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Research Note

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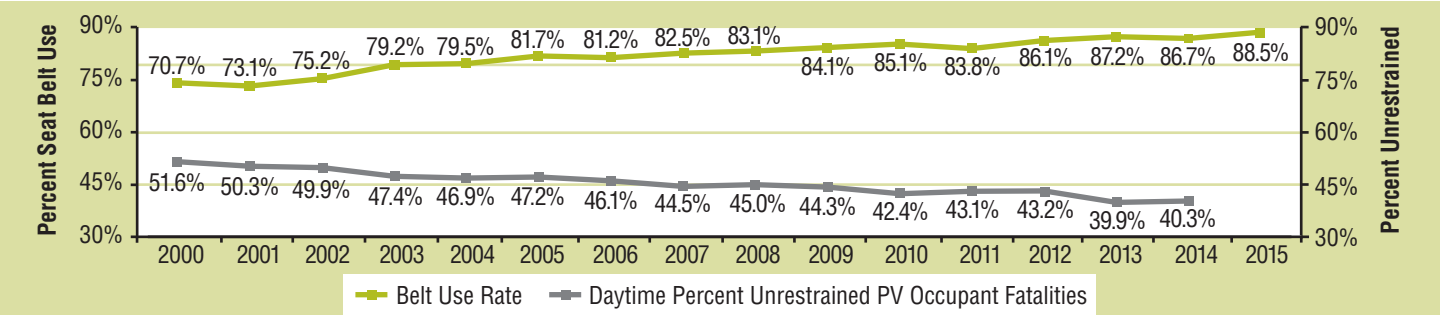
Seat Belt Use in 2015—Overall Results

Seat belt use in 2015 reached 88.5 percent,* up from 86.7 percent in 2014; this was not a statistically significant difference. This result is from the National Occupant Protection Use Survey (NOPUS), which is the only survey that provides nationwide probability-based observed data on seat belt use in the United States. The NOPUS is conducted annually by the National Center for Statistics and Analysis of the National Highway Traffic Safety Administration. In 2015, NHTSA conducted a redesign to select a new NOPUS sample representative of the most current demographic and traffic conditions. For more details, please see *The 2015 NOPUS Redesign* on page 4.

Seat belt use has shown an increasing trend since 2000, accompanied by a steady decline in the percentage of unrestrained passenger vehicle (PV) occupant fatalities during daytime (Figure 1). The 2015 survey also found the following:

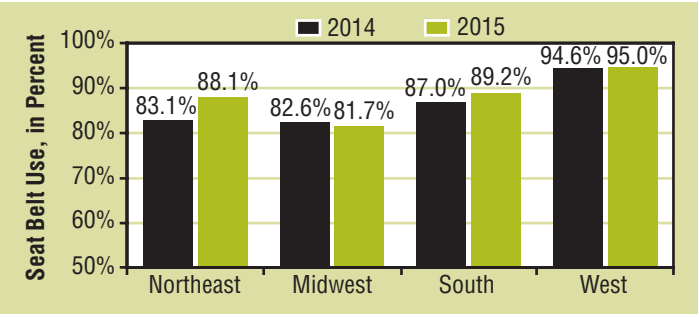
- Seat belt use for occupants in the West is higher than in the other regions: Northeast, Midwest, and South in 2015 (Figure 2).
- Seat belt use continued to be higher in the States in which vehicle occupants can be pulled over solely for not using seat belts ("primary law States") as compared with the States with weaker enforcement laws ("secondary law States") or without seat belt laws (Figure 3).
- Seat belt use for occupants in passenger cars increased significantly from 88.1 percent in 2014 to 90.3 percent in 2015 (Table 1).
- Seat Belt use for occupants in pickup trucks increased significantly from 77.2 percent in 2014 to 80.8 percent in 2015 (Table 1).

Figure 1
National Seat Belt Use Rate and Daytime Percent of Unrestrained Passenger Vehicle Occupant Fatalities



