AN ASSESSMENT OF REGIONAL ROAD USER NEEDS IN THREE RURAL STATES

Jill Hough
Gary Hegland
Crystal Bahe

Upper Great Plains Transportation Institute
North Dakota State University

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AN ASSESSMENT OF REGIONAL ROAD USER NEEDS IN THREE RURAL STATES

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ABSTRACT

There are two major players in the transportation system: users and decision makers. Traditionally, public agencies (transportation agencies at the federal, state, county, and local level) held most of the decision-making powers related to transportation. The decision makers referred to in this study include county engineers, county road supervisors, and county commissioners. These decisions pertain to the physical infrastructure and operating characteristics of roadways. Infrastructure issues include financing and programming of building, improving, and maintaining highway transportation structures. Operational issues include regulations, enforcement, and taxing of users. A multitude of federal and state laws were established to assure efficient and safe use of the nation's transportation infrastructure. Road users, on the other hand, include motorists and motor carriers who utilize the highway transportation system. These users finance some costs of the transportation system by paying taxes and user fees. Road users typically expect adequate road services to be provided by governmental agencies. Users of transportation services participate in directing some road decisions through public input mechanisms and input to elected officials. However, in many cases, there still will be differences between perceptions of providers and users. To fill this gap, new federal policy specifically had mandated transportation agencies to adopt active and effective public participation plans. The transportation plans developed according to the 1991 Inter-modal Surface Transportation Efficiency Act (ISTEA) requirements and continued in the Transportation Efficiency Act of the 21st Century (TEA-21) consider input from extensive public involvement process. However, these efforts still are rudimentary in many states. In addition, user groups targeted for participation usually are located in urban centers where most of the population and economic activities are located. Even in these areas, citizen participation is

limited. This paper summarizes the results of a study on direct assessment of rural user needs in three states including Montana, North Dakota, and South Dakota. The objective of the study was to assess rural road users and providers perception of rural road needs. Different rural road user groups were identified to obtain a representative sample of perceptions. User groups targeted in the study included commuters, delivery services, mail carriers, school bus drivers, and farmers. An attitudinal survey was developed and administered to these groups. The survey yielded good return rates in each of the states, suggesting that more road users are becoming aware of road management and finance issues. This paper summarizes development of the survey and discusses major findings.

CHAPTER 1

INTRODUCTION

Rural states in the Midwest face unique transportation planning challenges. Their transportation circumstances and geographical, socioeconomic, and environmental characteristics differ greatly from states in the East, South, and Pacific Coast regions. The tri-state area of Montana, North Dakota, and South Dakota could be characterized by sparse rural populations, large transit-dependent populations among the elderly and economically disadvantaged, vast land-locked transportation systems, and an economic base heavily concentrated in agricultural and other natural resources. For example, the states of Montana, North Dakota, and South Dakota have 76.7, 55.8, and 65.4 percent, respectively, of the states' population that live in non-metropolitan areas, compared to the national average of 19.7 percent. The average population densities in these states are 6.2, 9.3, and 9.9 capita per square mile, respectively, compared to the average U.S. population density of 79.6 capita per square mile (United States Census). The low population densities and considerable distances between towns have dictated an extensive road system infrastructure characterized by low traffic densities.

According to the Federal Highway Administration (FHWA) for the year 2000, Montana, North Dakota, and South Dakota have 69,567 miles, 86,611 miles, and 83,471 miles, respectively. Montana has 157 lane miles of road per 1,000 people; North Dakota has 273 lane miles of road per 1,000 people; South Dakota has 223 lane miles of road per 1,000 people. Montana has greater population in the western half of the state, while North Dakota and South Dakota have the greater population in the eastern half of their states. The road requirements and available road resources differ throughout the states. However, several routine road needs are common, e.g., snow removal, maintenance, etc.

A common goal that all states share is improved customer satisfaction. This is evident by their Department of Transportation mission statements. The mission statements are:

MTDOT: *To serve the public by providing a transportation system and service that emphasizes quality, safety, cost effectiveness, economic vitality and sensitivity to the environment.*

NDDOT: *North Dakota will provide a transportation system that offers personal choices, enhances business opportunities, and promotes the wise use of all resources.*

SDDOT: *We provide a transportation system to satisfy diverse mobility needs while retaining concern for safety and the environment.*

An important part of identifying whether customer needs are being met is measuring customers' perception of the road factors: roadway elements, operational conditions, maintenance, and funding. This survey examines how the road decision makers and users in the tri-state area view the road systems in their respective states. All three states have many of the same challenges in meeting customer needs.

BACKGROUND

The tri-states of Montana, North Dakota, and South Dakota are among the many states plagued by declining revenues for road budgets, increasing road user demands, and a deteriorating infrastructure. Decision makers are faced with difficult choices regarding the rural road infrastructure and allocation of limited resources. These choices are not likely to get easier in the future. Road users pay taxes and expect a safe and reliable infrastructure to move from one point to another. The following paragraphs briefly describe basic road financing as well as the role of decision makers and road users.

Decision Makers and Road Users

Montana, North Dakota, and South Dakota have several categories of transportation decision makers and road users. Decision makers at the state, county, and local levels determine the quality and capacity of their respective transportation infrastructure. State road decision makers include legislators, the governor, the commissioner of transportation, and other DOT personnel. County decision makers

include county road engineers, road superintendents, and county commissioners. Local decision makers involve township officers.

Most county road decision makers devise a transportation work plan to initiate and maintain the road network in the county. Generally, the work plan has several prioritized projects to be completed over a given number of years. The work plan is open for public scrutiny. Dissatisfied road users can write their county commissioners with recommended changes. Decision makers may face some difficult decisions developing the work plan and taking into consideration the needed road improvements. On one hand, they must consider that taxpayers contribute to the funds designated for roads and taxpayers have certain needs and expectations. On the other hand, they must be realistic and allocate the limited funds to the best possible uses. This may result in a creative tension between those who think they pay for the system and those directly responsible for developing and maintaining the system.

Several user groups of the rural road system including agricultural producers, school buses, tourists, and commuters have different needs and requirements. In the past, agricultural producers were the largest user group. They primarily needed roads that could move their products and farm machinery; the quality of the road surface was less of a factor. However, the agricultural sector has been in transition. There is a trend toward fewer but larger farms and larger equipment. The larger, heavier equipment places increased demands for wider, stronger rural roads. In addition, many farm families earn off-farm income either seasonally or all year around. As the purpose of rural trips has changed, priorities and needs perceptions also may have changed. For example, pavement surface conditions probably have become more important as farm families travel more regularly and frequently to nearby communities.

In addition to farmers, there is a growing segment of rural residents who enjoy living in a rural environment but commute to a nearby town or city for employment. They have concerns about the road system to ensure they reach their place of employment. Rural road users may have several other needs and these must be identified to assure “customer” satisfaction.

RESEARCH PROBLEM

The interpretation of providers' perceptions and users' perceptions of road-related needs may be different. The ISTEA of 1991 and TEA-21 of 1998 required each state to adopt public participation (public input) while developing state plans and management systems. Even after the state plans and management systems are in place, it is important for decision makers to have continuous and ongoing public involvement regarding the rural road infrastructure. This participation results in a transportation system that is more consistent with the needs of users and allows the users to become more active stakeholders. Much of the public input has been focused at the state level and the metropolitan areas. This project was designed to take into consideration needs at the county and township level and could serve as a supplement to existing public input avenues.

After the rural road users' perceptions have been identified through interviews and surveys, more user needs can be considered effectively in transportation decisions. Furthermore, as decision makers are aware of users' needs and perceptions on a continuous basis, it will be easier to detect changes in perceptions and take the appropriate actions to respond to these changes. This will result in a more responsive transportation system overall.

OBJECTIVES OF STUDY

The overall objective of the study is to gain a better understanding of differences in perceptions on rural road needs between rural road providers and rural road users. A survey instrument was designed and sent to individual road users in North Dakota, South Dakota, and Montana to measure the difference in perceptions between decision makers and users on paved and unpaved roads. The specific tasks of the study were to:

1. Identify the rural road decision makers.
2. Identify the rural road users.

3. Gather information about the perceptions of decision makers regarding rural road decisions.

4. Gather information about the perceptions of rural road users needs regarding the rural road system.

5. Use the information gathered to compare the perceptions between the rural road decision makers and rural road users.

REPORT ORGANIZATION

The remainder of this report is divided into three parts. The questionnaire and methods used to examine the perceptions of decisions makers and rural road users are described in Chapter 2. The results of the questionnaires are presented in Chapter 3. Finally, the summary, conclusions, and need for further study are presented in Chapter 4.

CHAPTER 2

RESEARCH METHOD

This report is based on data collected from Montana, North Dakota, and South Dakota rural road users and providers' (also referred to as decision makers) perceptions of township and county roads. The perceptions were attained through a questionnaire mailed to various user groups and decision makers in the year 2000. It could be assumed that users and decision makers agree on the condition of the roads if their perceptions closely match. Furthermore, if providers know what the road users need, it would be easier to make better user-based decisions. In addition, it would be beneficial for decision makers to share relevant information with the road users and ask for their input because this would create a better partnership or alliance between them. The method used to attain road user and decision makers' perceptions about the road system are explained in this chapter.

DATA COLLECTION

To better understand the perceptions of road users and decision makers, primary data were collected by a mail survey. The survey was sent to select road users and decision makers to gather pertinent attitudinal information. The survey and the methods used in this comparison will be examined more closely in the following pages.

User Group Identification

The LTAP Centers and DOTS in each state helped identify the specific user groups to survey. The specific user groups vary among the states. In Montana, the user groups surveyed are school bus and transit drivers. The North Dakota user groups are agricultural producers, school bus drivers, and rural road commuters. The South Dakota user groups are delivery services and mail carriers.

Survey Instrument Design

A two-page survey was developed and mailed to selected user groups and decision makers to compare their perceptions. The questionnaire contained only 12 questions to assure as many responses as possible. Questions were divided into sections relating to physical roadway conditions, operational conditions, maintenance, funding, and needed improvements and were kept uniform among the different questionnaires. Several questions asked for a YES or NO response along with a brief explanation, while other questions had a five-point scale used for rating each roadway factor along with a "not applicable" rating. The rating range was 1 = very good, 2 = good, 3 = fair, 4 = poor, 5 = very poor, and 6 = not applicable. The final question on the survey asked road users and decision makers to list the 10 improvements they would like to see on roads they most frequently travel.

A county road advisory committee pre-tested the survey for relevance of issues and ease of completion. The survey instruments were modified to incorporate the suggested improvements.

Mailings

The LTAP Centers and DOTs worked to obtain the mailing lists and labels for the user groups from private and public sources. The response rates for each of the states are presented in Table 1. In Montana 500 surveys were mailed with 238 returned for a 48 percent response rate. In North Dakota 1,927 surveys were mailed with 473 returned for a response rate of 25 percent. South Dakota sent 688 surveys with 377 returned for a 55 percent return rate. The overall return rate for the tri-state area was 35 percent.

