**Instructions and Best Practices for Development and Submittal of Onroad Inputs for the**

**2023 National Emissions Inventory (NEI)**

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U.S. Environmental Protection Agency

Office of Air and Radiation

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# 1    Introduction

The U.S. Environmental Protection Agency (EPA)'s Air Emissions Reporting Rule requires state and local agencies who submit to the National Emissions Inventory (NEI) to submit model inputs (activity) for mobile sources, rather than emissions, in the form of county-specific databases (CDBs). Emissions estimates may be submitted in addition to model inputs, and emissions estimates will still be accepted from tribes without inputs. If you do not submit onroad input data, EPA will generate emission estimates using EPA-developed county-specific inputs.

The EPA's Motor Vehicle Emission Simulator—commonly referred to as MOVES—is a set of modeling tools for estimating air pollution emissions produced by onroad (highway) and nonroad mobile sources. For the 2023 NEI, EPA will use the most current version of the Motor Vehicle Emission Simulator (MOVES) model, MOVES4, to estimate both onroad and nonroad emissions. For onroad mobile sources, MOVES4 is used to generate emission factors, which are then used to calculate onroad emission inventories by multiplying emission factors by the appropriate emission-related activity for each county and SCC. Vehicle population and other types of activity data are ever-changing as new historical data becomes available and new projections are generated. The EPA receives MOVES CDBs from many state and local (S/L) air agencies to populate the various MOVES inputs. The EPA also develops a set of input activity that is used for S/L areas that do not provide MOVES CDBs or for S/L areas that provide partial or outdated data in the CDBs. This document is meant to serve both as instructions and a guide to best practices when developing S/L CDBs for the NEI. Further information on development of data for use by MOVES4 is provided in the EPA document, "Population and Activity of Onroad Vehicles in MOVES 4", (EPA-420-R-23-005, August 2023). Some changes with MOVES4 over previous versions of MOVES that affect CDB submissions include:

- No need to estimate ramp fractions,
- Source type 41 is now "Other Buses" (non-school, non-transit), rather than "Intercity Buses," and
- A few additional source and fuel type combinations are allowed (e.g., "Other Buses" can be gasoline, diesel, or CNG; instead of just diesel).

# 2    Overview of Onroad Inventory Preparation

Onroad mobile source emissions result from motorized vehicles operating on public roadways. These include passenger cars, motorcycles, minivans, sport-utility vehicles, light-duty trucks, heavy-duty trucks, and buses. The sources are further divided by the fuel they use, including diesel, gasoline, E-85, compressed natural gas (CNG), and electric vehicles. The sector characterizes emissions from parked vehicle processes (e.g., starts, hot soak, and extended idle) as well as from on-network processes (i.e., from vehicles as they move along the roads). Except for California, all onroad emissions are generated using the SMOKE-MOVES framework that leverages MOVES-generated emission factors, county and SCC-specific activity data, and hourly meteorological data. The onroad source classification codes (SCCs) in the modeling platform and MOVES are more finely resolved than those in the National Emissions Inventory (NEI). The NEI SCCs distinguish vehicles and fuels while the SCCs used in the modeling platform and

MOVES also distinguish between emissions process (e.g., running exhaust, start exhaust and evaporative emissions), and road types.

Figure 2-1 shows the data flow used to create an onroad emissions inventory. The emission rate (i.e., "lookup") tables input to SMOKE-MOVES are generated by MOVES. These tables differentiate emissions by process, fuel type, vehicle type, road type, temperature, speed, hour of day, and day of week. To generate the MOVES emission rates that could be applied across the U.S., MOVES is run to produce emission factors for a series of temperatures and speeds for a set of "representative counties," to which every other county in the country is mapped. Representative counties are used because it is impractical to generate a full set of emission factors for the more than 3,000 counties in the U.S. The representative counties for which emission factors are generated are selected according to their state, elevation, fuels used in the region, vehicle age distribution, and inspection and maintenance programs. Every county in the country is then mapped to a representative county based on its similarity to the representative county with respect to those attributes. For vehicle age distributions and fuel types, rather than choose values specific to each representative county, a weighted average was computed for all counties represented by each representative county, and the mean of those averages was used.
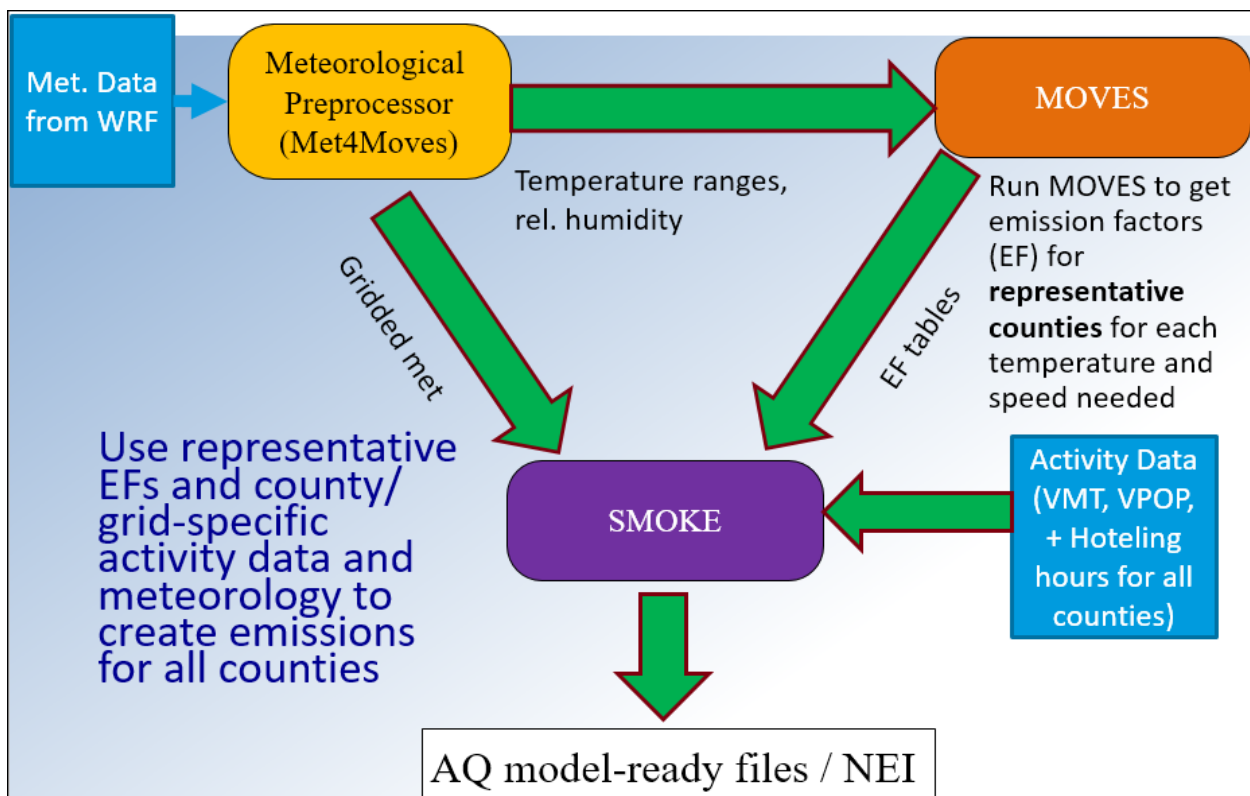


**Figure 2-1. Schematic of Onroad Inventory Preparation**

This document addresses submitting onroad MOVES4 CDB inputs only. For information on submitting MOVES4-Nonroad CDBs, see the companion document "Instructions for Submitting MOVES4-Nonroad Inputs to the 2023 National Emissions Inventory (NEI)."

The MOVES4 default database includes significant updates to many county-specific input tables including fuels and inspection and maintenance (I/M) program data and these data should be used instead of the data from earlier versions of MOVES. EPA recommends that data submitters use local county-specific data for activity, fleet information, speeds, and temporal profiles if local data are available. Any local data originally derived for use with versions of MOVES3 or earlier would likely need to be updated as well. EPA recommends creating new input databases using MOVES4 rather than attempting to convert and update existing input databases. EPA has created a set of 2023 starting point CDBs for S/L agencies to download and optionally replace certain tables where local data is available. The starting point CDBs are already formatted for MOVES4, so agencies do not need to use any conversion tools if working from these. The starting point CDBs contain entirely placeholder data from the MOVES4 database and in most cases, these tables do not represent final "EPA default" data for NEI. Note: onroad CDB submissions must be checked using a quality assurance (QA) script (provided by EPA) that is specific to MOVES4.

> *Tip: the CDBs for the 2023 NEI are not due from states until January 2025. EPA published a set of CDBs in MOVES4 format that the states can start from for their submissions.*

MOVES4 inputs must be submitted to the EPA Emissions Inventory System (EIS) for each county as a CDB, which consists of a set of MariaDB database tables specifically formatted to store county-specific inputs for MOVES4. The emissions in the NEI are developed for all months of the year and all counties in every state, plus the District of Columbia, Puerto Rico, and US Virgin Islands. This means that EPA will need to have county-level information for every county. For the NEI, MOVES4 will be run at the county scale, which requires a separate CDB for each county that contains the data specific to that county.

Since the MOVES4 inputs are county-based, tribal agencies should run MOVES4 and submit emissions. However, tribal agencies may use the input information from adjacent counties to prepare local inputs that may be suitable for their tribal area MOVES4 runs.

On a county-by-county basis, agencies can change the CDBs as needed to reflect their own input data, or they may choose to use the EPA-provided default inputs. Agencies must check their CDBs prior to submittal using the provided QA Tool that will generate a QA Report to include with submittals. Agencies should submit their CDB submittal package to the EIS QA environment to confirm there are no errors prior to submitting to the production environment. Agencies that want to accept EPA's defaults and submit nothing may do so via a 'support request' message that states that intent, through the EIS gateway.

> *Tip: Indicate in your submittal checklists which tables contain any local data, using footnotes to indicate any limitations or caveats (e.g., local data age distributions for only certain source types).*

The following sections describe how to create/revise onroad CDBs, QA check them, and submit them to EIS.

Supporting tools and files referenced here can be downloaded from the 2023 onroad supporting data FTP site.

## 3    MOVES4 Onroad County Database Content

States are asked to supply the CDB tables listed in Table 3-3-1. MOVES CDB Tables and Contents below, with a focus on those marked as Medium and High priority for the NEI. Table 3-3-1 indicates the contents of the CDBs and the data EPA plans to use as defaults. Note that the values in the 2023 starting point CDBs are largely a placeholder developed from the MOVES4 database; the EPA default data will be developed later during the 2023 NEI process. It is expected that states will have more accurate information in many cases than MOVES4 placeholder values and EPA default data, so we encourage submittals.

The CDB tables should contain the complete set of information needed to run MOVES4 for all the vehicles in a county for all months of a single calendar year (2023) using county-specific information.

As stated in the section above, starting point 2023 CDBs based on MOVES4 are available here: https://gaftp.epa.gov/air/nei/2023/doc/supporting_data/onroad/initial_CDBs/. These CDBs may be used by states as a starting point for generating CDBs to provide to EPA or states may provide CDBs created independently using MOVES4.

