# TECHNICAL ASSISTANCE REPORT

# SAFETY BELT AND MOTORCYCLE HELMET USE IN VIRGINIA: THE 2001 UPDATE



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VIRGINIA TRANSPORTATION RESEARCH COUNCIL

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Virginia Transportation Research Council (A Cooperative Organization Sponsored Jointly by the Virginia Department of Transportation and the University of Virginia)

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#### **EXECUTIVE SUMMARY**

Safety belt use data were first collected in Virginia in 1974. Early data (1974-77 and 1983-86) were collected from only the four metropolitan areas (Northern Virginia, Tidewater, Richmond, and Roanoke) of the state. Between 1987 and 1992, data were also collected in nine communities with a population under 15,000. In 1991 and 1992, data were collected in four communities with a population between 50,000 and 100,000. It was only with the initiation of this project in 1992 that the state had a true statewide survey.

This series of surveys to determine the safety belt and motorcycle helmet use rates in Virginia was initiated to qualify the Commonwealth for incentive funds in accordance with the requirements of Section 153 of the Intermodal Surface Transportation Efficiency Act of 1991. To receive the funds, states had to have laws requiring the use of safety belts and motorcycle helmets and to meet certain use rate standards. The National Highway Traffic Safety Administration specified the survey criteria to be used in determining a state's use rate.

Even though the Section 153 funding program ended in 1994, Virginia's Department of Motor Vehicles requested that data collection continue and that the same methods, procedures, and sites used for the Section 153 program be used. The Transportation Efficiency Act for the 21st Century established a new grant program (Section 157) for allocating funds to the states. The federal guidelines for conducting surveys to determine a state's use rate are nearly identical with those for the Section 153 program, and Virginia has an approved methodology.

This report describes the methodology used for site selection and data collection and adds the results of the 2001 survey to those of the previous years (1992-2000). The results show that Virginia's 2001 safety belt use rate was 72.3% and its motorcycle helmet use rate was 100%. In each of the 10 years of the survey, virtually all of the motorcycle drivers and passengers observed were using a helmet. For the passenger car drivers and right-front passengers observed in the 10 years of the study, use rates varied from a low of 67.1% in 1997 to a high of 73.6% in 1998. The 2001 use rate of 72.3% is an increase over the 69.9% use rate in 2000 (see Figure ES-1).

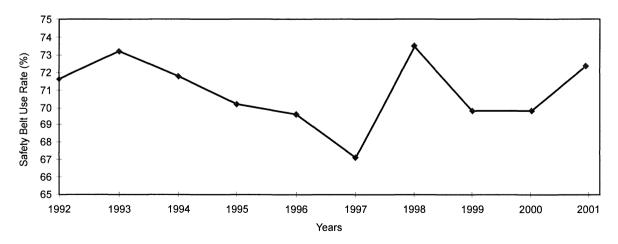


Figure ES-1. Trends in Safety Belt Use

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#### **INTRODUCTION**

The Intermodal Surface Transportation Efficiency Act of 1991 (ISTEA) added a new section (153) to Title 23 of the U.S. Code. This section authorized the U.S. Secretary of Transportation to establish a grant program to support states in adopting and implementing laws governing the use of safety belts and motorcycle helmets. To qualify for first-year funds, a state was required to have laws requiring the use of a helmet by all motorcycle riders and the use of a belt or child safety seat by all front-seat occupants in passenger vehicles. To qualify for second-and third-year funding, a state was required to have mandatory use laws *and* demonstrate a specified level of compliance.

On January 23, 1997, the President directed the Secretary of Transportation to develop a plan to increase safety belt use in the United States. On April 16, 1997, a plan was presented to the President that established a goal of 85% use by the year 2000 and 90% by 2005. As part of the Transportation Efficiency Act for the 21st Century, Section 157 of Title 23 was added, which established a new grant program for allocating funds to the states. The National Highway Traffic Safety Administration (NHTSA) published new guidelines, to become effective September 1, 1998, for conducting safety belt use surveys. The new guidelines were essentially the same as the previous guidelines except that they required that data from passenger cars, pickup trucks, vans, minivans, and sport utility vehicles be included.

On June 29, 1992, NHTSA published the final guidelines for conducting surveys of belt and helmet use in the states.<sup>1</sup> The guidelines required that the selection of survey samples be based on a single probability-based survey design and that only direct observational data be used to demonstrate compliance. The sample design had to include predetermined protocols for (1) determining sample size; (2) selecting sites; (3) selecting alternate sites when necessary; (4) determining which route, lane, and direction of traffic flow were to be observed; (5) collecting the observational data; and (6) beginning and concluding an observation period. The guidelines further stated that the relative error of the estimate could be no more than  $\pm 5\%$  and that all drivers, outboard front-seat passengers, and motorcycle drivers and passengers had to be eligible for observation. The guidelines also required that at least 85% of the state's population be eligible for inclusion and that only the smallest counties, based on population, could be eliminated from the sampling frame. Finally, data for all daylight hours and all days of the week had to be eligible for inclusion in the sample, and the scheduling of the time and day for each sample site had to be done randomly.

In 1992, 28 states (with 73% of the U.S. population) conducted probability-based surveys that had been reviewed by NHTSA and met the minimum standards.<sup>2</sup> Another 11 states conducted probability-based surveys but did not demonstrate compliance with the guidelines. In 1997, 43 states conducted safety belt use surveys. NHTSA used these data to calculate a population-weighted national average of 69%. The 1997 average usage rate for states with primary enforcement (11) was 79% and that for states with secondary enforcement (32) was 62%. The rate in New Hampshire, the only state without a mandatory usage law, was 58%.

#### **PURPOSE AND SCOPE**

The purpose of this project was to conduct a survey of safety belt and motorcycle helmet use in Virginia in accordance with NHTSA's guidelines. Even though the Section 153 funding program ended in 1994, safety belt and motorcycle helmet data have continued to be collected at the request of Virginia's Department of Motor Vehicle's Transportation Safety Services. The methods and procedures that qualified the state for incentive funds in 1992 through 1994 were used in all nine surveys. In this way, longitudinal data could be compared between years and over a period of years. When methods of data collection change, the making of comparisons is compromised to the extent that differences in collection procedures affect the results.

#### **METHODS**

This survey required five tasks: (1) defining the population from which the sample was drawn, (2) determining the number of survey sites, (3) developing the sampling plan, (4) developing procedures and collecting data, and (5) determining how estimates would be weighted to approximate statewide figures.

#### Population

According to federal guidelines, localities with the smallest populations and that made up less than 15% of the state's total population could be removed from the study population. In Virginia, determining which localities made up 15% of the population was difficult. In most states, a city is a part of the surrounding county. In Virginia, although towns are considered to be a part of the surrounding county, the 41 independent cities are not. To accommodate this arrangement of political jurisdictions, both counties and independent cities were considered in establishing the sampling population.

Table 1 shows the 136 counties and independent cities in Virginia ranked by population. According to 1990 census figures (the data available when the study sites were first selected), Virginia's total population was about 6.2 million. However, most of the population is located in the four population centers: Northern Virginia, Tidewater, Richmond, and Roanoke. Thus, there is a great disparity between the populations of rural and urban areas. For instance, the least populated county, Highland County, had fewer than 2,700 residents, and the least populated city, Norton, had fewer than 4,300. Twenty-seven of the 136 political jurisdictions had a population less than 10,000, and another 40 had a population between 10,000 and 20,000. Nearly 50% (49.3%) of the jurisdictions had fewer than 20,000 residents and accounted for 12.2% of the state's total population. On the other hand, 13 jurisdictions had a population of more than 100,000 and accounted for more than 48% of the total population of the state. Because of this disparity in population, the 74 least populated jurisdictions (the non-shaded portion of Table 1) made up just under 15% of the state's populated jurisdictions (the shaded portion of Table 1) made up just under 15% of the state's population; thus, they were excluded from sampling. Figure 1 shows the jurisdictions that were excluded (the shaded portion). All other locations in the state were equally eligible for inclusion in the sample.

## Number of Survey Sites

The next step in the project was to determine the number of statewide sites necessary to fulfill NHTSA's requirements of a relative error of  $\pm 5\%$  and 95% confidence. When computations were carried out to determine the number of sites necessary to meet these requirements, it was found that 78 sites would be adequate. After reviewing the project work plan, NHTSA wrote (September 4, 1992) that they would require Virginia to use 120 sites that were to be allocated to urban and rural areas based on population. Two of the 84 urban sites were moved in 1998 to safer locations along the same roadway and within the adjacent intersections (procedures meeting the original guidelines), and the other 82 sites have been used for every survey. Over the years, it was necessary to move 2 of the 36 rural sites. One was moved to a safer location just down the road before the next intersection, and the other was moved to an alternate site within the same grid box (see "Sampling Plan"). In addition, data were collected on the same day of the week and the same hour of the day at each site during the 10 years.

