

Introduction to MOVES

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FHWA Resource Center

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National Webinar

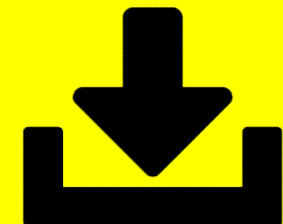


U.S. Department of Transportation
Federal Highway Administration

Housekeeping Items

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- All participants are in listen only mode
- Questions will be taken through the chat pod
- Slides are available for download in the web room



Purpose

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- This Webinar provides an introduction to the U.S. Environmental Protection Agency's (EPA) MOVES Onroad model within the context of regional transportation conformity analyses for ozone
- It is based on EPA's MOVES2014a 2-Day Hands-On Training Course for New MOVES Users
- This Webinar focuses on the types of information and data required for running MOVES
- It does not provide technical guidance or technical assistance for using MOVES in a regulatory application



Outline

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- EPA resources and guidance
- Graphical user interface
- Navigation panel
- County Data Manager
- Summarizing data needs and sources
- Obtaining results
- Training and technical assistance



- EPA resources and guidance
- Graphical user interface
- Navigation panel
- County Data Manager
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MOtor Vehicle Emission Simulator (MOVES)

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- EPA's model for estimating emissions from mobile sources
- The current version, MOVES2014a, is approved for regulatory applications of criteria air pollutants at the county and project-level in all states except California for:
 - New State Implementation Plans (SIPs)
 - Regional transportation conformity analyses
 - Project-level transportation conformity analyses



EPA Resources

(<https://www.epa.gov/moves>)





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An official website of the United States government.

EPA United States Environmental Protection Agency

Environmental Topics Laws & Regulations About EPA Search EPA.gov

MOVES and Other Mobile Source Emissions Models

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MOtor Vehicle Emission Simulator (MOVES)

[Latest version of MOVES](#)

EPA's MOtor Vehicle Emission Simulator (MOVES) is a state-of-the-science emission modeling system that estimates emissions for mobile sources at the national, county, and project level for criteria air pollutants, greenhouse gases, and air toxics.

Using MOVES

- Current Version: [MOVES2014a](#)
- [MOVES2014 and MOVES2010b: Limited Use](#)
- [Tools to Develop or Convert MOVES Inputs](#)
- [MOVES Training Sessions](#)
- [Methods to Produce Emission Inventories](#)

Understanding Algorithms & Default Data

- [MOVES Algorithms](#)
- [MOVES Technical Reports](#)
- [NONROAD Technical Reports](#)
- [Presentations and Workshops on MOVES Data](#)
- [MOVES Model Review Work Group](#)
- [Fuel Analysis Programs](#)

Older Models

- [Previous MOVES Versions](#)
- [MOBILE Model](#)
- [NONROAD Model](#)
- [NMIM \(National Mobile Inventory Model\)](#)

Search MOVES and Other Models

[Search this Site](#)



U.S. Department of Transportation
Federal Highway Administration

EPA Guidance

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- MOVES2014 SIP and Conformity Policy Guidance
 - Guidance on when MOVES should be used in SIPs and transportation conformity analyses
 - nepis.epa.gov/Exe/ZyPDF.cgi?Dockey=P100K4EB.txt
- MOVES2014a Q&A document
 - nepis.epa.gov/Exe/ZyPDF.cgi?Dockey=P100NNR0.txt
- MOVES2014 and MOVES2014a Technical Guidance
 - Detailed guidance on appropriate inputs for MOVES in SIPs and regional conformity analyses
 - Defaults vs. local information
 - Developing appropriate local inputs
 - nepis.epa.gov/Exe/ZyPDF.cgi?Dockey=P100NN9L.txt

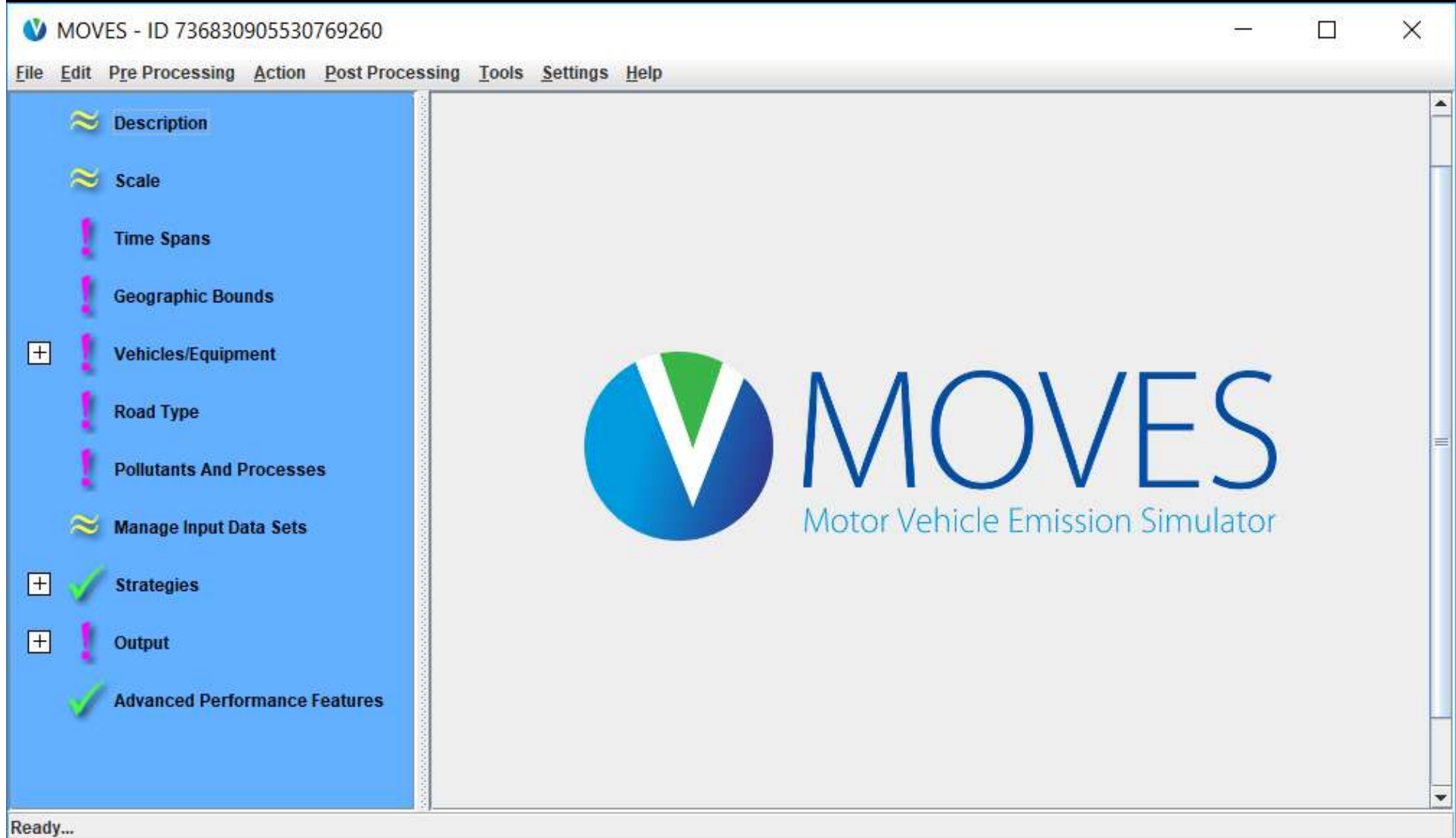


- EPA resources and guidance
- Graphical user interface
- Navigation panel
- County Data Manager
- Summarizing data needs and sources
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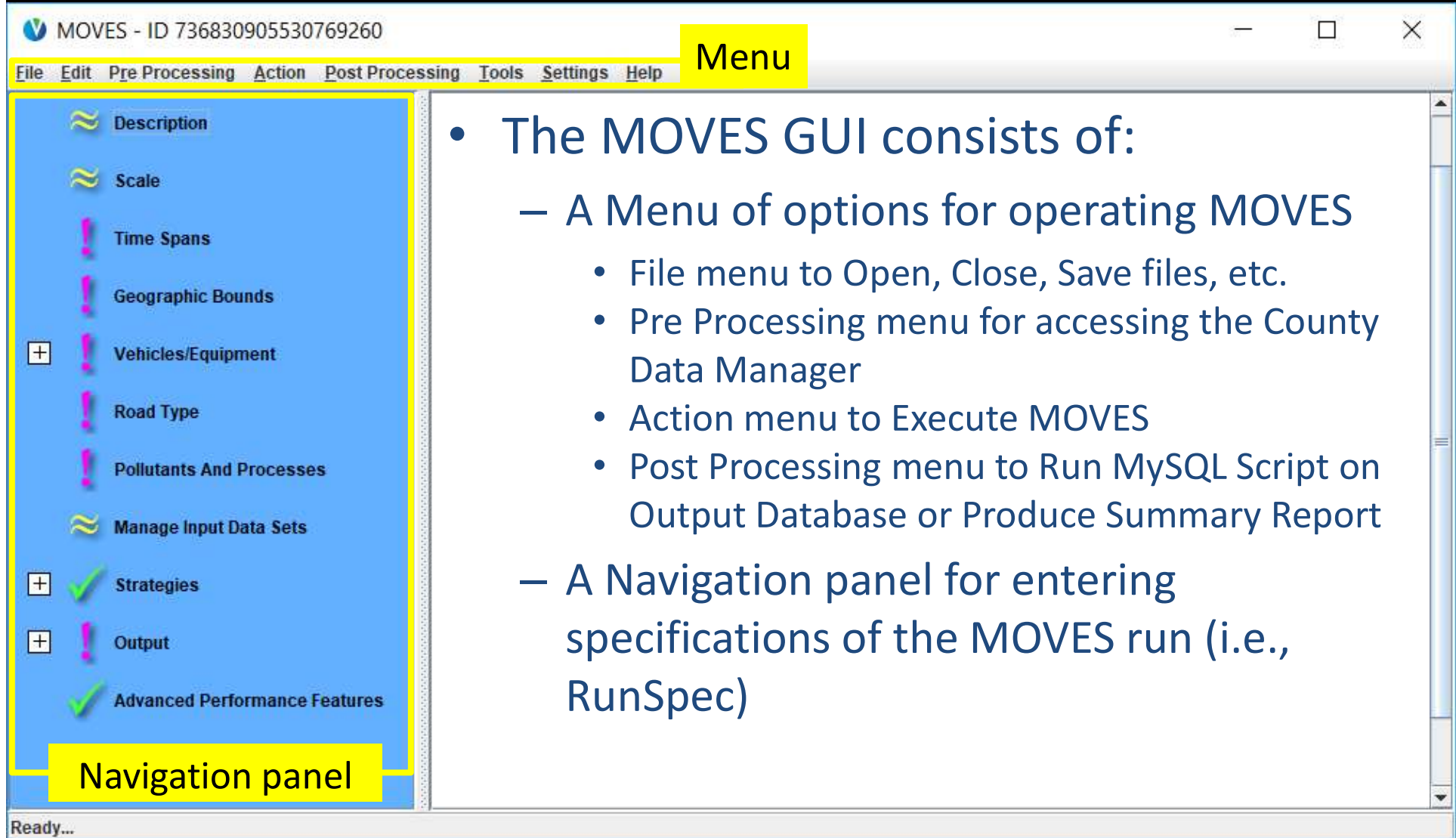
Graphical User Interface (GUI)

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Graphical User Interface (GUI)

11



The screenshot displays the MOVES GUI interface. The title bar reads "MOVES - ID 736830905530769260". The menu bar includes "File", "Edit", "Pre Processing", "Action", "Post Processing", "Tools", "Settings", and "Help". A yellow box labeled "Menu" highlights the menu bar. The left sidebar, labeled "Navigation panel", contains a list of options with icons: "Description" (wavy line), "Scale" (wavy line), "Time Spans" (exclamation mark), "Geographic Bounds" (exclamation mark), "Vehicles/Equipment" (plus sign and exclamation mark), "Road Type" (exclamation mark), "Pollutants And Processes" (exclamation mark), "Manage Input Data Sets" (wavy line), "Strategies" (plus sign and checkmark), "Output" (plus sign and exclamation mark), and "Advanced Performance Features" (checkmark). The main window area contains a bulleted list describing the GUI components.