Table 1. Response Rate of Groups Surveyed in the Tri-State Area			
Group Surveyed	**Number Sent**	**Number Returned**	**Percent Response Rate**
Montana			
Decision Makers	57	54	95
Rural Road Users	443	184	42
Total	500	238	48
North Dakota			
Decision Makers	383	94	25
Rural Road Users	1544	379	18
Total	1927	473	25
South Dakota			
Decision Makers	135	135	100
Rural Road Users	556	242	44
Total	691	377	55

Responses from the survey were entered into a spreadsheet. The rating structure was combined for road services and features for the local road system. Before any analysis was performed on responses for road services and features, certain ratings were combined. The ratings were between 1 and 5 (1=very good; 2= good; 3= fair; 4=poor; 5=very poor 6=not applicable). For analysis purposes, ratings 1 and 2 were combined to represent "good" while 4 and 5 were combined to represent "poor." A further expansion of the survey analysis included a breakdown of suggested road improvements. Each road user and decision maker listed up to 10 road improvements they would like to see on the roads they most frequently travel. The rural road users were combined in each state to make the comparisons to decision makers more straightforward. Appendix A contains tables with the results of each user group by state. The research methods used to analyze the data were straightforward. A chi-square test was used to identify statistical significant differences in perceptions between the rural road decision makers and rural

road users. This test would indicate if the decision makers and the users view roadway elements and services similarly. In addition, basic means and frequencies were calculated for the variables to compare mean values and percentage responses. A significant difference was found between several of the road and service features. These differences are identified in the next chapter.

CHAPTER 3

SURVEY RESULTS OF ROADWAY FACTORS AND SERVICES

In this chapter, empirical results of the analysis of rural road users and decision makers responses are presented. This chapter is divided into three sections. In the first section, a brief description of respondents road use characteristics, i.e., number of miles traveled, are presented. The second section summarizes responses on roadway features including physical and operational roadway features, as well as maintenance. Finally, the third section summarizes the type of tax rural road users would most support to raise road improvement funds.

ROAD USER CHARACTERISTICS

The questionnaires mailed to each road user group contained questions about physical roadway conditions, road maintenance, and road funding. All respondents were asked about the number of miles they travel in one day and the surface type on roads leading to the nearest community.

On average, decision makers in Montana travel 56 miles a day, while the rural road users travel 74 miles. The average miles for users is high primarily because school bus drivers reported the route miles they travel during the day. North Dakota decision makers reported they travel an average of 40 miles each day and road users reported an average of 58 miles per day. As in Montana, school bus drivers were one of the groups surveyed in North Dakota and they travel a high number of route miles each day. In South Dakota, decision makers reported an average of 46 miles traveled per day while the rural road users reported 126 miles. The user groups in South Dakota are delivery services and mail carriers, so once again route miles are used, which are quite high. However, these users cover much of the rural system and can provide a cursory view.

Physical Roadway Elements

Physical road characteristics are important to every driver and passenger. Since a large number of crashes involve vehicles that are run off the roadway, a great deal of care should be given to the design of the physical road environment. Road users and decision makers from each of the three states were asked about their perceptions of road width, ditch steepness, and condition of the rural road shoulders they most frequently travel. The elements are evaluated for all roads and this report divides the responses by type of road the user most frequently uses (paved or unpaved).

Road width certainly is an important element, particularly with the wide range of rural road users traversing these roads. Some of the diverse users include agricultural producers with large equipment, school bus drivers moving children and mail carriers and delivery drivers providing service to the rural areas. The road widths must be adequate to carry these users in a safe manner. Montana, North Dakota, and South Dakota use similar standards for their rural roads. The majority of their rural roads carry less than 750 vehicles per day, with the exception of roads near towns and cities. The paved rural roads tend to have widths of a minimum of 32 feet, but the average road is between 34 and 36 feet. Unpaved rural roads with gravel are approximately 24 feet wide but may vary.[1]

Ditch steepness is important for drainage purposes. Further, for safety reasons it is desirable to design slopes that are not too steep. The Texas Department of Transportation found that crash test data reveals that steeper slopes (up to 1 Vertical to 3 Horizontal written as 1V:3H) are negotiable by drivers; however, recovery of vehicular control on these steeper slopes is less likely.[2] The tri-states that we surveyed generally have slopes of 1V:4H.

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[1]Phone conversation with Mr. David Leftwich, North Dakota Department of Transportation, Local Government Engineer, December 2002.

[2] Texas Department of Transportation. *Roadway Design Manual.* October 2002. Available online http://manuals.dot.state.tx.us.

Road shoulders may be minimal on rural roads; however, there generally is a flatter area beside the road prior to the ditch break. Although it may be grass, it often serves as the shoulder. Individuals may sometimes perceive road shoulders to be narrower than they actually are. Rural roads with higher levels of traffic — those with 2,000 to 3,000 cars per day — tend to have more apparent road shoulders, approximately 2 to 3 feet wide.

Regarding the physical roadway elements included in the survey, we found that decision makers perceived the physical roadway conditions to be better than the rural road users perceived them for each of the states. The level of significance was tested by a chi-square test on the difference between the mean value for the physical roadway elements as rated by road users and decision makers. The results of the survey and the chi-square test are presented below.

Montana Physical Roadway Elements

When considering the rating of roadway elements for overall roads (Figure 1), there is no significant difference between the road users and the decision makers in Montana at the 0.05 level for perceptions of road width, ditch steepness, or road shoulder. However, road shoulder did show

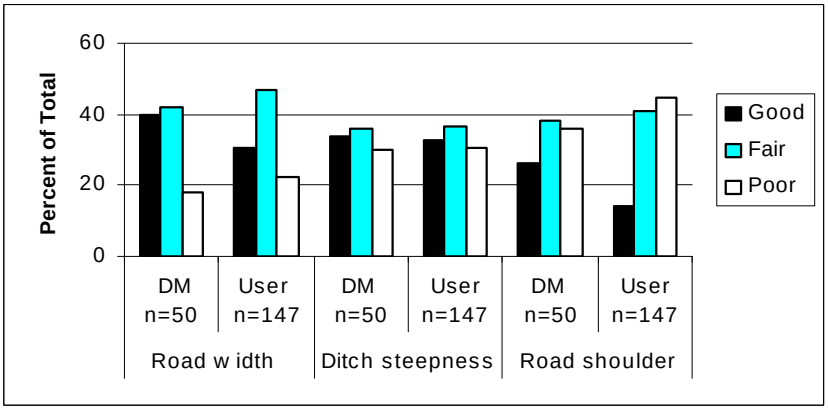

Figure 1. Montana Roadway Element Ratings on All Roads.

Note: DM = Decision Makers; User = Combined Road User Groups
n = number of responses.

significant difference at the 0.20 level with a chi-square value of 0.1547. The decision makers perceived the poor ratings of road shoulders correctly, as more than 40 percent of road users rated road shoulder poorly. Most of the rural roads in Montana do not have road shoulders. The road users may see this as a problem if they need to pull over to the side of the road for emergency purposes. Ditch steepness received nearly identical ratings from the decision makers and road users, so we could conclude the decision makers are quite in tune with the road users' perceptions. When looking at the roadway elements by road type, paved (Figure 2) and unpaved (Figure 3), we find little difference in the perceptions. Once again decision makers view the roadway elements slightly more positively but with no level of significance.

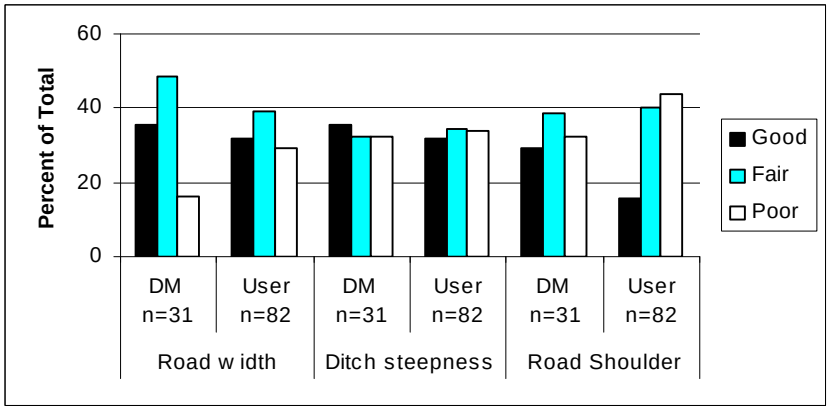

Figure 2. Montana Roadway Element Ratings on Paved Roads.

Note: DM = Decision Makers; User = Combined Road User Groups;
n = number of responses

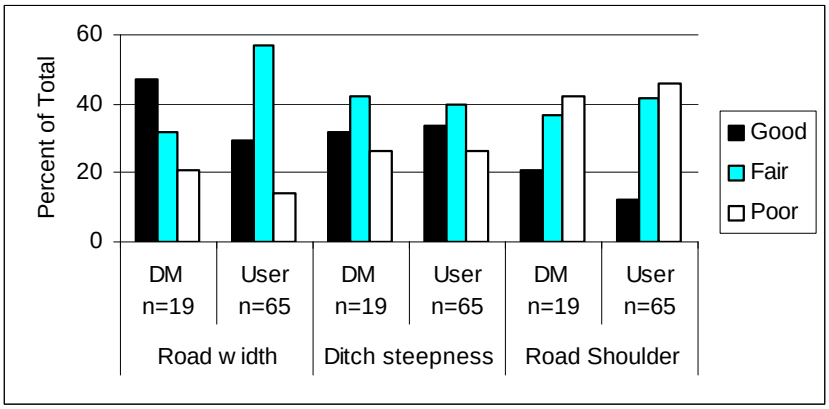

Figure 3. Montana Roadway Element Ratings on Unpaved Roads.

Note: DM = Decision Makers; User = Combined Road User Groups; n = number of responses.

The high level of "poor" ratings was unexpected; however, decision makers do realize there are problems. The majority of rural roads were not built to include road shoulders and it is costly to make this change. The lack of funding is a large problem for counties, so as funds become available decision makers most likely will address the problems they can in order of priority.

North Dakota Roadway Elements

North Dakota decision makers and road users do not have the same perceptions of roadway elements when looking at overall roads. There is statistical significance between the ratings of each of the three roadway elements considered: road width, ditch steepness, and road shoulders (Figure 4). Road width is significant at the .10 level with the decision makers rating the road width better than the road users.

Similarly, decision makers rated ditch steepness and road shoulder significantly 0.05 level better than the road users rated them (Figure 4). Road shoulders were rated poor by about 30 percent of road users, where only 12 percent of decision makers perceived a poor rating of road shoulders. Looking more closely at paved and unpaved roads provides an indication of which roads are more problematic. There is

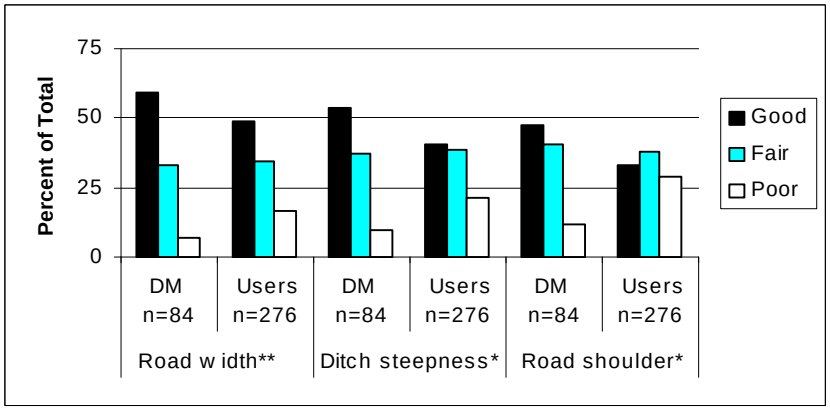

Figure 4. North Dakota Roadway Element Ratings on all Roads.

Note: DM = Decision Makers; User = Combined Road User Groups; n = number of responses; * Significance at 0.05 level; ** Significance at 0.10 level.

no statistical significance with any of the road elements between the decision makers and the road users for paved roads (Figure 5). However, there is statistical significance on the ratings of roadway elements on the unpaved roads (Figure 6). The decision makers consistently rated roadway elements significantly better than the users rated them. Unfortunately, unpaved roads may not be receiving the attention needed.

