application within Finnra's maintenance operations. Figure 3 illustrates a conventional Tyler zero-velocity spreader unit on a Mn/DOT truck.

Fiber Optic Warning Lights

Fiber optic warning lights are currently being field tested by Mn/DOT to provide better snowplow visibility in a snow cloud to the other road users. Initial tests show that the fiber optic lights effectively pierce the snow cloud and define the snow plow within. Marko Kolattu believes this innovation will soon be part of a standard maintenance vehicle package in Minnesota, and that it will be of great interest in Finnra.

Snow Removal Equipment

Other Mn/DOT maintenance operations equipment of interest to Finnra includes the grader-mounted Icebuster™ scarifier, illustrated in Figure 4. This is a rotating star wheel device for mechanically crushing hard packed snow and ice which are then removed with the grader blade. Also, Mn/DOT uses carbide cutting edges. Tests conducted a few years ago in Finland did not produce similar results due to a different blade operating and mounting technique. Marko Kolattu now expects that



FIGURE 4 Icebuster™ scarifier.

they can be effectively used in Finland with a small change in their operating technique.

In snow removal operations, Mn/DOT uses medium and large truck-mounted snow blowers to remove large drifts or snow banks. They are used also for clearing snow from intersections, interchange areas and under bridges. While not used in Finland, Marko believes that they would effectively complement Finnra's snow removal fleets. Mn/DOT also uses side wings to remove snow from both median and right shoulders. Mn/DOT keeps the shoulders clear of snow including the leveling of banks beyond the shoulder where Finnra does not typically clear. Again it was seen by Marko that opportunities exist within Finnra's operations for greater use of side wing plows.

An additional idea of interest was the siping of truck tires in the Duluth District. This is a method of closely spacing shallow transverse slices on the tire wearing surface to increase friction on slippery surfaces.

IMPLEMENTATION AND TRANSFER OF NEW TECHNOLOGY WITHIN MN/DOT (2, 3)

To improve the transfer of ideas to state and local maintenance personnel in Minnesota, John Scharffbillig will make presentations and participate in workshops conducted under the Minnesota Circuit Rider Technology Transfer Program for one year. This program is jointly sponsored by Mn/DOT, the University of Minnesota's Center for Transportation Studies, the Minnesota Local Road Research Board, and the Federal Highway Administration.(1)

In addition, selected innovations are to be subjects for further maintenance operations field research within Minnesota. The exchange worker is expected to be an

active champion, sponsor, or principal investigator for Mn/DOT maintenance research projects developed and approved based on the technology brought from Finland. It is expected also that he will study, facilitate and work toward implementation of specific innovative Finnra operational knowledge and maintenance technologies or modifications to fit into Mn/DOT's scheme of maintenance operations.

A note of caution must be observed when planning to use any other agency's standard equipment. The Scandinavian blades for example use metric measurements for mounting hole spacing that differs from American or Mn/DOT dimensions. Typically, some modifications will be needed to adopt the other's equipment. For the P-300 cutting edges it was necessary for Mn/DOT to get separate mounting boards from the manufacturer. If an idea or innovation catches on, subsequent volume purchases could provide for adaptations to the other agency's requirements, and in Finland's case it should lead to international private sector partnerships.

CONCLUSION

Because of the Maintenance Technology Exchange Partnership, both agencies have found new, innovative and cost-effective ways to deliver maintenance products and services. Also, they have confirmed that most of their maintenance operations are managed and handled in an effective manner. Yet the most immediate result of the exchange for Minnesota is its input through technology transfer and training to maintenance field operations personnel and culture throughout the state.

To continue its active Maintenance Technology Exchange Program, Mn/DOT has approached other state agencies in the US and Canada, and some international transportation agencies to create further opportunities for maintenance technology exchange partnerships, based on the positive experience with the Finnra. Mn/DOT will be pursuing cooperative exchanges of personnel and equipment with interested agencies in the coming year.

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