# COUNTY ROAD SURVEY FOR TRANSPORTATION MANAGERS

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# ABSTRACT

North Dakota county road managers were surveyed regarding safety practices, training, and resources. Responses establish a benchmark for understanding common practices and opportunities to promote safety on this high risk road system. Results show a range of activity with regard to county adaptation of proven safety measures and planning activities. Although counties do include safety elements in construction and maintenance activities, they do not have any ongoing safety planning initiatives that institutionalize common road safety features. For instance, none of the counties report the use of chevrons on curves, proven to be a highly effective crash reduction factor. Only about one in ten report that they use delineators on a consistent basis. While almost half of the counties reported using rumble strips or stripes, only one in four frequently apply the countermeasure. In another critical low-cost rural road safety feature, 80% have problems with right of way interference in trying to maintain an adequate clear zone. Survey results provide baseline information that is valuable in prioritizing knowledge investments and safety promotion to reduce crashes on the state's rural roads.

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# INTRODUCTION

North Dakota travel is dominated by rural roadways. Unlike many states, travel is most likely to occur outside urban centers. In North Dakota, approximately 72% of the miles traveled to reach jobs, market goods, and access community services are rural in nature compared to just 33% nationwide. The rural road system is associated with a relatively high crash risk –more than 80% of traffic fatalities occur on these rural roads (FHWA 2010a). This rural road system is comprised of several functional classes including interstates, arterials, and local roads. Interest here is in the local road system – including the practices, resources, and needs for improving safety on these roadways.

Local rural roads are the most dangerous network in the network of road classes considering fatality incidence – using vehicle miles traveled as the exposure measure. Fatalities are three times more likely on local roads than on principle arterials and four times more frequent than on interstates – considering travel exposure (Figure 1). Between 2002 and 2008, 87% of fatalities and 39% of the injuries in North Dakota occurred on rural roads (ND Crash Summary, 2008).[1] Of these crashes, 37% of fatalities and 32% of injuries occurred on local roads. Therefore, dedicating resources to gaining a better understanding of safety practices and needs is well justified. The information collected here will provide a baseline for peers, decision-makers, and technical experts in continuing to strengthen expectations for safety investments in local roads.

In this document, the local road networks are primarily managed by county and township authorities. The county road system is the primary local road system. This road network has corridors of heavily traveled roads along with lighter density interconnector routes that provide accessibility for highly dispersed residents citizens and markets. It is a subset of the larger local road system, selected by counties for improvement and operation to encourage efficient and effective travel for commerce and residents. Counties face challenges with upgrading and maintaining rural county roads as construction and maintenance costs increase. County road managers work to optimize scarce resource allocation in constructing, maintaining and improving the road system. This system was built many years ago without the advantages of today's safety measures.

[1] Rural roads in this case include: interstate, principal arterial, minor arterial, collector and local roads.

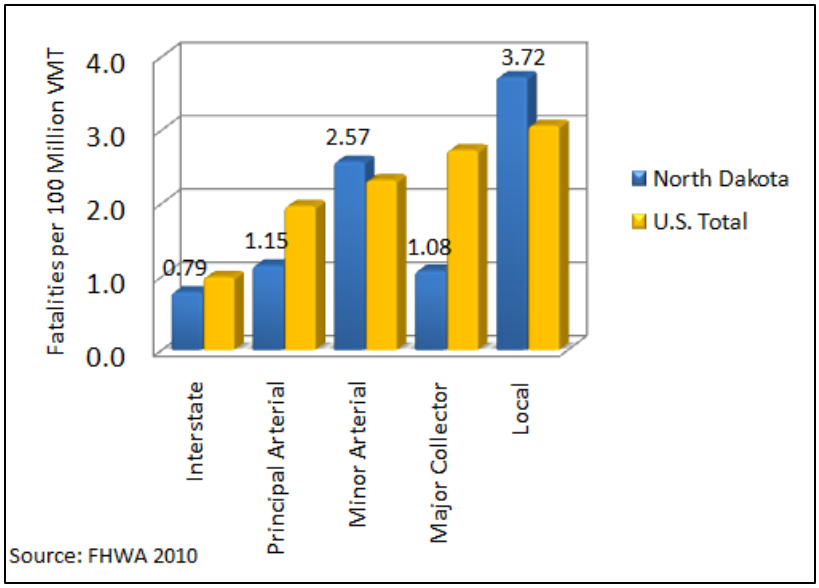


**Figure 1** Fatalities per 100 Million Vehicle Miles Traveled, Rural Roads

A first step in contributing to local road safety is in understanding current priorities, practices, and decision processes. While some information about assets and practices can be gathered in a road scan, local roads managers can offer important information about their current practices and priorities in road safety. These road managers were surveyed in cooperation with the ND Association of County Engineers (NDACE).

A survey was drafted to ascertain information about assets, investment decision, asset management, training resources, public education, and planning related to road safety. The survey focused on the current level of safety-related activities ND county road managers employ. Also, they were asked about priorities in resources and training to improve safety on the gravel and paved roads in their counties. Questions did highlight proven low-cost safety improvements.

Safety improvements can be classified as low, moderate and moderate-to-high costs. Low-cost remedies can improve the safety of rural roadways. Examples of low-cost safety improvements would include: adding rumble strips on the edge of the road and/or the center of the road which may keep a driver within their lane on paved roads, adding signs that are more easily read because of reflectivity or that provide additional guidance, removing obstacles that impair line of sight, or that could increase the severity of a crash, adding guidance for difficult curves, improving sign reflectivity and adding or upgrading guardrails. Examples of moderate cost improvements include: adding turn lanes at intersections along with other pavement markings such as stop ahead etc.; increasing road width to give drivers more space and installing median barriers to aid drivers in navigating rural roads. However, depending on the extent of these improvements they may also come under the high cost category. Examples of relatively high cost improvements include: adding shoulders, improving the alignment, widening or adding lanes (McGill, J.; et al., 2005). High costs projects may involve longer-term construction and reconstruction projects. Understanding current practices is valuable in benchmarking and in identifying leading counties that integrate sustained safety practices in local roads management.

# OBJECTIVE

This project is aimed at understanding asset characteristics and current management practices related to improving safety on local roads. The objective of the project is to evaluate assets and safety practices of counties throughout North Dakota. A secondary objective is to determine needs of the counties in establishing safety standards and implementing safety enhancements.

# METHODS

A mail survey was conducted in cooperation with the NDACE. The survey was comprised of four parts. The first section defined the assets, scope and resources targeted specifically at safety. The second part of the survey was designed to determine current practices used by the county for maintaining current infrastructure and some safety practices employed. The third and fourth parts of the survey collected information related to training and resource needs.