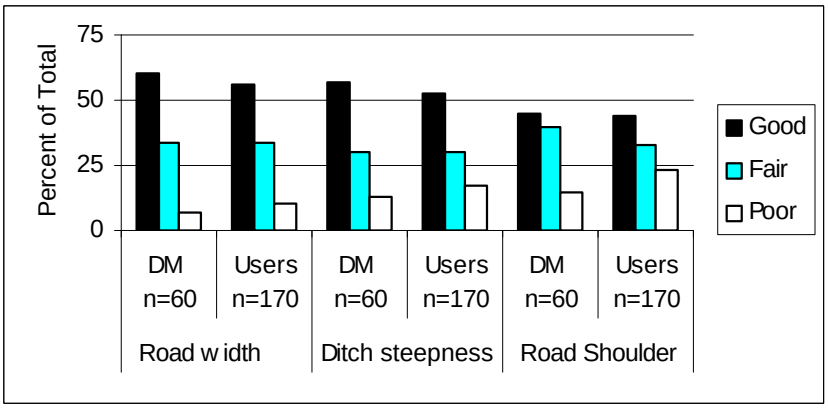

Figure 5. North Dakota Roadway Element Ratings on Paved Roads.

Note: DM decision Makers; Users = Combined User Groups; n = number of responses.

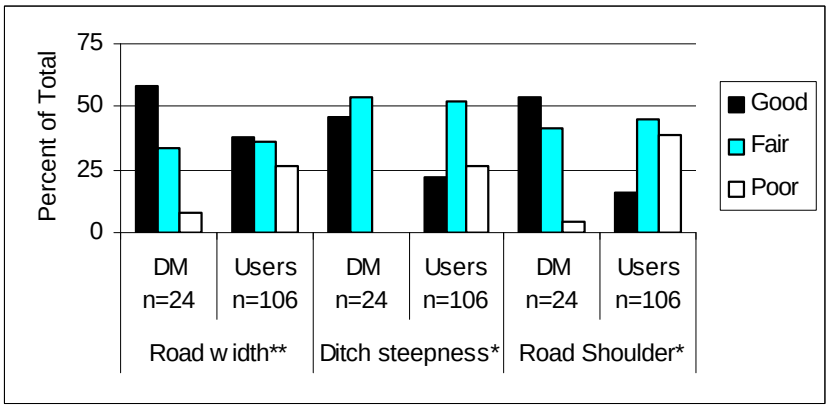

Figure 6. North Dakota Roadway Element Ratings on Unpaved Roads.

Note: DM = Decision Makers; User = Combined User Groups; n = number of responses; * Significance at 0.05 level; ** Significance at 0.10 level.

South Dakota Physical Roadway Elements

There are significant differences in the perceptions between road users and decision makers for physical roadway elements on South Dakota rural roads. There is some significant difference on paved and unpaved roads. There is significant difference at the 0.05 level in the perceptions of road width.

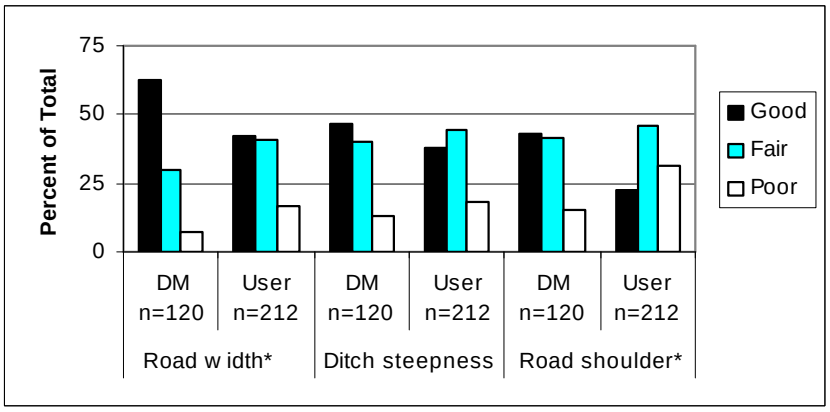

Figure 7. South Dakota Roadway Element Ratings on all Roads.

Note: DM = Decision Makers; Users = Combined User Groups; *Significance at 0.05; ** Significance 0.10 significance.

Nearly 63 percent of the decision makers viewed the road width as good whereas about 43 percent of the road users viewed road width as good, but more road users viewed the road width as poor (Figure 7.)

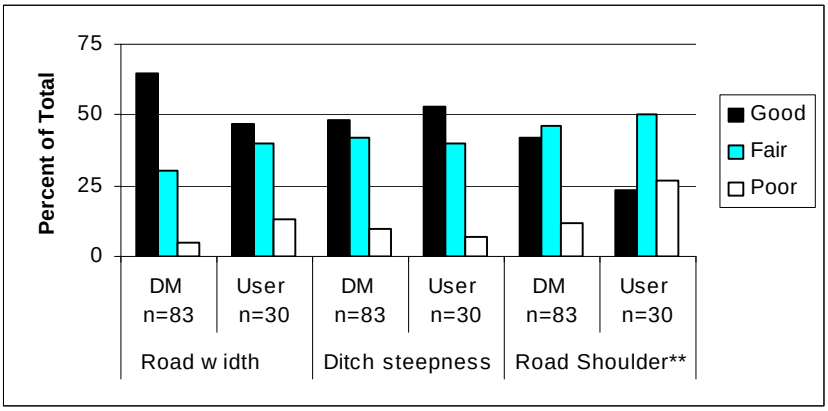

Figure 8. South Dakota Roadway Element Ratings on Paved Roads.

Note: DM = Decision Maker; Users= Combined User Groups; n = number of respondents; ** significance at 0.10 level.

There was no significant difference in the perceptions of ditch steepness, but there was significance for the road shoulder element at the 0.05 level. More than 30 percent of the road users rated road shoulders as “poor”; 15 percent of decision makers perceived road shoulders as “poor.” The paved and unpaved breakdown may shed more light on where the problems are located. The decision makers consistently rated each of the roadway elements better than the road users (Figure 8 and Figure 9). Road shoulders received the poorest ratings from the road users. It appears that paved and unpaved road shoulders are not in the conditions that road users would like.

For all three states, decision makers consistently rated the physical roadway elements better than did the road users. Decision makers rated the physical roadway elements more favorably than road users, with the exception of ditch steepness, which the road users rated higher. The element that had the most frequent statistical significant difference was road shoulder in each of the three states.

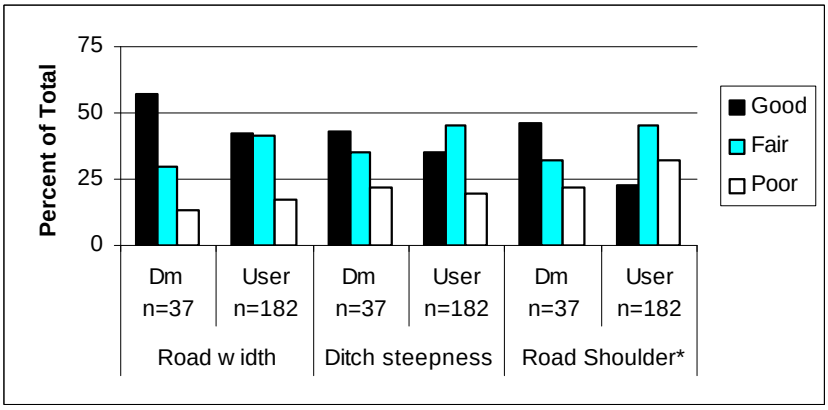

Figure 9. South Dakota Roadway Element Ratings on Unpaved Roads.

Note: DM = Decision Maker; Users = Combined User Groups; n = number of respondents; * Significance at 0.05 level.

Operational Conditions

Several questions were asked to determine users' and decision makers' perceptions toward operational conditions. Operational conditions included signs and road elements that affect the speed vehicles can travel on the road network. Traffic signs are imperative to control the movement of vehicles and to reduce the hazard of traffic operation. For these next two sections, we've combined all roads for lack of statistical significance and ease of presentation.

There is an operational aspect to the roads that affects drivers in a number of ways, i.e., signs that warn of road conditions ahead, railroad tracks, or curves in the road. Roughness of roads and loose gravel from recent blading are some of the factors that limit speed on unpaved roads. Some of these factors also may tend to increase wear and tear on personal vehicles. The survey instrument captured the perceived differences between decision makers and users for these three operational road conditions in Montana, North Dakota, and South Dakota. All respondents, both decisions makers and road users, were asked to respond "yes" or "no" to specific questions: are there adequate signs along the road to warn of hazards, do elements affect the road speed drivers could travel, and do conditions of the roads cause

additional wear and tear on vehicles. “Yes” responses to the three questions on road operating conditions are illustrated in Figure 10.

The first concern addressed is whether there is adequate signage along the roads to warn motorists of upcoming hazards. Decision makers (DM) gave slightly higher positive responses than users (Users) for each state. The results from Montana and South Dakota had no statistical significance by the chi test. Only North Dakota’s results were statistically significant at the 0.05 level. Almost 100 percent of decision makers in North Dakota thought there were adequate signs along the roads in their state.

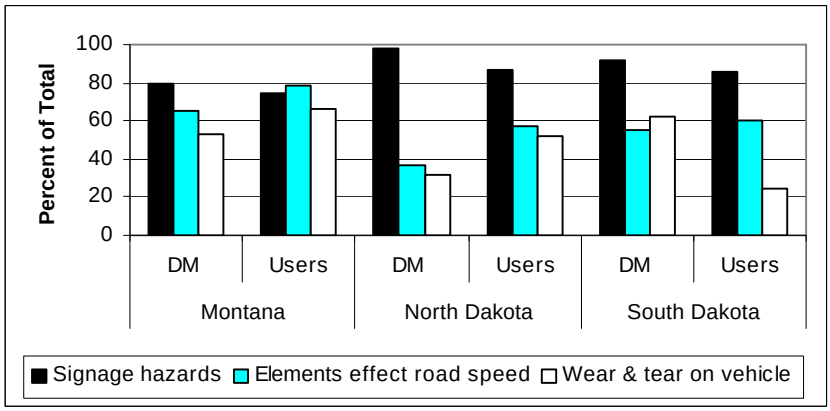

Figure 10. Operational Road Conditions; Yes Responses.

Note: Signage hazards: Adequate signs to warn of upcoming hazards;
Elements affect road speed: Elements on the road that affect the drivers’ speed;
Wear and tear on vehicle: Do the road condition cause added wear and tear on your vehicle.

Elements on paved and unpaved roads affect road speeds. On paved roads, they may include cracks in pavement, pot holes where pieces of the road surface are missing, and wildlife. On unpaved roads, they may include loose gravel, washboard conditions, weather, and wildlife. Users gave higher “good” responses than decision makers, indicating that decision makers thought there were fewer elements on the road affecting speed than did users (Figure 10). Again, only in North Dakota was the difference statistically significant by the chi test at the 0.05 level.

The last operational concern addressed in this survey was the effect roads have on the wear and tear of vehicles. Here the responses were mixed. In Montana and North Dakota a higher percentage of road user respondents than of decision makers thought there was excessive wear and tear to their vehicles due to road condition. However, in South Dakota the decision makers thought wear and tear was greater than the user groups that responded. The user groups in South Dakota were delivery people and mail carriers; perhaps they did not all own the vehicles they spent most of their time driving. Results in Montana and South Dakota were too close to be statistically significant.