MOVES - ID 736830905530769260

File Edit Pre Processing Action Post Processing Tools Settings Help

Menu

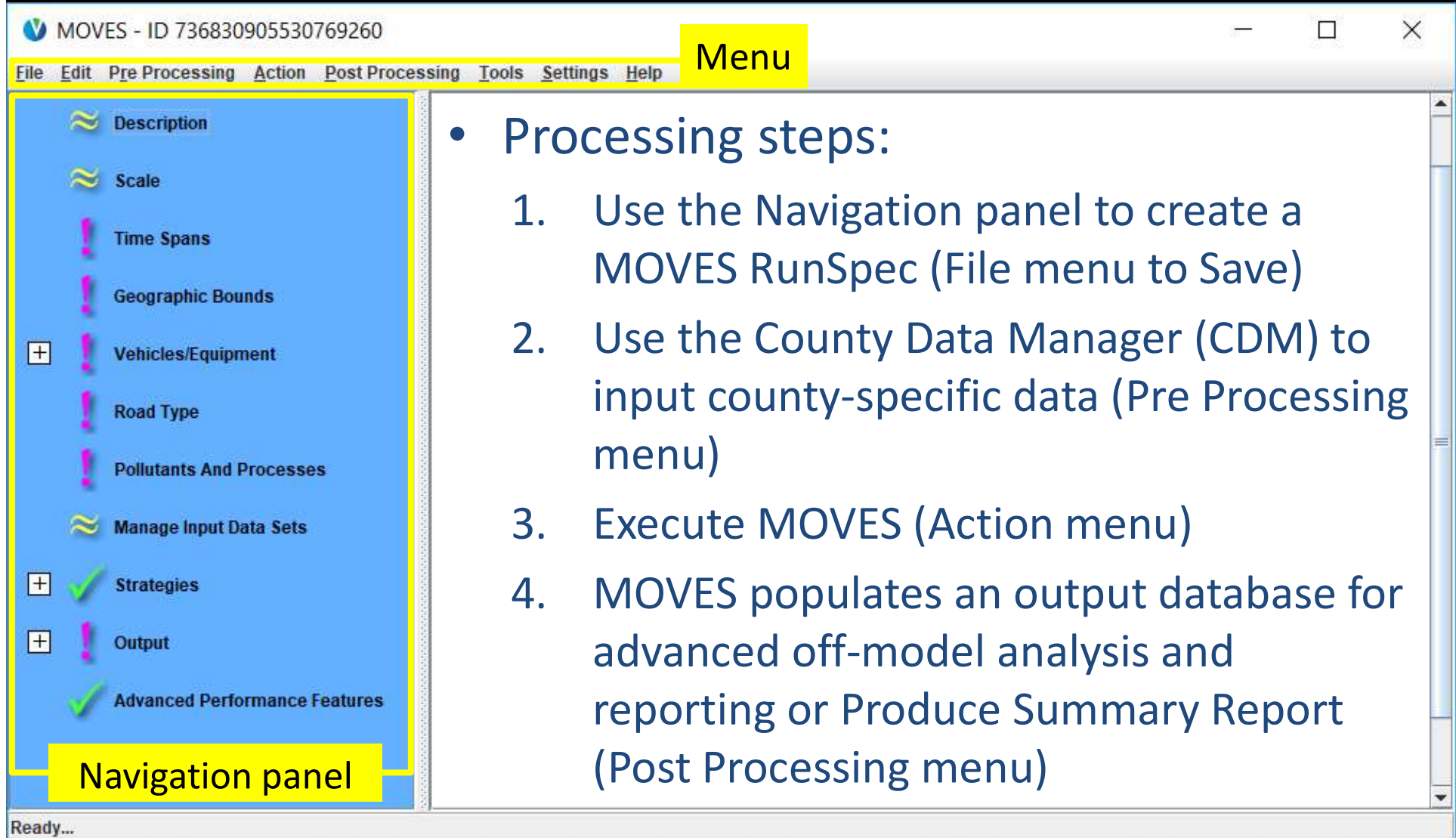
- The MOVES GUI consists of:
 - A Menu of options for operating MOVES
 - File menu to Open, Close, Save files, etc.
 - Pre Processing menu for accessing the County Data Manager
 - Action menu to Execute MOVES
 - Post Processing menu to Run MySQL Script on Output Database or Produce Summary Report
 - A Navigation panel for entering specifications of the MOVES run (i.e., RunSpec)

Navigation panel

Ready...

Graphical User Interface (GUI)

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The screenshot displays the MOVES software interface. At the top, a title bar shows 'MOVES - ID 736830905530769260' and standard window controls. Below this is a menu bar with options: File, Edit, Pre Processing, Action, Post Processing, Tools, Settings, and Help. A yellow box highlights the 'Menu' label. On the left side, a blue 'Navigation panel' is outlined in yellow, containing a list of settings with icons: Description (wavy line), Scale (wavy line), Time Spans (exclamation mark), Geographic Bounds (exclamation mark), Vehicles/Equipment (plus and exclamation mark), Road Type (exclamation mark), Pollutants And Processes (exclamation mark), Manage Input Data Sets (wavy line), Strategies (plus and checkmark), Output (plus and exclamation mark), and Advanced Performance Features (checkmark). A yellow box at the bottom of this panel is labeled 'Navigation panel'. The main workspace on the right contains a list of processing steps. The status bar at the bottom left reads 'Ready...'.

MOVES - ID 736830905530769260

File Edit Pre Processing Action Post Processing Tools Settings Help Menu

- Processing steps:
 1. Use the Navigation panel to create a MOVES RunSpec (File menu to Save)
 2. Use the County Data Manager (CDM) to input county-specific data (Pre Processing menu)
 3. Execute MOVES (Action menu)
 4. MOVES populates an output database for advanced off-model analysis and reporting or Produce Summary Report (Post Processing menu)

Navigation panel

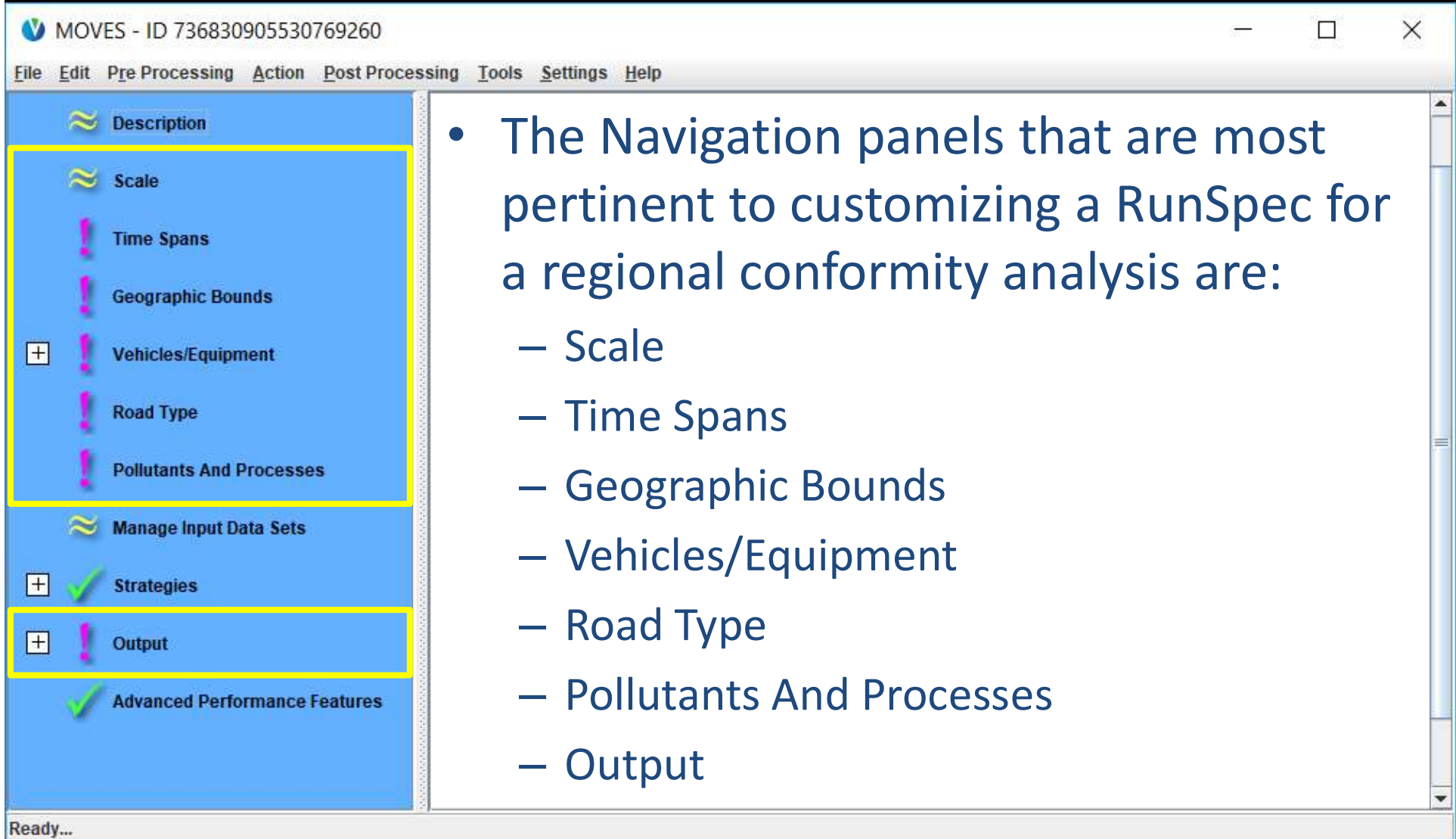
Ready...

