Technical Report

Vehicle Occupancy Factor and Transit Occupancy Factor Calculation

Florida Department of Transportation
Forecasting and Trends Office

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Executive summary

Vehicle Occupancy Factors (VOFs), also referred to as average vehicle occupancy, are estimates of the average number of occupants for a single vehicle. VOFs are used to calculate useful person movement measures used in decision making like person-miles traveled, person-hours of delay, and travel time reliability. Accordingly, the Federal Highway Administration (FHWA) established a set of measures to assess the performance of the National Highway System (NHS), freight movement on the Interstate system, and the Congestion Mitigation and Air Quality Improvement Program (CMAQ). Those measures used to assess the NHS and level of travel time reliability apply a vehicle occupancy factor in their calculation. All states are required to report on either all or a subset of these measures. Therefore, monitoring accurate occupancy factors assists in proper transportation decision making and performance reporting.

Multiple approaches have been used in the past to collect and estimate VOFs including collecting data in the field and travel surveys. Examples of field collection include the roadside/windshield observation method and photographic surveillance. Survey methods may vary from household surveys, telephone interviews, parking lot surveys, employer surveys, travel diaries, and mail-out surveys. These approaches are usually expensive, time consuming, and resources intensive, which limits the scope and time of collection.

Recently, FHWA developed a new methodology to establish VOF values through vehicle occupancies recorded in crash records instead of traditional approaches. Using crash records which are readily available to Departments of Transportation, the approach extracts vehicle occupants' information from crash records and infers the average vehicle occupancy for the entire population by accounting for estimation bias and prevalence from crash data. In addition, the FHWA developed a framework to calculate transit occupancy factors. This factor could also be used by policy makers to understand transit system utilization and performance monitoring.

The objectives of this document are to:

- review the new FHWA methodologies and data sources,
- develop a valid calculation framework for the state of Florida, and
- detail the methodologies used to develop the occupancy factors.

This methodology could be applied at varying geographic boundaries. The outcome of this effort and calculations could be used to update VOFs for the state of Florida, its counties, and FDOT's districts on a recurring basis.

Contents

Tables

Figures

Appendices

1 Section I: Passenger Vehicle Occupancy Factors Calculation Literature and Data Review

1.1 FHWA methodology review

1.1.1 Key concepts

This section defines some key concepts from the FHWA approach in an alphabetical order.

Bayes Theorem: Bayes' Rule is widely used to relate the conditional and unconditional probabilities of an event:

$$P\,(A|B) = \frac{P(A\ \cap B)}{P\,(B)} = P(A) * \frac{P(B|A)}{P\,(B)}$$

Where *P (A|B)* is the probability of A given B, $P(A\ \cap B)$ is the probability of A and B, $P(B|A)$ is the probability of B given A, and $P(A\ or\ B)$ is the probability of A or B, respectively. From FHWA methodology, the distribution of the occupancy is conditional on the distribution in a crash which cannot reflect the true occupancy distribution for the population. The Bayes rule is used to link the relationships.

Binary Logistic Regression: Binary logistic regression predicts the odds of being a categorical variable that falls into one of two categories based on a set of independent variables.

Occupancy bias: Studies have shown that the probability of getting into a crash could be affected by the number of occupants in a vehicle. Therefore, the distribution of vehicle occupancy is conditional on the distribution of being in a crash. However, unconditional distribution of the occupancy is needed to calculate VOF. Therefore, FHWA estimates occupancy bias to remove the bias and to get the true occupancy distribution.

Poisson Distribution: In statistics, a Poisson distribution is a discrete probability distribution that shows a given number of events (count data) occurring in fixed interval time or space with a known constant mean rate.

Poisson Regression: Poisson regression is usually used for modeling count data. In a Poisson Regression model, an offset is a variable to denote the exposure period.

Prevalence: Prevalence is the proportion of vehicle miles travelled by a particular subpopulation group. FHWA suggests that prevalence should be estimated to account for over or under representation of a subpopulation group.

Raking, Iterative Proportional Fitting: Raking, also referred as Iterative Proportional Fitting, is a mathematic procedure used in a variety of scientific disciplines to adjust the distribution of variables given totals are known. It is used when the marginal distributions of variables are available while the full joint distribution is unclear. The process is used in this study to estimate the prevalence of the subpopulation groups based on the FHWA Traffic Volume Trends (TVT), Highway Statistics Series (HSS), and National Household Travel Survey (NHTS).

Subpopulation: In determining vehicle occupancy based on crash data, FHWA suggests that the selection of crash samples might not represent the entire driving population. Therefore, crash data could over- or under-represent the entire population. To account for such estimation bias, a post-stratification by subpopulation is recommended by FHWA. The subpopulation classification is based on data availability including gender, age, road type, urbanized area, etc.

1.1.2 FHWA approach background

As mentioned in the previous section, FHWA has proposed an approach that extracts vehicle occupant information which is usually available in crash reports (**Appendix A** provides a full FHWA report.). In addition, the approach accounts for potential misrepresentation from crash data due to prevalence and occupancy bias – the prevalence bias refers to the different distributions between vehicle miles traveled of groups of drivers and the likelihood to being in a crash, and the occupancy bias refers to conditional distribution of vehicle occupancy affected by crash. The equation below shows the calculation process to estimate average occupancy. **Figure 1** shows an outline of the approach.

$$VOF = \sum_{v \in \{1,2,3,4+\}} E(VO|VO = v) \sum_{SubPop} \frac{\Pr(VO = v|SubPop, Crash) \Pr(SubPop)}{Bias(Subpop, VO = v)}$$

Where the average VOF is a function of each vehicle occupancy class (VOF = 1, 2, 3, 4, 4+) and its probability after accounting for the bias.

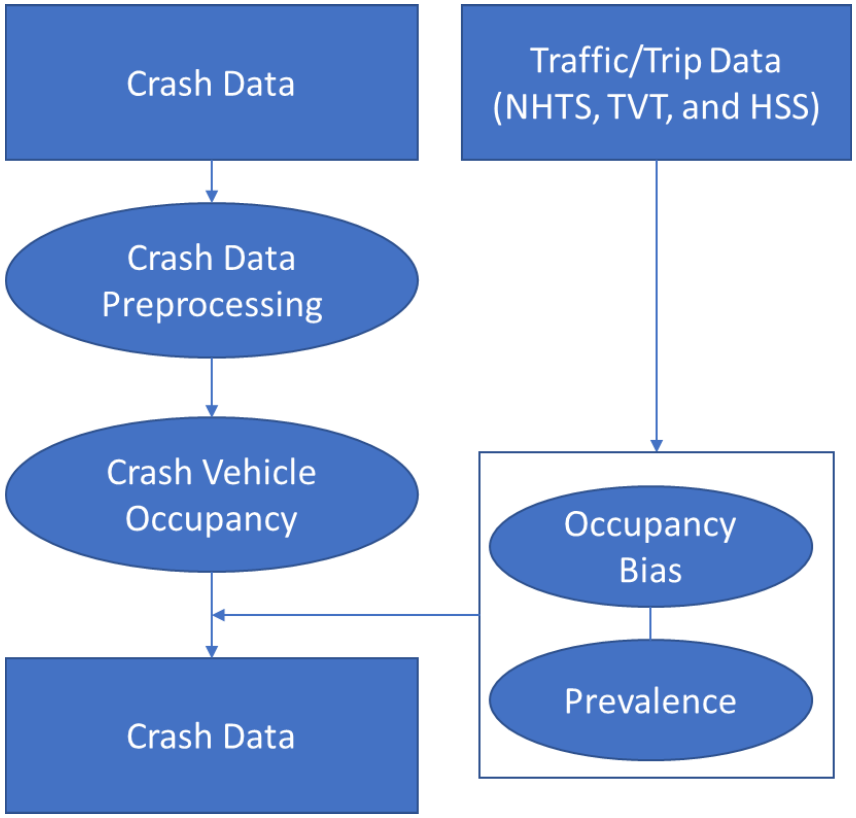

Figure 1 FHWA Methodology Framework

1.1.3 Data sources

The following data sources are required in the FHWA approach to calculate passenger vehicle occupancy:

- Crash Records – Crash records with the number of occupants in vehicles, and such information can be used to estimate occupancy. Further, crash records should provide information on driver age, gender, crash time, and crash location.
- National Household Travel Survey (NHTS) - The NHTS provides information on vehicle miles traveled and person trips. It is used to control for biases from crash records and calculate the travel prevalence. Most recent NHTS data is from 2017.
- FHWA Traffic Volume Trends (TVT) and Highway Statistics Series (HSS)- The TVT and HSS data were used to provide additional information on vehicle miles traveled by road type and urban/rural designation. Such information is used to estimate prevalence by subpopulation.

1.2 FHWA Estimation process

The FHWA approach involves a series of steps to develop estimates with preliminary data processing and bias correction. This section provides a brief overview of the calculation steps.

1.2.1 Data preprocessing

Preliminary data preprocessing differs based on data used for the analysis. FHWA listed the following general steps to preprocess data:

- Missing occupancy
- No information on the driver or crash
- Multiple drivers for a vehicle or duplicate vehicle information
- Parked cars (usually have occupancy of 0)
- Pedestrian and bicycle records
- Subpopulation – Subpopulation consists of drivers' socio-economic characteristics, crash attributes, vehicle attributes, and geospatial information.

1.2.2 Prevalence and occupancy bias estimation

Vehicle occupancy distribution in crashes estimation: This step estimates the vehicle distribution from crash records, $\Pr(VO = v | SubPop, Crash)$. A simple way from the FHWA methodology is to use empirical records to estimate the proportion of crashes by subpopulation with *v* occupants. This is a valid approach when there is a large sample size of crashes compared to the number of variables. However, it is likely to cause highly variable estimation when the number of crashes is limited, and subpopulation involves more variables.

As an alternative, a Binary Logistics Regression modeling approach is suggested by FHWA to estimate the occupancy distribution:

$$\Pr(VO = v | SubPop_i, Crash) = f_v(x_{1i}, x_{2i}, \ldots, x_{pi})$$

Where $x_{1i}, \ldots, x_{ij}$ is a vector of categorical variable representing subpopulation groups. In addition, the function takes a form:

$$f_v(x_{1i}, x_{2i}, \ldots, x_{pi}) = \sigma(\beta_0 + \sum \beta_j x_{ji})$$

Where σ is the logistic sigmoid function, which constrains the probability estimates to be between 0 and 1. Different modeling techniques could be used to estimate this relationship, including multilevel regression, machine learning techniques, etc.

Prevalence estimation: Prevalence represents the proportion of vehicle miles traveled by a subpopulation group to account for the potential "over or under" representation of the group in estimating occupancy from crash records. For example, subpopulation groups with gender need to be assigned with specific weights if male drivers make up 75% of vehicle miles traveled and female drivers make up 25% of miles traveled. When the distribution of crashes by gender is known, the distribution of miles traveled should be used to re-weight and estimate the true representation of the occupancy. During this process, raking, or Iterative Proportional Fitting, is used to estimate the prevalence. The process involves initializing the joint estimation with a seed matrix, which provides a priori expected proportion of traffic for each subpopulation. Traffic information from TVT, HSS, and NHTS are extracted for this estimation.

Occupancy bias estimation: As mentioned in the previous section, occupancy bias exists when the likelihood of being in a crash is affected the number of occupants in a vehicle. To account for the effect, occupancy bias for a subpopulation could be calculated by dividing the proportion of crashes in the subpopulation by the proportion of the prevalence in a subpopulation group. This relationship is based on Bayes Theorem:

$$Bias(SubPop, VO = v) = \frac{\Pr(Crash|SubPop, VO = v)}{\Pr\,(Crash|SubPop)} = \frac{\#(Crash|SubPop, VO = v)}{\#\,(Crash|SubPop)} * \frac{VMT(SubPop)}{\mathrm{VMT}(SubPop, VO = v)}$$

From the above equation, occupancy bias could be calculated by direct estimation of empirical data. However, FHWA suggested that small sample sizes for some subpopulation groups are likely to cause variability issue in estimation process. For example, if a subpopulation group had no crashes during the analysis period, the estimation bias will be zero. Therefore, FHWA suggested a Poisson Regression approach to estimate the occupancy bias as an alternative to direct estimation. For each vehicle occupancy group, the estimation process involves constructing sub-models with Poisson distribution of crash counts with the log of the mean:

$$\log\left(\frac{\#(Subpop, Crash) * \mathrm{VMT}(SubPop, VO = v)}{VMT(SubPop)}\right) + f(x_{ij}, x_{i+1j}, \dots, x_{pj})$$

Vehicle occupancy estimation: the calculation of the occupancy involves combining estimates from previous steps (i.e., occupancy, prevalence, and occupancy bias). The calculation is shown as:

$$VOF = \sum_{v \in \{1,2,3,4+\}} E(VO|VO = v) \sum_{SubPop} \frac{\Pr(VO = v|SubPop, Crash)\,\Pr\,(SubPop)}{Bias(Subpop, VO = v)}$$

Where $E(VO|VO = 1) = 1$, $E(VO|VO = 2) = 2$, $E(VO|VO = 3) = 3$, and $E(VO|VO = 4+) = E(VO|VO \geq 4) = 4.5$.

For vehicle occupancy recorder greater than 4, the value of 4.5 is used based on the average estimates recommended by FHWA.

In addition to direct estimation, FHWA conducted a simulation approach where multiple rounds of estimation were done to get a standard error to account for the uncertainty during the process. However, as FHWA suggested, this step is computationally intensive and should be improved in future studies.

1.2.3 Methodology limitations

Upon reviewing the FHWA methodology, the following limitations were identified. First, the future success of implementing the FHWA methodology for other DOTs/MPOs depends on the quality and availability of the data. Critical information on vehicles in a crash is needed such as the number of occupants in the crashed vehicle, vehicle type, etc. In addition, data containing roadways, traffic, and location attributes must be acquired for the calculation process. For agencies with limited data availability, FHWA's methodology might not be fully implemented, and the process might produce inaccurate estimates. Second, FHWA's methodology does not distinguish occupancy by trip purpose which affects occupancy. In the future, the methodology could be improved to address these limitations.

1.3 Review of state-of-the-art practices of VOF estimation

A review of the literature suggested VOF is mainly estimated through travel surveys or travel demand models. This section lists some examples in Florida Standard Urban Transportation Model Structure (FSUTMS) models as well as studies from other agencies.

VOF has been greatly utilized during the regional travel demand model (TDM) development and validation process. In most of the trip-based models, once the transit and non-motorized trips are separated from the total trips, the remaining person trips are converted into vehicle trips using VOFs for each trip purpose. Then the trip assignment step assigns the calculated vehicle trips and transit trips on network. In most of the activity-based models (ABM), the role of VOF transitioned from a major input to a validation target for shared-rides, as detailed activity and travel and travel choices across the entire day for individuals are explicitly modeled. As more MPOs and local agencies explore HOV lanes for congestion relief, the ability of travel demand models to appropriately estimate or reliably forecast drive-alone and shared-ride activities becomes increasingly important.

There are five main sources to obtain VOFs when developing or validating the regional TDM:

- NCHRP Report 365: Travel Estimation Techniques for Urban Planning
- NCHRP Report 716: Travel Demand Forecasting Parameters and Techniques
- Local Household Travel Survey
- NHTS Data
- Other/similar regional models

In general, VOFs are provided in the Mode Choice module, before the Highway Assignment by three trip purpose classifications: home-based work (HBW), home-based other (HBO), and non-home-based (NHB). The use of VOFs in the trip-based models is described below:

- In the District One Regional Planning Model (D1RPM), VOFs are compared with household travel time surveys to calibrate the mode choice model and also applied in the DIURNAL FACTORS step to develop drive-alone, shared-ride, and truck vehicle trips.
- In the Central Florida Regional Planning Model (CFRPM7), after the non-motorized and transit trips are deducted from the person trip table, VOFs are used to convert the remaining person trips to vehicle trips for assignment.
- In the Gainesville MPO model, VOFs are used to process person-trips matrices to automobile matrices for assignment.
- In the Tampa Bay Regional Planning Model (TBRPM), personal trips are converted to vehicle trips by applying the VOFs by trip purpose by the highway mode chosen.

Upon reviewing FSUTMS models, only the TBRPM from the District 7 (D7) model provides direct VOF values, and these values are summarized by county in **Table 1**.

Table 1 VOF values from the D7 model

County Name	District	Travel Demand Models (TDM)	TDM VOF
Citrus	7	TBRPM v9.0 (2015 Base Year)	Countywide overall - 1.448
Hernando	7		Countywide overall - 1.441
Hillsborough	7		Countywide overall - 1.434
Pasco	7		Countywide overall - 1.437
Pinellas	7		Countywide overall - 1.439

VOFs are also largely utilized in the travel demand models nation-wide. The table below summarizes the VOFs from the NCHRPM 716 report and the DeKalb Sycamore Area Transportation Study travel demand model (DSATS TDM). Regional TDMs often use the parameters from NCHRP Report 716 as a starting point and apply adjustments when local data is available.

Table 2 NCHRPM 716 and DSATS TDM VOF information

Trip Purpose	NCHRP 716	DSATS TDM
HBW	1.10	1.11
HB-School	1.14	1.44
HBO	1.75	1.67
NHB	1.66	1.66

In addition to travel demand models, some agencies conducted independent studies on VOF estimation. Arizona Department of Transportation conducted a study to understand a variety of factors and their effects on vehicle occupancy. Several approaches were used to get the vehicle occupancy information including field observations, home interviews, and travel surveys. The study concluded that trip purpose was the most significant factor to impact vehicle occupancy. The factors least impacting vehicle occupancy were determined to be trip distance and household income. The study further concluded that the vehicle occupancy varies by time of day, showing low values during AM and PM hours when most of the trips were home-work-based trips.

Fayetteville Area Metropolitan Planning Organization conducted a vehicle occupancy rate study as required by the North Carolina Department of Transportation. The study was conducted in 2018 on eight principal arterials, six minor arterials, and one freeway to estimate vehicle occupancy counts. Observations were done for one week to consider the daily variations that might occur. Occupants of cars, vans, and pickups were counted over a 15-minute interval each day. The study observed that the Central Business District (CBD) had a higher vehicle occupancy rate than the non-CBD area. It also showed that occupancy rate demonstrates time-of-day and day-of-week variability.

1.4 Crash analysis reporting system (CARS)

Upon reviewing data to be used for the implementation of FHWA's methodology in Florida, traffic data from FHWA (i.e., TVT, HSS, and NHTS) will be used. In addition, two safety data sources available to FDOT were explored – Florida Crash Analysis Reporting System (CARS) and Florida Signal Four Analytics (S4) database. While both of these datasets provide abundant crash information for the State of Florida, the S4 dataset lacks information which is critical to the calculation process - the vehicle occupancy and drivers' socioeconomics. Therefore, CARS data is used for the implementation of the FHWA approach.

Maintained by the FDOT State Safety Office, CARS data contains all information recorded on the long form Florida Traffic Crash Report including individual crash attributes and individual vehicle/passenger/driver information. Specifically, the CARS data has more than 300 variables that describe the time of the crash, the site, the traffic control, the geometric conditions, as well as driver/occupant/bicyclist/pedestrian characteristics. **Appendix B** provides the data structure of the CARS data reporting. The CARS variables can be sorted into three categories: crash, vehicle, and non-motorists. There are other advantages of using CARS data including:

- The interactive CARS data website generates crash summary reports with percentages of contributing factors based on user-defined queries
- The dataset provides crash rate analysis to identify high crash roadway segments and intersections by crash category on the state highway system, and
- The website allows for exporting data and analyses in .pdf, .csv and MS Excel formats.

1.5 Source Book measures

The FDOT Source Book is produced by the Florida Department of Transportation, Forecasting and Trends Office. It is an annual multimodal performance report which describes the current mobility conditions on roadway networks statewide. It also provides performance reporting of airports, railways, transit, seaports, and spaceports. As part of the implementation of this study for FDOT, two person-related mobility measures from the FDOT Source Book, which use VOF, will be recalculated. This section gives a brief overview of these two measures. **Appendix C** provides the VOF values currently used in the FDOT Source Book, derived from the 2009 NHTS database.

1.5.1 Person miles traveled

Per FDOT Source Book (2022), Person Miles Traveled (PMT) is defined as the miles each person travels in a vehicle during the peak hour, daily or annually. It is computed by multiplying VMT by the average vehicle occupancy. Average vehicle occupancies were provided on a county-by-county basis.

$$\sum (\text{Segment Length} \times \text{Volume} \times \text{Average Vehicle Occupancy})$$

1.5.2 Person hours delayed

Per FDOT Source Book (2022), Person Hours of Delay is calculated as the product of directional hourly volume, average vehicle occupancy, and the difference between travel time at “threshold” speeds and travel time at the average speed. The thresholds are based on Level of Service (LOS) B, as defined by FDOT.

$$\sum (\text{Daily or Peak Travel Time} - \text{Travel Time of LOS B}) \times \text{Vehicle Volume} \times \text{Average Vehicle Occupancy}$$

2 Section II: VOF Estimation Step-by-Step for Florida

2.1 Data processing

2.1.1 Subpopulation stratification

As described in the methodology review, one bias in determining the occupancy distribution stems from the fact that the crash sample might not represent the vehicle traffic on the road. To account for the fact that some groups might be over or under represented from the crash data, a post-stratification was conducted. Several sources were used to represent Florida traffic including NHTS and FDOT Reports of Highway Mileage and Travel (DVMT). **Table 3** shows the list of variables that are used for the subpopulation stratification. Other variables including seasons, time of day, and day of week have also been considered but were dropped due to data availability and statistical significance in later steps.

Table 3 List of variables for subpopulation

Variable Category	Variables	Source
Gender	Male Female	CARS data
Age	<=24 <=34 <=44 <=54 <=64 >=65	
FHWA Functional Classification	Principal Arterial Interstate Principal Arterial Expressway Principal Arterial Other Minor Arterial Major Collector Minor Collector Local	FDOT Reports of Highway Mileage and Travel (DVMT)
Location	Urban Rural	
County	all Florida counties	

The subpopulation process grouped crashes by creating unique combinations from variables of each group – for example, a subpopulation group could be identified as a male driver who is 34-45 years old and drives on a rural major collector in Brevard County. The subpopulation groups were used to calculate the prevalence of vehicle miles traveled.

2.1.2 Crash analysis reporting system (CARS) preprocessing

Maintained by the FDOT State Safety Office, CARS data contains a wide range of information on a crash including crash attributes and vehicle/driver/passenger information. CARS data was downloaded through the CARS database website[1]. The process of preprocessing CARS crash data is discussed below:

1. Navigate to CARS crash data webpage (**Figure 2**)

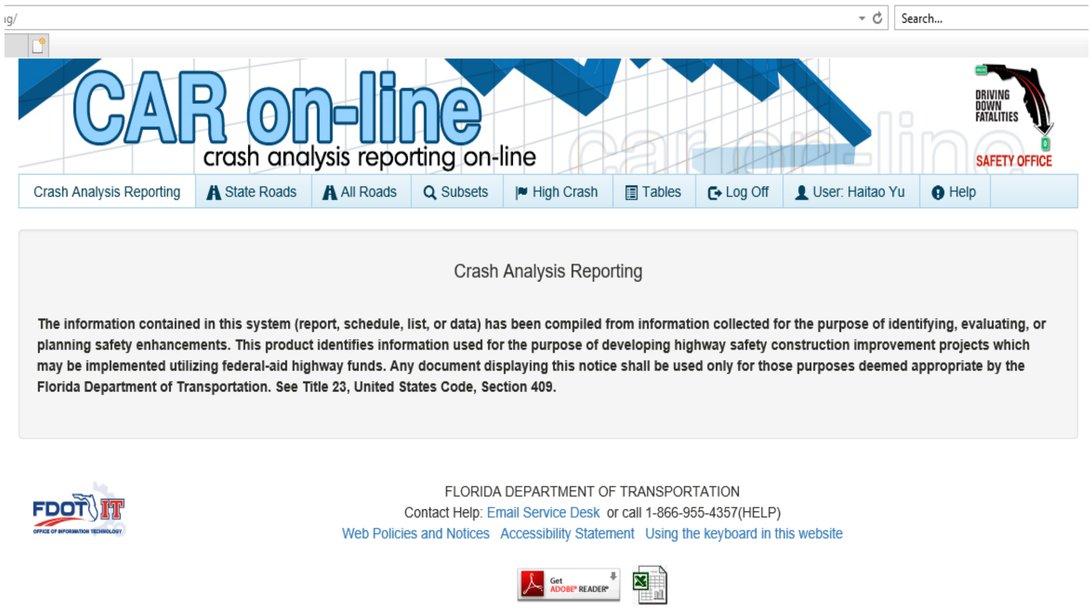

Figure 2 CARS crash data main page

2. Navigate to the All Roads Tab (**Figure 3**)

[1] https://fdotwp2.dot.state.fl.us/CrashAnalysisReporting/

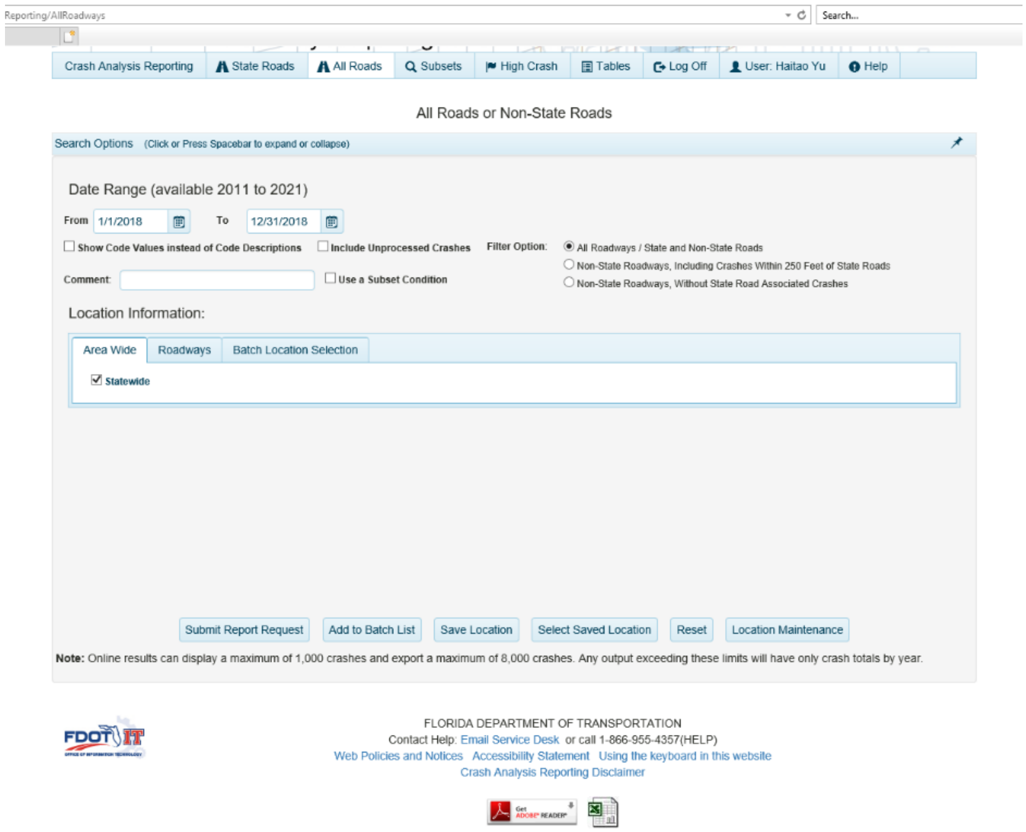

Figure 3 CARS crash data selection page (example)

3. In the Data Range – choose the data range for the download of the data (the data range for this study is from 01/01/2018 to 12/31/2018)
4. In the Location Information – Area Wide Tab – choose the geographic unit for the crash data to download. This option allows data to be extracted by county level and statewide level. The geographic unit, statewide, should be selected for all counties.
5. In the Filter Option – this option allows for the selection of crashes that are associated with different roads including all roads, state, and non-state roads. All roads should be selected – the All Roadways – State/Non-State Roads
6. After the download settings, click on the Add to Batch List button to extract the data (**Figure 4**).

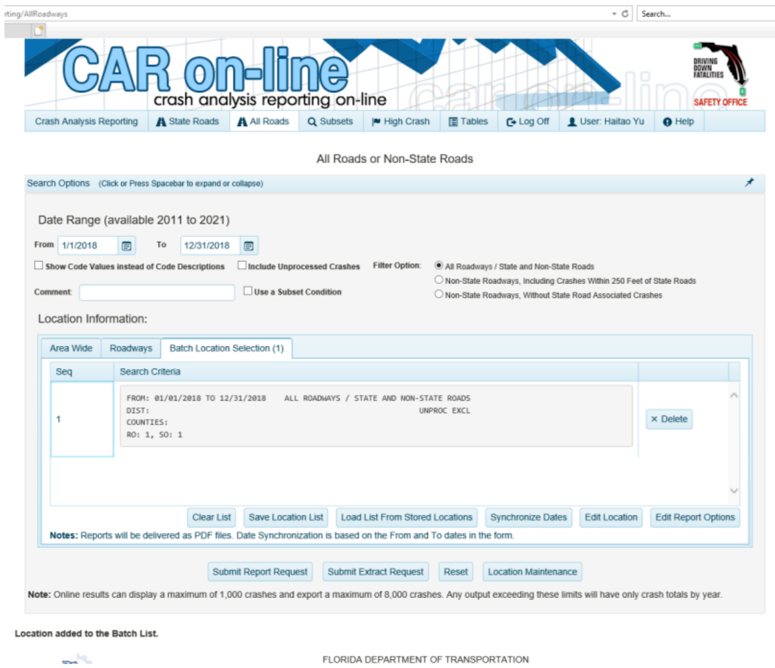

Figure 4 CARS crash data download page

7. Click on Submit Extract Request to start the download process. This will lead to the selection of different crash data files (including the files for crash level, vehicle-driver level, and non-motorist). After the selection and data preparation, an email will be sent to the address linked to the CARS database which will provide the download link for all available files (it is recommended that all these steps be conducted in Internet Explorer browser). Three files are usually included in the file after downloading: crash information, non-motorist information, and vehicle-driver-passenger information. For these next steps, the vehicle-driver-passenger spreadsheet was used.
8. In addition to CARS data, the following datasets were collected:
    a. FDOT functional classification GIS data[2] – this data is used to assign roadway functional classification to each crash. It should be noted that original CARS data contains functional classification information. However, many crash records have missing information, and it is recommended that a GIS approach should be used to get the roadway information.
    b. Florida urban area – this data is used to assign urban and rural information for each crash.
    c. Florida county – this data is used to assign county information for each crash.
9. Clean CARS data. The following steps, recommended by FHWA, were used to clean CARS data, remove:

[2] https://www.fdot.gov/statistics/gis/default.shtm this website uses *guest* as download username and password.

a. Crash that has missing occupancy
b. Crash that has no socio-economic information on driver
c. Duplicate information
d. Parked cars with 0 occupancy
e. Pedestrian and bicycle records that don't involve vehicles

10. Upon reviewing the downloaded CARS data, the following additional steps were used for cleaning:
    a. Original CARS crash data from the database has positive longitude values which should be negative for the western hemisphere. Therefore, the column from CARS data (CAR_LONG_NUM) were multiplied by -1.
    b. Some crashes have incomplete latitude and longitude information from the original dataset (e.g., most of these records have 0s for the latitude and longitude columns). These crashes were excluded for calculation.
    c. Geocode CARS data
    d. Crashes were geocoded in ArcGIS by using the "Make XY Event Layer" tool.
    e. Assign CARS data with spatial attributes
    f. Spatial join was conducted to determine which county the crashes are in, and whether they are within an urban area. The method used was "within". If the crashes were located within the urban boundary, they were labeled as urban crash. Otherwise, crashes were labeled as rural crash. The same approach was applied to the spatial join between county data and crash data.
    g. Spatial join was also conducted to assign road functional classifications to crash data (**Table 4**). Several bands of distance tolerance were tested, and 75 ft. was used as the spatial join distance.

Table 4 FDOT functional classifications

FDOT Code	Functional classification
01	Principal Arterial Interstate Rural
02	Principal Arterial Expressway Rural
04	Principal Arterial Other Rural
06	Minor Arterial Rural
07	Major Collector Rural
08	Minor Collector Rural
09	Local Rural
11	Principal Arterial Interstate Urban
12	Principal Arterial Freeway and Expressway Urban
14	Principal Arterial Other Urban
16	Minor Arterial Urban
17	Major Collector Urban
18	Minor Collector Urban
19	Local Urban

2.1.3 Prevalence estimation with iterative process fitting

Prevalence is the proportion of the vehicle miles traveled (VMTs) by a subpopulation to VMTs by the overall population. As suggested by the FHWA methodology, a direct estimation of prevalence for subpopulations from different data sources will not likely give statistically valid results especially for smaller subpopulation groups with limited sample sizes. Raking, also called iterative proportional fitting (IPF), is recommended by FHWA to address this issue. The raking process is described as follows[3]:

- Create unique combinations of individual variables from each variable group as listed in **Table 3**.
- Initialize joint estimation with a seed matrix with no a priori expected proportions (i.e., equal weights with 1)
- Assign marginal distribution to each known variable combination to calculate the full joint distribution. Vehicle miles traveled totals for county, functional classification, and urban/rural were extracted from the FDOT Reports of Highway Mileage and Travel (DVMT).

2.1.4 Vehicle occupancy distribution estimation

This step estimates the crash distribution from the CARS database, Pr (V0=*v*| *SubPopulation, Crash*). The empirical estimates from CARS data are unreliable for small subpopulations and will introduce estimate bias, especially when the subpopulation has limited number of crashes or no crashes. To avoid this issue, a Logistic modeling approach is suggested by FHWA to estimate the occupancy distribution:

[3] Raking could be performed by a variety of computer packages such as the ipfr package in an R environment.

$$\Pr(VO = v \mid SubPop_i, Crash) = f_v(x_{1i}, x_{2i}, \ldots, x_{pi})$$

Where x_{1i}, … , x_{ij}, is a vector of categorical variables representing subpopulation groups. In addition, the function takes a form:

$$f_v(x_{1i}, x_{2i}, \ldots, x_{pi}) = \sigma(\beta_0 + \sum \beta_j x_{ji})$$

Where σ is the logistic sigmoid function, which constrains the probability estimates to be between 0 and 1. The model was performed in an R environment. All the study variables used from subpopulations including urban/rural, socioeconomics, counties, and functional classification were statistically significant, and no additional variables were added/removed (**Figure 5** shows the model fit between fitted values and actual values which follows a diagonal line).

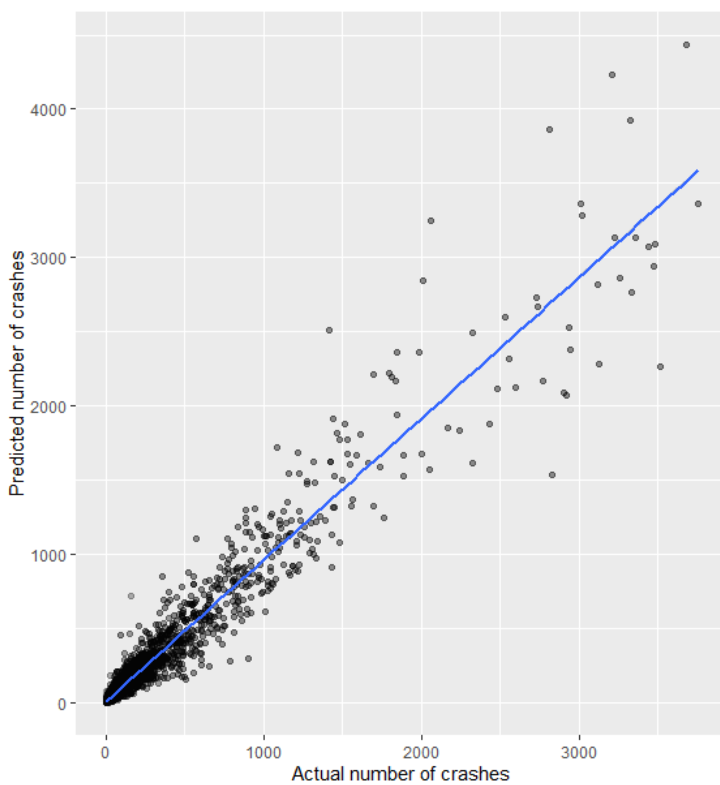

Figure 5 Actual number of crashes vs predicted number of crashes

2.1.5 Occupancy bias estimation

This step estimates the occupancy bias based on the Bayes Theorem to account for the estimation bias from different distributions between general population and crashes:

$$Bias(SubPop, VO = v) = \frac{\Pr(Crash \mid SubPop, VO = v)}{\Pr\,(Crash \mid SubPop)} = \frac{\#(Crash \mid SubPop, VO = v)}{\#\,(Crash \mid SubPop)} * \frac{VMT(SubPop)}{\mathrm{VMT}(SubPop, VO = v)}$$

Similar to distribution estimation, some subpopulation groups might have a very limited number of crash samples or zero crashes. A Poisson Regression approach as an alternative was implemented. For each vehicle occupancy group, the estimation process involves constructing sub-models with Poisson distribution of crash count with the log of the mean:

$$\log\left(\frac{\#(Subpop, Crash) * \mathrm{VMT}(SubPop, VO = v)}{VMT(SubPop)}\right) + f(x_{ij}, x_{i+1j}, \ldots, x_{pj})$$

the model was performed in an R environment. All the study variables are statistically significant, and no additional variables were removed/added.

2.1.6 Regional aggregation

Counties that are less populated (i.e., counties in rural area and not within a metropolitan planning organization boundary) were aggregated to account for the small sample issue (Table 5). The aggregation was based on the following criteria:

- Counties should be within the same FDOT District
- Counties should have small sample sizes of crashes
- Counties should not be located within any metropolitan planning organization area (Non-MPO counties).

Table 5 List of counties for aggregation

District	Counties
District 1	Collier and Lee
District 2	Baker, Bradford, Columbia, Dixie, Gilchrist, Hamilton, Lafayette, Levy, Madison, Putnam, Suwannee, Taylor, and Union
District 3	Calhoun, Franklin, Gulf, Holmes, Jackson, Liberty, and Washington

2.2 Results

2.2.1 Vehicle occupancy factors by county

Table 6 shows the VOF estimation results as well as results for aggregation (**Appendix D** shows full details of occupancy factor results and comparison). **Figure 6** shows the average passenger vehicle occupancy factors by county. It could be seen that non-MPO counties usually have higher occupancy than MPO counties.

Table 6 Vehicle occupancy estimation results

County Name	Vehicle Occupancy Factor (NHTS 2009)[1]	Calculated Vehicle Occupancy Factor (2018)
Alachua	1.77	1.74
Baker	1.72	1.91
Bay	1.52	1.64
Bradford	1.72	1.76
Brevard	1.58	1.63
Broward	1.55	1.50

County Name	Vehicle Occupancy Factor (NHTS 2009)[1]	Calculated Vehicle Occupancy Factor (2018)
Calhoun	1.53	1.54
Charlotte	1.55	1.67
Citrus	1.63	1.68
Clay	1.27	1.42
Collier	1.59	1.71
Columbia	1.72	1.81
Desoto	1.81	1.85
Dixie	1.68	1.79
Duval	1.61	1.54
Escambia	1.90	1.58
Flagler	1.71	1.70
Franklin	1.53	1.51
Gadsden	1.29	1.66
Gilchrist	1.68	1.74
Glades	1.81	1.73
Gulf	1.53	1.57
Hamilton	1.68	1.73
Hardee	1.81	1.78
Hendry	1.81	1.81
Hernando	1.62	1.73
Highlands	1.81	1.72
Hillsborough	1.69	1.69
Holmes	1.77	1.76
Indian River	1.79	1.70
Jackson	1.77	1.77
Jefferson	1.53	1.70
Lafayette	1.68	1.69
Lake	1.48	1.49
Lee	1.48	1.65
Leon	1.57	1.62
Levy	1.68	1.78
Liberty	1.53	1.69
Madison	1.53	1.65
Manatee	1.73	1.66
Marion	1.75	1.76
Martin	1.92	1.71
Miami-Dade	1.76	1.52
Monroe	1.76	1.84
Nassau	1.78	1.78
Okaloosa	1.60	1.61
Okeechobee	1.79	1.89
Orange	1.70	1.69
Osceola	1.60	1.72
Palm Beach	1.55	1.55
Pasco	1.57	1.63
Pinellas	1.44	1.54
Polk	1.73	1.67
Putnam	1.71	1.68
Santa Rosa	1.51	1.65
Sarasota	1.46	1.63

County Name	Vehicle Occupancy Factor (NHTS 2009)[1]	Calculated Vehicle Occupancy Factor (2018)
Seminole	1.64	1.56
St. Johns	1.84	1.74
St. Lucie	1.47	1.52
Sumter	1.63	1.66
Suwannee	1.68	1.80
Taylor	1.53	1.67
Union	1.72	1.66
Volusia	1.66	1.65
Wakulla	1.53	1.69
Walton	1.77	1.76
Washington	1.77	1.69
Regional aggregation[2]		
District 1	-	1.65
District 2	-	1.72
District 3	-	1.72

Notes: 1. These values are from 2009 National Household Travel Survey 2009 version and currently applied in the Source Book performance measure calculation. 2. No baseline VOF values could be used

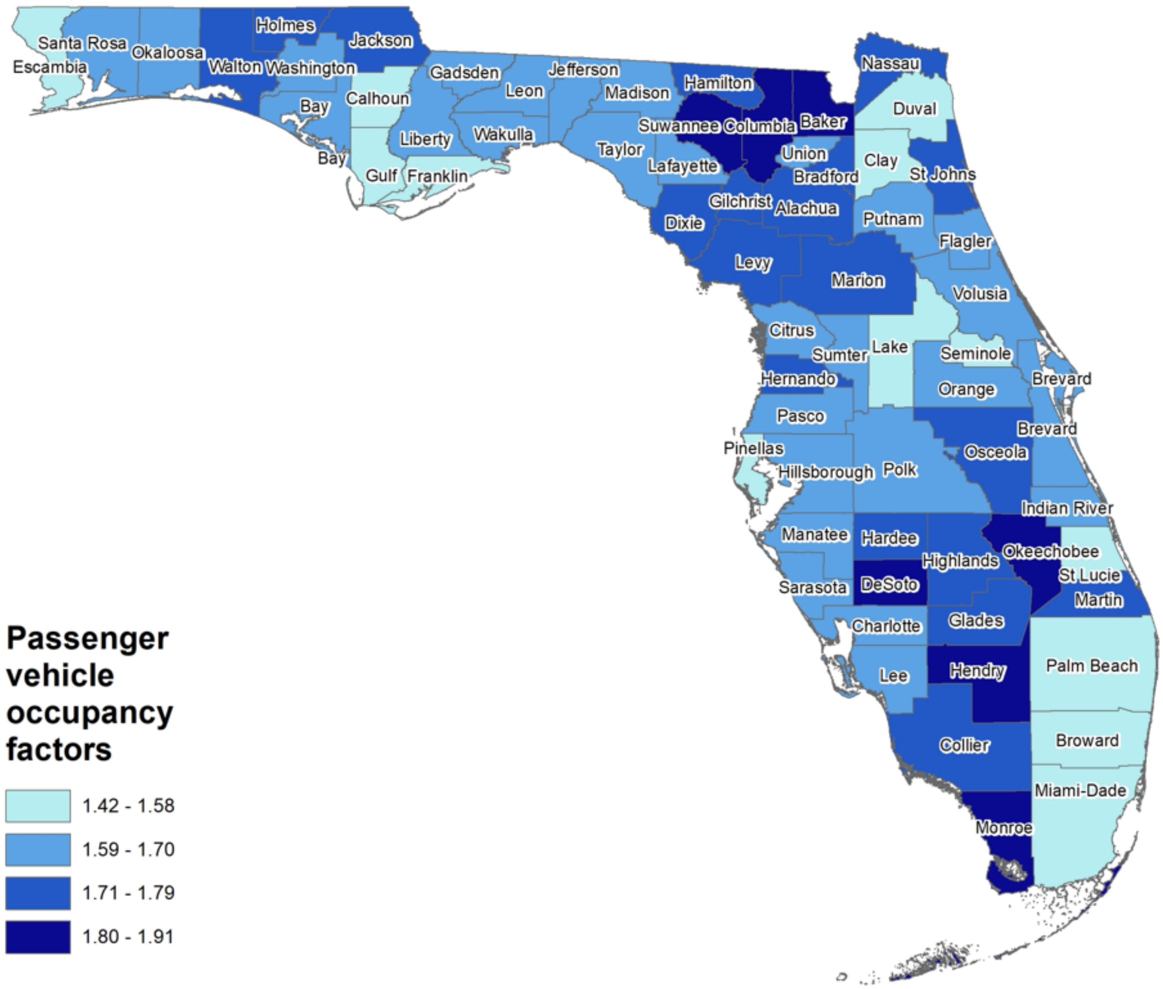

Figure 6 Average passenger vehicle occupancy factors by county

2.2.2 2021 Source Book calculation comparison

The new VOF values were implemented to recalculate personal movement measures from the 2021 Source Book. The data input and calculation methodology were based on the 2021 Source Book calculation.

Person miles traveled - Per FDOT Source Book (2022), Person Miles Traveled (PMT) is defined as the miles each person travels in a vehicle during the peak hour, daily or annually. It is computed by multiplying VMT by the average vehicle occupancy. Average vehicle occupancies were provided on a county-by-county basis.

$$\sum (\text{Segment Length} \times \text{Volume} \times \text{Average Vehicle Occupancy})$$

Person hours delayed - Per FDOT Source Book (2022), Person Hours of Delay (PHD) is calculated as the product of directional hourly volume, average vehicle occupancy, and the difference between travel time at "threshold" speeds and travel time at the average speed. The thresholds are based on LOS B, as defined by FDOT.

$$\sum (\text{Daily or Peak Travel Time} - \text{Travel Time at LOS B}) \times \text{Vehicle Volume} \times \text{Average Vehicle Occupancy}$$

The following measures were calculated – weekday peak hour PMT and PHD, daily PMT and PHD, and Yearly PHD. Results of the output based on new and current Source Book VOFs could be found in **Appendix E**.

2.3 Summary and recommendation

This effort was conducted as a pilot study to help FDOT better understand FHWA's most recent approach to updating vehicle occupancy factors and facilitate the implementation of this approach. Crash data and VMT information were used to produce 2018 vehicle occupancy factors. The following tasks were completed: literature review, methodology framework development, and occupancy factor development. For literature review, the FHWA methodology, travel demand models by different FDOT Districts, travel surveys, and other relevant data sources have been reviewed and summarized. Based on the review, a methodology framework was then developed for Florida. As part of this, potential data sources that can be used in Florida were identified. The methodology framework could be used to estimate vehicle occupancy factors regularly when refreshed data becomes available. As a methodology demonstration, 2018 VOF tables were developed, and Source Book person movement related measures were estimated with the new VOF values.

Based on the pilot study results, the team summarized the methodology's limits and developed several recommendations for further implementing the FHWA methodology in Florida.

Implementation Recommendation

- The approach as proposed appears to produce credible results for application in determining Florida VOF estimates – the FHWA methodology framework identifies crash data and VMT information as key variables. These datasets are generally available and updated annually with FDOT. It is recommended that a regular update effort be established when data becomes available.
- Distinguish different types of occupancy factors – occupancy factors could be estimated in different ways and have multiple uses. It should be noted that occupancy factors that are used in travel demand models usually comes from travel surveys with a focus on Florida residents and do not account for pass-by trips within a region. These numbers are inconclusive for the understanding of person movement. Using crash data with bias adjustments, on the other hand, could reflect an accurate picture for this purpose.

Methodology limits

Several methodology limits have been identified:

- Data availability for less populated regions – it was identified that for some counties in rural areas, the crash sample size is limited. This pilot study used statistical regression models to estimate subpopulation sample as suggested by the FHWA methodology. In addition, regional aggregation was used as an alternative to produce occupancy factors.
- Subpopulation VMT – This information was used to assign weights to each subpopulation group during the calculation process. The IPF, or raking process, was used to integrate VMT information from multiple data sources. While this approach has been

widely used in many disciplines, further effort should be made to get direct estimates for subpopulation VMT.

- Lack of ground truth comparison – Vehicle occupancy factors from the 2009 National Household Travel Survey (NHTS), also applied in annual FDOT Source Book update, have been used as the ground truth comparison.

3 Section III: Transit Occupancy Factors Calculation Literature and Data Review

3.1 FHWA methodology review

3.1.1 Key concepts

This section defines some key concepts from the FHWA approach in an alphabetical order.

Commuter bus: According to 2019 NTD Policy Manual, a commuter bus is local fixed route bus transportation that mainly connects central city with outlying areas. Commuter buses usually have limited stops and at least five miles of closed-door service.

Commuter rail: A commuter rail provides urban passenger train service consisting of local travel and operates between a central city and outlying areas. Service must be operated on a regular basis within urbanized areas or between urbanized areas and their outlying areas.

Heavy rail: An electric railway that operates service on exclusive right-of-way. The service is often provided by long trains of six to eight cars or more and operates relatively short distances between stops within a city and its immediate suburbs.

Motor bus or bus: Motor bus or bus refers to, according to 2019 NTD Policy Manual, a transit mode using rubber-tired passenger vehicles, which operate on fixed routes and schedules. The vehicles are powered by a gas or electric motor.

Motorail/Automated guideway transit: An electrically powered mode that operates in an exclusive guideway. The service is characterized by either Monorail systems with automated or human-operated vehicles or by people-mover systems with automated operation over relatively short distances.

Passenger miles: Transit passenger-miles are the cumulative sum of distance ridden by each transit passenger.

Rapid bus: According to the 2019 NTD Policy Manual, a rapid bus refers to a fixed-route bus system that

- operates over 50 % of its route in dedicated right-of-way (ROW) for transit during peak hours,
- has defined stations and provides schedule and route information,
- uses active signal priority and queue jump lanes,
- has short headways and bidirectional services, and
- applies a separate and consistent brand to identify stations and vehicles.

School bus: School bus is a passenger vehicle which is primarily used to transport pre-primary, primary, or secondary school students between home and school.

Streetcar: A mode of public transportation mainly operating routes on streets in mixed traffic with an antique rail car.

Urbanized area: An urbanized area is an incorporated area with a population of 50,000 or more that is designated as such by the U.S. Department of Commerce, Bureau of the Census.

Vehicle revenue miles: Vehicle revenue miles refer to transit vehicle miles traveled in revenue service. This measure excludes transit miles traveled for deadhead service such as vehicle maintenance, operator training, etc.

3.1.2 Overall methodology framework

The bus, in the FHWA methodology, is defined as Class 4 from FHWA's 13 Vehicle Category Classification (**Figure 7**). The total average bus occupancy from the FHWA methodology (for the full report, see **Appendix F**) for these three groups can be estimated as below:

$$\text{Average vehicle occupancy} = \sum\nolimits_n VRMT_n * AVO_n / \sum\nolimits_n VRMT_n$$

Where n= 1, 2, 3, …, n for different modes of buses, Vehicle Revenue Miles Traveled (VRMT) is the annual revenue miles traveled, and AVO is the average vehicle occupancy for each mode of buses. The FHWA's approach estimates the average vehicle occupancy for each bus mode with VRMT as the weights. The general framework of FHWA's methodology is shown in **Figure 8**. As for VRMT for each transit mode, FHWA proposed an approach as below:

$$\text{VRMT}_n = \text{Average VRMT}_n * \text{Vehicle Count}_n \text{ (}n\text{ for each mode of transit)}$$

In discussions with FDOT, it was determined that school buses and motorcoaches would not be considered for this effort for the following reasons. First, school bus data is not available for the geographic granularity of this study. Second, this study focuses on developing an approach to understand people movement within a specific geographic region. Since services of motorcoaches usually span multiple regions, integrating motorcoaches into the occupancy factor is beyond the scope of this study.

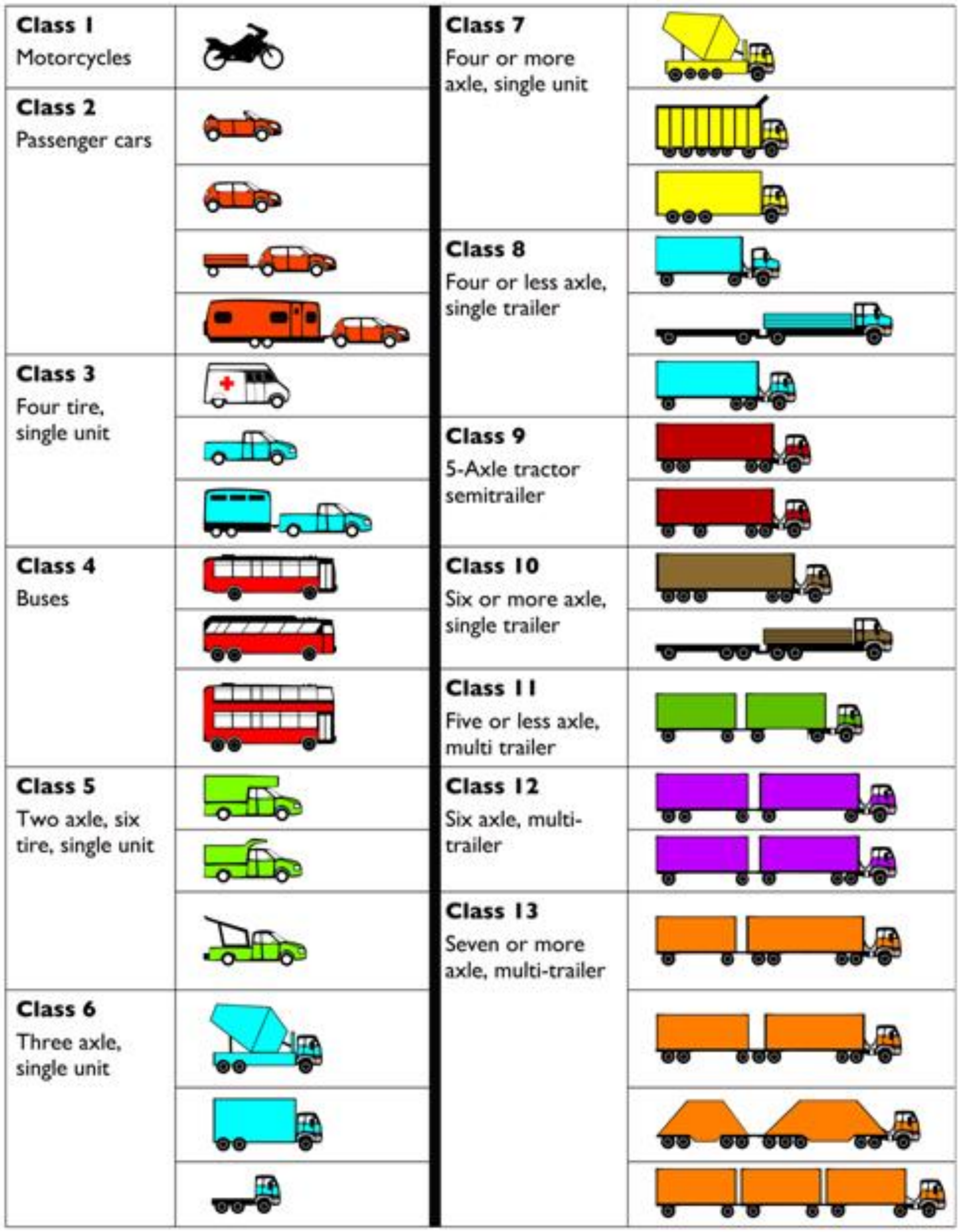

Figure 7 FHWA 13 Vehicle Category Classification (Source: Federal Highway Administration)

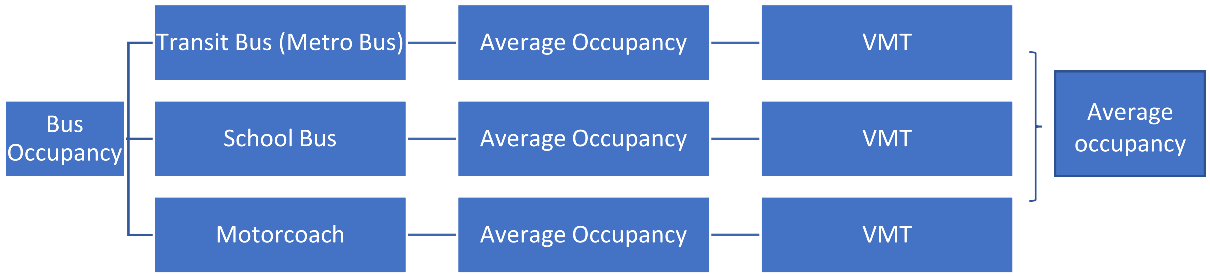

Figure 8 General Framework for FHWA methodology

3.2 Data Sources

3.2.1 National Transit Database (NTD)

The main database that FHWA used is the Federal Transit Administration (FTA) NTD. The most recent year of the database is 2020. All public bus operators that are receiving federal funding are required to report operational and financial data annually. Passenger and vehicle miles traveled, the two variables used in the FHWA methodology, are reported in NTD.

3.2.2 NTD database structure

In the NTD database, transit reporting is categorized as *Full Reporter, Reduced Reporter,* and *Rural Reporter.* FHWA suggested the *Full Reporter* as the data source for calculation purposes since this type of reporter has been fully certified by each agency and subjected to audit according to the FHWA requirements.

The FHWA methodology considers the following modes of transit as reported in NTD:

- Commuter Bus (CB)
- Demand Responsive (DR)
- Motor Bus (MB)
- Rapid Bus (Bus Rapid Transit) (RB)
- Trolley Bus (TB)

3.3 Occupancy calculation

The occupancy calculation uses two main data inputs: passenger miles traveled (PMT) and vehicle revenue mile (VRM). The general calculation process could be expressed with the following equations:

$$AVO = \text{average ridership} + \text{driver}$$

$$AVO = PMT/VMT + 1$$

Where $PMT\ and\ VMT$ are the total PMT and VMT for the specific mode for each transit agency.

As for the average transit occupancy within a region, the calculation is expressed as:

$$\text{Average vehicle occupancy} = \sum_n VMT_n * AVO_n / \sum_n VMT_n$$

Where n= 1, 2, 3, …, n for different modes of buses.

It should be noted that the FHWA methodology used a statistical regression model to derive regions with no data. This part of the calculation was not reviewed since no missing data were reported for Florida.

4 Section IV: Transit Occupancy Step-by-Step for Florida

4.1 Transit occupancy calculation

Maintained by the Federal Transit Administration (FTA), the NTD database serves as the transit data repository about the financial, operation, and asset conditions of the nation's transit systems. The database is designed to support planning efforts at local, state, and regional levels and help agencies to perform trend analyses. All public bus companies that receive federal funding are required to report annual financial and operational data to the FTA. A number of transit measures are reported including system ridership, Vehicle Revenue Miles (VRM), Passenger Miles Traveled (PMT), etc. The NTD website provides reference to NTD database and supporting materials [4].