Road users identified improvements they would like to see on the road network. Some responses were categorized as operational improvements. The suggested operational improvements identified by respondents from the three states are:

- More signs (railroad crossing and curves)
- Better road drainage
- Guard rails on bridges
- Reflectors along ditch for night travel.

The last three suggestions were not addressed on the survey instrument. However, the users viewed them as important enough to mention them frequently; therefore, they should not be overlooked.

In conclusion, the decision makers' responses were more favorable about the roads' operational conditions than were road users' responses. The specific percent of response for the three categories measured were different in each state. The differences were statistically significant only in North Dakota. Users from all three states had some additional concerns they would like to see addressed. The overall results for operational road conditions in this survey suggest that decision makers perceive the roads more favorably than road users.

Maintenance

The condition of the roads we drive every day to work, shopping, conducting business. or to visit family and friends is affected by the maintenance of roads and bridges. Across the tri-sate area, thousands of miles of roads and bridges have to be maintained on a daily to monthly basis. In this survey, we are measuring the difference between how decision makers and users perceive the accomplishment of these tasks. In this section, we will consider perceptions on all roads and then break them into perceptions for paved and unpaved roads. In general, we found that decision makers gave more favorable responses to the three maintenance categories than the users did, both overall and individually, on paved and unpaved roads

Montana

Decision makers scored maintenance higher in each category than did users for all roads, as illustrated in Figure 11. The difference between the mean response of decision makers and users for snow removal and road maintenance was statistically significant, while for bridge maintenance the

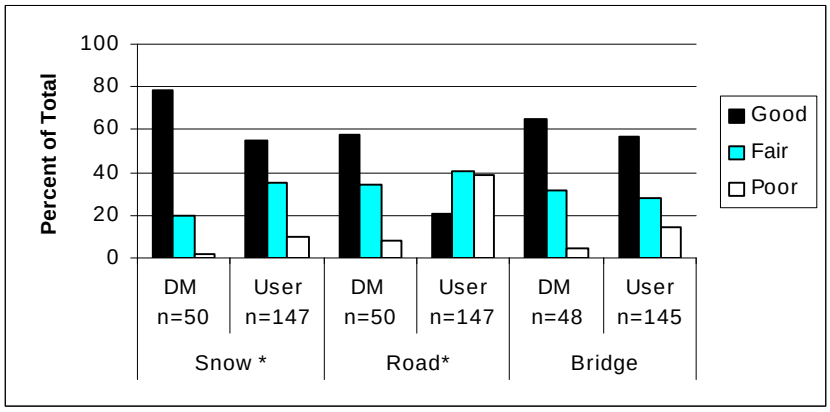

Figure 11. Montana Maintenance Ratings, All Roads.

Note: DM = decision makers; User = Combined User Groups; n=number of respondents; Snow = snow removal; Road = road maintenance; Bridge = bridge maintenance.

difference was not statically significant by the chi test to the level of 0.05. Decision makers rated snow removal extremely high. Montana has an aggressive program for winter snow and ice removal. Montana is working hard to balance a good maintenance program with an affordable price tag.[3]

Road maintenance was graded the hardest by users, with 80 percent of respondents rating it "poor" or "fair" while only 20 percent thought it was "good." The difference between decision makers and road users on road maintenance was statistically significant.

Decision makers rated maintenance higher in all three categories than did users. Only road maintenance was statistically significant (Figure 12). Maintenance on paved roads is not required as regularly as on unpaved roads, but when needed it is more expensive. Users' response may indicate a significant desire for additional road maintenance.

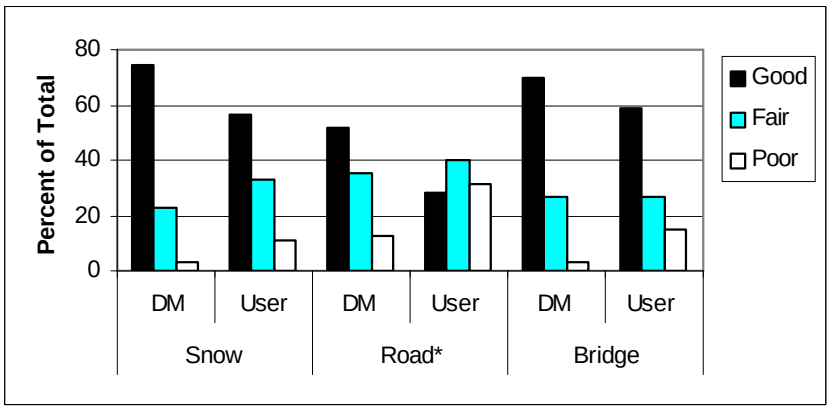

Figure 12. Montana Maintenance Rating, Paved Roads.

Note: DM = Decision Makers; User = Combined Road Users Groups;
n = number of responses; Snow = snow removal;
Bridge = bridge maintenance; * Significance at .05 level

More than 50 percent of the decision makers and users gave bridge maintenance a "good" response. The difference in the response between paved and unpaved roads was small. This is somewhat surprising because the national bridge inventory reveals that Montana has 5,341 bridges on file; 659 are

[3] http://www.mdt.state.mt.us/departments/maintenance/goals_objectives.html

structurally deficient and 572 are functionally obsolete.[4] This indicates that there are serious problems with 22.7 percent of the bridges in Montana.

For unpaved roads, decision makers gave a high rating to snow removal, with just more than 84 percent rating it as "good" (Figure 13). No decision makers gave snow removal a "poor" response. Again, decision makers rated all categories higher than did users. Users' view of road maintenance on unpaved roads was well below average with statistical significance. Ten percent of the users rated road maintenance "good"; 47 percent rated it "poor." Decision makers did not give a single response of "poor" for road maintenance.

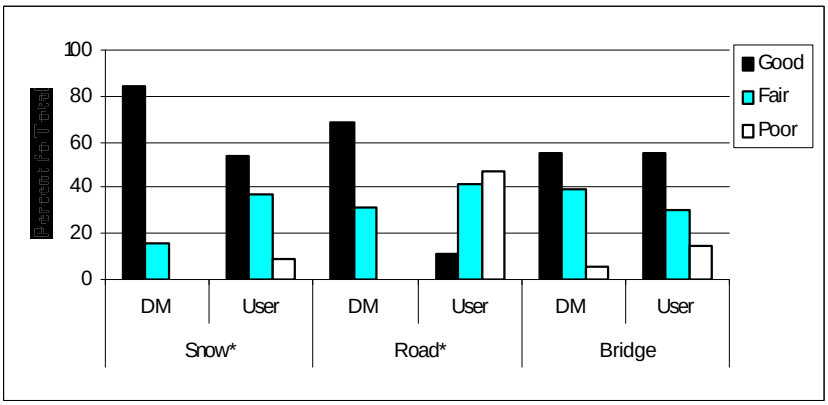

Figure 13. Montana Maintenance Rating, Unpaved Roads.

Note: DM = Decision Makers; Users = Combined User Groups; n = number of responses; Snow = snow removal; Road = road maintenance; Bridge = maintenance; * Significance at .05 level.

In conclusion, Montana decisions makers are highly satisfied with snow removal, less satisfied with road maintenance and least satisfied with bridge maintenance. Bridge maintenance received the least amount of "good" responses; however, it was more than 50 percent "good." Users are the most

[4] McClure, Scott, *Quick Facts About your National Bridge Inventory*, (2002) Sandia Analytics, Daytona Beach, Florida

unhappy with road maintenance, especially on unpaved roads, and are most impressed with bridge maintenance on paved roads.

North Dakota

The North Dakota response to the survey was good and comparison results all were statistically significant by the chi tests. The results show decision makers gave a high "good" response to the tested road maintenance items (Figure 14). One reason may be that decision makers know the cost of road maintenance. For example, the North Dakota highway distribution fund received $128,100,000 in fiscal year 1999. The NDDOT receives 63 percent, counties receive 23 percent and cities receive 14 percent of the funds.[5] Brian Bremmer (1995) of Utah states that yearly per mile maintenance costs of gravel roads is $3,864.00 — 200 percent of the maintenance costs of paved roads. Construction of gravel roads is about 40 percent the cost of paved roads, amounting to an average of $2,457 per mile.[6] North Dakota decision makers from all roads gave the highest "good" response to road maintenance. Users gave their highest percent "good" responses to snow removal, and bridge maintenance was a close second. Road maintenance received the highest percent of "poor" responses from North Dakota users.

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[5] Freier, Tom D., North Dakota Surface Transportation Fact book, December 2000, North Dakota Department of Transportation, Bismarck ND

[6]Hough, Jill, Proceedings of the TEL 8 Low Volume Road Conference.(November 21, 1995) Upper great Plains Transportation Institute, Fargo North Dakota. Pg23

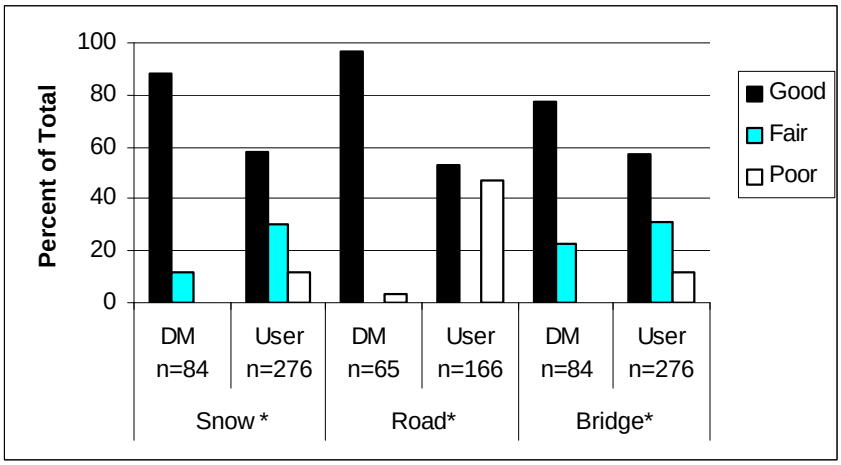

Figure 14. North Dakota Maintenance Ratings, All Roads.

Note: DM = Decision Makers; User = Combined User Groups; Snow = snow removal; Road = road maintenance; Bridge = bridge maintenance; * Statistical significance at 0.05 level.

On paved roads, decision makers gave 80 percent or more "good" responses to all three categories: snow removal, road maintenance, and bridge maintenance (Figure 15). All three categories were statistically significant. Bridge maintenance received the lowest percent of "good" responses from decision makers. According to the National Bridge Inventory, North Dakota has 4,780 bridges on file, with 872 structurally deficient and 276 bridges functionally obsolete.[7] These statistics show that 24 percent of all North Dakota bridges are either structurally deficient or functionally obsolete. Bridge maintenance received the lowest percent of "poor" votes from decision makers and users combined (Figure 16).

[7] McClure, Scott, *Quick Facts About your National Bridge Inventory*, (2002) Sandia Analytics, Daytona Beach, Florida

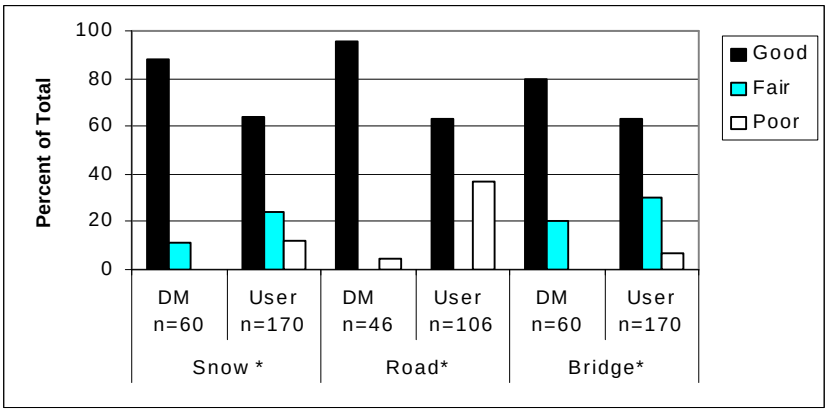

Figure 15. North Dakota Maintenance Ratings, Paved Roads.

