



U.S. Department
of Transportation
**Federal Aviation
Administration**

Aviation Environmental Design Tool (AEDT)

Supplemental Manual

Using MOVES with AEDT

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INTRODUCTION

The FAA's Office of Environment and Energy (AEE) has developed the Aviation Environmental Design Tool (AEDT)¹ as a software system designed to dynamically model aircraft performance in space and time to compute noise, emissions, and fuel consumption. A primary objective of the AEDT application is to help the analyst efficiently answer questions of interest about the environmental consequences of aviation activity. These environmental consequences are evaluated through metrics, many of which are defined by regulatory standards. AEDT has replaced the Emissions and Dispersion Modeling System (EDMS) as the preferred model for conducting airport emissions inventory and air quality analyses. Further information can be found at the AEDT website, <http://aedt.faa.gov/>.

As of March 2013, for estimating emissions from on-road mobile sources the Environmental Protection Agency (USEPA) requires the usage of the Motor Vehicle Emissions Simulator (MOVES)² as a replacement for MOBILE. MOVES also adds the capability of modeling off-road mobile sources with the integration of NONROAD2008. Analysts are still permitted to use the standalone version of NONROAD2008 for regulatory purposes.³ It is recommended that analysts utilize the NONROAD2008 based data integrated into AEDT for modeling ground support equipment (GSE). For cases where construction activity needs to be modeled, the analyst can use the standalone version of NONROAD2008 or the integrated version within MOVES to generate emissions rates.³

The analyst is required to generate emissions inventories and/or AERMOD input files for on-road or off-road mobile sources (e.g., construction equipment) independently of AEDT when conducting airport analyses. AEDT includes the capability of creating roadway, parking facilities construction zones using the AEDT graphical user interface (GUI) and exporting "Links" for use as input with the MOVES model. AEDT reads MOVES/NONROAD generated annual emissions inventory data in a pre-defined format and helps the analyst generate an emissions inventory report. For dispersion modeling it is enough for the analyst to generate the control (CO) and source (SO) pathway information needed for AERMOD; AEDT parses the control and source path information, identifies the pollutant in CO pathway and merges the source pathway information to the AEDT generated AERMOD file for all aircraft and airport operations. This document discusses the methodology for preparing an emissions inventory generated by MOVES or NONROAD output to be merged to an AEDT emission inventory and how to prepare MOVES and NONROAD output data for AERMOD when conducting dispersion analysis. Please refer to the AEDT User Guide for more information on the capability for viewing on-road and non-road sources in the AEDT map interface.

¹ FAA, Aviation Environmental Design Tool (AEDT) User Guide

² USEPA, Motor Vehicle Emissions Simulator (MOVES) User Guide for MOVES2014a, EPA-420-B-15-095, November 2015

³ USEPA, Policy Guidance on the Use of MOVES2014 for State Implementation Plan Development, Transportation Conformity, and Other Purposes, EPA-420-B-14-008, July 2014

RUNNING MOVES

To execute a MOVES run the analyst is required to develop a run specification file (“RunSpec”) through the “Navigation Panel” of the MOVES GUI. Once the RunSpec has been defined, the analyst imports project specific data through the “Project Data Manager” within the MOVES GUI. This document provides the best practice in making the appropriate selections in the “Navigation Panel” and importing data utilizing the “Project Data Manager” in the MOVES GUI.

Using MOVES when conducting an airport study requires the analyst to execute MOVES at the project level domain. Determining the number of MOVES runs is a key step in conducting a project level analysis. When run at the project level domain, each MOVES run estimates vehicular emissions for a single hour of a single month of a single year specified by the analyst. The number of MOVES runs is determined by the variation in activity (e.g., changes in traffic volume) as well as seasonal and daily meteorological variation of the project area. The number of MOVES runs will also vary depending on the AEDT use case; in some instances the analyst will only be required to conduct an emissions inventory, while in others an air quality dispersion analysis will be required. Typically, fewer MOVES runs are required for conducting an emissions inventory, while a higher number of MOVES runs are required for conducting an air quality dispersion analysis. However, for each use case, be it an emissions inventory or an air quality dispersion analysis, the number of MOVES runs could vary by the pollutant of concern or by the ambient air quality standard being assessed. The analyst should rely on the inter-agency coordination process to determine the appropriate number of MOVES runs when conducting an AEDT study.

Several use cases are highlighted below that provide some explanation on the number of MOVES runs required for a particular type of analysis. This document is only guidance for using MOVES with AEDT, for more specific questions on the appropriateness of using certain input parameters the analyst should refer to interagency coordination.

- Voluntary Airport Low Emissions (VALE) Program Analysis
MOVES runs for a VALE analysis will only be required if the emissions reductions include on-road mobile source related equipment. A VALE analysis will only require a single MOVES run for each year being analyzed for each of the ‘the baseline condition’⁴ and ‘the project condition’⁵ scenarios. The number of years will vary based on the useful life of the equipment being assessed for emissions reductions. For example, an airport is going to replace diesel buses with compressed natural gas (CNG) buses that service the economy and employee parking lots. The CNG buses will have a useful life of 12 years. MOVES runs will need to be conducted for the VALE analysis associated with this vehicle replacement project. This project is funded in Fiscal Year 2020 so MOVES runs will need to be conducted for the years 2020 through 2031 to account for the emissions reduction through the 12 years of useful life of the CNG buses. For this VALE analysis,

⁴ The baseline condition reflects the operation of existing or new conventional-fuel vehicles and equipment that would occur if no VALE project were implemented.

⁵ The project condition reflects operating changes that result from implementation of the VALE low-emission project.

‘the baseline condition’ and ‘the project condition’ will each consist of 12 MOVES runs each (total of 24 MOVES runs). Each MOVES run will represent an annual emissions inventory for on-road mobile sources utilizing the airport average annual temperature that is used with AEDT (i.e., the AEDT airport average annual temperature and relative humidity and the MOVES ‘temperature’ and ‘humidity’ meteorological inputs are to be identical). For each MOVES run the ‘year’ will need to match the year of the analysis (e.g., the FY 2020 runs will select the ‘year’ 2020 in MOVES, the FY 2021 runs will select the ‘year’ 2021 in MOVES). Please refer the AEDT User Guide for more information on conducting VALE analyses.

- **Emissions Inventory for General Conformity Analysis**
The number of MOVES runs required for an emissions inventory associated with a general conformity analysis can vary depending on a number of factors. However, in many cases where an analysis to determine if a project is above or below general conformity de minimis thresholds⁶ a single MOVES run using the annual average temperature and humidity can be executed for each year being analyzed for each of the ‘build’ and ‘no build’ scenarios to determine the net emissions change. For example, a new carrier is adding operations at a regional airport which is located in a carbon monoxide (CO) maintenance area. AEDT will be used to model the emissions inventories associated with aircraft and GSE. MOVES will be used to model the emissions inventories associated with roadways, parking facilities, and construction sources. The aircraft operations are modeled using annual average meteorological data in AEDT. Since, the aircraft operations are using annual average meteorological data, the MOVES runs will also utilize annual average temperature and humidity data for the runs. In this example the net emissions increase for CO is only 10 tons per year which is below the general conformity de minimis threshold for CO of 100 tons per year. Therefore, no further analysis would be required. However, if the net emission increase is near or over the general conformity threshold, additional MOVES runs may need to be conducted to account for the seasonal variation of vehicular traffic and emission rates. In this event, the analyst should rely on the inter-agency coordination process to determine the appropriate number of MOVES.
- **Air Quality Dispersion Analysis for National Environmental Protection Act (NEPA)**
When conducting an air quality dispersion analysis, the analyst will need to conduct a more detailed MOVES analysis to account for the temporal change in on-road vehicle activity and emission rates. For example, 16 MOVES runs are utilized for explanatory purposes. The number of MOVES runs should be determined through the inter-agency coordination process and will be dependent on the complexity of the project. The 16 runs represent an example combination of the four quarters of the calendar year (i.e., January through March, April through June, July through September, and October through December) and four levels of traffic volume (i.e., morning peak, midday, evening peak, and overnight) as well as daily variation in meteorology. Tables 1 and 2 define these time periods, respectively.

⁶ <https://www.epa.gov/general-conformity/de-minimis-tables>

Table 1. Quarters of the year for MOVES runs

| Code | Name | Months |
|-----------|----------------|--------------------|
| Q1 | First Quarter | January - March |
| Q2 | Second Quarter | April – June |
| Q3 | Third Quarter | July - September |
| Q4 | Fourth Quarter | October - December |

Table 2. Traffic volume times of day for MOVES runs

| Code | Name | Time of Day |
|-----------|--------------|------------------------|
| AM | Morning Peak | 0600 – 0900 (3 hours) |
| MD | Midday | 0900 – 1600 (7 hours) |
| PM | Evening Peak | 1600 – 1900 (3 hours) |
| ON | Overnight | 1900 – 0600 (11 hours) |

In this case a set of 16 MOVES runs will need to be conducted for each individual alternative for the year being analyzed.