The process of transit data collection is discussed below:

1. Transit data was downloaded through NTD database website [5]
2. Navigate to NTD webpage (**Figure 9**)

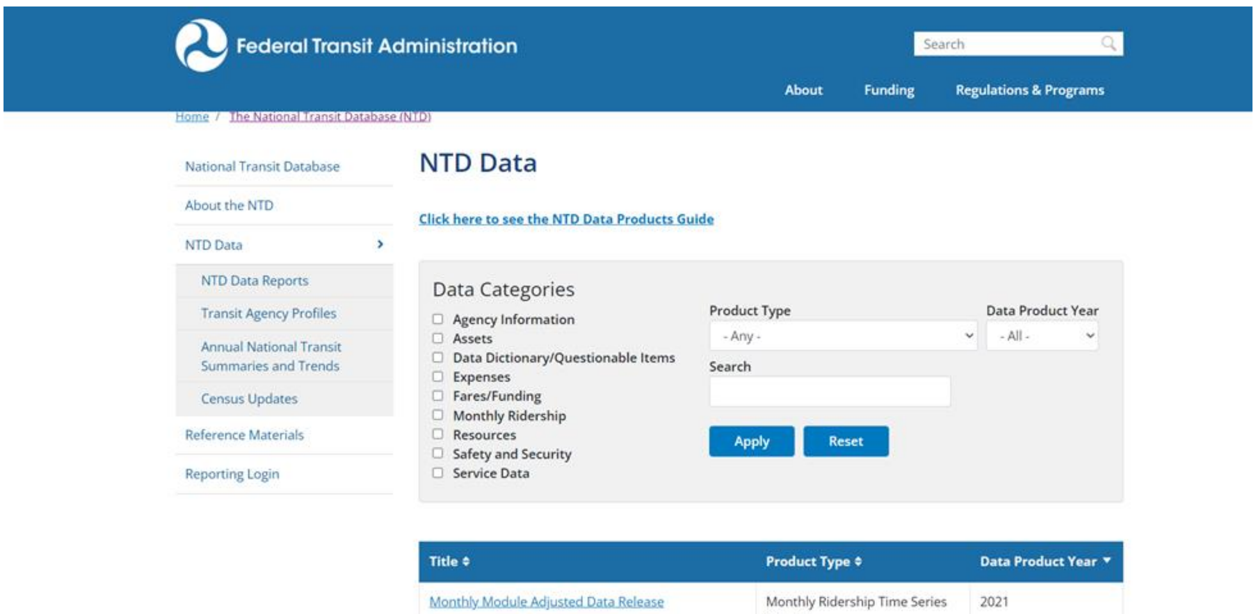

Figure 9 NTD database webpage

3. To extract urbanized measures, download the Annual Database Federal Funding Allocation data (for a complete structure of all NTD database file, refer to **Appendix G**)
4. Agencies that provide transit reports are classified into three types of reporters – Full Reporter, Reduced Reporter, and Rural Reporter. The FHWA methodology suggests to only use the *Full Reporter* because this group has been certified and

[4] The National Transit Database: https://www.transit.dot.gov/ntd

[5] 2018 NTD data was used to be consistent with vehicle occupancy factor calculation. The methodology could be applied to calculations with other year's data.

is subjected to audit according the FHWA requirement. Therefore, when cleaning data, the *Full Reporter* should be selected.

5. In discussion with the FDOT, the following modes for urbanized area in **Table 7** were used,

Table 7 Transit mode

Type	NTD Mode	Full Name	Example
Non-Rail	MB	Bus	- LYNX bus (Orange County, Florida) - StarMetro (City of Tallahassee, Florida)
	RB	Bus Rapid Transit	- LYNX bus (Orange County, Florida)
	CB	Commuter Bus	- 95 Express Bus (Broward County Transit and Miami-Dade Transit)
Rail	MG	Monorail/Automated guideway transit	- Jacksonville Skyway (Jacksonville Transportation Authority)
	CR	Commuter Rail	- SunRail (Orlando, Florida)
	HR	Heavy Rail	- Metrorail (Miami-Dade County)
	SR	Streetcar	- TECO Streetcar (Tampa, Florida)

*: for a full description of the modes included, refer to ***Section III: Transit Occupancy Factors Calculation Literature and Data Review, FHWA methodology review, Key concepts***

6. To extract urbanized area data, remove any data records for *Florida Non-UZA.*
7. PMT and VRM are used, and the average occupancy for a specific transit mode could be expressed as

$$AVO = PMT/VRM + 1$$

Where $PMT \text{ and } VRM$ are the total PMT and VMT by each transit agency and mode within the urbanized area. As for the average transit occupancy urbanized area (**Table 8**), the calculation weighted by the vehicle revenue miles is expressed as:

$$\text{Average vehicle occupancy} = \sum_n VRM_n * AVO_n / \sum_n VRM_n$$

Table 8 List of urbanized area in NTD data

UZA Name
Bonita Springs, FL
Cape Coral, FL
Deltona, FL
Fort Walton Beach-Navarre-Wright, FL
Gainesville, FL
Jacksonville, FL
Kissimmee, FL
Lakeland, FL
Leesburg-Eustis-Tavares, FL
Miami, FL
North Port-Port Charlotte, FL
Ocala, FL
Orlando, FL

Palm Bay-Melbourne, FL
Palm Coast-Daytona Beach-Port Orange, FL
Pensacola, FL-AL
Port St. Lucie, FL
Sarasota-Bradenton, FL
Sebastian-Vero Beach South-Florida Ridge, FL
Tallahassee, FL
Tampa-St. Petersburg, FL
Titusville, FL
Winter Haven, FL
Zephyrhills, FL

4.2 Transit occupancy factors by urbanized area

Table 9 shows the estimation results for transit occupancy factors by urbanized area and by mode.

Table 9 Average transit occupancy factor by urbanized area and mode

Group	Urbanized Area	Average TOF	Mode	TOF
Rail Mode	Jacksonville, FL	6.4	MG - Monorail/Automated guideway transit	6.4
	Miami, FL	23.2	CR - Commuter Rail	34.5
			HR - Heavy Rail	19.9
			MG - Monorail/Automated guideway transit	8.3
	Orlando, FL	20.8	CR - Commuter Rail	20.8
	Tampa--St. Petersburg, FL	11.6	SR - Streetcar Rail	11.6
Non-Rail Mode	Bonita Springs, FL	5.9	MB - Bus	5.9
	Cape Coral, FL	6.5	MB - Bus	6.5
	Deltona, FL	5.5	MB - Bus	5.5
	Gainesville, FL	8.1	MB - Bus	8.1
	Jacksonville, FL	8.1	MB - Bus	8.1
	Kissimmee, FL	9.3	MB - Bus	9.3
	Lakeland, FL	5.4	MB - Bus	5.4
	Leesburg-Eustis-Tavares, FL	4.7	MB - Bus	4.7
	Miami, FL	11.3	CB - Commuter Bus	11.8
			MB - Bus	11.3
	North Port-Port Charlotte, FL	5.0	MB - Bus	5.0
	Ocala, FL	5.5	MB - Bus	5.5
	Orlando, FL	9.4	MB - Bus	9.6
			RB - Bus Rapid Transit	3.6
	Palm Bay-Melbourne, FL	7.7	MB - Bus	7.7

Group	Urbanized Area	Average TOF	Mode	TOF
	Palm Coast-Daytona Beach-Port Orange, FL	5.5	MB - Bus	5.5
	Pensacola, FL-AL	5.5	MB - Bus	5.5
	Port St. Lucie, FL	4.3	CB - Commuter Bus	2.1
		4.3	MB - Bus	4.6
	Sarasota-Bradenton, FL	5.0	CB - Commuter Bus	5.6
			MB - Bus	5.0
	Sebastian-Vero Beach South-Florida Ridge, FL	6.8	MB - Bus	6.8
	Tallahassee, FL	5.2	MB - Bus	5.2
	Tampa-St. Petersburg, FL	8.2	MB - Bus	8.2
	Titusville, FL	7.7	MB - Bus	7.7
	Winter Haven, FL	5.4	MB - Bus	5.4
	Zephyrhills, FL	4.0	MB - Bus	4.0

4.3 Summary and recommendation

Based on the pilot study results, the team made the following recommendations for further implementation of the FHWA methodology in Florida to calculate transit occupancy factors:

- The NTD database is updated annually. It is recommended annual update efforts be established when annual data becomes published.
- As demonstrated in this pilot study, the FHWA methodology could be applied by varying geographic boundaries, including non-urbanized area, urbanized area, etc.

Appendix A FHWA methodology final report - Developing Vehicle Occupancy Factors and Percent of Non-Single Occupancy Vehicle Travel

Developing Vehicle Occupancy Factors and Percent of Non-Single Occupancy Vehicle Travel

Final Report

Publication No. FHWA-PL-18-020

April 2019

U.S. Department of Transportation
Federal Highway Administration

Notice

Quality Assurance Statement

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15. Supplementary Notes
The project was managed by Task Managers for the Federal Highway Administration, Wenjing Pu and Daniel Jenkins, who provided technical directions.

16. Abstract
Vehicle occupancy factors (VOF) and percent of non-single occupancy vehicle (NonSOV) travel are important considerations for transportation planners and policy makers. A methodology is proposed to estimate VOF and NonSOV based primarily on police records of occupancy from crashes. These data may be biased due to non-representativeness of occupancy in crashes compared to that of all driving. The bias is proposed to be corrected with post-stratification weighting and an occupancy bias correction from historical data.

VOF and NonSOV were estimated for 10 years for all states and urbanized areas with a population of at least 200,000 using national records from the Fatality Analysis Reporting System (FARS). Crash records from individual states were utilized for estimates of seven pilot states and their urbanized areas. Validation checks were conducted for these estimates. The computer code used to generate the estimates is provided.

The development of credible VOFs and NonSOV from crash records was accomplished on this task. There were certain limitations to the approach that could not be immediately overcome and some potential future limitations. With appropriate documentation of these issues, the general methodology is recommended to be implemented with state-based crash records as the primary source, where available, and the FARS system otherwise.

17. Key Words Vehicle occupancy factor, non-single occupancy vehicle travel, FARS, SDS, HSIS	18. Distribution Statement No restrictions. This document is available to the public.		
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Table of Contents

List of Figures

List of Tables

Introduction

Vehicle occupancy factors (VOF), also called average vehicle occupancy (AVO), are estimates of the average number of occupants in a single vehicle. They are an important consideration for transportation planners and policy makers. They are used to calculate person-miles traveled, set policies for high-occupancy lanes, and derive traffic delays per person. Non-single occupancy vehicle (NonSOV) travel is a measure of the proportion of person trips as well as trips avoided by telecommuting that are not in a single occupancy vehicle. It is an important multi-modal metric which captures travel behaviors that are more efficient than driving alone. NonSOV travel is estimated, in part, through VOFs.

Unlike vehicle counting, which can be efficiently automated for large-scale coverage of the number of vehicles that travel in certain areas at certain times, occupancy counting has traditionally been done via field collection or through surveys. These methods are more generally resource intensive, which limits the scope of the areas and time periods that can be collected in an efficient manner. Alternatively, methods that use already-available police records of occupancy from crashes have been proposed to estimate vehicle occupancy (Gaulin, 1991; Asante et al., 1996; Gan et al., 2008). These methods hold promise but have to overcome the technical challenge that occupancy at the time of crashes cannot be assumed to be representative of occupancy in general.

This report provides the detailed analytical methodology for estimating VOF and NonSOV from police crash records and other relevant information. Where methodological choices are possible or necessary, options and recommendations are provided. The methodological details are accompanied by a draft of actual estimates and their statistical uncertainties. Validation checks are provided for these estimates. Finally, the computer code used to generate the estimates is provided.

The development of credible VOFs from crash records was accomplished on this task. From the VOFs, NonSOV travel was also successfully estimated. There were certain limitations to the approach that could not be immediately overcome and some potential future limitations, but with appropriate documentation of these issues, the general methodology is recommended to be implemented.

Scope of the Estimates

VOFs and NonSOV travel as detailed in this report are estimated as average values. The reported average estimates are accompanied by estimates of their standard errors. These standard errors provide a measure of the degree of uncertainty introduced in determining the factors through a sample of data rather than being able to determine them from an entire population (i.e., perform a census).

VOF estimates apply for combinations of vehicle type, road type, geographic resolution and time period. These categories and their respective reporting levels are detailed in Table 1. In addition to estimation at a unique category, some estimates are aggregated (e.g., all times of day for an urbanized area). NonSOV travel is estimated just for urbanized area by year. The methodology section details the general steps necessary to make estimates. The implementation section lists the specific choices and assumptions that were made to make the estimates with the data available.

Table 1: List of categories and levels for which vehicle occupancy factors are reported.

Category	Name	Levels
Vehicle Type	Vehicle Class Group	Car (FHWA Vehicle Classes 1, 2, and 3) Bus (FHWA Vehicle Class 4) Truck (FHWA Vehicle Classes 5-13)
Road Type	Highway Type	Interstate Highways Non-Interstate National Highway- System
Geographic Resolution	State	The 50 U.S. States and the District of Columbia
	Urbanized Area	U.S. Census (2010) defined urbanized areas with population of 200,000 or more (n=177)
Time Period	Time of Day	Weekday 6AM-10AM Weekday 10AM-4PM Weekday 4PM-8PM Weekend 6AM-8PM Overnight (Any day of the week 8PM – 6AM)
	Year	Calendar Year

Data Sources

A few different data sources were used to estimate VOF and NonSOV. Broadly, the data sources were used to estimate 1) the occupancy of vehicles, 2) the amount of non-vehicle travel, or 3) the bias adjustments needed since crash data is not necessarily representative of the driving population. Some data sources were used for multiple purposes. Following is a brief description of each data source and its use(s).

State crash records, including State Data Systems (SDS) and Highway Safety Information Systems (HSIS)

Every time a crash is reported to police, the information of the crash is recorded in a police accident report (PAR). The PAR includes information on the characteristics of the crash, vehicles, and people involved. The recorded number of occupants in the vehicles can be used to estimate occupancy. Further, information about the vehicle, driver, and time/location of the crash is used to correct for biases that are observed in the data. Some states, such as TX and MD, make these records freely available to researchers online, and they were accordingly downloaded for this analysis. Further, the National Highway Traffic Safety Administration (NHTSA) collects and maintains these PAR's for 34 states in the SDS, which are available at the acceptance of the corresponding states. The analysis in this report was completed with SDS records from twelve different states. FHWA's Highway Safety Information System (HSIS) has recent crash data on seven states, with Maine and California records being used in this evaluation. The state crash records in general have the advantages of being freely available, regularly updated, and having a large sample of vehicles. The disadvantages include the potential unrepresentativeness of the crashes to the driving population and the fact that each state has different coding schemes and do not necessarily collect the same attributes. Additionally, the data quality for the reports could vary from state to state, by time, or by system.

Fatality Analysis Reporting System (FARS)

NHTSA also collects and maintains FARS, which is a census of all U.S. vehicle crashes from 1975 to 2016 that resulted in a fatal injury within 30 days of the crash. As opposed to the SDS, this data is freely available nationwide, but has a much smaller sample size. Further, because it only contains crashes that resulted in fatal injuries, it may be less representative of the driving population. Like the state crash records, this data source was used in the analysis to estimate occupancy, while information about the vehicle, driver, and time/location of the crash was used to correct for biases that are observed in the data.

National Transit Database (NTD)

The Federal Transit Administration (FTA) collects and maintains the NTD, which contains data on all transit systems that receive benefits from the FTA. Information in this database on passenger trips was used for calculating the percent of non-single occupancy travel and the passenger miles and vehicle miles values were used for vehicle occupancy factors.

National Household Travel Survey (NHTS)

The NHTS is used to control for biases. First, it is used to adjust the estimation of vehicle occupancy for a subset of drivers and vehicles in crashes by their prevalence in the population. This is done by estimating the person trips and vehicles miles for certain subpopulations. NHTS contains information on vehicle trips only for privately-operated vehicles (POV), which need not be owned by anyone in the household. Notably, POV's exclude buses, streetcars, taxis, and school buses. Vehicle trips are trips in which the respondent is the driver and the transportation mode is a POV. Second, NHTS is used in combination with crash records from matching years to estimate how the presence of occupants in a vehicle affects the probability of getting in a crash.

FHWA Traffic Volume Trends (TVT) and Highway Statistics Series (HSS)

While NHTS provides the number of person trips or vehicle miles by many different categories, it was not designed to do so for small subpopulations and may be inaccurate in these cases. NHTS also cannot provide the amount of travel that was on highways versus other roads. The TVT and HSS data were used to provide more information on travel by vehicle type, road type, states, month of year, and by urban/rural designation.

American Community Survey (ACS)

The Census Bureau's ACS samples approximately one percent of the U.S. population each year. The survey contains questions on travel mode to work. These data were used to find the number of telecommuting trips as well as other non-vehicle commuting patterns.

The remainder of this report provides overall methodology behind the calculations, details of how the methodology was implemented for the available data, validation of the resulting estimates, and details regarding the deliverable estimates and corresponding computer code. The actual estimates and computer code are included as attachments to this report.

Methodology

Overview of Calculating VOF and Percent of NonSOV Travel

Vehicle occupancy is defined mathematically so that $\Pr(VO = v)$ is the probability that the vehicle occupancy (VO) equals v (for $v = 1, 2, 3, \ldots$). The VOF is the expected value of VO.

$$VOF = \sum_{v} v \ \Pr(VO = v)$$

The summation in the above equation conceptually could include any non-zero integer value, but it is practically limited under the observation that most passenger vehicles have 4 or fewer occupants.

The overall non-single occupancy vehicle travel (NonSOV) is obtained by combining the proportion of non-single occupancy vehicle travel which takes place in vehicles, $NonSOV_{veh}$, with the probability that a mode of transportation for a trip is a vehicle, $\Pr(Vehicle)$. That is, the NonSOV is the proportion of trips not taking place in a vehicle ($1 - \Pr(Vehicle)$) plus the proportion of trips that are in a vehicle *and* where the vehicle has more than one occupant ($\Pr(Vehicle) * NonSOV_{veh}$).

$$NonSOV = (1 - \Pr(Vehicle)) + \Pr(Vehicle) * NonSOV_{veh}$$

For trips taking place in a vehicle, the proportion of non-single occupancy vehicle travel is the number of passenger trips that are not single occupancy divided by the total number of passenger trips. Equivalently, it is 1 minus the proportion of passenger trips that have only one occupant, which is the proportion of vehicle trips with one occupant divided by the expected number of occupants in the vehicle.

$$NonSOV_{veh} = 1 - \frac{\Pr(VO = 1)}{\sum_v v \Pr(VO = v)} = 1 - \frac{\Pr(VO = 1)}{VOF}$$

This simplifies to

$$NonSOV = \left(1 - \Pr(Vehicle)\frac{\Pr(VO = 1)}{VOF}\right)$$

The calculation of both VOF and $NonSOV_{veh}$ require estimation of the probability distribution of vehicle occupancy.

When using crash records, this evaluation found that only private vehicles and trucks permit reliable estimation of $\Pr(VO = v)$ ($v = 1, 2, 3, \ldots$). Buses are not prevalent enough in crash records, and even when present, the occupancy numbers are often capped. This means crash records can be used to estimate all forms of VOF for cars and trucks, but additional data sources are required to estimate VOF for buses. Estimating overall NonSOV for urbanized areas requires knowledge of non-vehicle traffic to estimate $\Pr(Vehicle)$. This estimate must come from other sources than crash records.

The remainder of the methodology section first discusses how to estimate the vehicle occupancy distribution from crash records and then how to estimate VOF for cars and trucks. The final two subsections discuss the methodology for estimating VOF for buses and the estimation of non-vehicle traffic necessary to determining NonSOV travel.

Estimating Vehicle Occupancy Distribution from Crashes

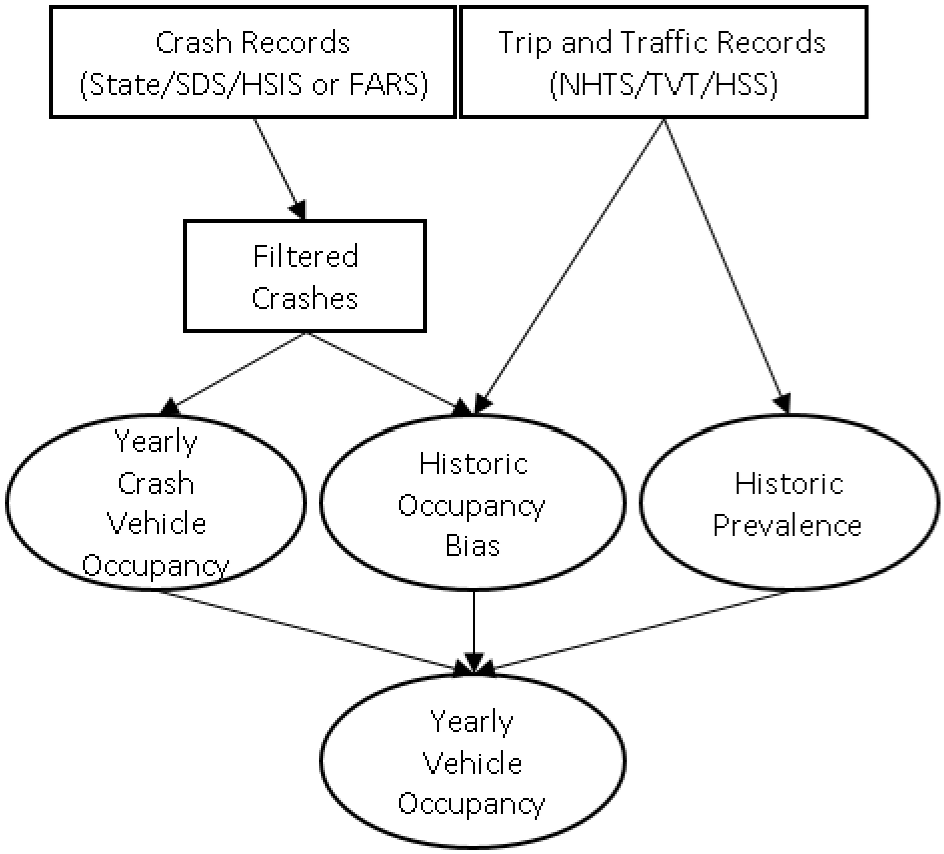

Figure 1: Flowchart of the steps to estimating occupancy in passenger vehicles and trucks from crash records.

Figure 1 is an outline of the process for estimating occupancy in passenger vehicles and trucks from crash records. The source data on the top row has been identified in the previous section and its detailed treatment is discussed in the implementation section to follow. The next two subsections describe how the crash data is filtered and how the occupancy is estimated. Following that, the processes for estimating the historic occupancy and prevalence biases are described. Finally, the pieces are combined to get a final estimate of vehicle occupancy.

Two strategies are employed to make the estimates of vehicle occupancy from crash records as valid as possible:

1. Filtering the data so that it is as consistently representative as possible
2. Correcting for biases that cannot be filtered out

The filtering process is discussed below, but after it is employed, there is still a likelihood that crash records are not representative of the entire driving population. Two specific biases for this non-representative nature of crash data are considered.

First, as previously observed by Chen et al. (2000), the probability of getting in a crash can be affected by the number of occupants in the vehicle. Specifically, Chen et al. (2000) found that 16 and 17-year-olds are more likely to get into a fatal crash when there are more people in the vehicle. The opposite is true for older drivers. They are more likely to get into a fatal crash when driving alone. The vehicle occupancy distribution for crash data is therefore generally *conditional on there being a crash* and can be denoted as ($\Pr(VO = v|Crash)$). This distribution is not necessarily the same as the desired unconditional occupancy distribution ($\Pr(VO = v)$) required to calculate the VOF. To relate the conditional and unconditional distributions, the following relationship due to Bayes Theorem can be used,

$$\Pr(VO = v) = \Pr(VO = v|Crash)\frac{\Pr(Crash)}{\Pr(Crash|\ VO = v)}$$

If the probability of getting in a crash changes depending on how many people are in the car, as is the case in the referenced Chen et al (2000) work, then the naïve estimates of occupancy distribution from unadjusted crash data will be incorrect. The ratio $\Pr(Crash|\ VO = v)\ /\ \Pr(Crash)$ is the probability of getting in a crash, conditional on v occupants being in the vehicle, divided by the probability of getting in a crash, regardless of how many occupants are in the vehicle. This quantity, which is the inverse of the final term in the equation, is defined to be the ***occupancy bias***. If it can be satisfactorily estimated, the bias effect it has can be removed from the equation to get the true occupancy distribution.

A second bias in determining the occupancy distribution from crash data stems from the fact that the drivers, vehicles, and time/locations of crashes may not be representative of a random sample of drivers, vehicles, and time/locations of vehicle traffic on the road. To account for the fact that some subpopulations will be over or under represented in the crash data, a post-stratification by subpopulations ($SubPop$) is performed.

$$\boldsymbol{Pr(VO = v) = \sum_{SubPop} \Pr(VO = v|SubPop, Crash)\Pr(SubPop)\frac{\Pr(Crash|SubPop)}{\Pr(Crash|SubPop, VO = v)}} \quad (1)$$

In the above equation, $\Pr(SubPop)$ is the ***prevalence*** of the subpopulation, which is the proportion of vehicle miles driven by the subpopulation. Subpopulations consist of combinations of driver, vehicle, and crash characteristics. Variables that are considered are listed in Table 2.

Table 2: List of variables that are used to classify crashes into subpopulations.

Data Type	Variables
Factors required for reporting	Road type, time period, state, urbanized area More detailed vehicle type (Passenger car, light truck, motorcycle, truck)
Crash	Location (urban/rural, Census region/division, state, metro size), Time (season of year)
Driver	Age (grouped), gender
Interactions	Between all the required factors and the other crash and driver factors

One example of prevalence bias can be seen with gender. Table 3 shows the proportion of vehicle miles that were driven by each gender in 2009, as estimated by the NHTS, as well as the proportion of fatal crashes in 2009 and the corresponding estimates of VOF, as reported in FARS. Fatal crashes are much more likely to involve male drivers (72%) than the general proportion of vehicle miles driven (60%). The estimated VOF without reweighting by prevalence (28% * 1.51 + 72% * 1.38 = 1.41) will underweight the VOF of female drivers and overweight the VOF of male drivers. The net result is an estimated VOF, at 1.41, which is biased compared to a correctly weighted VOF estimate (40% * 1.51 + 60% * 1.38 = 1.43).

Table 3: A comparison of the prevalence of male and female drivers on the road versus those involved in fatal crashes.

Driver Gender	Proportion of 2009 Fatal Crashes (FARS)	Proportion of 2009 Vehicle Miles (NHTS)	2009 FARS VOF
Female	28%	40%	1.51
Male	72%	60%	1.38

To estimate the distribution of vehicle occupancy for passenger vehicles and trucks from crashes, three components are necessary for each subpopulation

- The occupancy in crashes ($\Pr(VO = v|SubPop, Crash)$)
- The prevalence ($\Pr(SubPop)$)
- The occupancy bias ($\Pr(Crash|\, SubPop, VO = v)\ /\ \Pr(Crash|SubPop)$)

The methodology for estimating each quantity is provided below, after describing how crash data is pre-processed.

Crash data preparation

If measured data have consistent and reproducible biases, these biases can potentially be removed by mathematical adjustment. Some measured data are not well suited to this type of bias adjustment and such records are recommended to be filtered out of the crash data subsequently used. For example, FARS data records imply that at least one person must have died as a result of the crash. Since multiple vehicles can be part of a crash, and a crash can impact those outside a vehicle, this means that each vehicle may or may not have any deaths in it. Further, if there was a death in the vehicle, it could have been the driver, a passenger, or both. Table 4 shows occupancy statistics for passenger vehicles in the FARS data from 1998 to 2015. As a reference, the national average VOF for cars is 1.67 according to FHWA's Transportation Performance Management guidance, which uses the 2017 NHTS (https://www.fhwa.dot.gov/tpm/guidance/avo_factors.pdf). When only a non-driver died, there would have had to have been at least two occupants in the vehicle, which makes the occupancy biased much higher. Consistent with Heidtman et al. (1997), the methodology employed here is to remove records where only a non-driving passenger was a fatality.

Table 4: Passenger vehicles in FARS from 1998-2015.

Casualties	# Vehicles	VOF	% NonSOV
None	277,310	1.52	56.0
Driver (at least)	360,170	1.37	44.8
Non-Driver(s)	87,234	2.96	100

Several other types of vehicles and crashes were removed from both FARS and the state crash records:

- Missing occupancy
- No information on the driver or crash
- Multiple drivers for a vehicle or duplicate vehicle information
- Parked cars (usually have occupancy of 0)
- Pedestrian and bicycle records

Estimating vehicle occupancy distribution in crashes

For both FARS and state crash records, the strategy for estimating the distribution of passenger vehicle and truck occupancy is the same. From Equation (1),

$$\Pr(VO = v | SubPop, Crash)$$

is estimated for $v = 1, 2, \ldots$. As previously detailed, v is limited to taking values $VO = 1, VO = 2, VO = 3,$ and $VO \geq 4$.

A simple way to approach this problem is to use empirical estimates of the proportion of crashes for each subpopulation that has v occupants. If the number of subpopulations is small compared to the number of crashes, this is a feasible solution. However, correctly estimating the overall vehicle occupancy requires estimates for this probability for every subpopulation where $\Pr(VO = v | SubPop, Crash)$ changes. For example, if the occupancy is similar for both male and female drivers, then driver gender does not need to be included in the subpopulations. However, if occupancy does differ in a significant way between males and female drivers, then gender should be included. Example subpopulations may include all unique combinations of road type, day of week, time of day, vehicle type, driver age, and driver gender, as outlined in Table 2. A mathematical model of the occupancy as a function of the subpopulation is recommended since it can reduce the variability that would result from a large number of empirical estimates, many of which would come from sparse data.

This is a multinomial regression problem and the probabilities must sum to 1 for every $SubPop$. Say that subpopulations consist of a combination of p variables $(X_1, \ldots, X_p)$ and that $SubPop_i$ has values $X_1 = x_{1i}, X_2 = x_{2i}, \ldots, X_p = x_{pi}$. Continuing the example from above, there would be $p = 6$ variables with X_1 representing road type, X_2 representing day of week, and so on. For $SubPop_i$, x_{1i} would represent the road type for the ith subpopulation, which may be interstate highway, for example. As a technical aside, since the variables are all categorical, x_{ji} is a vector composed of all 0's except for a 1 for the category that the j'th variable belongs to.

Using a binary logistic regression approach, for each v, a model can be fit of the form

$$\Pr(VO = v | SubPop_i, Crash) = f_v(x_{1i}, x_{2i}, \ldots, x_{pi}).$$

One form of $f_v(x_{1i}, x_{2i}, \ldots, x_{pi})$ on the simple end of the spectrum would be standard linear logistic regression (McCullagh and Nelder, 1987):

$$f_v(x_{1i}, x_{2i}, \ldots, x_{pi}) = \sigma\left(\beta_0 + \sum_{j=1}^{p} \beta_j x_{ji}\right),$$

where σ is the logistic sigmoid function, which constrains the probability estimates to be between 0 and 1. Models including ordered logistic regression, LASSO regularized multinomial regression (Tibshirani, 1996), multi-level logistic regressions, and random forest (Breiman, 2001) were all evaluated. Multi-level logistic regressions performed best generally, as will be shown in the implementation section (Table 7) and had the additional benefit of providing the possibility of drawing approximate posterior samples to help in uncertainty quantification.

The estimation is done separately for each data source and year, including FARS, even though it has a smaller sample size. Validation was done by training on 75% of the crashes and predicting on the remaining 25%. The models were compared based on the log-likelihood of their predictions. All available variables from Table 2 were included in the model. This form of modeling allows for estimates for all subpopulations that may have an occupancy-related effect, even if it is small. The interactions ensure that the estimates vary for the different levels that are reported in the deliverable, even if the difference is small.

Estimating prevalence

Prevalence for a subpopulation is the proportion of vehicle miles that are traveled by that subpopulation. The NHTS has information on the prevalence of many of the subpopulations of interest. For example, it can be used to estimate the number of vehicle miles driven by a number of driver demographics (gender, age, location of home), vehicle characteristics (type of vehicle, age of vehicle), and time characteristics (day of week, month of year, time of day). More precise traffic data for a subset of characteristics can be found with the Traffic Volume Trends (TVT) and the Highway Statistics Series (HSS). These data sources provide vehicle miles by state, urban/rural area, vehicle type, and route type.

When estimating prevalence for many subpopulations, the NHTS is likely to give highly variable estimates (and often observed values of 0) especially for some smaller subpopulations due to the limited sample size. To get reliable estimates of the prevalence for small subpopulations, raking, also called iterative proportional fitting (IPF), was employed. Raking also allowed combining and refining the prevalence of the NHTS with the TVT and HSS prevalence estimates.

Raking is used when the marginal distribution of a number of variables is known, or even the joint distribution for some crossed variables, but the full joint distribution of all variables is not. For example, assume it is known that males make up 60% of traffic, with females making up 40%, and that 25% of traffic occurs on weekday mornings, with 75% occurring at other times of day, but it is not known what percentage of the weekday morning traffic is male versus female. In this simple example, an estimate of 15% male (25%*60%) and 10% female (25%*40%) would satisfy the requirements, but the solution is more involved with many variables. Raking is a way to mathematically estimate subpopulation prevalence, so it matches, to the extent possible, all the known distribution margins simultaneously.

Raking requires initializing the joint estimation with a seed matrix, which provides the a priori expected proportion of traffic for each subpopulation. A seed matrix of all ones was used for this analysis, which gave equal weight and no a priori information to the estimates. For the marginal distributions, available information from HSS and TVT was used first and then supplemented by added information from NHTS that is not available in the other sources.

- HSS, tables VM-2 and VM-4, provided the vehicle miles travelled (VMT) for combinations of state, route type, urban/rural, and vehicle type.
- TVT provided the VMT for combinations of state and season of the year.
- TVT also provided the VMT for combinations of urban/rural, route type, and season of the year.
- NHTS VMT was used for every other bivariate combination of the variables. For example, combinations of driver age and season of the year were included from NHTS, but vehicle type and urban/rural were not, since that combination was already present in the TVT. The nine US Census divisions were the most detailed geographic area used with NHTS due to small sample sizes for some states. A total of 40 bivariate combinations were included from NHTS.

The raking was implemented to ensure that the marginals of the raked estimates matched the HSS and TVT provided marginals. Prevalence was calculated for the subpopulations listed in Table 2. Since the NHTS is only updated every eight years between 2001 and 2017, this methodology assumed that the NHTS-based prevalence stayed relatively constant from year to year. For example, if males made up

60% of the traffic in 2009, they were expected to continue to make up 60% of the traffic in the near future (2010 to 2016).

Estimating occupancy bias

The occupancy bias for a subpopulation in a vehicle with v occupants can be calculated by dividing the proportion of crashes in the subpopulation that had v occupants by the proportion of the prevalence in the subpopulation that had v occupants, as shown in the following equation, where vehicle miles travelled (VMT) is being used for prevalence in this example.

$$\text{Bias}(SubPop, VO = v) = \frac{\Pr(Crash|SubPop, VO = v)}{\Pr(Crash|SubPop)} = \frac{\#(Crash, SubPop, VO = v)}{\#(Crash, SubPop)} \frac{VMT(SubPop)}{VMT(SubPop, VO = v)}$$

This bias is calculated with the number of crashes for each subpopulation and the number of occupants (from the state crash records or FARS) and the vehicle miles for each subpopulation and number of occupants (from the estimation of the prevalence). For maximum defensibility of the bias estimates, the time periods for the prevalence and crash data should coincide. In the case of the NHTS, though, prevalence estimates are only available every eight years between 2001 and 2017. The approach used for this analysis was to use years that overlap in the crash and prevalence data and then to assume that the estimated biases would still apply into the future. For example, the 2009 NHTS and 2009 state crash records were used to estimate the occupancy biases for each subpopulation (e.g. young male drivers) in 2009, but then were assumed to remain the same for the next several years.

Similar to the occupancy distribution from crashes, the data can be used to directly get empirical estimates of occupancy bias. However, the occupancy bias must be calculated for every subpopulation where it varies, and the empirical bias estimates will be unreliable for small subpopulations. For example, if a subpopulation had no crashes in 2009 for a given number of occupants in the data (even though it is not believed no crashes occurred in truth), the empirical bias estimate will be 0, which will cause the estimate of the VOF to be undefined because it will involve dividing by 0. Further, there may be some subpopulations where the data did not show any crashes in 2009, regardless of the number of occupants, in which case it would be impossible to make the empirical estimate of bias at all.

To avoid having to estimate the occupancy bias directly, a methodology that is commonly used to model disease and other rates was applied. The quantity $\#(Crash, SubPop, VO = v)$ is treated as the response and the other three elements of the bias equation as the known exposures. Since the number of crashes is a count, a Poisson distribution is assumed, and the other three elements are treated as an offset in the Poisson regression. Similar to the occupancy distribution estimation, the occupancy is broken into four groups ($VO = 1, VO = 2, VO = 3$, and $VO \geq 4$) and fit to a model for each group such that $\#(Crash, SubPop_i, VO = v)$ is Poisson distributed with the log of the mean equal to

$$\log\left(\frac{VMT(SubPop_i, VO = v) \times \#(Crash, SubPop_i)}{VMT(SubPop_i)}\right) + f_v(x_{1i}, x_{2i}, \dots, x_{pi}).$$

The estimated bias for subpopulation i is $e^{f_v(x_{1i}, x_{2i}, \dots, x_{pi})}$.

Similar to estimating occupancy, several models were considered, including Poisson regression, LASSO-penalized Poisson regression, and multi-level Poisson regression. Multi-level Poisson regression and standard Poisson regression performed best generally, as will be shown in the implementation section. Standard Poisson regression was ultimately selected, because it was simpler and did not require incorporation of uncertainty into the bias estimates.

The occupancy bias estimation was done separately for each crash data source and NHTS year (2001, 2009, and 2017). Since FARS has smaller sample sizes, multiple years of FARS records were modeled around each NHTS year. Validation was done by training on one year and predicting the bias and the counts on the following NHTS year. The models were compared based on the weighted mean squared error of the predicted bias and the log-likelihood of the predicted counts. All available variables from Table 2 were included in the model, with interactions with the occupancy level.

As an example of the benefit of the modeling approach, Figure 2 compares prediction of FARS occupancy bias in 2009 with both the empirical bias in 2001 and a linear Poisson regression model fit using 2001 data. The model follows the diagonal line much more closely, giving more accurate and less variable predictions of bias.

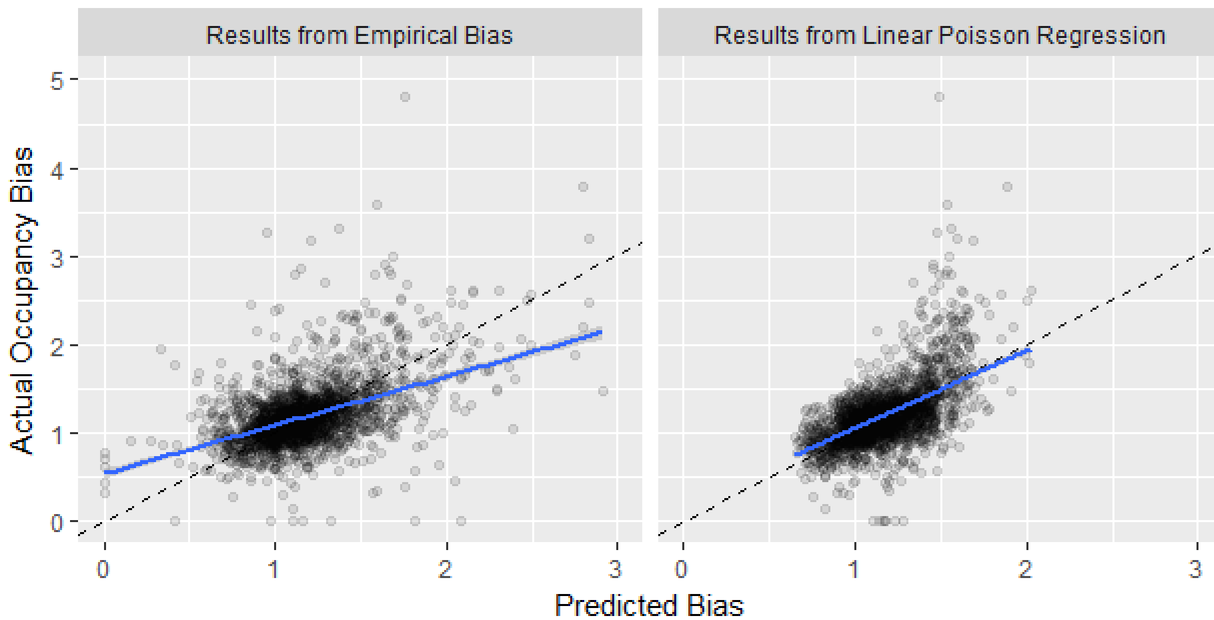

Figure 2: Predicted occupancy bias versus actual occupancy bias in FARS in 2009 for subpopulations with over one billion vehicle miles. The plot on the left uses the empirical bias in 2001 to estimate the bias in 2009. The plot on the right used the proposed linear Poisson regression model fit on 2001 data to predict the bias in 2009. The blue line is the ordinary regression line and the dashed line indicates where predicted equals actual.

Correcting for occupancy bias has the effect of adjusting the crash occupancy estimate to more closely match the occupancy estimate from the source of the prevalence (NHTS). This means that using 2009 crash records and 2009 NHTS data to estimate occupancy bias will produce vehicle occupancy estimates that more closely match NHTS for 2009.

It is possible that NHTS will change what type of data is collected in the future, which would limit the ability to use it as a source of bias correction. The example above has shown that FARS occupancy bias is consistent over an eight-year time span (2001 to 2009). This suggests that the occupancy bias estimates using the 2017 NHTS will be valid for several years before some sort of re-validation would be necessary.

Generating the combined estimate

The final estimation of the vehicle occupancy distribution is accomplished by substituting the estimates of crash occupancy, prevalence, and occupancy bias into equation (1). Additionally, the probabilities are normalized so they sum to 1. That is,

$$\Pr(VO = 1) + \Pr(VO = 2) + \Pr(VO = 3) + \Pr(VO \geq 4) = 1.$$

Vehicle Occupancy Factor for Passenger Vehicles and Trucks

The calculation of VOF involves the estimates of occupancy from crashes, prevalence, and occupancy bias.

$$VOF = \sum_{v \in \{1,2,3,4+\}} E(VO|VO = v) \sum_{SubPop} \frac{\Pr(VO = v|SubPop, Crash)\Pr(SubPop)}{\text{Bias}(SubPop, VO = v)}.$$

This demonstration was completed with FARS data for every state as well as with selected state crash records. FARS and state crash records were separately used to create independent estimates. Each individual VOF estimate may be for a specific condition (e.g., passenger vehicle, morning, NHS, in a state for a year) or for an aggregate of conditions (e.g., all of one state for one year). The estimated VOF includes only the relevant subpopulations for the condition of interest. Additionally, in the above equation, $E(VO|VO = 1) = 1$, $E(VO|VO = 2) = 2$, $E(VO|VO = 3) = 3$, and $E(VO|VO = 4+) = E(VO|VO \geq 4) = 4.5$. The use of 4.5 as the expected value for all records with occupancy 4+ is based on averages observed in NHTS and the crash records.

In addition to the direct VOF estimate, a standard error of the estimate is derived, which provides a measure of the uncertainty in the estimate. To estimate standard errors, the VOF is simulated many times and then a standard deviation is calculated for these simulated estimates. Each simulated VOF is a draw of an approximate Bayesian posterior sample from the crash occupancy distribution, $\Pr^{(l)}(VO = v|SubPop, Crash)$, for $l = 1, \ldots, 50$. This results in 50 simulations from the posterior distribution,

$$VOF^{(l)} = \sum_{v \in \{1,2,3,4+\}} E(VO|VO = v) \sum_{SubPop} \frac{\Pr^{(l)}(VO = v|SubPop, Crash)\Pr(SubPop)}{\text{Bias}(SubPop, VO = v)},$$

for $l = 1, \ldots, 50$. The estimate of the standard error of VOF is the standard deviation of these 50 simulations. This standard error methodology does not incorporate the uncertainty in estimating the prevalence or occupancy bias. Doing so would likely involve the replication weights of the NHTS, which would be computationally intensive. Additionally, the relationship between occupancy bias, prevalence, and crash occupancy would need to be evaluated. This methodological development could represent a future enhancement of the overall VOFs but was beyond the scope of the current demonstration project.

For urbanized areas that overlap with multiple states, the approach was to estimate the VOF of the portion of the urbanized area in each state separately. Then the estimates from all the states were averaged, weighted by the proportion of the urbanized area's population that is in each state. Since the states' records can be considered independent, the combined squared standard error is equal to the sum of the states' squared standard errors, weighted by the squared proportion of the population in each state.

Vehicle Occupancy Factor for Buses

Due to the lack of crashes involving buses, especially in FARS, vehicle occupancy factors for buses are estimated with a different approach. The National Transit Database (NTD) provides passenger miles traveled (PMT) and vehicle revenue miles (VRM), which are divided to get an overall VOF for an area of interest.

Three potential data sources were evaluated:

1. The Annual Database UZA Sums (https://www.transit.dot.gov/ntd/data-product/2016-annual-database-uza-sums) has PMT and VRM for each urbanized area, but no mode to differentiate buses from other methods of transit
2. The Annual Database Service (https://www.transit.dot.gov/ntd/data-product/2016-annual-database-service-0) has PMT, VRM, mode, and time period associated with each agency, but not detailed enough state and city information.
3. Service (https://www.transit.dot.gov/ntd/data-product/2016-service) data contains PMT, VRM, mode, and state and city information associated with each agency, but no time period information.

The third ("Service") data source was selected because it had enough information to make estimates at the state and urbanized area level. However, it does not include enough information to estimate at the time period level. None of the data sources allowed estimation of VOF for different route types.

Records with zero or missing PMT values were excluded from analysis. In addition, only records pertaining to buses, commuter buses, rapid bus transit, and trolley buses were included in the analysis (i.e. records with mode value equal to "CB", "MB", "RB", or "TB").

The VOF for buses in a particular urbanized area or state and year was computed with the following equation from the queried data, which follows the guidance of FHWA's Transportation Performance Management (https://www.fhwa.dot.gov/tpm/guidance/avo_factors.pdf),

$$\mathrm{VOF_{buses}} = \frac{\sum_{r=1}^{R}[PMT]_r}{\sum_{r=1}^{R}[VRM]_r},$$

where r is a record in the queried data, R is the total number of records in the urbanized area or state, $[PMT]_r$ are the passenger miles traveled in a year for the data record r, and $[VRM]_r$ are the vehicle revenue miles in a year for the data record r.

A major limitation of this methodology is that it only includes transit systems that are in the NTD, which include systems that receive benefits from the FTA. Therefore, the estimates may not generalize to all bus traffic.

Estimating the Proportion of Non-Single Occupancy Vehicle Traffic

The NonSOV travel requires the VOF calculations above, as well as the proportion of passenger trips that are not from vehicles. A preferred source for this latter estimate is the ACS which is an adequately large sample and is updated yearly. The ACS provides the mode of transportation (including telecommuting) that people use for commuting trips. The NonSOV travel must be based on more than just commuting trips, though, so ACS data for percentage of non-vehicle travel in large MSAs was compared to a similar calculation from the NHTS, which takes into account all trips, not just commuting, but has the disadvantage of only being conducted periodically and having a relatively small sample. Figure 3 shows the relationships between the non-vehicle travel on commuting trips (from ACS) to the non-vehicle travel on all trips (from NHTS) at the metropolitan statistical area (MSA) level. In Figure 3, each point is one of the 50 large MSAs in the US that is included in the NHTS in 2009 and 2017. A regression line is also plotted, assuming a log transformation on the x-axis. The relationship between the two measures is similar for the two years.

Other variables, such as population size and the MSA's density, were evaluated to see if they would improve the fit, but neither did. As a result of this evaluation, the ACS estimate of non-vehicle travel for the urbanized area and year was selected as the appropriate input to the overall NonSOV estimate.

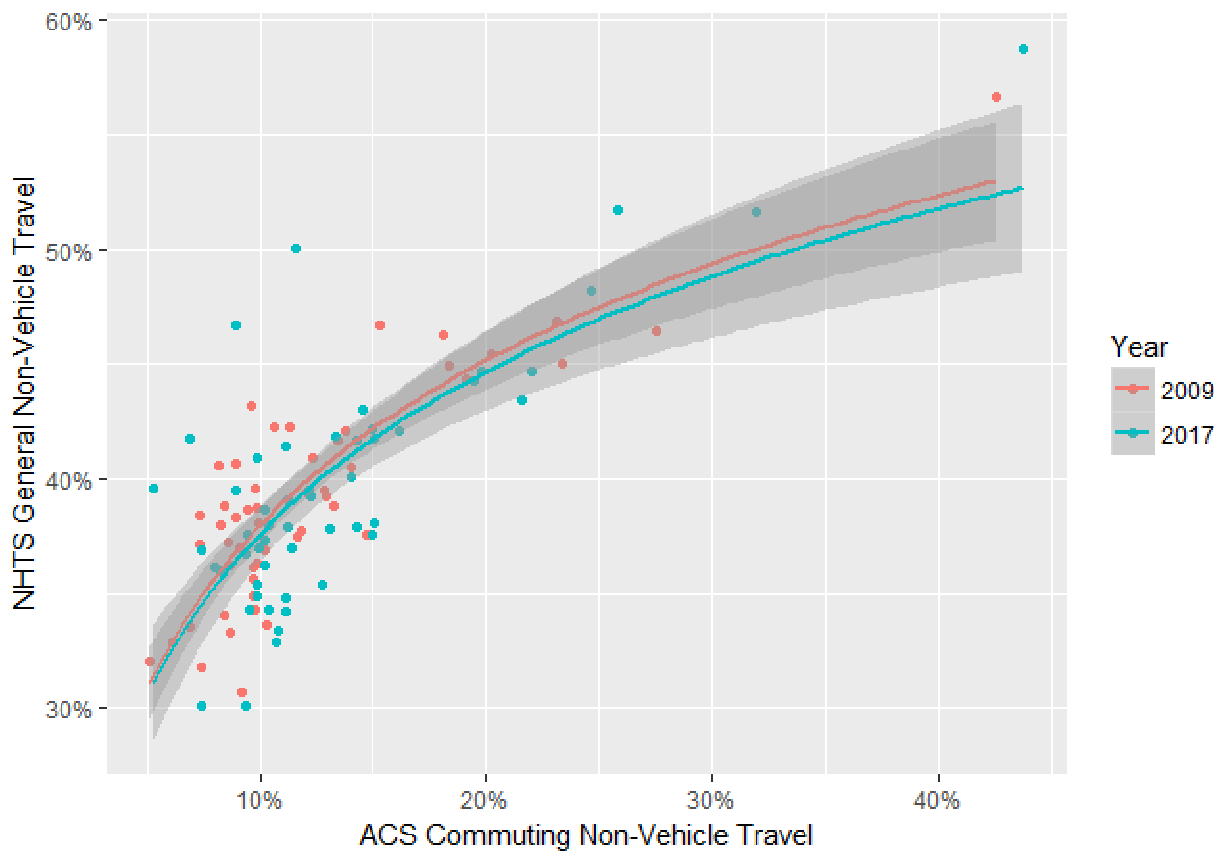

Figure 3: Comparison of the percent of non-vehicle commuting trips from ACS and non-vehicle general trips from NHTS.

NonSOV travel was estimated for a given urbanized area by the previously given equation, combining the occupancy distribution and the estimated proportion of vehicle traffic,

$$NonSOV = \left(1 - \Pr(Vehicle)\frac{\Pr(VO = 1)}{VOF}\right)$$

where

$$\Pr(VO = 1) = \sum_{SubPop} \frac{\Pr(VO = 1|SubPop, Crash)\Pr(SubPop)}{\mathrm{Bias}(SubPop, VO = 1)}.$$

Uncertainty estimates for $\frac{\Pr(VO=1)}{VOF}$ can be obtained by the same method discussed as used for VOF, but the addition of the non-vehicle estimation makes the overall estimation of NonSOV uncertainty more challenging. NonSOV uncertainty estimates were not produced in this evaluation. Estimates from state crash records of urbanized areas that overlap with multiple states used the same method as used for VOF, weighting the vehicle NonSOV estimates by the proportion of the urbanized area's population that lives in each state.

Implementation Details

The implementation of the proposed methodology on specific data required additional considerations which are detailed in this section.

Data Sources

The data sources and all variables considered in the modeling process are shown in Table 5 and Table 6. Not every desired variable was available for each data source. In addition, some variables were only available for a subset of the years. The tables further show that more variables were collected and normalized than those listed in Table 1 and Table 2. Many variables were consistent from data source-to-data source, but others, such as car type and road type, required a manual process of matching the source data to the predetermined categories. These tables also list some variables that were ultimately not included in the analyses. Driver race and ethnicity were excluded because they were unavailable in most data sources. Severity of the crash and the weather were examined for the possibility of using them to filter the data but were not used due to the data source-to-data source variability, which would necessitate subjectivity in the filtering process.

Table 5: Variable Availability among NHTS, FARS, Online, and HSIS Datasets.

Variable	NHTS	FARS	MD Online	TX Online	CA HSIS	ME HSIS
Years	'01,'09,'17	'98-'16	'15-'16	'10-'16	'10-'14	'06-'10
Urban/Rural	●	●		●	●	
Road Type	● [a]	●	●	●	●	●
Time /Date	●	●	●	●	●	●
Weather		●	●	●	●	●
Overall Crash Severity		●		●	●	●
Number Vehicles		●	●	●	●	●
Vehicle Type	●	●	●	●	●	●
Vehicle Year (Age)	●	●	●	●	●	
Number Occupants	●	●	●	●	●	●
Number Fatalities		●	●	●	●	●
Driver Fault		●	●	●	●	●
Vehicle Severity		●	●			
Driver Age	●	●	●	●	●	●
Driver Gender	●	●	●	●	●	●
Driver Race	●	● [b]		●		
Driver Ethnicity	● [a]	● [b]				
Driver Injury /Severity		●	●	●	●	●
Latitude/Longitude		● [b]	●	●	● [c]	
City				●		
County			●	●		●

a NHTS: Road type 2009 only, ethnicity 2009 and 2017 only, Urban Area provided in urban size of household
b FARS: Latitude/Longitude missing 1998-2000, Race and Ethnicity provided only in fatalities 2000-2016
c HSIS CA: Latitude/Longitude only available 2010-2011

Table 6: Variable Availability among SDS Datasets by State.

Variable	CA	FL	IA	MD	MT	DE	IL	NE	NJ	NM	PA	VA
Years	‘06-‘10	‘06-‘14	‘06-‘14	‘01-‘15	‘01-‘08	‘01-‘14	‘01-‘14	‘01-‘13	‘01-‘14	‘01-‘13	‘06-‘13	‘01-‘15
Urban/Rural	●	●					●	●		●	● [g]	● [h]
Road Type	●	●	●	● [c]	●	●	●	●	●	● [a]	●	●
Time /Date	●	●	●	●	●	●	●	●	●	●	●	●
Weather	●	●	●	●	●	●	●	●	●	●	●	●
Overall Crash Severity	●	● [b]	●	●	●	●	●	●	●	●	● [g]	● [h]
Number Vehicles	●	●	●	●	●	●	●	●	●	● [f]	● [g]	●
Vehicle Type	●	●	●	●	●	●	●	●	●	●	●	●
Vehicle Year (Age)	●	●	●	●	●	● [d]	● [e]	●	●	●	●	●
Number Occupants	●	●	●	●	●	● [d]	●	●	●	●	● [g]	● [h]
Number Fatalities	●	●	●	●	●	●	●	●	●	●	●	●
Driver Fault	●	● [b]	●	●	●	● [d]	●	●	●	●	● [g]	●
Vehicle Severity		●	●	● [c]	●	●		●		●	●	●
Driver Age	●	●	●	●	●	●	●	●	●	●	●	●
Driver Gender	●	●	●	●	●	●	●	●	●	● [f]	●	●
Race	● [a]	● [b]				● [d]				● [f]		
Ethnicity						● [d]						
Driver Injury /Severity	●	●	●	●	●	●	●	●	●	●	●	●
Latitude/Longitude												
City	●	●	●	●	●		●	●	●	●	●	● [h]
County	●	●	●	●	●	●	●	●	●	●	●	● [h]

a CA: Race available 2009 and 2010 only
b FL: Crash severity, driver fault, and Race 2006-2010 only
c MD: Vehicle Severity missing 2009-2014
d DE: 2001-2004, 2007-2014; Vehicle Age, Occupancy, and Driver Fault 2007-2014; Race and Ethnicity 2010-2014
e IL: Vehicle Age 2001-2003, 2007-2014
f NM: Road class 2001-2011; Number vehicles, Race, and Ethnicity 2012-2013
g PA: 2006-2012; Urban vs. Rural 2006-2012; Overall crash Severity missing 2006-2007
h VA: Urban vs. Rural 2001-2007; Overall Severity missing 2008-2009, 2015; Occupancy 2001-2009, 2013-2015; City 2001-2004, 2008-2013; County 2001-2004, 2008-2011, 2013

Urbanized areas were not included in any of the data sources. For data with latitude and longitude of the crash, the location of the crash was used to assign the urbanized area. For all other sources the city name of the crash was mapped to the urbanized area, using relation files from the 2010 U.S. Census. If a city name was not available, then the county was mapped to the urbanized area also using relation files.

The census relation files only provide the proportion of the land area, population, or housing units in each urbanized area, not the amount of traffic. The proportion of the population was used as a proxy for traffic, with the following adjustment. According to HSS, 70% of traffic takes place on urban roads, however 81% of people live in urban areas, according to ACS. This means the odds of driving in an urban area (70/30) are 1.83 times lower than the odds of living in an urban area (81/19). For each city and county, the odds of living in the urbanized area was reduced by a factor of 1.83 to estimate the adjusted proportion of the traffic that takes place in the urbanized area. Crashes are weighted by their probability of being in the urbanized area for estimation purposes.

Another variable that was required for the VOF estimates is whether the crash took place on a National Highway System (NHS) highway. Only FARS included this as a stand-alone variable, but it was possible to reasonably derive it for crashes with longitude and latitude so long as the coordinates of the crash’s location was within 150 feet of any NHS highway.

Finally, all of the crash data sets had at least some missing values. Single imputation was performed using the method of Stekhoven and Buehlmann (2012). This provided the benefit of being able to estimate crash occupancy and occupancy bias using as many data records as possible.

Occupancy from Car and Truck Crashes

The methodology section identified different modeling options that were considered for the occupancy estimation. The selection of the best model was based in part on the validation accuracy of the predicted distribution for 25% held out crashes. Table 7 shows a representative example of the model comparisons using FARS for 2015. With lowest negative log likelihood as the metric and smaller values preferred, the multi-level regression with interactions is the preferred model in this example. A large enough number of similar results led to selection of this model as the basis for all occupancy distribution estimation.

Table 7: Validation of crash occupancy distribution models for FARS.

Model	Negative Log Likelihood
Multi-level Regression w/Interactions	0.1746
Multi-level Regression	0.1747
LASSO	0.1756
LASSO w/Interactions	0.1768
Random Forest	0.1785
Ordered Logistic Regression	0.1795

Geographic attribution of crashes to urbanized areas represented a challenge since the urbanized area was not a directly coded value in the databases. When the geographic definition of the crash location made urbanized area assignment unclear, a randomization approach was employed. For each geographic division (e.g., city or county), the relative proportion of its traffic associated with a particular urbanized area was estimated. For a crash in that geographic division, it was either assigned to the urbanized area or excluded from the urbanized area using a random probability compared against the relative proportion.

In all crash data sources, there are very few occurrences where a motorcycle has 3 or 4 occupants. This very rare occurrence caused some technical issues with the estimation of multi-level models and increased the simulated variance. To deal with this, motorcycles were assigned 0 probability of having 3 or more occupants.

Prevalence

Prevalence estimates were made for the years of the three most recent NHTS surveys: 2001, 2009, and 2017. HSS and TVT data were used from the same years, with two exceptions. The most recent complete HSS data was for 2015, so that was used with the 2017 NHTS data. The oldest TVT year was 2003, so that was used with the 2001 NHTS data. The 2017 NHTS did not have any information on truck traffic, and hence the 2009 NHTS marginals related to trucks were used for information not available from HSS or TVT.

When estimating occupancy, 2001 prevalence was used for years 2005 and prior, 2009 prevalence for years 2006 through 2012, and 2017 prevalence for years 2013 and later.

Occupancy Bias

Occupancy bias is only estimated for years with prevalence estimates: 2001, 2009, and 2017. For FARS-based estimation, several years of crash records were used surrounding each prevalence year. Crashes from 2001 to 2003 were used for 2001 occupancy bias, crashes from 2007 to 2011 were used for 2009 occupancy bias, and crashes from 2014 to 2016 were used for 2017 occupancy bias. For estimation with state data records, only the year of crash records that was closest to each prevalence year was used, as long as it was within two years. If no crash records were available within two years, the bias was not estimated. Occupancy estimation was done with the most recent bias estimate that was made with prior crash records. For example, occupancy estimation for 2011 with FARS data used the 2001 bias estimates, since the 2009 estimates would have included 2011 FARS data.

Model selection for occupancy estimation was based in part on the validation accuracy of the predicted bias and counts for the next bias period. For FARS, crash and prevalence data from 2001 were used to predict the bias from 2009. The results from FARS are in Table 8. The weighted MSE is the mean squared error of the predicted bias, weighted by the number of VMT. The negative log likelihood is for a Poisson distribution, predicting the number of crashes with a certain number of occupants given the offset term, which includes the total number of crashes, and the proportion of VMT with that number of occupants. The models "by occupant" assume the relation between the variables and bias varies by occupancy. Smaller values of the weighted MSE and negative log likelihood correspond to better model fits.

The results provided for FARS are representative of the results for all crash data sources. Poisson Regression by Occupant and multi-level by occupant typically are the top two, with nearly identical performance. Poisson Regression by Occupant was used for all occupancy bias estimation.