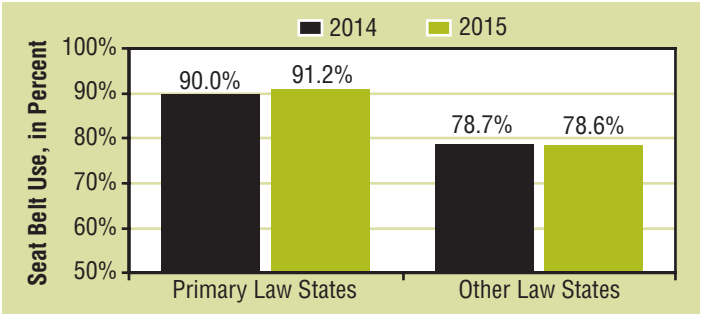
Source: NOPUS and FARS

Figure 2
Seat Belt Use by Region



Source: NOPUS

Figure 3
Seat Belt Use by Law Type



Source: NOPUS

*NOPUS reporting precision has been changed with the publication of the 2015 survey data. For more details, please see the section *The 2015 NOPUS Redesign* on p. 4.
[1]The FARS 2015 data on the percentage of unrestrained passenger vehicle occupant fatalities during daytime will be available later in 2016.

Table 1
Seat Belt Use by Major Characteristics

Occupant Group[1]	2014		2015		2014 – 2015 Change		
	Belt Use[2]	95% Confidence Interval[3]	Belt Use[2]	95% Confidence Interval[3]	Change in Percentage Points	95% Confidence Interval[4]	P-value[5]
All Occupants	86.7%	(84.6, 88.6)	88.5%	(86.8, 90.0)	1.8	(-0.2, 3.8)	0.07
Drivers	87.1%	(84.9, 88.9)	89.0%	(87.3, 90.4)	1.9	(-0.1, 3.9)	0.06
Right-Front Passengers	85.5%	(83.2, 87.5)	86.8%	(84.7, 88.7)	1.4	(-0.9, 3.6)	0.23
Occupants in States With[6]							
Primary Enforcement Laws	90.0%	(87.7, 92.0)	91.2%	(89.7, 92.6)	1.2	(-1.4, 3.8)	0.37
Secondary/No Enforcement Laws	78.7%	(72.3, 84.0)	78.6%	(72.3, 83.8)	-0.1	(-6.8, 6.6)	0.98
Occupants Traveling on							
Expressways	90.4%	(87.3, 92.7)	91.4%	(89.7, 92.8)	1.0	(-1.2, 3.2)	0.36
Surface Streets	84.2%	(81.6, 86.6)	86.7%	(84.5, 88.6)	2.5	(-0.4, 5.3)	0.09
Occupants Traveling in							
Fast Traffic	89.1%	(86.0, 91.6)	90.7%	(89.0, 92.1)	1.6	(-0.8, 3.9)	0.19
Medium-Speed Traffic	85.6%	(82.5, 88.2)	87.7%	(85.7, 89.6)	2.2	(-1.0, 5.3)	0.17
Slow Traffic	81.8%	(77.4, 85.6)	84.6%	(79.7, 88.5)	2.8	(-3.1, 8.7)	0.35
Occupants Traveling in							
Heavy Traffic	90.2%	(87.8, 92.2)	91.2%	(89.7, 92.5)	1.0	(-1.4, 3.3)	0.41
Moderately Dense Traffic	83.7%	(80.1, 86.7)	85.9%	(83.6, 88.0)	2.3	(-0.2, 4.8)	0.07
Light Traffic	**73.8%**	**(70.0, 77.3)**	**79.4%**	**(76.0, 82.4)**	**5.6**	**(1.3, 9.9)**	**0.01**
Occupants Traveling Through							
Light Precipitation	83.7%	(75.9, 89.4)	87.7%	(84.1, 90.6)	4.0	(-3.2, 11.2)	0.27
Light Fog	**81.0%**	**(74.6, 86.0)**	**91.4%**	**(86.3, 94.7)**	**10.4**	**(2.2, 18.6)**	**0.01**
Clear Weather Conditions	87.1%	(85.1, 88.9)	88.6%	(86.9, 90.1)	1.5	(-0.6, 3.6)	0.17
Occupants in							
Passenger Cars	**88.1%**	**(86.0, 89.8)**	**90.3%**	**(88.7, 91.7)**	**2.3**	**(0.1, 4.4)**	**0.04**
Vans and SUVs	89.1%	(87.2, 90.8)	90.3%	(88.6, 91.8)	1.2	(-0.7, 3.2)	0.22
Pickup Trucks	**77.2%**	**(73.6, 80.4)**	**80.8%**	**(77.8, 83.4)**	**3.6**	**(0.3, 6.8)**	**0.03**
Occupants in the							
Northeast	83.1%	(76.4, 88.2)	88.1%	(81.7, 92.4)	5.0	(-2.2, 12.2)	0.17
Midwest	82.6%	(75.8, 87.8)	81.7%	(76.6, 86.0)	-0.9	(-4.2, 2.4)	0.59
South	87.0%	(83.1, 90.2)	89.2%	(87.5, 90.6)	2.1	(-1.6, 5.9)	0.26
West	94.6%	(92.5, 96.1)	95.0%	(94.0, 95.8)	0.4	(-1.2, 1.9)	0.62
Occupants in							
Urban Areas	89.6%	(84.2, 93.3)	89.4%	(87.7, 90.9)	-0.2	(-4.4, 3.9)	0.92
Rural Areas	79.7%	(69.3, 87.3)	86.8%	(84.1, 89.1)	7.1	(-1.6, 15.7)	0.11
Occupants Traveling During							
Weekdays	86.2%	(83.8, 88.3)	87.9%	(86.0, 89.6)	1.7	(-0.5, 4.0)	0.13
Weekday Rush Hours	85.8%	(83.4, 88.0)	88.0%	(86.1, 89.6)	2.2	(-0.6, 5.0)	0.13
Weekday Non-Rush Hours	86.5%	(83.6, 89.0)	87.9%	(85.5, 89.9)	1.4	(-1.9, 4.6)	0.41
Weekends	87.8%	(85.5, 89.8)	89.7%	(87.9, 91.3)	1.9	(-0.7, 4.5)	0.15