The survey was pre-tested in cooperation with six NDACE members. The revised survey, along with a cover letter from the NDACE, was mailed to the roads manager in each of the 53 counties in North Dakota (Appendix 1 and 2). Descriptive analysis is used to evaluate answers to the survey questions.

# RESULTS

The mailing to 53 counties resulted in 37 valid responses after a series of follow-up phone calls. These responses were submitted from across the state (Figure2). The surveys were completed primarily by county engineers and county road managers. A few surveys were completed by engineering consultants who provide road management services for the counties. These responses may be distinguished, especially with regard to training and information needs.


**Figure 2** Participating Counties

## County Asset Scope

The initial series of questions established the county asset and spending profile. Roads managers were asked about county road miles, sign inventory, township road activities, and road safety budgets. In addition, information on population and geography were collected from secondary sources to estimate the relative scope of assets and resources in the county.

Road miles are distinguished as gravel and paved categories due to the unique service levels and construction/maintenance requirements. The road surface is a crucial aspect of road safety because performance recovery from use and environmental stresses, such as rain and snow, are directly related to the road surface conditions. For example, driving lane and shoulder surface conditions directly affect friction which is a fundamental force in maneuvers such as curve navigation, stopping, and edge recovery (Al-Qadi et. al 2002).

The road system managed in individual counties ranges from 150 to 1,700 miles. Relative service scope and safety performance can be discussed using exposure measures such as population, area, and crashes. The importance of gravel roads in county road safety management is evident in the extent of this road category. County road miles are predominately gravel surface with managers reporting more than 80% of the roads they operate are gravel. The average miles of gravel road maintained by the 37 counties reporting are 461 miles per county. The distribution ranged from a low of 83 miles in Renville to a high of 1,635 miles in McHenry – the median gravel miles was 339 miles. The 37 counties reported a total of 18,138 gravel road miles.

Paved local roads provide unique challenges for local roads managers in identifying safety issues and assessing alternative treatments. Safety treatments are typically devised from studies on major facilities which facilitate high-volume traffic flows. Local roads fall into the narrowest definition – which have been defined as less than 200 to less than 1000 vehicles per day among studies (Hall et. al 2008). Although a much smaller share of the road miles than gravel, paved roads are often included as high priority local connectors that operate as primary local traffic corridors.

The 37 counties reported a total of 4082 miles of pavement. The median miles of paved road reportedly maintained by the counties are 100 miles. The range miles of paved road varied from a low of 0 in Towner County to a high of 300 miles for Cass County. One in four counties reported having less than 50 miles of pavement. Over half the counties reported paved roads of 51 miles to 150 miles. Almost 1 in 5 counties reported over 200 miles in pavement.

The local road system, rural population, and local road crash metrics offer a means to consider resources and safety across the rural road system. McHenry County has the largest county road system, in terms of miles operated. It includes 1,635 gravel miles and 90 paved miles for a total of 1,725 miles. McHenry County is in the 75$^{th}$ quartile for the miles per population metric at 28.8 miles per 100 residents. The geographic coverage in the county is among the lowest at 1.1 miles of road per square mile of land area. Analyzing counties by geography shows that the median county road system includes 2.9 miles of road per square mile of land area. Counties with under 2.3 miles of road per square mile are in the 25$^{th}$ quartile and among the lowest for this metric (Table 1).

In addition to asset extent, crash risk is also important in discussing local road safety. Crash rate metrics can use different variables to discuss the number of crashes and exposure. For instance, traffic safety metrics often rely on fatal crash incidents and annual vehicle travel. Local roads, however, often do not have annual measures of traffic and have few, if any, fatal crash events.

Measuring local roads crash rates against rural population provides some insight about relative risk. All counties with a greater than 4.4 crashes per 100 residents are in the upper 75th quartile for crashes. Ramsey County has the highest rural crash rate per 100 residents at 5.8 and followed closely by Burleigh County at 5.7. Some counties reported low crash rates per 100 residents. All counties with a crash rate of less than 2 per 100 residents are in the 25th, or lowest quartile for crash rate. Griggs and Oliver Counties had the lowest crashes per 100 residents at 0.7. Other counties have less than 1 crash per 100 residents including, Towner County and Adams County.

Local crashes and all rural crashes are highly correlated with a Pearson correlation of 0.86.[2] In Cass County, the highest population center in North Dakota, over ½ of all rural crashes occurred on local roads. About ½ of the rural crashes in Richland, Stark, Burleigh and Barnes counties also occurred on local roads.

North Dakota counties vary in that some counties have organized townships that maintain their roads, other organized townships contract with the county in which they reside, and some county townships have no board or governing body and road maintenance is done by the county. A majority or 3 of 4 counties, report maintaining gravel township roads while 1 in 4 counties reported that they maintain some paved roads for townships.

In addition to the extent of the roads in the county, county road managers were asked about sign inventory. Signs are a critical asset in traffic safety, providing drivers with essential information about road features and traffic interaction. Visibility of signs at night can be enhanced by improved reflectivity as headlights illuminate roadside signs for drivers.

Even though the timing for meeting reflectivity standards varies by sign type, a new federal rule requires counties to have a sign management program in place by January 2012 (FHWA 2010b). The new traffic sign retroreflectivity requirements are included as Revision 2 of the 2003 Manual on Uniform Traffic Control Devices (MUTCD). Under this directive, public agencies must implement a program to maintain traffic sign retroreflectivity at or above the minimum levels based on acceptable maintenance methods for traffic signs identified in the MUTCD. FHWA notes that agencies may use alternative methods based on engineering studies.

[2] "The *Pearson Product-Moment Correlation Coefficient* (r), or correlation coefficient for short *is a measure of the degree of linear relationship between two variables*." http://www.psychstat.missouristate.edu/introbook/sbk17.htm