Downloaded CDBs are stored in a MySQL/MariaDB database format. So, if the user has any MySQL experience, it is straightforward to open the database in a MySQL user interface tool (e.g., MySQL Workbench, HeidiSQL administration tool, etc.) to open any MySQL databases. For those without hands-on MySQL knowledge, the County Database Manger (CDM) feature, which is integrated into the MOVES user interface has CDB data import/export features, interfacing with Microsoft Excel. The MOVES4 CDM also provides quality assurance checks on messages that S/L areas may import, which can be very helpful. For a state with a large number of databases, S/L areas may find it more efficient to use the MOVES CDM sparingly to check one county's data inputs but rely on HeidiSQL or other means to efficiently update CDBs for an entire state. The details of how to use the CDM can be found in MOVES training materials:

- o   Go to https://www.epa.gov/moves/moves-training-sessions

- o   Scroll-down to "MOVES4 Hands-on Training Course."

Any CDBs submitted to EIS for the 2023 NEI should be complete and ready to run for the calendar year 2023.

> *Tip: The EIS Production Submission Window opens for S/L submittals 7/1/24. S/Ls last day for EIS submittal of Point, Onroad Mobile, Nonroad Mobile and Events data category emissions is 1/15/2025. More information can be found here:*
>
> *https://www.epa.gov/air-emissions-inventories/2023-national-emissions-inventory-nei-documentation*

Table 3-1 contains many tables that are marked as "Not needed" to be supplied by agencies. For example, EPA uses refinery production compliance data to develop the fuel supply. S/Ls are therefore not expected to supply fuel property information. The EPA uses meteorological data derived from the Weather Research and Forecasting (WRF) model to develop MOVES4-ready meteorological inputs. S/Ls are therefore not expected to populate fuelformulation, fuelsupply, or zonemonthour tables in their submitted CDBs. For more information on table information see the MOVES GitHub site.

**Table 3-1. MOVES CDB Tables and Contents**

| CDB Tables | Description of Content | EPA-Default CDB Table Content | Priority Level for NEI |
|---|---|---|---|
| auditlog** | Information about the creation of the database | | Not needed |
| avft** | Sales fractions of all fuel types | The starting point CDBs have national average MOVES4 placeholder values. EPA defaults for NEI will likely come from 2023 county-level registration data. | Low (EPA has a good source) |
| avgspeeddistribution | Average speed distributions. See Section 6.6 for more information. | Starting point CDBs have national average placeholder values for this table that will change when 2023-specific activity data become available. | Low (EPA has a good source) |

| CDB Tables | Description of Content | EPA-Default CDB Table Content | Priority Level for NEI |
|---|---|---|---|
| county | Description of the county | MOVES4 database. | Not needed |
| countyyear* | Description of the Stage 2 program | EPA's starting point CDBs do not include this table and it is not required for a county-scale run. S/L agencies may optionally provide this data if local data is different than MOVES4. | Not needed |
| dayvmtfraction | VMT distribution across the type of day. | Data specific to the county or a group of similar counties. This may be default data until 2023-specific data become available. | High |
| emissionratebyage* | Emission rates to reflect adoption of California emission standards. | EPA will populate the EmissionRateByAge tables for some counties using the appropriate data described in the guidance for states adopting California emission standards. See notes below *** | Not needed

(EPA already accounts for this) |
| fuelformulation | Fuel properties | EPA's starting point 2023 CDBs already have placeholder values for this table. Final NEI data will come from 2023 refinery data. | Not needed |
| fuelsupply | Fuel differences by month of the year | EPA's starting point 2023 CDBs already have placeholder values for this table. Final NEI data will come from 2023 refinery data. | Not needed |
| fuelsupplyyear* | Year for the fuel properties | Set to 2023 in CDBs or can leave it blank. | Not needed |
| fuelusagefraction | Fuel use by flexi-fuel vehicles. | Based on EPA estimates for 2023. EPA's starting point CDBs already have values for this table from MOVES4 that will likely remain the final 2023 values. S/L agencies may override these with local data. | Not needed |

| CDB Tables | Description of Content | EPA-Default CDB Table Content | Priority Level for NEI |
|---|---|---|---|
| hotellingactivitydistribution** | Distribution of hotelling hours using extended idle or auxiliary power units. | Based on EPA estimates for 2023. EPA will consider submitted hotelling activity distributions in place of EPA estimates. This table is empty in the starting point CDBs and is not required to be filled by S/L agencies. | Low |
| hotellingagefraction | Allocates hotelling activity across vehicle ages | Empty (using national average EPA estimates). | Not needed |
| hotellinghourfraction | Allocates hotelling activity by day type across hours of the day | Empty (using national average EPA estimates). | Not needed |
| hotellinghoursperday | Hours of hotelling by day type.<br><br>See Section 6.2 for further information. | County-specific hours for 2023. EPA will consider submitted hotelling hours in place of EPA estimates. This table is empty in the starting point CDBs and is not required to be filled by S/L agencies. | Not needed |
| hotellingmonthadjust | Adjusts hotelling activity by month | Empty (using national average EPA estimates). | Not needed |
| hourvmtfraction | VMT distribution across the hours of the day. See Section 6.8 for more information. | EPA's starting point CDBs have national average placeholder values for this table that will change when 2023-specific activity data become available. | High |
| hpmsvtypeday** | Daily VMT by HPMS vehicle type<br><br>Alternate method of providing VMT by HPMS vehicle types, day types, and months. | This table is empty in EPA's starting point CDBs because the SourceTypeYearVMT table is used. | High<br><br>(Note: only 1 of the 4 VMT tables should be populated) |
| hpmsvtypeyear** | Total annual VMT by HPMS vehicle type<br><br>Alternate method of providing VMT by HPMS vehicle type. | This table is empty in EPA's starting point CDBs because the SourceTypeYearVMT table is used. EPA default VMT in the NEI will likely come from 2023 FHWA data | High<br><br>(Note: only 1 of the 4 VMT tables should be populated) |

| CDB Tables | Description of Content | EPA-Default CDB Table Content | Priority Level for NEI |
|---|---|---|---|
| | | and other sources. States may provide VMT estimates by MOVES4 source type in SMOKE format directly for use in the 2023 NEI. | |
| idledayadjust** | Adjusts off-network idling activity by day type | Empty (using national average EPA estimates). | Not needed. |
| idlemodelyeargrouping** | Total amount of off-network idling activity as a fraction of source hours operating by source type and model year range | Empty (using national average EPA estimates). | Not needed. |
| idlemonthadjust** | Adjusts off-network idling activity by month | Empty (using national average EPA estimates). | Not needed. |
| imcoverage | Description of the Inspection and Maintenance program | I/M program description in the starting point CDBs is from MOVES4 database for the year 2023. Update only if this data needs correction. | High |
| monthvmtfraction | VMT distribution across the months of the year. | The starting point CDBs have national average MOVES4 placeholder values. EPA defaults for NEI will likely come from 2023-specific activity data when it becomes available. | High (Capture pandemic recovery) |
| onroadretrofit** | Emission adjustments to reflect local retrofit programs. | Empty (no retrofits assumed). | Not needed |
| roadtypedistribution | VMT distribution across the road | The starting point CDBs have national average | High |

| CDB Tables | Description of Content | EPA-Default CDB Table Content | Priority Level for NEI |
|---|---|---|---|
| | types. See Section 6.5 for more information | MOVES4 placeholder values. EPA default for the NEI will by county-specific and likely come from 2023 FHWA data and other sources. | |
| sourcetypeagedistribution | Distribution of vehicle ages. See Section 6.3 for more information. | The starting point CDBs have national average MOVES4 placeholder values. EPA defaults for NEI will likely come from 2023 county-level registration data. | High |
| sourcetypedayvmt** | Daily VMT by source type.

Alternate method to provide VMT by source types, day types, and months. | This table is empty in EPA's starting point CDBs because the SourceTypeYearVMT table is used. | High

(Note: only 1 of the 4 VMT tables should be populated) |
| sourcetypeyear | Vehicle populations | The starting point CDBs have year 2022 placeholder values. EPA defaults for NEI will likely come from 2023 county-level registration data. | High |
| sourcetypeyearvmt | Total annual VMT by source type.

Preferred method to provide VMT by source types. | The starting point CDBs have year 2022 placeholder values. EPA default VMT in the NEI will likely come from 2023 FHWA data and other sources. | High

(Note: only 1 of the 4 VMT tables should be populated) |
| starts** | Number of engine starts | Empty (using national average EPA estimates). | Not needed |
| startsageadjustment** | Adjustment factors to reflect differences in starts per day by age. | Empty (using national average EPA estimates). | Not needed |
| startshourfraction** | Distribution of starts by hour of the day | Empty (using national average EPA estimates). | Not needed |
| startsmonthadjust** | Variation of the starts per vehicles by month. | Empty (using national average EPA estimates). | Not needed |

| CDB Tables | Description of Content | EPA-Default CDB Table Content | Priority Level for NEI |
|---|---|---|---|
| startsperday** | Engine starts per day/hour per vehicle. | Empty (using national average EPA estimates). | Not needed |
| startsopmodedistribution** | Engine soak distributions. | Empty (using national average EPA estimates). | Not needed |
| startsperdaypervehicle** | Engine starts per day per vehicle. | Empty (using national average EPA estimates). | Not needed |
| state | Description of the state | MOVES4 database | Not needed |
| totalidlefraction** | Total amount of off-network idling activity as a fraction of source hours operating by source type, model year range, month, and day type | Empty (using national average EPA estimates). | Not needed |
| year | Year of the database | Set to 2023. | Not needed |
| zone | Allocations of starts, extended idle and vehicle hours parked to the county | Allocations must all be 1.0 (100%). This data should <u>not</u> be changed. | Not needed |
| zonemonthhour** | Temperature and relative humidity values | EPA will use WRF meteorology for the NEI, so states do not need to populate this table. | Not needed |
| zoneroadtype | Allocation of road types to the county | Allocations must all be 1.0 (100%). This data should not be changed. | Not needed |

*Tables that are not created by MOVES County Database Manager (CDM), but are generated as empty tables by the QA tool that checks CDBs for EIS submittal

**Tables that can be empty but must be present in EIS submittal

*** The following states are given early NLEV programs in the EPA defaults:

- Connecticut (9)
- Delaware (10)
- District of Columbia (11)
- Maryland (24)
- New Hampshire (33)
- New Jersey (34)
- Pennsylvania (42)
- Rhode Island (44)
- Virginia (51)

EPA accounts for the 13 states who've adopted LEV standards: California (6), Connecticut (9), Delaware (10), Maine (23), Maryland (24), Massachusetts (25), New Jersey (34), New York (36), Oregon (41), Pennsylvania (42), Rhode Island (44), Vermont (50), and Washington (53).