In either case, the analyst should rely on the inter-agency coordination process to determine the appropriate number of MOVES runs when conducting an AEDT study.

Navigation Panel

When conducting a MOVES run the analyst needs to develop a RunSpec file through the “Navigation Panel” of the MOVES GUI. This section provides the best practice on the pertinent panel selections that should be made when using MOVES with AEDT. For a detailed description of the MOVES “Navigation Panel” options not discussed in this document, refer to the MOVES User Guide for further information. ¹

Scale

For conducting an airport analysis using MOVES with AEDT, the analyst chooses the “Project” domain to allow MOVES to accept detailed activity input at the link level. The “Inventory” option under “Calculation Type” needs to be selected for developing an emission inventory or conducting a dispersion analysis.

Time Spans

When using the project domain, MOVES will only process one hour, of one day, of one month, of one year for each run. The analyst should enter the desired time period within the “Time Span” panel. “Time Aggregation” should be set to “hour”. The analyst only selects either “weekday” or “weekend” for the “day” selection. Both options cannot be selected for project level analysis. The selection for “day” should correspond to the type of activity data being used.

Geographic Bounds

The “Geographic Bounds” panel is where the analyst specifies the county in which the airport study area is located.

Vehicles/Equipment

The “Vehicles/Equipment” panel is used to specify the vehicle types and fuel combinations that are to be included in the MOVES runs for use with AEDT. The MOVES runs for airport analyses must include all the vehicle types and fuel types (e.g., gasoline, diesel, or Compressed Natural Gas (CNG)) that the analyst wants to model in the project area.

Road Type

The “Road Type” panel is used to define the types of roads that the analyst wants to include in the airport study area. MOVES defines five different road types:

- Rural Restricted Access – a rural highway that can be accessed only by an onramp;
- Rural Unrestricted Access – all other rural roads (arterials, connectors, and local streets);
- Urban Restricted Access – an urban highway that can be accessed only by an onramp;
- Urban Unrestricted Access – all other urban roads (arterials, connectors, local streets, or parking facility links); and
- Off-Network – any location where the predominant activity is vehicle starts and idling (Used for modeling vehicle starts for airport parking facilities).

Pollutants and Processes

The “Pollutants and Processes” panel is used to select the types of pollutants and the emissions processes the analyst wants to include in the analysis. When using MOVES for conducting an airport analysis, the analyst conducts a separate set of runs for modeling roadway links and parking facility links (parking facility will include off-network links). Whether a roadway or a parking facility link is being modeled will determine the emissions processes that are to be selected.

The analyst has discretion to determine the specific pollutants to be analyzed with MOVES for the airport study. In some airport analyses only a single pollutant will be of concern so the analyst may only need to model that specific pollutant. However, it is important to note that some pollutants are chained pollutants within MOVES, so multiple pollutant selections need to be made in order to complete the chain and model the desired pollutant. For example, if the analyst is interested in obtaining Volatile Organic Compound (VOC) emissions, then Total Gaseous Hydrocarbons needs to also be selected. The MOVES GUI prompts the analyst if there is an incomplete pollutant chain. Table 3 lists all the pollutants and their associated processes in MOVES for producing an emission inventory and/or emission rates for dispersion modeling that are compatible with AEDT. Table 4 lists all the pollutants and their associated processes for analyzing parking facility links (including off-network links). Although the analyst has discretion to determine which pollutant(s) are modeled with MOVES, the analyst is required to select the appropriate emissions process associated with the pollutants listed in Tables 3 and 4.

Table 3. Pollutant and Its Associated Emissions Processes for Roadway Links

| Pollutant | Emissions Process |
|---|---|
| Total Gaseous Hydrocarbons | Running Exhaust and Crankcase Running Exhaust |
| Non-Methane Hydrocarbons | |
| Non-Methane Organic Gases | |
| Volatile Organic Compounds | |
| Total Organic Gases | |
| Carbon Monoxide (CO) | |
| Methane (CH ₄) | |
| Oxides of Nitrogen (NO _x) | |
| Sulfur Dioxide (SO ₂) | |
| Total Energy Consumption | |
| Atmospheric CO ₂ | |
| Primary Exhaust PM ₁₀ - Total | |
| Primary Exhaust PM _{2.5} - Total | |
| Primary PM _{2.5} – Species | |
| Primary PM ₁₀ - Brakewear Particulate | Running Exhaust, Crankcase Running Exhaust, and Brakewear |
| Primary PM _{2.5} - Brakewear Particulate | |
| Primary PM ₁₀ - Tirewear Particulate | Running Exhaust, Crankcase Running Exhaust, and Tirewear |
| Primary PM _{2.5} - Tirewear Particulate | |

**Table 4. Pollutant and Its Associated Emissions Processes for Parking Facility Links
(Includes off-network links)**

| Pollutant | Emissions Process |
|---|---|
| Total Gaseous Hydrocarbons | Running Exhaust, Start Exhaust, Crankcase Running Exhaust and Crankcase Start Exhaust |
| Non-Methane Hydrocarbons | |
| Non-Methane Organic Gases | |
| Volatile Organic Compounds | |
| Total Organic Gases | |
| Carbon Monoxide (CO) | |
| Methane (CH ₄) | |
| Oxides of Nitrogen (NO _x) | |
| Sulfur Dioxide (SO ₂) | |
| Total Energy Consumption | |
| Atmospheric CO ₂ | |
| Primary Exhaust PM ₁₀ - Total | |
| Primary Exhaust PM _{2.5} - Total | |
| Primary PM _{2.5} – Species | |
| Primary PM ₁₀ - Brakewear Particulate | Running Exhaust, Start Exhaust, Crankcase Running Exhaust, Crankcase Start Exhaust, Brakewear, Extended Idle Exhaust*, and Crankcase Extended Idle Exhaust* |
| Primary PM _{2.5} - Brakewear Particulate | |
| Primary PM ₁₀ - Tirewear Particulate | Running Exhaust, Start Exhaust, Crankcase Running Exhaust, Crankcase Start Exhaust, Brakewear, Extended Idle Exhaust*, and Crankcase Extended Idle Exhaust* |
| Primary PM _{2.5} - Tirewear Particulate | |

* Extended Idle Exhaust and Crankcase Extended Idle Exhaust only need to be included when modeling combination long-haul truck (source type 62) within the parking facility. MOVES does not model these emissions processes for any other source type.

Output

The “Output” panel provides two sub-panels:

- **General Output.** The “General Output” sub-panel allows the analyst to name and create an output database. When modeling with MOVES to obtain emissions inventories or emission rates for AERMOD to be used with AEDT, the analyst models the roadway links and parking facility links (including off-network links) within MOVES.
 - **Roadway Links and Parking Facility Links.** The analyst names and creates an output database to be used for each MOVES run that will be conducted. When modeling roadway links, all output data to be used for developing an emission inventory or for dispersion with AERMOD is located in the “movesoutput” table within the output database. For every

MOVES run that is conducted, a unique identifier is populated in the “MOVESRunID” field within the “movesoutput” table. For example, if the analyst conducts multiple MOVES runs to account for vehicle activity and meteorological variations, the first MOVES run conducted is assigned a “MOVESRunID” of 1. The second conducted MOVES run is assigned a “MOVESRunID” of 2, and the “MOVESRunID” is incremented accordingly for each subsequent MOVES run thereafter. The analyst is responsible for managing the output data in the “movesoutput” table and confirming that the associated “MOVESRunID” values represent the intended scenario being modeled. It is important to note that each level a parking facility is to be assigned an individual link.

For the “Units” selections, the analyst selects “grams” for “Mass Units”, “MillionBTU” for “Energy Units”, and “Miles” for “Distance Units”. “Distance Traveled” and “Population” are preselected for the “Activity” selections.

- **Output Emissions Detail.** Output Emissions Detail is used to specify the level of detail desired in the output data. For running MOVES to develop emission inventories and emission rates for AERMOD to be utilized with AEDT, the analyst must select “road type” under the “On/Off-Road” section. No other items need to be selected other than “road type”. The “emissionQuant” field in the “movesoutput” table represents the total emissions that occur for the timeframe being modeled (i.e., hourly, monthly, quarterly or annual).

