

Module 8

Project-Scale Analyses



Module Overview

- Introduction to Project Scale Analyses
 - Project Scale RunSpec
 - What is a MOVES link?
- Project Scale Class Demonstration
 - Defining the Project
 - Creating the MOVES Project Scale RunSpec
 - Creating an Project Scale Input Database
 - Options for On-Road Activity
 - Project Level Outputs in MySQL

Introduction to Project Scale

- The National Academy of Sciences suggested that EPA add a 'microscale' modeling domain to its emission modeling 'toolkit'
- Project Scale allows MOVES modeling at the 'Link' level
 - Roadway links
 - Off-network link
- Project Scale models the 'average' conditions on one or more links.
 - However, it is not a traffic simulation model

Summary: MOVES Three Scales

	National	County	Project
Geographic area covered	<ul style="list-style-type: none"> • Entire nation • One or more states • One or more counties 	<ul style="list-style-type: none"> • One county • A multi-county area 	An individual transportation project (e.g., a highway, intersection, or transit project)
Purpose	Non-regulatory only	Required for SIP and regional conformity analyses	Required for project-level conformity analyses
Input database	User does not need to create, use of Data Importer is optional*	User creates with local data, through the County Data Manager	User creates with local data, through the Project Data Manager
Default data	Used unless overridden	Access to default data is limited	Access to default data is limited

* User cannot provide information for certain inputs at the National scale

MOVES Project Scale

- Project scale is appropriate for:
 - CO and PM “Hot-spot” analyses for project conformity
 - National Environmental Policy Act (NEPA) Environmental Impact Statements (EISs)
 - Roadway/Intersection level energy and Greenhouse Gas analysis
- Link-specific data must be entered if the Project scale is selected
- Data can be exported or imported using the Project Data Manager (PDM)
 - **NOTE: Access to default data is limited**

Project v. National and County Scales

- Project scale utilizes the same MOVES emission rates and correction factors as county and national scale
- Project scale does NOT utilize the default MOVES growth, VMT or population data
 - This data must be supplied by the user.
- Project scale allows the user to model a only one hour:
In RunSpec, make one selection for each of the following:
 - County
 - Year
 - Month
 - Day type
 - Hour

e.g. Washtenaw County, Michigan in
January 2010, weekday at 8:00am

NOTE: Because only a single hour is selectable, you cannot use Project Scale to evaluate evaporative processes

Project Scale Guidance

- EPA has developed guidance for:
 - Quantitative PM hot-spot analyses for transportation conformity (includes PM project scale MOVES guidance)
 - Using MOVES for CO project scale analyses
 - Both documents located here:
www.epa.gov/state-and-local-transportation/project-level-conformity-and-hot-spot-analyses
- NOTE: This module is not intended to reflect technical or policy guidance but provide an overview and illustrative example of MOVES capabilities at the project scale.

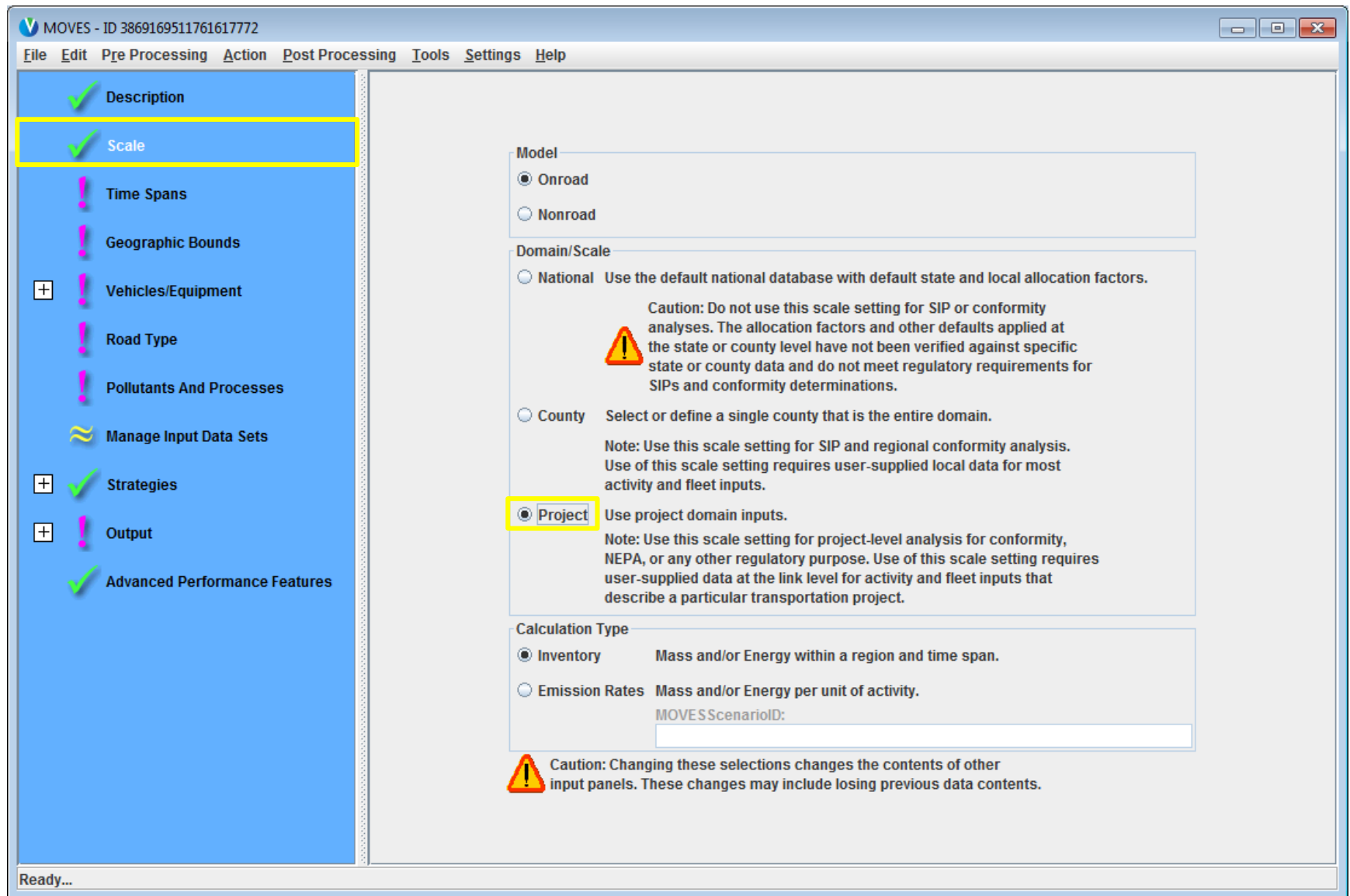
Hot-spot Training Course

- Additionally, the EPA and US DOT have developed a 3-day training course specific to the PM hot-spot requirement in the conformity rule
 - The training covers how to use MOVES consistent with EPA guidance
 - Also covers air quality modeling, background concentrations, design values, and other topics
- For training materials and updated training dates/locations, see EPA's website: <https://www.epa.gov/state-and-local-transportation/project-level-training-quantitative-pm-hot-spot-analyses>

Project Scale for Regulatory Purposes

- When using MOVES at the project scale for regulatory purposes, more than one hour is needed to capture variability over time
 - E.g., activity and temperature will vary
- Each hour modeled will need a unique
 - RunSpec
 - Input database
- See EPA guidance mentioned above for more information

Scale Panel Choice for Project Scale



Time Spans for Project Scale

MOVES - ID 7787106860417327407

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

Time Aggregation Level

☐ Year ☐ Month ☐ Day ☒ Hour

Years

Select Year: 2010 Add

Years:

2010

Remove

Months

☒ January ☐ July

☐ February ☐ August

☐ March ☐ September

☐ April ☐ October

☐ May ☐ November

☐ June ☐ December

Select All Clear All

Days

☐ Weekend

☒ Weekdays

Select All Clear All

Hours

Start Hour: 08:00 - 08:59

End Hour: 08:00 - 08:59

Select All Clear All

Create new Run Spec

Geographic Bounds in Project Scale

MOVES - ID 3869169511761617772

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

Region: Nation State County Zone & Link Custom Domain

States:

MAINE
MARYLAND
MASSACHUSETTS
MICHIGAN
MINNESOTA
MISSISSIPPI
MISSOURI
MONTANA
NEBRASKA

Counties:

MICHIGAN - Schoolcraft County
MICHIGAN - Shiawassee County
MICHIGAN - St. Clair County
MICHIGAN - St. Joseph County
MICHIGAN - Tuscola County
MICHIGAN - Van Buren County
MICHIGAN - Washtenaw County
MICHIGAN - Wayne County
MICHIGAN - Wexford County

Selections:

MICHIGAN - Washtenaw County

Select All Add Delete

Domain Input Database

The Project domain scale requires a database of detailed data.

Server:

Database:

Refresh Enter/Edit Data

Geographic Bounds Requirements

Please select a domain database.

Create new RunSpec

Accessing Project Data Manager (PDM)

MOVES - ID 7787106860417327407

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

- ✓ General Output
- ✓ Output Emissions Detail
- ✓ Advanced Performance Features

Region:

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

States:

MAINE
MARYLAND
MASSACHUSETTS
MICHIGAN
MINNESOTA
MISSISSIPPI
MISSOURI
MONTANA
NEBRASKA

Counties:

Selections:

MICHIGAN - Washtenaw County

Select All Add Delete

Domain Input Database
The Project domain scale requires a database of detailed data.
Server:
Database:

Refresh
Enter/Edit Data

Geographic Bounds Requirements
Please select a domain database.

Create new RunSpec

A Newly Opened PDM

MOVES Project Data Manager

Hotelling I/M Programs Retrofit Data Generic Tools

Operating Mode Distribution Age Distribution Fuel Meteorology Data

Run Spec Summary Database Links Link Source Types Link Drive Schedules Off-Network

Select or create a database to hold the imported data.