- EPA resources and guidance
- Graphical user interface
- **Navigation panel**
- County Data Manager
- Summarizing data needs and sources
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Navigation Panel

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The screenshot shows the MOVES software interface. The title bar reads "MOVES - ID 736830905530769260". The menu bar includes "File", "Edit", "Pre Processing", "Action", "Post Processing", "Tools", "Settings", and "Help". The left sidebar, titled "Navigation Panel", contains several expandable sections. A yellow box highlights the following items: "Description", "Scale", "Time Spans", "Geographic Bounds", "Vehicles/Equipment", "Road Type", and "Pollutants And Processes". Below these are "Manage Input Data Sets", "Strategies", "Output", and "Advanced Performance Features". The main area on the right contains a bulleted list of the highlighted items.

MOVES - ID 736830905530769260

File Edit Pre Processing Action Post Processing Tools Settings Help

- Description
- Scale
- Time Spans
- Geographic Bounds
- Vehicles/Equipment
- Road Type
- Pollutants And Processes
- Manage Input Data Sets
- Strategies
- Output
- Advanced Performance Features

- The Navigation panels that are most pertinent to customizing a RunSpec for a regional conformity analysis are:
 - Scale
 - Time Spans
 - Geographic Bounds
 - Vehicles/Equipment
 - Road Type
 - Pollutants And Processes
 - Output

Ready...

Scale panel

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MOVES - ID 736830905530769260

File Edit Pre Processing Action Post Processing Tools Settings Help

- ✓ Description
- ✓ Scale
- ! Time Spans
- ! Geographic Bounds
- + ! Vehicles/Equipment
- ! Road Type
- ! Pollutants And Processes
- ≈ Manage Input Data Sets
- + ✓ Strategies
- + ! Output
- ✓ Advanced Performance Features

- On this panel, the user specifies:
 - Model ☒ Onroad
 - Applicable to transportation planning
 - Domain/Scale ☒ County
 - County scale must be used for SIPs and regional transportation conformity analyses
 - Calculation Type ☒ Inventory or ☒ Emission Rate

Ready...

Time Spans panel

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MOVES - ID 736830905530769260

File Edit Pre Processing Action Post Processing Tools Settings Help

- ✓ Description
- ✓ Scale
- ✓ Time Spans
- ! Geographic Bounds
- + ! Vehicles/Equipment
- ! Road Type
- ! Pollutants And Processes
- ≈ Manage Input Data Sets
- + ✓ Strategies
- + ! Output
- ✓ Advanced Performance Features

- On this panel, the user specifies:
 - Time Aggregation Level ☒ Hour
 - Must be set to hour for regulatory purposes
 - Years
 - Only one year per MOVES run can be selected for County scale
 - Separate MOVES runs are required for multiple analysis years to cover applicable
 - Budget tests: attainment year, intermediate year(s), last year of the transportation plan
 - Interim tests: a year within 5 years of the conformity determination year, intermediate year(s), last year of the transportation plan

Ready...

Time Spans panel

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MOVES - ID 736830905530769260

File Edit Pre Processing Action Post Processing Tools Settings Help

☒ Description
☒ Scale
☒ Time Spans
☐ Geographic Bounds
☐ Vehicles/Equipment
☐ Road Type
☐ Pollutants And Processes
☐ Manage Input Data Sets
☐ Strategies
☐ Output
☒ Advanced Performance Features

– Months ☒ July

- Select the month(s) representative of the local ozone season

– Days ☐ Weekend ☒ Weekdays

- Weekend, Weekdays, or both can be selected
- Select the type of day(s) representative of the local ozone season

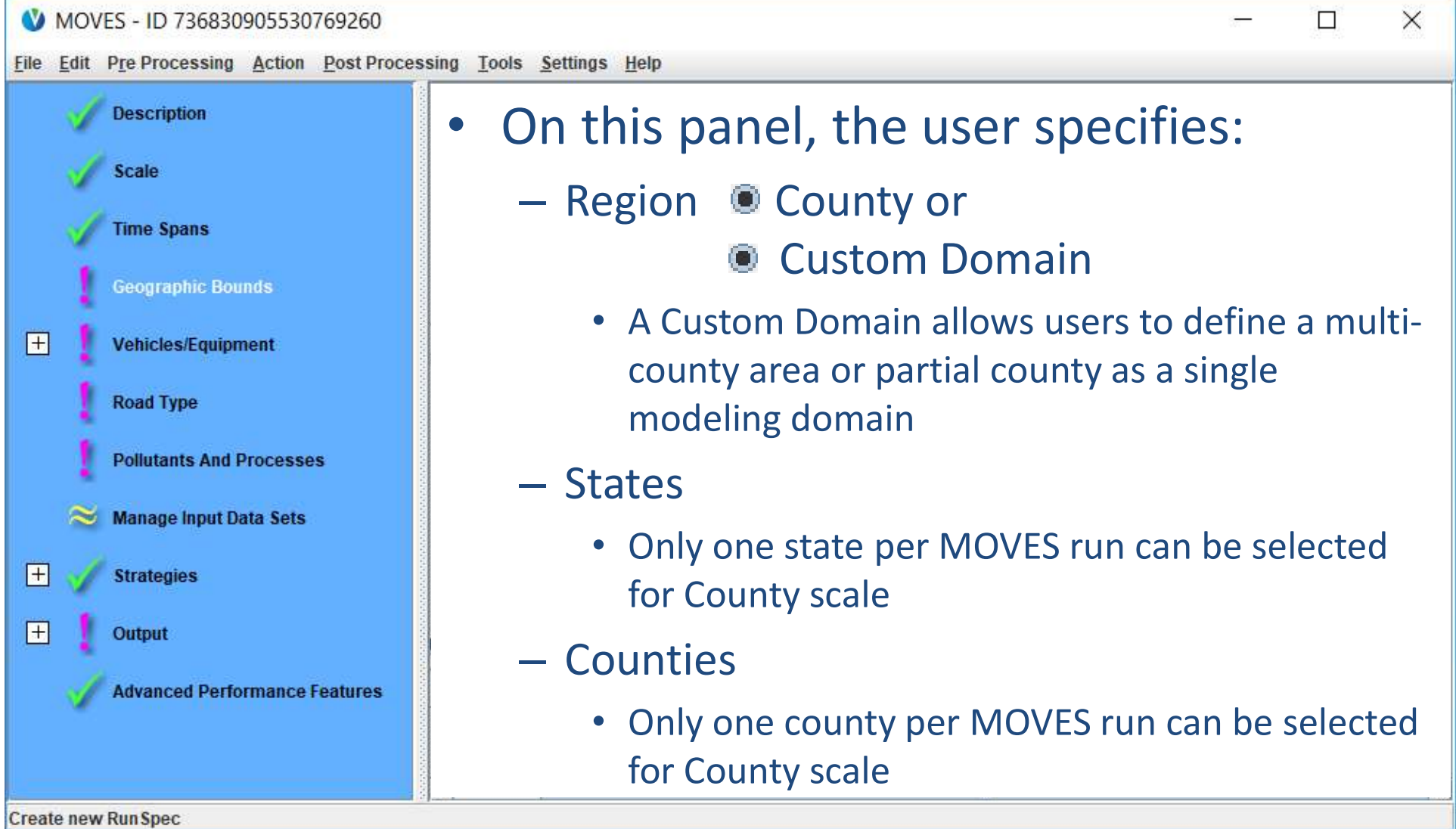
– Hours Start Hour: 00:00 - 00:59 End Hour: 23:00 - 23:59

- All hours should be selected for regulatory purposes

Ready...

Geographic Bounds panel

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The screenshot shows the MOVES software interface. The title bar reads "MOVES - ID 736830905530769260". The menu bar includes "File", "Edit", "Pre Processing", "Action", "Post Processing", "Tools", "Settings", and "Help". On the left is a blue sidebar with a list of settings, each with a status icon (green checkmark, pink exclamation mark, or yellow plus sign):

- Description (green checkmark)
- Scale (green checkmark)
- Time Spans (green checkmark)
- Geographic Bounds (pink exclamation mark)
- Vehicles/Equipment (yellow plus sign)
- Road Type (pink exclamation mark)
- Pollutants And Processes (pink exclamation mark)
- Manage Input Data Sets (yellow plus sign)
- Strategies (green checkmark)
- Output (yellow plus sign)
- Advanced Performance Features (green checkmark)

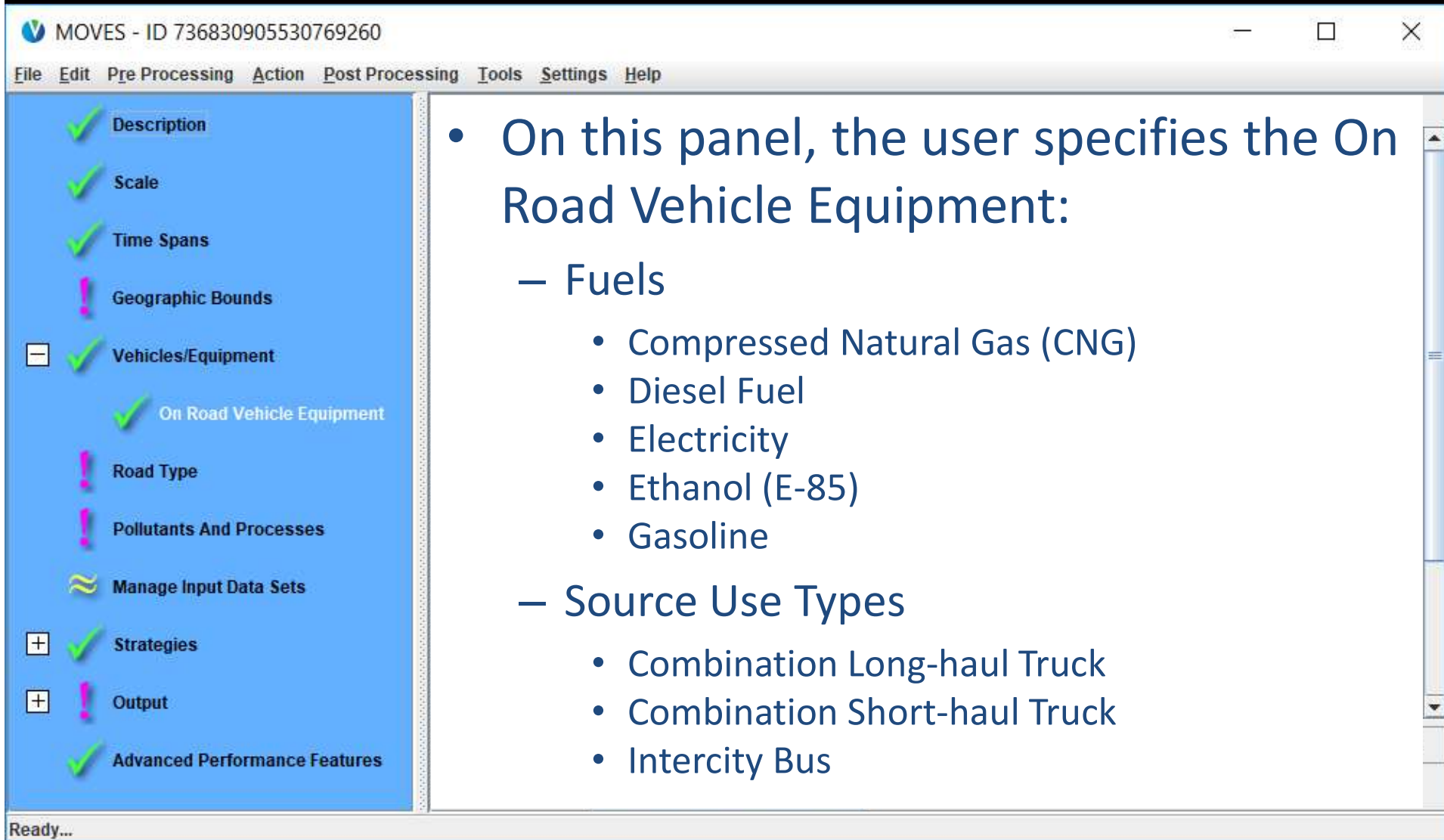
The main panel on the right contains the following text:

- On this panel, the user specifies:
 - Region ☒ County or ☒ Custom Domain
 - A Custom Domain allows users to define a multi-county area or partial county as a single modeling domain
 - States
 - Only one state per MOVES run can be selected for County scale
 - Counties
 - Only one county per MOVES run can be selected for County scale

At the bottom left of the window is a button labeled "Create new Run Spec".

