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 based on a field survey of driver and right front-seat passenger seat belt use. This National Occupant Protection Use Survey (NOPUS) is based on national standards for survey design and field observation protocol. It provides the North Dakota Department of Transportation (NDDOT) with a systematic evaluation of seat belt use rates within the state. The National Highway Traffic Safety Administration (NHTSA) funds NOPUS through the NDDOT's Highway Safety Division.

During the week of June 5-11, 2022, trained observers visited each site in their assigned counties to collect seat belt use observations for drivers and right front-seat passengers in vehicles with gross vehicle weights up to 10,000 lbs. Data were collected for 13,541 drivers and 2,318 right front-seat passengers for a total of 15,859 vehicle occupants. The observations were conducted at 320 sites across 16 counties. Based on the sampling methodology weighting procedures, the final estimate for statewide seat belt use was 80.6%.

A summary of major findings from the 2022 survey regarding seat belt use in North Dakota follows:

- **County.** Weighted rates of seat belt use by county showed Stark County with the highest use at 98.3%, and Stutsman County with the lowest use at 71.8%. Burleigh, McLean, and Rolette counties were also observed to have low use of less than 80% in 2022. Applying three-year averages for trend comparison showed nine counties with improved rates in the 2020-2022 time period over the previous 2017-2019 average. Trends were not available in three counties that were new to the survey with the 2022 county reselection. The change in the county composition was due to the NHTSA-mandated reselection process that is required in five-year intervals.

- **Vehicle Occupant.** Driver seat belt use was 85.9% while passenger use was 88.4% statewide. At the county level, Stark county reflected the highest rate of drivers belted at 98.2%. Driver restraint use in Stutsman County was observed to be less than 70%. Walsh County reflected the highest passenger belt use at 100%. In addition, Barnes, Benson, Cass, Grand Forks, McKenzie, Morton, Mountrail, Stark, Ward, and Williams counties had rates of passenger belt use greater than 90%. The lowest rate for passengers was found in Burleigh County at 75.3%.

- **Region.** Overall rates of seat belt use were higher in the west region at 88.5%, compared with 82.9% in the east region. The current rates reflect a shift in regional disparity, with the west region overtaking the east for the first time on record. The west region demonstrated a 7-percentage point increase when comparing rates from the previous three-year average (76.7%) to the most recent three-year average (83.6%). The five-year rates in the east ranged from a high of 85.7% in 2021 to a low of 82.9% in 2022, a possible result of the county reselection process. This regional disparity has also shifted for drivers and passengers. In 2022, drivers in the

east registered use of 82.2%, compared with their counterparts in the west at 88.4%. Passenger rates continued to reflect this trend, with 87.4% usage in the east and 89.1% usage in the west.

- **Vehicle Type.** The results of the 2022 statewide survey indicated occupants of cars, SUVs, and vans demonstrated restraint use of 83.8%, 90.7%, and 88.1%, respectively. Truck occupants were belted at a lower rate of 83.3%, but demonstrated highest usage rate on record for the vehicle type. The sample size of this demographic (40.4%) combined with the lower usage has historically negatively influenced the overall North Dakota rate. Male occupants in trucks were belted at 81.9% in 2022, compared with 91.1% for females, and had the lowest five-year average at 75.9%.

- **Gender.** In 2022, female occupants continued to show higher rates of seat belt use overall (90.6%) than male occupants (83.5%). When considering rates at the county level, females registered use greater than 80% in 14 of the 16 counties. Male rates reached that same level in only nine counties. The gender rates by counties varied from 1.9 to 18.7 percentage points. Higher rates hold for females in every county whether they are drivers or passengers.

- **Gender and Vehicle Type.** Females had higher rates of seat belt use than males in every vehicle type in 2022. The highest rate for males was found in SUVs, 87.9%, and the lowest in trucks, 81.9%. By comparison, female rates ranged from a high of 92.4% in vans to a low of 85.9% in cars.

- **Road Type.** Primary roads held the largest share of occupants in the sample (60.9%), followed by secondary roads (36.4%). Local roads had the smallest share (2.8%) mainly due to their selection only in counties designated as metropolitan statistical areas (MSA) per NHTSA protocol. Seat belt use in 2022 was highest on primary roads (87.4%), followed by secondary roads (85%), and local roads (76.3%). A comparison of results defined by MSA versus non-MSA county designation showed slight variations among road types as well. MSA-classified counties showed rates of use by vehicle occupants as 85.6% on primary roads, 84.1% on secondary roads, and 76.3% on local roads. However, the majority of the sample is from non-MSA counties, with rates of 87.9% on primary roads and 85.3% on secondary roads. Regional differences in shares and use rates by road type were also noticed. MSA counties in the east showed higher rates than those in the west for all road types, while non-MSA counties in the west had higher rates than those in the east.

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INTRODUCTION

The Upper Great Plains Transportation Institute (UGPTI), a research, education, and outreach center at North Dakota State University (NDSU) in Fargo, ND, was contracted by the North Dakota Department of Transportation (NDDOT) to conduct a field survey of seat belt use in 2022. The study replicates the sampling methodology previously approved by the NHTSA and NDDOT for the 2012 survey. That methodology was a redesign of an earlier method to yield a more statistically robust estimate of seat belt use on all roadways in North Dakota. In 2022, survey researchers implemented a NHTSA-mandated review of state crash-related fatalities that resulted in modifications to county inclusion and selection, and a complete reselection of observation sites. This reselection is certified for five years. 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 objective of this study was to estimate the statewide rate of seat belt use of drivers and right front-seat passengers in North Dakota.

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

- Occupant position (driver, passenger)
- Gender (male, female)
- Type of vehicle (car, van, sport utility vehicle, truck)
- Region of state (east, west)
- Roadway type (primary, secondary, local)
- Population density/economic activity (MSA, non-MSA)

A description of the tasks involved in conducting the statewide seat belt survey is provided in this report. It includes general information about the methods and protocols. Survey sample design methods were employed to ensure the results were representative of the behavior statewide. One exception to this was that local roads were only sampled in MSA counties per NHTSA protocol.

SEAT BELT SURVEY RESULTS

Statewide Results

Sample Size by Year

Table 1: Survey Sample by Occupant Position

Occupants Observed	2018	% of Sample	2019	% of Sample	2020	% of Sample	2021	% of Sample	2022	% of Sample
Drivers	19,383	79.5%	19,397	80.7%	17,836	80.6%	19,798	81.4%	13,541	85.4%
Passengers	5,007	20.5%	4,645	19.3%	4,283	19.4%	4,512	18.6%	2,318	14.6%
Total	24,390	100.0%	24,042	100.0%	22,119	100.0%	24,310	100.0%	15,859	100.0%

Table 1 shows the size of annual seat belt surveys from 2018-2022 by occupant position. There were 15,859 occupants in 2022, consisting of 13,541 drivers, which represented 85.4% of the sample, and 2,318 passengers, which represented 14.6% of the sample. These figures include only vehicle occupants where protection status could be determined.

Total sample size can vary from year to year depending on site locations and traffic flow. This year's decrease may reflect the nationwide increase in gas prices, according to AAA[1] rising 44.1% between July 2021 and July 2022. The average price per gallon in North Dakota peaked at $4.79, which occurred during the week of observations, compared to the June 2021 average of $2.85[2]. Fuel costs and site reselection aside, the overall sample size has remained relatively consistent. Considering sample sizes from the most recent five-year period, the current sample size is below average, with occupant shares being comparable to previous surveys. It is not uncommon to have several individual sites capture only a limited number of vehicles. However, these sites are important to an inclusive and representative sample in the aggregate measurement of statewide seat belt use, so they are captured each year.

The driver-to-passenger ratio can influence overall use rates because use rates among passengers are typically higher than driver. In 2022, the ratio was 5.8 drivers for every occupant, meaning drivers represent 85.4% of the sample. Table 2 shows only minor variations in this ratio since 2018. Driver share of the sample deviated roughly 2 percentage points or less over the time period shown.

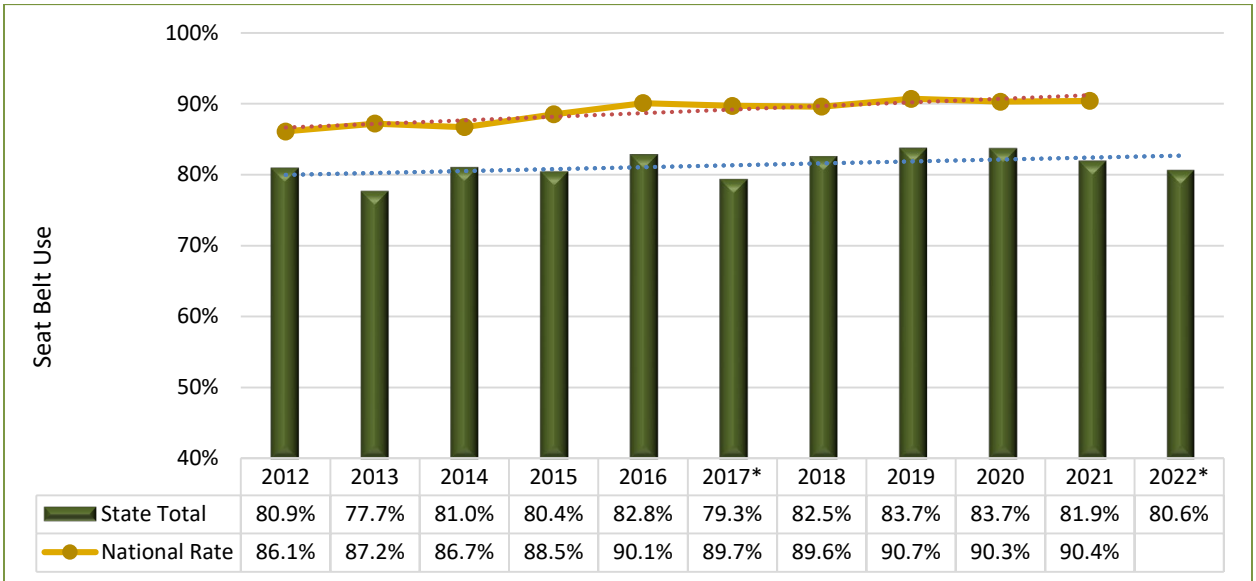
[1] AAA. "Gas Prices." Accessed August 4, 2022

[2] GasBuddy. "Historical Gas Price Chart." Accessed August 4, 2022

Table 2: Ratio of Drivers to Passengers, 2018-2022

Ratio	2018	2019	2020	2021	2022
Drivers:Passengers	3.9:1	4.8:1	4.2:1	4.4:1	5.8:1
Drivers as % of Sample	79.5%	80.7%	80.6%	81.4%	85.4%

Overall unweighted results of the 2022 statewide survey indicated 86.3% 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 seat belt use is found by weighting the unadjusted rate. Using those formulas, the overall weighted rate of seat belt use in North Dakota was 80.6% for 2022. Figure 1 shows annual seat belt use since the implementation of the amended methodology in 2012. In addition, the graph includes national use as reported by NHTSA with the most recent data showing a rate of 90.4% in 2021. Nationally, NOPUS survey data confirm that vehicle occupants in states with primary enforcement of seat belt laws demonstrate higher restraint use (91%) than states with secondary laws (88%). Accordingly, North Dakota aligns more closely with states without primary seat belt laws, and ranks in the bottom half among those states.[3]



	2012	2013	2014	2015	2016	2017*	2018	2019	2020	2021	2022*
State Total	80.9%	77.7%	81.0%	80.4%	82.8%	79.3%	82.5%	83.7%	83.7%	81.9%	80.6%
National Rate	86.1%	87.2%	86.7%	88.5%	90.1%	89.7%	89.6%	90.7%	90.3%	90.4%	

*2017 and 2022 rates mark NHTSA-mandated resampling of counties and sites

Figure 1: Statewide Seat Belt Use, Weighted

[3] National Highway Traffic Safety Administration. Traffic Safety Facts Research Note. December, 2021. Seat Belt Use in 2021 – Overall Results (dot.gov)

County Results

The 2022 weighted seat belt rates by county are shown in Figure 2. Restraint use ranged from a high of 98.3% in Stark County to a low of 71.8% in Burke County. In the past, higher seat belt use was generally noticed in counties that follow interstate corridors. However, this year counties without interstate corridors had slightly higher average rate of 86.7% compared to 84.4%. This change may have come with the county and observation site reselection. In addition, it should be noted that road segment sample was drawn from the state's public road network (NDDOT 2021). It was determined to be a more precise representation than the national imagery network used with the previous site selection (US Census TIGER).

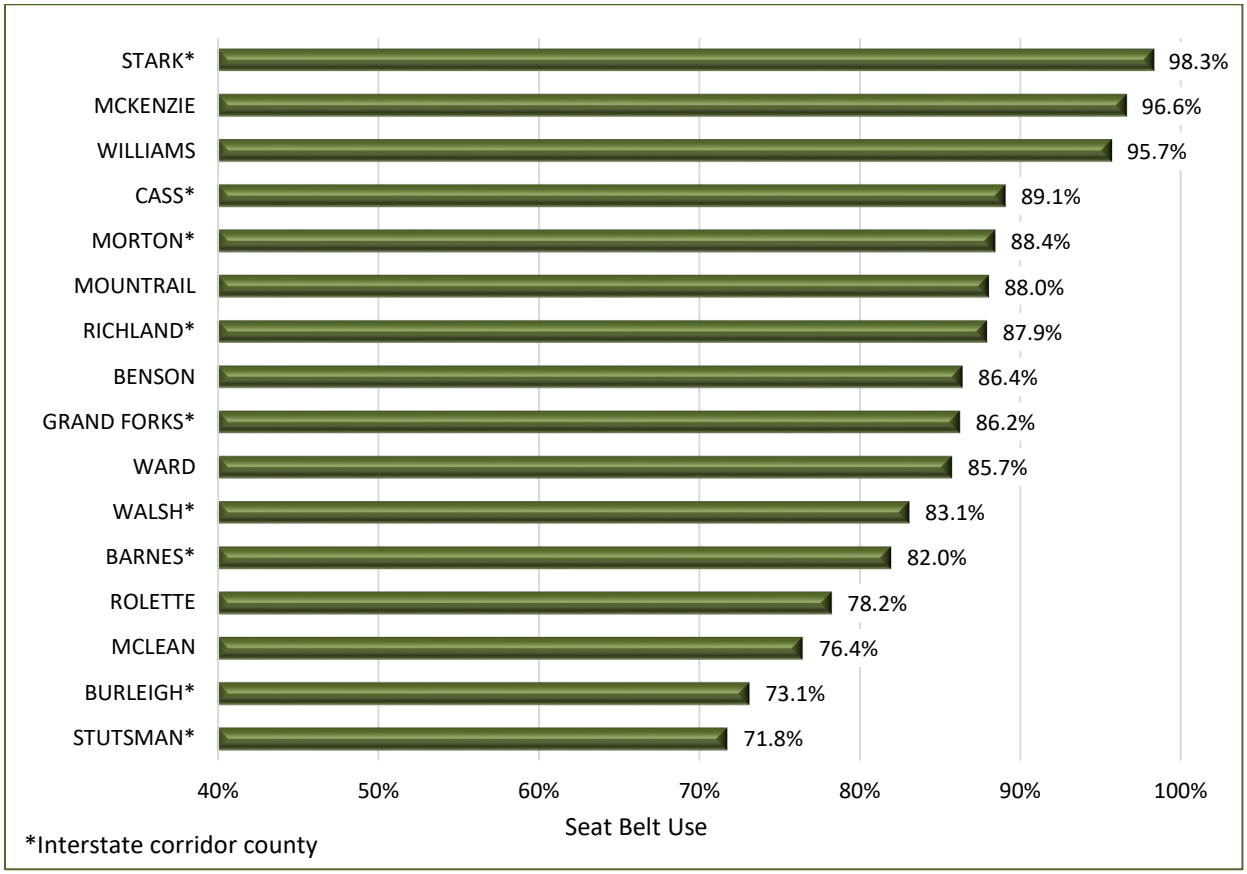


Figure 2: Seat Belt Use by County, 2022, Weighted

Rates vary from year to year at the county level. The changes can represent sampling differences and are not likely to be statistically significant, especially for counties where there are fewer total observations. However, even the rates for counties with more observations may exhibit noticeable change from one year to the next.