MOVES table descriptions can also be found on the GitHub site:

https://github.com/USEPA/EPA_MOVES_Model/blob/master/docs/MOVESDatabaseTables.md

## 4    Data used to generate MOVES CDBs

MOVES CDBs may include the following input data: vehicle miles traveled (VMT), vehicle population, vehicle starts, average speed distribution, fuels, hotelling, age distributions, hourly average speed profiles, VMT fraction (by month, day, hour, and road type), inspection and maintenance (I/M) program descriptions, and Stage II refueling program effectiveness. States often develop some of these inputs based on output data from their state departments of transportation, which may include travel demand model data. The EPA also develops a set of default input values to use in the event a state does not supply inputs. These input values will be developed later in the NEI process, so are not present in the starting point CDBs that contain mostly MOVES4 default information. For NEI defaults, the EPA uses data from various sources and studies (e.g., FHWA, IHS (registration data), and StreetLight (telematics data) to create a set of CDBs for inputs not provided by the S/Ls. Figure 4-1 shows state and local regions in dark blue that submitted CDBs for the 2020 NEI. California is the exception; they use their own model and send emissions to EPA. There are also a few tribes that send emissions to EPA instead of CDBs.
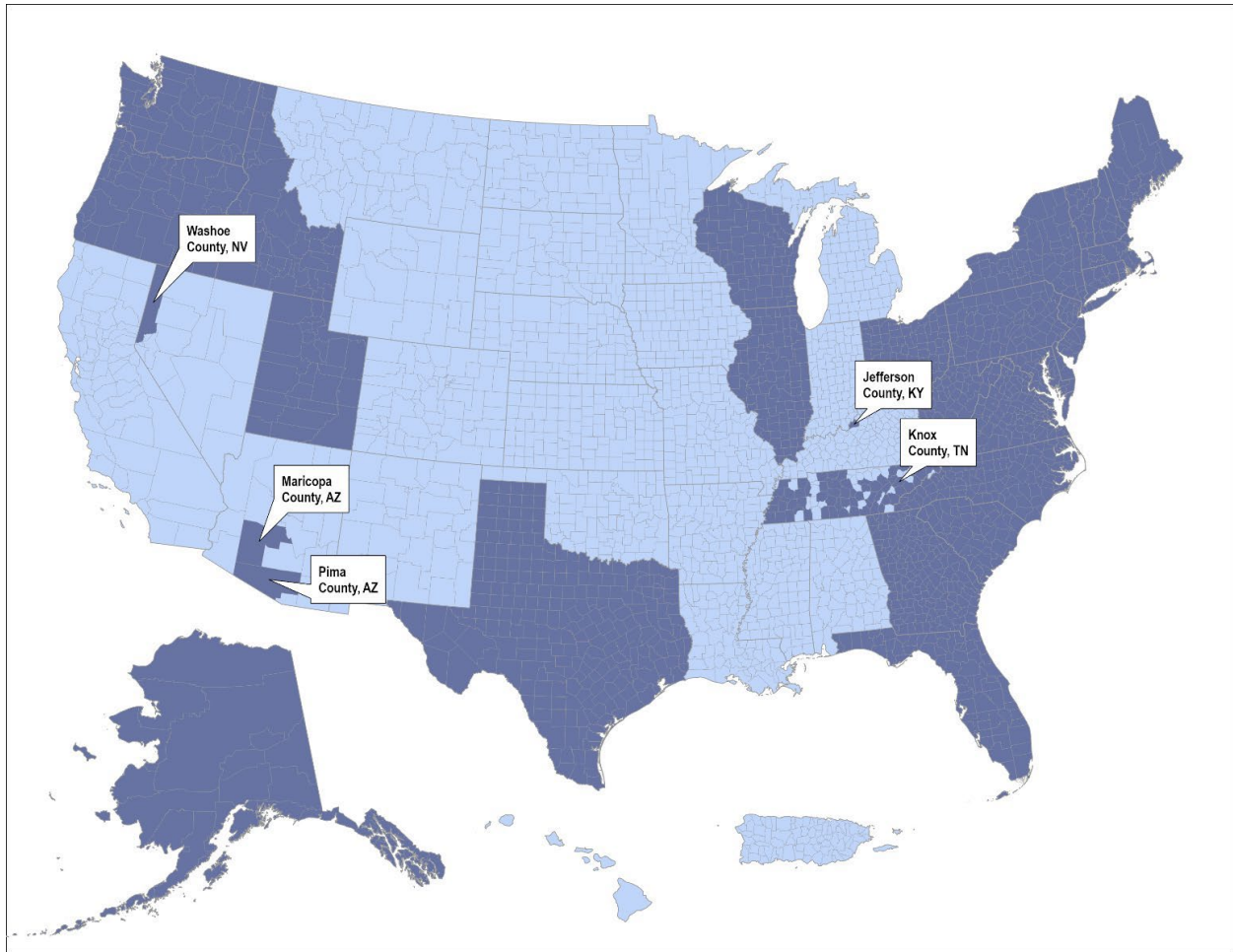
**Figure 4-1. State/Local Submitted Data for 2020 NEI Shown in Dark Blue**

Note that not all states submit data for all counties and/or MOVES inputs. Figure 4-2 provides a snapshot of the number of counties within each submitting state that submitted data in the identified MOVES tables for the 2020 NEI. The complete table for all submitting agencies can be found in the 2020 NEI Technical Support Document (TSD), Section 5 Onroad Mobile.

| statename | avft | avgspeeddistribution | county | dayvmtfraction | fuelformulation | fuelsupply | fuelusagefraction | hotellingactivitydistribution | hotellingagefraction | hotellinghourfraction | hotellinghoursperday | hotellingmonthadjust | hourvmtfraction | hpmsvtypeday | hpmsvtypeyear | idledayadjust | idlemodelyeargrouping | idlemonthadjust | imcoverage | monthvmtfraction | onroadretrofit | roadtypedistribution | sourcetypeagedistribution | sourcetypedayvmt | sourcetypeyear | sourcetypeyearvmt | starts | startsageadjustment | startshourfraction | startsmonthadjust |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Alaska | 29 | 29 | 29 |  |  |  |  |  |  |  |  |  |  |  | 29 |  |  |  |  |  |  | 29 | 29 |  | 29 |  |  |  |  |  |
| Connecticut |  | 8 |  | 8 |  |  | 8 |  |  |  |  |  | 8 |  | 8 |  |  |  | 8 | 8 |  | 8 | 8* |  | 8* |  |  |  |  |  |
| District of Columbia |  | 1 | 1 | 1 |  | 1 |  |  |  |  |  |  | 1 |  | 1 |  |  |  | 1 | 1 |  | 1 | 1 |  | 1 |  |  |  |  |  |
| Delaware | 3 |  |  |  |  |  | 3 |  |  |  |  |  |  |  |  |  |  |  | 3 | 3 |  |  | 3 |  | 3 | 3 |  |  |  |  |
| Florida |  | 67 |  |  |  |  |  |  |  |  |  |  | 67 |  | 67 |  |  |  | 67 |  |  | 67 | 67 |  | 67 |  |  |  |  |  |
| Georgia |  |  |  | 159 |  |  |  |  |  |  |  |  | 159 |  | 159 |  |  |  | 13 | 159 |  | 159 | 159 |  | 159 |  |  |  |  |  |
| Idaho | 44 | 44 |  | 44 |  |  |  |  |  |  |  |  | 44 |  | 44 |  |  |  | 44 | 44 |  | 44 | 44 |  | 44 |  |  |  |  |  |
| Illinois | 102 |  | 102 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | 11 |  |  |  | 11* |  | 102 | 102 |  |  |  |  |
| Knox Co. TN |  | 1 |  | 1 |  |  |  |  |  |  |  |  | 1 |  | 1 |  |  |  | 1 | 1 |  | 1 | 1 |  | 1 |  |  |  |  |  |
| Jefferson Co. KY | 1 | 1 | 1 |  |  |  |  |  |  |  |  |  |  |  | 1 |  |  |  |  |  |  | 1 | 1 |  | 1 |  |  |  |  |  |
| Massachusetts |  |  |  |  |  |  |  |  |  |  |  |  |  |  | 14 |  |  |  | 14 |  |  | 14 | 14 |  | 14 |  |  |  |  |  |
| Maricopa Co. AZ | 1 | 1 | 1 | 1 | 1 | 1 |  |  |  |  |  |  | 1 |  | 1 |  |  |  | 1 | 1 |  | 1 | 1 |  | 1 |  |  |  |  |  |
| Maryland | 24 | 24 |  | 24 |  |  |  |  |  |  |  |  | 24 |  | 24 |  |  |  | 24 | 24 |  | 24 | 24 |  | 24 |  |  |  |  |  |
| Maine |  | 16 |  | 16 |  |  |  |  |  |  |  |  | 16 |  | 16 |  |  |  |  | 16 |  | 16 | 16 |  | 16 |  |  |  |  |  |
| North Carolina |  |  |  |  |  |  |  |  |  |  |  |  |  |  | 100 |  |  |  | 22 |  |  | 100 | 100 |  | 100 |  |  |  |  |  |

**Figure 4-2. Example State Submissions**

After the submission window closes, the EPA merges default data and state-submitted data to come up with a complete set of CDB data for all counties in the US.

## 4.1    County Database Naming Convention

To keep track of the thousands of CDBs used in the NEI calculations, EPA has established a naming convention for CDBs that differentiates between databases and makes automation of running and processing the inputs and outputs from MOVES easier.

The naming convention for each CDB folder has 20 characters. The first 6 characters identify the county, the next 5 indicate the calendar year of the county database, and the last characters indicate the date on which the database was created.

The first 6 characters consist of the letter "c" followed by the 5-digit Federal Information Processing Standard (FIPS) code for the county, including a leading zero when necessary. The next 5 characters are the letter "y", followed by a 4-digit calendar year. This calendar year indicates the calendar year of the data contained in the database. A CDB can only contain data from a single county and calendar year. The last 8 digits, following and underscore character, are the date on which the database was created or last modified in a YYYYMMDD format.

An example of a CDB name is "c26161y2023_20240601" where this CDB names indicates "c26161" refers to the county FIPS code (in this case Washtenaw County, Michigan). "y2023" refers to the calendar year for the county database and "20240601" identifies the database modification date of June 1, 2024, in YYYYMMDD format.

## 5    Steps to Submit CDBs

The steps for submitting CDBs are discussed in more detail in the subsections that follow:

1. Create CDBs
   a. Edit existing CDBs to meet NEI requirements or
   b. Create new CDBs from scratch or
   c. Revise EPA's starting point CDBs that are already in MOVES4 format. (Preferred)
2. Run EPA's MOVES4 QA Tool and revise the CDB as needed until the QA Tool creates a QA report that confirms no errors exist.
3. Create a Checklist that indicates where changes have been made to the starting point CDBs or where local data were provided in S/L-developed CDBs. Please add footnotes as necessary to convey any nuances in how much data is local for a particular table(s). For example, perhaps you only have local data age distributions on school buses, and the other source types were not modified. Please convey this.
4. Provide documentation for the agency-supplied inputs.
5. Submit the files to the EIS.

## 5.1 Creating County Databases (CDBs)

The NEI relies on MOVES runs at the County Scale which requires input CDBs to provide the model with data representative of the county.

There are many ways to create a CDB for submission. We prefer that the submitter start from EPA's 2023 starting point CDBs to perform county specific edits.