**Table 1** County Asset and Crash Comparisons

| County | Gravel Miles | Paved Miles | Signs on Rural Road System | All Rural Crashes (No Inter-state) | Local Crashes, No Towns | County Road Miles per 100 Rural Pop. | County Road Miles per Square Mile | Number of Signs per Mile of Road | Local Road Crashes per 100 Rural Pop. |
|---|---|---|---|---|---|---|---|---|---|
| **Adams** | 280 | 34 | 801 | 117 | 22 | 12.1 | 3.1 | 2.6 | 0.8 |
| **Barnes** | 110 | 230 | 2700 | 391 | 199 | 6.7 | 4.5 | 7.9 | 3.9 |
| **Benson** | 37 | 77 | 2018 | 793 | 201 | 6.1 | 3.3 | 4.8 | 2.9 |
| **Bottineau** | 100 | 220 | 3000 | 718 | 333 | 4.5 | 5.3 | 9.4 | 4.7 |
| **Bowman** | 130 | 140 | 613 | 255 | 82 | 8.3 | 4.4 | 2.3 | 2.5 |
| **Burleigh** | 373 | 139 | 10000 | 1397 | 655 | 4.5 | 3.2 | 19.5 | 5.7 |
| **Cass** | 350 | 300 | 3500 | 616 | 425 | 3.9 | 2.8 | 5.4 | 2.6 |
| **Cavalier** | 283 | 70 | | 333 | 90 | 7.3 | 4.3 | | 1.9 |
| **Dickey** | 400 | 100 | 1500 | 516 | 184 | 8.7 | 2.3 | 3.0 | 3.2 |
| **Dunn** | 860 | 16 | 2500 | 411 | 91 | 24.3 | 2.4 | 2.9 | 2.5 |
| **Eddy** | 90 | 62 | | 202 | 76 | 5.5 | 4.2 | | 2.8 |
| **Emmons** | 1130 | 18 | 900 | 461 | 158 | 26.5 | 1.4 | 0.8 | 3.6 |
| **Golden Valley** | 339 | 22 | | 52 | 29 | 18.8 | 2.8 | | 1.5 |
| **Grand Forks** | 225 | 282 | 5672 | 1284 | 461 | 4.4 | 2.9 | 11.2 | 4.0 |
| **Grant** | 1500 | | | 141 | 40 | 52.8 | 1.1 | | 1.4 |
| **Griggs** | 203 | 40 | 485 | 91 | 20 | 8.8 | 3.0 | 2.0 | 0.7 |
| **LaMoure** | 125 | 148 | 1200 | 641 | 235 | 5.8 | 4.2 | 4.4 | 5.0 |
| **McHenry** | 1635 | 90 | | 968 | 227 | 28.8 | 1.1 | 0.0 | 3.8 |
| **McKenzie** | 1083 | 137 | 6588 | 670 | 127 | 21.3 | 2.3 | 5.4 | 2.2 |
| **McLean** | 350 | 130 | 5200 | 1125 | 177 | 5.2 | 4.9 | 10.8 | 1.9 |
| **Mercer** | 550 | 110 | 2000 | 624 | 162 | 11.6 | 1.7 | 3.0 | 2.8 |
| **Nelson** | 351 | 81 | 1407 | 643 | 149 | 11.6 | 2.3 | 3.3 | 4.0 |
| **Oliver** | 480 | 18 | 179 | 47 | 15 | 24.1 | 1.5 | 0.4 | 0.7 |
| **Pierce** | 1038 | 12 | 527 | 410 | 84 | 58.9 | 1.0 | 0.5 | 4.7 |
| **Ramsey** | 140 | 100 | | 1142 | 268 | 5.2 | 5.5 | | 5.8 |
| **Ransom** | 270 | 52 | | 290 | 118 | 5.5 | 2.7 | | 2.0 |
| **Renville** | 83 | 70 | 300 | 224 | 97 | 5.9 | 5.8 | 2.0 | 3.7 |
| **Richland** | 275 | 250 | 4000 | 793 | 414 | 5.6 | 2.8 | 7.6 | 4.4 |
| **Sheridan** | 953 | 22 | | 175 | 75 | 57.0 | 1.0 | | 4.4 |
| **Slope** | 750 | 1 | | 125 | 34 | 97.9 | 1.6 | | 4.4 |
| **Stark** | 1099 | 99 | 1800 | 411 | 207 | 17.4 | 1.1 | 1.5 | 3.0 |
| **Stutsman** | 166 | 233 | 1930 | 848 | 339 | 6.4 | 5.8 | 4.8 | 5.4 |
| **Towner** | 320 | 0 | 1500 | 164 | 24 | 11.1 | 3.3 | 4.7 | 0.8 |
| **Traill** | 203 | 140 | 2870 | 357 | 152 | 4.0 | 2.5 | 8.4 | 1.8 |
| **Walsh** | 286 | 172 | 3722 | 932 | 370 | 5.8 | 2.9 | 8.1 | 4.7 |
| **Ward** | 411 | 298 | 4322 | 2386 | 664 | 5.2 | 2.9 | 6.1 | 4.9 |
| **Williams** | 850 | 170 | 6000 | 1003 | 349 | 15.2 | 2.1 | 5.9 | 5.2 |
| **Total** | **18138** | **4082** | **77234** | **21756** | **7353** | **10.6** | **2.3** | **3.5** | **3.5** |

The new retroreflectivity mandates for signage is a large issue for counties and local municipalities – considering sign costs along with the labor and equipment resource demands. ND county road managers were asked about the number of signs on their system. The average inventory is 2,853 signs per county, ranging from 300 to 10,000. The median for sign inventory was 2,018 per county and may be more representative of most counties. The median number of signs per mile is five. Burleigh reports the highest number of signs per mile at 20, followed by Grand Forks and Bottineau with 11 and 9, respectively. Burleigh County is in the upper 75$^{th}$ or upper quartile for signs per mile of road at 19.5, followed by Grand Forks County at 11.2 and McClean County at 10.8. Counties with 0.4 signs per mile or fewer are in the 25$^{th}$ quartile.

Understanding current practices in project management and budgeting provides guidance for conducting additional research and knowledge transfer. With regard to purchasing assets or services such as pavement striping, counties indicate that cooperating with the state and other county transportation departments can reduce costs through the purchase of larger combined quantities. Four counties report that they cooperate with other counties on road safety service purchases. Additionally, four counties reported working with the state. Three counties reported cooperating with townships and fifteen counties report no cooperation in their safety service purchases.[3]

The budget allocated to safety was derived as a part of total road spending based on recommendations from NDACE pre-test responses. The county average budget dedicated to construction was reported at 29%. The median budget percentage was 30%. The average share of the annual budget allocated to road safety improvements was 15%. However the median was only 6%. The share of the annual budget reportedly spent on other road safety improvements such as striping and signs was 5.6% but the median was only 3%.[4]

## Asset Management

Asset management as applied to the roads sector represents "a systematic process of maintaining, upgrading and operating assets, combining engineering principles with sound business practice and economic rationale, and providing tools to facilitate a more organized and flexible approach to making the decisions necessary to achieve the public's expectations" (OECD 2000). Counties were queried in regards to their asset management, including sign replacement cycle, gravel replacement practices, and striping. Factors such as road design, traffic density, and environment may affect treatment of assets. The county road system is largely grouped into a low-volume road category so a general understanding of management practices for this road system is appropriate for identifying common practices and establishing benchmarks for asset management.