#### **Sampling Plan**

To select the sample of sites, a grid with sections measuring 0.64 by 0.64 cm (1/4 by 1/4 in) was placed over a standard map of Virginia issued by the Virginia Department of Transportation (VDOT) and drawn to a scale of 2.54 cm = 20.92 km (1 in = 13 mi). Figure 2 is a sample section of the map. Each grid box contained an area of approximately 27.19 km<sup>2</sup> (10.5 mi<sup>2</sup>). This procedure produced a system of 144 sections across the horizontal axis and 63

Highland County         2,635         0.04         Orange County         21,421         818,373         13.23           Craig County         4,372         11,254         0.18         Wunchester         21,947         862,010         13.98           Craig County         4,379         10,333         0.26         Hopswell         23,101         885,111         14.31           Bath County         4,799         20,732         0.34         Scott County         23,204         988,311         14.31           Bath County         4,799         20,732         0.34         Scott County         23,204         988,211         15.06           Bedront County         6,071         33,111         0.52         Statution         24,465         982,321         15.66           County         6,218         45,338         0.72         Boribaut County         25,035         103,107,166         16.66         15,733         11.26         Mythe County         25,046         105,539         17.08           Bland County         6,519         6,771         103         Uterwith County         25,774         120,975         119,921         119,921         119,923         113,93         119,123         119,123         119,123         119,123 </th <th>Jurisdiction</th> <th></th> <th>Cumulative Population</th> <th>Cumulative Percent</th> <th>Jurisdiction</th> <th></th> <th>Cumulative Population</th> <th>Cumulative Percent</th>	Jurisdiction		Cumulative Population	Cumulative Percent	Jurisdiction		Cumulative Population	Cumulative Percent
Craig County         4,372         11,254         0.18         Winchester         21,947         852,010         13.93           Bath County         4,799         12,933         0.26         Hopeweil         23,101         885,111         14.31           Bath County         4,799         20,732         0.34         Scott County         23,204         902,315         14.64           Bedford         6,073         32,111         0.52         Statistic         23,204         902,315         15.06           Darde City County         6,389         50,827         0.82         Inter City County         23,037         16.26           King and Queen County         6,514         65,747         1.03         Write County         22,466         1,052,811         17.90           Bland County         6,514         65,747         1.03         Write County         22,544         1,109,218         17.93           Galax         6,670         77,139         1.35         County         22,544         1,109,218         19.34         Anihear County         23,576         12,29,983         17.93           Galax         6,670         77,273         11.93         1.81         Haitison County         22,576         12,29,983	Highland County	2,635		0.04		21,421	818,373	
Chiffon Forgé         4,679         15,933         0.26         Hopewell         23,101         85,111         14.31           Bath County         4,799         20,732         0.34         Satation         23,726         998,315         11.46.83           Emporia         5,306         26,038         0.42         Satation         23,726         996,325         15.46           Surrey County         6,145         38,256         0.62         Lee County         24,466         945,537         15.26           Surrey County         6,60         72,233         0.92         Writen County         22,466         1092,6539         17.08           Bland County         6,612         70,369         1.14         Carroll County         22,466         1092,757         17.93           Galax         6,670         70,391         1.25         Prisce George County         22,471         1092,757         17.93           Covington         6,939         97,723         1.43         Anhaert County         23,674         12,924         13,924         11,92,471         19,275         19,275         19,275         19,237         14,224         12,92,471         13,92,471         13,92,471         13,92,471         13,92,471         13,92,471								
Bath County         27.99         20.732         0.34         Scient County         22.204         900.315         14.68           Bedford         6.073         32.111         0.52         Stainsion         22.4461         955.632         1.5.46           Bedford         6.073         32.111         0.52         Stainsion         24.461         956.532         1.5.46           King and Queen County         6.242         44.538         0.72         Betenuts County         24.492         1.060.6020         1.6.26           Buen Acta         6.514         6.770         0.72         Betenuts County         22.4492         1.060.6020         1.6.26           Barpahanock         6.770         77.039         1.25         Priace George County         27.374         1.136.6669         18.37           Galax         6.670         77.039         1.25         Priace George County         27.374         1.220.995         19.73           South Booton         6.959         90.732         1.47         Manassa         27.937         1.220.995         11.43         1.33.057         1.220.995         1.147         1.937         1.199         1.69         Rasell County         2.246.67         2.206         2.266         2.206								
Emporia         5,006         26,038         0.42         Salarity         23,725         936,532         15,06           Bedford         6,073         32,111         0.52         Suriayioon         24,465         956,532         15,46           Surrey County         6,145         38,256         0.62         Lee,County         24,965         910,028         15,86           King and Queen County         6,289         50,827         0.82         Iale of Wight County         22,053         1,013         Wight County         22,045         1,013,017         16,66           Bland County         6,514         57,767         1,03         Wight County         22,045         1,136,666         18,37           Covington         6,991         97,723         1,13         Anissent County         22,677         1,242,965         19,97           Covington         6,991         97,723         1,18         Anissent County         22,477         22,4965         19,92           Coundord County         7,223         119,818         1,94         Maickienbarg, County         23,478         22,020         11,193         1,81         Haikienbarg, County         23,478         24,020         22,020         11,194         1,144,633         1,21,								
Surrey County         6,145         38,256         0.62         Lee County         24,496         21,005,000         16.26           King and Queen County         6,289         50,827         0.82         Iale of Wight County         25,035         1,031,073         16.66           Bland County         6,514         63,747         1.03         Wythe County         25,1465         1,032,073         17.50           Rappatannock County         6,217         73,073         1.23         Prince George County         22,7464         1,042,081         17.50           Rappatannock County         6,991         97,733         1.37         Minanars         72,737         1.192,417         18.27           Covington         6,991         97,723         1.58         Amheart County         28,667         1.248,662         20.20           Richmond County         7,273         1.193         1.81         Halifar County         28,667         1.249,662         20.20           Mathews County         8,481         16,603         2.20         Gioachester County         30,131         1,305,67         1.163           Mathews County         8,253         144,683         2.34         Buchanar County         30,377         1,242,663         1.441,74	<b>*</b>				Salem	23,204		
Surrey County         6,145         38,256         0.62         Lee County         24,496         21,005,000         16.26           King and Queen County         6,289         50,827         0.82         Iale of Wight County         25,035         1,031,073         16.66           Bland County         6,514         63,747         1.03         Wythe County         25,1465         1,032,073         17.50           Rappatannock County         6,217         73,073         1.23         Prince George County         22,7464         1,042,081         17.50           Rappatannock County         6,991         97,733         1.37         Minanars         72,737         1.192,417         18.27           Covington         6,991         97,723         1.58         Amheart County         28,667         1.248,662         20.20           Richmond County         7,273         1.193         1.81         Halifar County         28,667         1.249,662         20.20           Mathews County         8,481         16,603         2.20         Gioachester County         30,131         1,305,67         1.163           Mathews County         8,253         144,683         2.34         Buchanar County         30,377         1,242,663         1.441,74					Staunton	24.461		
King and Queen County         6.289         50.827         0.82         Tale of Wight County         253.656         10.51.073         16.666           Bland County         6.514         63.747         1.03         Wight County         26.142         1.032.659         1.7.03           Rappahannock County         6.522         70.399         1.14         Carreil (crunty)         22.5394         1.103.257         1.7.93           Galax         6.670         77.039         1.23         Priace George County         27.791-         1.164.640         18.37           Manssana Park         6.734         83.773         1.33         Cuiperge County         27.391-         1.192.447         19.27           South Boston         6.997         104.720         1.69         Russell County         28.067         1.248.062         20.00           Combertaind County         7.221         11.931         1.81         Haidawas County         28.067         1.249.062         20.00           Franklin         County         8.633         144.683         2.43         Buainama County         31.071         1.263.64         24.163           Eveex County         8.53         171.012         2.76         Sarryth County         31.636         4.451.73						. 24,496		
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Galax         6,670         77,039         1.25         Prince George County         27,791         1,164,460         18.82           Lexington         6,959         90,732         1.47         Manassas         77,971         1,164,460         18.82           South Boston         6,991         97,723         1.88         Amikent County         28,577         1,122,497         19,217         19,2417         19,273           South Boston         6,991         97,723         1.18         Hattice County         28,033         1,278,695         20,67           Cumberland County         7,825         119,818         1.94         Mecklenburg County         30,131         1,338,140,0107         22,63           Mattlews County         8,488         153,372         2.48         Bhenandohan County         31,333         1,400,107         22,63           Lareset County         8,639         144,683         2.34         Bhenandohan County         31,435         1,400,107         22,63           GreenerVille County         8,737         1,633         3,667         2,443         Bhenandohan County         31,703         1,443,246         2,563           GreenerVille County         8,737         1,622,912         2,11,800         3,22						20,144		
Manassa Park         6.734         83.773         1.35         Cubreger County         27.957         1.164.460         18.22           Covington         6.991         97.723         1.58         Amisent Centry         28.067         1.20.995         19.73           Covington         6.991         197.723         1.58         Amisent Centry         28.067         1.24.9662         20.20           Richmond County         7.273         111.993         1.81         Halffac County         29.241         1.30.7936         21.14           Franklin         7.864         127.682         2.00         Harrisonburg         20.707         1.338.067         21.12           Middlesex County         8.633         144.683         2.34         Sbeanadona County         31.635         1.43.1743         23.14           Amelia County         8.633         17.102         2.76         Sanyti County         31.493.164         23.44         18.0         2.42         1.263.0         1.463.446         23.65         1.63.57         2.53.0         1.493.446         23.65         1.63.57         2.53.0         1.278.05         2.11.14         3.14         3.144         3.144         3.144.63.3         2.11.14         2.11.14         2.11.14         2.11.1						27 304		
Lexington         6.959         90,732         1.47         Manassa         27,957         1,192,417         19.27           South Boston         6,991         97,723         1.58         Amiseric County         28,678         1,220,995         19.73           South Boston         6,991         97,723         111,993         1.81         Hatifac County         29,033         1,278,695         20,67           Cumberland County         7,825         119,818         1.94         Macklenburg County         30,131         1,338,067         21,63           Mathews County         8,348         136,030         2.20         Harisonburg         30,131         1,333,1,400,0107         22,63           Essex County         8,689         153,372         2.48         Buchmain County         31,370         1,463,446         23,64           Greenerville County         8,77         162,199         2.62         Accornack County         34,495         1,550,171         25,92           New Kent County         10,248         190,838         3.08         James Cicy County         34,89         1,663,166         26,72         72.02           Lancater County         10,297         201,135         3.29         Peterioturg         38,398								