To smooth the annual variability, three-year averages are graphed in Figure 3 to provide a representation of county rates. This analysis does not offer the earlier three-year averages for comparison on the three counties (McLean, Rolette, and Walsh) that were first-year additions to the survey in 2022 because of the reselection process.

The three-year averages used for trend comparison show variations in seat belt use in several counties. In the most recent three-year time frame, McKenzie County leads in belt use at 94.4%. Barnes, Cass, McKenzie, Morton, Mountrail, Richland, Stark, and Walsh counties all register rates above 80%. The preceding statewide data are based on the weighted county sampling frame. However, the following sections of this report describe strata frequencies that are unadjusted because of survey design. It is important to note the county rates are based on the sites visited as part of the statewide rate sample; thus, may not statistically represent seat belt use in a county.

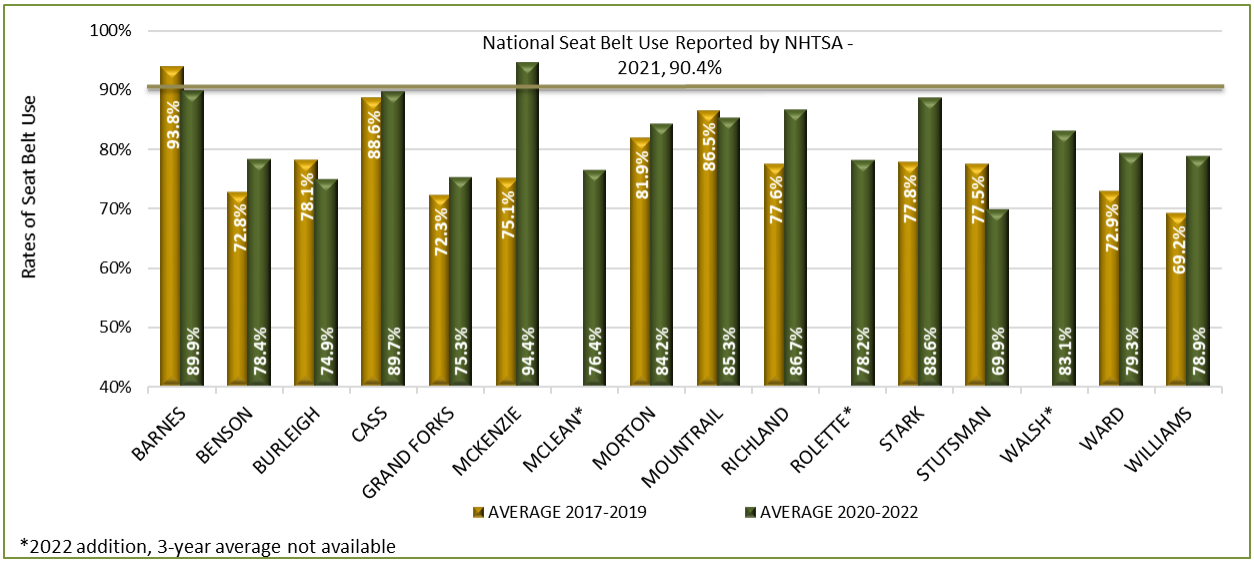


Figure 3: Seat Belt Use by County, Three-Year Averages, Weighted

Results for Vehicle Occupants by Position

Figure 4 illustrates seat belt use by occupant position in 2022. At the county level, driver use ranged from a low in Stutsman County of 69.8% to a high of 98.2% in Stark County. The spread in passenger use was 75.3% to 100% in Burleigh and Walsh counties, respectively. Annual surveys confirm that, as a rule, passengers buckle up at higher rates than drivers. The 2022 survey showed two counties, Richland and Williams, with lower restraint use among passengers than drivers differing by 8.0 and 4.3 percentage points, respectively.

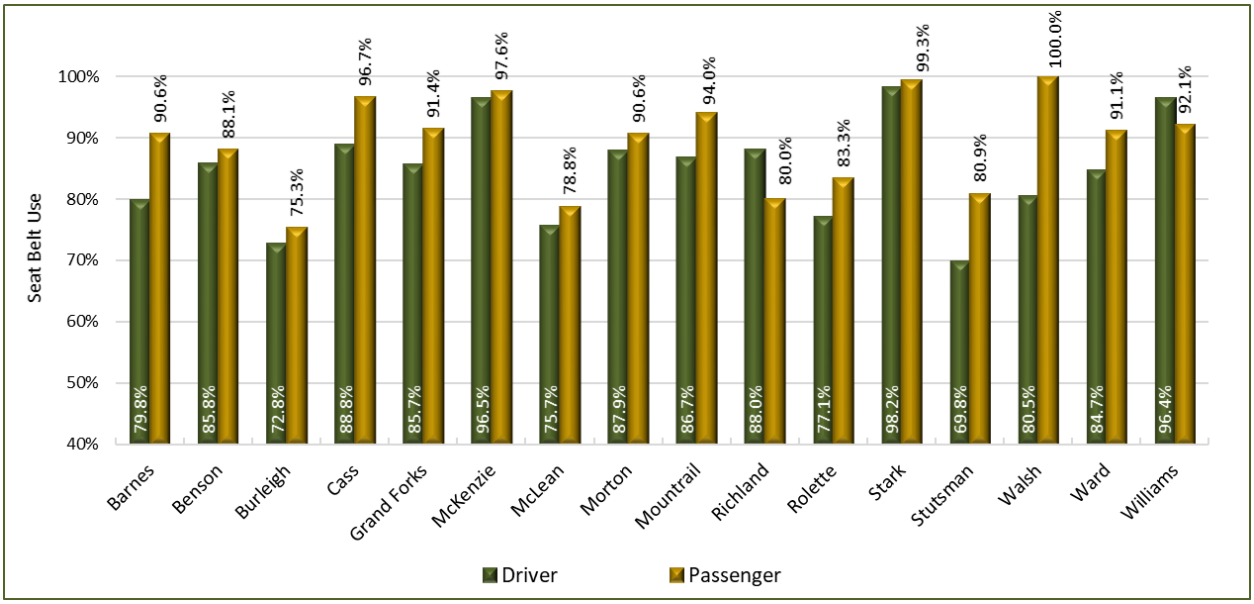
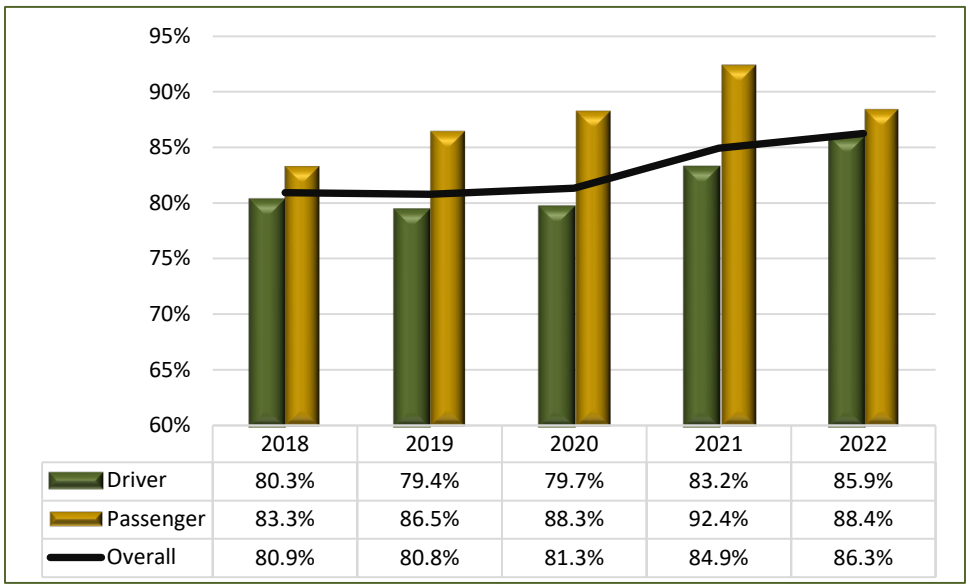


Figure 4: Percent Belted by Position and County, Annual, Unweighted

Considering the state as a whole, the unweighted estimates of seat belt use in 2022 were 85.9% for drivers and 88.4% for passengers, with an overall estimate of the seat belt use rate of 86.3% for drivers and passengers combined (Figure 5). These rates compare with 83.2%, 92.4%, and 84.9%, respectively, in 2021.



	2018	2019	2020	2021	2022
Driver	80.3%	79.4%	79.7%	83.2%	85.9%
Passenger	83.3%	86.5%	88.3%	92.4%	88.4%
Overall	80.9%	80.8%	81.3%	84.9%	86.3%

Figure 5: Percent Belted by Position, Annual, Unweighted

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 the enactment of a primary seat belt law, which NHTSA suggests would increase seat belt use rates by 10% to 15%. Other possible interventions include heightened education and enforcement across the state.

Some factors that may be useful in administering programs to increase seat belt use in North Dakota are found in the remainder of this report. Differences in seat belt use among regions of the state, gender, vehicle type, and roadway type are explored for additional insight.

Results by North Dakota Regions

The survey sampling methodology groups the state into an east/west regional division (Figure 6). Each region is represented by eight counties. Both east and west regions contain "certainty" counties, five in the east and seven in the west, with the rest selected from the remaining counties in each region.[4]

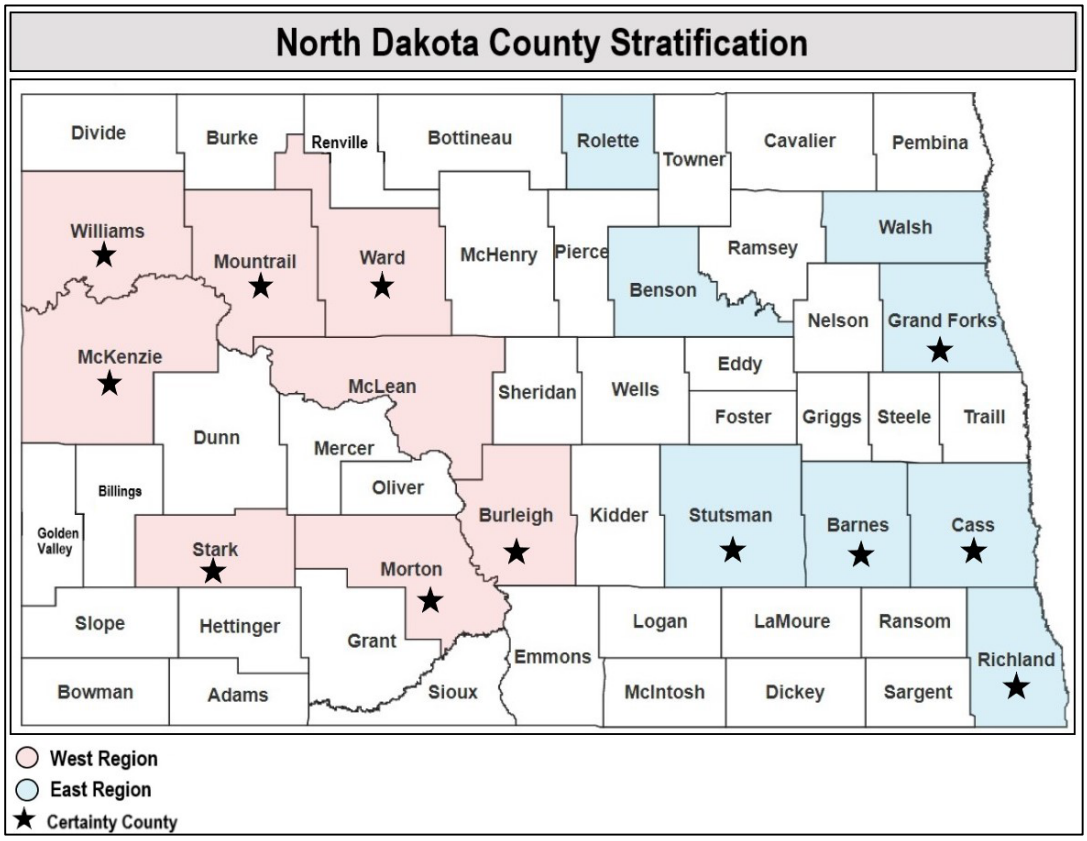


Figure 6: North Dakota County Stratification

Year-to-year variations in sample size may be associated with revised sites and/or changes in travel levels and patterns. Table 3 shows a proportionate sample distribution between regions throughout the five-year period. Two-thirds of the sample data was collected in western North Dakota from 9,510 occupants. The remaining proportion of 6,349 occupants were observed in eastern North Dakota.

[4]For details on methodology, certainty counties, and the selection processes, contact NDDOT Safety Division.

Table 3: Sample Size by Region

Region	2018	% of Sample	2019	% of Sample	2020	% of Sample	2021	% of Sample	2022	% of Sample
East	12,041	49.4%	11,620	48.3%	9,917	44.8%	11,455	47.1%	6,349	40.0%
West	12,349	50.6%	12,422	51.7%	12,202	55.2%	12,855	52.9%	9,510	60.0%
Total	24,390	100.0%	24,042	100.0%	22,119	100.0%	24,310	100.0%	15,859	100%

Historically, seat belt use has been routinely higher in the east than the west, as shown in Figure 7. However, this year the rates in the east (82.9%) were lower than in the west (88.5%) for the first time on record. The comparison of seat belt use in Figure 8 shows an average rate in the east of 83.5% from 2017-2018 and 84.6% from 2020-2022. Seat belt use in the west was lower, yet increased between the two periods, 76.7% from 2017-2019 and 83.6% from 2020-2022.