Server: localhost Refresh

Database: Create Database

Log: Clear All Imported Data

Database

Done

PDM Inputs

- Links
- Off-Network
- Link Source Types
- Operating Mode Distribution
- Link Drive Schedules
- Age Distribution
- Meteorology Data
- Fuel
- I/M
- Hotelling
- Retrofit Data

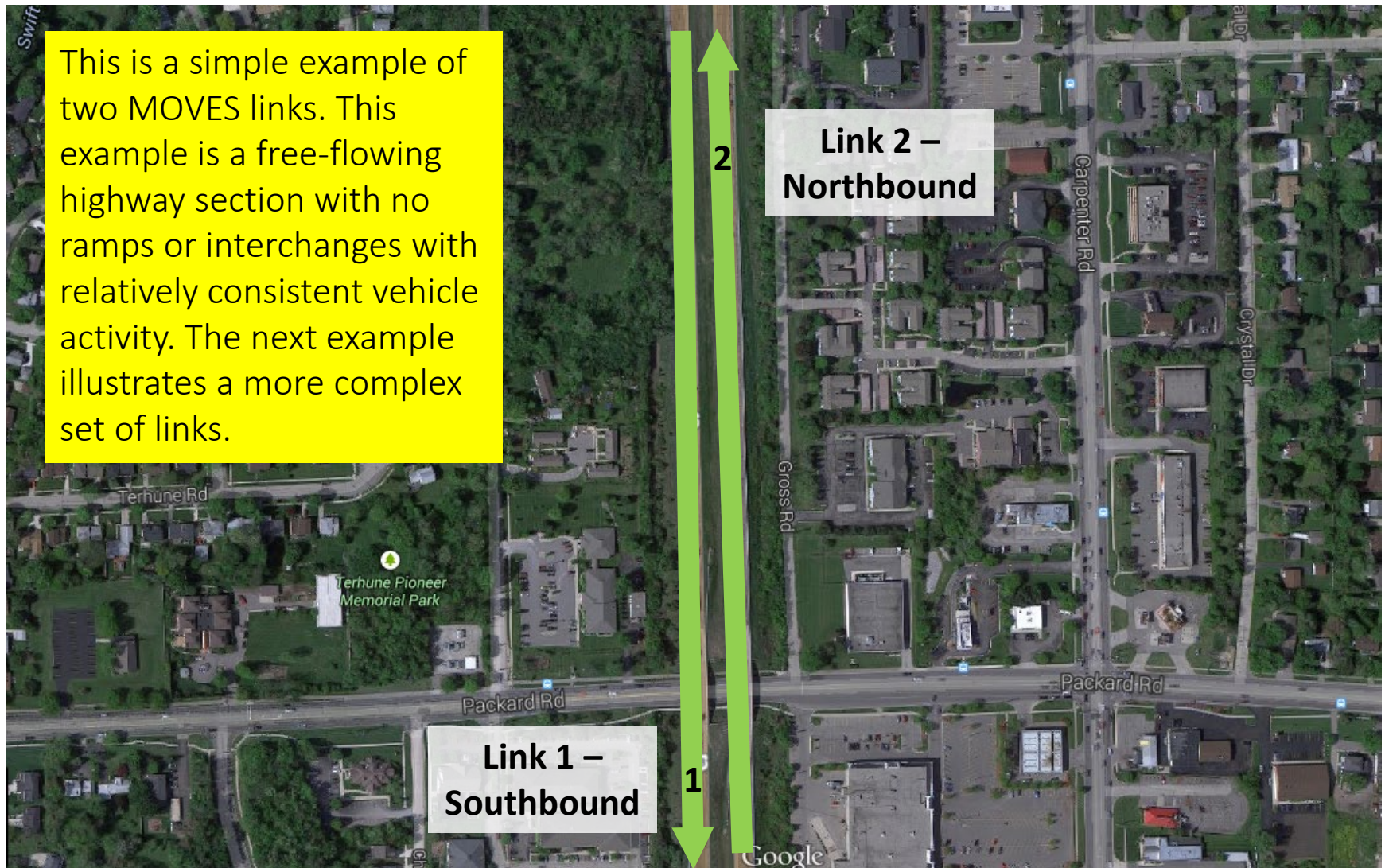
These inputs are unique to the MOVES project scale

These inputs are common for both MOVES county scale and project scale analyses

What is a MOVES link?

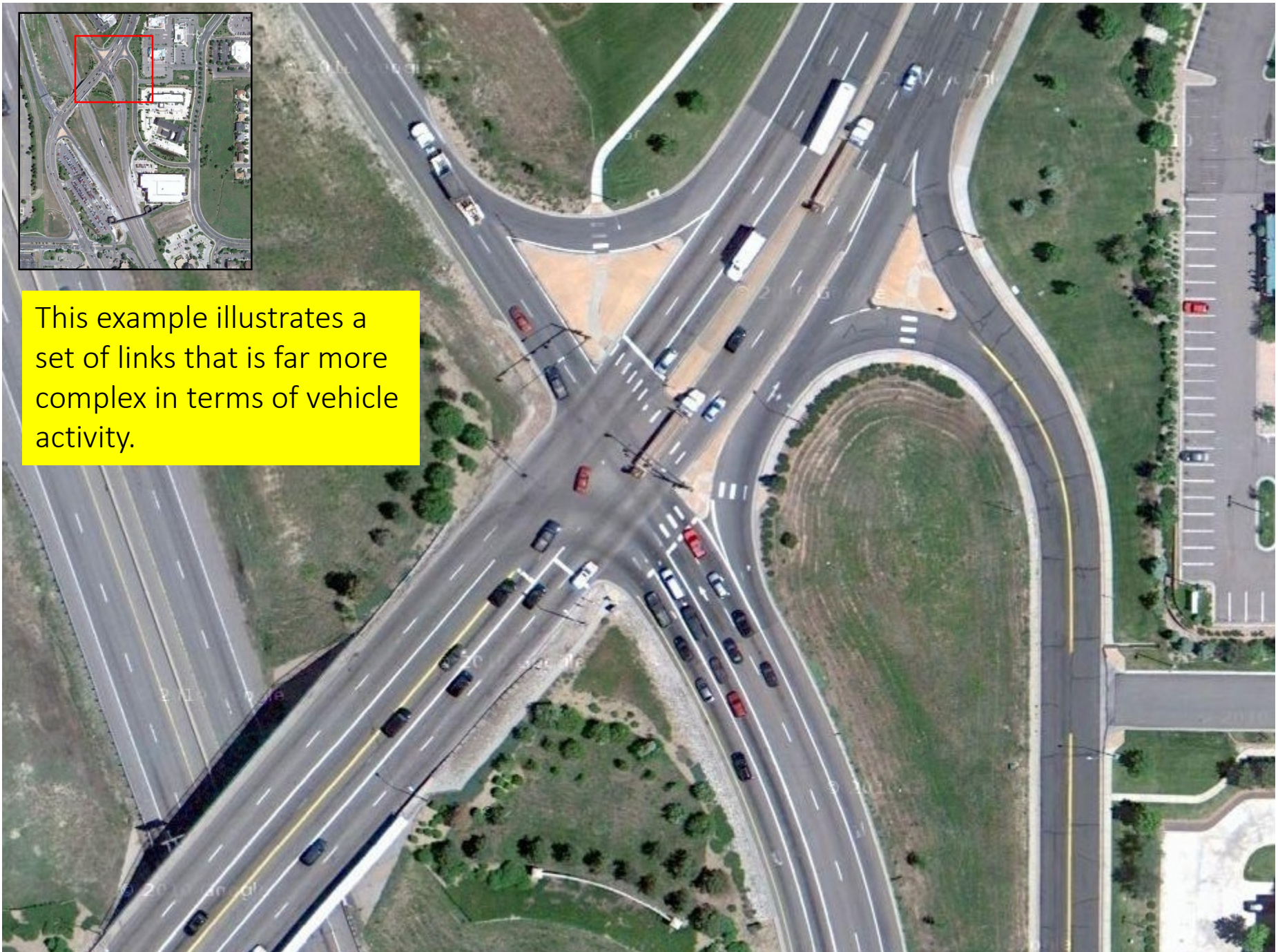
- A link is a segment of road or an “off-network” location where a similar type of vehicle activity occurs
- There are two primary types of links:
 1. **Running links**
 - Used to describe driving activity: e.g., free-flow highways, ramps, arterials, intersections (cruise, deceleration, idle, and acceleration activity)
 - Running exhaust, crankcase, brake/tire wear emissions
 - No limit on the number of running links in a run
 2. **Off-Network links**
 - Used to describe start and hotelling activity: e.g., parking areas, truck or transit terminals
 - Only needed if a project contains vehicles starting or hotelling
 - **Hotelling applies only combination long-haul trucks, sourcetypeid 62**
 - Only one off-network link can be defined per run

Running Link Examples





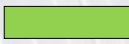


This example illustrates a set of links that is far more complex in terms of vehicle activity.