Covington         6.991         97,723         1.58         Amheart County         1,220,995         1,273,095         10,73           Richmond County         7,273         111,993         1.81         Haiffax County         28,667.1249,662         20.20           Richmond County         7,273         111,993         1.81         Haiffax County         28,261         1,338,067         21.64           Franklin         7,864         127,682         2.06         Giochester County         3,0707         1,368,074         21.64           Mathews County         8,653         144,683         2.34         Buchman County         31,635         1,443,1743         23.14           Areelia County         8,659         153,72         2.42         Accomack County         31,635         1,413,743         23.14           Areen County         8,737         162,159         2.62         Accomack County         31,446         12.53         31.65         1,703         1,463,446         23.65         7.155         1.76         Sanyit County         31,460,107         22.51         30.60         1,693,517         25.30           Greene County         10,297         201,135         3.25         Peicerburg         39,569         1,643,105         25.65<	• ·							
Richmond County         7,273         111.993         1.81         Hänfax County         20/231         12/76.895         20.67           Kindhews County         7,825         119.818         1.04         Micklenburg County         20/211         1,338.9057         21.63           Mathews County         8,653         144.683         2.06         Biocheneter County         30/707         1,368.774         22.12           Middlexex County         8,653         144.683         2.34         Buchanari County         31.636         1,443.1743         21.63           Greenerville County         8,787         162.159         2.62         Accomate County         31.636         1,443.1743         21.64         23.63           Greenerville County         8,787         170.12         2.62         Stromate County         34.469         1.330.212         24.73           Sussex County         10,248         190.838         3.06         James City County         34.459         1.665.171         25.30           Greene County         10,247         22.104         3.39         Wile County         39.454         1.642.577         27.20           Northumberiand County         10,380         2.37         0.439         Wile County         4.242.1		6,991	97,723	1.58			1,220,995	19.73
Cumberland County         7,825         119,818         1.94         Mecklenburg County         20,241         1,307,936         21,14           Mathews County         8,348         136,030         2.00         Glianchester County         30,131         1,338,067         1,238,067         22,63           Middlesex County         8,639         144,633         2.248         Buchmari County         31,636         1,443,1743         23,16           Ametia County         8,687         152,159         2.62         Accomark County         1,663,445         23,65           GreenexUlle County         8,838         171,012         2.76         Smyth County         34,496         1,563,171         25,02           Sussex County         10,248         190,838         3.08         Jammes City County         38,386         1,693,557         25,92           New Kent County         10,245         221,143         342         Franklin County         39,549         1,643,106         26,556           King WilliamsCounty         10,353         327         Chaotaserills         40,341         1,723,020         27,83           Northumbering County         10,353         327         Chaotaserills         40,341         1,726,442         28,358	South Boston							
Franklin         7.864         127.682         2.06         Gloicehester County         30,131         1.318,067         21.63           Middlesex County         8.639         153,372         2.20         Harrisonbarg         30,701         1368,77         22.163           Middlesex County         8.659         153,372         2.44         Buchnain County         31,635         1.443,1743         23.14           Arnelia County         8.787         162,159         2.62         Accomack County         33,336         1.495,816         24.18           Greeneville County         8.787         162,159         2.62         Accomack County         33,4496         1.530,312         24.73           Sussex County         10,248         190,883         3.08         James City County         34,495         1.565,171         25.30           Northumberinad County         10,445         211,330         3.42         Franklin County         35,549         1.664,3106         26.56           Northumberinad County         10,237         23,191         3.44         Pranklin County         43,421         1.753,422,123         2.02         1.735,422,123         2.02         1.435,681,106         2.55         1.62,658         Northumston         1.62,658         Northu								· · · · · ·
Mathew County         8,348         136(030         2.00         Harrisonburg         30,707         1368,774         22.12           Middlesex County         8,653         144.663         2.34         Buchnair County         31,633         1,400,107         22.63           Armelia County         8,787         162,159         2.62         Accomack County         31,636         1,431,743         23.14           Armelia County         8,853         171,012         2.62         Accomack County         31,433         1,406,452         24.18           Falls Church         9,578         180,590         2.92         Pulakic County         34,495         1,503,112         24.73           Sussex County         10,248         190,838         3.08         James City County         36,386         1,603,557         2.592           New Kent County         10,445         21,1580         3.42         Franklin County         39,577         1,682,679         27.20           Laneaster County         10,913         243,913         3.94         York County         42,442         1,765,442         28.35           Poquoson         11,005         254,918         4.12         Bedford County         45,763         1,902,708         0.71								
Middlesex County       8.653       144.683       2.34       Buchnain County       31,333       1,400,107       22.63         Ensex County       8.689       153,372       2.44       Shenandoh County       31,703       1,495,446       23.65         Greensville County       8.787       162,159       2.62       Accomack County       31,703       1,495,446       23.65         Green County       10,248       190,838       3.08       Jamee City County       34,459       1,503,72       2.2473         Sussex County       10,248       190,838       3.08       Jamee City County       34,459       1,663,77       2.530         Greene County       10,247       21,135       3.24       Franklin County       39,549       1,664,105       26.56         Northumberland County       10,524       22,104       39       Wile County       49,341       1,723,020       27.85         King Willama County       10,952       24,918       4.12       Bedford County       45,555       1,811,098       29.27         Lunenburg County       11,838       289,555       4.68       Tazeweil County       45,656       1,841,683       1.402       20.778         Gradistic County       12,905       313,509								
Essex County         8,689         153,372         2.48         Sheanadosh Cöunty         31,636         1,431,743         23,145           Arnelia County         8,787         162,159         2.62         Accornack County         32,370         1,4453,846         23,65           Greensville County         9,578         180,590         2.92         Pulaskic County         34,459         1,565,171         25,92           New Kent County         10,297         201,135         3.23         Petersburg         38,386         1,663,557         25,92           Northumberiand County         10,452         221,104         3.99         Wast County         39,573         1,682,679         27,20           Lancaster County         10,394         233,000         3.97         Chatotisarville         40,341         1,723,020         27,73           Lancaster County         11,039         254,918         4.12         Bedford County         45,765         1,811,098         29,27           Lancaster County         11,688         289,555         4.68         Tazevell County         45,722         1,966,240         32,26           Producounty         12,010         315,009         5.07         Fauguser County         47,722         1,966,240 <td< td=""><td></td><td></td><td></td><td></td><td>Franciscondurg</td><td></td><td></td><td></td></td<>					Franciscondurg			
Ametia County         8,787         162,159         2.62         Accomack County         31,703         1,463,446         23,654           Greensville County         9,578         180,550         2.92         Puiasić County         34,459         1,565,171         25,330         1,493,446         1,530,312         24,73           Sussex County         10,248         190,838         3.08         Jamee City County         34,859         1,565,171         25,330           Greene County         10,445         211,380         3.42         Franklin County         39,349         1,643,106         26,577         25,922           Northumberiand County         10,952         222,104         3.93         York County         42,0421         1,763,442         28,537         1,662,679         7,202           Lancaster County         10,996         233,000         3.77         Chalotterville         40,341         1,723,1,856,581         30,01           Williamsburg         11,350         277,867         4.49         Washington County         45,867         1,902,708         30,75           Floyd County         12,005         313,509         5.07         Fausevell County         45,772,21,1,856,681,31         30,01           Fluwana County         12,4								
Greenerville County         8,853         171,012         2.76         Smydi County         32,370         1,495,816         24,18           Sussex County         10,248         190,838         3.08         James City County         34,859         1,565,171         25,392           New Kent County         10,247         201,135         3.25         Petersburg         38,386         1,663,557         25,992           New Kent County         10,354         222,104         3.59         Wise County         39,573         1,642,679         27,20           Lancaster County         10,845         231,000         3.77         Chalotterwille         40,241         1,723,020         27,85           Poquoson         11,050         254,918         4.12         Bedford County         45,765         1,811,098         29,27           Lunenburg County         11,449         266,337         4.30         Predexick County         45,787         1,902,708         30,755           Charlotte County         11,648         289,555         4.68         Tezewell County         45,960         1,948,668         31,49           Madison County         12,407         313,509         5.67         Pauquier County         48,747         2,204,4861         33,05<					Accomack County			
Falls Church         9,578         180,590         2.92         Puliski County         34,496         1,530,312         24,73           Greene County         10,248         190,838         3.08         James Cipy County         34,859         1,663,557         25,30           New Kent County         10,445         211,580         342         Franklin County         39,549         1,643,105         26,56           Northumberland County         10,824         222,104         359         Wise County         40,341         1,723,020         27,835           King William County         10,913         243,913         3.94         Yick County         45,656         1,811,098         29,277           Lueneburg County         11,610         254,918         4.12         Bedford County         45,723         1,526,821         30,01           Williamsburg         11,530         277,867         4.49         Washington County         45,966         1,948,668         31,49           Madison County         11,949         301,504         4.87         Campbell County         47,972         1,946,364         31,49           Madison County         12,007         313,509         5.07         Faugure County         47,5172         1,946,364         3					Smyth County	32,370	the second se	
Greene County         10,297         201,133         3.23         Petersburg         38,386         1,003,537         23,37           New Kent County         10,524         222,104         3.59         Wise County         39,573         1,682,079         27,20           Lancaster County         10,934         223,000         3.77         Chaditerville         40,341         1,723,020         27,83           Forgueson         11,005         254,918         4.12         Bedford County         45,556         1,811,098         29,27           Lunenburg County         11,419         266,337         4.30         Predesick County         45,368         1,002,708         30,01           Williamsburg         11,530         277,867         4.49         Washington County         45,368         1,902,708         30,12           Charlotte County         11,688         289,555         4.68         Tazewell County         47,972         1,946,668         31,49           Madison County         12,005         315,009         5.07         Fauguiter County         47,972         1,946,763         33,05           Clarke County         12,210         325,610         5.26         Staffolk         52,042         2,317,453         35,63		9,578	180,590	2.92	Pulaski County	34,496		
Greene County         10,297         201,133         3.23         Petersburg         38,386         1,003,537         23,37           New Kent County         10,524         222,104         3.59         Wise County         39,573         1,682,679         27,20           Lancaret County         10,913         243,913         3.94         York County         42,422         1,765,442         28,33           Poquoson         11,005         254,918         4.12         Bedford County         45,556         1,811,098         29,27           Lunenburg County         11,419         266,337         4.30         Predesick County         45,966         1,948,668         30,01           Williamsburg         11,530         277,867         4.49         Washington County         45,966         1,948,668         31,49           Madison County         11,648         289,555         4.68         Tazewell County         47,972         1,946,368         31,49           Ioyd County         12,005         315,509         5.07         Fauguite County         47,971         204,4981         33,05           Iarke County         12,208         337,908         5.46         Darwille         53,056         2,150,178         34,77         2,204,855<	Sussex County				James City County			