Table 8: Validation of model for FARS' occupancy bias.

Model	Weighted MSE	Negative Log Likelihood
Poisson Regression by Occupant	1.865	0.432
Multilevel by Occupant	1.865	0.431
Poisson Regression	1.870	0.443
Multilevel	1.870	0.443
Lasso by Occupant	1.937	0.529
Lasso with Interactions	1.983	0.501
Naive Estimate	2.808	

Validation

A critical component of the evaluation was to determine whether the estimates were accurate. Where available, estimates were compared between measurement systems. In the absence of this option, several internal consistency checks were identified that could provide confidence in the quality of the estimates.

Internal Consistency

One method of validation that Heidtman et al. (1997) recommended was to confirm that the estimates follow known patterns of vehicle occupancy. This validates the relative values of the estimates, but not the absolute values. Specifically, they recommend confirming that:

- Weekday AM estimates are lower than weekday PM estimates,
- Weekend estimates are larger than the weekday estimates,
- Off peak estimates are larger than on peak estimates, and
- Winter estimates are smaller than summer estimates.

A natural additional test is to confirm that:

- Car estimates are larger than truck estimates.

The estimates produced in this evaluation are determined for subpopulations that include highway type, time of day, and vehicle class within each year and geographic division. A sampling of these estimates was selected to evaluate the recommended validation checks. They include:

1. Weekday AM peak to weekday PM peak for cars on non-interstate NHS highways,
2. Weekend day time to weekday midday for cars on non-interstate NHS highways,
3. Weekday AM to weekday midday for cars on non-interstate NHS highways, and
4. Cars to trucks for weekday midday on non-interstate NHS highways.

Comparison of winter to summer was not possible since all estimates produced were for full years. To complete the comparison, a statistic was calculated for whether the comparison provided the expected outcome with regard to which VOF was larger. As a control, the statistical comparison was repeated with VOF estimated by a more naïve methodology, where the average of the number of occupants for all crashes fitting the given criteria was used without application of the bias and prevalence estimates.

The results of the four validation tests are in Table 9, using both FARS and the state crash records as the data sources. Pass and fail are counts of the number of unique state (or urbanized area) and year combinations where the VOFs determined by the two methods generated the expected result (Pass) or the opposite (Fail). The table shows that the bias and prevalence adjusted methodology passed every test for all geography/year combinations using both data sources and for both geography levels. The results for the naïve estimates are generally not 100 percent consistent with the expected trends. Additionally, many of these naïve estimates could not even be developed because there were no crashes in the database for a given year/geography and other filtering criteria.

Table 9: Results of the validation tests for VOF.

			Full Adjustment			Naïve		
Test	Data Source	Geography	Pass	Fail	% Pass	Pass	Fail	% Pass
1	FARS	State	510	0	100%	355	106	77%
1	FARS	UZA	1770	0	100%	396	114	78%
1	State Crash Records	State	53	0	100%	53	0	100%
1	State Crash Records	UZA	383	0	100%	339	19	95%
2	FARS	State	510	0	100%	354	126	74%
2	FARS	UZA	1770	0	100%	468	216	68%
2	State Crash Records	State	53	0	100%	53	0	100%
2	State Crash Records	UZA	383	0	100%	350	10	97%
3	FARS	State	510	0	100%	340	128	73%
3	FARS	UZA	1770	0	100%	417	136	75%
3	State Crash Records	State	53	0	100%	53	0	100%
3	State Crash Records	UZA	383	0	100%	332	28	92%
4	FARS	State	510	0	100%	390	34	92%
4	FARS	UZA	1770	0	100%	248	31	89%
4	State Crash Records	State	53	0	100%	50	3	94%
4	State Crash Records	UZA	383	0	100%	305	27	92%

Year-Over-Year Consistency of Estimates

Another measure of validity would be consistency of the estimates from year-to-year. While some change in VOF is certainly possible, it seems unlikely that large scale geographies would see large year-over-year changes. Figure 4 shows the yearly overall state-wide VOF estimates using the bias and prevalence-adjusted methodology compared to the naïve average based solely on FARS crash occupancy. The more robust methodology leads to more consistent year-over-year results (plot on left) compared to the more random appearing pattern on the right. While more consistent, the fully adjusted VOFs are still susceptible to movement as evident by the separation of the states into two groupings at 2012.

After review, this is caused by a change in the occupancy bias estimation at 2012 that drove most states results higher, but seemed to depress the results for the states in the Mountain Census division (CO, MT, ID, WY, UT, NM, AZ, NV). Figure 5 shows the VOF by Census division[1] as estimated by the NHTS for 2001, 2009, and 2017. Only the Mountain division had a significant decrease in VOF from 2001 to 2009. Since the occupancy bias estimates used for 2012 and on were derived from the 2009 NHTS, this caused those estimates to likewise decrease.

[1] Map available at https://www2.census.gov/geo/pdfs/maps-data/maps/reference/us_regdiv.pdf

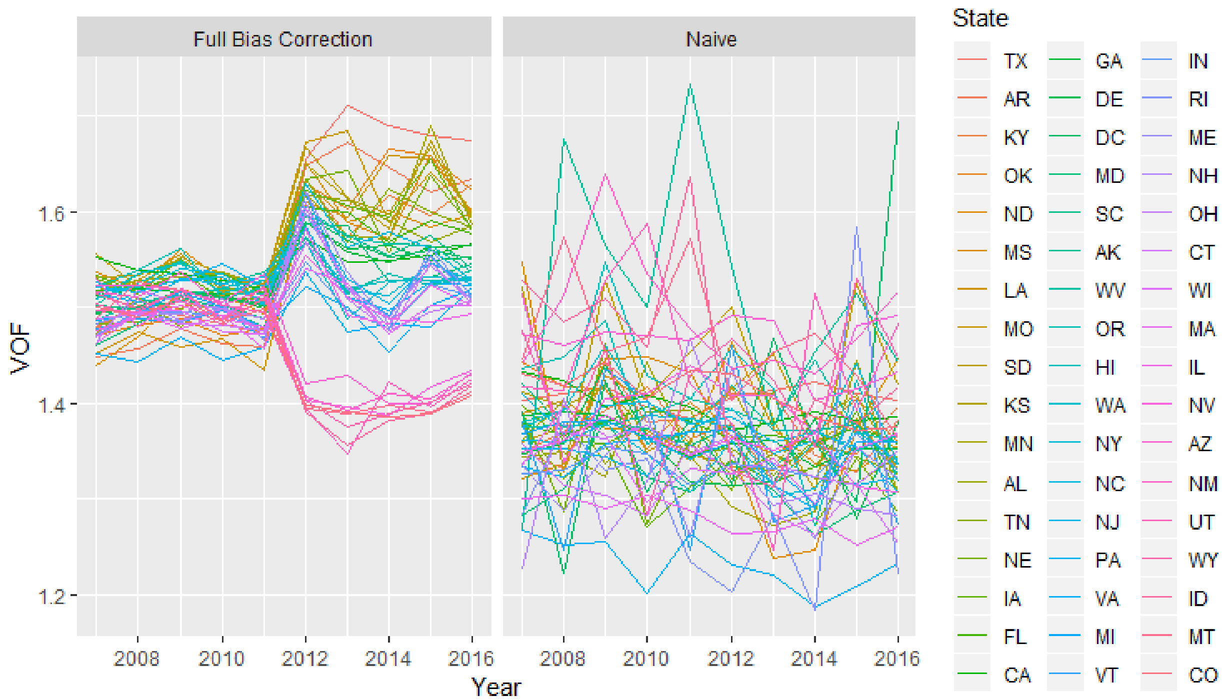

Figure 4: State-wide car and truck VOF estimates using the fully adjusted estimation methodology and the naïve average using FARS data.

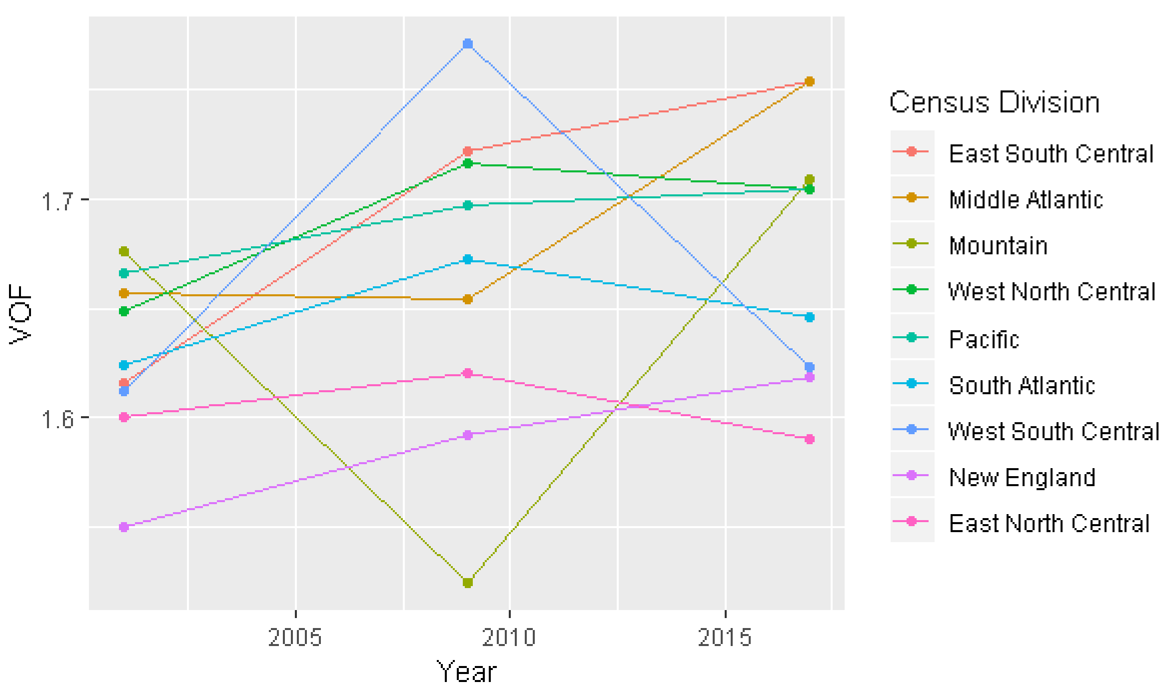

Figure 5: NHTS VOF estimates by Census division.

A similar analysis for year-over-year consistency of VOFs was conducted using the state crash records, as shown in Figure 6. This plot includes error bars indicating one standard error and adds a post-stratified estimate without the occupancy bias correction in addition to the naïve estimate and the fully adjusted estimates. In contrast to the results of the consistency analysis for FARS, the naïve estimates from the state crash data appear just as consistent from year-to-year as the adjusted estimates. This is most likely due to the much larger amount of data on crashes in the state data. When comparing the absolute values of the estimates, though, the fully adjusted estimates appear to be systematically larger and closer to the national NHTS estimate of 1.67. The one exception is for CA HSIS data, where the naïve estimates are much higher than the fully adjusted estimates. Investigation of this result suggests there may be a bias in the way the CA HSIS data are recorded, where the number of passengers were less likely to be recorded if there was only the driver in the car.

The inclusion of the intermediate estimate with post-stratification was intentional and it provided an important observation in that the results of this method were more like the naïve estimates than to the fully adjusted ones. This indicates that the population of drivers who get in some sort of crash is not too dissimilar from the general population of drivers. The larger adjustment from the occupancy bias indicates that the methodology finds that the number of occupants in the car effects the likelihood of getting in a crash.

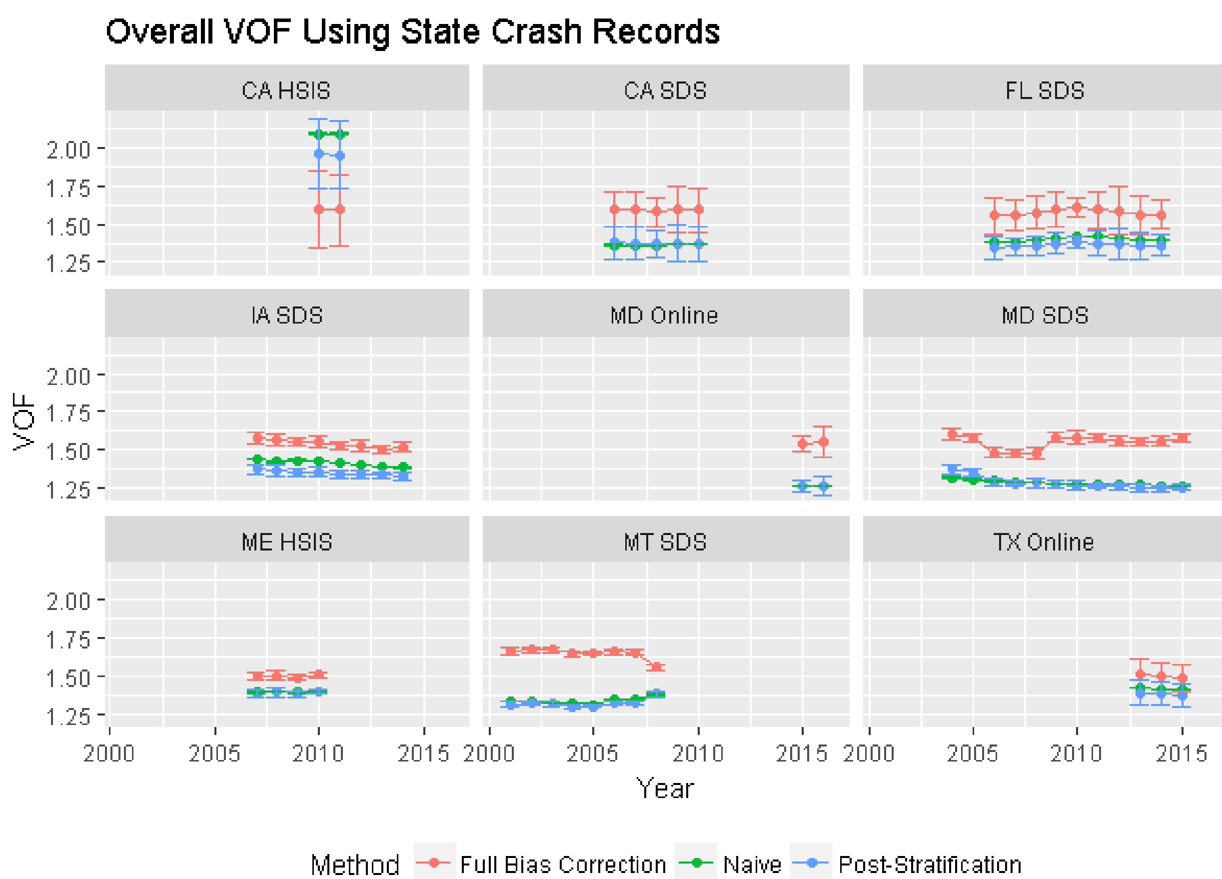

Figure 6: State-wide car and truck VOF estimates with standard errors using the fully adjusted estimation methodology, post-stratification, and the naïve average using state crash records.

Comparison of Different VOF Estimates

The use of different source data in FARS and the various state-based systems, as well as the overall NHTS VOF provide another way to validate the proposed methodology. Figure 7 shows the comparison of the state-wide car and truck estimates from the seven pilot states using the different data sources: SDS, HSIS, and Online for state crash records, FARS for deadly crashes, and NHTS for a survey of the driving population. ME and MT do not have NHTS estimates for 2001 because their sample sizes were too small to be included in the survey. Standard errors are provided for all estimates. The estimates from the crash records use the methodology outlined in this report, while the NHTS estimates use replicate weights.

In general, the estimates from the different crash data sources (FARS, SDS, HSIS, Online) are consistent, with the standard errors often overlapping. The estimates from NHTS are either in line with the crash-based estimates or a little higher. One reason the NHTS estimates are higher could be due to a difference in the relative proportion of truck traffic. In the NHTS, the percent of VMT driven by trucks were 2.7%, 1.6%, and 0% in the three surveys. In contrast, according to the 2015 Highway Statistics Series, 9.0% of VMT were driven by “single-unit 2-axle 6-tire or more and combination trucks”. Since the fully adjusted method uses the HSS data to post-stratify and truck occupancy is generally much lower than car occupancy, it is not unexpected that crash-based estimates are lower than NHTS.

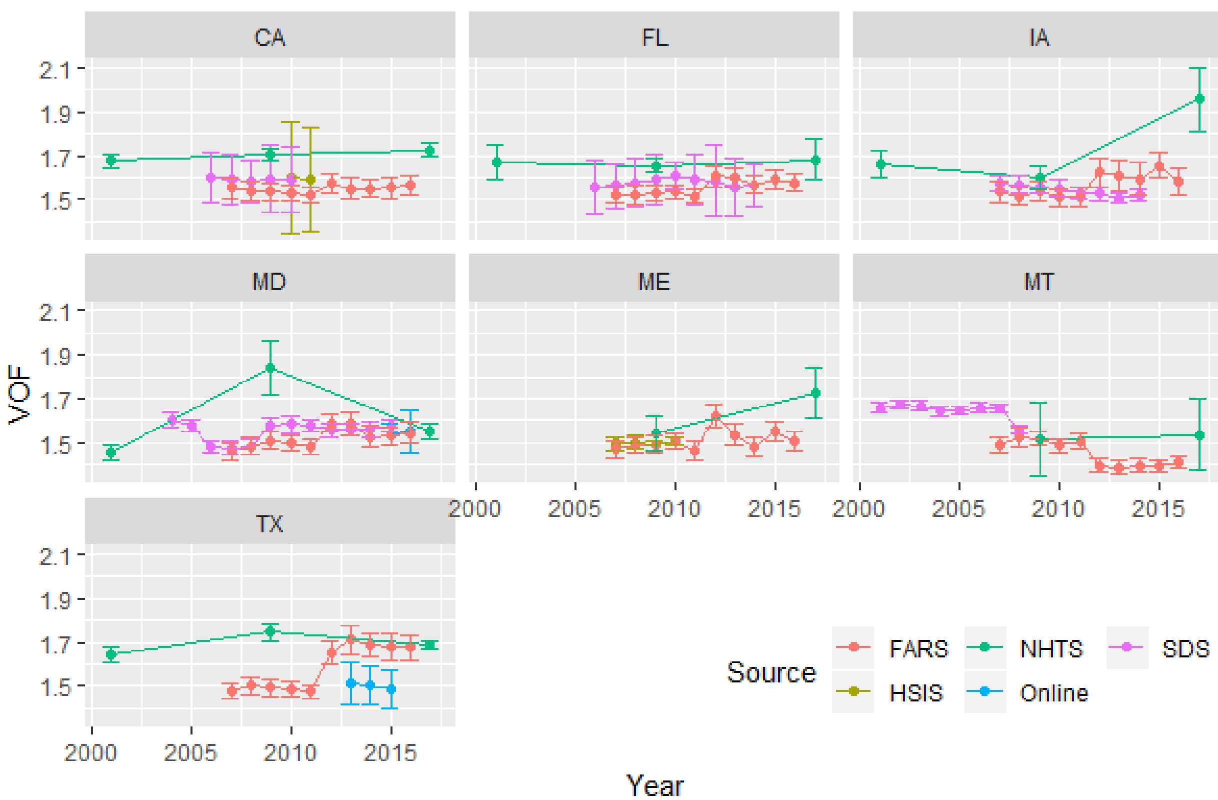

Figure 7: Comparison of state-wide car and truck VOF estimates from different data sources.

Local municipal planning organizations and state DOT’s sometimes conduct their own VOF surveys. Among the seven pilot state DOTs, ME provided their VOF estimates based on crash data. FL DOT commissioned a report to estimate VOF with crash records. An estimate of Washington, D.C.’s VOF was obtained from Washington Council of Governments’ 2007/08 Household Travel Survey.

The comparisons of VOFs in this evaluation to the targeted ones listed above is shown in Figure 8. The FL external estimate was transcribed from a graphic. Its values unfortunately pre-date the earliest estimates in this evaluation. The ME external estimate does not have an associated year, so it was simply plotted for the entire 2007 to 2016 time period. The DC external estimate is within the standard error bars of the fully adjusted FARS-based estimate. The FL and ME external estimates are lower than the fully adjusted estimates. This may be due to the fact that they are based on crash data and as was demonstrated in the previous section, the proposed occupancy adjustment in this evaluation typically increases estimates. ME makes no adjustments to the crash data, while FL does some post-stratification by driver age and gender.

Finally, in 2013, the Federal Motor Carrier Safety Administration conducted a nationally-representative survey of commercial motor vehicles to estimate seatbelt usage (https://www.trucking.org/ATA%20Docs/What%20We%20Do/Trucking%20Issues/Documents/Safety/SBUCMVD%202013%20Final%20Report%20020414.pdf). They observed a VOF of 1.06 in the front seat. Since they only observed the front seat and there may be occlusion issues, this estimate is a lower bound of the true VOF. The 2013 truck VOF morning estimates using the proposed methodology with FARS data varied from 1.07 to 1.16, depending on the road type and state. For all road types and states, 41% of the estimates have a 95% confidence interval that contains the survey estimate (1.06). This provides weak evidence that the proposed methodology overestimates truck VOF, possibly due to pooling the estimates with cars. The difference could also be caused by random variation and so additional verification is needed to make any conclusions.

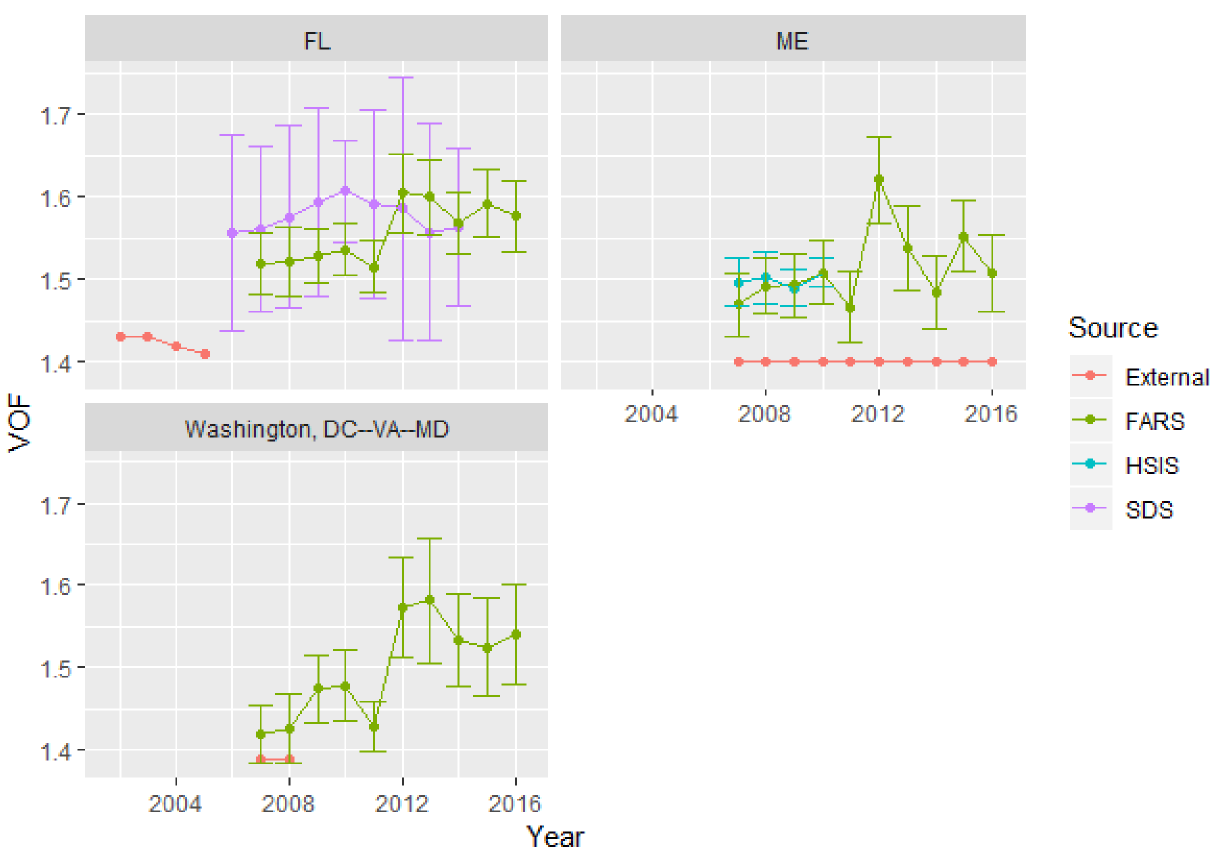

Figure 8: External comparison for select geographies.

NonSOV Comparison

To better understand whether the estimated NonSOV are of the correct magnitude, the distribution of the estimates from the urbanized areas is compared to similar estimates for metropolitan statistical areas from both ACS and NHTS. This comparison of NonSOV estimates is based on FARS data since all urbanized areas are estimated every year.

The ACS provides NonSOV estimates, but it is only for commuting trips and so is much lower than general NonSOV. Figure 9 compares commuting-based non-SOV from the ACS to general NonSOV from the NHTS for metropolitan statistical areas in 2009 and 2017. The ACS commuting NonSOV is typically between 15% and 35%, while the NHTS general NonSOV is typically much higher, between 50% and 70%.

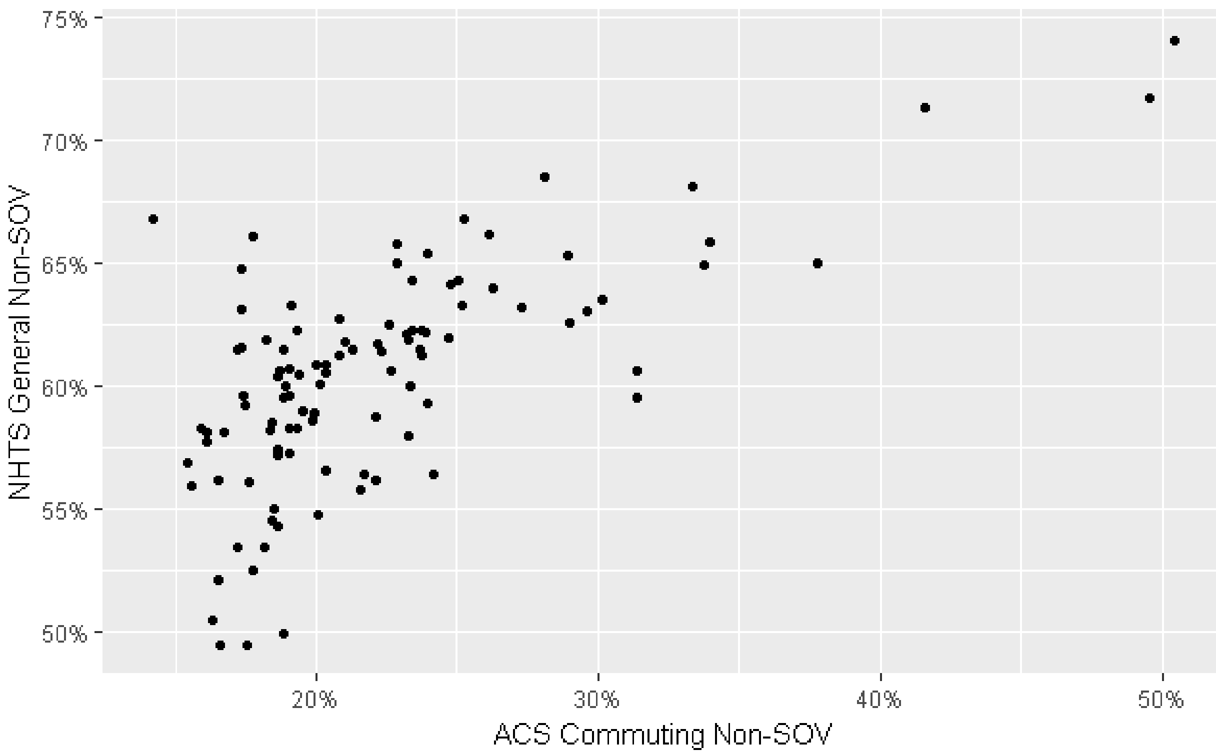

Figure 9: Comparison of ACS commuting NonSOV and NHTS general non-SOV.

The distribution of the NonSOV estimates made using FARS data (2007-2016) are next compared to NonSOV estimates made with NHTS data (2001, 2009, 2017) in Figure 10. Each line is a kernel density estimate for one year. The FARS-based estimates are at the urbanized area level, while the NHTS estimates are at the metropolitan statistical area level. Two methods of calculating NonSOV with NHTS data are presented. The first is trip-based, where the proportion of trips, regardless of driver, are used to estimate NonSOV. This is the recommended method and gives estimates lower than the proposed estimates. To explore why the proposed estimates are higher, NonSOV is also calculated with a vehicle-based method, that more closely mirrors the proposed methodology. For the vehicle-based method, the proportion vehicle SOV is calculated by dividing the proportion of vehicle trips with only one occupant by the VOF. Since crashes occur at the vehicle level, estimates made using crash data must use this methodology. When doing so, the NHTS estimates become even higher. Therefore, it is not possible to definitively state whether the proposed estimates are too high or too low.

Further, there may be a small effect of differing city sizes on NonSOV. Since metropolitan statistical areas are typically larger than their corresponding urbanized areas, there may be less sprawl and more vehicle traffic in MSAs.

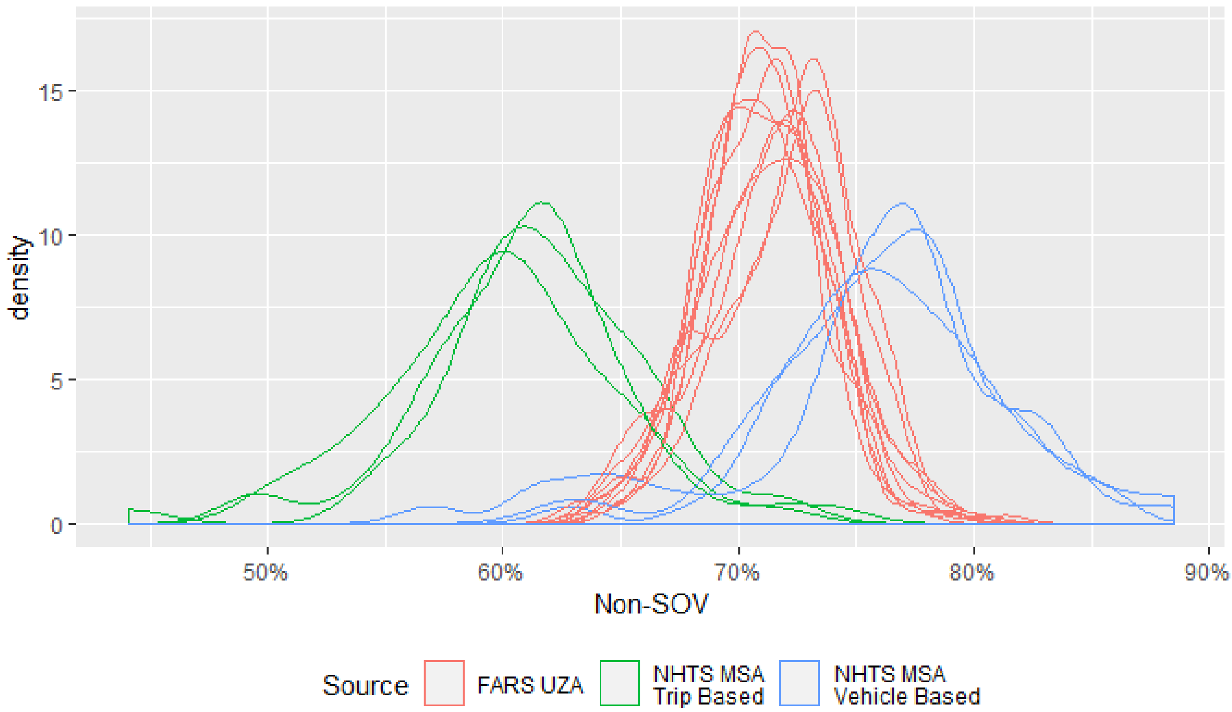

Figure 10: Comparison of the proposed non-SOV urbanized area estimates based on FARS and two methods of calculating non-SOV with NHTS data for metropolitan statistical areas. Each density curve visualizes the distribution for one year.

As a first datapoint, the relevant information to calculate vehicle-based NonSOV ($NonSOV_{veh}$) was available from a 2010/2011 survey by the New York Metropolitan Transportation Council and the North Jersey Transportation Planning Authority, which covered an area slightly larger than the New York--Newark, NY--NJ--CT urbanized area (NYMTC and NJTPA, 2014). They found that for all weekday travel, 68.2% of trips were single occupant, 21.7% had 2 occupants, 6.6% had 3 occupants, and 3.5% had 4 or more occupants (Table 4-53 of NYMTC and NJTPA, 2014). Assuming the conditional mean occupancy is 4.5 when there are 4 or more occupants, this implies the $NonSOV_{veh}$ was 53.7%. The proposed methodology using FARS estimates $NonSOV_{veh}$ was 56.0% in 2010 and 52.7% in 2011, with an average value of 56.7% between 2007 and 2016. This is in line with other urbanized areas, as the average $NonSOV_{veh}$ for all urbanized areas over all years estimated is 54.0% using FARS. This data point provides validation that our $NonSOV_{veh}$ estimates using crash data are in line with this external survey. The other input to NonSOV estimation, $\Pr(Vehicle)$, is not estimated using crash records and gives estimates in line with the NHTS (see Figure 9).

A more systematic survey was done to determine if the larger values of NonSOV are reasonable and possibly provide validation of the estimates. Metropolitan planning organization (MPOs) of all urban cities/counties across the nation with population more than 200,000 were contacted. A total of 177 MPOs were contacted to provide the non-SOV or VOF values they use for planning purposes. A generic email was sent to lead individuals in the planning division of the MPOs or their equivalent. Of the 177 MPOs, 20 replied, and 12 provided relevant information. A few agencies mentioned that they do not collect travel data to estimate the regional non-SOV and VOF values, rather they adopt values that neighboring or other agencies use.

Table 10 shows the details of the information obtained from the MPOs that responded, as well as the 2016 5-year estimates from ACS, which only includes commuting trips, and the estimates proposed in this report. In addition, New York, Philadelphia, Atlanta, Detroit, Denver, and Cincinnati provided estimates, but were not included because they only included either work trips or auto-based trips.

In general, the estimates from the agencies are much higher than the ACS commuting estimates, and closer to the proposed methodology, although the estimates from the proposed methodology are typically larger. This gives further credibility the general NonSOV should be much higher than the ACS estimates, which only account for commuting trips. The one outlier is St. Louis, which has NonSOV values closer to the ACS than the methodology proposed in this report. They did not explicitly state the source of their estimate, and so may not be comparable.

Table 10. Summary of NonSOV values used by major MPOs.

Urbanized Area	Agency Name	Study Year	NonSOV from Agency	NonSOV from 2016 ACS 5-Year	NonSOV Estimate using FARS
Chicago, IL--IN	Chicago Metropolitan Agency for Planning	2015	57%	31%	75%
Miami, FL	Miami-Dade Transportation Planning Organization	2014-2017	64%	22%	74% (2014-2016)
Minneapolis--St. Paul, MN--WI	Minneapolis-St Paul Twin Cities Metropolitan Council	2010	52%	23%	74%
Tampa--St. Petersburg, FL	District Seven Planning & Environmental Management Office	2009	60%	20%	73%
St. Louis, MO--IL	East West Gateway Gov Association	Not Given	28%	18%	74% (for 2016)
San Antonio, TX	Alamo Area MPO	2006	66%	20%	69% (for 2007)
Orlando, FL	Metro Plan Orlando	2015	Home-based work 48% Non-home-based work 50%	20%	75%
Salt Lake City--West Valley City, UT	Wasatch Front Regional Council	2012	55%	25%	67%
El Paso, TX--NM	El Paso MPO	2012	59%	20%	74%
Reno, NV--CA	Washoe County Regional Commission	Not Given	52%	22%	65% (for 2016)
Stockton, CA	San Joaquin Council of Governments	2015	60-65%	23%	71%
Visalia, CA	Tulare County Association of Governments	2015	63%	18%	69%

Deliverables

VOF and NonSOV estimates

Table 11 shows the car and truck VOFs, and NonSOV estimates generated using FARS data and the different state crash data options. This includes NonSOV estimates for every urbanized area in Table 12. Further, car and truck VOF estimates are provided for the same urbanized areas as well as for the seven pilot states (California, Florida, Iowa, Maine, Maryland, Montana, and Texas). The car and truck VOF estimates include subgroup estimates by time of day and highway type within each vehicle class, year, and geographic region. All estimates are reported with mean values and standard errors

Table 11: Estimates provided by geography and data source for car and truck VOF and NonSOV.

Geography	FARS	SDS	HSIS	Online	Notes
CA State and UZAs	2007-2016	2006-2010	2010-2011		Missing Reno, NV--CA using SDS and HSIS
FL State and UZAs	2007-2016	2006-2014			
IA State	2007-2016	2007-2014			
• Omaha, NE—IA	2007-2016	2007-2013			
• Des Moines, IA	2007-2016	2007-2014			
• Davenport, IA—IL	2007-2016	2007-2014			
MD State	2007-2016	2004-2015		2015-2016	
• Philadelphia, PA—NJ—DE—MD	2007-2016	2010-2012			
• Washington, DC—VA—MD	2007-2016				
• Baltimore, MD	2007-2016	2004-2015*		2015-2016	
• Aberdeen--Bel Air South--Bel Air North, MD	2007-2016	2004-2015*		2015-2016	
ME State and UZA	2007-2016		2007-2010		
MT State	2007-2016	2001-2008			
TX State and UZAs	2007-2016			2013-2015	Missing El Paso, TX--NM using Online
All Other States and UZAs	2007-2016				

* NonSOV estimates are limited to 2006 to present, due to ACS availability

Urbanized areas that overlap more than one state presented some challenges to the analysis.

For the Washington, DC--VA--MD urbanized area, state crash data from VA and MD was adequate, but not from DC. The data from DC was missing vehicle and person identifiers necessary to count the number of occupants in the vehicles. Therefore, estimates were only possible through FARS.

The Reno, NV--CA urbanized area was only estimated through FARS. Virtually all of the population of this urbanized area is in Nevada and no state crash records were available in this analysis from Nevada.

The El Paso, TX--NM urbanized area was only estimated through FARS. State crash records were available for TX from 2013 to 2015 and for NM from 2001 to 2011, but this did not provide any single year where both sets of data were available.

The Pensacola, FL--AL urbanized area was estimated through FARS and also through Florida state crash records. Alabama state crash records were not available in this analysis, so the state-based analysis of the urbanized area utilized only Florida crash records. This decision was made as less than 2% of the urbanized area population is estimated to live in AL.

Estimates of bus VOF were generated for 2015 and 2016. Due to limited data availability, these estimates could only be made at the state and urbanized area level, and not for the time of day and highway type categories that were possible for passenger vehicles and trucks. Additionally, of the 59 urbanized areas in the seven pilot states, adequate data were only available to estimate the bus VOF for 45 urbanized areas.

Computer Code

The code to reproduce these estimates is also provided. Since there is a fair amount of variability between the crash records from different states and nationally, code is provided on how the data was processed, combined, and filtered for each state separately. For each crash data source, code to preprocess, filter, and normalize of the data was written in SAS. After the data has been pre-processed, the following procedure was used for each crash data source, all written in R:

1. If latitude and longitude are available, geographic information system techniques were used to identify the urbanized area, metropolitan statistical area, and whether it was on a national highway system highway
2. Additional processing, filtering, normalization, and variable reduction to retain the same variables for all sources
3. Data codebook creation and comparison of variable distributions to FARS
4. Data codebook creation and comparison of variable distributions to NHTS
5. Model comparison and report for estimating crash occupancy distribution
6. Model comparison and report for estimating occupancy bias
7. Estimate and save occupancy bias
8. Estimate and save model of crash occupancy distribution, and
9. Combine estimated prevalence, bias, and crash occupancy to estimate and save VOF and vehicle NonSOV.

The above nine files are used for each data source but can generally be applied to new data by updating the source and destination of the files, as well as the appropriate years. A template version of the 9 files is provided as well.

In addition to the code for estimating occupancy from crash records, code is included to:

- Process and normalize the NHTS
- Calculate prevalence, including data from NHTS, HSS, and TVT
- Estimate the proportion of non-vehicle traffic using ACS data
- Combine the non-vehicle estimates with the vehicle NonSOV, and
- Estimate the bus VOF using NTD data.

Selected Results

Selected graphical summaries are provided below to show the relative range of results obtained using this methodology. Figures 11 and 12 show the range of vehicle occupancy factors and NonSOV travel, respectively, across the 177 urbanized areas in the continental US based on FARS data for the 2016 calendar year. From Figure 11, six of the lowest nine VOFs for 2016 were UZAs in Colorado and Utah, while 13 of the top 18 were in Texas. For the NonSOV data in Figure 12, results ranged from a low in Fort Wayne (0.643) to a high in New York City—Newark (0.803).

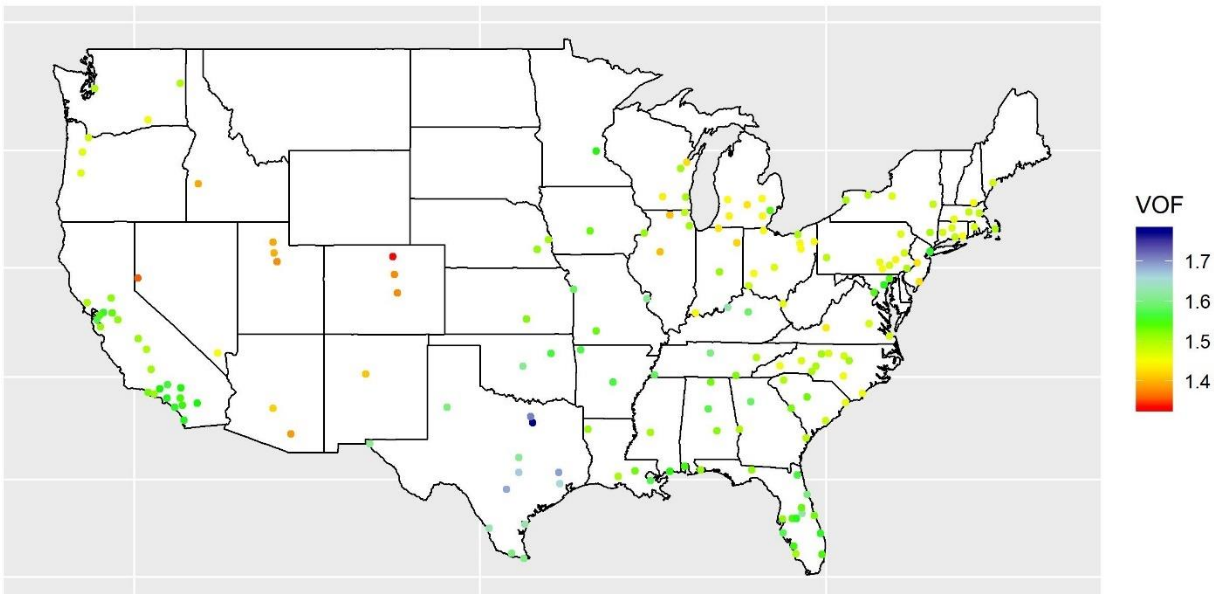

Figure 11: FARS based Vehicle Occupancy Factors by census urbanized area for 2016.

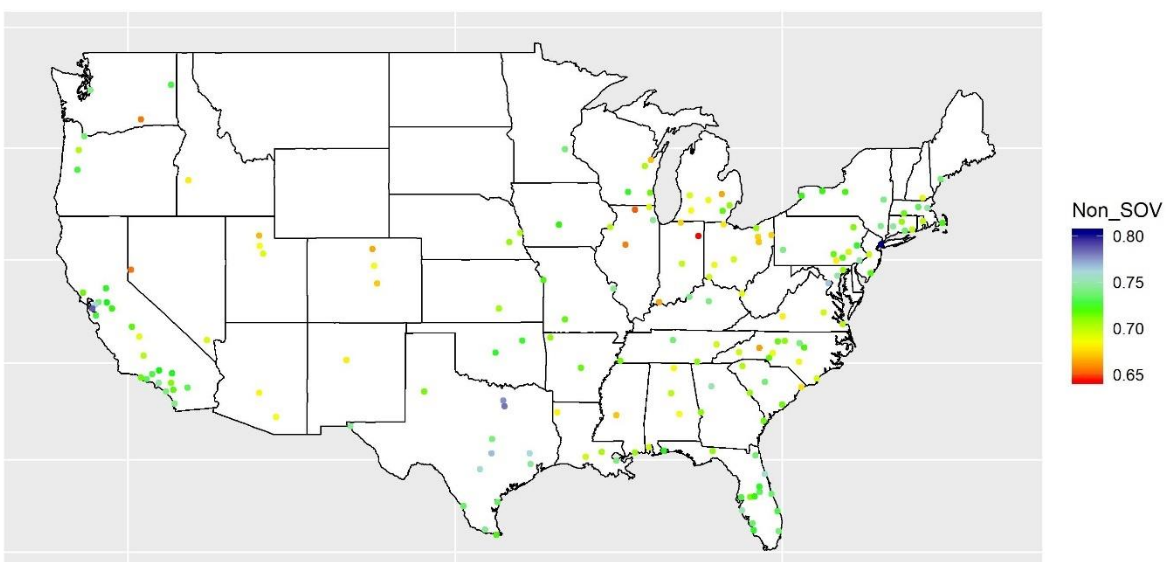

Figure 12: FARS based NonSOV by census urbanized area for 2016.

Figure 13 shows boxplots of the range of VOF estimates of the aggregate of cars and trucks (weighted by VMT) across U.S. States (and the District of Columbia) using FARS data. From this Figure, the overall shift in median state VOF from approximately 1.5 in years 2007 through 2011 can be plainly seen. The impact of the use of the 2009 NHTS starting in 2012 coincided with an almost 0.1 increase in VOF from the previous year. Following 2012, the median VOF returned to levels of 1.55 and below, but the state to state variability that was discussed above continued through 2016.

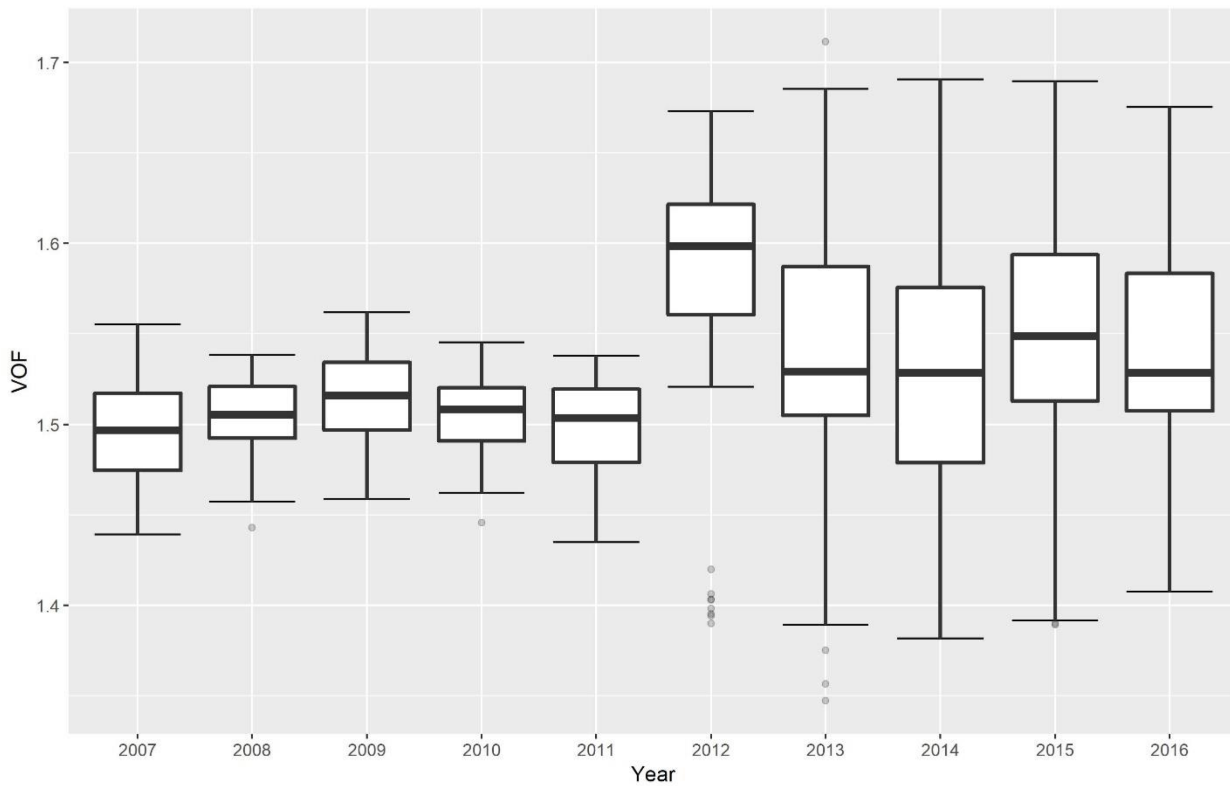

Figure 13: FARS based Vehicle Occupancy Factors of Cars and Trucks across states by Year.

Figure 14 provides some indication of how VOF varied by the covariates of time of day and whether travel was on the Interstate highway system. Whether for cars or trucks, the non-interstate NHS VOFs tended to be a little higher than for interstate, though the differences were small. Time of day was associated with much more impactful VOF measurement differences, with weekday AM rush (6-10 AM) consistently the lowest VOF, and weekday PM rush (4-8 PM) running second. The weekend daytime VOFs showed the largest estimates of any time period. The substantially lower VOFs for trucks are also apparent in Figure 14.

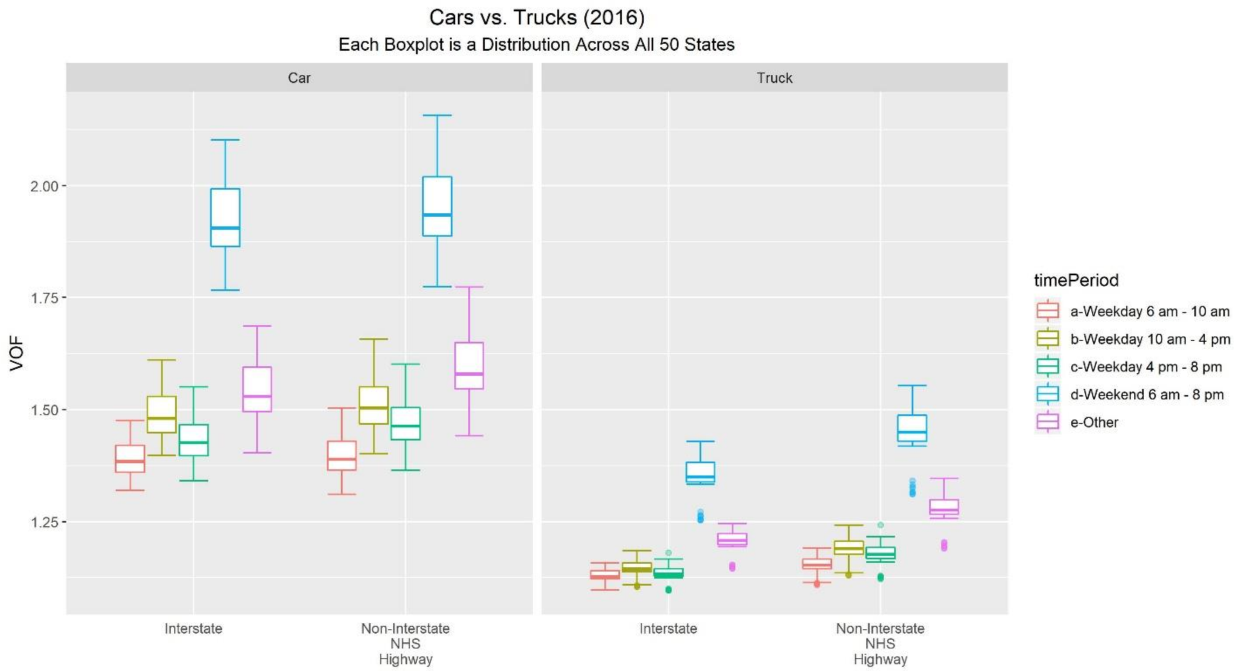

Figure 14: FARS based Vehicle Occupancy Factors by State in 2016 Between Cars and Trucks at Different levels of the interstate and time of day covariates.

Conclusions and Recommendations

The following conclusions and recommendations are provided:

1) For passenger cars and trucks, the method as proposed appears to work to produce credible VOF and NonSOV. The estimates produced were compared in both internal and external validation checks and found to be within the ranges that would be expected.
    a. Estimates were also demonstrated for buses, but these estimates were not so easily validated, and they were only able to be calculated for higher level geographic divisions.
2) Future use of the methodology is always dependent on quantity and quality of crash data as well as some source of occupancy bias since this did appear to be an important factor in the methodology. The uncertainty of the future form of NHTS is a concern since it forms one central part of the bias adjustments. The use of the 2017 NHTS for occupancy bias in passenger vehicles may be acceptable for a few years before drift in this bias over time would have to be investigated.
3) Individual state records are more numerous and can produce a more representative estimate than FARS but have the disadvantage on not necessarily being uniform in their content and data quality, both of which are issues for a sustainable system. However, using FARS or the state system, or even an average of the two, is arguably superior to the current system of only a single national NHTS value, or the great cost of implementing a statewide system.
4) The code used to generate a large subset of VOF and NonSOV estimates has been provided. The system of obtaining and preparing the input data records for this task is non-trivial and would best be completed by someone trained and knowledgeable in data management, data science, and statistics. The code does not anticipate all future issues that could generate questionable results and estimates generated from the code should still be evaluated for realism before being published.

If new users wish to adopt this methodology, this code can be used, with some understanding and modifications, to generate data from other crash records, especially in future time periods. The contents of this evaluation were originally meant to be a demonstration of a proposed methodology and were required for only a subset of U.S. geographic and temporal divisions. The estimates delivered herein greatly exceed those original requirements, in many cases achieving a true national scope. In some areas, though, the estimates could be further enhanced, especially with state level crash data. Additionally, the methodology as implemented assumes the continued availability of data of the type and fidelity currently available. This assumption is discussed where there are concerns that this condition will not persist.

References

Asante, S., Adams, L., Shufon, J., & McClean, J. (1996). Estimating average automobile occupancy from accident data in New York State. *Transportation Research Record: Journal of the Transportation Research Board*, (1553), 115-123.

Breiman, Leo (2001). Random forests. *Machine learning* 45.1: 5-32.

Chang, Li-Yen, and Fred Mannering (1998). Predicting vehicle occupancies from accident data: An accident severity approach. *Transportation Research Record: Journal of the Transportation Research Board* 1635: 93-104.

Chen, Li-Hui, et al (2000). Carrying passengers as a risk factor for crashes fatal to 16-and 17-year-old drivers. *JAMA* 283.12: 1578-1582.

Gan, Albert, K. Y. Liu, and Rax Jung (2007). Vehicle occupancy data collection methods (Phase II). *BD015-14, Transportation Statistics Office, Florida Dept. of Transportation, Tallahassee, FL*.

Heidtman, K., B. Skarpness, and C. Tornow (1997). *Improved vehicle occupancy data collection methods*. No. DTFH61-93-C-00055. Office of Highway Information Management, Federal Highway Administration.

Gaulin, R. (1991). A Procedure to Calculate Vehicle Occupancy Rates from Traffic Accident Data. Bureau of Planning, Connecticut Department of Transportation, Newington.

McCullagh, P., Nelder, J. (1987). *Generalized Linear Models*, Second Edition. CRC Press, New York.

NYMTC and NJTPA (2014). 2010/2011 Regional Household Travel Survey Final Report. https://www.nymtc.org/portals/0/pdf/RHTS/RHTS_FinalReport%2010.6.2014.pdf.

Stekhoven, D.J. and Buehlmann, P. (2012). MissForest - nonparametric missing value imputation for mixed-type data, *Bioinformatics, 28*(1), 112-118, doi: 10.1093/bioinformatics/btr597

Tibshirani, Robert (1996). Regression shrinkage and selection via the lasso. *Journal of the Royal Statistical Society. Series B (Methodological)*: 267-288.

Wang, Wei, et al (2015). Forecasting elections with non-representative polls. *International Journal of Forecasting* 31.3: 980-991.

Appendix

Table 12: Urbanized area with a population of at least 200,000 in the seven[2] designated states. The population was recorded in the 2010 Census.

State	Urbanized Area	Population	Other States Needed
California	Los Angeles--Long Beach--Anaheim, CA	12,150,996	
	San Francisco--Oakland, CA	3,281,212	
	San Diego, CA	2,956,746	
	Riverside--San Bernardino, CA	1,932,666	
	Sacramento, CA	1,723,634	
	San Jose, CA	1,664,496	
	Fresno, CA	654,628	
	Concord, CA	615,968	
	Mission Viejo--Lake Forest--San Clemente, CA	583,681	
	Bakersfield, CA	523,994	
	Murrieta--Temecula--Menifee, CA	441,546	
	Reno, NV—CA	392,141	NV
	Stockton, CA	370,583	
	Oxnard, CA	367,260	
	Modesto, CA	358,172	
	Indio--Cathedral City, CA	345,580	
	Lancaster--Palmdale, CA	341,219	
	Victorville--Hesperia, CA	328,454	
	Santa Rosa, CA	308,231	
	Antioch, CA	277,634	
	Santa Clarita, CA	258,653	
	Visalia, CA	219,454	
	Thousand Oaks, CA	214,811	
Florida	Miami, FL	5,502,379	
	Tampa--St. Petersburg, FL	2,441,770	
	Orlando, FL	1,510,516	
	Jacksonville, FL	1,065,219	
	Sarasota--Bradenton, FL	643,260	
	Cape Coral, FL	530,290	
	Palm Bay--Melbourne, FL	452,791	
	Port St. Lucie, FL	376,047	
	Palm Coast--Daytona Beach--Port Orange, FL	349,064	
	Pensacola, FL—AL	340,067	AL

[2] Note that Montana is one of the seven states to be evaluated in this study, but it is excluded from this table due to no qualifying urbanized area.

