SEAT BELT USE IN NORTH DAKOTA

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Thank you to North Dakota Tourism and Gerald Blank for the use
of the North Dakota picture on the cover.

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Disclaimer

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EXECUTIVE SUMMARY

North Dakota's seat belt use study provides statistically reliable data from which generalizations, comparative analyses and recommendations can be developed. The National Occupant Protection Use Survey (NOPUS) provides the North Dakota Department of Transportation (NDDOT) with a system to monitor seat belt use rates within the state. The National Highway Traffic Safety Administration (NHTSA) funds NOPUS through the NDDOT's Safety Division.

The initial sampling methodology for this study was developed in 2001 with guidance from NHTSA. Other than to update the site and county vehicle miles traveled (VMT) to the latest NDDOT estimates for the 2009 through 2011 surveys, there was little change in the counties and sites that made up the sample. In April 2011, NHTSA issued new Uniform Criteria for the state observational survey of seat belt use to improve the survey's representativeness. One of the main changes NHTSA implemented was to focus county selection using crash-related fatalities data, as reported by the Fatality Analysis Reporting System (FARS), instead of the population-based exclusion criterion used in the past. The revised criteria, implemented for the 2012 survey and outlined in the Federal Register Vol. 76 No. 63, resulted in changes to the county selection, sites, road type classifications and weighting procedures.

To choose the survey counties, all 53 counties in North Dakota were listed in descending order based on the average number of motor vehicle crash-related fatalities from 2006 to 2010. The top 27 counties accounted for at least 85% of the state's total crash-related fatalities. These 27 counties were then stratified by region based on statistical differences in seat belt use observed in prior surveys between the counties in the western and eastern parts of the state. Therefore, the 27 counties in the sampling frame were stratified according to geographical region with 14 counties in the west and 13 counties in the east. Eight counties were selected from each region using probability proportional to size (PPS) sampling with vehicle miles traveled (VMT) as the measure of size (MOS).

Road segments within each county were then stratified by the MAF/TIGER Feature Class Code (MTFCC) road type and sorted by segment length. A random, systematic sample of 20 road segments was selected using PPS with road segment length by road segment type within each sampled county as the MOS. This represents the second stage of sample selection. This process resulted in the selection of 320 road segments (16 counties x 20 sites per county). Additional sites were also selected for use as alternate sites.

The 2016 survey followed the revised criteria and methodology implemented in 2012. During the week of June 6-12, trained observers visited each site in their assigned counties to collect seat belt use data as outlined in the training materials. Seat belt use of drivers and right front seat passengers was observed in vehicles with a gross vehicle weight up to 10,000 lbs.

For the 2016 statewide survey, observers determined seat belt use for 21,023 drivers and 5,802 right front-seat passengers, for a total of 26,825 vehicle occupants. The estimates of seat belt use were 80.4% for drivers, 87.3% for passengers, and an overall unweighted estimate of 81.9% belted for drivers and passengers combined. Adjusting the raw state rate for the survey design and weights resulted in a weighted state rate of 82.8%.

Males were less likely than females to wear seatbelts (76.6% vs. 89.7%). Male rates were observed to be anywhere from 4% to 27% lower than female use rates for counties surveyed. This trend of higher rates of female seat belt use held for each vehicle type as well – female use ranged from 86.0% to 94.5% over the four vehicle types, while male use ranged from 71.0% to 86.6%. Van occupants had the highest seat belt use rate at 90.4% followed by SUVs (88.1%), cars (84.0%), and pickups (73.7%).

Although drivers outnumbered passengers by a ratio of 3.6:1, passengers buckled up at a rate of 87.3% compared to drivers at 80.4%. This may be mainly due to the fact that drivers were more likely to be men than women (67.6% vs. 32.4%), and their seat belt use rates were much lower than women – 76.6% compared to 88.3%, respectively. For passengers, the reverse was true. Women represented 66.4% of the passengers with a use rate of 92.4%, while men represented 33.6% of the passengers with a use rate of 77.0%.

Rates by region indicate occupants in the east were more likely to buckle up (85.7%) than those in the west (78.5%). Regional differences in seat belt use were also reflected by road type. Occupants from the east half of the state had a greater tendency for seat belt use on all road types – primary, secondary, and local – however, the difference was slight on the secondary roads.

NHTSA reports the national average seat belt use rate was 88.5% in 2015. North Dakota falls below this average with a weighted rate of 82.8%. In general, the findings in the 2016 North Dakota statewide survey are consistent with the findings of previous surveys. However, comparisons to years prior to 2012 should be made with caution because of changes in the sampling methodology implemented that year.

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INTRODUCTION

The Upper Great Plains Transportation Institute (UGPTI), a research and education center at North Dakota State University (NDSU) located in Fargo, ND, was contracted by the North Dakota Department of Transportation (NDDOT) to conduct a field survey of seat belt use in 2016. The study replicates the sampling methodology previously revised and approved by the National Highway Transportation Safety Administration (NHTSA) and the NDDOT for the 2012 survey. Requirements for conducting statewide seat belt surveys are published in the Federal Register, Vol. 76 No. 63, April 1, 2011, Rules and Regulations, pp. 18042 – 18059. The methodology was redesigned to yield a more statistically robust estimate of the current seat belt use rate on all roadways in North Dakota.

OBJECTIVE

The objective of this study was to determine the rate of seat belt use of drivers and right front-seat passengers in the state of North Dakota.

Additional analyses determined seat belt use rates in the following categories:

- Occupant position (driver, passenger)
- Gender (male, female)
- Type of vehicle (car, van, sport utility vehicle, pickup/small truck)
- Region of state (east, west)
- Roadway type (primary, secondary, local)

A description of the tasks involved in conducting the statewide seat belt survey is provided in this report which also includes general information about the methods and protocols. Table 1 summarizes the 2016 survey. Categories are generally representative of statewide behavior based on survey sample design. The local road type, however, was limited to segments randomly selected in the Metropolitan Statistical Area (MSA) counties per NHTSA protocol guidance.

Table 1: Summary of the Seat Belt Use Survey

Methodology	Multistage Stratified Cluster Design with Probability Proportional to Size Sampling
Source of Samples	2011 revised methodology, approved by NDDOT and NHTSA; Westat* supplied list of road segments using 2010 TIGER data developed by the U.S. Census Bureau based on the MAF/TIGER Feature Class Code (MTFCC); three classifications: 1) Primary Roads, 2) Secondary Roads, and 3) Local Roads
Geographic Coverage	State of North Dakota
Identified Regions	East West
Selected Counties	East Region: Barnes, Cass, Grand Forks, Pembina, Ramsey, Richland, Stutsman, Traill West Region: Billings, Burleigh, McLean, McKenzie, Morton, Pierce, Stark, Ward
Number of Sites	320
Survey Period	June 6-12, 2016
Observation Duration Per Site	60 minutes
Sample Size	21,140 vehicles (includes all vehicles where either the driver or passenger or both had a known protection status)

*A research and statistical survey organization

METHODOLOGY OVERVIEW

From 1998 to 2000, the methodology for the observational seat belt survey in North Dakota was based on simple random sampling of 12 counties followed by random sampling of intersections within those selected counties. As a result, the sample produced a strong rural bias by excluding some of the most populous counties with higher traffic density and vehicle miles traveled. Following the 2000 survey, the NDDOT concluded that a new sampling methodology was needed to obtain results that were more representative of traffic patterns and the distribution of drivers and passengers in North Dakota. The NDDOT worked with research methodology experts at NHTSA to review the process.

The methodology from 2001 to 2011 included 16 counties, representing the quadrants of the state, and 319 sites, with approximately half above and half below the mean vehicle miles traveled within each county. This methodology could therefore be described as stratified random sampling modified by the inclusion of what are referred to in the federal guidelines as "certainty" counties. The certainty counties represented about three-fourths of North Dakota's population and approximately two-thirds of the vehicle miles traveled in the state.

On April 1, 2011, NHTSA published revised Uniform Criteria for the state observational seat belt surveys to guide occupant protection programs. The new rule changed many aspects of the survey design. One of these changes was to include counties in the sampling frame based on fatality-based inclusion criterion as opposed to the population-based criterion of the past.

It was determined that 27 counties accounted for at least 85% of North Dakota's total crash-related fatalities from 2006 to 2010. A subsample of 16 counties was selected for the survey of seat belt use in North Dakota. Counties represent the primary sampling unit. Half of the counties were selected from the western part of the state and the other eight were selected from the eastern half. Within each of those 16 counties a sample of 20 sites were selected providing a total of 320 site locations across the state. In the event that any original sites could not be observed due to unforeseen circumstances, a reserve sample of sites was also selected. The sites within the counties are the secondary sampling unit. The sites were stratified by road types, identified within three MAF/TIGER Feature Class Code (MTFCC) classifications: primary roads, secondary roads, and local roads.

The formulas contained in this report use the following definitions.

g – denotes the county strata (east or west)

c – denotes the county

h – denotes the road segment strata (primary, secondary, or local)

i – denotes the road segment

j – denotes the time segment

k – denotes the vehicles direction of travel

l – denotes the lane of observation

m – denotes the vehicle

n – denotes the front-seat occupant (driver or passenger)

Within each stratum, east and west, counties were selected with probability proportional to size (PPS) with the measure of size (MOS) being vehicle miles traveled (VMT). If we let $g = 1,2$ be the first stage strata, v_{gc} be the VMT for county c in stratum g, and $v_g = \sum_{all\ c\ in\ g} v_{gc}$ be the total VMT for all counties in first stage stratum g, then the primary sampling unit (PSU) inclusion probability is: $\pi_{gc} = n_g v_{gc}/v_g$, here $n_g$is the PSU sample size for first stage stratum g that was allocated. First each strata was analyzed to identify if any certainty counties existed. A county was selected with certainty if its MOS was equal to or exceeded v_g/n_g. Each certainty county identified was set aside and the stratum MOS was reduced by that county's VMT and n_g was reduced by one. This process was repeated until no county's MOS was equal to or greater than v_g/n_g based on the reduced values for v_g and n_g. The probabilities of selection for the remaining counties in the stratum were calculated based on the new values for v_g and n_g. Three certainty counties were identified in each region. Burleigh, Ward, and Morton counties were selected with certainty from the west region, while Cass, Grand Forks, and Stutsman counties were selected with certainty from the east region. The remaining counties for each region were selected using the SAS procedure PROC SURVEYSELECT based on the re-calculated probabilities of selection.

