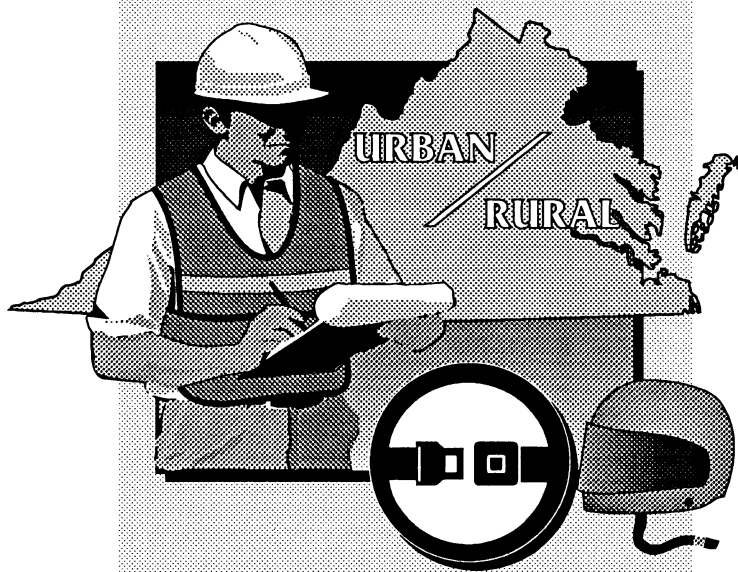


TECHNICAL
ASSISTANCE REPORT

**SAFETY BELT AND
MOTORCYCLE HELMET USE IN VIRGINIA:
RESULTS OF THE 1993 SURVEY
TO QUALIFY FOR INCENTIVE FUNDS
UNDER ISTEA, SECTION 153**



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Sponsoring Agencies' Names and Addresses <table style="width: 100%; border: none;"> <tr> <td style="width: 33%; border: none;"> Virginia Department of Transportation 1401 E. Broad Street Richmond, Virginia 23219 </td> <td style="width: 33%; border: none;"> Va. Dept. of Motor Vehicles P.O. Box 27412 Richmond, VA 23269 </td> <td style="width: 33%; border: none;"> University of Virginia Charlottesville Virginia 22903 </td> </tr> </table>					Virginia Department of Transportation 1401 E. Broad Street Richmond, Virginia 23219	Va. Dept. of Motor Vehicles P.O. Box 27412 Richmond, VA 23269	University of Virginia Charlottesville Virginia 22903
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Supplementary Notes							
Abstract <p>Section 153 of the Intermodal Surface Transportation Efficiency Act of 1991 (ISTEA) established an incentive grant program to support states in adopting and implementing laws requiring the use of safety belts and motorcycle helmets. Having such laws that applied to all front seat occupants of passenger cars and all motorcycle occupants qualified a state for first-year funding. Second- and third-year funding was dependent upon demonstrating a specified level of compliance with each law. Virginia qualified for both first- and second-year funding.</p> <p>This report contains the methodology and results of an observational survey conducted in Virginia in June and July 1993. This survey was conducted according to guidelines established by the National Highway Traffic Safety Administration.</p> <p>The results show that Virginia's safety belt use rate was 73.2 percent, with a standard error of 0.0008. Motorcycle helmet use was observed to be 100 percent. Virginia, therefore, qualifies for third-year funding.</p>							

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(The opinions, findings, and conclusions expressed in this
report are those of the authors and not necessarily
those of the sponsoring agencies.)

**Virginia Transportation Research Council
(A Cooperative Organization Sponsored Jointly by the
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Charlottesville, Virginia

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VTRC 94-TAR2**

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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 authorizes the 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 funding, a state had 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 cars. Virginia qualified for first-year funding. To qualify for a second- or third-year grant, a state must not only have mandatory use laws but must also demonstrate a specified level of compliance. In FY '93, states were required to demonstrate statewide belt usage of at least 55% and helmet usage of at least 70%. Virginia also qualified for second-year funding. For FY '94, the required usage levels increased to 70% for belts and 85% for helmets.

On June 29, 1992, the National Highway Traffic Safety Administration (NHTSA) published the final guidelines for the conduct of surveys of belt and helmet use in the states.¹ The guidelines require 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 must 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 are to be observed; (5) collecting the observational data; and (6) beginning and concluding an observation period. The guidelines further state that the relative error of the estimate should be no more than $\pm 5\%$ and that all drivers and outboard front-seat passengers must be eligible for observation. Additionally, both motorcycle drivers and passengers must be eligible for observation. The guidelines require that at least 85% of the state's population be eligible for inclusion

and that only the smallest counties, based on population, may be eliminated from the sampling frame. Finally, all daylight hours and all days of the week must be eligible for inclusion in the sample, and the scheduling of the time and day for each sample site must be done randomly.

PURPOSE AND SCOPE

The purpose of this project was to conduct a survey of safety belt and motorcycle helmet use that conformed with NHTSA's guidelines to determine whether Virginia would qualify for third-year funding. The project was limited to collecting only the information required by the guidelines.

METHOD

This survey included five major tasks: (1) defining the population from which the sample was drawn, (2) determining the sample size, (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 the federal guidelines, localities in each state with the smallest populations and making up less than 15% of its total population may be removed from the population from which sites are chosen. In Virginia, determining which localities made up 15% was somewhat complex. In most states, cities are a part of their surrounding counties. In Virginia, although towns are considered to be part of their surrounding counties, the 41 independent cities are not. In order to accommodate this arrangement of political jurisdictions, both counties and independent cities were considered in establishing the sampling population.