Project Data Manager

After the analyst has completed all of the necessary panels to create the MOVES RunSpec, the analyst must then create an input database and provide the necessary input database tables that describe the project in detail. The input database is populated using the Project Data Manager (PDM), which can be accessed from the “Pre-Processing” menu item at the top of the MOVES GUI, or by selecting “Enter/Edit Data” in the “Domain Input Database” section of the “Geographic Bounds” panel. It is recommended that the analyst create a unique input database for each MOVES run that is to be conducted. For example, if the analyst is conducting multiple MOVES runs to account for vehicle activity and meteorological variations, individual input databases should be created for each run.

The PDM includes multiple tabs that open data importers, which are used to enter project-specific data. These tabs and data importers are:

- Meteorology
- Age Distribution
- Fuel Supply
- Inspection and Maintenance
- Link Source Type
- Links
- Link Drive Schedule
- Operating Mode Distribution

- Off-Network

When using the AEDT GUI to create roadways and parking facilities in the map viewer, AEDT will generate Links input files for Roadway Links, Parking Facility Links and Construction Links. Only the Roadway Links and Parking Facility Links can be modeled with MOVES. Construction Links need to be modeled with NONROAD and manually appended to the MOVES. Please refer to the AEDT User Guide for information on exporting Roadway Links, Parking Facility Links, and Construction Links files.

The remainder of this section describes the PDM inputs and how they specifically relate to using MOVES for developing emissions inventories and emission rates for AERMOD to be utilized with AEDT. The analyst should rely on interagency coordination to determine the appropriateness of the project specific input data that is to be imported into MOVES. The analyst should also refer to the MOVES User's Guide for the mechanics of using the data importers for project level analysis.²

Meteorology

MOVES requires the use of ambient air temperature and relative humidity data. When developing meteorological data for input into MOVES, the analyst should rely on interagency coordination to determine the appropriate data to be used. Neither FAA nor EPA endorses the use of the MOVES default meteorological data for project level analyses. The meteorological data required to be imported into MOVES directly corresponds to the number of MOVES runs to be executed for the airport study and are dependent on the use case. In some instances, when only an emissions inventory is being conducted, the airport average annual weather may be able to be used. In this particular case the analyst models all associated MOVES runs using the annual average temperature and relative humidity associated with the airport being modeled in AEDT for the MOVES run(s). For other instances where multiple MOVES runs need to be conducted to better represent activity and meteorological variation for an emissions inventory or air quality dispersion analysis, the analyst needs to rely on interagency coordination to determine the appropriate method of processing and/or obtaining representative meteorological data.

Age Distribution

The "Age Distribution" importer is used to enter data that provide the distribution of vehicle fractions by age for each calendar year (yearID) and vehicle type (sourceTypeID). These data are required for running MOVES at the project level for airport analyses. The distribution of ageID (the variable for vehicle age) fractions must sum to one for each vehicle type and year. This type of data should be obtained through the interagency coordination process; depending on the use case, a local agency may require the analyst to use the latest available state or local age distribution assumptions from their State Implementation Plan (SIP) or transportation conformity regional emissions analysis.

Fuel Supply

The analyst must define the fuel information that is used in the study area in MOVES. The "Fuel Supply", "Fuel Formulation", "fuelusagefraction", and "AFVT" importers are used to enter the necessary information to describe fuel type and fuel mix for each

respective MOVES run. The analyst should obtain this type of data through the interagency coordination process.

Inspection and Maintenance

Projects within areas covered by an I/M program should define the program in the MOVES “Inspection and Maintenance” importer. The analyst should obtain this type of data through the interagency coordination process.

Link Source Type for On-Road Vehicles and Parking Facilities

The “Link Source Type” importer allows the analyst to enter the fraction of the link traffic volume (fleet mixture) that is represented by each vehicle type (source type). For each LinkID the “SourceTypeHourFraction” must sum to one across all source types. Additionally, the analyst needs to ensure that the source types selected in the MOVES Vehicles/Equipment panel match the source types defined through the “Link Source Type” importer. Otherwise, if a vehicle is represented in the “Link Source Type” table but is excluded from the RunSpec, the vehicle will not be modeled. There are no defaults that can be exported from the “Link Source Type” importer. For any analysis at the project level, the analyst may provide source type fractions for all vehicles being modeled and for each MOVES run (as vehicle mixes may change from hour to hour and month to month).

Links

The “Links” importer is used to define the individual roadway links and/or parking facility links (including off-network link) to be established in MOVES when conducting an airport study. All links being modeled are required to have unique LinkIDs. The “Links” importer requires information on each link’s length (in miles), traffic volume (units of vehicles per hour), average speed (miles per hour), and road grade (percent). When using the AEDT GUI to create Roadway Links and Parking Facility Links, AEDT will determine the link length based upon the distance of the link segments. The analyst is able to modify the link length to the appropriate distance to be modeled.

The information below describes how to set up a Links input file for use with MOVES when conducting an airport study. The analyst should refer to the interagency coordination process to determine the appropriate number of links and the lengths of specific links that are to be used for the study.

- **Roadway Links.** Create a unique LinkID for each roadway segment that is to be modeled in the airport study. When developing the roadway links input file the analyst creates a unique link (between 1 and 599,999) for each Roadway Link that would be set up within the airport study. If using the AEDT GUI to generate Roadway Links, AEDT will automatically assign the appropriate LinkID. The output associated with these roadway links are the total emissions that occur for the timeframe being modeled.
- **Parking Facility Links.** Create a unique Link ID for each parking facility link that is to be modeled in the airport study. When creating Parking Facility Links in the AEDT GUI, AEDT will automatically assign the appropriate unique LinkID for all the Parking Facility Links. When an analyst models a parking facility for

an airport analysis, they must specify speed, distance traveled, and an idle time. For multi-level parking facilities (i.e., parking garages), the analyst is to model these links for each level. This information serves as inputs for the links input file. When modeling a parking facility in MOVES for use with an airport study, the analyst must create three links for each parking facility.

1. **Parking Facility Movement Link** - The Parking Facility Movement link models the vehicle movement within the parking facility. The analyst enters distance traveled and the speed. These values are entered into the MOVES links input file as the “link length” (in miles) and the “average speed”, respectively, when building the links input file for parking facilities. The “Urban Unrestricted Access” road type (Road Type 5) should also be selected when modeling this link. A unique LinkID between the range of 700001 and 799999 must be used for the Parking Facility Movement Link. If using the AEDT GUI to generate Parking Facility Links, AEDT will automatically assign the appropriate LinkID.
2. **Parking Facility Idle Link** - A unique link is created utilizing an average speed of 0 miles-per-hour to obtain idle emissions for the parking facility. This link is only required if there is excess idling that needs to be accounted for when modeling the parking facility. Excess idling may occur in colder regions. Please rely to interagency coordination to determine if excess idling needs to be modeled for parking facilities. A unique LinkID between the range of 800001 and 899999 must be used for the Parking Facility Idle Link. If using the AEDT GUI to generate Parking Facility Links, AEDT will automatically assign the appropriate unique LinkID.
3. **Parking Facility Off-Network Link** - An off-network link for the purpose of calculating vehicle starts needs to be modeled. When modeling a parking facility for an airport analysis the analyst must consider vehicle starts. Previously with MOBILE6.2, vehicle starts were built into the emissions rates. However, with MOVES vehicle starts are modeled as a separate emissions process. For modeling vehicle starts the analyst uses the “off-network” road type (Road Type 1). The analyst also needs to enter data into the “Off-Network” and “Operating Mode Distribution” data importers to correctly model vehicle starts by accounting for the appropriate soak time. Soak time is the amount of time the vehicle engine is off while parked and is used to differentiate a hot or cold start. . A unique LinkID between the range of 600001 and 699999 must be used for the Parking Facility Off-Network Link. If using the AEDT GUI to generate Parking Facility Links, AEDT will automatically assign the appropriate unique LinkID.

It is also important to note that MOVES can only model a single off-network link per MOVES run. If parking facilities are similar, they may be able to utilize the same off-network link to obtain vehicle start emissions rates. This depends on whether they have the same fleet

mixture and operating mode distribution (soak times). In most cases, off-network links associated with hourly, daily, and longer term economy parking facilities need to be modeled using separate MOVES runs. The analyst should rely on the interagency coordination process to determine the appropriate number of off-network links that need to be modeled.

Link Drive Schedule

For using MOVES for airport analyses the FAA recommends that the analyst utilize the average speed approach to model roadway and parking facility links. However, the analyst does have the option to use Link Drive Schedule through the Link Drive Schedule Importer if data are available.

Operating Mode Distribution

For using MOVES for airport analyses the FAA recommends that the analyst utilize the average speed approach when modeling roadway links. When an off-network link is selected to model vehicle starts, the analyst is required to enter an operating mode distribution to assign appropriate soak time (this is discussed in further detail below). However, the analyst does have the option of using operating mode distributions through the “Operating Mode Distribution” importer for modeling roadway links, if data are available.