[1] Drivers and right-front passengers of all observed passenger vehicles
[2] Shoulder belt used observed from 7 a.m. to 6 p.m.
[3] The Wilson Confidence Interval has the form: $\{(2n_{EFF}p + t^2) \pm t\sqrt{(t^2 + 4n_{EFF}pq)}\}/2(n_{EFF} + t^2)$, where p is the estimated percentage of Belt Use, $n_{EFF} = n/DEFF$ is the effective sample size (where n is the sample size and $DEFF$ is the design effect), $t \equiv t_{1-\alpha/2}(df)$, is a multiplier from the t-distribution with df degrees of freedom, and $q = 1 - p$. For percentages these endpoints are multiplied by 100.
[4] The regular symmetric interval was used for the estimated change in percentage point, which is in the form: $p \pm t_{1-\alpha/2}(df)\sqrt{v(p)}$, where p is the estimated change in percentage point, $v(p)$ is its estimated variance, and $t_{1-\alpha/2}(df)$ is a multiplier from the t-distribution with df degrees of freedom. The degrees of freedom used in 2015 is different from that used in 2014.
[5] A p-value of 0.05 or less indicates that there is a statistically significant difference (at the alpha=0.05 level) between the 2014 and 2015 estimates for the group in question, indicated with bold type.
[6] Use rates reflect the laws in effect at the time data were collected. Data Source: National Occupant Protection Use Survey, NCSA.

Survey Methodology

The NOPUS is the only nationwide probability-based observational survey of seat belt use in the United States. The survey observes seat belt use as it actually occurs at randomly selected roadway sites, and thus provides the best tracking of the extent to which passenger vehicle occupants in this country are buckling up.

Table 2
Sites, Vehicles, and Occupants* Observed

Numbers of	2014	2015	Percentage Change
Sites Observed	1,700	1,966	15.65%
Vehicles Observed	75,590	98,721	30.60%
Occupants Observed*	95,105	122,376	28.67%

*Drivers and right-front passengers only.

The survey data is collected by sending trained observers to probabilistically sampled roadways, who observe passenger vehicles from 7 a.m. to 6 p.m. Observations are made either while standing at the roadside or, in the case of expressways, while riding in a vehicle in the traffic. In order to capture the true behavior of passenger vehicle occupants, the NOPUS observers do not stop vehicles or interview occupants. The 2015 NOPUS data was collected from June 1 to June 27, 2015, while the 2014 data was collected from June 2 to June 27, 2014.

The NOPUS uses a complex, multistage probability sample, statistical data editing, imputation of unknown values, and complex estimation procedures. The sample sites for the 2015 NOPUS were selected from the 2014/2015 NOPUS sample redesign. Table 2 shows the observed sample sizes of the 2015 NOPUS Moving Traffic Survey. A total of 122,376 occupants were observed in the 98,721 vehicles at the 1,966 data collection sites.

Because the NOPUS sites were selected probabilistically, we can analyze the statistical significance of its results. Statistically significant increases in seat belt use between 2014 and 2015 are identified in Table 1 by having P-Value that is 0.05 or less in the table's column 8. The statistical confidence intervals that use in a given occupant group, e.g., occupants in the Midwest, are provided in columns 3, 5, and 7 of Table 1.