Northumberland County         10,524         222,104         3.59         Wise County         39,573         1,682,679         27.20           Lancaster County         10,913         243,913         3.94         York County         40,341         1,723,020         27.85           Forgusson         11,005         254,918         4.12         Bedford County         45,656         1,811,098         29.27           Lunenburg County         11,419         266,337         4.30         Predexick County         45,723         1,856,821         30.01           Williamsburg         11,530         277,867         4.49         Washington County         45,966         1,948,663         31.49           Madison County         11,949         301,504         4.87         Campbell County         47,971         1,996,6240         32.26           Floyd County         12,101         325,610         5.26         Surfolk         52,141         2,044,981         33.05           Clarke County         12,298         337,908         5.46         Auguist County         56,462         2,317,453         34,577         34,475           Fluvanna County         12,778         363,115         5.87         Pitrylvanis County         56,462         2,317,4535					Petersburg			
Lancaster County         10,896         233,000         3.77         Charlotterville         40,341         1,713,020         27.85           King William County         10,913         243,913         3.94         York County         42,442         1,765,442         28.53           Poqueson         11,005         254,918         4.12         Bedford County         45,656         1,811,098         29.27           Lunenburg County         11,419         266,337         4.30         Prederick County         45,887         1,902,708         30.15           Charlotterville         301,504         4.87         Tazeweil County         45,887         1,902,708         30.25           Floyd County         12,005         313,509         5.07         Pauquier County         47,572         1,996,240         32.26           Floyd County         12,101         325,610         5.26         Suffolk         52,150,178         34.75           Flovanna County         12,298         303,337         5.66         Darwile         53,056         2,150,178         34.75           Relson County         12,778         363,115         5.87         Pritrylremia County         54,642         2,317,453         35.63           Northampton County								
King William County       10,913       243,913       3.94       York County       42,422       1,765,442       28,53         Poquoson       11,005       254,918       4.12       Bedford County       45,656       1,811,098       29,27         Iunenburg County       11,419       266,337       4.30       Predexick County       45,783       1,810,098       29,27         Chartote County       11,688       289,555       4.68       Tazewell County       45,666       1,941,668       31,49         Madison County       11,949       301,504       4.87       Campbell County       47,572       1,996,240       32,26         Ployd County       12,101       325,610       5.26       Suffolk       33,056       2,150,178       34,75         Clarke County       12,298       337,008       5.46       Dataville       53,056       2,150,178       34,75         Fluvana County       12,473       350,337       5.66       Augusta County       55,655       2,260,510       36,53         Buckingham County       13,804       6.29       Spotisylvania County       55,655       2,260,510       36,53         Buckingham County       13,627       415,752       6.72       Stafford County       51,4								
Poquoson         11,005         254,918         4.12         Bedford County         45,556         1,811,098         29.27           Lunenburg County         11,419         266,337         4.30         Frederick County         45,526         1,816,098         29.27           Milliamsburg         11,530         277,867         4.49         Waisington County         45,960         1,948,663         31.49           Madison County         11,648         289,555         4.68         Tezzewell County         47,572.1         1,962,240         32.26           Floyd County         12,005         313,509         5.07         Fauguier County         48,741         2,044,981         33.05           Clarke County         12,101         325,610         5.26         Suffolk         53,055         2,2161,178         34.75           Fluvanna County         12,473         363,115         5.87         Pirtyrivaria County         55,932         35,63           Netlson County         13,061         389,049         6.29         Spoirylvania County         55,9422         2,317,452         35,63           Northampton County         13,061         402,225         6.50         Rockingham County         55,942         2,317,452         32,374,855 <t< td=""><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></t<>								
Lunenburg County       11,419       266,337       4.30       Prederick County       45,723       1,856,821       30.01         Williamsburg       11,530       277,867       4.49       Washington County       45,887       1,902,708       30.75         Charlotte County       11,688       289,555       4.68       Tazeweil County       47,572       1,996,240       32.26         Ployd County       12,005       313,509       5.07       Fraquier County       47,772       1,996,240       32.26         Clarke County       12,101       325,610       5.26       Suffolk       52,141       2,097,122       33.89         Appomattox County       12,429       350,337       5.66       Augusta County       54,653       2,150,478       34.75         Fluvana County       12,473       375,988       6.08       Heinry County       55,635       2,260,510       36.53         Nothampton County       13,061       389,049       6.29       Spoisylvaria County       57,403       2,374,853       374.45         Nothampton County       13,176       402,225       6.72       Stafford County       61,326       2,432,337       93.31         King George County       13,527       415,752       6.72								
Williamsburg       11,530       277,867       4.49       Washington County       45,887       1,902,708       30.75         Charlotte County       11,648       289,555       4.68       Tazeweil County       45,960       1,948,668       31.49         Madison County       11,949       301,504       4.87       Campbell County       47,772       1,996,240       32.26         Floyd County       12,005       313,509       5.07       Fauguier County       48,741       2,044,981       33.05         Clarke County       12,298       337,908       5.46       Datwille       53,056       2,150,178       34.75         Fluvana County       12,429       350,337       5.66       Augusta: County       54,677       2,204,855       35.63         Nelson County       12,478       361,15       5.87       Priterylvania County       56,342       2,317,452       37.45         Northampton County       13,164       429,915       6.59       Rotixity County       57,403       2,374,853       38.38         Allephany County       13,176       402,225       6.70       Rotixity County       57,402       2,3274,853       38.38         Northampton County       13,527       415,752       6.72       <								
Madison County         11,949         301,504         4.87         Campbell County         47,572         1,996,240         32,26           Ployd County         12,005         313,509         5.07         Fauguier County         48,741         2,044,981         33,05           Clarke County         12,298         337,908         5.46         Dansville         53,056         2,150,178         34,75           Pluvana County         12,429         350,337         5.66         Augusta County         54,677         2,204,835         35,653           Nelson County         12,873         375,988         6.08         Henry County         55,932         2,317,452         37,45           Northampton County         13,167         402,225         6.50         Rockingham County         51,236         2,492,373         39,31           King George County         13,527         415,752         6.72         Stafford County         63,306         2,255,879         41,32           Nottoway County         14,993         444,908         7.19         Lyinchburg         66,049         2,622,928         42,39           Powhatan County         15,328         400,236         7.44         Albemarte County         73,913         2,764,881         44.69 <td></td> <td>11,530</td> <td>277,867</td> <td>4.49</td> <td></td> <td></td> <td></td> <td>30.75</td>		11,530	277,867	4.49				30.75
Floyd County       12,005       313,509       5.07       Fauguier County       48,741       2,044,981       33.05         Clarke County       12,101       325,610       5.26       Surfolk       52,141       2,097,122       33.89         Appomatrox County       12,429       350,337       5.66       Augusta County       53,056       2,150,178       34.75         Fluvanna County       12,473       375,988       6.08       Heiny County       56,942       2,317,452       37.45         Northampton County       13,061       389,049       6.29       Spotsylvania County       57,403       2,374,855       38,38         Alleghany County       13,176       402,225       6.50       Rockingham County       51,242,2377       493,373       40,30         Goochland County       14,163       429,915       6.95       Hanover County       63,306       2,493,573       40,30         Powhatan County       15,328       460,236       7.44       Albemark County       63,306       2,556,879       41.32         Nottoway County       15,328       460,236       7.44       Albemark County       73,931       2,644,243       43.99         Westmoreland County       15,480       475,716       7.69								
Clarke County       12,101       325,610       5.26       SuffOlk       52,141       2,097,122       33.89         Appomattox County       12,298       337,908       5.46       Danville       53,056       2,150,178       34.75         Fluvana County       12,429       350,337       5.66       Augusts County       54,677       2,204,855       35,635         Nelson County       12,873       375,988       6.08       Heinry County       57,452       2,317,452       37.455       38.38         Alleghany County       13,176       402,225       6.50       Rockingham County       57,442       2,317,452       37.455       38.38         Alleghany County       13,176       402,225       6.50       Rockingham County       61,226       2,493,573       40.30         King George County       14,993       444,908       7.19       Lynchburg       66,049       2,622,928       42.39         Nottoway County       14,993       444,908       7.19       Lynchburg       66,049       2,662,929,944       43.49         Radford       15,940       475,716       7.69       Montgomery County       73,913,2,764,881       44.69         Radford       15,940       491,656       7.95       <								1 1 a 1 a 1
Appomattox County       12,298       337,908       5.46       Danville       53,056       2,150,178       34.75         Fluvanna County       12,429       350,337       5.66       Auguste County       54,677       2,204,835       35,63         Belson County       12,873       375,988       6.08       Henry County       55,652       2,260,8510       6.53         Buckingham County       13,061       389,049       6.29       Spoisylvania County       57,403       2,374,853       38,38         Northampton County       13,076       402,225       6.50       Rockingham County       57,403       2,374,853       38,38         King George County       13,527       415,752       6.72       Stafford County       61,236       2,493,573       40,30         Goochland County       14,193       4429,915       6.55       Hänover County       63,306       2,556,879       41,32         Nottoway County       14,993       444,908       7.19       Lynchburg       66,049       2,622,928       42,39         Powhatan County       15,328       460,236       7.44       Albernarie County       68,040       2,690,968       43,49         Westmoreland County       15,487       507,643       8.20								
Fluvanna County       12,429       350,337       5.66       Augusta County       54,677       2,204,855       35,63         Nelson County       12,778       363,115       5.87       Pitery Ivaria County       55,655       2,260,510       36.53         Northampton County       13,061       389,049       6.29       Spotsylvania County       57,403       2,374,855       38.38         Alleghany County       13,176       402,225       6.50       Rockingham County       57,482       2,432,337       39.31         King George County       13,527       415,752       6.72       Stafford County       61,236       2,493,573       40.30         Goochland County       14,163       429,915       6.95       Harover County       63,206       2,556,879       41.32         Nottoway County       15,328       460,236       7.44       Albemarle County       68,040       2,692,928       42.39         Powhatan County       15,480       475,716       7.95       Roanoke County       79,332       2,844,213       45.97         Brunswick County       15,940       491,656       7.95       Roanoke County       79,332       2,844,213       45.97         Brunswick County       15,987       507,643       <								
Nelson County         12,778         363,115         5.87         Pitrylymis County         55,655         2260,510         36,53           Buckingham County         12,873         375,988         6.08         Heinry County         56,942         2,317,452         37,45           Northampton County         13,061         389,049         6.29         Spotsylvanis County         57,403         2,374,855         38,38           Alleghany County         13,176         402,225         6.72         Stafford County         61,236         2,493,573         40,30           Goochland County         14,163         429,915         6.95         Hanover County         63,306         2,556,879         41.32           Nottoway County         15,328         460,236         7.44         Albemarte County         68,040         2,690,968         43.49           Westmoreland County         15,940         491,656         7.95         Roanoke County         79,332         2,844,213         45.97           Brunswick County         15,940         491,656         7.95         Roanoke County         79,332         2,844,213         45.97           Brunswick County         16,266         572,513         9.25         Hamptoin         103,907         3,10,646								