State	Urbanized Area	Population	Other States Needed
	Kissimmee, FL	314,071	
	Bonita Springs, FL	310,298	
	Lakeland, FL	262,596	
	Tallahassee, FL	240,223	
	Winter Haven, FL	201,289	
Iowa	Omaha, NE—IA	725,008	NE
	Des Moines, IA	450,070	
	Davenport, IA—IL	280,051	IL
Maine	Portland, ME	203,914	
Maryland	Philadelphia, PA—NJ—DE—MD	5,441,567	PA, NJ, DE
	Washington, DC—VA—MD	4,586,770	DC, VA
	Baltimore, MD	2,203,663	
	Aberdeen--Bel Air South--Bel Air North, MD	213,751	
Texas	Dallas--Fort Worth--Arlington, TX	5,121,892	
	Houston, TX	4,944,332	
	San Antonio, TX	1,758,210	
	Austin, TX	1,362,416	
	El Paso, TX—NM	803,086	NM
	McAllen, TX	728,825	
	Denton--Lewisville, TX	366,174	
	Corpus Christi, TX	320,069	
	Conroe--The Woodlands, TX	239,938	
	Lubbock, TX	237,356	
	Laredo, TX	235,730	
	Killeen, TX	217,630	
	Brownsville, TX	217,585	

Appendix B CARS data structure

1 - CRASH LEVEL EXTRACT (ONE ROW PER CRASH)

COL	CAR COLUMN NAME	TYPE	SIZE	START	EXAMPLE	COLUMN DESCRIPTION
1	CRSH_NUM	CHAR	9	1	123456789	CRASH NUMBER
2	CAL_YR	CHAR	4	11	CCYY	CALENDAR YEAR
3	EVNT_CRSH_DT	DATE	10	16	CCYY-MM-DD	EVENT CRASH DATE
4	EVNT_CRSH_TM	CHAR	4	27	23:38	EVENT CRASH TIME
5	DAYOWEEK	CODE	1	32	1	DHSMV DAY OF WEEK
6	MANDIST	CODE	2	34	01	MANAGING DISTRICT
7	CONTYDOT	CODE	2	37	00000001, 000	DEPT OF TRANSPORTATION COUNTY
8	RDWYID	CHAR	8	40	55020021	ROADWAY ID WITHIN COUNTY
9	LOCMP	CHAR	7	49	333.444	CRSH LOC FINAL MP ON ROADWAY
10	LOCNODE	CHAR	5	57	99999	FINAL REF NODE NUMBER CRASH LO
11	LOCDIST	CHAR	8	63	4444.666	CRSH LOC FINAL DIST REL NODE N
12	LOCMEACD	CODE	2	72	01	CRASH LOCATION FINAL MEASURE C
13	LOCDIRCD	CODE	1	75	A	CRASH LOCATION FINAL DIRECTION
14	EVNT_ON_RD_NM	CHAR	50	77	HOLLYWOOD BLV	EVENT ON ROAD NAME
15	EVNT_INTCT_RD_NM	CHAR	50	128	UNIVERSITY BL	EVENT INTERSECING ROAD NAME
16	DISTINTS	CHAR	8	179	0010.091	DISTANCE TO INTRSECT ROAD
17	MEAINTCD	CODE	2	188	11	CODE FOR DIST TO INTRSCT ROAD
18	DIRINTCD	CODE	1	191	A	CODE FOR DIR INTRSCT ROAD
19	ROUTEID	CHAR	8	193	BR-A- 1-A	ROUTE OR ROAD FULL ID
20	USRTNO	CHAR	8	202	I- 95	US ROUTE NUMBER
21	CONTYDMV	CODE	2	211	13	DEPT MOTOR VEHICLES COUNTY NUM
22	DHSCTYNO	CHAR	2	214	01	DHSMV CITY NUMBER
23	EVNT_CTY_PLCE_NM	CHAR	32	217	WINTER HAVEN	EVENT CITY PLACE NAME
24	EVNT_CTY_LMT_CD	CODE	1	250	2	EVENT CITY LIMIT CODE
25	ACCISEV	CODE	1	252	1	ACCIDENT SEVERITY CODE
26	TYP_DR_ACDNT_CD	CODE	1	254	1	TYPE DRIVER ACCIDENT CODE
27	FRST_HARM_EVNT_CD	CODE	2	256	14	FIRST HARMFUL EVENT CODE
28	IMPCT_TYP_CD	CODE	2	259		IMPACT TYPE CODE
29	FRST_HARM_LOC_CD	CODE	2	262	01	FIRST HARMFUL LOCATION CODE
30	JCT_CD	CODE	2	265	01	JUNCTION CODE
31	INTCHG_CD	CODE	2	268		INTERCHANGE CODE
32	ACCSIDRD	CODE	1	271	L	ACCIDENT SIDE OF ROAD
33	ACCLANE	CODE	1	273	P	LANE OF ACCIDENT CODE
34	DHSRDSYS	CODE	2	275	01	DHSMV ROAD SYSTEM IDENTIFIER
35	TYPESHLD	CODE	2	278	1	SHOULDER TYPE
36	INTCT_TYP_CD	CODE	2	281	01	INTERSECTION TYPE CODE
37	RD_SRFC_COND_CD	CODE	2	284	01	ROAD SURFACE CONDITION CODE
38	LGHT_COND_CD	CODE	2	287	01	LIGHTING CONDITION CODE
39	EVNT_WTHR_COND_CD	CODE	2	290	01	EVENT WEATHER CONDITION CODE
40	SCHL_BUS_REL_CD	CODE	2	293	01	SCHOOL BUS RELATED CODE
41	WRK_ZONE_REL_CD	CODE	2	296	01	WORK ZONE RELATED CODE
42	LOC_WTHN_ZONE_CD	CODE	2	299	04	LOCATION WITHIN ZONE CODE
43	WRK_ZONE_TYP_CD	CODE	2	302	03	WORK ZONE TYPE CODE
44	WRK_PRSNT_CD	CODE	2	305	01	WORKERS PRESENT CODE
45	LAW_ENFRC_PRSNT_CD	CODE	2	308	01	LAW ENFORCEMENT PRESENT CODE
46	FRST_RD_COND_CD	CODE	2	311	10	FIRST ROAD CONDITION CODE
47	SCND_RD_COND_CD	CODE	2	314	01	SECOND ROAD CONDITION CODE
48	THRD_RD_COND_CD	CODE	2	317	88	THIRD ROAD CONDITION CODE
49	FRST_ENVRN_COND_CD	CODE	2	320	02	FIRST ENVIRONMENT CONDITION CO

1 - CRASH LEVEL EXTRACT (ONE ROW PER CRASH)

COL	CAR COLUMN NAME	TYPE	SIZE	START	EXAMPLE	COLUMN DESCRIPTION
50	SCND_ENVRN_COND_CD	CODE	2	323	05	SECOND ENVIRONMENT CONDITION C
51	THRD_ENVRN_COND_CD	CODE	2	326	04	THIRD ENVIRONMENT CONDITION CO
52	V1_TRAF_CTRL_CD	CODE	2	329	01	VEH #1 TRAFFIC CONTROL CODE
53	V2_TRAF_CTRL_CD	CODE	2	332	01	VEH #2 TRAFFIC CONTROL CODE
54	ALCINVCD	CODE	1	335	0	ALCOHOL INVOLVED IN ACCIDENT C
55	FAHWYSYS	CODE	1	337	1	FEDERAL HIGHWAY SYSTEM CODE
56	FUNCLASS	CODE	2	339	01	HWY FUNCTIONAL CLASS CODE
57	CRRATECD	CODE	2	342	11	CRASH RATES CALCULATION CATEGO
58	RDACCESS	CODE	1	345	2	ACCESS CONTROL TYPE
59	PLACECD	CODE	4	347	2791(ALPHABET	CENSUS PLACE CODE
60	SURWIDTH	CHAR	3	352	45	THRU PAVEMENT SURFACE WIDTH
61	SHLDTYPE	CODE	1	356	6	HIGHWAY SHOULDER TYPE
62	SHLDTYP2	CODE	1	358	6	HIGHWAY SHOULDER TYPE TWO
63	SHLDTYP3	CODE	1	360	6	HIGHWAY SHOULDER TYPE
64	SLDWIDTH	CHAR	4	362	10.0	HIGHWAY SHOULDER WIDTH NUMBER
65	SHLDWTH2	CHAR	4	367	5.0	HIGHWAY SHOULDER WIDTH NUMBER
66	SHLDWTH3	CHAR	4	372	99.9	HIGHWAY SHOULDER WIDTH
67	MEDWIDTH	CHAR	3	377	40	HIGHWAY MEDIAN WIDTH
68	HRZDGCRV	CHAR	6	381	2D 3' 20"	HORIZONTAL DEGREE OF CURVE
69	MAXSPEED	CHAR	3	388	55	MAXIMUM POSTED SPEED LIMIT
70	TYPEPARK	CODE	1	392	1	TYPE OF ROADWAY PARKING
71	SECTADT	CHAR	6	394	4,150	SECTION AVERAGE ANNUAL DAILY T
72	AVGTFACT	CHAR	5	401	4.00	RDWY SECTION AVG T FACTOR NUMB
73	SKTRESNM	NUM	4	407	1	SKID TEST RESULT NUMBER
74	V1_MOST_HARM_EVNT_CD	CODE	2	412	01	VEH #1 MOST HARMFUL EVENT CODE
75	V1_HARM_EVNT_SQ01_CD	CODE	2	415	40	VEH #1 HARMFUL EVENT SEQ 01 CD
76	V1_VHCL_BDY_TYP_CD	CODE	2	418	01	VEH #1 BODY TYPE CODE
77	V1_VHCL_SPCL_FNC_CD	CODE	2	421	01	VEH #1 SPECIAL FUNCTION CODE
78	V1_CMRC_USE_CD	CODE	2	424	01	VEH #1 COMMERCIAL USE CODE
79	V1_CMRC_VEH_CNFIG_CD	CODE	2	427	01	VEH #1 COMMERCIAL CONFIG CODE
80	V1_CARY_BDY_TYP_CD	CODE	2	430	01	VEH #1 CARRIER BODY TYPE CODE
81	V1_CMRC_VEH_WT_CD	CODE	2	433	01	VEH #1 COMMERCIAL WEIGHT CODE
82	V1_POINTIMP	CODE	2	436	01	VEH #1 POINT OF IMPACT
83	V1_VHCL_MOVE_CD	CODE	2	439	01	VEH #1 MOVEMENT CODE
84	V1_TRAVDIR	CODE	1	442	E	VEH #1 DIRECTION OF TRAVEL
85	V1_FRST_DR_ACTN_CD	CODE	2	444	01	VEH #1 FIRST DRIVER ACTION CD
86	V1_AGE3	CHAR	3	447	018	VEH #1 DRIVER AGE
87	V1_SUSP_ALC_USE_CD	CHAR	2	451	01	VEH #1 SUSPECT ALCOHOL USE CD
88	V1_SUSP_DRUG_USE_CD	CHAR	2	454	01	VEH #1 SUSPECT DRUG USE CODE
89	V2_MOST_HARM_EVNT_CD	CODE	2	457	01	VEH #2 MOST HARMFUL EVENT CODE
90	V2_HARM_EVNT_SQ01_CD	CODE	2	460	40	VEH #2 HARMFUL EVENT SEQ 01 CD
91	V2_VHCL_BDY_TYP_CD	CODE	2	463	01	VEH #2 BODY TYPE CODE
92	V2_VHCL_SPCL_FNC_CD	CODE	2	466	01	VEH #2 SPECIAL FUNCTION CODE
93	V2_CMRC_USE_CD	CODE	2	469	01	VEH #2 COMMERCIAL USE CODE
94	V2_CMRC_VEH_CNFIG_CD	CODE	2	472	01	VEH #2 COMMERCIAL CONFIG CODE
95	V2_CARY_BDY_TYP_CD	CODE	2	475	01	VEH #2 CARRIER BODY TYPE CODE
96	V2_CMRC_VEH_WT_CD	CODE	2	478	01	VEH #2 COMMERCIAL WEIGHT CODE
97	V2_POINTIMP	CODE	2	481	01	VEH #2 POINT OF IMPACT
98	V2_VHCL_MOVE_CD	CODE	2	484	01	VEH #2 MOVEMENT CODE

1 - CRASH LEVEL EXTRACT (ONE ROW PER CRASH)

COL	CAR COLUMN NAME	TYPE	SIZE	START	EXAMPLE	COLUMN DESCRIPTION
99	V2_TRAVDIR	CODE	1	487	E	VEH #2 DIRECTION OF TRAVEL
100	V2_FRST_DR_ACTN_CD	CODE	2	489	01	VEH #2 FIRST DRIVER ACTION CD
101	V2_AGE3	CHAR	3	492	018	VEH #2 DRIVER AGE
102	V2_SUSP_ALC_USE_CD	CHAR	2	496	01	VEH #2 SUSPECT ALCOHOL USE CD
103	V2_SUSP_DRUG_USE_CD	CHAR	2	499	01	VEH #2 SUSPECT DRUG USE CODE
104	TOT_CRSH_DMG_AMT	CHAR	16	502	1000.00	TOTAL CRASH DAMAGE AMOUNT
105	TOT_VHCL_DMG_AMT	CHAR	16	519	2000.00	TOTAL VEHICLE DAMAGE AMOUNT
106	TOT_PROP_DMG_AMT	CHAR	16	536	500.00	TOTAL PROPERTY DAMAGE AMOUNT
107	TOT_OF_PERS_NUM	NUM	3	553	3	TOTAL NUMBER OF PERSON
108	TOT_OF_DR_NUM	NUM	3	557	3	TOTAL OF DRIVER NUMBER
109	TOT_OF_VHCL_NUM	NUM	3	561	2	TOTAL NUMBER OF VEHICLE
110	TOT_OF_FATL_NUM	NUM	3	565	111	TOTAL NUMBER OF FATALITY
111	TOT_OF_INJR_NUM	NUM	3	569	222	TOTAL OF INJURIES NUMBER
112	TOTSEVREINJ_NUM	NUM	3	573	222	TOTAL SEVERE INJURIES NUMBER
113	TOTNONTRAFFATL_NUM	NUM	3	577	2	TOTAL NONTRAFFIC FATALITY NUMB
114	TOT_OF_PEDST_NUM	NUM	3	581	05	TOTAL NUMBER OF PEDESTRIAN
115	TOTOF_PEDLCYCL_NUM	NUM	3	585	12	TOTAL OF PEDAL CYCLIST NUMBER
116	EVNT_LAT_NUM	CHAR	10	589	30.2870000	EVENT LATITUDE NUMBER
117	EVNT_LONG_NUM	CHAR	11	600	-81.5122000	EVENT LONGITUDE NUMBER
118	CAR_LAT_NUM	CHAR	10	612	30.2870000	CAR LATITUDE NUMBER
119	CAR_LONG_NUM	CHAR	11	623	-81.5122000	CAR LONGITUDE NUMBER
120	RUN DATE	DATE	10	635	2014-08-04	DATE REPORT WAS RUN
121	RUN TIME	TIME	8	646	14:00:50	TIME THAT REPORT WAS RUN
122	OPT	CHAR	2	655	01	EXTRACT OPTION RUN
123	PROGRAM	CHAR	8	658	CARPJ126	PROGRAM THAT CREATED EXTRACT

2 - VEHICLE DRIVER PASSENGER EXTRACT (ONE ROW PER VEHICLE)

COL	CAR COLUMN NAME	TYPE	SIZE	START	EXAMPLE	COLUMN DESCRIPTION
1	CRSH_NUM	CHAR	9	1	123456789	CRASH NUMBER
2	CAL_YR	CHAR	4	11	CCYY	CALENDAR YEAR
3	VEH_SQ	NUM	4	16	1	VEHICLE SEQUENCE NUMBER
4	MOTN_CD	CODE	1	21	1	MOTION CODE
5	HAR_CD	CODE	2	23	02	HIT AND RUN CODE
6	REGST	CODE	2	26	FL	STATE OF VEHICLE REGIST
7	VEHYEAR	CHAR	4	29	99	VEHICLE YEAR
8	VHCL_MAKE_TXT	CHAR	5	34	CHEV	VEHICLE MAKE TEXT
9	DSABL_FNC_DMG_CD	CODE	2	40	02	DISABLING FUNCTIONAL DAMAGE CO
10	ESTVEHDM	NUM	9	43	000555	ESTIMATED VEH DAMAGE
11	TOW_DMG_CD	CODE	2	53	01	TOW DAMAGE CODE
12	VHCL_MOVE_CD	CODE	2	56	13	VEHICLE MOVEMENT CODE
13	MOST_HARM_EVNT_CD	CODE	2	59	14	MOST HARMFUL EVENT CODE
14	HARM_EVNT_SQ01_CD	CODE	2	62	14	HARMFUL EVENT SEQUENCE 01 CODE
15	HARM_EVNT_SQ02_CD	CODE	2	65	15	HARMFUL EVENT SEQUENCE 02 CODE
16	HARM_EVNT_SQ03_CD	CODE	2	68	42	HARMFUL EVENT SEQUENCE 03 CODE
17	HARM_EVNT_SQ04_CD	CODE	2	71	10	HARMFUL EVENT SEQUENCE 04 CODE
18	TRAVDIR	CODE	1	74	N	DIRECTION OF TRAVEL
19	VHCL_ON_RD_NM	CHAR	50	76	SHERIDAN ST	VEHICLE ON ROAD NAME
20	VEHSPEED	CHAR	3	127	1	VEHICLE SPEED
21	SPDLIMIT	CHAR	2	131	55	SPEED LIMIT
22	TOT_LN_CNT	NUM	2	134	2	TOTAL NUMBER OF LANES COUNT
23	TRAF_WAY_CD	CODE	2	137	04	TRAFFIC WAY CODE
24	RDWY_GRDE_CD	CODE	2	140	01	ROADWAY GRADE CODE
25	RDWY_ALIGN_CD	CODE	1	143	1	ROADWAY ALIGNMENT CODE
26	TRAF_CTRL_CD	CODE	2	145	01	TRAFFIC CONTROL CODE
27	POINTIMP	CODE	2	148	LS	POINT OF IMPACT
28	MOST_DMG_AREA_CD	CODE	2	151	08	MOST DAMAGED AREA CODE
29	VHCL_BDY_TYP_CD	CODE	2	154	16	VEHICLE BODY TYPE CODE
30	EMER_VEH_USE_CD	CODE	2	157	01	EMERGENCY VEHICLE USE CODE
31	VHCL_SPCL_FNC_CD	CODE	2	160	88	VEHICLE SPECIAL FUNCTION CODE
32	CMRC_USE_CD	CODE	2	163	02	COMMERCIAL USE CODE
33	CMRC_VEH_CNFIG_CD	CODE	2	166	06	COMMERCIAL VEHICLE CONFIG CODE
34	CARY_BDY_TYP_CD	CODE	2	169	03	CARRIER CARGO BODY TYPE CODE
35	CMRC_VEH_WT_CD	CODE	2	172	04	COMMERCIAL VEHICLE WEIGHT CODE
36	TRLR_01_TYP_CD	CODE	2	175	01	TRAILER 01 TYPE CODE
37	TRLR_01_TAG_ST_ID	CHAR	2	178	FL	TOWED VEHICLE 01 TAG STATE COD
38	TOW_VHCL_01_YR	CHAR	4	181	2006	TOWED VEHICLE 01 YEAR
39	TOW_VHCL01_MAKE_ID	CHAR	4	186	UTIL	TOWED VEHICLE 01 MAKE ID
40	TRLR_01_LNGTH	NUM	3	191	53	TRAILER 01 LENGTH
41	TRLR_01_AXL_CNT	NUM	2	195	2	TRAILER 01 TOTAL AXLES COUNT
42	TRLR_02_TYP_CD	CODE	2	198	77	TRAILER 02 TYPE CODE
43	TRLR_02_TAG_ST_ID	CHAR	2	201	FL	TOWED VEHICLE 02 TAG STATE COD
44	TOW_02_VHCL_YR	CHAR	4	204	2005	TOWED VEHICLE 02 YEAR
45	TOW_VHCL02_MAKE_ID	CHAR	4	209	CHEV	TOWED VEHICLE 02 MAKE ID
46	TRLR_02_LNGTH	NUM	3	214	28	TRAILER 02 LENGTH
47	TRLR_02_AXL_CNT	NUM	2	218	2	TRAILER 02 TOTAL AXLES COUNT
48	HAZMAT_RLS_CD	CODE	2	221	88	HAZMAT RELEASE CODE
49	HAZMAT_PLCRD_CD	CODE	2	224	01	HAZMAT PLACARD CODE

2 - VEHICLE DRIVER PASSENGER EXTRACT (ONE ROW PER VEHICLE)

COL	CAR COLUMN NAME	TYPE	SIZE	START	EXAMPLE	COLUMN DESCRIPTION
50	HAZMAT_PLCRD_ID	CHAR	4	227	1203	HAZARDOUS MATERIAL PLACARD ID
51	HAZMAT_CLS_CD	CHAR	1	232	3	HAZARDOUS CLASS CODE
52	CARY_ST_CD	CHAR	2	234	GA	CARRIER STATE CODE
53	FRST_VHCL_DFECT_CD	CODE	2	237	01	FIRST VEHICLE DEFECT CODE
54	SCND_VHCL_DFECT_CD	CODE	2	240	88	SECOND VEHICLE DEFECT CODE
55	VIOL_ISSUE_CD	CODE	1	243	Y	VIOLATION ISSUED CODE
56	TOT_OCCP_CNT	NUM	3	245	1	TOTAL OCCUPANTS COUNT
57	TOT_BLT_OCCP_CNT	NUM	3	249	2	TOTAL BELT OCCUPANTS COUNTED
58	TOT_OF_FATL_NUM	NUM	3	253	111	TOTAL NUMBER OF FATALITY
59	TOT_OF_INJR_NUM	NUM	3	257	222	TOTAL OF INJURIES NUMBER
60	TOTSEVREINJ_NUM	NUM	3	261	222	TOTAL SEVERE INJURIES NUMBER
61	TOT_NOTRF_FATL_CNT	NUM	3	265	2	TOTAL NONTRAF FATAL COUNT
62	DR_PERS_SQ	CHAR	4	269	1	DRIVER PERSON SEQUENCE NUMBER
63	DR_STATEID	CODE	2	274	FL	DRIVER STATE ABREVIATION CODE
64	DR_ZIPCODE9	CHAR	9	277	323030000	DRIVER NINE DIGIT ZIPCODE
65	DR_AGE3	CHAR	3	287	21	DRIVER AGE
66	DR_PERS_SEX_CD	CODE	2	291	01	DRIVER SEX CODE
67	DR_INJSEVER	CODE	1	294	3	DRIVER INJURY SEVERITY
68	DR_RECOEXD	CODE	1	296	Y/N	DRIVER RE-COMMENT / RE-EXAM
69	DR_RQIR_ENDRS_CD	CODE	1	298	A	DRIVER REQUIRED ENDORSEMENT CD
70	DR_FRST_DR_ACTN_CD	CODE	2	300	01	FIRST DRIVER ACTION CODE
71	DR_SCND_DR_ACTN_CD	CODE	2	303	02	SECOND DRIVER ACTION CODE
72	DR_THRD_DR_ACTN_CD	CODE	2	306	03	THIRD DRIVER ACTION CODE
73	DR_FOUR_DR_ACTN_CD	CODE	2	309	04	FOURTH DRIVER ACTION CODE
74	DR_DR_COND_CD	CODE	2	312	01	DRIVER CONDITION CODE
75	DR_DR_DSTR_CD	CODE	2	315	02	DRIVER DISTRACTED BY CODE
76	DR_VISN_OBST_CD	CODE	2	318	01	DRIVER VISION OBSTRUCTED CODE
77	DR_ROW_POS_CD	CODE	2	321	01	DRIVER ROW POSITION CODE
78	DR_SEAT_POS_CD	CODE	2	324	01	DRIVER SEAT POSITION CODE
79	DR_OTH_POS_CD	CODE	2	327	01	DRIVER OTHER POSITION CODE
80	DR_EJCT_CD	CODE	2	330	02	DRIVER EJECT CODE
81	DR_HLMT_USE_CD	CODE	2	333	03	DRIVER HELMET USE CODE
82	DR_EYE_PRTCT_CD	CODE	2	336	02	DRIVER EYE PROTECTION CODE
83	DR_AIR_BAG_DPLOY_CD	CODE	2	339	04	DRIVER AIR BAG DEPLYED CODE
84	DR_RSTRN_SYS_CD	CODE	2	342	02	DRIVER RESTRAIN SYSTEM CODE
85	DR_SUSP_ALC_USE_CD	CODE	2	345	02	DRIVER SUSPECTED ALCOHOL USE
86	DR_ALC_TST_CD	CODE	2	348	03	DRIVER ALCOHOL TESTED CODE
87	DR_ALC_TST_TYP_CD	CODE	2	351	02	DRIVER ALCOHOL TEST TYPE CODE
88	DR_ALC_TST_RSLT_CD	CODE	2	354	01	DRIVER ALCOHOL TEST RESULT CD
89	DR_BAC_NUM	NUM	4	357	0.10	DRIVER BLOOD ALCOHOL CONTENT
90	DR_SUSP_DRUG_USE_CD	CODE	2	362	02	DRIVER SUSPECTED DRUG USE CODE
91	DR_DRUG_TST_CD	CODE	2	365	03	DRIVER DRUG TESTED CODE
92	DR_DRUG_TST_TYP_CD	CODE	2	368	03	DRIVER DRUG TEST TYPE CODE
93	DR_DRUG_TST_RSLT_CD	CODE	2	371	01	DRIVER DRUG TEST RESULT CODE
94	DR_TRNSP_SRCE_CD	CODE	2	374	03	DRIVER TRANSPORTATION SRCE CD
95	DR_VIOL_ISSUE_CD	CODE	1	377	Y	DRIVER VIOLATION ISSUED CODE
96	P1_PERS_SQ	NUM	4	379	1	PASSENGER 1 PERSON SEQ NUMBER
97	P1_INJSEVER	CODE	1	384	2	PASSENGER 1 INJURY SEVERITY
98	P1_AGE3	CHAR	3	386	35	PASSENGER 1 AGE

2 - VEHICLE DRIVER PASSENGER EXTRACT (ONE ROW PER VEHICLE)

COL	CAR COLUMN NAME	TYPE	SIZE	START	EXAMPLE	COLUMN DESCRIPTION
99	P1_PERS_SEX_CD	CODE	2	390	02	PASSENGER 1 SEX CODE
100	P1_ROW_POS_CD	CODE	2	393	01	PASSENGER 1 ROW POSITION CODE
101	P1_SEAT_POS_CD	CODE	2	396	01	PASSENGER 1 SEAT POSITION CODE
102	P1_OTH_POS_CD	CODE	2	399	01	PASSENGER 1 OTHER POSITION CD
103	P1_EJCT_CD	CODE	2	402	02	PASSENGER 1 EJECT CODE
104	P1_HLMT_USE_CD	CODE	2	405	03	PASSENGER 1 HELMET USE CODE
105	P1_EYE_PRTCT_CD	CODE	2	408	02	PASSENGER 1 EYE PROTECTION CD
106	P1_AIR_BAG_DPLOY_CD	CODE	2	411	04	PASSENGER 1 AIR BAG DEPLYED CD
107	P1_RSTRN_SYS_CD	CODE	2	414	02	PASSENGER 1 RESTRAIN SYSTEM CD
108	P1_VIOL_ISSUE_CD	CODE	1	417	Y	PASSENGER 1 VIOLATION ISSUED
109	P2_PERS_SQ	NUM	4	419	1	PASSENGER 2 PERSON SEQ NUMBER
110	P2_INJSEVER	CODE	1	424	2	PASSENGER 2 INJURY SEVERITY
111	P2_AGE3	CHAR	3	426	35	PASSENGER 2 AGE
112	P2_PERS_SEX_CD	CODE	2	430	02	PASSENGER 2 SEX CODE
113	P2_ROW_POS_CD	CODE	2	433	01	PASSENGER 2 ROW POSITION CODE
114	P2_SEAT_POS_CD	CODE	2	436	01	PASSENGER 2 SEAT POSITION CODE
115	P2_OTH_POS_CD	CODE	2	439	01	PASSENGER 2 OTHER POSITION CD
116	P2_EJCT_CD	CODE	2	442	02	PASSENGER 2 EJECT CODE
117	P2_HLMT_USE_CD	CODE	2	445	03	PASSENGER 2 HELMET USE CODE
118	P2_EYE_PRTCT_CD	CODE	2	448	02	PASSENGER 2 EYE PROTECTION CD
119	P2_AIR_BAG_DPLOY_CD	CODE	2	451	04	PASSENGER 2 AIR BAG DEPLYED CD
120	P2_RSTRN_SYS_CD	CODE	2	454	02	PASSENGER 2 RESTRAIN SYSTEM CD
121	P2_VIOL_ISSUE_CD	CODE	1	457	Y	PASSENGER 2 VIOLATION ISSUED
122	P3_PERS_SQ	NUM	4	459	1	PASSENGER 3 PERSON SEQ NUMBER
123	P3_INJSEVER	CODE	1	464	2	PASSENGER 3 INJURY SEVERITY
124	P3_AGE3	CHAR	3	466	35	PASSENGER 3 AGE
125	P3_PERS_SEX_CD	CODE	2	470	02	PASSENGER 3 SEX CODE
126	P3_ROW_POS_CD	CODE	2	473	01	PASSENGER 3 ROW POSITION CODE
127	P3_SEAT_POS_CD	CODE	2	476	01	PASSENGER 3 SEAT POSITION CODE
128	P3_OTH_POS_CD	CODE	2	479	01	PASSENGER 3 OTHER POSITION CD
129	P3_EJCT_CD	CODE	2	482	02	PASSENGER 3 EJECT CODE
130	P3_HLMT_USE_CD	CODE	2	485	03	PASSENGER 3 HELMET USE CODE
131	P3_EYE_PRTCT_CD	CODE	2	488	02	PASSENGER 3 EYE PROTECTION CD
132	P3_AIR_BAG_DPLOY_CD	CODE	2	491	04	PASSENGER 3 AIR BAG DEPLYED CD
133	P3_RSTRN_SYS_CD	CODE	2	494	02	PASSENGER 3 RESTRAIN SYSTEM CD
134	P3_VIOL_ISSUE_CD	CODE	1	497	Y	PASSENGER 3 VIOLATION ISSUED
135	P4_PERS_SQ	NUM	4	499	1	PASSENGER 4 PERSON SEQ NUMBER
136	P4_INJSEVER	CODE	1	504	2	PASSENGER 4 INJURY SEVERITY
137	P4_AGE3	CHAR	3	506	35	PASSENGER 4 AGE
138	P4_PERS_SEX_CD	CODE	2	510	02	PASSENGER 4 SEX CODE
139	P4_ROW_POS_CD	CODE	2	513	01	PASSENGER 4 ROW POSITION CODE
140	P4_SEAT_POS_CD	CODE	2	516	01	PASSENGER 4 SEAT POSITION CODE
141	P4_OTH_POS_CD	CODE	2	519	01	PASSENGER 4 OTHER POSITION CD
142	P4_EJCT_CD	CODE	2	522	02	PASSENGER 4 EJECT CODE
143	P4_HLMT_USE_CD	CODE	2	525	03	PASSENGER 4 HELMET USE CODE
144	P4_EYE_PRTCT_CD	CODE	2	528	02	PASSENGER 4 EYE PROTECTION CD
145	P4_AIR_BAG_DPLOY_CD	CODE	2	531	04	PASSENGER 4 AIR BAG DEPLYED CD
146	P4_RSTRN_SYS_CD	CODE	2	534	02	PASSENGER 4 RESTRAIN SYSTEM CD
147	P4_VIOL_ISSUE_CD	CODE	1	537	Y	PASSENGER 4 VIOLATION ISSUED

2 - VEHICLE DRIVER PASSENGER EXTRACT (ONE ROW PER VEHICLE)

COL	CAR COLUMN NAME	TYPE	SIZE	START	EXAMPLE	COLUMN DESCRIPTION
148	P5_PERS_SQ	NUM	4	539	1	PASSENGER 5 PERSON SEQ NUMBER
149	P5_INJSEVER	CODE	1	544	2	PASSENGER 5 INJURY SEVERITY
150	P5_AGE3	CHAR	3	546	35	PASSENGER 5 AGE
151	P5_PERS_SEX_CD	CODE	2	550	02	PASSENGER 5 SEX CODE
152	P5_ROW_POS_CD	CODE	2	553	01	PASSENGER 5 ROW POSITION CODE
153	P5_SEAT_POS_CD	CODE	2	556	01	PASSENGER 5 SEAT POSITION CODE
154	P5_OTH_POS_CD	CODE	2	559	01	PASSENGER 5 OTHER POSITION CD
155	P5_EJCT_CD	CODE	2	562	02	PASSENGER 5 EJECT CODE
156	P5_HLMT_USE_CD	CODE	2	565	03	PASSENGER 5 HELMET USE CODE
157	P5_EYE_PRTCT_CD	CODE	2	568	02	PASSENGER 5 EYE PROTECTION CD
158	P5_AIR_BAG_DPLOY_CD	CODE	2	571	04	PASSENGER 5 AIR BAG DEPLYED CD
159	P5_RSTRN_SYS_CD	CODE	2	574	02	PASSENGER 5 RESTRAIN SYSTEM CD
160	P5_VIOL_ISSUE_CD	CODE	1	577	Y	PASSENGER 5 VIOLATION ISSUED
161	MORE_THAN_5	CODE	1	579	Y	MORE THAN 5 PASSENGERS
162	RUN DATE	DATE	10	581	2014-08-04	DATE REPORT WAS RUN
163	RUN TIME	TIME	8	592	14:00:50	TIME THAT REPORT WAS RUN
164	OPT	CHAR	2	601	01	EXTRACT OPTION RUN
165	PROGRAM	CHAR	8	604	CARPJ126	PROGRAM THAT CREATED EXTRACT

Appendix C Source Book VOF values (2009 NHTS data)

County Name	Source Book (7 Day Average)
ALACHUA	1.77
BAKER	1.72
BAY	1.52
BRADFORD	1.72
BREVARD	1.58
BROWARD	1.55
CALHOUN	1.53
CHARLOTTE	1.55
CITRUS	1.63
CLAY	1.27
COLLIER	1.59
COLUMBIA	1.72
DESOTO	1.81
DIXIE	1.68
DUVAL	1.61
ESCAMBIA	1.90
FLAGLER	1.71
FRANKLIN	1.53
GADSDEN	1.29
GILCHRIST	1.68
GLADES	1.81
GULF	1.53
HAMILTON	1.68
HARDEE	1.81
HENDRY	1.81
HERNANDO	1.62
HIGHLANDS	1.81
HILLSBOROUGH	1.69
HOLMES	1.77
INDIAN RIVER	1.79
JACKSON	1.77
JEFFERSON	1.53
LAFAYETTE	1.68
LAKE	1.48
LEE	1.48
LEON	1.57
LEVY	1.68
LIBERTY	1.53
MADISON	1.53
MANATEE	1.73
MARION	1.75
MARTIN	1.92
MIAMI-DADE	1.76
MONROE	1.76
NASSAU	1.78
OKALOOSA	1.60
OKEECHOBEE	1.79
ORANGE	1.70
OSCEOLA	1.60
PALM BEACH	1.55
PASCO	1.57
PINELLAS	1.44
POLK	1.73
PUTNAM	1.71
SANTA ROSA	1.51
SARASOTA	1.46
SEMINOLE	1.64
ST.JOHNS	1.84
ST.LUCIE	1.47
SUMTER	1.63

County Name	Source Book (7 Day Average)
SUWANNEE	1.68
TAYLOR	1.53
UNION	1.72
VOLUSIA	1.66
WAKULLA	1.53
WALTON	1.77
WASHINGTON	1.77

Appendix D VOF results and comparison

County Name	Vehicle Occupancy Factor (2018)	Vehicle Occupancy Factor (NHTS 2009) [1]	Ground Truth Comparison			
			VOF	Year	Region	Source
Alachua	1.74	1.77	-	-	-	-
Baker	1.91	1.72	-	-	-	-
Bay	1.64	1.52	-	-	-	-
Bradford	1.76	1.72	-	-	-	-
Brevard	1.63	1.58	-	-	-	-
Broward	1.50	1.55	-	-	-	-
Calhoun	1.54	1.53	-	-	-	-
Charlotte	1.67	1.55	-	-	-	-
Citrus	1.68	1.63	1.448	2015	County	Tampa Bay Regional Planning Model V9.2 Output
Clay	1.42	1.27	-	-	-	-
Collier	1.71	1.59	-	-	-	-
Columbia	1.81	1.72	-	-	-	-
Desoto	1.85	1.81	-	-	-	-
Dixie	1.79	1.68	-	-	-	-
Duval	1.54	1.61	-	-	-	-
Escambia	1.58	1.90	-	-	-	-
Flagler	1.70	1.71	-	-	-	-
Franklin	1.51	1.53	-	-	-	-
Gadsden	1.66	1.29	-	-	-	-
Gilchrist	1.74	1.68	-	-	-	-
Glades	1.73	1.81	-	-	-	-
Gulf	1.57	1.53	-	-	-	-
Hamilton	1.73	1.68	-	-	-	-
Hardee	1.78	1.81	-	-	-	-
Hendry	1.81	1.81	-	-	-	-

County Name	Vehicle Occupancy Factor (2018)	Vehicle Occupancy Factor (NHTS 2009) [1]	Ground Truth Comparison			
			VOF	Year	Region	Source
Hernando	1.73	1.62	1.441	2015	County	Tampa Bay Regional Planning Model V9.2 Output
Highlands	1.72	1.81	-	-	-	-
Hillsborough	1.69	1.69	1 - 1.40 2 - 1.43	1 - 2020 2 - 2015	County	1 . Hillsborough County Mobility Fee Update Study (2020) 2. Tampa Bay Regional Planning Model V9.2 Output(2015)
Holmes	1.76	1.77	-	-	-	-
Indian River	1.70	1.79	-	-	-	-
Jackson	1.77	1.77	-	-	-	-
Jefferson	1.70	1.53	-	-	-	-
Lafayette	1.69	1.68	-	-	-	-
Lake	1.49	1.48	-	-	-	-
Lee	1.65	1.48	-	-	-	-
Leon	1.62	1.57	-	-	-	-
Levy	1.78	1.68	-	-	-	-
Liberty	1.69	1.53	-	-	-	-
Madison	1.65	1.53	-	-	-	-
Manatee	1.66	1.73	-	-	-	-
Marion	1.76	1.75	-	-	-	-
Martin	1.71	1.92	-	-	-	-
Miami-Dade	1.52	1.76	-	-	-	-
Monroe	1.84	1.76	-	-	-	-

County Name	Vehicle Occupancy Factor (2018)	Vehicle Occupancy Factor (NHTS 2009) [1]	Ground Truth Comparison			
			VOF	Year	Region	Source
Nassau	1.78	1.78	-	-	-	-
Okaloosa	1.61	1.60	-	-	-	-
Okeechobee	1.89	1.79	-	-	-	-
Orange	1.69	1.70	-	-	-	-
Osceola	1.72	1.60	-	-	-	-
Palm Beach	1.55	1.55	-	-	-	-
Pasco	1.63	1.57	1.437	2015	County	Tampa Bay Regional Planning Model V9.2 Output
Pinellas	1.54	1.44	1.439	2015	County	Tampa Bay Regional Planning Model V9.2 Output
Polk	1.67	1.73	-	-	-	-
Putnam	1.68	1.71	-	-	-	-
Santa Rosa	1.65	1.51	-	-	-	-
Sarasota	1.63	1.46	-	-	-	-
Seminole	1.56	1.64	-	-	-	-
St. Johns	1.74	1.84	-	-	-	-
St. Lucie	1.52	1.47	-	-	-	-
Sumter	1.66	1.63	-	-	-	-
Suwannee	1.80	1.68	-	-	-	-
Taylor	1.67	1.53	-	-	-	-
Union	1.66	1.72	-	-	-	-
Volusia	1.65	1.66	-	-	-	-
Wakulla	1.69	1.53	-	-	-	-
Walton	1.76	1.77	-	-	-	-
Washington	1.69	1.77	-	-	-	-

County Name	Vehicle Occupancy Factor (2018)	Vehicle Occupancy Factor (NHTS 2009) [1]	Ground Truth Comparison			
			VOF	Year	Region	Source
Region Aggregation [2]						
District 1	1.65					
District 2	1.72					
District 3	1.72					

Note: 1: These values are from 2009 National Household Travel Survey 2009 version and currently applied in the Source Book performance measure calculation.

2: Regional aggregation was performed to account for the limited crash sample sizes for some counties. The aggregation was done for non-MPO counties within District 1, 2, and 3. For District 1, Collier County and Lee County were aggregated as one region. For District 2, the following counties were aggregated - Baker, Bradford, Columbia, Dixie, Gilchrist, Hamilton, Lafayette, Levy, Madison, Putnam, Suwannee, Taylor, and Union. For district 3, the following counties were aggregated - Calhoun, Franklin, Gulf, Holmes, Jackson, Liberty, and Washington.

Appendix E People movement related measures in Source Book results with current and calculated 2018 VOF values

	Original Source Book Performance Measures [1]					Updated Source Book Perfromance Measrues [2]				
County Name	Weekday Peak Hour Person Miles Traveled	Weekday Peak Hour Person Hours of Delay	Daily Person Miles Traveled	Daily Person Hous of Delay	Yearly Person Hours of Delay	Weekday Peak Hour Person Miles Traveled	Weekday Peak Hour Person Hours of Delay	Daily Person Miles Traveled	Daily Person Hous of Delay	Yearly Person Hours of Delay
Alachua	764,530.2	1,308.6	9,420,467.8	7,602.8	2,775,032.4	750,423.5	1,284.5	9,246,646.8	7,462.5	2,723,829.2
Baker	124,771.6	25.0	1,606,540.3	302.9	110,540.8	138,430.4	27.7	1,782,408.2	336.0	122,641.7
Bay	410,218.9	796.4	4,928,525.2	5,908.9	2,156,756.8	442,599.2	859.3	5,317,553.7	6,375.3	2,326,998.4
Bradford	102,327.0	17.4	1,227,077.8	166.1	60,634.0	104,762.6	17.9	1,256,285.7	170.1	62,077.3
Brevard	1,284,880.0	839.8	15,435,717.4	5,989.8	2,186,287.5	1,324,967.1	866.0	15,917,298.2	6,176.7	2,254,497.7
Broward	3,243,957.9	11,455.9	38,707,907.3	65,889.7	24,049,748.2	3,148,451.4	11,118.7	37,568,294.3	63,949.8	23,341,691.1
Calhoun	41,554.4	6.0	497,809.5	60.0	21,886.0	41,918.2	6.0	502,168.0	60.5	22,077.6
Charlotte	341,587.4	138.9	4,159,214.6	1,459.6	532,743.1	368,727.1	149.9	4,489,672.0	1,575.5	575,070.5
Citrus	192,842.2	53.9	2,318,451.7	479.1	174,874.2	198,366.5	55.4	2,384,868.5	492.8	179,883.8
Clay	225,693.9	415.4	2,709,869.7	2,242.6	818,559.4	252,191.7	464.2	3,028,024.5	2,505.9	914,663.2
Collier	467,165.7	330.1	5,774,125.4	2,192.4	800,229.4	501,295.1	354.2	6,195,961.6	2,352.6	858,691.2
Columbia	356,888.9	172.2	4,585,712.9	1,659.3	605,637.4	376,337.9	181.5	4,835,616.0	1,749.7	638,642.3
Desoto	93,766.4	37.9	1,124,264.4	371.4	135,568.7	96,082.3	38.8	1,152,031.3	380.6	138,917.0
Dixie	39,583.5	0.2	474,114.1	3.7	1,343.1	42,224.9	0.3	505,751.2	3.9	1,432.7
Duval	2,614,912.2	4,593.5	31,239,096.8	26,326.4	9,609,135.5	2,494,580.6	4,382.1	29,801,553.0	25,114.9	9,166,947.5
Escambia	853,154.0	1,879.1	10,268,748.3	14,004.4	5,111,607.9	707,662.8	1,558.6	8,517,584.6	11,616.2	4,239,908.4
Flagler	278,463.6	48.3	3,349,394.9	739.3	269,841.2	276,710.9	48.0	3,328,312.8	734.6	268,142.8
Franklin	39,126.4	1.1	468,581.2	11.7	4,258.6	38,521.0	1.1	461,331.4	11.5	4,192.7
Gadsden	160,806.5	26.6	1,985,054.4	303.3	110,720.2	206,816.2	34.2	2,553,014.8	390.1	142,399.3
Gilchrist	43,609.4	9.0	523,142.9	84.5	30,840.9	45,125.5	9.3	541,329.3	87.4	31,913.1
Glades	65,667.2	1.7	786,386.5	23.7	8,657.0	62,693.1	1.6	750,770.3	22.6	8,265.0
Gulf	44,295.0	0.7	531,208.4	8.0	2,916.8	45,339.0	0.8	543,729.6	8.2	2,985.6
Hamilton	156,027.9	4.1	2,052,791.6	81.3	29,677.2	160,271.6	4.2	2,108,623.7	83.5	30,484.4
Hardee	89,920.3	2.9	1,077,830.0	33.8	12,325.4	88,363.4	2.9	1,059,168.4	33.2	12,112.0
Hendry	111,234.1	34.2	1,333,160.6	368.0	134,324.1	111,099.6	34.2	1,331,548.5	367.6	134,161.7
Hernando	303,218.4	25.1	3,639,255.6	365.9	133,570.9	323,902.9	26.8	3,887,512.7	390.9	142,682.6
Highlands	200,523.9	15.3	2,408,062.3	186.8	68,168.6	190,454.1	14.6	2,287,136.4	177.4	64,745.3
Hillsborough	2,867,048.8	9,351.2	34,236,228.4	47,497.8	17,336,697.9	2,867,523.2	9,352.8	34,241,893.9	47,505.7	17,339,566.8
Holmes	77,299.6	1.8	980,433.7	32.6	11,885.2	76,696.7	1.8	972,787.0	32.3	11,792.5
Indian River	331,615.2	155.6	3,978,664.9	1,401.5	511,535.8	315,072.0	147.8	3,780,183.0	1,331.6	486,017.1
Jackson	251,804.9	22.4	3,138,041.2	246.9	90,109.7	251,603.5	22.4	3,135,531.7	246.7	90,037.6
Jefferson	82,425.4	1.2	1,052,056.8	21.9	7,991.1	91,386.5	1.3	1,166,434.5	24.3	8,859.8
Lafayette	21,700.1	0.4	259,934.9	3.7	1,336.1	21,848.7	0.4	261,715.6	3.7	1,345.2
Lake	667,855.9	382.4	8,013,396.1	3,008.9	1,098,255.7	672,850.8	385.3	8,073,328.0	3,031.4	1,106,469.5
Lee	853,080.8	1,283.2	10,224,587.2	6,212.3	2,267,485.8	948,614.6	1,427.0	11,369,606.2	6,908.0	2,521,414.4
Leon	470,673.4	912.7	5,680,836.4	6,189.6	2,259,218.0	486,809.8	944.0	5,875,596.1	6,401.8	2,336,672.2
Levy	118,035.1	20.9	1,414,202.7	247.6	90,379.7	124,863.9	22.2	1,496,020.3	261.9	95,608.6
Liberty	22,242.2	0.1	266,349.3	1.6	585.0	24,615.4	0.1	294,767.9	1.8	647.4
Madison	113,854.1	10.0	1,468,607.9	89.1	32,528.3	122,719.4	10.8	1,582,962.0	96.1	35,061.2
Manatee	836,872.2	1,743.5	10,136,442.8	9,710.0	3,544,162.7	804,818.7	1,676.7	9,748,201.6	9,338.1	3,408,415.9
Marion	896,947.1	604.7	10,747,312.3	4,114.1	1,501,649.3	903,932.5	609.4	10,831,011.8	4,146.1	1,513,344.1
Martin	680,256.1	487.9	8,144,849.6	3,136.3	1,144,733.1	605,047.5	434.0	7,244,361.3	2,789.5	1,018,172.3
Miami-Dade	4,171,888.7	26,907.3	49,479,211.8	170,228.5	62,133,403.6	3,606,501.1	23,260.8	42,773,631.4	147,158.6	53,712,886.8
Monroe	297,567.2	246.0	3,582,632.7	2,505.9	914,667.4	311,087.2	257.2	3,745,410.0	2,619.8	956,225.4
Nassau	288,629.0	143.8	3,458,143.9	1,428.9	521,532.0	288,179.2	143.6	3,452,755.4	1,426.6	520,719.3
Okaloosa	562,393.5	837.0	6,852,983.4	5,197.7	1,897,154.6	564,243.4	839.7	6,875,524.4	5,214.8	1,903,394.8
Okeechobee	143,745.2	27.6	1,723,705.0	296.4	108,202.9	151,882.4	29.2	1,821,281.0	313.2	114,328.1
Orange	3,145,824.7	9,366.5	37,436,367.9	48,463.1	17,689,034.1	3,135,317.6	9,335.3	37,311,330.3	48,301.2	17,629,952.7
Osceola	707,616.6	2,468.0	8,467,458.5	11,182.1	4,081,458.2	762,144.5	2,658.1	9,119,948.9	12,043.8	4,395,969.7
Palm Beach	2,618,589.5	5,196.5	31,048,158.9	25,852.4	9,436,137.2	2,624,788.5	5,208.8	31,121,659.0	25,913.6	9,458,475.3
Pasco	846,249.9	1,078.5	10,157,103.0	4,657.8	1,700,094.4	881,081.7	1,122.9	10,575,171.0	4,849.5	1,770,070.6
Pinellas	1,159,074.8	3,126.0	13,839,918.3	18,360.2	6,701,476.9	1,238,708.2	3,340.7	14,790,779.2	19,621.6	7,161,896.7
Polk	1,602,716.3	1,686.5	19,442,705.2	12,093.5	4,414,125.0	1,548,363.7	1,629.3	18,783,349.1	11,683.4	4,264,429.8
Putnam	180,356.1	52.3	2,163,261.6	448.0	163,538.1	177,425.7	51.5	2,128,112.8	440.8	160,880.9
Santa Rosa	400,716.6	316.8	4,861,480.5	1,425.8	520,399.0	436,788.9	345.3	5,299,107.9	1,554.1	567,245.0

County Name	Original Source Book Performance Measures [1]					Updated Source Book Perfromance Measrues [2]				
	Weekday Peak Hour Person Miles Traveled	Weekday Peak Hour Person Hours of Delay	Daily Person Miles Traveled	Daily Person Hous of Delay	Yearly Person Hours of Delay	Weekday Peak Hour Person Miles Traveled	Weekday Peak Hour Person Hours of Delay	Daily Person Miles Traveled	Daily Person Hous of Delay	Yearly Person Hours of Delay
Sarasota	757,320.6	1,056.0	9,343,425.6	6,388.7	2,331,876.5	844,746.5	1,177.9	10,422,040.5	7,126.2	2,601,070.8
Seminole	742,502.6	1,865.0	8,853,353.2	8,154.7	2,976,461.4	704,176.4	1,768.8	8,396,363.8	7,733.8	2,822,823.4
St.Johns	817,902.2	575.0	9,800,193.6	4,925.6	1,797,834.4	773,003.4	543.4	9,262,211.7	4,655.2	1,699,142.3
St.Lucie	556,768.8	283.5	6,662,918.2	2,084.6	760,870.2	574,168.6	292.4	6,871,143.4	2,149.7	784,648.4
Sumter	395,266.3	106.7	4,877,319.3	988.8	360,917.9	403,069.3	108.9	4,973,602.6	1,008.3	368,042.8
Suwannee	164,777.6	23.8	2,101,995.0	272.4	99,410.9	176,240.7	25.4	2,248,225.4	291.3	106,326.6
Taylor	51,194.6	15.1	613,458.1	131.8	48,100.9	56,006.9	16.5	671,124.3	144.2	52,622.5
Union	38,270.4	2.8	458,657.1	35.8	13,073.5	37,025.1	2.7	443,732.1	34.7	12,648.1
Volusia	1,308,486.8	1,263.8	15,828,125.8	10,709.9	3,909,119.2	1,302,221.4	1,257.7	15,752,337.1	10,658.6	3,890,401.4
Wakulla	55,708.3	14.7	669,926.2	63.9	23,316.6	61,696.8	16.3	741,940.8	70.7	25,823.0
Walton	388,903.0	251.7	4,769,326.0	1,533.9	559,885.7	387,718.6	250.9	4,754,801.3	1,529.3	558,180.6
Washington	111,697.8	18.5	1,393,319.1	156.3	57,064.1	106,648.9	17.6	1,330,338.4	149.3	54,484.7

Note: 1: The performance measures were calculated using the 2009 NHTS Vehicle Occupancy Factor table based on 2021 Source Book input.
2: The performance measures were calculated using the updated vehicle occupancy factors based on 2021 Source Book input.

Appendix F Developing a Statistically Valid and Practical Method to Compute Bus and Truck Occupancy Data

Methodology Report

FHWA

TOPR 33-01-18005: Developing a Statistically Valid and Practical Method to Compute Bus and Truck Occupancy Data

Technical and Program Support for Highway Policy Analysis

May 29, 2019

U.S.Department of Transportation
Federal Highway Administration

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The project was managed by Task Managers for the Federal Highway Administration, Wenjing Pu and Daniel Jenkins, who provided technical directions.

16. Abstract
This project aims to assist the Federal Highway Administration (FHWA) in providing data to states and metropolitan areas in accordance with Title 23 of the US Code of Federal Regulations, Part 490 National Performance Management Measures. The specific task is to provide and implement a statistically valid and practical method to estimate bus and truck occupancy rates for each urbanized area (UZA) as defined by the U.S. Census Bureau, each state, and the District of Columbia (DC). All fifty states, DC, and 183 UZA's with a population higher than 200,000 are included in this project.
Bus occupancies were estimated separately for each of three categories: transit bus, school bus, and motorcoach. Average total bus occupancy was estimated by aggregating the average vehicle occupancies (AVO) for the above three categories weighted by annual vehicle miles traveled (VMT). Specifically, the Federal Transit Administration (FTA) National Transit Database (NTD) was used to calculate transit bus occupancy; "U.S. State by State Transportation Statistics 2015-16," reported by SchoolBusFleet.com were used to calculate average school bus occupancy for each state; and data provided by the Port Authority of New York and New Jersey (PANYNJ) for the Port Authority Bus Terminal (PABT) in New York City, the largest bus terminal in the US, were used to calculate motorcoach occupancy rates. For trucks, an overall average truck occupancy rate was calculated for all truck types based on National Highway Traffic Safety Administration (NHTSA) Trucks in Fatal Accidents (TIFA) data.
Results show that the mean state-level bus occupancy rate is 20.29, with a standard deviation of 5.24; and the mean state-level truck occupancy rate is 1.19, with a standard deviation of 0.07. Recommendations for future work include (1) work with providers of the various relevant data sources to ensure access to regularly updated new data; (2) initiate a training program for the software code to ensure the results can be easily updated in the future; and (3) make further use of the proposed alternative methods to validate results.

17. Key Words
Bus Occupancy, Truck Occupancy, Transit, School Bus, Motorcoach, Urbanized Area

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Contents

General Background

Problem Statement

Many urban areas have introduced varieties of transportation management strategies which are designed to reduce the number of vehicles on the road. Some of these methods are aiming to encourage more high-occupancy-vehicle (HOVs) on the road to avoid severe congestion. Thus, monitoring and estimating average vehicle occupancy (AVO) has become a key prerequisite before implementing these strategies. Often, AVO rates are acquired via road-side video-recording and carousel methods. Heidtman et al. (1997) set up an observation team along the side of the roadway to count the passengers in the vehicles passing by, and they concluded that the method was most effective for collecting data for corridors and roadways of low functional classification, but less effective on multilane freeways. Hao et al. (2011) developed an imaging technique to make the occupants more visible in the vehicle, by use of infrared, while simultaneously using a video recording system. A study of vehicle occupancy conducted in Arizona used the carousel method as a supplement to roadside observations for AVO estimation, and applied a carousel method usually that used more than one vehicle with several observers in the traffic stream to observe occupants in other vehicles (MAG, 2013).

In addition to technical methodologies, researchers have also used survey and crash datasets to estimate vehicle occupancy. Gan et al. (2005) developed a user-friendly software system which could be used to estimate occupancy rates in Florida from multiple years of crash data; the system also included a stand-alone GIS interface to facilitate the selection of geographic features and display of occupancy rate estimates. Gan et al. (2008) also carried out a thorough AVO estimation study using existing traffic crash data co-modeled with other variables such as district, county, hour, week etc. However, in their paper, they admitted that the results are highly susceptible to potential bias resulting from issues related to traffic crash reports. Jung et al. (2010) provided a detailed process for estimating AVOs at the individual location, facility type, and county levels, along with a detailed sampling process designed to select data collection locations and dates on different facility types.

While aforementioned studies have implemented AVO estimation methods that have proven to work well, they are limited in their scope and often focused on a geographic area no larger than a state. Additionally, methods that involve manual counts are too time and resource intensive to be used to estimate AVO of each urban area nationwide. More importantly, most of the methods mentioned does not include a special consideration for AVO rates of buses and trucks. As such, methods are needed that can be applied nationally and only rely on data that are easily available nationwide, and are updated regularly. For this project, in order to estimate vehicle occupancy for urbanized areas nationwide, a combination of national-wide, local, and survey data will be used for large-scale sampling and modeling work.

Goals and Scope of Work

The goal of this task order is to provide and implement a statistically valid and practical method to estimate 1) bus occupancy rate for each of the urbanized areas as defined by the U.S. Census Bureau and each of the states and the District of Columbia and 2) truck occupancy rate for each of the urbanized areas as defined by the U.S. Census Bureau and each of the states and the District of Columbia. There are 497 urbanized areas defined by the U.S. Census Bureau as shown in Figure 1. Note that this project will only include the urbanized area with a population higher than 200,000. After filtering the urbanized area based on the population information obtained from the U.S. Census Bureau (U.S. Census Bureau, 2012), 183 urbanized areas are considered in this project. Table 1 summarizes top 20 urbanized areas in terms of population. To map different data into the urbanized areas, the U.S. Census Bureau website also provides a set of files that contains the relationships between the urbanized areas and other geospatial regions (e.g., county, city, and zip code) (U.S. Census Bureau, 2010).

The tasks are to develop statistically valid and practical methods to estimate a) bus occupancy rate each of the urbanized areas as defined by the U.S. Census Bureau and each of the states and the District of Columbia and b) truck occupancy rate for each of the urbanized areas as defined by the U.S. Census Bureau and each of the states and the District of Columbia.

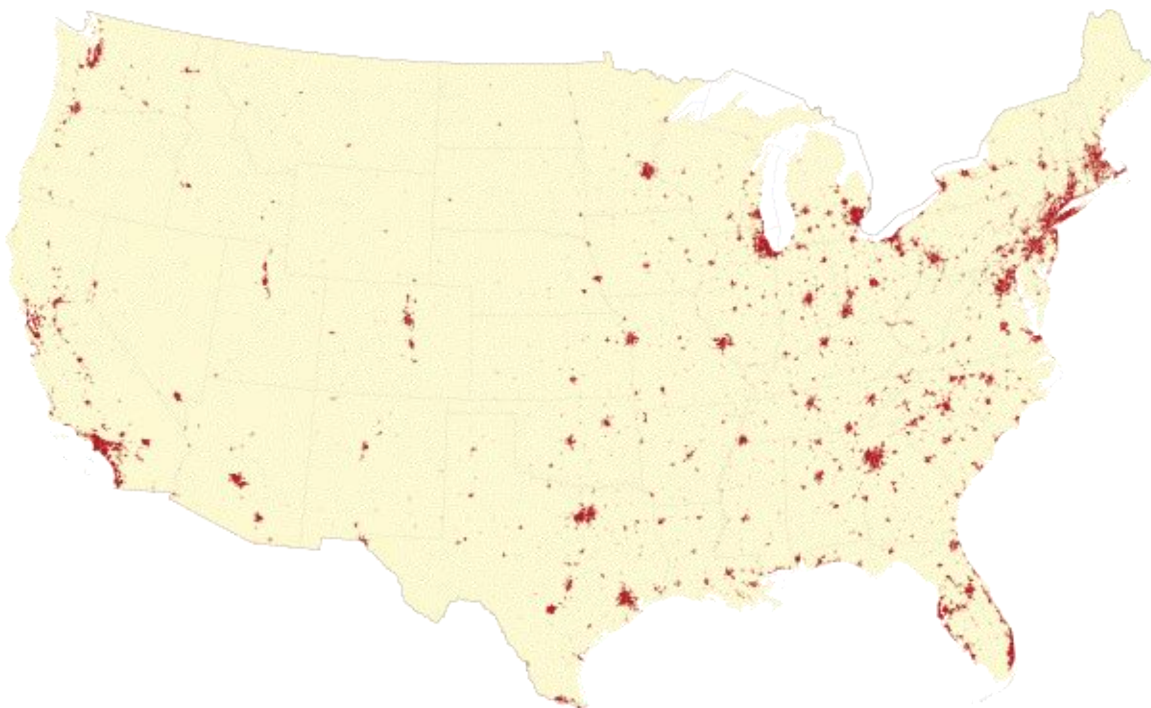


Figure 1. Urbanized areas in the United States. Source: https://en.wikipedia.org/wiki/United_States_urban_area#/media/File:USA-Urban-Areas.svg.

Table 1. Top 20 Urbanized Areas in US

Urban Code	Name	State	Population	Land Area (mi^2)	Population Density
63217	New York--Newark, NY--NJ--CT	NY	12,191,715	1563.15	7799.5
51445	Los Angeles--Long Beach--Anaheim, CA	CA	12,150,996	1736.02	6999.3
16264	Chicago, IL--IN	IL	8,018,716	2122.25	3778.4
63217	New York--Newark, NY--NJ--CT	NJ	6,159,466	1886.99	3264.2
56602	Miami, FL	FL	5,502,379	1238.61	4442.4
22042	Dallas--Fort Worth--Arlington, TX	TX	5,121,892	1779.13	2878.9
40429	Houston, TX	TX	4,944,332	1660.02	2978.5
3817	Atlanta, GA	GA	4,515,419	2645.35	1706.9
9271	Boston, MA--NH--RI	MA	4,087,709	1750.57	2335.1
69076	Philadelphia, PA--NJ--DE--MD	PA	3,760,387	1245.92	3018.2
23824	Detroit, MI	MI	3,734,090	1337.16	2792.5
69184	Phoenix--Mesa, AZ	AZ	3,629,114	1146.57	3165.2
78904	San Francisco--Oakland, CA	CA	3,281,212	523.62	6266.4
80389	Seattle, WA	WA	3,059,393	1010.31	3028.2
78661	San Diego, CA	CA	2,956,746	732.41	4037
57628	Minneapolis--St. Paul, MN--WI	MN	2,650,614	1021.31	2595.3
86599	Tampa--St. Petersburg, FL	FL	2,441,770	956.99	2551.5
23527	Denver--Aurora, CO	CO	2,374,203	667.95	3554.4
92242	Washington, DC--VA--MD	VA	2,235,884	696.16	3211.7
4843	Baltimore, MD	MD	2,203,663	717.04	3073.3

The term of "statistically valid" means that the information generated from any underlying data used in the estimation should be representative of the entire population with an 85% confidence interval. The term of "practical" means that the method is not relying on a new survey activity, doesn't cost more than $250,000 to implement the methods for all urbanized areas and states on an annual basis, and can be completed within 6 months after the end of year. Here, bus is defined as Class 4 vehicles in FHWA's 13 Vehicle Category Classification. According to FHWA's 13 Vehicle Category Classification, trucks are defined as Class 5 through Class 13 vehicles, but this project specifically considers Class 6-13 (as requested by the TOPR, see Figure 2) vehicles when estimating average truck occupancy. For bus occupancy rates, factors will cover both the public and private charters, transit, school, tourism and long-distance service buses.