- **Operating Mode Distribution for off-network (parking facility) links.** In most cases an airport study includes multiple parking facilities that need to be modeled. If the airport study does contain an off-network (parking facility) link, then both the “Off-Network” table and “Operating Mode Distribution” table should be populated and imported into the input database. The analyst needs to specify the fractions of the time spent during the hour in each operating mode. Creating an operating mode distribution for an off-network link specifically models vehicle starts and/or extended idle (if necessary) emissions. Table 5 lists the operating modes associated with calculating emissions for vehicle starts and extended idle emissions. The sum of the fractions of OpmodeID 101 through 108 needs to be 1. The fraction for Extended Idle Operating Mode (OpmodeID 200) should always be set to 1.

Table 5. Off-Network Operating Mode Distributions

| OpmodeID Code | Operating Mode Description |
|---------------|--|
| 101 | Soak Time < 6 minutes |
| 102 | 6 minutes <= Soak Time < 30 minutes |
| 103 | 30 minutes <= Soak Time < 60 minutes |
| 104 | 60 minutes <= Soak Time < 90 minutes |
| 105 | 90 minutes <= Soak Time < 120 minutes |
| 106 | 120 minutes <= Soak Time < 360 minutes |
| 107 | 360 minutes <= Soak Time < 720 minutes |
| 108 | 720 minutes <= Soak Time |
| 200 | Extended Idle Operating Mode |

The use of operating mode distribution to define either a roadway link or parking facility link must be determined through the interagency coordination process.

Off-Network

The “Off-Network” importer is used to provide data about vehicle starts and extended idle activity within a parking facility. As previously mentioned, MOVES is only capable of modeling one off-network link per run. If more than one off-network (parking facility) link is associated with the airport study, another MOVES run (or set of MOVES runs) is required to characterize each additional off-network link. The Off-Network importer should also be used if the airport study includes an area where highway vehicles are parked, start their engines, or are in extended idling mode (such as at a truck stop, parking lot, or passenger or freight intermodal terminal).

There are no default values available for any of the off-network inputs; the analyst needs to populate the Off-Network table with information describing vehicle activity in the off-network link being modeled. The necessary fields are vehicle population, start fraction, and extended idle fraction:

- The vehicle population reflects the total number of vehicles parked, starting, or idling on the off-network area, over the course of the hour covered by the MOVES run.
- The start fraction is the fraction of the total vehicle population that starts during the hour.
- The extended idle fraction specifies the fraction of time that the vehicle population spends in extended idle operation in the hour.

Extended idle operation applies only to long-haul combination trucks (source type 62) and is defined as the operation of the truck's propulsion engine when not engaged in gear for a period greater than 15 consecutive minutes, except when associated with routine stoppages due to traffic movement or congestion. Shorter periods of idling for long-haul combination trucks, and all idling for other vehicles, should be modeled as a roadway link with an Op-Mode distribution that consists only of idle operation (Op-Mode 1). This can be specified in the Links table by inputting the vehicle population and specifying an average speed of “0” mile-per-hour.

USING MOVES and NONROAD OUTPUT WITH AEDT

After all MOVES runs have been completed for both roadway links and parking facility links (construction links are modeled with NONROAD, this section further describes how to incorporate NONROAD results into MOVES output to import into AEDT), the analyst will have generated output by each link represented in total grams of each pollutant for the timeframe modeled (depending on the use case, the total emissions by link may represent hourly, monthly, quarterly, or annual emissions per link). The MOVES output for all links is located in the “movesoutput” table within the output database.

AEDT does not manage or utilize geospatial data associated with roadway links or parking facility links for usage with AERMOD dispersion modeling. However for emissions inventories, AEDT can import on-road mobile source emissions inventories using one of two file formats.

The first format AEDT can import are annual inventories for each pollutant modeled with MOVES for Roadways, Parking Facilities, and Construction categories. AEDT will accept a comma separated file (.csv) with the annual emissions by pollutant modeled and add it to the emissions inventory calculated by AEDT. Figure 1 displays the information required of the emissions inventory input file. With this format the analyst must conduct post processing on the MOVES and/or NONROAD output so that pollutants match those generated by the other sources modeled with AEDT. The Categorized Emissions Inventory Results File can contain an emissions inventory for a single year or multiple years that will be read into AEDT. The source categories that AEDT accepts are Roadways, Parking Facilities, and Construction. For the Pollutant ID column, the analyst only needs to provide the numerical Pollutant ID in the file. The information shown in the Pollutant ID column below displays how the MOVES/NONROAD Pollutant IDs match to the AEDT pollutant name. The Emission Quant Field represents the emission inventory results in the units of grams. Appendix C provides an example displaying the .csv file format that is accepted by AEDT.

Figure 1. MOVES Categorized Emissions Inventory Results File Format

| Year ID | Source | Pollutant ID | Emission Quant |
|----------------------------------|--|------------------------------------|---|
| Year – YYYY (example 2015) | Roadways Parking Facilities Construction | Matches the MOVES pollutant ID. | Total emissions in the units of Grams. |
| | | THC 1 | |
| | | CO 2 | |
| | | VOC 87 | |
| | | NMHC 79 | |
| | | TOG 86 | |
| | | NOx 3 | |
| | | SOx 31 | |
| | | CO2 90 | |
| | | PM10 100 | |
| | | PM10 Brakewear 106 | |
| | | PM10 Tirewear 107 | |
| | | PM2.5 110 | |
| | | PM2.5 Brakewear 116 | |
| | | PM2.5 Tirewear 117 | |
| | | H2O 119 | |

The second format AEDT can import are MOVES Link Level Inventory Results. When following the instructions in the Output section starting on Page 7 of this document the analyst can export the ‘movesoutput’ table from the output database by exporting a .csv file using MySQL which will already be in a format AEDT will accept. When using this

format to import MOVES output into AEDT the results should represent an annual inventory for each type of link that was modeled. In the case where multiple Parking Facilities were modeled (MOVES can only model a single off-network link per run) using multiple MOVES runs or Construction Links modeled with NONROAD, the output from those runs will need to be copied and appended into the links output file the analyst chooses to import into MOVES. Any NONROAD results for construction sources will need to be formatted so that they are consistent with the 'movesoutput' table format associated with the MOVES runs. Also, Link IDs for Construction Links must use a unique ID range between 9000001 and 999999. Please refer to Appendix D for an example of a .csv formatted MOVES Link Level Inventory Results file.

When conducting an air quality dispersion analysis to obtain pollutant concentrations for roadways, parking facilities, and/or construction activity associated with an airport analysis, the analyst needs to run MOVES and/or NONROAD and prepare the AERMOD input files (.inp file and .hre file) independently of AEDT. Ensuring that the geospatial location of the airport roadways and parking facilities are correctly referenced to the airport coordinates listed in the Airport Details Pane is imperative when developing the .inp files (see the AEDT User Guide). The analyst is responsible for managing the geospatial coordinates of each MOVES roadway link and parking facility link. The analyst is also responsible for managing the geospatial location of any construction activity. All MOVES geospatial coordinates are to be based on the location of the airport reference point in the Airport Details Pane and entered into AERMOD in local coordinates. Although AERMOD can accept UTM coordinates, AEDT does not use UTM coordinates when generating the .inp file at this time. Once again, it is imperative that the same coordinate system and that all roadway, parking facilities, and/or construction activity are located relative to the airport reference point found in the Airport Details Pane in order for pollutant concentrations from mobile sources to be appropriately placed relative to other sources and receptor locations defined in AEDT.

The analyst is responsible for managing the source name and location within the AERMOD input (.inp) file as well as the source names and associated emission rates in the hourly emission rate (.hre) file. Roadway links are to be represented in the AERMOD input file as area sources. Parking facility links are to be represented in the AERMOD as AREAPOLY sources. Construction activity can be modeled utilizing any AERMOD source deemed appropriate (e.g., AREA, AERAPOLY, POINT, or VOLUME).

For roadway links, the analyst is required to enter the appropriate information for the following parameters for defining an area source using the SRCPARAM keyword:

- Aremis - area emission rate in g/(sec-m²),
- Relhgt - release height above ground in meters,
- Xinit - length of X side of the area (in the east-west direction if Angle is 0 degrees) in meters,
- Yinit - length of Y side of the area (in the north-south direction if Angle is 0 degrees) in meters (optional),
- Angle - orientation angle for the rectangular area in degrees from North, measured positive in the clockwise direction (optional), and

- Szinit - initial vertical dimension of the area source plume in meters (optional).

For parking facility links the analyst is required to enter the appropriate information for the following parameters;

- Aremis - area emission rate in $g/(s \cdot m^2)$,
- Relhgt - release height above ground in meters,
- Nverts - number of vertices (or sides) of the area source polygon,
- Szinit - initial vertical dimension of the area source plume in meters (optional).