Next, road segments within each county were stratified by its MTFCC primary, secondary and local. The list of eligible road segments within each county was then sorted by segment length within each MTFCC group to obtain an ordered list. Road segments were selected with PPS using length as the MOS. The same procedure that was used to identify certainty counties was used to identify any certainty sites. With no certainty road segments being identified, a sampling interval (I) was calculated as the total length across all remaining road segments within the county divided by the number of road segments to select within each county (i.e. 20 less the number of certainty sites). A random starting point (RS) was selected between 0 and I, which determined the first road segment selected. Subsequent road segments selected were determined by adding multiples of I to RS until the desired number of road segments was selected and/or the end of the sorted list was reached.

Once the sites were chosen, a random order of the sites to observe within each county was constructed. One of the sites in each county was randomly chosen as the starting site. This site was then randomly assigned to one of the 77 one-hour time slots within the week as mandated by the Uniform Criteria. The time slots cover Monday through Sunday from 7 a.m. to 6 p.m. Once the initial site was selected and assigned to a time slot, the remaining sites were clustered and arranged within the county to achieve administrative and economic efficiencies. After each site was identified, the direction of travel was chosen randomly as either N/W or S/E. The lane of traffic was chosen as the closest lane to where the observer could find a suitable and safe place to make observations.

Under the stratified multistage sample design, the inclusion probability for each observed vehicle is the product of selection probabilities at all stages:

π_{gc} for county,$\pi_{hi|gc}$ for road segment, $\pi_{j|gchi}$ for time segment, $\pi_{k|gchij}$ for direction, $\pi_{l|gchij}$ for lane, and $\pi_{m|gchijl}$for vehicle.

So the overall vehicle inclusion probability is:

$$\pi_{gchijklm} = \pi_{gc} \cdot \pi_{hi|gc} \cdot \pi_{j|gchi} \cdot \pi_{k|gchij} \cdot \pi_{l|gchij} \cdot \pi_{m|gchijl}$$

The sampling weight (design weight) for vehicle *m* is:

$$w_{gchijklm} = \frac{1}{\pi_{gchijklm}}$$

Noting that all front-seat occupants were observed and letting the driver/passenger seat belt use status be:

$$y_{gchijklmn} = \begin{cases} 1, & if\ belt\ used \\ 0, & otherwise \end{cases}.$$

Then the seat belt use rate estimator is a ratio estimator calculated as follows:

$$\rho = \frac{\sum_{all\ gchijklmn} w_{gchijklm} y_{gchijklmn}}{\sum_{all\ gchijklmn} w_{gchijklm}}.$$

This estimator captures traffic volume and vehicle miles traveled through design weights (which will include nonresponse adjustment factors) at various stages and it does not require knowledge of VMT/DVMT.

The weighted average seat belt use rate for North Dakota calculated using this estimator was found to be 82.8% for 2016. This compares to the weighted rate of 80.4% in 2015, 81.0% in 2014, 77.7% in 2013, and 80.9% in 2012.

Standard Error and Confidence Intervals

The standard error of the state seat belt use rate measures the amount of random sampling error in the survey results. The smaller the standard error, the more accurate the seat belt use rate when compared to the true, but unknown, seat belt use rate for North Dakota. Assuming the design of the survey accurately measures the variable of interest, the larger the survey sample the more accurate the results.

The estimated standard error for the state seat belt use rate is found by taking the square root of the variance, so

$$SE(\hat{p}_s) = \sqrt{V(\hat{p}_s)}$$

Where:

$SE(\hat{p}_s) =$ the estimated standard error for the state seat belt use rate

$V(\hat{p}_s)$ = the estimated variance for the state seat belt use rate

$\hat{p}_s$ = the estimated state seat belt use rate

Using SAS callable SUDAAN statistical software, the standard error for the state seat belt use was calculated to be 0.75%. From this, we can build a 95% confidence interval for the state seat belt use. The 95% confidence interval formula is $\hat{p}_s \pm 1.96 * SE(\hat{p}_s)$, where each of the terms has the meaning above and the value 1.96 is the tabled value from the standard normal distribution for a 95% confidence interval.

Table 2: Confidence Interval

95% Confidence Interval and Estimated Standard Error for the 2016 State Seat Belt Use				
Occupants	**State Rate**	**Standard Error**	**95% CI Lower Limit**	**95% CI Upper Limit**
26,825	82.8%	0.75%	81.3%	84.2%

The 95% confidence interval means that statistically there is only a 5% chance that the actual statewide seat belt percentage falls outside the range of 81.3% to 84.2%.

Nonresponse Rate

A factor that could potentially bias the results and invalidate the survey is exceedingly high nonresponse rates. A nonresponse occurs when the observer tries but cannot determine an occupant's seat belt use. In

the 2016 survey, 22,378 drivers and 6,483 passengers were observed for a total of 28,861 vehicle occupants. Seat belt use could not be determined for 2,036 vehicle occupants resulting in a nonresponse rate of 7.05%. As stipulated in NHTSA's guidelines, the nonresponse rate did not exceed the allowable maximum of 10%.

Protocols

Observers

Observers were contracted to conduct the 2016 statewide seat belt survey. In the past, observers were required to participate annually in in-house training and accuracy testing prior to conducting the field observations. In 2016 online training was introduced. The training module covered survey methods and observer responsibilities, as well as true/false questions requiring correct responses in order to move forward in the module. Completion of training was verified by survey staff.

Institutional Review Board (IRB) training, required by North Dakota State University for Human Subjects Research, was compulsory for all observers prior to the 2014 survey. Supplementary information clarifying survey protocols was provided to the IRB, and the board subsequently ruled this research project exempt in accordance with federal regulations. As a result, IRB training certification was not necessary for observers in subsequent surveys.

All observers were required to have a current license with proof of adequate vehicle insurance, and were required to use seat belts and wear safety vests while conducting observations.

Observational Protocols

The observational protocols used in the 2016 study adhere to the Uniform Criteria as outlined in the Federal Register.

Observations were conducted Monday through Sunday. The day of the week and time of day were randomly chosen for one site within each county. The remaining sites within each county were arranged based on the first site to minimize travel time and costs. This predetermined order of daily observation sites was provided to each observer before the survey. A complete list of county observation sites are found in Appendix A of this report. The traffic direction of vehicles to be observed was randomly chosen in advance and was limited to one direction.

An 11-hour block of daylight, from 7 a.m. to 6 p.m., was identified as the observational period.

Observations at each site occurred in a predetermined time slot, requiring a 60-minute observation period, which began at the start of the pre-determined time slot - or the first 5-minute interval after arrival at the site if the observer was delayed - and ended exactly 60 minutes later.

Traffic Conditions and Data Collection Problems

Observers were trained to cope with traffic problems in the following manner:

- When traffic was heavy and there were too many vehicles to count visually, recording was done as long as possible and then stopped until the observer could catch up with observations. Some vehicles were, of necessity, outside the sample. When this occurred, counting resumed after no more than a one-minute pause. Once an observer's eyes were locked on a vehicle, a count of that vehicle was required on the observation form.

- At sites with more than one lane of traffic in the predetermined direction, observations were made from the lane closest to the observer.

Site Accessibility Problems

Field observers could terminate observations at a preselected site if any of the following circumstances arose: (1) weather conditions that would hinder the accuracy of the observations; (2) heavy traffic flow that might endanger the safety of the observer; or (3) road conditions that rendered observations unfeasible, such as road construction, detoured traffic, or a crash site. In these circumstances, observers were directed to contact the project coordinator immediately for assignment of an alternate site if a suitable vantage point could not be established.

Observed Vehicles

All vehicles with a gross vehicle weight up to 10,000 lbs. were observed and classified on the observation form as cars, vans, sport utility vehicles, and pickups (includes other small trucks, i.e. flatbed, utility service, and small box trucks, etc.). Large trucks (semi or large box), large emergency vehicles (ambulance/fire), and RVs/motor homes were not included in the survey.

Observations

Type of vehicle, gender characteristics and seat belt use for both drivers and right front seat passengers were recorded. Observations occurred from within the observer's vehicle whenever possible. The observer was parked as close as possible to the road for accurate observation without compromising observer safety. If observations could not be conducted from within the vehicle, the observer was allowed

to stand off the roadway. Observers were required to wear an ANSI-approved Type-2 safety vest at all times to enhance the visibility of the observer.

Problems Encountered by Observers

No alternate sites were assigned due to traffic, safety, or construction issues. There were occasional problems in observer positioning due to road construction in 2016, but placement was managed according to site protocols without having to assign alternate sites. Intermittent problems were also encountered relating to road construction that had a slight impact on on-time site arrival. These delays did not seriously impede schedules. Hour-long observations were fulfilled as described in the protocol, and on-time arrival at subsequent sites was not impacted. In accordance with the Federal Register, if observations had not been carried out at a site, the observer would have returned the following week adhering to the prescribed schedule. Detailed site information is found in Appendix A.

QUALITY ASSURANCE

Observers

Online training was offered at the observers' convenience. All contracted observers were required to complete the online training prior to survey week. Completion was verified and follow-up phone calls were made to novice observers to answer any questions and ensure full understanding of observer duties and survey protocols.

During observation week, quality control personnel carried out unannounced site visits (one per county) to verify observers were located within valid road segments, conforming to the prearranged day of week/time of day schedules, and properly recording seat belt data. It is required that quality control personnel visit any new observers during their initial observation period to assure protocol compliance and verify safe observation practices.

Data Entry

Steps were taken to ensure quality control with respect to data entry. Each site packet was checked to ensure the number of observation sheets submitted was the same as that noted by the observers. Database records were verified to match the number of observations. An accuracy check was done on a systematic sample of records and was measured at greater than 99.9% for every field. Errors discovered during quality assurance checks were corrected prior to completion of all analyses.

