Customer Perceptions and Expectations of Minnesota's Bare Pavement Product

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In recent years the road maintenance division of the Minnesota Department of Transportation (MnDOT) has redefined its role, moving from a traditional focus on internal activities to an external-looking vision of customer-based products and services. Toward this end MnDOT conducted research to understand the attributes of its bare pavement product (the result of MnDOT's snow removal operations) that are important to the customer as well as to determine customer expectations for levels of service in different highway environments. The research was designed to measure the effects on highway consumers of six levels of snow removal on three different classes of roads throughout the state—two-lane roads, four-lane divided highways, and Interstate highways—as well as to determine whether driving habits or opinions vary by demographic group. Study participants viewed winter driving road conditions on videotape, then documented their opinions and reactions on a self-administered questionnaire. In partnership with local community groups and organizations, a market research firm was commissioned to assist with the study, including identifying and recruiting study participants. Results of this research will be used to improve delivery of MnDOT's snow removal operations in order to better meet the needs and desires of its customers.

The research was designed to meet the following objectives:

1. To measure the impact of six levels of snow removal service on the willingness of drivers to use the roads;
2. To identify driving comfort levels for the six levels of snow removal service;
3. To identify acceptability levels for the six levels of snow removal service;
4. To determine how the above opinions and perceptions (willingness to drive, comfort level, and acceptability) change, if at all, as time passes after the end of a snowfall;
5. To assess the above opinions and perceptions for three different classes of roads: two-lane roads, four-lane divided highways, and Interstate highways;
6. To gather customer input from all areas of the state, specifically the Greater Minnesota and Metro regions, the North/North-Central region, the West-Central/Northwest regions, and the southern part of the state; and
7. To determine whether driving habits or opinions vary for specific demographic groups.

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Methodology

The study's methodology was designed to assess customer opinions and perceptions concerning three classes of roads: two-lane roads, four-lane divided highways, and Interstate highways. Study participants were invited to a central location where they viewed winter driving road conditions on videotapes and recorded their reactions on a self-administered questionnaire. To eliminate respondent fatigue, only four of the six winter road conditions (reflecting four of the six levels of MnDOT snow removal service) were shown to a participant for a single class of road. Selection of service level was accomplished by having each individual view the worst level (snow-covered, compacted), the best level (fully bare), and two of the four in-between winter driving road conditions (Figures 1 to 6). Care was taken to assure that each of the

FIGURE 1 Snow-covered, compacted (worst).

FIGURE 2 One intermittent wheelpath.

FIGURE 3 Two intermittent wheelpaths.

FIGURE 4 Two lanes plowed with centerline covered and no edge lines showing.

FIGURE 5 Two lanes plowed with centerline covered but edge lines showing.

FIGURE 6 Fully bare (best).

four in-between winter road conditions received an equal number of evaluations.

For Greater Minnesota, two-lane and four-lane highways were evaluated, therefore each participant evaluated eight different videos. In Metro Minnesota, two-lane roads, four-lane divided highways, and Interstate highways were evaluated, and each participant evaluated 12 different videos.

Participants in each city were invited, in groups, to a central location. Each group viewed a set of four winter driving road condition videos for a specific road class. After each video ended, a still photograph from the video was placed before the participant as a reminder of the winter driving road condition being evaluated. Participants were then instructed to consider the following information while rating the road conditions:

- Roads in the videotapes showed various levels of snow removal after a 3-in. to 4-in. snowfall.
- The snowfall had ended at 3 a.m. (in the Metro area some questions concerned snowfalls that ended at 3 p.m. or 6 p.m.).
- The driver need not be concerned with ice on the roads.
- The wind had diminished when the snowfall ended and remained calm.
- The temperature had remained constant throughout the day.

Representatives of the market research firm then administered a group interview, and participants registered their opinions on a self-administered questionnaire. Upon completion of the questionnaire, market research firm representatives ensured they had been filled out correctly and that instructions had been followed accurately.

In the interest of using its research funds judiciously, MnDOT and the market research firm it commissioned used the proven technique of partnering with local community groups and organizations to identify and recruit study participants. Groups and organizations who committed to the study followed guidelines provided by the market research firm in qualifying and recruiting study participants from their membership lists or rosters. For each recruited participant who completed the study, the recruiting group or organization received a $15 donation. This method provided a high level of respondent participation at a low per-interview cost. Building in variation across organizational type and consumer market also aided in securing a demographically representative sample.