When modeling multi-level parking facilities, the analyst will need to enter each level as a separate source. For example, a five-level parking facility source names could be;

- PARKA001 for level 1
- PARKA002 for level 2
- PARKA003 for level 3
- PARKA004 for level 4
- PARKA005 for level 5

In addition to defining each level as a source using the SRCPARAM keyword, the analyst will also need to enter the location (e.g., local x and y coordinates) of all of the vertices associated with each level using the AERAVERT keyword. The analyst will assign a release height for each of the levels.

The Szinit parameter which defines the initial vertical dimension of the AREA and AREAPOLY source plume is to be set at 3 meters for all roadway and parking facility sources. The analyst will enter a value of 1 for the Aremis input parameter because the actual emission rates will be in the hourly emission rate file. Figure 2 displays an example AERMOD input file which the analyst will need to create to input into AEDT.

Figure 2. Example of AERMOD Input File (.inp)

```

CO STARTING
TITLEONE Example CO 1 HOUR INP FILE
TITLETWO Example
MODELOPT CONC DEFAULT
AVERTIME 1
POLLUTID CO
FLAGPOLE 1.8
RUNORNOT RUN
SAVEFILE
CO FINISHED

SO STARTING
SO ELEVUNIT METERS
**
** SOURCE TYPE X(m) Y(m) Z(m)
**
LOCATION PARKA001 AREAPOLY 1213.10 2565.50 16.76
LOCATION RD000001 AREA 719.51 1742.71 16.76
LOCATION RDC00001 VOLUME 1345.69 2147.62 16.76
**
** AREA AND VOLUME SOURCE PARAMETERS: HEIGHT WIDTH LENGTH ANGLE SIGMA-Z0
**
SRCPARAM RD000001 1.00 0.00 14.63 100.0 91.39 3.00
SRCPARAM RDC00001 1.00 13.00 3.00 3.00
**
** AREAPOLY PARAMETERS: HEIGHT POINTS SIGMA-Z0
**
SRCPARAM PARKA001 1.00 1.00 4 3.00
AREAVERT PARKA001 1213.10 2565.50 1358.80 2519.78 1346.30 2453.03 1193.29 2499.97
**
** HOURLY EMISSION FILE:
**
HOUREMIS appendixA.HRE RD000000-RD999999
HOUREMIS appendixA.HRE RDC00001-RDC999999
HOUREMIS appendixA.HRE PARKA001-PARKA999
**
** SOURCE GROUP DEFINITIONS:
**
SRCGROUP ALL
SRCGROUP ROADWAYS RD000000-RD999999
SRCGROUP CONSTRUCTION RDC00000-RDC99999
SRCGROUP PARKING PARKA001-PARKA999
SO Finished

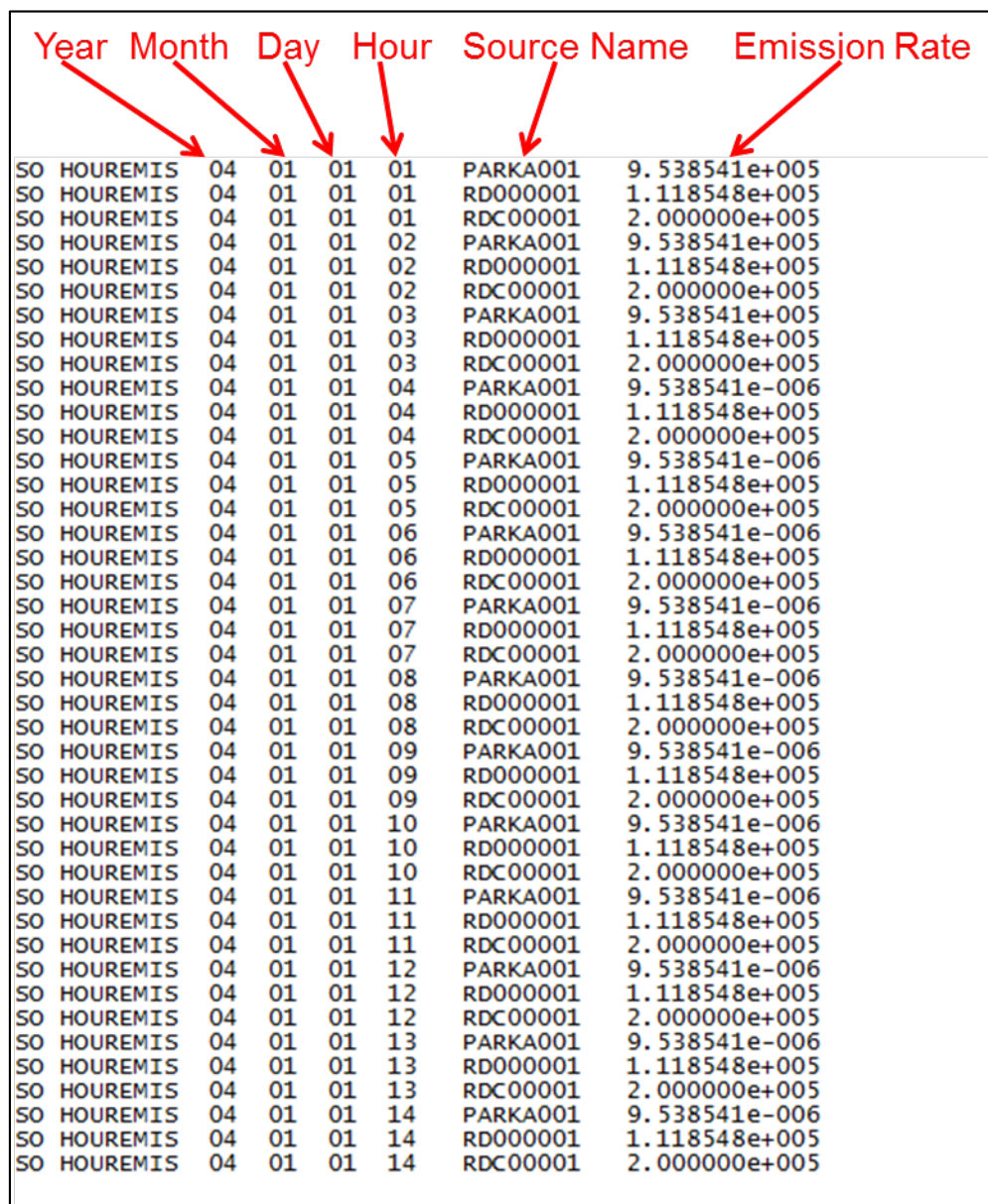
```

The AERMOD input file example in Figure 2 will model CO pollutant concentrations for a 1-hour averaging period. The LOCATION information for a single parking facility source (PARKA001), a single roadway source (RD000001), and a single construction source (RDC00001) are identified as AREAPOLY, AREA, and VOLUME sources, respectively and the local x, y and z coordinates are referenced for each. The origin associated with those coordinates is based upon the airport reference point for the specific airport being modeled with AEDT. The SRCPARAM information for the parking facility source and the roadway source provides the source dimensions. The HOUREMIS specifies the file name of the hourly emission rate file including the range of source names associated within that file. The SRCGROUP defines how the analyst wishes to group the modeled sources. In this example the parking facility source, roadway source, and construction source are assigned to their own source groups. Roadway, parking facility, and construction sources should be allocated separate source groups in the AERMOD input file.

The analyst will create an hourly emission rate file (.hre file) to capture the variation of seasonal meteorological and daily traffic volume conditions associated with the MOVES emission rates. The emission rates for each hour throughout the year is defined for each source in the hourly emission rate file. For example, if 16 MOVES runs were conducted the emission rates associated with those runs are to be assigned to the time periods listed in Table 1 and Table 2 for the hourly emission rate file. The total emissions output for roadway links and parking facility links for each MOVES run will need to be converted from grams per hour (g/hour) to grams per second square meter (g/sec-m²), which is the emission rate per unit area. This is obtained by dividing the emission rate from each

MOVES link by 3600 and the total area associated with the source. Figure 3 displays an example of the hourly emission rate file. Please refer to Section 3.3.9 of the AERMOD User's Guide for further detail on using an hourly emission rate file.⁷ It is important to note that all parking facility sources must be ordered before all roadway sources in the .hre file.