In Table 1, the 136 counties and independent cities in Virginia are ordered by population. The total population in Virginia is about 6.2 million according to 1990 census figures. However, most of that 6.2 million is located in the four population centers: Northern Virginia, Tidewater, Richmond, and Roanoke. Thus, there is a great disparity between the population size of the rural counties and cities and the more urban ones. For instance, the least populated county, Highland, has fewer than 2,700 residents, and the least populated city, Norton, has fewer than 4,300. Twenty-seven of the 136 political jurisdictions have a population less than 10,000. On the other hand, 13 jurisdictions have a population of more than 100,000 and account for more than 48% of the total population of the state. Because of this disparity in population, the 74 least populated jurisdictions make up just under 15% of the state's population; thus, they were excluded from sampling according to the federal guidelines. See Figure 1 for a map that shows the jurisdictions that were excluded (the shaded portion). All other locations in the state were equally eligible for inclusion in the sample.

**Table 1
POPULATION BY POLITICAL JURISDICTION**

Jurisdiction	Jurisdiction Population	Cumulative Population	Cumulative Percent	Jurisdiction	Jurisdiction Population	Cumulative Population	Cumulative Percent
Highland County	2,635	2,635	0.04	Orange County	21,421	818,373	13.23
Norton	4,247	6,882	0.11	Page County	21,690	840,063	13.58
Craig County	4,372	11,254	0.18	Winchester	21,947	862,010	13.93
Clifton Forge	4,679	15,933	0.26	Hopewell	23,101	885,111	14.31
Bath County	4,799	20,732	0.34	Scott County	23,204	908,315	14.68
Emporia	5,306	26,038	0.42	Salem	23,736	932,071	15.06
Bedford	6,073	32,111	0.52	Staunton	24,461	956,532	15.46
Surrey County	6,145	38,256	0.62	Lee County	24,496	981,028	15.86
Charles City County	6,282	44,538	0.72	Botetourt County	24,992	1,006,020	16.26
King and Queen County	6,289	50,827	0.82	Isle of Wight County	25,053	1,031,073	16.66
Buena Vista	6,406	57,233	0.92	Wythe County	25,466	1,056,539	17.08
Bland County	6,514	63,747	1.03	Warren County	26,142	1,082,681	17.50
Rappahannock County	6,622	70,369	1.14	Carroll County	26,594	1,109,275	17.93
Galax	6,670	77,039	1.25	Prince George County	27,394	1,136,669	18.37
Manassas Park	6,734	83,773	1.35	Culpeper County	27,791	1,164,460	18.82
Lexington	6,959	90,732	1.47	Manassas	27,957	1,192,417	19.27
Covington	6,991	97,723	1.58	Amherst County	28,578	1,220,995	19.73
South Boston	6,997	104,720	1.69	Russell County	28,667	1,249,662	20.20
Richmond County	7,273	111,993	1.81	Halifax County	29,033	1,278,695	20.67
Cumberland County	7,825	119,818	1.94	Mecklenburg County	29,241	1,307,936	21.14
Franklin	7,864	127,682	2.06	Gloucester County	30,131	1,338,067	21.63
Mathews County	8,348	136,030	2.20	Harrisonburg	30,707	1,368,774	22.12
Middlesex County	8,653	144,683	2.34	Buchanan County	31,333	1,400,107	22.63
Essex County	8,689	153,372	2.48	Shenandoah County	31,636	1,431,743	23.14
Amelia County	8,787	162,159	2.62	Accomack County	31,703	1,463,446	23.65
Greensville County	8,853	171,012	2.76	Smyth County	32,370	1,495,816	24.18
Falls Church	9,578	180,590	2.92	Pulaski County	34,496	1,530,312	24.73
Sussex County	10,248	190,838	3.08	James City County	34,859	1,565,171	25.30
Greene County	10,297	201,135	3.25	Petersburg	38,386	1,603,557	25.92
New Kent County	10,445	211,580	3.42	Franklin County	39,549	1,643,106	26.56
Northumberland County	10,524	222,104	3.59	Wise County	39,573	1,682,679	27.20
Lancaster County	10,896	233,000	3.77	Charlottesville	40,341	1,723,020	27.85
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
Lunenburg County	11,419	266,337	4.30	Frederick 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	Tazewell County	45,960	1,948,668	31.49
Madison County	11,949	301,504	4.87	Campbell County	47,572	1,996,240	32.26
Floyd County	12,005	313,509	5.07	Fauquier County	48,741	2,044,981	33.05
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
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	Pittsylvania County	55,655	2,260,510	36.53
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	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	Hanover 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	Albemarle County	68,040	2,690,968	43.49
Westmoreland County	15,480	475,716	7.69	Montgomery County	73,913	2,764,881	44.69
Radford	15,940	491,656	7.95	Roanoke County	79,332	2,844,213	45.97
Brunswick County	15,987	507,643	8.20	Loudoun 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	Portsmouth	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	17,320	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	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				
Dinwiddie County	20,960	796,952	12.88	Total Population	6,187,358		

