Seat Belt Use in Washington State, 2019

As Submitted to the National Highway Traffic Safety Administration per 23 CFR Part 1340: Uniform Criteria for State Observational Surveys of Seat Belt Use

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REPORT SUMMARY – 2019 Seat Belt Use Observation Survey

- The 2019 seat belt use rate was nearly identical to the 2018 seat belt use rate, 93.2 percent and 93.1 percent.

- For the 2018-2022 surveys the number of counties included in the survey increased from 21 to 26. These counties account for 91 percent of all passenger vehicle occupant fatalities and 93 percent of all unrestrained passenger vehicle occupant fatalities.

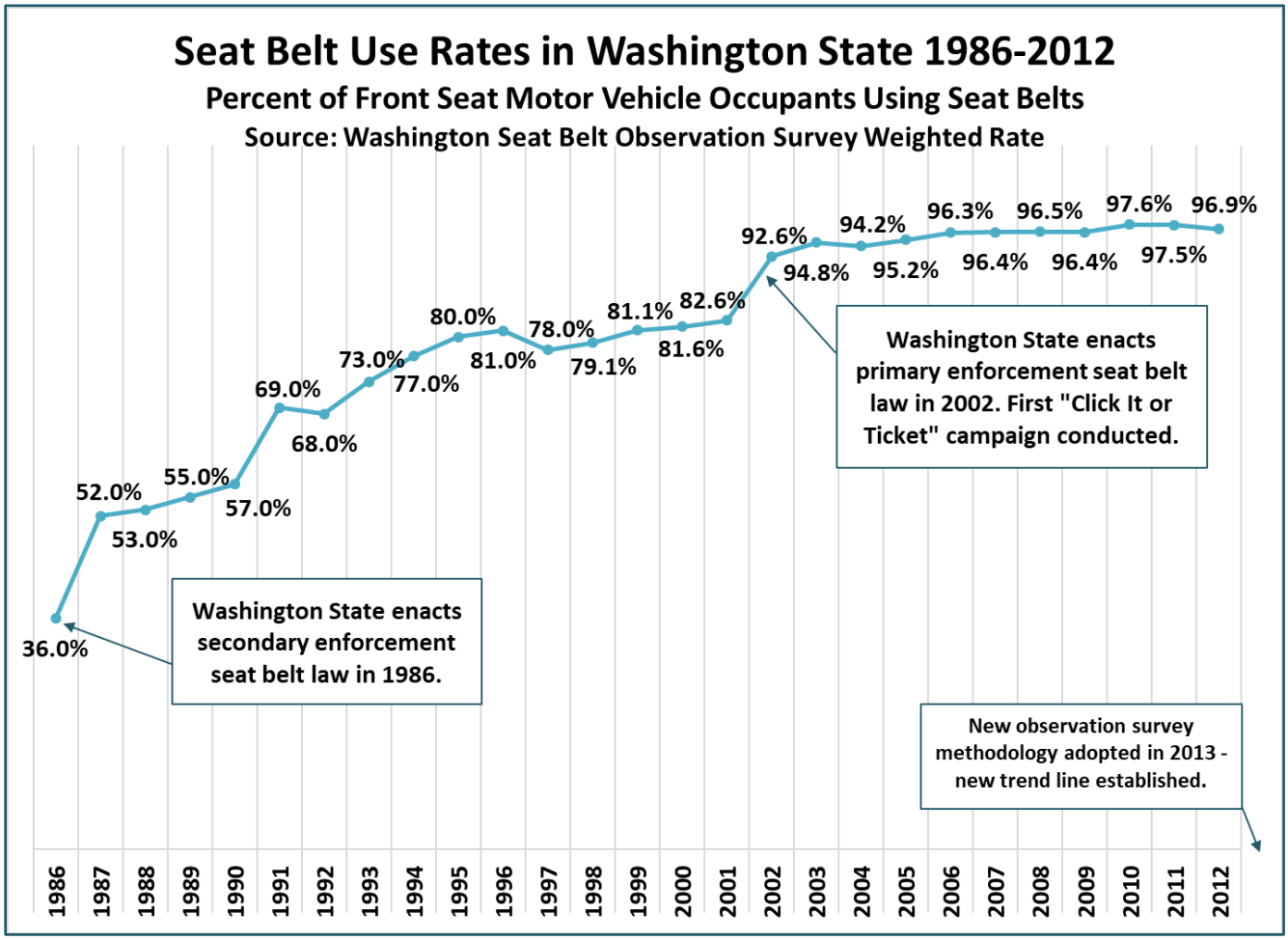
- Three counties (Kitsap, Pierce, and Thurston) have lower seat belt use rates than the state rate, while eight counties have better rates. Thirteen counties have rates that do not differ from the state. Three counties (Ferry, Pend Oreille, and Stevens) could not be reported due to a high survey standard error, a measure of statistical accuracy.

- The seat belt use rate measured on city streets (91.4 percent) was slightly lower than the rate measured on county roads (93.0 percent) and on state routes (93.5 percent). However, these are not statistically significant differences. These rates did not change from the 2018 rates.

- All county-level seat belt use rates for 2013-2019 are available in Appendix A.

SEAT BELT USE IN WASHINGTON STATE

Seat belts are highly effective for reducing the severity of traffic injuries. Seat belt use by all motor vehicle occupants is both a national and Washington State priority. Over the past three decades, dramatic increases in seat belt use have been achieved by enacting mandatory use laws, law enforcement strategies, and public education campaigns. Since Washington enacted a secondary enforcement seat belt law in 1986, annual observation surveys of seat belt use have been conducted to assess changes in the rates of seat belt use in Washington.



Since the survey was first conducted in 1986, seat belt use in Washington State has shown a fairly consistent upward trend—more than doubling in the 10 years following implementation of the secondary enforcement law (from 36 percent in 1986 to 80 percent in 1995). The usage rates in Washington under the secondary law were among the highest reported by secondary-law states. However, little change in belt use was seen between 1995 and 2001.

