
# 2022
# Maryland Seat Belt Usage Report

THIS REPORT WAS PREPARED IN COOPERATION WITH THE
Maryland Department of Transportation
Highway Safety Office
And
U.S. Department of Transportation
National Highway Traffic Safety Administration

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# Executive Summary

The National Study Center for Trauma and EMS at the University of Maryland, Baltimore conducted a comprehensive study of seat belt usage in the State of Maryland in June 2022. Seat belt usage data were collected on drivers and front seat outboard passengers observed in a total of 33,674 vehicles at 140 select sites located within 14 jurisdictions of the State. Observed vehicles included passenger cars, vans, sport utility vehicles (SUV), pick-up trucks, and other vehicles below 10,000 pounds of gross vehicle weight. Data were collected on occupants of vehicles traveling on Primary (interstate roadways), Secondary (arterial roadways), and Local roads.

Overall usage rate and standard error (SE) results of the Statewide study, following weighted adjustment by probability of road segment selection and proportion of jurisdiction-level vehicle miles traveled (VMT) and exclusion of unknown observations, were as follows:

| | **All Vehicles** | | | | **Passenger Cars/SUVs** | | | | **Pick-up Trucks** | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | **Number (N) of Occupants** | **Usage Rate (%)** | **SE (%)** | | **N of Occupants** | **Usage Rate (%)** | **SE (%)** | | **N of Occupants** | **Usage Rate (%)** | **SE (%)** |
| **All Roadways** | 40,645 | 92.7 | 0.6 | | 34,988 | 93.4 | 0.6 | | 5,657 | 88.0 | 1.5 |
| **Primary Roads** | 20,505 | 95.2 | 0.7 | | 18,038 | 95.9 | 0.6 | | 2,467 | 89.7 | 1.9 |
| **Secondary Roads** | 18,680 | 91.8 | 0.6 | | 15,720 | 92.5 | 0.6 | | 2,960 | 87.2 | 1.3 |
| **Local Roads*** | 1,460 | 85.2 | 0.0 | | 1,230 | 85.3 | 0.0 | | 230 | 83.8 | 0.0 |

*Standard Error = 0% because no more than 1 Local Road was observed per jurisdiction, thus no variability was measured.

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## Introduction

The National Highway Traffic Safety Administration (NHTSA) published new Uniform Criteria for State Observational Surveys of Seat Belt Use in Federal Register Vol. 76 No. 63, April 1, 2011, Rules and Regulations, pp. 18042 – 18059. This report represents the eleventh year of Maryland's response to the requirement to submit to NHTSA a data collection protocol and resulting observation findings of an annual State survey to estimate passenger vehicle occupant restraint use. This plan is fully compliant with the Uniform Criteria and has been used for the implementation of Maryland's 2022 seat belt survey. Using a consistent method to collect Statewide seat belt information will provide documentation for Maryland and the Nation on the success of occupant protection traffic safety programs.

Maryland is comprised of 24 jurisdictions, including 23 counties and Baltimore City; 14 of these jurisdictions account for about 86% of the passenger vehicle crash-related fatalities according to Fatality Analysis Reporting System (FARS) data averages for the period 2017 to 2019. These data contributed to the selection of roadway observation sites for use during the five-year period from 2022 to 2026 and were therefore employed to assess belt usage for this report. Road segments were mapped according to the latitude and longitude of their midpoints. A selected road segment was identified by an intersection or interchange that occurred within or just beyond the segment. If no intersection or interchange occurred within the segment, any point on that road could be used for observation. Data collection sites were selected such that traffic would be moving during the observation period. Data collection occurred as per the Site Assignment Sheets: at controlled intersections, ramps, overpasses, or on the side of the road. For interstate highways, data collection occurred on the next closest overpass. The observed direction of travel was randomly assigned for each road segment. The locations of the data collection sites were described on Site Assignment Sheets for each jurisdiction and maps were developed to aid the Data Observation Teams and Quality Control (QC) Monitors in traveling to the assigned locations.

## Objective

This research initiative used the NHTSA Uniform Criteria for State Observational Surveys of Seat Belt Use to address the following objectives for 2022:

- Develop and implement a strategic process for observing seat belt use in the State of Maryland for drivers and right front seat passengers.
- Determine the seat belt usage rate for Maryland.
- Estimate differences in passenger seat belt use for belted and unbelted drivers.
- Compare restraint usage in rural and urban jurisdictions and roadways.
- Develop and implement a means of Quality Control to ensure that data were collected properly following all survey protocols.

## Sampling Methodology

### Study Design

All of Maryland's 24 jurisdictions were ranked in descending order of the average number of motor vehicle crash-related fatalities for the period of 2017 to 2019 (Table 1). Data from the FARS were used to determine the average number of crash-related fatalities per jurisdiction. It was determined that 14 jurisdictions accounted for at least 85% of Maryland's total crash-related fatalities during that time period. The 85% threshold is a requirement of the NHTSA Uniform Criteria. These 14 jurisdictions comprise the sample frame (NHTSA Defined) and accounted for 86.2% of Maryland's motor vehicle crash-related fatalities as determined by FARS. The remaining 10 jurisdictions were classified as 'Non-NHTSA Defined' with limited data collection.

***Table 1 - Maryland Average Motor Vehicle Crash-Related Fatalities by Jurisdiction 2017-2019***

| Jurisdiction | Average Fatality Counts (2017-2019) | Fatality Percentage Within Maryland | Cumulative Fatality Percentage |
|---|---|---|---|
| ***NHTSA Defined*** | | | |
| Prince George's | 57.0 | 18.7 | 18.7 |
| Baltimore County | 35.3 | 11.6 | 30.2 |
| Anne Arundel | 25.0 | 8.2 | 38.4 |
| Charles | 17.0 | 5.6 | 44.0 |
| Baltimore City | 17.0 | 5.6 | 49.6 |
| Cecil | 16.3 | 5.3 | 54.9 |
| Howard | 15.0 | 4.9 | 59.8 |
| Montgomery | 14.0 | 4.6 | 64.4 |
| Frederick | 13.7 | 4.5 | 68.9 |
| St. Mary's | 12.7 | 4.1 | 73.0 |
| Carroll | 12.0 | 3.9 | 77.0 |
| Harford | 11.0 | 3.6 | 80.6 |
| Washington | 10.0 | 3.3 | 83.8 |
| Caroline | 7.3 | 2.4 | 86.2 |

***Table 1 Continued - Maryland Average Motor Vehicle Crash-Related Fatalities by Jurisdiction 2017-2019***

| Jurisdiction | Average Fatality Counts (2017-2019) | Fatality Percentage Within Maryland | Cumulative Fatality Percentage |
|---|---|---|---|
| ***Non-NHTSA Defined*** | | | |
| Wicomico | 6.7 | 2.2 | 88.4 |
| Queen Anne's | 5.7 | 1.9 | 90.3 |
| Talbot | 5.0 | 1.6 | 91.9 |
| Worcester | 5.0 | 1.6 | 93.6 |
| Calvert | 4.3 | 1.4 | 95.0 |
| Allegany | 4.0 | 1.3 | 96.3 |
| Garrett | 4.0 | 1.3 | 97.6 |
| Dorchester | 3.0 | 1.0 | 98.6 |
| Somerset | 2.7 | 0.9 | 99.5 |
| Kent | 1.7 | 0.5 | 100.0 |

## Road Segment Selection

After the 14 jurisdictions were identified, and to assure sufficient sample allocation and maintenance of errors below a threshold of 2.5% as mandated by the NHTSA Uniform Criteria, site sample sizes remained at 10 road segments per jurisdiction, for a total of 140 road segments. A probability proportional to size (PPS) sample was employed to select the road segments to be used as observation sites, using segment length as the measure of size (MOS). Maryland exercised the available exclusion option and removed non-public roads, unnamed roads, unpaved roads, vehicular trails, access ramps, cul-de-sacs, traffic circles and service drives from the dataset.

Maryland employed the Topologically Integrated Geographic Encoding and Referencing (TIGER) database from the Census Bureau, as provided by NHTSA, for the selection of road segments. The Maryland Department of Transportation – State Highway Administration estimates the jurisdiction level vehicle miles traveled (VMT) for each jurisdiction by functional class. Sample proportions within each jurisdiction were based on the jurisdictional VMT estimates applied in the creation of the 2022-2026 sample and partitioned relative to the three-way functional class grouping of Primary (interstate highways), Secondary (numbered arterial roadways), and Local/City roads using the TIGER Feature Class Code (MTFCC). A listing of the sample size allocation by jurisdiction and MTFCC classification, along with partitioned VMT estimates obtained as of January 1, 2022 for use as computation weights, is displayed in Table 2.

***Table 2 - Roadway Functional Strata by Jurisdiction, Road Segments Population (N), 2022 VMT, and Number of Segments Selected (n)***

| **Jurisdiction** | | **MTFCC Strata** | | | |
|---|---|---|---|---|---|
| | | **Primary** | **Secondary** | **Local** | **Total** |
| Anne Arundel | Segment Frequency (N) | 992 | 3,154 | 27,553 | 31,699 |
| | VMT | 2,960 | 2,457 | 457 | 5,874 |
| | Sample (n) | 5 | 4 | 1 | 10 |
| Baltimore County | Segment Frequency (N) | 1,152 | 4,305 | 36,898 | 42,355 |
| | VMT | 4,213 | 3,247 | 641 | 8,101 |
| | Sample (n) | 5 | 4 | 1 | 10 |
| Caroline* | Segment Frequency (N) | 0 | 1,549 | 4,124 | 5,673 |
| | VMT | 21 | 329 | 70 | 399 |
| | Sample (n) | 0 | 9 | 1 | 10 |
| Carroll | Segment Frequency (N) | 13 | 2,384 | 13,429 | 15,826 |
| | VMT | 39 | 1,084 | 129 | 1,252 |
| | Sample (n) | 1 | 8 | 1 | 10 |
| Cecil | Segment Frequency (N) | 131 | 2,061 | 8,815 | 11,007 |
| | VMT | 528 | 646 | 144 | 1,318 |
| | Sample (n) | 4 | 5 | 1 | 10 |
| Charles | Segment Frequency (N) | 0 | 2,983 | 13,093 | 16,076 |
| | VMT | 0 | 1,145 | 120 | 1,265 |
| | Sample (n) | 0 | 9 | 1 | 10 |
| Frederick | Segment Frequency (N) | 563 | 3,013 | 17,874 | 21,450 |
| | VMT | 1,767 | 1,061 | 321 | 3,149 |
| | Sample (n) | 6 | 3 | 1 | 10 |
| Harford | Segment Frequency (N) | 136 | 2,828 | 12,716 | 15,680 |
| | VMT | 902 | 1,399 | 227 | 2,528 |
| | Sample (n) | 4 | 5 | 1 | 10 |
| Howard | Segment Frequency (N) | 498 | 1,749 | 13,247 | 15,494 |
| | VMT | 2,400 | 1,293 | 351 | 4,044 |
| | Sample (n) | 6 | 3 | 1 | 10 |
| Montgomery | Segment Frequency (N) | 929 | 4,602 | 33,277 | 38,808 |
| | VMT | 2,851 | 3,755 | 534 | 7,140 |
| | Sample (n) | 4 | 5 | 1 | 10 |
| Prince George's | Segment Frequency (N) | 968 | 5,898 | 34,689 | 41,555 |
| | VMT | 4,468 | 3,788 | 649 | 8,905 |

| Jurisdiction | | MTFCC Strata | | | |
|---|---|---|---|---|---|
| | | Primary | Secondary | Local | Total |
| | Sample (n) | 5 | 4 | 1 | 10 |
| St. Mary's | Segment Frequency (N) | 0 | 1,953 | 9,304 | 11,257 |
| | VMT | 0 | 788 | 120 | 908 |
| | Sample (n) | 0 | 9 | 1 | 10 |
| Washington | Segment Frequency (N) | 502 | 2,576 | 11,132 | 14,210 |
| | VMT | 1,014 | 793 | 226 | 2,033 |
| | Sample (n) | 5 | 4 | 1 | 10 |
| Baltimore City | Segment Frequency (N) | 747 | 2,780 | 25,752 | 29,279 |
| | VMT | 1,121 | 1,852 | 227 | 3,200 |
| | Sample (n) | 3 | 6 | 1 | 10 |

[*]**Although VMT data were reported for Primary roads in Caroline County, TIGER road segment data did not identify any road segment in the county as a Primary roadway. Thus, no Primary roads were sampled for observation in Caroline County.**

The jurisdictional and functional class specific proportions were merged by MTFCC (Primary, Secondary and Local) with the TIGER data containing road segments within each jurisdiction and corresponding segment length. The list of eligible road segments in each jurisdiction was then sorted by segment length within MTFCC group to obtain an ordered list. Road segments were selected within each jurisdiction and MTFCC functional class with PPS using length as the MOS. Let $c = 1,2, \ldots C$ be the jurisdiction strata, h = 1,2, …H be the MTFCC strata, $v_{chi}$ be the length for road segment i in stratum h in jurisdiction $c$, and $v_{ch} = \sum_{all\ i\ in\ ch} v_{chi}$ be the total length for all road segments in stratum h within jurisdiction $c$. Then the road segment inclusion probability is: $\pi_{chi} = n_{ch} v_{chi} / v_{ch}$, where $n_{ch}$is the sample size for the roadway stratum h that was allocated within jurisdiction c. In Maryland, there were no roadway segments whose MOS was equal to or exceeded $v_{ch}/n_{ch}$; therefore, no roads were selected with certainty. SAS procedure SURVEYSELECT, with MOS and probability vector as described above, was used to obtain the road segment samples with PPS by three-way functional class grouping within each jurisdiction.

