



MINNESOTA OBSERVATIONAL SEAT BELT USE STUDY:2021

Final Report



Contents

- Section 1
Executive Summary 3

- Section 2
Data Presentation 10

- Appendix A
Methodology 48

- Appendix B
Data Collection 59

- Appendix C
List of Road Segment Samples by Stratum 66

Section 1

EXECUTIVE SUMMARY: INTRODUCTION AND KEY FINDINGS



- > This study is the 2021 implementation of the National Highway Traffic Safety Administration's (NHTSA) Uniform Criteria for State Observational Surveys of Seat Belt Use (reported in Title 23: Highways, Part 1340 of the Code of Federal Regulations).
- > This study follows the same approach, and as therefore comparable with previous studies conducted with this approach. The study design was accepted by NHTSA on March 30, 2012, and the sites were approved by NHTSA on February 21, 2017.
- > While comparability is high with other studies, the same approach and data sites have been in use for the 2017, 2018, 2019, and 2021 studies. (COVID-19, a global pandemic, prohibited the collection of data in 2020.)
- > The objective of the report is to present a statewide estimate of seat belt use in the state of Minnesota by front-seat occupants (drivers and passengers),
- > Data on seat belt use are also presented by:
 - Age
 - Day of Week
 - Gender
 - Seating Position
 - Time of Day
 - Vehicle type
 - Weather Conditions

01

Overall seat belt use rate declined in 2021

Percent seat belt use declines in 2021 by 1.0 percent compared to seat belt usage rates in 2019 (92.4% vs 93.4%, 2021 vs 2019). This may be an effect of commuting pattern changes due to Covid-19.

02

The decline is due to changes in male seat belt use.

Ninety-five percent of observed female front seat occupants wore seat belts in both 2019 and 2021. Male front seat occupants seat belt usage rate declined 1.8% in 2021 (90.2%), which produced the overall decline.

03

Pickup truck occupants continue to have the lowest seat belt use rates among vehicle type (85.2% in 2021)

Pickup truck front seat occupant's percent seat belt use decreased from 2019 (-3.3% since 2019).

04

Passengers are more likely than drivers to wear seat belts
In 2021, there was a 3.6% difference between the percent seat belt use among passengers and drivers.

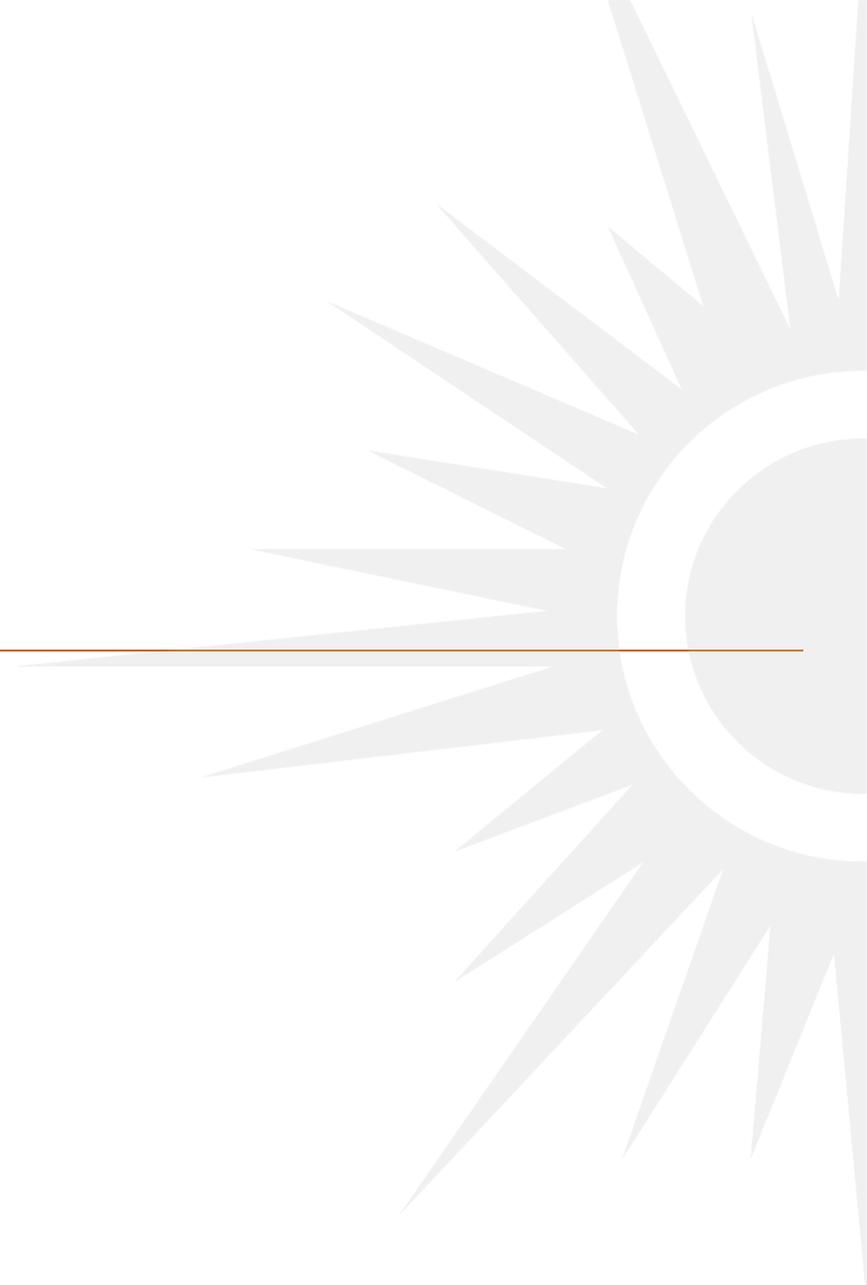
05

Young adults are least likely to wear seat belts

In 2021, vehicle occupants between the ages of 16 and 29 were the only age group below the overall average, at 91.2 percent. This follows a long-term historic pattern.

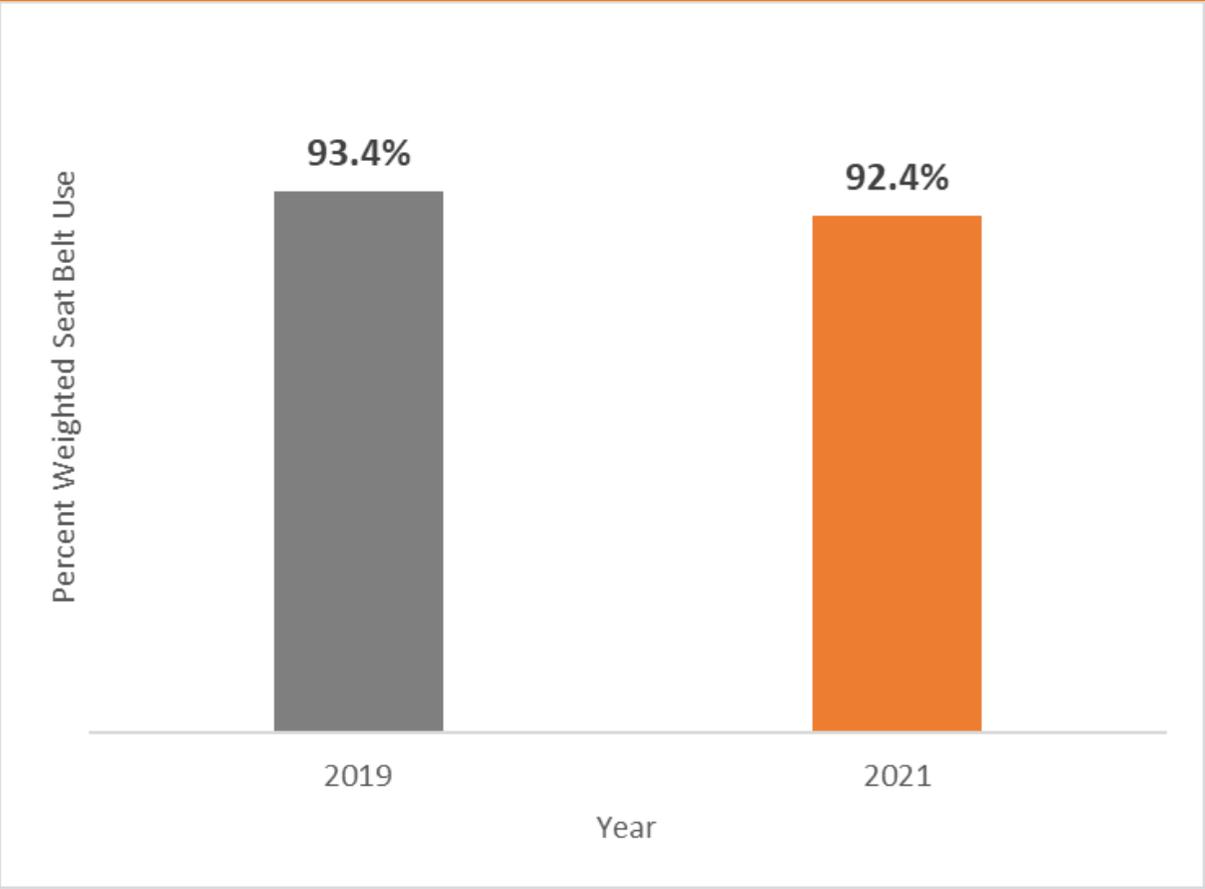
Section 2

DATA PRESENTATION



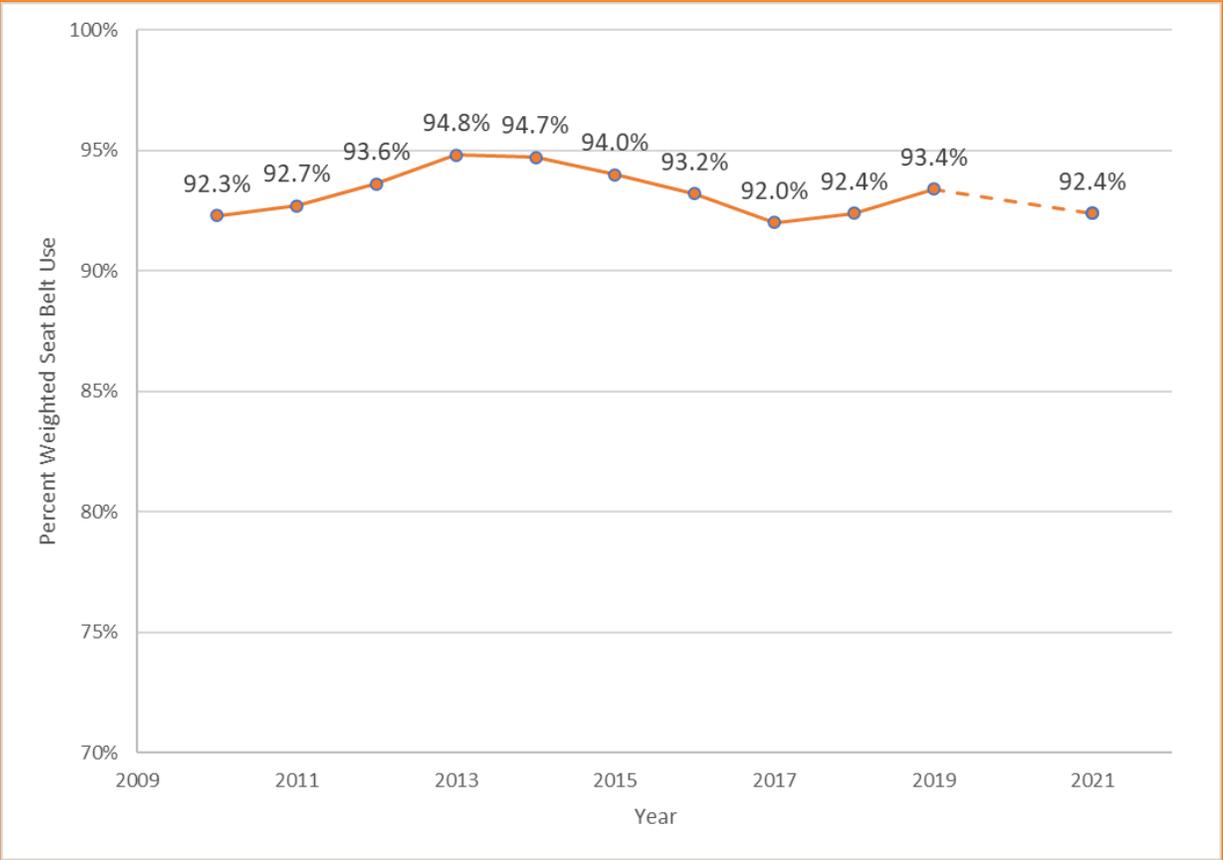
- > The 2021 Minnesota seat belt survey included 13,467 front seat occupant observations from 10,907 vehicles. The overall percent seat belt use was 92.4 percent ((standard error = 0.55 percent; 95 percent confidence interval is 91.3 to 93.5 percent). Though slightly lower than the 2019 estimate (93.4 percent; 95 percent confidence interval of 92.4 to 94.5), the difference is not statistically significant, and this weighted value is identical to the value for 2018 (92.4 percent; 95 percent confidence interval of 91.2 to 93.7 percent).).
- > The remainder of this section provides high-level summary data in graphic format. In the figures that are presented here, all percentages are based on weighted data that ensures that the collected raw data reflects overall state vehicular traffic.

Figure 1. Weighted Seat Belt Use: 2019 and 2021



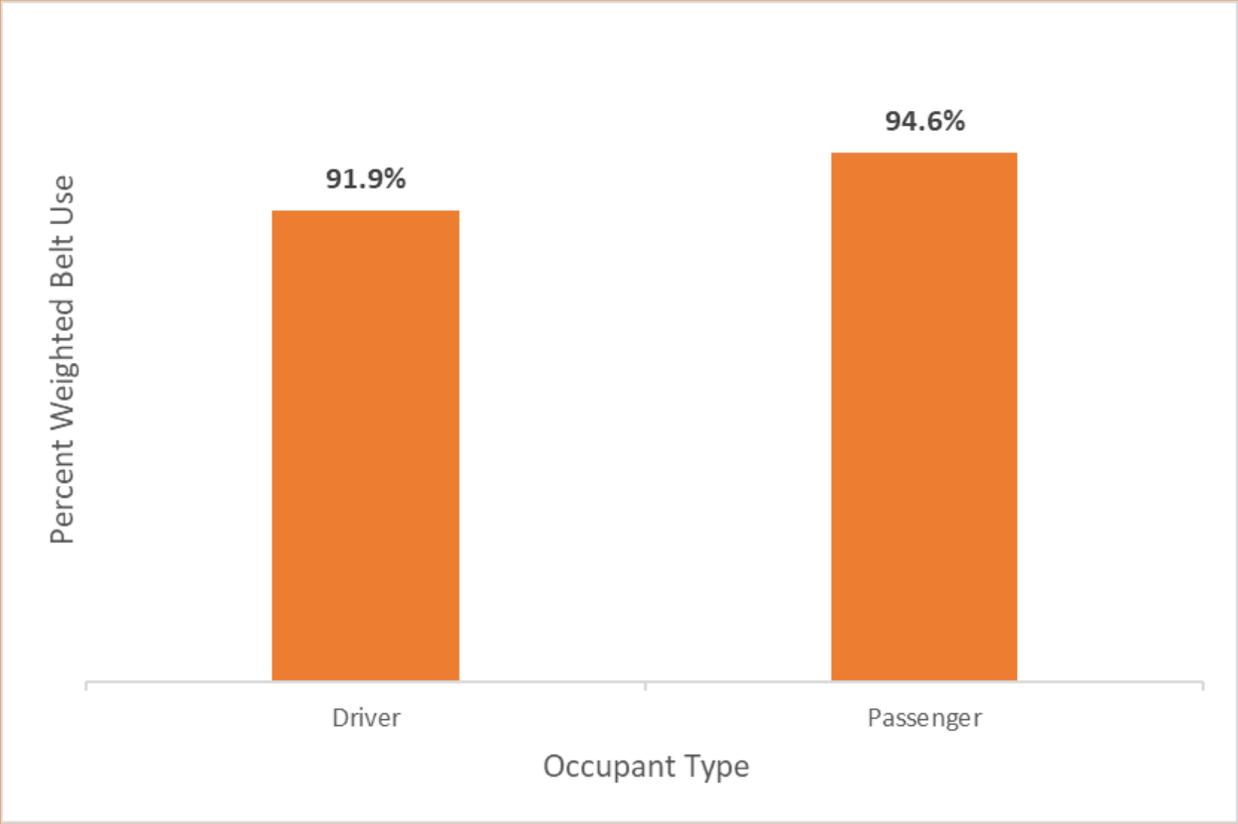
- > Figure 1 shows the overall weighted seat belt use rate for 2019 vs 2021.
- > In 2021, the overall weighted seat belt use declined by 1% over the 2019 (the last year data was collected).