Buckingham County         12,873         375,988         6.08         Henry County         56,942         2,317,452         37,45           Northampton County         13,061         389,049         6.29         Spotsylvania County         57,403         2,374,855         38,38           Alleghany County         13,176         402,225         6.50         Rockingham County         51,432,237         39,31           King George County         13,527         415,752         6.72         Stafford County         61,236         2,493,573         40,30           Goochland County         14,163         429,915         6.95         Hanover County         63,306         2,556,879         41,32           Nottoway County         15,328         460,236         7.44         Albernate County         66,049         2,622,928         42,39           Powhatan County         15,328         460,236         7.95         Roanokic County         79,332         2,844,213         45,97           Brunswick County         15,940         491,656         7.95         Roanokic County         79,332         2,844,213         45,97           Brunswick County         15,987         507,643         8.20         Loudoim County         86,129         2,30,342         47,36								
Northampton County         13,061         389,049         6.29         Spötsylvania County         57,403         2,374,855         38,38           Alleghany County         13,176         402,225         6.50         Rockingham County         57,403         2,374,855         38,38           King George County         13,527         415,752         6.72         Stafford County         61,236         2,493,573         40,30           Goochland County         14,163         429,915         6.95         Haitover, County         63,306         2,556,879         41.32           Nottoway County         14,993         444,908         7.19         Lynchburg         66,049         2,622,928         42.39           Powhatan County         15,480         475,716         7.69         Montgomery, County         73,913         2,764,881         44.69           Radford         15,940         491,656         7.95         Roinoke County         73,932         2,844,213         45.97           Brunswick County         15,987         507,643         8.20         Loudoum County         86,129         2,930,342         47.36           Colonial Heights         16,064         523,707         8.46         Roanoke         96,397         3,026,739 <td< td=""><td><b>. .</b></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></td<>	<b>. .</b>							
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Goochland County14,163429,9156.95Hanover County63,3062,556,87941.32Nottoway County14,993444,9087.19Lynchburg66,0492,622,92842.39Powhatan County15,328460,2367.44Albemarle County68,0402,690,96843.49Westmoreland County15,480475,7167.69Montgomery County73,9132,764,88144.69Radford15,940491,6567.95Roanoke County79,3322,844,21345.97Brunswick County15,987507,6438.20Loudoin County86,1292,930,34247.36Colonial Heights16,064523,7078.46Roanoke96,3973,026,73948.92Marinsville16,162539,8698.73Portamouth103,9073,130,64650.60Gravson County16,278556,1478.99Alexandria111,1833,241,82952.39Prince Edward County17,320589,8339.53Chesupeake151,9763,527,59857.01Patrick County17,620624,85610.10Arlington County170,0433,697,64359.76Southampton County17,550624,85610.10Arlington County203,0544,716,63565.81Dickenson County17,620642,47610.38Richmond203,0564,071,63565.81Dickenson County17,620642,47610.38Richmond203,0564,071,63565.81 <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td>								
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Radford         15,940         491,656         7.95         Roanoke County         79,332         2,844,213         45.97           Brunswick County         15,987         507,643         8.20         Loudoin County         86,129         2,930,342         47.36           Colonial Heights         16,064         523,707         8.46         Roanoke         96,397         3,026,739         48.92           Martinsville         16,162         539,869         8.73         Portamouth         103,907         3,130,646         50.60           Grayson County         16,278         556,147         8.99         Alexandria         111,183         3,241,829         52,39           Giles County         16,366         572,513         9.25         Hampton         133,793         3,375,622         54.56           Prince Edward County         17,473         607,306         9.82         Newport News         170,045         3,697,643         59.76           Southampton County         17,620         642,476         10.38         Richmond         203,056         4,071,635         65.81           Dickenson County         17,620         642,476         10.38         Richmond         203,056         4,071,635         65.81								
Brunswick County         15,987         507,643         8.20         Loudoin County         86,129         2,930,342         47.36           Colonial Heights         16,064         523,707         8.46         Rcanoke         96,397         3,026,739         48.92           Martinsville         16,162         539,869         8.73         Portamouth         103,907         3,130,646         50.60           Grayson County         16,278         556,147         8.99         Alexandria         111,183         3,241,829         52,39           Giles County         16,366         572,513         9.25         Hampion         133,793         3,375,622         54.56           Prince Edward County         17,473         607,306         9.82         Newport News         170,045         3,697,643         59.76           Southampton County         17,520         642,476         10.38         Richmond         203,056         4,071,635         65.81           Dickenson County         17,620         642,476         10.38         Richmond         203,056         4,496,595         72.67           Waynesboro         18,549         697,801         11.28         Henrico County         217,686         4,496,595         72.67						79.332	2,844,213	
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Giles County         16,366         572,513         9.25         Hampton         133,793         3,375,622         54,56           Prince Edward County         17,320         589,833         9.53         Chesapeake         151,976         3,527,598         57,01           Patrick County         17,473         607,306         9.82         Newport News         170,045         3,697,643         59,76           Southampton County         17,550         624,856         10.10         Arlington County         170,936         3,868,579         62,52           Dickenson County         17,620         642,476         10.38         Richmond         203,056         4,071,635         65,81           Rockbridge County         18,350         660,826         10.68         Chesterfield County         209,274         4,280,909         69,19           Bristol         18,426         679,252         10.98         Prince William County         215,686         4,496,595         72,67           Waynesboro         18,549         697,801         11.28         Henrice County         217,881         4,714,476         76,20           Caroline County         19,027         716,828         11.59         Norfolk         261,229         4,975,705         80.42 </td <td></td> <td></td> <td></td> <td></td> <td></td> <td>103,907</td> <td></td> <td></td>						103,907		
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Patrick County         17,473         607,306         9.82         Newport News         170,043         3,697,643         59.76           Southampton County         17,550         624,856         10.10         Arlington County         170,936         3,868,379         62.52           Dickenson County         17,620         642,476         10.38         Richmond         203,056         4,071,635         65.81           Rockbridge County         18,350         660,826         10.68         Chesterfield County         209,274         4,280,909         69.19           Bristol         18,426         679,252         10.98         Prince William County         215,686         4,496,595         72.67           Waynesboro         18,549         697,801         11.28         Henrico County         217,881         4,714,476         76.20           Fredericksburg         19,027         716,828         11.59         Nortoik         261,229         4,975,705         80.42           Caroline County         19,622         755,667         12.21         Fairfax County         818,584         6,187,358         100.00           Louisa County         20,325         775,992         12.54         40.00         10.00         10.00								
Southampton County         17,550         624,856         10.10         Arlington County         170,936         3,868,579         62.52           Dickenson County         17,620         642,476         10.38         Richmond         203,036         4,071,635         65.81           Rockbridge County         18,350         660,826         10.68         Chesterfield County         209;274         4,280,909         69.19           Bristol         18,426         679,252         10.98         Prince William County         215,686         4,496,595         72.67           Waynesboro         18,549         697,801         11.28         Henrico County         217,881         4,714,476         76.20           Garoline County         19,027         716,828         11.59         Norfolk         261,229         4,975,705         80.42           Caroline County         19,217         736,045         11.90         Virginia Beach         393,069         5,368,774         86.77           Fairfax         19,622         755,667         12.21         Fairfax County         818,584         6,187,358         100.00           Louisa County         20,325         775,992         12.54         40.00         10.00         10.00 <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td>								
Dickenson County         17,620         642,476         10.38         Richmond         203,056         4,071,635         65.81           Rockbridge County         18,350         660,826         10.68         Chesterfield County         209,274         4,280,909         69.19           Bristol         18,426         679,252         10.98         Prince William County         215,686         4,496,595         72,67           Waynesboro         18,549         697,801         11.28         Henrice County         217,881         4,714,476         76,20           Fredericksburg         19,027         716,828         11.59         Nortolk         261,229         4,975,705         80.42           Caroline County         19,217         736,045         11.90         Virginia Beach         393,069         5,368,774         86.77           Fairfax         19,622         755,667         12.21         Fairfax County         818,584         6,187,358         100.00           Louisa County         20,325         775,992         12.54         40.00         10.00								
Rockbridge County         18,350         660,826         10.68         Chesterfield County         209,274         4,280,909         69,19           Bristol         18,426         679,252         10.98         Prince William County         215,686         4,496,595         72,67           Waynesboro         18,549         697,801         11.28         Henrico County         217,881         4,714,476         76,20           Predericksburg         19,027         716,828         11.59         Norfolk         261,229         4,975,705         80.42           Caroline County         19,217         736,045         11.90         Virginia Beach         393,069         5,368,774         86,77           Fairfax         19,622         755,667         12.21         Fairfax County         818,584         6,187,358         100.00           Louisa County         20,325         775,992         12.54         561,259         100.00								
Bristol         18,426         679,252         10.98         Prince William County         215,686         4,496,595         72,67           Waynesboro         18,549         697,801         11.28         Henrico County         217,881         4,714,476         76.20           Predericksburg         19,027         716,828         11.59         Norfolk         261,229         4,975,705         80.42           Caroline County         19,217         736,045         11.90         Virginia Beach         393,069         5,368,774         86.77           Fairfax         19,622         755,667         12.21         Fairfax County         818,584         6,187,358         100.00           Louisa County         20,325         775,992         12.54         561         561         561								
Waynesboro         18,549         697,801         11.28         Henrico County         217,881         4,714,476         76.20           Fredericksburg         19,027         716,828         11.59         Norfolk         261,229         4,975,705         80.42           Caroline County         19,217         736,045         11.90         Virginia Beach         393,069         5,368,774         86,77           Fairfax         19,622         755,667         12.21         Fairfax County         818,584         6,187,358         100.00           Louisa County         20,325         775,992         12.54         54         56	Bristol	18,426	679,252	10.98				
Caroline County         19,217         736,045         11.90         Virginia Beach         393,069         5,368,774         86.77           Fairfax         19,622         755,667         12.21         Fairfax County         818,584         6,187,358         100.00           Louisa County         20,325         775,992         12.54         54         55         100.00						217,881	4,714,476	76.20
Fairfax         19,622         755,667         12.21         Fairfax County         818,584         6,187,358         100.00           Louisa County         20,325         775,992         12.54         Fairfax County         818,584         6,187,358         100.00								
Louisa County 20,325 775,992 12.54							a second a second	
					rainer county	ā18,384	0,187,358	100.00
	Dinwiddie County	20,960	796,952	12.34	Total Population	6,187,358		