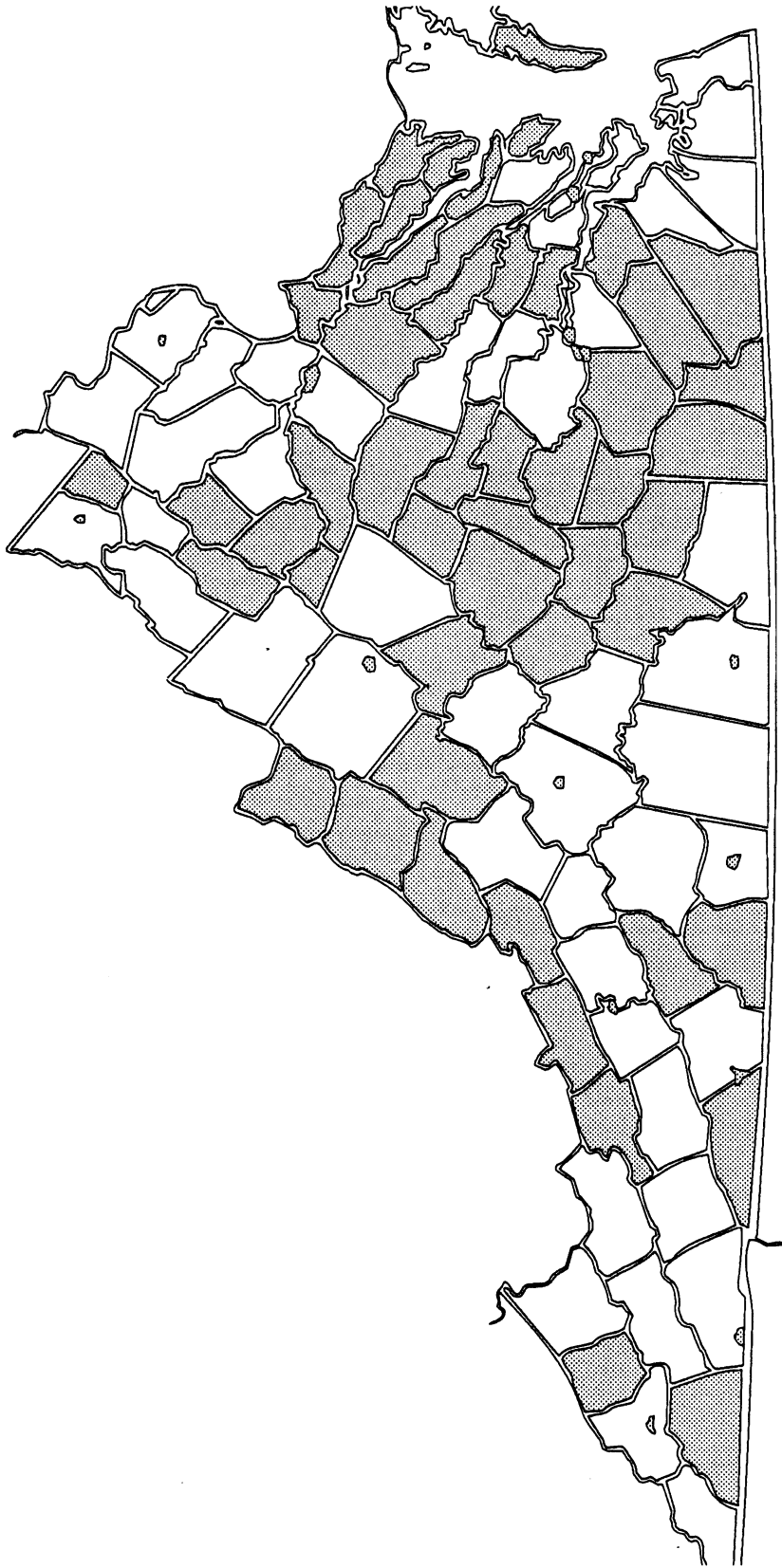


Figure 1. Areas excluded from sampling procedures (shaded).

Sample Size

The next step in the project was to determine the number of statewide sites necessary to fulfill NHTSA's requirement of a relative error of $\pm 5\%$ and 95% confidence. The first consideration in determining sample size was the selection of an appropriate formula. After considering a number of formulas for calculating the minimum sample size, the following one was selected as the most appropriate for this particular project:

$$n = \frac{(Z_{1-a}^2 + Z_{1-b}^2) \cdot (sd)^2}{(M_1 - M_0)^2}$$

where n = the calculated minimum sample size
 a, b = alpha and beta error levels (in this case, 0.05 and 0.20, respectively)
 Z_{1-a}, Z_{1-b} = normal values for the alpha and beta errors
 sd^2 = variance estimate
 $M_1 - M_0$ = smallest detectable difference between the mean and the true mean or standard.

$$\text{Corrected } n = \frac{\text{population size} \times n}{\text{population size} + n}$$

where population size = estimated total number of intersections.

This formula yields a sample size that would produce use rates for safety belts and motorcycle helmets that adequately approximates the true statewide use figures.

The variance estimate used was based on the estimates of use that were found in a survey of safety belt use in Virginia in 1991. The calculation of the variance between sites in the proportion of usage was based on the 50 sites at which data were taken across the state. The minimum detectable difference is based on a 5% relative error of the statewide mean safety belt use found in the 1991 survey. The following figures were entered into the formula for drivers and outboard passengers:

Z_{1-a}	= 1.96
Z_{1-b}	= 0.85
sd	= 9.44
$M_1 - M_0$	= 3.02
Population size	= 250,000
Uncorrected sample size	= 77.1512
Corrected sample size	= 77.1274.

Thus, a random sample of 78 sites was deemed adequate to determine Virginia's safety belt use within $\pm 5\%$ as required by NHTSA's guidelines. In order to further

minimize the relative error of the estimate, the initial project work plan proposed to observe safety belt use at 84 sites. However, because of comments received from NHTSA on September 4, 1992, suggesting that additional sites would be needed to ensure that the required precision was reached, data were collected at 120 sites in 1992. The same 120 sites used in 1992 were used in 1993. In addition, data were collected on the same day of the week and the same hour of the day at each site during both years.