Figure 2. Overall Weighted Seat Belt Use: 2010 through 2021 (excluding 2020)



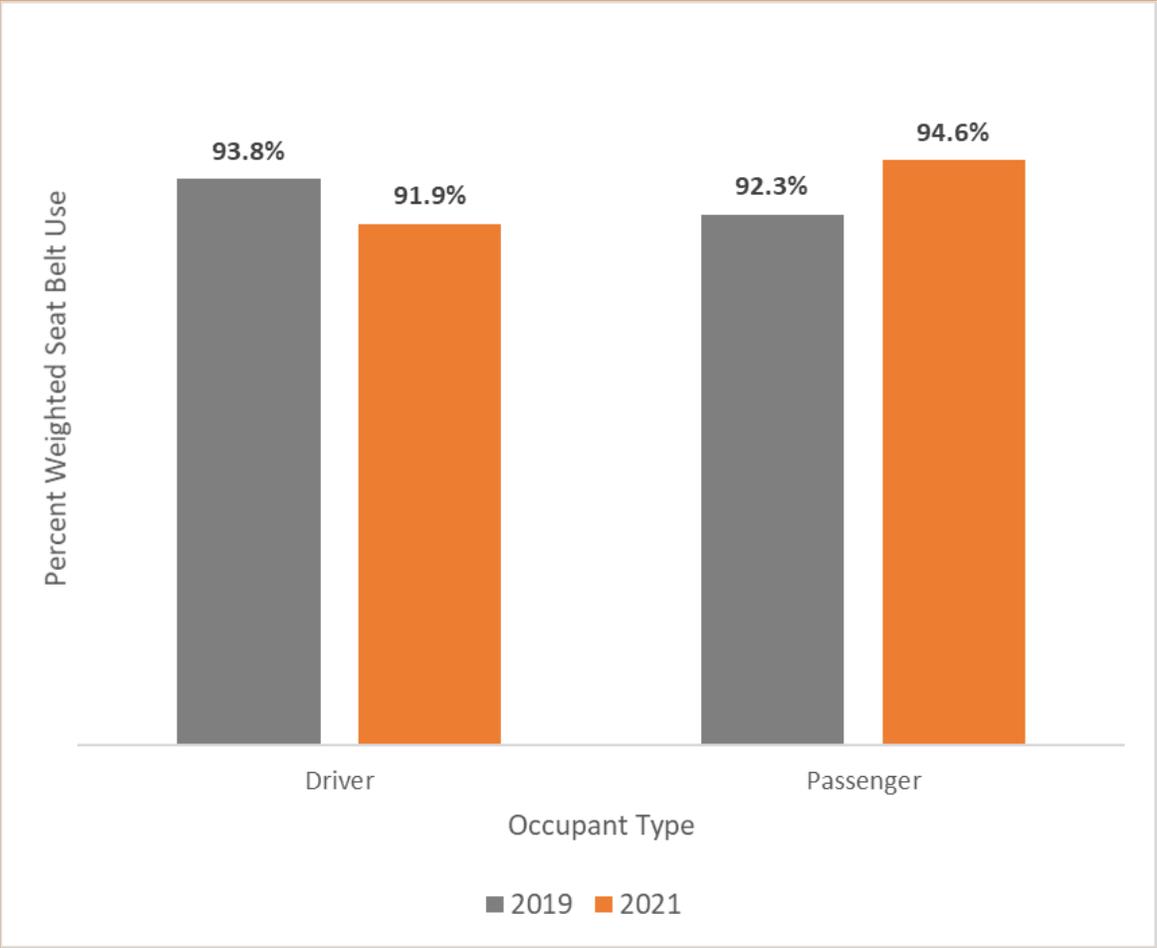
- > Figure 2 shows the overall weighted seat belt use rate from 2010 through 2021 (excluding 2020, when data were not collected due to Covid-19 issues).
- > In 2021, the overall weighted seat belt use declined by 1% over the 2019 (the last year data was collected).

Figure 3. Seat Belt Use Across Occupant Type: 2021



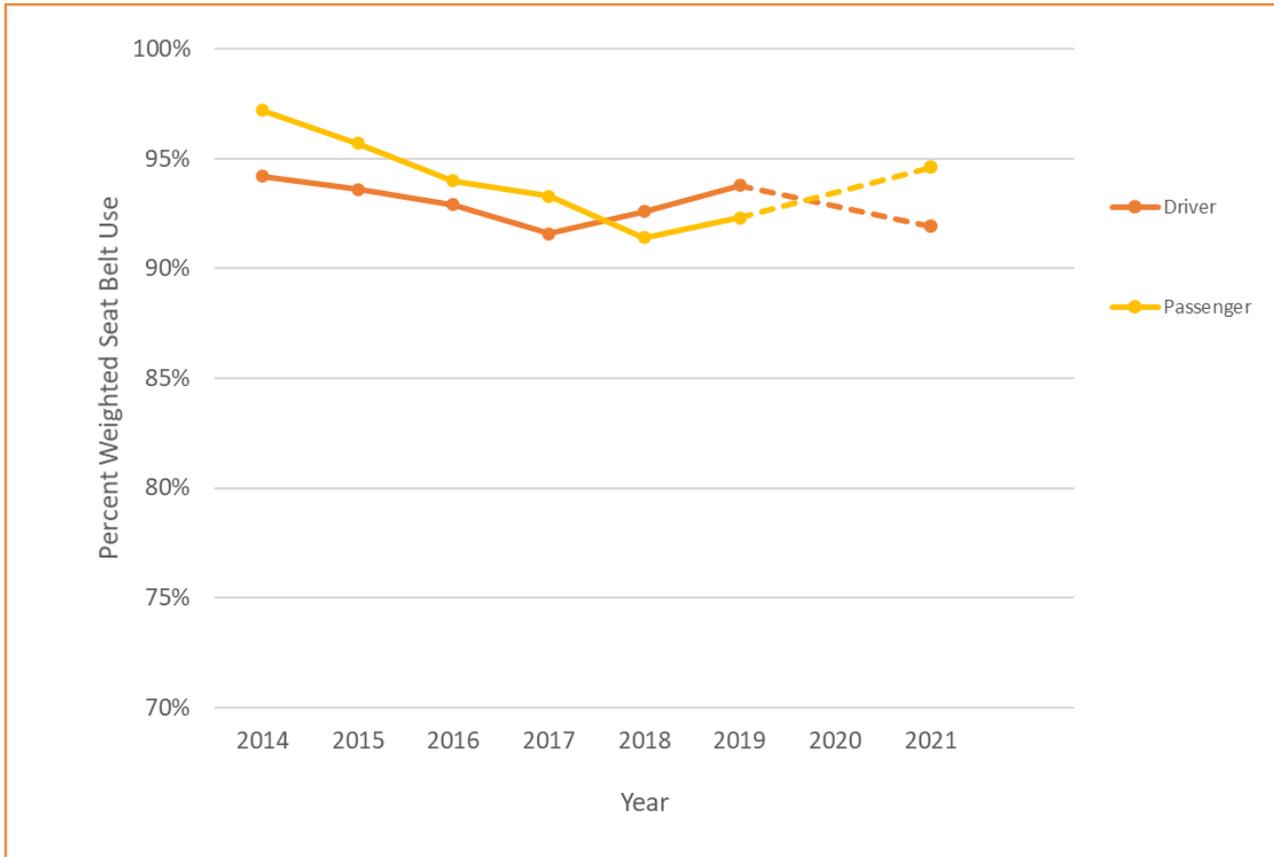
- > Figure 3 shows the weighted seat belt use rate by occupant type for 2021.
- > Passengers are more likely than drivers to be observed wearing seat belts.

Figure 4. Seat Belt Use Across Occupant Type: 2019 vs 2021



- > Figure 4 shows the year-over-year (YoY) weighted seat belt use rate by occupant type for 2019 compared to 2021.
- > Driver seat belt use rates decreased from 2019 (-1.9% YoY).
- > Passenger percent seat belt use increased in 2021 (+2.3% YoY).

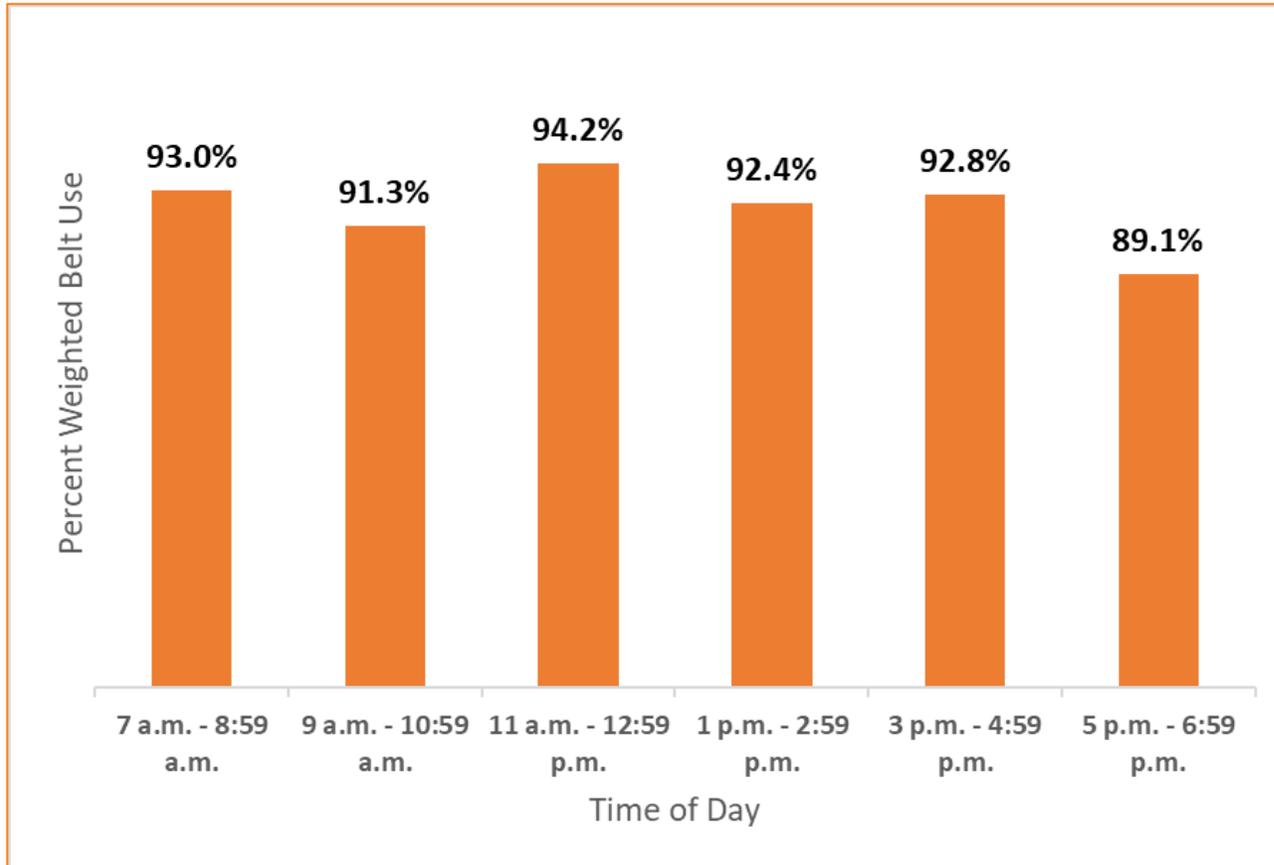
Figure 5. Seat Belt Use Across Occupant Type: 2014 - 2021



- > Figure 5 shows the time series graph of seat belt use by occupant from 2014-2021 (excluding 2020).
- > Over time, passenger seat belt usage rates declined until 2018. Data from 2019 and 2021 show an increasing trend in seat belt use by passengers.
- > Driver seat belt usage rates have fluctuated within a band (between 91% and 95%) over time, with the most recent trend slightly downward in 2021.
- > In most cases, excluding results from 2018 and 2019, passengers are more likely to wear seat belts compared to drivers.

Data Analysis: Seat Belt Use by Time of Day

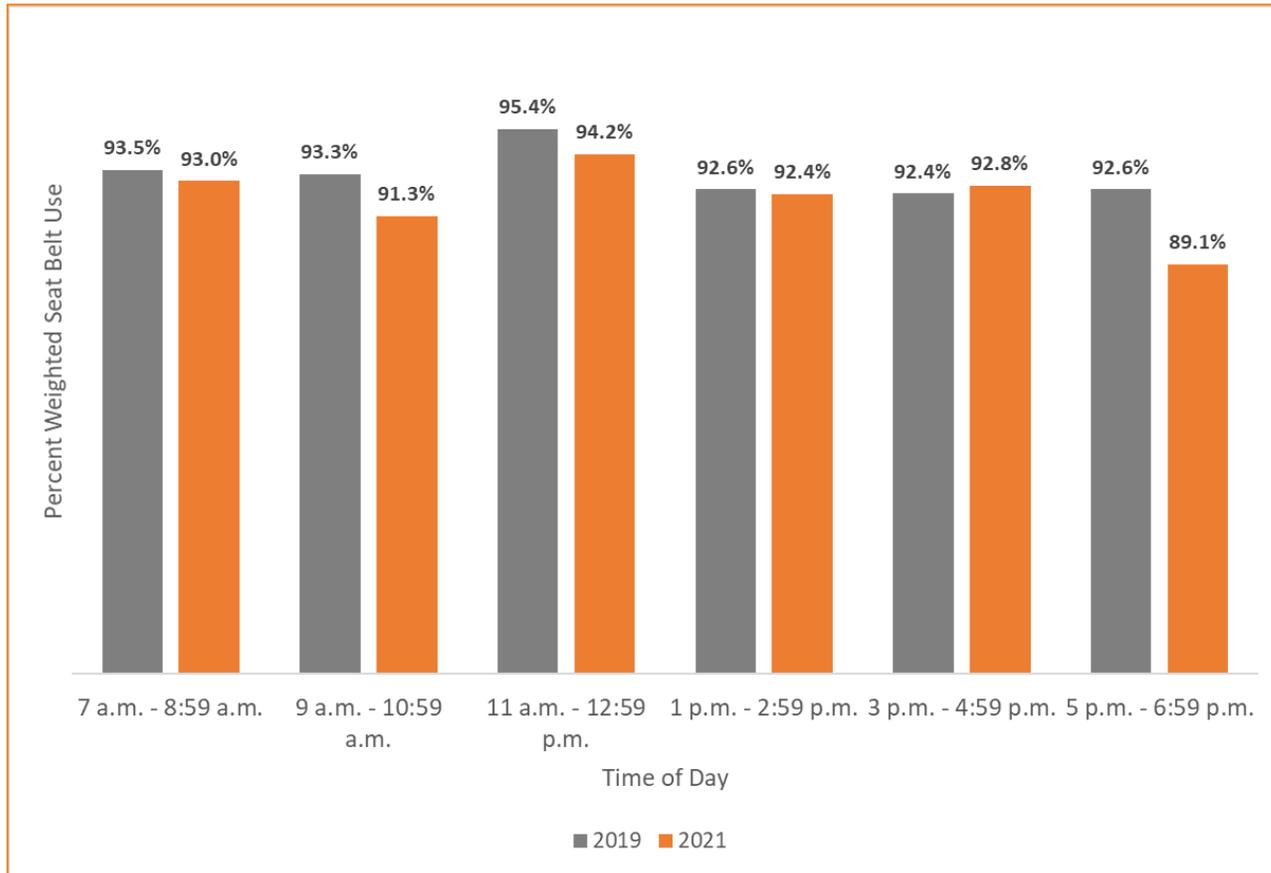
Figure 6. Seat Belt Use Across Time of Day: 2021



- > Figure 6 shows the weighted seat belt use rate by time of day for 2021.
- > Percent seat belt use was at the highest between 11 a.m. and 12:59 p.m. (94.2%)
- > Percent seat belt use was lowest between 5 p.m. and 6:59 p.m. (89.1%)

> * Data were not collected after 6:00 pm. The two-hour window is only for presentation consistency.

Figure 7. Seat Belt Use Across Time of Day: 2019 vs 2021



- > Figure 7 shows the year-over-year (YoY) weighted seat belt use rate by time of day for 2019 compared to 2021.
- > Percent weighted seat belt use declined notably during the 5 p.m. – 6:59 p.m. observation period (-3.5% YoY)*.
- > There is a slight decline in 2021 for weighted seat belt use rates between 9 a.m.- 10:59 a.m. and 11 a.m. – 12:59 p.m. over time (-2.0% YoY and -1.2% YoY, respectively).
- > All other time periods result in similar percent seat belt use rates over time.

- > * Data were not collected after 6:00 pm. The two-hour window is only for presentation consistency.