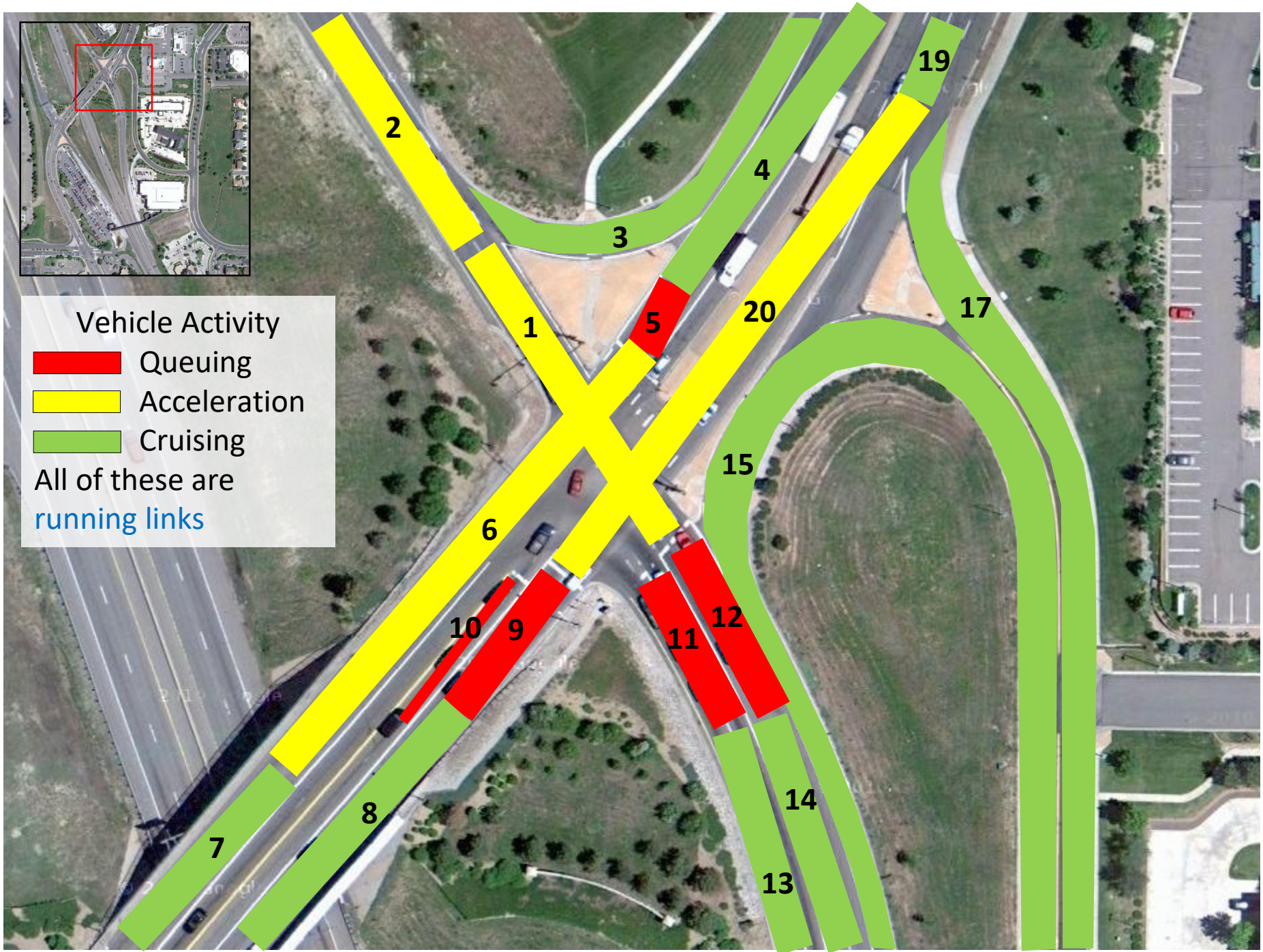




Vehicle Activity

-  Queuing
-  Acceleration
-  Cruising

All of these are
running links



Inputs Unique to Project Scale: Running Links

- For **running links**, you will need to complete:
 - Links: Used to describe the link (road type, length, etc.)
 - Link Source Types: Used to define vehicle mix on each link
 - Optional inputs:
 - Operating Mode Distribution
 - Link Drive Schedules
- There is no limit on the number of **running links** that can be defined in one run

Links Input

- There are 9 columns that need to be completed for each link:
 - LinkID: name of each link in the project, user provides
 - CountyID: Five digit code (comes with template)
 - ZoneID: county ID with zero at the end (comes with template)
 - RoadTypeID: the roadtype for each link, user provides
 - Link Length: in miles, user provides
 - Link Volume: total traffic volume in one hour, user provides
 - Link Average Speed: in mph, user provides
 - Could use optional inputs instead to more precisely define activity
 - Link Description: optional text field, user provides
 - Link Grade: in percent grade (100% = 45 degree slope), user provides

Note: this input also needed for an [off-network link](#)

Links Input

link template.xls [Compatibility Mode] - Excel

FILE HOME INSERT PAGE LAYOUT FORMULAS DATA REVIEW VIEW DEVELOPER

Clipboard Font Alignment Number Styles Cells Editing

A1 linkID

	A	B	C	D	E	F	G	H	I	J	K
1	linkID	countyID	zoneID	roadTypeID	linkLength	linkVolume	linkAvgSpeed	linkDescription	linkAvgGrade		
2		26161	261610								
3											
4											
5											
6											
7											
8											
9											
10											
11											
12											
13											
14											
15											
16											
17											
18											
19											
20											
21											
22											

link County RoadType Zone

READY 130%

Defining Vehicle Activity on Running Links

Users may choose one or more options:

1. Define a link average speed (through the “Links” input)
 - MOVES includes default OpMode distributions based on typical driving cycles
2. Enter a link specific drive cycle, through “Link Drive Schedule” input
 - User defines a second-by-second drive cycle for each link
3. Directly enter a link specific OpMode distribution, through “Operating Mode Distribution” input
 - Precisely describes distribution of activity on a link (fraction of time spent in each OpMode bin)
 - Not a typical output from current traffic models

More about these options later in this module

Link Source Type Input ([Running Links](#))

- Three columns need to be completed for each link:
 - LinkID
 - Must include all roadway LinkIDs defined in Links Input
 - SourceType
 - Must include all source types selected in On Road Vehicle/Equipment panel
 - SourceTypeHourFraction
 - Specify vehicle mix (fraction of VHT) on each link
 - Fractions must sum to “1” for each linkID
- Note: This input is not used for an [off-network link](#)

Link Source Type Input (Running Links)

The screenshot shows the Microsoft Excel interface with the file 'linksourcetype.xls' in Compatibility Mode. The ribbon is set to 'HOME'. The active cell is A1, which contains the text 'linkID'. The formula bar shows 'linkID'. The spreadsheet has columns labeled A through K and rows 1 through 22. The first row (row 1) has the following headers: A1: 'linkID', B1: 'sourceTypeID', C1: 'sourceTypeHourFraction'. The rest of the cells in row 1 and all cells in rows 2 through 22 are empty. The status bar at the bottom shows 'READY' and a zoom level of 130%.

	A	B	C	D	E	F	G	H	I	J	K
1	linkID	sourceTypeID	sourceTypeHourFraction								
2											
3											
4											
5											
6											
7											
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22											

Off-Network Link Examples



Bus terminal: start activity only



Truck terminal: start and hotelling activity

- An off-network link represents start and/or hotelling emissions only
- Any driving activity, including idling, that takes place in the same area should be represented with running links
 - E.g., Buses idling at a bus terminal are not hotelling; represent activity with a running link

Off-Network Link Examples



Park and ride lot

- Start activity only
 - No trucks and therefore no hotelling



Inputs Unique to Project Scale: Off-Network Link

- For an **off-network link**, you will need to complete:
 - Links: same input as running links
 - Off-Network: Used to describe activity on such a link
 - Operating Mode Distribution: Used to describe fraction of time in each operating mode bin

Optional:

- Hotelling Activity Distribution: Used to define type of hotelling activity (only applicable if modeling combination long-haul truck hotelling)
- MOVES can currently model only one **off-network link** per run

Links Input for an Off-Network Link

- There are 9 columns that need to be completed:
 - LinkID: name of each link in the project, user provides
 - CountyID: Five digit code (comes with template)
 - ZoneID: county ID with zero at the end (comes with template)
 - RoadTypeID: [off-network](#) road type is 1
 - Link Length: for the [off-network link](#), enter “0”
 - Link Volume: total traffic volume in one hour, user provides
 - Link Average Speed: for the [off-network link](#), enter “0”
 - Link Description: optional text field, user provides
 - Link Grade: for the [off-network link](#), enter “0”

Links Input

link template.xls [Compatibility Mode] - Excel

FILE HOME INSERT PAGE LAYOUT FORMULAS DATA REVIEW VIEW DEVELOPER

Clipboard Font Alignment Number Styles Cells Editing

A1 linkID

	A	B	C	D	E	F	G	H	I	J	K
1	linkID	countyID	zoneID	roadTypeID	linkLength	linkVolume	linkAvgSpeed	linkDescription	linkAvgGrade		
2		26161	261610								
3											
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22											

link County RoadType Zone

READY 130%

Off-Network Input

This input includes six columns:

- ZoneID
- Source Type ID
- Vehicle Population: Average number of off-network vehicles
- Start Fraction: Average fraction of the population which has been started during the hour
 - (may be greater than 1.0 if the average vehicle is started more than once per hour)
- Extended Idle Fraction: Enter range 0 – 1.0
 - Fraction of source hours where hotelling is occurring (e.g. if vehicle population is 20 and 10 vehicles are hotelling for entire hour, enter fraction of 0.5)
 - Used only for long-haul combination trucks (sourcetypeid 62)
- Parked Vehicle Fraction
 - Used only for evaporative emissions and is currently inactive

Off-Network Input

offnetworklink.xls [Compatibility Mode] - Excel

VanGessel, Benjamin

	A	B	C	D	E	F	G	H	I
1	zoneID	sourceTypeID	vehiclePopulation	startFraction	extendedIdleFraction	parkedVehicleFraction			
2	261610								
3									
4									
5									
6									
7									
8									
9									
10									
11									
12									
13									
14									
15									
16									
17									
18									
19									
20									
21									
22									

offNetworkLink SourceUseType Zone

READY 130%

Operating Mode Distribution Input

This input needed for [off-network link](#) and includes six columns:

- sourceTypeID
- hourDayID
- linkID: in this case, just the off-network link
- pollutantProcessID: combination of pollutant and emissions process producing it
- opModeID: conditions affecting the emissions process, e.g., soak time (how long the vehicle was parked)
- opModeFraction
 - Fraction of the population that is in each operating mode
 - For some processes, there is only one operating mode, and the fraction is always 1
 - For starts, the fractions represent the fraction of the population which has been started during the hour (may be greater than 1.0 if the average vehicle is started more than once per hour)
 - For hoteling, set the opModeFraction to 1 for both opModeID =200 and opModeID =201