RESULTS

Sample Size by Year

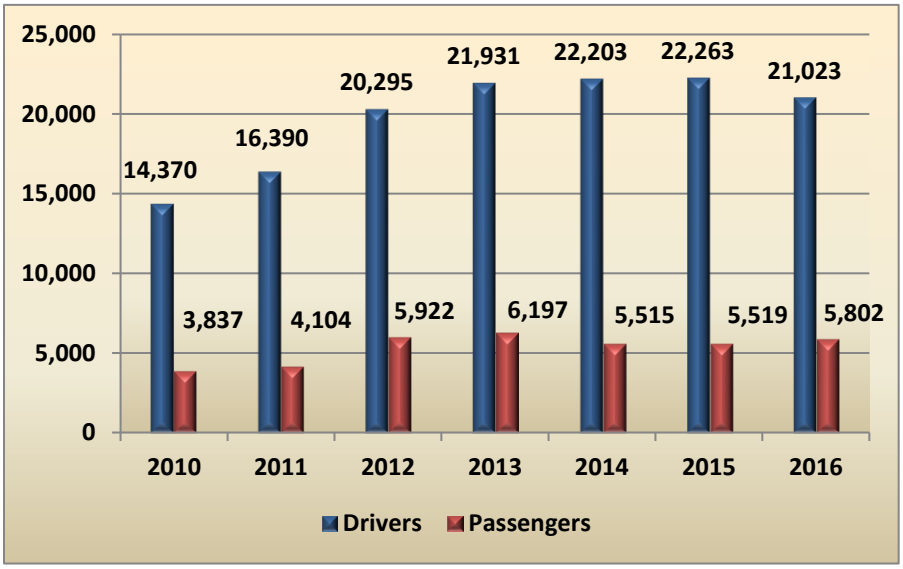


Figure 1: Driver & Passenger Observations, 2010-2016

Sample size in Figures 1 and 2 includes only vehicle occupants where protection status could be determined. The 2016 sample size remained stable compared to previous survey years. Prior to 2012, observation times were 30 minutes at each site. An extension of an additional one-half hour of observation time was implemented at all sites in 2012 to coincide with the application of new federal rules. The increased sample size reflected in 2012 and forward was the result of this time extension. The larger sample size helps comply with standard error stipulations. Even with extended observation times, several individual sites capture only a limited number of observed vehicles. However, these sites are still important to the aggregate measurement of statewide and county seat belt use, and therefore are captured each year.

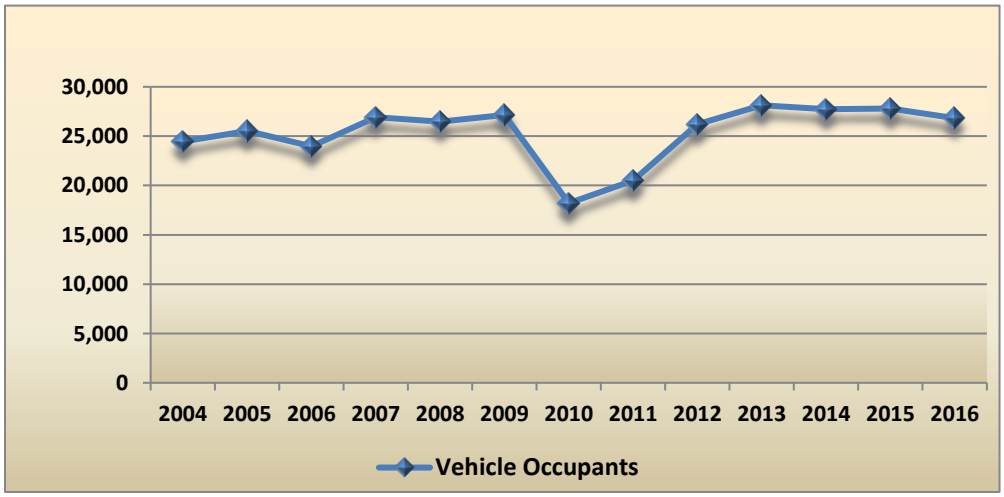


Figure 2: Vehicle Occupants, 2004 - 2016

Complete details on numbers of observations and use by site are found in Appendix E. The sample size of each annual seat belt survey from 2004 to 2016 is found in Figure 2.

Statewide Results

Overall unweighted results of the 2016 statewide survey indicated 81.9% of vehicle occupants were observed wearing seat belts on North Dakota roads. Because the survey employs a two-stage stratified random sampling scheme, a more appropriate estimate of the seat belt use rate is found by weighting the unadjusted rate using the formulas from the methodology section. Using those formulas, the overall weighted seat belt use rate in North Dakota was 82.8% for 2016. Figure 3 shows a comparison of years of seat belt use since implementation of the amended methodology.

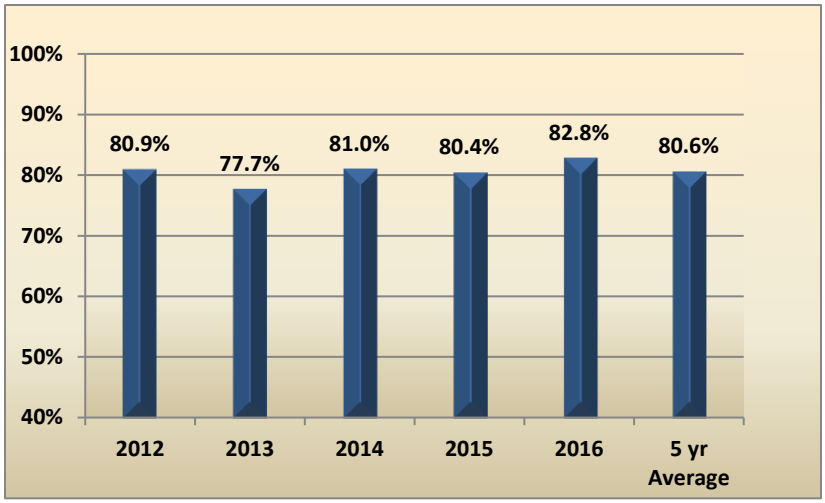


Figure 3: Statewide Seat Belt Use, Weighted

The driver-to-passenger ratio can influence overall use rates. Table 3 shows only minor variation in this ratio throughout the five years. The deviation in driver share of the sample was less than 3 percentage points over the same time period.

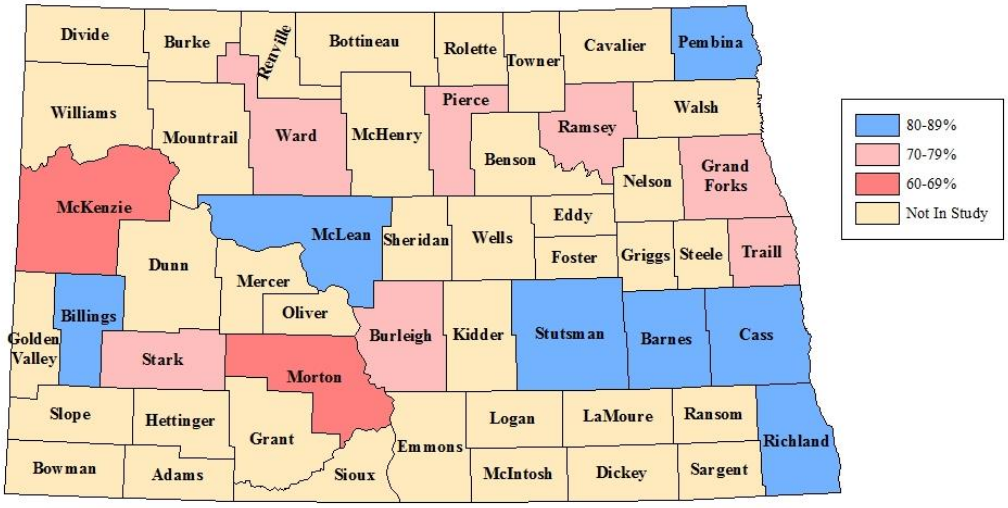
Table 3: Driver Passenger Ratio, 2012-2016

	2012	2013	2014	2015	2016	Differenced Baseline (2012) to Current Year
Ratio Drivers:Passengers	3.4:1	3.5:1	4.0:1	4.0:1	3.6:1	+0.2
Drivers as % of Sample	77.4%	78.0%	80.1%	80.1%	78.4%	+1.0%

County Results

Rates can vary considerably from year-to-year at the county level. The changes can often represent sampling differences and are not likely to be statistically significant, especially for counties where there are few total observations. However, even the rates for counties with more observations may be volatile from year-to-year. To balance this variability, the 5-year average is mapped in Figure 4 to provide a representation of county rates.

Weighted rates of seat belt use ranged from a high of 88.3% in Barnes County to a low of 62.2% in McKenzie County. Highest seat belt use was generally recorded in counties that follow the interstate corridors. Two exceptions were McLean County - which registered use above 80%, and Morton County which measured near the low end in restraint use.



5 YR AVERAGE 2012-2016	
Barnes	88.3%
Richland	86.3%
Stutsman	85.7%
Cass	84.6%
Billings	84.1%
Pembina	83.5%
McLean	82.7%
Stark	79.9%
Grand Forks	79.9%
Burleigh	74.6%
Ward	74.0%
Ramsey	72.6%
Traill	72.2%
Pierce	70.5%
Morton	62.8%
McKenzie	62.2%

Figure 4: Total Seat Belt Use, 2012 - 2016 Average, Weighted

Figure 5 identifies 3-year rolling averages for trend comparison and shows increased seat belt use in about two-thirds of the sampled counties. Barnes County led in belt use at 89.1%, followed closely by Billings County at 88.3%. McKenzie and Morton Counties, with near equal use (65.7% and 65.6%, respectively), fall well below the national seat belt use reported by NHTSA. However, belt use in McKenzie County improved by 5 percentage points over the 2013 – 2015 time period. Morton County rates were unchanged. Individual 2016 rates are provided in the frequencies in Appendix C.