In 2002 changes implemented in laws, policies, and programs had a dramatic influence on seat belt use rates. These changes included the following:

- The primary enforcement law was enacted.
- The Chief of the Washington State Patrol made seat belt enforcement one of the core missions of the agency.
- Washington State participated in the first national "Click it or Ticket" campaign.

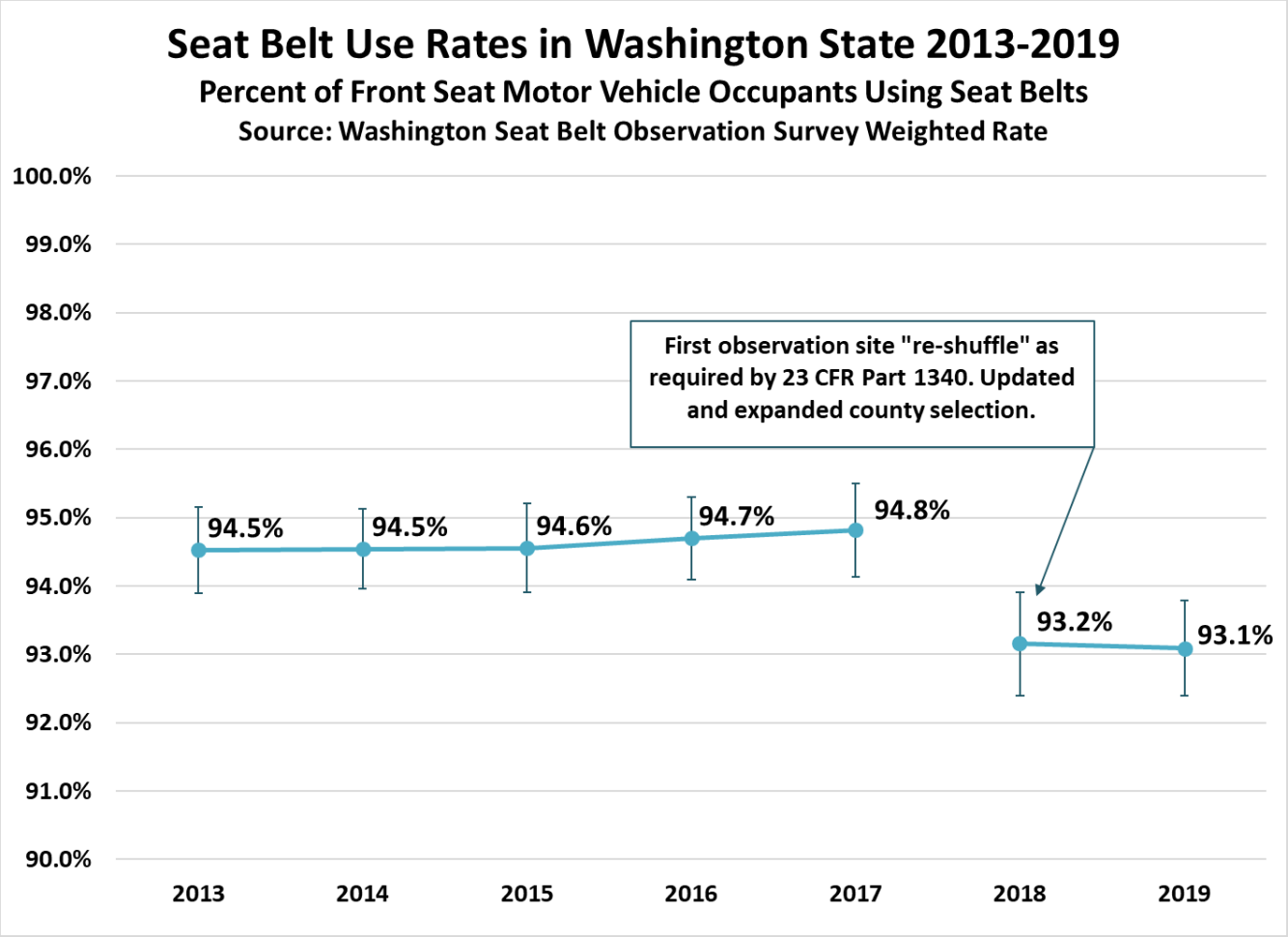
Consequently, observed belt use increased from 82.6 percent in 2001 to 92.6 percent in 2002. Washington has been able to maintain a high rate of seat belt use (93 to 98 percent) in the years since 2002 by continuing to support enhanced enforcement programs in conjunction with public education efforts. These programs include the following:

- Regular waves of Click it or Ticket mobilizations – two waves per year through 2009, and one per year from 2010 through 2018.
- Road signs that constantly remind the public that the seat belt law is enforced and that the fine is expensive (currently $136).
- High school-based seat belt education projects conducted in over 60 schools since 2007.

Until 2013 the Washington Traffic Safety Commission (WTSC) had conducted all annual seat belt use surveys according to a methodology that reflected the state's population and vehicle travel patterns from 1986. In 2010 the National Highway Traffic Safety Administration (NHTSA) proposed changes to 23 CFR Part 1340—the federal rule outlining the requirements under which all states are meant to conduct seat belt observation surveys. Some of these changes are highlighted in Appendix B. These changes resulted in a nationwide upgrade and update of survey methodologies. Accordingly, Washington developed a new survey methodology conforming to NHTSA's updated specifications. In early 2013 NHTSA accepted Washington's proposal for the new seat belt observation method.

The new survey method resulted in an entirely new sample of observation sites and a more comprehensive survey weighting approach. The outcome of this new method was a slight decline in the statewide seatbelt use rate estimate (from 96.9 percent in 2012 to 94.5 percent in 2013). This decline did not represent a decrease in statewide seatbelt use, but rather, the change in method. Seat belt use estimates derived under the new method (2013 and forward) are not comparable to estimates derived under the old method (2012 and previous). The new method results in a more accurate estimate with greater confidence. The level of statistical accuracy with the new method is nearly double what it was under the old method. This is reflected in the very stable seat belt use rate 2013-2017.