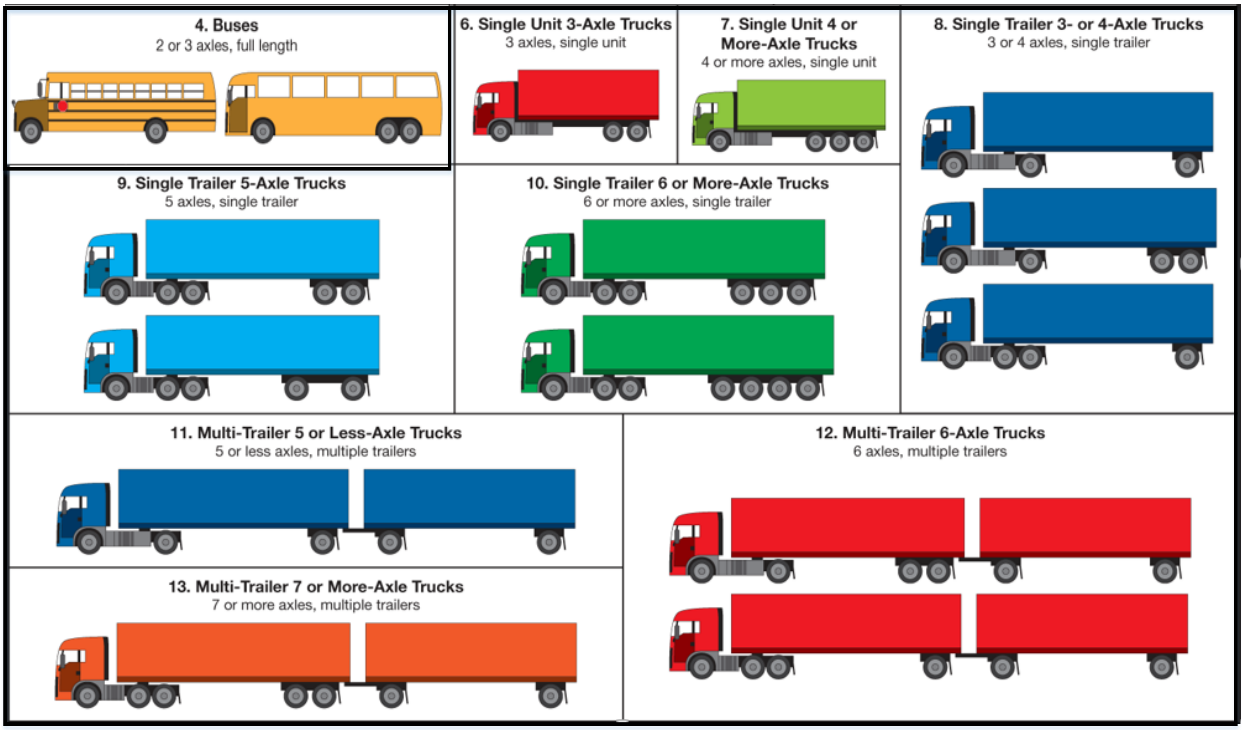


Figure 2. Definition of bus and truck based on FHWA vehicle classification. Source: https://www.agroclasi.com/freight-class-chart-pdf/using-truck-fleet-data-in-combination-with-other-sources-for-fhwa_classification_chart_/.

Methodology

Developing Bus Occupancy Factors

Methodology Framework

Generally, buses defined as Class 4 vehicles in FHWA's 13 Vehicle Category Classification can be subdivided into three categories: (1) transit bus (metro bus); (2) school bus; and (3) motorcoach. Total average bus occupancy can be estimated by aggregating the average vehicle occupancies (AVO) for the above three subgroups as shown below:

$$AVO_{Bus} = \frac{AVO_{Transit} \times VMT_{Transit} + AVO_{School} \times VMT_{School} + AVO_{Motorcoach} \times VMT_{Motorcoach}}{VMT_{Transit} + VMT_{School} + VMT_{Motorcoach}}$$

where AVO =Average Vehicle Occupancy; *VMT*=Annual Vehicle Miles Traveled. It is necessary to develop the bus occupancy factors based on the above three subgroups because their AVOs differ significantly. Our methodology estimates the AVOs for transit bus, school bus, and motorcoach independently based on multi-source datasets from state and urbanized area levels, and then aggregates them based on their proportion of total bus VMT. The VMT for each bus category can be calculated based on their average VMT (national level) and the vehicle count data from the Polk dataset which contains detailed vehicle registration information (Polk City Directory, 2018) by using the following equations:

$$VMT_{Transit} = Average\ VMT_{Transit} \times Vehicle\ Count_{Transit}$$
$$VMT_{School} = Average\ VMT_{School} \times Vehicle\ Count_{School}$$
$$VMT_{Motorcoach} = Average\ VMT_{Motorcoach} \times Vehicle\ Count_{Motorcoach}$$

where $Average\ VMT_{Transit} = 34{,}053$ miles per vehicle (U.S. Department of Energy, 2015); $Average\ VMT_{School} = 12{,}000$ miles per vehicle (American School Bus Council, 2015); $Average\ VMT_{Motorcoach} = 38{,}385$ miles per vehicle (American Bus Association, 2017). The state-level bus count by type is shown in Figure 3.

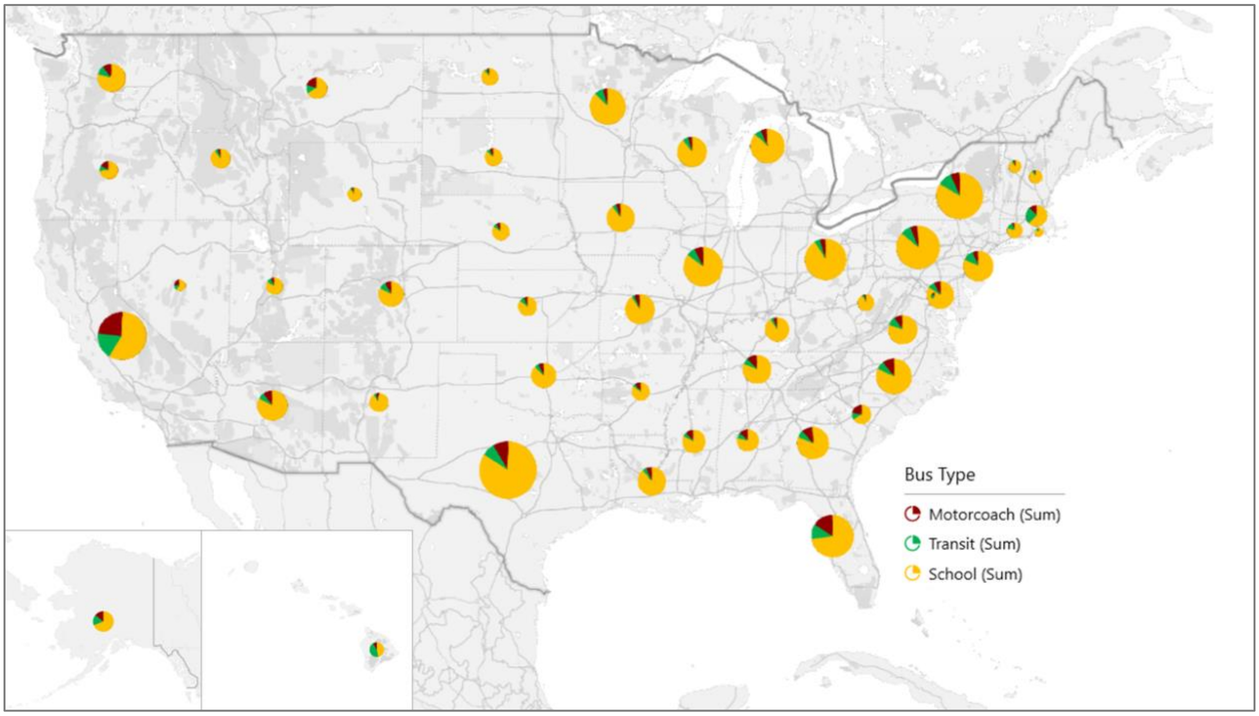


Figure 3. State level bus count by type.

Figure 4 illustrates the general framework of our methodology for developing bus occupancy factors. The details about how to estimate the AVOs for transit bus, school bus, and motorcoach will be explained in the following sections.

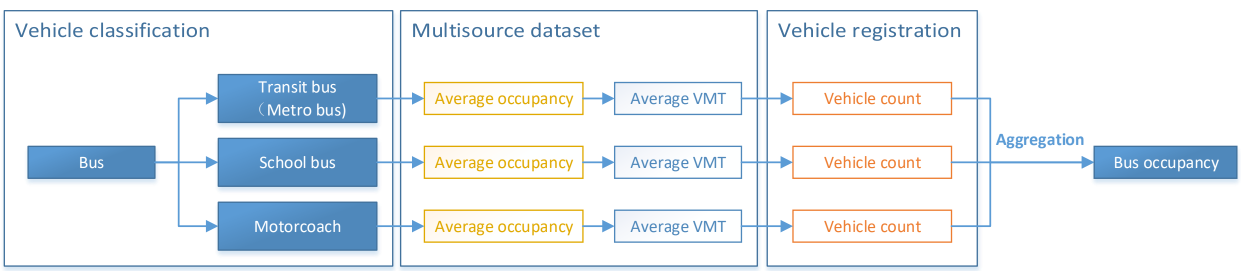


Figure 4. General framework for developing bus occupancy factors.

Methodology: Transit Bus

Data Sources

The primary dataset used for transit bus occupancy calculation is the Federal Transit Administration (FTA) National Transit Database (NTD). The most recent dataset is for the year 2017. All public bus companies that receive Federal funding are required to annually report operational and financial data to the FTA, including transit modes operated, number of vehicles in operation, service hours, etc. Passenger and vehicle miles traveled, the two variables used in occupancy calculation, are also included in the NTD.

Transit agencies are classified into three types of reporters, “Full Reporter”, “Reduced Reporter”, and “Rural Reporter.” Only data from “Full Reporters” has been certified as to accuracy by each agency's CEO and subjected to audit according to the FHWA requirement (FHWA, 2017). After filtering out transit modes that are not considered in this project (e.g., rail and ferry transit), the final dataset includes five transit modes: Commuter Bus (CB), Demand Responsive (DR), Motor Bus (MB), Rapid Bus (Bus Rapid Transit) (RB), and Trolley Bus (TB). For these five modes, a total of 1,051 bus transit agencies were labeled as "Full Reporters" as of 2016. Table 2 presents the reporting rate for transit agencies of different modes. In general, NTD data shows a very high reporting rate (i.e., around 99% across all transit modes) and it is not necessary to impute missing data.

Table 2. Reporting Rate for Transit Agencies of Different Modes

Transit Mode	# of PMT/VMT Reports	Total Count	Report Rate
Commuter Bus (CB)	101	102	99.0%
Demand Responsive (Paratransit) (DR)	454	458	99.1%
Motor Bus (MB)	469	475	98.7%
Rapid Bus (Bus Rapid Transit) (RB)	11	11	100.0%
Trolley Bus (TB)	5	5	100.0%
Total	**1040**	**1051**	**99.0%**

Method for Estimating Occupancy Factors

State level

Two important data items to be used in occupancy calculation are passenger miles (PMT) and vehicle revenue miles (VMT). The average occupancy of transit bus can be expressed as

$$AVO_{transit} = average\_ridership + driver = \frac{\sum_i PMT_i}{\sum_i VMT_i} + 1$$

where $\sum_i PMT_i$ and $\sum_i VMT_i$ are total PMT and VMT from all transit agencies in the analysis area. Figure 5 shows the average transit occupancy by state. Average VMT for transit buses is an important variable to aggregate occupancy information among different bus types. Figure 6 also shows the average VMT by states based on 2016 NTD data. In general, transit occupancy is higher on the east and west coasts but average VMT is higher for the central region. All transit agencies in Wyoming are labelled as "Reduced Reporter" or "Rural Reporter" thus no PMT and VMT information is reported.

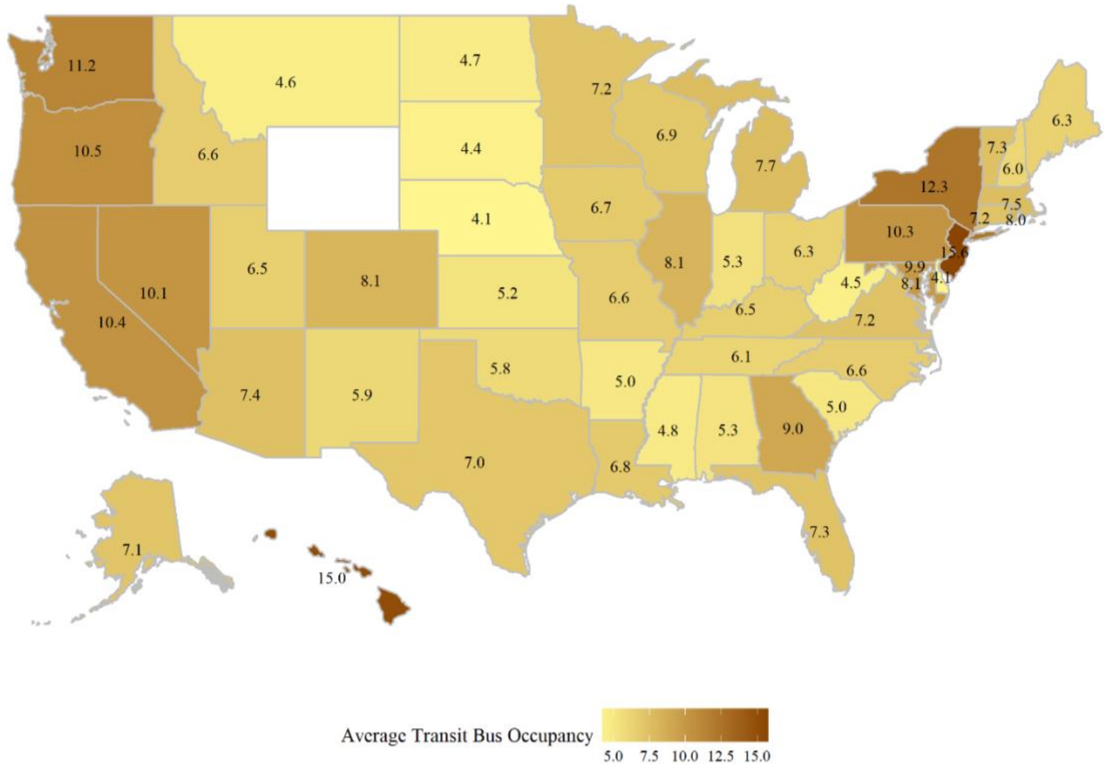


Figure 5. Average transit bus occupancy by state without Wyoming.

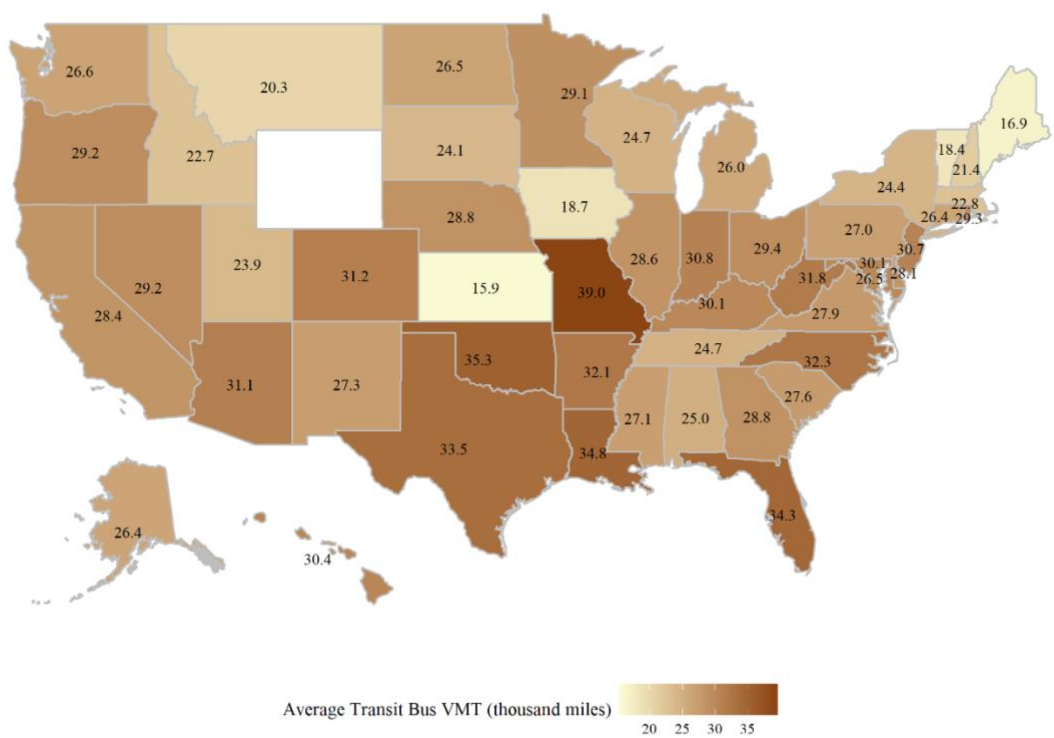


Figure 6. Average transit bus VMT by state without Wyoming.

A multiple linear regression model is developed to estimate the transit occupancy in Wyoming. Previous study has shown that transit occupancy is closely related with the local population and economics (Mittal et al., 2017). Thus, local GDP and population density data are used as two predictors in the regression model. Population density data by state and urbanized area have been collected from U.S. Census Bureau (U.S. Census Bureau, 2018). Annual GDP information by state and metropolitan area can be downloaded from the U.S. Bureau of Economic Analysis (BEA) (BEA, 2018). Note that BEA also provides GPS break down by different industries, and in the regression model development we tested both the total GDP and GDP in transit and ground passenger transportation.

To increase the sample size and obtain a more consistent estimate for model parameters, a total of five years (i.e., 2012-2016) of data were used to fit the regression model. Figure 7 (a-c) show the scatterplots of state average transit occupancy against all industry GDP, transit GDP, and population density, respectively. Smooth trend curves (orange curves) and local variations (grey shadow) are also displayed to represent general relationships between variables. According to the data, there is a positive relationship between transit occupancy and population density. But for GDP data, the relationship is more complicated, although the general trend is increasing. It is important to note that a linear regression model is not suitable to capture the curvilinear relationship between variables. Thus, more data pre-processing work is required before regression modeling. In addition, Hawaii transit agencies (points in red ovals) have significantly higher occupancy than other states and are removed from the final dataset, as our goal is to estimate transit occupancy only in Wyoming.

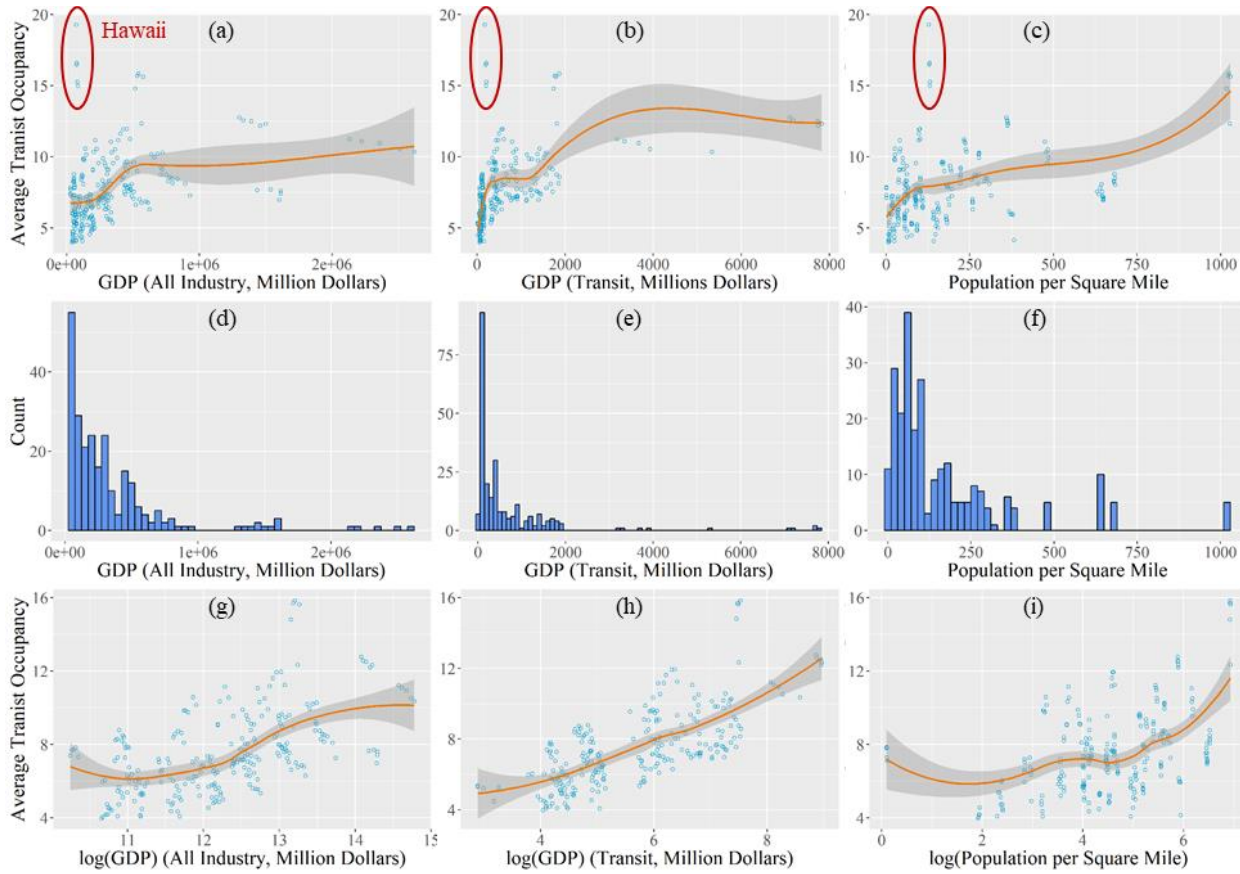


Figure 7. Explanatory analysis for regression modeling.

Figure 7 (d-f) show the distribution of candidate predictors (i.e., all industry GDP, transit GDP, population density). All candidate predictors have right-skewed distributions, indicating that logarithmic transformation may be needed to normalize the data. Figure 7 (g-i) show the scatterplots of average transit occupancy with log-transformed candidate predictors. The trend curves for all industry GDP and transit GDP become more linear after log-transformation, while the trend curve for population density is not significantly improved in terms of linearity. In this report, we use log to denote the natural logarithmic transformation.

A total of five regression models were trained using different variable settings. Table 3 presents the regression results for all five models. Model 1 takes all candidate predictors into regression, and the result shows that all industry GDP is not significant with transit GDP already in the model. After removing all industry GDP (Model 2), transit GDP becomes more significant as indicated by the higher t-value. The overall model fitting is almost the same (i.e., R^2 values are very close). As mentioned in the explanatory analysis, Model 3 tested regression results with log-transformed predictors. According to the smaller residual standard error (σ) and higher R^2, models with log-transformed predictors performed better than non-transformed data. Note that log(gdp_all) shows a negative impact on transit occupancy, while in the scatterplot the trend should be positive (as shown in Figure 7 (g)). This suggests that all industry GDP is highly correlated with Transit GDP and should be removed to avoid multicollinearity. Models 4 and 5 tested the performance of including transit GDP and population density with different data transformations. According to the results, Model 5 outperforms Model 4 in terms of the higher R^2, lower residual standard error (σ), as well as more significant coefficient estimates.

Table 3. Regression Results for Different Model Settings

Model 1: $\boldsymbol{occupancy \sim gdp\_all + gdp\_transit + pop\_density}$				
Variable	Estimate	Std. Error	t-value	p-value
(Intercept)	6.5090	0.1998	32.574	$< 2 \times 10^{-16}$
gdp_all	2.64×10^{-7}	4.85×10^{-7}	0.544	0.5870
gdp_transit	7.21×10^{-4}	1.77×10^{-4}	4.064	6.48×10^{-5}
pop_density	3.55×10^{-3}	7.04×10^{-4}	5.045	8.80×10^{-7}
	$\sigma = 2.140$	$DF = 246$	$F = 34.55$	$R^2 = 0.2964$
Model 2: $occupancy \sim gdp\_transit + pop\_density$				
Variable	Estimate	Std. Error	t-value	p-value
(Intercept)	6.5538	0.1815	36.112	$< 2 \times 10^{-16}$
gdp_transit	7.92×10^{-4}	1.20×10^{-4}	6.612	2.33×10^{-10}
pop_density	3.54×10^{-3}	7.02×10^{-4}	5.037	9.13×10^{-7}
	$\sigma = 2.137$	$DF = 247$	$F = 51.82$	$R^2 = 0.2956$
Model 3: $occupancy \sim log(gdp\_all) + log(gdp\_transit) + log(pop\_density)$				
Variable	Estimate	Std. Error	t-value	p-value
(Intercept)	10.5275	2.1346	4.932	1.50×10^{-6}
log(gdp_all)	-1.1982	0.2494	-4.803	2.71×10^{-6}
log(gdp_transit)	1.8317	0.1936	9.459	$< 2 \times 10^{-16}$
log(pop_density)	0.3222	0.1161	2.776	5.92×10^{-3}
	$\sigma = 1.953$	$DF = 246$	$F = 57.97$	$R^2 = 0.4070$
Model 4: $occupancy \sim log(gdp\_transit) + log(pop\_density)$				
Variable	Estimate	Std. Error	t-value	p-value
(Intercept)	0.6759	0.6175	1.095	0.2748
log(gdp_transit)	1.0828	0.1199	9.033	$< 2 \times 10^{-16}$
log(pop_density)	0.1967	0.1180	1.667	0.0969
	$\sigma = 2.038$	$DF = 247$	$F = 69.23$	$R^2 = 0.3540$
Model 5: $occupancy \sim log(gdp\_transit) + pop\_density$				
Variable	Estimate	Std. Error	t-value	p-value
(Intercept)	1.5122	0.6073	2.490	0.01343
log(gdp_transit)	1.0227	0.1126	9.081	$< 2 \times 10^{-16}$
pop_density	2.26×10^{-3}	6.96×10^{-4}	3.241	0.00136
	$\sigma = 2.008$	$DF = 247$	$F = 75.19$	$R^2 = 0.3784$

The final model used to estimate the state-level transit occupancy is expressed as

$$AVO_{transit}(state) = 1.5122 + 1.0227 \times \log GDP_{transit}(state) + 2.26 \times pop\_density(state)$$

where $GDP_{transit}$ is the GDP for Transit and Ground Transportation Industry ($\$ \ 1 \times 10^6$) and $pop\_density$ is the population density of the state (1,000 per mi^2). The estimated prediction error is 2. As of 2016, the transit GDP for Wyoming is $\$ \ 33 \times 10^6$ and the population density is 5.980 people per mi^2. This gives a prediction of state average transit occupancy of 3.08, which is the lowest among all states and slightly smaller than the neighboring Montana and South Dakota.

Above illustrates the general procedure for estimate state-level transit bus occupancy when the data is missing. However, given that there is no urbanized area in Wyoming, it's might be more appropriate to fit the regression model only using nearby states that are more similar to Wyoming in terms of transit GDP and population density. Thus, for estimating Wyoming transit bus occupancy, we just focused on the nearby seven states (i.e., Idaho, Montana, North Dakota, South Dakota, Nebraska, Colorado, and Utah) that are relatively less-populated. Although Colorado, and Utah have some large urbanized areas, these two states are included to ensure sufficient variations in model input. The final model used to specifically estimate the transit bus occupancy in Wyoming is expressed as

$$AVO_{transit}(state) = 0.3353 + 0.9294 \times \log GDP_{transit}(state) + 55.24 \times pop\_density(state)$$

Plug in the 2016 transit GDP and population density in Wyoming, the estimated Wyoming average transit bus occupancy is 3.92 (as shown in Figure 8), which is slightly higher than the regression estimate using all states as model input.

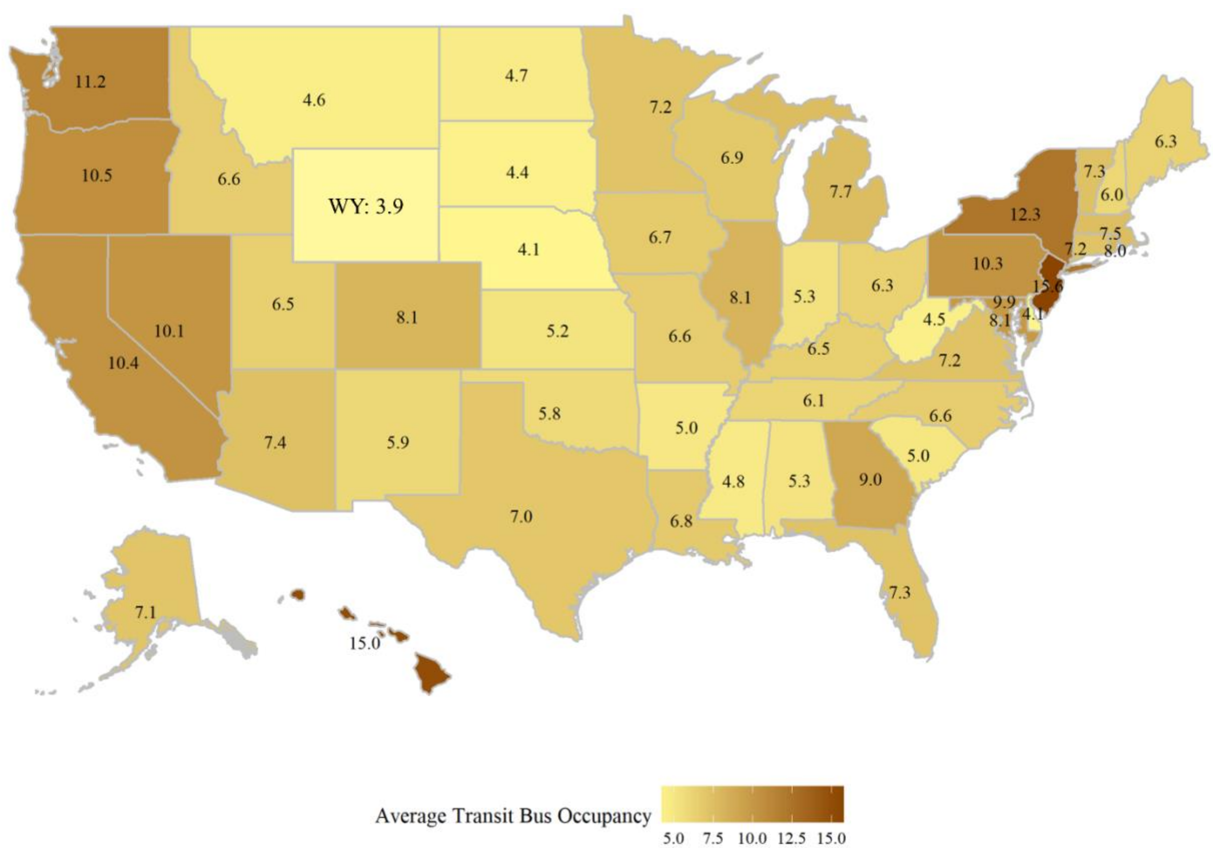


Figure 8. Average transit bus occupancy by state with Wyoming.

Urbanized area level

For data at the urbanized area level, transit agencies can be mapped into the corresponding urbanized area based on the zip code information. The NTD transit agencies have covered 161 of the total 183 urbanized areas considered in this project. For urbanized areas not covered by NTD data, a linear regression model was developed to estimate the average transit bus occupancy. Although U.S. BEA also has GDP summarized at the metropolitan statistical area (MSA) level, the data cannot be further broken down to the urbanized area level. Additionally, the MSA-level transit GDP data are missing in some areas, especially in small MSAs where the NTD information is also missing. Thus, we used the population density as the only predictor in the regression model to estimate the urban area level transit bus occupancy. Using calculated average transit bus occupancy for urbanized areas with NTD agencies, the fitted regression model is expressed as below

$$AVO_{transit}(urban\_area) = -19.2956 + 3.3793 \times \log pop\_density(urban\_area)$$

For the 22 urbanized areas where NTD information is missing, the average transit bus occupancy was estimated using the above equation. The average transit bus annual mileage was assumed to be the same as that in the corresponding state.
Table **4** summarizes the average transit occupancy results for top 20 urbanized areas (in terms of population).

Table 4. Transit Occupancy Results for Top 20 Urbanized Areas

Area Name	State	Average Occupancy	Average VMT (mi)
New York--Newark, NY--NJ--CT	New York	12.99	24109
Los Angeles--Long Beach--Anaheim, CA	California	15.81	29005
Chicago, IL--IN	Illinois	8.64	28313
New York--Newark, NY--NJ--CT	New Jersey	15.61	31311
Miami, FL	Florida	8.62	35389
Dallas--Fort Worth--Arlington, TX	Texas	5.57	36521
Houston, TX	Texas	4.84	16412
Atlanta, GA	Georgia	9.65	30390
Boston, MA--NH--RI	Massachusetts	8.29	23315
Philadelphia, PA--NJ--DE--MD	Pennsylvania	12.74	27210
Detroit, MI	Michigan	10.17	33035
Phoenix--Mesa, AZ	Arizona	7.02	32654
San Francisco--Oakland, CA	California	11.74	24422
Seattle, WA	Washington	14.27	26910
San Diego, CA	California	8.82	30955
Minneapolis--St. Paul, MN--WI	Minnesota	7.29	29334
Tampa--St. Petersburg, FL	Florida	7.43	33762
Denver--Aurora, CO	Colorado	8.31	32630
Washington, DC--VA--MD	Virginia	8.98	26418
Baltimore, MD	Maryland	11.01	29012

Methodology: School Bus

Data Sources

The U.S. State by State Transportation Statistics 2015-16 reported by SchoolBusFleet.com (Data Source: http://files.schoolbusfleet.com/stats/SBFFB18StateByState.pdf) is employed to calculate the school bus occupancy for state level. The report provides a breakdown of information for each of the 50 states, including the number of K-12 public and private school students transported daily, the number of school buses in each state and the total state aid paid for pupil transportation. The data is updated annually, so it is straight forward to use the new data with our developed methodology. Figure 9 shows an example of the data table in the report. In our method, the public K-12 students transported daily and the total annual route mileage are employed as the input data. Based on the data reported from American School Bus Council (ASBC) (Data Source: http://www.americanschoolbuscouncil.org/issues/environmental-benefits), we can know the following two important information:

(1) Average distance from home to school for bus riders (ASBC estimate, miles) = 5 miles
(2) Length of average school year (days) = 180 days

SCHOOL TRANSPORTATION: 2015-16 SCHOOL YEAR

State	Public K-12 students transported daily	Total K-12 public students enrolled	Percent of total public students transported	Private K-12 students transported daily	Total yellow school buses	District-owned yellow buses	Contractor-owned yellow buses	State-owned yellow buses	Total annual route mileage	Total state aid paid for pupil transportation
Alabama	362,567	734,119	49%	0	7,795	7,473	322	0	86,653,080	$339,228,938
Alaska	29,775	129,588	23%	n/a	1,072	228	844	0	7,702,265	$78,611,743
Arizona	301,135	1,082,643	28%	n/a	7,166	n/a	n/a	n/a	80,638,240	n/a
Arkansas	350,373	477,268	73%	n/a	4,532	n/a	n/a	n/a	537,988	$198,217,127
California	666,314*	6,226,737	11%	500,543	24,201	15,914	8,287	12	254,325,996	$491,112,000
Colorado	376,195	899,112	42%	n/a	3,982*	n/a	n/a	0	291,444	$56,438,573
Connecticut*	467,000**	548,181	85%	n/a	7,795	479	7,316	0	n/a	n/a
Delaware	117,000	135,000	87%	0	1,650	0	1,050	600	19,000,000	$92,000,000

Figure 9. Sample data of the U.S. State by State Transportation Statistics 2015-16. Source: http://files.schoolbusfleet.com/stats/SBFFB18StateByState.pdf.

Method for Estimating Occupancy Factors

State level

As a result, the average school bus occupancy for each state can be estimated based on the following equation:

$$AVO_{school} = \frac{\sum_i PMT_i}{\sum_i VMT_i} + 1 = \frac{Number\ of\ Student\ Transported\ Daily \times 180 \times (5 \times 2)}{Total\ Annual\ Route\ Mileage} + 1$$

where (5×2) is the average round trip distance from home to school. The estimated average school bus occupancy for the states are summarized in Figure 10. The total annual route mileage data are missing for 14 states, and these states require additional model to estimate the average school bus occupancy.

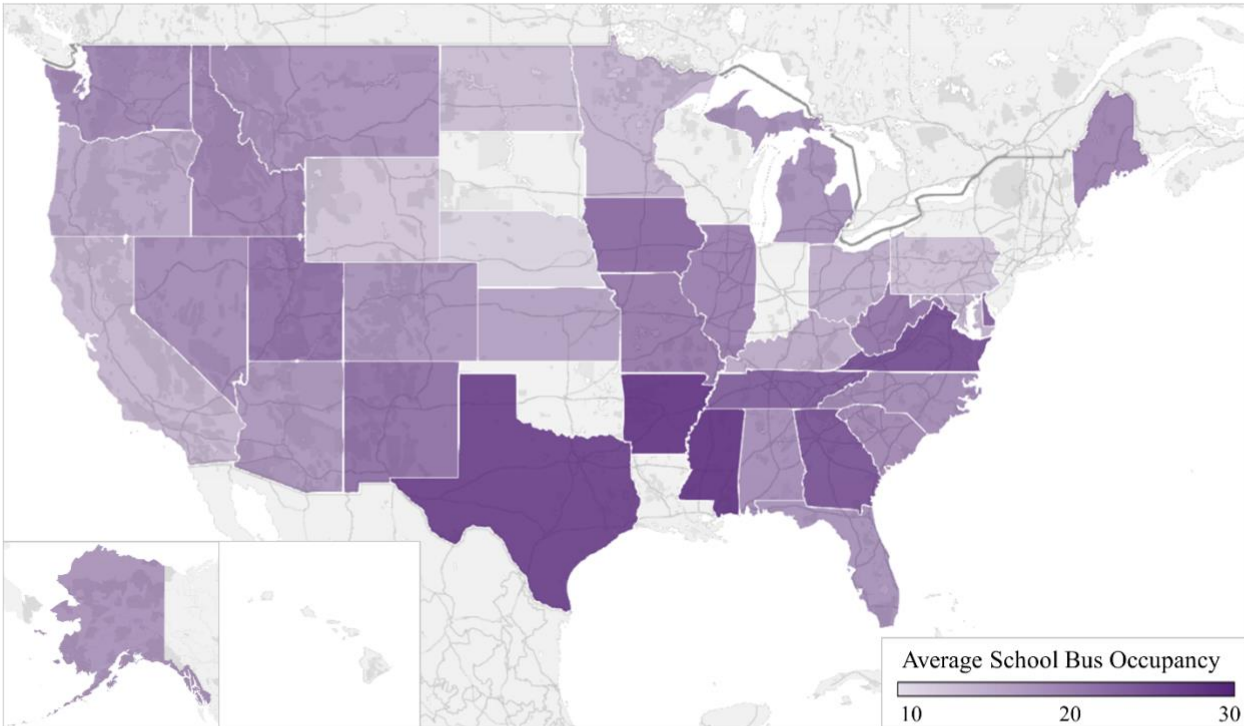


Figure 10. Average school bus occupancy by state (14 states missing).

To address the missing data issue, a local factors-based weighted model is developed by incorporating local factors such as total school enrollment, average district enrollment, total districts, total schools, total students transported daily, total yellow school buses as below

$$AVO_{school}(State\ i) = \sum_{j=1}^{N} w(i,j) \times AVO_{school}(State\ j)$$

where the weight $w(i,j)$ is defined as an index to describe the similarity between state *i* and state *j*. If the local factors of state *i* is close to those of state *j*, the similarity between them is high which implies a high value of weight $w(i,j)$. Let $F_l(\mathrm{i})$ be a local factor of state *i*, then the weight $w(i,j)$ can be defined as

$$w(i,j) = \frac{\sum_{l=1}^{L}\left(1 - \frac{|F_l(\mathrm{i}) - F_l(\mathrm{j})|}{max\{F_l(\mathrm{i}), F_l(\mathrm{j})\}}\right)}{\sum_{j=1}^{N}\sum_{l=1}^{L}\left(1 - \frac{|F_l(\mathrm{i}) - F_l(\mathrm{j})|}{max\{F_l(\mathrm{i}), F_l(\mathrm{j})\}}\right)}$$

where the design of the item $\frac{|F_l(\mathrm{i}) - F_l(\mathrm{j})|}{max\{F_l(\mathrm{i}), F_l(\mathrm{j})\}}$ can guarantee that the value ranges between 0 and 1. The data for these local factors can be found from SchoolBusFleet.com (Data Source: http://files.schoolbusfleet.com/stats/SBFFB18StateByState.pdf) and Governing.com (Data Source: http://www.governing.com/gov-data/education-data/school-district-totals-average-enrollment-statistics-for-states-metro-areas.html). By using weight $w(i,j)$, the state has similar local factors will have more impacts on the estimation of the average school bus occupancy for the targeted state. For example, our results indicate that North Dakota shows higher similarity ($w(i, j) = 0.495$) with South Dakota compared to any other state. Based on the developed local factors-based weighted model, the average school bus occupancies for all states are estimated and presented in Table 5 and Figure 11.

Table 5. Estimated Average School Bus Occupancy by State

State	Occupancy	State	Occupancy	State	Occupancy	State	Occupancy
Alabama	16.06	Illinois	18.21	Montana	15.42	South Carolina	17.01
Alaska	14.92	Indiana	12.52	Nebraska	7.09	South Dakota	12.09
Arizona	14.44	Iowa	21.83	Nevada	16.28	Tennessee	23.77
Arkansas	29.84	Kansas	12.98	New Hampshire	11.58	Texas	28.20
California	9.26	Kentucky	11.29	New Jersey	12.27	Utah	20.55
Colorado	15.26	Louisiana	13.29	New Mexico	20.75	Vermont	11.07
Connecticut	12.52	Maine	17.61	New York	12.26	Virginia	26.19
Delaware	23.17	Maryland	10.13	North Carolina	16.47	Washington	16.87
Distric of Columbia	10.59	Massachusetts	12.45	North Dakota	8.43	West Virginia	19.67
Florida	15.22	Michigan	15.17	Ohio	10.79	Wisconsin	12.29
Georgia	25.21	Minnesota	9.78	Oklahoma	12.13	Wyoming	7.23
Hawaii	9.67	Mississippi	30.07	Oregon	11.85		
Idaho	17.50	Missouri	19.33	Pennsylvania	7.95		

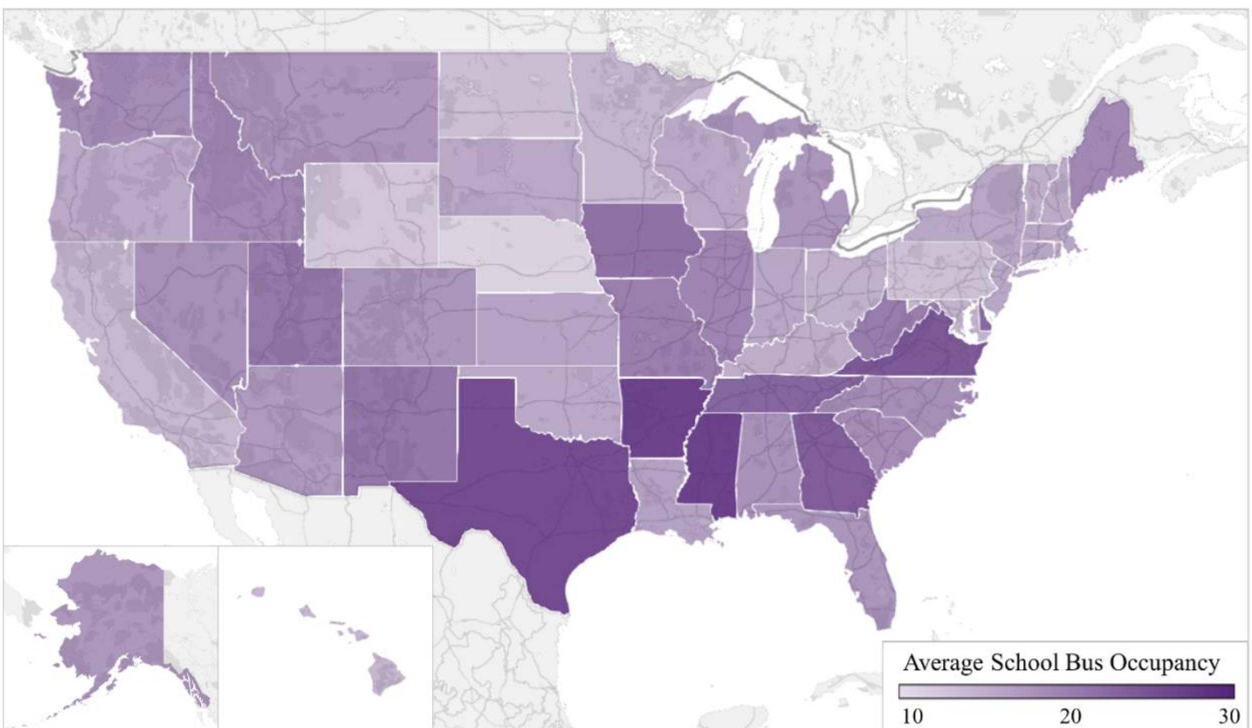


Figure 11. Average school bus occupancy by state (all states).

Urbanized area level
The Governing.com (Data Source: http://www.governing.com/gov-data/education-data/school-district-totals-average-enrollment-statistics-for-states-metro-areas.html) also provides metro area school district data includes total districts, total schools, total public school enrollment, and average district enrollment for an urbanized area as shown in Figure 12. The dataset covers over 490 metro areas which include all the urbanized area with population over 200,000.

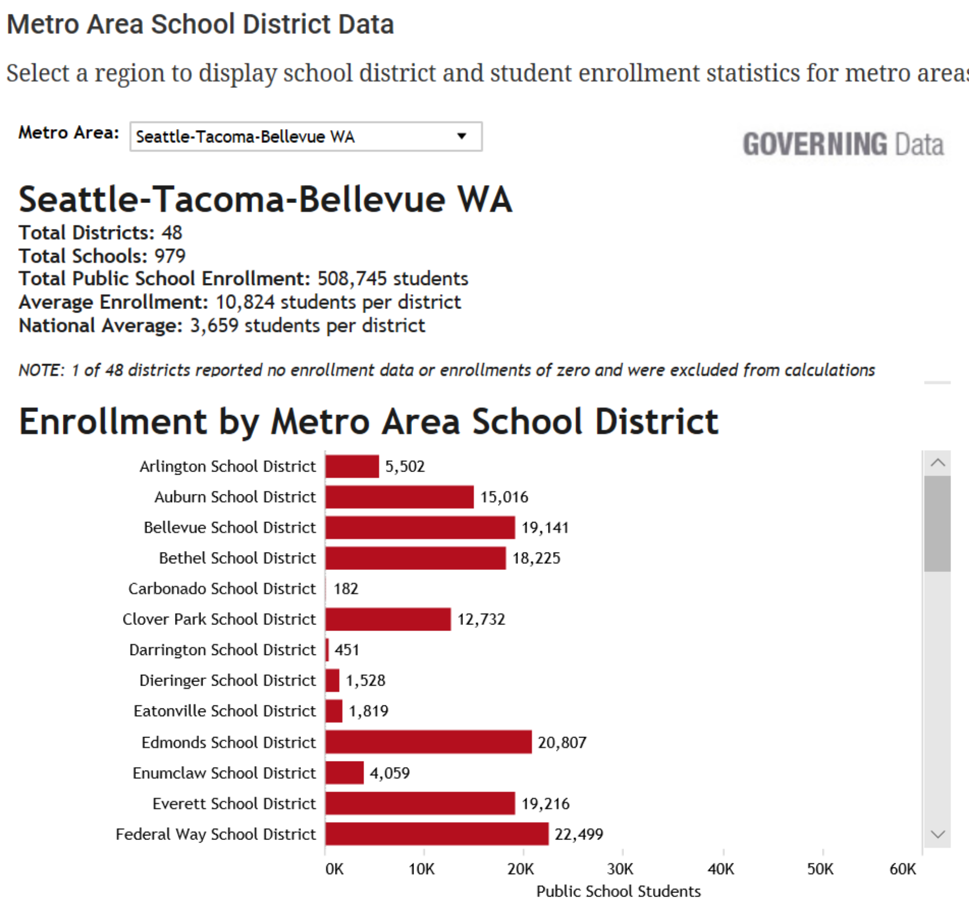


Figure 12. Example of the metro area school district data. Source: https://www.governing.com/gov-data/education-data/school-district-totals-average-enrollment-statistics-for-states-metro-areas.html.

To estimate the average school bus occupancy for the urbanized areas, the Empirical Bayes idea is employed to combine the state level estimation with local level factors. For an urbanized area, its state level school bus occupancy is used as a benchmark value with a weight defined based on the local level factors. Since the total districts, total schools, and total public school enrollment of an urbanized area are significantly less than those at the state level, the local average district enrollment (ADE) is selected to develop the weight. If the local ADE is close to the state level ADE, the weight for the benchmark value (state level school bus occupancy) will be high. The definition of the weight is expressed as below

$$w = 1 - \frac{|ADE_u - ADE_s|}{max\{ADE_u, ADE_s\}}$$

where ADE_u is the average district enrollment for an urbanized area, ADE_s is the average district enrollment for the corresponding state. Therefore, the empirical Bayes model for estimating the urbanized area average school bus occupancy is developed as below

$$AVO_{school}(urban\_area) = w \times AVO_{school}(state) + (1 - w) \times EAVO_{school}(urban\_area)$$

where $EAVO_{School}(urban\_area)$ is the expected average school bus occupancy for the urbanized area. In order to estimate $EAVO_{School}(urban\_area)$, the factors such as total districts, total schools, total public school enrollment, and average district enrollment are explored to identify their relationship with the average school bus occupancy as shown in Figure 13. The state level data including total districts, total schools, total public school enrollment, and average district enrollment are used to establish the regression models to estimate the average school bus occupancy. The outliers such as California, Texas, Nevada, Florida, Maryland (points in red ovals) that have significant higher values than other states are removed from the final datasets. Five different regression models including linear regression, log regression exponential regression, polynomial regression, and power regression are tested based on the final datasets for different factors. The models with best performance are selected and shown in Figure 13.

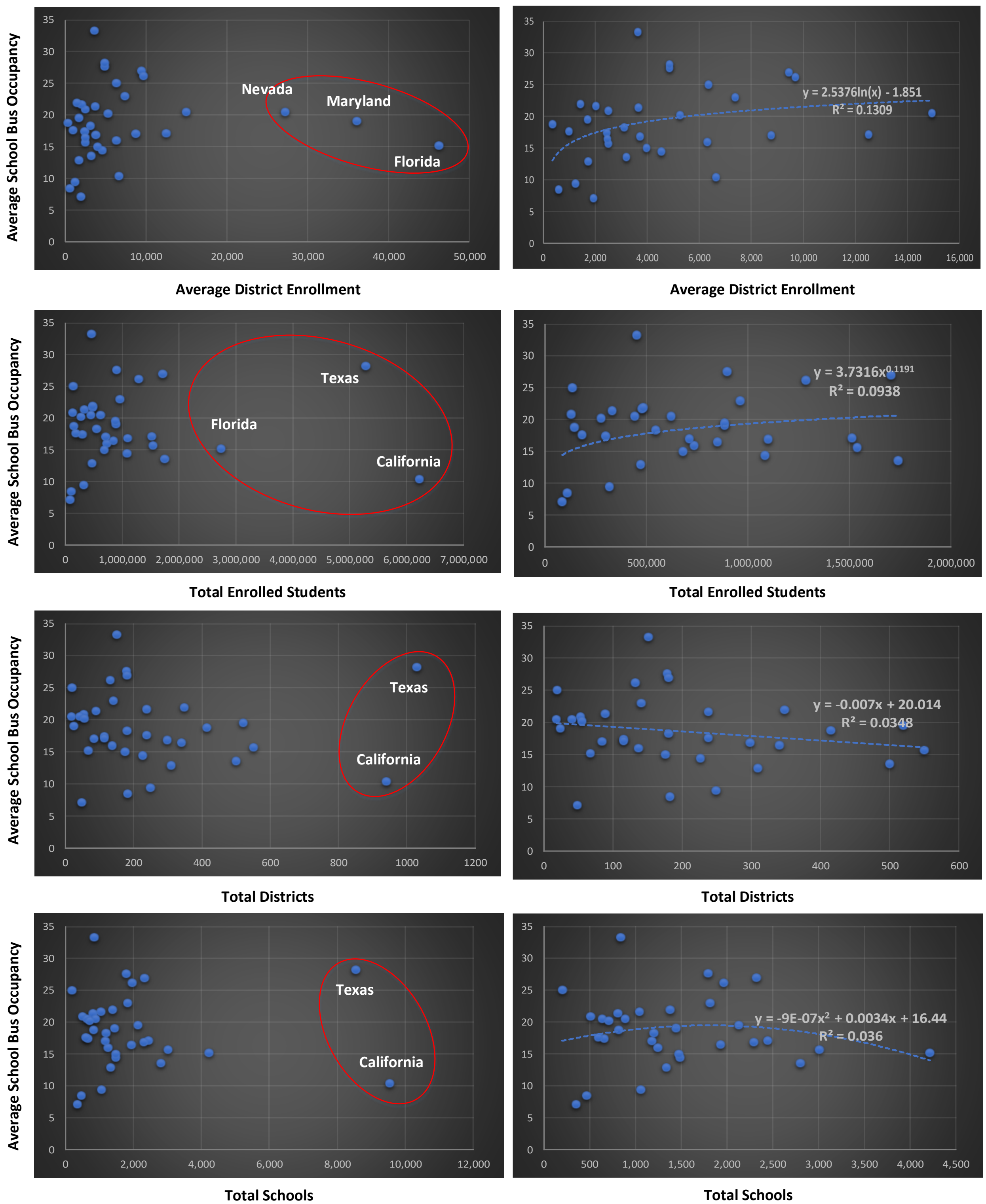


Figure 13. Regression analysis for urbanized area level school bus occupancy estimation.

The results show that the log regression model based on the final dataset of average district enrollment performances best as compared to the other models ($R^2 = 0.1309$). As a result, the final model used to estimate the expected average school bus occupancy for the urbanized areas is expressed as

$$EAVO_{school}(urban\_area) = 2.5376 \times \log ADE_u - 1.851$$

Based on the above method, the average school bus occupancy for all the urbanized areas required in the project can be estimated. The average school bus occupancy rates for top 20 urbanized areas are presented in Table 6.

Table 6. School Bus Occupancy Results for Top 20 Urbanized Areas

Area Name	State	Average Occupancy	Average VMT (mi)
New York--Newark, NY--NJ--CT	New York	13.82	12000
Los Angeles--Long Beach--Anaheim, CA	California	17.32	10509
Chicago, IL--IN	Illinois	18.78	7553
New York--Newark, NY--NJ--CT	New Jersey	13.78	12000
Miami, FL	Florida	22.26	17219
Dallas--Fort Worth--Arlington, TX	Texas	24.57	2477
Houston, TX	Texas	24.45	2477
Atlanta, GA	Georgia	24.38	9642
Boston, MA--NH--RI	Massachusetts	13.01	12000
Philadelphia, PA--NJ--DE--MD	Pennsylvania	7.99	18253
Detroit, MI	Michigan	17.78	10212
Phoenix--Mesa, AZ	Arizona	15.33	11253
San Francisco--Oakland, CA	California	10.10	10509
Seattle, WA	Washington	19.94	12529
San Diego, CA	California	14.94	10509
Minneapolis--St. Paul, MN--WI	Minnesota	15.94	13919
Tampa--St. Petersburg, FL	Florida	21.68	17219
Denver--Aurora, CO	Colorado	19.92	12356
Washington, DC--VA--MD	Virginia	25.42	7680
Baltimore, MD	Maryland	12.44	17262

As an alternative method to estimate the school bus occupancy, we also conducted surveys to get local data for school bus occupancy related information. Such information includes the minimum busing distance, total travel distance, and school bus loading factor. Survey results were collected from two urbanized areas, Milwaukee and Madison in Wisconsin, and summarized in Table 7. The distribution of school bus capacity is mined from Polk data and based on the vehicle model and manufacturer website (as shown in Figure 14). The average school bus capacity for Milwaukee and Madison are 72.29 and 76.82, respectively.

Table 7. School Bus Occupancy Survey Results from Milwaukee and Madison

Variable	Item	Milwaukee	Madison
d_{min}	Minimum busing distance	0.5 mile	1 mile
d_{total}	Total travel distance	12 mile	15 mile
L	School bus loading factor	85 %	80 %
C	Average school bus capacity	72.29	76.82

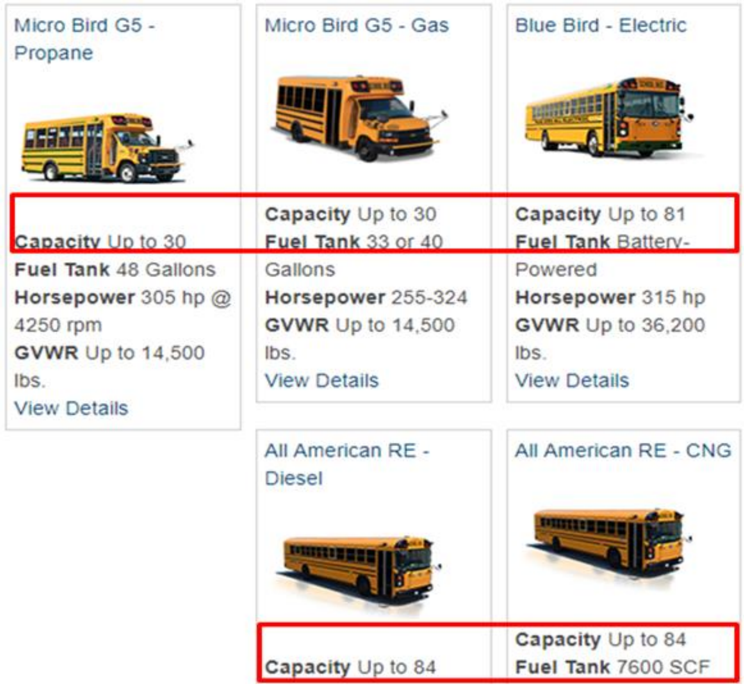


Figure 14. Example of school bus capacity information from the website. Source: https://www.blue-bird.com/buses.