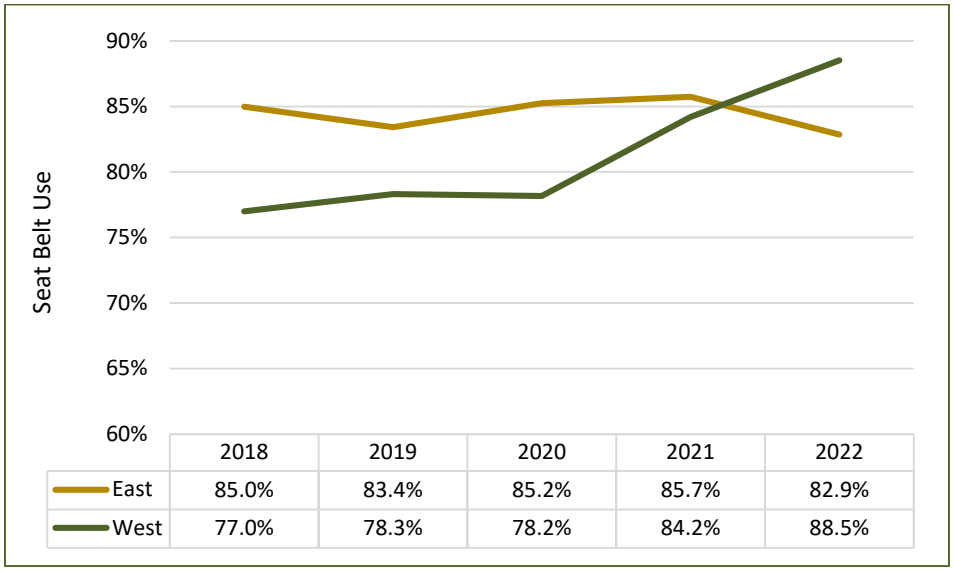


Figure 7: Percent Belted by Region, Unweighted

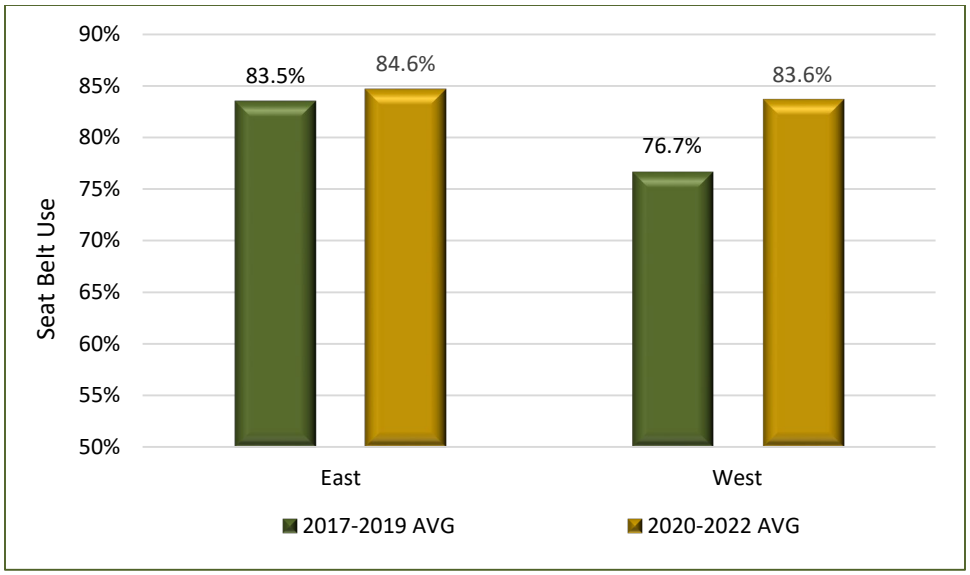


Figure 8: Seat Belt Use by Region, Three Year Averages, Unweighted

A further breakdown of driver and passenger use by region is seen in Figure 9. Minor up and down fluctuations in belt use by both occupant positions from the east region are seen during the five-year span shown in the graph. Currently, the rate for drivers in the east is 82.2% and for passengers is 87.4%, which now represent the lowest usage of the four occupant groups. A five-year high of 88.5% was observed in west region driver usage rates. Passengers in the west demonstrated the highest usage of the four occupant groups.

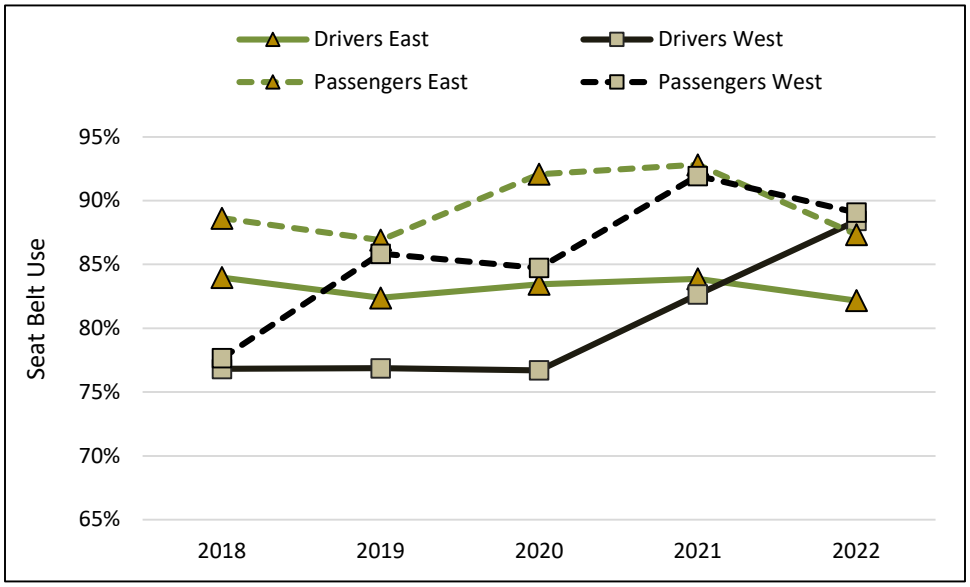


Figure 9: Percent Belted by Region and Occupant Position, Annual, Unweighted

Historically, lower seat belt usage in the west region was explained by the high prevalence of truck occupants, who have typically exhibited the lowest rate of use among vehicle types. For example, large truck volume of greater than 50% was observed in McKenzie, Mountrail, and Williams counties. Truck share was as high as 74.8% in McKenzie County. Overall, this region accounts for 64.6% of the statewide

share of occupants in this vehicle type. However, because rates of use in the west have risen overall, the disproportionate influence of truck occupants has become less apparent.

Results by Vehicle Type

Table 4 shows the fleet distribution annually since 2018. During that time, the number of cars surveyed has decreased from the 22% share in 2018 to 19% in 2022. Van representation has also declined slightly over this same period, and currently represents the smallest share (5.2%) of the sample. The share of SUVs (35.5%) is consistent with last year's share. Trucks make up 40.4% of the occupant share in 2022, and historically hold the largest share of vehicle type.

Table 4: Sample by Vehicle Type

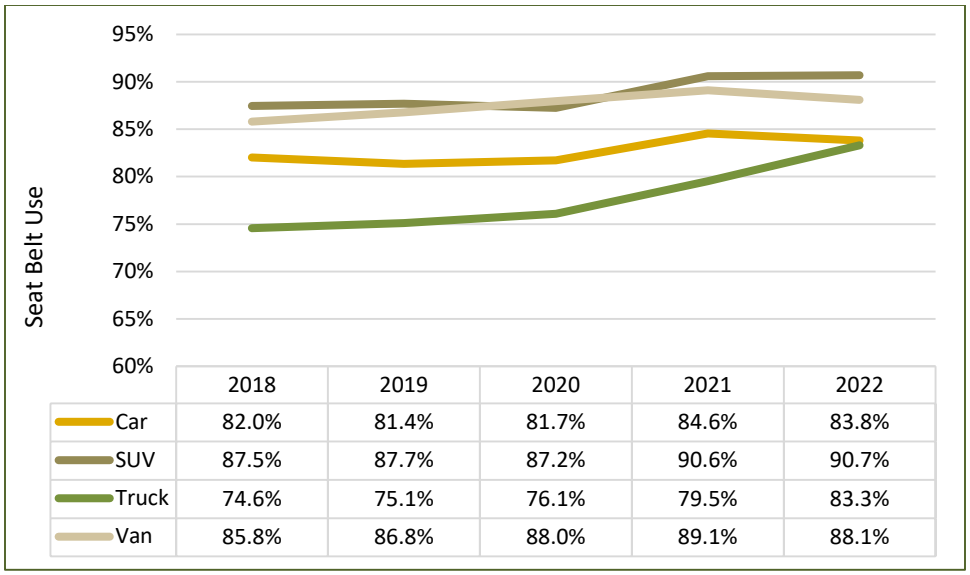
Vehicles Observed	2018	% of Sample	2019	% of Sample	2020	% of Sample	2021	% of Sample	2022	% of Sample
Car	5,364	22.0%	5,620	23.4%	4,122	18.6%	4,168	17.1%	3,015	19.0%
SUV	7,479	30.7%	6,616	27.5%	6,955	31.4%	8,723	35.9%	5,623	35.5%
Truck	9,857	40.4%	10,255	42.7%	9,754	44.1%	9,988	41.1%	6,404	40.4%
Van	1,690	6.9%	1,551	6.5%	1,288	5.8%	1,431	5.9%	817	5.2%
Total	24,390	100.0%	24,042	100.0%	22,119	100.0%	24,310	100.0%	15,859	100.0%

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, small box trucks, etc. Trucks with commercial use indicated by logos on doors or truck body are within the survey scope.

Regionally, trucks represented 43.5% of vehicles in the west, and 35.7% in the east. The larger share of vehicles in the western region (60.4%), along with the higher volume of trucks, may influence the statewide seat belt rate. The larger truck share may be correlated with the proximity to the Bakken oil region, particularly in McKenzie, Mountrail, Ward, and Williams counties where the truck share represented more than half of their total vehicle counts. The nature of the travel environments, with fewer urban lane miles in the west, also likely impacts fleet composition.

At the county level, this disproportionate share of trucks in the west region was most noticeable in McKenzie County, where trucks made up 74.8% of the share of vehicles observed. This was followed by 57.7% in Mountrail, and 56.4% in Williams County. In the east region, Benson (42.9%), Rolette (40.1%), and Walsh (39%) counties registered the largest shares of trucks.

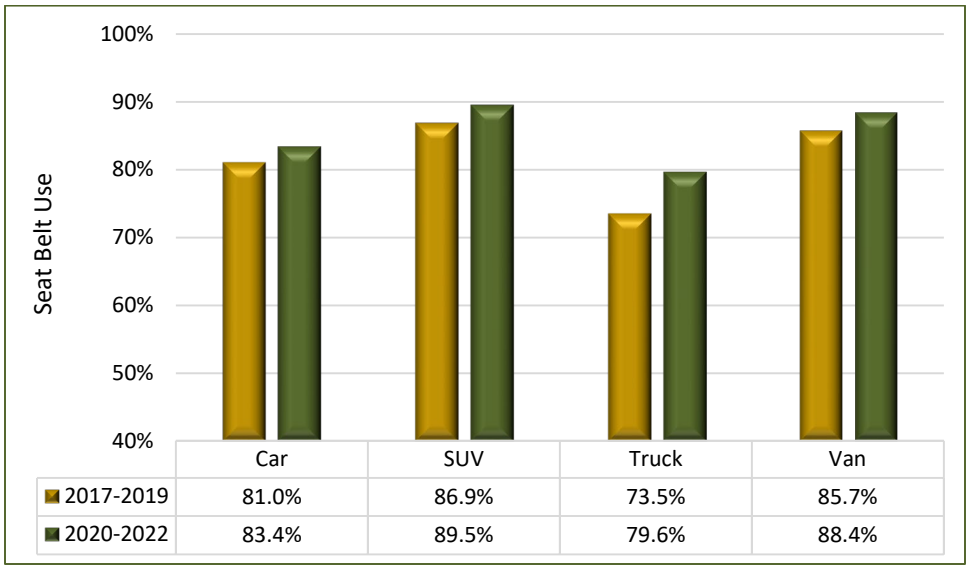
Annual results for overall seat belt use by vehicle type are shown in Figure 10. SUV and van occupants continue to demonstrate the highest usage rates at 90.7% and 88.1%, respectively, followed by car and truck occupants at 83.8% and 83.3%, respectively. Truck occupants' use rates have steadily increased (by nearly 10 percentage points since 2018), but are consistently the group least likely to be belted.



	2018	2019	2020	2021	2022
Car	82.0%	81.4%	81.7%	84.6%	83.8%
SUV	87.5%	87.7%	87.2%	90.6%	90.7%
Truck	74.6%	75.1%	76.1%	79.5%	83.3%
Van	85.8%	86.8%	88.0%	89.1%	88.1%

Figure 10: Percent Belted by Vehicle Type, Annual, Unweighted

The three-year averages used to measure belt use for occupants of cars, SUVs, and vans show marginal increases between the three-year periods (Figure 11). Truck occupants have again demonstrated the most change, increasing seat belt use by approximately 6 percentage points. Individual county rates by each vehicle type are found in Table 5.



	Car	SUV	Truck	Van
2017-2019	81.0%	86.9%	73.5%	85.7%
2020-2022	83.4%	89.5%	79.6%	88.4%

Figure 11: Seat Belt Use by Vehicle Type, Three-Year Averages, Unweighted

The 2022 results are consistent with long-term trends for seat belt use in North Dakota and other states that a) do not have primary seat belt laws, b) are largely rural in nature, and c) have a high proportion of trucks. While seat belt use by occupants in trucks has increased in recent years, Table 5 shows this demographic with rates of less than 80% in 7 of the 16 observed counties. This lower use, coupled with the proportion of trucks in the sample, can reduce both county rates and the overall state rate.

Table 5: Percent Belted by County and Vehicle Type, 2022, Unweighted

2022							
Car		**SUV**		**Truck**		**Van**	
Barnes	81.1%	Barnes	91.0%	Barnes	69.2%	Barnes	87.5%
Benson	77.8%	Benson	92.1%	Benson	85.0%	Benson	86.7%
Burleigh	70.8%	Burleigh	75.4%	Burleigh	71.7%	Burleigh	75.9%
Cass	84.5%	Cass	92.9%	Cass	87.0%	Cass	96.4%
Grand Forks	89.7%	Grand Forks	90.3%	Grand Forks	77.7%	Grand Forks	90.2%
McKenzie	97.4%	McKenzie	98.7%	McKenzie	96.1%	McKenzie	94.7%
McLean	76.8%	McLean	84.3%	McLean	66.7%	McLean	88.5%
Morton	86.3%	Morton	93.1%	Morton	83.2%	Morton	94.4%
Mountrail	82.6%	Mountrail	94.1%	Mountrail	86.2%	Mountrail	81.8%
Richland	84.2%	Richland	92.6%	Richland	85.9%	Richland	90.4%
Rolette	73.1%	Rolette	85.6%	Rolette	74.1%	Rolette	87.5%
Stark	99.6%	Stark	99.3%	Stark	96.4%	Stark	100.0%
Stutsman	71.2%	Stutsman	79.6%	Stutsman	64.2%	Stutsman	75.0%
Walsh	87.8%	Walsh	91.7%	Walsh	70.8%	Walsh	94.1%
Ward	81.6%	Ward	91.6%	Ward	80.0%	Ward	90.8%
Williams	97.4%	Williams	97.2%	Williams	94.5%	Williams	95.1%

Results by Occupant Gender and Position

Minimal year-to-year variation in sample composition is observed for occupant gender and summarized in Table 6. Overall, males represented 61.1% and females 38.4% of the sample in 2022. In a small percentage of observations, 0.5%, occupant gender could not be determined, but occupant protection was still recorded. These cases are included in all 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.

Table 6: Sample by Gender

Gender Observed	2018	% of Sample	2019	% of Sample	2020	% of Sample	2021	% of Sample	2022	% of Sample
Female	9,049	37.1%	8,800	36.6%	8,242	37.3%	8,909	36.6%	6,091	38.4%
Male	15,099	61.9%	14,921	62.1%	13,695	61.9%	15,287	62.9%	9,693	61.1%
Unknown	242	1.0%	321	1.3%	182	0.8%	114	0.5%	75	0.5%
Total	24,390	100.0%	24,042	100.0%	22,119	100.0%	24,310	100.0%	15,859	100.0%

Survey results for seat belt use by gender continued the trend of higher rates of use by female occupants. Females demonstrated 90.6% usage in 2022 and have consistently registered of 87.3% or more throughout the last five years (Figure 12). At the same time, male restraint use has been increasing, this year registering an all-time high of 83.5%, yet it still fails to reach the minimum rate demonstrated by females (87.3% in 2018).