## Reserve Site Selection

Maryland also identified reserve data collection sites. These sites were used in the event that a pre-identified site was unavailable due to temporary or permanent circumstances. Reserve road segments consisted of up to five additional road segments per original road segment selected, resulting in a reserve sample of 210 road segments. The reserve segments were also selected with PPS, stratifying by MTFCC within jurisdiction and using segment length as MOS; this was the same approach that was used to select all other roadway segments. Thus, for the purposes of data weighting, the reserve road segment inherited all probabilities of selection and weighting components up to and including the road segment stage of selection from the original road segments actually selected. Probabilities and weights for any subsequent stages of selection (e.g., the sampling of vehicles) were determined by the reserve road segment itself.

Table 3 outlines the survey methodology details used in Maryland in 2022.

***Table 3 - Methodology Summary Chart***

| | | | |
|---|---|---|---|
| Methodology | Multistage Stratified Cluster Design with Probability Proportional to Size Sampling | | |
| Sources of Samples | 2022 revised methodology, approved by Maryland Highway Safety Office (MHSO) and NHTSA; 2020 TIGER data developed by the U.S. Census Bureau based on the MAF/TIGER Feature Class Code (MTFCC) | | |
| Geographic Coverage | State of Maryland | | |
| Site Roadway Classification | Based on the VMT estimate for each jurisdictional roadway type: Primary, Secondary, Local | | |
| Number of Sites | | *NHTSA Defined* | *Non-NHTSA Defined* |
| | *Primary* | 48 | 2 |
| | *Secondary* | 78 | 18 |
| | *Local/City* | 14 | 10 |
| | TOTALS | 140 | 30 |
| Survey Period | June 5, 2022 – June 18, 2022 | | |
| Observation Duration Per Site | *Primary*: 20-minute survey<br>*Secondary*: 40-minute survey<br>*Local/City*: 60-minute survey | | |
| Sample Size | 33,674 vehicles | | |

## Sampling Weights

The following is a summary of the notation used in this section:

*c* – Subscript for jurisdiction (PSU)
*h* – Subscript for road segment strata
*i* – Subscript for road segment
*j* – Subscript for time segment
*k* – Subscript for road direction
*l* – Subscript for lane
*m* – Subscript for vehicle
*n* – Subscript for front seat occupant

Under this stratified multistage sample design, the inclusion probability for each observed vehicle was the product of selection probabilities at all stages: $\pi_c$ for jurisdiction, $\pi_{hi|c}$ for road segment, $\pi_{j|chi}$ for time segment, $\pi_{k|chij}$ for direction, $\pi_{l|chij}$ for lane, and $\pi_{m|chijl}$for vehicle. The overall vehicle inclusion probability was:

$$\pi_{chijklm} = \pi_c \pi_{hi|c} \pi_{j|chi} \pi_{k|chij} \pi_{l|chij} \pi_{m|chijl}.$$

The sampling weight (design weight) for vehicle *m* was:

$$w_{chijklm} = \frac{1}{\pi_{chijklm}}$$

## Non-response Adjustment

Given the data collection protocol described in this plan, including the provision for the use of alternate observation sites, road segments with nonzero eligible volume and yet zero observations conducted should be a rare event. Nevertheless, if eligible vehicles passed an eligible site or an alternate eligible site during the observation time but no usable data were collected for some reason, then this site was considered as a "non-responding site." The weight for a non-responding site was distributed over other sites in the same road type in the same PSU.

Let:

$$\pi_{chi} = \pi_c \pi_{hi|c}$$

be the road segment selection probability, and

$$w_{chi} = \frac{1}{\pi_{chi}}$$

be the road segment weight. The non-responding site non-response adjustment factor

$$f_{ch} = \frac{\sum_{all\ i} w_{chi}}{\sum_{responding\ i} w_{chi}}$$

would be multiplied by all weights of non-missing road segments of the same road type in the same jurisdiction and the missing road segments would be dropped from the analysis file. However, if no vehicles passed the site during the selected observation time (either 20, 40 or 60 minutes), then this site was simply an empty block; the site would not be considered as a non-responding site and would not require non-response adjustment.

## Estimators

Noting that all front seat occupants were observed, let the driver/passenger seat belt use status be:

$$y_{chijklmn} = \begin{cases} 1, & if\ belt\ used \\ 0, & otherwise \end{cases}.$$

VMT data were available for Maryland jurisdictions at the functional class level. Hence, the seat belt use rate estimator was a ratio estimator with VMT weights:

$$p_{VMT} = \frac{\sum_c \sum_h VMT_{ch} p_{chi}}{\sum_c \sum_h VMT_{ch}}.$$

Here $VMT_{ch}$ is the VMT for functional class h in jurisdiction c. Assuming that all vehicles observed at the same road segment i have equal probability for being selected, then the road segment level seat belt use rate $p_{chi}$ can be reduced to the following:

$$p_{chi} = \frac{\sum_{all\ i\ in\ ch} w_{chi} y_{chijklmn}}{\sum_{all\ i\ in\ chi} w_{chi}}.$$

where $w_{chi}$ is the road segment selection weight.

### Sample Size

A standard error of less than 2.5% for the seat belt use estimates is required by NHTSA Uniform Criteria. From 1999-2011, Maryland conducted the Annual Seat Belt Use Study and historically obtained standard errors well below this threshold (e.g., 0.4%, 0.4% and 0.5% in the most recent three years) via observed sample sizes of approximately 58,000-73,000 motor vehicle front seat occupants. These observed sample sizes were obtained from previous sample designs using 12 jurisdictions and 1-16 road segments per jurisdiction. The roadway set was revised in 2012, and again five years later in 2017, as required by the Uniform Criteria. From 2012 to 2017, the average annual number of observed occupants with known seat belt use hovered just below 50,000, with an average standard error of 0.6%. In 2021, the year following the COVID-19 pandemic, 46,717 front seat occupants with known belt use were observed with a standard error of 0.6%. Thus, the sample size with known belt use for the 2022 seat belt use survey sample was projected to be approximately 45,000 to 50,000 occupants.

## Data Collection

### Data Collection Team Training and Quality Control

In FFY2022, The NSC provided updated slides for the training power point presentation and attended the in-person training sessions of the Data Collection Teams that were conducted by the MHSO, offering input when appropriate. The quality control site visits were conducted by MHSO staff and the QC forms were sent to the NSC for review upon completion of the site visit.

### Data Collection Agent

The MHSO hired WBA Research to conduct the data collection in an accurate, timely, and efficient manner. That contractor, known as the Data Collection Agent (DCA), was responsible for:

- hiring and retaining observers for the duration of the survey period;
- observing and recording seat belt use data at 140 designated seat belt observation sites;
- collecting the resulting data and submitting the data to the MHSO or its designated data analysis partner (the NSC); and
- responding to any questions from the MHSO or NHTSA concerning the hiring, observation, and reporting processes.

## Data Collection Teams

Each Data Collection Team (DCT) was comprised of a Data Observer and a Data Recorder. The Data Observer was responsible for observing the flow of traffic and spotting, or calling out, vehicle seat belt observation information. The Data Recorder was responsible for documenting and recording the data as observed on the Maryland Seat Belt Observation Form. Observation at each site was conducted by a complete DCT consisting of both members.

## Data Collection Lanes

Before starting the actual data collection at a particular site or Observation Post, the DCT determined, through observation, the traffic flow and number of lanes that could be observed without error. The Data Observer observed, at a minimum, the right-most lane on the roadway. If traffic was light enough to survey an additional lane(s), the team may have done so, provided that 100% of the traffic in the observed lanes was recorded for the duration of the survey at that site. Each DCT was requested to observe more than one lane when possible.

Only one direction of traffic was observed at any given site unless otherwise noted on the Site Assignment Sheet (pre-determined roads may have required observation in both directions of travel). The direction of travel was predetermined and identified on the Site Assignment Sheet. If an intersection contained a turning lane, the DCT was instructed to strategically move its location so that the traffic in the turning lane could be included in the count. Should the site not allow for the collection team to move due to safety concerns, the DCT observed both the turn lane and the next right-most lane.

## Vehicles and Occupants

Directions given to the DCT to observe belt usage included:

- Stand on the right-hand curb or roadside of the selected roadway as directed on the Site Assignment Sheet
- Face the assigned direction of traffic
- Never stand in any traffic lane
- Look for the vehicle "B-pillar," integrated seat belt or seat back mount to determine if the belt is being utilized.

All passenger vehicles with a gross vehicle weight up to 10,000 pounds were observed in the survey. The target population included all drivers and right front seat passengers.

The only right front seat occupants excluded from this study were child passengers who were traveling in child passenger safety seats with harness straps. If a child in the right front seat was in a child passenger safety seat, the DCT did not record anything, treating the observation as if that seat was empty. If there was more than one front seat passenger, only the driver and the outboard passenger seating positions were observed.

If the vehicle was equipped with shoulder belts, but they appeared to be improperly used, the person was considered to be NOT belted.

## Unknowns

Maryland developed a structure for the inclusion of unknowns in its observation counts. Data Observers and Recorders were instructed to report known belt use only if they were absolutely sure that the occupant was or was not wearing his/her seat belt; otherwise, belt use was to be reported as unknown. Unknowns included any individual in the front seat of a motor vehicle who could not be identified as being properly or improperly restrained.

Classic cars were counted only if the DCT could directly observe the use of a lap belt, as these vehicles were manufactured prior to the legislative mandate requiring vehicles to have both lap and shoulder belt harness systems. If the lap belt could not be seen, these vehicles were excluded and not documented as unknowns.

## Site Locations

Maps displaying the locations of all observation sites were provided to each DCT and Quality Control (QC) Monitor on Site Assignment Sheets. Each jurisdiction had a Site Assignment Sheet with an overview of all sites within that set. Site Assignment Sheets indicated the observed road name, the crossroad included within the road segment (or nearest crossroad), assigned date, assigned time, and written directions. A detailed map was included for the observation teams, marking the Observation Post and the direction of traffic to be observed. In addition, each DCT was provided with XY coordinates indicating where to stand to conduct the observations.

Sites within relatively close geographic proximity were assigned as data collection clusters (Site Set). Each data collection cluster was assigned a random day of the week and a random time (between 7 am – 7pm) for completion. The observation schedule included the day and the time. If the observation day was Monday and time was 7 am then the first site was assigned the 7 am and the other sites within the cluster were assigned to minimize travel distance between sites.

## Scheduling and Rescheduling

All seat belt observations were conducted during daylight hours. The schedule included rush hour (before 9:30 AM, after 3:30 PM) and non-rush hour observation times. It was anticipated that fewer than 60 minutes of observation would provide sufficient sample sizes for highways and arterial roads. Thus, data collection was conducted for 20 minutes (Primary), 40 minutes (Secondary), or 60 minutes (Local) at each site, depending on the road classification. Multiple sites were scheduled each day. In 2022, the MHSO authorized the observations to be conducted beginning Saturday, June 4$^{th}$ through Saturday, June 25$^{th}$ including makeup times. There was one instance where, after reviewing the observation forms, it was believed the team observed an incorrect roadway. This was discussed with MHSO and, after further investigation on MHSO's part, a team was sent out for re-observation of the correct site.