Sampling Plan

In order to select the sample of sites, a grid with 1/4-in by 1/4-in sections was placed over a standard map of Virginia issued by the Virginia Department of Transportation (VDOT) and drawn to a scale of 1 in = 13 miles. See Figure 2 for a sample section of the map. Each grid box contained approximately 10.5 square miles. This procedure produced a system of 144 sections across the horizontal axis of Virginia and 63 sections across the vertical axis. However, because Virginia is not perfectly rectangular and because political jurisdictions representing Virginia's smallest 15% of the population were excluded from the sample, some boxes fell outside the geography of Virginia or were wholly within areas that were excluded. So that these boxes would not affect the random nature of the sample, they were not defined as part of the population to be studied. 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.

To respond to a concern expressed by NHTSA that a pure statewide random sample of 120 sites would produce a sample that would overrepresent the nonurban areas of Virginia, a change was made in the originally proposed procedures. 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 state's population, the urban areas have about 68% of the remaining population, and the rural areas have about 32%. Of the 120 total sites, 82 were randomly selected from the four metropolitan areas, and 38 were randomly selected from the remainder of the state.

By the use of detailed maps of urban areas available in book form from ADC map publishers,²⁻⁶ 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 the route observed at the selected intersection, the direction of travel observed, and whether traffic entering or exiting the intersection was observed. See Figures 3 and 4 for examples of urban and rural grid boxes and potential sites.

Members of the study team visited and evaluated each site to determine whether data could be safely and adequately collected at the site. The safety of the observer was the primary criterion for judging each site, followed by the ability to

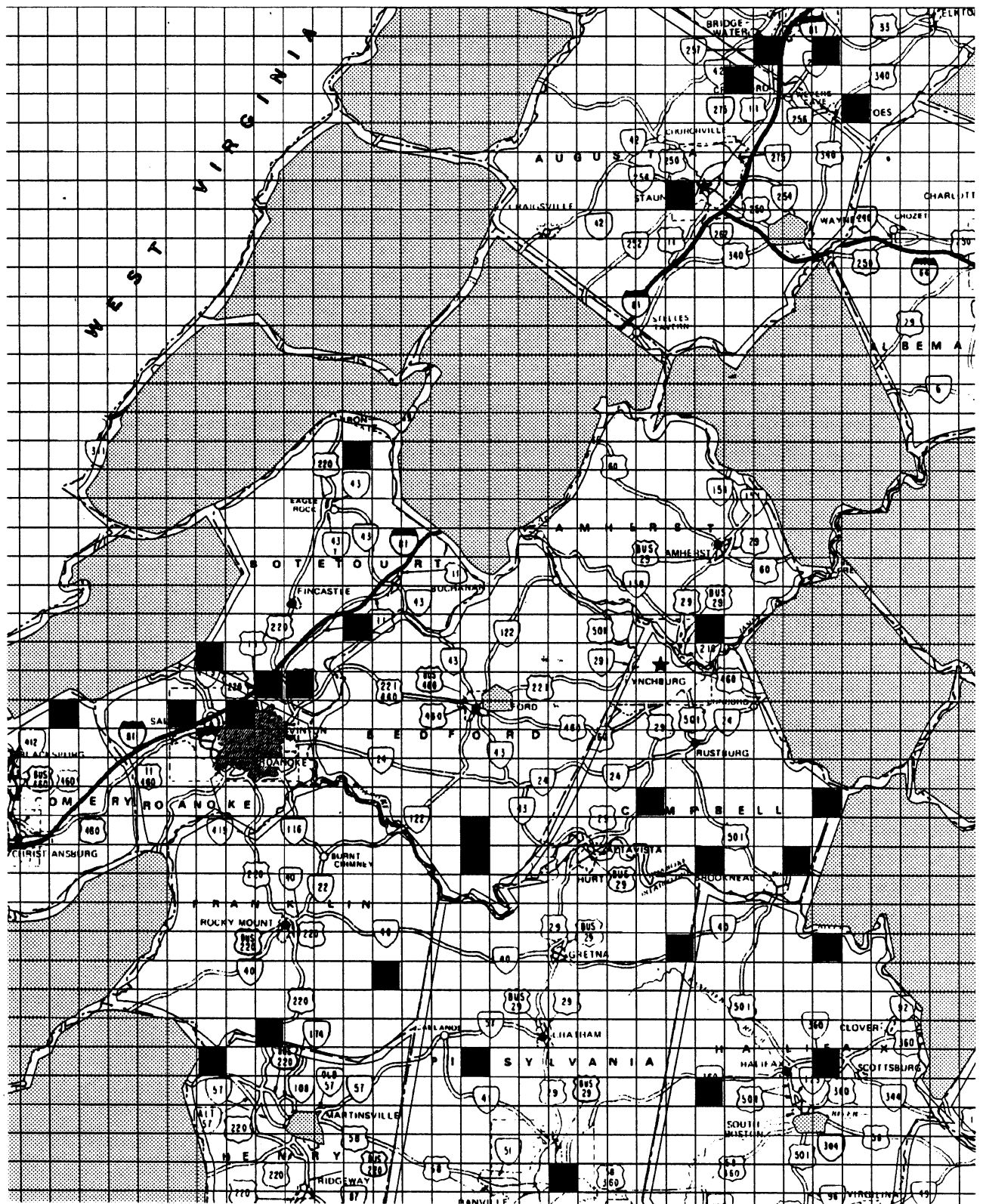


Figure 2. Sample section of state map showing grid boxes.