Note: this input is optional for [running links](#)

Off-Network Input: Operating Mode

	A	B	C	D	E	F	G	H	I	J	K	L
1	sourceTypeID	hourDayID	linkID	polProcessID	opModelID	opModeFraction						
2	21	95	5	202	101	1						
3	62	95	5	202	104	0.5						
4	62	95	5	202	108	0.5						
5	62	95	5	290	200	1						
6	62	95	5	291	201	1						

polProcess IDs:

21	190	90	Extended Idle Exhaust	1	Total Gaseous Hydrocarbons
22	191	91	Auxiliary Power Exhaust	1	Total Gaseous Hydrocarbons
23	201	1	Running Exhaust	2	Carbon Monoxide (CO)
24	202	2	Start Exhaust	2	Carbon Monoxide (CO)
25	215	15	Crankcase Running Exhaust	2	Carbon Monoxide (CO)
26	216	16	Crankcase Start Exhaust	2	Carbon Monoxide (CO)
27	217	17	Crankcase Extended Idle Exhaust	2	Carbon Monoxide (CO)
28	240	40	Nonroad	2	Carbon Monoxide (CO)
29	290	90	Extended Idle Exhaust	2	Carbon Monoxide (CO)
30	291	91	Auxiliary Power Exhaust	2	Carbon Monoxide (CO)
31	301	1	Running Exhaust	3	Oxides of Nitrogen (NOx)
32	302	2	Start Exhaust	3	Oxides of Nitrogen (NOx)

opMode IDs:

28	101	Soak Time < 6 minutes
29	102	6 minutes <= Soak Time < 30 minutes
30	103	30 minutes <= Soak Time < 60 minutes
31	104	60 minutes <= Soak Time < 90 minutes
32	105	90 minutes <= Soak Time < 120 minutes
33	106	120 minutes <= Soak Time < 360 minutes
34	107	360 minutes <= Soak Time < 720 minutes
35	108	720 minutes <= Soak Time
36	150	Hot Soaking
37	151	Cold Soaking
38	200	Extended Idling
39	201	Hotelling Diesel Aux
40	203	Hotelling Battery AC
41	204	Hotelling APU Off

Hotelling Input (Optional, Off-Network Link)

This input includes four columns:

- Beginning model year of trucks hotelling
- Ending model year of trucks hotelling
- opModeID:

28	101	Soak Time < 6 minutes	
29	102	6 minutes <= Soak Time < 30 minutes	
30	103	30 minutes <= Soak Time < 60 minutes	
31	104	60 minutes <= Soak Time < 90 minutes	
32	105	90 minutes <= Soak Time < 120 minutes	
33	106	120 minutes <= Soak Time < 360 minutes	
34	107	360 minutes <= Soak Time < 720 minutes	
35	108	720 minutes <= Soak Time	
36	150	Hot Soaking	
37	151	Cold Soaking	
38	200	Extended Idling	
39	201	Hotelling Diesel Aux	
40	203	Hotelling Battery AC	
41	204	Hotelling APU Off	

- opModeFraction: fraction of the population that is in each operating mode

Hotelling Input

hotelling [Compatibility Mode] - Microsoft Excel

File Home Insert Page Layout Formulas Data Review View Acrobat SecureZIP

Normal Page Layout Custom Views Full Screen Workbook Views Show Zoom 100% Zoom to Selection Zoom New Window Arrange All Freeze Panes Window Save Workspace Windows Switch Macros

E3

	A	B	C	D	E	F	G	H	I	J
1	beginMode	endMode	opMode	ID	opModeFraction					
2	1960	2050	200	0.5						
3	1960	2050	201	0.5						
4	1960	2050	203	0						
5	1960	2050	204	0						
6										
7										
8										
9										
10										
11										
12										
13										
14										
15										
16										

hotellingActivityDistribution hotellingHours HourDay

Ready 100%

Hotelling Summary

Hotelling information entered in three tables:

- Off-Network input
 - Fraction of source hours when hoteling is occurring
- Hotelling input
 - Fraction of the vehicle population that is in each operating mode by model year range
 - Operating modes are extended idle (truck engine on), auxiliary power unit (APU on)
- Operating Mode Distribution input
 - Always set op modes 200 and 201 equal to 1

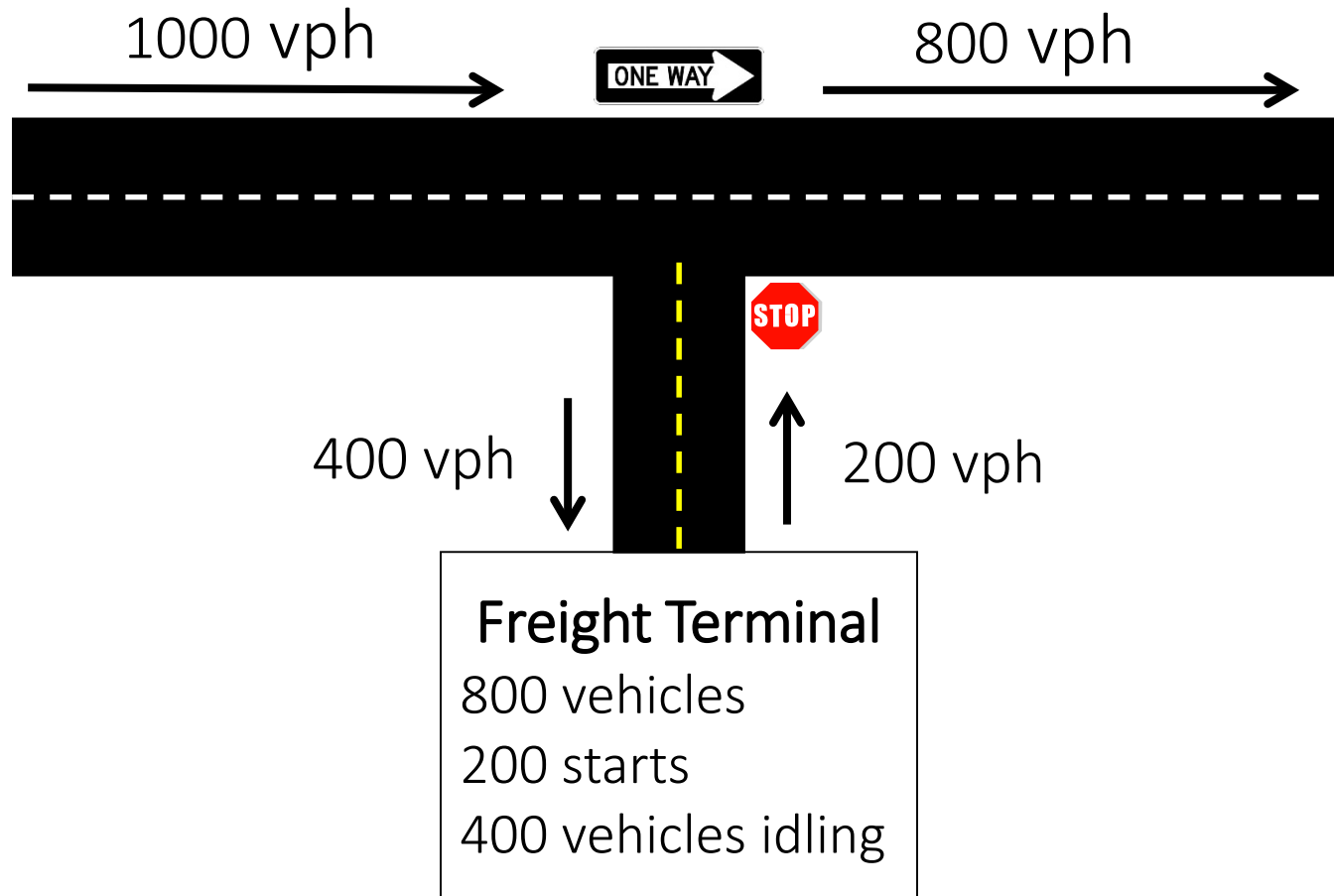
Project Scale Class Demonstration



Demonstration Objectives

- Use the MOVES project scale in a practical example: modeling carbon monoxide emissions from a freight terminal and connector links
- Evaluate emissions under two activity input options
 - Run #1: Average Speeds
 - Run #2: Drive Cycles (link-drive schedule)
- Produce link specific grams/hour emission factors for use in air quality modeling
- Demonstrates full-range of MOVES capabilities at the project scale, but is not intended to reflect technical or policy guidance