A large majority – 89% – reported changing signs as needed. One county reported changing signage for construction projects and another reported replacing for the new reflectivity standards. One county has a revolving replacement policy of every seven years. As noted, road agencies have until January 2012 to establish and implement a sign assessment or management method to maintain minimum levels of sign

[3] Some counties reported cooperation with contractors. The interpretation may be that they hire contractors to perform maintenance and/or construction work and may not be the cooperation the survey was trying to reveal. The intent for the question was two or more jurisdictions work together to take advantage of economies that may exists by partnering.

[4] The question was confusing to some as they entered a dollar amount not a percentage.

retroreflectivity. The compliance date for meeting the minimum retroreflectivity requirements for regulatory, warning, and ground-mounted guide signs is January 2015. For overhead guide signs and street name signs, the compliance date is January 2018 (FHWA 2010b).

As with road signs, pavement markings are an important safety asset in communicating information about road features and traffic operations on paved roads (Carlson et. al 2009, Gross et. al 2008). The pavement marking information collected from counties focused on the centerline strip. The centerline is a standard road feature that drivers expect to see as they travel county roads. Just over half of counties report a regular interval for centerline striping with 3 years being the most common interval at 29%. One in ten counties report centerline striping annually and 16% reported striping every other year. For the counties that indicate the "Other" interval, one reports no striping and another indicates striping heavy traffic areas more than once a year. Two counties reported striping when chip seal is done. Five counties report that they do not have an established interval for their centerline striping program.

Asset management related to gravel roads is considered in road crown and gravel replacement. Road crown is important in maintaining road structure. The crown of the road moves the water off the road and provides for safer travel as the road may remain dryer reducing danger from slippery conditions. Road crown also contributes to long term road stability (AASHTO 2001). Quality of the driving surface provides stability for traction on gravel roads. A gravel replacement plan can be an asset in gravel road management and safety (Patterson et. al 2008).

Counties were asked about the degree of road crown typically used in their road design. The average road crown is 3%, but the median is 4%. Almost half of the counties reported using a 4% grade crown on their gravel roads. Five counties use a 2% grade and four report using both 3.5% and 4% grades, while two others using a 4.5% and 5% grades. Four counties reported not knowing the required or designated grade. (This may be a function of who completed the survey).

A majority of counties (62%) reported replacing gravel as needed (Figure 3). About one in ten report different intervals, including as needed and annually. One county reported "putting gravel on the poorest roads until the budget is spent."

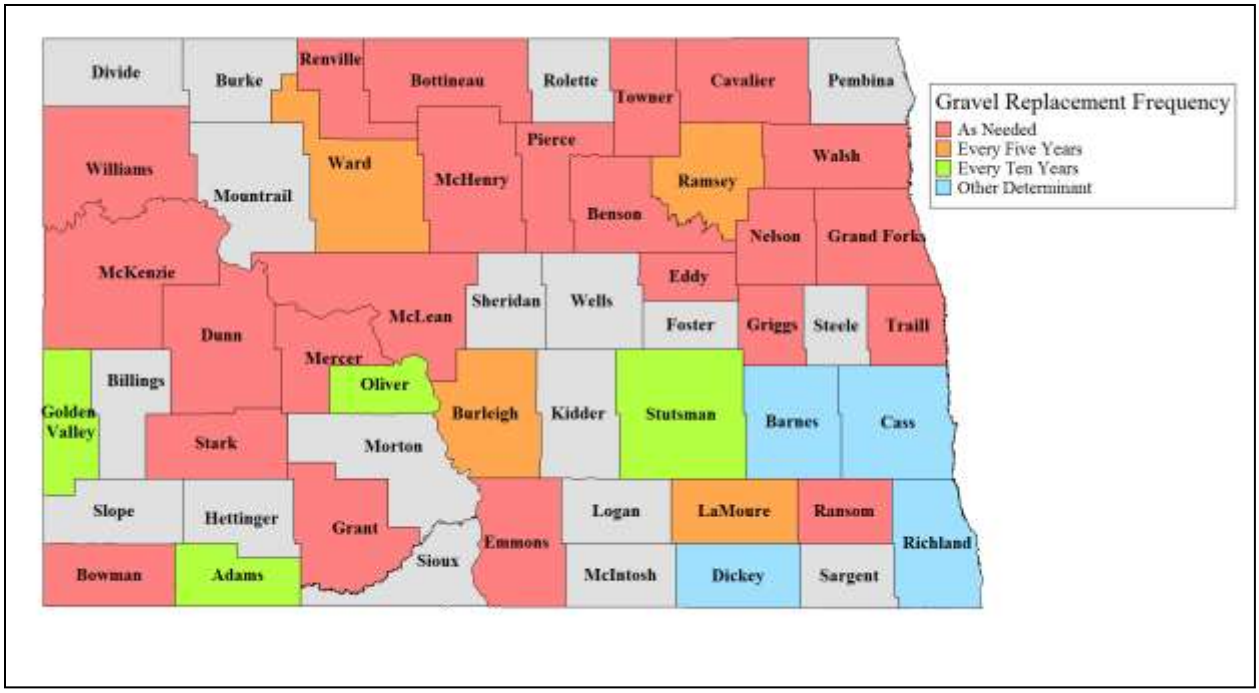


**Figure 3** County Gravel Replacement Frequency

Road width is associated with safety as it provides room to maneuver and for recovery time. It is especially important with a top-heavy passenger vehicle such as a school bus and oversize truck and farm equipment traffic. The average reported lane width for counties was 12.35 feet and the average shoulder width was just over 2 feet. The narrowest and widest lane width reported was 11.5 and 13.5 feet, respectively. The narrowest and widest shoulder width reported was 0 and 6 feet, respectively.

Counties were asked about applying low-cost safety improvements and how often they use some of the different strategies. Low-cost safety improvements may be employed to reduce hazards or aid drivers. These strategies include improved signage such as using delineators[5] or chevrons[6] on curves to guide drivers; using rumble strips or stripes to warn drivers when they are wandering out of the driving lane; maintaining a clear roadway right-of-way; and installing safety end caps on bridges and guardrails. Curve treatment is an important factor in local road safety. Studies have shown curves to be a relatively high-risk area in the rural road system with regard to crash injury and risk (FHWA 2009). Proven treatments are available for these environments. For example, chevrons are shown to reduce fatal crashes by 20% when installed on rural two-lane highways (FHWA 2008). Chevrons and delineators, commonly

[5] A commonly used device for showing the curve alignment to the motorist is the delineator—a retroreflective device mounted above the roadway surface and along the side of the roadway in a series to show roadway alignment. A delineator is considered a guidance device rather than a warning device and is most effective at night and during adverse weather when pavement markings are not visible.
http://safety.fhwa.dot.gov/roadway_dept/horicurves/fhwasa07002/ch2.cfm

[6] Chevron Alignment (W1-8) sign is intended to emphasize and guide drivers through a change in horizontal alignment. Because of their pattern and size and that several of the signs are in view of the motorist, they define the direction and sharpness of the curve the best of all the traffic control devices.
http://safety.fhwa.dot.gov/roadway_dept/horicurves/fhwasa07002/ch2.cfm

recommended safety treatments for curves, are the least common safety measure used by ND counties. None of the counties report the use of the chevron safety feature. Only 12.5% of counties report that they use delineators on a consistent basis.
Almost 50% of counties reported using rumble strips or stripes with 26% using them always and 22% using them most of the time.[7] More than ½ of the counties report they maintain a clear right of way even though they report in the next question that over 80% have problems with right of way interference. Again, more than 50% of counties install safety end caps on guardrails when performing maintenance on roadways.