To calculate the average school bus occupancy, Figure 15 shows the change of school bus loading rate during a typical route. During the morning peak trip, the school bus is assumed to leave the base station and go to pick up students one by one. The loading ratio will gradually increase until arrives the peak level (usually around 75%-95%). After the school bus picked up the last student, it will travel another minimum bussing distance and eventually let all the student get off at the school. Then it will go back to the base station with empty load. Therefore, the average loading factor during the route should be

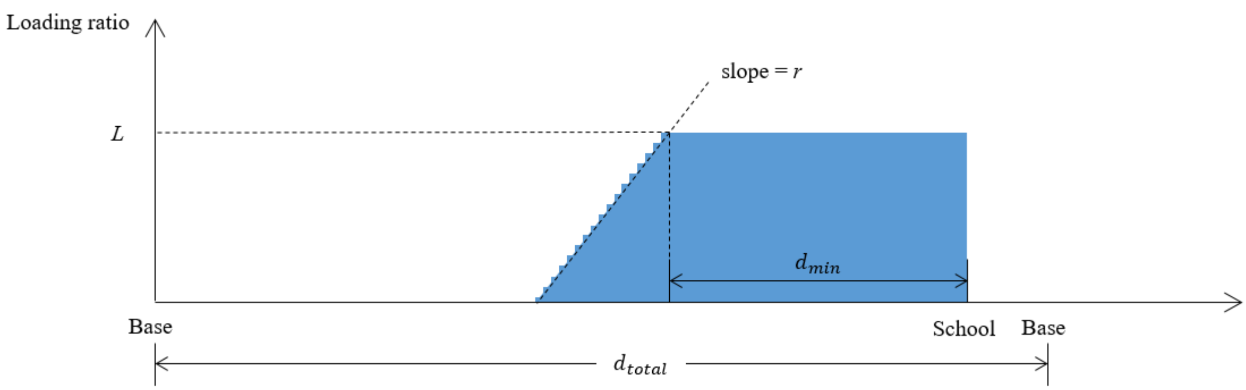


Figure 15. Changes of school bus loading ratio during a typical route (morning peak).

$$\bar{L} = \frac{\frac{L^2}{2r} + L \times d_{min}}{d_{total}}$$

Further assume that the school bus base is located or very close to the school served, then the length of the outbound trip with only the driver would be approximately equal to the length of the trip back to school with students. This is expressed as

$$\frac{L}{r} + d_{min} = \frac{d_{total}}{2}$$

This gives the average loading factor as

$$\bar{L} = \left(\frac{1}{4} + \frac{d_{min}}{2d_{total}}\right) L$$

So the school bus occupancy can be calculated as

$$AVO_{School} = 1 + C \times \bar{L}$$

Based on the above model, the estimated average school bus occupancy for Milwaukee and Madison are 17.65 and 18.39, respectively.

Methodology: Motorcoach (Private Bus)

Data Sources

The Port Authority of New York and New Jersey (PANYNJ) provided motorcoach and passenger hourly arrivals and departures data at the Port Authority Bus Terminal (PABT) for 2015. The PABT data were collected by surveying bus carriers who have direct service to PANYNJ, and the annual survey results can be requested periodically. This dataset covers 24 states and 35 urbanized areas. The PABT is the main gateway for interstate buses into Manhattan in New York City. The PABT is located in Midtown at 625 Eighth Avenue between 40th Street and 42nd Street, one block east of the Lincoln Tunnel and one block west of Times Square. It is one of three bus terminals operated by the PANYNJ, the others being the George Washington Bridge Bus Station in Upper Manhattan and the Journal Square Transportation Center in Jersey City. The PABT serves as a terminus and departure point for commuter routes as well as for long-distance intercity routes and is a major transit hub.

The Motorcoach Census Report 2015 developed by American Bus Association Foundation and John Dunham & Associates are also used as a data source to obtain the national level motorcoach occupancy information (American Bus Association. 2017). Additionally, some local reports such as Motor Coach Tourism in Savannah produced by the Armstrong Atlantic State University for the City of Savannah are also referenced as alternative methods to estimate the urbanized area level motorcoach occupancy (Armstrong Atlantic State University. 2013).

Method for Estimating Occupancy Factors

State level

The Port Authority Bus Terminal data included detailed total bus and passenger hourly arrivals and departures for 256 routes identified by origin and destination. The motorcoach occupancy for a route can be estimated by using the following equation

$$AVO_{motorcoach}(route) = \frac{Daily\ Passenger\ Departures + Daily\ Passenger\ Arrivals}{Daily\ Bus\ Departures + Daily\ Bus\ Arrivals} + 1$$

Here both the arrivals and departures data are used to estimate the average motorcoach occupancy. Since the interstate bus usually goes across several states, the average motorcoach occupancy for a state can be estimated by using the following equation

$$AVO_{motorcoach}(state) = \frac{\sum_{route \ni state} AVO_{motorcoach}(route) \times bus\_count(route)}{\sum_{route \ni state} bus\_count(route)}$$

where $route \ni state$ represents aggregating across all routes that pass the state. Based on the above model, the average motorcoach occupancies for 25 states are estimated as shown in Table 8 and Figure 16.

Table 8. Estimated Average Motorcoach Occupancy by State

State	Occupancy	State	Occupancy	State	Occupancy	State	Occupancy
Alabama	47.48	Illinois	47.13	Montana	NA	Rhode Island	44.03
Alaska	NA	Indiana	NA	Nebraska	NA	South Carolina	45.23
Arizona	NA	Iowa	NA	Nevada	NA	South Dakota	NA
Arkansas	NA	Kansas	NA	New Hampshire	41.09	Tennessee	47.48
California	33.40	Kentucky	45.81	New Jersey	29.47	Texas	NA
Colorado	NA	Louisiana	NA	New Mexico	NA	Utah	NA
Connecticut	38.94	Maine	38.00	New York	31.86	Vermont	NA
Delaware	39.28	Maryland	48.19	North Carolina	45.03	Virginia	42.71
District of Columbia	48.32	Massachusetts	44.19	North Dakota	NA	Washington	NA
Florida	40.31	Michigan	40.69	Ohio	43.42	West Virginia	NA
Georgia	41.53	Minnesota	NA	Oklahoma	NA	Wisconsin	NA
Hawaii	NA	Mississippi	NA	Oregon	NA	Wyoming	NA
Idaho	NA	Missouri	33.40	Pennsylvania	38.19		

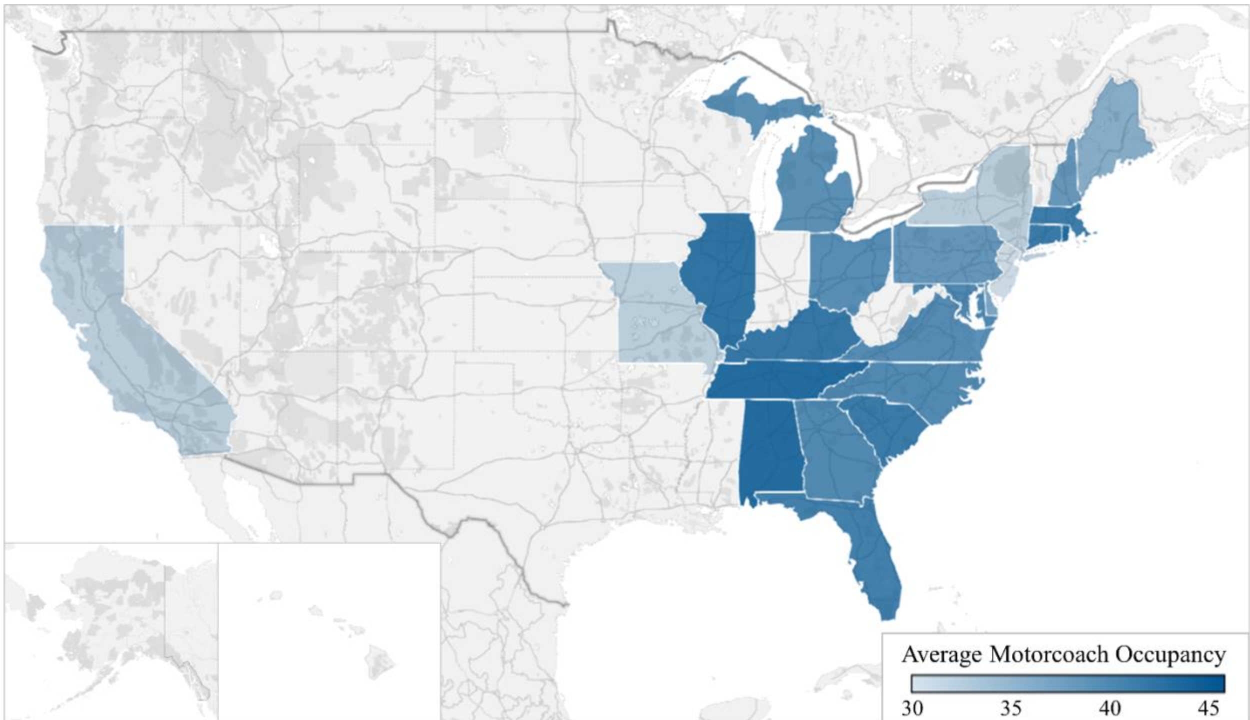


Figure 16. Average motorcoach occupancy by state (20 states).

In order to estimate the average motorcoach occupancy for remaining states, a geographical distance based weighted linear regression model is developed. Similar to the regression model for estimating state level average transit bus occupancy, population density and GDP in transit and ground passenger transportation were used as two regression predictors. The general regression equation is expressed as

$$AVO_{motorcoach}(state) = \beta_0 + \beta_1 \times \log GDP_{transit}(state) + \beta_2 \times pop\_density(state)$$

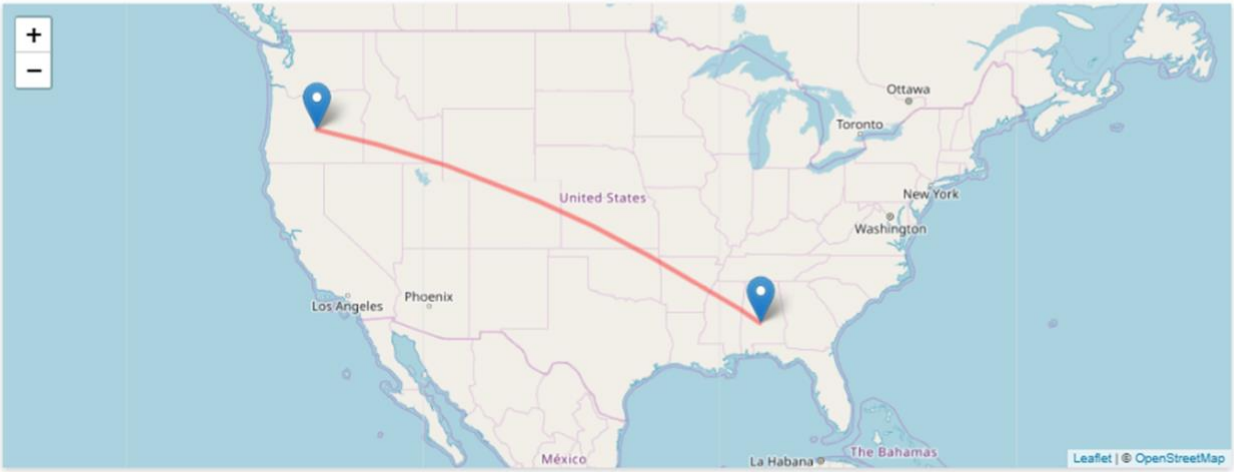
Since the motorcoach operation is spatially correlated, nearby states tend to have similar average motorcoach occupancies. Thus, the geographical distance between states were used as regression weights. The primary difference between a weighted linear regression and a simple linear regression is that, instead of minimizing the sum of squared residuals (SSR), a weighted linear model estimates the regression parameters by minimizing the weighted sum of squared residuals (WSSR), which is

$$WSSR_i = \sum_j w(i,j) \times \left(y_j - \hat{y}_j\right)^2$$

The regression weight $w(i,j) = 1/dist(i,j)$ is defined as the inversed distance between two states, i and j. The closer two states are, the higher regression weight $w(i,j)$ will reflect a strong correlation between the two states. Note that this will result in a unique linear regression model for each state where we need to estimate the average motorcoach occupancy. The center location for each state as well as distances between states can be obtained from the website DistanceFromTo (https://www.distancefromto.net/) as shown in Figure 17.

Distance from Alabama to Oregon

Distance from Alabama to Oregon is 3,189 kilometers. This air travel distance is equal to 1,982 miles.



Alabama

Alabama is located in United States.

GPS Coordinates (DMS)	32° 19´ 5.6280" N 86° 54´ 8.2800" W
Latitude	32.31823
Longitude	-86.90230
Altitude	65 m
Country	United States

Oregon

Oregon is located in United States.

GPS Coordinates	43° 48´ 14.8680" N 120° 33´ 15.1200" W
Latitude	43.80413
Longitude	-120.55420
Altitude	1415 m
Country	United States

Figure 17. Example of calculating distance between two states using DistanceFromTo. Source: https://www.distancefromto.net/.

The complete state level average motorcoach occupancy is presented in Figure 18. In general, the average motorcoach occupancy is higher in less populated areas and lower in more populated areas. According to the 2015 Motorcoach Census Report, the national average motorcoach occupancy is 36.4, which generally agrees with the results estimated using PABT data.

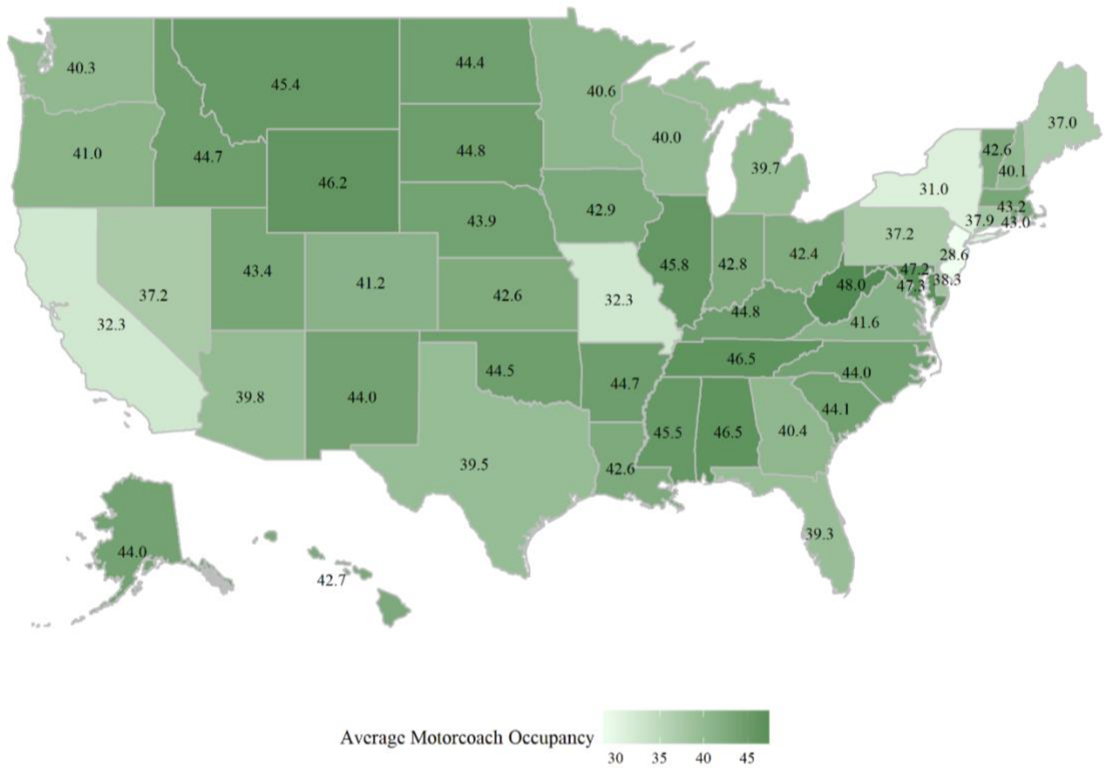


Figure 18. Average motorcoach occupancy by state (all states).

Urbanized area level

Similar to the state level motor coach occupancy calculation, the equation to estimate the average motorcoach accuracy at the urbanized area level is

$$AVO_{motorcoach}(urban\_area) = \frac{\sum_{route \ni urban\_area} AVO_{motorcoach}(route) \times bus\_count(route)}{\sum_{route \ni urban\_area} bus\_count(route)}$$

where $route \ni state$ represents aggregating across all routes that pass the urbanized area. The 2015 PABT data covered 35 urbanized areas. For urbanized areas where PABT data are missing, we employed a similar Empirical Bayesian method as that used to estimate urbanized area level school bus occupancy. The empirical weight to adjust between the state level and the urbanized area level motorcoach occupancy is defined using the population density, which can be written as

$$w = 1 - \frac{|pop\_density_u - pop\_density_s|}{max\{pop\_density_u, pop\_density_s\}}$$

The Empirical Bayesian equation is expressed as

$$AVO_{motorcoach}(urban\_area) = w \times AVO_{motorcoach}(state) + (1 - w) \times EAVO_{motorcoach}(urban\_area)$$

where $EAVO_{motorcoach}(urban\_area)$ is the expected average motorcoach occupancy for the urbanized area, and is estimated by a linear regression model fitted by calculated motorcoach occupancy data in the 35 urbanized areas covered by the 2015 PABT data. The regression equation is expressed as

$$EAVO_{motorcoach}(urban\_area) = 45.705 - 0.761 \times \log pop\_density(urban\_area)$$

Following the Empirical Bayesian equation, the estimated average motorcoach occupancy rates for top 20 urbanized areas are presented in Table 9.

Table 9. Motorcoach Occupancy Results for Top 20 Urbanized Areas

Area Name	State	Average Occupancy
New York--Newark, NY--NJ--CT	New York	31.86
Los Angeles--Long Beach--Anaheim, CA	California	33.40
Chicago, IL--IN	Illinois	47.13
New York--Newark, NY--NJ--CT	New Jersey	29.37
Miami, FL	Florida	36.14
Dallas--Fort Worth--Arlington, TX	Texas	39.68
Houston, TX	Texas	39.65
Atlanta, GA	Georgia	41.35
Boston, MA--NH--RI	Massachusetts	44.82
Philadelphia, PA--NJ--DE--MD	Pennsylvania	45.81
Detroit, MI	Michigan	40.69
Phoenix--Mesa, AZ	Arizona	39.59
San Francisco--Oakland, CA	California	38.84
Seattle, WA	Washington	39.66
San Diego, CA	California	39.03
Minneapolis--St. Paul, MN--WI	Minnesota	39.77
Tampa--St. Petersburg, FL	Florida	46.73
Denver--Aurora, CO	Colorado	39.52
Washington, DC--VA--MD	Virginia	39.75
Baltimore, MD	Maryland	48.35

Some local reports such as Motor Coach Tourism in Savannah can also be used as supplementary data sources. The report from the City of Savannah summarized motorcoach occupancy and related information such as passengers per coach and bus type market share for different bus type in 2013 (see Figure 19). The average motorcoach occupancy in Savannah can be directly calculated as

$$AVO_{motorcoach}(Savannah) = \sum_{t=1}^{T} Passengers\ per\ Coach\ (t) \times Bus\ Type\ Market\ Share\ (t) + 1 = 41.72$$

The estimated average motorcoach occupancy for Savannah in 2013 is 41.72 while the result based on the 2015 PABT data is 46.12. The estimation difference between two methods is around 10%.

Motor Coach Tourism in Savannah

Produced for the City of Savannah

By the

Armstrong Atlantic State University
Center for Regional Analysis

March 2013

Table 1
Estimated Number of MC-Based Tourists

Bus Type	Number of Seats	Bus Occupancy	Passengers per Coach	Bus Type Market Share	Permits by Type	Estimated Passengers by Type
45 feet	59	71%	41.89	80%	1,578	66,119
40 feet	51	95%	48.45	10%	197	9,559
33 feet	29.5	80%	23.60	10%	197	4,656
				Total Passengers		**80,335**

Figure 19. Occupancy related information in Motor Coach Tourism in Savannah. Source: http://www.savannahga.gov/DocumentCenter/View/4364/FINAL-CoachStudy_AASU_031213?bidId=.

Developing Truck Occupancy Factors

Methodology Framework

The estimation of average truck occupancy relies on accident reports. As the truck accident dataset is usually aggregated (e.g., crashes that involve different types of truck are all included in the same data), it's not necessarily to calculate the average truck occupancy by each truck class. An overall average truck occupancy number can be calculated for all truck types. According to the project scope, pickup trucks (i.e., FHWA class 3) and 2-axle single unit trucks (FHWA class 5) are not considered in this project. Those trucks are filtered out from the crash data before estimating the average truck occupancy. However, the methodology being introduced below is generally applicable to all truck types, and it is straightforward to include class 3 and 5 trucks into calculation if there is a future need.

Methodology: Truck

Data Sources

The NHTSA's Trucks in Fatal Accidents (TIFA) data were used as the primary dataset for truck occupancy estimation. The TIFA data were built based on cases that involved medium and heavy trucks in Fatality Analysis Reporting System (FARS). Additional information was also provided beyond FARS such as more accurate vehicle classification and truck details (e.g., fuel type, weight type) processed from VIN numbers (Jarossi et al., 2012). To obtain a sufficient sample size and improve our estimation accuracy, 5 years (i.e., 2006-2010) of TIFA data were collected to estimate truck occupancy.

Table 10 summarized the sample size as well as the average occupancy and standard error calculated for each year. Note that there is a general decreasing trend of truck crashes, indicating the necessity of using data from earlier years to get enough samples. According to the table, the average truck occupancy varies between 1.15 and 1.20 during the 5 years, and there is no obvious change over time.

Table 10. Summary Statistics of TIFA Data from 2006 to 2010

Year	Count	Average Occupancy	Standard Error
2006	5250	1.209	0.573
2007	5049	1.162	0.460
2008	4352	1.179	0.514
2009	3450	1.193	0.573
2010	3699	1.174	0.508

Method for Estimating Occupancy Factors

State level

Figure 20 shows the estimated average truck occupancy by state after aggregating the 5 years of TIFA data. In general, average truck occupancy is higher in the Rocky Mountain region and lower in the Eastern US.

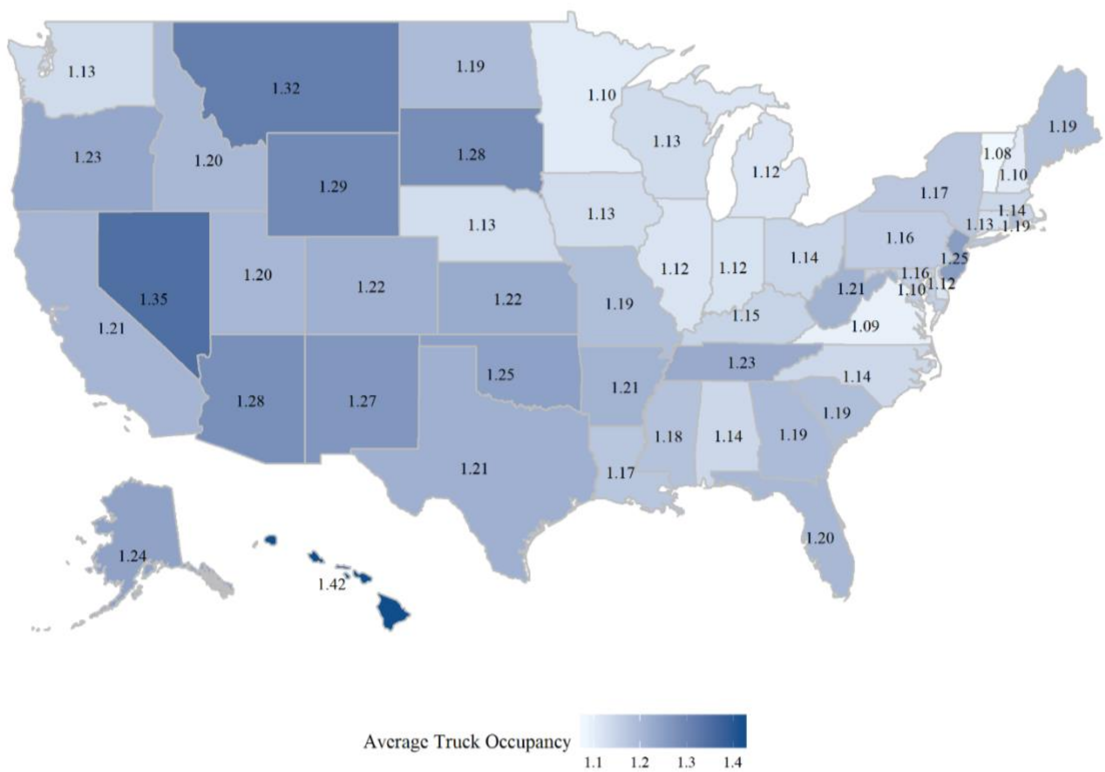


Figure 20. Average truck occupancy by state.

Urbanized area level

One major concern of using TIFA data is the limited sample size. Although combining 5 years of data provides sufficient samples (e.g., hundreds of crashes) for estimating state-level truck occupancy, the sample size might not be sufficient when looking into each urbanized area. The limited number of carashes in each urbanized area may result in greater variance and thus less confidence in the estimated average occupancy.

To overcome the data limitation issue, a Bayesian method is developed to estimate the truck occupancy specifically for urbanized areas. The Bayesian theorem applies a rational estimate procedure that updates a prior belief with new information. In the truck occupancy estimation task, we can regard the state-level truck occupancy as our "prior" belief for urbanized areas within the state. Then truck crashes actually happening in each urbanized area can be considered as the "new information" to generate more accurate localized estimates. This method is based on the assumption that trucks observed in each urbanized area most likely also have travelled to other areas in the same state. Additionally, local truck policies and regulations that can possibly influence regional truck occupancy are more consistent within each state. Thus, the state-level truck occupancy can serve as our prior belief before looking at truck crashes in each specific urbanized area.

The equations for the Bayesian method depend on the specific distribution of the data. The overall distribution of truck occupancy data is shown in Figure 21. Based on the distribution shape and the discrete nature of occupancy data, Poisson distribution seems to be a good candidate to model the truck occupancy. Note that the minimum value for truck occupancy is 1 (as we only want to consider trucks in operation), but the minimum possible value for Poisson distribution is 0. Thus we assume the truck occupancy follows

$$O_{truck} - 1 \sim \text{Poisson}(\lambda)$$

where $\lambda = \bar{O}_{truck} - 1$

The dashed trend line in Figure 21 shows the theoretical probability mass function (pmf) calculated from the corresponding Poisson distribution ($\lambda = 0.184$). The theoretical pmf matched pretty well with the actual distribution of truck count, indicating that truck occupancy is approximately Poisson distributed.

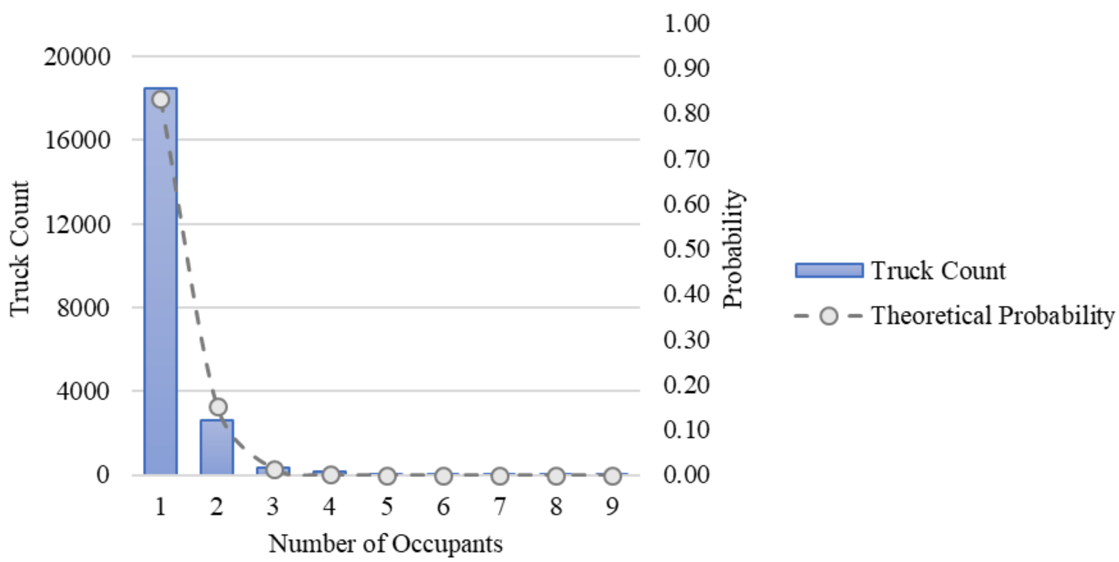


Figure 21. Distribution of truck occupancy and theoretical probability.

The Bayesian equation can thus be derived based on Poisson distributed truck occupancy data. Given $O_{truck} - 1 \sim \text{Poisson}(\lambda)$, the joint probability of observing $O_{t1}, O_{t1}, \dots O_{tn}$ is

$$p(O_{t1} = o_{t1}, O_{t2} = o_{t2}, \dots, O_{tn} = o_{tn} | \lambda) = \prod_{i=1}^{n} e^{-\lambda} \frac{\lambda^{o_{ti}-1}}{o_{ti} - 1!} \propto \lambda^{\Sigma o_{ti} - n} e^{-n\lambda}$$

Based on Bayesian theorem

$$p(\lambda | o_{t1}, \dots, o_{tn}) = \frac{p(o_{t1}, \dots, o_{tn} | \lambda) \times p(\lambda)}{p(o_{t1}, \dots, o_{tn})} \propto p(\lambda) \times \lambda^{\Sigma o_{ti} - n} e^{-n\lambda}$$

Thus, the density of our parameter (λ) estimate include terms like $\lambda^{c_1} e^{-c_2 \lambda}$. The simplest probability distribution that includes such terms is the family of Gamma distributions, and the corresponding probability distribution function is

$$p(\lambda) = \frac{b^a}{\Gamma(a)} \lambda^{a-1} e^{-b\lambda}$$

where a, b are distribution parameters and $\Gamma()$ is the Gamma function. The mean and variance of Gamma distribution is

$$E(\lambda) = \frac{a}{b}$$
$$Var(\lambda) = \frac{a}{b^2}$$

For a particular state s_i, if we have observed n_s truck crashes with occupancy $o_{s_1}, o_{s_2}, \dots, o_{s_{ns}}$, our estimated average occupancy is $\Sigma o_{si} / n_s$, which corresponds to a parameter estimate of

$$\lambda_s = \frac{\Sigma o_{si}}{n_s} - 1 = \frac{\Sigma o_{si} - n_s}{n_s}$$

Thus, the state-level parameter λ_s follows a Gamma distribution with $a_s = \Sigma o_{si} - n_s$ and $b_s = n_s$. Use this as our prior belief of λ. For an urbanized area within this state, if we have n_u truck crashes with occupancy $o_{u_1}, o_{u_2}, \dots, o_{u_{nu}}$, then the posterior distribution of λ is

$$p(\lambda | o_{u_1}, \dots, o_{u_{nu}}) \propto p(\lambda) \times \lambda^{\Sigma o_{uj} - n_u} e^{-n_u \lambda} \propto \lambda^{a_s - 1} e^{-b_s \lambda} \times \lambda^{\Sigma o_{uj} - n_u} e^{-n_u \lambda}$$
$$\propto \lambda^{(a_s + \Sigma o_{uj} - n_u) - 1} e^{-(b_s + n_u)\lambda}$$

This follows a Gamma$(a_s + \Sigma o_{uj} - n_u, b_s + n_u)$ distribution and the posterior parameter estimate for the urbanized area is

$$E(\lambda_u) = \frac{a_s + \Sigma o_{uj} - n_u}{b_s + n_u} = \frac{\Sigma o_{si} + \Sigma o_{uj} - n_s - n_u}{n_s + n_u}$$

And the corresponding estimation of urbanized average truck occupancy is

$$O_u = E(\lambda_u) + 1 = \frac{\Sigma o_{si} + \Sigma o_{uj}}{n_s + n_u}$$

Note that the final equation for estimating average truck occupancy takes the similar form of a weighted average computation, indicating that our confidence in prior belief and new information is proportional to the number of truck crashes observed in the state and urbanized area, respectively. The major benefit of using a Bayesian method to estimate the urbanized average truck occupancy is the significant decrease in estimation error. If we denote $p = n_u/n_s$ which is the proportion of truck crashes occurred in the urbanized area compared to the state, one can simply derive that comparing to only using crash data from the urbanized area, using the proposed Bayesian method achieve a variance reduction rate of around $p/(1+p)$. The Bayesian method significantly increase the estimation accuracy, especially for urbanized areas with very few truck crashes.

To obtain the average occupancy at the urbanized area level, the TIFA data have been mapped into the corresponding urbanized areas based on the state and county codes.

Table 11 presents the average truck occupancy results for top 20 urbanized areas.

Table 11. Average Truck Occupancy Results for Top 20 Urbanized Areas

Urbanized Area Name	State	Crash Count	Average Occupancy
Atlanta, GA	Georgia	327	1.26
Baltimore, MD	Maryland	158	1.18
Boston, MA--NH--RI	Massachusetts	92	1.13
Chicago, IL--IN	Illinois	286	1.10
Dallas--Fort Worth--Arlington, TX	Texas	330	1.19
Denver--Aurora, CO	Colorado	110	1.18
Detroit, MI	Michigan	169	1.11
Houston, TX	Texas	281	1.23
Los Angeles--Long Beach--Anaheim, CA	California	584	1.24
Miami, FL	Florida	284	1.23
Minneapolis--St. Paul, MN--WI	Minnesota	86	1.08
New York--Newark, NY--NJ--CT	New Jersey	244	1.28
New York--Newark, NY--NJ--CT	New York	269	1.25
Philadelphia, PA--NJ--DE--MD	Pennsylvania	147	1.14
Phoenix--Mesa, AZ	Arizona	231	1.27
San Diego, CA	California	73	1.18
San Francisco--Oakland, CA	California	122	1.17
Seattle, WA	Washington	104	1.19
Tampa--St. Petersburg, FL	Florida	223	1.17
Washington, DC--VA--MD	Virginia	69	1.09

Testing Result

The following tables present the method testing result for five states and two urbanized areas. The selected states include California, Florida, Maryland, Pennsylvania, and Tennessee. The selected urbanized areas include Miami, FL and the Philadelphia urbanized area which includes portions of PA, NJ, DE, and MD.

Table 12. Methodology Testing Results for Five Selected States

State	California	Florida	Maryland	Pennsylvania	Tennessee
Transit Bus Occupancy	10.35	7.27	9.91	10.27	6.09
Transit Bus Average VMT	28431	34336	30083	26991	24711
Transit Bus Count	2862	1379	403	1059	407
School Bus Occupancy	9.26	15.22	10.13	7.95	23.77
School Bus Average VMT	10509	17219	17214	18253	16177
School Bus Count	9257	8841	4378	11368	4683
Private Bus Occupancy	32.33	43.51	42.30	40.21	46.48
Private Bus Average VMT	38385	38385	38385	38385	38385
Private Bus Count	3748	1922	413	762	678
Average Bus Occupancy	**19.83**	**21.48**	**15.04**	**11.75**	**27.47**
Average Truck Occupancy	**1.21**	**1.20**	**1.16**	**1.16**	**1.23**

Table 13. Methodology Testing Results for Two Selected Urbanized Areas

Urbanized Area Name	Miami, FL	Philadelphia, PA--NJ--DE--MD
State	Florida	Pennsylvania
Transit Bus Occupancy	8.62	12.74
Transit Bus Average VMT	35389	27210
Transit Bus Count	364	204
School Bus Occupancy	10.22	23.65
School Bus Average VMT	17219.03	18253.18
School Bus Count	1919	1819
Private Bus Occupancy	43.51	40.21
Private Bus Average VMT	38385	38385
Private Bus Count	375	171
Average Bus Occupancy	**17.82**	**24.72**
Area Truck Occupancy	1.23	1.14
Area Crash Count	284	147
State Truck Occupancy	1.20	1.16
State Crash Count	1360	923
Average Truck Occupancy	**1.20**	**1.16**

References

American Bus Association. (2017). Motorcoach Census Report: A Study of the Size and Activity of the Motorcoach Industry in the United States and Canada in 2015. https://www.buses.org/assets/images/uploads/pdf/Motorcoach_Census_2015.pdf

American School Bus Council. (2015). Environmental Benefits - Fact: You can Go Green by Riding Yellow. http://www.americanschoolbuscouncil.org/issues/environmental-benefits

Armstrong Atlantic State University. (2013). Motorcoach Tourism in Savannah. http://www.savannahga.gov/DocumentCenter/View/4364/FINAL-CoachStudy_AASU_031213?bidId=

Bureau of Economic Analysis (BEA). Regional Data: GDP & Personal Income. https://apps.bea.gov/itable/iTable.cfm?ReqID=70&step=1#reqid=70&step=1&isuri=1. Accessed 10/15/2018.

Federal Highway Administration. (2017). Requirement to estimate vehicle occupancy for cars, buses, and trucks. https://www.gpo.gov/fdsys/pkg/FR-2017-01-18

Gan, A., Jung, R., Liu, K., Li, X., & Sandoval, D. (2005). Vehicle occupancy data collection methods.

Gan, A., Liu, K., Shen, L., & Jung, R. (2008). Prototype information system for estimating average vehicle occupancies from traffic accident records. *Transportation Research Record: Journal of the Transportation Research Board*, (2049), 29-37.

Hao, X. L., Chen, H. J., Yang, Y. Y., Yao, C., Yang, H., & Yang, N. (2011). Occupant detection through near-infrared imaging. *Tamkang Journal of Science and Engineering*, 14(3), 275–283.

Heidtman, K., Skarpness, B., & Tornow, C. (1997). *Improved vehicle occupancy data collection methods* (No. FHWA-PL-98-042,). Office of Highway Information Management, FHWA.

Jarossi, L., Hershberger D. & Woodrooffe J. (2012). Trucks Involved in Fatal Accidents Codebook 2010. Center for National Truck and Bus Statistics.

Jung, R., & Gan, A. (2010). Sampling and analysis methods for estimation of average vehicle occupancies. *Journal of transportation engineering*, 137(8), 537-546.

MAG. (2013). *MAG 2012 Vehicle Occupancy Study: Final Report*. Maricopa Association of Governments, Phoenix, Arizona.

New York MTC. (2006). The Vehicle Classification and Occupancy report for 2006. https://www.nymtc.org/Utility-Menu/Archive/DATA-MODELING-ARCHIVE/VCOS

Mittal, S., Dai, H., Fujimori, S., Hanaoka, T., Zhang, R. (2017). Key factors influencing the global passenger transport dynamics using the AIM/transport model. Transportation Research Part D, Vol. 55, pp. 373-388.

Polk City Directory. (2018). Automobile Data. https://www.polkcitydirectories.com/automobile-data/

U.S. Census Bureau. (2012). 2010 Census Urban and Rural Classification and Urban Area Criteria. https://www.census.gov/geo/reference/ua/urban-rural-2010.html

U.S. Census Bureau. (2018). State Population Totals and Components of Change: 2010-2017. https://www.census.gov/data/tables/2017/demo/popest/state-total.html. Accessed 10/15/2018

U.S. Census Bureau. (2010). Download Urban Area Relationship Files. https://www.census.gov/geo/maps-data/data/ua_rel_download.html

U.S. Department of Energy. (2015). Maps and Data - Average Annual Vehicle Miles Traveled of Major Vehicle Categories. https://www.afdc.energy.gov/data/10309

Appendix G NTD data dictionary

Master List of Data Fields by NTD File

Comprehensive list of all data collected by the NTD Annual Report and Profile, organized by Database File.

Database File	Record	Attributes	NTD Form (Reported On)	NTD Form Field or Data Element	Definition	Former USOA Number	Current USOA Number	Former Database File Heading	Exceptions
Agency Information	Address Line 1		P-10	Address (Line 1)	First line of the agency's mailing address.			Address (2013) Street1_Nm (2011-2012)	
Agency Information	Address Line 2		P-10	Address (Line 2)	Second line of the agency's mailing address (if applicable).			Street2_Nm (2011-2012)	
Agency Information	City		P-10	City	City of the agency's mailing address.			City_Nm (2011-2012)	
Agency Information	Doing Business As		P-10	Doing Business As	The name under which the reporting agency is doing business.			n/a prior to 2011-2014	
Agency Information	Duns Number		P-10	DUNS Number	A system developed and regulated by Dun & Bradstreet (D&B), which assigns a unique nine-digit numeric identifier to a single business entity. The Office of Management and Budget (OMB) announced in the June 27, 2003 issue of the Federal Register (68 FR 38402) that a Data Universal Numbering System (DUNS) number would be required for all grant applicants for new or renewal awards on or after October 1, 2003. The DUNS number will supplement other identifiers, e.g., Employer Identification Number (EIN).			Duns_Num (2012)	
Agency Information	FTA Recipient ID		P-10	FTA Recipient ID	The four-digit number assigned to a transit agency for the Federal Transit Administration (FTA) electronic grant making system — TrAMS (Transportation Award Management System).			FTAvc_Cd (2011-2012)	
Agency Information	FY End Date		B-10	Fiscal Year End Date	Calendar selection for the last day of an agency's fiscal year.			Fiscal Year End (2013) Fy_Day_Num (2012) Fy_Month_Num, Fy_Day_Num, Fy_Year_Num (2011)	**ONLY APPLIES TO:** Rural General Public Transit Sub-recipient, Urban/Tribal Sub-recipient, Intercity Bus Sub-recipient
Agency Information	Organization Type		B-10	Organization Type	Description of the agency's legal entity.			Org_Type (2012) Agency_Type_Desc (2011)	
Agency Information	P.O. Box		P-10	PO Box	The PO Box of the agency (if applicable).			Po_Box (2011-2012)	
Agency Information	Personal Vehicles		RR-20	Number of Personal Vehicles in Service	Vehicles that are used by the transit provider to transport passengers in revenue service but are owned by private individuals, typically an employee of the agency or a volunteer driver				**ONLY APPLIES TO:** Rural General Public Transit Sub-Recipient
Agency Information	Primary UZA		B-10	Primary UZA (given)	The primary urbanized area served by the transit agency (see UZA).			UZA_Cd (2012) Agency_UZAs, UZA_Code (2011)	**DOES NOT APPLY TO:** Rural General Public Transit Sub-recipients, Intercity Bus Sub-recipients
Agency Information	Reporter Acronym		P-10	Acronym	The acronym used by the reporting agency.			Abbr (2013) Logo_Cd (2011-2012)	
Agency Information	Reporter Name		P-10	Reporter Name	The name of the reporting agency.			Agency (2013) Company_Nm (2011-2012)	
Agency Information	Service Area Pop		B-10	Service Area Population	A measure of access to transit service in terms of population served and area coverage (square miles). The reporting transit agency determines the service area boundaries and population for most transit services using the definitions contained in the Americans with Disabilities Act of 1990 (ADA), i.e. a corridor surrounding the routes 3/4 of a mile on either side, or for rail, a series of circles of radius 3/4 mile centered on each station Transit agency reporters are required to submit service area information.			Service_Area_Population (2011-2012)	**DOES NOT APPLY TO:** Rural General Public Transit Sub-recipients, Intercity Bus Sub-recipients
Agency Information	Service Area Sq Mi		B-10	Service Area Sq. Miles	A measure of access to transit service in terms of population served and area coverage (square miles). The reporting transit agency determines the service area boundaries and population for most transit services using the definitions contained in the Americans with Disabilities Act of 1990 (ADA), i.e. a corridor surrounding the routes 3/4 of a mile on either side, or for rail, a series of circles of radius 3/4 mile centered on each station Transit agency reporters are required to submit service area information.			Service_Area (2011-2012)	**DOES NOT APPLY TO:** Rural General Public Transit Sub-recipients, Intercity Bus Sub-recipients
Agency Information	State		P-10	State	State of the agency's mailing address.			State_Desc (2011-2012)	
Agency Information	Tribal Area Name		B-10	Tribal Area	The tribal land, determined by US Census data, on which tribes operate.			n/a 2011-2013	**ONLY APPLIES TO:** Tribal Reporters
Agency Information	URL		P-10	Website URL	Agency's transit website.			Website (2013) Url_Cd (2011-2012)	
Agency Information	UZA Name		B-10		Name of Urbanized Area (see UZA).				
Agency Information	Volunteer Drivers		RR-20	Number of Volunteer Drivers	Individuals who drive vehicles in revenue service to transport passengers for the transit provider but are not employees of the transit provider and are not compensated for their labor.				**ONLY APPLIES TO:** Rural General Public Transit Sub-Recipient
Agency Information	Zip Code		P-10	Zip Code	Zip Code of the agency's mailing address.			Zip (2013) Zip_Cd (2011-2012)	
Agency Information	Zip Code Ext		P-10	Zip Extension	Zip Code Extension of the agency's mailing address.			Zip4 (2013) Zip_4_Cd (2011-2012)	
Agency Mode Service	Commitment Date		P-20	Commitment Date	The date where the agency first applied funds, committing to the construction of and provision of service.			n/a 2011-2012	
Agency Mode Service	End Service Date		P-20	End Date	The last date that the agency operated the service.			n/a 2011-2012	
Agency Mode Service	Fixed Guideway/High Intensity		P-20	FG/HIB	Identifies whether the individual mode/TOS operates over Fixed Guideway or HIB lanes.			Fixed Guideway Mode (2013) Fixed_Guideway (2012)	
Agency Mode Service	Mode		P-20	Mode	A system for carrying transit passengers described by specific right-of-way (ROW), technology, and operational features			Mode_Cd (2011-2012)	
Agency Mode Service	Seasonal Segment		P-20	Seasonal Segments	Identifies whether the individual mode/TOS operates on a seasonal basis.			n/a 2011-2012	
Agency Mode Service	Service Type		B-10	Modes Filing a Separate NTD Report	Modes of public transit that are purchased by the transit agency but reported by a separate entity.			Mode Reported Separately (2013) Option_B_Only_Fl (2011-2012)	**DOES NOT APPLY TO:** Rural General Public Transit Sub-recipients, Intercity Bus Sub-recipients
Agency Mode Service	Start Service Date		P-20	Start Date	The date that the service was first operated by the agency.			n/a 2011-2012	
Agency Mode Service	TOS		P-20	Type of Service Directly Operated	Describes how public transportation services are provided by the transit agency: directly operated (DO) or purchased transportation (PT) services.			Service_Cd (2011-2012)	
Agency UZAs	UZA		B-10		An area defined by the U.S. Census Bureau that includes: • One or more incorporated cities, villages, and towns (central place) • The adjacent densely settled surrounding territory (urban fringe) that together has a minimum of 50,000 persons The urban fringe generally consists of contiguous territory having a density of at least 1,000 persons per square mile. Urbanized areas do not conform to congressional districts or any other political boundaries.			UZA_Name (2011-2012)	**DOES NOT APPLY TO:** Rural General Public Transit Sub-recipients, Intercity Bus Sub-recipients
Agency UZAs	UZA Primary	Yes, No	B-10	Secondary UZA/non-UZA	Indicates if this row is for the agencies primary UZA.				
Capital Use	Administrative Buildings	Existing Service, Expansion of Service	F-20	Admin. Buildings	Facilities and offices which house the executive management and supporting activities for overall transit operations such as accounting, finance, engineering, legal, safety, security, customer services, scheduling and planning (see General Administration (160) function). They include separate buildings for customer information or ticket sales, which are owned by the transit agency and which are not part of passenger stations.	n/a	6300	Admin_Buildings_Amt (2012) Admin_Building (2011)	
Capital Use	Communication Information Systems	Existing Service, Expansion of Service	F-20	Comm. Info. Systems	Systems for exchanging information including two-way radio systems for communications between dispatchers and vehicle operators, cab signaling and train control equipment in rail systems, automatic vehicle locator systems, automated dispatching systems, vehicle guidance systems, telephones, facsimile machines and public address systems.	n/a	6800	Systems_Amt (2012) Systems (2011)	
Capital Use	Fare Revenue Collection Equipment	Existing Service, Expansion of Service	F-20	Fare Revenue Collection Equipment	Equipment used in collecting passenger fares including turnstiles, fare boxes (drop), automated fare boxes and related software, money changers and fare dispensing machines (tickets, tokens, passes).	n/a	6700	Fare_Rev_Coll_Equip_Amt (2012) Fare_Collection_Equipment (2011)	
Capital Use	Guideway	Existing Service, Expansion of Service	F-20	Guideway	A public transportation facility using and occupying a separate right-of-way (ROW) or rail for the exclusive use of public transportation including the buildings and structures dedicated for the operation of transit vehicles such as: • At grade • Elevated and subway structures • Tunnels • Bridges Track and power systems for rail modes Paved highway lanes dedicated to bus (MB) mode Guideway does not include passenger stations and transfer facilities, MB pull-ins or communication systems (e.g., cab signaling and train control).	n/a	6100	Guideway_Amt (2012) Guideway (2011)	
Capital Use	Maintenance Buildings	Existing Service, Expansion of Service	F-20	Maint. Buildings	Facilities where maintenance activities are conducted including garages, shops (e.g., body, paint, machine) and operations centers (see Vehicle Maintenance (041) function). Include in maintenance buildings, equipment that enhances the maintenance function, for example: bus (MB) diagnostic equipment. Do not include information systems such as computers that are used to process maintenance data.	n/a	6400	Fac_Amt (2012) Maintenance_Facilities (2011)	

Capital Use	Other	Existing Service, Expansion of Service	F-20	Other	Any item not described as guideway, passenger stations, administrative buildings, maintenance buildings, revenue vehicles, service vehicles, fare revenue collection equipment, or systems including: • Furniture and equipment that are not an integral part of buildings and structures; and • Shelters, signs, and passenger amenities (e.g., benches) not in passenger stations.	n/a	6900	Other_Amt (2012) Other_Capital (2011)	
Capital Use	Passenger Stations	Existing Service, Expansion of Service	F-20	Passenger Stations	Passenger stations are significant structures in a separate right-of-way (ROW). Therefore, agencies may not report a street stop or passenger shelter as a passenger station. Passenger stations typically mean a platform area for rail modes. The following rules apply: • All rail passenger facilities are stations (except for light rail (LR), streetcar (SR), and cable car (CC) modes); • All LR, CC, and SR passenger facilities serving track that is in a separate ROW (not in mixed street traffic) that have platforms are stations; • All motorbus (MB), rapid bus (RB), commuter bus (CB), and trolley bus (TB) passenger facilities in a separate ROW that have an enclosed structure (building) for passengers for such items as ticketing, information, restrooms, concessions, and telephones are stations; • When service is operated in mixed traffic, stops on streets or in medians for CC, LR, SR, MB, RB, CB, and TB are not stations if at most they have shelters, canopies, lighting, signage or ramps for accessibility requirements, (i.e. no separate, enclosed buildings); and • All transportation, transit or transfer centers, park-and-ride facilities, and transit malls are stations if they have an enclosed structure (building) for passengers for items such as ticketing, information, restrooms, concessions, and telephones. A passenger boarding/deboarding facility may include: • Stairs • Elevators • Escalators • Passenger controls (e.g., fare gates or turnstiles) • Canopies • Wind shelters • Lighting • Signs • Buildings with a waiting room, ticket office or machines, restrooms, or concessions, including: o All fixed guideway (FG) passenger facilities (except for on-street cable car (CC) and light rail (LR) stops) o Busway passenger facilities o Underground, at grade, and elevated rail stations o Ferryboat (FB) terminals o Transportation/transit/transfer centers, park-and-ride facilities, and transit malls with the above components, including those only utilized by motor buses (MB)	n/a	6200	Stations_Amt (2012) Stations (2011)	
Capital Use	Revenue Vehicles	Existing Service, Expansion of Service	F-20	Revenue Vehicles	The floating and rolling stock used to provide revenue service for passengers. Existing Service - Amount expended on revenue vehicles to improve or replace the existing service provided by the agency. The amount should be reported based on predominant use as opposed to allocating for expenses that serve multiple modes. Expansion of Service - Amount expended on revenue vehicles to expand service provided by the agency. The amount should be reported based on predominant use as opposed to allocating for expenses that serve multiple modes.	n/a	6500	Stk_Amt (2012) Revenue_Vehicle (2011)	
Capital Use	Service Vehicles	Existing Service, Expansion of Service	F-20	Service Vehicles	The vehicles used to support revenue vehicle operations and that are not used to carry transit passengers. These vehicles may be referred to as non-revenue vehicles. Examples include: • Tow trucks • Supervisor vans • Transit police cars • Staff cars • Maintenance vehicles for maintaining passenger facilities and rights-of-way (ROW) (rail stations, bus shelters, track, etc.)	n/a	6600	Service Vehicles (non-revenue) (2013) Other_Vehicle_Amt (2011-2012)	
Capital Use	Total Capital Funds	Existing Service, Expansion of Service	RR-20	Funds Expended On Capital - by Mode/TOS	Total funds expended on capital in order to provide the service in its entirety. Agency reporters totals for each mode and type of service.			Total Funds (2013) n/a 2011-2012	**<u>DOES NOT APPLY TO:</u>** Intercity Bus Sub-recipient, Urban/Tribal Sub-recipient
Contractual Relationship	Buyer Provides Maintenance Facility to Seller		B-30	Buyer Provides Maintenance Facility to Seller	Indicates which party of the contract provides the maintenance facility for the service (Flag - Yes or No).			Buyer Provides Facilities (2013) n/a 2011-2012	
Contractual Relationship	Buyer Supplies Vehicles to Seller		B-30	Buyer Provides Vehicles to Seller	Indicates which party of the contract provides the revenue vehicles for the service (Flag - Yes or No). If the buyer does not provide vehicles to the seller, it would be expected that part of the costs paid to the seller would be for capital leasing expenses.			Buyer Provides Vehicles (2013) n/a 2011-2012	
Contractual Relationship	Contract Capital Leasing Expenses		B-30	Contract Capital Leasing Expenses	The portion of a purchased transportation payment that covers depreciation costs. This applies only when the contractor (seller of service) uses its own capital assets (such as vehicles and maintenance facilities) to provide transit service; if the buyer of service provides all the capital assets, there is no capital leasing expenditure.	n/a	5120	Capital Leasing Expenditures (2013) n/a 2011-2012	
Contractual Relationship	Contract/Subsidy OE Net of Fare Revenues and Capital Leasing Expenses		B-30	Contract/Subsidy Operating Expenses Net of Fare Revenues and Capital Leasing Expenses ($)	The total amount of money exchanged for the provision of service, less fare revenues and capital leasing expenses.	n/a	5112	Net Contract Operating Expenditures (2013) Expenditure_Amt (2012) Net_Contract_Expenditures (2011)	
Contractual Relationship	Contractee Agency Name		B-30		Name of the NTD reporter under contract by the respective buyer to provide transit service.				
Contractual Relationship	Contractee Company Name		B-30		Name of the non-NTD reporter under contract by the respective buyer to provide transit service.				
Contractual Relationship	Contractee NTD ID		B-30		NTD ID of the NTD reporter under contract by the respective buyer to provide transit service.				
Contractual Relationship	Describe Other Public Assets Provided		B-30	Describe Other Public Assets Provided	Description of the other assets provided by either party.			Relationship Description (2013)	
Contractual Relationship	Direct Payment/Agency Subsidy		B-30		Direct payment is the amount paid by the buyer directly to the seller during the reporting period. If the seller retains some or all fare revenues, the buyer does not include fare revenues in the direct payment.		5112		
Contractual Relationship	Fares Retained by		B-30		Identifies whether the buyer or the seller retain the fare revenues generated by the service funded by the given contractual relationship.				
Contractual Relationship	Mode		B-30	Mode	The mode of service operated under the contract. A contractor can operate more than one mode/TOS under a contract (only one B-30 for that contractor).			Mode_Cd (2011-2012)	
Contractual Relationship	Months Seller Operated in FY		B-30	Number of Months Seller Operated Service During Report Year	The number of months the contract was in effect this report year (1 - 12 months).			Months Service Operated (2013) Report_Yr_Months (2012) Months_Seller_Operated_Service (2011)	
Contractual Relationship	Other Costs by Buyer		B-30	Other Operating Expenses Incurred by the Buyer	Expenses of the buyer (public transit agency or governmental unit) that are directly attributable to the provision of purchased transportation (PT) services. Examples include: • The provision of maintenance services or fuel for the vehicles used by the seller; • Gathering and compiling National Transit Database (NTD) data; and • Monitoring of the seller's operations and other similar costs where the buyer uses its resources to support the purchased service.	n/a	5131	Other Costs Incurred by Buyer (2013) Other_Amt (2012) Other_Costs_Incurred_By_Buyer (2011)	**<u>DOES NOT APPLY TO:</u>** Reporter is the seller
Contractual Relationship	Other Operating Expenses Incurred by the Buyer		B-30		Most of the Other Costs Incurred by the Buyer will fall into this category. This includes expenses such as salaries and utility costs that agencies will report as operating expenses.		5130		
Contractual Relationship	Other Party		B-30		Identifies whether the contractor is a private or public entity.				
Contractual Relationship	Other Public Assets Provided		B-30	Other	Identifies any additional assets provided by either party for the service within the contract (Flag - Yes or No).			n/a 2011-2013	
Contractual Relationship	Other Public Assets Provided Desc		B-30		Description identifying the Other Public Assets provided.				
Contractual Relationship	Other Reconciling Item Expenses Incurred by Buyer		B-30	Other Reconciling Item Expenses Incurred by the Buyer	The total amount the buyer of the service expended on reconciling items in addition to the contract amount and other operating expenses (it is rare to have an amount reported here).	n/a	5132	n/a 2011-2013	**<u>DOES NOT APPLY TO:</u>** Reporter is the seller
Contractual Relationship	Passenger Out of Pocket Expenses		B-30		These expenses include all costs paid for by the passengers directly, such as fuel, tolls, and maintenance.		5114		
Contractual Relationship	Primary Feature		B-30	Primary Feature	Indicates whether the contract requires the buyer to pay a negotiated fixed rate per unit of service (trip) or requires the buyer to reimburse the seller's net operating expenses (based on an approved budget).			Primary Contract Feature (2013) n/a 2011-2012	
Contractual Relationship	PT Fare Revenues/Passenger Fees		B-30	Purchased Transportation Fare Revenues (F-10 Fare Revenues) ($)	The fare revenues derived from the transit services provided under the purchased transportation (PT) agreement, regardless of whether fares are retained by the seller or returned to the buyer. The seller usually collects them. However, they also include fares collected or sold by the buyer for users of the purchased service. For example, if the buyer of the PT service sells tickets, tokens or passes for these users, this revenue is part of PT fare revenues.	n/a	5111	Purchased Transportation Fares (2013) Pt_Fare_Rev (2012) Purch_Tranp_Fare_Revenues (2011)	
Contractual Relationship	Reporter Contractual Position		B-30	Contractual Position	The National Transit Database (NTD) reporter contracting with a seller under a purchased transportation agreement to receive transit services. The contractor may be a public transit agency or a private company.			Contractual Relationship Type (2013) Buyer_Seller_Type_Desc (2011-2012)	