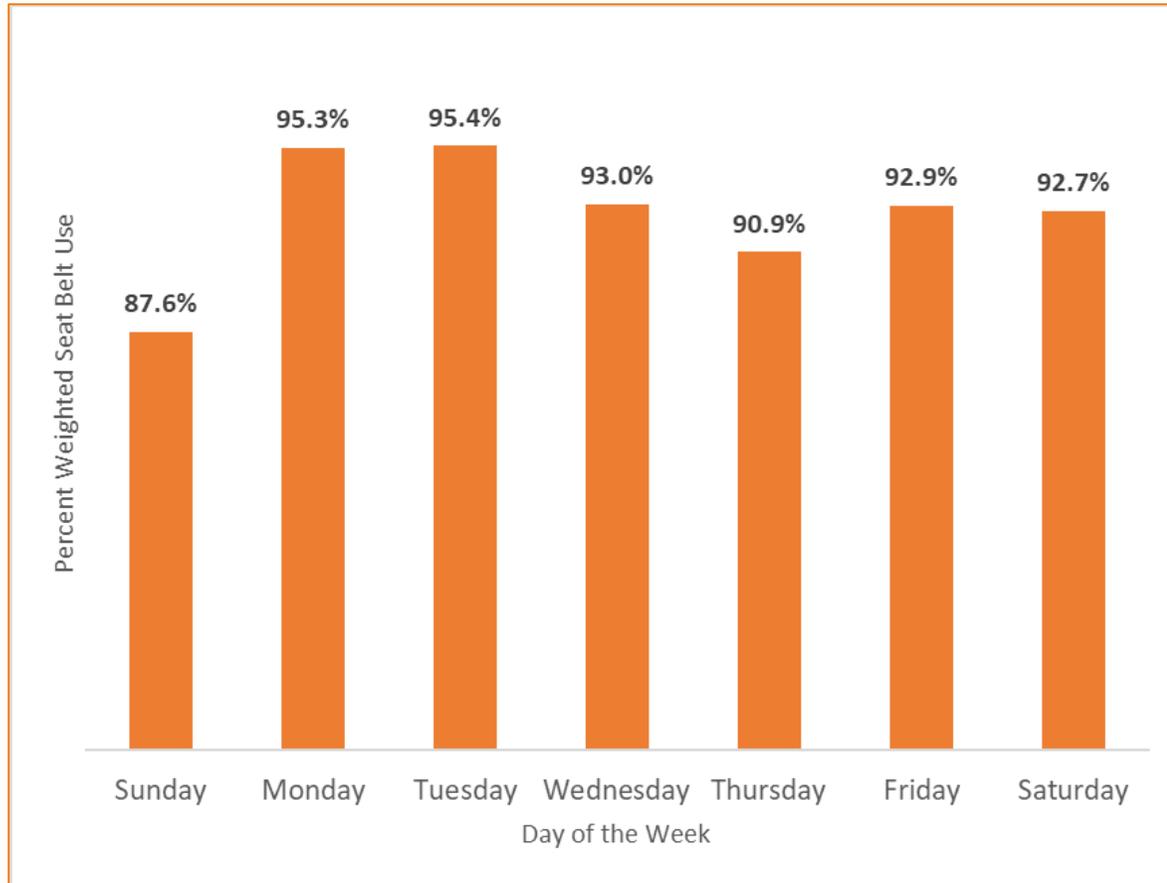
Figure 8. Seat Belt Use Across Time of Day: 2014 - 2021

- > Figure 8 shows the time series graph for seat belt use across time of day from 2014 to 2021 (excluding 2020).
- > The 9 a.m. to 10:59 a.m. time period shows consistent, albeit small, increases of seat belt use over time, the most recent year excluded (2021).
- > Most time periods exhibit erratic behavior with no clear trends emerging regarding percent seat belt use.
- > Typical evening rush hour time periods, 3 p.m. to 4:59 p.m. and 5 p.m. to 6:59 p.m., display the most significant shifts back and forth between increasing seat belt usage and decreasing seat belt usage over time.

	7 a.m. - 8:59 a.m.	9 a.m. - 10:59 a.m.	11 a.m. - 12:59 p.m.	1 p.m. - 2:59 p.m.	3 p.m. - 4:59 p.m.	5 p.m. - 6:59 p.m.
Long-Term Median	93.2%	91.2%	94.4%	92.5%	92.9%	93.1%
2021	93.0%	91.3%	94.2%	92.4%	92.8%	89.1%
2020	N/A	0.0%	0.0%	0.0%	0.0%	0.0%
2019	93.5%	93.3%	95.4%	92.6%	92.4%	92.6%
2018	91.3%	91.6%	91.4%	90.8%	94.8%	97.8%
2017	92.1%	91.4%	93.0%	90.6%	93.1%	91.9%
2016	96.1%	91.0%	94.6%	93.5%	91.6%	93.6%
2015	93.2%	90.5%	95.8%	97.0%	93.6%	96.1%
2014	95.8%	88.5%	95.1%	96.6%	95.0%	98.4%

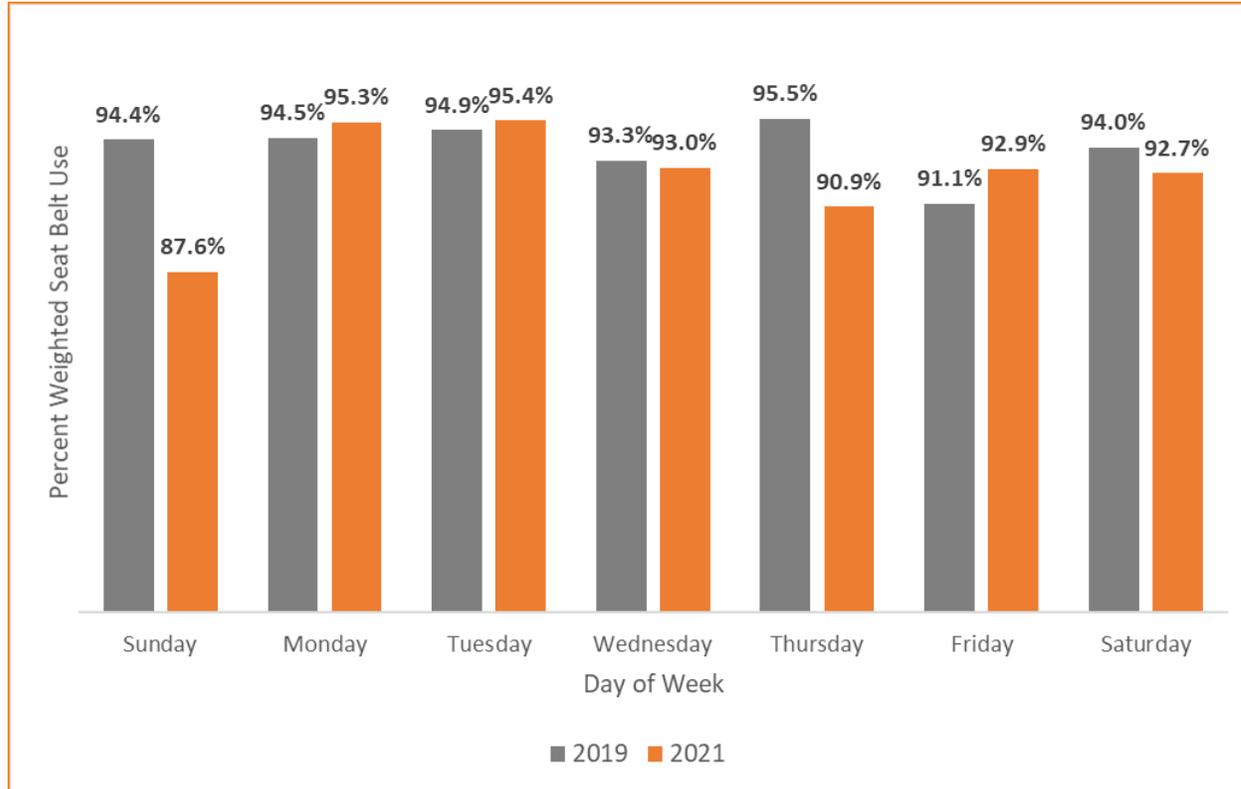
- > Green shading indicates a top-two seat belt rate compared to other times of day in each year, and brown represents a bottom-two rate.

Figure 9. Seat Belt Use Across Days of the Week: 2021



- > Figure 9 shows the weighted seat belt use patterns over the days of the week for 2021.
- > The highest observed percent seat belt use rates were on Monday (95.3%) and Tuesday (95.4%), the start of a new work week.
- > The lowest observed percent seat belt use rate was observed on Sunday (87.6%), followed by Thursday (90.9%).

Figure 10. Seat Belt Use Across Days of the Week: 2019 vs 2021



- > Figure 10 shows the year-over-year (YoY) weighted seat belt use patterns over the days of the week for 2019 compared to 2021.
- > Comparative analysis shows a notable difference in the observed percent seat belt use rates on Sunday between the two study periods (-6.8% YoY).
- > Thursday also sees a rather significant drop in percent weighted seat belt use in 2021 (-4.6% YoY).
- > Friday sees an increase in weighted seat belt use rates in 2021 compared to 2019 (+1.8% YoY).

Data Analysis: Seat Belt Use by Day of the Week (Trend)

- > Figure 11 shows the time series graph for seat belt use across days of the week over time (2014 – 2021, excluding 2020).
- > Excluding Sunday of 2021, seat belt use rates by days of the week, remain above 90.0% for all days.
- > Monday and Tuesday display the most stable patterns of seat belt use over time since 2017.

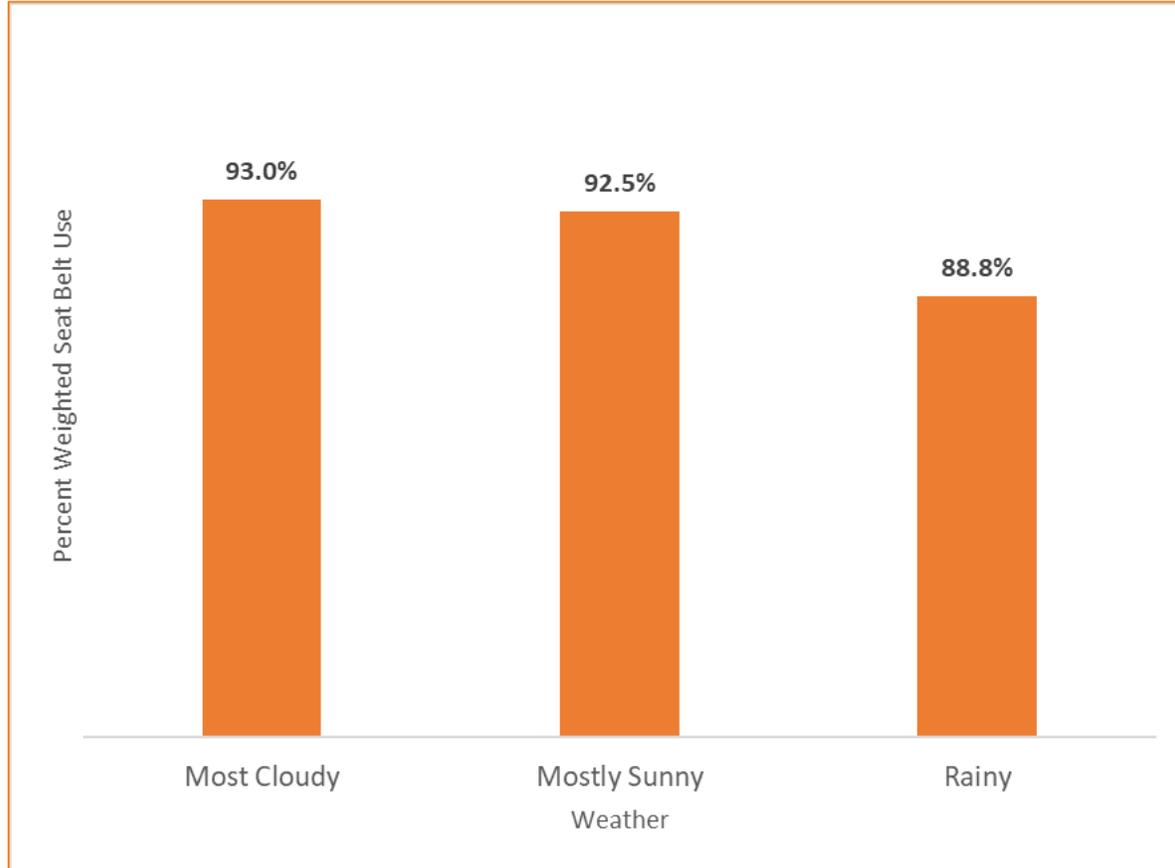
	Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
Long-Term Median	94.4%	93.3%	93.9%	93.3%	92.5%	91.7%	93.9%
2021	87.6%	95.3%	95.4%	93.0%	90.9%	92.9%	92.7%
2020	N/A	N/A	N/A	N/A	N/A	N/A	N/A
2019	94.4%	94.5%	94.9%	93.3%	95.5%	91.1%	94.0%
2018	90.3%	92.6%	93.9%	91.5%	90.9%	93.2%	92.5%
2017	91.7%	92.4%	93.9%	93.4%	91.4%	90.3%	91.4%
2016	97.4%	92.3%	91.4%	94.0%	94.7%	90.9%	93.9%
2015	96.2%	97.2%	93.8%	91.6%	93.2%	91.7%	96.9%
2014	95.8%	93.3%	97.6%	93.3%	92.5%	91.9%	97.6%

- > Green shading indicates a top-two seat belt rate compared to other days of the week in each year, and brown represents a bottom-two rate.

Figure 11. Seat Belt Use Across Days of the Week: 2014 - 2021

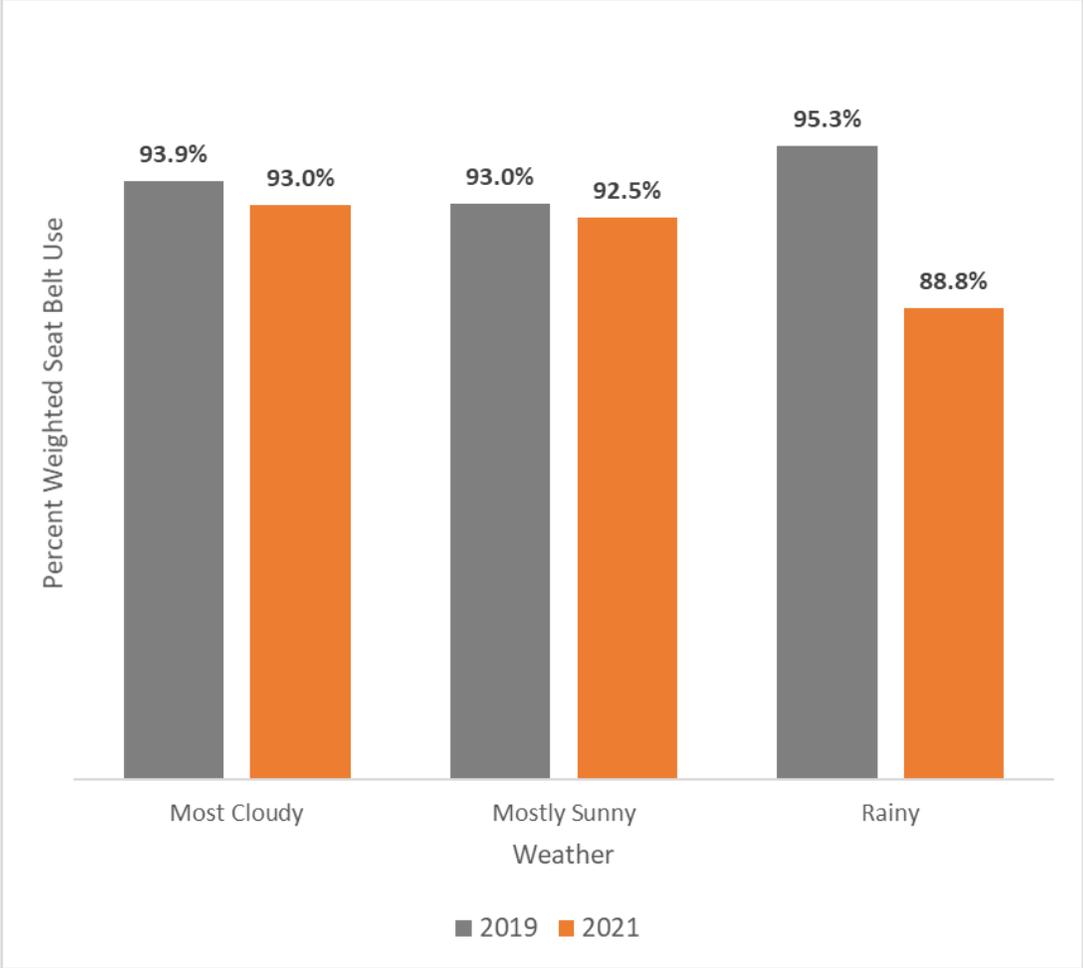
Data Analysis: Seat Belt Use by Weather

Figure 12. Seat Belt Use Across Weather: 2021



- > Figure 12 shows the weighted seat belt use across weather for 2021.
- > Front seat occupants were less likely to wear seat belts in rainy weather compared to mostly cloudy or mostly sunny weather.
- > The highest percentage of seat belt usage by weather was recorded during mostly cloudy weather.
- > It should be noted that rainy weather is less common in data collection, and differences may be a function of the particular nature of the sites that were observed rather than a weather-specific pattern.