Study Limitations and Assumptions

Because of the nature of the research design that was necessary to address study objectives within a reasonable budget, the following study limitations should be considered when interpreting the results:

1. First, the sample is a strict random probability sample. Because it was believed that study participants could give a more accurate expression of their opinions by viewing a moving videotape of road conditions, it was necessary to invite participants to a specific location. As a result, participants from only 12 general areas of Minnesota are included in the study. To mitigate potential bias, test locations were carefully chosen to reflect populations similar to those of other cities across Minnesota while also providing geographical dispersion. Further, in each market recruiting was conducted through the rosters and membership lists of local organizations. While this recruiting method has the potential to over- or underrepresent certain demographic groups, experience has shown that it also has the advantage of gaining cooperation from individuals who might not otherwise give their time to research. This is especially significant in light of the lower levels of cooperation being experienced more often in research among these groups due to answering machines or caller ID telephone services.

2. Second, the videotape illustrating the second-best road condition ("the center of the lane plowed with centerline covered but edge lines showing") appears to have included sections of road that were more difficult to drive on than those shown in the third-best level of road maintenance service ("the center of the lane plowed with centerline covered and no edge lines showing"). It is believed that the video of the second-best winter driving road conditions (edge lines showing) included curved roads and may also have given the impression of icy roads. While participants were told that the roads did not have icy patches, it is possible that the video impressions did not permit research participants to fully comprehend this road condition.

Summary of Findings

The survey was structured to learn the conditions under which MnDOT's customers are willing to drive, how acceptable MnDOT's level of service is to highway consumers, and how comfortable consumers are while driving on roads that reflect varying levels of MnDOT service. MnDOT was also interested in learning how tolerant drivers are as time passes after the end of a snow event and if the willingness to drive differs depending on the purpose of a trip.

Following are the results of the survey:

1. Minnesotans said they would drive to work under any road condition after a 3-in. to 4-in. snowfall, even though few road conditions are rated as acceptable or comfortable for driving.

• Most Minnesota drivers (80 percent or more depending on test area) said they would drive to work at their usual time on any of the six presented road conditions. This was true for the three road types [two-lane roads, four-lane divided highways, and Interstate highways (Interstate highways were rated only in the Metro area)] in both Greater Minnesota and in the Metro area at 6 a.m. 3 h after a snowfall had ended, and between 7 a.m. and 9 a.m. 4 to 6 h after a snowfall had ended. Most Metro drivers said they would also drive home from work between 4 p.m. and 6 p.m. on any road type or in any condition if the snowfall ended at 3 p.m. (1 to 3 h before leaving for home).

• Most Minnesota drivers (80 percent or more) indicated they are comfortable driving to work only under the following road conditions, which they also rate as acceptable at 6 a.m. and 7 a.m. to 9 a.m. [and also 4 p.m. to 6 p.m. (asked in the Metro area only)]:

– Fully bare conditions for all three road types in all areas,

– Centerline covered with edge lines showing (four-lane divided highways in Greater Minnesota only), and

– Centerline covered and edge lines not showing (two-lane roads and four-lane divided highways in Metro area only and Interstate highways).

• In general, Minnesota drivers indicated they are not comfortable driving to or from work under the following road conditions, which are also not rated as acceptable at any time of the day and on any of the three categories of roads:

– Two intermittent wheelpaths,

– One intermittent wheelpath, or

– Snow-covered, compacted roads.

2. Most Minnesotans said they would drive to an appointment after a 3-in. to 4-in. snowfall under any four-lane divided highway or Interstate highway condition. Some two-lane road conditions limited respondents' expressed willingness to drive to appointments earlier in the day. Again, few road conditions were rated as acceptable or comfortable for driving to an appointment, and Minnesota drivers were especially critical of four-lane divided highway conditions.

• Most Minnesota drivers (80 percent or more) in both Greater Minnesota and the Metro area indicated they would be willing to drive an appointment between 7 and 9 a.m., 4 to 6 h after a snowfall has ended, under the following winter driving conditions:

– Fully bare conditions (all road types),

– Centerline covered with edge lines showing (all road types),

– Centerline covered and edge lines not showing (all road types),

– Two intermittent wheelpaths (four-lane divided highways and Interstate highways only), or

– One intermittent wheelpath (four-lane divided highways and Interstate highways only).