## Data Collection Forms

### Observation Form Cover Sheet

The Observation Form Cover Sheet was designed to allow for documentation of descriptive site information, such as date, site location, jurisdiction, start and end times for observation, weather

conditions, and more. The Cover Sheet was completed by the DCT at each site before data collection began.

#### Data Collection Sheet(s)

Scantron Data Collection Sheet(s) were used to record seat belt use by drivers and right front seat passengers, and hand-held cell use by drivers for up to 100 vehicles per sheet. Multiple sheets were used for each site, if needed.

#### Observation Form Summary Sheet

The Observation Summary Sheet was used to certify complete and accurate data submission by the DCA as well as to document any comments or concerns related to the site.

### Quality Control

As stated earlier, the MHSO made the decision that QC checks would be conducted by in-house staff only and the QC forms would be sent to the NSC for review upon the completion of the site visit. During these visits, the QC Monitors used standardized forms to document and evaluate Maryland's process. For instance, on one form, the QC monitor indicated that his "*one concern at the site is the traffic coming around the bend. It's not super heavy, but there is not tons of room for them to stand and there isn't a lot of room for drivers to see them. Several drivers were across the shoulder line and I spent most of my time watching their backs*." This site will be reviewed before next year's observation. Glare was also noted by the monitors.

### Data Entry

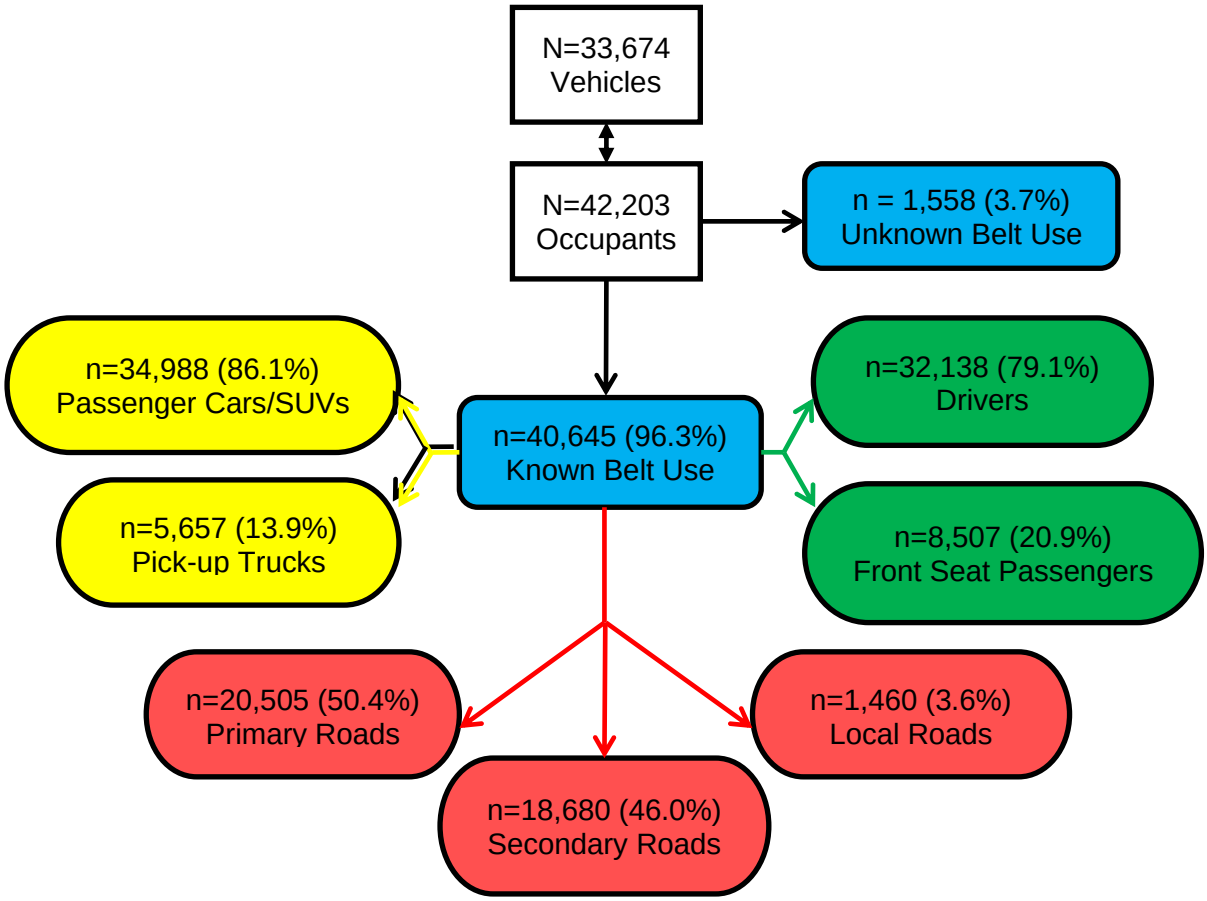
The DCTs inserted all completed data collection forms into the provided Jurisdiction/Site Set envelope and submitted it to the DCA. The DCA forwarded the envelopes to the NSC (designated analysis partner) upon completion of all observations, where (1) formal data entry and QC processes were outlined and (2) databases were designed for the capture of both summary figures and individual record-level data. Trained NSC staff members scanned the Scantron data collection sheets, noting any QC concerns.

## Results

### NHTSA Sites – Occupants

A total of 33,674 motor vehicles (i.e., passenger cars, sport utility vehicles (SUVs), and pick-up trucks) with 42,203 front seat occupants were observed within the 14 sampled jurisdictions (Figure 1). These totals represented decreases of 15.5% in the number of motor vehicles and 14.7% in the number of front seat occupants observed in the 2021 survey. Known seat belt use was ascertained for 40,645 (96.3%) of the occupants, of whom 32,138 (79.1%) were drivers and 8,507 (20.9%) were right front seat passengers.

***Figure 1 – Study Population***
***Flowchart of Vehicle and Occupant Observations***




Of the 40,645 drivers and right front seat passengers with known seat belt usage, 34,988 (86.1%) were occupants of passenger cars or SUVs and 5,657 (13.9%) were occupants of pick-up trucks. Most of the 40,645 occupants were observed on Interstate/Primary roads (n=20,505, 50.4%) as opposed to arterial Secondary roadways (n=18,680, 46.0%) or Local roads (n=1,460, 3.6%).

Data collection by jurisdiction (Table 4) indicated that the largest number of occupants with known belt use were observed in Harford County (n=5,218) and the fewest were observed in Caroline County (n=1,381). The average number of occupants observed per jurisdiction with known seat belt usage was 2,903.

***Table 4 – Number of Front Seat Occupants Observed With Known Seat Belt Use by NHTSA-Surveyed Jurisdiction of Maryland***

| Jurisdiction | Number Observed |
|---|---|
| Harford | 5,218 |
| Howard | 4,181 |
| Baltimore Co | 3,669 |
| Frederick | 3,366 |
| Baltimore City | 3,142 |
| Montgomery | 3,066 |
| Washington | 2,763 |
| Anne Arundel | 2,652 |
| Prince George's | 2,579 |
| Charles | 2,390 |
| St. Mary's | 2,365 |
| Cecil | 2,083 |
| Carroll | 1,790 |
| Caroline | 1,381 |

## NHTSA Sites – Weighted Analysis

The overall seat belt usage rate among the 14 sampled jurisdictions for all drivers and right front seat passengers, weighted by probability of roadway selection and jurisdictional roadway specific VMT, was 92.7% (Table 5, Figure 2). Weighted usage rates were higher for occupants of passenger cars or SUVs (93.4%) than for occupants of pick-up trucks (88.0%). The overall weighted standard error rate of 0.6% was well below the 2.5% threshold required by NHTSA, yielding a 95% confidence interval of 91.5% to 93.9% for the combined usage rate. Relative to the data collected for passenger cars, the standard error rate for pick-up trucks was much higher (1.5% vs. 0.6%) but was still below the 2.5% NHTSA limit.

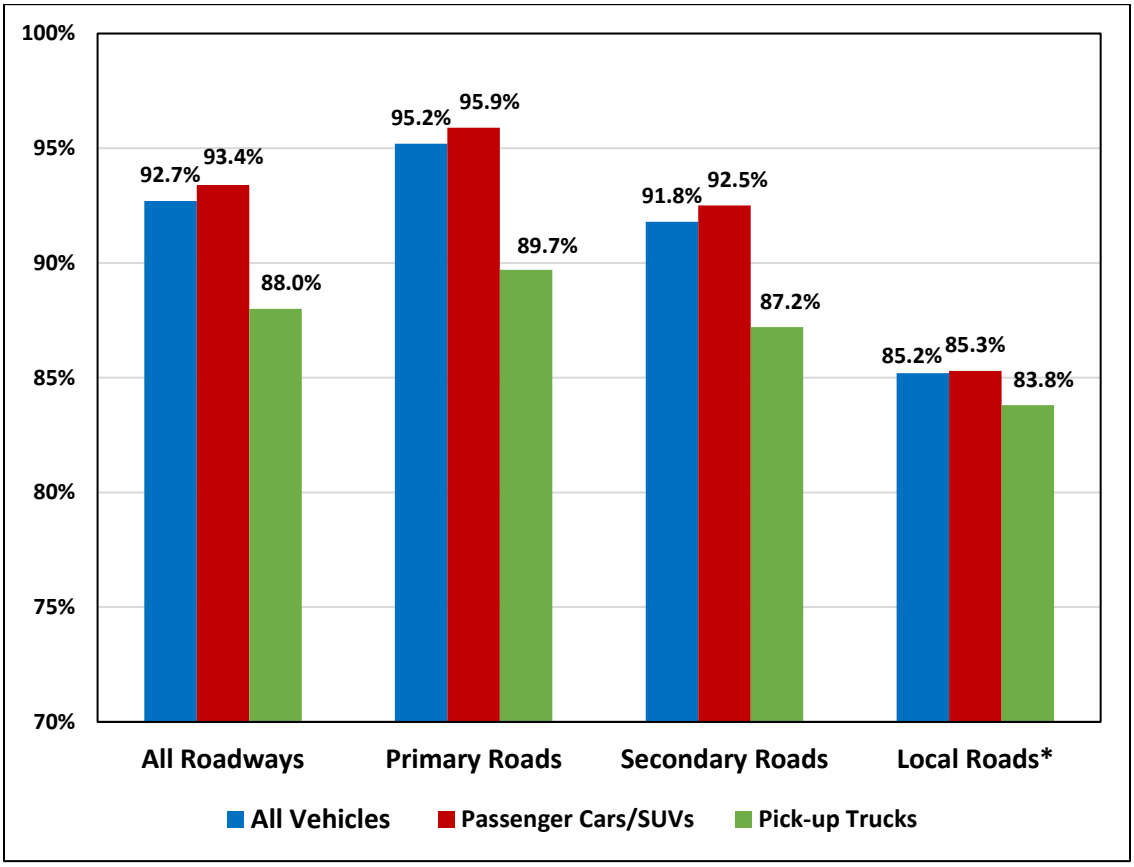
Vehicle occupants were more likely to use seat belts on Interstate/Primary roadways as opposed to Secondary roads and Local roads. Approximately 95.2% of drivers and passengers observed on Primary roadways were belted. This proportion fell to 91.8% on Secondary roads and 85.2% on Local roads. Front seat occupants of passenger cars or SUVs had higher rates than corresponding occupants of pick-up trucks on Primary roads (95.9% vs. 89.7%, respectively), Secondary roads (92.5% vs. 87.2%), and Local roads (85.3% vs. 83.8%).