Project Scenario



Scenario Assumptions

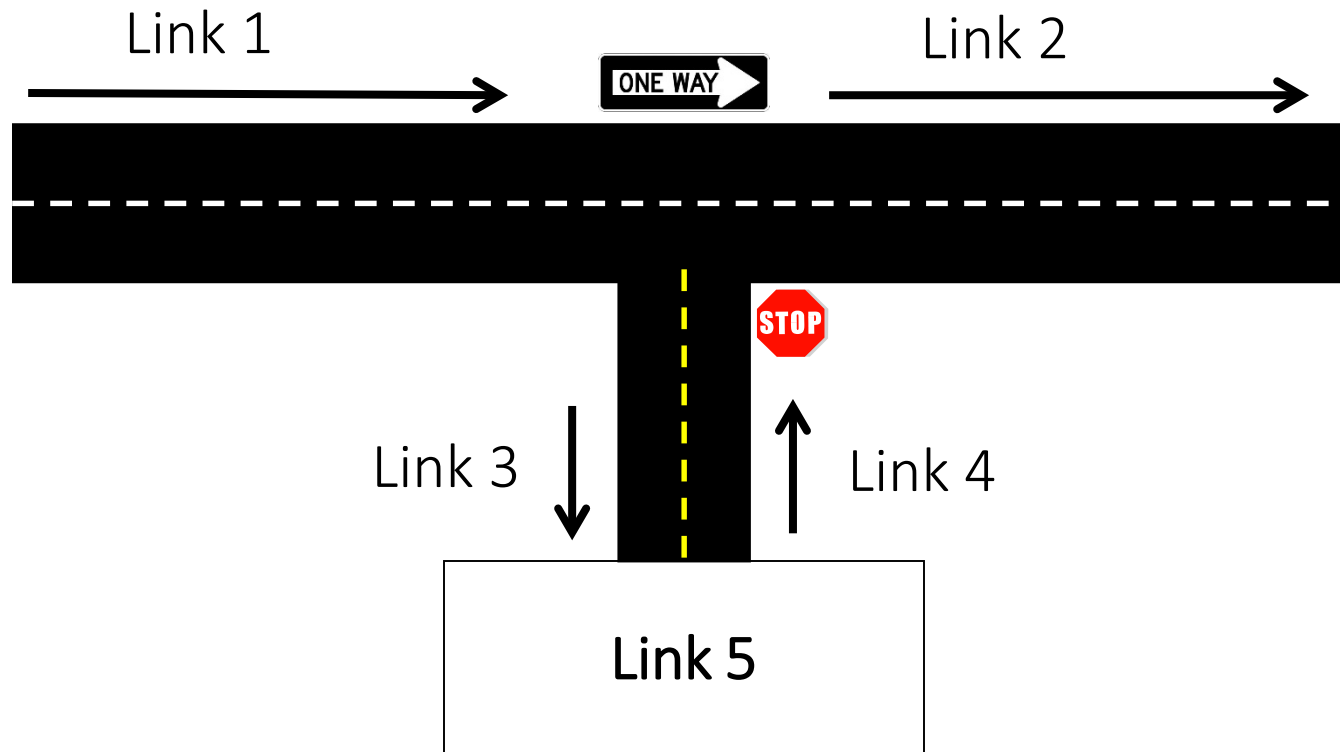
- Only CO emissions from running, starts, extended idle and APU considered (no crank-case emissions considered for simplicity)
- The on-road links ([running links](#)) consist of heavy-duty combination long-haul diesel trucks and passenger vehicles (source types 62 and 21)
 - not realistic, but assumed for simplicity
- The [off-network link](#) consists of only heavy-duty combination long-haul diesel trucks
- Only looking at the peak hour



Project Details

• Location County	Washtenaw County, MI
• Calendar Year	2015
• Month	January
• Weekday/Weekend	Weekday
• Time	8:00 AM to 8:59 AM
• Temperature	20.3° F
• Humidity	70.0 %
• Link Roadtype	Urban Unrestricted Access

Project Link Details



Link ID	Road Type	Link Length	Link Volume	Truck Fraction	Car Fraction	Average Speed (accounting for intersection delay)
1	Urban Unrestricted	0.5 mi	1000	0.4	0.6	25 mph
2	Urban Unrestricted	0.5 mi	800	0.25	0.75	35mph
3	Urban Unrestricted	0.25 mi	400	1	0	15 mph
4	Urban Unrestricted	0.25 mi	200	1	0	15 mph
5	Off-Network	N/A	800	1	0	N/A

Off-Network Link Details: Freight Terminal

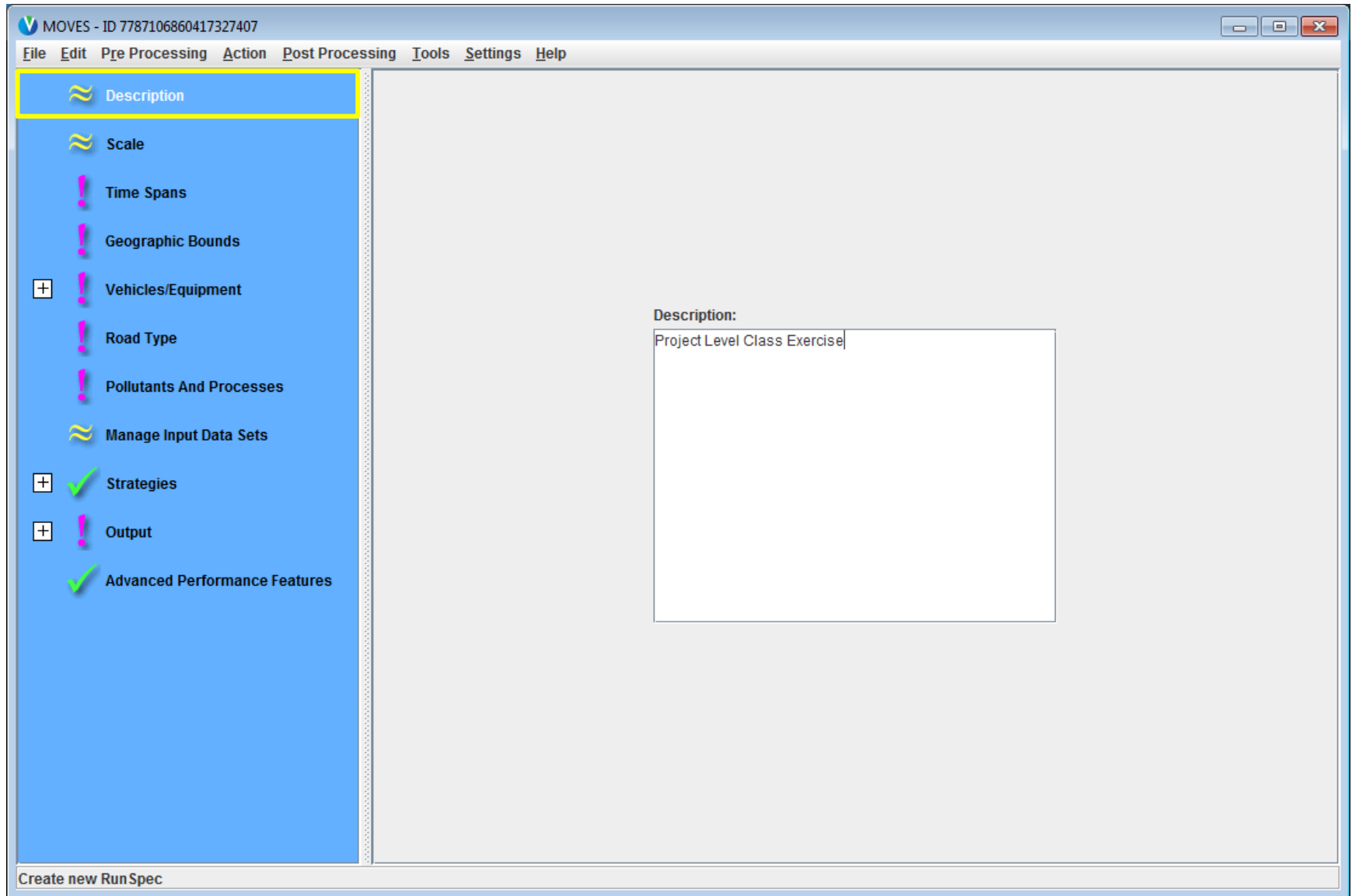
800 Trucks: 200 starts, 400 idle hours

- Average Vehicle Population 800 vehicles
- Start Fraction 0.25
- Hotelling Fraction 0.5
- Hotelling Activity Distribution 0.5 Extended Idle
0.5 APU Use
- Soak Distribution 0.5 soaking 60 min to 90 min
0.5 soaking >720 min

Creating a MOVES Project Scale RunSpec



Creating a MOVES Project RunSpec



Creating a MOVES Project RunSpec

MOVES - ID 7787106860417327407

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


Model

☒ Onroad

☐ Nonroad

Domain/Scale

☐ National Use the default national database with default state and local allocation factors.

 Caution: Do not use this scale setting for SIP or conformity analyses. The allocation factors and other defaults applied at the state or county level have not been verified against specific state or county data and do not meet regulatory requirements for SIPs and conformity determinations.

☐ County Select or define a single county that is the entire domain.

Note: Use this scale setting for SIP and regional conformity analysis. Use of this scale setting requires user-supplied local data for most activity and fleet inputs.

☒ Project Use project domain inputs.


Note: Use this scale setting for project-level analysis for conformity, NEPA, or any other regulatory purpose. Use of this scale setting requires user-supplied data at the link level for activity and fleet inputs that describe a particular transportation project.

Calculation Type

☒ Inventory Mass and/or Energy within a region and time span.

☐ Emission Rates Mass and/or Energy per unit of activity.

MOVESScenarioID:

 Caution: Changing these selections changes the contents of other input panels. These changes may include losing previous data contents.

Create new RunSpec

Creating a MOVES Project RunSpec

MOVES - ID 432605545302680795

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

Time Aggregation Level

☐ Year ☐ Month ☐ Day ☒ Hour

Years

Select Year: 2015 Add

Years:

2015

Remove

Months

☒ January ☐ July

☐ February ☐ August

☐ March ☐ September

☐ April ☐ October

☐ May ☐ November

☐ June ☐ December

Select All Clear All

Days

☐ Weekend

☒ Weekdays

Select All Clear All

Hours

Start Hour: 08:00 - 08:59

End Hour: 08:00 - 08:59

Select All Clear All

Create new Run Spec

Creating a MOVES Project RunSpec

MOVES - ID 7787106860417327407

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

Region:

☐ Nation

☐ State

☒ County

☐ Zone & Link

☐ Custom Domain

States:

MAINE

MARYLAND

MASSACHUSETTS

MICHIGAN

MINNESOTA

MISSISSIPPI

MISSOURI

MONTANA

NEBRASKA

Counties:

MICHIGAN - Shiawassee County

MICHIGAN - St. Clair County

MICHIGAN - St. Joseph County

MICHIGAN - Tuscola County

MICHIGAN - Van Buren County

MICHIGAN - Washtenaw County

MICHIGAN - Wayne County

MICHIGAN - Wexford County

Selections:

MICHIGAN - Washtenaw County

Select All Add Delete

Domain Input Database

The Project domain scale requires a database of detailed data.