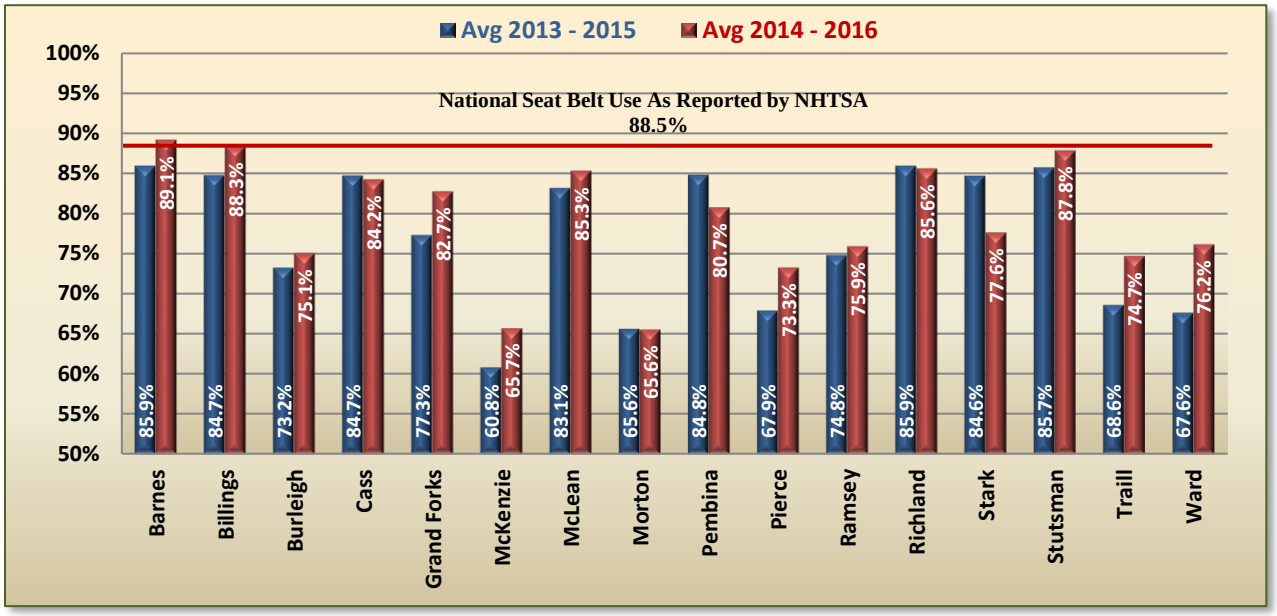
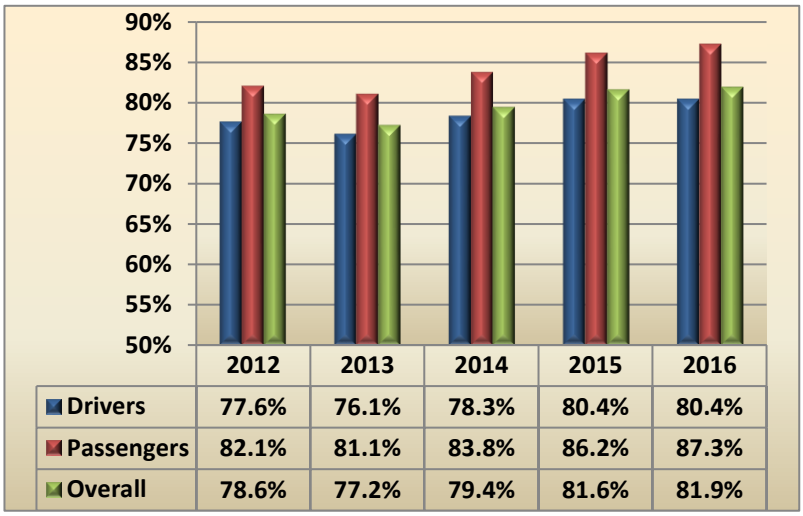


Figure 5: Seat Belt Use by County, 3-Year Averages, Weighted

Results for Vehicle Occupants

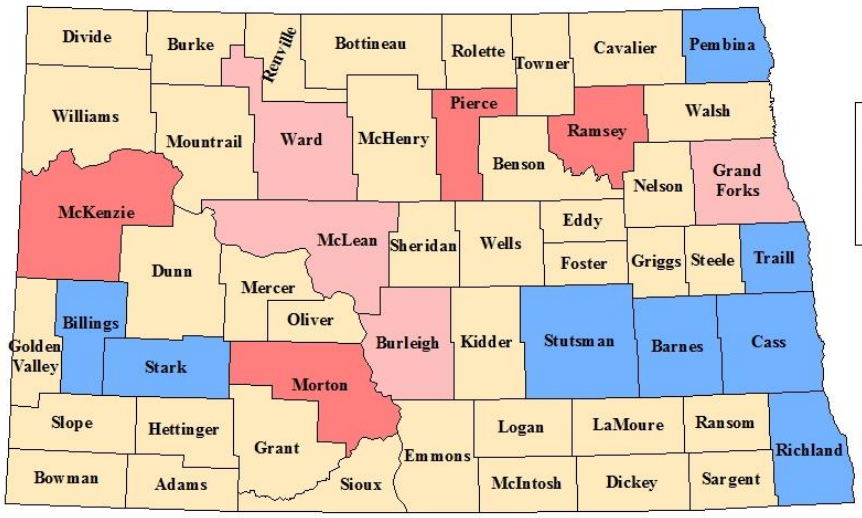
The unweighted estimates of seat belt use in 2016 are 80.4% for drivers, 87.3% for passengers, with an overall estimate of the seat belt use rate of 81.9% for drivers and passengers combined (Figure 6). These rates effectively mirror 2015 rates.



	2012	2013	2014	2015	2016
Drivers	77.6%	76.1%	78.3%	80.4%	80.4%
Passengers	82.1%	81.1%	83.8%	86.2%	87.3%
Overall	78.6%	77.2%	79.4%	81.6%	81.9%

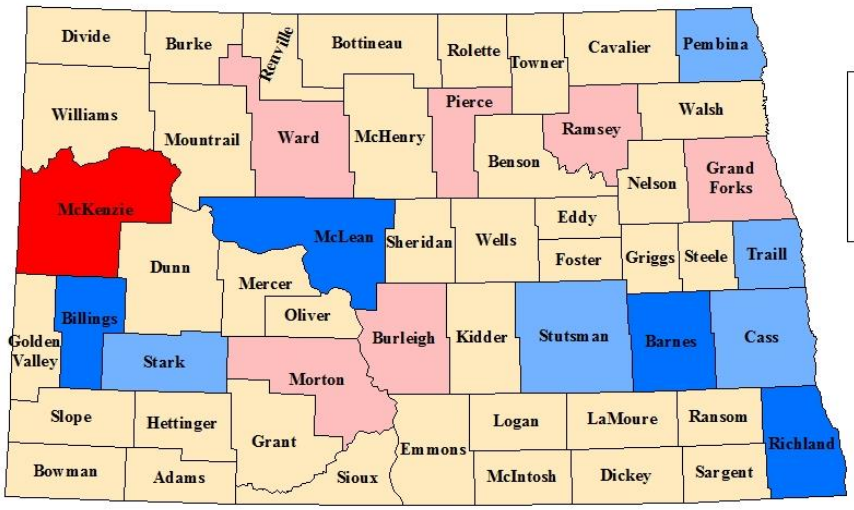
Figure 6: Percent Belted by Vehicle Occupant, Unweighted

County use by occupant position is mapped in Figures 7 and 8. Average seat belt use for drivers from 2012 – 2016 was highest in Barnes County at 87.2%. Four counties recorded driver rates of less than 70%. Within the sample counties represented in the western half of the state, only Billings and Stark had driver use at or above 80%. These two counties are recognized as having a significant number of interstate sites where belt use is typically higher.



5 YR AVERAGE 2012 - 2016	
Barnes	87.2%
Stutsman	85.0%
Cass	84.4%
Richland	83.9%
Billings	83.2%
Traill	82.6%
Pembina	81.1%
Stark	80.0%
McLean	77.7%
Burleigh	76.9%
Grand Forks	75.4%
Ward	73.1%
Morton	69.4%
Ramsey	68.4%
Pierce	67.1%
McKenzie	64.6%

Figure 7: Driver Seat Belt Use, Average 2012 - 2016



5 YR AVERAGE 2012 - 2016	
Richland	95.6%
Barnes	92.4%
McLean	91.0%
Billings	90.3%
Stutsman	88.8%
Cass	88.7%
Pembina	88.2%
Stark	87.8%
Traill	84.9%
Ward	79.2%
Grand Forks	78.8%
Ramsey	77.9%
Burleigh	77.7%
Morton	77.2%
Pierce	74.1%
McKenzie	58.8%

Figure 8: Passenger Seat Belt Use, Average 2012 - 2016

Passenger use outpaced driver use in all counties surveyed, with the exception of McKenzie. Passenger rates range from a low of 58.8% in McKenzie County to a high of 95.6% in Richland County (Figure 8).

The overall weighted rate this year rose to 82.8%. While the rate improved over 2015, it continues to be lower than the national average of 88.5% reported by NHTSA. Considerable effort has been made to address seat belt use in North Dakota. Experiences from other states suggest that some impetus to cause a major shift will be necessary to achieve significant increases in seat belt use. One possibility would be

enactment of a primary seat belt law which NHTSA suggests would change seat belt use rates by 10% to 15%. Another related possibility is heightened education and/or enforcement across the state.

Some factors that may be useful in discussions about increasing seat belt use in North Dakota are found in the remainder of this report, which focuses on differences in seat belt use among regions of the state, gender, vehicle type, and roadway type.

Results by North Dakota Regions

The survey sampling methodology groups the state into an east/west regional division. Both east and west regions contain three "certainty" counties and five additional counties selected from the remaining counties in each region.[1]

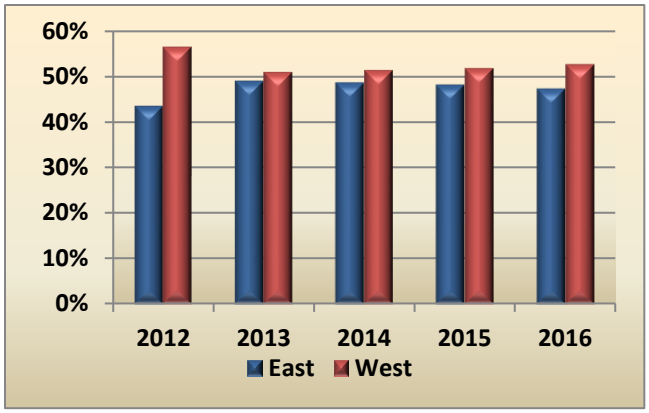


Figure 9: Percent of Sample by Region

Regional distribution of the survey sample followed that of previous surveys with more vehicle observations collected from western North Dakota (14,112) than from the eastern half of the state (12,713). This represented 53% and 47% of the 2016 sample, respectively (Figure 9).

Seat belt use is routinely higher in the east than the west as shown in Figure 10. Rates within each region closely resemble differences seen in prior years. The mean for the 2012 – 2016 time period is 82.9% in the east and 76.9% in the west. A further breakdown of 2016 driver/passenger use by region is described in the frequencies in Appendix C.