#### Table 1 POPULATION BY POLITICAL JURISDICTION

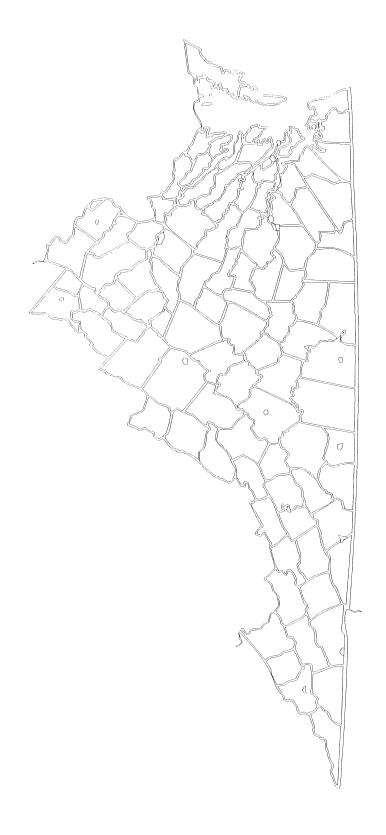


Figure 1. AREAS EXCLUDED FROM SAMPLING PROCEDURES (SHADED)

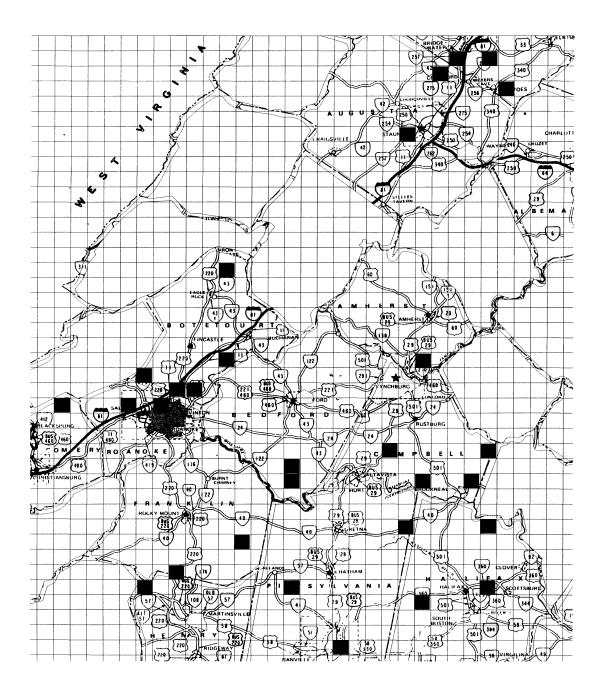


Figure 2. SAMPLE SECTION OF STATE MAP SHOWING GRID BOXES

sections across the vertical axis. However, because Virginia is not perfectly rectangular and because political jurisdictions representing the smallest 15% of the population were excluded from the sample, some boxes fell outside the geographical area or were wholly within excluded areas. To keep these boxes from affecting the random nature of the sample, they were not defined as part of the study population. Each valid grid box containing at least one intersection in an included part of Virginia was numbered. Random numbers were generated to select 120 of the 2,572 valid grid boxes, without replacement, from which specific intersections were selected. Grid box selection was the first stage of the site selection process.

To respond to a concern expressed by NHTSA that a pure statewide random sample of 120 sites would overrepresent the nonurban areas of Virginia, the originally proposed procedures were changed. The selection of sites was based on the proportion of the population in the urban and rural areas of the state. Excluding the lowest 15% of the population, the urban areas had about 68% of the remaining population and the rural areas had about 32%. Of the 120 total sites, 84 were randomly selected from the four metropolitan areas and 36 were randomly selected from the remainder of the state.

By the use of detailed maps of urban areas available in book form from ADC of Alexandria, Inc.<sup>3-7</sup> and county maps prepared by VDOT, each intersection in a selected grid box was numbered and a random number was generated to select the specific intersection to be sampled. Two alternate sites were also selected randomly from the box. For each primary and alternate site, random numbers were used to select which route and direction of travel and whether traffic entering or exiting the selected intersection would be observed. This was the second stage in the process. Figures 3 and 4 are examples of urban and rural grid boxes and potential sites.

Staff of the Virginia Transportation Research Council visited and evaluated each site to determine whether data could be safely and adequately collected. The safety of the observer was the primary criterion for evaluating each site, followed by the ability to observe traffic. If an intersection was found to be inadequate, attempts were made to find an adequate observation point downstream if traffic exiting the intersection was to be observed and upstream if entering traffic was to be observed. In either case, if an adequate site could not be found before the next intersection was reached, an alternate site was investigated. Choosing a point before the next intersection ensured that the same traffic characteristics would be present at the upstream or downstream sites as would have been present at the original intersection. Very few original sites were discarded in favor of alternates. Those that were discarded had no safe area for the observer to stand or park or required the observer to be below the level of the roadway, making observation impossible.

After selection, the sites were sorted geographically into seven groups. The days of the week were randomly assigned, without replacement, to each geographic group. Data were collected for 1 hour at each site all 10 years. For each day, the sites in a geographic group were assigned a random hour to begin, without replacement, from 7 A.M. to 6 P.M. When inclement weather precluded the collection of data at a site, data were collected at that site at a later date but at the originally specified time and on the same day of the week.