Figure 3. Example of Hourly Emission Rate File (.hre)



| | Year | Month | Day | Hour | Source Name | Emission Rate |
|----|----------|-------|-----|------|-------------|---------------|
| SO | HOUREMIS | 04 | 01 | 01 | PARKA001 | 9.538541e+005 |
| SO | HOUREMIS | 04 | 01 | 01 | RD000001 | 1.118548e+005 |
| SO | HOUREMIS | 04 | 01 | 01 | RDC00001 | 2.000000e+005 |
| SO | HOUREMIS | 04 | 01 | 02 | PARKA001 | 9.538541e+005 |
| SO | HOUREMIS | 04 | 01 | 02 | RD000001 | 1.118548e+005 |
| SO | HOUREMIS | 04 | 01 | 02 | RDC00001 | 2.000000e+005 |
| SO | HOUREMIS | 04 | 01 | 03 | PARKA001 | 9.538541e+005 |
| SO | HOUREMIS | 04 | 01 | 03 | RD000001 | 1.118548e+005 |
| SO | HOUREMIS | 04 | 01 | 03 | RDC00001 | 2.000000e+005 |
| SO | HOUREMIS | 04 | 01 | 04 | PARKA001 | 9.538541e-006 |
| SO | HOUREMIS | 04 | 01 | 04 | RD000001 | 1.118548e+005 |
| SO | HOUREMIS | 04 | 01 | 04 | RDC00001 | 2.000000e+005 |
| SO | HOUREMIS | 04 | 01 | 05 | PARKA001 | 9.538541e-006 |
| SO | HOUREMIS | 04 | 01 | 05 | RD000001 | 1.118548e+005 |
| SO | HOUREMIS | 04 | 01 | 05 | RDC00001 | 2.000000e+005 |
| SO | HOUREMIS | 04 | 01 | 06 | PARKA001 | 9.538541e-006 |
| SO | HOUREMIS | 04 | 01 | 06 | RD000001 | 1.118548e+005 |
| SO | HOUREMIS | 04 | 01 | 06 | RDC00001 | 2.000000e+005 |
| SO | HOUREMIS | 04 | 01 | 07 | PARKA001 | 9.538541e-006 |
| SO | HOUREMIS | 04 | 01 | 07 | RD000001 | 1.118548e+005 |
| SO | HOUREMIS | 04 | 01 | 07 | RDC00001 | 2.000000e+005 |
| SO | HOUREMIS | 04 | 01 | 08 | PARKA001 | 9.538541e-006 |
| SO | HOUREMIS | 04 | 01 | 08 | RD000001 | 1.118548e+005 |
| SO | HOUREMIS | 04 | 01 | 08 | RDC00001 | 2.000000e+005 |
| SO | HOUREMIS | 04 | 01 | 09 | PARKA001 | 9.538541e-006 |
| SO | HOUREMIS | 04 | 01 | 09 | RD000001 | 1.118548e+005 |
| SO | HOUREMIS | 04 | 01 | 09 | RDC00001 | 2.000000e+005 |
| SO | HOUREMIS | 04 | 01 | 10 | PARKA001 | 9.538541e-006 |
| SO | HOUREMIS | 04 | 01 | 10 | RD000001 | 1.118548e+005 |
| SO | HOUREMIS | 04 | 01 | 10 | RDC00001 | 2.000000e+005 |
| SO | HOUREMIS | 04 | 01 | 11 | PARKA001 | 9.538541e-006 |
| SO | HOUREMIS | 04 | 01 | 11 | RD000001 | 1.118548e+005 |
| SO | HOUREMIS | 04 | 01 | 11 | RDC00001 | 2.000000e+005 |
| SO | HOUREMIS | 04 | 01 | 12 | PARKA001 | 9.538541e-006 |
| SO | HOUREMIS | 04 | 01 | 12 | RD000001 | 1.118548e+005 |
| SO | HOUREMIS | 04 | 01 | 12 | RDC00001 | 2.000000e+005 |
| SO | HOUREMIS | 04 | 01 | 13 | PARKA001 | 9.538541e-006 |
| SO | HOUREMIS | 04 | 01 | 13 | RD000001 | 1.118548e+005 |
| SO | HOUREMIS | 04 | 01 | 13 | RDC00001 | 2.000000e+005 |
| SO | HOUREMIS | 04 | 01 | 14 | PARKA001 | 9.538541e-006 |
| SO | HOUREMIS | 04 | 01 | 14 | RD000001 | 1.118548e+005 |
| SO | HOUREMIS | 04 | 01 | 14 | RDC00001 | 2.000000e+005 |

⁷ USEPA, User's Guide for the AMS/EPA Regulatory Model— AERMOD, EPA-454/B-03-001, September 2004

Due to the current computational code within AEDT that allows the analyst to import the AERMOD input file (.inp) and hourly emission rate file (.hre), there are specific criteria that must be followed when constructing the .inp file and .hre for it to be correctly imported into AEDT.

- A minimum of one parking facility must be included in the .inp and corresponding .hre file. If the analyst does not want to model a parking facility then the emission rates can be set to zero in the .hre file.
- The following naming conventions must be used in order for the AERMOD .inp to import correctly into AEDT.
 1. Parking Facilities: naming range of PARKA001 through PARKZ999
 2. Roadways: naming range of RD000001 through RD999999
 3. Construction: naming range of RDC00001 through RDC99999
- The order of the sources listed under the SRCPARAM keyword in the .inp must be ordered in the following manner:
 1. All roadway sources are to be defined first
 2. All construction sources are to be defined following the roadway sources
 3. All parking facility sources are to be defined after the construction sources. If there are no construction sources to be modeled then the parking facility sources will follow the roadway sources.
- The POLLUTID in the CO (control) Pathway in the AERMOD input file must match the AEDT Metric Result being modeled. For example, if the CO (carbon monoxide) Metric is chosen to be modeled in AEDT then CO (carbon monoxide) must be listed with the POLLUTID keyword within the CO (control) Pathway section of the AERMOD input file.
- The AERMOD input file (.inp) and the hourly emission rate file (.hre) must have the same naming convention. For example, if the AERMOD input file name is CO_airportXYZ.inp then the hourly emission rate file is to be named CO_airportXYZ.hre.
- The order of sources in the hourly emission rate file (.hre) must be ordered in the following manner:
 1. All parking facility sources are to be listed first
 2. All roadway sources are to be listed following the parking facility sources
 3. All construction sources are to be listed following the roadway sources.

AEDT **will not** import the AERMOD input file (.inp) correctly and AERMOD will fail to execute if any of these criteria are not followed.

Once the analyst has constructed the AERMOD input file and the hourly emission rate file for roadway and parking facility sources, the analyst can then import those files into AEDT which will combine the input with all the airport sources and execute AERMOD. Refer to the AEDT User Guide for more information on importing the .inp and .hre files associated with roadway, parking facility, and/or construction sources.

It is important to note that although the analyst is required to define source groups in the AERMOD input file (.inp), AEDT **will not** currently create a PLOTFILE or POSTFILE to output the pollutant concentrations associated with a specific source group. Even if the analyst supplies PLOTFILE and POSTFILE information into the AERMOD input file (.inp), AEDT will not import that information. If the analyst wishes to obtain the pollutant concentration contributions from roadway, parking facility, or construction sources, then the merged .inp and .hre files with the combined airport sources (e.g., Aircraft, GSE, Stationary Sources) and on-road/off-road sources (e.g., roadways, parking, and construction) can be found in the following directory.

C:\AEDT\DATA\username\STUDYNAME@localhost\Output_Files\METRICRESULT_JOBID

The AERMOD input file (.inp) and the hourly emission rate file (.hre) will have the following naming convention.

- .inp file: STUDYNAME_JOBID_METRICRESULT_PollutantWithMove.INP
- .hre file: STUDYNAME_JOBID_METRICRESULT_PollutantWithMove.HRE

Once those files are obtained the analyst can add in the desired PLOTFILE or POSTFILE information into the AERMOD input file (.inp) and execute AERMOD independent of AEDT to produce roadway, parking, and/or construction source pollutant concentration contribution output files.

Appendix A contains the AERMOD (.inp) file example and Appendix B contains the hourly emission rate (.hre) file example that can be used with AEDT. The example contains a single parking facility source, a single roadway source, and a single construction source. The hourly emission rate file (.hre) contains emission rates for the full 24 hour period occurring on January 1st, 2004.