Another change to the federal rule was a requirement to re-sample survey sites every five years. The first site re-sampling required under the new guideline occurred in 2017 for use in completing the 2018-2022 surveys. The site re-sampling in itself is not likely to affect the estimated seat belt use rate; however, several changes to the way the 2017 site sampling was conducted likely explain the small dip in the 2018 and 2019 seat belt use rate estimates. Thus, the estimates 2018 and forward are not comparable to the 2013-2017 estimates. These changes affecting 2018 forward are described in detail in the following section.



SEAT BELT SURVEY OBSERVATION SITE SELECTION AND RESULTS

In 2017 changes were implemented to the selection process of seat belt observation sites in Washington State. The intent of such changes is always to increase accuracy or to derive useful information for strategic and intentional deployment of resources for increasing seat belt use. Working with NHTSA experts, the following changes for selecting survey sites were implemented for the 2018-2022 seat belt observation surveys. This process will be replicated for the 2023-2027 observation survey site selection, which will occur in 2022.

The combined effect of these survey site sampling changes, especially the intentional sampling in counties with high rates of unrestrained fatalities and serious injuries (and therefore presumably having lower overall seat belt use rates), is likely the culprit for the slight seat belt use rate decline shown in 2018. It is unlikely that the decline in 2018 is due to any change in policy, practice, or driver behavior, although this cannot be completely ruled out.

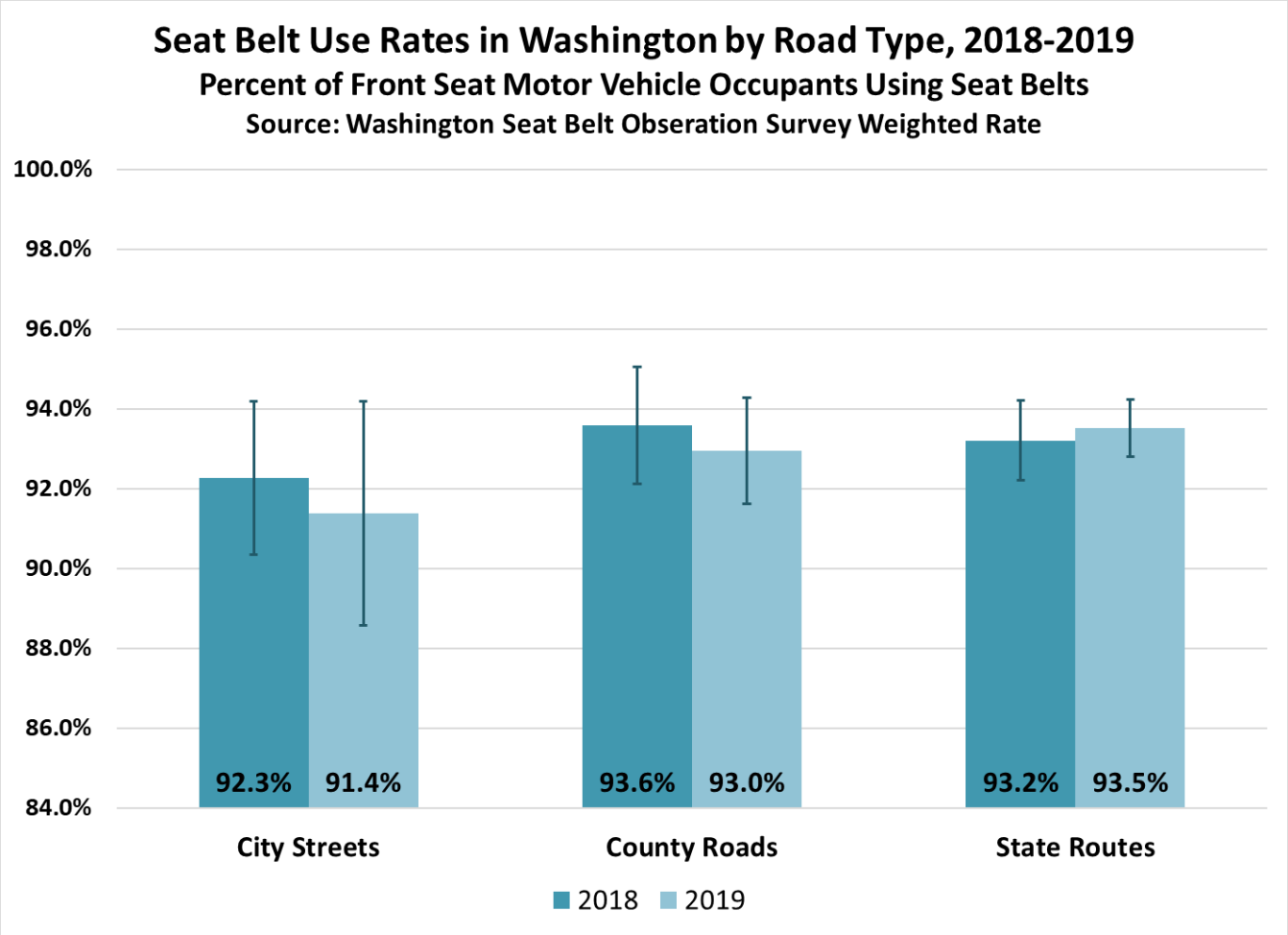
IMPROVED ROAD SEGMENT DATA SOURCE AND ROAD TYPE CATEGORIZATION

For the 2013-2017 survey site selection (which occurred in 2012), the Washington State Department of Transportation (WSDOT) had a road segment dataset that included only state routes. This information was spatially joined with the WSDOT Vehicle Miles Traveled (VMT) dataset to derive the complete set of possible "major" road observation survey sites. NHTSA provided an "all segment" file to all states modified from the U.S. Census TIGER (Topologically Integrated Geographic Encoding and Referencing) data files. The "major" roads survey site dataset was merged with the modified TIGER dataset to identify non-overlapping road segments which comprised the complete set of "minor" road observation survey sites. Survey sites from the "major" road segment dataset were sampled using VMT-based interval random sampling, and survey sites from the "minor" road segment dataset were sampled using simple random sampling.