Note: DM = Decision Makers; User= Combined Road User Groups n = number of responses; Snow = snow removal; Road = road maintenance; Bridge = bridge maintenance; * Significance to 0.05 level;

Most of the "fair" and "poor" rating by decision makers in all categories stayed under 20 percent with the exception of bridge maintenance on unpaved roads, which received 29 percent "fair" responses from decision makers (Figure 16). The users graded road maintenance 37 percent "poor" on paved roads (noted above Figure 15) and 65 percent "poor" on unpaved roads (noted Figure 16).

Statistical significance exists in the differences between decision makers and users in all three categories on unpaved roads in North Dakota. The decision makers gave a 100 percent "good" to road maintenance on unpaved roads (Figure 16, note n=19). The users scored it with the highest percent "poor" of 65 percent. There is significant maintenance on unpaved roads as compared to paved roads. Gravel or unpaved roads have many factors, such as loose gravel, wash boards, narrow shoulders, steep or no ditches, sharp curves, some roads built many years ago, and infrequent grading.

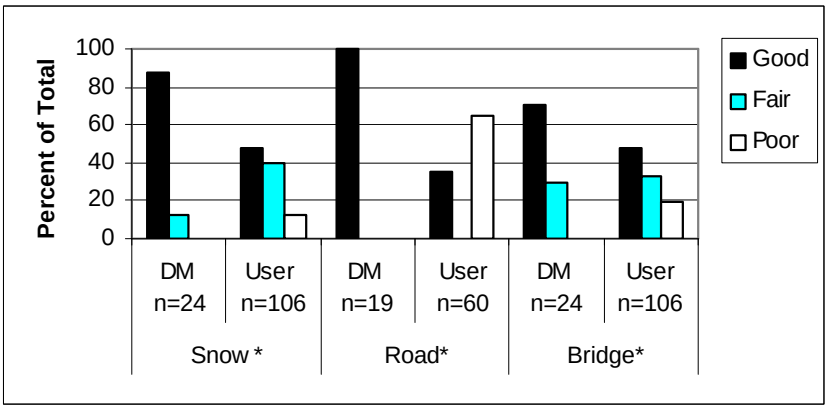

Figure 16. North Dakota Maintenance Ratings, Unpaved Roads.

Note: DM = Decision Makers; User = Combined user groups; Snow = snow removal; Road = road maintenance; Bridge = bridge maintenance; * Statistical significance at .05 level.

In conclusion, North Dakota decision makers gave a higher percentage "good" response to the three measured road maintenance items. There appears to be a distinct difference in perceptions between decision makers and users. The fact that North Dakota counties spend 23 percent of the 128.1 million on road construction and maintenance may influence these perceptions. Decision makers gave a close to 100 percent "good" response to road maintenance on both paved roads and unpaved roads.

South Dakota

South Dakota follows the pattern of Montana and North Dakota in that the decision makers graded all services better than did the users (Figure 17). Snow removal received 89 percent "good" response from decision makers and only 46 percent from users. This difference had strong statistical significance. The SDDOT typically budgets about $5.2 million for winter snow and ice removal each fiscal year.[8] The "good" ratings for snow removal and road maintenance for decision makers was twice

[8] http://www.state.sd.us/factpage.htm

that of the users. Road maintenance received 69.2 percent "good" response from decision makers. This contrasts with road users, who gave road maintenance the lowest "good" response at only 32.5 percent.

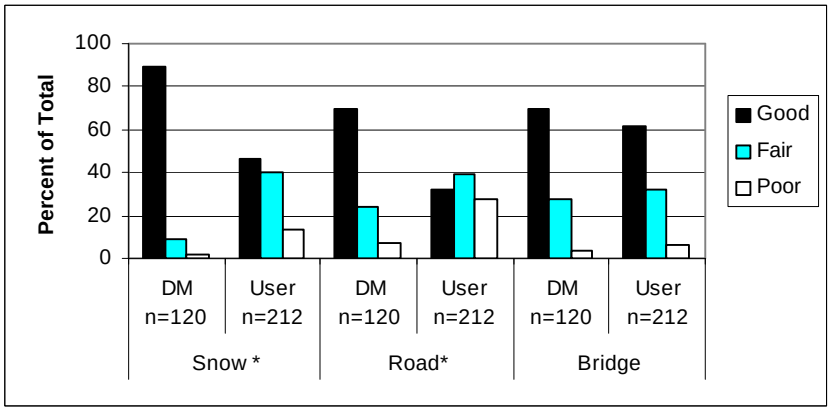

Figure 17. South Dakota Maintenance Ratings, All Roads.

Note. DM = Decision Makers; User= Combined Users Groups
n = number of responses; Snow = snow removal; Road = road maintenance; Bridge = bridge maintenance; * Significant at 0.05 level

Approximately 70 to 90 percent of the South Dakota decision makers gave a "good" rating to all three maintenance categories on paved roads measured by this survey (Figure 18). The user range for the same categories was from 32 percent to 61 percent of "good" responses with the highest "good" response for snow removal. The "good" responses were closest between decision makers and road users in the bridge maintenance category. This is a little surprising when considering the status of the state's bridges. The National Bridge Inventory states that South Dakota has 6,042 bridges on file: 1,426 are structurally deficient and 371 are functionally obsolete.[9] That means 29.7 percent of the bridges have structural problems.

[9] McClure, Scott, *Quick Facts About your National Bridge Inventory*, (2002) Sandia Analytics, Daytona Beach, Florida

Almost 80 percent of decision makers in South Dakota gave a "good" response for snow removal on unpaved roads, Figure 18. For unpaved roads, snow removal and road maintenance had statistical difference by the chi test.

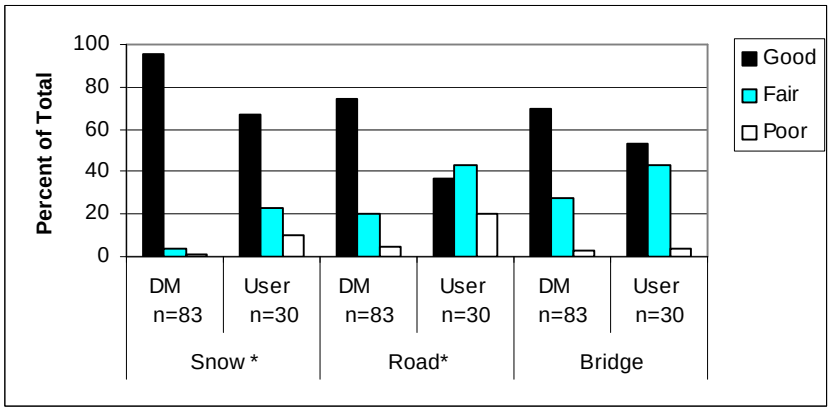

Figure 18. South Dakota Decision Makers and Users, Paved Roads.

Note: DM = Decision Makers; User =Combined Road User Groups n = number of responses; Snow = snow removal; Road = road maintenance; Bridge = bridge maintenance; * Significant at level 0.05.

The makeup of respondents was a little different in South Dakota as there were more decision makers responding to the survey than road users. One may assume that the South Dakota decision makers are aware that, during the fiscal year of 2002, the SDDOT had a $424 million budget. Twenty-four percent of the budget was for operations; the remaining 76 percent was for maintenance and road and airport construction contracts. Approximately $25 million was for local governments to use on roads and bridges.[10] South Dakota received about an average percentage of "fair" responses in all three categories.

[10] http://www.sddot.com/geninfo_facts.asp

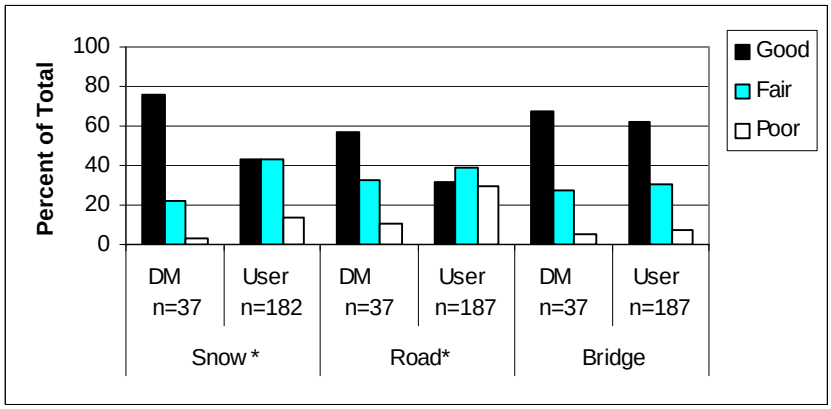

Figure 19. South Dakota Maintenance Ratings, Unpaved Roads.

Note. DM = Decision Makers; Users = Combined User Groups
n = number of respondents; Snow = snow removal; Road = road maintenance; Bridge = maintenance; * Significance at 0.05 level.

The conclusive results for South Dakota, as with other states, were that the total percentage of "good" responses in each category were higher for paved roads than unpaved roads. The decision makers in all cases gave higher responses than users; snow removal and road maintenance were statistically significant. Decision makers and users gave the poorest response for road maintenance; less than 40 percent of users gave road maintenance a "good"response on unpaved roads.

Respondents were given opportunities to add their own comments to road maintenance. Road users identified improvements they would like to see on the road network. Some of the responses were categorized as maintenance improvements. The suggested maintenance improvements identified by respondents from the three states were:

- Better snow removal
- More blading
- Better overall maintenance
- Cut grass from ditches
- Fill pot holes

Snow removal was the most frequent response in the comments section; however, road maintenance, especially on unpaved roads, received the highest percent of "poor" responses. The last four suggestions above all refer to general road maintenance, which received very poor ratings from users in all three states surveyed. Blading, filling pot holes, mowing grass, and better overall maintenance all improve the riding comfort and safety of the country roads.

In conclusion, there were differences in response from the decision makers and users in each of the three states of Montana, North Dakota, and South Dakota. In the preceding nine figures there were measured statistical differences in 20 of the 29 measured categories. The response rates showed differences of a wide range, i.e., unpaved roads in North Dakota, where 100 percent of decision makers gave a "good" and only 35 percent of users gave a "good" response. The closest response was bridge maintenance in Montana on unpaved roads, where both decision makers and users returned 55.6 percent "good." In all other measured categories the decision makers gave higher "good" response to road maintenance categories than did users. In South Dakota where decision makers who responded outnumbered the users, the response rates remained the same. The conclusion is that decision makers perceive road maintenance at a higher quality level than do road users. Many references point to finances as a limiting factor to amount of road maintenance decision makers are able to achieve in any given year.

Emergency Response

An emergency response is a required response to some type of accident or mishap. The time required for help to arrive in a rural area is a function of two variables: speed and distance. A number of road factors can affect these two variables, i.e., paved verses unpaved roads, loose gravel, sharp curves, etc. We asked survey respondents if they received adequate emergency response in their area. More than 85 percent of all survey respondents in the tri-state area thought their local emergency services were adequate.

Users on paved roads in Montana were the only user group to indicate a higher number of responses believing they received adequate emergency response did than decision makers. In Montana, on paved roads, 86.7 percent of the decision makers and 91.4 percent of the users indicated that emergency services were adequate. On unpaved roads it was reversed; and 88.9 percent of the decision makers and 85.5 percent of the users thought emergency services were adequate (Figure 20).

