

CHAPTER 15: OPERATOR INPUT AND ACCEPTANCE

The success of any new venture depends on its acceptance by the end users. This is particularly true when new equipment or technologies are introduced to maintenance workers and equipment operators. If vehicle operators and mechanics are not supportive, there are sure to be implementation problems. Early in this project, the consortium members recognized the importance of end-user involvement and support and placed winter maintenance staff and snowplow operators at the center of the Phase I focus group activities. Many of the technologies added to the prototype maintenance vehicles are thus a direct result of end-user input about desired vehicle functionality.

The winter of 1997-1998 was an important observation period for the prototype vehicles, and end users were again centrally involved. The prototype vehicles were assigned to active duty, and they provided snow and ice control on roads in Michigan, Minnesota, and Iowa. Equipment operators and mechanics had first-hand experience with the prototype vehicles' performance, and their feedback was critical to evaluating the vehicles' performance during Phase II activities.

OBJECTIVE

Develop end-user input and acceptance.

MEASUREMENT

Record questionnaire responses from equipment operators and mechanics in the three consortium states.

DISCUSSION

Understanding that reporting procedures that require minimal effort will benefit everyone involved in the study, CTRE did not want to burden equipment operators and mechanics with lengthy, time-consuming documentation. CTRE's goal was to develop questions that made sense and were easy to respond to and would therefore have a high response rate. Two questionnaires were developed. The first was used by CTRE staff to guide personal telephone interviews with prototype vehicle operators. The second was an equipment performance log sheet, which could be completed by either the vehicle operators or mechanics. CTRE sent the log sheets, along with sample operator questionnaires, to each of the three state DOTs and the maintenance garages where the prototype maintenance vehicles were located, with instructions about completing the log sheets and responding to the telephone interviews.

Operator Interviews

After winter storms, CTRE conducted telephone interviews with prototype vehicle operators using questions approved by the study team. A key question was whether the add-on technology made the vehicle operator's workload easier or if it added to the equipment operator's job. Of

course, if the technology made the job more difficult, it would not be successful when implemented on a larger scale.

As they conducted telephone interviews with prototype vehicles operators, CTRE staff recorded operator responses on the form shown in Figure 15-1.

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| PROTOTYPE VEHICLE PERFORMANCE RECORD |
| Please answer each of the following questions. |
| Date: |
| Time of your shift: |
| What piece of equipment on the prototype truck worked the best? |
| What piece of equipment on the prototype truck worked the worst? Did this have any negative impact on your operation of the prototype truck? |
| Was the PlowMaster display easy to read while you were driving? |
| How did the added technology on the prototype vehicle affect your comfort and attention to the road, as compared to a conventional maintenance truck? |
| Any other problems you had with the truck while driving it? |
| What suggestions for improvement do you have? |
| Initials: |

Figure 15-1 Sample equipment performance evaluation questionnaire

The questionnaire's sections and their intended meanings are as follows:

Date

The date of the shift.

Time of shift

The beginning and ending times of the shift.

What piece of equipment on the prototype truck worked the best?

The element on the prototype vehicle that performed the best during the vehicle's run. CTRE wanted to identify those components that worked well for the operators.

What piece of equipment on the prototype truck worked the worst? Did this have any negative impact on your operation of the prototype truck?

The element on the prototype vehicle that performed the worst during the vehicle's run. CTRE wanted to determine if poor performance had a negative impact on vehicle operation compared to the operation of a standard winter maintenance truck.

Was the PlowMaster display easy to read while you were driving?

For the best performance, the PlowMaster display must be easy to read while the prototype truck operator is driving. If the screen is too dim or too bright, for example, the brightness feature should be corrected. Good visibility is especially important for the PlowMaster screen due to its central function on the truck.

Any other problems you had with the truck while driving it?

CTRE wanted to know of any other problems were encountered with the prototype vehicle while the operator was driving it. Other problems might include equipment failures, or other problems with equipment.

What suggestions for improvement do you have?

CTRE was especially interested in suggestions for improvement of the prototype trucks. Since the truck operators use these trucks the most, they would have valuable insight.

Some of the more common answers to these questions follow:

1. What element of the new technology worked the best?

Equipment operators commented positively on the operation of the variable speed material applicators. With these tools, the equipment operators were able to set a prescribed amount at a given speed, and the material applicator compensates material application for changes in speed. One equipment operator termed the material applicator user interface valuable and friendly.

In addition, the operators appreciated the user-friendliness of the PlowMaster computer.

2. What element of the new technology worked the worst? Did this relatively poor performance have any negative impact on the operation of the other vehicle components?

Equipment operators faced continuous challenges with both the temperature sensors and the friction meter. At one point, the Iowa DOT reported the pavement temperature sensor off by as much as 30° F, prompting replacement of the sensor with a better functioning one. The Iowa and Minnesota DOTs reported problems with broken belts on the friction meter, in addition to problems associated with corrosion of the friction meter's parts.

When a piece of equipment malfunctioned or failed, that particular piece was usually rendered out of service until the vehicle returned to its garage. However, even when the equipment malfunctioned, the drivers reported that they were still able to operate the truck at the same level of service at which they operated conventional snow plows. This fact was considered important by CTRE, as it showed that operating the advanced technology vehicle provided no more demand on equipment operators than operating unmodified vehicles.

3. Was the PlowMaster display easy to read while you were driving?

Equipment operators reported the screen dimness and brightness feature of the PlowMaster display was relatively easy to use while they were driving the vehicle. During the day the operators would brighten the screen, and during the evening the operators would dim the screen. The only reported problem of reading the PlowMaster display was in direct sunlight (from the Minnesota DOT)—then the display was difficult to read. Polarized sunglasses may help correct this problem.