When Washington was due for a survey site re-sample in 2017, the WSDOT shared a Local Agencies Public Roads (LAPR) dataset which the WTSC determined could be used in place of the modified TIGER file and imperfect spatial join. The state-level datasets were easier to work with and more accurate regarding road segment overlap and implementation of the pre-sampling road segment exclusion criteria. Using these files also enabled survey site selection based on city and county road type specification rather than a generic "minor" road type, resulting in the selection of three road type categories (state routes, city streets, and county roads) instead of two (major and minor). This is also a more meaningful categorization for reporting the survey results.

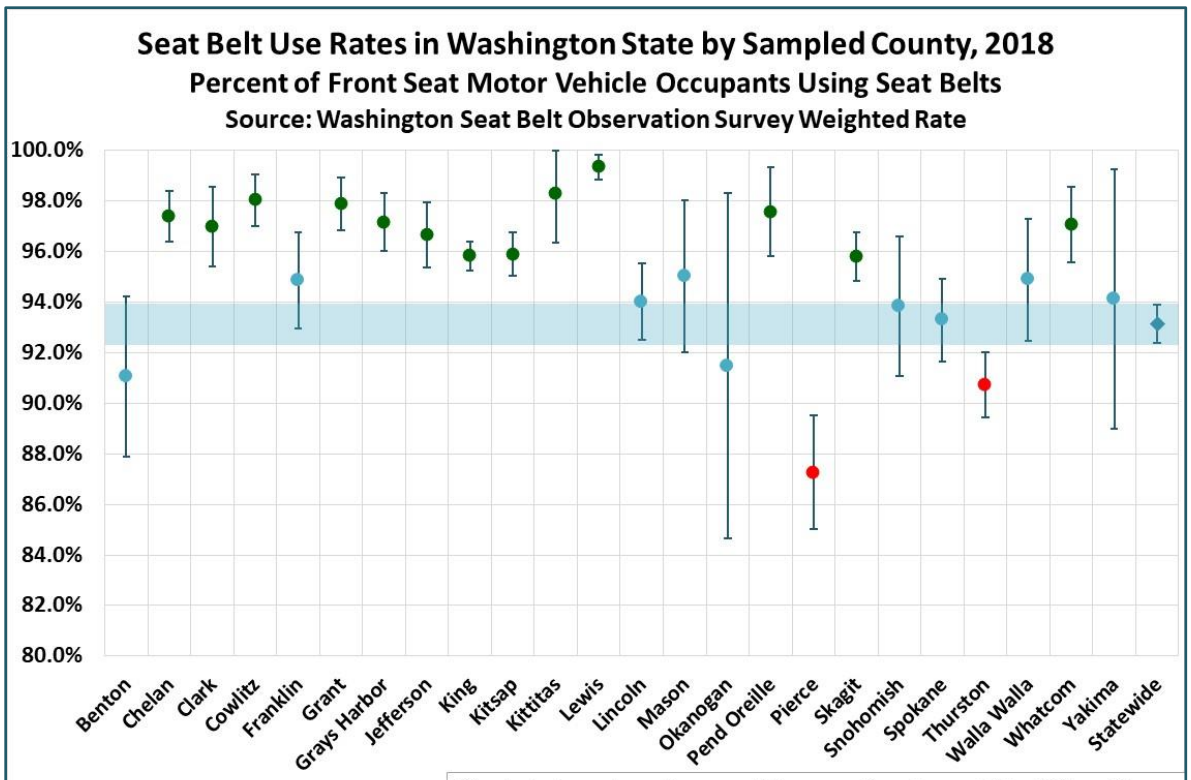
The number of statewide observation survey sites selected from each road type category was proportionate to the average statewide VMT for that road type classification. The resulting survey site proportions were 56 percent state routes, 27 percent city streets, and 17 percent county roads. This is similar to the 60 percent major/40 percent minor proportions used for the 2012 survey site sampling. Also like the 2012 survey site sampling procedure, state routes were sampled using VMT-based interval random sampling and the city streets and county roads were sampled using simple random sampling.

The graph on the following page displays the 2018 and 2019 seat belt use rate estimates by road type.