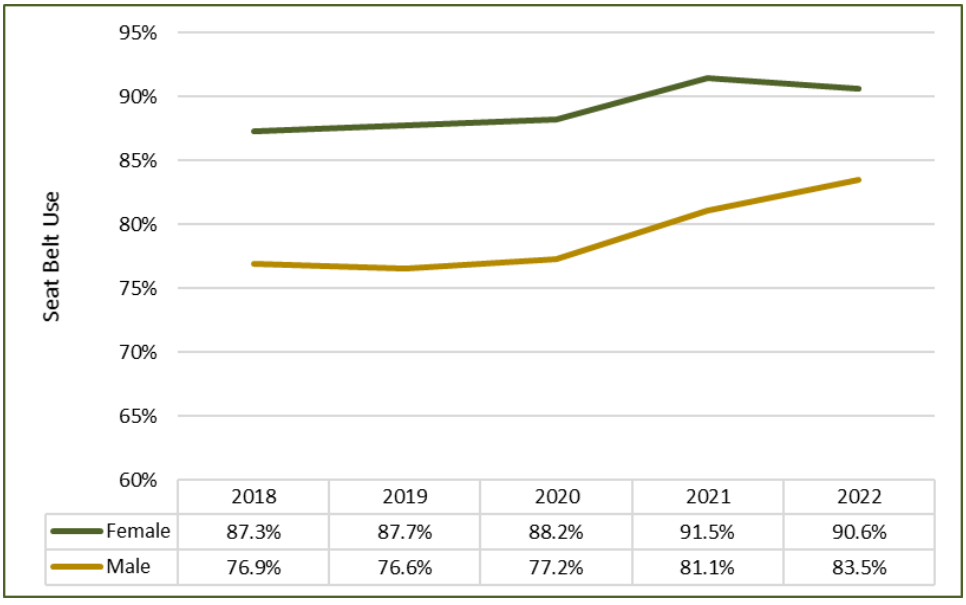


Figure 12: Percent Belted by Gender, Annual, Unweighted

Table 7 shows restraint use by county and gender. Female occupants were observed to have rates above 80% in 14 of 16 counties. In comparison, 9 counties showed male rates at the same level. In fact, the male seat belt use rate was lower than the female rate in all counties. For both genders, the two highest rates were found in Stark and McKenzie counties, Burleigh and Stutsman counties had the two lowest.

Table 7: Percent Belted by Gender & County, 2022

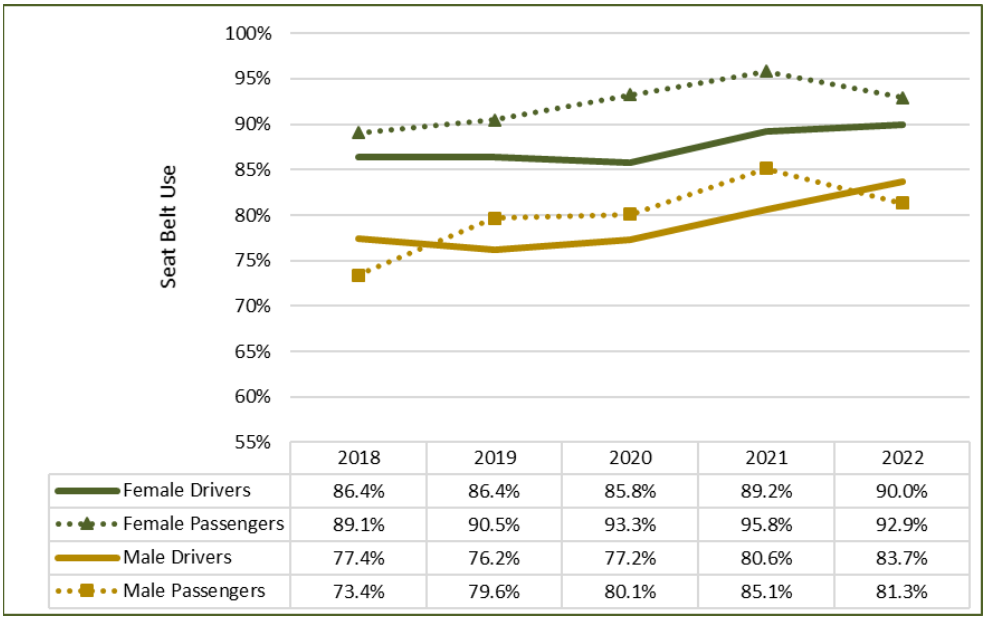
2022			
FEMALE OCCUPANTS		**MALE OCCUPANTS**	
Barnes	92.3%	Barnes	73.6%
Benson	90.4%	Benson	83.7%
Burleigh	75.3%	Burleigh	71.5%
Cass	93.2%	Cass	86.9%
Grand Forks	91.2%	Grand Forks	82.5%
McKenzie	98.1%	McKenzie	96.2%
McLean	83.6%	McLean	71.6%
Morton	92.6%	Morton	85.4%
Mountrail	94.3%	Mountrail	85.0%
Richland	90.7%	Richland	86.4%
Rolette	86.0%	Rolette	72.4%
Stark	99.9%	Stark	97.3%
Stutsman	79.2%	Stutsman	66.3%
Walsh	93.3%	Walsh	76.1%
Ward	92.8%	Ward	79.7%
Williams	97.8%	Williams	94.6%

The sample by gender and occupant position also remains stable from year to year. As described in Table 8, drivers were more than twice as likely to be male than female (8,833 compared with 4,683). In contrast, passengers were more than twice as likely to be female than male (1,408 compared with 860).

Survey results corroborate higher rates of seat belt use by females regardless of occupant position (Figure 13). Female passengers used restraints at a rate of 92.9%, the highest usage of gender and occupant positions. This was followed by female drivers at 90.0%. Male rates were considerably lower at 83.7% for drivers and 81.3% for passengers. Male passengers' seat belt use has seen the most improvement, increasing from 73.4% in 2018 to 81.3% in 2022. Figure 14 shows a comparison of three-year averages.

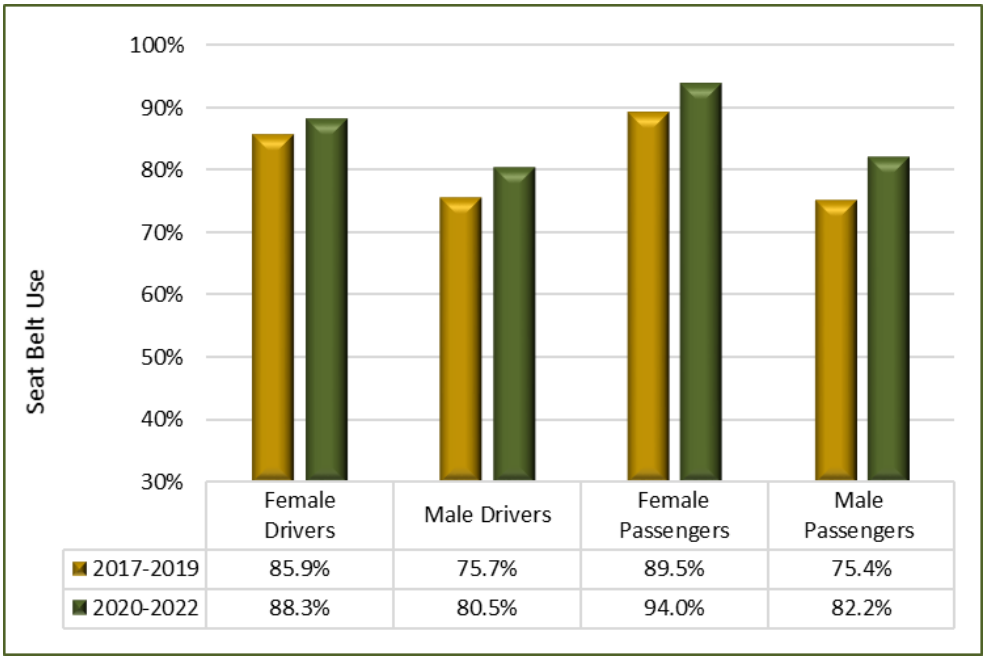
Table 8: Sample by Gender and Position

Occupants Observed	2018	% of Sample	2019	% of Sample	2020	% of Sample	2021	% of Sample	2022	% of Sample
Drivers:										
Male	13,268	54.4%	13,188	54.9%	12,124	54.8%	13,858	57.0%	8,833	55.7%
Female	5,943	24.4%	6,001	25.0%	5,647	25.5%	5,888	24.2%	4,683	29.5%
Passengers:										
Male	1,831	7.5%	1,733	7.2%	1,571	7.1%	1,429	5.9%	860	5.4%
Female	3,106	12.7%	2,799	11.6%	2,595	11.7%	3,021	12.4%	1,408	8.9%
Unknown:	242	1.0%	321	1.3%	182	0.8%	114	0.5%	75	0.5%
Total	24,390	100.0%	24,042	100.0%	22,119	100.0%	24,310	100.0%	15,859	100.0%



	2018	2019	2020	2021	2022
Female Drivers	86.4%	86.4%	85.8%	89.2%	90.0%
Female Passengers	89.1%	90.5%	93.3%	95.8%	92.9%
Male Drivers	77.4%	76.2%	77.2%	80.6%	83.7%
Male Passengers	73.4%	79.6%	80.1%	85.1%	81.3%

Figure 13: Percent Belted by Gender & Position, Annual, Unweighted



	Female Drivers	Male Drivers	Female Passengers	Male Passengers
2017-2019	85.9%	75.7%	89.5%	75.4%
2020-2022	88.3%	80.5%	94.0%	82.2%

Figure 14: Seat Belt Use by Gender & Position, Three-Year Averages, Unweighted

There are wide-ranging seat belt use rates in individual counties in all occupant positions (Table 9). At the county level, female drivers' rates were generally high with only four counties below 80%. Male drivers were found to have use rates below 80% in Ward (78.9%), Walsh (75.8%), Barnes (72.7%), McLean (72.3%), Rolette (71.9%), Burleigh (75.1%), and Stutsman (65.9%). Female passengers' use rates were generally high, with five counties at 100% use, and only one below 80%. Male passengers' rates varied widely, from a high of 100% in Walsh County to 33.3% in Richland County.

Table 9: Percent Belted by Gender & Position by County, 2022, Unweighted

2022							
FEMALE DRIVERS		**FEMALE PASSENGERS**		**MALE DRIVERS**		**MALE PASSENGERS**	
Barnes	90.8%	Barnes	95.4%	Barnes	72.7%	Barnes	80.3%
Benson	90.5%	Benson	90.3%	Benson	83.5%	Benson	84.6%
Burleigh	74.7%	Burleigh	77.5%	Burleigh	71.5%	Burleigh	70.9%
Cass	92.8%	Cass	100.0%	Cass	86.8%	Cass	91.7%
Grand Forks	90.2%	Grand Forks	96.0%	Grand Forks	82.7%	Grand Forks	75.0%
McKenzie	97.6%	McKenzie	100.0%	McKenzie	96.2%	McKenzie	95.7%
McLean	82.3%	McLean	85.9%	McLean	72.3%	McLean	68.6%
Morton	91.6%	Morton	94.4%	Morton	85.9%	Morton	79.7%
Mountrail	92.8%	Mountrail	96.9%	Mountrail	84.7%	Mountrail	88.2%
Richland	90.4%	Richland	100.0%	Richland	86.8%	Richland	33.3%
Rolette	85.1%	Rolette	89.6%	Rolette	71.9%	Rolette	75.9%
Stark	99.8%	Stark	100.0%	Stark	97.3%	Stark	98.3%
Stutsman	75.6%	Stutsman	91.8%	Stutsman	65.9%	Stutsman	68.6%
Walsh	90.7%	Walsh	100.0%	Walsh	75.8%	Walsh	100.0%
Ward	92.4%	Ward	94.4%	Ward	78.9%	Ward	85.3%
Williams	98.6%	Williams	95.8%	Williams	95.4%	Williams	89.7%

Results by Gender and Vehicle Type

Examining the survey sample size without respect to the driver/passenger demographic shows the ratio of male to female occupants is about 1.6 to 1 in 2022 (Table 10). When considering vehicle type, males show lower representation in SUVs, but higher shares of the overall sample in all other vehicle types. A large gender imbalance continues to be noticed in the truck category, where males accounted for 84.1% of the overall occupant share of this vehicle type.

Table 10: Sample by Vehicle Type and Gender

Occupants Observed	2018	% of Sample	2019	% of Sample	2020	% of Sample	2021	% of Sample	2022	% of Sample
Male										
Car	2,843	11.7%	2,856	11.9%	2,131	9.6%	2,348	9.7%	1,722	10.9%
SUV	3,089	12.7%	2,576	10.7%	2,756	12.5%	3,750	15.4%	2,170	13.7%
Truck	8,248	33.8%	8,671	36.1%	8,087	36.6%	8,392	34.5%	5,363	33.8%
Van	919	3.8%	818	3.4%	721	3.3%	797	3.3%	438	2.8%
Female										
Car	2,438	10.0%	2,666	11.1%	1,950	8.8%	1,790	7.4%	1,270	8.0%
SUV	4,316	17.7%	3,926	16.3%	4,135	18.7%	4,926	20.3%	3,432	21.6%
Truck	1,551	6.4%	1,500	6.2%	1,604	7.3%	1,565	6.4%	1,017	6.4%
Van	744	3.1%	708	2.9%	553	2.5%	628	2.6%	372	2.3%
Unknown:	242	1.0%	321	1.3%	182	0.8%	114	0.5%	75	0.5%
Total	24,390	100.0%	24,042	100.0%	22,119	100.0%	24,310	100.0%	15,859	100.0%

Differences in seat belt use by gender varied across vehicle types (Figure 15). In the 2022 survey, male occupants were belted at rates ranging from a low of 81.9% in trucks to a high of 87.9% in SUVs. Females were belted at rates above 80% in all vehicle types, ranging from a low of 85.9% in cars to a high of 92.4% in SUVs.

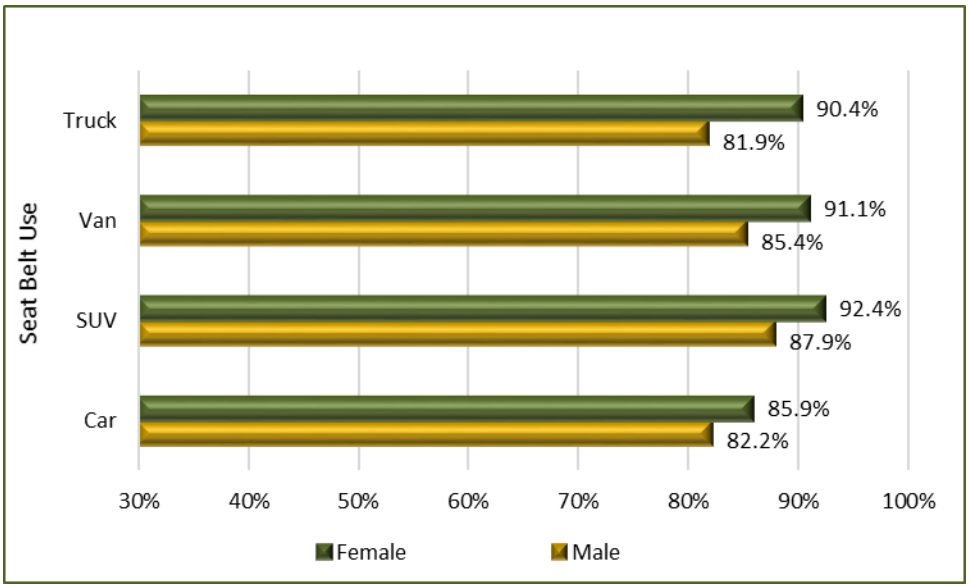


Figure 15: Percent Belted by Gender and Vehicle Type, 2022, Unweighted

Although the size of the disparity between gender seat belt use shifts from year to year, male use is lower than female use in every vehicle type in every year by as much as 13.7 percentage points in trucks in 2021 to as little as 3.7 percentage points in cars in 2022 (Table 11). Throughout the five-year period, female rates are consistently high, with usage rates ranging between 83.2% and 92.5%. By contrast, annual rates for male seat belt use are much lower, with the rates ranging between 72.8% and 88.2% throughout the same time frame. Males are observed to have the lowest usage in trucks (81.9%), for the fifth consecutive year, while females had the lowest usage in cars (85.9%) for the third consecutive year.