> *Tip: Please ensure that the IMCoverage table covers flex-fuel vehicles in addition to gasoline vehicles.*
>
> *Tip: Please ensure that the IMCoverage table contains correct countyIDs.*
>
> *Tip: Please ensure you use the correct table structure (keys, column order, etc.) on all CDB tables. This is guaranteed if you either create CDBs with the MOVES4 County Data Manager or use EPA's starting point CDBs.*

## 5.2 Use the CDB QA Tool to Create a QA Report to include with your Submittal

For Agencies submitting onroad CDBs based on MOVES4, from 2023 onroad supporting data FTP site, the QA Report generated by the QA Tool script verifies all table contents meet range, naming convention, format and other checks. The report confirms that each CDB contains the appropriate number of tables and that the values within those tables are valid. It is very important that the QA tool be properly run for each submitted CDB, because if it is not and the CDB contains errors that are not resolved, the data may not work when we go to generate the NEI and we will need to follow up with you at that time, or we may not be able to use your submitted data.

EIS will check to see that each county listed in this report has an associated CDB in the submission. Only include counties in the QA report that you will be submitting. If the counties in the QA report do not match those in the CDB folder, or if any errors are indicated in the QA report, EIS will indicate a critical error and will not accept the submission. The format is .txt, but this file can be opened as a table using Microsoft Excel to make it more readable.

The QA tool uses tables from the default MOVES onroad database that was distributed with MOVES4.0.1. If you do not have MOVES4.0.1 installed, you will need to install it. The following subsection describes the commands for using the QA tool. For complete instructions it is recommended to view NEI QA Instructions on the GitHub site.

### 5.2.1  Command Line Interface

The CDB QA tool can be run on an individual CDB or list of many CDBs using a Windows command prompt window and entering commands built into MOVES. To use MOVES' command line tools, first open the Windows command prompt and navigate to the MOVES installation directory (likely C:\Users\Public\EPA\MOVES\MOVES4.0). Then, run the command setenv. For more information on using MOVES' command line for CDB QA refer to NEI QA Instructions, and for other command line tools see CommandLineMOVES.md. The Ant command to run the NEI QA script is onroadNEIQA, and the Ant command to run the nonroad NEI QA script is nonroadNEIQA. Inputs to the commands are specified by the following flags:

| Flag | Behavior | Examples |
|---|---|---|
| -Dinput | There are three types of input allowed: 1. A single input database 2. A comma-separated list of databases, wrapped in quotes 3. A .txt file with a list of databases, one on each line | 1. -Dinput=c12345y2023_20240314 2. -Dinput="c12345y2023_20240314,c23456y2023_20240314" 3. -Dinput=db_list.txt |
| -Doutput | A file to write the QA results to. Accepted formats are: * .xlsx or .xls for spreadsheet output * .csv for comma-separated output * .txt or .tab for tab-separated output This input does not need | 1. -Doutput=PSC_QA_Report.xlsx 2. -Doutput="PSC QA Report.csv" 3. -Doutput=PSC_QA_Report.txt |

| | to be wrapped in quotes unless there are spaces or commas in the filename. | |
|---|---|---|

For input option #3 above, databases need to be separated by a new line. The following would be a valid db_list.txt file:

c12345y2023_20240314

c23456y2023_20240314

Putting everything together, the following are all valid ways of calling the QA scripts:

setenv

ant onroadNEIQA -Dinput=c12345y2023_20240314 -Doutput=PSC_QA_Report.xlsx

ant onroadNEIQA -Dinput="c12345y2023_20240314,c23456y2023_20240314" -Doutput =PSC_QA_Report.csv

ant onroadNEIQA -Dinput=db_list.txt -Doutput=PSC_QA_Report.txt ant

The QA scripts create two new tables in the input database, cdb_checks and qa_checks_log. The contents of cdb_checks are copied to the output file. If multiple databases are run using the tool, they are all combined into one output file. qa_checks_log is used to log the checks that have been performed, so that users can tell how far the script got if something goes wrong.

Name your QA report with your agency Program System Code (PSC), such as "PSC_QA_Report.txt". For example, Delaware's state agency PSC is "DEDNR" and their QA report would be named "DEDNR_QA_Report.txt".

**Figure 5-1. Example of QA Report Results**



In the example in Figure 5-1, there is an error with the AvgSpeedDistribution table. The submission has a distribution that adds to zero (0.0). This entry (i.e., all zeros) can inadvertently eliminate any VMT associated with that combination and cause an incorrect result. The sum of the fractions in the AvgSpeedDistribution table must add to 1.0 for every combination of SourceTypeID, RoadTypeID, and HourDayID, even if the Source Type, Road Type or HourDayID do not have VMT associated with that combination. Never fill distribution tables with zeros. You should use the starting point CDB distribution if no county-specific values are available.

*Tip: Speeds distributions should be different for different vehicles and road types (e.g., vehicles likely spend a higher fraction of time in higher speed bins on rural roads than on urban roads). See Section 6.4 below for further instructions.*

The "status" category may not contain any "Error" entries to successfully pass QA. The report will pass if only these entries appear:

1)      Completed – this indicates a successful check.

2)      Warning – This indicates the user-supplied values that may not have been intended (i.e., distributions that sum to zero), but will not cause MOVES to generate inappropriate results.

3)      Comment – This will indicate that the table contains no user supplied rows to be checked.

Name your QA report with your agency Program System Code (PSC), such as "PSC_QA_Report.txt". For example, Delaware's state agency PSC is "DEDNR" and their QA report would be named "DEDNR_QA_Report.txt".

## 5.3    Create Your CDB Checklist

From the https://gaftp.epa.gov/air/nei/2023/doc/supporting_data/onroad/, download the CDB checklist, "MOVES_Onroad_County_Checklist.xlsx". This spreadsheet will contain rows for every county in the nation. You can trim this list to only include the counties in your state.

This checklist is intended to indicate which tables your agency has revised from EPA's placeholder values with local data for each county's CDB. Please add footnotes as necessary to convey any nuances in the amount of local data in a particular table, for example – local age distributions for only certain source types. The CDB checklist also has a column to allow your agency to indicate counties for which you accept all EPA default estimates for the submittal. Note that the starting point CDBs do not contain EPA defaults for the 2023 NEI; these will be developed later in the NEI development cycle. The checklist you submit should include all the counties in your state, even if you are only submitting CDBs for some of the counties. See Figure 5-2.

**Figure 5-2. CDB Checklist.**

Name your checklist with your agency Program System Code (PSC), such as "PSC_Checklist.xls (or xlsx)". For example, Delaware's state agency PSC is "DEDNR" and their checklist would be named "DEDNR_Checklist.xls".

The purpose of the checklist is to provide a method to determine which parts of the state submission contain new information. This will greatly assist EPA in using this information for making projections to other calendar years.

Figure 5-3 shows an example of a complete agency submittal checklist from a prior NEI. This S/L went above and beyond the detail we ask for and it was very useful to our efforts to streamline the submission and QA processes. We encourage other agencies to use footnotes similar to Figure 5-3, especially if there are any tables with partial local data.

| | County | | | Accept EPA Default Values | auditlog** | avft** | avgspeeddistribution | county | daymtfraction | fuelformulation | fuelsupply | fuelsupplyyear | fuelusagefraction | hotellingactivitydistribution** | hotellinghours** | hourvmtfraction | hpmsvtypeday** | hpmsvtypeyear | imcoverage | importstartssopmodescmbfscrp/imcoverageSIP** | monthvmtfraction | onroadretrofit** | roadtype** | roadtypedistribution | sourcetypeagedistribution | sourcetypedaymt** | sourcetypeyear | sourcetypeyearvmt** | starts** | startshourfraction** | startsmonthadjust** | startsperday** | startssourcefraction** | state | year | zone | zonemonthhour | zoneroadtype | countyyear | emissionratebyage |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| stateid | statename | countyid | countyname | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 9 | CONNECTICUT | 9001 | Fairfield County | | x | m | x | m | x | m | m | m | x | 1 | 1 | x | | x | x | 2 | x | | x | 3 | 3 | | | | | | | | | m | m | m | x | x | x | x |
| 9 | CONNECTICUT | 9003 | Hartford County | | x | m | x | m | x | m | m | m | x | 1 | 1 | x | | x | x | 2 | x | | x | 3 | 3 | | | | | | | | | m | m | m | x | x | x | x |
| 9 | CONNECTICUT | 9005 | Litchfield County | | x | m | x | m | x | m | m | m | x | 1 | 1 | x | | x | x | 2 | x | | x | 3 | 3 | | | | | | | | | m | m | m | x | x | x | x |
| 9 | CONNECTICUT | 9007 | Middlesex County | | x | m | x | m | x | m | m | m | x | 1 | 1 | x | | x | x | 2 | x | | x | 3 | 3 | | | | | | | | | m | m | m | x | x | x | x |
| 9 | CONNECTICUT | 9009 | New Haven County | | x | m | x | m | x | m | m | m | x | 1 | 1 | x | | x | x | 2 | x | | x | 3 | 3 | | | | | | | | | m | m | m | x | x | x | x |
| 9 | CONNECTICUT | 9011 | New London County | | x | m | x | m | x | m | m | m | x | 1 | 1 | x | | x | x | 2 | x | | x | 3 | 3 | | | | | | | | | m | m | m | x | x | x | x |
| 9 | CONNECTICUT | 9013 | Tolland County | | x | m | x | m | x | m | m | m | x | 1 | 1 | x | | x | x | 2 | x | | x | 3 | 3 | | | | | | | | | m | m | m | x | x | x | x |
| 9 | CONNECTICUT | 9015 | Windham County | | x | m | x | m | x | m | m | m | x | 1 | 1 | x | | x | x | 2 | x | | x | 3 | 3 | | | | | | | | | m | m | m | x | x | x | x |

**Tables that can be empty but must be present in EIS submittal

x — Tables were created from scratch using local data instead of using data provided in EPA provided default CDBs

m — Tables were created from scratch using MOVES2014a default data instead of using data provided in EPA provided default CDBs

Notes

1 — Connecticut left these tables blank but CT believes that MOVES2014b defaults are not appropriate and EPA should use their own calculated defaults. We also did not include the 2014 EPA CDB defaults that were provided because, ideally, EPA would calculate an updated 2017 hotellinghours input using the latest available information.

2 — This additional table will be ignored for the 2017 NEI runs, however EPA should use this data for regulated analyses (conformity, etc.) and future year projection analyses. To use this MOVES input EPA would need to rename the table files to "imcoverage" and adjust dates if the MOVES run is for a calendar year other than 2017.

3 — Connecticut provided a sourcetype age distribution that would be appropriate for a conformity analysis using the best available information to us at the time we prepared these inputs for 2017. EPA may update this input with more recent information (e.g. EPA 2017 VIN decode) with the exception of Motorcycles (11) and School Buses (43) which is based on actual local data decoded from a 2017 CT DMV registration pull.

**Figure 5-3. Complete Agency Submittal Checklist**

## 5.4 Documentation

All submissions must include documentation. At a minimum, the documentation should address all of the changes made by the state to the EPA provided CDBs. For each change, the document should state briefly the source of the state supplied information used to populate the CDB. References to other documents with more detail are encouraged.