APPENDIX A.**.INP Filename = appendixA.inp**

```

CO STARTING
  TITLEONE Example CO 1 HOUR INP FILE
  TITLETWO Example
  MODELOPT CONC DFAULT
  AVERTIME 1
  POLLUTID CO
  FLAGPOLE 1.8
  RUNORNOT RUN
  SAVEFILE
CO FINISHED

SO STARTING
SO ELEVUNIT METERS
** -----
**          SOURCE   TYPE    X(m)      Y(m)      Z(m)
** -----
  LOCATION PARKA001 AREAPOLY 1213.10 2565.50 16.76
  LOCATION RD000001 AREA 719.51 1742.71 16.76
  LOCATION RDC00001 VOLUME 1345.69 2147.62 16.76
** -----
-----
** AREA AND VOLUME SOURCE PARAMETERS:          HEIGHT      WIDTH      LENGTH
ANGLE    SIGMA-Z0
** -----
-----
  SRCPARAM RD000001  1.00 0.00 14.63 100.0 91.39 3.00
  SRCPARAM RDC00001  1.00 13.00 3.00 3.00
** -----
** AREAPOLY PARAMETERS:          HEIGHT    POINTS    SIGMA-Z0
** -----
  SRCPARAM PARKA001  1.00 1.00 4 3.00
  AREAVERT PARKA001  1213.10 2565.50 1358.80 2519.78 1346.30 2453.03
1193.29 2499.97
** -----
** HOURLY EMISSION FILE:
** -----
  HOUREMIS  appendixA.HRE  RD000000-RD999999
  HOUREMIS  appendixA.HRE  RDC00001-RDC99999
  HOUREMIS  appendixA.HRE  PARKA001-PARKA999
** -----
** SOURCE GROUP DEFINITIONS:
** -----
  SRCGROUP ALL
  SRCGROUP ROADWAYS RD000000-RD999999
  SRCGROUP CONSTRUC RDC00000-RDC99999
  SRCGROUP PARKING PARKA001-PARKA999
SO Finished

```

APPENDIX B.**.HRE Filename = appendixA.hre**

| | | | | | | |
|-------------|----|----|----|----|----------|---------------|
| SO HOUREMIS | 04 | 01 | 01 | 01 | PARKA001 | 9.538541e+005 |
| SO HOUREMIS | 04 | 01 | 01 | 01 | RD000001 | 1.118548e+005 |
| SO HOUREMIS | 04 | 01 | 01 | 01 | RDC00001 | 2.000000e+005 |
| SO HOUREMIS | 04 | 01 | 01 | 02 | PARKA001 | 9.538541e+005 |
| SO HOUREMIS | 04 | 01 | 01 | 02 | RD000001 | 1.118548e+005 |
| SO HOUREMIS | 04 | 01 | 01 | 02 | RDC00001 | 2.000000e+005 |
| SO HOUREMIS | 04 | 01 | 01 | 03 | PARKA001 | 9.538541e+005 |
| SO HOUREMIS | 04 | 01 | 01 | 03 | RD000001 | 1.118548e+005 |
| SO HOUREMIS | 04 | 01 | 01 | 03 | RDC00001 | 2.000000e+005 |
| SO HOUREMIS | 04 | 01 | 01 | 04 | PARKA001 | 9.538541e-006 |
| SO HOUREMIS | 04 | 01 | 01 | 04 | RD000001 | 1.118548e+005 |
| SO HOUREMIS | 04 | 01 | 01 | 04 | RDC00001 | 2.000000e+005 |
| SO HOUREMIS | 04 | 01 | 01 | 05 | PARKA001 | 9.538541e-006 |
| SO HOUREMIS | 04 | 01 | 01 | 05 | RD000001 | 1.118548e+005 |
| SO HOUREMIS | 04 | 01 | 01 | 05 | RDC00001 | 2.000000e+005 |
| SO HOUREMIS | 04 | 01 | 01 | 06 | PARKA001 | 9.538541e-006 |
| SO HOUREMIS | 04 | 01 | 01 | 06 | RD000001 | 1.118548e+005 |
| SO HOUREMIS | 04 | 01 | 01 | 06 | RDC00001 | 2.000000e+005 |
| SO HOUREMIS | 04 | 01 | 01 | 07 | PARKA001 | 9.538541e-006 |
| SO HOUREMIS | 04 | 01 | 01 | 07 | RD000001 | 1.118548e+005 |
| SO HOUREMIS | 04 | 01 | 01 | 07 | RDC00001 | 2.000000e+005 |
| SO HOUREMIS | 04 | 01 | 01 | 08 | PARKA001 | 9.538541e-006 |
| SO HOUREMIS | 04 | 01 | 01 | 08 | RD000001 | 1.118548e+005 |
| SO HOUREMIS | 04 | 01 | 01 | 08 | RDC00001 | 2.000000e+005 |
| SO HOUREMIS | 04 | 01 | 01 | 09 | PARKA001 | 9.538541e-006 |
| SO HOUREMIS | 04 | 01 | 01 | 09 | RD000001 | 1.118548e+005 |
| SO HOUREMIS | 04 | 01 | 01 | 09 | RDC00001 | 2.000000e+005 |
| SO HOUREMIS | 04 | 01 | 01 | 10 | PARKA001 | 9.538541e-006 |
| SO HOUREMIS | 04 | 01 | 01 | 10 | RD000001 | 1.118548e+005 |
| SO HOUREMIS | 04 | 01 | 01 | 10 | RDC00001 | 2.000000e+005 |
| SO HOUREMIS | 04 | 01 | 01 | 11 | PARKA001 | 9.538541e-006 |
| SO HOUREMIS | 04 | 01 | 01 | 11 | RD000001 | 1.118548e+005 |
| SO HOUREMIS | 04 | 01 | 01 | 11 | RDC00001 | 2.000000e+005 |
| SO HOUREMIS | 04 | 01 | 01 | 12 | PARKA001 | 9.538541e-006 |
| SO HOUREMIS | 04 | 01 | 01 | 12 | RD000001 | 1.118548e+005 |
| SO HOUREMIS | 04 | 01 | 01 | 12 | RDC00001 | 2.000000e+005 |
| SO HOUREMIS | 04 | 01 | 01 | 13 | PARKA001 | 9.538541e-006 |
| SO HOUREMIS | 04 | 01 | 01 | 13 | RD000001 | 1.118548e+005 |
| SO HOUREMIS | 04 | 01 | 01 | 13 | RDC00001 | 2.000000e+005 |
| SO HOUREMIS | 04 | 01 | 01 | 14 | PARKA001 | 9.538541e-006 |
| SO HOUREMIS | 04 | 01 | 01 | 14 | RD000001 | 1.118548e+005 |
| SO HOUREMIS | 04 | 01 | 01 | 14 | RDC00001 | 2.000000e+005 |
| SO HOUREMIS | 04 | 01 | 01 | 15 | PARKA001 | 9.538541e-006 |
| SO HOUREMIS | 04 | 01 | 01 | 15 | RD000001 | 1.118548e+005 |
| SO HOUREMIS | 04 | 01 | 01 | 15 | RDC00001 | 2.000000e+005 |
| SO HOUREMIS | 04 | 01 | 01 | 16 | PARKA001 | 9.538541e-006 |
| SO HOUREMIS | 04 | 01 | 01 | 16 | RD000001 | 1.118548e+005 |
| SO HOUREMIS | 04 | 01 | 01 | 16 | RDC00001 | 2.000000e+005 |
| SO HOUREMIS | 04 | 01 | 01 | 17 | PARKA001 | 9.538541e-006 |
| SO HOUREMIS | 04 | 01 | 01 | 17 | RD000001 | 1.118548e+005 |

| | | | | | | |
|-------------|----|----|----|----|----------|---------------|
| SO HOUREMIS | 04 | 01 | 01 | 17 | RDC00001 | 2.000000e+005 |
| SO HOUREMIS | 04 | 01 | 01 | 18 | PARKA001 | 9.538541e-006 |
| SO HOUREMIS | 04 | 01 | 01 | 18 | RD000001 | 1.118548e+005 |
| SO HOUREMIS | 04 | 01 | 01 | 18 | RDC00001 | 2.000000e+005 |
| SO HOUREMIS | 04 | 01 | 01 | 19 | PARKA001 | 9.538541e-006 |
| SO HOUREMIS | 04 | 01 | 01 | 19 | RD000001 | 1.118548e+005 |
| SO HOUREMIS | 04 | 01 | 01 | 19 | RDC00001 | 2.000000e+005 |
| SO HOUREMIS | 04 | 01 | 01 | 20 | PARKA001 | 9.538541e-006 |
| SO HOUREMIS | 04 | 01 | 01 | 20 | RD000001 | 1.118548e+005 |
| SO HOUREMIS | 04 | 01 | 01 | 20 | RDC00001 | 2.000000e+005 |
| SO HOUREMIS | 04 | 01 | 01 | 21 | PARKA001 | 9.538541e-006 |
| SO HOUREMIS | 04 | 01 | 01 | 21 | RD000001 | 1.118548e+005 |
| SO HOUREMIS | 04 | 01 | 01 | 21 | RDC00001 | 2.000000e+005 |
| SO HOUREMIS | 04 | 01 | 01 | 22 | PARKA001 | 9.538541e-006 |
| SO HOUREMIS | 04 | 01 | 01 | 22 | RD000001 | 1.118548e+005 |
| SO HOUREMIS | 04 | 01 | 01 | 22 | RDC00001 | 2.000000e+005 |
| SO HOUREMIS | 04 | 01 | 01 | 23 | PARKA001 | 9.538541e-006 |
| SO HOUREMIS | 04 | 01 | 01 | 23 | RD000001 | 1.118548e+005 |
| SO HOUREMIS | 04 | 01 | 01 | 23 | RDC00001 | 2.000000e+005 |
| SO HOUREMIS | 04 | 01 | 01 | 24 | PARKA001 | 9.538541e-006 |
| SO HOUREMIS | 04 | 01 | 01 | 24 | RD000001 | 1.118548e+005 |
| SO HOUREMIS | 04 | 01 | 01 | 24 | RDC00001 | 2.000000e+005 |

APPENDIX C.