Table 11: Annual Percent Belted by Gender & Vehicle Type, Unweighted

Male	2018	2019	2020	2021	2022
Car	78.8%	77.3%	78.3%	81.2%	82.2%
SUV	85.2%	84.4%	84.2%	88.2%	87.9%
Van	80.3%	82.8%	85.2%	86.4%	85.4%
Truck	72.8%	73.4%	73.9%	77.3%	81.9%
Female	**2018**	**2019**	**2020**	**2021**	**2022**
Car	85.4%	85.4%	85.7%	88.9%	85.9%
SUV	89.0%	89.6%	89.3%	92.4%	92.4%
Van	92.2%	91.4%	91.7%	92.5%	91.1%
Truck	83.2%	85.0%	86.9%	91.1%	90.4%

When comparing the 2017-2019 with 2020-2022 averages, seat belt use by females across vehicle types has remained stable with minor increases, (Figure 16). Male occupants show similar trends across vehicle types. Yet, rates have increased by close to 6 percentage points for both genders, in trucks, between the two periods.

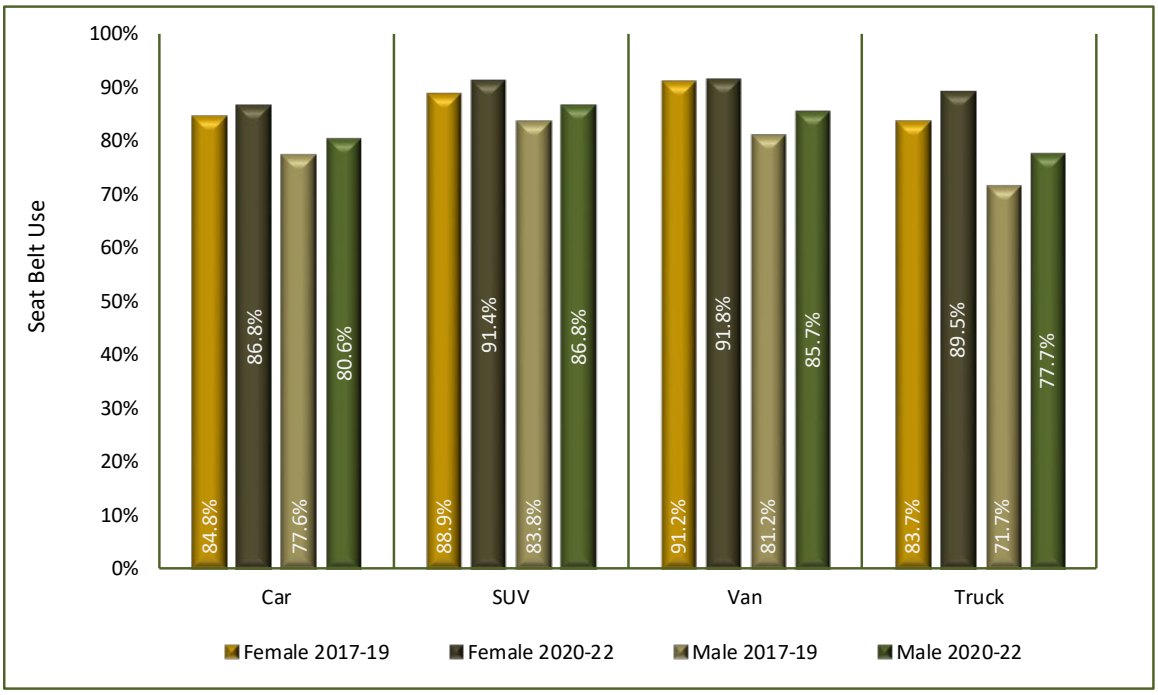


Figure 16: Seat Belt Use by Gender and Vehicle Type, Three-Year Averages, Unweighted

Results by Road Type

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

- Primary road: divided, limited-access, e.g., 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

There were 6,349 observations collected from the east region and 9,510 from the west during the 2022 survey. Primary, secondary, and local roadways accounted for 60.9%, 36.4%, and 2.8% of the vehicle occupants, respectively. Sample distribution by road type and region is diverse as shown in Table 12. Through 2016, more observations were collected from primary and local road sites in the east and fewer observations from sites located on secondary roads. The NHTSA-mandated reselection of sites for the 2017 survey heightened the regional disparity in road classification sample sizes. There was a sizeable decrease in the local road sample in the east, as well as the primary road sample in the west, over previous years. Sample variations are associated with revisions in the number of sites drawn in each road type between 2012, 2017, and 2022 as well as contrasting traffic volume in newly selected counties and site locations.

Table 12: Sample by Road Type

Occupants Observed	2018	% of Sample	2019	% of Sample	2020	% of Sample	2021	% of Sample	2022	% of Sample
East										
Primary	7,680	31.5%	7,430	30.9%	6,029	27.3%	7,302	30.0%	3,995	25.2%
Secondary	3,223	13.2%	3,085	12.8%	2,949	13.3%	3,126	12.9%	2,096	13.2%
Local	1,138	4.7%	1,105	4.6%	939	4.2%	1,027	4.2%	258	1.6%
Total East	12,041	49.4%	11,620	48.3%	9,917	44.8%	11,455	47.1%	6,349	40.0%
West										
Primary	2,515	10.3%	1,737	7.2%	2,476	11.2%	3,455	14.2%	5,658	35.7%
Secondary	8,664	35.5%	9,539	39.7%	8,576	38.8%	8,369	34.4%	3,671	23.1%
Local	1,170	4.8%	1,146	4.8%	1,150	5.2%	1,031	4.2%	181	1.1%
Total West	12,349	50.6%	12,422	51.7%	12,202	55.2%	12,855	52.9%	9,510	60.0%
Total	24,390	100.0%	24,042	100.0%	22,119	100.0%	24,310	100.0%	15,859	100%

Contextual information is provided in Figure 17, which identifies the proportion of sites by road type established with the amended methodology in 2012 followed by the reselections in 2017 and 2022. These sample disparities, along with diverse habits of restraint use, factor into the regional differences in rates. Although the weighted results do include adjustments for changes to road site characteristics, the unweighted results may be influenced by the site mix and underlying characteristics such as higher use rates on interstate corridors.

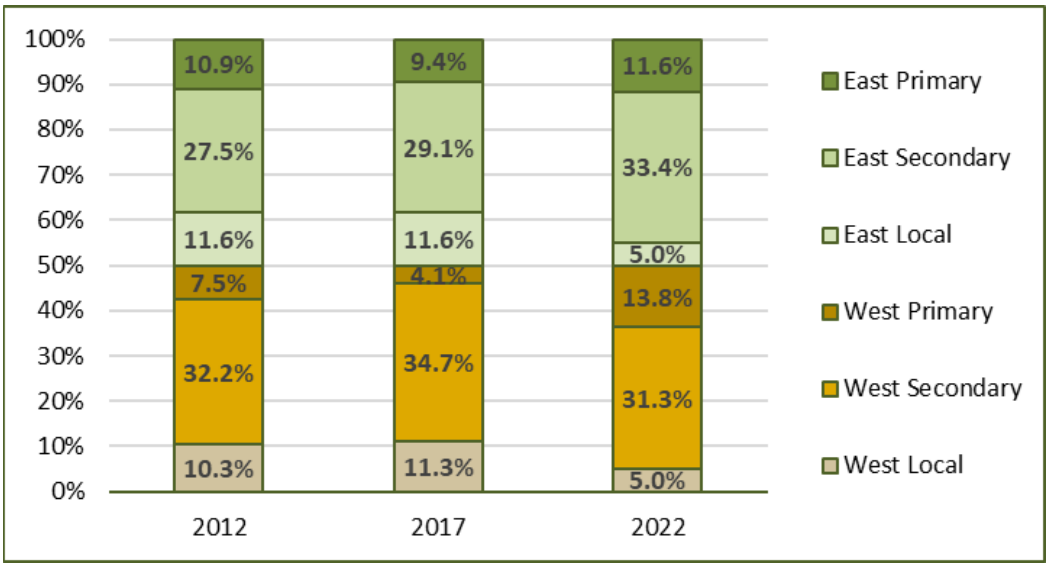


Figure 17: Percent of 320 Survey Sites by Road Type, 2012, 2017, and 2022

Figure 18 shows vehicle occupants traveling primary roadways in 2022 were belted at a higher rate (87.4%) than occupants on secondary (85%) and local roads (76.3%). Primary roadway occupants used seat belts at rates from 85.7% to 90.8% within the five-year time frame. Belt use by occupants on local roads has been trending down since the high of 82.2% in 2019 to this years' 76.3% use rate. By contrast, belt use by occupants on secondary roads has been trending up, from 71.7% in 2018 to 85% in the current survey.

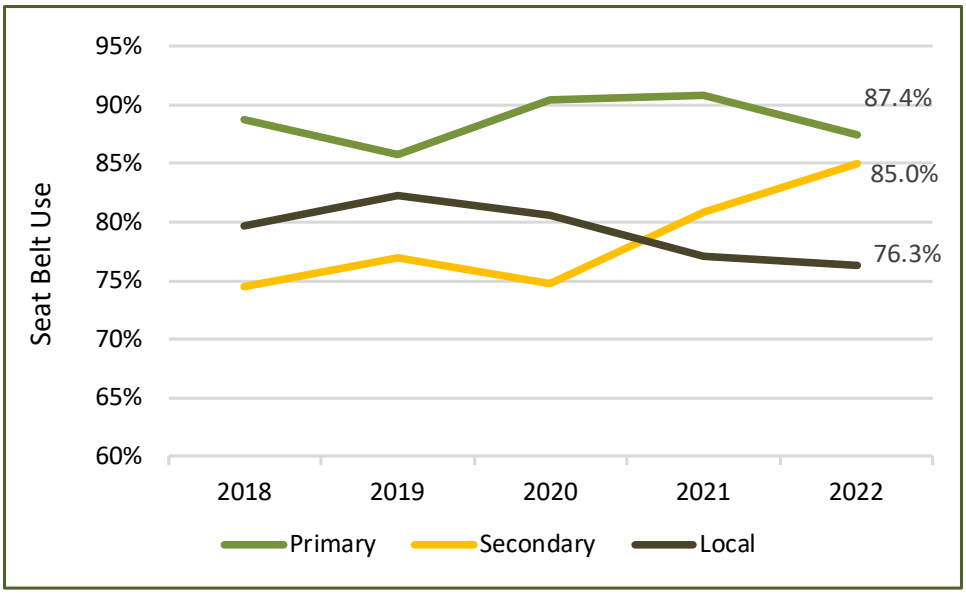


Figure 18: Percent Belted by Road Type, Annual, Unweighted

Annual rates stratified by region and road type over a five-year period are identified in Table 13. Restraint use on primary roads in the east region ranges from 86.2% to 89.9%, while corresponding roads in the west region range from 83.6% to 92.7%. Use on secondary roads ranges from 72.6% to 80.5% in the east and 71.5% and 87.6% in the west. Occupants traveling local roads were belted at rates from 80.4% to 86.0% and 66.3% to 79.0% the east and west regions, respectively. Generally, higher rates of use have been observed on primary and secondary roads in the west compared to the east. Local roads in the east tend to have higher rates of use than those in the west.

Table 13: Percent Belted by Region and Road Type, Unweighted

EAST	2017	2018	2019	2020	2021	2022
Primary	86.3%	89.5%	86.2%	89.7%	89.9%	84.1%
Secondary	72.6%	74.8%	75.7%	77.0%	77.7%	80.5%
Local	80.4%	83.1%	86.0%	82.6%	80.4%	83.3%
WEST	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**
Primary	86.0%	86.4%	83.6%	92.2%	92.7%	89.8%
Secondary	71.5%	74.3%	77.3%	74.0%	82.0%	87.6%
Local	76.3%	76.3%	78.6%	79.0%	73.6%	66.3%
TOTAL	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**
Primary	86.2%	88.8%	85.7%	90.4%	90.8%	87.4%
Secondary	71.7%	74.5%	76.9%	74.8%	80.8%	85.0%
Local	78.2%	79.7%	82.2%	80.6%	77.0%	76.3%

When balancing the year-to-year variability of rates in each road type (Figure 19), little difference is seen between the time periods on most road types in the two regions. The most notable change came from secondary roads in the west, increasing 6 percentage points over the two time periods. Conversely, local

roads in the west saw a decrease of 7 percentage points. Regionally the east and west averages are relatively uniform on primary and secondary roads in both periods.

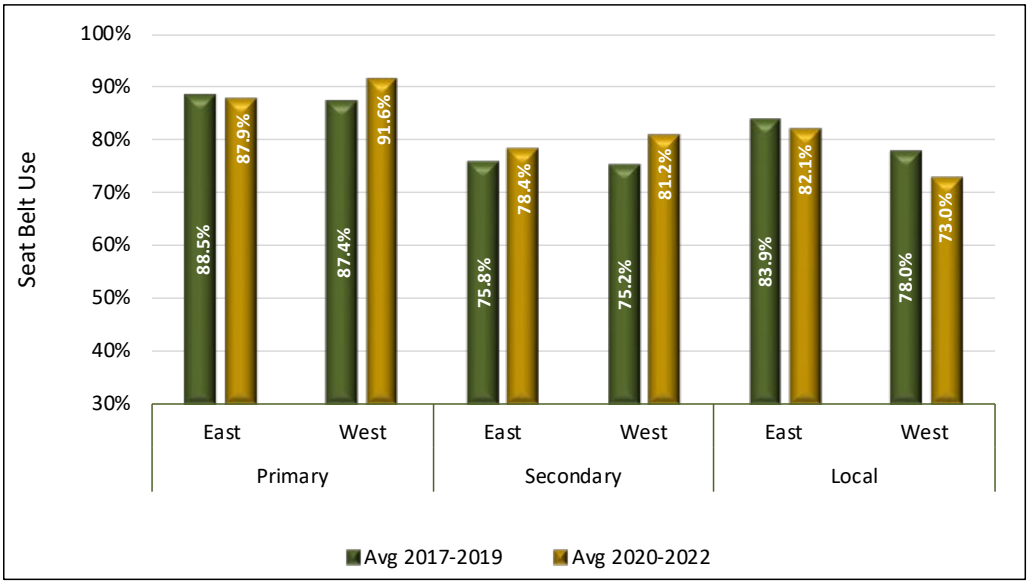


Figure 19: Seat Belt Use by Roadway Type, Three-Year Averages, Unweighted

Additional insight is found in delineating restraint use by road type and metropolitan statistical areas (MSA). MSA counties are defined as a core area consisting of a larger population nucleus and adjacent communities with high economic and social involvement (U.S. Census Bureau). The designated MSA counties in the North Dakota observational seat belt survey are Burleigh, Morton, Cass, and Grand Forks.

The data shown in Figure 20 are unweighted and do not account for the allocation of sites by road type in the two categories. Analysis shows restraint use in MSA counties on secondary roads (85.3%) similarly compared with the same road type in non-MSA counties (84.4%). Vehicle occupants in non-MSA counties were buckled up at a rate of 87.9% on primary roads compared with MSA counties at 85.6%. Occupants on local roads in MSA counties were restrained at the lowest rate (76.3%). Local road sites were outside the sampling frame in non-MSA counties, so a comparison of that road type is not available.