If you created the CDBs from scratch (not editing the EPA provided CDBs), please document where local data were used and where default data from MOVES were used.

You may include additional documentation files that are referenced by the main documentation. These additional files can be in any format (e.g., .pdf or .xls).

Name your documentation with your agency Program System Code (PSC), such as "PSC_Documentation.doc (or docx)". For example, Delaware's state agency PSC is "DEDNR" and their documentation would be named "DEDNR_Documentation.doc". Any additional files provided can keep their original names and do not need to conform to any standard.

## 5.5 Bundle CDB Submittal Components and Create the XML for EIS Submittal

Once you have prepared the parts of your submittal, you'll need to zip them together in a specific way and reference them with the EIS/CDX required XML file. The CDBs are folders located in the MariaDB/data directory on your system. Once you have completed creating/editing the CDBs for your state, these folders and their contents are to be included in the zip file for submission.

Figure 5-4 below shows that the individual CDBs are zipped into one zip file. That zip file and the remaining parts (QA report, checklist, and documentation) are then zipped into a zip folder.
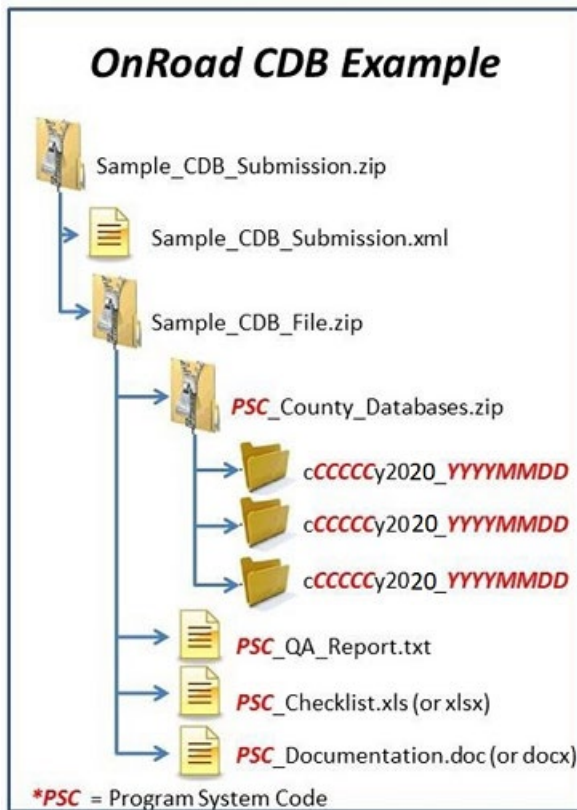


**Figure 5-4. OnRoad CDB Zipping Example**

To create the xml file Use the EIS Access Bridge Tool

1.    Download the "Nonpoint/Onroad/Nonroad Bridge Tool".

2.    Open the file in Microsoft Access.

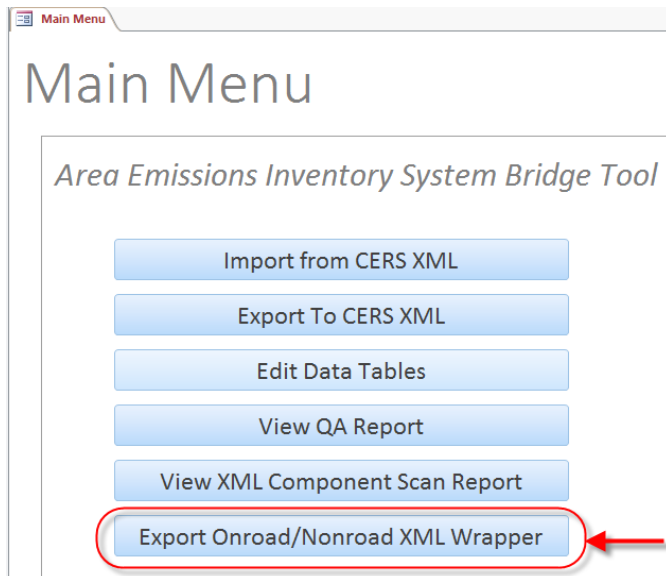3.    Choose the "Export Onroad/NonRoad XML Wrapper" from the Main Menu (Figure 5-5).

**Figure 5-5. Main Menu Bridge Tool**

4.      Fill out the form with the appropriate information Figure 5-6.



**Figure 5-6. CERS XML Wrapper Example**

a. File Location = The name and location where the resulting XML file will be generated.

b. Data Category: Choose "Onroad"

c. Emissions Year: Set to 2023

d. Submission Type: Choose either "QA" or "Production"

e. Activity Database Type: Set to "CDB"

f. Activity Database File: The name of the packaged set of zip files. Using the earlier example: "Sample_CDB_File.zip"

g. User Identifier: Your EIS User ID

h. Author Name: Your name (optional)

i. Organization Name: The name of your organization (optional)

j. Program System Code: The program system code of your organization

k. EPA Dataset: Leave blank

l. Keywords: Any keywords you would like to submit about the document (optional)

m. Comment: Any comments about the document (optional)

5. Press the "Begin Export" button. Your file will be generated to the location specified.

NOTE: Each CDB submittal is a total replacement to any CDBs previously submitted by that agency. Thus, if a state submits every county in one submittal, then submits only one county in a subsequent submittal, only the one county will be present in EIS. You can check the feedback on your submittal in EIS by choosing your agency and the "Feedback Reports" tab as shown in Figure 5-7 below:

**Figure 5-7. EIS Gateway - Agency Organization Detail: Feedback**

# 6 Key Data Sources for Inputs

The Following sections discuss best practices when creating your CDBs. As discussed earlier, the EPA will develop a set of complete CDBs for all counties that includes submitted local data and EPA default data. In the past, EPA defaults included vehicle registration data, from which we derived population, age distribution, and fuel fractions; county-level VMT from FHWA; and vehicle speed distributions and temporal profiles from county specific telematics data. For the 2023 NEI, some temporal profiles may come from the FHWA's Travel Monitoring and Analysis System (TMAS). These inputs will be used where there was no acceptable submitted S/L data. EPA is working toward developing 2023-specific data for these parameters and will keep states informed as to the progress.

## 6.1 Representative Counties

Representative counties are developed based on:

- Their state (counties represent others in the same state),
- Light-duty age distributions,
  - Note: representative county CDBs use a population-weighted average of the member county age distributions.
- Altitude,
- Fuel region, and
- Inspection and maintenance programs.

Figure 6-1 shows the roughly 300 representative counties used for a recent project. These will be reassessed for the 2023 NEI.
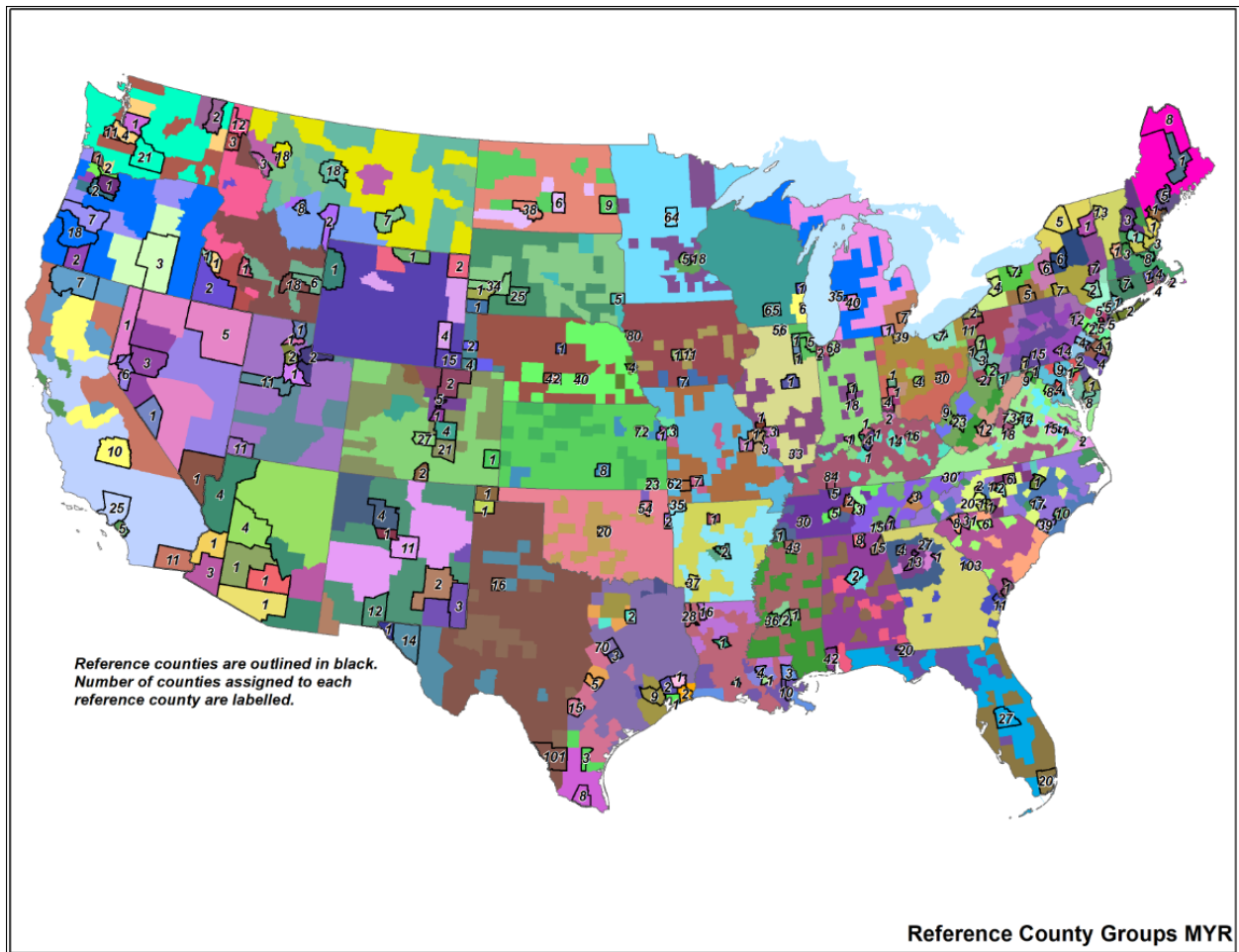
**Figure 6-1. 2020 Representative County Map**

## 6.2    Hotelling Hours Per Day

Hotelling Hours refers to the time spent idling by diesel long-haul combination trucks during federally mandated rest periods of long-haul trips. Submitting agencies have the option to directly provide MOVES with the number of hotelling hours.