Figure 13. Seat Belt Use Across Weather: 2019 vs 2021



- > Figure 13 shows the year-over-year (YoY) weighted seat belt use patterns by weather for 2019 compared to 2021.
- > From 2019 to 2021, a 6.5% decline in seat belt usage was observed among front seat passengers during rainy weather.
- > Again, it should be noted that rainy weather is less common in data collection, and differences may be a function of the particular nature of the sites that were observed rather than a weather-specific pattern.

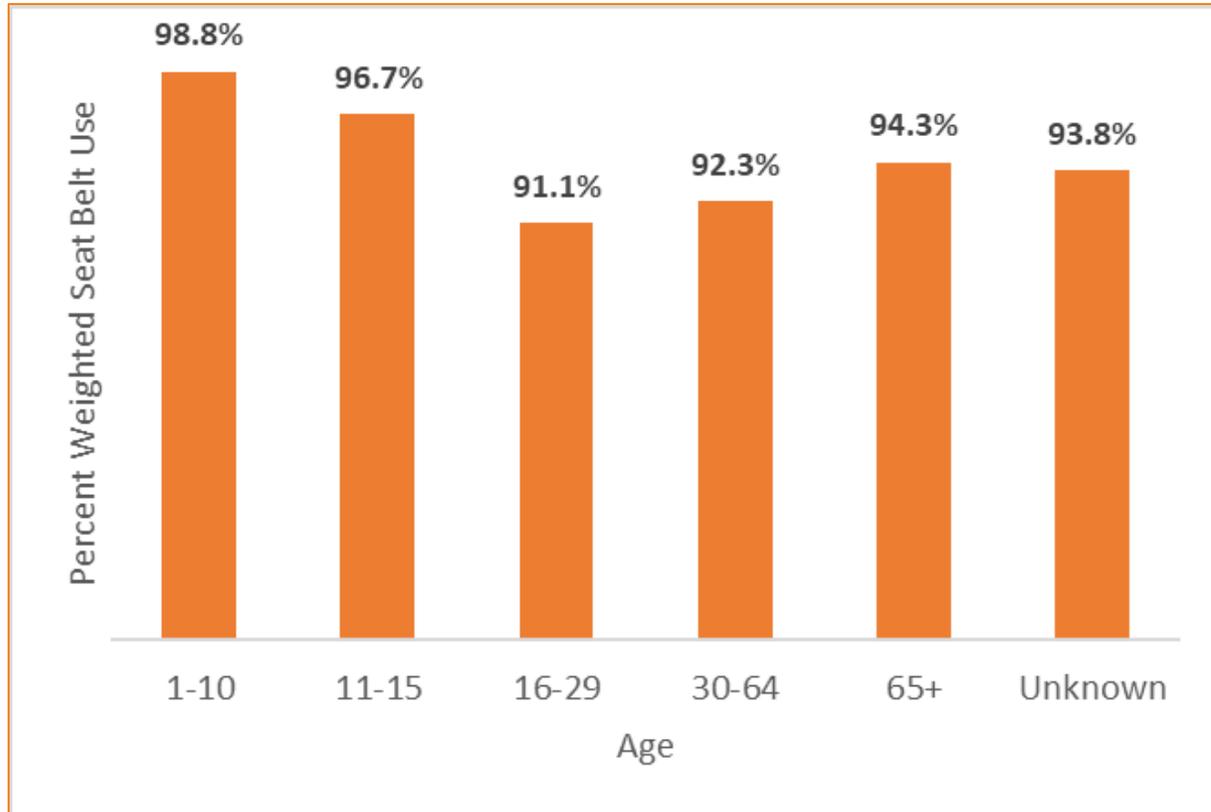
Figure 14. Seat Belt Use Across Weather: 2014 - 2021

	Most Cloudy	Mostly Sunny	Rainy
Long-Term Median	93.2%	93.0%	92.1%
2021	93.0%	92.5%	88.8%
2020	N/A	N/A	N/A
2019	93.9%	93.0%	95.3%
2018	92.0%	92.9%	92.1%
2017	91.8%	92.2%	92.9%
2016	93.2%	93.5%	84.6%
2015	94.3%	94.7%	90.6%
2014	95.2%	93.9%	96.1%

- > Figure 14 shows the time series graph for seat belt use by weather from 2014 to 2021, excluding 2020.
- > Seat belt use remains relatively stable for front seat passengers when observed during mostly cloudy and mostly sunny weather over time.
- > Percent seat belt use patterns for front seat passengers during rainy weather are erratic and exhibit significant and unpredictable changes from year to year.
- > Green shading indicates the highest seat belt rate compared to other weather conditions in each year, and brown represents the lowest rate.

Data Analysis: Seat Belt Use by Age

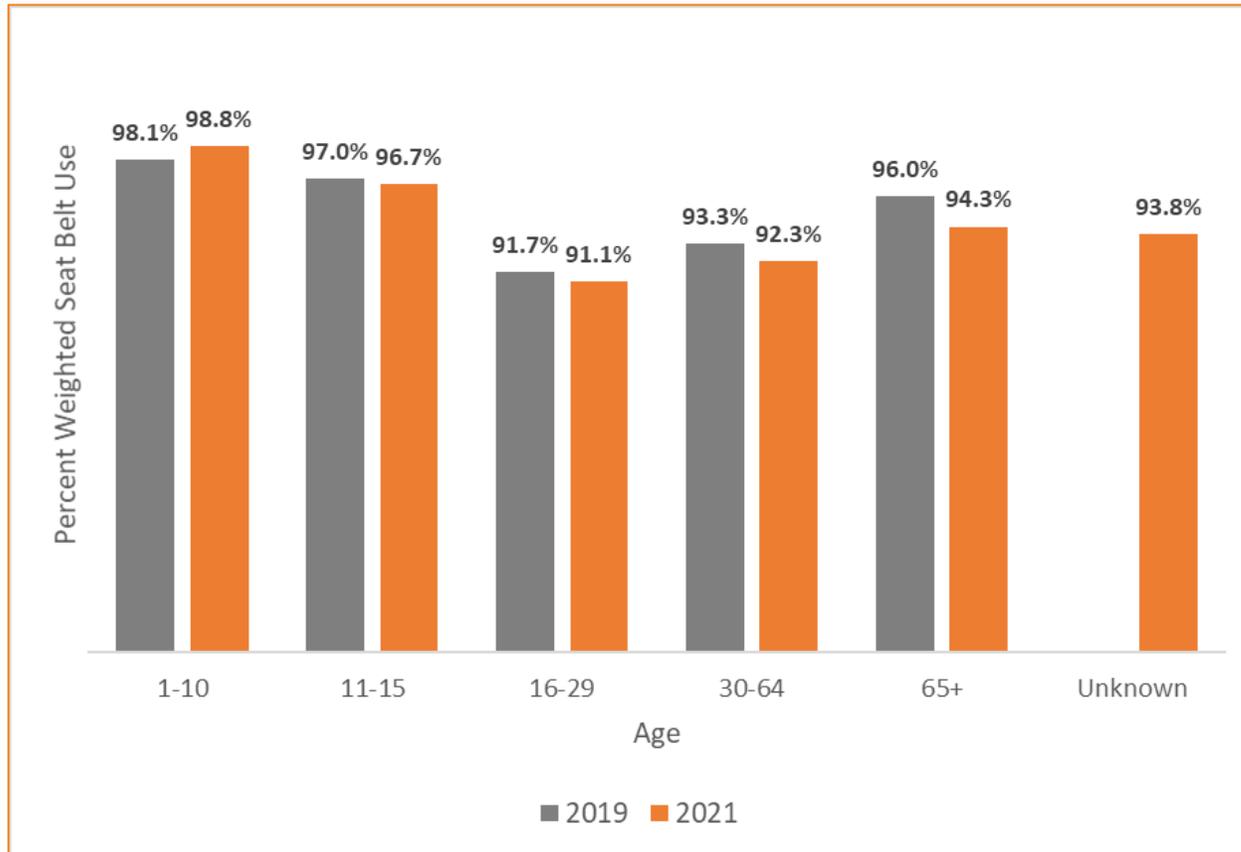
Figure 15. Seat Belt Use Among Age Groups: 2021



- > Figure 15 shows the weighted seat belt use patterns by front seat occupant age for 2021.
- > The highest observed percent seat belt use was observed among front seat occupants below 16 years of age (1-10: 98.8% and 11-15: 96.7%).
- > The lowest percent seat belt use was observed among 16–29-year-olds (91.1%) followed by 30–64-year-olds (92.3%).

Data Analysis: Seat Belt Use by Age (Trend)

Figure 16. Seat Belt Use Among Age Groups: 2019 vs 2021



**Note: In 2019, there were not any "unknown" age observations; therefore, there is no comparative analysis for this category.*

- > Figure 16 shows the year-over-year (YoY) weighted seat belt use patterns by occupant age for 2019 compared to 2021.
- > Similar seat belt use patterns were observed YoY for front seat occupants 29 years of age or younger.
- > A small decline in percent seat belt use rates was reported among 30–64-year-old occupants (-1% YoY) and a greater decline was observed among those recorded as 65 years or older (-1.7% YoY).

Data Analysis: Seat Belt Use by Age (Trend)

Figure 17. Seat Belt Use Among Age Groups: 2014 - 2021

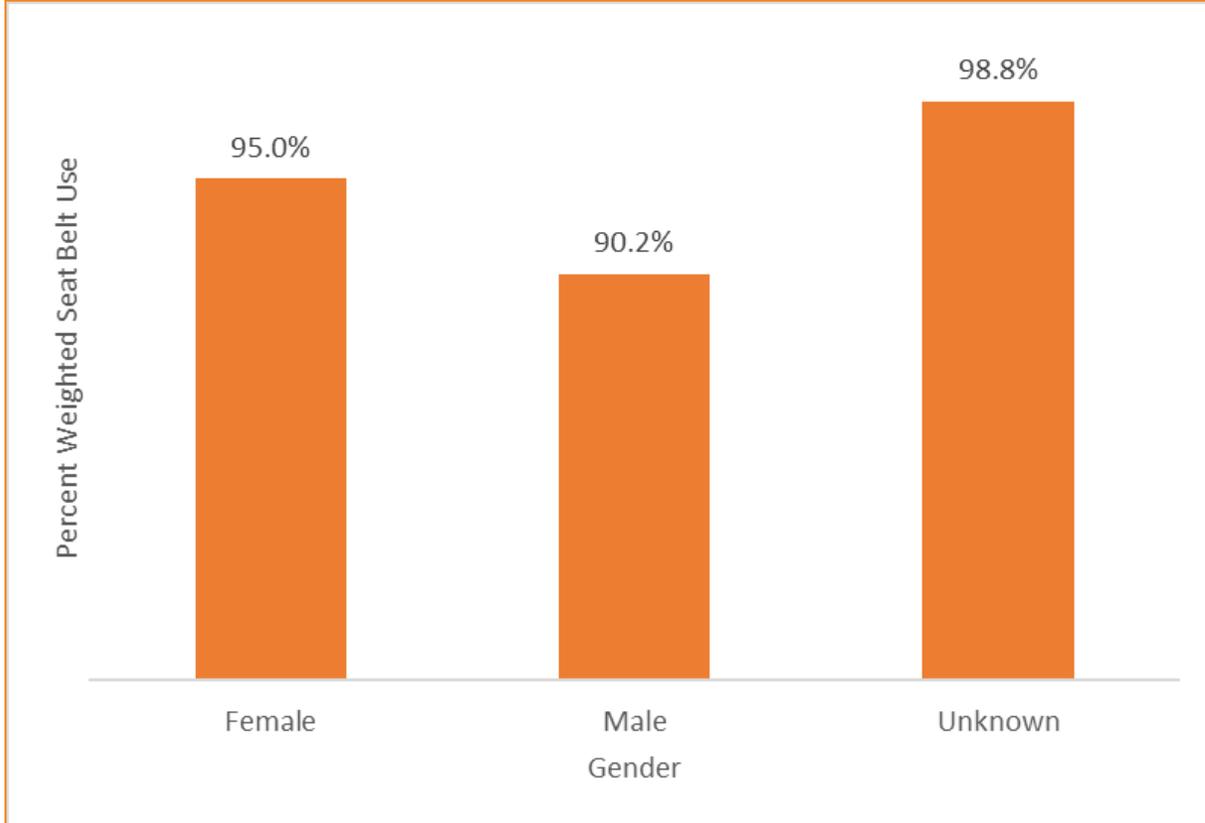
	1-10	11-15	16-29	30-64	65+
Long-Term Median	97.2%	96.7%	91.7%	93.2%	93.2%
2021	98.8%	96.7%	91.1%	92.3%	94.3%
2020	N/A	N/A	N/A	N/A	N/A
2019	98.1%	97.0%	91.7%	93.3%	96.0%
2018	97.2%	93.3%	89.9%	93.2%	93.2%
2017	82.7%	98.3%	90.3%	92.9%	90.7%
2016	100.0%	98.7%	92.9%	93.1%	92.7%
2015	92.4%	96.1%	92.4%	95.1%	91.4%
2014	94.6%	96.2%	94.0%	94.7%	96.4%

- > Figure 17 shows the times series graph for seat belt use among age groups from 2014 to 2021, excluding 2020.
- > Data collected in 2021, support or maintain the gains in percent seat belt use rates observed in 2019 among nearly all age groups, with minor fluctuations. The greatest of those fluctuations being observed among 65-year-old occupants or older.
- > Seat belt use rates among front seat occupants 15-years-old or younger are the most unpredictable and exhibit the greatest differences among years.
- > Green shading indicates the highest seat belt rate compared to other age groups in each year, and brown represents the lowest rate.

*Note: "Unknown" has been excluded from this time series analysis, as this age classification was collected ONLY for 2021.

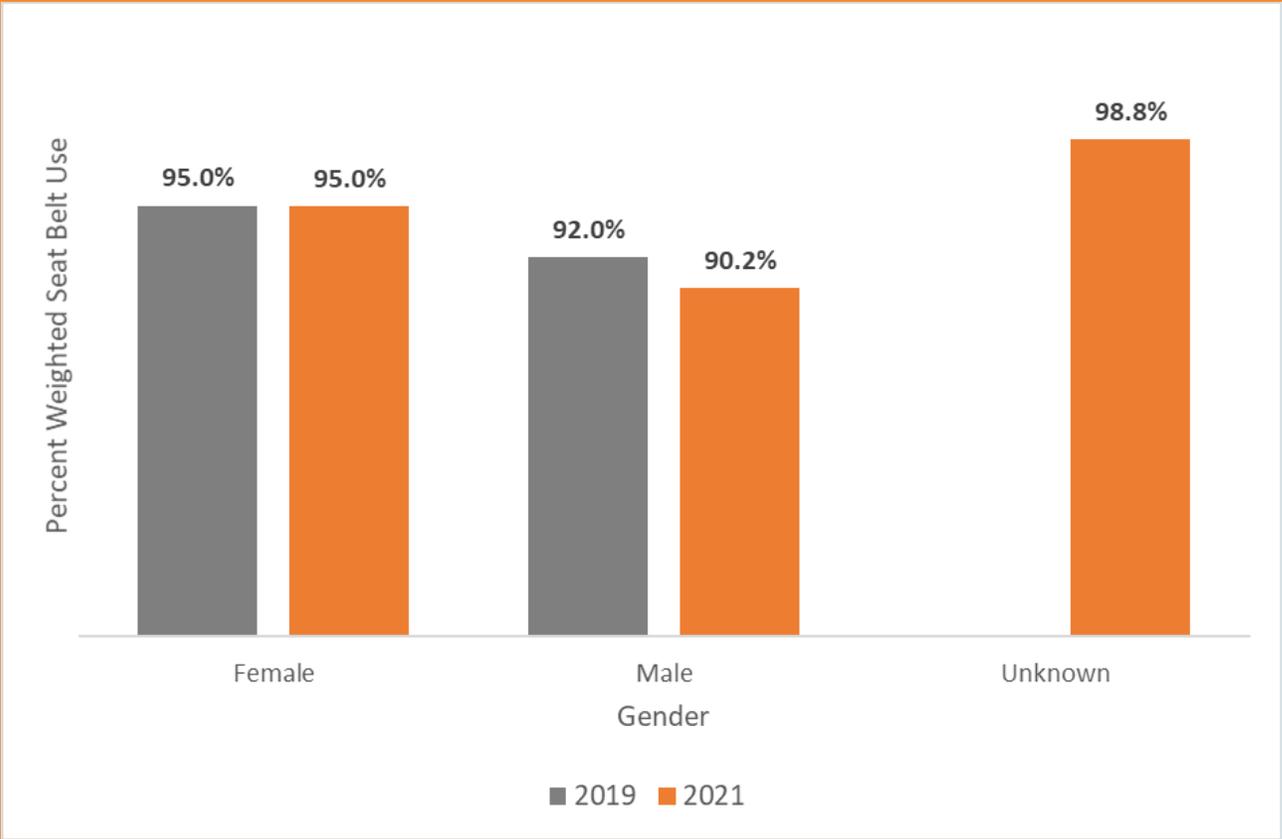
Data Analysis: Seat Belt Use by Gender

Figure 18. Seat Belt Use as a Function of Gender: 2021



- > Figure 18 shows the weighted seat belt use for male and female front seat occupants for 2021.
- > Female occupants were more likely to wear a seat belt compared to males (+4.8%).
- > Kbr start here