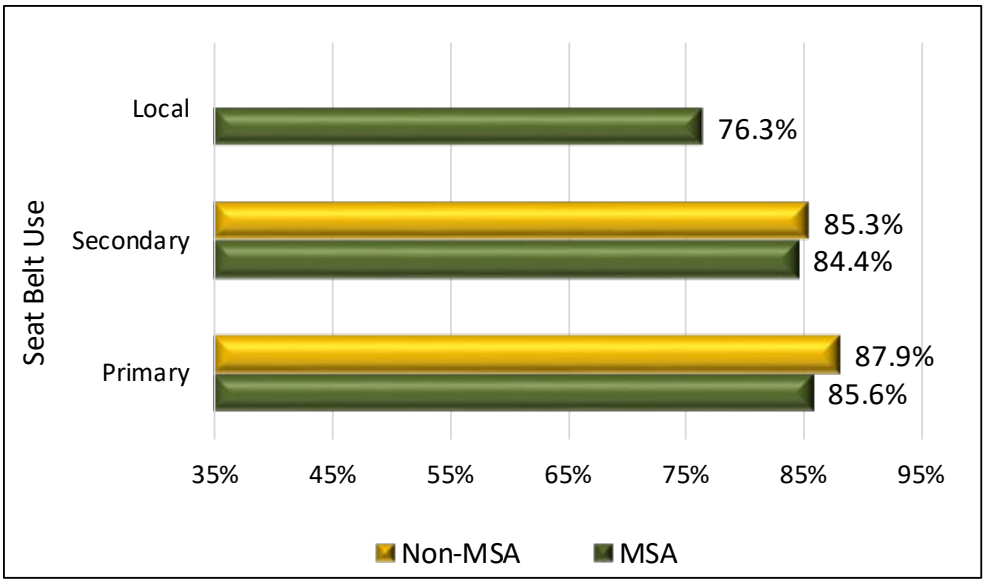


Figure 20: Percent Belted by Road Type & Metropolitan Statistical Areas, 2022, Unweighted

Sample size and restraint use by MSA designation, road type, and region are shown in Table 14. Vehicle observations from primary roads were predominantly collected in non-MSA counties in the west (27%) compared with the east (20.4%). Survey data indicated the rate of belted occupants on primary road segments in non-MSA counties was 82.6% in the east and 92% in the west. Primary roads in MSA counties were observed to have rates of 90.2% and 83.1% in the east and west, respectively.

Secondary roads in non-MSA western counties represented 17.2% of the sample, compared with the east (7.8%). Noting the disparate size of the sample between regions, the rates were lower in the east at 75.8% than in the west at 89.6%. Vehicle occupants on secondary roads in MSA counties were observed to have lower rates of use in the west at 81.9% than in the east 87.2%, by 6% and 5.4% of the sample, respectively.

As mentioned previously, observations were collected on local roads in MSA counties only per NHTSA protocol guidance. The sample size by region was similar (approximately 1.4%) with much higher use rates in the east than the west, at 83.3% and 66.3%, respectively.

Table 14: Seat Belt Use by Region and MSA Designations

Occupants Observed		East		West	
Road Type	**MSA**	**Sample**	**Belted**	**Sample**	**Belted**
Primary	**MSA**	765	90.2%	1381	83.1%
	non-MSA	3230	82.6%	4277	92.0%
Secondary	**MSA**	860	87.2%	949	81.9%
	non-MSA	1236	75.8%	2722	89.6%
Local	**MSA**	258	83.3%	181	66.3%
	non-MSA	n.a.	n.a.	n.a.	n.a.

FIELD SURVEY PROTOCOL

Table 15: Summary of the Seat Belt Use Survey

Methodology	Multistage stratified cluster design with probability proportional to size sampling
Source of Samples	NHTSA supplied FARS, VMT, and road segment data
Geographic Coverage	State of North Dakota
Identified Regions	East West
Selected Counties	East Region: Barnes, Benson, Cass, Grand Forks, Richland, Rolette, Stutsman, Walsh West Region: Burleigh, McKenzie, McLean, Morton, Mountrail, Stark, Ward, Williams
Number of Sites	320
Survey Period	June 5-11, 2022
Observation Duration Per Site	60 minutes
Sample Size	15,859 vehicle occupants (includes all vehicles where either the driver or passenger or both had a known protection status)

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 with 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 standard error for the state seat belt use was calculated to be 0.0003% using SAS statistical software. From this, a 95% confidence interval for state seat belt use can be determined. The 95% confidence interval means that, statistically, there is only a 5% chance the actual statewide seat belt percentage falls outside the 80.5% to 80.7% range.

Table 16: Confidence Interval

95% Confidence Interval and Estimated Standard Error for 2021 State Seat Belt Use				
Occupants	**State Rate**	**Standard Error**	**95% CI Lower Limit**	**95% CI Upper Limit**
15,859	80.59%	0.0003%	80.52%	80.67%

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 2022 survey, 13,541 drivers and 2,318 passengers were observed for a total of 15,859 vehicle occupants. Seat belt use could not be determined for 696 vehicle occupants, resulting in a nonresponse rate of 4.2%. As stipulated in NHTSA's guidelines, the nonresponse rate did not exceed the allowable maximum of 10%, so no resampling was necessary.

Protocols

Observers

Observers contracted to conduct the 2022 statewide seat belt survey were required to complete online training. The training module covered survey methods, observer responsibilities, and instructions for operation of tablets for electronic data collection. Knowledge points required the trainee's correct responses in order to move forward in the module. Completion of training was verified by the survey administrator.

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

Observational Protocols

The observational protocols used in the 2022 study adhere to the uniform criteria as outlined in the Federal Register.

Observations were conducted Sunday through Saturday. The initial observation site day of the week and time of day were randomly chosen within each county. The remaining sites within each county were arranged sequentially through the survey week based on the first site. Observation route sequencing was aimed to minimize travel time and costs among the sample site locations. This predetermined order of daily observation sites was provided to each observer before the survey. A complete list of county observation sites is available in the survey certification documentation submitted to NHTSA. 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 the predetermined time slot, requiring a 60-minute observation period, which began at the start of the predetermined time slot—or the first five-minute interval after arrival at the site if the observer was delayed—and ended 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 observe, recording took place for

as long as possible and then stopped until the observer could catch up with observations. Some vehicles were, therefore, 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 record 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 approximate to the detour.

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 trucks. 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, 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

If traffic, observer safety, or construction issues were problematic, alternate sites were available through the project coordinator. Observer placement was managed according to site protocols. Intermittent problems relating to road construction and inclement weather did not seriously impede schedules, and hour-long observations were fulfilled as described in the protocol with on-time arrival at subsequent sites not seriously impacted. In accordance with the Federal Register, if scheduled observations were not carried out for any of the above reasons, a return visit would have been arranged the following week while adhering to the original prescribed schedule for data collection.

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 or emails were made to first-time 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 was required that quality control personnel visit any new observers during their initial observation day to assure protocol compliance and verify safe observation practices.

CONCLUSION

Uniform Criteria published in 2011 guided the development of methodology used for seat belt surveys in North Dakota from 2012 through 2016. This methodology changed the focus from population-based criterion to traffic-crash-related fatality data for county sampling. The federal criteria mandated a reselection of observation sites at five-year intervals. This reselection requirement was carried out in 2017, and again in 2022 without further modifications to the survey design.

For the 2022 statewide survey, observers recorded seat belt use for 13,541 drivers and 2,318 right front-seat passengers, for a total of 15,859 vehicle occupants. The unweighted estimates of seat belt use were 85.8% for drivers, 88.2% for passengers, and 86.3% overall. Adjusting the raw state rate for the survey design and weights resulted in an overall weighted state rate of 80.6%, which is the generalizable seat belt use rate for the state. Rates by strata such as gender, vehicle type, region, roadway, population density, and distraction are unweighted due to the sample design.

North Dakota's weighted seat belt rate of 80.6% falls below the national estimate of 90.4% according to the most recent NHTSA report (December, 2021). The gap is less disparate when compared to states with similar seat belt laws (secondary) where NHTSA reports a restraint use rate of 88% (2021). In general, the findings in the 2022 North Dakota statewide survey are consistent with the findings of previous surveys. 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).

APPENDICES

Appendix A: Survey Methodology

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, 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. 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. This methodology was used for surveys from 2012 to 2016. The federal rule directs states to update sampling frame data every five years to ensure accurate fatality distribution as well as a representative inventory of road segments. Accordingly, in 2022 a review of fatalities over the five-year period 2015 to 2019 was performed, resulting in changes in county involvement and a complete reselection of sites.

It was determined that 23 counties accounted for at least 85% of North Dakota's total crash-related fatalities from 2015 to 2019. 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. If any of the 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: $\pi_{gc} = n_g v_{gc}/v_g$, where $n_g$is the PSU sample size for first stage stratum g that was allocated. First, each stratum 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. Seven certainty counties were identified in the west region: Burleigh, McKenzie, Morton, Mountrail, Stark, Ward, Williams. Barnes, Cass, Grand Forks, Stutsman, and Richland 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 their MTFCC class: 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.

Appendix B: Seat Belt Use Rates with Site and County Weights

Barnes County

June 2022

Site Rates with Weights					
Site	Site Weight	County Weight	Total Belted	Total Occupants	Seat Belt Rate
1	0.0315	1	155	216	71.8%
2	0.1544	1	92	96	95.8%
3	0.3103	1	335	353	94.9%
4	0.4374	1	18	19	94.7%
5	0.0096	1	48	67	71.6%
6	0.0305	1	16	26	61.5%
7	0.096	1	9	13	69.2%
8	0.1527	1	20	26	76.9%
9	0.2	1	2	4	50.0%
10	0.2373	1	1	2	50.0%
11	0.3607	1	13	15	86.7%
12	0.4046	1	46	60	76.7%
13	0.471	1	2	5	40.0%
14	0.5276	1	2	9	22.2%
15	0.5418	1	0	0	0.0%
16	0.5664	1	6	6	100.0%
17	0.6663	1	2	6	33.3%
18	0.6838	1	7	12	58.3%
19	0.7833	1	3	4	75.0%
20	0.8517	1	4	11	36.4%

Benson County

June 2022

Site Rates with Weights					
Site	Site Weight	County Weight	Total Belted	Total Occupants	Seat Belt Rate
1	0.1315	1.7632	104	114	91.2%
2	0.2243	1.7632	100	140	71.4%
3	0.3099	1.7632	126	137	92.0%
4	0.4874	1.7632	41	43	95.3%
5	0.5025	1.7632	99	113	87.6%
6	0.5652	1.7632	13	13	100.0%
7	0.9078	1.7632	11	13	84.6%
8	0.0134	1.7632	5	5	100.0%
9	0.1757	1.7632	14	17	82.4%
10	0.3378	1.7632	27	30	90.0%
11	0.3909	1.7632	14	15	93.3%
12	0.4455	1.7632	4	4	100.0%
13	0.4735	1.7632	0	0	0.0%
14	0.6077	1.7632	19	23	82.6%
15	0.7073	1.7632	27	29	93.1%
16	0.7377	1.7632	10	10	100.0%
17	0.7882	1.7632	17	18	94.4%
18	0.8982	1.7632	23	27	85.2%
19	1	1.7632	5	6	83.3%
20	1	1.7632	1	3	33.3%

Burleigh County

June 2022

Site Rates with Weights					
Site	Site Weight	County Weight	Total Belted	Total Occupants	Seat Belt Rate
1	0.0014	1	162	231	70.1%
2	0.0538	1	234	329	71.1%
3	0.2144	1	91	113	80.5%
4	0.0016	1	83	113	73.5%
5	0.0067	1	26	34	76.5%
6	0.0289	1	49	70	70.0%
7	0.1145	1	85	101	84.2%
8	0.1669	1	30	32	93.8%
9	0.2182	1	19	33	57.6%
10	0.2877	1	9	13	69.2%
11	0.0012	1	19	29	65.5%
12	0.0016	1	6	6	100.0%
13	0.0024	1	3	4	75.0%
14	0.0033	1	5	10	50.0%
15	0.0044	1	5	11	45.5%
16	0.0056	1	7	10	70.0%
17	0.0076	1	0	0	0.0%
18	0.0106	1	2	2	100.0%
19	0.0143	1	1	2	50.0%
20	0.0224	1	2	3	66.7%

Cass County

June 2022

Site Rates with Weights					
Site	Site Weight	County Weight	Total Belted	Total Occupants	Seat Belt Rate
1	0.0044	1	217	238	91.2%
2	0.0708	1	184	201	91.5%
3	0.0012	1	317	368	86.1%
4	0.0043	1	5	6	83.3%
5	0.0085	1	102	111	91.9%
6	0.0187	1	17	17	100.0%
7	0.0481	1	22	25	88.0%
8	0.0764	1	14	15	93.3%
9	0.1179	1	6	8	75.0%
10	0.1492	1	9	9	100.0%
11	0.3095	1	25	28	89.3%
12	0.0009	1	13	15	86.7%
13	0.0013	1	14	15	93.3%
14	0.0019	1	19	22	86.4%
15	0.0024	1	7	9	77.8%
16	0.003	1	3	3	100.0%
17	0.0037	1	2	4	50.0%
18	0.0048	1	2	2	100.0%
19	0.0064	1	2	3	66.7%
20	0.0097	1	5	7	71.4%

Grand Forks County

June 2022

Site Rates with Weights					
Site	Site Weight	County Weight	Total Belted	Total Occupants	Seat Belt Rate
1	0.034	1	69	74	93.2%
2	0.1204	1	97	108	89.8%
3	0.1912	1	123	144	85.4%
4	0.0033	1	28	33	84.8%
5	0.0119	1	51	59	86.4%
6	0.0492	1	2	7	28.6%
7	0.0928	1	58	64	90.6%
8	0.1245	1	15	18	83.3%
9	0.1613	1	1	2	50.0%
10	0.1943	1	52	58	89.7%
11	0.2495	1	5	9	55.6%
12	0.2923	1	10	11	90.9%
13	0.3503	1	11	12	91.7%
14	0.0015	1	3	4	75.0%
15	0.002	1	7	9	77.8%
16	0.0028	1	7	8	87.5%
17	0.0043	1	81	97	83.5%
18	0.0072	1	4	7	57.1%
19	0.0164	1	44	51	86.3%
20	0.2908	1	2	2	100.0%

McKenzie County

June 2022

Site Rates with Weights					
Site	Site Weight	County Weight	Total Belted	Total Occupants	Seat Belt Rate
1	0.089	1	107	118	90.7%
2	0.1815	1	90	90	100.0%
3	0.2116	1	77	78	98.7%
4	0.277	1	121	123	98.4%
5	0.3163	1	53	54	98.1%
6	0.4081	1	86	90	95.6%
7	0.0394	1	9	9	100.0%
8	0.0862	1	15	15	100.0%
9	0.1185	1	14	16	87.5%
10	0.144	1	10	10	100.0%
11	0.1925	1	7	8	87.5%
12	0.2702	1	1	2	50.0%
13	0.2944	1	30	30	100.0%
14	0.331	1	9	10	90.0%
15	0.3627	1	17	19	89.5%
16	0.3892	1	27	28	96.4%
17	0.4357	1	5	5	100.0%
18	0.5658	1	76	77	98.7%
19	0.5808	1	36	36	100.0%
20	0.7741	1	3	3	100.0%

McLean County

June 2022

Site Rates with Weights					
Site	Site Weight	County Weight	Total Belted	Total Occupants	Seat Belt Rate
1	0.097	2.9149	119	166	71.7%
2	0.2506	2.9149	148	187	79.1%
3	0.3278	2.9149	26	41	63.4%
4	0.3426	2.9149	177	210	84.3%
5	0.0127	2.9149	9	12	75.0%
6	0.0509	2.9149	2	3	66.7%
7	0.1432	2.9149	42	52	80.8%
8	0.1635	2.9149	8	12	66.7%
9	0.1938	2.9149	10	13	76.9%
10	0.2534	2.9149	7	7	100.0%
11	0.2953	2.9149	81	108	75.0%
12	0.3293	2.9149	3	3	100.0%
13	0.3457	2.9149	18	27	66.7%
14	0.4809	2.9149	6	9	66.7%
15	0.5341	2.9149	23	28	82.1%
16	0.5872	2.9149	22	30	73.3%
17	0.6033	2.9149	35	51	68.6%
18	0.6156	2.9149	6	8	75.0%
19	0.6657	2.9149	22	33	66.7%
20	0.8153	2.9149	5	6	83.3%