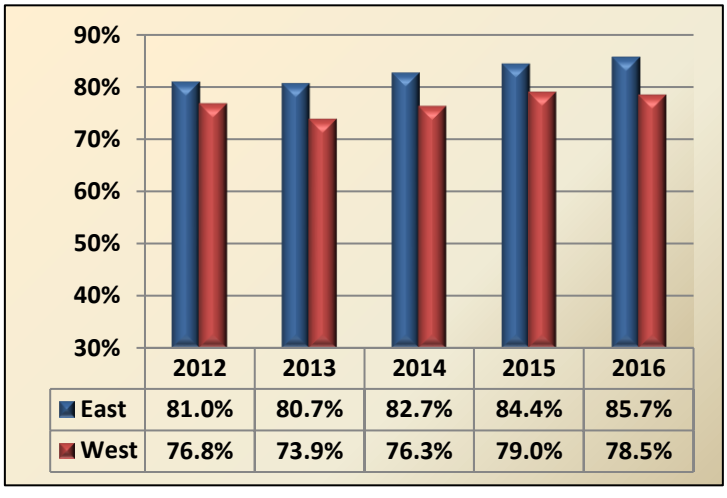


Figure 10: Percent Belted by Region, Unweighted

[1] See the discussion of the sampling methodology for details on certainty counties and the selection processes.

Results by Vehicle Type

Beginning with the 2012 statewide seat belt survey, North Dakota incorporated the expanded Uniform Criteria vehicle eligibility to define a fleet that included all passenger vehicles with a gross vehicle weight up to 10,000 pounds. This change necessitated the inclusion of various small trucks - e.g. flatbed, utility service, and small box trucks, etc. These additional truck observations are included in the "pickup" category to prevent confusion with larger truck activity.

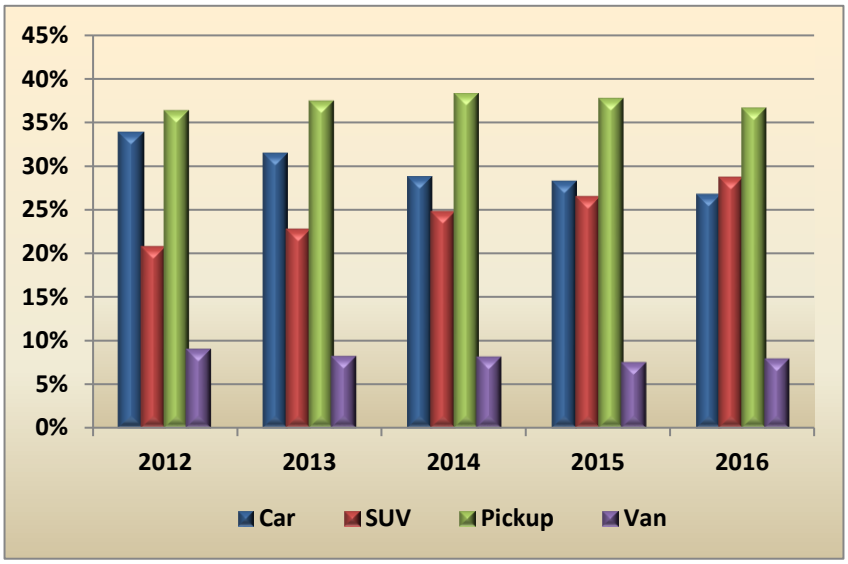
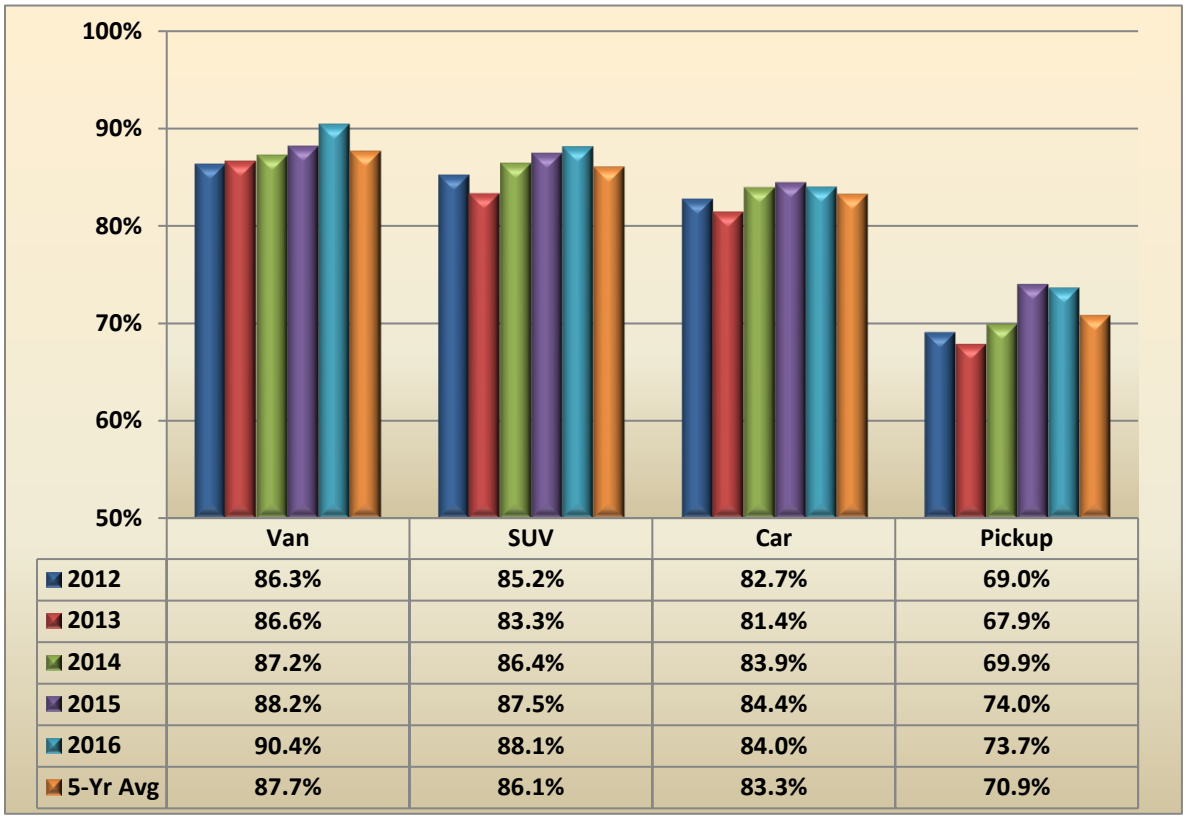


Figure 11: Composition of Sample by Vehicle Types

Since incorporating the expanded vehicle eligibility rules, surveys show fleet distribution fluctuates only marginally from year-to-year. However, as shown in Figure 11, over time the number of cars has continued to decrease, from 33.9% in 2012 to 26.8% in 2016. Over the same time period, SUV share increased from 20.8% to 28.7%. Pickup/small truck observations again comprised the largest share of vehicle type (36.6%) in the 2016 sample. Van representation continues to be low at less than 10% of the sample.

Even with east/west regions holding a comparable share of the overall sample, the volume of pickups provides added insight to the statewide seat belt rate. Although there has been a slump in oil development and expansion in recent years in western North Dakota, a disproportionate number of pickups in the sample still originated from that region. Pickups represented 42.0% of vehicles in the west, and only 30.5% in the east. At the county level, this disproportionate share of pickups in the west region was most noticeable in McKenzie County which lies in the middle of the oil patch and recorded 71.9% of this vehicle type. More than 40% of the vehicles observed in Billings and Ward Counties were pickups as well. Ramsey is the single county in the east with a larger share of pickups – 42.6%.

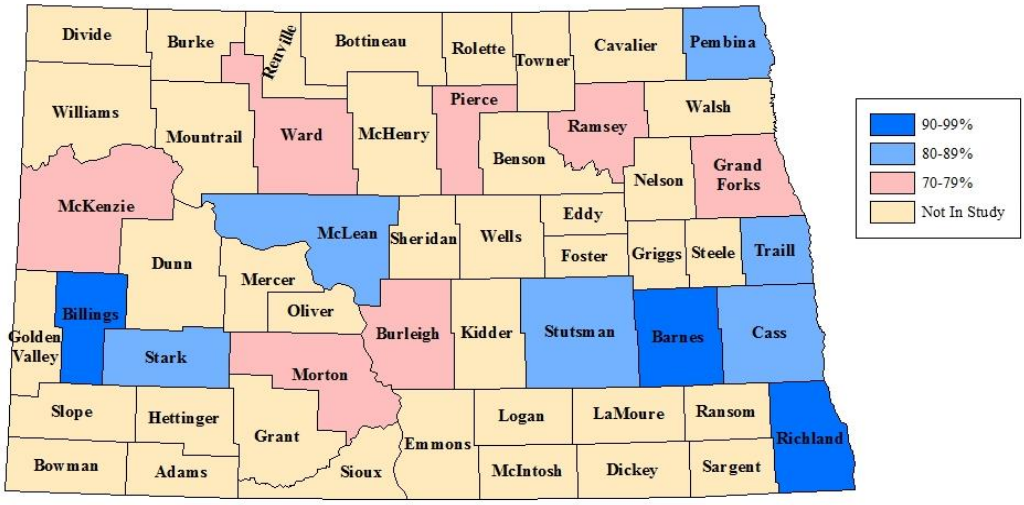


	Van	SUV	Car	Pickup
2012	86.3%	85.2%	82.7%	69.0%
2013	86.6%	83.3%	81.4%	67.9%
2014	87.2%	86.4%	83.9%	69.9%
2015	88.2%	87.5%	84.4%	74.0%
2016	90.4%	88.1%	84.0%	73.7%
5-Yr Avg	87.7%	86.1%	83.3%	70.9%

Figure 12: Percent Belted by Vehicle Type for All Occupants, Unweighted

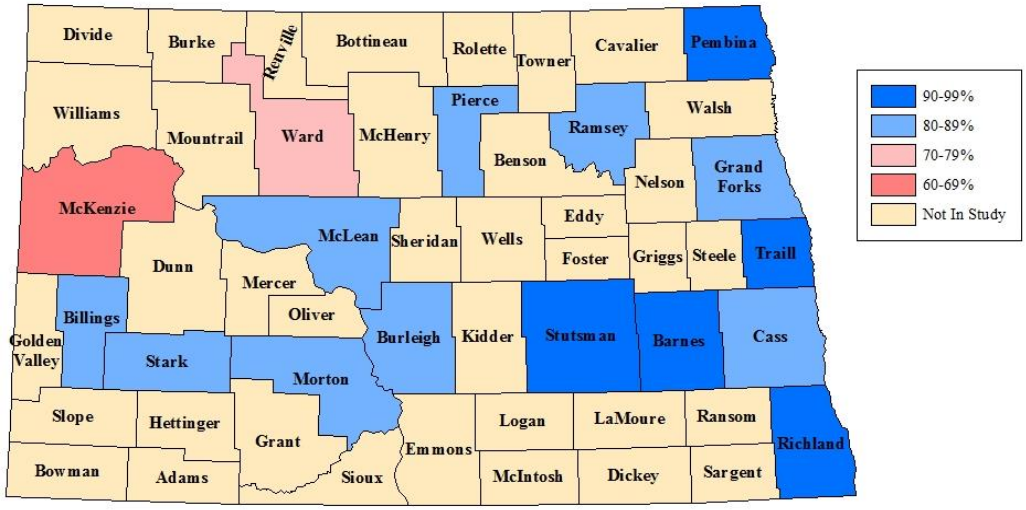
Annual results for overall seat belt use by vehicle type are shown in Figure 12. A general upward trend in rates is noticed throughout the vehicle types in the last five years. Belt use by van occupants, typically higher than other vehicle types, rose above 90% in 2016. Notable is the increase observed in belt use by pickup occupants from the low of 67.9% in 2013 to current levels. Nevertheless, this group continues to demonstrate noticeably lower rates than those in other vehicle types. This lower use, coupled with the pickup share of the sample, can reduce the overall rate. These 2016 results are consistent with long-term trends for seat belt use in North Dakota and other states that are largely rural and have a high proportion of pickup trucks.