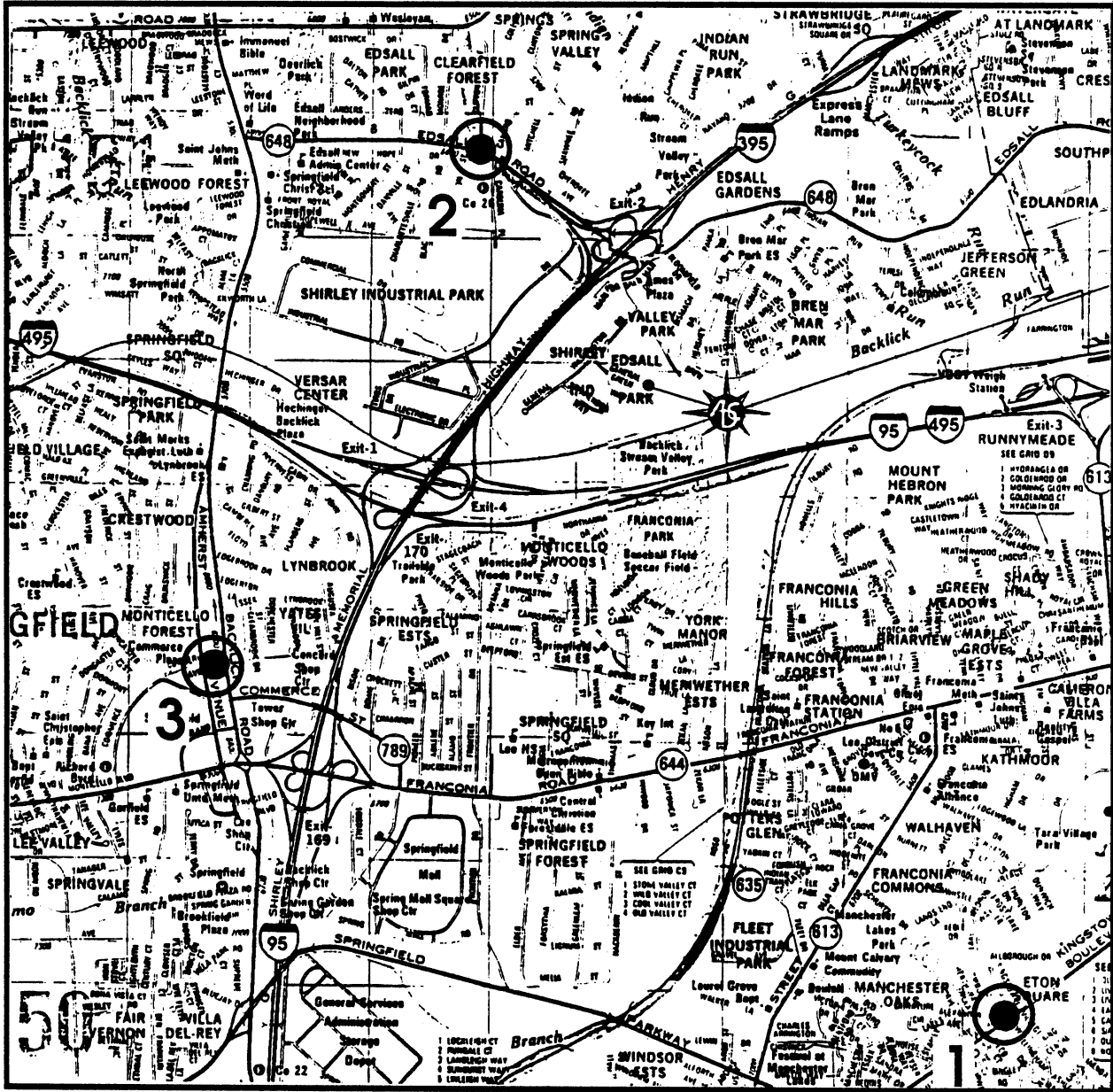


Figure 3. Detail of urban grid showing intersection choices.

observe traffic. If the 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 site 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, thus making observation of the occupants 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. As in 1992, data were collected for 1 hour at each site. 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.