Contractual Relationship	Service Captured		B-30	Service Captured	The payment or accrual (net of fare revenues) to other transit agencies, public or private, for providing transportation service and purchased transportation (PT) fare revenues involving sellers whose nonfinancial data are included in the buyer's report.			Type Number (2013) Type_Number (2012) n/a 2011	
Contractual Relationship	TOS		B-30	Type of Service	The type of service operated under the contract.			Service_Cd (2012) n/a 2011	
Contractual Relationship	Total Modal Expenses		B-30	Total Modal Expenses	The sum of Total Contract/Subsidy Costs and Other Operating Expenses Incurred by the Buyer.			n/a 2011-2012	
Contractual Relationship	Type of Contract		B-30	Type of Contract	Transit agencies must indicate if a service is either competitively bid or negotiated. Competitive contracts include: • Sealed bids • Requests for Proposals • Two-step procurement Agencies must report a contract as competitively bid if the contract was competitively procured and later negotiated during subsequent option years.			Contract Type (2013) n/a 2011-2012	
Contractual Relationship	VOMS Under Contract		B-30	Vehicle/Passenger Cars Operating In Annual Maximum Service Under Contract	The maximum number of revenue vehicles operated at one time under the contract (VOMS Under Contract).			Maximum Vehicles Operated (2013) Veh_Cnt (2012) Vehicles_Operated_Max_Service (2011)	
Energy Consumption	Fuel Type		A-30	Type of Fuel	Total units of fuel/power consumed by the vehicles for the entire mode/TOS.				**DOES NOT APPLY TO:** Small Systems Reporters, Rural General Public Transit Sub-recipients, Intercity Bus Sub-recipients, Urban/Tribal Sub-recipients
Facilities Inventory	City		A-15	City	City where the facility is located				
Facilities Inventory	Condition Assessment		A-15	Condition Assessment	Transit agencies are required to report a condition assessment for all facilities for which they have capital replacement responsibility. The condition assessment is based on FTA's Transit Economic Requirements Model or TERM scale.				**DOES NOT APPLY TO:** Facilities in which the agency does not have capital responsibility.
Facilities Inventory	Condition Assessment Date		A-15	Est. Date of Condition Assessment	The date the condition assessment was completed. If not recorded, can be estimated.				**DOES NOT APPLY TO:** Facilities in which the agency does not have capital responsibility.
Facilities Inventory	Facility ID		A-15	ID	Unique ID number assigned to each facility. This number is only generated once the facility is created and saved.				
Facilities Inventory	Facility Name		A-15	Name	Unique description provided by the agency for each facility.				
Facilities Inventory	Facility Type		A-15	Facility Type	Each facility must be defined as a specific type. There are three categories: Administrative, Maintenance, and Passenger/Parking. Each category has multiple selections available.				
Facilities Inventory	Latitude		A-15	Lat	Latitude of the physical location of the facility.				
Facilities Inventory	Longitude		A-15	Long	Longitude of the physical location of the facility.				
Facilities Inventory	Non-Agency Mode Served		A-15	Non-Agency Mode	Modes of public transit that the reporting transit agency does not operate.				
Facilities Inventory	Notes		A-15	Notes	Additional information about the facility or description if "Other" or a combined facility type is selected				
Facilities Inventory	Number of Parking Spaces		A-15	Parking Spaces	The number of parking spaces at the facility.				**DOES NOT APPLY TO:** Administrative or Maintenance Facilities
Facilities Inventory	Percent Agency Capital Responsibility		A-15	Transit Agency Capital Responsibility (%)	The percentage of capital responsibility the agency is responsible for. Transit agencies have direct capital responsibility for assets that they own, jointly own with another entity, or for assets that they are responsible for replacing, overhauling, refurbishing, or conducting major repairs on that asset, or the cost of those activities are itemized as a capital line item in the agency's budget.				
Facilities Inventory	Primary Mode Served		A-15	Primary Mode	The mode in which the facility is predominantly used.				
Facilities Inventory	Private Modes Served		A-15	Private Mode	Non-public transit modes that serve the facility				
Facilities Inventory	Secondary Mode Served		A-15	Secondary Mode	Other modes in which the facility is used, however to a lesser degree than the primary mode.				
Facilities Inventory	Section Larger Flag		A-15	Section of Larger Facility	A section of a facility that varies in age from the rest of the main facility due to significant rebuilding, addition, or retrofitting. Agencies are encouraged to report sections of the facility in multiple entries to more accurately represent its age and function in the inventory. Facilities that are adjacent to one another must be reported separately.				
Facilities Inventory	Square Feet		A-15	Sqft	The square footage of the facility.				
Facilities Inventory	State		A-15	State	State where the facility is located.				
Facilities Inventory	Street Address		A-15	Street	Street address of the facility.				
Facilities Inventory	Year Built		A-15	Year Built or Reconstructed as New	The year in which facility was built or the year the transit agency reinvested in the facility to enhance its reliability or extend its useful life.				
Facilities Inventory	Zip Code		A-15	Zip	Zip Code where the facility is located.				
Fare Revenue	Fares	Funds Earned (Full Reporters Only), Funds Expended on Operations, Funds Expended on Capital	RR-20	Funds Expended On Operations - Fare Revenues by Mode/TOS	The amount of Funds Earned, Expended on Operations or Expended on Capital that was funded by passenger fares. Agency reporters totals for each mode and type of service.	401	4110	Directly Generated Funds, Total All Purchased Transportation Fares (2013) Directly Generated Funds, Total_PT_Fare_Revenues (2011-2012)	**DOES NOT APPLY TO:** Intercity Bus Sub-recipient, Urban/Tribal Sub-recipient
Federal Funding Allocation	Directional Route Miles		FFA-10	04 FG DRM	Agency allocation of fixed guideway directional route miles to a particular UZA (see Directional Route Miles).			UZA_Allocation, Fixed Guideway Directional Route Miles (2011, 2013) UZA_Allocation, FG_DRM (2012)	
Federal Funding Allocation	Fixed Guideway Operating Expenses		FFA-10	07 FG OE	Agency allocation of fixed guideway operating expense to a particular UZA (see Operating Expenses and Fixed Guideway).			UZA_Allocation, Fixed Guideway Operating Expenses (2011, 2013) UZA_Allocation, FG_OE (2012)	
Federal Funding Allocation	Fixed Guideway Passenger Miles		FFA-10	06 FG PMT	Agency allocation of fixed-guideway passenger miles traveled to a particular UZA (see Passenger Miles Traveled and Fixed Guideway).			UZA_Allocation, Fixed Guideway Passenger Miles (2013) UZA_Allocation, FG_PMT (2012) UZA_Allocation, Fixed Guideway Passenger Miles Traveled (2011)	
Federal Funding Allocation	Fixed Guideway Vehicle Revenue Miles		FFA-10	05 FG VRM	Agency allocation of fixed guideway vehicle revenue miles to a particular UZA (see Vehicle Revenue Miles and Fixed Guideway).			UZA_Allocation, Fixed Guideway Vehicle Revenue Miles (2011, 2013) UZA_Allocation, FG_VRM (2012)	
Federal Funding Allocation	Fixed Guideway/ Non Fixed Guideway Reporting Method	Actual Data, Actual VRM	FFA-10		Drop-down selection, which updates the form allowing the agency to allocate fixed guideway data for each data point specific to each urbanized area.				
Federal Funding Allocation	Non-Fixed Guideway Operating Expenses		FFA-10	06 NFG OE	Agency allocation of non-fixed guideway operating expense to a particular UZA (see Vehicle Revenue Miles and Fixed Guideway).			UZA_Allocation, Non-Fixed Guideway Operating Expenses (2013) UZA_Allocation, NFG_OE (2012) UZA_Allocation, Non-Fixed Guideway Operating Expenses (2011)	**DOES NOT APPLY TO:** rail modes.
Federal Funding Allocation	Non-Fixed Guideway Passenger Miles		FFA-10	05 NFG PMT	Agency allocation of non-fixed guideway passenger miles traveled to a particular UZA (see Passenger Miles Traveled and Fixed Guideway).			UZA_Allocation, Non-Fixed Guideway Passenger Miles (2011, 2013) UZA_Allocation, NFG_PMT (2012)	**DOES NOT APPLY TO:** rail modes.
Federal Funding Allocation	Non-Fixed Guideway Vehicle Revenue Miles		FFA-10	04 NFG VRM	Agency allocation of non-fixed guideway vehicle revenue miles to a particular UZA (see Vehicle Revenue Miles and Fixed Guideway).			UZA_Allocation, Non-Fixed Guideway Vehicle Revenue Miles (2011, 2013) UZA_Allocation, NFG_VRM (2012)	**DOES NOT APPLY TO:** rail modes.
Federal Funding Allocation	SGR FG Directional Route Miles		FFA-10	08 DRM >= 7 Years @ FFYE	Agency allocation of directional route miles greater than or equal to 7 years old for a particular UZA (see Directional Route Miles).			UZA_Allocation, Fixed Guideway Directional Route Miles >=7 years (2013) UZA_Allocation, FG_OLD_DRM (2012) UZA_Allocation, Directional Route Miles Greater Than or Equal to 7 Years (2011)	
Federal Funding Allocation	SGR FG Vehicle Revenue Miles		FFA-10	09 VRM >= 7 Years @ FFYE	Agency allocation of vehicle revenue miles greater than or equal to 7 year old's for a particular UZA (see Vehicle Revenue Miles and Fixed Guideway).			UZA_Allocation, Fixed Guideway Vehicle Revenue Miles >=7 years (2013) UZA_Allocation, FG_OLD_VRM (2012) UZA_Allocation, Vehicle Revenue Miles Greater Than or Equal to 7 Years (2011)	
Federal Funding Allocation	SGR HIB Directional Route Miles		FFA-10	16 HIB DRM >= 7 Years @ FFYE	Agency allocation of high intensity bus directional route miles greater than or equal to 7 year for a particular UZA (see Directional Route Miles).			UZA_Allocation, High Intensity Bus Directional Route Miles >= 7 years (2013) n/a prior to 2013	**DOES NOT APPLY TO:** rail modes.
Federal Funding Allocation	SGR HIB Vehicle Revenue Miles		FFA-10	17 HIB VRM >= 7 Years @ FFYE	Agency allocation of high intensity bus vehicle revenue miles greater than or equal to 7 year for a particular UZA (see Vehicle Revenue Miles and Fixed Guideway).			UZA_Allocation, High Intensity Bus Vehicle Revenue Miles >= 7 years (2013) n/a 2011-2012	**DOES NOT APPLY TO:** rail modes.
Federal Funding Allocation	Total Operating Expenses		FFA-10	06 Total OE	Agency allocation of operating expenses to the respective UZA (see Operating Expenses).			UZA_Allocation, Total Operating Expenses (2013) UZA_Allocation, Operating_Expenses (2012) UZA_Allocation, Operating Expenses (2011)	

Federal Funding Allocation	Total Passenger Miles Traveled		FFA-10	04 Total PMT	Agency allocation of passenger miles traveled to the respective UZA (see Passenger Miles Traveled).			UZA_Allocation, Total Passenger Miles (2013) UZA_Allocation, Passenger_Miles_Traveled (2012) UZA_Allocation, Passenger Miles Traveled (2011)	
Federal Funding Allocation	Total Unlinked Passenger Trips		FFA-10	03 Total UPT	Agency allocation of unlinked passenger trips to the respective UZA (see Unlinked Passenger Trips).			UZA_Allocation, Total Unlinked Passenger Trips (2013) UZA_Allocation, ANN_UPT (2012) UZA_Allocation, Unlinked Passenger Trips (2011)	
Federal Funding Allocation	Total Vehicle Revenue Hours		FFA-10	02 Total VRH	Agency allocation of vehicle revenue hours to the respective UZA (see Vehicle Revenue Hours)			UZA_Allocation, Total Vehicle Revenue Hours (2013) UZA_Allocation, ANN_VRH (2012) UZA_Allocation, Vehicle Revenue Hours (2011)	
Federal Funding Allocation	Total Vehicle Revenue Miles		FFA-10		Agency allocation of vehicle revenue miles to the respective UZA (see Vehicle Revenue Miles).			UZA_Allocation, Total Vehicle Revenue Hours (2013) UZA_Allocation, ANN_VRH (2012) UZA_Allocation, Vehicle Revenue Hours (2011)	
Federal Funding Allocation	UZA Reporting Method	Actual Data, Actual VRM	FFA-10		Drop-down selection, which updates the form allowing the agency to allocate data for each data point specific to each urbanized area.			n/a 2011-2013	
Federal Funding Allocation	UZA Reporting Method Explanation		FFA-10	UZA Reporting Method Explanation	Agency explanation for how they are allocating data. Only available when the Other allocation method is selected.			n/a 2011-2013	
Operating Expenses	ADA Related Expenses		F-30	ADA Related Expenses	In this object class, agencies report the portion of their operating expenses that is attributable to ADA-required service.	n/a	5910	Ada_Related_Amt (2012)	**ONLY APPLIES TO:** DR and DT modes
Operating Expenses	Casualty and Liability Costs	Vehicle Maintenance, Non-Vehicle Maintenance, General Administration	F-30	Casualty and Liability Costs	The cost elements covering protection of the transit agency from loss through insurance programs, compensation of others for their losses due to acts for which the transit agency is liable, and recognition of the cost of corporate losses.	506	5050	Casualty_Liability_Amt (2011-2012)	
Operating Expenses	Fringe Benefits	Vehicle Operations, Vehicle Maintenance, Non-Vehicle Maintenance, General Administration	F-30	Fringe Benefits	The payments or accruals to others (insurance companies, governments, etc.) on behalf of an employee and payments and accruals direct to an employee arising from something other than a piece of work. These payments are transit agency costs over and above labor costs, but still arising from the employment relationship. Does not include other post-employment benefits (OPEB) recorded under GASB-45.	502	5015	Fringe_Benefit_Amt (2011-2012)	
Operating Expenses	Fuel and lubricants	Vehicle Operations, Vehicle Maintenance	F-30	Fuels and Lubricants	The costs of gasoline, diesel fuel, propane, lubricating oil, transmission fluid, grease, etc., for use in vehicles.	504.01	5031	Fuel and lube (2013) Fuel_Lubricant_Amt (2011-2012)	
Operating Expenses	Miscellaneous Expenses	Vehicle Operations, Vehicle Maintenance, Non-Vehicle Maintenance, General Administration	F-30	Miscellaneous Expenses	This object class includes expenses that cannot be attributed to any of the other expense object classes.	509	5090	Other (2013) Misc_Expense_Amt (2011-2012)	
Operating Expenses	Operating Expense Type		F-30	Operating Expense Type	Transit agencies are required to report operating expenses within four functions (or types): 1) Vehicle Operations; 2) Vehicle Maintenance; 3) Facilities Maintenance; and 4) General Administration.				
Operating Expenses	Operators' Paid Absence		F-30	Operators' Paid Absences	This includes vacation leave, sick time, and other paid time off not contingent on a specific event outside the control of the transit agency for revenue vehicle operators or crewmembers.	n/a	5012		
Operating Expenses	Operators' salaries and wages	Vehicle Operations, Vehicle Maintenance, Non-Vehicle Maintenance, General Administration	F-30	Operators' Salaries and Wages	Operators' salaries and wages include the cost of labor, excluding paid absences and fringe benefits, for the transit agency's employees who are classified as revenue vehicle operators or crewmembers.	501.01	5011	Operators Wages (2013) Op_Sal_Wage_Amt (2011-2012)	
Operating Expenses	Other Materials and Supplies	Vehicle Operations, Vehicle Maintenance, Non-Vehicle Maintenance, General Administration	F-30	Other Materials and Supplies	The expenses in this object class include products obtained from outside suppliers or those manufactured internally that are not covered in the two preceding object classes. Costs associated with this object class include materials and supplies issued from inventory or purchased for immediate use (i.e., items used without going through inventory).	504.99	5030	Tires and Other (2013) Other_Mat_Sup_Amt (2011-2012)	
Operating Expenses	Other Paid Absence		F-30	Other Paid Absences	This includes vacation leave, sick time, and other paid time off not contingent on a specific event outside the control of the transit agency for its employees that are not classified as revenue vehicle operators or crewmembers.	n/a	5014		
Operating Expenses	Other salaries and wages	Vehicle Operations, Vehicle Maintenance, Non-Vehicle Maintenance, General Administration	F-30	Other Salaries and Wages	This object class includes the cost of labor, excluding paid absences and fringe benefits, of employees of the transit agency who are not classified as revenue vehicle operators or crewmembers (e.g., maintenance workers, administrative staff, and transit managers).	501.02	5013	Other_Sal_Wage_Amt (2011-2012)	
Operating Expenses	PT Funds In Report	Vehicle Operations, Vehicle Maintenance, Non-Vehicle Maintenance, General Administration	F-30	In Report	This object class includes the payments or accruals to sellers or providers of service, including fare revenues retained by the seller. The agency reports Purchased Transportation (PT) expenses in this object class when they report the associated service in their own NTD report.	508.01	5101	In Report (2013) In_Report_Amt (2011-2012)	
Operating Expenses	PT Funds Reported Separately	Vehicle Operations, Vehicle Maintenance, Non-Vehicle Maintenance, General Administration	F-30	Filing Separate Report	The agency reports Purchased Transportation (PT) expenses in this object class when the other party reports the associated service data (e.g., miles, ridership) in their own NTD report.	508.02	5102	Filing Separate Report (2013) Sep_Report_Amt (2011-2012)	
Operating Expenses	Reduced Reporting Waiver - Total OE		F-30	Total	The sum of all operating expenses, by funding source, for Reduced Reporters (agencies with fewer than 30 Vehicles Operated in Maximum Service).				ONLY APPLIES TO REDUCED REPORTERS
Operating Expenses	Service Costs	Vehicle Operations, Vehicle Maintenance, Non-Vehicle Maintenance, General Administration	F-30	Services	Services are the labor and other work provided by outside organizations for fees and related expenses. Outside organizations may be private companies or public entities.	503	5020	Services (2013) Service_Costs_Amt (2011-2012)	
Operating Expenses	Taxes	Vehicle Operations, Vehicle Maintenance, Non-Vehicle Maintenance, General Administration	F-30	Taxes	Tax expenses are the charges and assessments levied against the transit agency by federal, state and local governments.	507	5060	Other (2013) Tax_Amt (2011-2012)	
Operating Expenses	Tires and tubes	Vehicle Operations, Vehicle Maintenance	F-30	Tires and Tubes	This object class includes the cost of tires and tubes, whether they are rented, leased or purchased. Purchase discounts, cash discounts, sales taxes, and excise taxes are included in the cost of the tires and tubes.	504.02	5032	Tires and Other (2013) Tire_Tube_Amt (2011-2012)	
Operating Expenses	Total Fringe Benefits		F-30	Total Fringe Benefits	Total fringe benefits is the sum of Vehicle Operations Fringe Benefits, Vehicle Maintenance Fringe Benefits, Facility Maintenance Fringe Benefits, and General Administration Fringe Benefits.				
Operating Expenses	Total Operating Expenses	Vehicle Operations, Vehicle Maintenance, Non-Vehicle Maintenance, General Administration	F-30	Total	All activities associated with vehicle operations, including: • Transportation administration and support • Revenue vehicle movement control • Scheduling of transportation operations • Revenue vehicle operation • Ticketing and fare collection • System security All activities associated with revenue and non-revenue (service) vehicle maintenance, including: • Administration • Inspection and maintenance • Servicing (cleaning, fueling, etc.) vehicles In addition, vehicle maintenance includes repairs due to vandalism and accident repairs of revenue vehicles. All activities associated with facility maintenance, including: • Administration • Repair of buildings, grounds and equipment as a result of accidents or vandalism • Operation of electric power facilities • Maintenance of: Vehicle movement control systems • Fare collection and counting equipment • Structures, tunnels and subways • Roadway and track • Passenger stations, operating station buildings, grounds and equipment • Communication systems • General administration buildings, grounds and equipment • Electric power facilities	010	n/a		**DOES NOT APPLY TO:** Intercity Bus Sub-recipient, Urban/Tribal Sub-recipient
Operating Expenses	Total Operating Expenses (No Funds Reported Separately)		F-30	Total	Total Operating Expenses is the sum of Labor (5010), Services (5020), Materials and Supplies (5030), Utilities (5040), Casualty and Liability Costs (5050), Taxes (5060), Purchased Transportation In Report (5101), and Miscellaneous Expenses (5090).				ONLY APPLIES TO FULL REPORTERS
Operating Expenses	Utilities	Vehicle Operations, General Administration	F-30	Utilities	This object class includes expenses for electricity, gas, water, telephone, heating oil, fuel for backup generators, and internet.	505	5040	Utility_Amt (2011-2012)	

Operating Expenses Reconciling	ADA Related Reconciling Items	Funds Applied, Fund Not Applied	F-40	ADA Related Reconciling Items	In this object class, agencies report the portion of their reconciling item expenses that are attributable to ADA-required service.	n/a	5920	Operating Expenses Reconciliation, ADA Related Funds (2014) Operating Expenses Reconciliation, ADA Related Expenses (2013) Ada_Related_Amt (2011-2012)	
Operating Expenses Reconciling	Amortization of Intangibles	Funds Applied, Fund Not Applied	F-40	Amortization of Intangibles	The amortization of the intangible costs of the transit agency including organization costs, franchises, patents, goodwill and other intangible assets. Funds Applied - Cash expenditures related to a physical payment of amortization. Funds Not Applied - A non-cash write-off of amortization.	513.13	5270	Operating Expenses Reconciliation, Amortization of Intangibles (2013-2014) Operating_Expense_Reconciliation, Intangible_Amortization_Amt (2011-2012)	
Operating Expenses Reconciling	Depreciation	Funds Applied, Fund Not Applied	F-40	Depreciation	The charges that reflect the loss in service value of the transit agency's assets. Depreciated items have a high initial cost and a useful life of more than one accounting period. In order to account for the reduction in value (usefulness) of this type of asset, a portion of the cost is expensed each year of the asset's life. Depreciation and amortization include the depreciation of the physical facilities such as: • Guideways • Tracks and roadbeds • Elevated structures • Passenger stations and parking facilities • Revenue vehicles • Operating stations • Facilities (including buildings, equipment and furnishings) for power generation and distribution • Revenue vehicle movement control • Data processing • Revenue collection and processing • Other general administration	513	5260	Operating Expenses Reconciliation, Depreciation (2013-2014) Operating_Expense_Reconciliation, Depreciation_Amt (2011-2012)	
Operating Expenses Reconciling	Expense Type		F-40	Expense Type	There are two types of expenditures for reconciling items: • Funds Applied - costs that a transit agency incurs when there is a monetary transaction to cover the expense. • Funds Not Applied - when there is not a transfer of money to cover the expense.				
Operating Expenses Reconciling	Interest Expenses	Funds Applied, Fund Not Applied	F-40	Interest Expenses	The charges for the use of borrowed capital incurred by the transit agency, including: • Interest on long term • Short-term debt obligations • Interest charges pertaining to construction debt that is capitalized will not be reflected as interest expense	511	5210	Operating Expenses Reconciliation, Interest Expenses (2013-2014) Operating_Expense_Reconciliation, Interest_Amt (2011-2012)	
Operating Expenses Reconciling	Leases and Rentals	Funds Applied, Fund Not Applied	F-40	Leases and Rentals	The payments for the use of capital assets not owned by the transit agency. True leases are those in which the lessor and lessee are: • Not related parties • The total lease payments cover the lessor's cost of the property for the period of the lease plus interest • The ownership of the property remains with the lessor upon expiration of the lease For the true lease, this object class includes: • The lease payments on true lease property	512	5220	Operating Expenses Reconciliation, Leases and Rentals (2013-2014) Operating_Expense_Reconciliation, Lease_Rental_Amt (2011-2012)	
Operating Expenses Reconciling	Other Reconciling Items	Funds Applied, Fund Not Applied	F-40	Other Reconciling Items	Any other costs that cannot be captured in the object classes of interest expenses (511), leases and rentals (512), depreciation (513), purchase lease agreements (514) and related parties lease agreements (515).	516	5290	Operating Expenses Reconciliation, Other Reconciling Items (2013-2014) Operating_Expense_Reconciliation, Other_Amt (2011-2012)	
Operating Expenses Reconciling	Purchase Lease Agreement	Funds Applied, Fund Not Applied	F-40	Purchase Lease Agreement	A financing plan involving leasing which ultimately leads to the purchase of an asset by the transit provider. The ownership of the property passes to the lessee upon expiration of the lease, sometimes with an additional payment far below the expected market value of the property. The property covered by such leases may or may not have been booked as owned assets, either during or after the period of the lease, in the transit agency's internal accounting records. If purchase leases have not been capitalized in the transit agency's internal accounting records, this category includes the lease payments for the purchase lease agreement. If the lease has been capitalized in the internal accounting records of the transit agency, it is to be accounted for in the National Transit Database (NTD) system as it has been accounted for internally.	514	5230	Operating Expenses Reconciliation, Purchase Lease Agreement (2013-2014) Operating_Expense_Reconciliation, Purch_Lease_Agmt_Amt (2011-2012)	
Operating Expenses Reconciling	Related Parties Lease Agreement	Funds Applied, Fund Not Applied	F-40	Related Parties Lease Agreements	Leases for which the lease payments required of the lessee differ substantially from those in a true lease arrangement because the lessor and lessee are related organizations.	515	5240	Operating Expenses Reconciliation, Related Parties Lease Agreement (2013-2014) Operating_Expense_Reconciliation, Rel_Party_Lease_Agmt_Amt (2011-2012)	
Operating Expenses Reconciling	Total Reconciling Items	Funds Applied, Fund Not Applied	F-40	Total Reconciling Items - Funds Applied	Total Reconciling Items is the sum of Interest Expenses (5210), Operating Lease Expenses (5220), Capital Leases (5230), Related Parties Lease Agreements (5250), Voluntary Non-Exchange Transactions (5250), Depreciation (5260), Amortization of Intangibles (5270), Extraordinary and Special Items (5280), and Other Reconciling Items (5290).			Operating Expenses Reconciliation, Total Reconciling Items (2013-2014) Operating_Expense_Reconciliation, Total_Reconciling (2012)	
Performance Measures	2018 Target (%)		A-90	2018 Target	Percent of asset type expected to meet or exceed performance measure at the end of the agency's 2018 fiscal year. Value reported in Report Year 2017.				
Performance Measures	2019 Target (%)		A-90	2019 Target	Percent of asset type expected to meet or exceed useful life at the end of the agency's 2019 fiscal year. Targets set in the current year will be auto-populated each consecutive year after.				
Performance Measures	Form Section	Rolling Stock Equipment Facility Infrastructure	A-90		Asset sections for transit asset management performance measures: Rolling Stock - Percent of revenue vehicles expected to meet or exceed their useful life benchmark Equipment - Percent of service vehicles expected to meet or exceed their useful life benchmark Facilities - Percent of facilities expected to rate below 3 on the TERM scale Infrastructure - Percent of track segments expected to have performance restrictions.				
Performance Measures	Performance Measure	AB - Articulated Bus, AG - Automated Guideway Vehicle AO - Automobile, BR - Over-the-road Bus, BU - Bus, CC - Cable Car, CU - Cutaway, DB - Double Decker Bus, FB - Ferryboat, HR - Heavy Rail Passenger Car, IP - Inclined Plane Vehicle, LR - Light Rail Vehicle, MO - Monorail Vehicle, MV - Minivan, OR - Other, RL - Commuter Rail Locomotive, RP - Commuter Rail Passenger, Coach, RS - Commuter Rail Self-Propelled Passenger Car, SB - School Bus, SR - Streetcar Rail, SV - Sports Utility Vehicle, TB - Trolleybus, TR - Aerial Tramway, VN - Van, VT - Vintage Trolley Bus, Automobiles, Trucks and Other Rubber Tire Vehicles, Steel Wheel Vehicles, Administrative/Maintenance Facilities, Passenger/Parking Facilities, AR - Alaska Railroad, CC - Cable Car, CR - Commuter Rail, HR - Heavy Rail, IP - Inclined Plane, LR - Light Rail, MG - Monorail/Automated Guideway, SR -	A-90		Asset Class by which performance measure targets are reported.				
Reportable Segments	Agency Revenue Service Date		P-40	Agency Revenue Service Date	The date the segment was first used and reported by the reporting agency.				
Reportable Segments	Begins At		P-40	Begin At	The starting location of the segment.			Fixed Guideway, Begins At (2013) Fixed Guideway, Begin_Pt (2011-2012)	
Reportable Segments	Claim Mode		P-40	Claiming Mode / Type of Service	The mode operated on this segment by the claiming agency.			Fixed Guideway, Claiming Mode and Fixed Guideway, Claiming TOS (2013) Fixed Guideway, Mode_Id and Fixed Guidway, Service_Id (2012) Fixed Guideway, Claiming_Mode and Fixed Guideway, Claiming_Service (2011)	
Reportable Segments	Claim NTDID		P-40	Claiming Agency	The NTD ID of the agency receiving sole credit for the directional route miles of the segment. Other agencies operating on the segment receive credit for the VRM, but not DRM. Claiming agency is decided locally by the agencies that operate on the segment.			Fixed Guideway, Claiming Agency (2013) Fixed Guideway, Agency_Id (2012) Fixed Guideway, Claiming_Agency (2011)	

Reportable Segments	Claim TOS		P-40	Claiming Mode / Type of Service	The type of service operated on this segment by the claiming agency.			Fixed Guideway, Claiming Mode and Fixed Guideway, Claiming TOS (2013) Fixed Guideway, Mode_Id and Fixed Guidway, Service_Id (2012) Fixed Guideway, Claiming_Mode and Fixed Guideway, Claiming_Service (2011)	
Reportable Segments	Claiming Agency Name		P-40	Claiming Agency	The name of the agency receiving sole credit for the directional route miles of the segment. Other agencies operating on the segment receive credit for the VRM, but not DRM. Claiming agency is decided locally by the agencies that operate on the segment.			Fixed Guideway, Claiming Agency (2013) Fixed Guideway, Agency_Id (2012) Fixed Guideway, Claiming_Agency (2011)	
Reportable Segments	Directionality		P-40	Directionality	The number of directions a segment can operate; One Way or Two Way.			Fixed Guideway, One/Two Way (2013) Fixed Guideway, Agency_Way_Fl (2012) Fixed Guideway, One_Two_Ways (2011)	
Reportable Segments	Ends At		P-40	Ends At	The ending location of the segment.			Fixed Guideway, Ends At (2013) Fixed Guideway, End_Pt (2011-2012)	
Reportable Segments	Hours of Enforced Prohibition		P-40	Hours Enforced	Hours during which the restriction of the segment is enforced by transit or local police.			Fixed Guideway, Hours Enforced (2013) Fixed Guideway, Enf_Proh_Num (2012) Fixed Guideway, Hours_Enforced (2011)	**ONLY APPLIES TO:** MB and CB modes
Reportable Segments	Hours of SOV Prohibition		P-40	Hours Prohibited	Hours during which the segment is restricted to only High Occupancy or Public Transportation vehicles.			Fixed Guideway, Hours Prohibited (2013) Fixed Guideway, Hrs_Proh_Num (2012) Fixed Guideway, Hours_Prohibited (2011)	**ONLY APPLIES TO:** TB, MB and CB modes
Reportable Segments	Length in Miles		P-40	Length (In Miles)	The length of the segment to the nearest hundredth mile.			Fixed Guideway, Length (2013) Fixed Guideway, Length_Num (2011-2012)	
Reportable Segments	Months Operated in FY		B-10	Selected Months	Months during which the seasonal segment operates.				**ONLY APPLIES TO:** Full Reporters with a mode with Seasonal Service = Yes.
Reportable Segments	Original Revenue Service Date		P-40	Original Revenue Service Date	The date the segment was first used and reported to the NTD system.			Fixed Guideway, Original Revenue Service Start (2013) Fixed Guideway, Revsrv_Dt (2012) Fixed Guideway, Revenue_Serv_Start_Date (2011)	
Reportable Segments	Out of Revenue Service Date		P-40	Out of Revenue Service Date	The date the segment was no longer in operation by the reporting agency.			Fixed Guideway, Out of Revenue Service (2013) Fixed Guideway, Agency_Endsrv_Dt (2012) Fixed Guideway, Revenue_Serv_End_Date (2011)	
Reportable Segments	Peak Level of Service		P-40	Peak LOS	A qualitative measure that characterizes operational conditions within a traffic stream and their perception by motorists and passengers. Must be measured by a qualified traffic engineer. The descriptions of individual levels of service characterize these conditions in terms of such factors as: • Speed and travel time • Freedom to maneuver • Traffic interruptions • Comfort and convenience			Fixed Guideway, Peak Level of Service (2013) Fixed Guideway, LOS_Peak_Type_Cd (2012) Fixed Guideway, Los_Peak_Type_Desc (2011)	**ONLY APPLIES TO:** MB and CB modes
Reportable Segments	Safe Operation		P-40	Safe Operation	Concept that applies to priority lanes on freeways, expressways and other high-speed facilities used by rubber tire modes (commuter bus (CB), motor bus (MB), bus rapid transit (RB), and vanpool (VP)) and other High Occupancy Vehicles (HOV), i.e. carpools, to ensure safe travel. For these lanes, there must be some indication of separation to ensure safe access between free flowing HOV lanes and the congested, unrestricted lanes. Separation can be accomplished at least two ways: • Physical barriers such as cones, concrete dividers, medians • Pavement markings such as a double solid wide line, a single solid wide line, a single broken wide line, or a diagonally striped area between lanes			Fixed Guideway, Safe Operation (2013) Fixed Guideway, Safe_Operation_Fl (2011-2012)	**ONLY APPLIES TO:** MB and CB modes
Reportable Segments	Segment ID		B-10, P-40	Segment ID	Unique identifier assigned by the system to each segment upon creation.				
Reportable Segments	Segment Name		P-40	Segment Name	The name of the segment assigned by the creating agency.			Fixed Guideway, Segment Name (2013) Fixed Guideway, Seg_Nm (2012) Fixed Guideway, Segment_Name (2011)	
Reportable Segments	Segment Type		P-40	Segment Type	Description of the segment for purposes of determining if it is FG or HIB.			Fixed Guideway, Segment Type (2013) Fixed Guideway, Segment_Type_Desc (2011-2012)	**ONLY APPLIES TO:** MB and CB modes
Reportable Segments	Shoulder Lane		P-40	Shoulder Lane	Identifies whether the segment is a lane that was intended to be a shoulder (True or False).			n/a prior to 2014	**ONLY APPLIES TO:** MB and CB modes
Reportable Segments	Statutory BRT		P-40	Statutory BRT	Indicates whether the segment is considered BRT for FTA funding purposes.			Fixed Guideway, Statutory BRT (2013) n/a prior to 2013	**ONLY APPLIES TO:** RB mode
Reportable Segments	UZA		P-40	UZA	The Urbanized Area in which the segment resides.			Fixed Guideway, UZA (2012-2013) Fixed Guideway, UZA_Cd (2011)	
Reportable Segments	UZA Name		B-10		Name of Urbanized Area (see UZA).				
Revenue Sources	§5307 - capital assistance spent on operations (including maintenance expenses)	Funds Expended on Operations	F-10, RR-20	Funds Expended on Operations - FTA Urbanized Area Program Funds: Capital Assistance Spent on Operations (§5307)	Capital grants expended from §5307 that an agency ultimately utilizes to cover operating expenses.			Tax Funds, §5307 - capital assistance spent on operations (including maintenance expenses) (2013-2014) Tax Funds, UAF_Amt (2011-2012)	**DOES NOT APPLY TO:** Rural General Public Transit Sub-recipient, Intercity Bus Sub-recipient, Urban/Tribal Sub-recipient
Revenue Sources	§5310 - capital assistance spent on operations (including maintenance expenses)	Funds Expended on Operations	F-10, RR-20	Funds Expended on Operations - Capital Assistance Spent on Operations (§5310)	Funds expended on Operations from Capital grants (§5310).			Tax funds, §5310 - capital assistance spent on operations (including maintenance expenses) (2013-2014) Tax Funds, FTA_Operating_Assit_Amt_5310 (2011-2012)	**DOES NOT APPLY TO:** Intercity Bus Sub-recipient, Urban/Tribal Sub-recipient
Revenue Sources	§5311 - capital assistance spent on operations (including maintenance expenses)	Funds Expended on Operations	F-10, RR-20	Funds Expended on Operations - Capital Assistance Spent on Operations (§5311)	Funds expended on Operations from Capital Assistance Spent on Operations (§5311) funds.			Tax Funds, §5311 - capital assistance spent on operations (including maintenance expenses) (2013-2014) Tax Funds, FTA_Operating_Assit_Amt_5311 (2011-2012)	**DOES NOT APPLY TO:** Intercity Bus Sub-recipient, Urban/Tribal Sub-recipient
Revenue Sources	§5317 - capital assistance spent on operations (including maintenance expenses)	Funds Expended on Operations	F-10, RR-20	Funds Expended on Operations - Capital Assistance Spent on Operations (§5317)	Funds expended on Operations from Capital Assistance (§5317) grants.			Tax Funds, §5317 - capital assistance spent on operations (including maintenance expenses) (2013-2014) Tax Funds, FTA_Operating_Assit_Amt_5317 (2011-2012)	**DOES NOT APPLY TO:** Intercity Bus Sub-recipient, Urban/Tribal Sub-recipient
Revenue Sources	ARRA Fixed Guideway Modernization Funds (§5309)	Funds Earned (Full Reporters Only), Funds Expended on Operations, Funds Expended on Capital	F-10	Funds Earned - ARRA Fixed Guideway Modernization Funds (§5309)	Funds earned, expended on operations or expended on Capital from ARRA fixed guideway modernization program.			Tax Funds,ARRA Fixed Guideway Modernization Funds (§5309) (2013-2014) Tax Funds, ARRA_Guideway_Amt_5309 (2011-2012)	
Revenue Sources	ARRA major Capital investment (New Starts) Funds (§5309)	Funds Earned (Full Reporters Only), Funds Expended on Operations, Funds Expended on Capital	F-10, RR-20	Funds Expended on Operations - ARRA Major Capital investment (New Starts) Funds (§5309)	Funds earned, expended on Operations or expended on Capital from ARRA Major Capital Investment (New Starts) Funds (§5309).			Tax Funds, ARRA major Capital investment (New Starts) Funds (§5309) (2013-2014) Tax Funds, ARRA_Capital_Amt_5309 (2011-2012)	**DOES NOT APPLY TO:** Intercity Bus Sub-recipient, Urban/Tribal Sub-recipient
Revenue Sources	ARRA TIGER Multimodal Discretionary Funds	Funds Earned (Full Reporters Only), Funds Expended on Operations, Funds Expended on Capital	F-10, RR-20	Funds Expended on Operations - ARRA TIGER Multimodal Discretionary Funds	See: Form F-10, Federal Government Sources of Funds, Funds Earned - ARRA TIGER Multimodal Discretionary Funds			Tax Funds, ARRA TIGER Multimodal Discretionary Funds (2013-2014) Tax Funds, ARRA_Tgr_Multimod_Discre_Fund (2011-2012)	**DOES NOT APPLY TO:** Rural General Public Transit Sub-recipient, Intercity Bus Sub-recipient, Urban/Tribal Sub-recipient

Revenue Sources	ARRA TIGGER (Greenhouse Gas and Energy Reduction) Funds	Funds Earned (Full Reporters Only), Funds Expended on Operations, Funds Expended on Capital	F-10, RR-20	Funds Expended on Operations - ARRA TIGGER (Greenhouse Gas and Energy Reduction) Funds	Funds expended on Operations from ARRA TIGGER (Greenhouse Gas and Energy Reduction) funds.			Tax Funds, ARRA TIGGER (Greenhouse Gas and Energy Reduction) Funds (2013-2014) Tax Funds, ARRA_Tigger_Amt (2011-2012)	**DOES NOT APPLY TO:** Intercity Bus Sub-recipient, Urban/Tribal Sub-recipient
Revenue Sources	ARRA Tribal Transit funds (§5311)	Funds Earned (Full Reporters Only), Funds Expended on Operations, Funds Expended on Capital	F-10, RR-20	Funds Expended on Operations - ARRA Tribal Transit Funds (§5311)	Funds earned, expended on Operations or expended on Capital from ARRA Tribal Transit Funds (§5311).			Tax Funds, ARRA Tribal Transit funds (§5311) (2014) n/a 2011-2013	**DOES NOT APPLY TO:** Intercity Bus Sub-Recipient
Revenue Sources	ARRA Urbanized Area Program Funds (§5307)	Funds Earned (Full Reporters Only), Funds Expended on Operations, Funds Expended on Capital	F-10, RR-20	Funds Expended on Operations - ARRA Urbanized Area Program Funds (§5307)	Funds earned, expended on Operations or expended on Capital from ARRA Urbanized Area Program Funds (§5307).			Tax Funds, ARRA Urbanized Area Program Funds (§5307) (2013-2014) Tax Funds, ARRA_Capital_Amt_5307(2011-2012)	**DOES NOT APPLY TO:** Rural General Public Transit Sub-recipient, Intercity Bus Sub-recipient, Urban/Tribal Sub-recipient
Revenue Sources	ARRA Urbanized Area Program Funds (§5307) – Capital assistance spent on operations (including maintenance expenses)	Funds Expended on Operations	F-10, RR-20	Funds Expended on Operations - Capital Assistance Spent on Operations (§5307)	Funds expended on Operations from ARRA Urbanized Area Program Funds (§5307) capital grants			Tax Funds, ARRA Urbanized Area Program Funds (§5307) – Capital assistance spent on operations (including maintenance expenses) (2013-2014) Tax Funds, ARRA_Capital_Amt_5307 (2011-2012)	**DOES NOT APPLY TO:** Rural General Public Transit Sub-recipient, Intercity Bus Sub-recipient, Urban/Tribal Sub-recipient
Revenue Sources	Auxiliary Revenue - Advertising (Earned Only)		F-10	Auxiliary Transportation Funds - Advertising Revenues	Advertising revenues include funds earned from displaying advertising materials on transit system vehicles and property and includes agency media.	n/a	4141		
Revenue Sources	Auxiliary Revenue - Concessions (Earned Only)		F-10	Auxiliary Transportation Funds - Concessions	Concessions are revenues earned from granting operating rights to businesses (e.g., newsstands, candy counters) on property and equipment maintained by the transit agency (e.g., stations, vehicles).	n/a	4142		
Revenue Sources	Auxiliary Revenue - Other (Earned Only)		F-10	Auxiliary Transportation Funds - Other	The agency earns other auxiliary transportation revenues from auxiliary operations other than those specified above. This might include, but is not limited to: merchandising, photo identification (ID) fees, locker rentals, movie licensing fees, naming rights, and fines for fare evasion or illegal parking.	n/a	4149		
Revenue Sources	Auxiliary Revenue Advertising	Funds Earned	F-10	Auxiliary Transportation Funds - Advertising Revenues	The revenue earned from displaying advertising materials on transit agency vehicles and property. The amounts should be net of any fees paid to advertising agencies, which place the advertisement with the transit agency.	406.03	4141	Directly Generated Funds, Aux Revenue Advertising (2014) Directly Generated Funds, Advertising Revenues (2013) Directly Generated Funds, Aux_Advertising_Rev_Amt (2011-2012)	
Revenue Sources	Auxiliary Revenue Concessions	Funds Earned	F-10	Auxiliary Transportation Funds - Concessions	Auxiliary transportation funds are earned from activities related to the provision of transit service, but are not payment for transit service. Auxiliary funds result from business-related activities in which an agency earns supplemental revenues, including advertising and concessions.	406.01, 406.02	4142	Directly Generated Funds, Aux Revenue Concessions (2014) Directly Generated Funds, Concessions Funds (2013) Directly Generated Funds, Aux_Concession_Rev_Amt (2011-2012)	
Revenue Sources	Auxiliary Revenue Other	Funds Earned	F-10	Auxiliary Transportation Funds - Other	The revenue earned from operations closely associated with transportation operations other than concessions and advertising revenues. Other auxiliary transportation revenues include: • ID card fees (seniors, persons with disabilities, employees) • Fare evasion and park-and-ride lot fines • Automotive vehicle ferriage	406.99	4149	Directly Generated Funds, Aux Revenue Other (2014) Directly Generated Funds, Other Auxiliary Funds (2013) Directly Generated Funds, Aux_Other_Rev_Amt (2011-2012)	
Revenue Sources	Bridge, tunnel, and highway tolls	Funds Earned	F-10	Funds Earned - Dedicated Tolls - Bridge, tunnel and highway	A tax or fee paid for the liberty or privilege of using a bridge, tunnel, or highway.	n/a	4260	Tax Funds, Bridge, tunnel, and highway (2014) Tax Funds, Bridge, tunnel, and highway tolls (2013) Tax Funds, Tolls_Amt (2011-2012)	
Revenue Sources	Contract Revenue Amount (RR)		F-10	Funds Expended on Operations - Contract Revenues	Reimbursement by any organization, government, agency, or company, as a result of a formal contractual agreement with the transit service operator for trips provided to a specific passenger or group of passengers.				
Revenue Sources	Contributed Services State and Local Government	Funds Earned (Full Reporters Only), Funds Expended on Operations, Funds Expended on Capital	F-10	Funds Earned - Contributed Services - state and local government	The receipt of services (not cash) from another entity where such services benefit transit operations and the transit agency is under no obligation to pay for the services.	430	4610	Directly Generated Funds, Contributed Services State (2014) Directly Generated Funds, Services Contributed by State and Local Government (2013) Directly Generated Funds, Cont_Serv_State_Amt (2011-2012)	
Revenue Sources	Describe Other Dedicated Funds		F-10	Describe Other Dedicated Tolls	Description of the Other Dedicated Funds.			Tax Funds	
Revenue Sources	Describe Other Directly Generated Funds		RR-20	Describe Other Directly Generated Funds	Description of the Other Directly Generated Funds, spent on either Operations or Capital.			Tax Funds, Other Directly Generated Funds Desc (2013) Other_Dir_Gen_Funds_Comm (2011-2012)	**DOES NOT APPLY TO:** Intercity Bus Sub-recipient, Urban/Tribal Sub-recipient
Revenue Sources	Donations Amount (RR)		F-10	Funds Expended on Operations - Donations	The amount of Funds Expended on Operations or Capital that was funded by donations.				
Revenue Sources	Extraordinary and Special Item Funds		F-10	Extraordinary and Special Items	Extraordinary items are events or transactions that are distinguished by their unusual nature and by the infrequency of their occurrence. Special items are events or transactions that are either unusual in nature or infrequent, but not both.	n/a	4180		
Revenue Sources	Extraordinary and Special Item Funds Description		F-10	Describe Extraordinary and Special Item Funds Received	Description of Extraordinary and Special Item Funds.				
Revenue Sources	FTA ARRA Other than Urbanized Area Program funds (§5311)		F-10	Funds Earned - FTA ARRA Other than Urbanized Area Program funds (§5311)	Funds earned, funds expended on operations or funds expended on capital from FTA's ARRA Other Than Urbanized Area program.			Tax Funds, FTA ARRA Other than Urbanized Area Program funds (§5311) (2013-2014) Tax Funds, ARRA_Other_UAP_Amt_5311 (2011-2012)	
Revenue Sources	FTA ARRA other than Urbanized Area Program funds (§5311) - capital assistance spent on operations (including maintenance expenses)	Funds Expended on Operations	F-10, RR-20	Funds Expended on Operations - Capital Assistance Spent on Operations (§5311)	Funds expended on Operations from ARRA Capital Assistance (§5311) funds.			Tax Funds, FTA ARRA other than Urbanized Area Program funds (§5311) - capital assistance spent on operations (including maintenance expenses) (2013-2014) Tax Funds, ARRA_Other_Capital_Amt_5311 (2011-2012)	**DOES NOT APPLY TO:** Intercity Bus Sub-recipient, Urban/Tribal Sub-recipient
Revenue Sources	FTA Capital Program Funds (§5309)	Funds Earned (Full Reporters Only), Funds Expended on Operations, Funds Expended on Capital	F-10, RR-20	Funds Expended on Operations - FTA Capital Program Funds (§5309)	Funds earned, expended on Operations or expended on Capital from FTA Capital Program Funds (§5309).			Tax Funds, FTA Capital Program Funds (§5309) (2013-2014) Tax Funds, ARRA_Capital_Amt_5309 (2011-2012)	**DOES NOT APPLY TO:** Intercity Bus Sub-recipient, Urban/Tribal Sub-recipient
Revenue Sources	FTA Clean Fuels Program (§5308)	Funds Earned (Full Reporters Only), Funds Expended on Operations, Funds Expended on Capital	F-10, RR-20	Funds Expended on Operations - FTA Clean Fuels Program (§5308)	Funds earned, expended on Operations or expended on Capital from FTA Clean Fuels Program (§5308) funds.			Tax Funds, FTA Clean Fuels Program (§5308) (2013-2014) FTA_Cleans_Fuels_Amt (2011-2012)	**DOES NOT APPLY TO:** Rural General Public Transit Sub-recipient, Intercity Bus Sub-recipient, Urban/Tribal Sub-recipient
Revenue Sources	FTA Job Access and Reverse Commute Formula Program (§5316)	Funds Earned (Full Reporters Only), Funds Expended on Operations, Funds Expended on Capital	F-10, RR-20	Funds Expended on Operations - FTA Job Access and Reverse Commute Formula Program (§5316)	Funds earned, expended on Operations or expended on Capital from FTA Job Access and Reverse Commute Formula Program (§5316).			Tax Funds, FTA Job Access and Reverse Commute Formula Program (§5316) (2013-2014) Tax Funds, FTA_Job_Access_Rev_Com_5316 (2011-2012)	**DOES NOT APPLY TO:** Intercity Bus Sub-recipient, Urban/Tribal Sub-recipient
Revenue Sources	FTA Metropolitan Planning (§5303)	Funds Earned and Funds Expended on Operations	F-10, RR-20	Funds Expended on Operations - FTA Metropolitan Planning (§5303)	Funds earned or expended on Operations from FTA Job Access and Reverse Commute Formula Program (§5316).			Tax Funds, FTA Metropolitan Planning (§5303) (2013-2014) Tax Funds, Fta_Metro_Planning_Amt (2011-2012)	**DOES NOT APPLY TO:** Rural General Public Transit Sub-recipient, Intercity Bus Sub-Recipient, Urban/Tribal Sub-recipient
Revenue Sources	FTA New Freedom Program (§5317)	Funds Earned (Full Reporters Only), Funds Expended on Operations, Funds Expended on Capital	F-10, RR-20	Funds Expended on Operations - FTA New Freedom Program (§5317)	Funds earned, expended on Operations or expended on Capital from FTA New Freedom Program (§5317).			Tax Funds, FTA New Freedom Program (§5317) (2013-2014) Tax Funds, FTA_Freedom_Program_5317 (2011-2012)	**DOES NOT APPLY TO:** Intercity Bus Sub-recipient, Urban/Tribal Sub-recipient
Revenue Sources	FTA Other Than Urbanized Area (§5311)	Funds Earned (Full Reporters Only), Funds Expended on Operations, Funds Expended on Capital	F-10, RR-20	Funds Expended on Operations - FTA Other Than Urbanized Area (§5311)	Funds earned, expended on Operations or expended Capital from FTA Other Than Urbanized Area (§5311) funds.			Tax Funds, FTA Other Than Urbanized Area (§5311) (2013-2014) Tax Funds, FTA_Capital_Oper_Amt_5311 (2011-2012)	
Revenue Sources	FTA Special Needs of Elderly Individuals and Individuals with Disabilities Formula Program (§5310)	Funds Earned (Full Reporters Only), Funds Expended on Operations, Funds Expended on Capital	F-10, RR-20	Funds Expended on Operations - FTA Special Needs of Elderly Individuals and Individuals with Disabilities Formula Program (§5310)	Funds earned, expended on Operations or expended Capital from FTA Special Needs of Elderly Individuals and Individuals with Disabilities Formula Program (§5310).			Tax Funds, FTA Special Needs of Elderly Individuals and Individuals with Disabilities Formula Program (§5310) (2013-2014) Tax Funds, FTA_Capital_Invest_Amt_5310 (2011-2012)	**DOES NOT APPLY TO:** Intercity Bus Sub-Recipient, Urban/Tribal Sub-recipient

Revenue Sources	FTA Transit in the Park (§5320)	Funds Earned (Full Reporters Only), Funds Expended on Operations, Funds Expended on Capital	F-10, RR-20	Funds Expended on Operations - FTA Transit in the Park (§5320)	Funds earned, expended on Operations or expended Capital from FTA Transit in the Park (§5320) funds.			Tax Funds, FTA Transit in the Park (§5320) (2013-2014) Tax Funds, FTA_Park_Transit_Amt_5320 (2011-2012)	**DOES NOT APPLY TO:** Intercity Bus Sub-recipient, Urban/Tribal Sub-recipient
Revenue Sources	FTA Tribal Transit funds (§5311)	Funds Earned (Full Reporters Only), Funds Expended on Operations, Funds Expended on Capital	F-10, RR-20	Funds earned, expended on Operations or expended Capital from FTA Special Needs of Elderly Individuals and Individuals with Disabilities Formula Program (§5310).	Funds earned, expended on Operations or expended Capital from FTA Tribal Transit Funds (§5311).			Tax Funds, FTA Tribal Transit funds (§5311) (2014) n/a 2011-2013	**DOES NOT APPLY TO:** Intercity Bus Sub-recipient
Revenue Sources	FTA Urbanized Area Formula (UAFP) program (§5307)	Funds Earned (Full Reporters Only), Funds Expended on Operations, Funds Expended on Capital	F-10, RR-20	Funds Expended on Operations - FTA Urbanized Area Formula (UAFP) program (§5307)	Funds earned, expended on Operations or expended Capital from FTA Urbanized Area (UAP) program (§5307).			Tax Funds, FTA Urbanized Area Formula (UAFP) program (§5307) (2013-2014) Tax Funds, UAF_Amt (2011-2012)	**DOES NOT APPLY TO:** Rural General Public Transit Sub-recipient, Intercity Bus Sub-recipient, Urban/Tribal Sub-recipient
Revenue Sources	Funds Received from other USDOT Grant Programs	Funds Earned (Full Reporters Only), Funds Expended on Operations, Funds Expended on Capital	F-10, RR-20	Funds Expended on Operations - Funds Received from Other USDOT Grants	Funds earned, expended on Operations or expended on Capital from Funds Received from other USDOT Grants.			Tax Funds, Funds Received from other USDOT Grant Programs (2013-2014) Tax Funds, Usdot_Grant_Amt (2011-2012)	**DOES NOT APPLY TO:** Rural General Public Transit Sub-recipient, Intercity Bus Sub-recipient, Urban/Tribal Sub-recipient
Revenue Sources	Gasoline Taxes	Funds Earned - Funds Dedicated to Transit at their Source & Other Directly Generated Funds, Funds Earned - Local, Funds Earned - State	F-10	Funds Earned - Dedicated Taxes - Gasoline	Funds earned from gasoline tax levied by the transit agency, the local government or the state government.	408	4240	Tax Funds, Gasoline Taxes (2013-2014) Tax Funds, Gas_Tax_Amt (2011-2012)	
Revenue Sources	High Occupancy tolls	Funds Earned - Funds Dedicated to Transit at their Source & Other Directly Generated Funds, Funds Earned - Local, Funds Earned - State	F-10	Funds Earned - Dedicated Tolls - High Occupancy	A concept that allows single occupancy vehicles (SOVs) to gain access to High Occupancy Vehicle (HOV) lanes by paying a toll. For formula purposes, the Federal Transit Administration (FTA) recognizes High Occupancy/Toll (HO/T) lanes as fixed guideway if the following conditions are met: • A State agency with jurisdiction over the HOV facility certifies to the U.S. Secretary of Transportation that they have established a program to monitor, assess, and report on the operation of the facility and the effect of high occupancy/toll vehicles and other low emission and energy efficient vehicles; • That there is an adequate enforcement program and provision made for limiting or discontinuing the exemptions if the facility becomes seriously degraded; and • The State agency's certification is submitted to the National Transit Database (NTD). If a transit agency has stricter requirements for HOV facilities than the prohibition of SOVs, for example, three or more persons per vehicle, then those requirements apply to the HO/T lane, i.e. one and two-person vehicles would pay tolls.	n/a	4270	Tax Funds, High Occupancy Tolls (2013-2014) Tax Funds, High_Occpy_Tolls (2011-2012)	
Revenue Sources	Income Taxes	Funds Earned - Funds Dedicated to Transit at their Source & Other Directly Generated Funds, Funds Earned - Local, Funds Earned - State	F-10	Funds Earned - Dedicated Taxes - Income	Funds earned from income tax levied by the transit agency, local government or state government.	408.03	4210	Tax Funds, Income Taxes (2013-2014) Tax Funds, Inc_Tax_Amt (2011-2012)	
Revenue Sources	MAP-21 Bus & Bus Facilities Formula (§5339)	Funds Earned (Full Reporters Only), Funds Expended on Operations, Funds Expended on Capital	F-10	Funds Earned - MAP-21 Bus & Bus Facilities Formula (§5339)	A formula program that finances capital projects to replace, rehabilitate, and purchase buses and related equipment and to construct bus-related facilities. Grants received under the old §5309 Bus and Bus Facilities program should be reported under §5309; this category should be used only for new grants made under MAP-21.			Tax Funds, MAP-21 Bus & Bus Facilities Formula (§5339) (2013-2014) n/a 2011-2012	
Revenue Sources	MAP-21 Bus and Bus Facilities Formula (§5339)		F-10	Funds Earned - MAP-21 Bus & Bus Facilities Formula (§5339)	A formula program that finances capital projects to replace, rehabilitate, and purchase buses and related equipment and to construct bus-related facilities. Grants received under the old §5309 Bus and Bus Facilities program should be reported under §5309; this category should be used only for new grants made under MAP-21.	n/a	5339		
Revenue Sources	MAP-21 State of Good Repair (§5337)	Funds Earned (Full Reporters Only), Funds Expended on Operations, Funds Expended on Capital	F-10	Funds Earned - MAP-21 State of Good Repair (§5337)	A formula program that replaced the Fixed Guideway Modernization program. It provides capital assistance to maintain fixed guideway and high intensity bus systems in a state of good repair.			Tax Funds, MAP-21 State of Good Repair (§5337) (2013-2014) n/a 2011-2012	
Revenue Sources	Non-Public Transportation Funds Description		F-10	Describe Non-Public Transportation Revenues	Description of Non-Public Transportation Revenues (4130).				
Revenue Sources	Non-Public Transportation Revenue (Earned Only)		F-10	Non-Public Transportation Revenues	Revenues for providing transportation services to private groups or entities or for carrying freight.	n/a	4130		
Revenue Sources	Non-Transportation Funds	Funds Earned	F-10	Non-Transportation Funds	The revenue earned from activities not associated with the provision of transit service. Nontransportation funds include: • Investment earnings • Other non-transportation sources, including: o Revenues earned from sales of maintenance services on property not owned or used by the transit agency o Rentals of revenue vehicles to other operators o Rentals of transit agency buildings and property to other organizations o Parking fees generated from parking lots not normally used as park-and-ride locations o Donations o Grants from private foundations o Development fees o Rental car fees o Other	407	4150	Directly Generated Funds, Non Trans (2014) Directly Generated Funds, Non-Transportation Funds (2013) Directly Generated Funds, Non_Trans_Amt (2011-2012)	
Revenue Sources	Non-Transportation Revenue (Earned Only)		F-10	Other Agency Revenues	This object class includes revenues earned from activities not associated with the provision of the transit agency's transit service.	n/a	4150		
Revenue Sources	Non-Transportation Revenue Description		F-10	Describe Non-Transportation Funds	Description of the Non-Transportation Funds.			Directly Generated Funds, Non-Trans Description (2013) Directly Generated Funds, Non_Trans_COMM (2011-2012)	
Revenue Sources	Other Auxiliary Revenue Description		F-10	Describe Other Auxiliary Transportation Funds	Description of the Other Auxiliary Transportation Funds.			Directly Generated Funds, Other Description (2013) Directly Generated Funds, Aux_Other_Rev_COMM (2011-2012)	
Revenue Sources	Other Dedicated Funds	Funds Earned - Funds Dedicated to Transit at their Source & Other Directly Generated Funds, Funds Earned - Local, Funds Earned - State	F-10	Funds Earned - Dedicated Tolls - Other	Funds earned from other fees levied by the transit agency, local government or state government.	n/a	4290	Tax Funds, Other Dedicated (2014) Tax Funds, Other dedicated funds (2013) Tax Funds, Other_Ded_Amt (2011-2012)	
Revenue Sources	Other Dedicated Funds Description		F-10	Other Dedicated Funds	Description of revenues dedicated to transit other than taxes or tolls (4290).				
Revenue Sources	Other Dir Gen Funds	Funds Earned (Full Reporters Only), Funds Expended on Operations, Funds Expended on Capital	F-10, RR-20	Funds Earned - Other Directly Generated Funds	Funds earned, expended on operations or expended on capital from other transit agency sources.	407.99	4150	Tax Funds, Other Dir Gen Funds (2014) Tax Funds, Other Directly Generated Funds (2013) Tax Funds, Other_Dir_Gen_Funds_Amt (2011-2012)	
Revenue Sources	Other Directly Generated Funds	Funds Expended on Operations, Funds Expended on Capital	RR-20	Funds Expended On Operations - Other Directly Generated Funds	The amount of Funds Expended on Operations or Capital that was funded by all other directly generated funds, i.e. advertising revenue.	406, 407	4140, 4150	Tax Funds, Other Dir Gen Funds (2014) Tax Funds, Other Directly Generated Funds (2013) Tax Funds, Other_Dir_Gen_Funds_Amt (2011-2012)	**DOES NOT APPLY TO:** Intercity Bus Sub-recipient, Urban/Tribal Sub-recipient
Revenue Sources	Other Directly Generated Funds Description		F-10	Describe Other Directly Generated Funds	Description of the Other Directly Generated Funds.			Tax Funds, Other Directly Generated Funds Desc (2013) Other_Dir_Gen_Funds_Comm (2011-2012)	
Revenue Sources	Other Federal Funds	Funds Earned (Full Reporters Only), Funds Expended on Operations, Funds Expended on Capital	F-10, RR-20	Funds Expended on Operations - Other Federal Funds	Funds earned, expended on Operations or expended on Capital from other Federal funding sources.			Tax Funds, Other Federal Funds (2013-2014) Tax Funds, Other_Fund_Amt (2011-2012)	**DOES NOT APPLY TO:** Intercity Bus Sub-recipient, Urban/Tribal Sub-recipient
Revenue Sources	Other Federal Funds Description		F-10, RR-20	Describe Other Federal Funds	Description of the Other Federal Funds.			Tax Funds, Other Federal Funds desc (2013) Tax Funds, Other_Fed_Sate_Fund_Desc (2011-2012)	**DOES NOT APPLY TO:** Intercity Bus Sub-recipient, Urban/Tribal Sub-recipient