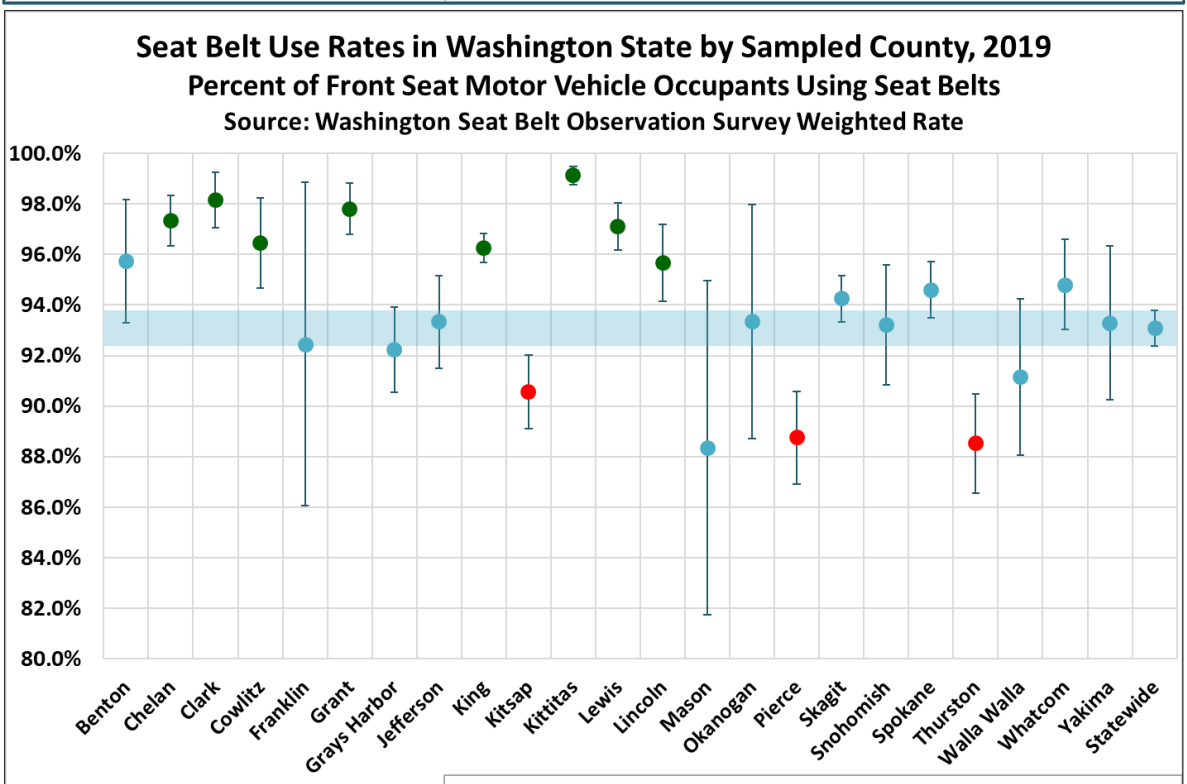
INCREASED NUMBER OF COUNTIES DUE TO UPDATED COUNTY SELECTION CRITERIA

Washington is comprised of 39 counties. Since 2018 the annual seat belt use observation survey is conducted in 26 counties. The graph on the following page compares each surveyed county's 2018 and 2019 seat belt use rate to the statewide seatbelt use rate. In 2018 two counties (Pierce and Thurston) had lower seat belt use rates than the state, increasing to three counties with the addition of Kitsap in 2019. Rates and confidence intervals for years 2013 and later for all sampled counties is included in Appendix A.



Estimates for Ferry and Stevens County are not included on the chart due to a standard error >5%.

The shaded area shows the range of the statewide estimate within a 95% confidence interval. Counties with GREEN dots have higher than state average seat belt use rates and counties with RED dots have lower than state average seat belt use rates.



Estimates for Ferry, Pend Oreille and Stevens County are not included on the chart due to a standard error >5%.

The shaded area shows the range of the statewide estimate within a 95% confidence interval. Counties with GREEN dots have higher than state average seat belt use rates and counties with RED dots have lower than state average seat belt use rates.

In the 2012 survey sample design, total passenger vehicle occupant fatalities using five years of data were derived by county. These counties were sorted highest to lowest by number of fatalities, then the counties cumulating 85 percent of the state total passenger vehicle occupant fatalities were selected for surveying. This inclusion method ignored within county-level proportions, total statewide proportions of unrestrained fatalities, and did not consider serious injuries.

The number of counties sampled was expanded to derive a more accurate state-level estimate and to better direct resources at the county-level. The WTSC wanted to include counties previously excluded from the sample design that have a high proportion of unrestrained fatalities and serious injuries. For example, in the 2013-2017 survey Ferry County was not included in the seat belt observation survey sample design despite having the highest county-level proportion of unrestrained fatalities and serious injuries (44.7 percent versus 12.6 percent statewide). In order to ensure these counties were being included in the sample design, the WTSC implemented two new exclusion criteria for selecting counties, versus the simple and limited statewide sort-based inclusion criteria used in 2012. In 2017 counties were excluded from the survey sample design if:

1) There were less than 10 unrestrained fatalities and serious injuries in the previous five years (2012-2016). This excluded six counties.

2) The total number of unrestrained fatalities and serious injuries in the county comprised less than one percent of the statewide total AND the county-level proportion of unrestrained fatalities and serious injuries was less than 20 percent. This excluded seven more counties. Lincoln County was included even though unrestrained fatalities and serious injuries occurring in Lincoln County comprised only 0.8 percent of the statewide total, they were 28 percent of the county total.

These sampling exclusion criteria resulted in a total of 26 counties being included in the sampling design. This is an increase of five counties from the 2012 sample (six new counties added and one county dropped from the previous sample). Twenty of the 21 counties included in the 2012 sample design are also included in the 2017 sample design. The following table demonstrates the 2017 county selection sample design following the new exclusion criteria.

County 2012-2016	Unrestrained Fatalities and Serious Injuries	Percent of Statewide Total Unrestrained Fatalities and Serious Injuries	Percent of Total County Fatalities and Serious Injuries
King	**293**	**18.2%**	**8.9%**
Pierce	**168**	**10.4%**	**11.3%**
Snohomish	**126**	**7.8%**	**10.9%**
Yakima	**113**	**7.0%**	**20.0%**
Spokane	**87**	**5.4%**	**10.5%**
Clark	**78**	**4.8%**	**10.5%**
Kitsap	**59**	**3.7%**	**14.7%**

County 2012-2016	Unrestrained Fatalities and Serious Injuries	Percent of Statewide Total Unrestrained Fatalities and Serious Injuries	Percent of Total County Fatalities and Serious Injuries	
Grant	55	3.4%	20.5%	
Thurston	53	3.3%	12.3%	
Whatcom	49	3.0%	15.3%	
Lewis	46	2.9%	19.2%	
Skagit	42	2.6%	14.5%	
Benton	34	2.1%	12.6%	
Okanogan	31	1.9%	23.8%	
Kittitas	31	1.9%	19.9%	
Mason	29	1.8%	14.6%	
Franklin	28	1.7%	19.3%	
Chelan	25	1.5%	14.5%	
Stevens	24	1.5%	20.9%	
Grays Harbor	24	1.5%	13.1%	Continued on next page.
Cowlitz	24	1.5%	10.8%	
Jefferson	19	1.2%	16.5%	
Walla Walla	19	1.2%	16.0%	Continued from previous page.
Ferry	17	1.1%	44.7%	
Pend Oreille	17	1.1%	27.0%	
Island	15	0.9%	11.5%	2) Exclude counties a) comprising less than 1% of statewide unrestrained fatalities and serious injuries AND b) have a county unrestrained proportion of less than 20%.
Klickitat	14	0.9%	16.7%	
Adams	14	0.9%	13.7%	
Douglas	14	0.9%	12.7%	
Lincoln	13	0.8%	27.7%	
Clallam	12	0.7%	8.6%	
Whitman	11	0.7%	11.2%	
Skamania	10	0.6%	16.1%	
Pacific	7	0.4%	14.0%	1) Exclude counties with less than 10 total unrestrained fatalities and serious injuries in the most recent five years.
Wahkiakum	5	0.3%	38.5%	
San Juan	3	0.2%	14.3%	
Asotin	3	0.2%	11.5%	
Columbia	1	0.1%	4.3%	
Garfield	0	0.0%	0.0%	