**Table 2** Low Cost Safety Strategies Employed by Counties

| **Strategy** | **Scale** | | | | | |
|---|---|---|---|---|---|---|
| | 1=Never | 2 | 3 | 4 | 5=Always | 4 + 5 |
| Delineators on curves | 18.8% | 28.1% | 40.6% | 0.0% | 12.5% | 12.5% |
| Chevrons on curves | 35.3% | 41.2% | 23.5% | 0.0% | 0.0% | 0.0% |
| Rumble strips or stripes | 19.3% | 15.8% | 15.8% | 22.8% | 26.3% | 49.1% |
| Maintain clear right-of-way | 15.8% | 21.1% | 5.3% | 36.8% | 21.1% | 57.9% |
| Safety end caps on guardrails | 14.3% | 7.1% | 25.0% | 28.6% | 25.0% | 53.6% |

Counties were asked about their dedication and challenges in maintaining a clean right of way. "Right of way" interference includes: vegetation, hay stacking, machinery parking or other things. Sight distance is critical in road safety. Most counties have some level of problem with ROW interference. A drivers' ability to see on-coming traffic at intersections and around curves is an important safety consideration. Table 5 shows that over 80 percent of counties report problems and 40 percent have a chronic problem (North Dakota Century Code 24-05) [7].

[7] "Rumble Strips are an effective countermeasure for preventing roadway departure crashes. The noise and vibration produced by rumble strips alert drivers when they leave the traveled way. Rumble stripes is the term used for rumble strips painted with a retroreflective coating to increase the visibility of the pavement edge at night and during inclement weather conditions." http://safety.fhwa.dot.gov/roadway_dept/pavement/rumble_strips/

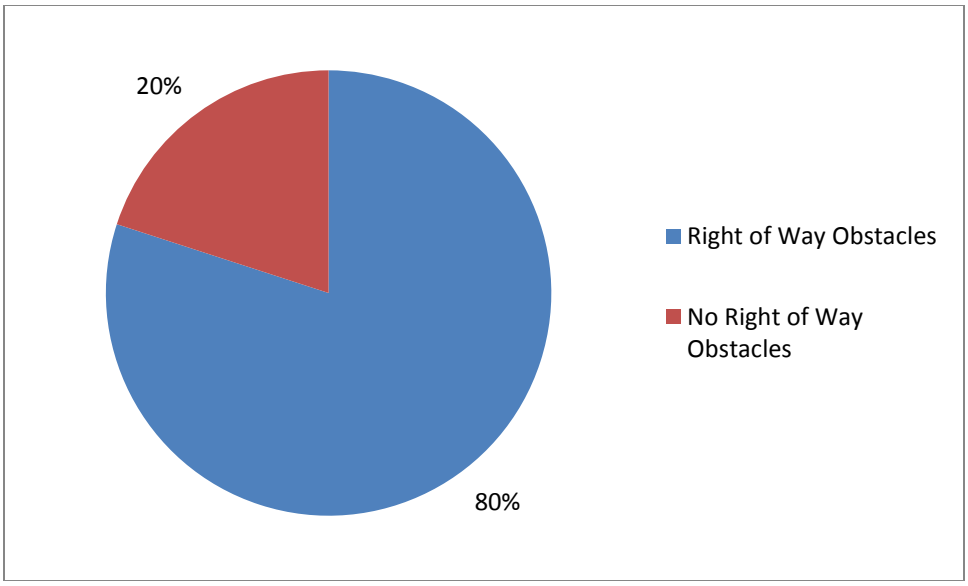


**Figure 4** Right of Way Interference

A strategic plan for road safety can be a critical asset in engaging stakeholders and identifying priorities to improve community health and attract business investment through reduced crash risk. The processes and actions most commonly drawn upon in these efforts rely on empirical study of historical crashes coupled with implementation of evidence-based interventions and countermeasures. Five counties of the 35 responding to the survey question report they have a safety plan (Figure 4). The other 30 did not have a plan. Within these counties, 20 counties have not discussed a formal plan or planning process while 10 had discussions about developing road safety plans.