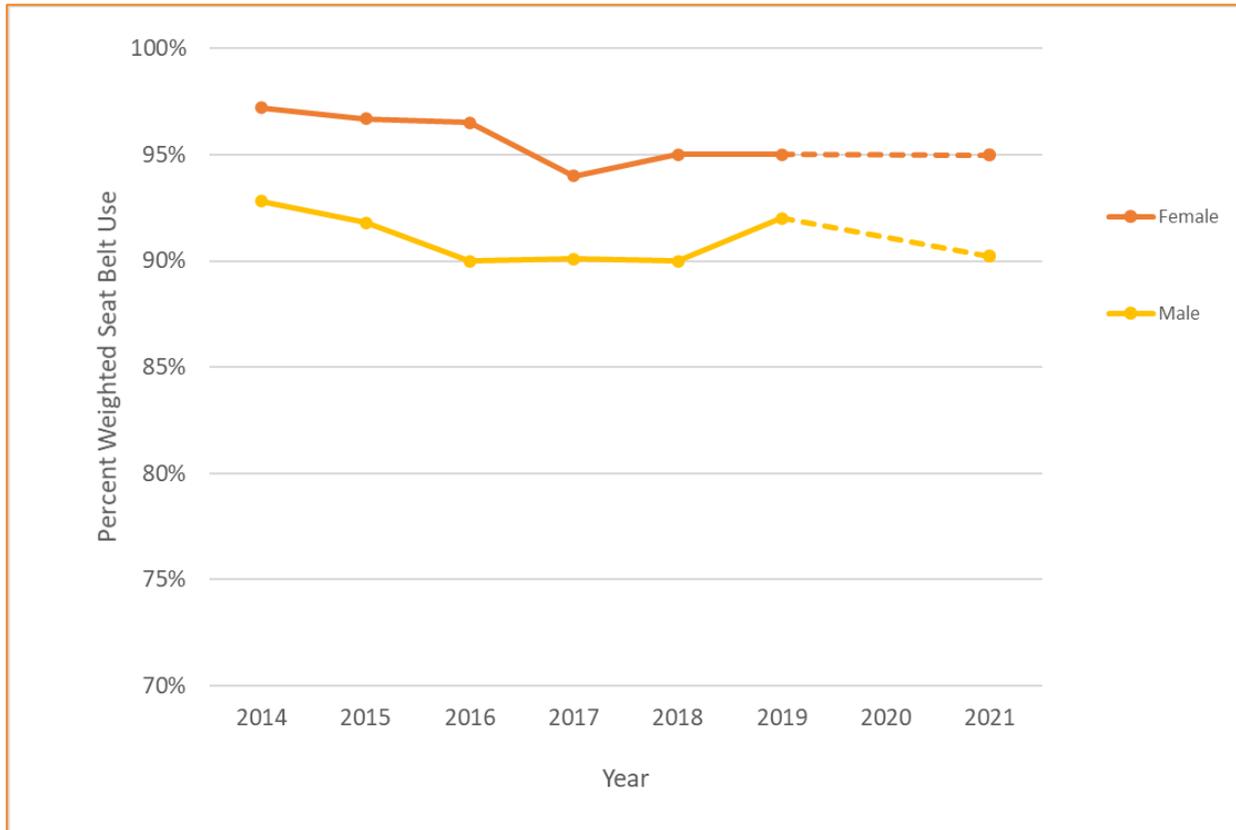
Figure 19. Seat Belt Use as a Function of Gender: 2019 vs 2021



- > Figure 19 shows year-over-year (YoY) weighted seat belt use for male and female front seat occupants for 2019 compared to 2021.
- > In 2021, male percentage belt use decreased two percent (2%) while female percentage belt use remained the same compared to 2019.

**Note: In 2019, there were not any "unknown" gender observations; therefore, there is no comparative analysis for this category.*

Figure 20. Seat Belt Use as a Function of Gender: 2019 - 2021

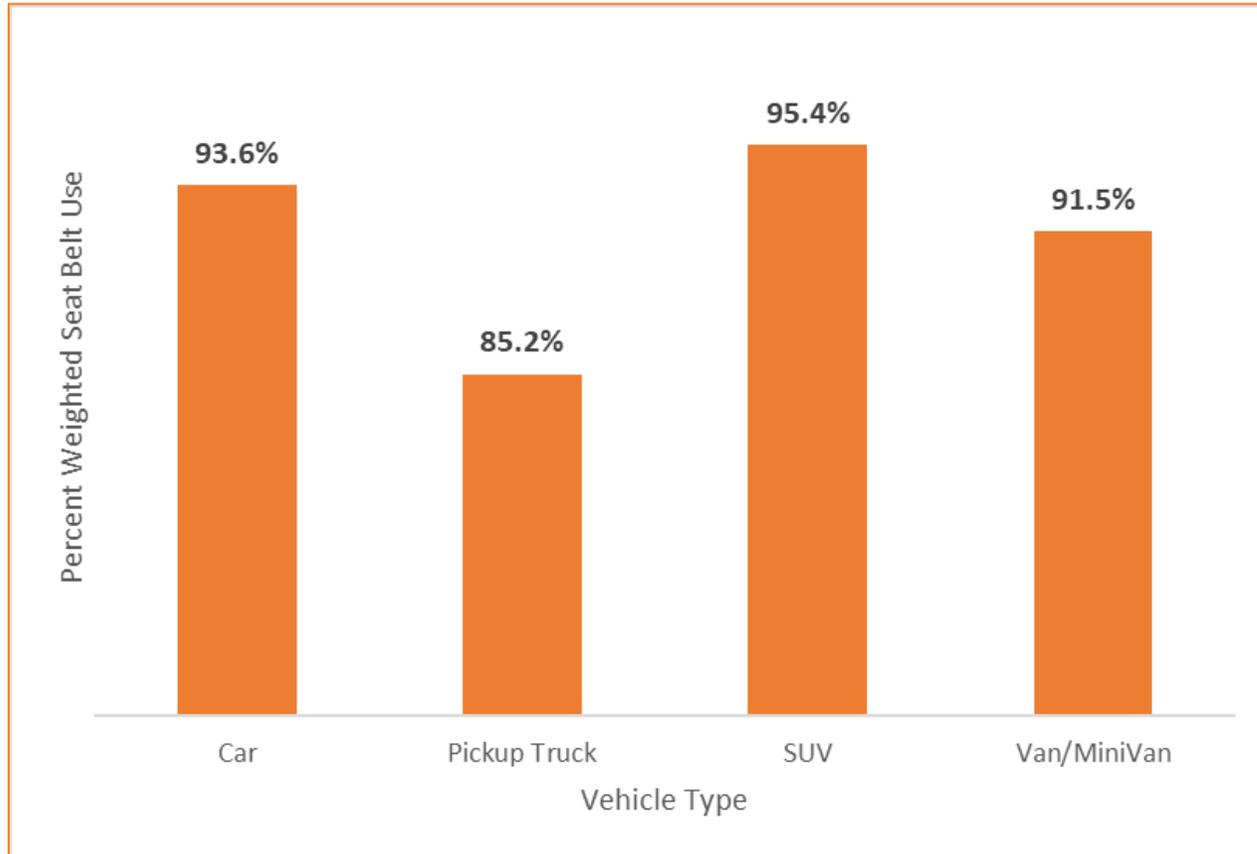


- > Figure 20 shows the time series graph for seat belt use by gender over time (2014 – 2021, excluding 2020).
- > After an initial decline of seat use rates from 2014 to 2016, percent seat belt use rates among females has stabilized, hovering around 95%.
- > Males began to show a stable pattern emerging among seat belt use rates until 2018, but in 2019 patterns begin to fluctuate again.
- > Regardless, females exhibit a clear pattern of being more likely to wear seat belts compared to males.

**Note: "Unknown" has been excluded from this time series analysis, as this gender classification was collected ONLY for 2021.*

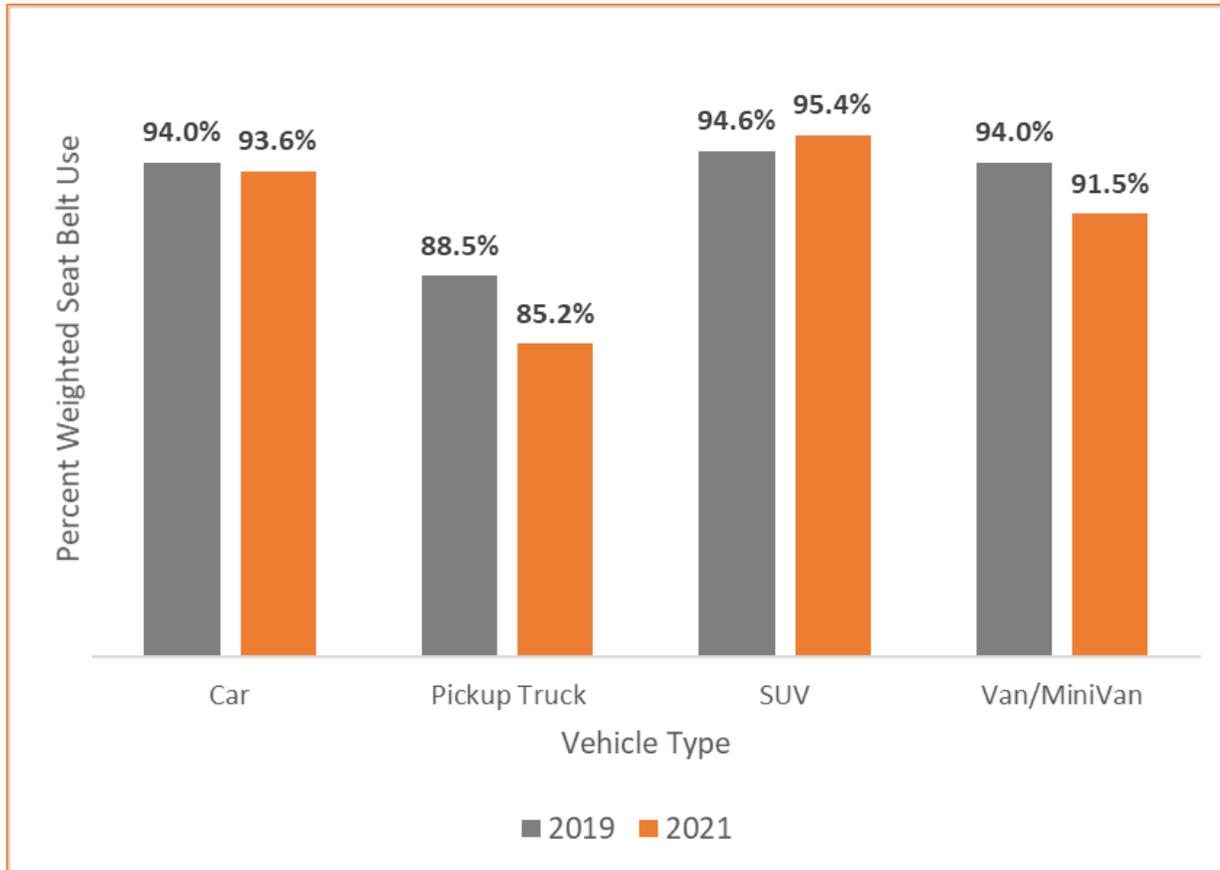
Data Analysis: Seat Belt Use by Vehicle Type

Figure 21. Seat Belt Use by Vehicle Type: 2021



- > Figure 21 shows the weighted seat belt use for front seat occupants of pickup trucks, vans/minivans, SUVs, and cars for 2021.
- > Seat belt use is highest among those in SUV's (95.4%) and cars (93.6%).
- > Pick up truck occupants were the least likely by more than six percent (-6.3%) to wear a seat belt compared to all other vehicles.

Figure 22. Seat Belt Use by Vehicle Type: 2019 vs 2021



- > Figure 22 shows the year-over-year (YoY) weighted seat belt use for front seat occupants of pickup trucks, vans/minivans, SUVs, and cars for 2019 vs 2021.
- > Comparative analysis shows pickup truck occupants are less likely to wear seat belts compared to any other vehicle type. Additionally, over time pickup truck drivers are wearing seat belts less frequently than before (-3.3% YoY).
- > Car and SUV occupants seat belt usage remains steady over time.
- > Van/minivan occupant seat belt usage drops by more than 2% in 2021 (-2.5% YoY).

Figure 23. Seat Belt Use by Vehicle Type: 2019 - 2021

- > Figure 23 shows the time series graph for seat belt use by vehicle type over time (2014-2021, excluding 2020).
- > Cars, SUVs, and Van/Mini-vans display front seat passenger seat belt usage rates above 90% for every year presented.
- > Pickup trucks, at no point since 2014, exceed a front seat occupant seat belt use rate greater or equal to 90%.
- > Since 2014, seat belt use rates have gradually declined in small increments over time for most vehicle types. Front seat occupants of vans/mini-vans have exhibited a bit of a more unpredictable pattern, but nevertheless, continue to remain lower than the high observed in 2014.
- > Car and SUV percent seat belt usage for front seat occupants appears to be stabilizing and finding support around the 94% level for cars and the 95% level for SUVs.

	Car	Pickup Truck	SUV	Van/MiniVan
Long-Term Median	93.8%	85.2%	95.2%	94.1%
2021	93.6%	85.2%	95.4%	91.5%
2020	N/A	N/A	N/A	N/A
2019	94.0%	88.5%	94.6%	94.0%
2018	92.5%	85.2%	94.7%	95.0%
2017	91.9%	86.4%	93.6%	95.3%
2016	95.2%	83.6%	95.2%	92.8%
2015	93.8%	89.6%	97.5%	94.1%
2014	96.9%	84.7%	97.0%	96.7%

- > Green shading indicates the highest seat belt rate compared to other vehicle types in each year, and brown represents the lowest rate.

- > To support comparing seat belt use results between this 2021 survey and prior years, this section presents data tables that are equivalent to those produced in 2019 (and previous years).

> Figure 24 presents the seat belt use results for each stratum. The seat belt use values and Ns are the unweighted (actual) number of front seat occupants observed. We recommend use of the weighted results, but present unweighted figures for informational purposes.

Figure 24. Unweighted Seat Belt Use Rates and Ns as a Function of Stratum, Roadway Type

Stratum	Location/Road Type	N	Unweighted Percent Use
Hennepin	Primary	2256	94.9%
Hennepin	Secondary	1310	92.8%
Hennepin	Local	94	94.0%
High VMT	Primary	1533	94.3%
High VMT	Secondary	2001	94.3%
High VMT	Local	66	88.0%

Data Analysis: Unweighted Seat Belt Use Summary Tables (continued)

Figure 24 (continued). Unweighted Seat Belt Use Rates and Ns as a Function of Stratum, Roadway Type

Stratum	Location/Road Type	N	Unweighted Percent Use
Med VMT	Primary	249	94.3%
Med VMT	Secondary	1654	88.3%
Med VMT	Local	85	89.5%
Low VMT	Primary	525	93.4%
Low VMT	Secondary	2504	92.5%
Low VMT	Local	240	93.8%
Overall	Statewide	12517	92.9%

We recommend use of the weighted results, but present these unweighted figures for informational purposes.

> Figure 25 presents the number of observations as a function of Site Type, Time of Day, Day of Week, Weather, Gender, Age and Position in the Vehicle.