• For the time of noon, most respondents said they would drive to an appointment under any winter driving condition and on any road type except for snow-covered, compacted two-lane roads. This was true for both Greater Minnesota and the Metro area.

• Most Minnesota drivers (80 percent or more) indicated they would be comfortable driving to an appointment in either Greater Minnesota or the Metro area only under the following road conditions, which they also rate as acceptable at either 7 a.m. to 9 a.m. or noon:

– Fully bare conditions (two-lane roads and Interstate highways only) and

– Centerline covered and no edge lines showing (two-lane roads and Interstate highways only).

• In general, few Minnesota drivers said they would be comfortable driving to an appointment under the following road conditions, which few rated as acceptable:

– Four-lane divided highways with two intermittent wheelpaths,

– Four-lane divided highways with one intermittent wheelpath, or

– Snow-covered and compacted roads.

3. The willingness to drive to school on two-lane roads was limited to at least two intermittent wheelpaths or better conditions such as cleared roads. Minnesotans said they would drive to school under any four-lane divided highway or Interstate highway road conditions between 7 and 9 a.m. after a 3-in. to 4-in. snowfall.

• Most Minnesota drivers (80 percent or more) in both Greater Minnesota and the Metro area said they would be willing to drive to school between 7 a.m. and 9 a.m. 4 to 6 h after a snowfall has ended under the following winter driving conditions:

– Fully bare conditions (all road types),

– Centerline covered with edge lines showing (all road types),

– Centerline covered and no edge lines showing (all road types),

– Two intermittent wheelpaths (all road types),

– One intermittent wheelpath (four-lane divided highways and Interstate highways only),

– Snow-covered, compacted conditions (four-lane divided highways in Greater Minnesota and only Interstate highways in the Metro area).

• Most respondents (80 percent or more) driving to school in either Greater Minnesota or the Metro area indicated they would be comfortable driving on very few road conditions and would also find few road conditions acceptable. Only the following road conditions were rated as comfortable to drive under or acceptable at 7 a.m. to 9 a.m.:

– Fully bare conditions (all road types) and

– Centerline covered and no edge lines showing (two-lane roads or four-lane divided highways in Greater Minnesota and only Interstate highways in the Metro area).

4. After-school activities (between 4 p.m. and 6 p.m.), such as extracurricular practice, would be severely limited according to respondents if the roads had not been cleared.

- In Greater Minnesota, if a snowfall has ended at 3 a.m. (13 to 15 h prior to 4 p.m. to 6 p.m.), most respondents (80 percent or more) said they would be willing to drive to such activities as practice and workouts under the following winter driving conditions:

  – Fully bare conditions (two-lane roads only),

  – Centerline covered with edge lines showing (two-lane roads only), and

  – Centerline covered and no edge lines showing (two-lane roads only).

- In the Metro area, if a snowfall has ended at 3 p.m. (1 to 3 h prior to 4 p.m. to 6 p.m.), most respondents (80 percent or more) said they would not be willing to drive to such activities as practice and workouts under any winter driving conditions.

- No winter driving conditions in the Metro area were considered as acceptable or rated as making respondents feel comfortable while driving to such activities as practice and workouts between 4 p.m. and 6 p.m. 1 to 3 h after a snowfall has ended. Only the following road conditions were rated as comfortable to drive under or as acceptable at 4 p.m. to 6 p.m. in Greater Minnesota, 13 to 15 h after the snowfall has ended:

  – Fully bare conditions (two-lane roads or four-lane divided highways in Greater Minnesota only) and

  – Centerline covered and no edge lines showing (two-lane roads in Greater Minnesota only).

5. Shopping was the most seriously curtailed activity after a snowfall. This was in part a result of a percentage of respondents who indicated they did not shop at certain times of the day and also a result of the discretionary nature of shopping, a task that can easily be rescheduled to a nonsnow day.

- Only a portion of Minnesota drivers (60 to 79 percent) said they would be willing to drive for the purpose of shopping under the following winter driving conditions:

  – Fully bare conditions [Greater Minnesota two-lane roads in the morning or noon only (not in the late afternoon), Greater Minnesota four-lane divided highways at any time of the day, Metro two-lane roads at any time of the day, Metro four-lane divided highways at noon or in the afternoon, and Metro area Interstate highways at any time of the day], and

  – Centerline covered and no edge lines showing (all road types).