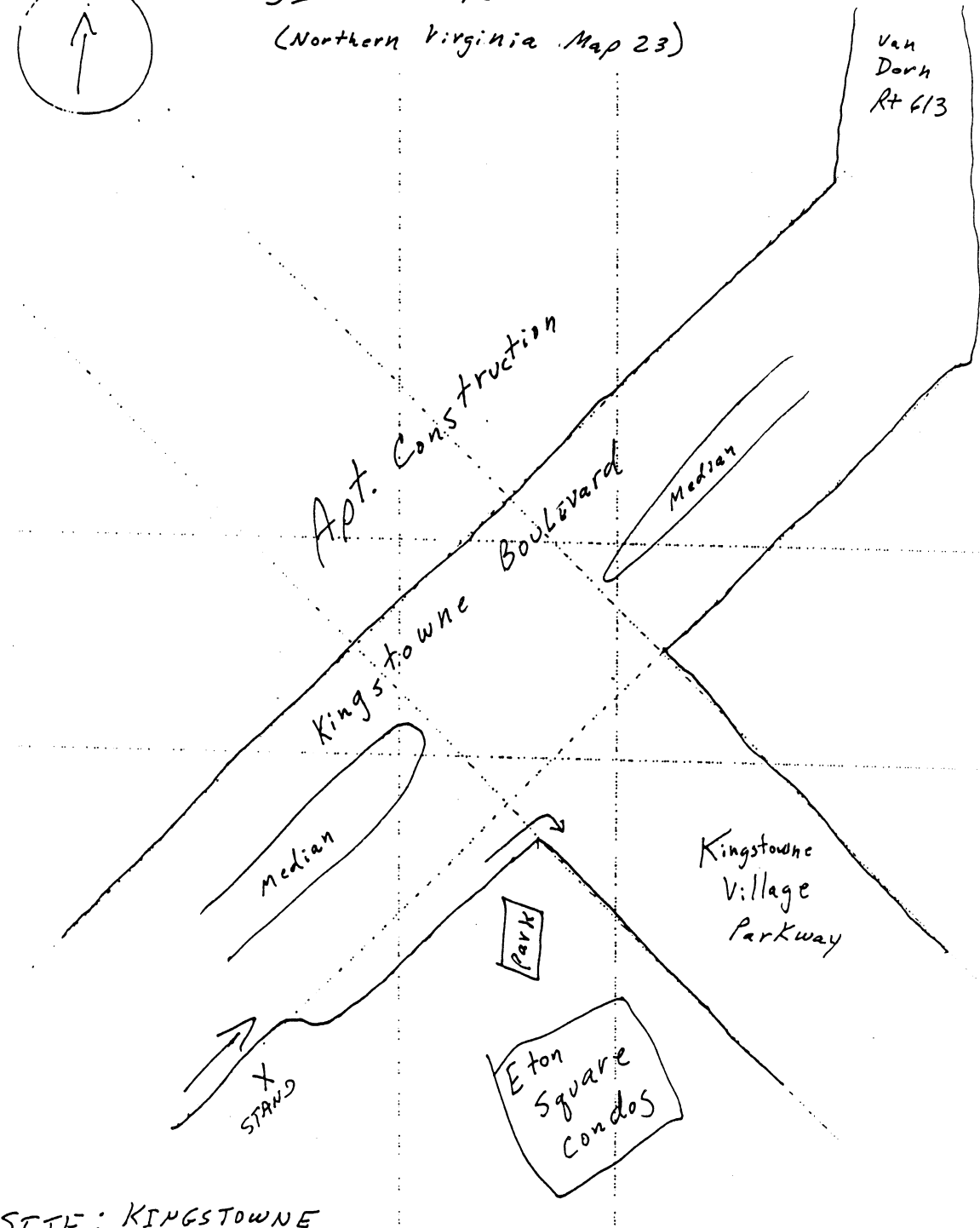
Data Collection Procedures

All passenger cars in the curb lane were observed for shoulder belt use. (Dedicated turning lanes were not considered to be curb lanes for the purpose of this study.) All observations began precisely on the hour and ended on the hour. Once observations were begun, they continued throughout the hour. If a momentary interruption occurred, the observer was instructed to resume observing vehicles, but in order to ensure that the beginning observation was not a nonrandom selection by the observer, data collection resumed with the fifth 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 a "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 or passenger helmet use in any lane in the appropriate direction of travel. To assist data collectors in moving from one vehicle or occupant classification to another (e.g., from drivers to passengers), all "yes" tallies were made by pressing a counter on the right side of the board and all "no" tallies by pressing a counter on the left. The data collectors were required to complete a training program on the use of the counter board and on how the data were to be collected and recorded. The data collectors were checked for inter-rater reliability in training sessions prior to the beginning of 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).



SITE 275
(Northern Virginia Map 23)



SITE: KINGSTOWNE
DIRECTION: NE
IN OR OUT: IN

Figure 5. Urban site intersection diagram.

