AN ASSESSMENT OF REGIONAL ROAD USER NEEDS IN THREE RURAL STATES

Gary Hegland
Jill Hough

Upper Great Plains Transportation Institute
North Dakota State University

Full Report: Hough, Jill, Gary Hegland, and Crystal Bahe. *An Assessment of Regional Road User Needs in Three Rural States*. MPC Report No.03-140, North Dakota State University, Fargo. 2003.

AN ASSESSMENT OF REGIONAL ROAD USER NEEDS IN THREE RURAL STATES

Gary Hegland, Jill Hough

ABSTRACT

There are two major players in the transportation system: users and decision makers. The decision makers referred to in this study include county engineers, county road supervisors, and county commissioners. Their decisions pertain to the physical infrastructure and operating characteristics of roadways. Infrastructure issues include financing and building, improving, and maintaining highway transportation structures. Operational issues include regulations, enforcement, and taxing of users. Federal and state laws were established to assure efficient and safe use of the nation's transportation infrastructure. Road users include motorists and motor carriers. These users finance some costs of the transportation system by paying taxes and user fees. Road users expect adequate road services to be provided by governmental agencies. They participate in directing some road decisions through public input mechanisms and input to elected officials. However, in many cases, there are differences between perceptions of providers and users. 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 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 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.

INTRODUCTION

Rural states in the Midwest face unique transportation planning challenges. Montana, North Dakota, and South Dakota are 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, in Montana, North Dakota, and South Dakota, 76.7, 55.8, and 65.4 percent, respectively, of the states' population 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 (U. S. 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 halves of the 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.

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.

BACKGROUND

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 face difficult choices regarding the rural road infrastructure and allocation of limited resources. Road users pay taxes and expect a safe and reliable infrastructure. Following is a brief description of basic road financing as well as the role of decision makers and road users.

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 include township officers.

Most county road decision makers devise a transportation work plan to initiate and maintain the road network in the county. Generally, the plan has several prioritized projects to be completed over a given number of years. The plan is open for public scrutiny. Dissatisfied road users can write their county commissioners with recommended changes. On one hand, decision makers 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 limited funds to the best possible uses.

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. There is a trend toward fewer but larger farms and larger equipment. The larger, heavier equipment increases demand for wider, stronger rural roads. In addition, many farm families earn off-farm income. 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.

RESEARCH PROBLEM

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. The result is a transportation system that is more consistent with the needs of users and allows the users to become more active stakeholders. 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.

The following are objectives for this study:

1. Determine the perceptions of decision makers on road decisions.
2. Determine the perceptions of rural road users needs on the rural road system.
3. Compare the perceptions between the rural road decision makers and rural road users.

REPORT ORGANIZATION

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

RESEARCH METHOD

This paper is based on data collected on the perceptions of township and county roads held by road users and decision makers in Montana, North Dakota, and South Dakota. 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, if decision makers share information with the road users and ask for their input the exchange would create a better partnership. 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 LTAP Centers and DOTS in each state helped identify the specific user groups. 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.

A two-page survey was developed and mailed to the 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 suggested improvements.

Mailings

The LTAP Centers and DOTs obtained the mailing lists for the user groups from private and public sources. The response rates for each of the states are presented in Table 1. The overall return rate for the tri-state area was 35 percent. Significant levels were calculated using chi square.

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**

SURVEY RESULTS OF ROADWAY FACTORS AND SERVICES

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

Questionnaires mailed to each road user group contained questions about physical roadway conditions, road maintenance, and road funding. 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. 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. These users travel much of the rural system and can provide a cursory view.

Physical Roadway Elements

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 of roads 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).

Ditch steepness is important for drainage purposes. Further, for safety reasons it is desirable to design slopes that are not too steep.

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.

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, perceptions of road shoulders did show 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. 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 and unpaved, we find little difference in the perceptions. Once again decision makers view the roadway elements slightly more positively but with no level of significance.