***Table 5 – 2022 Weighted Usage Rates in NHTSA-Surveyed Jurisdictions of Maryland Overall, by Vehicle Type and by Roadway***
***All Front Seat Occupants Combined With Known Seat Belt Use***

| **All Vehicles** | | | | | |
|---|---|---|---|---|---|
| | | | | **95% CI** | |
| | **N** | **Usage Rate (%)** | **SE (%)** | **Lower Limit (%)** | **Upper Limit (%)** |
| **All Roadways** | 40,645 | 92.7 | 0.6 | 91.5 | 93.9 |
| **Primary Roads** | 20,505 | 95.2 | 0.6 | 93.8 | 96.6 |
| **Secondary Roads** | 18,680 | 91.8 | 0.6 | 90.6 | 93.0 |
| **Local Roads*** | 1,460 | 85.2 | 0 | N/A | N/A |
| **Passenger Cars/SUVs** | | | | | |
| | | | | **95% CI** | |
| | **N** | **Usage Rate (%)** | **SE (%)** | **Lower Limit (%)** | **Upper Limit (%)** |
| **All Roadways** | 34,988 | 93.4% | 0.6 | 92.2 | 94.6 |
| **Primary Roads** | 18,038 | 95.9% | 0.6 | 94.7 | 97.1 |
| **Secondary Roads** | 15,720 | 92.5% | 0.6 | 91.3 | 93.7 |
| **Local Roads*** | 1,230 | 85.3% | 0.0 | N/A | N/A |
| **Pick-up Trucks** | | | | | |
| | | | | **95% CI** | |
| | **N** | **Usage Rate (%)** | **SE (%)** | **Lower Limit (%)** | **Upper Limit (%)** |
| **All Roadways** | 5,657 | 88.0 | 1.5 | 85.1 | 90.9 |
| **Primary Roads** | 2,467 | 89.7 | 1.9 | 86.0 | 93.4 |
| **Secondary Roads** | 2,960 | 87.2 | 1.3 | 84.7 | 89.7 |
| **Local Roads*** | 230 | 83.8 | 0.0 | N/A | N/A |

*Standard Error = 0% because no more than 1 Local Road was observed per jurisdiction, thus no variability was measured.

***Figure 2 - Usage Rate by Vehicle Type and Roadway Following Adjustment for Probability of Road Segment Selection and Vehicle Miles Traveled (VMT)***




The 2022 Maryland weighted seat belt usage rate increased by 1.3 percentage points over the previous year (Table 6 and Figures 3 and 4). Relevant to 2021, higher seat belt usage rates in 2022 were prevalent across the board, i.e., for passenger cars/SUVs (+1.1), pick-up trucks (+2.0), Primary roadways (+1.5), Secondary roadways (+1.2), and Local roadways (+0.4). An examination of usage rates over the most recent two-year period indicated that Local roadways (+4.6), Primary roads (+3.4) and pick-up trucks (+3.0) experienced the largest increases since 2020.

*Table 6- Change From 2020 to 2022 in Weighted Seat Belt Usage by Vehicle Type & Roadway*

| | 2020 | 2021 | 2022 | Change in Rate 2021-2022 | Change in Rate 2020-2022 |
|---|---|---|---|---|---|
| **All Vehicles** | 89.9% | 91.4% | 92.7% | +1.3% | +2.8% |
| **Cars/SUVs** | 90.9% | 92.3% | 93.4% | +1.1% | +2.5% |
| **Trucks** | 85.0% | 86.0% | 88.0% | +2.0% | +3.0% |
| **Primary Roads** | 91.8% | 93.7% | 95.2% | +1.5% | +3.4% |
| **Secondary Roads** | 89.6% | 90.6% | 91.8% | +1.2% | +2.2% |
| **Local Roads** | 80.6% | 84.8% | 85.2% | +0.4% | +4.6% |

*Figure 3 - Comparison from 2020 to 2022 of Weighted Seat Belt Usage Rates by Vehicle Type*

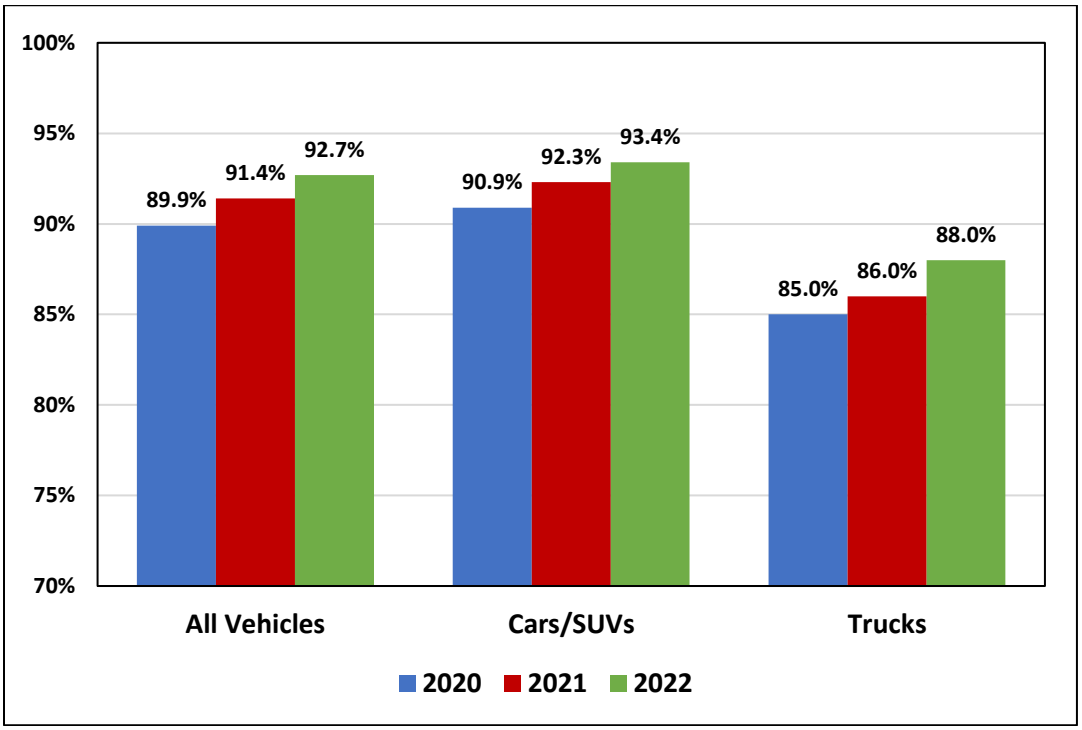
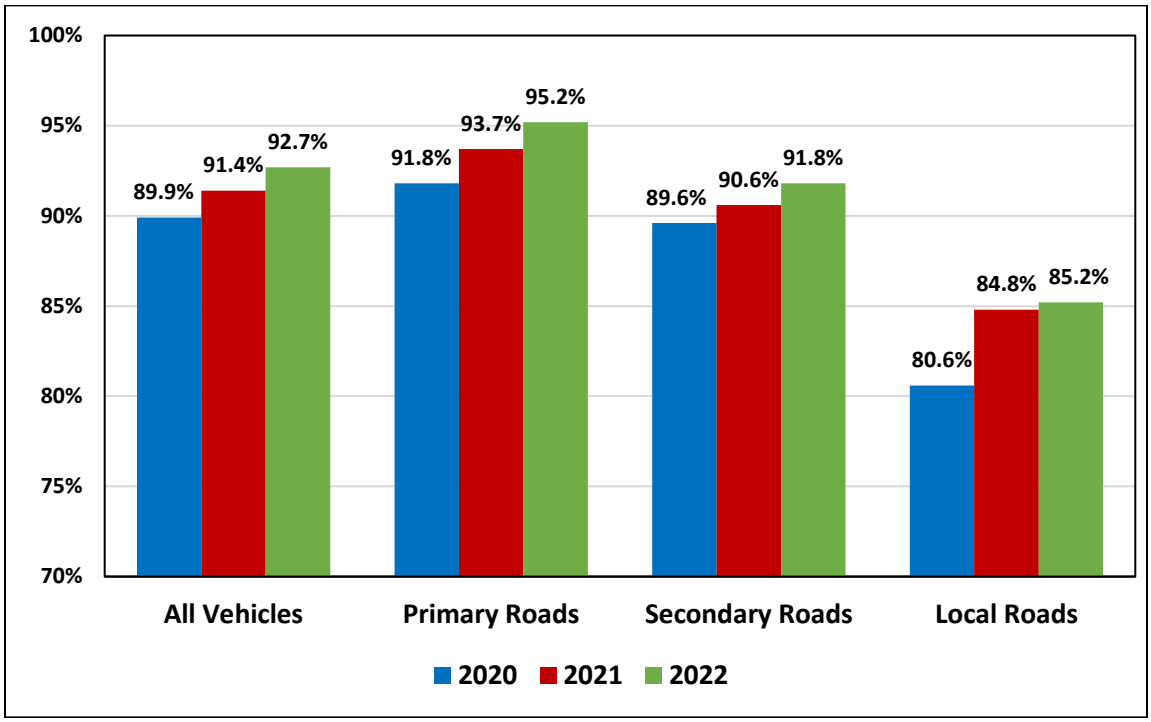



Table 7 contains a list of weighted belt use and standard error rates by jurisdiction for all vehicles combined. Nine (64.3%) of the 14 jurisdictions had seat belt usage rates of at least 90%. The highest seat belt usage rates were found in Prince George's County (98.1%), Montgomery County (96.3%) and Carroll County (94.8%), while Baltimore City (85.3%), Washington (84.6%) and Charles (80.6%) counties had the three lowest rates. Jurisdictional standard error rates ranged from a low of 0.1% in Carroll County to a high of 1.5% in Cecil County.

***Figure 4 - Comparison from 2020 to 2022 of Weighted Seat Belt Usage Rates by Roadway Type***




Jurisdictional usage rates of occupants observed in passenger cars or SUVs were at least 90% in nine (64.3%) of the 14 jurisdictions (see Table 7). Prince George's (98.9%), Montgomery (96.5%) and Carroll (95.8%) counties had the highest usage rates among occupants of cars/SUVs, while Washington County (86.1%), Baltimore City (85.7%) and Charles County (79.7%) had the lowest rates. The lowest standard error rate of 0.2% occurred in Prince George's and Carroll counties; Cecil County had the highest error rate (1.6%).

For occupants of pick-up trucks, three (21.4%) of the 14 jurisdictions had usage rates above 90%. The highest rates were found in Prince George's (94.7%), Montgomery (93.9%) and Carroll (91.8%) counties (see Table 7). Overall, there were nine jurisdictions with rates between 80% and 90%, with Washington (79.0%) and Charles (78.4%) counties owning the only rates below 80%. The standard error rate for trucks ranged from a low of 0.4% in Carroll County to a high of 2.9% in Harford County.

***Table 7 – 2022 Weighted Usage Rates in NHTSA-Surveyed Jurisdictions of Maryland by Jurisdiction and Vehicle Type***
***All Front Seat Occupants Combined With Known Seat Belt Use***

| | | All Vehicles | | | Passenger Cars/SUVs | | | Pick-up Trucks | |
|---|---|---|---|---|---|---|---|---|---|
| | **VMT (millions)** | **Usage Rate*** | **SE** | | **Usage Rate** | **SE** | | **Usage Rate** | **SE** |
| All 14 Jurisdictions | 50,116 | 92.7% | 0.6% | | 93.4% | 0.6% | | 88.0% | 1.5% |
| | | | | | | | | | |
| Prince George's | 8,905 | 98.1% | 0.3% | | 98.9% | 0.2% | | 94.7% | 0.9% |
| Montgomery | 7,140 | 96.3% | 0.9% | | 96.5% | 0.9% | | 93.9% | 1.8% |
| Carroll | 1,252 | 94.8% | 0.1% | | 95.8% | 0.2% | | 91.8% | 0.4% |
| Harford | 2,528 | 93.6% | 1.0% | | 94.7% | 0.6% | | 88.5% | 2.9% |
| Howard | 4,044 | 92.9% | 0.3% | | 94.1% | 0.5% | | 86.3% | 1.5% |
| Frederick | 3,149 | 92.8% | 0.4% | | 93.2% | 0.4% | | 83.2% | 2.2% |
| Anne Arundel | 5,874 | 92.4% | 0.5% | | 93.0% | 0.6% | | 89.2% | 0.6% |
| Baltimore Co | 8,101 | 91.4% | 0.6% | | 92.0% | 0.5% | | 84.1% | 2.0% |
| St. Mary's | 908 | 90.7% | 0.3% | | 91.5% | 0.4% | | 87.4% | 0.6% |
| Caroline | 399 | 89.9% | 0.4% | | 89.7% | 0.4% | | 89.2% | 0.7% |
| Cecil | 1,318 | 87.7% | 1.5% | | 91.0% | 0.4% | | 84.9% | 2.0% |
| Baltimore City | 3,200 | 85.3% | 1.3% | | 85.7% | 1.3% | | 80.3% | 1.4% |
| Washington | 2,033 | 84.6% | 0.5% | | 86.1% | 0.7% | | 79.0% | 1.8% |
| Charles | 1,265 | 80.6% | 0.7% | | 79.7% | 0.7% | | 78.4% | 0.7% |

* Jurisdictional usage rates are sorted in descending order for all vehicles combined.