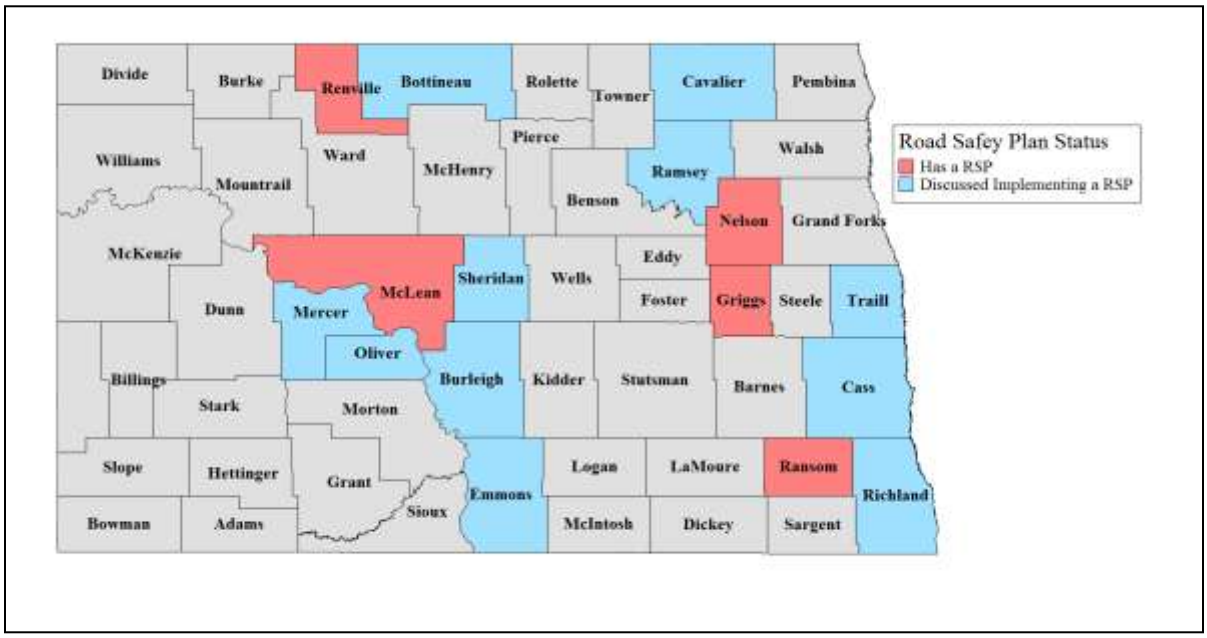


**Figure 5** Counties with a Road Safety Plan Implemented or Under Discussion

More than half the counties reported requesting assistance through NDDOT Highway Safety Improvement Program. The program is a resource for counties looking for supplemental funding that may be used to implement low-cost safety improvements such as the use of chevrons or delineators. Most counties in North Dakota are working to implement safety in their construction process; however a formal approach or process does not exist in many counties (62%). Fourteen counties report they have a formal process for examining safety issues on county roads while 23 report not having a formal process. Most counties (86%) report that law enforcement and the public alert them to safety concerns and most counties encourage this practices. Most counties (83%) also follow some standard work zone safety procedure.

Counties are increasingly using low-cost safety procedures to help reduce crashes. Sixty two percent of respondents report using low cost strategy to make roads safer. Over half (57%) of the counties responding report having a computerized sign inventory, However, only a third report using GIS or GPS to map sign location. The majority of reporting counties (76%) have a plan in place to replace current signs to meet the new retroreflectivity requirements.

**Table 3** Road Safety Management

| Element | Response | |
|---|---|---|
| | Yes | No |
| A formal process is used to examine safety on county roads, including intersections, curves, hills and signs | 38% | 62% |
| Law enforcement alerts on road safety concerns such as crashes and near-misses. | 84% | 16% |
| The public is encouraged to report road safety concerns. | 86% | 14% |
| Follows a standard work zone safety procedure. | 83% | 17% |
| Follows a program to make roads safer through low cost strategies. | 62% | 38% |
| Has computer sign inventory. | 57% | 43% |
| Uses GIS to map sign and asset locations. | 33% | 67% |
| Has plan in place to replace current signage with the new sign reflectivity and inventory requirements | 76% | 24% |
| Have sufficient emergency road signage inventory to deal with road closures. | 83% | 17% |
| Paved roads going to go back to gravel or reclaimed asphalt. | 22% | 78% |

## Training Needs

Time and resources for training is an ongoing problem for counties. Among respondents, 25 listed LTAP as their first source for training. Second was the NDACE and third was UGPTI. A wide range of training is available from these groups. Counties were asked to put a priority on certain training topics (Table 4.) The topic that ranked the highest for training needs was "gravel roads maintenance" followed closely by the "basics of a good road." Winter road maintenance also ranked high (Table 4). Given the prevalence of gravel roads in the county system and ongoing needs to make effective decisions for county road standards, these topics seem fundamental in basic management decisions. Moving beyond the basic principles, counties indicate that continued knowledge on winter road management practices and the over-arching topic of road safety is needed. Topics with a more specialized focus, such as work zone safety, traffic signing guidance, and newer geospatial mapping applications are above average in terms of training needs.

**Table 4** Rating Topics for Training Needs

| *Topics* | *Average* | *1= Low* | *2* | *3* | *4* | *5= High* | *4+5* |
|---|---|---|---|---|---|---|---|
| Gravel Roads Maintenance | 4.0 | 0% | 5% | 20% | 40% | 34% | 74% |
| Basics of a Good Road | 3.9 | 2% | 2% | 22% | 40% | 31% | 71% |
| Winter Road Maintenance | 3.8 | 0% | 8% | 28% | 40% | 22% | 62% |
| Low Cost Safety Improvements | 3.7 | 2% | 5% | 25% | 54% | 11% | 55% |
| Road Safety Planning | 3.7 | 2% | 8% | 28% | 40% | 20% | 60% |
| Road Side Safety Evaluation | 3.6 | 5% | 5% | 25% | 45% | 17% | 62% |
| Sign Reflectivity Regulations and Inventory Requirements | 3.6 | 5% | 14% | 22% | 31% | 25% | 57% |
| Traffic Signing | 3.6 | 2% | 11% | 28% | 40% | 17% | 57% |
| Work Zone Traffic Control | 3.4 | 5% | 14% | 28% | 37% | 14% | 51% |
| Asset Management | 3.3 | 5% | 14% | 37% | 25% | 17% | 42% |
| Basic MUTCD Training (Sign types, basic terminology, etc) | 3.3 | 8% | 11% | 37% | 22% | 20% | 42% |
| GIS Mapping and Data Management | 3.2 | 14% | 14% | 22% | 31% | 17% | 48% |
| Haz-Mat Routing | 2.9 | 14% | 25% | 31% | 17% | 11% | 28% |
| Cold-in-Place Asphalt Recycling | 2.4 | 28% | 25% | 28% | 11% | 5% | 17% |
| Community or City Traffic Control and Design | 2.1 | 34% | 31% | 28% | 2% | 2% | 5% |
| Community or City Traffic Management and Operations | 2.1 | 37% | 28% | 28% | 2% | 2% | 5% |

## Resources

In addition to priorities for training that may be offered or developed, counties were asked what was needed for resources such as field manuals/brochures, desktop reference documents, and information for public officials and residents. Nearly all the resource needs were viewed around the average rating of 3. The top rating for resource needs was a guide for building a good road. Reflectivity regulations and guidance, sign inventory requirements were second and closely followed by roadside safety evaluations, truck traffic impact guidelines, and winter road maintenance (Table 5). When sorted by the share in the top ratings of 4 and 5, sign inventory is the greatest need with the good road building guide second. The high ratings for the sign management program.