Example of Categorized Emissions Inventory Results File Format for Input into AEDT.

```

Year ID,Source,Pollutant ID,Emission Quant
2018,Roadways,100,100
2018,Roadways,106,200
2018,Roadways,107,300
2018,Parking Facilities,100,100
2018,Parking Facilities,106,200
2018,Parking Facilities,107,300
2018,Construction,100,100
2018,Construction,106,200
2018,Construction,107,300
2018,Roadways,1,455
2018,Roadways,2,433
2018,Roadways,3,221
2018,Parking Facilities,1,123
2018,Parking Facilities,2,6789
2018,Parking Facilities,3,4567
2018,Construction,1,345
2018,Construction,2,367
2018,Construction,3,234

```

APPENDIX D.

Example of MOVES Link Level Inventory Results from MOVES for input into AEDT.

```
MOVESRunID,iterationID,yearID,monthID,dayID,hourID,stateID,countyID,zoneID,linkID,pollutantID,processID,sourceTypeID,regClassID,fuelTypeID,fuelSubTypeID,modelYearID,roadTypeID,SCC,engTechID,sectorID,hpID,emissionQuant,emissionQuantMean,emissionQuantSigma
1,1,2018,7,5,9,25,25025,250250,11,122,NULL,NULL,NULL,NULL,NULL,NULL,5,NULL,NULL,NULL,NULL,0.93772,NULL,NULL
1,1,2018,7,5,9,25,25025,250250,10,122,NULL,NULL,NULL,NULL,NULL,NULL,5,NULL,NULL,NULL,NULL,14.8769,NULL,NULL
1,1,2018,7,5,9,25,25025,250250,9,122,NULL,NULL,NULL,NULL,NULL,NULL,5,NULL,NULL,NULL,NULL,23.0477,NULL,NULL
1,1,2018,7,5,9,25,25025,250250,8,122,NULL,NULL,NULL,NULL,NULL,NULL,5,NULL,NULL,NULL,NULL,8.08422,NULL,NULL
1,1,2018,7,5,9,25,25025,250250,7,122,NULL,NULL,NULL,NULL,NULL,NULL,5,NULL,NULL,NULL,NULL,0.545136,NULL,NULL
1,1,2018,7,5,9,25,25025,250250,6,122,NULL,NULL,NULL,NULL,NULL,NULL,5,NULL,NULL,NULL,NULL,1.62481,NULL,NULL
1,1,2018,7,5,9,25,25025,250250,5,122,NULL,NULL,NULL,NULL,NULL,NULL,5,NULL,NULL,NULL,NULL,1.98238,NULL,NULL
1,1,2018,7,5,9,25,25025,250250,4,122,NULL,NULL,NULL,NULL,NULL,NULL,5,NULL,NULL,NULL,NULL,4.86738,NULL,NULL
1,1,2018,7,5,9,25,25025,250250,3,122,NULL,NULL,NULL,NULL,NULL,NULL,5,NULL,NULL,NULL,NULL,16.4516,NULL,NULL
1,1,2018,7,5,9,25,25025,250250,2,122,NULL,NULL,NULL,NULL,NULL,NULL,5,NULL,NULL,NULL,NULL,42.1727,NULL,NULL
1,1,2018,7,5,9,25,25025,250250,1,122,NULL,NULL,NULL,NULL,NULL,NULL,5,NULL,NULL,NULL,NULL,209.949,NULL,NULL
1,1,2018,7,5,9,25,25025,250250,11,121,NULL,NULL,NULL,NULL,NULL,NULL,5,NULL,NULL,NULL,NULL,0.385567,NULL,NULL
1,1,2018,7,5,9,25,25025,250250,10,121,NULL,NULL,NULL,NULL,NULL,NULL,5,NULL,NULL,NULL,NULL,6.11701,NULL,NULL
1,1,2018,7,5,9,25,25025,250250,9,121,NULL,NULL,NULL,NULL,NULL,NULL,5,NULL,NULL,NULL,NULL,9.47663,NULL,NULL
1,1,2018,7,5,9,25,25025,250250,8,121,NULL,NULL,NULL,NULL,NULL,NULL,5,NULL,NULL,NULL,NULL,3.32403,NULL,NULL
1,1,2018,7,5,9,25,25025,250250,7,121,NULL,NULL,NULL,NULL,NULL,NULL,5,NULL,NULL,NULL,NULL,0.224146,NULL,NULL
1,1,2018,7,5,9,25,25025,250250,6,121,NULL,NULL,NULL,NULL,NULL,NULL,5,NULL,NULL,NULL,NULL,0.668081,NULL,NULL
1,1,2018,7,5,9,25,25025,250250,5,121,NULL,NULL,NULL,NULL,NULL,NULL,5,NULL,NULL,NULL,NULL,0.815104,NULL,NULL
1,1,2018,7,5,9,25,25025,250250,4,121,NULL,NULL,NULL,NULL,NULL,NULL,5,NULL,NULL,NULL,NULL,2.00135,NULL,NULL
1,1,2018,7,5,9,25,25025,250250,3,121,NULL,NULL,NULL,NULL,NULL,NULL,5,NULL,NULL,NULL,NULL,6.7645,NULL,NULL
1,1,2018,7,5,9,25,25025,250250,2,121,NULL,NULL,NULL,NULL,NULL,NULL,5,NULL,NULL,NULL,NULL,17.3404,NULL,NULL
1,1,2018,7,5,9,25,25025,250250,1,121,NULL,NULL,NULL,NULL,NULL,NULL,5,NULL,NULL,NULL,NULL,86.3259,NULL,NULL
1,1,2018,7,5,9,25,25025,250250,11,119,NULL,NULL,NULL,NULL,NULL,NULL,5,NULL,NULL,NULL,NULL,0,NULL,NULL
1,1,2018,7,5,9,25,25025,250250,10,119,NULL,NULL,NULL,NULL,NULL,NULL,5,NULL,NULL,NULL,NULL,0,NULL,NULL
1,1,2018,7,5,9,25,25025,250250,9,119,NULL,NULL,NULL,NULL,NULL,NULL,5,NULL,NULL,NULL,NULL,0,NULL,NULL
1,1,2018,7,5,9,25,25025,250250,8,119,NULL,NULL,NULL,NULL,NULL,NULL,5,NULL,NULL,NULL,NULL,0,NULL,NULL
1,1,2018,7,5,9,25,25025,250250,7,119,NULL,NULL,NULL,NULL,NULL,NULL,5,NULL,NULL,NULL,NULL,0,NULL,NULL
1,1,2018,7,5,9,25,25025,250250,6,119,NULL,NULL,NULL,NULL,NULL,NULL,5,NULL,NULL,NULL,NULL,0,NULL,NULL
1,1,2018,7,5,9,25,25025,250250,5,119,NULL,NULL,NULL,NULL,NULL,NULL,5,NULL,NULL,NULL,NULL,0,NULL,NULL
1,1,2018,7,5,9,25,25025,250250,4,119,NULL,NULL,NULL,NULL,NULL,NULL,5,NULL,NULL,NULL,NULL,0,NULL,NULL
1,1,2018,7,5,9,25,25025,250250,3,119,NULL,NULL,NULL,NULL,NULL,NULL,5,NULL,NULL,NULL,NULL,0,NULL,NULL
1,1,2018,7,5,9,25,25025,250250,2,119,NULL,NULL,NULL,NULL,NULL,NULL,5,NULL,NULL,NULL,NULL,0,NULL,NULL
1,1,2018,7,5,9,25,25025,250250,1,119,NULL,NULL,NULL,NULL,NULL,NULL,5,NULL,NULL,NULL,NULL,0,NULL,NULL
1,1,2018,7,5,9,25,25025,250250,11,118,NULL,NULL,NULL,NULL,NULL,NULL,5,NULL,NULL,NULL,NULL,6.83482,NULL
```