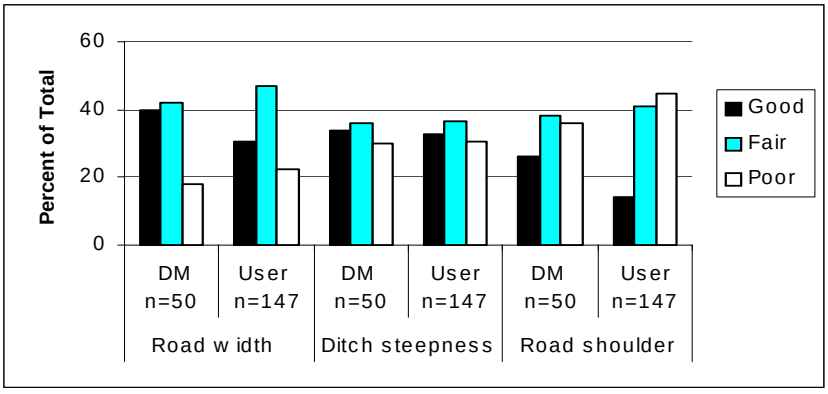

Figure 1. Montana Roadway Element Ratings on All Roads.

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

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. 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 2). 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 statistical significance on the ratings of roadway elements on the unpaved roads. The decision makers consistently rated roadway elements significantly better than the users rated them.

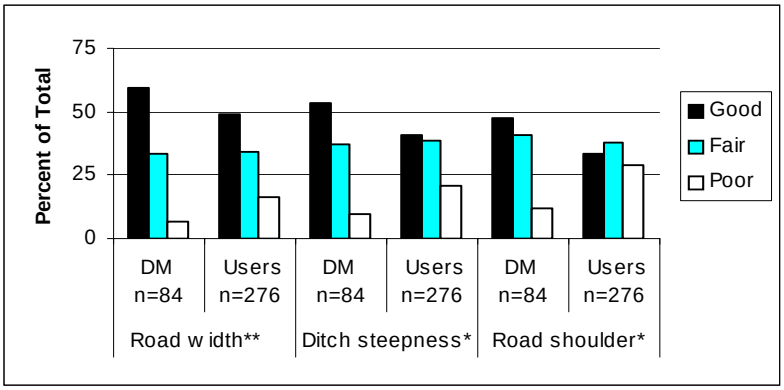

Figure 2. North Dakota Roadway Elements on all Roads
Note: DM=decision Maker; Users=Combined User Groups;
** Significance at 0.10; * Significance at 0.05.

South Dakota Physical Roadway Elements

Significant differences exist 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. 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.

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. 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.

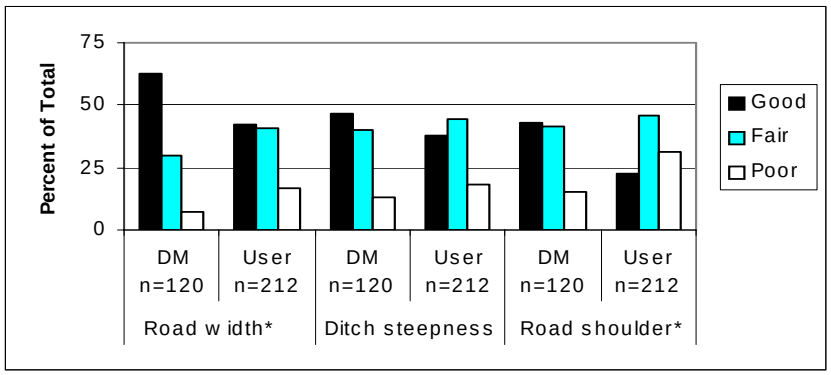

Figure 3. South Dakota Roadway Element Ratings on all Roads.
Note: DM = Decision Makers; Users = Combined User Groups;
*Significance at 0.05; ** Significance at 0.10.

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 first concern addressed is whether there is adequate signage along roads to warn motorists of hazards. Decision makers gave slightly higher positive responses than users in 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 4).