**Table 5** Resource Needs for Road Managers

| *Topics* | *Average* | *1=Low* | *2* | *3* | *4* | *5=High* | *4+5* |
|---|---|---|---|---|---|---|---|
| Guide for Building a Good Road | 3.7 | 5% | 5% | 31% | 31% | 25% | 57.1% |
| Sign Inventory Requirements | 3.6 | 3% | 9% | 30% | 36% | 21% | 57% |
| Reflectivity Regulations & Guidance | 3.6 | 5% | 5% | 37% | 25% | 25% | 51% |
| Guide for Traffic Signing | 3.6 | 2% | 2% | 42% | 34% | 17% | 51% |
| Truck Traffic Impact Guidelines | 3.4 | 5% | 8% | 38% | 29% | 17% | 47% |
| Roadside Safety Evaluations | 3.4 | 5% | 5% | 41% | 35% | 11% | 47% |
| Winter Road Maintenance | 3.4 | 8% | 11% | 34% | 25% | 20% | 45% |
| Work Zone Traffic Control Guidelines | 3.2 | 5% | 8% | 45% | 34% | 5% | 40% |
| Best Practices for Asset Management | 3.2 | 5% | 14% | 45% | 25% | 8% | 34% |
| Guide to GIS Applications | 3.0 | 22% | 11% | 17% | 34% | 14% | 38% |
| HazMat Routing Guidelines | 2.4 | 22% | 28% | 34% | 11% | 2% | 14% |

# SUMMARY

Safety measures are an increasingly important step in the maintenance and construction of the rural roads that are critical to the lives of many ND residents in reaching jobs, marketing goods, accessing community services, and attending social functions. These roads, however, are associated with a relatively high crash risk as over 80 percent of traffic fatalities in the state occur on rural roads. This report summarizes a survey of rural road managers. This project is aimed at understanding asset characteristics and current management practices related to improving safety on local roads.

The mailing to 53 counties resulted in 37 valid responses County road miles are predominately gravel surface with managers reporting that over 80% of the roads they operate are gravel. The median miles of gravel road reportedly maintained by a county is 339, ranging from 83 miles-to 1,635 miles. The 37 counties reported a total of 18,138 gravel road miles. The counties reported a total miles of pavement of 4,082. The median miles of paved road reportedly maintained by the counties are 100 miles. Although a much smaller share of the road miles than gravel, paved roads are often high-priority local connectors that operate as primary local traffic corridors. Paved local road provide unique challenges for local roads managers in identifying safety issues and assessing alternative treatments. Safety treatments are typically devised from studies on major facilities which facilitate high-volume traffic flows.

Crash rate metrics can use different variables for measurement. In rural areas many factors may have an effect. Measuring crash rates against rural population may provide some insight. All counties with a greater than 4.4 crashes per 100 residents are in the upper 75$^{th}$ quartile for crashes. Ramsey County has the highest rural crash rate per 100 rural residents at 5.8 and followed closely by Burleigh County at 5.7 rural crashes per 100 rural residents. The crash rate ranged from 0.7 per 100 residents to 5.8 per 100 residents.

More than half of the counties report cooperating with other counties or other entities on projects to share in volume purchase economies. However that means that a high percentage of counties are not partnering to save costs.

The county road system is largely grouped into a low-volume road category so a general understanding of management practices for this road system is appropriate for identifying common practices and establishing benchmarks for asset management. The majority of counties report sign replacement on an as-needed basis and the same is true for gravel replacement and striping. Factors such as road design, traffic density, scarce resources, and the environment may affect treatment of assets.

None of the counties report the use of the chevrons on curves. Only 12.5% of counties report that they use delineators on a consistent basis. Almost 50% of counties reported using rumble strips or stripes with 26% using them always and 22% using them most of the time. More than ½ of the counties report they maintain a clear right of way even though 80% report problems with right of way interference.
Most counties are working to implement safety in their construction process; however a formal approach or process does not exist in most counties. Most counties (86%) report that law enforcement and the public alert them to safety concerns and most counties encourage this practice. Most counties (83%) also follow a standard work zone safety procedure.

Twenty five counties listed LTAP as their first source for training. Second was the NDACE and third was UGPTI. Counties were asked to put a priority on certain training topics. The topic that ranked the highest for training needs was “gravel roads maintenance” followed closely by the “basics of a good road.” Winter road maintenance also ranked high

Counties were asked what was needed for resources such as field manuals/brochures, desktop reference documents, and information for public officials and residents Counties were asked what was needed for resources such as field manuals/brochures, desktop reference documents, and information for public officials and residents. The top rating for resource needs was a guide for building a good road, reflectivity regulations and guidance, sign inventory requirements were second and closely followed by roadside safety evaluations, truck traffic impact guidelines and winter road maintenance.

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# APPENDIX 1. SURVEY

**ROAD SAFETY SURVEY FOR COUNTY ROAD MANAGERS**

Name_____ County_____

E-mail_____
Phone: _____

## County Assets

1. How many miles of gravel county roads are maintained? _____

2. How many miles of paved county roads are maintained? _____

3. Do you maintain any township roads?
   a. Paved? ☐ Yes ☐ No
   b. Gravel? ☐ Yes ☐ No

4. How many signs are on your county road system?_____

5. Who does your county cooperate with on contracting for road safety services such as striping?
   ☐ Townships ☐ Counties ☐ State ☐ None ☐ Other _____

6. Share of annual budget dedicated to construction?_____%

7. Share of annual construction budget allocated to road safety improvements? _____%

8. Share of annual budget spent on other road safety improvements such as striping and signs? _____

## Current Practices

9. Signs on your county road system are typically replaced:
   ☐ As Needed ☐ Every 10 Years ☐ Other (please specify)_____

10. What is the typical interval for striping center line on county roads?
    ☐ 1 year ☐ 2 years ☐ 3 years ☐Other (please specify)_____

11. Routine gravel replacement is:
    ☐ As Needed ☐ 5 years ☐ 10 years ☐ Other (please specify)_____

12. What is your usual specification for gravel road crown? _____% grade ☐ Unknown

13. On paved roads, what is the typical? lane width_____ shoulder width_____

14. Do you have a county roads safety plan? □ Yes □ No

→ IF NO, HAS YOUR COUNTY DISCUSSED DEVELOPING ONE? □ YES □ NO

15. Has your county ever applied for NDDOT Highway Safety Improvement Program funding? □ Yes □ No

16. In managing your roads, how often do you use these strategies:

| **Strategy** | Never | | | | Always |
|---|---|---|---|---|---|
| a. Delineators on curves | 1 | 2 | 3 | 4 | 5 |
| b. Chevrons on curves | 1 | 2 | 3 | 4 | 5 |
| c. Rumble strips or stripes | 1 | 2 | 3 | 4 | 5 |
| d. Maintain clear right-of-way | 1 | 2 | 3 | 4 | 5 |
| e. Safety end caps on guardrails | 1 | 2 | 3 | 4 | 5 |