Jurisdictional changes in weighted rates over time are documented in Table 8 and Figure 5. Five (35.7%) of the 14 jurisdictions experienced an increase in usage rate over the previous year, with Prince George's (+9.0 percentage points) and Carroll (+7.2) counties experiencing the biggest gains. In fact, the three jurisdictions with the highest VMT (Prince George's, Baltimore, and Montgomery counties) saw increases in usage rates since 2021, giving added weight to an overall increase across the state. Anne Arundel County experienced no change in its usage rate of 92.4%. The largest declines occurred in Charles County (-10.0) and Baltimore City (-9.4). Nine (64.3%) of the 14 jurisdictions experienced an increase in rates over the previous two years, led by Prince George's County (+9.9) and Baltimore City (+7.4) . Charles (-11.8) and Washington (-8.7) counties experienced the largest decreases in rates since 2020. Overall, four jurisdictions had a rate that was consistently higher than the statewide rate each year since 2020 (Frederick, Harford, Howard, and Montgomery).

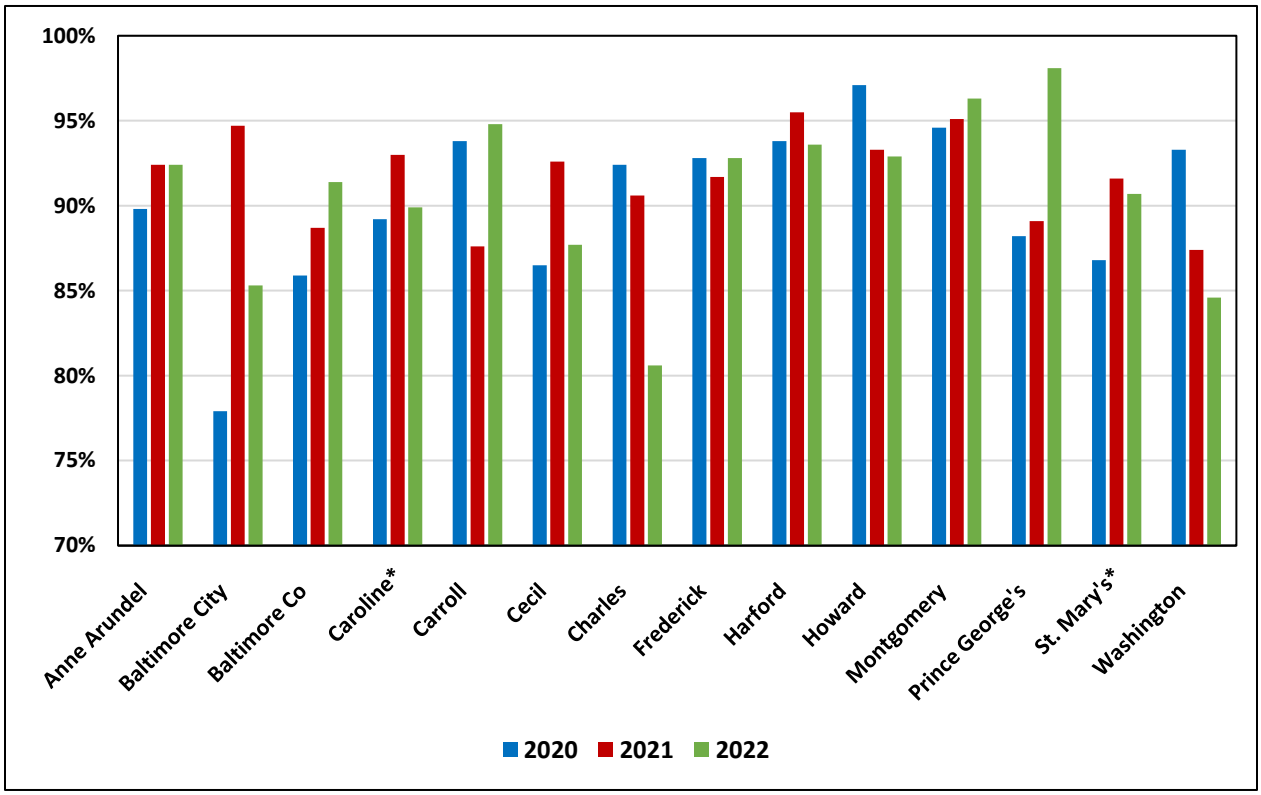
The large decrease in rates over the past year for Baltimore City, which has often exhibited some of the lowest rates in the state, may be partially due to the 2022 random sample of roadways. In 2021, originally sampled Secondary roadways were replaced with four reserve roads from the 2017-2021 sample due to safety concerns. However, the safer reserve road sites were in more affluent areas with a different racial distribution than in the original sites, possibly affecting the traditionally observed lower usage rate.

*Table 8 - Changes Between 2020 and 2022*
*in Weighted Seat Belt Usage by Jurisdiction*

| Jurisdiction | 2020 | 2021 | 2022 | Change in Rate 2021-2022 | Change in Rate 2020-2022 |
|---|---|---|---|---|---|
| **All Jurisdictions** | 89.9% | 91.4% | 92.7% | +1.3% | +2.8% |
| | | | | | |
| **Anne Arundel** | 89.8% | 92.4% | 92.4% | +0.0% | +2.6% |
| **Baltimore City** | 77.9% | 94.7% | 85.3% | -9.4% | +7.4% |
| **Baltimore Co** | 85.9% | 88.7% | 91.4% | +2.7% | +5.5% |
| **Caroline*** | 89.2% | 93.0% | 89.9% | -3.1% | +0.7% |
| **Carroll** | 93.8% | 87.6% | 94.8% | +7.2% | +1.0% |
| **Cecil** | 86.5% | 92.6% | 87.7% | -4.9% | +1.2% |
| **Charles** | 92.4% | 90.6% | 80.6% | -10.0% | -11.8% |
| **Frederick** | 92.8% | 91.7% | 92.8% | +1.1% | +0.0% |
| **Harford** | 93.8% | 95.5% | 93.6% | -1.9% | -0.2% |
| **Howard** | 97.1% | 93.3% | 92.9% | -0.4% | -4.2% |
| **Montgomery** | 94.6% | 95.1% | 96.3% | +1.2% | +1.7% |
| **Prince George's** | 88.2% | 89.1% | 98.1% | +9.0% | +9.9% |
| **St. Mary's** | 86.8% | 91.6% | 90.7% | -0.9% | +3.9% |
| **Washington** | 93.3% | 87.4% | 84.6% | -2.8% | -8.7% |

* Usage rates for Caroline and St.Mary's counties were not weighted in 2020 and 2021.

*Figure 5 - Comparison from 2020 to 2022 of Weighted Seat Belt Usage Rates by Jurisdiction*




* Usage rates for Caroline and St.Mary's counties were not weighted in 2020 and 2021.

## NHTSA Sites – Unweighted Analysis

An unweighted analysis of seat belt rates was conducted for subgroups of the observed sample that were not examined by probability of selection and VMT weights. These subgroups included drivers only, passengers only, and jurisdiction-specific roadway types.

Approximately 92.8% of all drivers were belted (Table 9). Belt use among drivers was more likely to occur in passenger cars or SUVs (93.4%) than in pick-up trucks (89.5%). Drivers were more likely to be belted on Primary roads (95.5%) than on Secondary roads (90.5%) or Local roads (85.3%). This difference in roadway seat belt usage remained whether the driver was in a car (96.0% vs. 91.0% and 85.5% for Primary, Secondary, and Local, respectively) or in a truck (92.1% vs. 87.6% and 84.4%).

A slightly higher proportion of passengers than drivers were belted overall (93.7%). As for drivers, passengers had a higher usage rate in passenger cars/SUVs (94.2%) than in trucks (90.3%). Passengers were more likely to be belted on Primary roads (95.3%) than on Secondary (92.5%) or Local roads (87.4%). This difference in roadway usage rates remained if the passenger was in a car (95.5% vs. 93.0% vs. 88.2% for Primary vs. Secondary vs. Local) or in a truck (92.4% vs. 89.5% vs. 84.2%).

The data in Table 9 indicate that 2022 usage rates among drivers and passengers were over 90% on Primary roadways for all vehicle types.

***Table 9 - 2022 Unweighted Usage Rates in NHTSA-Surveyed Jurisdictions of Maryland Overall, by Vehicle Type and by Roadway Classification Known Seat Belt Use by Front Seat Occupant Status***

| | All Vehicles | | | Passenger Cars/SUVs | | | Pick-up Trucks | |
|---|---|---|---|---|---|---|---|---|
| | N | Usage Rate | | N | Usage Rate | | N | Usage Rate |
| | | | | | | | | |
| **DRIVERS Only** | | | | | | | | |
| **All Roadways** | 32,138 | 92.8% | | 27,553 | 93.4% | | 4,585 | 89.5% |
| | | | | | | | | |
| **Primary Roads** | 16,102 | 95.5% | | 14,029 | 96.0% | | 2,073 | 92.1% |
| **Secondary Roads** | 14,837 | 90.5% | | 12,498 | 91.0% | | 2,339 | 87.6% |
| **Local Roads** | 1,199 | 85.3% | | 1,026 | 85.5% | | 173 | 84.4% |
| | | | | | | | | |
| **PASSENGERS Only** | | | | | | | | |
| **All Roadways** | 8,507 | 93.7% | | 7,435 | 94.2% | | 1,072 | 90.3% |
| | | | | | | | | |
| **Primary Roads** | 4,403 | 95.3% | | 4,009 | 95.5% | | 394 | 92.4% |
| **Secondary Roads** | 3,843 | 92.5% | | 3,222 | 93.0% | | 621 | 89.5% |
| **Local Roads** | 261 | 87.4% | | 204 | 88.2% | | 57 | 84.2% |

Analysis by jurisdiction indicated that seat belt usage rates for all occupants and all vehicle types combined were higher on Primary roads than on Secondary or Local roads in eight (72.7%) out of 11 jurisdictions having observations available on Primary roads (Table 10). Similarly, for cars or SUVs, eight (72.7%) of the 11 jurisdictions had higher usage rates on Primary roadways, and seven (63.6%) jurisdictions had higher rates on Primary roads for trucks. Belt use among truck occupants was 100% on Primary roads in Carroll and Harford counties and on Local roads in Baltimore and St. Mary's counties. Restraint usage observed among all occupants on a Local road in Anne Arundel County was also 100%. However, the single truck occupant observed on a Local road in Charles County was not belted, yielding a 0% usage rate.

A color-coded map of weighted rates by NHTSA jurisdiction is displayed in Figure A1 of the Appendix.