> *Tip: Please ensure that `HotellingHoursPerDay` and*
> *`HotellingActivityDistribution` represent the submission year. They may also*
> *be left empty.*

## 6.3    Age Distribution

Age distribution represents the fraction of vehicles by age and source type for calendar year. For S/L submittals it is important that this distribution be representative of the NEI year. Most states

rely on state vehicle registrations to determine age distribution. The EPA has found that if the data pull occurs too early in the calendar year, newer model cars will not have had the chance to infiltrate the vehicle population and the age distribution may be weighted toward older vehicles, which may result in unrealistically higher mobile emissions. The EPA suggests pulling the vehicle registrations mid-year (around July 1). EPA expects that agency-submitted age distributions developed from DMV data may differ from EPA defaults developed from nationally compiled county-level registration data. Figure 6-2 shows a comparison between an S/L submitted age distribution showing relatively fewer newer vehicles (and a larger fraction of older vehicles) compared to the EPA developed age distributions. EPA will consider all agency submitted age distributions and accept them as long as they contain realistic features. The EPA develops age distributions for all counties and for representative counties, where the latter is a population-weighted average of member counties' age distributions. Long-haul trucks are an exception to the county group averaging; they reflect national averages because long-haul trucks frequently travel across many states.



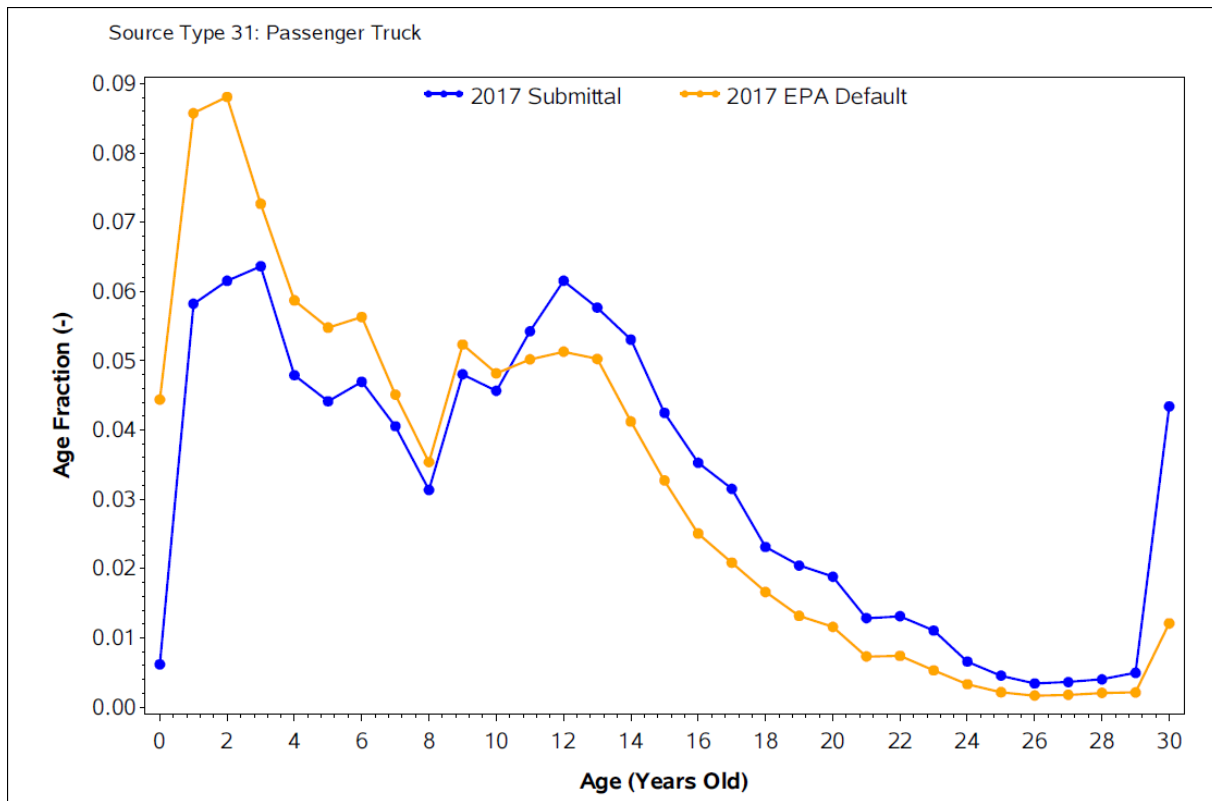**Figure 6-2. 2017 Age Distribution Example**

Age distribution was found to be a key parameter that impacted mobile emissions in past emissions modeling platforms. Many states provided age distributions with issues such as outdated year for age distribution draw (e.g., 2017), light-duty vehicle recession "dip" shifted by several years away from the actual recession year of 2009, or unrealistically high fraction of

older (or newer) vehicles. States should also consider using 2023 nationwide EPA defaults for long-haul trucks because they drive long distances from the counties and even states in which they are registered. The EPA default long haul truck age distributions will be shared with agencies through the MJO MOVES workgroup later on in the NEI development process.

## 6.4   Hourly Average Speed Distribution

Average speed is the distance traveled (in miles) divided by the time (in hours). EPA default speed distribution profiles in the 2023 NEI will be derived from Connected Vehicle Data (data generated by vehicles that are equipped with internet connectivity and onboard sensors) and GPS-based telematics data at the county level with differences for light-duty personal vehicles, medium-duty commercial trucks, and heavy-duty commercial trucks.

The EPA urges users to develop the most detailed local speed information that is reasonable to obtain. The speed distributions must vary by road type, hour, and weekday/weekend, and it is desirable that they also vary by source type (or groups of source types) though vehicle specificity is not always possible. Some of the less desirable features in the submitted speeds included:

- Zero time in bin 1 (speeds 0 to 2.5 mph), even on unrestricted roads where vehicles have to come to a stop at lights or stop signs (surface streets with intersections)
- Speed distributions that were the same for all source types
- No variation in speeds by hour of day or weekday/weekend
- No variation in speeds by road type

Speeds distributions should be different for different vehicles and road types (e.g., vehicles likely spend a higher fraction of time in higher speed bins on rural roads than on urban roads). If speed distributions are not realistic, EPA will not accept the submitted data because the EPA default data likely better represents average speeds in the area. Table 6-1 displays the speed bins in MOVES. Speed fractions need to sum to 1 over the 16 bins for each combination of county, road type, and vehicle type.

**Table 6-1. MOVES Speed Bins**

| Bin | Midpoint (mph) | Range |
|-----|----------------|-------|
| 1 | 2.5 | speed < 2.5mph |
| 2 | 5 | 2.5mph <= speed < 7.5mph |
| 3 | 10 | 7.5mph <= speed < 12.5mph |
| 4 | 15 | 12.5mph <= speed < 17.5mph |
| 5 | 20 | 17.5mph <= speed <22.5mph |
| 6 | 25 | 22.5mph <= speed < 27.5mph |
| 7 | 30 | 27.5mph <= speed < 32.5mph |
| 8 | 35 | 32.5mph <= speed < 37.5mph |
| 9 | 40 | 37.5mph <= speed < 42.5mph |
| 10 | 45 | 42.5mph <= speed < 47.5mph |
| 11 | 50 | 47.5mph <= speed < 52.5mph |
| 12 | 55 | 52.5mph <= speed < 57.5mph |
| 13 | 60 | 57.5mph <= speed < 62.5mph |
| 14 | 65 | 62.5mph <= speed < 67.5mph |
| 15 | 70 | 67.5mph <= speed < 72.5mph |
| 16 | 75 | 72.5mph <= speed |

Figure 6-3 shows an 8 am speed distribution for an urban non-freeway. The fraction of time spent in the 16 speed bins sums to 1 for this hour example (and for each hour). Notice that the state submitted data (purple) has the same profile for all source types, whereas the CRC A-100 data distinguishes between light duty, medium, and heavy duty. This particular submittal in Figure 6-3 captures time spent at bin 1 speeds (0 to 2.5 mph). Unfortunately, sometimes travel demand model (TDM) based approaches will average over links using already-averaged hourly speeds, and this can miss the lowest speed bins. Emissions are sensitive to speed, and particularly lower speed.

As mentioned above, EPA default speed distribution profiles in the 2023 NEI will be derived from Connected Vehicle Data (data generated by vehicles that are equipped with internet connectivity and onboard sensors) and GPS-based telematics data at the county level with differences for light-duty personal vehicles, medium-duty commercial trucks, and heavy-duty commercial trucks.

Regarding speed differences by vehicle type, different classes of vehicles drive the same speeds on the same road, with perhaps the exception of reduced speed limits for trucks in the rightmost lane of some freeways. The MOVES road type "Unrestricted Access" includes a broad group of road types such as arterials, collectors, and small local roads. Analysis of telematics data (e.g., CRC A-100) shows that HDVs tend to have faster overall speeds than passenger cars and trucks on Unrestricted Access road types, likely because they are traveling more on the faster arterial as opposed to the residential roads.
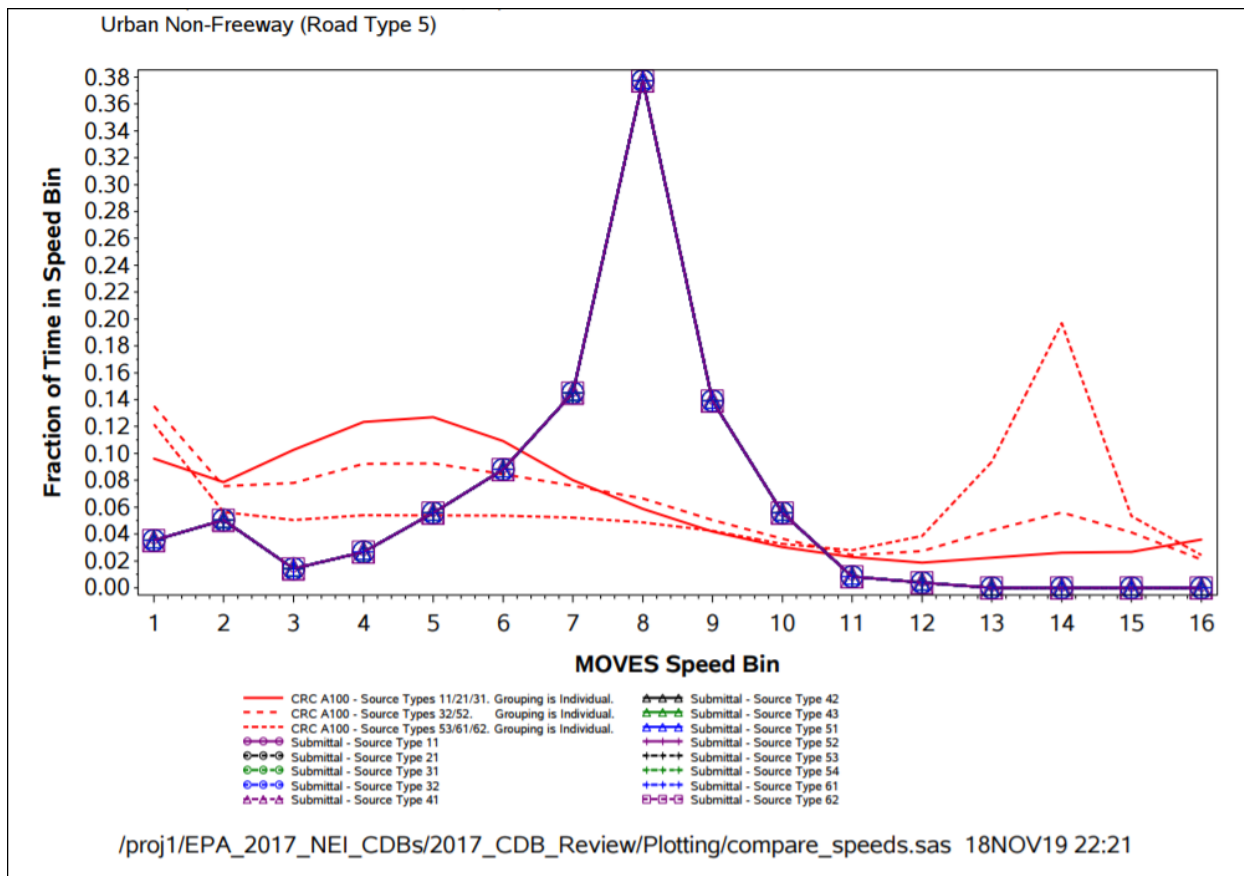
**Figure 6-3. Speed Distribution Example**