Morton County

June 2022

Site Rates with Weights					
Site	Site Weight	County Weight	Total Belted	Total Occupants	Seat Belt Rate
1	0.0347	1	445	469	94.9%
2	0.1416	1	91	93	97.8%
3	0.2095	1	11	12	91.7%
4	0.2622	1	24	25	96.0%
5	0.3383	1	42	50	84.0%
6	0.6282	1	48	59	81.4%
7	0.0032	1	108	146	74.0%
8	0.018	1	37	41	90.2%
9	0.0724	1	11	16	68.8%
10	0.1587	1	16	18	88.9%
11	0.2447	1	5	5	100.0%
12	0.2969	1	21	24	87.5%
13	0.3646	1	71	81	87.7%
14	0.511	1	207	222	93.2%
15	0.0022	1	19	26	73.1%
16	0.0034	1	31	52	59.6%
17	0.0042	1	13	16	81.3%
18	0.0076	1	2	2	100.0%
19	0.0129	1	0	0	0.0%
20	0.0411	1	5	6	83.3%

Mountrail County

June 2022

Site Rates with Weights					
Site	Site Weight	County Weight	Total Belted	Total Occupants	Seat Belt Rate
1	0.0996	1	115	124	92.7%
2	0.2029	1	49	56	87.5%
3	0.4097	1	104	115	90.4%
4	0.6613	1	128	145	88.3%
5	1	1	84	91	92.3%
6	0.0224	1	1	1	100.0%
7	0.0674	1	63	82	76.8%
8	0.1144	1	9	13	69.2%
9	0.1904	1	5	5	100.0%
10	0.3108	1	1	2	50.0%
11	0.3977	1	9	11	81.8%
12	0.4661	1	11	13	84.6%
13	0.4776	1	18	23	78.3%
14	0.5123	1	20	23	87.0%
15	0.519	1	14	15	93.3%
16	0.5942	1	3	3	100.0%
17	0.6669	1	10	12	83.3%
18	0.798	1	8	9	88.9%
19	1	1	26	30	86.7%
20	1	1	42	45	93.3%

Richland County

June 2022

Site Rates with Weights					
Site	Site Weight	County Weight	Total Belted	Total Occupants	Seat Belt Rate
1	0.0392	1	38	46	82.6%
2	0.2359	1	101	110	91.8%
3	0.3304	1	154	175	88.0%
4	0.4269	1	45	52	86.5%
5	0.5612	1	79	81	97.5%
6	0.0261	1	17	18	94.4%
7	0.0554	1	32	40	80.0%
8	0.1092	1	5	6	83.3%
9	0.1973	1	4	6	66.7%
10	0.2459	1	3	3	100.0%
11	0.2914	1	2	2	100.0%
12	0.3098	1	17	20	85.0%
13	0.3408	1	2	3	66.7%
14	0.3645	1	15	15	100.0%
15	0.4484	1	7	7	100.0%
16	0.4896	1	12	20	60.0%
17	0.5399	1	62	71	87.3%
18	0.5872	1	2	3	66.7%
19	0.6114	1	13	16	81.3%
20	0.733	1	8	9	88.9%

Rolette County

June 2022

Site Rates with Weights					
Site	Site Weight	County Weight	Total Belted	Total Occupants	Seat Belt Rate
1	0.1185	1.6889	104	141	73.8%
2	0.3314	1.6889	87	127	68.5%
3	0.3889	1.6889	41	42	97.6%
4	0.5615	1.6889	32	43	74.4%
5	0.693	1.6889	36	43	83.7%
6	0.7821	1.6889	53	57	93.0%
7	0.8344	1.6889	14	15	93.3%
8	0.0888	1.6889	13	18	72.2%
9	0.1848	1.6889	25	34	73.5%
10	0.4871	1.6889	35	43	81.4%
11	0.539	1.6889	8	9	88.9%
12	0.5729	1.6889	12	15	80.0%
13	0.6209	1.6889	9	10	90.0%
14	0.6433	1.6889	12	13	92.3%
15	0.8507	1.6889	11	18	61.1%
16	1	1.6889	34	42	81.0%
17	1	1.6889	22	24	91.7%
18	1	1.6889	10	18	55.6%
19	1	1.6889	4	7	57.1%
20	1	1.6889	17	21	81.0%

Stark County

June 2022

Site Rates with Weights					
Site	Site Weight	County Weight	Total Belted	Total Occupants	Seat Belt Rate
1	0.0175	1	56	56	100.0%
2	0.1184	1	220	221	99.5%
3	0.3913	1	227	232	97.8%
4	0.4142	1	164	166	98.8%
5	0.5613	1	190	191	99.5%
6	0.7094	1	66	69	95.7%
7	0.868	1	276	277	99.6%
8	1	1	28	28	100.0%
9	0.0048	1	86	88	97.7%
10	0.0115	1	143	143	100.0%
11	0.0267	1	45	46	97.8%
12	0.0441	1	57	59	96.6%
13	0.0678	1	16	17	94.1%
14	0.1355	1	12	16	75.0%
15	0.2867	1	120	121	99.2%
16	0.313	1	20	20	100.0%
17	0.4118	1	37	37	100.0%
18	0.5231	1	9	13	69.2%
19	0.5606	1	34	37	91.9%
20	1	1	14	15	93.3%

Stutsman County

June 2022

Site Rates with Weights					
Site	Site Weight	County Weight	Total Belted	Total Occupants	Seat Belt Rate
1	0.0157	1	245	401	61.1%
2	0.1363	1	55	78	70.5%
3	0.1863	1	103	117	88.0%
4	0.2294	1	186	207	89.9%
5	0.408	1	52	64	81.3%
6	0.0057	1	32	54	59.3%
7	0.0328	1	5	5	100.0%
8	0.0854	1	2	7	28.6%
9	0.1603	1	2	5	40.0%
10	0.231	1	6	9	66.7%
11	0.2771	1	3	7	42.9%
12	0.3171	1	7	10	70.0%
13	0.3231	1	5	8	62.5%
14	0.3596	1	2	4	50.0%
15	0.3895	1	4	7	57.1%
16	0.4483	1	3	4	75.0%
17	0.4813	1	13	21	61.9%
18	0.5211	1	3	7	42.9%
19	0.7603	1	4	8	50.0%
20	1	1	10	11	90.9%

Walsh County

June 2022

Site Rates with Weights					
Site	Site Weight	County Weight	Total Belted	Total Occupants	Seat Belt Rate
1	0.0719	1.0036	54	63	85.7%
2	0.331	1.0036	49	57	86.0%
3	0.4527	1.0036	29	35	82.9%
4	0.589	1.0036	18	19	94.7%
5	0.0362	1.0036	3	4	75.0%
6	0.1159	1.0036	2	5	40.0%
7	0.1679	1.0036	11	14	78.6%
8	0.1977	1.0036	1	1	100.0%
9	0.2533	1.0036	7	9	77.8%
10	0.2646	1.0036	3	4	75.0%
11	0.2936	1.0036	1	2	50.0%
12	0.3904	1.0036	6	7	85.7%
13	0.4168	1.0036	4	6	66.7%
14	0.4573	1.0036	3	3	100.0%
15	0.463	1.0036	0	0	0.0%
16	0.5193	1.0036	6	7	85.7%
17	0.5452	1.0036	11	13	84.6%
18	0.5854	1.0036	5	6	83.3%
19	0.6194	1.0036	4	7	57.1%
20	0.812	1.0036	9	10	90.0%

Ward County

June 2022

Site Rates with Weights					
Site	Site Weight	County Weight	Total Belted	Total Occupants	Seat Belt Rate
1	0.0182	1	200	250	80.0%
2	0.0572	1	43	49	87.8%
3	0.1439	1	47	55	85.5%
4	0.1928	1	213	240	88.8%
5	0.2193	1	62	65	95.4%
6	0.2865	1	69	75	92.0%
7	0.664	1	65	72	90.3%
8	0.0031	1	63	83	75.9%
9	0.009	1	88	108	81.5%
10	0.0177	1	56	60	93.3%
11	0.0351	1	59	70	84.3%
12	0.1004	1	13	14	92.9%
13	0.1582	1	10	12	83.3%
14	0.183	1	2	2	100.0%
15	0.2072	1	14	18	77.8%
16	0.2476	1	5	5	100.0%
17	0.323	1	26	27	96.3%
18	0.3563	1	15	19	78.9%
19	0.426	1	0	0	0.0%
20	0.5285	1	8	10	80.0%

Williams County

June 2022

Site Rates with Weights					
Site	Site Weight	County Weight	Total Belted	Total Occupants	Seat Belt Rate
1	0.0336	1	72	75	96.0%
2	0.1367	1	121	123	98.4%
3	0.2713	1	131	133	98.5%
4	0.4071	1	142	152	93.4%
5	0.7217	1	57	60	95.0%
6	0.0101	1	150	158	94.9%
7	0.021	1	172	178	96.6%
8	0.0412	1	11	11	100.0%
9	0.0919	1	17	17	100.0%
10	0.1464	1	56	57	98.2%
11	0.178	1	17	17	100.0%
12	0.2649	1	79	89	88.8%
13	0.301	1	62	64	96.9%
14	0.3163	1	10	10	100.0%
15	0.3301	1	14	14	100.0%
16	0.3569	1	44	50	88.0%
17	0.3871	1	10	11	90.9%
18	0.6286	1	9	10	90.0%
19	1	1	33	33	100.0%
20	1	1	6	6	100.0%

Appendix C: Site Locations

BARNES COUNTY

Site	Route ID	Longitude	Latitude	Direction	Segment Length
1	S94E000B290.803_01	-98.001573	46.923356	E	0.66
2	I94E000M	-97.976604	46.916792	W	3.22
3	I94E000M	-97.755319	46.919173	W	6.46
4	S1N000M	-98.192467	47.000940	E	9.11
5	L21_003M	-98.007044	46.907442	E	0.20
6	L22_003M	-98.009255	46.928781	W	0.65
7	L1_003M	-98.227656	46.921058	W	2.03
8	L52_003M	-98.027490	46.964941	N	3.24
9	L53_003M	-97.913157	46.949728	N	4.24
10	L4_003M	-98.139334	47.066830	S	5.03
11	L50_003M	-98.404169	47.040242	N	7.64
12	S32N000M	-97.749629	46.630080	N	8.57
13	S26E000M	-98.106735	47.183027	W	9.98
14	L53_003M	-97.896754	47.115817	E	11.18
15	L2_003M	-98.325851	47.182697	S	11.48
16	L1_003M	-98.228244	46.747054	E	12.00
17	L58_003M	-97.854463	47.153125	N	14.11
18	L10_003M	-97.986973	46.789883	E	14.49
19	S9E000M	-98.322587	47.095655	S	16.59
20	L8_003M	-98.333335	46.761865	N	18.04

BENSON COUNTY

Site	Route ID	Longitude	Latitude	Direction	Segment Length
1	U2E000M	-99.452774	48.289837	E	1.62
2	S57E000M	-98.903063	48.008047	W	2.77
3	U2E000M	-99.391782	48.284500	E	3.82
4	U281N000M	-99.200310	48.326480	E	6.01
5	U2E000M	-99.285471	48.277595	W	6.20
6	U281N000M	-99.177981	47.978072	E	6.97
7	U281N000M	-99.286842	48.145034	N	11.20
8	L52_005M	-99.210179	47.919630	E	0.15
9	L357_005M	-98.716572	47.932993	S	1.95
10	S19E000M	-99.807994	48.035931	W	3.76
11	S30N000M	-99.533623	47.871251	N	4.35
12	L52_005M	-99.265166	47.919418	W	4.96
13	L351_005M	-99.438349	48.332787	W	5.27
14	S30N000M	-99.529456	48.017703	N	6.76
15	S19E000M	-99.203007	48.115138	S	7.87
16	S19E000M	-99.349411	48.064496	N	8.21
17	S20N000M	-98.824152	47.993308	N	8.77
18	S20N000M	-98.763589	47.919986	E	9.99
19	L346_005M	-99.769576	47.934285	W	12.07
20	S30N000M	-99.538481	48.183763	S	17.25

BURLEIGH COUNTY

Site	Route ID	Longitude	Latitude	Direction	Segment Length
1	L1700_015M	-100.793810	46.844838	N	0.05
2	I94E000M	-100.751727	46.831262	E	2.02
3	U83N000M	-100.792082	47.099148	W	8.05
4	L362_015M	-100.768588	46.816477	E	0.07
5	L1674_015M	-100.776775	46.860165	S	0.30
6	L1734_015M	-100.776721	46.765698	S	1.28
7	S1804N000M	-100.818664	46.881484	S	5.06
8	S1804N000M	-100.896789	46.941848	S	7.37
9	S14N000M	-100.287488	46.906113	E	9.64
10	S1804N000M	-100.897190	47.076852	N	12.72
11	L839_015M	-100.789160	46.827743	N	0.05
12	L938_015M	-100.783695	46.814007	S	0.07
13	L713_015M	-100.778806	46.829623	S	0.11
14	L653_015M	-100.761197	46.825573	E	0.15
15	L758_015M	-100.775610	46.784210	W	0.20
16	L659_015M	-100.758705	46.811001	E	0.25
17	L525_015M	-100.749708	46.877545	N	0.34
18	L20253_015M	-100.753112	46.877497	W	0.48
19	L491_015M	-100.661679	46.805241	E	0.64
20	L539_015M	-100.698517	46.889034	W	1.01

CASS COUNTY

Site	Route ID	Longitude	Latitude	Direction	Segment Length
1	I94E000M	-97.680534	46.917501	W	0.26
2	I29N000M	-96.993410	47.211031	E	4.16
3	L1899_017M	-96.800443	46.883187	N	0.07
4	L1874_017M	-97.010980	46.889475	E	0.27
5	L1887_017M	-96.866669	46.905927	S	0.53
6	L1876_017M	-96.882946	46.984291	S	1.16
7	L1877_017M	-96.830338	46.745729	E	3.00
8	L1878_017M	-96.904815	46.664760	W	4.76
9	L1864_017M	-97.556017	46.820480	N	7.35
10	L1875_017M	-97.458005	46.774549	W	9.31
11	L1865_017M	-97.182396	47.151682	N	19.30
12	L800_017M	-96.799654	46.886338	N	0.06
13	L717_017M	-96.790499	46.854971	S	0.09
14	L956_017M	-96.829100	46.793308	S	0.13
15	L461_017M	-96.816299	46.826439	S	0.16
16	L500_017M	-96.803944	46.835979	W	0.21
17	L1033_017M	-96.911943	46.872177	S	0.25
18	L1702_017M	-96.901649	46.820808	E	0.33
19	L402_017M	-96.800467	46.962697	W	0.43
20	L517_017M	-96.804848	46.919280	S	0.66

GRAND FORKS COUNTY

Site	Route ID	Longitude	Latitude	Direction	Segment Length
1	I29N000M	-97.109230	48.006577	N	1.23
2	I29N000M	-97.184810	48.103489	S	4.34
3	U2E000M	-97.313402	47.933068	W	6.89
4	L881_035M	-97.034595	47.921284	S	0.13
5	L844_035M	-97.148199	47.889517	E	0.48
6	L840_035M	-97.602584	47.918276	W	1.97
7	L851_035M	-97.045285	47.820897	S	3.72
8	S18N000M	-97.452933	47.708229	N	4.99
9	L833_035M	-97.725478	48.151350	S	6.47
10	S15E000M	-97.303215	47.759322	S	7.79
11	L852_035M	-97.217480	47.672153	E	10.00
12	L846_035M	-97.365914	47.829634	N	11.72
13	S15E000M	-97.731730	47.744722	E	14.04
14	L302_035M	-97.032565	47.887297	N	0.05
15	L421_035M	-97.050237	47.936092	E	0.07
16	L411_035M	-97.030758	47.886758	W	0.10
17	L619_035M	-97.109559	47.919949	S	0.15
18	L83_035M	-97.581052	47.739014	E	0.25
19	L19_035M	-97.174831	47.938739	N	0.57
20	L97_035M	-97.752285	48.078563	E	10.06