DECREASED NUMBER OF SURVEY SITES AND NEW TWO-PERSON DATA COLLECTION TEAMS

As described in the previous section, the number of counties included in the sample design increased—specifically targeted at including counties with higher proportions of unrestrained fatalities and serious injuries. With the majority of counties now included in the sample design and the improved quality of the road segment data used for the 2017 site sampling (which contributed to more accurate implementation of road segment exclusions—the removal of non-public roads, unnamed roads, unpaved roads, vehicular trails, access ramps, cul-de-sacs, traffic circles, and service drives), the Washington survey team assumed the number of total observations would increase due to sampling from datasets cleaned of road segments unlikely to have observable traffic. Furthermore, the WTSC wanted to decrease the total number of sample sites to free up resources for implementing two-person data collection teams.

Two-person data collection teams were first implemented for the Washington distracted driving observation survey. Two-person teams (vehicle observer and data recorder) resulted in increased accuracy and observations because the observer was freed up to just focus on the observations rather than also having to input the observation into the iPad (now the role of the data recorder). The observer simply speaks the observation out loud, and the data recorder inputs the observation into the iPad data collection application. Therefore, one person is solely focused on accurate observations and another person is solely focused on correctly recording the data. This procedural change also increased the number of vehicle travel lanes that could be accurately observed. The success of two-person teams with the distracted driving observation survey led to the implementation of two-person teams for the seat belt observation survey beginning in 2018.

For all these reasons, the total number of active survey sites for 2018-2022 was decreased from 452 to 375. The assumption that the total number of observations would increase with the use of better source data and two-person data collection teams proved correct. Despite the 17 percent decrease in the total number of observation sites, the 2018 survey included the highest number of front seat occupant observations in this survey's history. There was a 38 percent increase in total observations in the 2018 survey compared to the 2017 survey.

The sum impact of the changes described here is the likely cause for the decrease in the statewide seat belt use rate from 94.8 percent in 2017 to 93.2 percent in 2018 and 93.1 percent in 2019. Similar to 2013-2017 we expect the rate to remain very stable through 2022 using the current sample. Future survey site re-sampling will likely have less impact on the rate if no other significant sampling changes are implemented.

APPENDIX A: COUNTY SEAT BELT USE RATE ESTIMATES 2013-2018

County	*Range*	***2013***	***2014***	***2015***	***2016***	***2017***	***2018***	***2019***
	High CI	98.7%	98.2%	98.5%	95.4%	95.3%	94.2%	98.2%
Benton	**Rate**	**96.8%**	**96.0%**	**96.6%**	**92.3%**	**93.1%**	**91.1%**	**95.7%**
	Low CI	95.0%	93.9%	94.7%	89.1%	91.0%	87.9%	93.3%
	High CI						98.4%	98.3%
Chelan	**Rate**						**97.4%**	**97.3%**
	Low CI						96.4%	96.3%
	High CI	98.9%	98.8%	100.0%	99.9%	100.0%	98.6%	99.3%
Clark	**Rate**	**96.4%**	**96.8%**	**98.7%**	**99.8%**	**99.5%**	**97.0%**	**98.2%**
	Low CI	94.0%	94.8%	97.2%	99.8%	98.6%	95.4%	97.0%
	High CI	99.8%	99.9%	100.0%	99.8%	99.9%	99.0%	98.2%
Cowlitz	**Rate**	**99.4%**	**95.6%**	**99.6%**	**99.4%**	**99.6%**	**98.0%**	**96.4%**
	Low CI	99.1%	91.3%	99.2%	99.1%	99.3%	97.0%	94.7%
	High CI						100.0%	100.0%
Ferry	**Rate**						**74.2%**	**90.6%**
	Low CI						47.4%	79.5%
	High CI	97.7%	100.0%	100.0%	98.7%	97.6%	96.8%	98.9%
Franklin	**Rate**	**96.6%**	**92.7%**	**95.7%**	**98.0%**	**94.4%**	**94.9%**	**92.5%**
	Low CI	95.5%	83.0%	93.1%	97.3%	91.3%	92.9%	86.1%
	High CI	96.2%	98.0%	98.0%	95.7%	95.6%	98.9%	98.8%
Grant	**Rate**	**93.4%**	**96.6%**	**97.1%**	**94.3%**	**94.0%**	**97.9%**	**97.8%**
	Low CI	90.7%	95.2%	96.2%	92.9%	92.4%	96.8%	96.8%
	High CI	93.0%	95.5%	97.3%	98.0%	98.8%	98.3%	93.9%
Grays Harbor	**Rate**	**91.3%**	**94.3%**	**95.5%**	**96.7%**	**97.9%**	**97.2%**	**92.2%**
	Low CI	89.5%	93.1%	93.7%	95.4%	96.9%	96.0%	90.5%
	High CI						98.0%	95.2%
Jefferson	**Rate**						**96.7%**	**93.3%**
	Low CI						95.4%	91.5%
	High CI	96.0%	95.4%	94.1%	98.1%	97.1%	96.4%	96.8%
King	**Rate**	**94.8%**	**94.1%**	**92.5%**	**96.9%**	**96.2%**	**95.8%**	**96.3%**
	Low CI	93.5%	92.9%	90.9%	95.7%	95.4%	95.3%	95.7%
	High CI	92.4%	96.3%	100.1%	98.7%	97.6%	96.7%	92.0%
Kitsap	**Rate**	**89.1%**	**94.6%**	**99.9%**	**97.4%**	**94.7%**	**95.9%**	**90.6%**
	Low CI	85.8%	92.9%	99.7%	96.2%	91.7%	95.0%	89.1%
	High CI	98.1%	98.2%	99.4%	99.3%	98.2%	100.0%	100.0%
Kittitas	**Rate**	**96.2%**	**96.0%**	**98.4%**	**98.2%**	**96.9%**	**98.3%**	**99.1%**
	Low CI	94.4%	93.8%	97.3%	97.1%	95.6%	96.3%	98.8%