Maps detailing seat belt use from 2012 - 2016 by vehicle type and county are found in Figures 13 through 16. As indicated in previous analyses, occupants in all vehicle types show higher use both along the interstate corridors and in the eastern counties within the sample. Seat belt use in relation to road type is described further on in this report. Barnes and Richland Counties record use above 90% in all vehicle types except pickups. While seat belt use by occupants in pickups has increased in recent years, Figure 16 reveals that roughly one-third of the counties have use by this demographic of less than 70%, with Morton and Pierce at the low end, 56.9% and 55.3%, respectively.



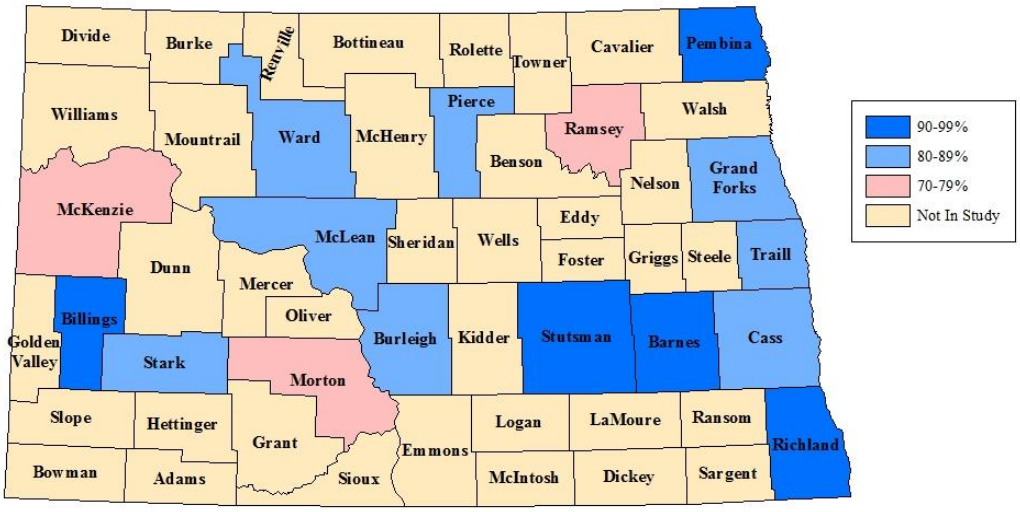
5 YR AVERAGE 2012 - 2016	
Barnes	91.7%
Richland	90.8%
Billings	90.5%
Stutsman	89.4%
Pembina	88.0%
Cass	85.7%
McLean	84.3%
Traill	83.4%
Stark	82.6%
Burleigh	79.7%
Morton	76.5%
Ramsey	74.4%
Ward	74.3%
Pierce	73.4%
Grand Forks	72.6%
McKenzie	70.8%

Figure 13: Car Seat Belt Use, Average 2012 – 2016



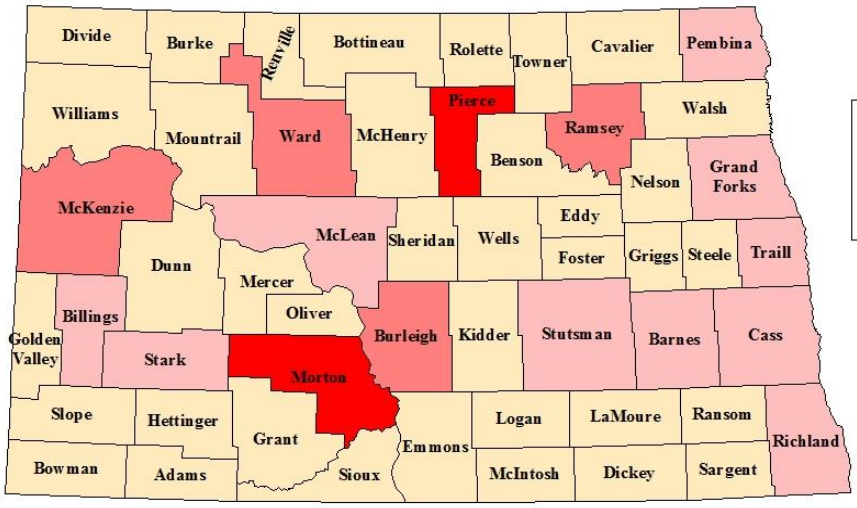
5 YR AVERAGE 2012 - 2016	
Barnes	92.6%
Pembina	92.0%
Richland	90.8%
Traill	90.7%
Stutsman	90.0%
Stark	89.6%
Billings	89.6%
Cass	89.4%
McLean	88.0%
Pierce	85.6%
Ramsey	85.2%
Grand Forks	83.7%
Burleigh	83.5%
Morton	82.8%
Ward	79.6%
McKenzie	67.4%

Figure 14: Van Seat Belt Use, Average 2012 – 2016



5 YR AVERAGE 2012 - 2016	
Richland	93.6%
Barnes	93.0%
Billings	92.0%
Stutsman	91.6%
Pembina	91.3%
Cass	89.3%
Traill	86.6%
Stark	85.6%
McLean	85.3%
Burleigh	83.5%
Ward	81.3%
Pierce	80.7%
Grand Forks	80.4%
Ramsey	76.8%
Morton	75.6%
McKenzie	75.2%

Figure 15: SUV Seat Belt Use, Average 2012 – 2016



5 YR AVERAGE 2012 - 2016	
Barnes	78.0%
Billings	76.8%
Stark	76.5%
Stutsman	76.3%
Traill	75.5%
Cass	75.4%
McLean	74.9%
Grand Forks	73.7%
Richland	71.4%
Pembina	70.5%
Ward	69.8%
Burleigh	63.7%
Ramsey	62.5%
McKenzie	60.4%
Morton	56.9%
Pierce	55.3%

Figure 16: Pickup Seat Belt Use, Average 2012 – 2016

Results by Gender and Seat Belt Use

There is minimal year-to-year variation in sample composition when defined by occupant position and gender (summarized in Figure 17). Overall, males represented 59.8% and females 39.4% of the sample. When considering occupant position, drivers were more than twice as likely to be male than female. In a small percentage of observations, occupant gender was unable to be determined, but occupant protection was still recorded. These cases are included in all of the analyses except where gender is one of the variables of interest. Removing these observations for these parts of the analyses has no effect on the overall numbers, but is mentioned here for comprehensive reporting.

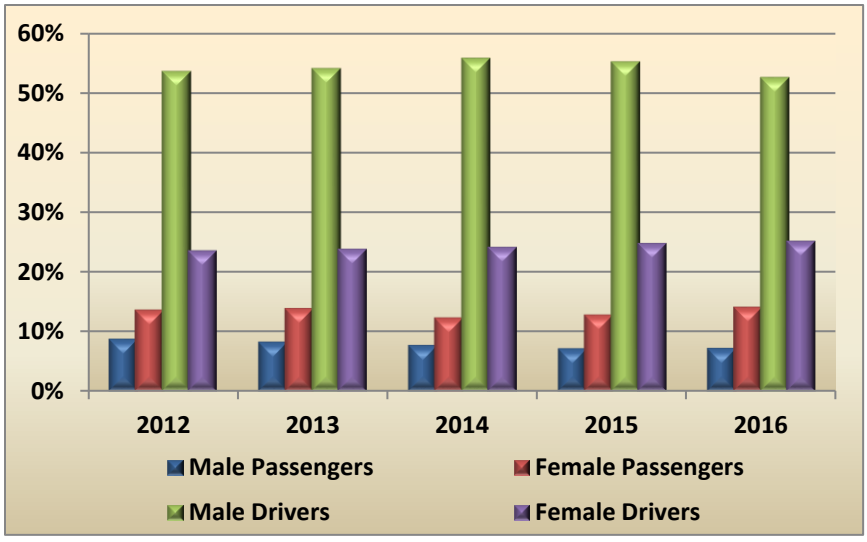
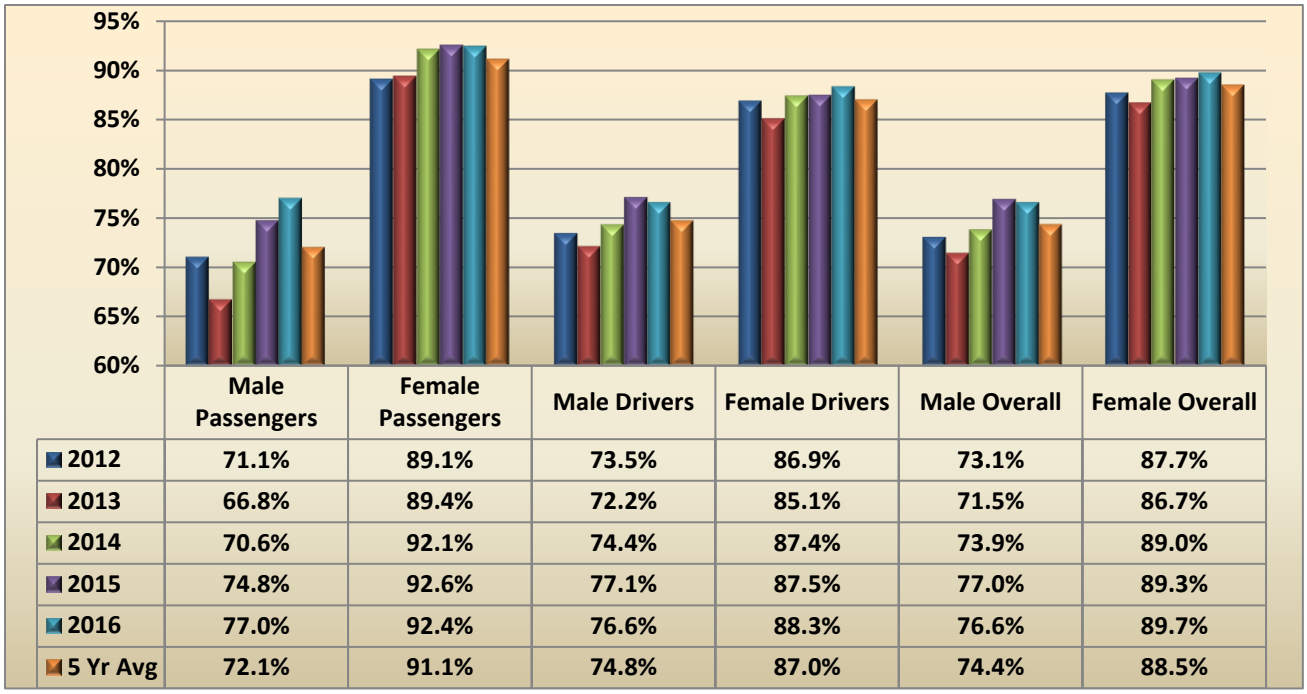