## 6.5 VMT Distribution by Road Type

The fraction of VMT by road type varies from area to area and can have a significant effect on overall emissions from onroad mobile sources. For each source type, the RoadTypeVMTFraction field in the RoadTypeDistribution table stores the fraction of total VMT for each source type that is traveled on each of the MOVES four road types. Figure 6-4 illustrates where a few states submitted non-zero values for VMT in counties that did not have rural restricted road type. Although this figure is from the 2016 platform, submittals were similar for the 2017 NEI. Erroneous gap filling should be avoided. Road type VMT should be county-specific and based on the actual road network within that county. In order to avoid unrealistic vehicle activity and emissions appearing to be distributed across an entire state, county-specific road type distributions should be supplied to EPA.

> *Tip: Please do not provide empty tables for the `roadTypeDistribution` tables. Please ensure that the values in the `RoadTypeDistribution` table sum to one for all source types.*
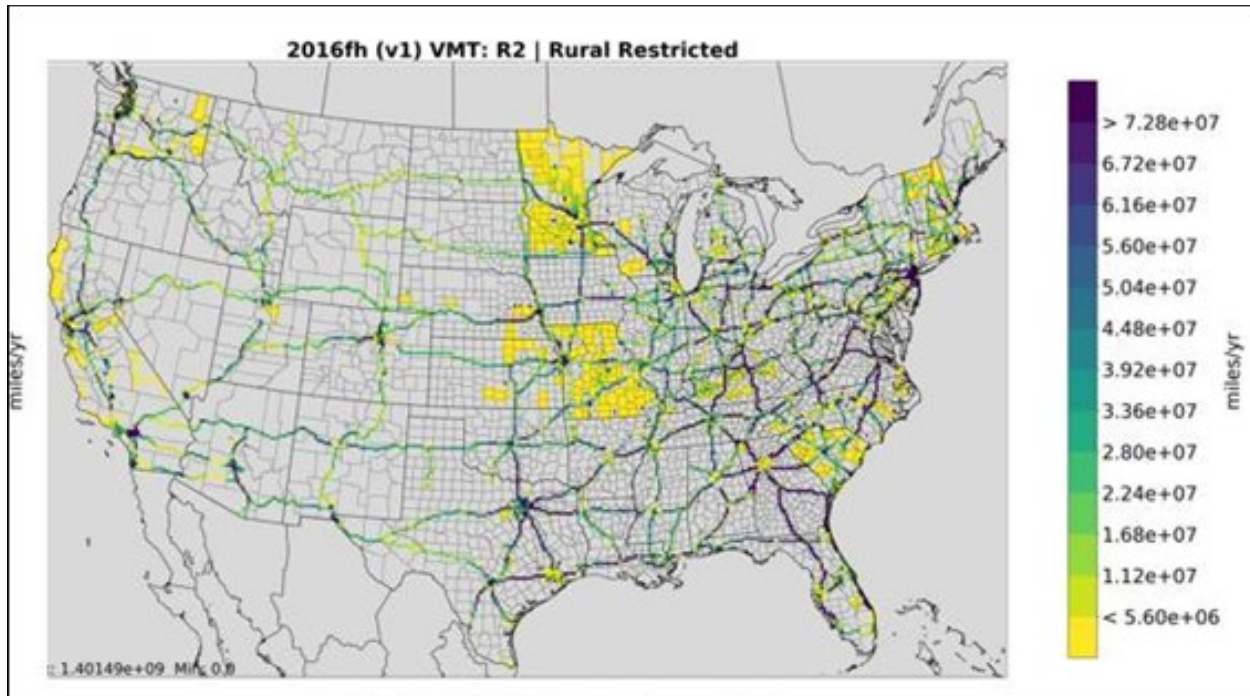
**Figure 6-4. VMT Distribution Example**

## 6.6    Average Speed Distribution

Average speed is used in MOVES to convert VMT inputs into the source hours operating units that MOVES uses for internal calculations. It is also used to select appropriate driving cycles, which are then used to calculate exhaust running operating mode distributions. Hourly speed profiles should vary by weekday versus weekend and by road type. Figure 6-5 is an example where the submitted state data held three road types at a constant speed, while variation was shown with the CRC A-100 data. Distributions should reflect AM and PM congestion/rush hour slowdowns in counties where such slowdowns exist. Please note that the EPA will not accept average speed profiles in 2023 that are identical for weekdays and weekends.

County ID = 24039. Maryland: Somerset
URBAN (Salisbury; MD-DE)
Weekday
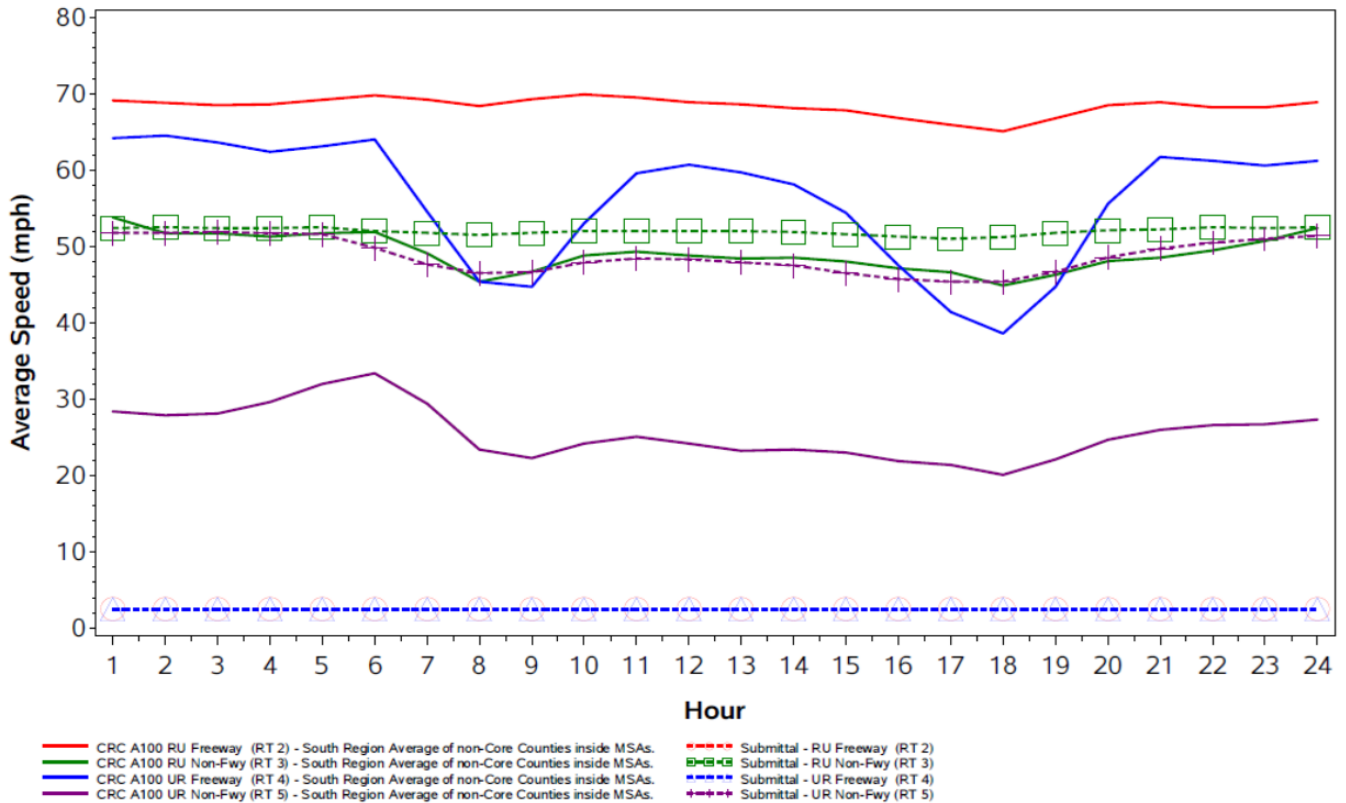


**Figure 6-5. Hourly Average Speed Profile Example**

## 6.7    VMT/VPOP Ratio

We want to avoid high ratios of VMT to vehicle population (VPOP) (e.g., a rural county with an interstate highway running through while few vehicles registered there), because in the past this has triggered MOVES to produce negative emission factors for some emission types that occur while vehicles are parked. For the 2017 NEI the EPA ranked VMT/VPOP ratios by state and source type to look at where this was happening and why. The EPA determined a threshold ratio to calculate more appropriate VPOP to reflect number of vehicles on the roadways, as opposed to registered in a county, and developed more moderate VMT/VPOP ratios. The maximum allowable ratios are shown in Table 6-2. These maximum allowable ratios were derived by examining the ratios nationwide for all vehicle types and were set to around the 95th percentile of

vehicles in that source type. The exception was combination long-haul truck, which was set to 150,000 miles per vehicle per year.

**Table 6-2. Enforced Maximum Allowable VMT/VPOP Ratios for 2023 NEI**

| MOVES source type | Source type description | Maximum VMT/VPOP ratio (miles per year) |
|---|---|---|
| 11 | Motorcycle | 7,500 |
| 21 | Passenger Car | 31,000 |
| 31 | Passenger Truck | 31,000 |
| 32 | Light Commercial Truck | 31,000 |
| 41 | Other Buses (non-school, non-transit) | 130,000 |
| 42 | Transit Bus | 90,000 |
| 43 | School Bus | 30,000 |
| 51 | Refuse Truck | 60,000 |
| 52 | Single Unit Short-haul Truck | 45,000 |
| 53 | Single Unit Long-haul Truck | 60,000 |
| 54 | Motor Home | 7,000 |
| 61 | Combination Short-haul Truck | 150,000 |
| 62 | Combination Long-haul Truck | 150,000 |

States can do this type of analysis on their own. Figure 6-6 shows the miles/vehicle for combination long-haul trucks for 2017. This shows where some of the higher ratios occurred and where vehicle population might need to be further analyzed and possibly increased to be more representative of the vehicles on the roadways as opposed to just those registered in the county.