SITE 26 NUMBER 1

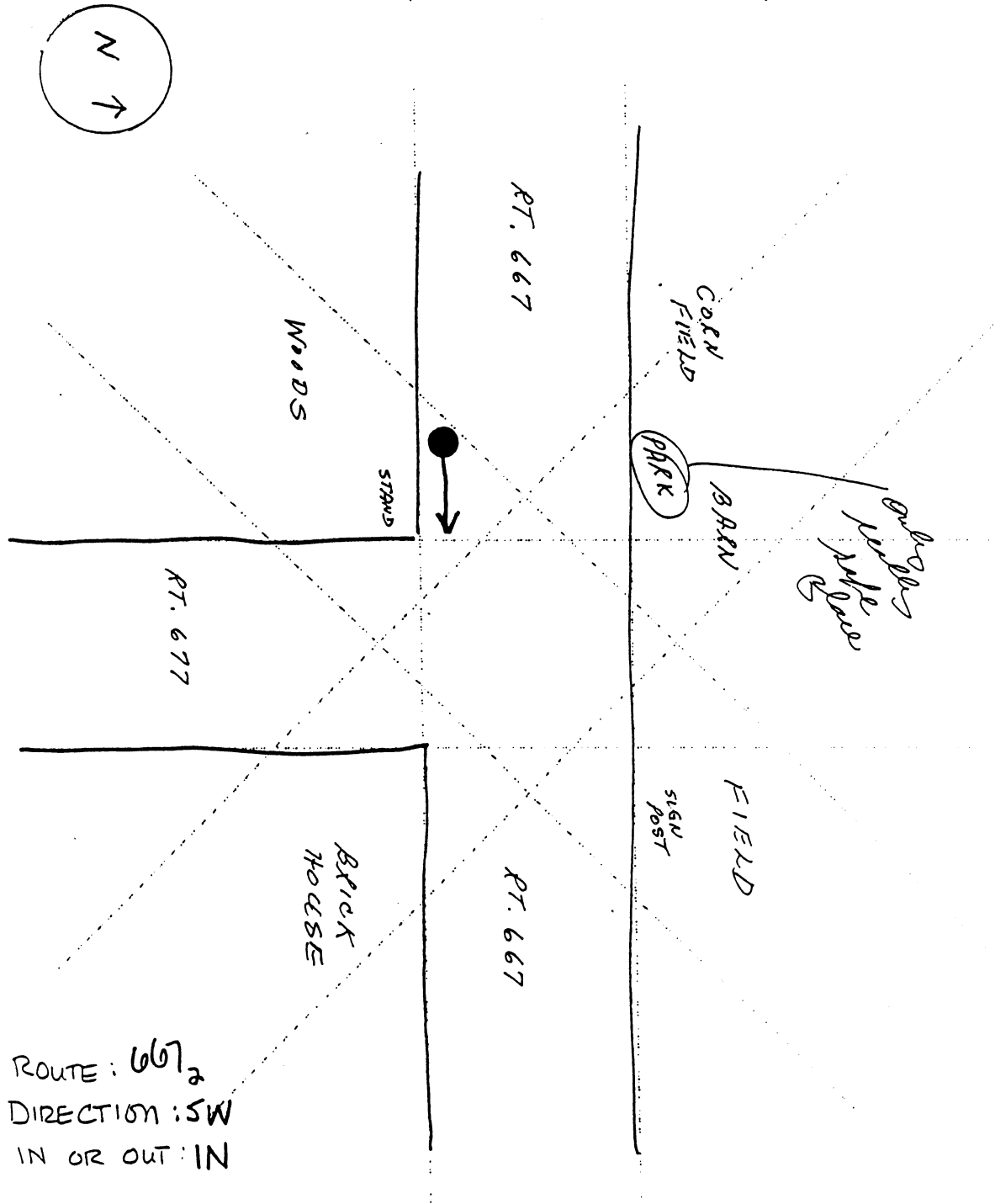


Figure 6. Rural site intersection diagram.

Calculation of Use and Error Rates

Because safety belt use was observed only in the curb lane, the NHTSA guidelines required that the observations taken 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 would be doubled to estimate the total number of drivers and passengers that crossed the site.

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

The use rate, P_B , is the estimated proportion of drivers and passengers using safety belts in Virginia, and is calculated by the formula:

$$P_B = \frac{\sum_{t=1}^2 \frac{N_t}{n_t} \sum_{i=1}^{n_t} N_{ti} B_{ti}}{\sum_{t=1}^2 \frac{N_t}{n_t} \sum_{i=1}^{n_t} N_{ti} O_{ti}} \quad [1]$$

- 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_{ti} = total number of intersections within each sampled grid box
 B_{ti} = 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:

$$V(P_B) \doteq \frac{1}{\bar{O}^2} [V(B) + P_B^2 V(O) - 2P_B COV(B, O)] \quad [2]$$

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

$$\bar{O} = \frac{1}{2} \sum_{t=1}^2 \frac{\sum_{i=1}^{n_t} N_{ti} O_{ti}}{n_t}$$

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

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

$$\text{where } \bar{B}_t = \frac{\sum_{i=1}^{n_t} N_{ti}B_{ti}}{n_t}$$

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

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

$$\text{where } \bar{O}_t = \frac{\sum_{i=1}^{n_t} N_{ti}O_{ti}}{n_t}$$

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

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

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

$$SE = \frac{\sqrt{V(P_B)}}{n - 1} \quad [3]$$

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

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

$$RE = \frac{SE}{P_B} \quad [4]$$

where RE = relative error of the estimate.

RESULTS

As can be seen from the data in Table 2, there were 24,299 weighted observations of occupants in passenger cars. Of these, there were 13,045 drivers and 4,396 right front-seat passengers who were observed to be using a shoulder belt. Passenger car occupants had a weighted safety belt use rate of 73.2%. The relative error of the estimate was 0.11%.

There were 236 motorcycle riders observed (208 drivers and 28 passengers), and the rate of use of helmets was 100%. The relative error of the estimate, which had no variance, was 0.

Table 2
SUMMARY OF SURVEY RESULTS

	Weighted Observations	Drivers Protected	Passengers Protected	Use Rate	Variance	Standard Error	Relative Error
Passenger cars	24,299	13,045	4,396	73.2% ($p = .732$)	0.008885	0.000792	0.001083
Motorcycles	236	208	28	100% ($p = 1$)	0	0	0

REFERENCES

1. *Federal Register*, Docket No. 92-12, Notice No. 02, Guidelines for State Observational Surveys of Safety Belt and Motorcycle Helmet Use, Monday June 29, 1992.
2. ADC of Alexandria, Inc., "Street Map of Northern Virginia," 34th Edition, Alexandria, Va., 1992.
3. ADC of Alexandria, Inc., "Street Map of Prince William County," 17th Edition, Alexandria, Va., 1992.
4. ADC of Alexandria, Inc., "Street Map of Richmond and Vicinity," 9th Edition, Alexandria, Va., 1991.
5. ADC of Alexandria, Inc., "Street Map of Tidewater," 15th Edition, Alexandria, Va., 1991.
6. ADC of Alexandria, Inc., "Street Map of Virginia Peninsula," 14th Edition, Alexandria, Va., 1991.