***Table 10 – 2022 Unweighted Usage Rates in NHTSA-Surveyed Jurisdictions of Maryland by Vehicle Type and Roadway Classification Within Jurisdiction***
***All Front Seat Occupants Combined With Known Seat Belt Use***

| | | | Unweighted Seat Belt Usage Rates | | |
|---|---|---|---|---|---|
| **Jurisdiction** | **# of Sites** | **Roadway Classification** | **All Vehicles** | **Passenger Cars/SUVs** | **Pick-up Trucks** |
| **Anne Arundel** | 5 | Primary | 93.2% | 93.8% | 90.8% |
| **Anne Arundel** | 4 | Secondary | 89.6% | 90.1% | 85.8% |
| **Anne Arundel** | 1 | Local | 100.0% | 100.0% | 100.0% |
| | | | | | |
| **Baltimore City** | 3 | Primary | 94.5% | 95.0% | 90.1% |
| **Baltimore City** | 6 | Secondary | 80.8% | 81.3% | 74.2% |
| **Baltimore City** | 1 | Local | 75.5% | 75.7% | 73.7% |
| | | | | | |
| **Baltimore Co** | 5 | Primary | 92.9% | 93.7% | 85.9% |
| **Baltimore Co** | 4 | Secondary | 90.8% | 92.2% | 82.7% |
| **Baltimore Co** | 1 | Local | 75.9% | 72.0% | 100.0% |
| | | | | | |
| **Caroline** | 9 | Secondary | 93.3% | 93.9% | 91.9% |
| **Caroline** | 1 | Local | 69.2% | 66.7% | 71.4% |
| | | | | | |
| **Carroll** | 1 | Primary | 98.3% | 97.9% | 100.0% |
| **Carroll** | 8 | Secondary | 96.1% | 96.4% | 94.8% |
| **Carroll** | 1 | Local | 82.6% | 87.5% | 71.4% |
| | | | | | |
| **Cecil** | 4 | Primary | 95.3% | 95.6% | 93.4% |
| **Cecil** | 5 | Secondary | 81.3% | 81.1% | 81.9% |
| **Cecil** | 1 | Local | 83.7% | 87.1% | 75.0% |
| | | | | | |
| **Charles** | 9 | Secondary | 92.8% | 93.0% | 91.7% |
| **Charles** | 1 | Local | 69.2% | 75.0% | 0.0% |
| | | | | | |
| **Frederick** | 6 | Primary | 94.4% | 94.8% | 90.7% |
| **Frederick** | 3 | Secondary | 91.1% | 91.8% | 82.9% |
| **Frederick** | 1 | Local | 89.3% | 89.3% | 89.0% |
| | | | | | |
| **Harford** | 4 | Primary | 99.7% | 99.7% | 100.0% |
| **Harford** | 5 | Secondary | 93.6% | 94.2% | 91.2% |
| **Harford** | 1 | Local | 84.7% | 87.1% | 78.3% |

***Table 10 Continued***
***2022 Unweighted Usage Rates in NHTSA-Surveyed Jurisdictions of Maryland by Vehicle Type and Roadway Classification Within Jurisdiction***
***All Front Seat Occupants Combined With Known Seat Belt Use***

| | | | Unweighted Seat Belt Usage Rates | | |
|---|---|---|---|---|---|
| **Jurisdiction** | **# of Sites** | **Roadway Classification** | **All Vehicles** | **Passenger Cars/SUVs** | **Pick-up Trucks** |
| **Howard** | 6 | Primary | 95.0% | 95.3% | 92.9% |
| **Howard** | 3 | Secondary | 91.4% | 92.4% | 84.7% |
| **Howard** | 1 | Local | 89.7% | 89.9% | 88.5% |
| | | | | | |
| **Montgomery** | 4 | Primary | 94.4% | 94.9% | 84.6% |
| **Montgomery** | 5 | Secondary | 97.5% | 97.5% | 97.2% |
| **Montgomery** | 1 | Local | 92.5% | 92.8% | 90.0% |
| | | | | | |
| **Prince George's** | 5 | Primary | 98.4% | 99.3% | 95.5% |
| **Prince George's** | 4 | Secondary | 98.9% | 99.4% | 96.5% |
| **Prince George's** | 1 | Local | 92.2% | 93.8% | 81.8% |
| | | | | | |
| **St. Mary's** | 9 | Secondary | 90.5% | 91.7% | 86.3% |
| **St. Mary's** | 1 | Local | 94.7% | 87.5% | 100.0% |
| | | | | | |
| **Washington** | 5 | Primary | 92.5% | 93.5% | 88.1% |
| **Washington** | 4 | Secondary | 81.8% | 82.9% | 78.0% |
| **Washington** | 1 | Local | 53.3% | 53.8% | 50.0% |

## NHTSA Sites – Unknown Observations

Seat belt usage could not be determined for 3.7% of all front-seat occupants, differing between drivers (4.6%) and passengers (0.3%). Unknown belt use was more prevalent in pick-up trucks (6.4%) than in passenger cars (3.2%) and higher on Local roads (5.5%) than on Primary (3.0%) or Secondary roads (4.3%). Belt use was ascertained for every driver and passenger in 12 (8.6%) of the 140 sites, while 10 sites (7.1%) had an unknown rate of at least 10%. Unknown observations were primarily attributed to glare (caused by bright sunny skies), extensive window tinting, and light rain. The overall proportion of unknown seat belt use in the 2022 survey was 1.8 percentage points lower than that computed in 2021.

## Non-NHTSA Sites – Unweighted Analysis

Limited data collection was also conducted within the 10 remaining jurisdictions in Maryland to gain a rough estimate of the seat belt usage rate in those areas. Because these jurisdictions were not included in the sampling frame of the NHTSA Observational Survey of Seat Belt Use, the findings were not weighted. Only three randomly chosen sites were observed in each

jurisdiction; hence, due to its potential instability, the standard error was not estimated. Unlike the NHTSA survey plan, any roadway type could be selected for observation, as roadways were not chosen according to VMT proportion.

A total of 6,908 motor vehicles (i.e., passenger cars, SUVs, and pick-up trucks) with 7,869 front seat occupants were observed within the 10 non-NHTSA jurisdictions. Known seat belt use was ascertained for 7,634 (97.0%) of the occupants, of whom 6,680 (87.5%) were drivers and 954 (12.5%) were front seat passengers. Most (74.2%) were occupants of passenger cars or SUVs and the remaining 25.8% were occupants of pick-up trucks. Because of the rural setting of the 10 remaining jurisdictions, only 496 (6.5%) of the observations were made on Primary roads, as opposed to 4,946 (64.8%) on Secondary roads and 2,192 (28.7%) on Local roads. The average number of occupants observed per jurisdiction with known seat belt usage was 763.

Approximately 93.4% of all drivers and passengers in the non-NHTSA jurisdictions were belted (Table 11), representing an increase of 3.2 percentage points from the 2021 unweighted usage rate. A higher proportion of passengers (96.3%) than drivers (93.0%) were belted (data not shown). Belt use among front seat occupants was more likely to occur in passenger cars or SUVs (94.8%) than in pick-up trucks (89.5%), and drivers and passengers in 2022 were more likely to be belted on Primary roads (96.8%) than on Secondary (94.7%) or Local roads (89.9%). This distribution according to roadway classification (i.e., Primary higher than Secondary higher than Local) was also found separately among front seat occupants in a car and in a truck.

***Table 11 - 2022 Unweighted Usage Rates in Non-NHTSA Jurisdictions of Maryland Overall, by Vehicle Type and by Roadway, All Front Seat Occupants Combined With Known Seat Belt Use***

| | **All Vehicles** | | | **Passenger Cars/SUVs** | | | **Pick-up Trucks** | |
|---|---|---|---|---|---|---|---|---|
| | | | | | | | | |
| | **N** | **Usage Rate** | | **N** | **Usage Rate** | | **N** | **Usage Rate** |
| **All Roadways** | 7,634 | 93.4% | | 5,666 | 94.8% | | 1,968 | 89.5% |
| | | | | | | | | |
| **Primary Roads** | 496 | 96.8% | | 368 | 98.1% | | 128 | 93.0% |
| **Secondary Roads** | 4,946 | 94.7% | | 3,646 | 95.5% | | 1,300 | 92.2% |
| **Local Roads** | 2,192 | 89.9% | | 1,652 | 92.5% | | 540 | 82.0% |

A list of unweighted usage rates by jurisdiction is displayed in Table 12. Eight (80.0%) of the 10 non-NHTSA jurisdictions had unweighted rates above 90%, with Somerset (98.9%) and Worcester (98.8%) counties having the highest observed seat belt rates for all vehicles combined. Queen Anne's (86.8%) and Kent (73.4%) counties were the only jurisdictions with a usage rate below 90%. Jurisdictional usage rates of occupants observed in passenger cars or SUVs were at least 90% in eight (80.0%) of the counties surveyed, with the usage rate ranging from a high of 99.2% in Wicomico County to a low of 76.2% in Kent County. Among occupants of pick-up trucks, six (60.0%) jurisdictions had a usage rate greater than 90%. Somerset (99.1%) and Worcester (98.0%) counties had the highest rates among truck occupants, while three

jurisdictions had usage rates below 80% (Queen Anne's, Garrett, and Kent). See Figure A2 in the Appendix for a color-coded map of unweighted usage rates in non-NHTSA jurisdictions.

***Table 12 - 2022 Unweighted Usage Rates in Non-NHTSA Counties of Maryland by Vehicle Type Within Jurisdiction, All Front Seat Occupants Combined With Known Seat Belt Use***

| | All Vehicles | | Passenger Cars/SUVs | | Pick-up Trucks |
|---|---|---|---|---|---|
| | Usage Rate* | | Usage Rate | | Usage Rate |
| | | | | | |
| **10 Non-NHTSA Jurisdictions** | 93.4% | | 94.8% | | 89.5% |
| | | | | | |
| **Somerset** | 98.9% | | 98.8% | | 99.1% |
| **Worcester** | 98.8% | | 99.1% | | 98.0% |
| **Wicomico** | 97.2% | | 99.2% | | 92.6% |
| **Talbot** | 97.1% | | 98.6% | | 93.3% |
| **Calvert** | 95.4% | | 95.2% | | 96.3% |
| **Allegany** | 94.7% | | 96.7% | | 90.2% |
| **Dorchester** | 93.8% | | 95.4% | | 89.4% |
| **Garrett** | 90.1% | | 93.6% | | 78.2% |
| **Queen Anne's** | 86.8% | | 89.4% | | 78.8% |
| **Kent** | 73.4% | | 76.2% | | 65.1% |

* Jurisdictional usage rates are sorted in descending order for all vehicles combined.

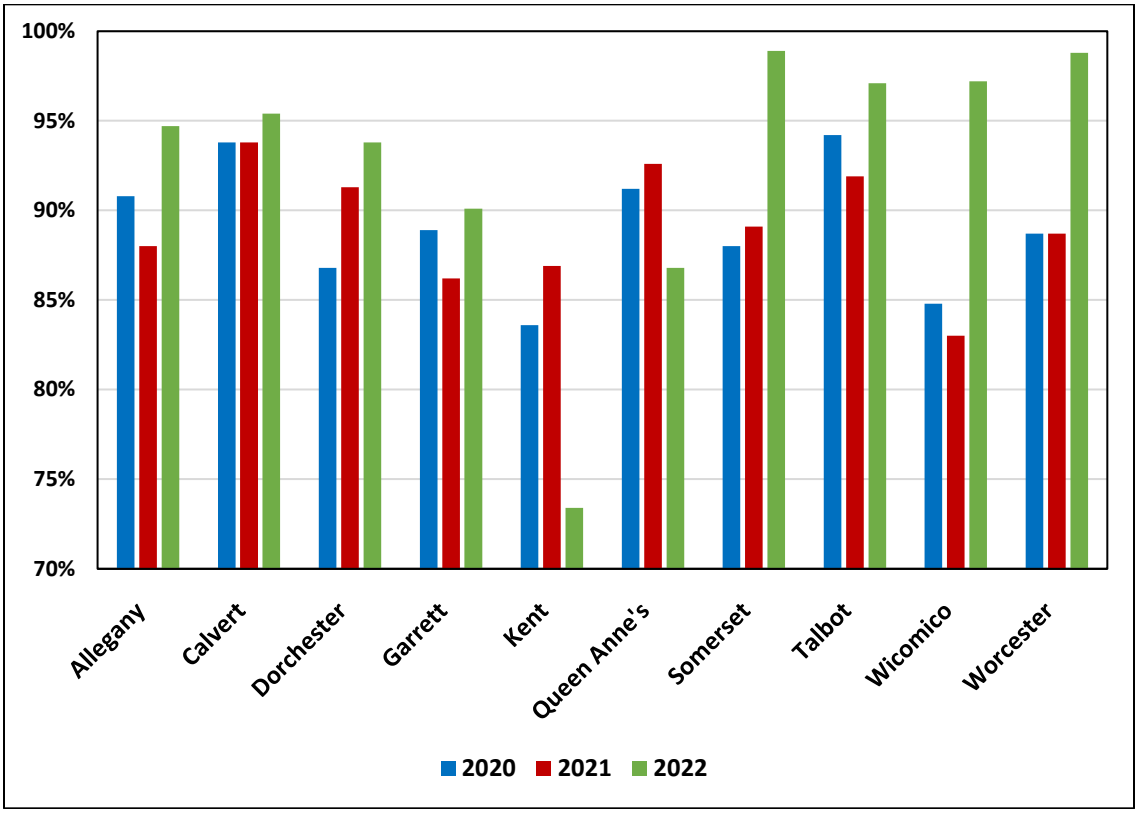
Jurisdictional changes in unweighted rates over time, for all vehicles combined, are documented for the non-NHTSA counties in Table 13 and Figure 6. The largest increase in usage rates over the past year was experienced by Wicomico County (+14.2 percentage points). Only two counties showed a decline in their usage rate since 2021: Queen Anne's (-5.8) and Kent (-13.5). Wicomico County had the biggest increase over the past two years (+12.4), while Queen Anne's (-4.4) and Kent (-10.2) counties were the only jurisdictions to experience a decline. Calvert and Talbot counties were the lone jurisdictions to post higher rates than the overall non-NHTSA usage rate each year since 2020.

