

State Planning and Research Program Quarterly Report

PROJECT TITLE: Identification and Recommendations for Correction of Equipment Factors Causing Fatigue in Snowplow Operations

OBJECTIVE: Identify in-cab and external equipment factors that cause operator fatigue in snowplow operations.

PERIOD COVERED: April 1, 2017, to June 30, 2017

PARTICIPATING AGENCIES: Minnesota Department of Transportation and the Clear Roads Technical Advisory Committee

PROJECT MANAGER:

Debra Fick/Tom Peters

SP&R PROJECT NO:

MnDOT Contract No.

PROJECT IS:

Planning

Research & Development

LEAD AGENCY: MnDOT

Federal Project Number:
TPF-5(218)

PRINCIPAL INVESTIGATOR: Jeffrey Hickman

ANNUAL BUDGET:

\$200,000 (project budget)

PROJECT EXPENDITURES TO DATE: \$57,662.14

WORK COMPLETED:

- **Task 8: Analyze Questionnaire Results.** Virginia Tech Transportation Institute (VTTI) researchers performed analyses on the questionnaire responses and submitted the Task 8 draft report on May 31, 2017. A total of 2,011 winter maintenance operators from 23 states provided responses to the questionnaire. Results showed the following factors were associated with **increased** winter maintenance equipment operator fatigue:

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| • night shifts | • shifts longer than 16 hours |
| • non-automatic tire chains | • noise and vibration from the front plow |
| • noise from the engine | • music/radio turned off |
| • exterior warning lights | • interior vehicle lighting |
| • windshield wipers | • number and placement of equipment controls |
| • placement of and light from liquid crystal displays | |

Additionally, winter maintenance operators indicated that the following equipment was associated with **decreased** fatigue:

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|---|---|
| • a comfortable seat with air-ride/vibration dampening technology | • air-ride vehicle suspension |
| • rubber-encased blades | • a blade float device |
| • segmented blades | • music/radio |
| • a citizen's band or Department of Transportation radio | • collision avoidance and lane positioning technologies |
| • improved cab insulation | • anti-glare glass |
| • heated/improved wipers | • heated windshield/mirrors/windows |
| • snow deflectors | • light emitting diode (LED) exterior lighting |
| • placement of auxiliary lighting | • audible alerts from snow/ice/safety equipment |
| • back-up cameras | |

The Clear Roads subcommittee provided VTTI with personal contact information for equipment manufacturer representatives. VTTI researchers contacted these individuals and other large truck manufacturers. All equipment manufacturers declined participation due to confidentiality. However, four of the equipment manufacturers did say operator fatigue was considered during the product design

process.

- **Task 9: Develop a Prioritized Scale of Equipment Fatigue and Assess Cost-Benefit Recommendations for Solutions.** The VTTI team used the results from the literature review and questionnaire to identify the equipment sources of winter maintenance operator fatigue. Additionally, VTTI identified the associated costs and potential reductions in fatigue for fatigue-reducing or -eliminating equipment countermeasures. The Task 9 draft report was submitted on June 14, 2017. VTTI conducted a webinar on June 20, 2017 to review Task 8 and Task 9.
- **Task 10: Final Recommendations and Technology Transfer Resources.** Using the results from Tasks 8 and 9, the VTTI team developed a list of final recommendations to reduce or eliminate winter maintenance operator fatigue. These recommendations focused on low-cost equipment with the greatest potential to reduce winter maintenance operator fatigue. The VTTI team recommended seven equipment solutions and six non-equipment solutions. The Task 10 draft report was submitted on June 19, 2017.

SUMMARY OF ACTIVITIES EXPECTED TO BE PERFORMED NEXT QUARTER:

- The project subcommittee will provide the VTTI team with comments and suggestions on the Task 8, 9, and 10 draft reports.
- The VTTI team will revise the Task 8, 9, and 10 draft reports based on comments from the project subcommittee. Additional analyses may be required.
- The research team will complete Task 11: Draft Final Report.
- The project subcommittee will review the Task 11 report and provide the VTTI team with comments and suggestions.
- The VTTI team will develop a technical brief that provides an easy-to-understand summary of the project along with final recommendations.

STATUS AND COMPLETION DATE:

This project is currently ongoing and ends on December 31, 2017.