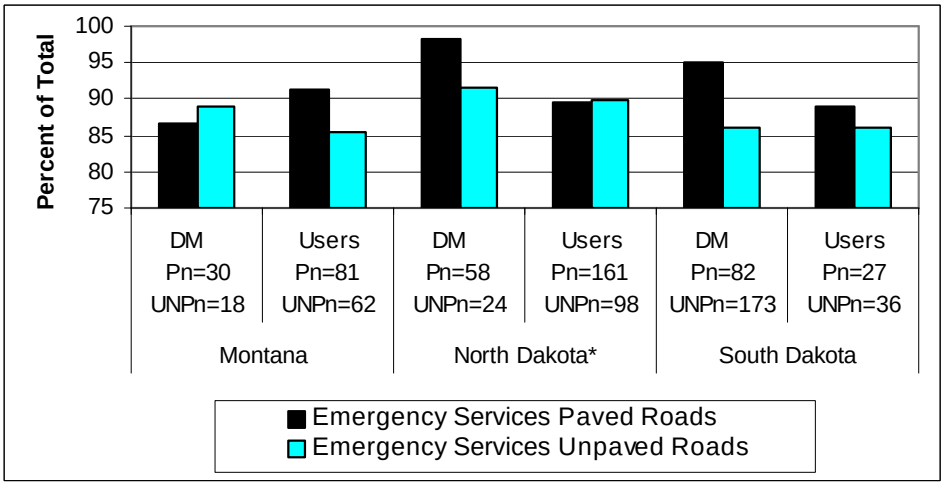

Figure 20. Emergency Response: Decision Makers and Users, by State.

Note: DM = Decision Makers; Users = Combined User Groups; Pn; number of responses from paved roads; UNPn; number of responses from unpaved roads;
* Significance at 0.05 level.

In North Dakota, on paved roads, 98.3 percent of the decision makers and 89.5 percent of the users indicated that emergency services were adequate. The difference between decision makers and users on paved roads in North had statistical significance. The differences between decision makers (91.7 percent) and users (89.8 percent) on unpaved roads did not have statistical significance.

In South Dakota, on paved roads, 95.1 percent of the decision makers and 88.9 percent of the users indicated that emergency services were adequate. On unpaved roads the difference was even closer at 86.11 for decision makers and 86.13 for the users. There was no statistical significance for emergency response between decision makers and users on either road type in South Dakota.

In conclusion, respondents in all three states thought they had adequate emergency services. In all categories, decision makers had a higher "yes" frequency response than users, except on paved roads in Montana.

Problem Reporting Procedures

An efficient way to catch problems early, when they are less expensive to fix, is for all road users to report problems as quickly as they are identified. Both decision makers and users share this responsibility. This survey investigated the differences between decision makers and users in their reporting of road problems. The narrowest margin of difference was between Montana decision makers and users with no statistical difference (Figure 21). Montana had a higher reporting frequency from users than decision makers in reporting problems on paved roads. Two user groups were surveyed in Montana — school bus drivers and rural road users. The survey results showed that 72.5 percent of the users on paved roads and 83 percent of users on unpaved roads reported road problems.

In North Dakota, there was statistical significance between decision makers and users who reported problems along the roads. The survey response revealed that decision makers report problems more often than users report problems. Decision makers and users on unpaved roads in North Dakota report problems they encounter more frequently those on paved roads. There are two possible reasons for this. First, unpaved roads are mostly county roads and there is a greater chance the user knows the decision makers who need to hear about the road problem. Second, the reporting of problems tends to reflect the feeling of responsibility, meaning decision makers take responsibility for the problem when they see it and react accordingly or report to the proper authority. In North Dakota, 63 percent of school bus drivers, 45 percent of the agriculture producers, and only 10 percent of the commuters said they reported problems encountered on the roads to appropriate officials. These results were users on both

paved and unpaved roads. The chart shows the combined results from users on paved (72.5percent) and unpaved roads (83.0 percent).

South Dakota showed little difference in frequency of reporting problems between paved roads and unpaved roads for decision makers and users (Figure 21). Decision makers showed a higher frequency of reporting problems than users on paved (91.5 percent) and unpaved roads (91.4 percent). South Dakota had two user groups, the mail carriers and delivery service drivers. The chart shows the average of these two groups on paved and unpaved roads. On paved roads 53.3 percent of the users reported problems and on unpaved roads 54.2 percent reported road problems.

The conclusion is that decision makers are doing a better job than users in reporting road problems. The results could be influenced by the fact that decision makers have been given authority by someone or a group to be in charge of the road systems. Nevertheless, in the tri-state area probably all users have an implied responsibility to report problems, especially if they feel strongly about the problem or want it quickly resolved.

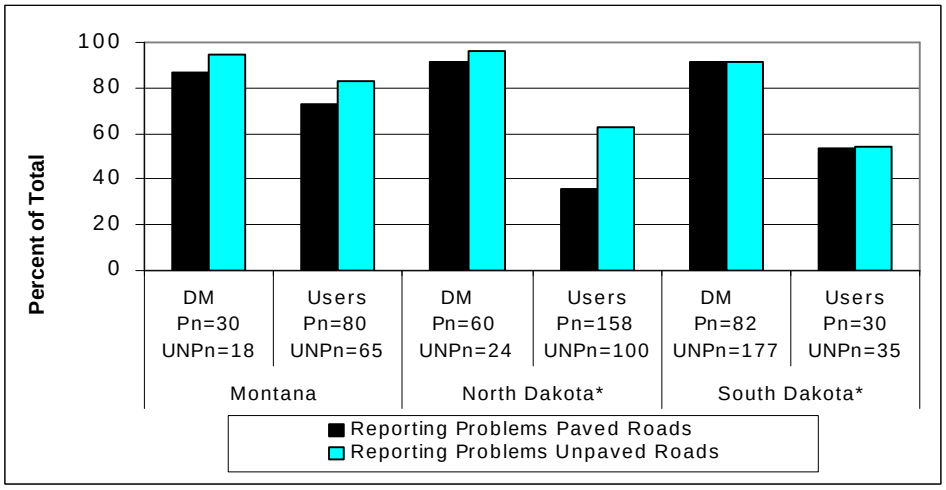

Figure 21. Reporting Problems: Decision Makers and Users, by State.

Note: DM = Decision Makers; Users = combined users from each state; Pn: Number of responses on paved roads; UNPn: Number of response on unpaved roads; * Significance at 0.05 level

Funding Road Improvements

The last section on the survey dealt with funding options for road maintenance, operational condition, and physical roadway elements. Many options exist for governments to collect funds for road expense. Currently, the cost is shared by the state and federal governments and funds are collected through a number of programs such as gas taxes, wheel taxes, and licensing fees. A question was asked on this survey to gain additional insight into decision makers and users acceptance of specific funding mechanisms such as fuel tax, sales tax , or property tax as options to assist counties, and states with funding their share of the road expenses. The following section reports on how the decision makers and users viewed adding to the existing tax load for road funding. The response from each state is evaluated separately for clarity.

Montana

State and county governments continually are searching for additional funding to cover the costs of services to the general public. Montana currently uses property tax, fuel tax, vehicle registration, and mill levy to fund road maintenance.[11] From the three taxing options provided in the survey, Montana decision makers favored sales tax over fuel tax by 32 percent and users by 23 percent (Figure 22). Montana has high gas and fuel taxes; they are tenth in the nation in gas tax at $.462 per gallon and the seventh highest in fuel tax in the nation at $.537 per gallon.[12] Montana has no sales tax. This tax structure may explain the response from the Montana survey respondents. Montana's second choice was fuel tax, and property tax was last choice. Sales tax is a mechanism to spread the tax burden over the

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[11] Hough, Jill A., Smadi, Aymen G., Bitzan, John D., *Innovative Financing Methods for local Roads in the Midwest and Mountain-Plains States.* Upper Great Plains Transportation Institute, Fargo, North Dakota, July 1997.

[12] Policy Analysis and Statistics Department. *Nationwide and State-by-State Motor Fuel Taxes*. March 2001, American Petroleum Institute. Washington, D. C.

entire population and the entire population, does benefit from the road infrastructure. Other taxes like wheel taxes, fuel taxes, and license fees are more directed to road users. Respondents could select "other" types of tax and specify what they recommended. Some of the suggestions under "other" from Montana decision makers were tax on harvested timber, tolls, and local tax options and from users tax on 4x4 trucks, increased fines for vehicle offenses, and higher commercial tax.

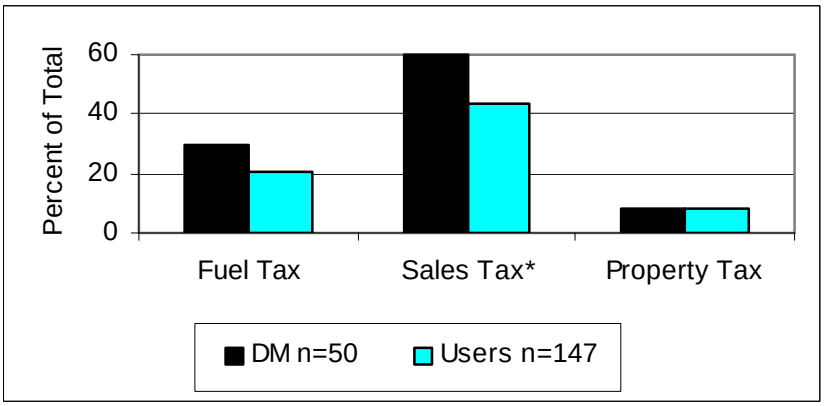

Figure 22. Montana Funding Options, All Roads.

Note: DM = Decision Makers on Paved and Unpaved Roads;
Users = Combined User Groups on Paved and Unpaved Roads.
* Significant at the 0.05 level.

North Dakota

North Dakota's present road funding comes from property tax, fuel tax, vehicle registration and mill levy.[13] North Dakota decision makers favored the fuel tax over sales tax by 35 percent, while users favored sales tax over fuel tax (Figure 23). The chi tests showed statistical significance between users and decision makers only for the fuel tax. The decision maker and user response for sales tax was about equal. North Dakota has the lowest fuel tax rate in the tri-state area, currently a $0.394 per gallon tax on

[13]Hough, Jill A., Smadi, Ayman G., Bitzan, John D., *Innovative Financing Methods for local Roads in the Midwest and Mountain-Plains States.* Upper Great Plains Transportation Institute, Fargo, North Dakota, July 1997.

gasoline and $0.454 per gallon tax on diesel fuel.[14] North Dakota assesses a 5 percent sales tax, the highest in the tri-state area.

North Dakota clearly rejected increasing property taxes to fund road improvements. North Dakota users showed some interest in researching other alternatives, they suggested federal tax, income tax, tobacco/alcohol, luxury tax and bulk oil.