*Table 13 - Change Between 2020 and 2022 in Combined Unweighted Seat Belt Usage by Non-NHTSA Jurisdiction*

| Jurisdiction | 2020 | 2021 | 2022 | Change in Rate 2021-2022 | Change in Rate 2020-2022 |
|---|---|---|---|---|---|
| **All 10 Jurisdictions** | 89.8% | 90.2% | 93.4% | +3.2% | +3.6% |
| | | | | | |
| **Allegany** | 90.8% | 88.0% | 94.7% | +6.7% | +3.9% |
| **Calvert** | 93.8% | 93.8% | 95.4% | +1.6% | +1.6% |
| **Dorchester** | 86.8% | 91.3% | 93.8% | +2.5% | +7.0% |
| **Garrett** | 88.9% | 86.2% | 90.1% | +3.9% | +1.2% |
| **Kent** | 83.6% | 86.9% | 73.4% | -13.5% | -10.2% |
| **Queen Anne's** | 91.2% | 92.6% | 86.8% | -5.8% | -4.4% |
| **Somerset** | 88.0% | 89.1% | 98.9% | +9.8% | +10.9% |
| **Talbot** | 94.2% | 91.9% | 97.1% | +5.2% | +2.9% |
| **Wicomico*** | 84.8% | 83.0% | 97.2% | +14.2% | +12.4% |
| **Worcester** | 88.7% | 88.7% | 98.8% | +10.1% | +10.1% |

* Usage rates for Wicomico County were weighted in 2020 and 2021.

*Figure 6 - Comparison from 2020 to 2022 of Combined Unweighted Seat Belt Usage Rates by Non-NHTSA Jurisdiction*




## Non-NHTSA Sites – Unknown Observations

Seat belt usage could not be ascertained for 3.0% of all front-seat occupants surveyed in the non-NHTSA jurisdictions; 3.3% of driver belt use was unknown and 0.7% of passenger belt use was unknown. Occupants of passenger cars or SUVs had an unknown rate of 2.4% and truck occupants had an unknown rate of 4.5%.

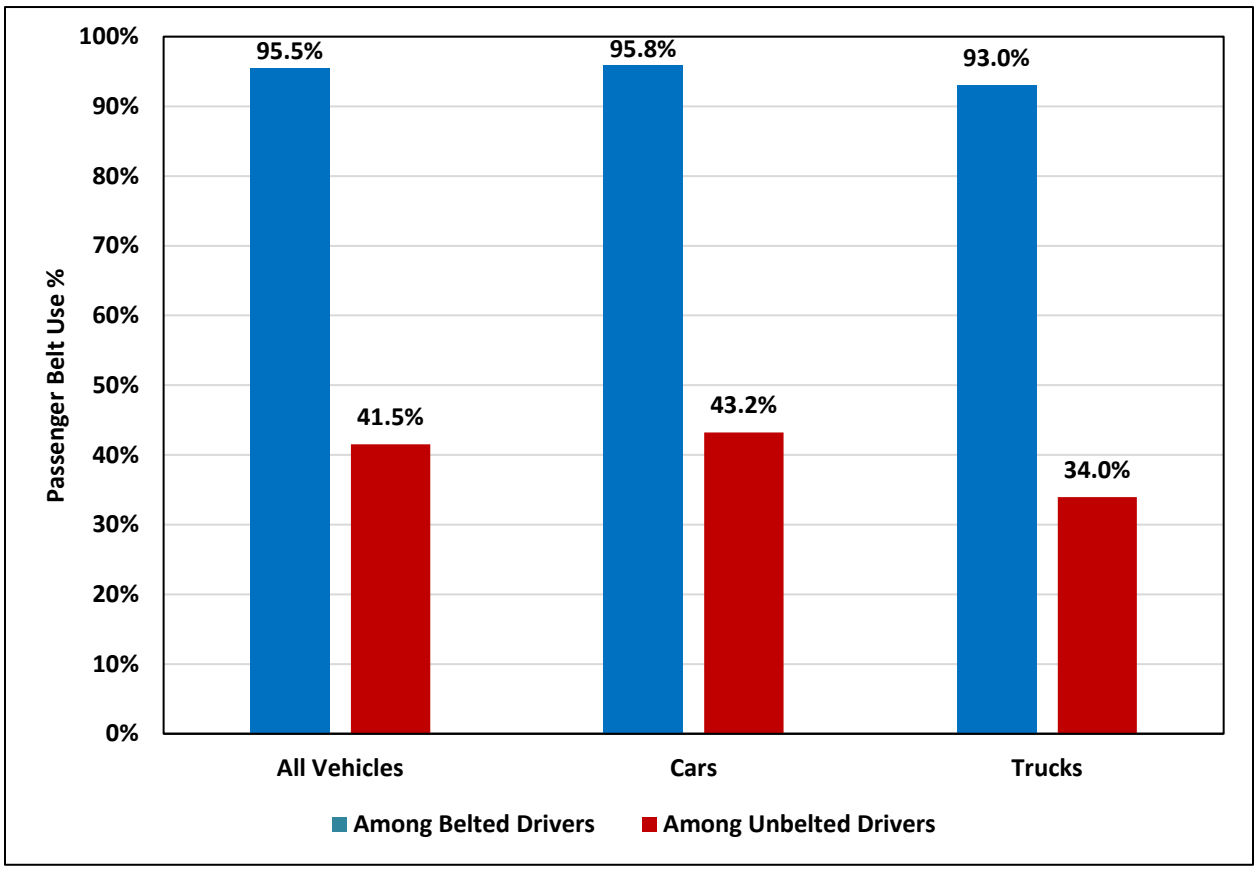
## Analysis of Individual Record-Level Data

In addition to the analysis of summary data to calculate overall usage rates, individual record-level data were analyzed for more in-depth study of occupant behavior within NHTSA jurisdictions. Specific analyses focused on the unweighted belt use of the right front passenger and their association with the driver's unweighted belt use. However, unlike in previous years, observations of hand-held cell phone use by drivers in 2022 were insufficient to allow for a conclusive analysis. The Data Collection Teams documented only 169 drivers (0.5%) using a hand-held cell phone in the study.

Of the 32,138 belted and unbelted drivers observed in NHTSA jurisdictions, approximately 26.4 % (n=8,847) also had a passenger observed in the right front seating position. Approximately 92.8% of those drivers were belted and the majority was riding in cars (85.7%). Of the drivers that were belted with passengers in the vehicle, 95.5% of those passengers were also belted. However, among the cases of unbelted drivers with passengers, only 41.5% of the passengers

were belted. This large difference was also prevalent when the data were stratified by vehicle type: 95.8% vs. 43.2% of passengers wore their seat belt in cars with belted and unbelted drivers, respectively, while 93.0% vs. 34.0% of passengers were belted in pick-up trucks with belted and unbelted drivers (Figure 7).

***Figure 7 – 2022 Right Front Passenger Seat Belt Use is Associated With Driver Use by Vehicle Type***




The associations of lower passenger belt use with unbelted drivers, and the larger difference among those in pickup trucks as compared to cars, were also present when examining the data by roadway classification. The overall difference in passenger belt use between cases of belted and unbelted drivers was 96.1% vs. 55.6% on Primary roads, 95.1% vs. 36.3% on Secondary roads, and 90.7% vs. 23.5% on Local roads. Thus, the large difference in passenger restraint by driver restraint use that was observed on Primary roads was even wider on Secondary and Local roadways.

## Analysis of Rural vs. Urban Jurisdictions and Roadway Segments

The Maryland State Office of Rural Health designates 18 out of the 24 jurisdictions in the State as "rural". Using this designation, the 14 NHTSA jurisdictions were classified as being either rural (Caroline, Carroll, Cecil, Charles, Frederick, Harford, St. Mary's and Washington Counties) or urban (Anne Arundel, Baltimore, Howard, Prince Georges, Montgomery Counties and Baltimore City). In addition, in collaboration with the Washington College GIS program, each roadway segment within the NHTSA jurisdictions, from both the 2021 and 2022 observation studies, was designated as either rural or urban. These designations were based upon the Maryland iMap services and US Census 2010 data. Unweighted occupant seat belt usage rates were then calculated to compare (1) rural vs. urban jurisdictions and (2) rural vs. urban roadway segments. The results for 2021 and 2022 are displayed in Table 14.

In 2022, the unweighted percent seat belt usage was higher in rural compared to urban jurisdictions for all vehicle types: Cars (**94.0%** vs 93,1%); Trucks (**89.9%** vs 89.3%); Cars and Trucks combined (**93.3%** vs 92.7%). However, the 2021 rates were higher in the urban jurisdictions for all vehicle types: Cars (93.6% vs **94.0%**); Trucks (84.9% vs **89.4%**); Cars and Trucks combined (92.3% vs **93.5%**).

When comparing the restraint use on roadways classified as being either rural or urban, there are differences by type of vehicle in 2022. While seat belt usage rates in cars remained slightly higher on rural roads as compared to urban roads (**93.7%** vs 93.5%), trucks on rural roadways had a slightly lower usage rate as compared to those on urban roadways (89.4% vs **89.8%**). The 2022 seat belt usage rate in cars and trucks combined was 93.0% on both rural and urban roadways. Similar to seat belt usage in rural and urban jurisdictions, belt usage in 2021 was higher on urban roadways for all vehicle types: Cars (93.4% vs **94.0%**); Trucks (84.8% vs **88.1%**); Cars and Trucks combined (92.0% vs **93.3%**).

A new sample of roadways were selected in 2022 for the current observational study, which may explain some of the differences found between Maryland's 2021 and 2022 rural and urban rates. The 2021 National Occupant Protection Use Survey (NOPUS) concluded that the unweighted seatbelt usage rate for occupants in Urban Areas was 90.5% (95% CI 88.8% ‐ 92.0%) and in Rural Areas 90.1% (95% CI 87.8% ‐ 92.1%). In Maryland, the unweighted statewide rates were even higher (93.5% Urban Areas and 92.3% in Rural Areas).

***Table 14 – 2021 and 2022 Unweighted Seat Belt Rates for Rural vs. Urban Jurisdictions and Roadways Among the 14 NHTSA Jurisdictions***

| | 2021 | 2022 |
|---|---|---|
| **CARS - Unweighted % Belted** | | |
| Rural Jurisdictions | 93.6% | 94.0% |
| Urban Jurisdictions | 94.0% | 93.1% |
| | | |
| Rural Roadways | 93.4% | 93.7% |
| Urban Roadways | 94.0% | 93.5% |
| | | |
| **TRUCKS - Unweighted % Belted** | | |
| Rural Jurisdictions | 84.9% | 89.9% |
| Urban Jurisdictions | 89.4% | 89.3% |
| | | |
| Rural Roadways | 84.8% | 89.4% |
| Urban Roadways | 88.1% | 89.8% |
| | | |
| **CARS & TRUCKS - Unweighted % Belted** | | |
| Rural Jurisdictions | 92.3% | 93.3% |
| Urban Jurisdictions | 93.5% | 92.7% |
| | | |
| Rural Roadways | 92.0% | 93.0% |
| Urban Roadways | 93.3% | 93.0% |

## Summary

The 2022 front seat belt observational survey in Maryland was conducted following a revised sampling of the State roadways, resulting in 14 jurisdictions that will follow the NHTSA data collection protocol between 2022 and 2026. Based on data sampled in these jurisdictions, the overall observed seat belt usage rate for drivers and right front seat passengers in the State of Maryland in 2022, after weighting by probability of roadway selection and jurisdictional roadway specific VMT, was 92.7%. The 2022 usage rate represented a 1.3 percentage point increase over the previous year. The Statewide standard error of 0.6% was well below the NHTSA threshold of 2.5%, yielding a 95% confidence interval of 91.5% to 93.9% for the combined usage rate. These rates were based on observation of 33,674 vehicles and 42,203 occupants, representing decreases of 15.5% and 14.7% in the number of vehicles and occupants observed, respectively, in the 2021 survey.