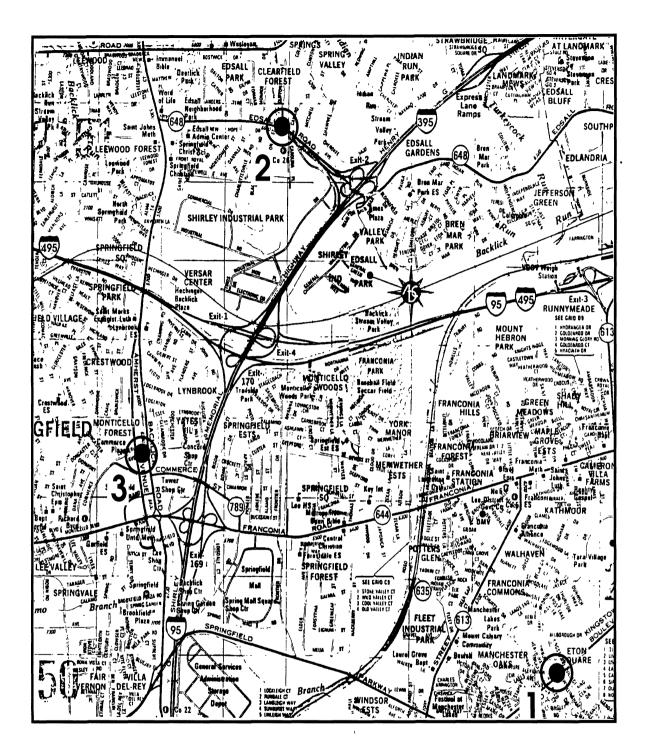


Figure 3. DETAIL OF URBAN GRID SHOWING INTERSECTION CHOICES

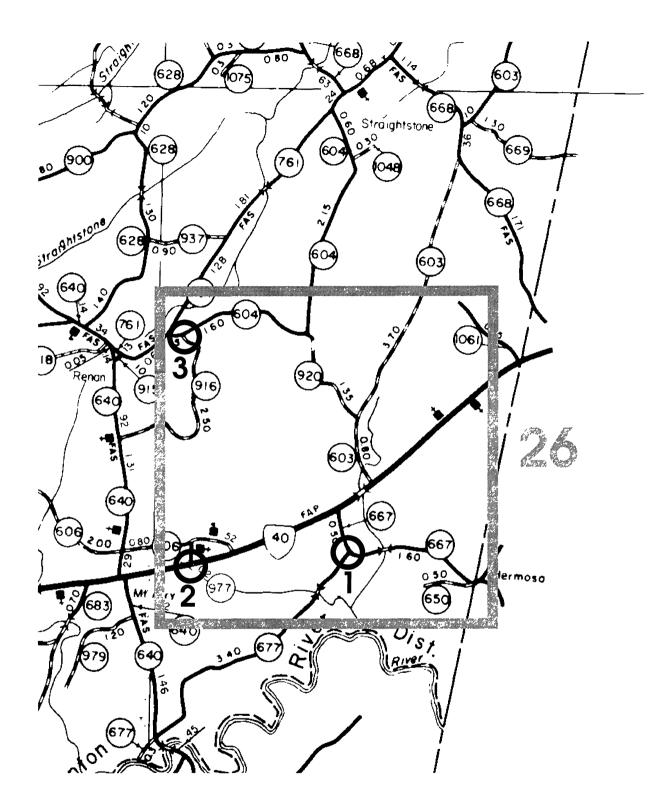


Figure 4. DETAIL OF RURAL GRID SHOWING INTERSECTION CHOICES

#### **Data Collection Procedures**

All passenger cars in the curb lane were observed for shoulder belt use by the specified passengers. The designation "passenger car" included vans, minivans, sport utility vehicles, and pickup trucks. All observations began precisely on the hour and ended on the hour. If a momentary interruption occurred, the observer was instructed to resume observing vehicles, but to ensure that the beginning observation was not a nonrandom selection by the observer, data collection resumed with the third vehicle to pass the site after the observer was ready.

Observations were recorded using eight counters mounted on a hand-held board. A "yes" or "no" count was made for shoulder belt use for drivers and outboard front-seat passengers for each passenger car in the curb travel lane and for motorcycle driver and passenger helmet use in any lane at the intersection. The data collectors were required to complete a training program on the use of the counter board and how the data were to be collected and recorded. The data collectors were checked for inter-rater reliability in training sessions before they began the survey. Since observation points were preselected at each site, the data collectors were instructed to use intersection diagrams and photographs to locate the point at which observations were to be made (see Figures 5 and 6).

#### **Calculation of Use and Error Rates**

Because safety belt use was observed only in the curb lane, the NHTSA guidelines required that the observations on multilane highways be weighted by the number of lanes of travel. However, no such weighting was necessary for motorcycles, which were observed in all lanes of travel. For passenger cars at each site, the number of driver and passenger observations was multiplied by the number of lanes in the observed direction of travel. Thus, at a site with two lanes in the travel direction, the number of observations was doubled to estimate the total number of drivers and passengers who crossed the site. This was the third stage.

As previously discussed, the selection of sites was stratified to represent urban and rural areas in proportion to their populations. Thus, more than two thirds of the sites were in urban areas.

In December 1992 correspondence, NHTSA's Washington Headquarters staff recommended that Virginia use the following formulas to compute the state's safety belt use rate. The use rate,  $P_B$ , is the estimated proportion of drivers and passengers using safety belts and is calculated by the formula:

$$P_{B} = \frac{\sum_{t=1}^{2} \frac{N_{t}}{n_{t}} \sum_{i=1}^{n_{t}} N_{ti}B_{ti}}{\sum_{t=1}^{2} \frac{N_{t}}{n_{t}} \sum_{i=1}^{n_{t}} N_{ti}O_{ti}}$$

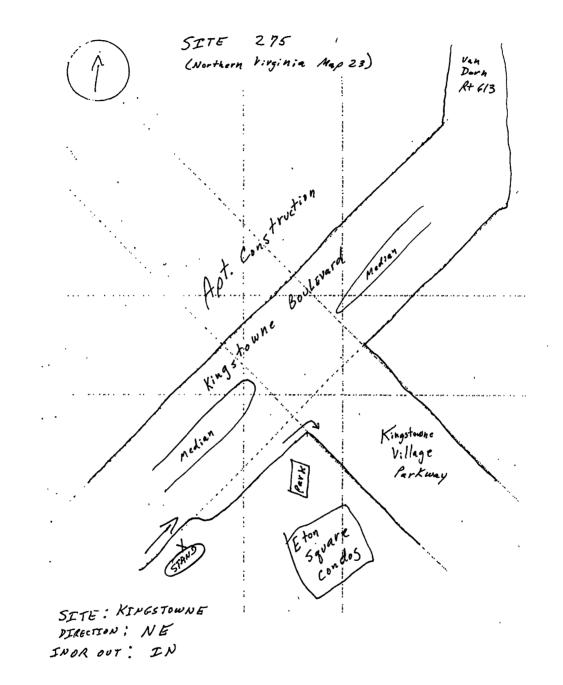


Figure 5. URBAN SITE INTERSECTION DIAGRAM

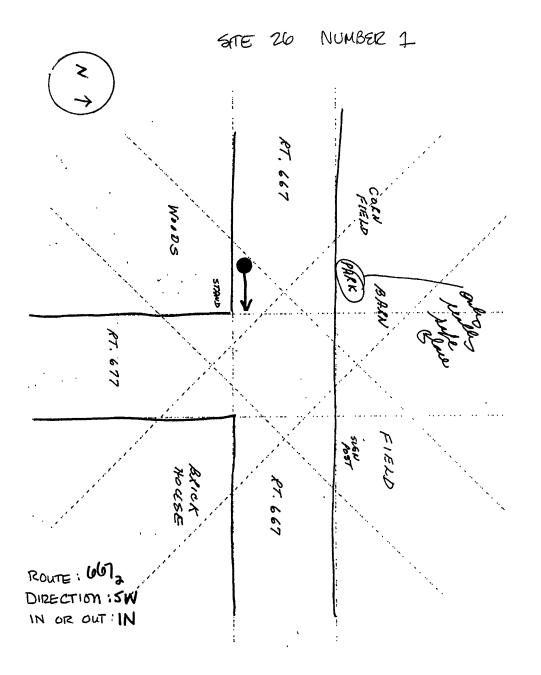


Figure 6. RURAL SITE INTERSECTION DIAGRAM

where t = stratum (1 = urban, 2 = rural)

ti = each site within a stratum

 $N_t$  = total number of grid boxes within stratum t

 $n_t$  = number of grid boxes selected from each stratum t

 $N_{tt}$  = total number of intersections within each sampled grid box

 $B_{tt}$  = number of belted occupants observed at site ti (weighted by lanes)

 $O_{ti}$  = total number of occupants observed at site *ti* (weighted by lanes).

The variance of the estimated belt use,  $V(P_B)$ , was approximated by the formula:

$$V(P_{B}) = \frac{1}{\overline{O}^{2}} [V(B) + P_{B}^{2}V(O) - 2P_{B}COV(B, O)]$$

where  $\overline{O}$  is the weighted average number of occupants observed per site and is computed by the formula:

$$\overline{O} = \frac{1}{2} \sum_{i=1}^{2} \frac{\sum_{i=1}^{n_i} N_{ii} O_{ii}}{n_i}$$

and where V(B) is the variance of the number of belted occupants and is computed by the formula:

$$V(B) = \frac{1}{(N_1 + N_2)^2} \sum_{t=1}^{2} \frac{N_t^2}{n_t(n_t - 1)} \sum_{i=1}^{n_t} (N_{ti}B_{ti} - \overline{B}_t)^2$$

where 
$$\overline{B}_{t} = \frac{\sum_{i=1}^{n_{t}} N_{ti} B_{ti}}{n_{t}}$$

and where V(O) is the variance of the number of observed occupants and is computed by the formula:

$$V(O) = \frac{1}{(N_1 + N_2)^2} \sum_{t=1}^{2} \frac{N_t^2}{n_t(n_t - 1)} \sum_{i=1}^{n_t} (N_{ti}O_{ti} - \overline{O}_t)^2$$
  
where  $\overline{O}_t = \frac{\sum_{i=1}^{n_t} N_{ti}O_{ti}}{n_t}$ 

and where COV(B, O) is the covariance of the number of belted and observed occupants and is computed by the formula:

$$COV(B,O) = \frac{1}{(N_1 + N_2)^2} \sum_{t=1}^{2} \frac{N_t^2}{n_t(n_t - 1)} \sum_{t=1}^{n_t} (N_{ti}B_{ti} - \bar{B}_t) (N_{ti}O_{ti} - \bar{O}_t)$$

The standard error of the estimate was calculated by the formula<sup>8</sup>:

$$SE = \frac{SD}{\sqrt{n-1}}$$

where SE = standard error of the estimate n = total number of sites sampled

SD = square root of variance.