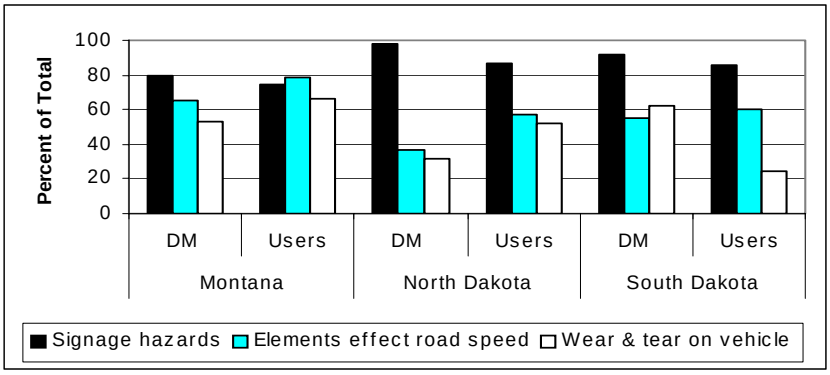

Figure 4. Operational Road Conditions; Yes Responses.
Note: Signage hazards: Adequate signs to warn of upcoming hazards;
Elements affect road speed: Elements on the road that affect the drivers' speed;
Wear and tear on vehicle: Do the road condition cause added wear and tear on your vehicle.

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. 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, 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. 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.

MAINTENANCE

Across the tri-sate area, thousands of miles of roads and bridges have to be maintained. 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. 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 difference was not statically significant by the chi test to the level of 0.05. Decision makers rated snow removal extremely high.

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 5).

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.

For unpaved roads, decision makers gave a high rating to snow removal, with just more than 84 percent rating it as "good." 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.

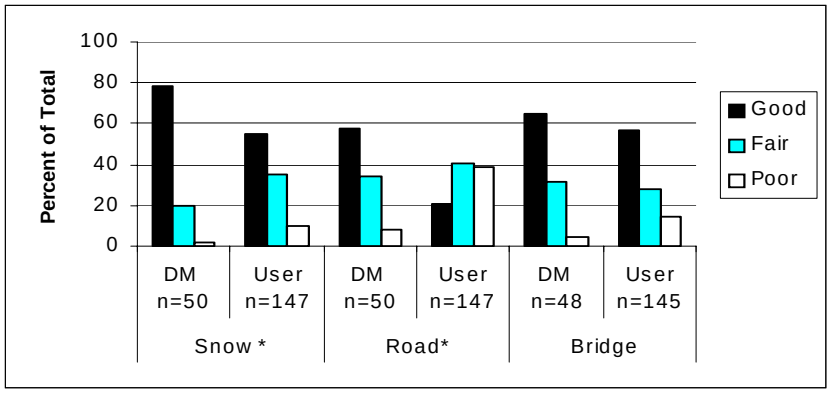

Figure 5. Montana Maintenance Ratings, All Roads.

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

North Dakota

In North Dakota 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 6). North Dakota decision makers from paved and unpaved 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.

On paved roads, decision makers gave 80 percent or more "good" responses to all three categories: snow removal, road maintenance, and bridge maintenance. All three categories were statistically significant. Bridge maintenance received the lowest percent of "good" responses from decision makers. 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. The users graded road maintenance 37 percent "poor" on paved roads and 65 percent "poor" on unpaved roads.

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. The users scored it with the highest percent "poor" of 65 percent. Gravel or unpaved roads have many factors, such as loose gravel, wash boards, narrow shoulders, steep or no

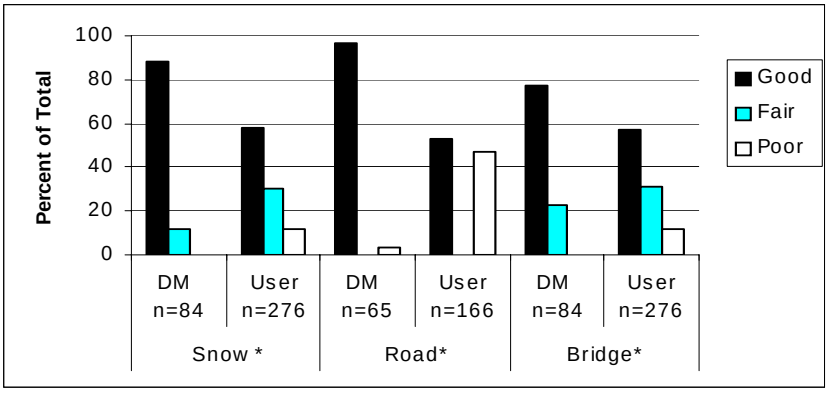

Figure 6. North Dakota Maintenance Ratings, All Roads.

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

ditches, sharp curves, some roads built many years ago, and infrequent grading.