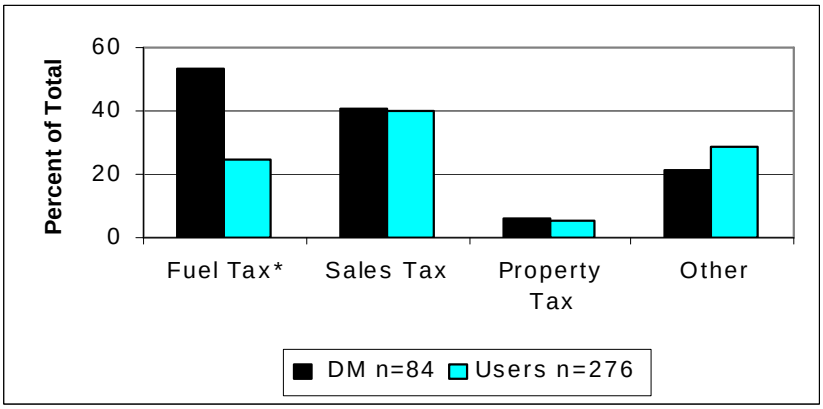

Figure 23. North Dakota Funding Options, All Roads

Note: DM = Decision Makers from paved and unpaved roads
Users = combines all users on paved and unpaved roads
* Significance at 0.05 level

South Dakota

Currently, South Dakota collects revenue for transportation purposes from property tax and mill levy.[15] The South Dakota decision makers favored fuel taxes as a funding source for road improvements. Fuel taxes are a more accepted user-based method to support road improvements. South Dakota currently

[14] Policy Analysis and Statistics Department, *Nationwide and State-by-State Motor Fuel Taxes*. March 2001, American Petroleum Institute, Washington D. C.

[15] Hough, Jill A., Smadi, Ayman G., Bitzan, John D., *Innovative Financing Methods for local Roads in the Midwest and Mountain-Plains States.* Upper Great Plains Transportation Institute, Fargo, North Dakota, July 1997.

assesses a $0.424 per gallon tax on gasoline and a $0.484 per gallon tax on diesel fuel and assesses a 4 percent sales tax.[16] Users favored sales tax by a narrow margin too close for statistical significance. Property tax had the least amount of support. Some decision makers were interested in looking at "other" sources. Wheel tax, income tax, license fees, and vehicle registration were the majority of the "other" write-in responses from decision makers. The users "other" write-in suggestions were income tax, county wheel tax, and fines.

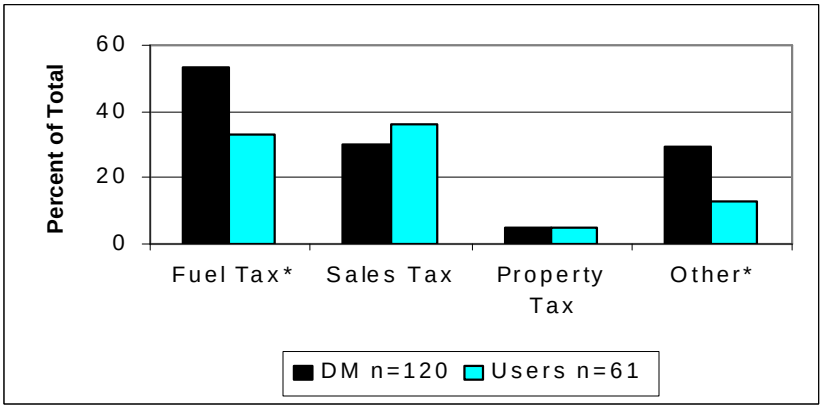

Figure 24. South Dakota Funding Options, All Roads

Note: DM = Decision Makers from paved and unpaved roads;
Users = Combined users on paved and unpaved roads;
* Significant at 0.05 level; n = number of respondent.

In conclusion, this survey question was used to gain some insight on the acceptability of various taxes from decision makers and users in the tri-state area. The results showed a sales tax was favored in Montana; North and South Dakota favored fuel taxes. North and South Dakota showed more interest in investigating some other alternatives. It is never popular when governments decide to increase taxation. If the benefits are clearly communicated to the population that an improved road infrastructure will be

[16] Policy Analysis and Statistics Department, *Nationwide and State-by-State Motor Fuel Taxes*. March 2001, American Petroleum Institute, Washington D. C.

the results of the increased taxes, a greater buy-in is possible. The following is a summary of some of the suggestions given by respondents to aid in funding of the road infrastructure:

- Increases in income taxes
- Wheel tax
- Have state lottery where funds go to roads
- Higher motor vehicle taxes
- Higher vehicle license fee

The challenge for state, county, and township governments to develop equitable tax strategies is difficult and controversial.

CONCLUSIONS

The rural states in the Midwest are characterized by large geographic regions, low population densities, and a large number of road miles to maintain. Further, the road structures are aging and the limited resources are not adequate to maintain or improve the road structures. Decision makers are responsible for the rural road infrastructure but have not always utilized public input in the decision-making process. Transportation legislation, ISTEA (1991) and TEA21 (1998), strongly encouraged public input so that decision makers would better understand the needs of the residents in their service area. Organizing rural input is challenging for rural states. The Upper Great Plains Transportation Institute, with the help of county engineers and road supervisors, developed a questionnaire survey to measure differences in perception of maintenance between decision makers and users (users to represent the general public).

This study took into consideration several road factors, including roadway elements, operational conditions, maintenance, and funding. The survey instrument was used to collect data to measure differences in perceptions of road users and decision makers in three states, including Montana, North Dakota, and South Dakota. This study found statistically significant differences in these perceptions for many of the road factors considered. In the majority of the factors, perceptions of the decision makers were more positive about the condition of the road system than the rural road users' perceptions. The statistical significance varied by state.

We found less statistical significance in Montana, revealing that the decision makers may be more aware of the needs of rural road users. There were statistically significant differences in perceptions of road users and decision makers for road maintenance and snow removal, indicating a need for decision makers to pay closer attention to maintenance activities and snow removal. Overall, decision makers' perceptions were more positive than the users, but not statistically, with the exception of "adequate emergency services" on paved roads.

North Dakota had the greatest amount of statistical significance in perceptions between decision makers and users. We do not know why there was such a high level of statistical significance between the groups. Three possible explanations are: 1) poor communications between decision makers and users; 2) decision makers are not aware of user demands; or 3) unrealistic expectations by the users.

South Dakota had limited statistically significant differences between the perceptions of decision makers and users. Although decision makers tended to have a more positive perception of the road system than users, it appears that decision makers are aware of the users' needs.

Surprisingly, several respondents were supportive of increasing certain taxes to improve the condition of the roads. We could conclude that decision makers in each of the three states have some avenues to consider for increasing rural road funding. Based on the survey responses, Montana decision makers may want to consider implementing a sales tax; North Dakota and South Dakota decision makers may want to consider increasing the fuel tax to pay for road improvements.

This study found significant differences in the perceptions of rural road users and decision makers regarding the rural road system. The perceived needs of the rural road users may always outweigh the available funding to improve or even maintain rural roads. The large geographic areas coupled with sparse populations will likely continue to plague rural areas and further challenge the decision makers, who already make difficult choices with the rural road system. The results of this study provide decision makers with a perspective of how users perceive the quality of rural roads. The findings validate the importance of good communication between decision makers and rural road users.

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APPENDIX A

QUESTIONS AND RESPONSES BY USER GROUPS

TABLE A1. Decision Makers and Users' Response Rate

Group Surveyed	Number Sent	Number Returned	Response Rate (%)
Montana			
Decision Maker	57	54	95
Rural Road Users *	101	16	16
School Bus Drivers	342	168	49
Total	500	238	48
North Dakota			
Decision Makers	383	94	25
School Bus Drivers	94	38	40
Rural Road Commuters	450	61	14
Agriculture Producers	1,000	280	28
Total	1,927	473	25
South Dakota			
Decision Makers	132	135	102*
Delivery Services	300	69	23
Mail Carriers	256	173	68
Total	688	377	55

* Montana Rural Road Users consist of Transit Drivers, Transit Providers, and Police Officers

TABLE A2. Montana Decision Makers and Users' Average Miles Traveled One Way

Group Surveyed	Average Miles One Way
Decision Makers	56
Rural Road Users	56
School Bus Drivers	192
Total	**304**

TABLE A3. North Dakota Decision Makers and Users' Average Miles Traveled One Way

Group Surveyed	Average Miles One Way
Decision Makers	48
Agricultural Producers	40
Rural Road Commuters	49
School Bus Drivers	84
Total	**221**

TABLE A4. South Dakota Decision Makers and Users' Average Miles Traveled One Way

Group Surveyed	Average Miles One Way
Decision Makers	46
Delivery Services	109
Mail Carriers	143
Total	**298**

PHYSICAL ROADWAY ELEMENTS

TABLE A5. Montana Decision Makers and Users' Ratings of Physical Roadway Elements, by Percentage Response

Groups	------Road Width------			-----Ditch Steepness-----			-----Road Shoulder-----		
	Good	***Fair***	***Poor***	***Good***	***Fair***	***Poor***	***Good***	***Fair***	***Poor***
Decision Makers	37	43	19	31	35	31	26	37	35
Rural Road Users	31	56	13	38	37	25	18	43	37
Schools	30	40	22	29	38	29	13	38	43

NOTE: The rating of 1 and 2 = Good; 3 = Fair; and 4 and 5 = Poor
Categories may not equal 100 percent, this is due to correspondents either not answering the question or choosing N/A.

TABLE A6. North Dakota Decision Makers and Users' Ratings of Physical Roadway Elements, by Percentage Response

Groups	------Road Width------			-----Ditch Steepness-----			-----Road Shoulder-----		
	Good	***Fair***	***Poor***	***Good***	***Fair***	***Poor***	***Good***	***Fair***	***Poor***
Decision Makers	60	34	6	52	38	9	47	40	12
Agricultural Producers	44	31	20	33	37	26	26	35	33
Rural Road Commuters	62	31	7	59	28	13	44	31	23
Schools	47	37	13	32	53	15	32	39	29

NOTE: The rating of 1 and 2 = Good; 3 = Fair; and 4 and 5 = Poor
Categories may not equal 100 percent, this is due to correspondents either not answering the question or choosing N/A.

TABLE A7. South Dakota Decision Makers and Users' Ratings of Physical Roadway Elements, by Percentage Response

Groups	------Road Width------			-----Ditch Steepness-----			-----Road Shoulder-----		
	Good	***Fair***	***Poor***	***Good***	***Fair***	***Poor***	***Good***	***Fair***	***Poor***
Decision Makers	61	30	7	46	34	14	43	40	16
Delivery Services	43	41	16	48	36	14	28	36	35
Mail Carriers	42	39	16	31	46	19	18	49	28

NOTE: The rating of 1 and 2 = Good; 3 = Fair; and 4 and 5 = Poor
Categories may not equal 100 percent, this is due to correspondents either not answering the question or choosing N/A.

OPERATIONAL CONDITIONS

TABLE A8. Montana Element's of the Road that Limit/Reduce Normal Operating Speed

Groups	Decision Makers		Rural Road Users		School Bus Driver		Total	
	Percent	R	Percent	R	Percent	R	Percent	R
Gravel	100.0	10	0.0	0	21.5	28	22.0	38
Rough roads	100.0	10	0.0	0	21.5	28	22.0	38
Washboards	0.0	0	6.1	2	16.9	22	13.9	24
Weather related	10.0	1	0.0	0	17.7	23	13.9	24
Potholes	30.0	3	6.1	2	7.7	10	8.7	15
Number of Respondents n =	10		33		130		173	

R = number of times listed.

TABLE A9. North Dakota Element's of the Road that Limit/Reduce Normal Operating Speed

Groups	Decision Makers		Agricultural Producers		Rural Road Commuters		School Bus Drivers		Total	
	Percent	R	Percent	R	Percent	R	Percent	R	Percent	R
Gravel	27.8	10	18.6	29	15.4	4	8.0	2	18.5	45
Rough roads	0.0	0	22.4	35	0.0	0	32.0	8	17.7	43
Weather related	13.9	5	9.0	14	15.4	4	36.0	9	13.2	32
Other	19.4	7	9.6	15	11.5	3	16.0	4	11.9	29
Washboards	11.1	4	13.5	21	0.0	0	8.0	2	11.1	27
Number of Respondents n =	25		26		156		36		243	

R = number of times listed.