Vehicles/Equipment panel

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The screenshot shows the MOVES software interface. The title bar reads "MOVES - ID 736830905530769260". The menu bar includes "File", "Edit", "Pre Processing", "Action", "Post Processing", "Tools", "Settings", and "Help". The left sidebar contains a list of panels with status icons: "Description" (green check), "Scale" (green check), "Time Spans" (green check), "Geographic Bounds" (pink exclamation mark), "Vehicles/Equipment" (green check, highlighted with a blue background), "On Road Vehicle Equipment" (green check), "Road Type" (pink exclamation mark), "Pollutants And Processes" (pink exclamation mark), "Manage Input Data Sets" (yellow wavy line), "Strategies" (green check), "Output" (pink exclamation mark), and "Advanced Performance Features" (green check). The main panel displays a bulleted list of options for specifying On Road Vehicle Equipment.

MOVES - ID 736830905530769260

File Edit Pre Processing Action Post Processing Tools Settings Help

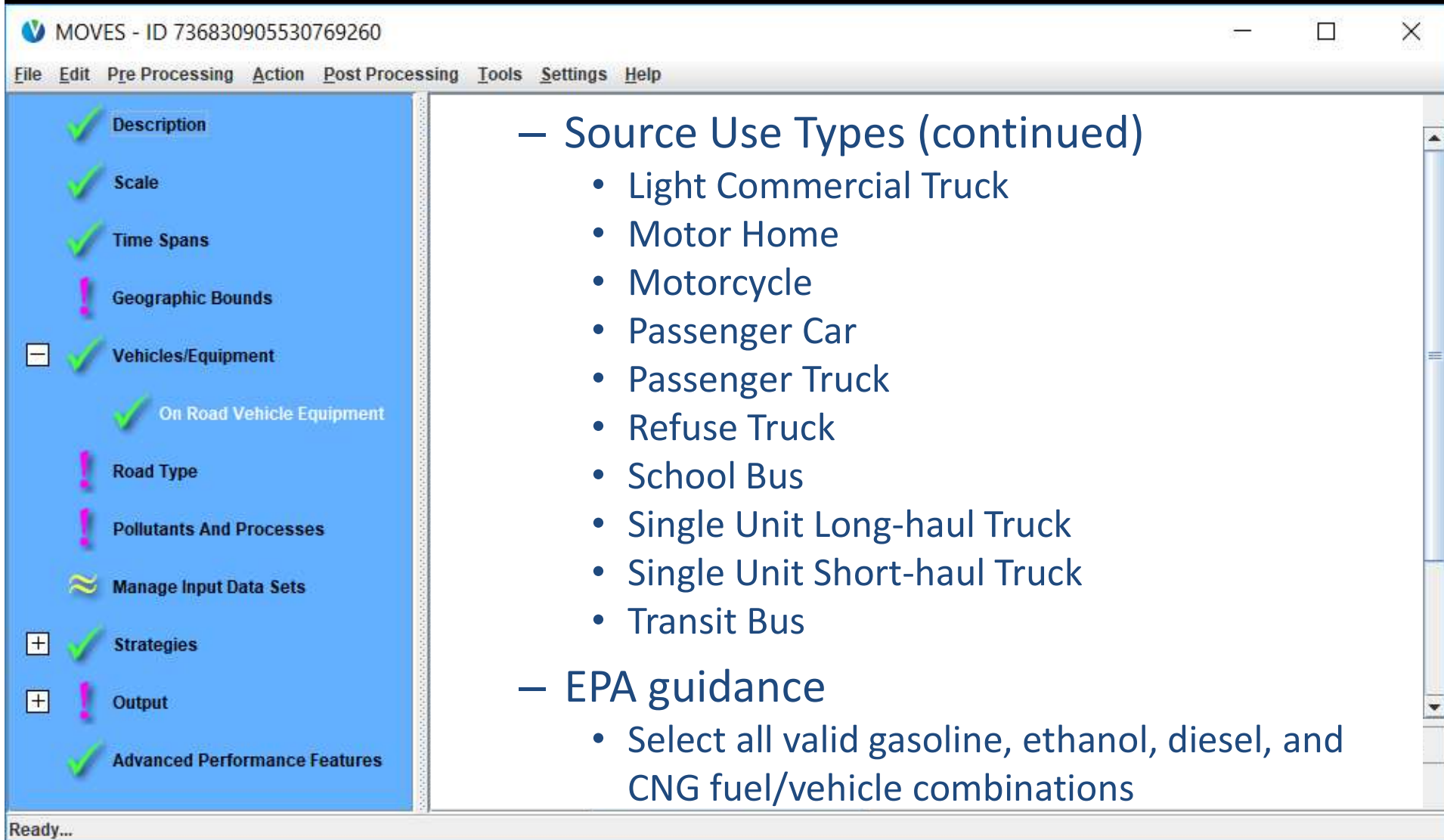
- ✓ Description
- ✓ Scale
- ✓ Time Spans
- ! Geographic Bounds
- [-] ✓ Vehicles/Equipment
 - ✓ On Road Vehicle Equipment
- ! Road Type
- ! Pollutants And Processes
- ≈ Manage Input Data Sets
- [+] ✓ Strategies
- [+] ! Output
- ✓ Advanced Performance Features

- On this panel, the user specifies the On Road Vehicle Equipment:
 - Fuels
 - Compressed Natural Gas (CNG)
 - Diesel Fuel
 - Electricity
 - Ethanol (E-85)
 - Gasoline
 - Source Use Types
 - Combination Long-haul Truck
 - Combination Short-haul Truck
 - Intercity Bus

Ready...

Vehicles/Equipment panel

20



The screenshot shows the MOVES software interface. The title bar reads "MOVES - ID 736830905530769260". The menu bar includes "File", "Edit", "Pre Processing", "Action", "Post Processing", "Tools", "Settings", and "Help". The left sidebar contains a list of panels with status icons: "Description" (green check), "Scale" (green check), "Time Spans" (green check), "Geographic Bounds" (pink exclamation mark), "Vehicles/Equipment" (green check, highlighted with a minus icon), "On Road Vehicle Equipment" (green check), "Road Type" (pink exclamation mark), "Pollutants And Processes" (pink exclamation mark), "Manage Input Data Sets" (yellow wavy line), "Strategies" (green check, plus icon), "Output" (pink exclamation mark, plus icon), and "Advanced Performance Features" (green check). The main panel displays the "Vehicles/Equipment" content, which includes two sections: "Source Use Types (continued)" and "EPA guidance".

MOVES - ID 736830905530769260

File Edit Pre Processing Action Post Processing Tools Settings Help

✓ Description
✓ Scale
✓ Time Spans
! Geographic Bounds
- ✓ Vehicles/Equipment
✓ On Road Vehicle Equipment
! Road Type
! Pollutants And Processes
≈ Manage Input Data Sets
+ ✓ Strategies
+ ! Output
✓ Advanced Performance Features

– Source Use Types (continued)

- Light Commercial Truck
- Motor Home
- Motorcycle
- Passenger Car
- Passenger Truck
- Refuse Truck
- School Bus
- Single Unit Long-haul Truck
- Single Unit Short-haul Truck
- Transit Bus

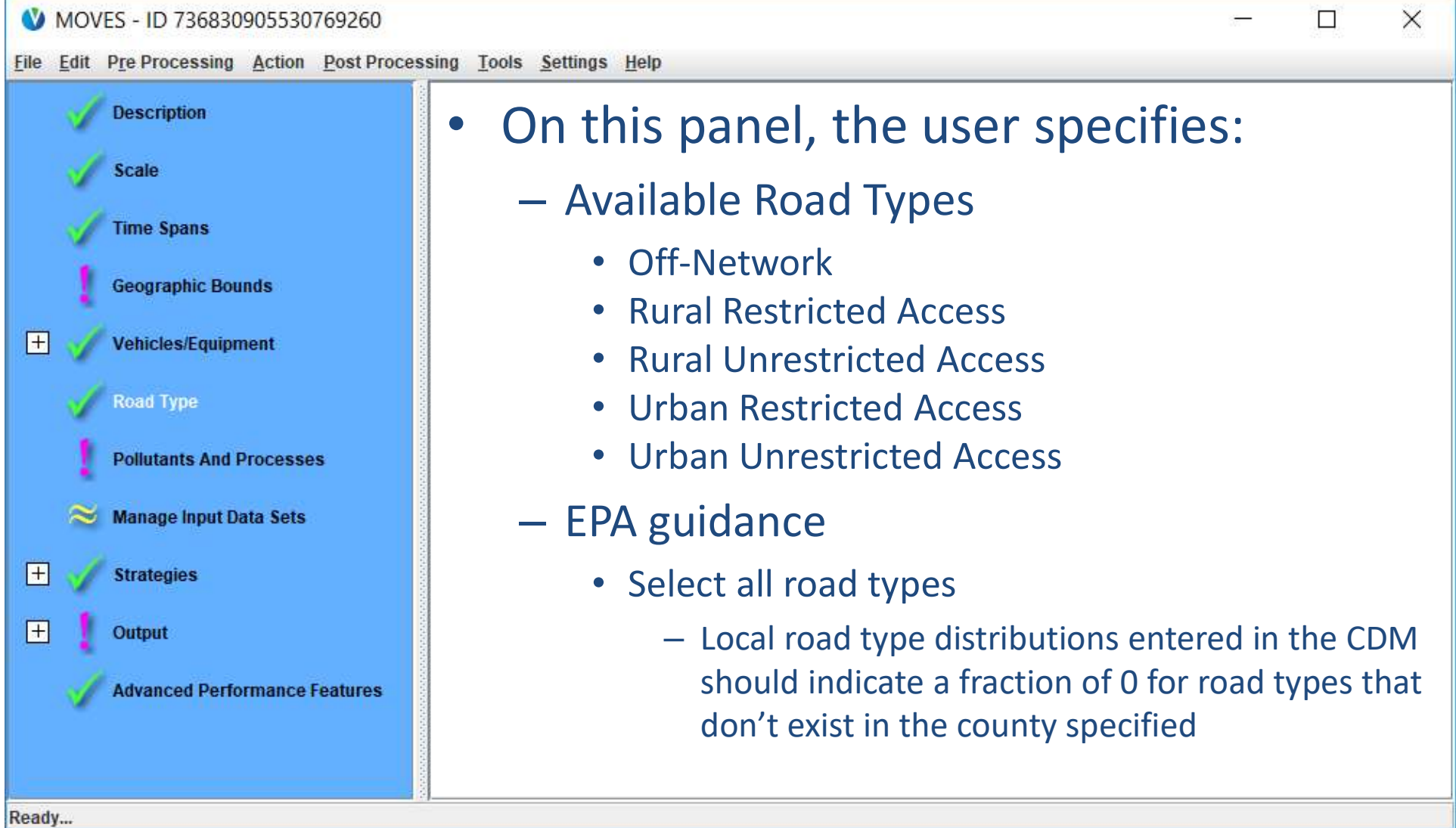
– EPA guidance

- Select all valid gasoline, ethanol, diesel, and CNG fuel/vehicle combinations

Ready...