Figure 17: Percent of Sample by Gender & Vehicle Occupant

The 2016 survey results for seat belt use by gender and position corroborate higher rates of use by females regardless of position (Figure 18). Female passenger seat belt use was 92.4% followed by

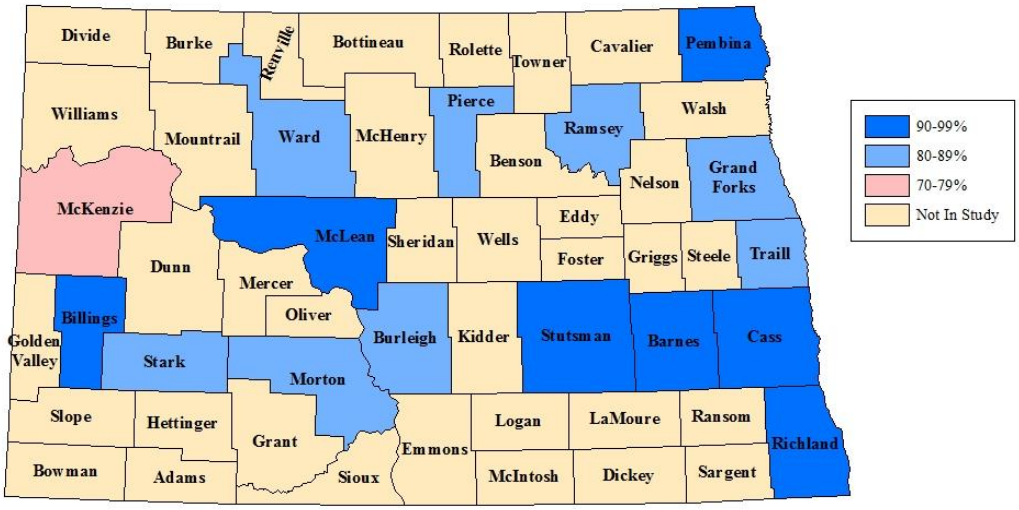
female driver use of 88.3%. Male belt use was considerably less – 77.0% for passengers and 76.6% for drivers. While female passengers consistently use seat belts at higher rates than female drivers, this has been opposite for male occupants. However, in 2016 male passenger use moved above male drivers by a slight margin. This group also represents the most sizeable improvement in rates of use from a low in 2013 of 66.8% to a high in 2016 of 77.0%.



	Male Passengers	Female Passengers	Male Drivers	Female Drivers	Male Overall	Female Overall
2012	71.1%	89.1%	73.5%	86.9%	73.1%	87.7%
2013	66.8%	89.4%	72.2%	85.1%	71.5%	86.7%
2014	70.6%	92.1%	74.4%	87.4%	73.9%	89.0%
2015	74.8%	92.6%	77.1%	87.5%	77.0%	89.3%
2016	77.0%	92.4%	76.6%	88.3%	76.6%	89.7%
5 Yr Avg	72.1%	91.1%	74.8%	87.0%	74.4%	88.5%

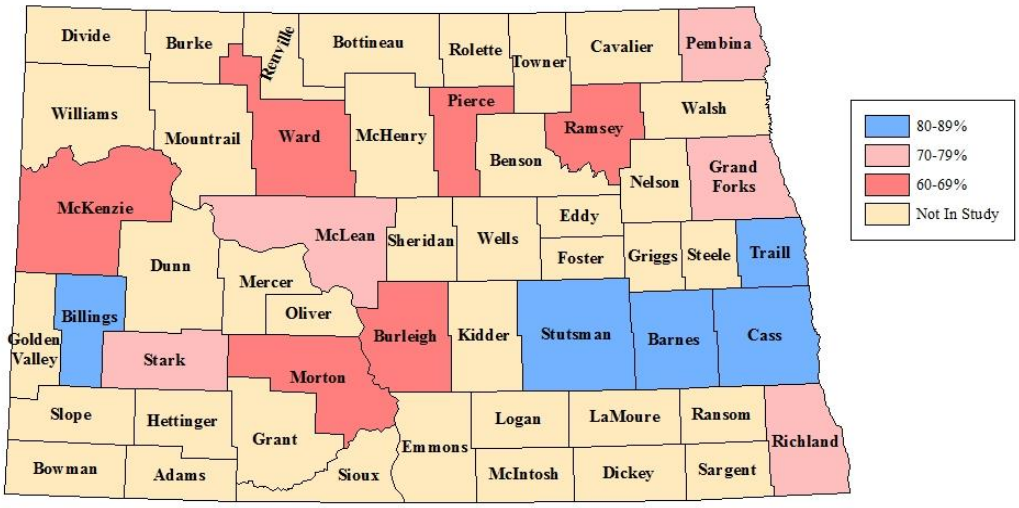
Figure 18: Percent Belted by Gender & Vehicle Occupant

When evaluating gender seat belt use by county from 2012 – 2016, seven of the 16 sample counties showed female use above 90% (Figure 19). Female use in the remaining counties ranges from 79.0% to 88.0%. Males were not observed to reach those levels of use. More than a third of the counties registered rates in the 60% - 69% range (Figure 20). The highest male use was found in Barnes County, 83.7%. The lowest rates of use for males were found in McKenzie and Pierce counties, both at 60.8%. Both genders exhibited higher seat belt use in the eastern half of the state. However, disparities in belt use by gender were also found within the regions.



5 YR AVERAGE 2012 - 2016	
Richland	96.9%
Barnes	94.5%
Billings	92.3%
Stutsman	92.1%
McLean	91.6%
Pembina	91.3%
Cass	90.2%
Stark	88.0%
Traill	87.2%
Burleigh	86.3%
Ramsey	83.7%
Ward	83.5%
Pierce	82.5%
Morton	81.9%
Grand Forks	81.2%
McKenzie	79.0%

Figure 19: Female Seat Belt Use, Average 2012 – 2016



5 YR AVERAGE 2012 - 2016	
Barnes	83.7%
Stutsman	82.3%
Billings	80.8%
Cass	80.3%
Traill	80.1%
Richland	78.6%
Pembina	78.4%
Stark	77.5%
McLean	74.1%
Grand Forks	71.9%
Ward	69.8%
Burleigh	69.4%
Ramsey	62.8%
Morton	62.2%
McKenzie	60.8%
Pierce	60.8%

Figure 20: Male Seat Belt Use, Average 2012 – 2016

Results by Gender and Vehicle Type

Examining survey sample size without respect to the driver/passenger demographic (Figure 21) showed 50% more male to female occupants overall. Individually, males showed lower representation in SUVs and cars. The largest disparity continued to be the share of male occupants in pickups - 82.4% compared to 17.6% female.

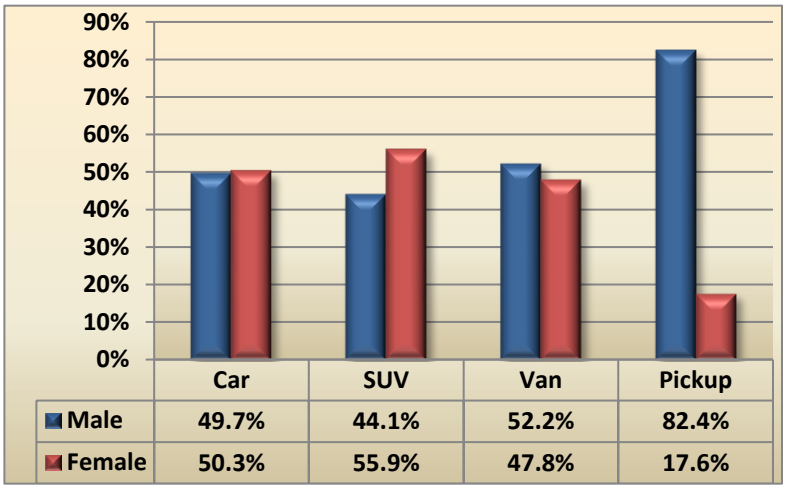


Figure 21: Percent of Sample by Vehicle Type and Gender, 2016

Although the size of the difference in seat belt use by gender varies across the vehicle types, the five-year averages show that females buckled up with greater frequency than males (Figure 22) regardless of vehicle type. Female rates were consistently high, at least 84.7%. In contrast, male use ranged from 68.3% to 83.5% over the five-year period. Both genders were observed to have the lowest use in pickups, and this is also where the gender difference was most noticeable – 68.3% males versus 84.7% females.