TABLE A10. South Dakota Element's of the Road that Limit/Reduce Normal Operating Speed

Groups	Decision Makers		Delivery Services		Mail Carriers		Total	
	Percent	R	Percent	R	Percent	R	Percent	R
Gravel	26.7	20	8.6	3	33.6	37	27.3	60
Washboards	4.0	3	22.9	8	36.4	40	23.2	51
Weather related	30.7	23	0.0	0	4.5	5	12.7	28
Poor maintenance	1.3	1	8.6	3	16.4	18	10.0	22
Potholes	9.3	7	11.4	4	7.3	8	8.6	19
Number of Respondents n =		75		35		110		220

R = number of times listed.

TABLE A11. Montana Decision Makers and Users' Have you noticed unusual wear and tear on your vehicle due to road conditions?

Groups	Total N	YES		NO		N/A	
		%	R	%	R	%	R
Decision Makers	54	53.7	29	44.4	24	1.9	1
Rural Road Users	16	50.0	8	50.0	8	0.0	0
School Bus Drivers	168	67.9	114	26.2	44	6.0	10
Total	238	63.4	151	31.9	76	4.6	11

R = Number of respondents to question.
N = Total number of surveys.

TABLE A12. North Dakota Decision Makers and Users' Have you noticed unusual wear and tear on your vehicle due to road conditions?

Groups	Total N	YES		NO		N/A	
		%	R	%	R	%	R
Decision Makers	96	33.3	32	66.6	64	0.0	0
Agricultural Producers	176	88.1	155	63.1	111	5.7	10
Rural Road Commuters	26	73.1	19	53.8	14	11.5	3
School Bus Drivers	61	41.0	25	59.0	36	0.0	0
Total	359	64.3	231	62.7	225	3.6	13

R = Number of respondents to question.
N = Total number of surveys.

TABLE A13. South Dakota Decision Makers and Users' Have you noticed unusual wear and tear on your vehicle due to road conditions?

Groups	Total N	YES		NO		N/A	
		%	R	%	R	%	R
Decision Makers	136	27.2	37	72.8	99	0.0	0
Delivery Service	96	34.4	33	37.5	36	0.0	0
Mail Carriers	174	67.2	117	28.7	50	4.0	7
Total	406	46.1	187	45.6	185	1.7	7

R = Number of respondents to question.
N = Total number of surveys.

TABLE A14. Montana Decision Makers and Users' Rating of Roadway Maintenance by Percentage Response

Groups	Winter Maintenance			Bridge Maintenance			Road Maintenance			Adequate Road Signing		
	Good	Fair	Poor	Good	Fair	Poor	Good	Fair	Poor	Good	Fair	Poor
Decision Makers	78	20	2	60	28	4	56	35	7	63	20	1
Rural Road Users	56	38	63	44	50	6	19	56	25	69	25	6
Schools	52	35	9	55	24	12	20	39	56	63	23	8

Note: Categories may not equal 100 percent, this is due to correspondents either not answering the question or choosing N/A.

TABLE A15. North Dakota Decision Makers and Users' Rating of Roadway Maintenance by Percentage Response

Groups	Winter Maintenance			Bridge Maintenance			Road Maintenance			Adequate Road Signing		
	Good	Fair	Poor	Good	Fair	Poor	Good	Fair	Poor	Good	Fair	Poor
Decision Makers	88	11	0	74	20	0	72	24	2	72	24	2
Agricultural Producers	59	28	11	40	24	11	30	40	28	69	19	9
Rural Road Commuters	46	26	26	52	30	10	34	25	36	74	21	3
Schools	45	37	16	63	21	5	29	37	32	87	10	3

Note: Categories may not equal 100 percent, this is due to correspondents either not answering the question or choosing N/A.

TABLE A16. South Dakota Decision Makers and Users' Rating of Roadway Maintenance by Percentage Response

Groups	Winter Maintenance			Bridge Maintenance			Road Maintenance			Adequate Road Signing		
	Good	Fair	Poor	Good	Fair	Poor	Good	Fair	Poor	Good	Fair	Poor
Decision Makers	88	10	1	66	25	3	68	26	6	87	7	5
Delivery Services	65	23	12	52	39	6	23	38	28	87	10	0
Mail Carriers	35	47	14	58	26	6	28	39	29	71	19	7

Note: Categories may not equal 100 percent, this is due to correspondents either not answering the question or choosing N/A.

TABLE A17. Montana Do you feel the emergency services in your area are effective?

Groups	Total N	YES		NO		N/A	
		%	R	%	R	%	R
Decision Makers	54	83	45	11	6	6	3
Rural Road Users	16	88	14	13	2	0	0
School Bus Drivers	168	86	144	8	14	6	10
Total	238	85.3	203	9.2	22	5.5	13

R = Number of respondents to question.
N = Total number of surveys.

TABLE A18. North Dakota Do you feel the emergency services in your area are effective?

Groups	Total N	YES		NO		N/A	
		%	R	%	R	%	R
Decision Makers	94	95	89	3	3	2	2
Agricultural Producers	280	80	224	11	31	9	25
Rural Road Commuters	61	85	52	7	4	8	5
School Bus Drivers	38	79	30	11	4	11	4
Total	473	83.5	395	8.9	42	7.6	36

R = Number of respondents to question.
N = Total number of surveys.

TABLE A19. South Dakota Do you feel the emergency services in your area are effective?

Groups	Total N	YES		NO		N/A	
		%	R	%	R	%	R
Decision Makers	135	90	122	7	10	2	3
Delivery Service	69	80	55	13	9	7	5
Mail Carriers	173	81	140	12	20	65	13
Total	377	84.1	317	10.3	39	5.6	21

R = Number of respondents to question.
N = Total number of surveys.

TABLE A20. Montana Do you report problems along your roadway to your county road office or other official?

Groups	Total N	YES		NO		N/A	
		%	R	%	R	%	R
Decision Makers	54	4	2	87	27	9	5
Rural Road Users	16	75	12	25	4	0	0
School Bus Drivers	168	75	126	21	36	4	6
Total	238	58.8	140	28.2	67	4.6	11

R = Number responding to question.
N = Total number of surveys sent out

TABLE A21. North Dakota Do you report problems along your roadway to your county road office or other official?

Groups	Total N	YES		NO		N/A	
		%	R	%	R	%	R
Decision Makers	94	89	84	11	10	0	0
Agricultural Producers	280	45	126	47	131	8	23
Rural Road Commuter	61	10	6	87	53	3	2
School Bus Drivers	38	63	24	29	11	8	3
Total	473	50.7	240	43.3	205	5.9	28

R = Number responding to question.
N = Total number of surveys sent out

TABLE A22. South Dakota Do you report problems along your roadway to your county road office or other official?

Groups	Total N	YES		NO		N/A	
		%	R	%	R	%	R
Decision Makers	135	90	121	8	11	2	3
Delivery Service	69	43	30	55	38	1	1
Mail Carriers	173	54	93	39	68	7	12
Total	377	64.7	244	31.0	117	4.2	16

R = Number responding to question.
N = Total number of surveys sent out

TABLE A23. Montana Funding Options Decision Makers and Road Users Would Support to Make Local Road Improvements, by Percentage Response

Type of Tax	Decision Makers		Rural Road Users		School Bus Drivers	
	----------Percentage----------					
	YES	NO	YES	NO	YES	NO
Sales Tax	76	24	69	31	38	62
Fuel Tax	30	70	13	87	21	79
Property Tax	9	91	6	94	9	91
Other	13	87	25	75	12	88

NOTE: Decision Makers N = 54, Rural Road User N = 16, School Bus Driver N= 168

TABLE A24. North Dakota Funding Options Decision Makers and Road Users Would Support to Make Local Road Improvements, by Percentage Response

Type of Tax	Agricultural Producers		Decision Makers			Rural Road Commuters		School Bus Drivers	
	----------Percentage----------								
	YES	NO	YES	NO	N/A	YES	NO	YES	NO
Sales Tax	37	63	39	61	_	46	54	42	58
Fuel Tax	25	75	53	46	1	23	77	21	79
Property Tax	5	95	5	95	_	8	92	5	95
Other	31	69	21	79	_	28	72	21	79

NOTE: Agricultural Producers N= 280, Decision Makers N= 94, Rural Road Commuters N=61, School Bus Drivers N= 38

TABLE A25. South Dakota Funding Options Decision Makers and Road Users Would Support to Make Local Road Improvements, by Percentage Response

Type of Tax	Decision Makers			Delivery Services		
	----------Percentage----------					
	YES	**NO**	**N/A**	**YES**	**NO**	**N/A**
Sales Tax	30	70	_	36	64	_
Fuel Tax	54	46	_	14	86	_
Property Tax	5	95	_	6	94	_
Other*	28	67	4	31	68	1

NOTE: * 4 percent of Decision Makers did not answer this question; 1% of Delivery Services did not answer this question.
Decision Makers N = 135, Delivery Service N= 69

TABLE A26. Montana Decision Makers and Users' Recommended Improvements, by Percentage Response

Groups	Decision Makers		Rural Road Users		Schools		Total	
Improvements	**Percent**	**R**	**Percent**	**R**	**Percent**	**R**	**Percent**	**R**
More Maintenance	51.9	28	6.3	1	53.6	90	50.0	119
Wider roads/ road shoulders	29.6	16	37.5	6	31.0	52	31.0	74
More Paved Roads	29.6	16	12.5	2	19.6	33	21.4	51
More and better gravel	14.8	8	6.3	1	22.6	38	19.7	47
Better snow removal	7.4	9	0.0	0	8.3	14	9.6	23
Number respondents n =	54		16		168		238	

R = Number of times this improvement was listed
Categories may not equal 100 percent, this is due to correspondents either not answering the question or choosing N/A.

TABLE A27. North Dakota Decision Makers and Users' Recommended Improvements, by Percentage Response

Groups	Decision Makers		Agricultural Producers		Rural Road Commuters		School Bus Drivers		Total	
Improvements	**Percent**	**R**	**Percent**	**R**	**Percent**	**R**	**Percent**	**R**	**Percent**	**R**
More and better gravel	25.4	71	12.8	12	8.2	5	13.2	5	19.6	93
More Paved Roads	17.9	50	16.0	15	9.8	6	10.5	4	15.8	75
Wider roads/ road shoulders	13.2	37	7.4	7	6.6	4	10.5	4	12.2	58
More Maintenance	10.7	30	9.6	9	14.8	9	23.7	9	12.1	57
Better snow removal	7.5	21	0.0	0	6.6	4	5.3	2	5.7	27
Number respondents n =		94		280		61		38		473

R = Number of times this improvement was listed
Categories may not equal 100 percent, this is due to correspondents either not answering the question or choosing N/A

TABLE A28. South Dakota Decision Makers and Users' Recommended Improvements, by Percentage Response

Groups	Decision Makers		Delivery Services		Mail Carriers		Total	
Improvements	**Percent**	**R**	**Percent**	**R**	**Percent**	**R**	**Percent**	**R**
More and better gravel	8.9	12	5.8	4	23.1	40	18.1	56
More Paved Roads	16.3	22	8.7	6	6.9	12	12.9	40
More Maintenance	19.3	26	17.4	12	0.0	0	12.3	38
Better snow removal	10.4	4	0.7	1	15.0	26	10.0	31
Wider roads/ road shoulders	7.4	10	5.8	4	5.2	9	7.4	23
Number respondents n =		135		69		173		308

R = Number of times this improvement was listed
Categories may not equal 100 percent, this is due to correspondents either not answering the question or choosing N/A.