Road Type panel

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The screenshot shows the MOVES software interface. The title bar reads "MOVES - ID 736830905530769260". The menu bar includes "File", "Edit", "Pre Processing", "Action", "Post Processing", "Tools", "Settings", and "Help". The left sidebar contains a list of panels with status icons: "Description" (green check), "Scale" (green check), "Time Spans" (green check), "Geographic Bounds" (pink exclamation mark), "Vehicles/Equipment" (green check, expanded with a plus icon), "Road Type" (green check), "Pollutants And Processes" (pink exclamation mark), "Manage Input Data Sets" (yellow wavy line), "Strategies" (green check, expanded with a plus icon), "Output" (pink exclamation mark, expanded with a plus icon), and "Advanced Performance Features" (green check). The main content area displays a bulleted list of specifications for the Road Type panel.

• On this panel, the user specifies:

- Available Road Types
 - Off-Network
 - Rural Restricted Access
 - Rural Unrestricted Access
 - Urban Restricted Access
 - Urban Unrestricted Access
- EPA guidance
 - Select all road types
 - Local road type distributions entered in the CDM should indicate a fraction of 0 for road types that don't exist in the county specified

Ready...

Pollutants And Processes panel

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MOVES - ID 736830905530769260

File Edit Pre Processing Action Post Processing Tools Settings Help

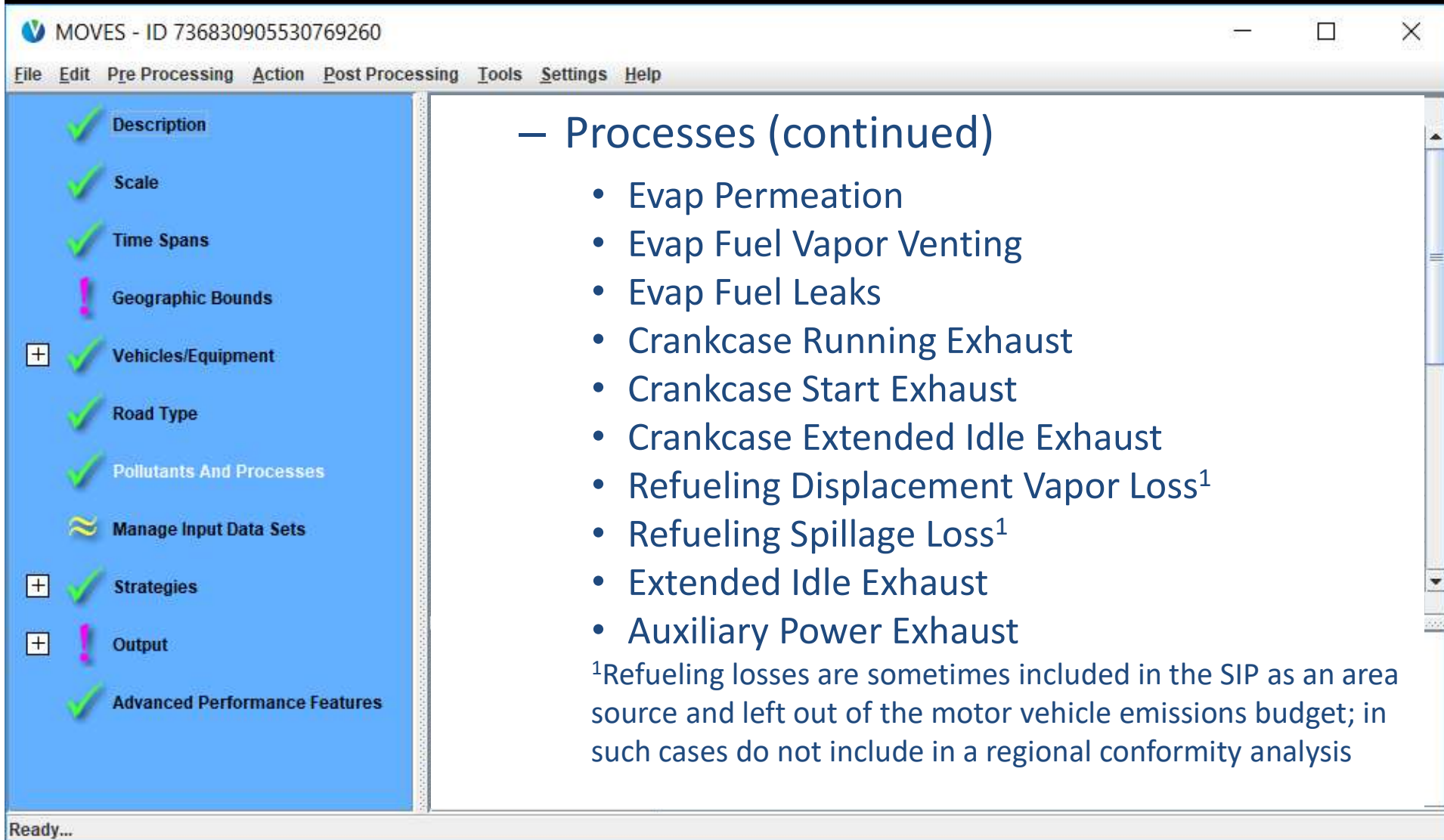
- ✓ Description
- ✓ Scale
- ✓ Time Spans
- ! Geographic Bounds
- + ✓ Vehicles/Equipment
- ✓ Road Type
- ✓ Pollutants And Processes
- ≈ Manage Input Data Sets
- + ✓ Strategies
- + ! Output
- ✓ Advanced Performance Features

- On this panel, the user specifies:
 - Pollutants (ozone precursors – dependent on precursor pollutants with established emission budgets)
 - Hydrocarbons
 - Total Gaseous Hydrocarbons
 - Total Organic Gases
 - Volatile Organic Compounds
 - Oxides of Nitrogen
 - Processes
 - Running Exhaust
 - Start Exhaust

Ready...

Pollutants And Processes panel

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The screenshot shows the MOVES software interface. The title bar reads "MOVES - ID 736830905530769260". The menu bar includes "File", "Edit", "Pre Processing", "Action", "Post Processing", "Tools", "Settings", and "Help". On the left is a blue sidebar with a list of categories, each with a green checkmark icon except for "Geographic Bounds" (pink exclamation mark) and "Output" (pink exclamation mark). The categories are: Description, Scale, Time Spans, Geographic Bounds, Vehicles/Equipment (with a plus icon), Road Type, Pollutants And Processes (highlighted), Manage Input Data Sets (with a wavy line icon), Strategies (with a plus icon), Output (with a plus icon), and Advanced Performance Features. The main window area displays the text "– Processes (continued)" followed by a bulleted list of processes. A footnote at the bottom explains that refueling losses are sometimes included in the SIP as an area source and left out of the motor vehicle emissions budget, and thus are not included in a regional conformity analysis.

MOVES - ID 736830905530769260

File Edit Pre Processing Action Post Processing Tools Settings Help

- ✓ Description
- ✓ Scale
- ✓ Time Spans
- ! Geographic Bounds
- + ✓ Vehicles/Equipment
- ✓ Road Type
- ✓ Pollutants And Processes
- ≈ Manage Input Data Sets
- + ✓ Strategies
- + ! Output
- ✓ Advanced Performance Features

– Processes (continued)

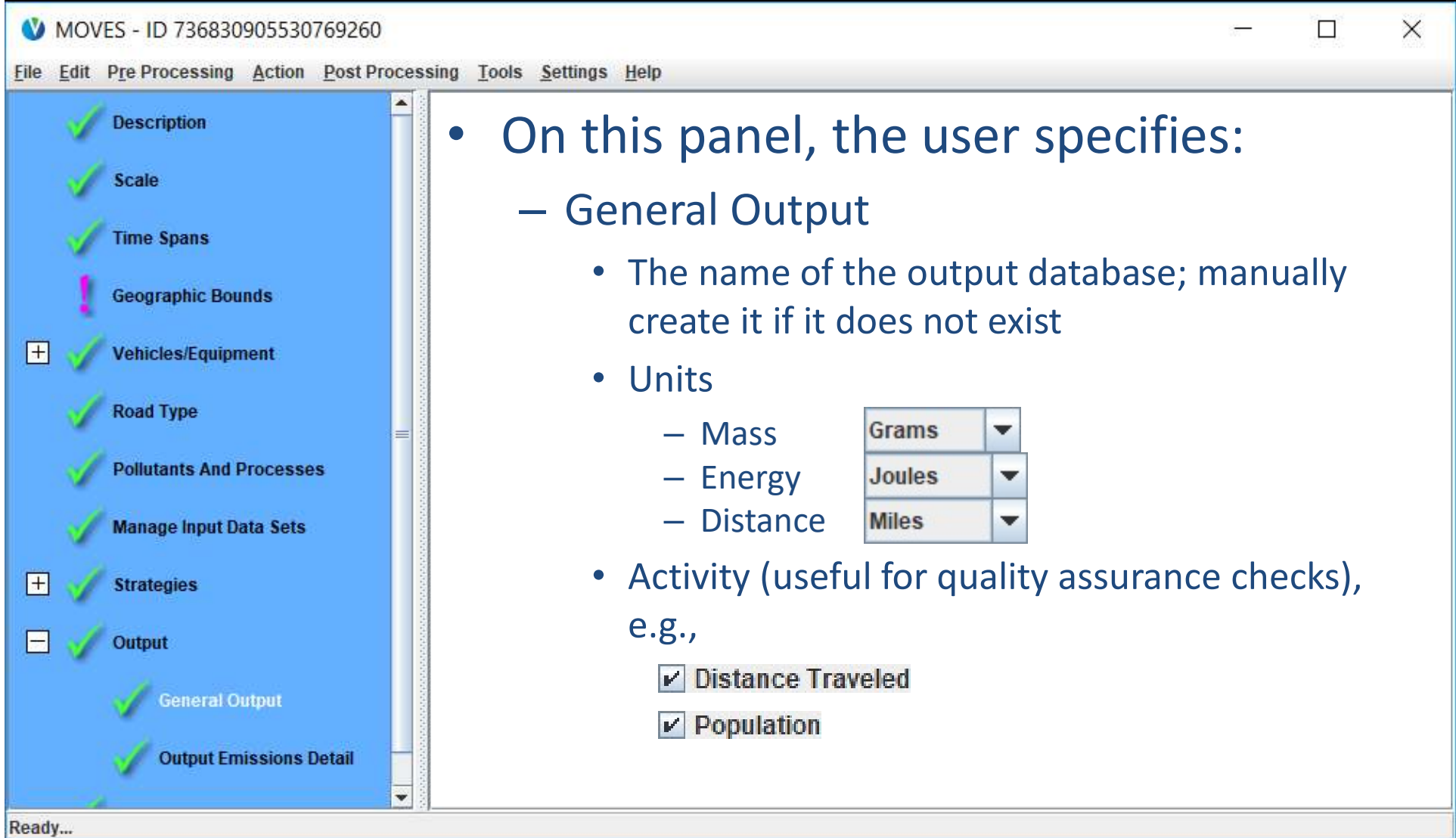
- Evap Permeation
- Evap Fuel Vapor Venting
- Evap Fuel Leaks
- Crankcase Running Exhaust
- Crankcase Start Exhaust
- Crankcase Extended Idle Exhaust
- Refueling Displacement Vapor Loss¹
- Refueling Spillage Loss¹
- Extended Idle Exhaust
- Auxiliary Power Exhaust