- Most drivers (80 percent or more) in either Greater Minnesota or the Metro area say they would be comfortable driving for shopping purposes under the following two winter driving road conditions, which they would also find acceptable:

  – Fully bare conditions (all road types in Greater Minnesota and two-lane roads and Interstate highways in the Metro area) and

  – Centerline covered and no edge lines showing (two-lane roads in Greater Minnesota and two-lane or Interstate highways in the Metro area).

Conclusions and Recommendations

Conclusions

Acceptability levels for all road conditions closely match comfort levels. This is true throughout the study for all road conditions on all classes of roads. As comfort levels increase, so do levels of acceptability.

Levels of acceptability and driving comfort, however, do not affect willingness to drive as might initially be expected. In numerous situations throughout the study, drivers' measured comfort levels and acceptability of road conditions were under 30 percent while at the same time their willingness to drive was in the 80 to 90 percent range. This was especially true for driving to or from work. As with work-related driving, the willingness to drive to school or to an important appointment decreased only if road conditions were snow-covered and compacted or showed one intermittent wheelpath.

Winter road conditions have a greater impact on driving that is more discretionary such as shopping or late afternoon school activities (practices, sports, workouts). This was true in both Greater Minnesota and the Metro area.

Greater Minnesota drivers' willingness to drive under poorer road conditions increased as the day passed. For the late afternoon, the willingness to drive on snow-covered and compacted roads for shopping purposes doubled from that measured for 7 a.m. to 9 a.m. However, even though acceptability for these poorer conditions increased, willingness to drive levels did not.

It is notable that in the Metro area drivers are more willing to drive on four-lane divided highways than on Interstate highways for discretionary driving under similar winter driving conditions. This may be for reasons other than the road condition, such as anticipated delays that might be experienced on Interstate highways due to traffic volume, or because of a greater feeling of safety on four-lane divided highways due to slower speeds.

If a snowfall occurs in the Metro area during the workday, drivers who otherwise leave for home between 4 p.m. and 6 p.m. will leave at their usual time. Similarly, many drivers who otherwise leave for home later than 6 p.m. will

also leave at their usual time. If road conditions are either snow-covered or characterized by intermittent wheelpaths, most of these drivers will be uncomfortable driving and will rate the roads as unacceptable. However, these same drivers remain willing to drive under these conditions.

Recommendations

Because the greatest impact on improving road acceptability is to clear two lanes, MnDOT should consider clearing all road classes to this level before going back to upgrade the road condition to fully bare. While fully bare roads are always rated as the most acceptable, those with two cleared lanes, centerline covered with or without edge lines showing, are most often considered to be almost as acceptable as the fully bare roads and more acceptable than those with intermittent wheel paths.

Greater Minnesota

For the greatest impact on acceptability in the Greater Minnesota area, four-lane divided highways should have two cleared lanes, centerline covered with edge lines showing, by 6 a.m. Greater Minnesota two-lane roads (two cleared lanes, centerline covered without edge lines) should be cleared to a high level of acceptability by 7 a.m. to 9:00 a.m.

The increase in road acceptability for two lanes cleared on two-lane roads far exceeds the increase in acceptability from improving two lanes cleared to fully bare on four-lane divided highways. Therefore as the day passes, MnDOT should focus on providing two-lane roads with two lanes cleared, centerline covered with or without edge lines showing, before clearing four-lane roads to a fully bare state.

Metro Area

In the Metro area, both Interstate highways and four-lane divided highways should be cleared to two lanes with centerline covered and no edge lines showing by 6 a.m. Two-lane roads should be improved to this level by 7 a.m. to 9 a.m. for greatest impact on acceptability.

Levels of acceptability for all winter driving road conditions worse than fully bare on Interstate highways are far below the acceptability level for fully bare. Therefore in the late afternoon (4 p.m. to 6 p.m. 1 to 3 h after a snowfall has ended), Metro area Interstate highways should be fully bare if at all possible. On four-lane highways, MnDOT should strive to have two lanes cleared, centerline covered with or without edge lines showing; in acceptability levels these conditions are closest to fully bare for four-lane divided highways. On two-lane roads, anything better than one intermittent wheelpath is a decided improvement for the late afternoon drive-time.