South Dakota

South Dakota follows the pattern of Montana and North Dakota in that decision makers graded all services better than did the users (Figure 7). Snow removal received 89 percent "good" response from decision makers and only 46 percent from users. This difference had strong statistical significance. The "good" ratings for snow removal and road maintenance for decision makers was twice 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.

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. 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

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

The makeup of respondents was a little different in South Dakota as there were more decision makers responding to the survey than road users. South Dakota received about an average percentage of "fair" responses in all three categories.

Respondents were given opportunities to add their own comments to road maintenance. Road users identified improvements they would like to see. 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

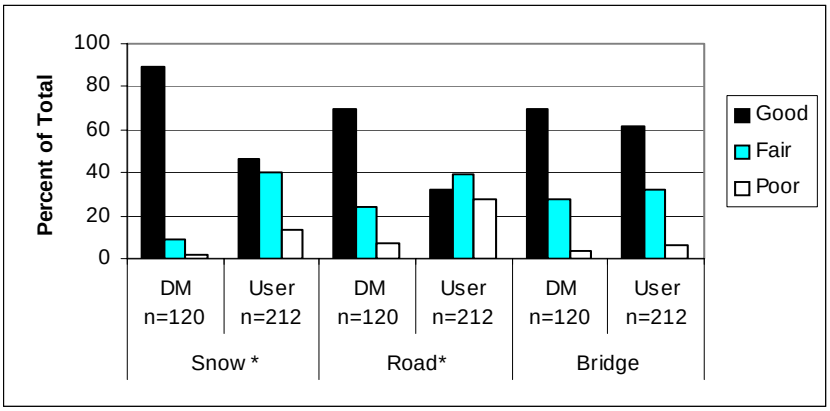

Figure 7. South Dakota Maintenance Ratings, All Roads.

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

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. 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. 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

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.

In North Dakota, on paved roads, 98.3 percent of the decision makers and 89.5 percent of the users indicated 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.

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 8). 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 than those on paved roads. In North Dakota, 63 percent of school bus drivers, 45 percent of agriculture producers, and only 10 percent of the commuters said they reported problems 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.

FUNDING ROAD IMPROVEMENTS

The last section on the survey dealt with funding options for road maintenance, operational condition, and physical roadway elements. Currently, the cost is shared by the state and federal governments and funds are collected from programs such as gas taxes, wheel taxes, and licensing fees.

Montana

Montana currently uses property tax, fuel tax, vehicle registration, and mill levy to fund road maintenance.[1] From the three taxing options provided in the survey, Montana decision makers favored sales tax over fuel tax by 32 percent and users favored that option by 23 percent . Montana is 10th in the nation in gas tax at $.462 per gallon and the seventh highest in fuel tax in the nation at $.537 per gallon.[2] Montana has no sales tax. Montana's second choice was fuel tax. Property tax was last choice. Sales tax is a mechanism to spread the tax burden over the entire population. Other taxes like wheel taxes, fuel taxes, and license fees are more directed to road users.

North Dakota

North Dakota's road funding comes from property tax, fuel tax, vehicle registration and mill levy.[3] North Dakota decision makers favored the fuel tax over sales tax by 35 percent, while users favored sales tax over fuel tax. 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 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 tax, luxury tax and a tax on bulk oil.

South Dakota

South Dakota collects revenue for transportation purposes from property tax and mill levy.[4] South Dakota decision makers favored fuel taxes as a funding source for road improvements. South Dakota currently assesses $0.424 per gallon on gasoline and a $0.484 per gallon on diesel fuel and assesses a 4 percent sales tax.[5] Users favored sales tax by a narrow margin too close for statistical significance. Property

---

[1] 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.

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

[3]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.

[4] 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.

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

tax had the least amount of support. 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.

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. Road structures are aging and 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. 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.

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. Several respondents were supportive of increasing certain taxes to improve the condition of the roads. 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.

Montana

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

North Dakota had the greatest amount of statistical significance in perceptions between decision makers and users. 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

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.

The findings validate the importance of good communication between decision makers and rural road users. 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.

BIBLIOGRAPHY

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

Leftwich, David. North Dakota Department of Transportation, Local Government Engineer. Phone conversation, December 2002.

McClure, Scott, *Quick Facts About your National Bridge Inventory*, Sandia Analytics, Daytona Beach, Florida, 2002.

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