Server:

Database:

Refresh

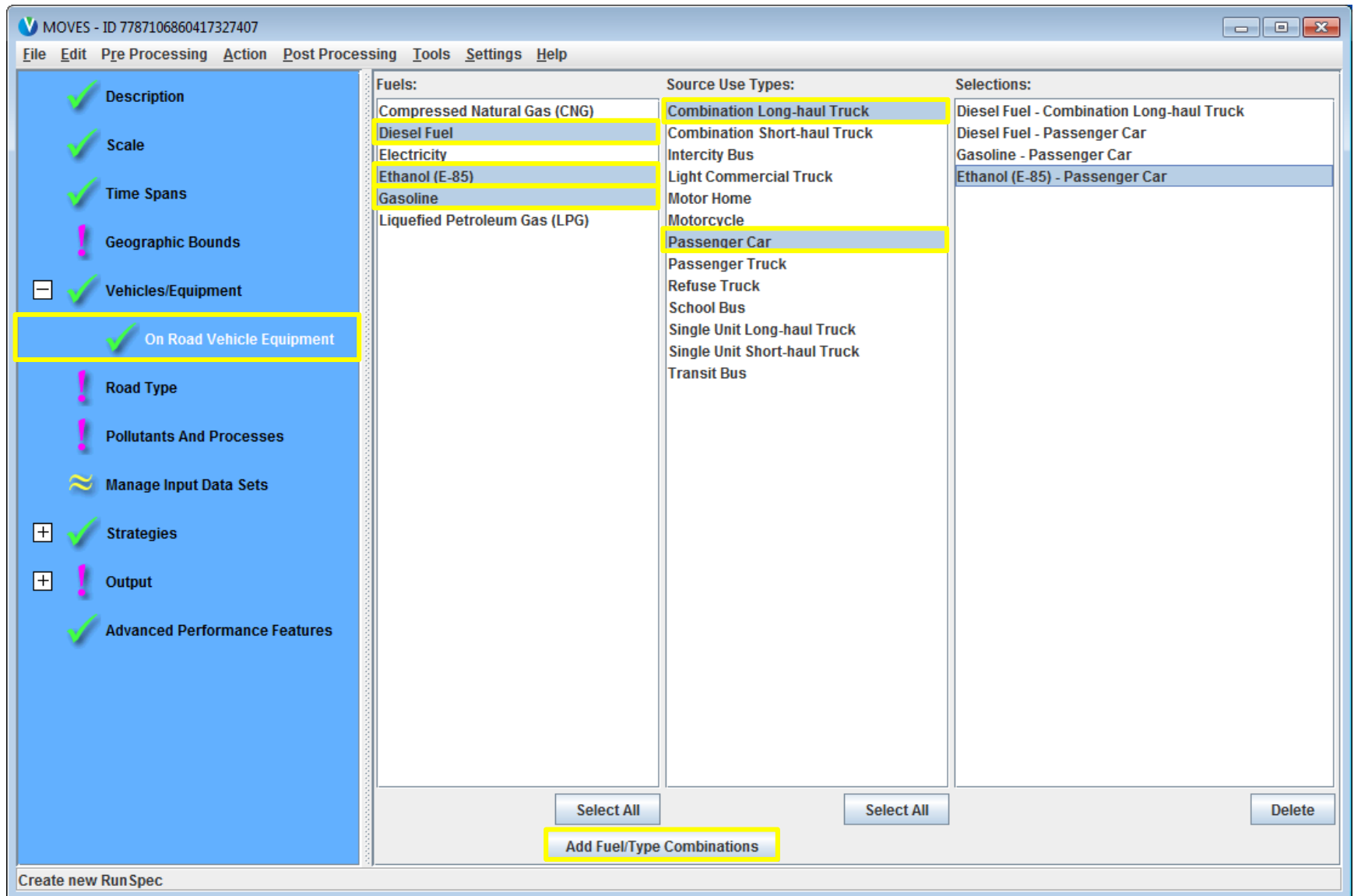
Enter/Edit Data

Geographic Bounds Requirements

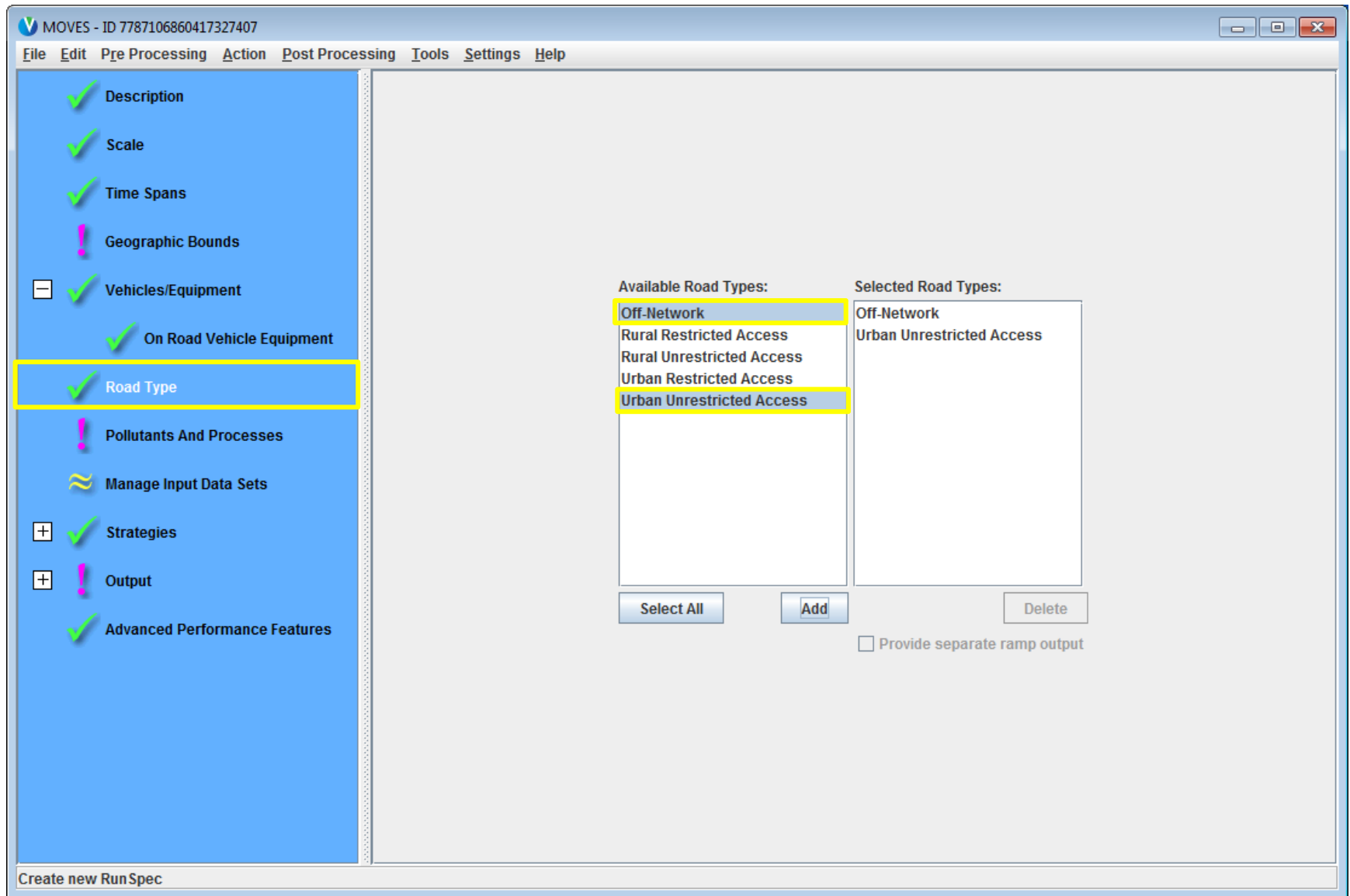
Please select a domain database.