MCKENZIE COUNTY

Site	Route ID	Longitude	Latitude	Direction	Segment Length
1	U85N000M	-103.283069	47.751105	E	2.03
2	U85N000M	-103.251589	47.582675	N	4.14
3	U85N000M	-103.324145	47.767038	W	4.83
4	U85N000M	-103.558751	47.804964	S	6.33
5	S23E000M	-102.941498	47.855543	N	7.22
6	S23E000M	-102.685267	47.973028	S	9.32
7	L794_053M	-103.454924	47.697486	S	0.98
8	S68E000M	-103.819878	47.673926	S	2.14
9	L794_053M	-103.369039	47.723861	W	2.94
10	L794_053M	-103.412036	47.703537	N	3.57
11	L741_053M	-104.019134	47.613915	E	4.78
12	L752_053M	-103.926489	47.575595	W	6.71
13	S73E000M	-102.863840	47.804085	N	7.31
14	S1806N000M	-102.876511	48.019793	S	8.22
15	L744_053M	-103.036902	47.905402	S	9.00
16	S200E000M	-103.938560	47.859186	S	9.66
17	L755_053M	-103.352520	47.419879	W	10.82
18	S22N000M	-102.731799	47.882835	W	14.05
19	S1806N000M	-103.197863	47.905668	N	14.42
20	S16N000M	-103.859299	47.568882	N	19.22

MCLEAN COUNTY

Site	Route ID	Longitude	Latitude	Direction	Segment Length
1	U83N000M	-101.262554	47.598130	W	2.29
2	U83N000M	-100.955403	47.241780	E	5.91
3	S200E000M	-100.798454	47.487221	S	7.73
4	U83N000M	-101.079144	47.352039	N	8.08
5	S53E000M	-101.279470	47.819165	E	0.25
6	L695_055M	-101.079060	47.841061	E	1.00
7	S48N000M	-101.227701	47.522373	N	2.83
8	L159_055M	-101.129274	47.371535	S	3.23
9	S53E000M	-100.617383	47.831157	S	3.83
10	L691_055M	-101.850489	47.710286	E	5.00
11	S37E000M	-101.354029	47.646925	N	5.83
12	L691_055M	-101.807771	47.793354	E	6.50
13	S1804N000M	-101.747802	47.646417	E	6.82
14	L899_055M	-100.912060	47.287532	S	9.49
15	S200E000A157.781_01	-101.035606	47.382003	W	10.54
16	S41N000M	-100.715832	47.407427	E	11.59
17	S37E000M	-101.551816	47.647176	N	11.91
18	S53E000M	-100.800482	47.830246	S	12.15
19	S41N000M	-100.907761	47.609922	N	13.14
20	S53E000M	-101.101885	47.819382	E	16.09

MORTON COUNTY

Site	Route ID	Longitude	Latitude	Direction	Segment Length
1	I94E000M	-100.848113	46.822633	W	0.81
2	S21E000M	-101.269176	46.443875	E	3.32
3	I94E000M	-101.624468	46.860513	S	4.92
4	S6N000M	-100.921068	46.429833	W	6.16
5	S6N000M	-100.903007	46.523781	N	7.94
6	S6N000M	-100.901892	46.682245	S	14.75
7	L702_059M	-100.894311	46.826329	E	0.08
8	S94E000B147.183_02	-100.833472	46.809641	E	0.43
9	L678_059M	-101.394664	46.821702	S	1.71
10	L670_059M	-101.472150	46.847516	W	3.74
11	L679_059M	-101.236812	46.501978	N	5.77
12	S49N000M	-101.865227	46.765818	N	7.00
13	S25N000M	-101.007368	46.923656	N	8.60
14	S1806N000M	-100.616762	46.595921	E	12.05
15	L263_059M	-101.828767	46.816730	N	0.05
16	L386_059M	-100.892827	46.829226	S	0.07
17	L605_059M	-101.410035	46.845686	E	0.09
18	L373_059M	-100.940181	46.861931	S	0.16
19	L378_059M	-100.941241	46.870260	N	0.28
20	L189_059M	-100.914912	46.888964	N	0.88

MOUNTRAIL COUNTY

Site	Route ID	Longitude	Latitude	Direction	Segment Length
1	U2E000M	-102.229307	48.327041	E	1.52
2	S23E000B248.391_01	-102.473174	47.992322	W	3.10
3	U2E000M	-102.469937	48.312507	N	6.26
4	U2E000M	-102.030222	48.326983	S	10.11
5	S23E000M	-102.069776	47.977901	S	18.47
6	L390_061M	-102.547966	48.318975	W	0.34
7	S37E000M	-102.128761	47.970587	W	1.01
8	L394_061M	-102.190846	48.032422	S	1.72
9	S1804N000M	-102.537237	48.030320	N	2.86
10	L388_061M	-102.636013	48.374357	E	4.67
11	L393_061M	-102.288966	48.153455	S	5.97
12	L389_061M	-102.320596	48.341667	S	7.00
13	L390_061M	-102.569157	48.262132	N	7.17
14	L390_061M	-102.557210	47.903237	E	7.69
15	S50E000M	-102.105367	48.546276	W	7.79
16	L388_061M	-102.646904	48.470616	W	8.92
17	S50E000M	-102.299236	48.546328	N	10.01
18	L393_061M	-102.482996	48.182397	N	11.98
19	S8N000M	-102.407915	48.436532	E	15.42
20	S1804N000M	-102.612457	48.119081	N	16.25

RICHLAND COUNTY

Site	Route ID	Longitude	Latitude	Direction	Segment Length
1	S127N000M	-96.616221	46.244440	W	0.66
2	I29N000M	-96.833817	46.166296	E	4.00
3	I29N000M	-96.835820	45.981224	W	5.60
4	S13E000M	-96.925073	46.261585	W	7.24
5	S13E000M	-96.734958	46.260901	S	9.51
6	L50_077M	-96.817608	46.572603	N	0.53
7	S11E000M	-96.898653	46.066095	W	1.13
8	L496_077M	-96.889887	46.051639	E	2.23
9	L51_077M	-96.653160	46.340096	N	4.03
10	L485_077M	-96.948813	46.593956	W	5.02
11	L50_077M	-97.010206	46.543291	S	5.95
12	S11E000M	-96.675342	46.051223	W	6.33
13	L484_077M	-97.008694	46.333262	E	6.96
14	S11E000M	-96.814089	46.051544	E	7.45
15	L491_077M	-96.765808	46.514595	E	9.16
16	S127N000M	-96.617732	46.007543	S	10.00
17	S127N000M	-96.616181	46.159791	S	11.03
18	L482_077M	-97.008942	46.470744	N	12.00
19	L491_077M	-96.736795	46.349708	W	12.49
20	S18N000M	-97.135020	46.521233	S	14.97

ROLETTE COUNTY

Site	Route ID	Longitude	Latitude	Direction	Segment Length
1	U281N000M	-99.778293	48.827066	S	1.06
2	U281N000M	-99.689669	48.849024	S	2.97
3	U281N000M	-99.563852	48.863138	N	3.49
4	U281N000M	-100.051483	48.856015	S	5.04
5	S3N000M	-100.051535	48.761620	S	6.22
6	S3N000M	-100.037140	48.595928	S	7.02
7	U281N000M	-100.051933	48.945474	N	7.49
8	L318_079M	-99.929027	48.834673	E	0.82
9	L320_079M	-99.723020	48.930148	W	1.71
10	L319_079M	-99.841797	48.699616	N	4.51
11	L322_079M	-100.091385	48.675238	N	4.99
12	S66E000M	-99.551322	48.631830	W	5.30
13	L323_079M	-99.623521	48.586556	S	5.75
14	S43E000M	-100.117371	48.950273	S	5.95
15	L316_079M	-99.743769	48.892072	E	7.87
16	S30N000M	-99.613934	48.724999	E	9.04
17	S66E000M	-99.944993	48.675590	S	9.06
18	L315_079M	-99.950706	48.950059	N	9.50
19	S30N000M	-99.657013	48.931278	W	9.98
20	S66E000M	-99.725388	48.660894	N	10.83

STARK COUNTY

Site	Route ID	Longitude	Latitude	Direction	Segment Length
1	S94E000B59.485_01	-102.750092	46.882231	W	0.22
2	I94E000M	-102.773864	46.895109	W	1.52
3	I94E000M	-102.570887	46.878276	W	5.01
4	I94E000M	-102.298765	46.869898	W	5.30
5	I94E000M	-102.445055	46.876978	E	7.19
6	U85N000M	-103.189943	46.695011	E	9.08
7	I94E000M	-103.115217	46.891076	W	11.11
8	S8N000M	-102.307372	46.751245	W	16.79
9	L716_089M	-102.768585	46.886921	W	0.07
10	L665_089M	-102.810434	46.870640	W	0.17
11	L719_089M	-102.747572	46.888079	E	0.40
12	L680_089M	-102.831907	46.897730	E	0.65
13	L661_089M	-102.894226	46.882917	S	1.00
14	L661_089M	-102.894225	46.861740	N	2.01
15	S22N000M	-102.789645	46.950171	N	4.25
16	S8N000M	-102.328616	46.916929	N	4.64
17	S22N000M	-102.789865	46.673544	N	6.10
18	S22N000B56.668_01	-102.841420	46.933986	N	7.75
19	L675_089M	-102.979920	46.876419	N	8.31
20	L658_089M	-102.560079	46.744638	S	16.00

STUTSMAN COUNTY

Site	Route ID	Longitude	Latitude	Direction	Segment Length
1	U52E000M	-98.708615	46.910298	W	0.35
2	U281N000M	-98.712845	46.855230	E	3.00
3	U52E000M	-98.811134	47.045120	W	4.10
4	I94E000M	-98.812266	46.892300	W	5.05
5	U281N000M	-98.712807	46.768424	W	8.99
6	L636_093M	-98.689020	46.884612	E	0.14
7	S9E000M	-98.832846	47.326912	E	0.81
8	L604_093M	-98.756140	46.921089	S	2.11
9	L598_093M	-99.143523	47.298130	E	3.97
10	L597_093M	-98.618746	47.167789	N	5.72
11	L607_093M	-98.640448	46.790613	E	6.86
12	S9E000M	-98.514958	47.167978	N	7.85
13	L611_093M	-98.481391	46.835320	W	8.00
14	S9E000M	-98.936271	47.326798	W	8.90
15	S46E000M	-99.243619	46.631085	N	9.64
16	L782_093M	-99.312601	47.063485	E	11.10
17	L599_093M	-99.133914	46.802154	E	11.91
18	S9E000M	-98.742314	47.276379	N	12.90
19	S36E000M	-99.111823	47.167537	S	18.82
20	S46E000M	-98.861547	46.630733	N	26.83

WALSH COUNTY

Site	Route ID	Longitude	Latitude	Direction	Segment Length
1	I29N000M	-97.190201	48.507392	N	1.10
2	I29N000M	-97.189965	48.375433	N	5.06
3	U81N000M	-97.405037	48.350613	S	6.92
4	S17E000M	-97.288402	48.412278	S	9.01
5	L413_099M	-97.517285	48.470548	S	0.63
6	L418_099M	-97.795369	48.238347	S	2.00
7	L416_099M	-97.415873	48.296320	S	2.91
8	L413_099M	-98.041835	48.485269	N	3.42
9	L416_099M	-97.505855	48.296132	S	4.38
10	L416_099M	-97.309817	48.295670	S	4.58
11	S35N000M	-98.122705	48.376223	E	5.08
12	L416_099M	-97.630590	48.310763	E	6.76
13	L417_099M	-97.258596	48.208446	N	7.21
14	L416_099M	-98.032538	48.310487	N	7.91
15	L415_099M	-97.552960	48.151020	E	8.01
16	S32N000M	-97.860565	48.260025	N	8.99
17	S17E000M	-97.962435	48.398330	S	9.43
18	S18N000M	-97.622727	48.470481	E	10.13
19	S17E000M	-98.201741	48.413005	E	10.72
20	S18N000M	-97.622451	48.296485	W	14.05

WARD COUNTY

Site	Route ID	Longitude	Latitude	Direction	Segment Length
1	U2E000B144.326_01	-101.265850	48.231566	W	0.50
2	U52E000M	-101.030859	48.085127	S	1.58
3	U52E000M	-102.046605	48.653083	N	3.97
4	U2E000M	-101.392699	48.243681	N	5.32
5	U52E000M	-101.535289	48.342212	N	6.05
6	U52E000M	-101.637357	48.405215	W	7.90
7	S23E000M	-101.486232	47.978481	W	18.31
8	L1260_101M	-101.322006	48.253905	W	0.09
9	L1260_101M	-101.317296	48.263702	W	0.25
10	L1260_101M	-101.318753	48.251426	N	0.50
11	L1241_101M	-101.263504	48.283416	N	0.99
12	S50E000M	-101.993358	48.547247	E	2.83
13	L7_101M	-101.508056	48.020689	N	4.46
14	L1238_101M	-101.868413	48.341758	S	5.16
15	L1244_101M	-101.708316	48.182463	W	5.84
16	L1232_101M	-101.807779	47.905341	S	6.98
17	L1248_101M	-101.057685	48.305700	N	9.11
18	L1249_101M	-101.403958	48.051927	S	10.05
19	L1244_101M	-101.515108	48.182142	E	12.01
20	S23E000M	-101.135067	47.978897	E	14.90

WILLIAMS COUNTY

Site	Route ID	Longitude	Latitude	Direction	Segment Length
1	U2E000B17.923_01	-103.635447	48.145196	N	0.74
2	U2E000M	-102.990661	48.341695	N	3.01
3	U2E000M	-103.088219	48.342348	N	5.98
4	U2E000M	-103.442363	48.342280	E	8.98
5	U85N000M	-103.624701	48.454740	E	15.91
6	L834_105M	-103.650776	48.168707	W	0.22
7	L824_105M	-103.626070	48.165380	W	0.55
8	L64_105M	-103.712216	48.219506	W	1.07
9	L822_105M	-102.929431	48.616024	S	2.39
10	L1016_105M	-103.582886	48.213693	E	3.80
11	S50E000M	-103.998989	48.619248	S	4.62
12	S1804N000M	-103.788185	48.091838	W	6.88
13	S1804N000M	-103.963762	48.002802	N	7.82
14	S50E000M	-103.567813	48.572113	W	8.22
15	L867_105M	-103.341987	48.404039	S	8.57
16	S40N000M	-102.929308	48.479353	W	9.27
17	L811_105M	-103.992342	48.069285	W	10.05
18	S50E000M	-103.092200	48.589927	W	16.32
19	S1804N000M	-103.251060	48.169331	W	23.41
20	L812_105M	-103.950223	48.430090	E	24.09

Appendix D: Roadway Classifications

Roadway Type Classifications

Code	Name	Definition
S1100	Primary Road	Primary roads are generally divided, limited-access highways within the interstate highway system or under state management, and are distinguished by the presence of interchanges. These highways are accessible by ramps and may include some toll highways.
S1200	Secondary Road	Secondary roads are main arteries, usually in the U.S. Highway, State Highway or County Highway system. These roads have one or more lanes of traffic in each direction, may or may not be divided, and usually have at-grade intersections with many other roads and driveways. They often have both a local name and a route number.
S1400	Local Neighborhood Road, Rural Road, City Street	Generally paved non-arterial streets, roads, or byways that usually have a single lane of traffic in each direction. Roads in this feature class may be privately or publicly maintained. Scenic park roads would be included in this feature class, as would (depending on the region of the country) some unpaved roads.