17. Farming or other resident activity interferes with the ROW maintenance.
□ Rarely □ Sometimes □ Often □ Always

18. Please tell us about road safety management in your county.

| **Element** | **Applies** | |
|---|---|---|
| a. A formal process is used to examine safety on county roads, including intersections, curves, hills and signs. | □ Yes | □ No |
| b. Law enforcement alerts on road safety concerns such as crashes and near-misses. | □ Yes | □ No |
| c. The public is encouraged to report road safety concerns. | □ Yes | □ No |
| d. Follows a standard work zone safety procedure. | □ Yes | □ No |
| e. Follows a program to make roads safer through low cost strategies. | □ Yes | □ No |
| f. Has computer sign inventory. | □ Yes | □ No |
| g. Uses GIS to map sign and asset locations. | □ Yes | □ No |
| h. Has plan in place to replace current signage with the new sign reflectivity and inventory requirements | □ Yes | □ No |
| i. Have sufficient emergency road signage inventory to deal with road closures. | □ Yes | □ No |
| j. Paved roads going to go back to gravel or reclaimed asphalt. | □ Yes | □ No |

19. What are your sources for training and techniques of road operations and maintenance? (Please List)

_____ _____

**Training Needs**

20. With the training now available, please rate the following topics from low to high priority regarding future needs.

| Topics | 1= Low | | | | 5=High |
|---|---|---|---|---|---|
| a. Low cost safety improvements | 1 | 2 | 3 | 4 | 5 |
| b. Work Zone Traffic Control | 1 | 2 | 3 | 4 | 5 |
| c. Community or City Traffic Control and Design | 1 | 2 | 3 | 4 | 5 |
| d. Community or City Traffic Management and Operations | 1 | 2 | 3 | 4 | 5 |
| e. Sign Reflectivity Regulations and Inventory Requirements | 1 | 2 | 3 | 4 | 5 |
| f. Roadside Safety Evaluation | 1 | 2 | 3 | 4 | 5 |
| g. Asset Management | 1 | 2 | 3 | 4 | 5 |
| h. Cold-in-Place Asphalt Recycling | 1 | 2 | 3 | 4 | 5 |
| i. Gravel Roads Maintenance | 1 | 2 | 3 | 4 | 5 |
| j. Road Safety Planning | 1 | 2 | 3 | 4 | 5 |
| k. Basic MUTCD Training (Sign types, basic terminology, etc) | 1 | 2 | 3 | 4 | 5 |
| l. Winter Road Maintenance | 1 | 2 | 3 | 4 | 5 |
| m. Traffic Signing | 1 | 2 | 3 | 4 | 5 |
| n. Basics of a Good Road | 1 | 2 | 3 | 4 | 5 |
| o. GIS Mapping and Data Management | 1 | 2 | 3 | 4 | 5 |
| p. HazMat Routing | 1 | 2 | 3 | 4 | 5 |

**Resources**

21. Please rate the following topics and classify from low to high priority with regard to need for additional resources such as field manuals/brochures, desktop reference documents, and information for public officials and residents.

| Topics | 1= Low | | | | 5=High |
|---|---|---|---|---|---|
| a. Truck Traffic Impact Guidelines | 1 | 2 | 3 | 4 | 5 |
| b. Work Zone Traffic Control Guidelines | 1 | 2 | 3 | 4 | 5 |
| c. Sign Inventory Requirements | 1 | 2 | 3 | 4 | 5 |
| d. Reflectivity Regulations & Guidance | 1 | 2 | 3 | 4 | 5 |
| e. Roadside Safety Evaluation Guidelines | 1 | 2 | 3 | 4 | 5 |
| f. Best Practices for Asset Management | 1 | 2 | 3 | 4 | 5 |
| g. Winter Road Maintenance | 1 | 2 | 3 | 4 | 5 |
| h. Guide for Traffic Signing | 1 | 2 | 3 | 4 | 5 |
| i. Guide for Building a Good Road | 1 | 2 | 3 | 4 | 5 |
| j. Guide to GIS Applications | 1 | 2 | 3 | 4 | 5 |
| k. HazMat Routing Guidelines | 1 | 2 | 3 | 4 | 5 |

# APPENDIX 2. COVER LETTER


March 15, 2010

Dear Member,

**Rural roads are critical to the lives of many ND residents in reaching jobs, marketing goods, accessing community services, and attending social functions. These roads, however, are associated with a relatively high crash risk – over 80 percent of traffic fatalities in the state occur on rural roads. In cooperation with the North Dakota Association of County Engineers, the Upper Great Plains Transportation Institute at NDSU is conducting this survey on behalf of the Rural Transportation Safety and Security Center. The project is aimed at understanding asset characteristics and current management practices related to improving safety on local roads.**

We hope you will take a few minutes to complete this survey. Your participation is important to understanding how we can work to improve road safety in the state. Individual responses will not be disseminated nor appear in any report or publication.

If you have any questions about the survey, feel free to contact Kimberly Vachal at (701) 231-6425 or at kimberly.vachal@ndsu.edu at the Upper Great Plains Transportation Institute, NDSU. Their mailing address is NDSU Dept 2880, PO Box 6050, Fargo, ND 58108-6050. We appreciate your help with this effort!

Sincerely,

Kerry Johnson
President
*North Dakota Association of County Engineers*

# APPENDIX 3. COMMENTS

1. These topics are all great but where does all of the funding come from?

2. Making it easier for counties to use federal safety funds for small projects is critical (see Minnesota example). They have reduced a requirement for small safety projects to a 2 page form. ND should more actively promote "toward zero deaths" in North Dakota. I would be interested in actively working with UGPTI/DOT/others on promoting low cost safety improvements on county and local roads in ND.

3. Oil development has overwhelmed the county and its resources, and keeping up with the many road issues that are developing each day is not possible. Only time and money will cure this. With Dunn County's activity from the oil development, safety issues are being addressed informally but constantly. Dunn County has many roads that were built using "muckers" which were elevators attached to motor graders that cut the dirt from the ditch and placed it on the roads. With this equipment no hills were cut down or low areas, filled consequently the roads are narrow and have limited sight distance. As fast as projects to address safety issues of sight distances and curves can be supported financially, they are being planned and built. Many issues interfere with this process namely, the Corps, permits and right-of-way acquisition. With 600 plus miles of impacted roads it will take years and millions of dollars to address all the safety issues that need to be addressed.

4. We do not have the funding to do a good job on a lot of these projects.

5. Safety issues will increase exponentially with the increase in oil exploration. A majority of county and township roads are not designed for the heavy oil truck type traffic. The increased volume and size of loads will make most of our roads obsolete and will deteriorate rapidly what is currently in place. The energy impact grant program doesn't begin to scratch the surface of what is needed for funding.

6. DOT wants us to go to 11' lanes on paved roads this is not a safety improvement.

7. Ward County does not budget a set amount for safety improvements, signing, or striping. These funds come directly out of materials, supplies, services, labor, with the exception of a large safety improvement, which would be included in our sip last year around $100,000 was spent on signing and around $80,000 on striping, this includes all cost associated with improvements and maintenance.