The relative error of the estimate was calculated by the formula:

$$RE = \frac{SE}{P_B}$$

where RE = relative error of the estimate.

#### RESULTS

The survey team observed 16,961 drivers and 4,696 right-front passengers for the use of a shoulder belt. Because the survey data were collected from moving traffic, the use of the lap portion of a belt system could not be observed. For computing a statewide use rate, the observations were weighted by the number of traffic lanes in the direction of traffic flow at the site where the data were collected (see Tables A-1 and A-2 for the complete data counts).

As can be seen from the 2001 data in Table 2, there were 37,393 weighted observations of occupants in passenger cars. Of these, there were 21,056 drivers and 5,583 right-front passengers (weighted) who were observed to be using a shoulder belt. Passenger car occupants had a weighted safety belt use rate of 72.3%. The relative error of the estimate was 1.33%. There were also 387 motorcycle riders observed (332 drivers and 55 passengers), and the rate of helmet use was 100%. Because the use rate was 100%, there was no relative error of the estimate. On the basis of actual counts, i.e., the data are not weighted by the number of lanes, a greater percentage of drivers (72.1%) use safety belts than do right-front passengers (66.8%).

The results of the fall 1992 survey are also shown in Table 2 as are those from the summers of 1993 through 2000. In each of the 10 years of the survey, virtually all of the motorcycle drivers and passengers observed were using a helmet. For the passenger car drivers and right-front passengers observed in the 10 years of the study, use rates varied from a low of 67.1% in 1997 to a high of 73.6% in 1998. The 2001 use rate of 72.3% is an increase over the 69.9% use rate in 2000.

Year	Vehicle Type	Weighted Observations	Drivers Protected	Passengers Protected	Use Rate (%)	Variance (%)	Standard Error (%)	Relative Error (%)
2001	Cars	37,393	21,056	5,583	72.3	1.10	0.96	1.33
	Motorcycles	387	332	55	100.0	0	0	0
2000	Cars	38,668	21,014	5,539	69.9	0.47	0.63	0.89
	Motorcycles	222	201	20	99.9	0.00	0.004	0.004
1999	Cars	37,869	20,213	5,445	69.9	0.49	0.64	0.92
	Motorcycles	198	169	28	99.1	0.27	0.47	0.48
1998	Cars	31,877	17,987	4,686	73.6	1.33	1.06	1.44
	Motorcycles	229	205	23	99.6	0.00	0.04	0.04
1997	Cars	35,508	18,544	5,013	67.1	1.88	1.26	1.87
	Motorcycles	134	121	11	98.7	0.04	0.18	0.18
1996	Cars	26,975	14,278	4,577	69.6	1.63	1.17	1.68
	Motorcycles	99	85	14	100.0	0	0	0
1995	Cars	29,584	15,632	4,521	70.2	1.52	1.13	1.61
	Motorcycles	247	208	39	100.0	0	0	0
1994	Cars	25,291	14,146	4,271	71.8	0.74	0.79	1.10
	Motorcycles	105	90	15	100.0	0	0	0
1993	Cars	24,299	13,045	4,396	73.2	0.89	0.86	1.18
	Motorcycles	236	208	28	100.0	0	0	0
1992	Cars	26,320	14,701	4,233	71.6	1.11	0.97	1.35
	Motorcycles	53	47	6	100.0	0	0	0

Table 2. SURVEY RESULTS FOR 1992 THROUGH 2001

#### ACKNOWLEDGMENTS

The authors extend thanks for the work of Prabhu Adie and Dave Goodman who traveled the length and breadth of the state of Virginia observing and recording shoulder belt use by occupants of passing cars and the use of helmets by motorcycle riders. There were periods when they were in the field for a week at a time while working days in excess of 12 hours, including weekends.

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# APPENDIX: 2001 RAW DATA BY SITE

		Table A-1. 200				
Site ID	Lanes	N <sub>ti</sub>	B <sub>ti</sub>	O <sub>ti</sub>	MC B <sub>ti</sub>	MC O <sub>ti</sub>
2	1	10	15	20	0	0
7	1	408	39	65	2	2
8	1	7	1	1	0	0
11	1	82	4	4	0	0
15	3	6	663	1089	20	20
17	3	115	915	1413	2	2
19	1	10	117	170	1	1
20	1	7	30	49	0	0
21	1	148	113	172	0	0
28	1	3	11	29	1	1
30	2	3	388	628	0	0
32	1	244	71	97	1	1
40	3	254	720	933	18	18
41	1	211	272	339	13	13
42	1	36	12	21	0	0
46	1	5	26	42	0	0
49	1	6	0	0	0	0
54	2	504	1206	1456	3	3
58	1	15	183	229	1	1
67	1	5	9	13	0	0
68	1	24	3	5	0	0
69	1	721	693	893	5	5
81	1	6	43	77	1	1
86	2	7	212	340	0	0
90	1	17	90	137	0	0
92	3	142	600	693	7	7
105	1	24	99	128	2	2
118	1	7	50	78	0	0
119	3	32	1701	2067	11	11
120	1	546	113	171	0	0
121	1	7	321	432	11	11
136	1	23	78	121	2	2
140	3	3	1488	1722	1	1
154	1	8	86	109	1	1
169	2	4	238	374	2	2
170	1	19	5	6	0	0
173	2	331	1376	1766	17	17
183	1	8	16	23	1	1
202	1	59	100	164	3	3
206	1	17	7	12	0	0
210	2	73	700	942	22	22
211	1	253	629	821	9	9
213	1	376	192	296	4	4
234	1	197	3	4	0	0
236	1	87	92	146	1	1
250	1	16	3	7	4	4
259	3	532	267	366	3	3
275	2	526	678	832	4	4

Table A-1. 2001 Urban Raw Data by Site<sup>a</sup>

Site ID	Lanes	N <sub>ti</sub>	B <sub>ti</sub>	O <sub>ti</sub>	MC B <sub>ti</sub>	MC O <sub>ti</sub>
280	1	104	25	36	2	2
290	1	3	221	289	1	1
300	1	110	9	14	0	0
306	1	12	3	5	0	0
313	3	186	996	1458	5	5
315	1	9	277	377	2	2
317	2	444	196	264	0	0
322	1	1	45	69	0	0
324	2	82	314	400	0	0
330	1	16	33	49	0	0
332	3	8	621	1095	38	38
353	1	11	146	210	10	10
359	1	9	62	87	1	1
371	2	64	46	62	0	0
372	3	5	750	1062	31	31
374	1	26	32	45	8	8
375	1	12	245	357	9	9
385	3	30	555	975	9	9
388	1	10	10	12	0	0
400	1	385	11	12	0	0
403	2	341	642	848	4	4
406	2	374	846	1154	2	2
411	1	19	79	123	4	4
420	1	223	115	163	0	0
425	1	365	71	97	0	0
426	2	626	582	1000	3	3
434	1	25	6	11	1	1
450	1	15	159	203	3	3
458	2	180	200	326	0	0
464	1	21	25	39	3	3
471	1	13	6	9	0	0
476	1	13	589	776	15	15
477	1	11	38	52	0	0
483	1	2	149	199	0	0
508	2	628	708	1122	2	2
512 <sup>a</sup> Site ID = ider	1	15	178	219	3	3

<sup>a</sup>Site ID = identifier of site sampled. Lanes = number of lanes in sampled direction at site.

 $N_{tt} = number of intersections within sampled direction at site.$   $N_{tt} = number of intersections within sample grid.$   $B_{tt} = number of belted occupants observed at site.$   $O_{tt} = number of occupants observed at site.$   $MC B_{tt} = number of motorcycle occupants with helmets at site.$   $MC O_{tt} = number of motorcycle occupants observed at site.$ 

	*******	Table A-2.         200	1 Rural Raw	Data by Si		
Site ID	Lanes	N <sub>ti</sub>	B <sub>ti</sub>	O <sub>ti</sub>	MC B <sub>ti</sub>	MC O <sub>ti</sub>
1	1	15	44	82	0	(
4	1	9	10	24	0	(
5	1	9	1	1	0	C
6	1	16	63	89	0	C
9	1	6	0	9	0	C
10	1	5	11	12	0	(
12	1	4	492	697	9	9
13	1	17	36	53	0	C
16	1	4	7	7	0	C
18	1	8	9	18	0	0
22	1	12	15	23	0	0
23	1	7	94	182	3	3
25	1	6	47	67	1	1
26	1	9	0	3	0	0
27	1	13	2	7	4	4
29	1	6	12	15	0	0
31	1	7	4	13	0	0
33	1	15	118	160	0	0
35	1	9	20	44	6	6
36	1	12	23	49	0	0
37	1	1	74	106	0	0
39	1	10	16	35	0	0
44	1	7	5	12	0	0
45	1	7	81	159	10	10
47	3	18	900	1374	17	17
48	1	15	5	7	0	0
50	1	8	43	95	2	2
51	1	11	1	4	0	0
52	1	3	9	29	0	0
53	1	2	12	31	0	0
55	1	12	40	89	0	0
56	2	5	58	150	0	0
57	1	13	1	2	0	0
59	1	7	2	8	0	0
62	2	13	580	812	6	6
63	1	15	136	204	0	0

Table A-2. 2001 Rural Raw Data by Site<sup>a</sup>

<sup>a</sup>Site ID = identifier of site sampled.

Site ID = identifier of site sampled. Lanes = number of lanes in sampled direction at site.  $N_{tt}$  = number of intersections within sample grid.  $B_{tt}$  = number of belted occupants observed at site.  $O_{tt}$  = number of occupants observed at site. MC  $B_{tt}$  = number of motorcycle occupants with helmets at site. MC  $O_{tt}$  = number of motorcycle occupants observed at site.