Create new RunSpec

Creating a MOVES Project RunSpec



Creating a MOVES Project RunSpec



Creating a MOVES Project RunSpec

MOVES - ID 7787106860417327407

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

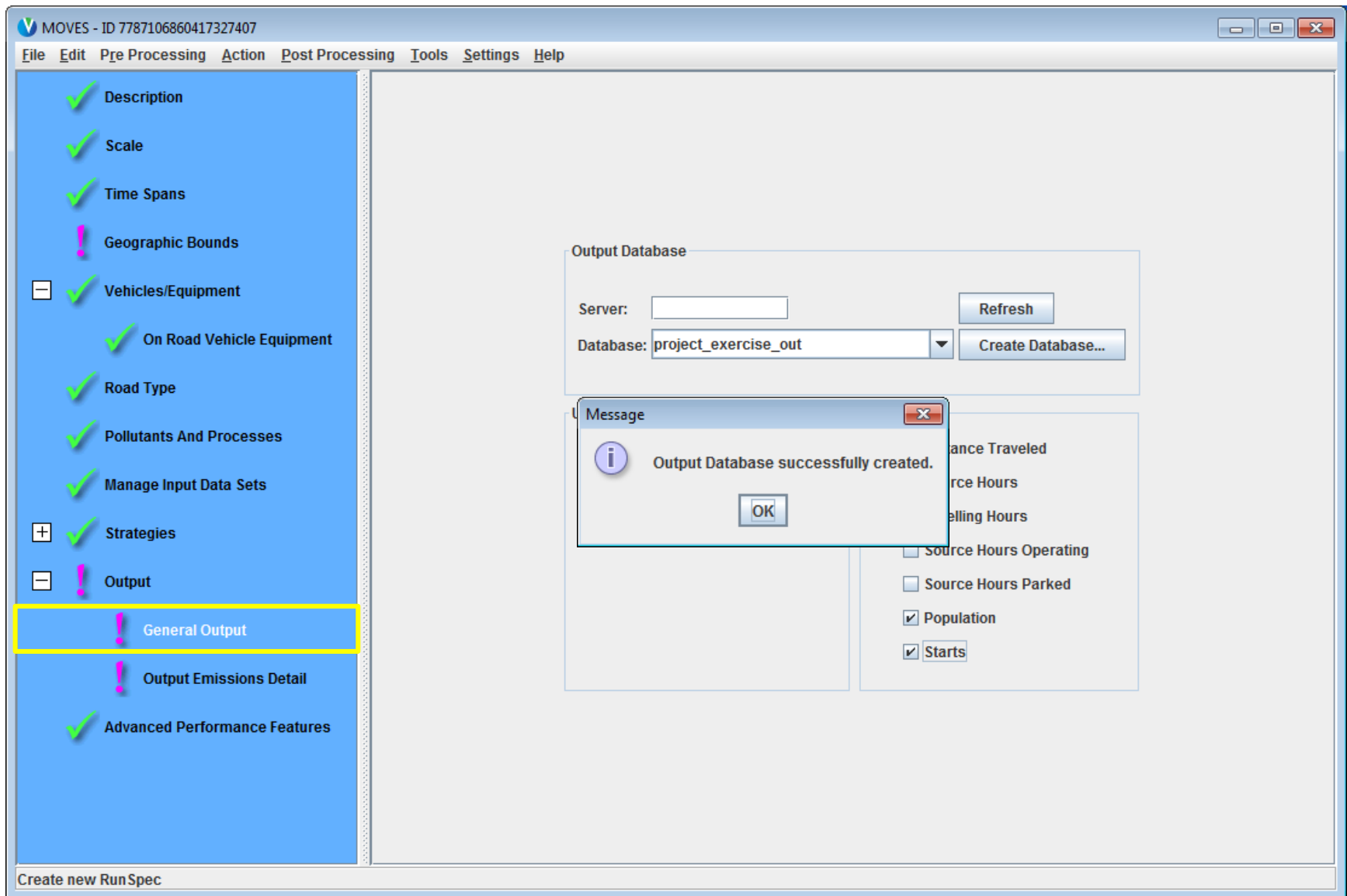
	Running Exhaust	Start Exhaust	Brakewear	Tirewear	Evap Permeation	Evap Fuel Vapor
<input type="checkbox"/> Total Gaseous Hydrocarbons	<input type="checkbox"/>	<input type="checkbox"/>			<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/> Non-Methane Hydrocarbons	<input type="checkbox"/>	<input type="checkbox"/>			<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/> Non-Methane Organic Gases	<input type="checkbox"/>	<input type="checkbox"/>			<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/> Total Organic Gases	<input type="checkbox"/>	<input type="checkbox"/>			<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/> Volatile Organic Compounds	<input type="checkbox"/>	<input type="checkbox"/>			<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/> Methane (CH4)	<input type="checkbox"/>	<input type="checkbox"/>				
<input checked="" type="checkbox"/> Carbon Monoxide (CO)	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>				
<input type="checkbox"/> Oxides of Nitrogen (NOx)	<input type="checkbox"/>	<input type="checkbox"/>				
<input type="checkbox"/> Nitrogen Oxide (NO)	<input type="checkbox"/>	<input type="checkbox"/>				
<input type="checkbox"/> Nitrogen Dioxide (NO2)	<input type="checkbox"/>	<input type="checkbox"/>				
<input type="checkbox"/> Nitrous Acid (HONO)	<input type="checkbox"/>	<input type="checkbox"/>				
<input type="checkbox"/> Ammonia (NH3)	<input type="checkbox"/>	<input type="checkbox"/>				
<input type="checkbox"/> Nitrous Oxide (N2O)	<input type="checkbox"/>	<input type="checkbox"/>				
<input type="checkbox"/> Primary Exhaust PM2.5 - Total	<input type="checkbox"/>	<input type="checkbox"/>				
<input type="checkbox"/> [+] Primary Exhaust PM2.5 - Species	<input type="checkbox"/>	<input type="checkbox"/>				
<input type="checkbox"/> Primary PM2.5 - Brakewear Particulate			<input type="checkbox"/>			
<input type="checkbox"/> Primary PM2.5 - Tirewear Particulate				<input type="checkbox"/>		
<input type="checkbox"/> Primary Exhaust PM10 - Total	<input type="checkbox"/>	<input type="checkbox"/>				
<input type="checkbox"/> Primary PM10 - Brakewear Particulate			<input type="checkbox"/>			
<input type="checkbox"/> Primary PM10 - Tirewear Particulate				<input type="checkbox"/>		
<input type="checkbox"/> Sulfur Dioxide (SO2)	<input type="checkbox"/>	<input type="checkbox"/>				
<input type="checkbox"/> Total Energy Consumption	<input type="checkbox"/>	<input type="checkbox"/>				
<input type="checkbox"/> Petroleum Energy Consumption	<input type="checkbox"/>	<input type="checkbox"/>				
<input type="checkbox"/> Fossil Fuel Energy Consumption	<input type="checkbox"/>	<input type="checkbox"/>				
<input type="checkbox"/> Atmospheric CO2	<input type="checkbox"/>	<input type="checkbox"/>				
<input type="checkbox"/> CO2 Equivalent	<input type="checkbox"/>	<input type="checkbox"/>				
<input type="checkbox"/> Benzene	<input type="checkbox"/>	<input type="checkbox"/>			<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/> Ethanol	<input type="checkbox"/>	<input type="checkbox"/>			<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/> MTDC	<input type="checkbox"/>	<input type="checkbox"/>			<input type="checkbox"/>	<input type="checkbox"/>

Select Prerequisites

Clear All

Create new RunSpec

Creating a MOVES Project RunSpec



Creating a MOVES Project RunSpec

MOVES - ID 7787106860417327407

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
 - ✓ General Output
 - ✓ Output Emissions Detail
 - ✓ Advanced Performance Features

Always

- ☒ Time Hour
- ☒ Location LINK
- ☒ Pollutant

for All Vehicle/Equipment Categories

- ☐ Model Year
- ☐ Fuel Type
- ☒ Emission Process

☐ Estimate Uncertainty

On Road/Off Road

- ☒ On Road/Off Road
- On and Off Road**
 - ☐ Road Type
 - ☒ Source Use Type
 - ☐ SCC
 - ☐ Regulatory Class
- Off Road**
 - ☐ Sector
 - ☐ Engine Tech.
 - ☐ HP Class

Number of iterations: 2

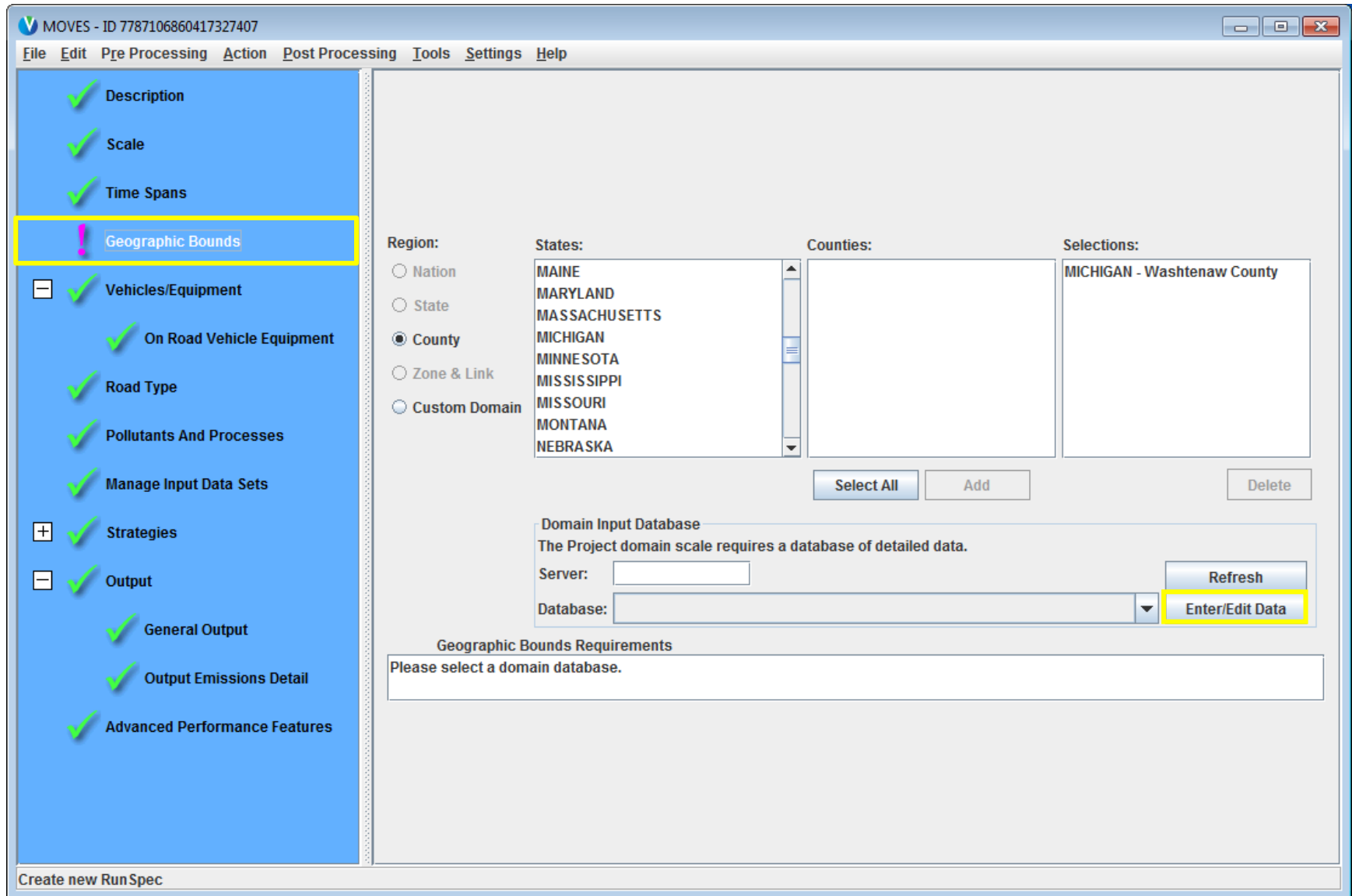
- ☐ Keep pseudo-randomly sampled input
- ☐ Keep output from each iteration

Create new RunSpec

Creating an Input Database



Opening the Project Data Manager



Project Data Manager

The screenshot shows the 'MOVES Project Data Manager' window. It features a series of tabs at the top: 'Hotelling', 'I/M Programs', 'Retrofit Data', 'Generic', 'Tools', 'Operating Mode Distribution', 'Age Distribution', 'Fuel', 'Meteorology Data', 'Run Spec Summary', 'Database' (which is currently selected), 'Links', 'Link Source Types', 'Link Drive Schedules', and 'Off-Network'. Below the tabs, a message reads: 'Select or create a database to hold the imported data.' The 'Server:' field is set to 'localhost'. The 'Database:' field is empty with a dropdown arrow. To the right of these fields are three buttons: 'Refresh', 'Create Database', and 'Clear All Imported Data'. Below the input fields is a large, empty rectangular area. At the bottom right of this area, the word 'Database' is displayed in a large font. A 'Done' button is located at the bottom right corner of the window.