Revenue Sources	Other FTA Funds	Funds Earned (Full Reporters Only), Funds Expended on Operations, Funds Expended on Capital	F-10, RR-20	Funds Earned - Other FTA Funds	Any Federal Transit Administration (FTA) funds not reported as FTA Capital Program (Section 5309) and FTA Urbanized Area Formula Program (5307) funds. These funds include: • FTA Metropolitan Planning (Section 5303) • FTA Clean Fuels Program (Section 5308) • FTA Special Needs of Elderly Individuals and Individuals with Disabilities Formula Program (Section 5310) • FTA Other Than Urbanized Area Formula Program (Section 5311) • FTA Research, Development, Demonstration and Training Projects (Section 5312) • FTA Job Access and Reverse Commute Formula Program (Section 5316) • FTA New Freedom Program (Section 5317) • FTA Alternative Transportation in Parks and Public Lands (Section 5320) • Interstate Transfer Program			Tax Funds, Other FTA Funds (2013-2014) Tax Funds, Other_Fta_Amount (2011-2012)	
Revenue Sources	Other FTA funds - capital assistance spent on operations (including maintenance expenses)	Funds Expended on Operations	F-10, RR-20	Funds Expended on Operations - Other FTA Funds: Capital Assistance Spent on Operations	Funds expended on Operations from other FTA Capital Assistance funding sources.			Tax Funds, Other FTA funds - capital assistance spent on operations (including maintenance expenses) (2014) Tax Funds, Other FTA Funds (2013) Tax Funds, Other_Fta_Amount (2011-2012)	**DOES NOT APPLY TO:** Intercity Bus Sub-recipient, Urban/Tribal Sub-recipient
Revenue Sources	Other FTA Funds Cap Asst Spent On Ops Description		F-10	Describe Other FTA Funds - Capital Assistance Spent on Operations (Including Maintenance Expenses)	Description of the Capital Assistance Spent on Operations (Including Maintenance Expenses).			Tax Funds, Other FTA Funds desc (2013) Tax Funds, Other_Fta_Funds_Capital_Comm (2011-2012)	
Revenue Sources	Other FTA Funds Description		F-10, RR-20	Describe Other FTA Funds	Description of the Other FTA Funds.			Tax Funds, Other FTA Funds desc (2013) Tax Funds, Other_Fta_Funds_Capital_Comm (2011-2012)	**DOES NOT APPLY TO:** Intercity Bus Sub-recipient, Urban/Tribal Sub-recipient
Revenue Sources	Other Taxes	Funds Earned - Funds Dedicated to Transit at their Source & Other Directly Generated Funds, Funds Earned - Local, Funds Earned - State	F-10	Funds Earned - Dedicated Taxes - Other	Revenues generated from a charge imposed by the state or local government, or independent political entity (e.g., transit authority) on persons or property help to pay expenses, including: • Payroll taxes • Utility taxes • Communication taxes (e.g., telephone taxes and fees) • Motor vehicle and tire excise taxes But excluding: • Income taxes • Property taxes • Sales taxes • Gasoline taxes	408.99	4250	Tax Funds, Other Taxes (2013-2014) Tax Funds, O_Tax_Amt (2011-2012)	
Revenue Sources	Other Taxes Description		F-10	Describe Other Dedicated Taxes	Description of the Other Dedicated Taxes.			n/a 2014 Tax Funds, Other taxes description (2013) Tax Funds, Dedicated_Tax_Desc (2011-2012)	
Revenue Sources	Other Transportation Funds Description		F-10	Describe Other Transportation Revenues	Description of the Other Transportation Funds.			Directly Generated Funds, Other Description (2013) Directly Generated Funds, Other_Transportation_Rev_COMM (2011-2012)	
Revenue Sources	Other Usdot Grants Description		RR-20	Describe Funds Received from Other USDOT Grant Programs	Description of the Other USDOT Grant Programs.			Tax Funds, Other USDOT desc (2013) Tax Funds, Usdot_Grant_Comm (2011-2012)	**DOES NOT APPLY TO:** Intercity Bus Sub-recipient, Urban/Tribal Sub-recipient
Revenue Sources	Park and Ride Revenue	Funds Earned	F-10	Park and Ride Parking Revenue	Revenues earned from parking fees paid by passengers who drive to park-and-ride lots operated by the transit agency to use transit service.	401.06	4120	Directly Generated Funds, Revenue Park Ride (2014) Directly Generated Funds, Park and Ride Parking Revenue (2013) Directly Generated Funds, Park_Ride_Rev_Amt (2011-2012)	
Revenue Sources	Park and Ride Revenue (Earned Only)		F-10	Park and Ride Parking Revenues	Parking fees paid by passenger who drive to park-and-ride facilities operated by the agency to use transit service.	n/a	4120		
Revenue Sources	Property Taxes	Funds Earned - Funds Dedicated to Transit at their Source & Other Directly Generated Funds, Funds Earned - Local, Funds Earned - State	F-10	Funds Earned - Dedicated Taxes - Property	Funds earned from property tax levied by the transit agency, local government or state government.	408.01	4230	Tax Funds, Property Taxes (2013-2014) Tax Funds, Prop_Tax_Amt (2011-2012)	
Revenue Sources	PT Agmt with Non-NTD Reporter Revenue		F-10	Revenues Accrued Through a Purchased Transportation Agreement - with a non-NTD reporting agency	The amount of Funds Earned, Funds Expended on Operations or Funds Expended on Capital that was funded by Purchased Transportation revenues from a non-NTD reporter. This amount should match the Contract/Subsidy Operating Expenses Net of Fare Revenues and Capital Leasing Expenses from a B-30 for a non-NTD reporter.				
Revenue Sources	PT Agmt with NTD Reporter Revenue		F-10	Revenues Accrued Through a Purchased Transportation Agreement - with a NTD reporting agency	The amount of Funds Earned, Funds Expended on Operations or Funds Expended on Capital that was funded by Purchased Transportation revenues from another NTD agency. This amount should match the Contract/Subsidy Operating Expenses Net of Fare Revenues and Capital Leasing Expenses from the B-30 for another NTD Reporter.				
Revenue Sources	Reduced Reporter Funds	Funds Expended on Operations, Funds Expended on Capital	RR-20	Funds Expended on Operations - Local Funds	Financial assistance from local or state governments to help cover the costs of providing transit services. Does not include funds generated directly by the transit agency.	409	4300	Tax Funds, SSW Funds (2014) Tax Funds, Small Systems Waiver Total (2013) Tax Funds, W30_State_Local_Funds (2011-2012)	**DOES NOT APPLY TO:** Intercity Bus Sub-recipient, Urban/Tribal Sub-recipient
Revenue Sources	Reduced Reporter Other Funds	Funds Expended on Operations, Funds Expended on Capital	RR-20	Funds Expended on Operations - Other	The amount of Funds Expended on Operations or Capital that was funded by other sources unable to be classified in the other categories.	411.99	4430	Tax Funds, SSW Other Funds (2013-2014) Tax Funds, W30_Other_Amt (2011-2012)	**DOES NOT APPLY TO:** Intercity Bus Sub-recipient, Urban/Tribal Sub-recipient
Revenue Sources	Reduced Reporter Other Funds Description		RR-20	Describe Other Funding Sources	Description of the Other Funding Sources, spent on either Operations or Capital.			Tax Funds, SSW Other desc (2013) Tax Funds, W30_Other_Comm (2011-2012)	**DOES NOT APPLY TO:** Intercity Bus Sub-recipient, Urban/Tribal Sub-recipient
Revenue Sources	Revenue from General Fund		F-10	Funds Earned - Funds Allocated to Transit out of the General Revenues of the Government Entity	Any funds allocated to transit out of the general revenues of the governmental entity. General revenue funds are usually determined through a state or local government's annual budgeting process.				
Revenue Sources	Revenue General Fund	Funds Earned - Local Government, Funds Expended on Operations - Local Government, Funds Expended on Capital - Local Government, Funds Earned - State Government, Funds Expended on Operations - State Government, Funds Expended on Capital - State Government	F-10	Funds Earned - Funds Allocated to Transit out of the General Revenues of the Government Entity	Any funds allocated to transit out of the general revenues of the governmental entity. General revenue funds are usually determined through a state or local government's annual budgeting process.	409	4310	Tax Funds, Revenue General Fund (2014) Tax Funds, Allocated to Transit from Government General Revenues (2013) Tax Funds, Gen_Rev_Fund_Amt (2011-2012)	
Revenue Sources	Revenue PT Agmt Non-NTD	Funds Earned (Full Reporters Only), Funds Expended on Operations, Funds Expended on Capital	F-10, RR-20	Funds Earned - Revenues Accrued Through a Purchased Transportation Agreement - with a non-NTD reporting agency	The amount of Funds Earned, Funds Expended on Operations or Funds Expended on Capital that was funded by Purchased Transportation revenues from a non-NTD reporter. This amount should match the Contract/Subsidy Operating Expenses Net of Fare Revenues and Capital Leasing Expenses from a B-30 for a non-NTD reporter.	414	4160	Directly Generated Funds, Revenue PT Agmt Non NTD (2014) Directly Generated Funds, Purchased Transportation Revenues with Non-NTD Reporter (2013) Directly Generated Funds, PT_Agmt_Rev_Amount_Non_NTD (2011-2012)	**DOES NOT APPLY TO:** Rural General Public Transit Sub-Recipient, Intercity Bus Sub-Recipient, Urban/Tribal Sub-recipient
Revenue Sources	Revenue PT Agmt NTD	Funds Earned (Full Reporters Only), Funds Expended on Operations, Funds Expended on Capital	F-10, RR-20	Funds Earned - Revenues Accrued Through a Purchased Transportation Agreement - with a NTD reporting agency	The amount of Funds Earned, Funds Expended on Operations or Funds Expended on Capital that was funded by Purchased Transportation revenues from another NTD agency. This amount should match the Contract/Subsidy Operating Expenses Net of Fare Revenues and Capital Leasing Expenses from the B-30 for another NTD Reporter.	414	4160	Directly Generated Funds, Revenue PT Agmt NTD (2014) Directly Generated Funds, Purchased Transportation Revenues with NTD Reporter (2013) Directly Generated Funds, PT_Agmt_Rev_Amount_NTD (2011-2012)	**DOES NOT APPLY TO:** Rural General Public Transit Sub-recipient, Intercity Bus Sub-recipient, Urban/Tribal Sub-recipient
Revenue Sources	RR Funds		F-10	Funds Expended on Operations - Local Funds	Financial assistance from local or state governments to help cover the costs of providing transit services. Does not include funds generated directly by the transit agency.				
Revenue Sources	RR Other Funds		F-10	Funds Expended on Operations - Other	The amount of Funds Expended on Operations or Capital that was funded by other sources unable to be classified in the other categories.				

Revenue Sources	RR Other Funds Description		F-10	Describe Other Funding Sources	Description of the Other Funding Sources, spent on either Operations or Capital.				
Revenue Sources	Sales and Disposals of Assets		F-10	Sales and Disposals of Assets	Sales and disposals of assets include, but are not limited to: sales of equipment, buildings, real estate and other property.	n/a	4630		
Revenue Sources	Sales Taxes	Funds Earned - Funds Dedicated to Transit at their Source & Other Directly Generated Funds, Funds Earned - Local, Funds Earned - State	F-10	Funds Earned - Dedicated Taxes - Sales	See: Form F-10, Funds Dedicated to Transit at their Source & Other Directly Generated Funds, Funds Earned - Dedicated Taxes - Other	408.02	4220	Tax Funds, Sales Taxes (2013-2014) Tax Funds, Sale_Tax_Amt (2011-2012)	
Revenue Sources	State/Local Other Funds	Funds Earned - Local, Funds Expended on Operations - Local, Funds Expended on Capital - Local, Funds Earned - State, Funds Expended on Operations - State, Funds Expended on Capital - State	F-10	Funds Earned - Other Funds	Funds earned, expended on operations or expended on capital from other local government sources or other state government sources.	409.99, 411.99	4390, 4430	Tax Funds, State/Local Other Funds (2014) Tax Funds, Non-Federal Other Funds (2013) Tax Funds, Other_Fund_Amt (2011-2012)	
Revenue Sources	State/Local Other Funds Description		F-10	Describe Funds Received from Other State/Local	Description of funds from state/local government that cannot be considered either an allocation from the general revenues, or a dedicated fund.				
Revenue Sources	Subsidy	Funds Earned (Full Reporters Only), Funds Expended on Operations, Funds Expended on Capital	F-10	Funds Earned - Subsidy from Other Sectors of Operations	The funds obtained from other sectors of a transit agency's operations to help cover the cost of providing transit service.	440	4170	Directly Generated Funds, Subsidy (2014) Directly Generated Funds, Subsidy from other Sectors of Operations (2013) Directly Generated Funds, Subsidy_Amt (2011-2012)	
Revenue Sources	Subsidy from Other Sectors Amount		F-10	Subsidy from Other Sectors of Operations	Occasionally, the transit operation is only one part of a larger transportation entity. Such transit agencies may receive subsidies from other sectors of operations within the larger transportation entity to help cover the cost of transit.	n/a	4170		
Revenue Sources	Total Auxiliary Revenue (Earned Only, N - P)		F-10	Total Auxiliary Transportation Funds	Total Auxiliary Transportation Funds is the sum of all Auxiliary Transportation Funds, including Concessions, Advertising, and Other.				
Revenue Sources	Total of Fares		F-10	Total Passenger Fares	Amounts paid by the rider to use transit services. Includes Passenger-paid fees and organization-paid fares.	n/a	4110		
Revenue Sources	Total Park Ride	Funds Expended on Operations, Funds Expended on Capita	F-10	Funds Expended on Operations - Park and Ride, Auxiliary Funds, Non-Transportation, Other	Amount of Total Park and Ride, Other Transportation, Auxiliary and Non-Transportation Expenditures expended on Operations or Capital during the period.	406-407	4140-4150	Directly Generated Funds, Total Park Ride (2014) Directly Generated, Total Park and Ride, Other Transportation, Auxiliary and Non-Transportation Revenues (2013) Directly Generated Funds, Park_Ride_Rev_Amt (2011-2012)	
Revenue Sources	Total Recoveries		F-10	Total Recoveries	Total recoveries include proceeds recovered from insurance companies to indemnify the transit agency for insured acts that resulted in a liability for damage to transit personnel or property or damage to the person or property of others.	n/a	4190		
Revenue Sources	Transit Development Credits		F-10	Transportation Development Credits	In some states, funds spent on transportation at the state level can be used as a nonfederal match for federal grants to transit agencies. These are known as Transportation Development Credits (TDCs) or toll credits.	n/a	4640		
Revenue Sources	Voluntary Non-Exchange Transactions		F-10	Voluntary Non-Exchange Transactions	In a voluntary non-exchange transaction, an agency gives or receives value (e.g., revenue vehicle) without directly receiving or giving equal value (e.g., cash) in return.	n/a	4642		
Revenue Sources	Voluntary Non-Exchange Transactions Description		F-10	Describe Voluntary Non-Exchange Transactions	Description of Voluntary Non-Exchange Transactions (4642).				
Revenue Vehicle Inventory	Active Fleet Vehicles		A-30	Active Vehicles	The vehicles available to operate in revenue service at the end of an agency's fiscal year, including: • Spares • Vehicles temporarily out of service for routine maintenance and minor repairs • Operational vehicles			Active Vehicles (2013) Actv_Fleet_Num (2012) Active_Fleet (2011)	
Revenue Vehicle Inventory	ADA Fleet Vehicles		A-30	Active ADA Accessible Vehicles	Public transportation revenue vehicles which, in compliance with the Americans with Disabilities Act of 1990 (ADA), do not restrict access, are usable, and provide allocated space and/or priority seating for individuals who use wheelchairs, and which are accessible using lifts or ramps.			ADA-Accessible Vehicles (2013) Ada_Lift_Num (2012) Ada_Lift_Fleet (2011)	
Revenue Vehicle Inventory	Avg Lifetime Miles per Active Vehicle		A-30	Average Lifetime Miles	The total miles accumulated on all active vehicles since date of manufacture divided by the number of active vehicles. Typically found by taking the average of all odometer readings at the end of the fiscal year.			Mileage_Avg_Num (2012) Avg_Lifetime_Mileage_Per_Veh (2011)	**<u>DOES NOT APPLY TO:</u>** Non-dedicated Fleets, Rural General Public Transit Sub-recipients, Intercity Bus Sub-recipients, Urban/Tribal Sub-recipients
Revenue Vehicle Inventory	Dedicated Fleet		A-30	Dedicated Fleet	Indicates whether or not the vehicles are used exclusively for public transit service of a modal classification. DO fleets default to "Yes," whereas PT fleets have the option to choose "Yes" or "No."			Dedicated_Fleet_Fl (2012) Dedicated_Fleet (2011)	
Revenue Vehicle Inventory	Emergency Contingency Vehicles		A-30	Emergency Contingency Vehicles	Revenue vehicles placed in an inactive contingency fleet for energy or other local emergencies after the revenue vehicles have reached the end of their normal minimum useful life. The vehicles must be properly stored and maintained, and the Federal Transit Administration (FTA) must approve the Emergency Contingency Plan. Substantial changes to the plan (10 percent change in fleet) require re-approval by FTA.			Emergency Vehicles (2013) Emergency_Num (2012) Emergency_Fleet (2011)	**<u>DOES NOT APPLY TO:</u>** Non-Dedicated Fleets, Intercity Bus Sub-recipients, Urban/Tribal Sub-recipients
Revenue Vehicle Inventory	Fuel Type		A-30	Fuel Type	The type of fuel (diesel, electric battery, dual fuel, etc.) used for the transit vehicles.			Fuel_Type_Desc (2012) Fuel_Type (2011)	**<u>DOES NOT APPLY TO:</u>** Rural General Public Transit Sub-recipients, Intercity Bus Sub-recipients, Urban/Tribal Sub-recipients
Revenue Vehicle Inventory	Funding Source		A-30	Funding Type	The original source of funding to purchase the transit vehicles			Funding_Type_Desc (2012) Funding_Type (2011)	
Revenue Vehicle Inventory	Manufacture Year		A-30	Year Manufactured	The year of original manufacture of the vehicle. Not the same as model year: a model 2013 vehicle was likely manufactured in 2012.			Manufacture_Yr (2012) Year_Manufacture (2011)	**<u>DOES NOT APPLY TO:</u>** Non-Dedicated Fleets
Revenue Vehicle Inventory	Manufacturer		A-30	Manufacturer	The original manufacturer of a transit vehicle. If a vehicle has more than one, agencies must report the final manufacturer of a vehicle fleet.			Manufacturer Code (2013) Manufacturer_Type_Desc (2012)	**<u>DOES NOT APPLY TO:</u>** Non-Dedicated Fleets, Rural General Public Transit Sub-recipients, Intercity Bus Sub-recipients, Urban/Tribal Sub-recipients
Revenue Vehicle Inventory	Model		A-30	Model	Vehicle model name The specific brand of a transit vehicle.			Model_Num (2012-2013) Model_Number (2011)	**<u>DOES NOT APPLY TO:</u>** Non-Dedicated Fleets, Rural General Public Transit Sub-recipients, Intercity Bus Sub-recipients, Urban/Tribal Sub-recipients
Revenue Vehicle Inventory	Other Man. Desc		A-30	Describe Other Manufacturer	Description of the other manufacturer.				**<u>DOES NOT APPLY TO:</u>** Non-Dedicated Fleets, Rural General Public Transit Sub-recipients, Intercity Bus Sub-recipients, Urban/Tribal Sub-recipients
Revenue Vehicle Inventory	Ownership Type		A-30	Ownership Type	Indicates whether the vehicles are owned or leased and by whom.			Ownership (2013) Ownership_Type_Desc (2012) Ownership_Type (2011)	
Revenue Vehicle Inventory	Rebuild Year		A-30	Year Rebuilt	The year in which the transit agency reinvested in the vehicle to enhance its reliability or extend its useful life			Rebuild_Year (2012) Year_Rebuild (2011)	**<u>DOES NOT APPLY TO:</u>** Non-Dedicated Fleets, Rural General Public Transit Sub-recipients, Intercity Bus Sub-recipients, Urban/Tribal Sub-recipients
Revenue Vehicle Inventory	Revenue Vehicle Inventory ID		A-30	RVI ID	Unique ID number assigned to each fleet of revenue vehicles with identical characteristics. This number is only generated once the fleet is created and saved.			Revenue_Vehicle_Inventory_Id (2012) Vehicle_Id (2011)	
Revenue Vehicle Inventory	Seating Capacity		A-30	Seating Capacity	The number of seats that are actually installed in the vehicle, not including the driver, except for Vanpool modes.			Seating (2013) Seat_Cap_Num (2012) Seating_Capacity (2011)	
Revenue Vehicle Inventory	Standing Capacity		A-30	Standing Capacity	The number of standing passengers that can be accommodated aboard the revenue vehicle during a normal full load (non-crush) in accordance with established loading policy or, in absence of a policy, the manufacturer's rated standing capacity figures.			Standing (2013) Stand_Cap_Num (2012) Standing_Capacity (2011)	**<u>DOES NOT APPLY TO:</u>** Non-Dedicated Fleets, Rural General Public Transit Sub-recipients, Intercity Bus Sub-recipients, Urban/Tribal Sub-recipients
Revenue Vehicle Inventory	Total Fleet Vehicles		A-30	Total Vehicles	All revenue vehicles held at the end of the fiscal year, including those: • In service • In storage • Emergency contingency • Awaiting sale The number of both active and inactive vehicles in the fleet at the end of the fiscal year.			Vehicles in Total Fleet (2013) Fleet_Vehicles_Num (2012) Total_Fleet (2011)	

Revenue Vehicle Inventory	Total Miles on Active Vehicles During Period		A-30	Miles This Year	The total miles driven on all active fleet vehicles during the agency's fiscal year .			Miles on Active Vehicles during Period (2013) Mileage_Num (2012) Mileage_During_Period (2011)	**DOES NOT APPLY TO:** Non-dedicated Fleets, Rural General Public Transit Sub-recipients, Intercity Bus Sub-recipients, Urban/Tribal Sub-recipients
Revenue Vehicle Inventory	Useful Life Benchmark		A-30	Useful Life Benchmark	The expected lifecycle of a capital asset for a particular transit agency's operating environment, or the acceptable period of use in service for a particular transit agency's operating environment. FTA has outlined default useful life benchmarks for each vehicle type, however agencies can choose to report their own ULBs.				**DOES NOT APPLY TO:** Non-Dedicated Fleets, Intercity Bus Sub-recipients, Urban/Tribal Sub-recipients
Revenue Vehicle Inventory	Vehicle Length		A-30	Vehicle Length (Feet)	The total length of the transit vehicles, measured in feet.			Vehicle_Length_Cnt (2012) Vehicle_Length (2011)	**DOES NOT APPLY TO:** Non-Dedicated Fleets
Revenue Vehicle Inventory	Vehicle Type		A-30	Vehicle Type	The form of passenger conveyance used for revenue operations.			Inventory_Vehicle_Type_Desc (2012) Vehicle_Type (2011)	
Safety Information	Fatalities		RR-20	Fatalities	A death or suicide that results from an event that occurs in or on transit property. Must be confirmed within 30 days of a reportable event. Excludes deaths that are a result of illness or other natural causes.				**DOES NOT APPLY TO:** Intercity Bus Sub-recipient, Urban/Tribal Sub-recipient
Safety Information	Injuries		RR-20	Injuries	Any damage or harm to persons as a result of an event that requires immediate medical attention away from the scene.				**DOES NOT APPLY TO:** Intercity Bus Sub-recipient, Urban/Tribal Sub-recipient
Safety Information	Reportable Incidents		RR-20	Reportable Incidents	A safety or security event occurring on transit right-of-way, in a transit revenue facility, in a transit maintenance facility, or involving a transit revenue vehicle that results in one or more of the following conditions: • A fatality confirmed within 30 days of the event • An injury requiring immediate medical attention away from the scene for one or more persons • Property damage equal to or exceeding $25,000 • Collisions involving transit vehicles that require towing away from the scene for a transit roadway vehicle or other non-transit roadway vehicle • An evacuation due to or under hazardous conditions or an evacuation to the rail right-of-way • Rail transit vehicle collisions occurring at a grade crossing • Rail transit vehicle collisions with an individual on the rail right-of-way • Rail transit vehicle collisions with another revenue or non-revenue rail transit vehicle • A mainline or yard derailment of revenue or non-revenue vehicles • Excludes occupational safety events occurring in administrative buildings				**DOES NOT APPLY TO:** Intercity Bus Sub-recipient, Urban/Tribal Sub-recipient
Service	ADA UPT	Annual Total	S-10	ADA Unlinked Passenger Trips (UPT) - Annual Total	The number of passengers who board public transportation vehicles for complementary paratransit services (demand response (DR)) associated or attributed to the Americans with Disabilities Act of 1990 (ADA) compliance requirements. The number of ADA unlinked passenger trips (UPT) should be less than or equal to the total number of unlinked passenger trips. These trips are reported only for the DR mode. ADA-related service reported to the National Transit Database (NTD) should not include any categorical service (i.e. services that are not available to the general public such as Medicaid, Meals-On-Wheels, Head Start, sheltered workshops, independent living centers, etc.) Also not included is service funded by the New Freedom program.			ADA Trips (2013) Ada_Unl_Pass_Trips_Num (2012) ADA_Unlinked_Passenger_Trips (2011)	**ONLY APPLIES TO:** DR and DT modes
Service	BRT Non-Statutory Mixed Traffic		S-10	BRT Non-Statutory Mixed Traffic Right-of-Way	Miles of roadway used by BRT routes that are not recognized by FTA as BRT for funding purposes.				
Service	Charter service hours	Annual Total	S-10	Charter Service Hours - Annual Total	The total hours operated by revenue vehicles while in charter service. Charter service hours include: • Hours operated while carrying passengers for hire, and • Associated deadhead hours			Charter_Hrs_Num (2012) Charter_Servie_Hours (2011)	**ONLY APPLIES TO:** DR and MB modes
Service	Days not operated due to officially declared emergencies	Total Weekday Schedule, Total Saturday Schedule, Total Sunday Schedule	S-10	Days Not Operated (Officially Declared Emergencies) - Total Weekday Schedule	The number of weekdays, Saturdays and Sundays that service did not operate due to officially declared emergencies.			Emergency_Days_Num (2012) Declared_Emergencies (2011)	
Service	Days not operated due to strikes	Total Weekday Schedule, Total Saturday Schedule, Total Sunday Schedule	S-10	Days Not Operated (Strikes) - Total Weekday Schedule	The number of weekdays, Saturdays and Sundays that service did not operate due to transit labor strikes.			Strike_Days_Num (2012) Strikes (2011)	
Service	Days not operated due to strikes comment	Total Weekday Schedule, Total Saturday Schedule, Total Sunday Schedule	S-10	Describe Emergency - Total Weekday Schedule	Description of Days Not Operated Due To Strikes.			n/a (2011-2012)	
Service	Days of service operated	Total Weekday Schedule, Total Saturday Schedule, Total Sunday Schedule	S-10	Days Operated - Total Weekday Schedule	See: Form S-10, Service Operated (Days), Days Operated - Annual Total			Days_Operated_Num (2012) Days_Operated (2011)	
Service	Emergency Comment	Total Weekday Schedule, Total Saturday Schedule, Total Sunday Schedule	S-10	Describe Emergency - Total Weekday Schedule	Description of Days Not Operated Due to Emergency			n/a (2011-2012)	
Service	Mixed Traffic Right of Way (ROW)		S-10	Mixed Traffic Right-of-Way (RoW)	Roadways other than exclusive and controlled access rights-of-way (ROW) used for transit operations that are mixed with pedestrian and/or vehicle traffic. Does not include guideway that only has grade crossings with vehicular traffic.			Transit Way Mileage, Mixed Traffic Right of Way Miles (2013) Transit Way Mileage, Mixed_Row_Num (2011-2012)	
Service	Passenger Miles	Average Weekday Schedule, Average Saturday Schedule, Average Sunday Schedule, Annual Total	S-10	Passenger Miles Traveled (PMT) - Average Weekday Schedule	The sum of the distances ridden by each passenger			Passenger Miles Traveled (2013) Passenger_Miles_Num (2012) Passenger_Miles (2011)	**DOES NOT APPLY TO:** DT Mode except for Annual Total.
Service	Scheduled Revenue Miles	Average Weekday Schedule, Average Saturday Schedule, Average Sunday Schedule, Annual Total	S-10	Total Scheduled Passenger Car Revenue Miles - Average Weekday Schedule	The anticipated revenue service to be completed by passenger cars if there were no missed trips for the average weekday, average Saturday, average Sunday and Annual Total. Excludes any deadhead and additional services performed.			Scheduled Vehicle Revenue Miles (2013) Pass_Car_Sched_Rev_Miles_Num (2012) Passenger_Car_Sched_Rev_Miles (2011)	**ONLY APPLIES TO:** Rail or exclusive Transit modes
Service	School bus hours	Annual Total	S-10	School Bus Hours - Annual Total	The vehicle hours of travel by revenue vehicles while serving as a school bus. School bus hours are only hours where a bus is primarily or solely dedicated to carrying school passengers.			School_Bus_Hrs_Num (2012) School_Bus_Hours (2011)	**ONLY APPLIES TO:** DR and MB modes
Service	Sponsored Service UPT	Annual Total	S-10	Sponsored Service (UPT) - Annual Total	Public transportation services that are paid, in whole or in part, directly to the transit provider by a third party. Transit providers may offer these services as part of a Coordinated Human Services Transportation Plan. Common sponsors include the Veterans Administration, Medicare, sheltered workshops, the Association for Retarded Citizens-Arc, Assisted Living Centers, and Head Start programs.			Sponsored Service Trips (2013) Sponsored_Service (2011-2012)	**ONLY APPLIES TO:** DR and DT modes
Service	Time Service Begins	Average Weekday Schedule, Average Saturday Schedule, Average Sunday Schedule, Weekday AM Peak, Weekday Midday, Weekday PM Peak	S-10	Time Service Begins - Average Weekday Schedule	Start of transit service, i.e. the time when the first revenue service vehicle leaves the garage or point of dispatch.			Begin_Tm (2012) Time_Service_Begins (2011)	**DOES NOT APPLY TO:** DT, peak times do not apply to DR & VP
Service	Time Service Ends	Average Weekday Schedule, Average Saturday Schedule, Average Sunday Schedule, Weekday AM Peak, Weekday Midday, Weekday PM Peak	S-10	Time Service Ends - Average Weekday Schedule	End of night transit service; i.e. the time when a revenue service vehicle returns to the garage or point of dispatch			End_Tm (2012) Time_Serivice_Ends (2011)	**DOES NOT APPLY TO:** DT, DR & VP
Service	Total actual train hours	Average Weekday Schedule, Average Saturday Schedule, Average Sunday Schedule, Annual Total	S-10	Total Actual Train Hours - Average Saturday Schedule	The hours that trains travel while in revenue service (actual train revenue hours) plus deadhead hours. Actual train hours include: • Revenue service • Deadhead • Layover/recovery time Actual train hours exclude: • Hours for charter services • Operator training • Vehicle maintenance testing			Actual Vehicle Hours (2013) Veh_Hrs_Num (2012) Vehicle_Or_Train_Hours (2011)	**ONLY APPLIES TO:** Rail or exclusive Transit modes
Service	Total actual train miles	Average Weekday Schedule, Average Saturday Schedule, Average Sunday Schedule, Annual Total	S-10	Total Actual Train Miles - Annual Total	The miles that trains travel while in revenue service (actual train revenue miles) plus deadhead miles. Actual train miles include: • Revenue service • Deadhead Actual train miles exclude: • Miles for charter services • Operator training • Vehicle maintenance testing			Actual Miles (2013) Veh_Miles_Num (2012) Vehicle_Or_Train_Miles (2011)	**ONLY APPLIES TO:** Rail or exclusive Transit modes
Service	Total actual train revenue hours	Average Weekday Schedule, Average Saturday Schedule, Average Sunday Schedule, Annual Total	S-10	Total Actual Train Revenue Hours - Annual Total	The hours that trains travel while in revenue service. Train revenue hours include: • Revenue service • Layover/recovery time Train revenue hours exclude: • Deadhead • Training operators prior to revenue service • Vehicle maintenance tests • Charter services			Vehicle Revenue Hours (2013) Veh_Rev_Hours_Num (2012) Vehicle_Or_Train_Rev_Hours (2011)	**ONLY APPLIES TO:** Rail or exclusive Transit modes

Service	Total actual train revenue miles	Average Weekday Schedule, Average Saturday Schedule, Average Sunday Schedule, Annual Total	S-10	Total Actual Train Revenue Miles - Annual Total	The miles that trains travel while in revenue service. Train revenue miles include: • Revenue service Train revenue miles exclude: • Deadhead • Training operators prior to revenue service • Vehicle maintenance vehicle tests • Charter services			Revenue Miles (2013) Veh_Rev_Miles_Num (2012) Vehicle_Or_Train_Rev_Miles (2011)	**ONLY APPLIES TO:** Rail or exclusive Transit modes
Service	Total actual vehicle or passenger car hours	Average Weekday Schedule, Average Saturday Schedule, Average Sunday Schedule, Annual Total	S-10	Total Actual Passenger Car Hours - Annual Total	The hours that vehicles or passenger cars travel while in revenue service (actual vehicle or passenger car revenue hours) plus deadhead hours. Actual hours include: • Revenue service • Deadhead • Layover/recovery time • Passenger loading time Actual hours exclude: • Hours for charter services • Operator training • Vehicle maintenance testing • Fueling			Actual Vehicle Hours (2013) Pass_Car_Hrs_Num (2012) Passenger_Car_Hours (2011)	**ONLY APPLIES TO:** Rail or exclusive Transit modes
Service	Total actual vehicle or passenger car miles	Average Weekday Schedule, Average Saturday Schedule, Average Sunday Schedule, Annual Total	S-10	Total Actual Passenger Car Miles - Annual Total	The miles that vehicles or passenger cars travel while in revenue service (actual passenger car revenue miles) plus deadhead miles. Actual vehicle or passenger car miles include: • Revenue service • Deadhead Actual vehicle or passenger car miles exclude: • Hours for charter services 2015 NTD Glossary • Operator training • Vehicle maintenance testing • Fueling			Actual Miles (2013) Pass_Car_Miles_Num (2012) Passenger_Car_Miles (2011)	**ONLY APPLIES TO:** Rail or exclusive Transit modes
Service	Total actual vehicle or passenger car revenue hours	Average Weekday Schedule, Average Saturday Schedule, Average Sunday Schedule, Annual Total	S-10	Total Actual Passenger Car Revenue Hours - Annual Total	The hours that vehicles or passenger cars travel while in revenue service. Vehicle or Passenger car revenue hours include: • Revenue service • Layover/recovery time • Passenger loading time Vehicle or Passenger car revenue hours exclude: • Deadhead • Operator training • Vehicle maintenance tests • School Bus and Charter services			Vehicle Revenue Hours (2013) Pass_Car_Rev_Hrs_Num (2012) Passenger_Car_Revenue_Hours (2011)	**ONLY APPLIES TO:** Rail or exclusive Transit Modes.
Service	Total actual vehicle or passenger car revenue miles	Average Weekday Schedule, Average Saturday Schedule, Average Sunday Schedule, Annual Total	S-10	Total Actual Passenger Car Revenue Miles - Annual Total	The miles that vehicles or passenger cars travel while in revenue service. Vehicle or Passenger car revenue miles include: • Revenue service • Layover/recovery time • Passenger loading time Vehicle or Passenger car revenue miles exclude: • Deadhead • Operator training • Vehicle maintenance tests • Charter services			Revenue Miles (2013) Pass_Car_Rev_Miles_Num (2012) Passenger_Car_Rev_Miles (2011)	**ONLY APPLIES TO:** Rail or exclusive Transit modes
Service	Trains in operation	Average Weekday Schedule, Average Saturday Schedule, Average Sunday Schedule	S-10	Passenger Cars In Operation - Average Saturday Schedule	The maximum number of trains actually operated to provide service on an average weekday, average Saturday and average Sunday.			Vehicles in Operation (2013) Rail_Cars_Num (2012) Passenger_Cars (2011)	**ONLY APPLIES TO:** Rail modes
Service	Unlinked Passenger Trips (UPT)	Average Weekday Schedule (S-10), Average Saturday Schedule (S-10), Average Sunday Schedule (S-10), Annual Total (S-10 and RR-20)	S-10, RR-20	Annual Unlinked Passenger Trips - by Mode/TOS	The number of passengers who board public transportation vehicles. Passengers are counted each time they board a vehicle no matter how many vehicles they use to travel from their origin to their destination.			Unl_Pass_Trips_Num (2012) Unlinked_Passenger_Trips (2011)	**DOES NOT APPLY TO:** Urban/Tribal Sub-recipient
Service	Vehicles Available for Maximum Service		S-10	Vehicles Available for Annual Maximum Service	The number of revenue vehicles available to meet the annual maximum service requirement. Vehicles available for maximum service include: • Operational vehicles • Spares • Out of service vehicles • Vehicles in or awaiting maintenance Vehicles available for annual maximum service exclude: • Vehicles awaiting sale; • Vehicle awaiting extensive rebuilds and repairs • Emergency contingency vehicles				
Service	Vehicles Operated in Maximum Service		S-10, RR-20	Vehicles Operated in Annual Maximum Service - by Mode/TOS	The number of revenue vehicles operated to meet the annual maximum service requirement. This is the revenue vehicle count during the peak season of the year; on the week and day, that maximum service is provided. Vehicles operated in maximum service (VOMS) exclude: • Atypical days • One-time special events			Vehicles in Operation (2013) Rail_Cars_Num (2012) Vehicles_In_Operation (2011)	**DOES NOT APPLY TO:** Intercity Bus Sub-recipient, Urban/Tribal Sub-recipient
Service	Vehicles or Passenger Cars in operation	Average Weekday Schedule, Average Saturday Schedule, Average Sunday Schedule	S-10	Passenger Cars In Operation - Average Weekday Schedule	The maximum number of vehicles or passenger cars actually operated to provide service on an average weekday, average Saturday and average Sunday.			Vehicles in Operation (2013) Rail_Cars_Num (2012) Passenger_Cars (2011)	**ONLY APPLIES TO:** Rail or exclusive Transit modes, excludes DT mode
Service Vehicle Inventory	Estimated Cost		A-35	Estimated Cost	The estimated cost of the vehicles.				
Service Vehicle Inventory	Notes		A-35	Notes	Any additional information the agency deems important.				
Service Vehicle Inventory	Number of Vehicles		A-35	Total Vehicles	Sum of all vehicles in the fleet.				
Service Vehicle Inventory	Percent Agency Capital Responsibility		A-35	Transit Agency Capital Responsibility	The percentage of capital responsibility the agency is responsible for. Transit agencies have direct capital responsibility for assets that they own, jointly own with another entity, or for assets that they are responsible for replacing, overhauling, refurbishing, or conducting major repairs on that asset, or the cost of those activities are itemized as a capital line item in the agency's budget.				
Service Vehicle Inventory	Primary Mode Served		A-35	Primary Mode	The mode in which the vehicles are predominantly used.				
Service Vehicle Inventory	Secondary Mode Served		A-35	Secondary Mode	Other modes in which the vehicles are used, however to a lesser degree than the primary mode.				
Service Vehicle Inventory	Service Fleet ID		A-35	ID	Unique ID number assigned to each fleet of revenue vehicles with identical characteristics. This number is only generated once the fleet is created and saved.				
Service Vehicle Inventory	Service Fleet Name		A-35	Fleet Name	Unique description of the fleet provided by the agency to track vehicles.				
Service Vehicle Inventory	Useful Life Benchmark		A-35	Useful Life Benchmark (Years)	The expected lifecycle of a capital asset for a particular transit agency's operating environment, or the acceptable period of use in service for a particular transit agency's operating environment. FTA has outlined default useful life benchmarks for each vehicle type, however agencies can choose to report their own ULBs.				
Service Vehicle Inventory	Vehicle Type		A-35	Vehicle Type	The type of vehicle used for service.				
Service Vehicle Inventory	Year Dollar of the Estimated Cost		A-35	Year Dollars of Estimated Cost	The year of the cost estimation.				
Service Vehicle Inventory	Year of Manufacture		A-35	Year Manufactured	The year of original manufacture. Not the model year.				
Statement of Finances	Accounts Receivable		F-60	Accounts Receivable	Accounts receivable are amounts owed to the transit agency by other parties. It includes trade receivables, notes, acceptances receivable, and receivables from officers, employees, affiliates, and others.	102	1120		
Statement of Finances	Accrued Liabilities		F-60	Accrued Liabilities	An accrued liability (also known as accrued expense) represents an expense recognized or incurred but not yet paid. Accrued liabilities include interest, wages, taxes and pension liabilities.	n/a	2130		

Statement of Finances	Capital Assets		F-60	Capital Assets	Capital assets include land, improvements to land, easements, buildings, building improvements, vehicles, machinery, equipment, works of art and historical treasures, infrastructure, and all other tangible assets that have useful lives over one year.	n/a	1210		
Statement of Finances	Capital Lease Obligations		F-60	Capital Lease Obligations	The lessee (i.e., the transit agency that is leasing the asset) will initially measure the capital lease asset and capital lease obligation at an amount equal to the present value at the beginning of the lease term of minimum lease payments during the lease term, excluding executory costs (e.g., insurance, maintenance, and taxes).	n/a	2230		
Statement of Finances	Capital Leases Receivables		F-60	Capital Lease Receivable	The lessor (the transit agency that owns the asset being leased) reports the capital lease as a noncurrent receivable in the amount of the sum of the minimum lease payments, net of executory costs (e.g., maintenance, taxes, and insurance) and the residual value.	n/a	1230		
Statement of Finances	Cash and Cash Equivalents		F-60	Cash and Cash Equivalents	Cash and cash equivalents include short-term, highly liquid investments that the agency can readily convert to known amounts of cash for the liquidation of transit agency liabilities, including special deposits for which a current liability exists.	101	1110		
Statement of Finances	Current Accounts Payable		F-60	Current Accounts Payable	Current accounts payable are the amounts payable to others within one year for materials and services received, including use of property, matured rents, amounts due to public authorities, amounts of payable judgments, current accounts with officers and employees, and personal injury and property damage claims.	n/a	2110		
Statement of Finances	Current Investments and Current Portions of Long-Term Investments		F-60	Current Investments and Current Portions of Long-Term Investments	Current, or short-term, investments are investments made by the transit agency that can be converted into cash within one year.	n/a	1150		
Statement of Finances	Deferred Inflows of Resources		F-60	Deferred Inflows of Resources	Deferred inflows of resources represent an acquisition of a transit agency's net assets that is applicable to a future period.	n/a	3200		
Statement of Finances	Deferred Outflows of Resources		F-60	Deferred Outflows of Resources	Deferred outflows of resources represent a consumption of a transit agency's net assets that is applicable to a future period.	n/a	3100		
Statement of Finances	Estimated Liabilities		F-60	Estimated Liabilities	An estimated liability represents recognition of a probable future charge that results from a prior act.	n/a	2250		
Statement of Finances	Intangible Assets		F-60	Intangible Assets	Intangible assets are not physical in nature. Examples of intangible assets include software, air rights, easements, water rights, timber rights, patents, and trademarks.	n/a	1220		
Statement of Finances	Inventory		F-60	Inventory	Inventory includes the cost of unapplied materials and supplies such as tools, repair parts, and fuel.	n/a	1130		
Statement of Finances	Investments		F-60	Investments	Investments of transit agency funds in the operation of other entities for purposes other than the temporary investment of surplus cash.	131	1260	Table 30: Statement of Finances, Investments (2011-2013)	
Statement of Finances	Long-Term Debt		F-60	Long Term Debt	Obligations of the transit agency due after one year from the current period ending date and evidenced by formal long-term debt instruments such as equipment obligations, bonds, etc.	221	2210	Table 30: Statement of Finances, Long Term Debt (2011-2013)	
Statement of Finances	Long-Term Pension Liabilities		F-60	Estimated Long Term Pension Liabilities	The estimated obligations of the transit agency, due more than one year from the current period ending date, to make payments to employees, their beneficiaries or trustees or managers of pension funds for pension, savings, relief and hospital benefits accruing to employees for the performance of their labor services.	213.01	2240	Est Long Term Pension Liabilities (2014) Table 30: Statement of Finances, Term Pension Liabilities (2011-2013)	
Statement of Finances	Net Position		F-60	Net position	Net position is typically known as the difference between assets, deferred outflows or inflows of resources and liabilities and is an indicator of an agency's financial position at a point in time.	n/a	3000		
Statement of Finances	Noncurrent Accounts Payable		F-60	Noncurrent Accounts Payable	This object class includes long-term obligations of the transit agency evidenced by open accounts and notes rather than by more conventional long-term debt instruments (e.g., equipment obligations, bonds).	n/a	2220		
Statement of Finances	Other Current Assets		F-60	Other Current Assets	Other current assets include other resources that are readily converted to cash, such as installment or deferred accounts, the value of the current portion of a prefunded lease, and federal grants and taxes receivable within the year.	n/a	1190		
Statement of Finances	Other Current Liabilities		F-60	Other Current Liabilities	Other current liabilities cover miscellaneous obligations of the transit agency due within one year of the current period ending date and not included in the above object classes.	n/a	2190		
Statement of Finances	Other Noncurrent Assets		F-60	Other Noncurrent Assets	Other noncurrent assets are resources that the agency expects to provide benefit for longer than one year that are not provided for in the above object classes.	n/a	1290		
Statement of Finances	Other Noncurrent Liabilities		F-60	Other Noncurrent Liabilities	Other noncurrent liabilities cover the amount of long-term obligations not provided for in the above object classes and maturing more than one year from the current period ending date.	n/a	2290		
Statement of Finances	Prepaid Expenses		F-60	Prepaid Expenses	Prepaid expenses arise when the transit agency makes a payment for goods or services to be received in the future.	n/a	1140		
Statement of Finances	Short-Term Debt and Current Portions of Long-Term Debt		F-60	Short-Term Debt and Current Portions of Long-Term Debt	Short-term debt covers obligations to repay borrowings for periods of less than one year and current maturities of long-term debt.	n/a	2120		
Statement of Finances	Special Funds		F-60	Special Funds	Cash and near cash items whose use is restricted to satisfying a specific class of transit agency long-term obligations.	141	1240	Table 30: Statement of Finances, Special Funds (2011-2013)	
Statement of Finances	Total Assets		F-60	Total Assets	Total Assets is the sum of Total Current Assets and Total Noncurrent Assets.				
Statement of Finances	Total Current Assets		F-60	Total Current Assets	Total Current Assets is the sum of Cash and Cash Equivalents (1110), Accounts Receivable (1120), Inventory (1130), Prepaid Expenses (1140), Current Investments and Current Portions of Long-Term Investments (1150), and Other Current Assets (1190).				
Statement of Finances	Total Current Liabilities		F-60	Total Current Liabilities	Total Current Liabilities is the sum of Current Accounts Payable (2110), Short-Term Debt and Current Portions of Long-Term Debt (2120), Accrued Liabilities (2130), and Other Current Liabilities (2190).				
Statement of Finances	Total Liabilities		F-60	Total Liabilities	Total Liabilities is the sum of Total Current Liabilities and Total Noncurrent Liabilities.				
Statement of Finances	Total Noncurrent Assets		F-60	Total Noncurrent Assets	Total Noncurrent Assets is the sum of Capital Assets (1210), Intangible Assets (1220), Capital Lease Receivable (1230), Special Funds (1240), Work in Progress (1250), Investments (1260), and Other Noncurrent Assets (1290).				
Statement of Finances	Total Noncurrent Liabilities		F-60	Total Noncurrent Liabilities	Total Noncurrent Liabilities is the sum of Long-Term Debt (2210), Noncurrent Accounts Payable (2220), Capital Lease Obligations (2230), Long-Term Pension Liabilities (2240), Estimated Liabilities (2250), and Other Noncurrent Liabilities (2290).				
Statement of Finances	Work in Progress		F-60	Work in Progress	Work in progress (or process) (WIP) covers labor, material and overhead amounts applied to projects not yet completed or placed in service.	n/a	1250		
Transit Agency Employees	Capital Labor Total	Full-Time Actual Employee Work Hours, Full-Time Actual Person Count, Part-Time Actual Employee Work Hours, Part-Time Actual Person Count	R-10	Total Capital Labor - FT Actual Employee Work Hours	Number of employees and hours worked by full and part-time employees surrounding the purchase of equipment or the construction of facilities.			FT_HRS_CAPITAL_LABOR_NUM (2012) F_Time_Cap_Labor_Emp_Hours (2011)	
Transit Agency Employees	General Administration	Full-Time Actual Employee Work Hours, Full-Time Actual Person Count, Part-Time Actual Employee Work Hours, Part-Time Actual Person Count	R-10	FT Actual Employee Work Hours - General Administration	Number of employees and hours worked by full and part-time employees for General Administration; excludes vacation and sick time.			FT_HRS_GEN_ADMIN_NUM (2012) F_Time_Gen_Admin_Emp_Hours (2011)	
Transit Agency Employees	Non-Vehicle Maintenance	Full-Time Actual Employee Work Hours, Full-Time Actual Person Count, Part-Time Actual Employee Work Hours, Part-Time Actual Person Count	R-10	FT Actual Employee Work Hours - Non-Vehicle Maintenance	Number of employees and hours worked by full and part-time employees for Non-Vehicle Maintenance; excludes vacation and sick time.			FT_HRS_NON_VEH_MAINT_NUM (2012) F_Time_Nonveh_Maint_Emp_Hours (2011)	
Transit Agency Employees	Vehicle Maintenance	Full-Time Actual Employee Work Hours, Full-Time Actual Person Count, Part-Time Actual Employee Work Hours, Part-Time Actual Person Count	R-10	FT Actual Employee Work Hours - Vehicle Maintenance	Number of employees and hours worked by full and part-time employees for Vehicle Maintenance; excludes vacation and sick time.			FT_HRS_MAINT_NUM (2012) F_Time_Veh_Maint_Emp_Hours (2011)	
Transit Agency Employees	Vehicle Operations	Full-Time Actual Employee Work Hours, Full-Time Actual Person Count, Part-Time Actual Employee Work Hours, Part-Time Actual Person Count	R-10	FT Actual Employee Work Hours - Vehicle Operations	Number of employees and hours worked by full and part-time employees for Vehicle Operations; excludes vacation and sick time.			FT_HRS_VEH_OP_NUM (2012) F_Time_Veh_Op_Emp_Hours (2011)	
Transit Facilities	Between 200 and 300 vehicles	Owned, Leased from Another Public Agency, Leased from a Private Entity	A-10	General Maintenance Facilities (Between 200 - 300 Vehicles) - Owned	Number of facilities owned, leased from another public agency or leased from a private entity by the reporting agency that have a maximum vehicle capacity between 200 and 300.			Facility size between 200-300 vehicles (2013) MAINT_200_300_NUM (2012) Maint_Serving_200_300 (2011)	
Transit Facilities	Greater than 300 vehicles	Owned, Leased from Another Public Agency, Leased from a Private Entity	A-10	General Maintenance Facilities (Greater than 300 Vehicles) - Owned	Number of facilities owned, leased from another public agency or leased from a private entity by the reporting agency that have a maximum vehicle capacity greater than 300.			Facility size is greater than 300 vehicles (2013) MAINT_300_NUM (2012) Maint_Serving_More_Than_300 (2011)	
Transit Facilities	Heavy Maintenance Facilities	Owned, Leased from Another Public Agency, Leased from a Private Entity	A-10	Heavy Maintenance Facilities - Owned	Facilities used for performing heavy maintenance work on revenue vehicles. Heavy maintenance includes the following: • Unit rebuild • Engine overhaul • Significant body repairs • Other major repairs			Number of Heavy Maintenance Facilities (2013) HEAVY_MAINT_FAC_NUM (2012) Heavy_Maint_Facilities (2011)	

Transit Facilities	Less than 200 vehicles	Owned, Leased from Another Public Agency, Leased from a Private Entity	A-10	General Maintenance Facilities (Less than 200 Vehicles) - Owned	Facilities used for inspecting, servicing, and performing light maintenance work upon revenue vehicles. Light maintenance includes the following: • Brake adjustments • Engine degreasing • Tire work • Minor body repairs • Painting			Facility size less than 200 vehicles (2013) MAINT_UNDER_200_NUM (2012) Maint_Serving_Under_200 (2011)	
Transit Stations	ADA Accessible Stations		A-10	Americans with Disabilities Act of 1990 (ADA) accessible	Public transportation passenger facilities which, in compliance with the Americans with Disabilities Act of 1990 (ADA), provide ready access to passengers with disabilities, including individuals who use wheelchairs, by meeting accessibility requirements of transport devices, signage, and other aids.			Americans with Disabilities Act of 1990 (ADA) accessible stations (2013) Ada_Accessible_Station_Cnt (2011-2012)	**DOES NOT APPLY TO:** DR, DT modes, Rural General Public Transit Sub-recipients, Intercity Bus Sub-recipients, Urban/Tribal Sub-recipients
Transit Stations	Elevators		A-10	Elevators	A compartment that usually moves up and down vertically to transfer passengers from one level of a station or parking facility to another. Elevators may move horizontally, such as from a station to an adjacent parking garage, but such movement is normally done by non-elevator means such as a pedestrian bridge or a moving sidewalk. Does not include non-passenger elevators used only for freight or by transit staff.			Elevator Count (2013) Elevator_Cnt (2011-2012)	**DOES NOT APPLY TO:** DR, DT modes, Rural General Public Transit Sub-recipients, Intercity Bus Sub-recipients, Urban/Tribal Sub-recipients
Transit Stations	Escalators		A-10	Escalators	A moving stairway that moves up and down at an angle to transfer passengers from one level of a station or parking facility to another. Does not include non-passenger escalators used only for freight or by transit staff.			Escalator Count (2013) Escalator_Cnt (2011-2012)	**DOES NOT APPLY TO:** DR, DT modes, Rural General Public Transit Sub-recipients, Intercity Bus Sub-recipients, Urban/Tribal Sub-recipients
Transit Stations	Multi-Modal Stations		A-10	Number of Multi-Modal Stations	A passenger station that serves more than one mode, possibly including modes not included in the National Transit Database (NTD).			Number of Multi-Modal Stations (2013) Multi_Mode_Cnt (2011-2012)	**DOES NOT APPLY TO:** DR, DT modes, Rural General Public Transit Sub-recipients, Intercity Bus Sub-recipients, Urban/Tribal Sub-recipients
Transit Stations	Non-ADA Accessible Stations		A-10	Americans with Disabilities Act of 1990 (ADA) non-accessible	Public transportation passenger facilities that do not provide ready access by individuals with disabilities, including individuals who use wheelchairs			Americans with Disabilities Act of 1990 (ADA) non-accessible stations (2013) Non_Ada_Accessible_Station_Cnt (2011-2012)	**DOES NOT APPLY TO:** DR, DT modes, Rural General Public Transit Sub-recipients, Intercity Bus Sub-recipients, Urban/Tribal Sub-recipients
Transit Stations	Total Stations		A-10	Total Stations	The Sum of ADA Accessible and ADA Non-Accessible passenger stations.			Total_Stations (2012) n/a 2011	**DOES NOT APPLY TO**: DR, DT modes, Rural General Public Transit Sub-recipients, Intercity Bus Sub-recipients, Urban/Tribal Sub-recipients
Transit Way Mileage	Age Groups	Pre-1930, 1930's, 1940's, 1950's, 1960's, 1970's, 1980's, 1990's, 2000's, 2010's, 2020's	A-20	Pre-1930, 1930's, 1940's, 1950's, 1960's, 1970's, 1980's, 1990's, 2000's, 2010's, 2020's	Year group in which the element was constructed.				**ONLY APPLIES TO:** Rail modes (Full Reporters)
Transit Way Mileage	Element Count		A-20	Count	Specific instances of the selected element				**ONLY APPLIES TO:** Rail modes (Full Reporters)
Transit Way Mileage	Element Name		A-20	Element Name	Name of transit way element				**ONLY APPLIES TO:** Rail modes (Full Reporters)
Transit Way Mileage	Expected Service Years		A-20	Expected Service Years When New	The average number of service years for each element. Agencies may report their own expected service years specific to their agency's conditions and current environment.				**ONLY APPLIES TO:** Rail modes (Full Reporters)
Transit Way Mileage	Guideway Elements	At-Grade Ballast (Including expressway) At-Grade In- Street/ Embedded Elevated/ Retained Fill Elevated/ Concrete Elevated/Steel Viaduct or Bridge Below-Grade/Retained Cut Below-Grade Cut-and-Cover Tunnel Below-Grade Bored or Blasted Tunnel Below-Grade Submerged Tube Controlled Access High Intensity Busway Exclusive Fixed Guideway Exclusive High-Intensity Busway	A-20	Guideway Element	Guideway elements used for rail modes, including elements used in revenue and non-revenue service.				**ONLY APPLIES TO:** Rail modes (Full Reporters)
Transit Way Mileage	Lane Miles		A-20	Lane Miles	The length of a roadway (in miles) dedicated to high occupancy vehicles (HOV) multiplied by the number of traffic lanes. Only pavement normally used should be included, shoulders should not be included, except if shoulders are legally used in peak hours.				**ONLY APPLIES TO:** Rail modes (Full Reporters)
Transit Way Mileage	Linear Miles		A-20	Linear Miles	The length in miles of the route path of track—regardless of multiple track railways over the same area				**ONLY APPLIES TO:** Rail modes (Full Reporters)
Transit Way Mileage	Notes		A-20	Notes	Notes pertaining to a particular asset				**ONLY APPLIES TO:** Rail modes (Full Reporters)
Transit Way Mileage	Other Description		A-20	Other Description	Description of the entity that shares responsibility in the case where it is not another NTD reporter.				**ONLY APPLIES TO:** Rail modes (Full Reporters)
Transit Way Mileage	Percent Agency Capital Responsibility		A-20	Percent Agency Capital Responsibility (%)	The percentage of capital responsibility the agency is responsible for. Transit agencies have direct capital responsibility for assets that they own, jointly own with another entity, or for assets that they are responsible for replacing, overhauling, refurbishing, or conducting major repairs on that asset, or the cost of those activities are itemized as a capital line item in the agency's budget.				**ONLY APPLIES TO:** Rail modes (Full Reporters)
Transit Way Mileage	Power and Signal Elements	Substation Building Substation Equipment Third Rail/Power Distribution Overhead Contact System/Power Distribution Train Control and Signaling	A-20	Power and Signal Element	Power and signal elements used for rail modes, including elements used in revenue and non-revenue service.				**ONLY APPLIES TO:** Rail modes (Full Reporters)
Transit Way Mileage	Responsibility Allocation Units		A-20	Allocation Unit	The unit used to report the elements in age groups. Agencies can report by quantity or percentage for Substation Buildings. The remaining power and signal elements must be reported in age groups by percentage.				**ONLY APPLIES TO:** Rail modes (Full Reporters)
Transit Way Mileage	Shared Capital Responsibility Other Party		A-20	Agency with Shared Responsibility	Other entity that shares capital responsibility for a particular asset in cases where it is shared.				**ONLY APPLIES TO:** Rail modes (Full Reporters)
Transit Way Mileage	Track Elements	Tangent – Revenue Service Curve – Revenue Service Non-Revenue Service Revenue Track – No Capital Replacement Responsibility Double (Diamond) Crossover Single Crossover Half-Grand Union Grade Crossing	A-20	Track Element	Track elements used for rail modes, including elements used in revenue and non-revenue service.				**ONLY APPLIES TO:** Rail modes (Full Reporters)
Transit Way Mileage	Track Miles		A-20	Track Miles	The cumulative length in miles of all track—including multiple track railways over the same area. This should represent the total length of all laid track				**ONLY APPLIES TO:** Rail modes (Full Reporters)
Vehicle Maintenance	Major mechanical system failures		R-20	Major Failures	A failure of some mechanical element that prevents a revenue vehicle from completing or starting a scheduled trip, either because the vehicle's physical movement has been impaired or the mechanical failure created a safety concern.			Major_Failure_Num (2012) Mechanical_Failures (2011)	
Vehicle Maintenance	Other mechanical system failures		R-20	Other Failures	A failure of some other mechanical element of the revenue vehicle that, because of local agency policy, prevents the revenue vehicle from completing a scheduled revenue trip or from starting the next scheduled revenue trip even though the vehicle is physically able to continue in revenue service. Examples include a malfunction in a vehicle's farebox or air conditioner.			Other_Failure_Num (2012) Other_Failures (2011)	
Vehicle Maintenance	Total Revenue Vehicle System Failures		R-20	Total Failures	Sum of Revenue Vehicle Mechanical System Failures, Other Failures			Total_Failures (2012)	