¹Refueling losses are sometimes included in the SIP as an area source and left out of the motor vehicle emissions budget; in such cases do not include in a regional conformity analysis

Ready...

Output panel

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The screenshot shows the MOVES software interface. The title bar reads "MOVES - ID 736830905530769260". The menu bar includes "File", "Edit", "Pre Processing", "Action", "Post Processing", "Tools", "Settings", and "Help". On the left is a blue sidebar with a tree view of settings. The "Output" section is expanded, showing "General Output" and "Output Emissions Detail", both with green checkmarks. The main panel on the right contains a bulleted list of user specifications. The list includes "General Output" with sub-items for "The name of the output database; manually create it if it does not exist" and "Units". The "Units" section has three rows: "Mass" with a dropdown set to "Grams", "Energy" with a dropdown set to "Joules", and "Distance" with a dropdown set to "Miles". The final item is "Activity (useful for quality assurance checks), e.g.", followed by two checked checkboxes: "Distance Traveled" and "Population". The status bar at the bottom left says "Ready...".

MOVES - ID 736830905530769260

File Edit Pre Processing Action Post Processing Tools Settings Help

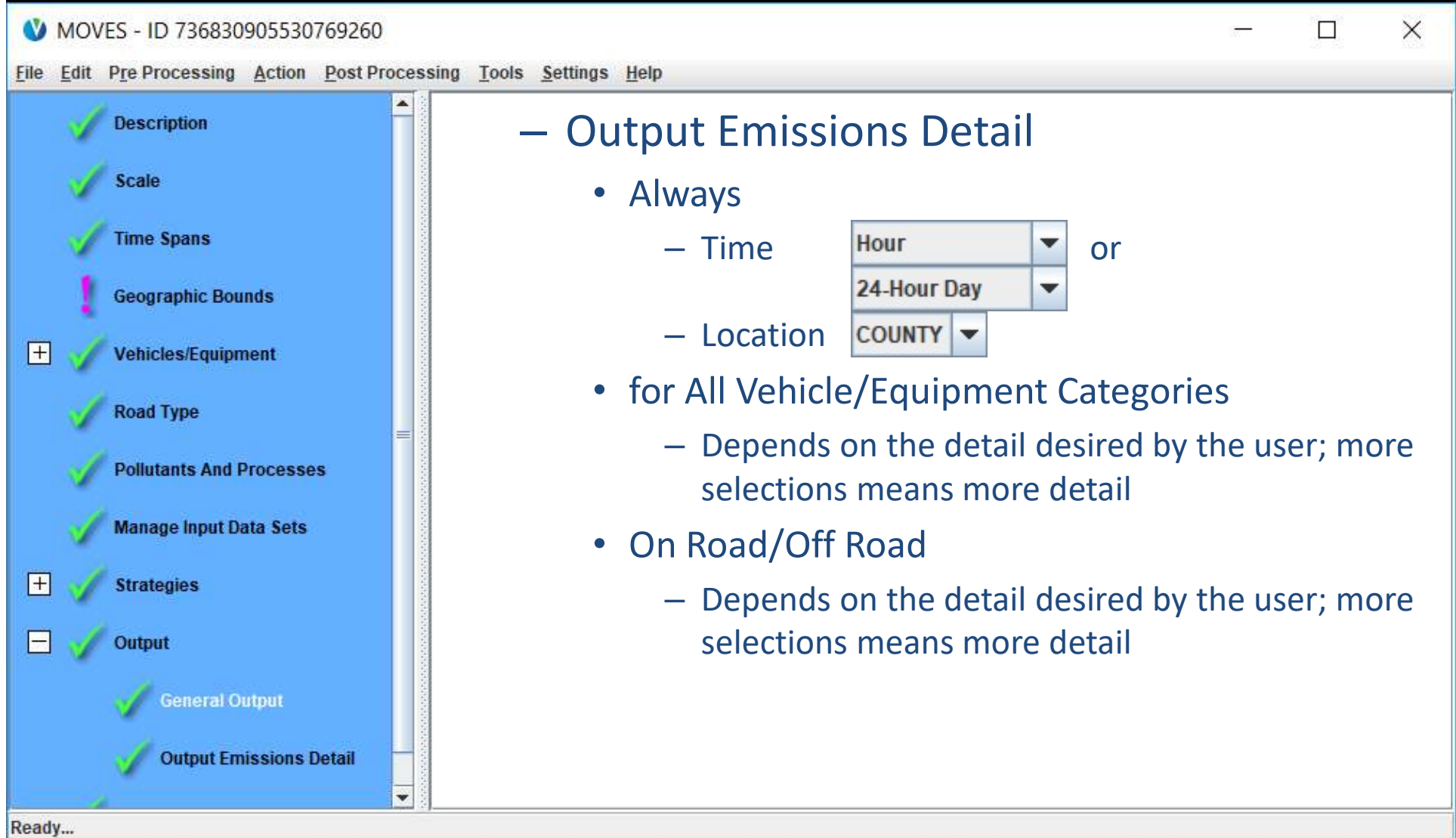
- ✓ Description
- ✓ Scale
- ✓ Time Spans
- ! Geographic Bounds
- + ✓ Vehicles/Equipment
- ✓ Road Type
- ✓ Pollutants And Processes
- ✓ Manage Input Data Sets
- + ✓ Strategies
- ✓ Output
 - ✓ General Output
 - ✓ Output Emissions Detail

- On this panel, the user specifies:
 - General Output
 - The name of the output database; manually create it if it does not exist
 - Units
 - Mass: Grams
 - Energy: Joules
 - Distance: Miles
 - Activity (useful for quality assurance checks), e.g.,
 - ☒ Distance Traveled
 - ☒ Population

Ready...

Output panel

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MOVES - ID 736830905530769260

File Edit Pre Processing Action Post Processing Tools Settings Help

- ✓ Description
- ✓ Scale
- ✓ Time Spans
- ! Geographic Bounds
- + ✓ Vehicles/Equipment
- ✓ Road Type
- ✓ Pollutants And Processes
- ✓ Manage Input Data Sets
- + ✓ Strategies
- ✓ Output
 - ✓ General Output
 - ✓ Output Emissions Detail

– Output Emissions Detail

- Always
 - Time

Hour	▼
24-Hour Day	▼
COUNTY	▼

 or
 - Location
- for All Vehicle/Equipment Categories
 - Depends on the detail desired by the user; more selections means more detail
- On Road/Off Road
 - Depends on the detail desired by the user; more selections means more detail

Ready...

- EPA resources and guidance
- Graphical user interface
- Navigation panel
- **County Data Manager**
- Summarizing data needs and sources
- Obtaining results
- Training and technical assistance



County Data Manager (CDM)

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MOVES - ID 736830905530769260

File Edit **Pre Processing** Action Post Processing Tools Settings Help

Data Importer
✓ **County Data Manager**
✓ Project Data Manager
Nonroad Data Importer
✓ Time Spans
! Geographic Bounds
+ ✓ Vehicles/Equipment
✓ Road Type
✓ Pollutants And Processes
✓ Manage Input Data Sets
+ ✓ Strategies
+ ✓ Output
✓ Advanced Performance Features

Start County Data Manager GUI

☐ Nation
☐ State
☒ County
☐ Zone & Link
☐ Custom Domain

States:

GEORGIA
HAWAII
IDAHO
ILLINOIS
INDIANA
IOWA
KANSAS
KENTUCKY
LOUISIANA

Counties:

GEORGIA - Cobb County
GEORGIA - Coffee County
GEORGIA - Colquitt County
GEORGIA - Columbia County
GEORGIA - Cook County
GEORGIA - Coweta County
GEORGIA - Crawford County
GEORGIA - Crisp County
GEORGIA - Dade County

Selections:

GEORGIA - Cobb County

Select All Add

Domain Input Database
The County domain scale requires a database of detailed data.

Server:

Database:

Refre Enter/Ed

Geographic Bounds Requirements
Please select a domain database.

Select and Import County-Level Data

County Data Manager (CDM)

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The screenshot shows the MOVES County Data Manager (CDM) application window. The title bar reads "MOVES County Data Manager". Below the title bar is a navigation pane with several tabs: "Vehicle Type VMT", "Hotelling", "I/M Programs", "Retrofit Data", "Generic", "Tools", "Meteorology Data", "Ramp Fraction", "Road Type Distribution", "Source Type Population", "Starts", "RunSpec Summary", "Database", "Age Distribution", "Average Speed Distribution", and "Fuel". The "Database" tab is currently selected. Below the navigation pane, there is a section titled "Select or create a database to hold the imported data." This section contains a "Server:" field with the value "localhost", a "Database:" dropdown menu with the value "My_Conformity_Run_in", and a "Log:" field. To the right of these fields are three buttons: "Refresh", "Create Database", and "Clear All Imported Data".