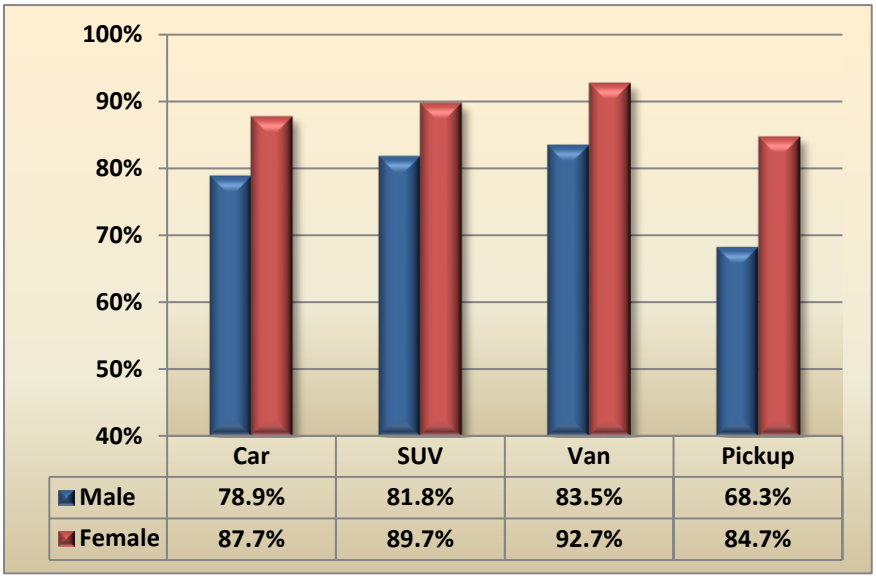


Figure 22: Percent Belted by Gender & Vehicle Type, 2012 – 2016 Average

Table 4 gives annual rates of seat belt use by gender and vehicle type. Note that belt use of males in pickups has increased annually since 2013 and, in 2015 exceeded 70% for the first time since the survey redesign (Table 4). However, the five-year average remains low at 68.3% for this demographic.

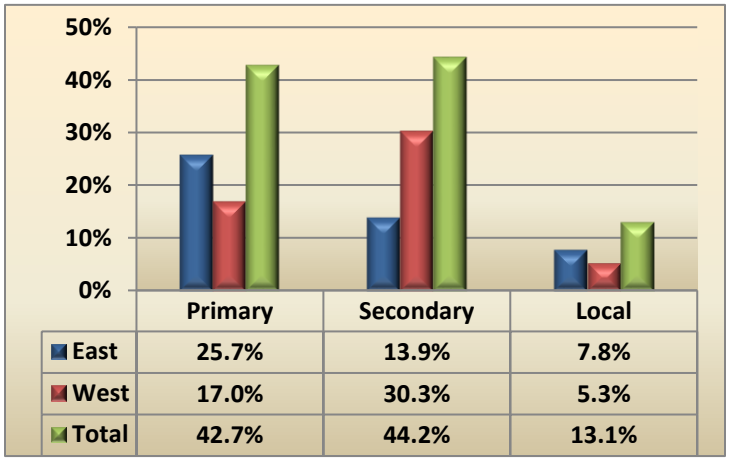
Table 4: Annual Rates by Gender & Vehicle Type

Male	2012	2013	2014	2015	2016
Car	78.4%	76.8%	79.6%	80.7%	79.1%
SUV	80.4%	78.2%	82.5%	83.7%	84.4%
Van	82.1%	81.9%	82.4%	84.4%	86.6%
Pickup	66.5%	65.1%	67.2%	71.8%	71.0%
Female	**2012**	**2013**	**2014**	**2015**	**2016**
Car	87.0%	86.0%	88.5%	88.4%	88.7%
SUV	89.6%	87.5%	89.9%	90.5%	91.0%
Van	91.5%	92.1%	92.6%	92.7%	94.5%
Pickup	83.1%	83.0%	85.7%	86.0%	86.0%

Results by Roadway Type

Roadways are classified into three road types and broadly described as follows:

- Primary road – divided, limited-access, i.e. interstates
- Secondary road – main arteries usually in the U.S./state/county highway system
- Local neighborhood road/rural road/city street – paved, non-arterial streets



A more comprehensive definition of road type is provided in Appendix F.

In the 2016 survey, primary, secondary and local roadways accounted for 42.7%, 44.2%, and 13.1% of the vehicle occupants, respectively (Figure 23).

Figure 23: Percent of Sample by Roadway Type, 2016

Differences in rates of seat belt use were found across the road types. North Dakota vehicle occupants on primary roadways were belted at a rate considerably higher than the rates for secondary and local roads. East/west use was relatively consistent on primary and secondary roads with a clearer disparity seen on local roads.

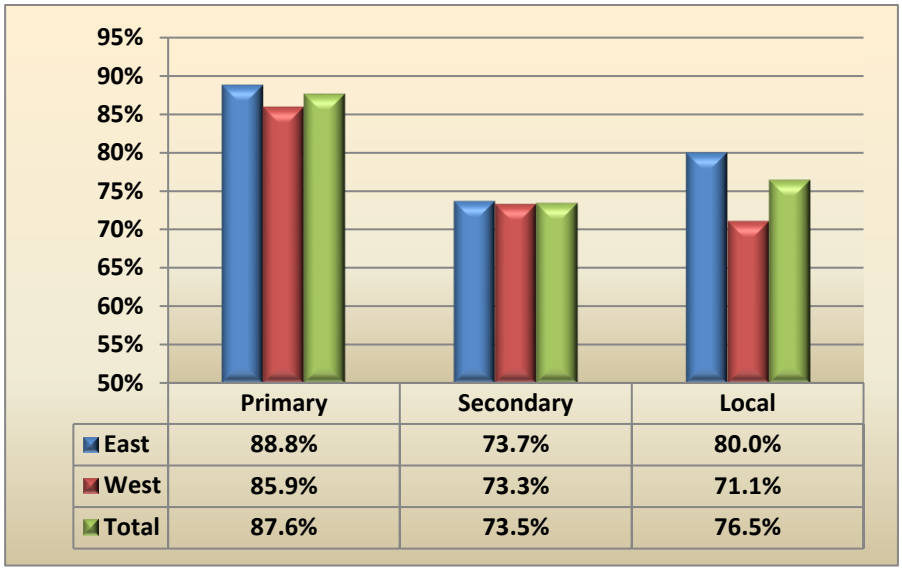


Figure 24: Seat Belt Use by Roadway Type, 2012 – 2016 Average

Annual seat belt use stratified by region and roadway type is shown in Table 5. Higher use by occupants on primary and secondary roads fluctuates between the regions, however, seat belt use on local roads is routinely lower in the west.

Table 5: Annual Rates by Region & Road Type

EAST	2012	2013	2014	2015	2016
Primary	87.2%	87.2%	88.1%	90.4%	91.0%
Secondary	70.2%	71.1%	74.1%	75.6%	77.5%
Local	79.8%	75.6%	80.7%	80.8%	83.1%
WEST	**2012**	**2013**	**2014**	**2015**	**2016**
Primary	84.7%	92.7%	85.1%	88.1%	79.0%
Secondary	73.9%	65.0%	72.7%	76.5%	78.5%
Local	68.8%	69.6%	72.5%	67.8%	76.5%
TOTAL	**2012**	**2013**	**2014**	**2015**	**2016**
Primary	86.1%	89.2%	87.0%	89.5%	86.2%
Secondary	73.0%	66.9%	73.1%	76.2%	78.2%
Local	75.7%	73.3%	77.7%	75.6%	80.4%

SUMMARY

Observers collected data on seat belt use for 21,023 drivers and 5,802 right front-seat passengers for a total of 26,825 vehicle occupants. The observations were collected at 320 sites across 16 counties. Based on the sampling methodology weighting procedures, the final estimate for the statewide seat belt use was 82.8%. Experiences from other states indicate that improvement in seat belt use will likely only occur through some type of significant change such as implementation of a primary seat belt law, increased funding for additional enforcement, or possibly higher fines (NHTSA).

A summary of major findings from the 2016 survey regarding seat belt use in North Dakota are:

- **County.** Applying a five-year average to measure county seat belt use shows rates above 80% in seven of the sixteen counties surveyed. Of those counties, the highest use was observed in Barnes at 88.3%, followed by Richland at 86.3%. The lowest use was observed in Morton and McKenzie counties with comparable rates of 62.8% and 62.2%, respectively. Seat belt use improved in roughly two-thirds of the sample counties when assessed using the three-year rolling average.

- **Vehicle Occupant.** Driver seat belt use was 80.4% while passenger use was 87.3% statewide. At the county level, Barnes reflected the highest rate of driver use, 87.2%, and Richland had the highest rate of passenger use, 92.4%. McKenzie, Morton, Pierce, and Ramsey demonstrated driver use less than 70%. Passenger use was lowest in McKenzie at 58.8%.

- **Region.** Overall rates of seat belt use were higher in the east region, 85.7% compared to 78.5% in the west region. This regional disparity has been evident throughout the 2012 – 2016 time frame. Rates in the east have ranged from a low of 80.7% to a high of 85.7%, while rates in the west were considerably lower, ranging from a low of 73.9% to a high of 79.0%.

- **Vehicle Type.** The results of the 2016 statewide survey indicated occupants of vans, SUVs, and cars all demonstrated relatively high restraint use ranging from 84.0% to 90.4%. Pickup occupants, on the other hand, were belted at a lower rate, 73.7%. The sample size of this demographic (36.6%) combined with the lower use continues to negatively influence the overall North Dakota rate. Male occupants in pickups were belted at 71.0% in 2016, with an average of 68.3% from 2012 – 2016.

- **Gender.** In 2016, female occupants overall had much higher rates of seat belt use than male occupants, 89.7% and 76.6%, respectively. When estimating five-year averages at the county

level, the lowest rate for female occupants was 79.0% in McKenzie County. Male occupants demonstrated notably lower rates than females in both McKenzie and Pierce Counties with use of 60.8%. Higher rates hold for females whether they are drivers or passengers, not only in North Dakota, but across the nation.

- **Gender and Vehicle Type.** Females had higher rates of seat belt use than males for every vehicle type. Using a 2012 – 2016 average, the highest rate for males was found in vans, 83.5%, and the lowest in pickups, 68.3%. By comparison, female rates were more consistent across vehicle types, ranging from 92.7% in vans to 84.7% in pickups.

- **Road Type.** Secondary roads held the largest share of occupants in the sample (44.2%), followed by primary roads (42.7%). Local roads had the smallest share (13.1%). Average seat belt use was highest on primary roads (87.6%) followed by local roads (76.5%) and secondary roads (73.5%).