Data collection, estimation, and variance estimation for the NOPUS are conducted by Westat, Inc., under the direction of the NCSA under Federal contract number DTNH22-13-D-00284.

Definitions

Under NOPUS observation protocols, a driver or right-front passenger is considered "belted" if a shoulder belt appears to be across the front of the body.

A jurisdiction that can enforce traffic laws, such as a State or the District of Columbia, has a "primary enforcement law" if occupants can be ticketed simply for not using their seat belts. Under "secondary enforcement laws" occupants must be stopped for another violation, such as an expired license tag, before being cited for seat belt nonuse. As of May 31, 2015, primary laws were in effect in 34 States and the District of Columbia, 15 States had secondary laws, and 1 State (New Hampshire) effectively has no seat belt laws. (In New Hampshire, it is legal for occupants over age 18 to ride unbelted.) Table 3 provides a list of the States with "primary enforcement laws."

Table 3
States With Primary Enforcement Seat Belt Laws*

Alabama	Alaska	Arkansas	California
Connecticut	Delaware	District of Columbia	Florida
Georgia	Hawaii	Illinois	Indiana
Iowa	Kansas	Kentucky	Louisiana
Maine	Maryland	Michigan	Minnesota
Mississippi	New Jersey	New Mexico	New York
North Carolina	Oklahoma	Oregon	Rhode Island
South Carolina	Tennessee	Texas	Utah
Washington	West Virginia	Wisconsin	

*States with laws in effect as of May 31, 2015.

"Expressways" are defined to be roadways with limited access, while "surface streets" comprise all other roadways. "Rush hours" is defined to comprise the time periods 7 to 9:30 a.m. and 3:30 to 6 p.m.

A roadway is defined to have "fast traffic" if during the observation period the average speed of passenger vehicles that pass the observers exceed 50 mph, with "medium-speed traffic" defined as 31 to 50 mph and "slow traffic" defined as 30 mph or slower.

A roadway is defined to have "heavy traffic" if the average number of vehicles on the roadway during the observation period is greater than 5 per lane per mile, with "moderately dense traffic" defined as greater than 1 but less than or equal to 5 vehicles per lane per mile, and "light traffic" as less than or equal to 1 vehicle per lane per mile. Please note that this traffic density breakdown was revised in the 2011 NOPUS to better capture the traffic patterns.

The survey uses the following definitions of geographic regions, which are defined in terms of the States contained in the region below:

Northeast:	CT, MA, ME, NH, NJ, NY, PA, RI, VT
Midwest:	IA, KS, IL, IN, MI, MN, MO, ND, NE, OH, SD, WI
South:	AL, AR, DC, DE, FL, GA, KY, LA, MD, MS, NC, OK, SC, TN, TX, VA, WV
West:	AK, AZ, CA, CO, HI, ID, MT, NM, NV, OR, UT, WA, WY

Seat belt use rates reflect the State laws in effect at the time of data collection.

The 2015 NOPUS Redesign

The NOPUS sample was redesigned in 2015 and implemented to conduct the 2015 survey. NHTSA initiated the redesign to make the NOPUS more efficient, accurate and representative. Also, beginning with the 2015 NOPUS, the reporting precision was increased to be consistent with generally recommended Federal practices for reporting survey estimates. In addition, the new design incorporates scalability and flexibility in its design to accommodate changing resources. A sample of 57 primary sampling units (PSUs) was selected from a frame of 1,588 PSUs.

The redesigned NOPUS sample was selected using a stratified two-stage design. The first stage of selection was the county, referred to as the PSU within the design framework. The PSUs were targeted for selection based on their measure of size (MOS). The second stage of selection or secondary sampling unit (SSU), within the selected PSUs, is the road segment. At the road segment level, the NOPUS data collectors are then positioned so that they can efficiently observe seat belt use, motorcycle helmet use, and driver electronic device use.

Frame Formation: The NOPUS sample frame of PSUs excluded Puerto Rico and other U.S. Territories due to data collection cost constraints. All other counties in the U.S. were included in the sampling frame with the exception of 37 counties and three areas in Alaska; these locations were excluded on the basis of low traffic volume measured in terms of vehicle miles traveled (VMT) or because they were geographically isolated. The sample frame of SSUs excluded segments along unnamed roads, culs-de-sac, private roads, and a variety of other road types that have traditionally had very low traffic volume measured by VMT.