Figure 25. Number of Observations (N) as a Function of Subgroup, Vehicle Type

Group/Subgroup	All Observations	Car	Pickup Truck	SUV	Van/ Minivan
Overall	13,467	4,309	2,475	4,676	2,007
Site Type					
Intersection	6,695	1,992	1,341	2,338	1,024
Mid-Block	1,289	411	289	480	109
Ramp	5,483	1,906	845	1,858	874

Data Analysis: Seat Belt Use Summary Tables (continued)

Figure 25 (continued). Number of Observations (N) as a Function of Subgroup, Vehicle Type

Group/Subgroup	All Observations	Car	Pickup Truck	SUV	Van/ Minivan
Overall	13,467	4,309	2,475	4,676	2,007
Time of Day					
7-9 a.m.	776	289	134	255	98
9-11 a.m.	2,017	685	333	655	344
11 a.m.-1 p.m.	2,696	828	496	868	504
1-3 p.m.	3,031	992	581	1,028	430
3-5 p.m.	3,180	984	586	1,189	421
5-7 p.m.	2,076	677	399	734	266
Day of Week					
Monday	2,779	836	524	1,057	362
Tuesday	1,863	602	358	710	193
Wednesday	2,340	826	383	737	394
Thursday	1,377	424	258	470	225
Friday	1,558	507	259	566	226
Saturday	1,979	644	378	620	337
Sunday	1,571	470	315	516	270

Figure 25 (continued). Number of Observations (N) as a Function of Subgroup, Vehicle Type

Group/ Subgroup	All Observations	Car	Pickup Truck	SUV	Van/ Minivan
Overall	13,467	4,309	2,475	4,676	2,007
Weather					
[Mostly] Sunny**	10,261	3,323	1,833	3,541	1,564
[Mostly] Cloudy**	2,665	835	507	941	382
Rainy	541	151	135	194	61
Gender					
Male	6,557	2,064	1,799	1,794	900
Female	4,304	1,485	209	1,959	651
Unknown***	46	17	3	19	7

**"Mostly" was added to the Sunny and Cloudy weather descriptions for the 2021 study.

***"Unknown" was added as an option for gender and age classifications for the 2021 study.

Figure 25 (continued). Number of Observations (N) as a Function of Subgroup, Vehicle Type

Group/ Subgroup	All Observations	Car	Pickup Truck	SUV	Van/ Minivan
Overall	13,467	4,309	2,475	4,676	2,007
Age					
0-10	58	15	8	21	14
11-15	223	50	31	87	55
16-29	3,256	1,456	389	977	434
30-64	8,384	2,284	1,762	3,006	1,332
65+	1,415	468	253	537	157
Unknown***	131	36	32	48	15
Position					
Driver	10,097	3,566	2,011	3,772	1,558
Passenger	2,560	743	464	904	449

**"Mostly" was added to the Sunny and Cloudy weather descriptions for the 2021 study.

***"Unknown" was added as an option for gender classification for the 2021 study.

> Figure 26 presents the resulting weighted seat belt use percentages.

Figure 26. Weighted Seat Belt Use Rates (%) as a Function of Subgroup, Vehicle Type

Group/ Subgroup	All Observations	Car	Pickup Truck	SUV	Van/ Minivan
Overall	92.4%	93.6%	85.2%	95.4%	91.5%
Site Type					
Intersection	92.2%	94.1%	83.5%	95.8%	90.4%
Mid-Block	92.1%	91.4%	88.9%	93.4%	95.3%
Ramp	95.0%	93.6%	93.6%	96.2%	97.5%
Time of Day					
7-9 a.m.	93.0%	92.9%	85.7%	96.2%	94.1%
9-11 a.m.	91.3%	94.5%	84.4%	96.5%	84.9%
11 a.m.-1 p.m.	94.2%	96.4%	86.5%	94.2%	97.4%
1-3 p.m.	92.4%	91.5%	87.4%	94.7%	93.3%
3-5 p.m.	92.8%	93.0%	87.7%	95.5%	91.8%
5-7 p.m.	89.1%	91.3%	68.5%	95.0%	87.4%

Figure 26 (continued). Weighted Seat Belt Use Rates (%) as a Function of Subgroup, Vehicle Type

Group/ Subgroup	All Observations	Car	Pickup Truck	SUV	Van/ Minivan
Overall	92.4%	93.6%	85.2%	95.4%	91.5%
Day of Week					
Monday	95.3%	96.5%	87.3%	97.7%	97.1%
Tuesday	95.4%	94.1%	94.4%	97.3%	95.1%
Wednesday	93.0%	92.0%	88.3%	96.2%	94.2%
Thursday	90.9%	91.7%	78.3%	96.1%	91.1%
Friday	92.9%	94.4%	87.2%	95.1%	90.2%
Saturday	92.7%	94.3%	90.7%	92.1%	92.9%
Sunday	87.6%	92.5%	75.9%	92.6%	81.8%
Weather					
[Mostly] Sunny**	92.5%	93.6%	84.8%	95.9%	91.1%
[Mostly] Cloudy**	93.0%	93.9%	90.1%	93.8%	92.4%
Rainy	88.8%	91.4%	66.9%	94.3%	98.0%

**"Mostly" was added to the Sunny and Cloudy weather descriptions for the 2021 study.

Data Analysis: Seat Belt Use Summary Tables (continued)

Figure 26 (continued). Weighted Seat Belt Use Rates (%) as a Function of Subgroup, Vehicle Type

Group/ Subgroup	All Observations	Car	Pickup Truck	SUV	Van/ Minivan
Overall	92.4%	93.6%	85.2%	95.4%	91.5%
Sex					
Male	90.2%	92.4%	83.6%	94.5%	89.0%
Female	95.0%	94.7%	91.8%	96.1%	93.9%
Unknown***	98.8%	98.9%	98.7%	98.3%	100.0%
Age					
0-10	98.8%	100.0%	100.0%	97.7%	100.0%
11-15	96.7%	88.9%	100.0%	99.7%	100.0%
16-29	91.1%	93.3%	79.7%	93.3%	89.7%
30-64	92.3%	93.8%	85.7%	95.2%	91.7%
65+	94.3%	92.7%	88.5%	98.3%	91.5%
Unknown***	93.8%	100.0%	85.6%	95.7%	92.3%
Position					
Driver	91.9%	93.6%	83.7%	95.0%	90.3%
Passenger	94.6%	93.3%	91.5%	96.6%	95.6%

***"Unknown" was added as an option for gender and age classifications for the 2021 study.

- > The 2021 Minnesota Seat Belt Use Survey succeeded in continuing use of the 2012 NHTSA-approved methodology. Key results and conclusions include:
- > Overall seat belt use declined slightly, down 1.0 percentage points from the 2019 figure. While we do observe an overall decline in overall seat belt usage rates in 2021, it is important to keep in mind the extenuating circumstances of this study within the longitudinal analysis. National trends imply significant changes in commuting patterns and commuter demographics due to Covid-19 impacts on workplace situations. Additionally, the observations for this study occurred months after the Click it or Ticket campaign (June 2021), whereas previous studies occurred closely on the heels of that annual campaign. These considerations are beyond the scope of the project, but warrant mentioning and should be considered in future studies.

- > Patterns were seen by various metrics.
 - **Occupant Type:** Passenger seat belt use increased from 2019, while driver seat belt use declined. Passengers have higher seat belt use rates than drivers.
 - **Time of Day:** Declines in seat belt use were seen mid-morning (9:00 to 10:59 am) and evening (5:00 to 5:59 pm) Other times of day saw generally similar rates to 2019 figures. Overall, there is very little difference in usage by time of day.
 - **Day of the Week:** Use rates decline on Sunday and Thursday and increased on Friday. Thursday and Friday are typically the lowest usage days of the week, while Sunday has historically been the highest day of the week.
 - **Weather:** Seat belt usage rates are historically lowest in rainy weather, and the same held true in 2021, through differences were not large.
 - **Age:** Usage rates by age were generally consistent (albeit slightly lower) with historical averages. Children tend to have the highest usage rates, and those in the 16-29 age range have the lowest. This held true in 2021.
 - **Gender:** Females historically have higher seat belt use rates than males, and the pattern held true in 2021. The overall decline in usage rates in 2021 compared to 2019 was fully due to lower male seat belt use rates, as female rates held steady.
 - **Vehicle Type:** Both van/mini van and pickup truck front seat occupants experienced declines in seat belt usage rates in 2021 compared to 2019, while SUV rates increased and automobile rates were generally steady. Consistent with past pattern, pickup trucks have far and away the lowest usage rates, while SUVs have the highest rates..

- > Vehicle choice appears to impact seat belt use rates for front seat occupants. As we examine pickup truck front seat occupants more closely, we see several patterns of note. (Note that many of these observations are based on small sample sizes.)
 - In rainy conditions, the seat belt use rate for front seat occupants of pickup trucks dropped to a low of 66.9% - the lowest percent seat belt use rate of the study in 2021.
 - The time interval with the lowest overall seat belt use rates was 5 p.m.-6:59 p.m. Pickup truck front seat occupants were observed wearing seat belts at a rate of 68.5% during this time interval.
 - Young front seat occupants were also much more likely to not wear seat belts when riding in pickup trucks; front seat occupants age 16-29-year-olds were observed wearing seat belts only 79.7% of the time.
 - Male front seat occupants of pickup trucks were more than 8 percent less likely to wear a seat belt compared to their female counterparts.
 - Front seat occupants of pickup trucks also experienced the lowest weekday percent seat belt use among all vehicle types on Sunday (75.9%).
- > Analyzing front seat occupant type by vehicle type, it is observed passengers were more likely in almost every case (excluding cars) to wear their seat belts compared to drivers.
 - The biggest disparities observed between drivers and passengers seat belt use were observed in pickup trucks (83.7% vs 91.5%, driver vs. passenger) and van/minivan (90.3% vs. 95.6%, driver vs passenger).

Appendix A

Methodology

- > *Because the methodology did not change from the previous study in 2019, this methodology documentation is largely a verbatim copy of the methodology writeup from that report (with minor edits), which was prepared by Greenway Transportation Planning. The only notable difference is the discussion of the reserve sample.*

- > The sample design presented in this report was accepted by NHTSA and MnDOT in 2021, with new sites selected in 2017 within that design. The research design conforms to the requirements of the Uniform Criteria. The selected approach incorporates a stratified systematic PPS sample of observation sites described below.
 - 1. Minnesota's counties were listed in descending order based on the average number of motor vehicle crash-related fatalities for the period of 2010 to 2014. Fatality Analysis Reporting System (FARS) data were used to determine the average number of crash-related fatalities per county. The 54 counties accounting for about 85 percent of Minnesota's total passenger vehicle occupant fatalities compose the sampling frame.
 - 2. Using 2014 Road Segment data provided by MnDOT, a listing of county road segments was developed. Each segment was identified by road functional classification (Interstate/Primary, Arterial/Secondary, and Local), by Average Annual Daily Traffic (AADT) and segment length. This descriptive information allowed for stratification of road segments.
 - 3. Counties were stratified based on calculated 2014 vehicle-miles-traveled (VMT) for each county. As in previous years, three levels (high, medium, and low VMT) were used, except in Hennepin County, which was treated as its own stratum. High, medium, or low traffic volume designations were determined by calculating the total VMT for the remaining 53 counties, then sorting the remaining counties highest VMT to lowest. Cut points were then determined, which created three strata with roughly equal VMT based on an analysis looking for cut points in the data for county VMT (after excluding Hennepin County from the analysis).
 - 4. Road segments were selected randomly and with PPS from all segments in the sampling frame. The road segments were stratified by functional classification (Interstate/Primary, Arterial/Secondary, and Local). This process resulted in the selection of 240 road segments (4 strata x 60 sites per stratum).
 - 5. Additional stages of random selection were used to determine each site's observation time of day, day of week and direction of direction.

- > The 54 counties accounting for 85.5 percent of the total fatalities represented the first stage of sampling. These counties were stratified into four groups according to their VMT. The strata, counties, their daily vehicle-miles-traveled (DVMT), and stratum total DVMT are shown in Figure 27. County and Regional Vehicle Miles Traveled, by Stratum, for County Selection.

Figure 27. County and Regional Vehicle Miles Traveled, by Stratum, for County Selection

Strata	County	County DVMT
Hennepin County	Hennepin	30,787,748
High VMT	Ramsey	12,296,484
High VMT	Dakota	10,742,955
High VMT	Anoka	8,267,551
High VMT	Washington	6,435,833
Total High VMT		37,742,823

Methodology: County Selection (continued)

Figure 27 (continued). County and Regional Vehicle Miles Traveled, by Stratum, for County Selection

Strata	County	County DVMT
Med VMT	St. Louis	5,835,807
Med VMT	Stearns	5,097,136
Med VMT	Wright	4,055,010
Med VMT	Olmsted	3,934,327
Med VMT	Scott	3,551,707
Med VMT	Sherburne	2,443,966
Med VMT	Carver	2,372,672
Med VMT	Otter Tail	2,224,865
Med VMT	Crow Wing	2,180,917
Med VMT	Chisago	2,112,333
Med VMT	Clay	2,051,186
Med VMT	Rice	1,960,352
Total Med VMT		37,820,280

Methodology: County Selection (continued)

Figure 27 (continued). County and Regional Vehicle Miles Traveled, by Stratum, for County Selection

Strata	County	County DVMT
Low VMT	Goodhue	1,814,534
Low VMT	Blue Earth	1,679,659
Low VMT	Winona	1,649,152
Low VMT	Douglas	1,621,568
Low VMT	Freeborn	1,534,487
Low VMT	Pine	1,501,447
Low VMT	Steele	1,449,781
Low VMT	Itasca	1,358,057
Low VMT	Carlton	1,339,551
Low VMT	Morrison	1,334,017
Low VMT	Kandiyohi	1,329,340
Low VMT	Benton	1,288,209

Methodology: County Selection (continued)

Figure 27 (continued). County and Regional Vehicle Miles Traveled, by Stratum, for County Selection

Strata	County	County DVMT
Low VMT	Cass	1,202,142
Low VMT	Beltrami	1,160,402
Low VMT	Mower	1,147,076
Low VMT	Polk	1,121,882
Low VMT	Becker	1,105,329
Low VMT	Mille Lacs	1,099,469
Low VMT	Nicollet	1,058,637
Low VMT	Isanti	1,031,488
Low VMT	McLeod	961,778
Low VMT	Nobles	865,717
Low VMT	Martin	853,837
Low VMT	Lyon	779,986

Methodology: County Selection (continued)

Figure 27 (continued). County and Regional Vehicle Miles Traveled, by Stratum, for County Selection

Strata	County	County DVMT
Low VMT	Hubbard	736,804
Low VMT	Jackson	713,046
Low VMT	Aitkin	702,209
Low VMT	Meeker	701,375
Low VMT	Brown	642,880
Low VMT	Redwood	610,693
Low VMT	Dodge	600,372
Low VMT	Wabasha	575,900
Low VMT	Rock	496,260
Low VMT	Lake	470,325
Low VMT	Wilkin	456,407
Low VMT	Chippewa	442,002
Low VMT	Norman	271,629
Total Low VMT		37,707,445

- > Using all 54 counties in the sampling frame, a total of 60 road segments were selected with PPS from within each stratum. The 2014 MnDOT roadway inventory and traffic volume data was used for the selection of road segments. The available dataset exclusion option was exercised for non-public roads, unnamed roads, unpaved roads, vehicular trails, access ramps, cul-de-sacs, traffic circles, and service drives.
- > Road segments within each county were first stratified by functional classification (Interstate/Primary, Arterial/Secondary, and Local). Within each VMT and functional class stratum road segments were selected with PPS with the measure of size (MOS) being DVMT.
- > The resulting composition of the sample of each functional class within each stratum is shown in Figures 28 through 31.

Figure 28. Road Segments Population (N), DVMT, and Number of Segments Selected (n) by Road Functional Strata: Hennepin County Stratum

Data	Interstate/ Primary	Arterial/ Secondary	Local	Total
N	185	2,229	15,465	17,879
DVMT	15,958,013	11,270,770	3,559,710	30,788,493
n	31	22	7	60

Figure 29. Road Segments Population (N), DVMT, and Number of Segments Selected (n) by Road Functional Strata: High VMT Stratum

Data	Interstate/ Primary	Arterial/ Secondary	Local	Total
N	171	3,564	24,348	28,083
DVMT	14,262,521	18,815,397	4,665,856	37,743,774
n	23	30	7	60

Figure 30. Road Segments Population (N), DVMT, and Number of Segments Selected (n) by Road Functional Strata: Medium VMT Stratum

Data	Interstate/ Primary	Arterial/ Secondary	Local	Total
N	91	5,290	29,611	34,992
DVMT	7,709,757	25,552,916	4,579,590	37,842,263
n	12	41	7	60

Figure 31. Road Segments Population (N), DVMT, and Number of Segments Selected (n) by Road Functional Strata: Low VMT Stratum

Data	Interstate/ Primary	Arterial/ Secondary	Local	Total
N	112	8,172	13,640	21,924
DVMT	5,999,139	26,987,744	4,793,023	37,779,906
n	10	43	8	60

- > The survey plan and site reassignment in 2017 initially included the development of a reserve road segment sample, consisting of two additional road segments per original road segment selected, resulting in a reserve sample of 480 road segments.
- > However, due to a change in research contractors and other logistical issues, the reserve road segment list was not available in 2021. Two of the 240 sites were not usable due to construction at the sites. In those cases, it was agreed by the Contractor, Minnesota Office of Traffic Safety, and NHTSA to consider those sites to be “empty block” sites with zero observations, in which case no adjustments to the survey plan or weightings were needed. The standard error of the study also remained well within the requirements.