- Data are not entered directly in the CDM
- Data are entered on Excel Worksheets
- All tabs provide an option to create a worksheet template pre-populated with some data based on entries made in the RunSpec created in the Navigation Panel

County Data Manager (CDM)

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The screenshot shows the MOVES County Data Manager (CDM) application window. The title bar reads "MOVES County Data Manager". Below the title bar is a tabbed interface with several tabs: "Vehicle Type VMT" (red X), "Hotelling" (green check), "I/M Programs" (red X), "Retrofit Data" (green check), "Generic" (green check), and "Tools". Below these are more tabs: "Meteorology Data" (red X), "Ramp Fraction" (green check), "Road Type Distribution" (red X), "Source Type Population" (red X), "Starts" (green check), "RunSpec Summary", "Database" (selected), "Age Distribution" (red X), "Average Speed Distribution" (red X), and "Fuel" (red X). The main area contains the text "Select or create a database to hold the imported data." Below this are input fields for "Server:" (containing "localhost"), "Database:" (containing "My_Conformity_Run_in"), and "Log:". To the right of these fields are three buttons: "Refresh", "Create Database", and "Clear All Imported Data".

- Templates contain the proper fields/column headings, but have blank cells for user-specified data
- Data are imported into CDM from an Excel worksheet that has been properly formatted with the correct columns

Age Distribution tab

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- Age fractions of fleet by age, year and MOVES source type

	A	B	C	D
1	sourceTypeID	yearID	ageID	ageFraction

- No defaults available in CDM
- National defaults and projection tool available on MOVES Tools web page:
 - <https://www.epa.gov/moves/tools-develop-or-convert-moves-inputs#fleet>

Age Distribution tab

31



- EPA Guidance

- Local age distribution data are recommended and encouraged
- Example: estimated from motor vehicle registration data
- Refer to Section 4.4 of MOVES Technical Guidance

Average Speed Distribution tab

32



- Average speed fraction by average speed bin, hour, road type and MOVES source type

	A	B	C	D	E
1	sourceTypeID	roadTypeID	hourDayID	avgSpeedBinID	avgSpeedFraction

- No local defaults are available in CDM, only National defaults

MOVES Speed Bins

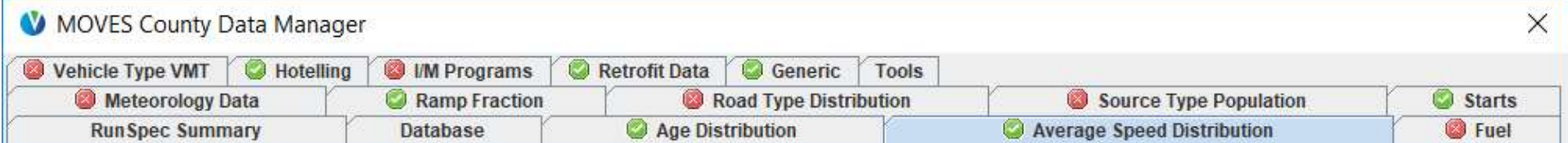
33

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



Average Speed Distribution tab

34



- EPA guidance
 - Local speed distribution by road type and source type is necessary
 - Examples: post-process the output from a travel demand forecasting model; process local on-vehicle Global Positioning System data
 - Refer to Section 4.6 of MOVES Technical Guidance

Fuel tab

35



- The Fuel tab contains four data tables:

1. Fuel Supply

	A	B	C	D	E	F
1	fuelRegionID	fuelYearID	monthGroupID	fuelFormulationID	marketShare	marketShareCV

2. Fuel Formulation

	A	B	C	D	E	F	G	H
1	fuelFormulationID	fuelSubtypeID	RVP	sulfurLevel	ETOHVolume	MTBEVolume	ETBEVolume	TAMEVolume

I	J	K	L	M	N
aromaticContent	olefinContent	benzeneContent	e200	e300	BioDieselEsterVolume

O	P	Q	R
CetaneIndex	PAHContent	T50	T90

Fuel tab

36



3. Fuel Usage Fraction

	A	B	C	D	E	F
1	countyID	fuelYearID	modelYearGroupID	sourceBinFuelTypeID	fuelSupplyFuelTypeID	usageFraction

4. AVFT (Alternate Vehicle and Fuel Technology)

	A	B	C	D	E
1	sourceTypeID	modelYearID	fuelTypeID	engTechID	fuelEngFraction

- County level defaults available in CDM

Fuel tab

37



- EPA guidance
 - Review default data and only make changes where precise local information is available
 - Exception: change the value for Reid Vapor Pressure to reflect any specific local regulatory requirements and differences between ethanol-and non-ethanol blended gasoline not reflected in the default database
 - Refer to Section 4.9 of MOVES Technical Guidance

Meteorology Data tab

38



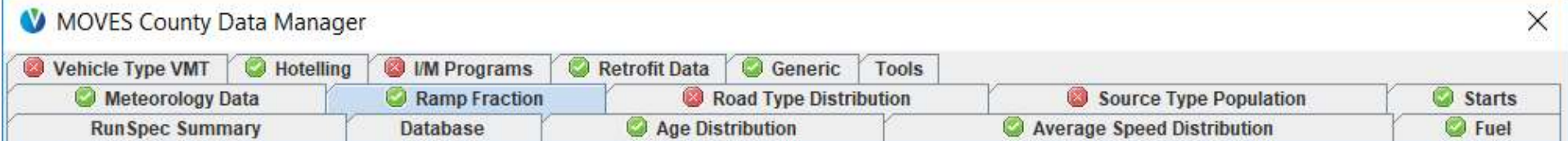
- Temperature and humidity inputs

	A	B	C	D	E
1	monthID	zoneID	HourID	temperature	relHumidity

- County level defaults available in CDM
- EPA guidance
 - Local temperature and humidity data are required inputs for regional conformity analysis with MOVES
 - Temperatures for regional conformity analysis must be consistent with those used to establish the motor vehicle emissions budgets in the SIP as required in the transportation conformity rule
 - Refer to Section 4.2 of MOVES Technical Guidance

Ramp Fraction Data tab

39



- Fraction of freeway vehicle-hours traveled (VHT) occurring on ramps for limited access roadway types

	A	B
1	roadTypeID	rampFraction

- Optional input
- National default available in CDM
- EPA guidance
 - Estimates of local ramp fraction are recommended
 - Example: information from travel demand forecasting models
 - Refer to Section 4.8 of MOVES Technical Guidance

Road Type Distribution tab

40



- VMT Fraction by road type and source type

	A	B	C
1	sourceTypeID	roadTypeID	roadTypeVMTFraction

- No defaults available in CDM
- EPA guidance
 - Local estimates of VMT by road type are needed
 - Should be consistent with the most recent information used for transportation planning
 - Example: information from travel demand forecasting models
 - Refer to Section 4.7 of MOVES Technical Guidance

Source Type Population tab

41



- Number (i.e., population) of local vehicles operating in the area

	A	B	C
1	yearID	sourceTypeID	sourceTypePopulation

- No defaults available in CDM
- EPA guidance
 - Local source type (vehicle type) population data are necessary
 - Examples: estimated from motor vehicle registration data; local transit agencies; school districts; bus companies; refuse haulers
 - Refer to Section 4.3 of MOVES Technical Guidance

Starts tab

42



- Provides information on vehicle starts per day by year, day and zone

	A	B	C	D
1	zoneID	dayID	yearID	startsPerDay

- Optional input
 - Default start activity determined by vehicle population
- EPA guidance
 - Use only if local start data are available; otherwise, rely on defaults
 - Refer to Section 4.12 of MOVES Technical Guidance

Vehicle Type VMT tab

43



- The Vehicle Type VMT tab contains four data tables:

1. HPMS Vtype Year

	A	B	C
1	HPMSVtypeID	yearID	HPMSBaseYearVMT

- Total annual or daily vehicle-miles traveled (VMT) by highway performance monitoring system (HPMS) vehicle type or MOVES source type

2. Month VMT fractions

	A	B	C
1	sourcetypeID	monthID	monthVMTFraction

3. Day VMT fractions

	A	B	C	D	E
1	sourceTypeID	monthID	roadTypeID	dayID	dayVMTFraction

Vehicle Type VMT tab

44



4. Hour VMT fractions

	A	B	C	D	E
1	sourceTypeid	roadTypeID	dayID	hourID	HourVMTFraction

- No defaults available for VMT in CDM
- National defaults available for month, day, and hour VMT fractions in CDM

Vehicle Type VMT tab

45



- EPA guidance
 - Local VMT estimates are needed and local month, day, and hour VMT fractions are recommended
 - Example: information from travel demand forecasting models developed by Metropolitan Planning Organizations and state Departments of Transportation
 - Refer to Section 4.5 of MOVES Technical Guidance

MOVES Source Types / HPMS Vehicle Types

46

Source Type ID	Source Types	HPMS Class ID	HPMS Vehicle Class
11	Motorcycle	10	Motorcycles
21	Passenger Car	25	Light Duty Vehicles – Short and Long Wheelbase
31	Passenger Truck		
32	Light Commercial Truck		
41	Intercity Bus	40	Buses
42	Transit Bus		
43	School Bus		
51	Refuse Truck	50	Single Unit Trucks
52	Single Unit Short-haul Truck		
53	Single Unit Long-haul Truck		
54	Motor Home		
61	Combination Short-haul Truck	60	Combination Trucks
62	Combination Long-haul Truck		

Hotelling tab

47



- The Hotelling tab contains two data tables:

1. Hotelling Activity Distribution

	A	B	C	D
1	beginModelYearID	endModelYearID	opModelID	opModeFraction

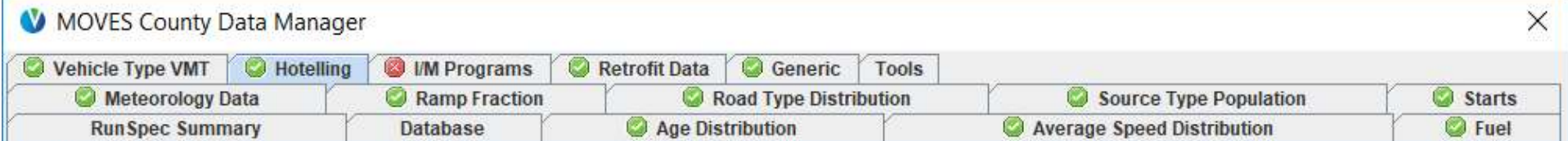
2. Hotelling Hours

	A	B	C	D	E	F	G
1	hourDayID	monthID	yearID	ageID	zoneID	sourceTypeID	hotellingHours

- Optional input
 - Default hotelling hours are determined by local road type distribution

Hotelling tab

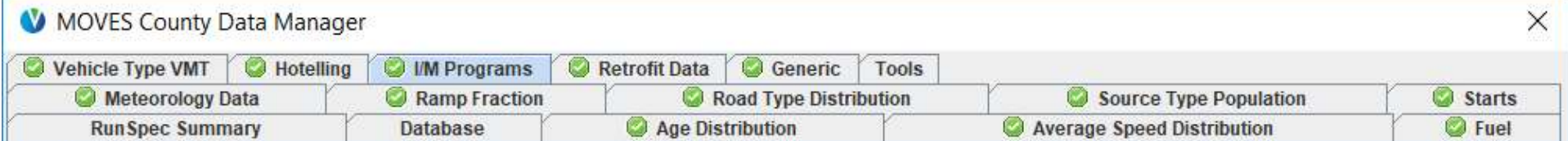
48



- National defaults available in CDM
- EPA Guidance
 - Use only if local hotelling data are available; otherwise, rely on defaults
 - Refer to Section 4.13 of MOVES Technical Guidance