County	*Range*	***2013***	***2014***	***2015***	***2016***	***2017***	***2018***	***2019***
	High CI	97.7%	99.5%	99.6%	100.0%	99.9%	99.8%	98.0%
Lewis	**Rate**	**96.8%**	**98.9%**	**99.5%**	**99.7%**	**99.8%**	**99.4%**	**97.1%**
	Low CI	95.9%	98.3%	99.5%	99.2%	99.6%	98.9%	96.2%
	High CI						95.5%	97.2%
Lincoln	**Rate**						**94.0%**	**95.7%**
	Low CI						92.5%	94.1%
	High CI	97.8%	99.4%	97.7%	97.6%	97.1%	98.0%	95.0%
Mason	**Rate**	**96.7%**	**98.9%**	**96.1%**	**95.9%**	**95.8%**	**95.0%**	**88.3%**
	Low CI	95.6%	98.4%	94.6%	94.3%	94.5%	92.0%	81.7%
	High CI	91.2%	94.6%	96.5%	93.9%	96.5%	98.3%	98.0%
Okanogan	**Rate**	**89.0%**	**93.0%**	**95.2%**	**91.8%**	**95.2%**	**91.5%**	**93.3%**
	Low CI	86.8%	91.4%	94.0%	89.8%	93.9%	84.6%	88.7%
	High CI						99.3%	96.5%
Pend Oreille	**Rate**						**97.6%**	**74.1%**
	Low CI						95.8%	51.7%
	High CI	95.8%	95.2%	99.9%	94.7%	93.7%	89.5%	90.6%
Pierce	**Rate**	**93.7%**	**93.5%**	**99.7%**	**93.5%**	**91.6%**	**87.3%**	**88.7%**
	Low CI	91.7%	91.8%	99.5%	92.3%	89.5%	85.0%	86.9%
	High CI	97.2%	94.4%	94.2%	98.2%	98.1%	96.8%	95.2%
Skagit	**Rate**	**95.2%**	**91.8%**	**90.3%**	**96.1%**	**95.4%**	**95.8%**	**94.3%**
	Low CI	93.3%	89.2%	86.4%	94.0%	92.8%	94.9%	93.3%
	High CI	98.5%	97.1%	96.0%	97.4%	96.8%	96.6%	95.6%
Snohomish	**Rate**	**97.0%**	**96.6%**	**94.3%**	**96.2%**	**95.4%**	**93.8%**	**93.2%**
	Low CI	95.5%	96.1%	92.6%	95.0%	94.0%	91.1%	90.8%
	High CI	87.7%	96.0%	92.7%	95.5%	96.1%	94.9%	95.7%
Spokane	**Rate**	**84.1%**	**93.8%**	**90.2%**	**93.2%**	**93.7%**	**93.3%**	**94.6%**
	Low CI	80.4%	91.6%	87.6%	91.0%	91.3%	91.7%	93.5%
	High CI	93.9%	93.9%	94.3%	93.1%	96.5%	100.0%	100.0%
Stevens	**Rate**	**92.2%**	**92.3%**	**92.9%**	**91.1%**	**95.5%**	**92.8%**	**82.7%**
	Low CI	90.5%	90.7%	91.5%	89.0%	94.4%	81.4%	63.5%
	High CI	96.9%	99.3%	95.8%	86.8%	96.4%	92.0%	90.5%
Thurston	**Rate**	**93.9%**	**99.1%**	**90.0%**	**82.3%**	**94.5%**	**90.7%**	**88.5%**
	Low CI	90.9%	98.8%	84.2%	77.8%	92.7%	89.5%	86.6%
	High CI						97.3%	94.3%
Walla Walla	**Rate**						**94.9%**	**91.2%**
	Low CI						92.5%	88.1%
	High CI	95.8%	94.3%	92.6%	94.9%	94.6%	98.6%	96.6%
Whatcom	**Rate**	**92.5%**	**91.2%**	**89.1%**	**91.1%**	**89.9%**	**97.1%**	**94.8%**
	Low CI	89.1%	88.2%	85.5%	87.4%	85.1%	95.6%	93.0%

County	*Range*	***2013***	***2014***	***2015***	***2016***	***2017***	***2018***	***2019***
	High CI	92.0%	96.9%	96.7%	96.3%	94.2%		
Whitman	**Rate**	**85.6%**	**95.2%**	**94.3%**	**93.8%**	**91.4%**		
	Low CI	79.2%	93.6%	92.0%	91.2%	88.5%		
	High CI	98.0%	100.0%	100.0%	97.1%	94.3%	99.3%	96.3%
Yakima	**Rate**	**95.7%**	**97.4%**	**97.4%**	**90.6%**	**87.6%**	**94.1%**	**93.3%**
	Low CI	93.3%	94.5%	91.4%	84.1%	80.8%	89.0%	90.3%

APPENDIX B: SURVEY METHODS SINCE 2013

Survey Design and Observation Sites

NHTSA's Final Rule to 23 CFR Part 1340 included a number of new requirements for state seat belt surveys beginning with road segment sampling in 2012 for conducting surveys 2013 and later. The following are highlights of the changes:

1. The sampling frame now includes counties that "account for at least 85 percent of the state's passenger vehicle occupant fatalities" (§1340.5). One result of this change is that the number of counties in the 2012 sample increased from 19 in the 1986 sample to 21, with four counties leaving the survey and six different counties joining. With the new county selection criteria implemented in the 2017 sample, the number of counties sampled increased to 26, including 20 of the 2012 sample counties. The 2017 sample counties account for 91 percent of the 2012-2016 passenger vehicle occupant fatalities and 93 percent of the unrestrained fatalities.