The PlowMaster screens were designed in a logical and easy-to-follow manner. Equipment operators reported being able to quickly call up information regarding the various elements reported by the PlowMaster computer.

On a related note, the equipment operators reported more problems reading the friction meter display, mostly because of the lack of a brightness or dimness feature. Norsemeter is working on this problem.

4. How did the added technology on the prototype vehicle affect your comfort and attention to the road, as compared with conventional maintenance trucks? (Was the added technology a detriment or enhancement to the attention you could give the road?)

The equipment operators reported the added technology helped them focus more of their attention on the road, especially when the equipment was functioning properly. The added technology took more tasks out of the hands of the equipment operators, allowing them to focus their attention where it was needed (for instance, on the road).

5. Any other problems you had with the truck while driving it?

Equipment operators from Iowa reported the material applicator control should be placed in a better location because its present location requires them to stop whenever they desire to change the material applicator's settings.

6. What suggestions for improvement do you have?

Equipment

The name of the equipment, such as “friction meter,” “lighting system,” or “pavement temperature sensor.”

P=Problem • R=Repair • M=Maintenance

Maintenance personnel can denote problems by “P”, repairs by “R”, and maintenance and modifications by “M”. Problems consist of electrical shorts, fuse blow-outs, or general equipment failure. Repairs consist of solutions to the problems. Maintenance or modifications consist of relocations of equipment, replacements, etc.

Start Date

The date the problem, repair, or maintenance, began.

End Date

The date when the problem, repair, or maintenance, ended. In the case of problems, “End Date” is the date on which the problem was diagnosed and repairs were started.

#Days

Duration of the problem, repair, or maintenance. Minimum duration for an entry is ½ day.

Initials

The initials of the person making the entry. If necessary, CTRE could contact the person to ask questions or clarifications regarding a problem, repair, or maintenance.

OBSERVATIONS

The winter of 1997-1998 was unusual in that there were relatively few snow events in the three consortium states, and the prototype vehicles were not tested as rigorously as they may be in future years. Given that limitation, however, equipment operators provided an overall positive and enthusiastic response to the advanced technologies on the prototype vehicles.

Observations from Operator Interviews

One major theme in operator responses was that the operators required additional time to become acclimated to the new technology. This was not unlike their previous experiences using a new piece of equipment and was not considered a negative. After becoming familiar with the new technology, equipment operators were able to function with relative ease and indicated efficiencies higher than experience with conventional snow plows.

Figure 15-3 summarizes equipment operator responses and how they viewed the concept vehicle. Sample records from CTRE interviews with operators are included in Appendix J.

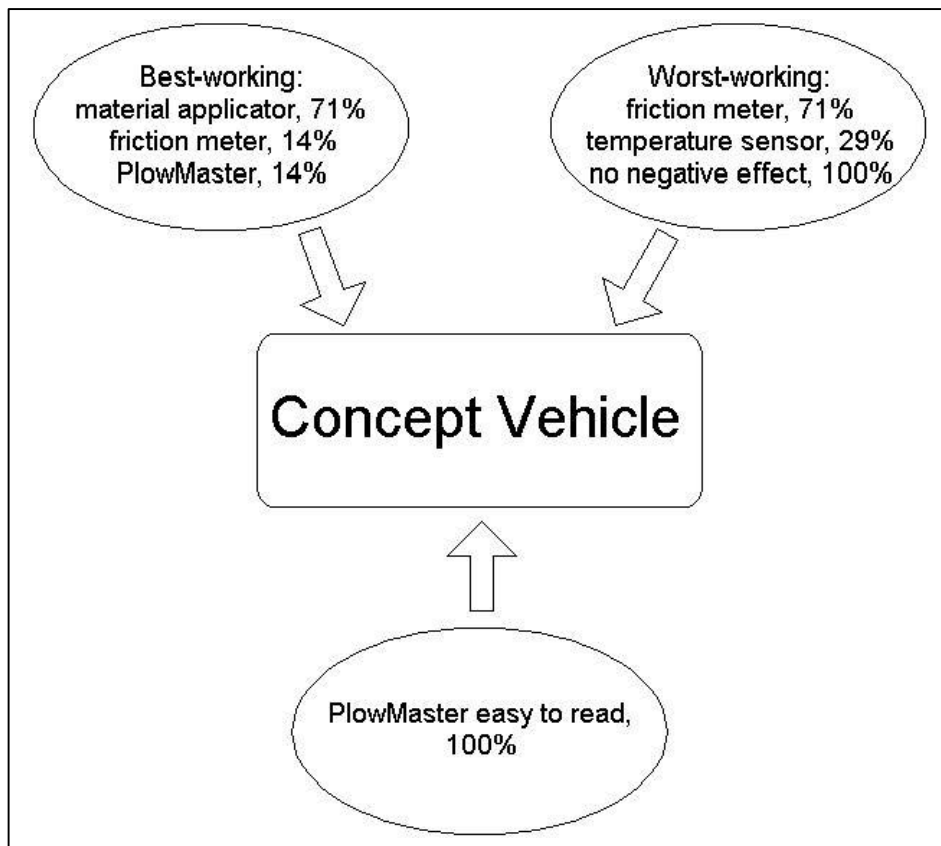


Figure 15-3 Equipment operators' response

Observations from Equipment Performance Log Sheets

No log sheet reports were returned to CTRE. Through other contacts with the state DOTs, CTRE learned about various equipment modifications, malfunctions, or other problems as documented in the technology chapters of this report. The lack of completed log sheets did not reflect a lack of interest in the project by operators and mechanics but rather their focus on their primary mission of snow and ice control.