Belt use was highest among passenger cars and SUVs relative to pick-up trucks (93.4% vs. 88.0%, respectively). Seat belt usage was also highest among all front seat occupants traveling on Primary roads relative to Secondary and Local roads (95.2% vs. 91.8% and 85.2%). Since 2021, the rates represented increases across the board for passenger cars/SUVs, pick-up trucks, and all three types of roadways.

Prince George's County (98.1%) had the highest usage rate among Maryland's 14 NHTSA jurisdictions, followed by Montgomery (96.3%), and Carroll (94.8%) counties. There were nine jurisdictions with combined rates of at least 90%; Baltimore City (85.3%), Washington County (84.6%) and Charles County (80.6%) experienced the lowest rates. Overall, five of the 14 jurisdictions experienced an increase in combined usage rates over the past year. The large decrease in rates over the past year for Baltimore City may be partially due to the 2022 random sample of roadways. For occupants of passenger cars or SUVs, ten jurisdictions had usage rates of at least 90%. Among occupants of pick-up trucks, three jurisdictions had a usage rate above 90% (Prince George's, Montgomery and Carroll counties), and two jurisdictions (Washington and Charles counties) experienced rates below 80%. Unweighted analysis indicated that drivers had a slightly lower Statewide usage rate (92.8%) than front seat passengers (93.7%).

Seat belt usage could not be ascertained for 3.7% of all drivers and passengers. Unknown belt use was more prevalent in pick-up trucks (6.4%) than in passenger cars (3.2%), higher for drivers (4.6%) than for passengers (0.3%), and slightly higher on Local roads (5.5%) compared to Primary roads (3.0%) and Secondary roads (4.3%).

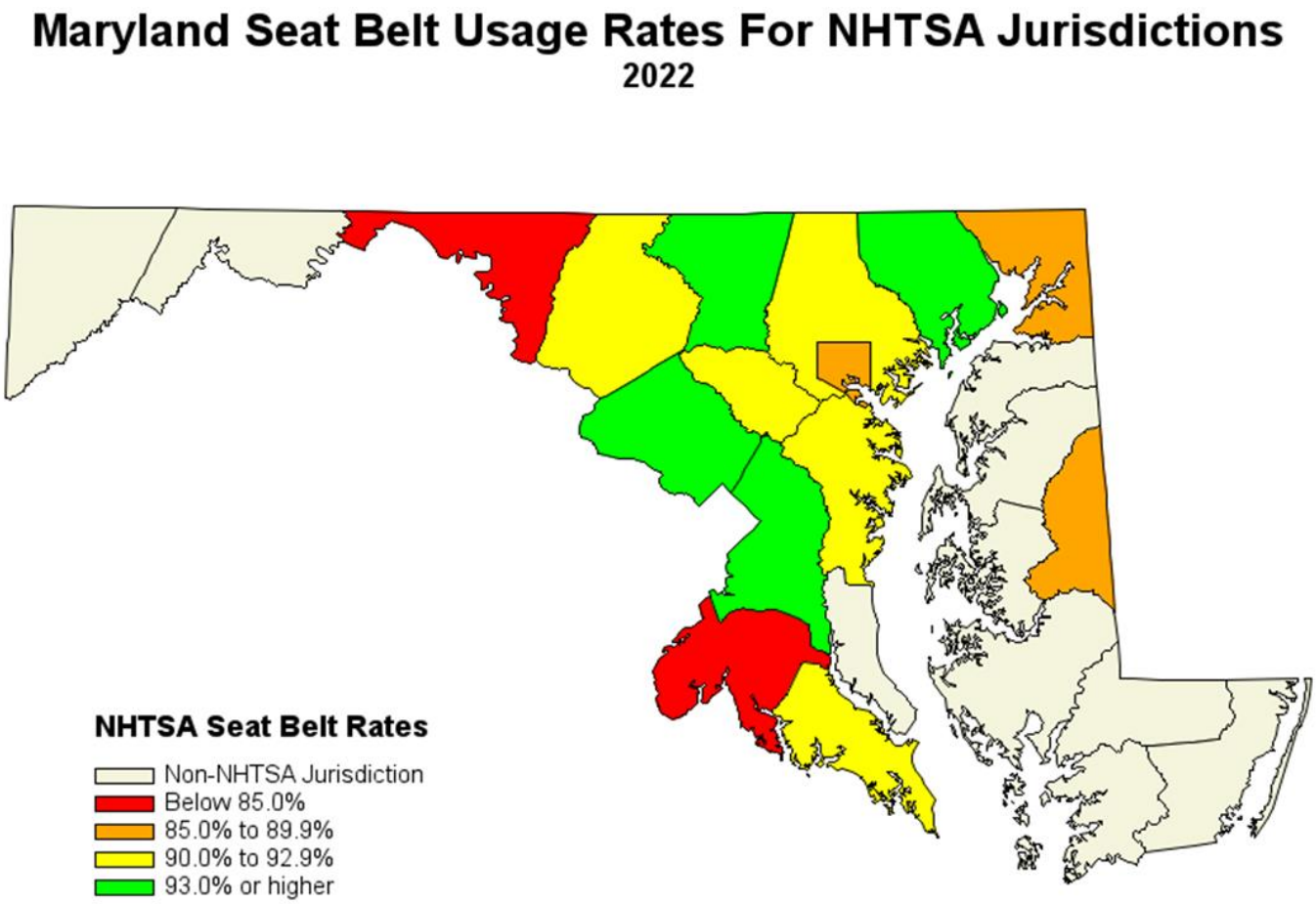
Approximately 93.4% of all drivers and right front-seat passengers traveling in the 10 non-NHTSA jurisdictions were belted, representing a 3.2 percentage point increase over the past year (unweighted analysis). A slightly lower proportion of drivers (93.0%) than passengers (96.3%) were observed to be belted. In addition, higher usage rates were found in passenger cars or SUVs (94.8%) than in pick-up trucks (89.5%), and on Primary as opposed to Secondary or Local roadways. Eight of the non-NHTSA jurisdictions had a usage rate above 90%. For passenger cars or SUVs, usage rates were also at least 90% in eight jurisdictions, while usage rates among occupants of trucks were above 90% in six non-NHTSA jurisdictions. Kent County experienced the lowest rate among all vehicles. Seat belt usage could not be ascertained for 3.0% of all front-seat occupants.

Examination of individual record-level data, for the instance in which both a driver and passenger were observed in the front seat, indicated that 95.5% of passengers were belted when the driver was belted. However, if the driver was unbelted, only 41.5% of passengers were observed to wear their belt. This large difference in passenger belt use occurred in cars and SUVs (95.8% for belted drivers vs. 43.2% for unbelted drivers) as well as in trucks (93.0% for belted drivers vs. 34.0% for unbelted drivers). There was also an association with roadway classification, with the Secondary or Local roadways corresponding to a larger difference in passenger belt use between belted and unbelted drivers than the discrepancy seen on Primary roads. Data on cell phone usage by drivers were not presented, as only 169 drivers (0.5%) were observed using a hand-held cell phone.

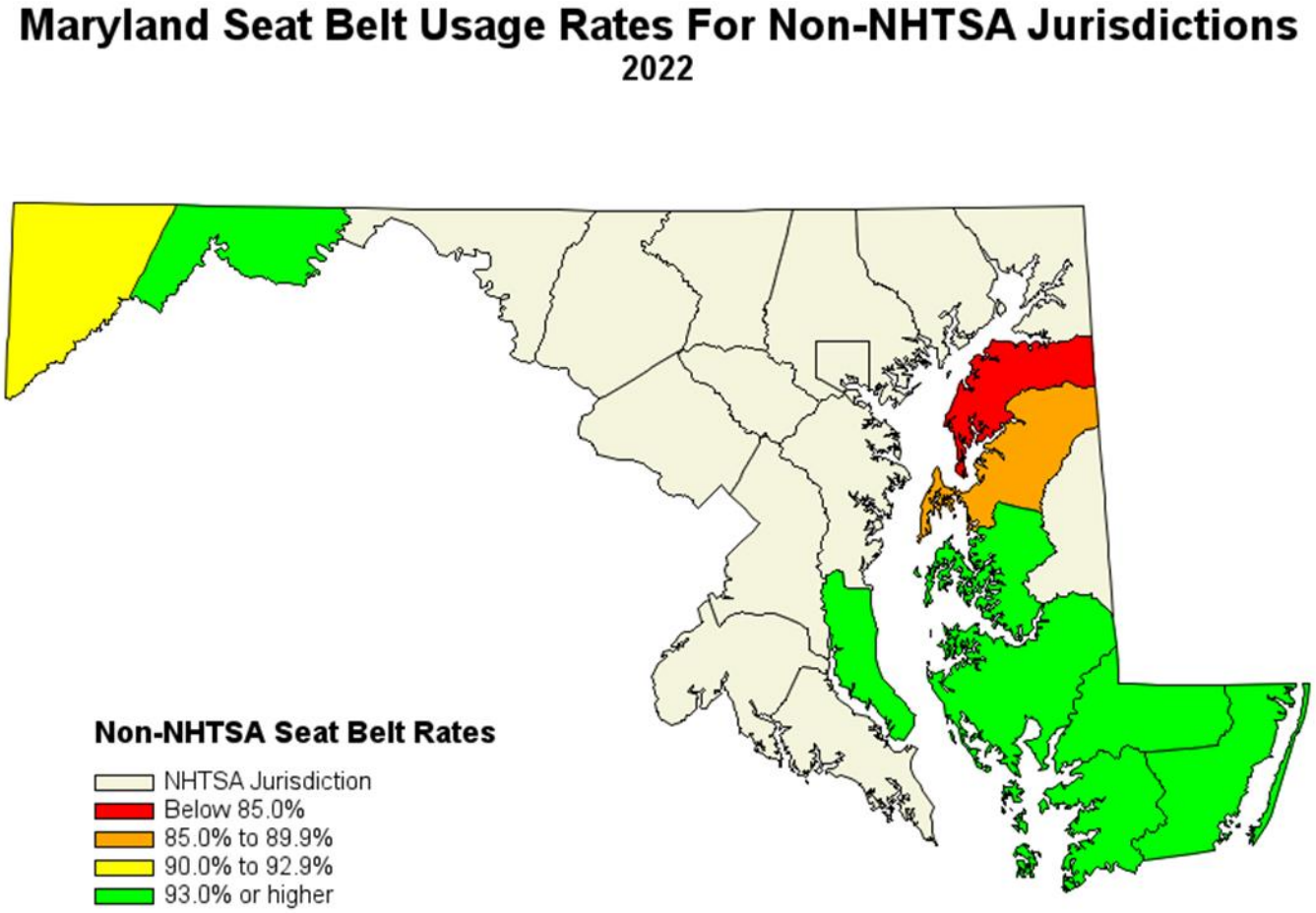
An additional analysis was carried out to compare rural vs. urban jurisdictions and roadways among the 14 NHTSA jurisdictions. In 2022, the unweighted percent seat belt usage was higher in rural compared to urban jurisdictions for all vehicle types, whereas the 2021 rates were higher in the urban jurisdictions. When comparing the 2022 restraint use findings on roadways classified as being either rural or urban, rates in cars remained slightly higher on rural roads while rates in trucks were slightly higher on urban roads.

## Appendix

# Figure A1



# Figure A2


Maryland Seat Belt Usage Rates For Non-NHTSA Jurisdictions
2022
Non-NHTSA Seat Belt Rates
NHTSA Jurisdiction
Below 85.0%
85.0% to 89.9%
90.0% to 92.9%
93.0% or higher