2. For the 2012 sample, all roads within the 21 Washington counties selected were included in the sampling frame. From that sample, based on an approximate 60/40 percent vehicle miles traveled (VMT) distribution between Major (i.e., highway) and Non- Major (i.e., city, county, or other local) roads in Washington, 271 Major and 181 Non-Major segments (a total of 452 road segments) were selected from road segment data provided by NHTSA and the Washington State Department of Transportation. For the 2017 sample, the VMT distribution was 56/27/17 State Routes/City Streets/County Roads resulting in the selection of 211 state route segments, 102 city street segments, and 62 county road segments (a total of 375 road segments).

3. Following selection of road segments, the specific observation site to be used in the survey was selected within each selected road segment through in-person inspections meant to optimize both observer safety and observer viewing ease.

4. The direction of traffic and the time period to be observed at each site were chosen independently and randomly, however the ordering of sites visited in a given county on a given day was chosen for practical scheduling purposes. That is, sites were grouped in clusters based on geographic proximity in order to minimize observer travel time.

For all sites chosen by the survey coordinator, hand-held Global Positioning System (GPS) devices were used to record specific latitudes and longitudes, as well as written and photographic records to further identify each site. Upon arrival at the site, observers used the device to "check-in"; assuring that every observer was at the right location and remained there for the right amount of time. This documentation also ensures that every site remains consistent until the survey sample is refreshed every five years according to CFR §1340.12(a).

The observation and data collection processes comply with NHTSA survey guidelines specified in CFR §1340.7. For the 2013-2017 seat belt observation surveys, four different types of vehicles – passenger cars, pickup trucks, sport utility vehicles (SUVs), and passenger vans – were observed during two separate 20-minute data collection periods at each of the road-side observation sites. Since passenger cars have consistently accounted for about 50 percent of all vehicles observed in the WTSC's annual seat belt surveys, one period was devoted to passenger cars alone and during a second 20-minute period, occupants in the other passenger vehicles were observed. Beginning with the 2018 survey, there is only a single 40-minute observation period for all passenger vehicles (i.e. the WTSC is no longer collecting seat belt use by specific passenger vehicle type).

Observation Procedures

A team of experienced observers (many returning yearly to conduct the survey) undergo annual survey training and then collect the survey data as scheduled and as outlined. The survey coordinator (also a retired police officer) trained the survey observers as well as quality-control monitors (QCMs) on all requirements outlined in CFR §1340.8(a). For the 2013-2017 surveys, QCMs were required to visit two survey sites in every county, which was approximately 10 percent of the survey sample, exceeding the 5 percent threshold required in CFR §1340.8(a). Beginning in 2018 QCMs visit at least one survey site in each survey county, and at least one visit for every survey team.

Survey personnel observed a maximum of eight sites per day during the hours between 7 a.m. and 6 p.m. Thus, the survey results should be generalized to represent daytime hours only. The roadways were observed from the shoulder, a sidewalk adjacent to the road, or from an overpass if possible. Survey personnel were instructed to observe shoulder belt use of drivers and right-front seat passengers. Traffic was observed in one direction of travel only, which was specified in the sampling plan. On multiple-lane roads, survey personnel were instructed to observe only as many lanes of traffic as was feasible based on traffic flow and vehicle speeds. For example, on exceptionally busy 4-lane interstate highways typically only one or two lanes were observed at a time. Both the total number of travel lanes and the number of lanes actually observed were recorded and considered in weighting.

Beginning in 2014 the WTSC purchased iPads for the observers to use during data collection. An observation survey data collection application was developed including a summary screen, followed by the observation data collection screen equipped with a timer. The observer completed the site summary screen at each site, then initiated the timer and collected data for each 20 minute observation period. Prior to data collection via iPads, the observers used a manual "ticker" device that consisted of four counters. The use of iPads vastly improved data collection and accuracy, as is evident when comparing the 2013 nonresponse rate at 2.7 percent to the 2015 nonresponse rate at only 0.9 percent.

The data collection application allowed observers to assign each front seat occupant as "Belted," "Not belted," or "Can't tell," with an additional option for passengers "No Passenger." Observers counted misuse of shoulder belts, such as passengers wearing the shoulder portion under the arm, as "Not belted." Cases where the observer was unsure about belt use were designated "Can't tell." Such cases typically resulted from sun glare or tinted windows on a vehicle.

Rate Estimation Procedure

The belt use rates computed from the survey data are weighted estimates derived from the number of belted occupants divided by the total number of occupants observed. The ratio of belted occupants to total occupants was adjusted by an estimate of vehicle time on the road for each road segment site. Time on the road was computed by the length of the road segment divided by the approximate speed of the vehicles observed. The estimates were also adjusted by a ratio of the actual number of lanes observed divided by the total number of lanes in that direction of travel.

The seat belt use rate estimates were calculated using the sampling probability weighting factor generated for each site. The sampling weights for all sites are defined as the "inverse of the probability that a particular vehicle is observed during the study" at each stage (i.e., the "joint probabilities") of the sampling procedure. The formula used to estimate belt usage is described in detail in the *Revised Sampling, Data Collection and Estimation Plan*.

Standard error estimates were generated using a weighted bootstrapping method. The method was developed in R statistical software by RSG. In 2013 (the first year the new method was deployed) RSG provided all weight calculations and estimates in order to fully test the methodologies they had developed on behalf of the WTSC. Beginning in 2014 all rate estimation calculations were conducted by WTSC's Research Director using SAS statistical software and R. Standard error estimates were generated in R using the syntax provided by RSG. The WTSC Research Director, Staci Hoff, PhD, meets the standard for statistical review as described in §1340.8(c).