The PSUs consist of individual counties or groups of counties that were formed to minimize the distance that data collectors might have to travel within a particular PSU, while maintaining road segments that reflected a minimum number of annual VMT for each PSU. All PSUs for the sample frame are contained within their States; a PSU cannot be in more than one State if it is comprised of multiple counties. The measure of size is the 2012 VMT obtained from the Federal Highway Administration.

Stratification: One PSU was sampled with certainty because of its large VMT, and the remaining PSUs were first grouped into eight major strata based on the four U.S. Census designated regions (Northeast, Midwest, South, and West) and the two urbanicity classes (Urban and Rural). Within each major stratum, the PSUs were ordered by their predicted seat belt use rates, from lowest to highest. Then the PSUs were further stratified through cut points of the predicted seat belt use rate, resulting in strata with approximately equal total MOS. The restraint use rates were predicted by a linear regression model that used primary seat belt law enforcement, the county-level ratio of fatal crashes to VMT, and other county-level demographic data.

Sample Selection: A sample of 57 PSUs was selected using a Sequential Poisson method (Ohlsson, 1998) with probability approximately proportional to the MOS (VMT). The new NOPUS sample was selected to maximize PSU overlap with the old sample, thus maintaining comparability of the estimates from the current and previous samples. A SSU sample of road segments within each PSU is selected based upon the types of roads and urban/rural status with specified sampling rates.

The sample size of the PSUs and SSUs were determined to minimize the overall variance (increasing the efficiency) of restraint use and the costs necessary to conduct the NOPUS. As described before, the stratification employed in the redesign clusters the sampling units so that the PSUs within each stratum are very similar in terms of their predicted seat belt use rates, resulting in increased efficiency (smaller variance) at the PSU-level than that generated from previous NOPUS sample. To minimize variance within the PSUs, NHTSA used updated cost and road segment information to revise the road segment stratum sampling rates in order to achieve more efficiency from the survey.

Changes and Improvements: Using estimated seat belt use rates to form PSU strata provides a stratification that allows flexibility if resources for the survey change. It is straightforward to collapse strata (reducing the number of PSUs in the sample) with this method by combining adjacent strata or to increase PSU sample sizes by sampling additional PSUs per stratum.

Data collection protocols remain largely the same in the redesigned NOPUS; however, NHTSA has made some minor adjustments to streamline data collection. In order to provide an estimate based on all vehicles affected by seat belt laws in relevant jurisdictions, data collectors observe and record seat belt use for all passenger vehicles observed at the data collection sites. In previous NOPUS surveys, government, emergency, and commercially marked vehicles were excluded from observation.

NOPUS is based on a probability sample, and this survey continues to use standard survey sampling methods for constructing sampling weights for estimating national seat belt use rates, and to use replication methods to calculate standard errors of these estimates.

Prior to 2015, NHTSA's NOPUS publications reported integer percentage values for seat belt use point estimates. Along with updating the survey design, NHTSA has revised its NOPUS reporting format to be consistent with statistical best practices across the Federal Government. The new reporting format presents percentage point estimates with one decimal place. Along with this change, 95 percent confidence intervals and p-values accompany the point estimates.

Reference

Ohlsson, E. (1998). Sequential Poisson sampling. *Journal of Official Statistics 14*, 149–162.

For More Information

This Research Note was written by Timothy M. Pickrell and Hongying (Ruby) Li, mathematical statisticians in the Mathematical Analysis Division, National Center for Statistics and Analysis, NHTSA. For questions regarding the information presented in this document, please contact timothy.pickrell@dot.gov.

Additional data and information on the survey design and analysis procedures will be available in upcoming publications posted at www-nrd.nhtsa.dot.gov/cats/index.aspx.

Research has found that lap/shoulder seat belts, when used, reduce the risk of fatal injury to front-seat passenger car occupants by 45 percent and the risk of moderate-to-critical injury by 50 percent. In 2014 alone, seat belts saved an estimated 12,802 lives (Traffic Safety Facts: 2014 Data, NHTSA, DOT HS 812 218). For more information on the campaign by NHTSA and the States to increase seat belt use, see www.nhtsa.gov/CIOT.

The NOPUS also observes other types of restraints, such as child restraints and motorcycle helmets, and observes driver electronic device use. This publication is part of a series that presents overall results from the survey on these topics. Please refer to the upcoming research notes and technical reports in the series, such as "Motorcycle Helmet Use in 2015–Overall Results," for the latest data on these topics.

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This research note and other general information on highway traffic safety may be accessed by Internet users at: www-nrd.nhtsa.dot.gov/CATS/index.aspx