Appendix

Rural and Urban Safety Belt and Motorcycle Helmet Use:

Raw Data by Site

Table A-1
URBAN SAFETY BELT AND MOTORCYCLE HELMET USE: RAW DATA BY SITE

Site ID	Lanes	N _{ti}	B _{ti}	O _{ti}	MC B _{ti}	MC O _{ti}
2	1	10	14	16	0	0
7	1	408	99	124	0	0
8	1	7	3	5	0	0
11	1	82	0	0	0	0
15	3	6	540	684	8	8
17	3	115	189	357	3	3
19	1	10	72	104	0	0
20	1	7	8	11	0	0
21	1	148	26	48	0	0
28	1	3	2	5	0	0
30	2	3	130	260	0	0
32	1	244	45	67	0	0
40	3	254	495	630	3	3
41	1	211	326	404	3	3
42	1	36	5	7	0	0
46	1	5	11	15	0	0
49	1	6	0	0	0	0
54	2	504	580	696	0	0
58	1	15	75	104	1	1
67	1	5	1	1	0	0
68	1	24	1	1	0	0
69	3	721	249	333	3	3
81	1	6	22	33	0	0
86	2	7	118	206	0	0
90	1	17	54	76	1	1
92	3	142	681	876	22	22
105	1	24	74	91	2	2
118	1	7	27	41	0	0
119	3	32	1,119	1,347	6	6
120	1	546	27	36	0	0
121	1	7	166	196	1	1
136	1	23	54	78	5	5
140	3	3	1,179	1,482	10	10
154	1	8	33	35	1	1
169	2	4	264	482	0	0
170	1	19	0	0	0	0
173	2	331	488	632	3	3
183	1	8	12	17	0	0
202	1	59	40	52	1	1
206	1	17	6	11	0	0
210	2	73	288	402	3	3
211	1	253	154	235	1	1
213	1	376	219	289	2	2
234	1	197	13	20	0	0
236	1	87	199	264	4	4
250	1	16	2	2	0	0
259	3	532	897	1,089	0	0
275	2	526	218	272	2	2
280	1	104	2	2	0	0
290	1	3	155	210	0	0
300	1	110	0	0	0	0

continues

Table A-1 (continued)

Site ID	Lanes	N_{ti}	B_{ti}	O_{ti}	MC B_{ti}	MC O_{ti}
306	1	12	2	3	2	2
313	3	186	582	720	3	3
315	1	9	108	158	2	2
317	2	444	242	342	0	0
322	1	1	26	36	2	2
324	2	82	146	210	2	2
330	1	16	12	12	0	0
332	3	8	1,386	2,037	18	18
353	1	11	74	113	6	6
359	1	9	39	54	0	0
371	2	64	26	42	1	1
372	3	5	495	687	37	37
374	1	26	19	28	0	0
375	1	12	149	215	1	1
385	3	30	402	621	2	2
388	1	10	0	2	0	0
400	1	385	3	7	0	0
403	2	341	328	494	2	2
406	2	374	484	746	4	4
411	1	19	73	93	3	3
420	1	223	80	100	1	1
425	1	365	35	43	2	2
426	2	626	480	698	2	2
434	1	25	1	4	0	0
450	1	15	53	82	0	0
458	2	180	104	156	1	1
464	1	21	43	69	0	0
471	1	13	3	3	0	0
476	1	13	225	275	0	0
477	1	11	31	43	0	0
483	1	2	90	115	0	0
508	2	628	504	776	16	16
512	1	15	83	106	0	0

Site ID = identifier of site sampled.

Lanes = number of lanes in sampled direction at site.

N_{ti} = total number of intersections within sampled grid .

B_{ti} = number of belted occupants observed at site.

O_{ti} = total number of occupants observed at site.

MC B_{ti} = number of motorcycle occupants with helmets at site.

MC O_{ti} = total number of motorcycle occupants observed at site.

Table A-2
RURAL SAFETY BELT AND MOTORCYCLE HELMET USE: RAW DATA BY SITE

Site ID	Lanes	N_{ti}	B_{ti}	O_{ti}	MC B_{ti}	MC O_{ti}
1	1	15	20	39	1	1
4	1	9	11	12	0	0
5	1	9	0	2	0	0
6	1	16	30	56	0	0
9	1	6	6	14	1	1
10	1	5	3	6	0	0
12	1	4	243	367	0	0
13	1	17	17	22	0	0
16	1	4	9	10	0	0
18	1	8	0	0	0	0
22	1	12	10	16	0	0
23	1	7	30	91	0	0
25	1	6	31	39	0	0
26	1	9	10	18	4	4
27	1	13	2	6	0	0
29	1	6	1	6	0	0
31	1	7	7	12	0	0
33	1	15	68	90	25	25
35	1	9	9	26	0	0
36	1	12	0	0	0	0
37	1	1	33	67	2	2
39	1	10	8	15	0	0
44	1	7	4	7	0	0
45	1	7	89	169	1	1
47	3	18	585	909	5	5
48	1	15	0	1	0	0
50	1	8	16	39	1	1
51	1	11	2	7	0	0
52	1	3	4	12	0	0
53	1	2	8	23	0	0
55	1	12	24	70	1	1
56	2	5	52	106	0	0
57	1	13	1	2	0	0
59	1	7	4	7	0	0
62	2	13	336	502	2	2
63	1	15	58	93	1	1

Site ID = identifier of site sampled.

Lanes = number of lanes in sampled direction at site.

N_{ti} = total number of intersections within sampled grid.

B_{ti} = number of belted occupants observed at site.

O_{ti} = total number of occupants observed at site.

MC B_{ti} = number of motorcycle occupants with helmets at site.

MC O_{ti} = total number of motorcycle occupants observed at site.