Appendix B

DATA COLLECTION

- > *Because the methodology did not change from the previous study in 2019, this data collection documentation is largely a verbatim copy of the writeup from that report (with minor edits), which was prepared by Greenway Transportation Planning. The only notable difference is the discussion of the staff selection and training, and some changes in the data collection technology.*

- > The site selection process described and used in this report was developed by Greenway Transportation Planning, accepted by NHTSA and MnDOT, and implemented in 2021 by Corona Insights. The points below reflect the initial 2017 site selection process, which carries forward into 2021.
 - Road segments were mapped according to their latitude and longitude. The selected road segments were examined using both Google and Esri mapping tools to identify an intersection or interchange that occurs within the segment. If no intersection or interchange occurred within the segment, then any suitable point within that segment was used for observation.
 - Observation sites were selected to identify a safe and convenient location for the observer to be stationed during the survey period. Observation site selection also included cross-checking survey dates against scheduled construction activities via MnDOT's 511 Traveler Information Service and inspection of state highway GIS base maps for posted speed limits and supporting traffic control installations.
 - Sites including an intersection or interchange were assigned to locations in the segment at or as near as possible to any controlled intersections. For interstate highways and other primary roads with interchanges, observation sites were selected to be on a ramp carrying traffic that is exiting the highway. The observed direction of travel was randomly assigned for each road segment.
 - For high-volume roadways (those in which an observer could not reasonably be assured of surveying all lanes of travel in the desired direction), observations were taken from the curbside or next-to-curbside lanes. This was because it was impractical (especially in free-flowing traffic at speeds over 40 mph) to observe vehicles more than two lanes distant from the observer's position. The locations of the observation sites were described on Site Assignment emails provided to aid the observers and Quality Control (QC) Monitor in traveling to the assigned locations.

- > Data collectors were recruited through a variety of hiring methods, and received the following testing and training.
 - Collectors attended a video meeting in which the project manager discussed the background and goals of the survey, and provided an overview of the research and the data collection process.
 - The project manager described data collection requirements and standards, including issues such as types of vehicles to observe, frequency protocols, definitions, and other issues pertinent to their duties.
 - The project manager provided training on how to use the smartphone-based data collection tool.
 - Each data collector took a test to assess their ability to accurately record seat belt data.
- > Only those potential data collectors who passed the test were hired to conduct data collection.
- > Per the project requirements, the project manager also conducted random on-site audits of data collectors to ensure proper on-site attendance and data collection methods.

- > Observations were conducted daily between 7 a.m. and 6 p.m.
- > Observation of seat belt use was conducted for 45 minutes per site, at up to five sites per day for each observer. Sites within proximity were grouped as observation clusters and were randomly assigned a day of the week observation period.
- > Start times were staggered to ensure that a representative number of weekday, weekend, rush hour and non-rush hour sites were included. The first site in each group and its observation time was randomly selected. The order for the observations of the remaining sites for the day was designed to reduce travel time and costs.
- > Maps showing the location of all observation sites and site assignment sheets were provided to the observers via email. These indicated the observed road name, the crossroad included within the road segment (or nearest crossroad), assigned date, assigned time, direction of travel, and lanes assigned.

Data Collection: Observation Periods and Quality Control (continued)

> Data Collection

- > All passenger vehicles, including commercial vehicles weighing less than 10,000 pounds, were eligible for observation.
- > A pre-survey was designed to allow for documentation of descriptive site information; including date, site location, site number, alternate site data, assigned traffic flow, number of lanes available and observed, and weather conditions. This form was completed by the observer at each site.
- > A five-minute pre-observation period was used to collect eligible vehicle counts for the lanes to be observed at each site. This period of counting was used to determine the sampling rate of vehicles at the site. In keeping with the guidance in the Preamble of the Uniform Criteria, observers were instructed to sample every Nth vehicle at locations, using the following guideline:
 - For 31 or more vehicles per five-minute count—observe every 5th vehicle.
 - For 16–30 vehicles per five-minute count—observe every 3rd vehicle.
 - For 0–15 vehicles per five-minute count—observe every vehicle.

Data Collection: Observation Periods and Quality Control (continued)

- > **Data Collection (continued)**
- > All relevant information was collected for all qualifying front seat occupants in eligible vehicles. This included children riding in booster seats. The only right front seat occupants excluded from this study were child passengers who were traveling in child seats with harness straps.
- > All entries were made via survey forms by the observer on smart phones, using a link that immediately uploaded the data to Corona Insights' data collection software. The data collection survey was designed to record seat belt use by drivers and passengers. The estimated age and gender of all drivers and front seat passengers were collected within the system as well.
- > A small number of sites were conducted using paper proxy forms for data collection due to a lack of internet access on the site.
- > Only one direction of traffic was observed at any given site.
- > At the end of the observation period for each site, observers completed a post-survey that afforded the opportunity to include any relevant site notes regarding the observation site and observation period.
- > Observations began on July 31, 2021, and all observations were completed by September 1, 2021.

Data Collection: Observation Periods and Quality Control (continued)

> Alternate Sites and Rescheduling

- > When a site could not be observed due to safety concerns, construction or inclement weather and no alternate site was immediately available, data collection was rescheduled for later in the data collection period at a similar time of day and day of week.
- > If the site was going to be unavailable for the duration of the study, then it was excluded from this year's study. Two sites (Site 184 and 235) were excluded due to road construction and the inability to access the pre-approved alternate sites list. These were classified as "empty block sites" with zero observations, per the approved survey plan.

> Quality Control Procedures

- > Per the project requirements, the project manager also conducted random on-site audits of data collectors. The requirements called for at least 5 percent of sites to be audited (12 of the 240 sites). The project manager conducted 13 audits, including at least one with each data collector.
- > Additionally, the data uploads from the smart phone survey were generally instantaneous, allowing for real-time monitoring of data collection remotely.

Appendix C

List of Road Segment Samples by Stratum

- > *Because the study sites did not change from the previous study in 2019, this documentation is largely a verbatim copy of the writeup from that report (with minor edits), which was prepared by Greenway Transportation Planning.*

List of Road Segment Samples by Stratum

ID ¹	Road Type	County	Observation Site	Route Number	Beg. Ref. Point	End Ref. Point
Hennepin County Stratum						
1	Primary	Hennepin	NB I-94 & MN 101 off ramp RT	100000094	208.15	214.05
2	Primary	Hennepin	NB I-94 & Maple Grove Pway off ramp RT	100000094	214.05	216.33
3	Primary	Hennepin	SB I-94 & Bottineau Blvd off ramp	100000094	220.38	221.28
4	Primary	Hennepin	SB I-94 & Shingle Creek Pkway off ramp T/RT	100000094	223.22	224.90
5	Primary	Hennepin	SB I-94 & Dowling Ave off ramp RT	100000094	227.39	228.77
6	Primary	Hennepin	SB I-94 & W Broadway Ave off ramp RT	100000094	229.80	232.06
7	Primary	Hennepin	NB I-94 & Hennepin Ave off ramp RT	100000094	232.86	233.44
8	Primary	Hennepin	SB I-94 & Huron Blvd off ramp	100000094	235.57	236.14
9	Primary	Hennepin	EB I-394 & Plymouth Rd off ramp RT	100000394	0.00	0.73
10	Primary	Hennepin	WB I-394 & Xenia Ave off ramp RT	100000394	4.61	5.86
11	Primary	Hennepin	WB I-494 & Nicollet Ave off ramp RT	100000494	3.95	4.52
12	Primary	Hennepin	EB I-494 & Penn Ave off ramp RT	100000494	5.29	6.03

List of Road Segment Samples by Stratum (continued)

ID ¹	Road Type	County	Observation Site	Route Number	Beg. Ref. Point	End Ref. Point
13	Primary	Hennepin	SB I-494 & MN 62 off ramp RT	100000494	13.66	16.02
14	Primary	Hennepin	NB I-494 & Carlson Pkway off ramp RT	100000494	17.62	19.77
15	Primary	Hennepin	NB I-494 & CR 6 off ramp RT	100000494	20.18	21.47
16	Primary	Hennepin	SB I-494 & MN 55 off ramp RT	100000494	22.06	23.34
17	Primary	Hennepin	SB I-494 & Rockford Rd off ramp RT	100000494	23.34	27.99
18 ^R	Primary	Hennepin	SB I-35W & 46 St off ramp	0100000035 W	13.90	15.22
19	Primary	Hennepin	NB I-35W & New Brighton Blvd off ramp RT	0100000035 W	19.28	20.26
20	Primary	Hennepin	SB US 169 & Anderson Lake Pkway off ramp RT	200000169	118.41	120.02
21	Primary	Hennepin	NB US 169 & Betty Crocker Dr off ramp RT/LT	200000169	127.84	128.32
22	Primary	Hennepin	SB US 169 & Plymouth Ave off ramp	200000169	129.13	130.18
23	Primary	Hennepin	NB US 169 & 36th Ave off ramp RT	200000169	130.18	132.10
24	Primary	Hennepin	SB US 169 & Elm Creek Blvd off ramp RT	200000169	136.63	137.23
25	Primary	Hennepin	SB US 169 & 109th Ave RT	200000169	139.39	141.07

List of Road Segment Samples by Stratum (continued)

ID ¹	Road Type	County	Observation Site	Route Number	Beg. Ref. Point	End Ref. Point
26	Primary	Hennepin	EB MN 5 & Post Rd off ramp	300000005	61.31	62.71
27	Primary	Hennepin	EB MN 62 & 28th Ave off ramp	300000062	113.68	114.51
28	Primary	Hennepin	NB MN 100 & 70th St off ramp RT	300000100	0.39	1.38
29	Primary	Hennepin	SB MN 100 & Edina Industrial Blvd off ramp RT	300000100	1.38	2.07
30	Primary	Hennepin	NB MN 100 & Exelsior Blvd off ramp RT	300000100	3.83	6.03
31	Primary	Hennepin	SB MN 100 & France Ave N off ramp RT	300000100	12.57	14.07
32	Secondary	Hennepin	NB MN 55 & 38th St RT	300000055	194.61	195.72
33 ^R	Secondary	Hennepin	NB MN 65 & S 10th St RT	300000065	0.00	0.62
34	Secondary	Hennepin	NB Eden Prairie Rd & Scenic Heights Rd RT	427000004	1.71	2.55
35	Secondary	Hennepin	NB Noble Pkway & 97th Ave N T/RT	427000012	1.21	1.63
36	Secondary	Hennepin	EB Shoreline Dr & Hidden Vale Ln	427000015	5.40	6.45
37	Secondary	Hennepin	NB France Ave S & W 90th St RT	427000017	1.16	2.19
38	Secondary	Hennepin	NB CR 19 Manitou Rd & Wood Duck Ln	427000019	1.19	2.61

List of Road Segment Samples by Stratum (continued)

ID ¹	Road Type	County	Observation Site	Route Number	Beg. Ref. Point	End Ref. Point
39	Secondary	Hennepin	NB CR 19 & CR 10 Woodland Trl RT	427000019	17.95	19.94
40	Secondary	Hennepin	SB Normandale Blvd & W 98th St RT	427000034	1.26	3.05
41	Secondary	Hennepin	SB Normandale Blvd & W 84th St RT	427000034	3.05	3.54
42	Secondary	Hennepin	SB Nicollet Ave & E 76th St RT	427000052	2.52	3.46
43	Secondary	Hennepin	SB Baker Rd & MN62 Townline Rd RT	427000060	2.29	3.29
44	Secondary	Hennepin	SB W Broadway Ave & Brooklyn Ave RT	427000103	0.00	1.00
45	Secondary	Hennepin	WB Brooklyn Blvd & Bottineau Blvd RT	427000152	0.00	0.36
46	Secondary	Hennepin	EB W 76th & Xerxes Ave	511050136	2.20	2.30
47	Secondary	Hennepin	WB W50th St & Arden Ave	511050141	0.82	1.10
48	Secondary	Hennepin	EB Weaver Lake Rd & E Fish Lake Rd RT	524300102	2.72	3.04
49	Secondary	Hennepin	SB Vicksburg Ln N & 32nd Ave RT	531050156	1.84	2.64
50	Secondary	Hennepin	EB Brookdale Dr N & Xerxes Ave N RT	504650101	0.81	1.87
51	Secondary	Hennepin	SB La Salle Ave & W Grant St	525850159	0.50	0.88

List of Road Segment Samples by Stratum (continued)

ID ¹	Road Type	County	Observation Site	Route Number	Beg. Ref. Point	End Ref. Point
52	Secondary	Hennepin	NB Bloomington Ave S & E 28th ST	525850160	2.98	3.47
53	Secondary	Hennepin	EB Old Rockford Rd & Dunkirk Ln N	531050173	0.48	1.24
54	Local	Hennepin	SB Fernbrook Ln & Rockford Rd T/RT	531050164	2.24	2.77
55	Local	Hennepin	SB 5th Ave S & E 96th St	1003850622	0.00	0.63
56	Local	Hennepin	SB Stevens Ave S & E 90th St	1003850626	0.00	1.28
57	Local	Hennepin	WB Triton Dr & Lilac Dr N	1014950015	0.00	0.51
58	Local	Hennepin	NB N Newton Ave & N 8th Ave	1025850328	0.00	1.12
59	Local	Hennepin	EB Traffic St NE & Taft St NE	1025850455	0.00	0.52
60	Local	Hennepin	WB Seymour Dr & Birch Rd	1026100431	0.00	0.27
High VMT Stratum						
61	Primary	Dakota	NB I-35W & Kenwood Trail off ramp RT	100000035	84.50	85.61
62	Primary	Anoka	NB I-35 & MN 97 Lake Dr NE off ramp RT	100000035	127.50	129.30
63	Primary	Ramsey	WB I-94 & Lexington Ave off ramp LT	100000094	240.23	242.04

List of Road Segment Samples by Stratum (continued)

ID ¹	Road Type	County	Observation Site	Route Number	Beg. Ref. Point	End Ref. Point
64	Primary	Ramsey	WB I-94 & Marion St off ramp LT	100000094	242.04	242.55
65	Primary	Washington	EB I-94 & Radio Dr off ramp LT	100000094	249.75	251.07
66	Primary	Dakota	EB I-494 & Maxwell Ave off ramp RT	100000494	63.41	64.21
67	Primary	Dakota	WB I-494 & Concord St S off ramp RT	100000494	64.21	64.83
68	Primary	Dakota	WB I-494 & Dodd Rd off ramp RT	100000494	66.64	67.47
69	Primary	Ramsey	WB I-694 & Silver Lake Rd NW off ramp RT	100000694	37.75	39.81
70	Primary	Ramsey	WB I-694 & Lexington Ave Rd N off ramp RT	100000694	42.97	43.78
71	Primary	Ramsey	EB I-694 & White Bear Ave Rd N off ramp RT	100000694	48.68	49.46
72	Primary	Dakota	SB I-35E & Cliff Rd N off ramp RT	0100000035E	93.54	94.63
73	Primary	Ramsey	NB I-35E & Randolph Ave off ramp RT	0100000035E	104.26	105.22
74	Primary	Ramsey	NB I-35E & Co Rd E East off ramp RT	0100000035E	114.95	115.67
75	Primary	Ramsey	SB I-35E & Co Rd E East off ramp RT	0100000035E	115.67	117.28
76	Primary	Ramsey	SB I-35W & Co Rd D West off ramp RT	0100000035 W	24.38	25.02

List of Road Segment Samples by Stratum (continued)

ID ¹	Road Type	County	Observation Site	Route Number	Beg. Ref. Point	End Ref. Point
77	Primary	Anoka	SB I-35W & Co Rd I West off ramp RT	010000035 W	30.04	30.76
78	Primary	Anoka	NB I-35W & 95th Ave NE off ramp RT	010000035 W	30.76	31.84
79	Primary	Anoka	SB I-35W & 95th Ave NE off ramp RT	010000035 W	31.84	33.44
80	Primary	Anoka	SB US 10 & Armstrong Blvd NW off ramp RT	200000010	219.81	222.19
81	Primary	Dakota	SB US 52 & Mendota Rd E off ramp RT	200000052	126.22	127.83
82	Primary	Ramsey	EB MN 36 & Hamline Ave off ramp	300000036	1.24	1.67
83	Primary	Dakota	SB MN 77 & Cliff Rd off ramp RT	300000077	2.85	4.90
84	Secondary	Washington	SB US 61 & W 3rd St RT	200000061	117.16	118.86
85	Secondary	Washington	WB MN 36 & Hilton Trl off ramp	300000036	12.81	16.78
86	Secondary	Washington	EB MN 36 & N Osgood Ave N RT	300000036	18.77	19.49
87	Secondary	Washington	NB MN 36 & Nelson St E	300000036	20.63	21.53
88	Secondary	Anoka	NB MN 65 & Osborne Rd NE RT	300000065	9.53	11.54
89	Secondary	Anoka	NB MN 65 & 125th Ave NE RT	300000065	16.31	17.17

List of Road Segment Samples by Stratum (continued)