*Tip: A useful quality check on population and VMT inputs is to divide VMT by source type by source type population to estimate VMT per vehicle, and then determine whether these estimates are reasonable.*
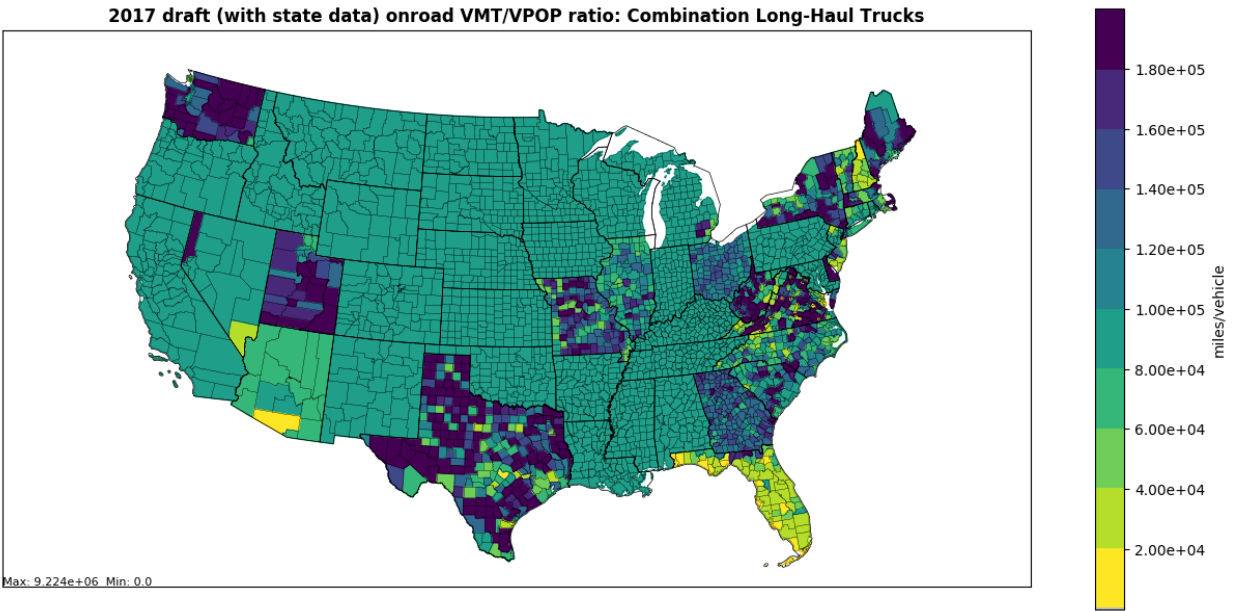
**Figure 6-6. VMT/VPOP Ratio Example Plot**

## 6.8     Hour, Day, and Month VMT Fractions

VMT fraction is the fraction of VMT occurring in each hour of the day, weekday/weekend, and month on each road type. This fraction will vary from location to location and the EPA encourages S/L agencies to submit local VMT fractions accordingly. VMT fraction also varies by vehicle type. Certain vehicles will drive more miles during certain times of the day. For example, school buses are not likely to be out on the road at night. Figure 6-7 shows a weekday example where a state submitted the same hourly VMT fractions for all vehicle types on rural unrestricted road type, whereas the EPA default data from CRC A-100 showed some variability by vehicle type.
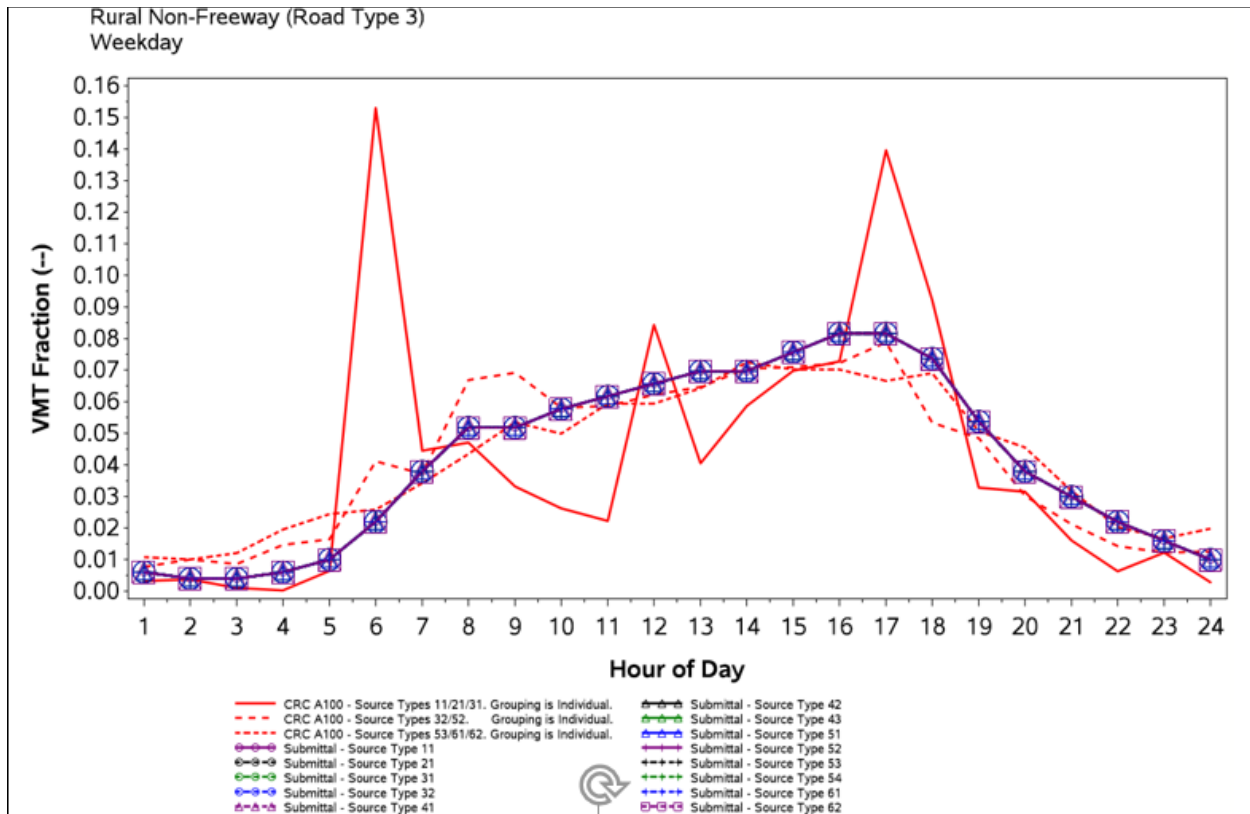
**Figure 6-7. VMT Fraction Vehicle Example**

In some cases, a county may not have a certain road type and will elect to put 100% of VMT in hour 1 for road types that do not exist (see Figure 6-8). There are two better options in this situation. EPA would prefer that states either substitute a real distribution from a similar road type in the area or do not update the starting point CDB data for those road types.
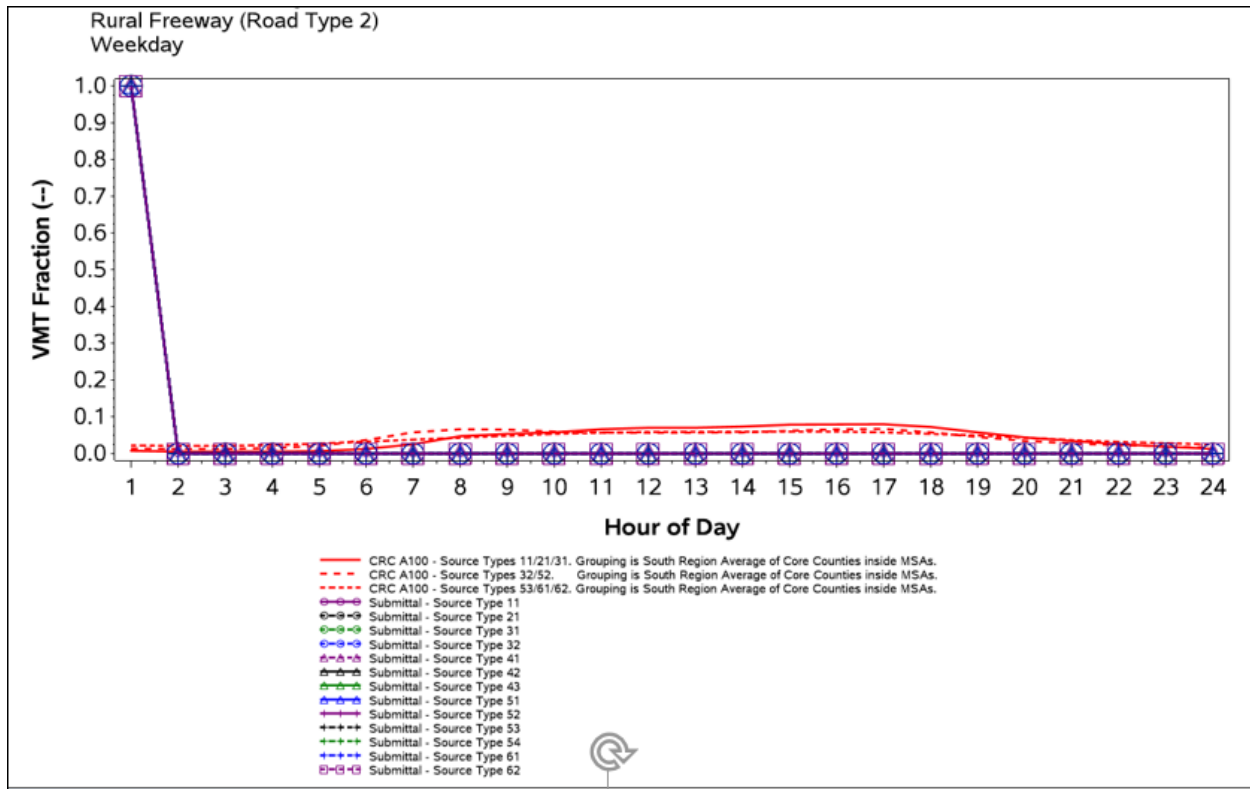
**Figure 6-8. VMT Fraction Non-Existing Road Type Example**

Hour VMT fraction should also vary by day type (weekday or weekend day) and vehicle type. For the 2023 NEI the EPA will not accept weekday=weekend profiles.

### 6.9 QA Resolution

The EPA resolves data problems by coordinating with S/L agencies individually and/or presenting intentions during monthly meetings with the multi-jurisdictional organization (MJO) MOVES workgroup. In some cases, during the 2017 NEI development, the S/L agency preferred to submit a corrected CDB. In other cases, the agency provided the EPA with instructions for a spot correction to a table or accepted the EPA's proposed update.

### 6.10 Considerations specific to 2023

## 7 Data Sources

[FHWA Home / Policy & Governmental Affairs / Highway Policy Information / Highway Statistics 2023](#)

[CRC A-100](#)

[CRC A-115](#)

## 7.1    Additional Resources

For additional assistance contact:

Submittal Issues -Janice Godfrey; 919-541-3391

Inventory Issues -Janice Godfrey; 919-541-3391

CDB Content Issues -Jaehoon Han; 734-214-4299

MOVES Issues -mobile@epa.gov