I/M Programs tab

49



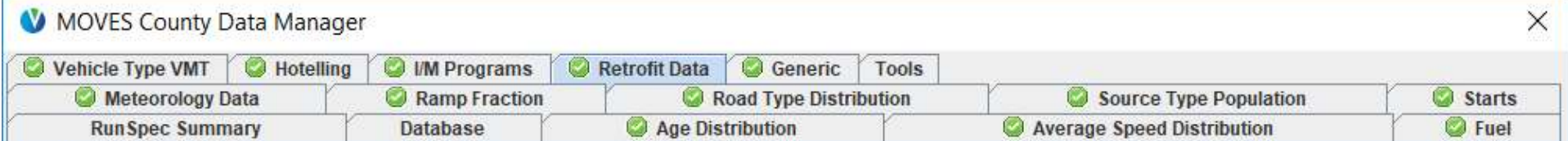
- Data on inspection/maintenance (I/M) program(s), if any

	A	B	C	D	E	F	G	H	I
1	polProcessID	stateID	countyID	yearID	sourceTypeID	fuelTypeID	IMProgramID	inspectFreq	testStandardsID
							J	K	L
							begModelYearID	endModelYearID	useIMyn
									M
									complianceFactor

- County level defaults available in CDM
- EPA guidance
 - Review the details of the I/M program and make any necessary changes to match the actual local program
 - Refer to Section 4.10 of MOVES Technical Guidance

Retrofit Data tab

50



- Defines retrofit programs

	A	B	C	D	E	F	G
1	pollutantID	processID	fuelTypeID	sourceTypeID	retrofitYearID	beginModelYearID	endModelYearID

H	I
cumFractionRetrofit	retrofitEffectiveFraction

- Optional input
- No defaults available in CDM

Retrofit Data tab

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- EPA guidance
 - Not a required input
 - Refer to Section 4.14 of MOVES Technical Guidance
 - Consult EPA's SIP and Conformity Retrofit Guidance for additional information
 - www.epa.gov/otaq/stateresources/transconf/policy.htm#quantify

- EPA resources and guidance
- Graphical user interface
- Navigation panel
- County Data Manager
- Summarizing data needs and sources
- Obtaining results
- Training and technical assistance



Summarizing Data Needs and Sources

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Item	Navigation Panel	Recommendations
1	Description	<ul style="list-style-type: none"> • Use this to document the purpose of each run
2	Scale	<ul style="list-style-type: none"> • Model – Onroad • Domain/Scale – County • Calculation Type – Inventory or Emission Rate
3	Time Spans	<ul style="list-style-type: none"> • Time Aggregation Level – Hour • Years – Separate MOVES runs are required for multiple analysis years to cover applicable budget tests and interim tests • Month(s) – Ozone season (e.g., July) • Days – Weekends, Weekdays, or both • Hours – All hours
4	Geographic Bounds	<ul style="list-style-type: none"> • Region – County or Custom Domain • States – Only one state per run can be selected for County scale • Counties – Only one county per run can be selected for County scale
5	On Road Vehicle Equipment	<ul style="list-style-type: none"> • Select all valid gasoline, ethanol, diesel, and CNG fuel/vehicle combinations

Summarizing Data Needs and Sources

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Item	Navigation Panel	Recommendations
6	Road Type	<ul style="list-style-type: none">• Select all road types
7	Pollutants and Processes	<ul style="list-style-type: none">• Pollutants – Select precursor pollutants with established emission budgets• Processes – Select all 12 processes, unless refueling losses are included in the SIP as an area source and omitted from the motor vehicle emissions budget
8	Manage Input Data Sets	<ul style="list-style-type: none">• No selections needed
9	Strategies	<ul style="list-style-type: none">• No selections needed
10	General Output	<ul style="list-style-type: none">• Create output database, if needed• Specify Units of Mass, Energy, and Distance• Select Activity, if desired
11	Output Emissions Detail	<ul style="list-style-type: none">• Time – Hour or 24-Hour Day• Location – County• For All Vehicle/Equipment Categories – Optional• On Road/Off Road - Optional
12	Advanced Performance Measures	<ul style="list-style-type: none">• No selections needed

Summarizing Data Needs and Sources

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MOVES County Data Manager						
<div> Vehicle Type VMT Hotelling I/M Programs Retrofit Data Generic Tools </div> <div> Meteorology Data Ramp Fraction Road Type Distribution Source Type Population Starts </div> <div> RunSpec Summary Database Age Distribution Average Speed Distribution Fuel </div>						
Data	Run Detail		Data Sources			
	Same for All Runs	Vary by Analysis Year	Local MPO	State Air Agency	State DOT	MOVES Default
Age Distribution	●	Optional		●	●	
Average Speed Distribution		●	●		●	
Fuel Fuel Supply		●		●		●
Fuel Fuel Formulation		●		●		●
Fuel Fuel Usage Fraction		●				●
Fuel AVFT	●					●
Meteorology Data	●			●		
Ramp Fraction		●	●		●	
Road Type Distribution		●	●		●	
Source Type Population		●		●	●	
Starts			●			●
Vehicle Type VMT HPMS Vehicle Type Year		●	●		●	
Vehicle Type VMT Month VMT Fraction	●		●		●	●
Vehicle Type VMT Day VMT Fraction	●		●		●	●
Vehicle Type VMT Hour VMT Fraction	●		●		●	●
Hotelling			●			●
I/M Programs		●		●		●
Retrofit	Not a Required Input					

Summarizing Data Needs and Sources

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MOVES County Data Manager		
<div> <div> <div>Vehicle Type VMT</div> <div>Hotelling</div> <div>I/M Programs</div> <div>Retrofit Data</div> <div>Generic</div> <div>Tools</div> </div> <div> <div>Meteorology Data</div> <div>Ramp Fraction</div> <div>Road Type Distribution</div> <div>Source Type Population</div> <div>Starts</div> </div> <div> <div>RunSpec Summary</div> <div>Database</div> <div>Age Distribution</div> <div>Average Speed Distribution</div> <div>Fuel</div> </div> </div>		
Item	County Data Manager Tab	Recommendations
1	Age Distribution	<ul style="list-style-type: none"> Local age distribution data are recommended and encouraged Example: estimated from motor vehicle registration data Refer to Section 4.4 of MOVES Technical Guidance
2	Average Speed Distribution	<ul style="list-style-type: none"> Local speed distribution by road type and source type is necessary Examples: post-process the output from a travel demand forecasting model; process local on-vehicle Global Positioning System data Refer to Section 4.6 of MOVES Technical Guidance
3	Fuel	<ul style="list-style-type: none"> Review default data and only make changes where precise local information is available Exception: change the value for Reid Vapor Pressure to reflect any specific local regulatory requirements and differences between ethanol-and non-ethanol blended gasoline not reflected in the default database Refer to Section 4.9 of MOVES Technical Guidance

Summarizing Data Needs and Sources

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Item	County Data Manager Tab	Recommendations
4	Meteorology Data	<ul style="list-style-type: none"> Local temperature and humidity data are required inputs for regional conformity analysis with MOVES Temperatures for regional conformity analysis must be consistent with those used to establish the motor vehicle emissions budgets in the SIP as required in the transportation conformity rule Refer to Section 4.2 of MOVES Technical Guidance
5	Ramp Fraction	<ul style="list-style-type: none"> Estimates of local ramp fraction are recommended Example: information from travel demand forecasting models Refer to Section 4.8 of MOVES Technical Guidance
6	Road Type Distribution	<ul style="list-style-type: none"> Local estimates of VMT by road type are needed Should be consistent with the most recent information used for transportation planning Example: information from travel demand forecasting models Refer to Section 4.7 of MOVES Technical Guidance

Summarizing Data Needs and Sources

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MOVES County Data Manager		
<div> <div> <div>Vehicle Type VMT</div> <div>Hotelling</div> <div>I/M Programs</div> <div>Retrofit Data</div> <div>Generic</div> <div>Tools</div> </div> <div> <div>Meteorology Data</div> <div>Ramp Fraction</div> <div>Road Type Distribution</div> <div>Source Type Population</div> <div>Starts</div> </div> <div> <div>RunSpec Summary</div> <div>Database</div> <div>Age Distribution</div> <div>Average Speed Distribution</div> <div>Fuel</div> </div> </div>		
Item	County Data Manager Tab	Recommendations
7	Source Type Population	<ul style="list-style-type: none"> Local source type (vehicle type) population data are necessary Examples: estimated from motor vehicle registration data; local transit agencies; school districts; bus companies; refuse haulers Refer to Section 4.3 of MOVES Technical Guidance
8	Starts	<ul style="list-style-type: none"> Use only if local start data are available; otherwise, rely on defaults Refer to Section 4.12 of MOVES Technical Guidance
9	Vehicle Type VMT	<ul style="list-style-type: none"> Local VMT estimates are needed and local month, day, and hour VMT fractions are recommended Example: information from travel demand forecasting models developed by Metropolitan Planning Organizations and state Departments of Transportation Refer to Section 4.5 of MOVES Technical Guidance
10	Hotelling	<ul style="list-style-type: none"> Use only if local hotelling data are available; otherwise, rely on defaults Refer to Section 4.13 of MOVES Technical Guidance

Summarizing Data Needs and Sources

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Item	County Data Manager Tab	Recommendations
11	I/M Programs	<ul style="list-style-type: none"> Review the details of the I/M program and make any necessary changes to match the actual local program Refer to Section 4.10 of MOVES Technical Guidance
12	Retrofit Data	<ul style="list-style-type: none"> Not a required input Refer to Section 4.14 of MOVES Technical Guidance Consult EPA's SIP and Conformity Retrofit Guidance for additional information <p>www.epa.gov/otaq/stateresources/transconf/policy.htm#quantify</p>

- EPA resources and guidance
- Graphical user interface
- Navigation panel
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Obtaining Results

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- MOVES output can be accessed via:
 - MySQL Workbench
 - Advantages: flexible and powerful for advanced off-model analysis and reporting
 - EPA recommends using MySQL Workbench for most analysis
 - MOVES Post Processing Summary Reporter
 - Advantages: quick and easy



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Training and Technical Assistance

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- EPA
 - MOVES Training Sessions webpage
 - <https://www.epa.gov/moves/moves-training-sessions>
 - MOVES2014a 2-Day Hands-On Training Course for New MOVES Users
 - Webinar – MOVES2014a: Introduction and New Features
 - Technical assistance
 - Send inquiries by email to: mobile@epa.gov or online at <https://www.epa.gov/moves/forms/contact-us-about-moves-and-related-models>



Training and Technical Assistance

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- FHWA
 - The Resource Center Air Quality Technical Services Team offers training and technical assistance on an as needed basis arranged through the FHWA Division in your state. Please contact:
 - Michael Claggett – Michael.Claggett@dot.gov or
 - Jeff Houk – Jeff.Houk@dot.gov



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U.S. Department of Transportation
Federal Highway Administration

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Federal Highway Administration