ID¹	Road Type	County	Observation Site	Route Number	Beg. Ref. Point	End Ref. Point
90	Secondary	Dakota	WB CR 42 & Portland Ave S RT	419000042	2.72	3.70
91	Secondary	Washington	NB US 61 & CR 97 210th St N	200000061	154.90	159.29
92	Secondary	Anoka	NB MN 47 & Alpine Dr NW RT	300000047	22.73	23.94
93	Secondary	Ramsey	SB Snelling Ave N & Lydia Ave N RT	300000051	9.08	9.59
94	Secondary	Anoka	SB Central Ave & 44th Ave NE	300000065	6.88	7.50
95	Secondary	Dakota	NB Dodd Rd & Yankee Doodle Rd RT	300000149	0.86	1.95
96	Secondary	Anoka	NB Lake George Blvd & Bridge St NW	402000009	9.62	11.66
97	Secondary	Anoka	SB Coon Creek Blvd NW & Main St NW RT	402000018	2.37	3.18
98	Secondary	Anoka	EB CR 26 227th Ave NE & Typo Creek Dr NE	402000026	3.45	6.54
99	Secondary	Dakota	EB Lone Oak Rd & Neil Armstrong Blvd RT	419000026	1.77	2.02
100	Secondary	Dakota	EB Cliff Rd & Ranhcliff Rd RT	419000032	4.02	4.78
101	Secondary	Dakota	SB Diamond Path W & 140th St W	419000033	1.00	2.33
102	Secondary	Dakota	EB 212th St W & Denmark Ave RT	419000050	8.15	9.14

List of Road Segment Samples by Stratum (continued)

ID¹	Road Type	County	Observation Site	Route Number	Beg. Ref. Point	End Ref. Point
103	Secondary	Ramsey	EB CR E West & Victoria St N T/RT	462000015	4.13	4.82
104	Secondary	Ramsey	EB CR C East & Cypress St N	462000023	6.44	7.14
105	Secondary	Ramsey	WB Larpenteur Ave E & Jessie St	462000030	5.82	6.42
106	Secondary	Ramsey	NB Hodgson Rd & MN 96 RT	462000049	7.38	8.66
107	Secondary	Ramsey	NB McKnight Rd N & Conway Ave RT	462000068	3.45	3.76
108	Secondary	Washington	NB Stonebridge Trl N & St Croix Ave W	482000005	2.68	2.81
109	Secondary	Dakota	WB Wescott Rd & Lexington Ave S RT	510630106	1.03	1.81
110	Secondary	Washington	WB Myrtle St & Owen St N	536750104	0.00	0.44
111	Secondary	Dakota	NB MN 13 & Riverside Ln	300000013	109.38	110.18
112	Secondary	Washington	WB Frenchman Rd & Victor Hugo Blvd RT	482000008	0.00	1.41
113	Secondary	Anoka	EB Green Valley Rd & St Francis Blvd NW	702000063	0.00	1.14
114	Local	Anoka	WB Rum River Dr & Dunham Dr	1000950204	0.00	0.81
115	Local	Dakota	SB Hayes Dr & 27th Ave S	1005370005	0.00	0.41

List of Road Segment Samples by Stratum (continued)

ID ¹	Road Type	County	Observation Site	Route Number	Beg. Ref. Point	End Ref. Point
116	Local	Washington	EB Pinehurst Rd & Donegal Dr	1041730191	0.00	1.65
117	Local	Dakota	NB Isosceles Ave & Irwindale Way	1021500958	0.00	0.23
118	Local	Ramsey	NB Saratoga St S & Summit Ave	1034250334	0.00	1.37
119	Local	Ramsey	WB Dayton Ave & Hamline Ave	1034251549	0.00	0.52
120	Local	Washington	WB Oxford Rd & Sunbury Dr	1041730643	0.00	0.62
Medium VMT Stratum						
121	Primary	Rice	NB I-35 & CR 1 Millersburg Blvd off ramp RT	100000035	59.11	66.46
122	Primary	Chisago	SB I-35 & E Viking Blvd off ramp RT	100000035	135.55	139.98
123	Primary	Chisago	NB I-35 & CR 10 Stark Rd off ramp	100000035	147.93	152.44
124	Primary	St Louis	NB I-35 & N Central Ave off Ramp	100000035	251.23	252.05
125	Primary	Clay	SB I-94 & CR 10 90th Ave S off ramp	100000094	6.23	15.44
126	Primary	Wilkin	NB I-94 & MN 34 off ramp	100000094	24.54	27.00
127	Primary	Stearns	SB I-94 & CR 11 1st Ave S off ramp	100000094	131.08	140.70

List of Road Segment Samples by Stratum (continued)

ID¹	Road Type	County	Observation Site	Route Number	Beg. Ref. Point	End Ref. Point
128	Primary	Wright	SB I-94 & CR 8 Elder Ave NW off ramp	100000094	178.95	184.13
129	Primary	Wright	SB I-94 & MN 25 CR 8 off ramp RT	100000094	184.13	193.92
130	Primary	Wright	NB I-94 & CR 37 60th St NE off ramp RT	100000094	202.54	205.43
131	Primary	Wright	SB I-94 & MN 241 45th St NE off ramp	100000094	205.43	206.01
132	Primary	Carver	EB US 212 & Powers Blvd RT	200000212	148.92	151.83
133	Secondary	Chisago	EB US 8 Lake Blvd & Redwing Ave RT	200000008	14.29	16.56
134	Secondary	Clay	WB US10 & CR 9 RT	200000010	12.96	21.12
135	Secondary	Sherburne	SB US 10 & MN 24 RT	200000010	182.09	190.04
136	Secondary	Olmsted	SB US 52 & Union St NE	200000052	35.58	38.95
137	Secondary	Olmsted	SB US 52 & CR 12 Ash Rd NW LT	200000052	69.06	69.85
138	Secondary	St Louis	SB US 53 & Haines Rd RT	200000053	6.97	8.32
139	Secondary	St Louis	SB US 53 & MN 53 (Bus) LT	200000053	68.65	70.86
140	Secondary	Olmsted	NB US 63 & 9th St SE	200000063	27.27	28.26

List of Road Segment Samples by Stratum (continued)

ID ¹	Road Type	County	Observation Site	Route Number	Beg. Ref. Point	End Ref. Point
141	Secondary	Scott	NB US 169 & Chestnut Blvd RT	200000169	103.61	105.96
142	Secondary	Scott	WB US 169 & Canterbury Rd S RT	200000169	111.97	113.69
143	Secondary	St Louis	WB US 169 & CR 67 RT	200000169	344.29	351.20
144	Secondary	Scott	EB MN13 & Lynn Ave RT	300000013	91.97	94.04
145	Secondary	Stearns	SB MN 23 & CR 82 RT	300000023	187.45	195.62
146	Secondary	St Louis	NB MN 23 & W Gary St	300000023	335.71	338.04
147	Secondary	St Louis	NB MN 23 & N 62nd Ave	300000023	340.55	341.47
148	Secondary	Crow Wing	WB MN 210 & Chippewa St	300000210	121.72	122.46
149	Secondary	Scott	WB Egan Dr & Vernon Dr RT	470000042	7.36	8.25
150	Secondary	Olmsted	NB S Broadway & 12th St SE RT	532350201	1.62	1.98
151	Secondary	Chisago	NB US 61 & Wyoming Trail RT	200000061	162.94	164.56
152	Secondary	Rice	WB MN 19 & Baldwin St NE	300000019	163.10	168.59
153	Secondary	Wright	NB MN 24 & US 94 on ramp RT	300000024	34.17	43.50

List of Road Segment Samples by Stratum (continued)

ID¹	Road Type	County	Observation Site	Route Number	Beg. Ref. Point	End Ref. Point
154	Secondary	Sherburne	SB MN 25 & US 10	300000025	80.62	86.02
155	Secondary	Olmsted	EB MN 30 & US 52	300000030	229.66	236.52
156	Secondary	St Louis	SB MN 73 & 13th St NW	300000073	93.38	114.48
157	Secondary	Carver	NB MN 284 & Sparrow Rd	300000284	2.94	5.18
158	Secondary	Carver	WB CR 20 & Paul Ave	410000020	11.34	13.71
159	Secondary	Olmsted	WB Collegeview Rd & E Center St RT	455000009	0.00	0.49
160	Secondary	Otter Tail	SB CR 88 & N Tower Rd	456000088	0.00	1.67
161	Secondary	St Louis	SB Midway Rd & MN 194 RT	469000013	7.57	10.72
162	Secondary	Scott	WB 217th St E/Lucerne Blvd & Texas Ave	470000008	13.55	15.21
163	Secondary	Scott	SB Canterbury Rd S & 17th Ave E RT	470000083	1.53	3.74
164	Secondary	Stearns	WB 3rd St N & 13th Ave N	473000081	0.45	0.65
165	Secondary	Wright	WB CR 39 NE & Labeaux Ave NE LT	486000039	25.00	26.52
166	Secondary	St Louis	NB W Superior St & S Lake Ave	510400171	0.52	0.69

List of Road Segment Samples by Stratum (continued)

ID ¹	Road Type	County	Observation Site	Route Number	Beg. Ref. Point	End Ref. Point
167	Secondary	Clay	NB 34th St & US 10 RT	526450135	2.07	2.59
168	Secondary	Rice	EB Jefferson Pkway E & Raider Dr	528500117	0.96	1.32
169	Secondary	Stearns	SB 25th Ave N & 5th St N	533800132	1.64	2.15
170	Secondary	Stearns	NB 10th Ave N & 1st St N	539450103	0.92	1.31
171	Secondary	Crow Wing	SB CR 20 & McKay Rd	418000020	0.69	3.78
172	Secondary	Otter Tail	SB CR 14 & CR 1	456000014	2.71	6.50
173	Secondary	St Louis	WB MN 52 Comstock Lake Rd & US 53	469000052	15.81	18.60
174	Local	Carver	WB Hundermark Rd & Hemingway Dr	506450108	0.44	1.06
175	Local	Carver	WB 78th St & Arboretum Rd	538950104	0.00	0.35
176	Local	St Louis	EB W Gary St & CR 23	1010400049	1.09	1.25
177	Local	Olmsted	SB W Frontage Rd & 43rd St NW	532350131	0.00	1.14
178	Local	Olmsted	SB E Frontage Rd & 22nd Ave NW	532350130	0.00	0.79
179	Local	Sherburne	WB Natures Edge Rd & CR 6	1007100014	0.00	0.18

List of Road Segment Samples by Stratum (continued)

ID ¹	Road Type	County	Observation Site	Route Number	Beg. Ref. Point	End Ref. Point
180	Local	Carver	SB Laketown Rd & CR 10	810000136	0.00	0.52
Low VMT Stratum						
181	Primary	Pine	SB I-35 & MN 48 off ramp RT	100000035	182.95	191.38
182	Primary	Pine	SB I-35 & MN 23 off ramp	100000035	191.38	195.62
183	Primary	Carlton	SB I-35 & CR 46 off ramp	100000035	209.67	214.91
184	Primary	Rock	WB I-90 & CR 6 off ramp	100000090	5.25	12.48
185	Primary	Freeborn	WB I-90 & MN 109 off ramp	100000090	146.29	154.74
186	Primary	Mower	WB I-90 & CR 46 off ramp	100000090	166.32	175.49
187	Primary	Mower	WB I-90 & CR 56 off ramp	100000090	183.56	187.49
188	Primary	Winona	EB I-90 & CR 29 off ramp	100000090	232.50	242.24
189	Primary	Winona	WB I-90 & MN 76 off ramp	100000090	257.90	266.24
190	Primary	Wilkin	NB I-94 & MN 108 off ramp	100000094	32.50	38.23
191	Secondary	Becker	NB US 10 & 2nd St RT	200000010	28.63	43.36

List of Road Segment Samples by Stratum (continued)

ID ¹	Road Type	County	Observation Site	Route Number	Beg. Ref. Point	End Ref. Point
192	Secondary	Becker	SB US 10 & US 59 RT	200000010	43.36	44.54
193	Secondary	Redwood	EB US 14 & US 71 T/RT	200000014	58.89	67.54
194	Secondary	Wabasha	NB US 61 & S Oak St	200000061	60.23	70.59
195	Secondary	Mower	SB US 63 & MN 16	200000063	18.65	23.21
196	Secondary	Kandiyohi	SB US 71 & 1st St	200000071	121.15	124.28
197	Secondary	Beltrami	NB US 71 & US 2 RT	200000071	304.05	307.03
198	Secondary	McLeod	WB MN 7 & CR 2	300000007	150.99	157.89
199	Secondary	McLeod	NB MN 22 & Doran St	300000022	107.28	114.37
200	Secondary	McLeod	SB MN 22 & Ames St	300000022	114.37	118.25
201	Secondary	Cass	NB MN 34 & MN 200 RT	300000034	93.47	102.97
202	Secondary	Winona	SB MN 43 & CR 12 RT	300000043	36.58	40.93
203	Secondary	Winona	NB MN 43 & E 8th St	300000043	43.39	43.74
204	Secondary	Lake	NB MN 61 & Ruth St	300000061	36.78	50.43

List of Road Segment Samples by Stratum (continued)

ID ¹	Road Type	County	Observation Site	Route Number	Beg. Ref. Point	End Ref. Point
205	Secondary	Cass	NB MN 371 & Railroad St	300000371	101.20	104.23
206	Secondary	Norman	NB US 75 & Southview Dr	200000075	270.82	277.84
207	Secondary	Polk	SB US 75 & McKinley Ave	200000075	292.05	302.62
208	Secondary	Beltrami	WB MN 1 & West St	300000001	119.44	122.33
209	Secondary	Dodge	WB MN 30 & US 56	300000030	200.27	203.56
210	Secondary	Dodge	SB US 56 & MN 30 RT	300000056	46.36	54.36
211	Secondary	Isanti	WB CR 95 1st Ave E & Flanders St NE RT	300000095	42.98	49.46
212	Secondary	Douglas	SB McKay Ave S & 7th Ave E	421000046	3.45	4.95
213	Secondary	Meeker	NB CR 2 & MN 55	447000002	0.00	8.70
214	Secondary	Martin	NB Albion Ave & E Belle Vue Rd	512400110	1.16	1.80
215	Secondary	Nicollet	NB Lor Ray Dr & US 14 RT	528550117	0.41	0.63
216	Secondary	Benton	SB Wilson Ave & 2nd St SE	533800106	0.27	0.51
217	Secondary	Douglas	EB MN 27 & CR 45 T/RT	0300000827 A	0.00	0.22

List of Road Segment Samples by Stratum (continued)

ID ¹	Road Type	County	Observation Site	Route Number	Beg. Ref. Point	End Ref. Point
218	Secondary	Meeker	SB MN 24 & MN 22	300000024	0.00	1.49
219	Secondary	Goodhue	SB MN 57 & County 30 Blvd	300000057	20.72	24.58
220	Secondary	Brown	SB MN 258 & CR 17 E	300000258	0.00	7.86
221	Secondary	Douglas	EB CR 82 & CR 45 T/RT	421000082	20.73	22.49
222	Secondary	Jackson	SB 490th Ave & 780th St	432000017	8.20	18.20
223	Secondary	McLeod	NB 1st St N & Fairlawn Ave E	443000116	0.54	0.92
224	Secondary	Martin	WB CR 26 & Burton Lane	446000026	25.79	30.78
225	Secondary	Martin	SB MN 263 & US I-90 RT	446000027	12.68	16.18
226	Secondary	Morrison	WB Iris Rd & US 10	449000035	0.00	4.66
227	Secondary	Mower	SB CR 8 & MN 16	450000008	13.98	16.97
228	Secondary	Steele	SB CR 45 & MN 30	474000045	5.47	7.47
229	Secondary	Morrison	SB Hilton Rd & Riverview Terrace	749000258	8.45	9.00
230	Secondary	Becker	EB CR 58/37 & CR 37 LT/T	403000058	0.00	4.06

List of Road Segment Samples by Stratum (continued)

ID ¹	Road Type	County	Observation Site	Route Number	Beg. Ref. Point	End Ref. Point
231	Secondary	Goodhue	SB County 7 Blvd & US 52	425000007	0.00	3.67
232	Secondary	Itasca	SB CR 48 & CR 19	431000048	0.00	2.01
233	Secondary	Norman	EB CR 23 & MN 200	454000023	4.08	12.11
234	Local	Blue Earth	NB Long St & Belle Ave	524200148	0.00	0.50
235	Local	Steele	SB 24 Ave NW & W Bridge St	529800137	1.47	2.25
236	Local	Polk	WB 265th St SW & 240th Ave SW	860000855	1.82	2.67
237	Local	Freeborn	EB Lake Shore Dr/Garden Lane	1000450170	0.00	1.46
238	Local	Mower	WB 6th St NW/14th St SW	1001500059	0.00	1.15
239	Local	Winona	NB 47th Ave & 6th St	1015200010	0.00	0.30
240	Local	Nobles	WB Miller St & 14th St	1041900015	0.00	0.59

Note: ¹ R indicates alternative site used

CORONA INSIGHTS

1401 Lawrence Street

Suite 1600

Denver, CO 80202

303.894.8246

CoronaInsights.com