MOVES Project Data Manager

Hotelling I/M Programs Retrofit Data Generic Tools

Operating Mode Distribution Age Distribution Fuel Meteorology Data

Run Spec Summary Database Links Link Source Types Link Drive Schedules Off-Network

Select or create a database to hold the imported data.

Server: localhost Refresh

Database: Create Database

Log: Clear All Imported Data

Database

Done

Project Data Manager

The screenshot shows the MOVES Project Data Manager application window. The title bar reads "MOVES Project Data Manager". The interface features a series of tabs at the top, including "Hotelling", "I/M Programs", "Retrofit Data", "Generic", "Tools", "Operating Mode Distribution", "Age Distribution", "Fuel", "Meteorology Data", "Run Spec Summary", "Database" (which is the active tab), "Links", "Link Source Types", "Link Drive Schedules", and "Off-Network". Below the tabs, a message states: "Select or create a database to hold the imported data." The form includes a "Server:" field with "localhost" entered, a "Database:" field which is currently empty, and a "Log:" field. To the right of these fields are three buttons: "Refresh", "Create Database", and "Clear All Imported Data". A yellow callout box with the text "Enter an input database name and click *Create Database*" has two arrows pointing to the "Database:" field and the "Create Database" button. At the bottom of the window, there is a green bar labeled "Database" and a "Done" button.

MOVES Project Data Manager

Hotelling I/M Programs Retrofit Data Generic Tools

Operating Mode Distribution Age Distribution Fuel Meteorology Data

Run Spec Summary Database Links Link Source Types Link Drive Schedules Off-Network

Select or create a database to hold the imported data.

Server: localhost

Database:

Log:

Refresh

Create Database

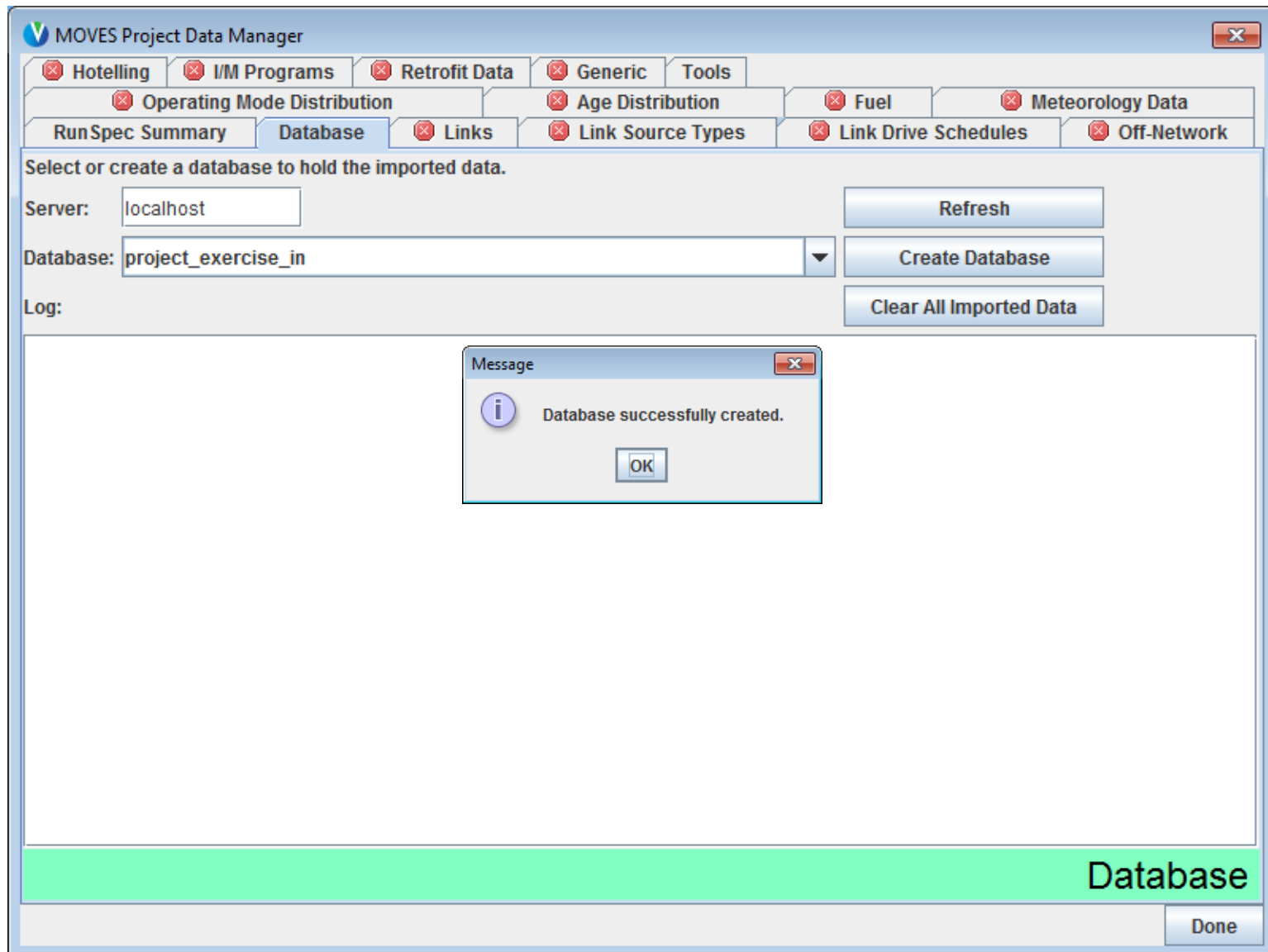
Clear All Imported Data

Enter an input database name and click *Create Database*

Database

Done

Project Data Manager



Demonstration Project Inputs

Next slides will show the following inputs completed:

- Age Distribution
- Meteorology Data
- Fuel
- Links
- Off-Network
- Link Source Types
- Operating Mode Distribution
- Hotelling
- Link Drive Schedules (used only in Run #2)

Age Distribution Input

The screenshot shows an Excel spreadsheet titled "agedist.xls [Compatibility Mode] - Excel". The ribbon at the top includes FILE, HOME, INSERT, PAGE LAYOUT, FORMULAS, DATA, REVIEW, VIEW, and DEVELOPER. The status bar at the bottom indicates "READY" and "100%".

The spreadsheet contains a table with the following data:

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q
1	sourceType	yearID	ageID	ageFraction													
2	21	2015	0	0.060182													
3	21	2015	1	0.060346													
4	21	2015	2	0.060815													
5	21	2015	3	0.061159													
6	21	2015	4	0.060975													
7	21	2015	5	0.060053													
8	21	2015	6	0.060408													
9	21	2015	7	0.060175													
10	21	2015	8	0.05951													
11	21	2015	9	0.057935													
12	21	2015	10	0.052781													
13	21	2015	11	0.049581													
14	21	2015	12	0.047932													
15	21	2015	13	0.046528													
16	21	2015	14	0.041319													
17	21	2015	15	0.036098													
18	21	2015	16	0.028861													
19	21	2015	17	0.021549													
20	21	2015	18	0.017246													
21	21	2015	19	0.013786													
22	21	2015	20	0.010748													
23	21	2015	21	0.008539													
24	21	2015	22	0.006149													
25	21	2015	23	0.004482													
26	21	2015	24	0.003359													
27	21	2015	25	0.002876													
28	21	2015	26	0.002294													
29	21	2015	27	0.001846													
30	21	2015	28	0.000969													
31	21	2015	29	0.00076													
32	21	2015	30	0.000738													
33	62	2015	0	0.057369													

Meteorology Input

	A	B	C	D	E	F	G	H
1	monthID	zoneID	hourID	temperatur	relHumidity			
2	1	261610	9	20.3	70			
3								
4								
5								
6								
7								
8								
9								
10								

zoneMonthHour

HourOfAn ... (+) :

Fuel Supply Input

	A	B	C	D	E	F	G
1	fuelRegionID	fuelYearID	monthGroup	fuelFormulationID	marketShare	marketShareCV	
2	270000000	2015	1	3213	0.962069	0.5	
3	270000000	2015	1	3215	0.0379313	0.5	
4	270000000	2015	1	25005	1	0.5	
5	270000000	2015	1	27001	1	0.5	
6							
7							
8							

FuelSupply | FuelFormulation | FuelUsi ...

Only Fuel Supply Input shown. All four fuel inputs are imported from the Excel file:

- Fuel Supply
- Fuel Formulation
- Fuel Usage Fraction, and
- AVFT

Links Input

	A	B	C	D	E	F	G	H	I	J
1	linkID	countyID	zoneID	roadTypeID	linkLength	linkVolume	linkAvgSpd	linkDescription	linkAvgGrade	
2	1	26161	261610	5	0.5	1000	25		0	
3	2	26161	261610	5	0.5	800	35		0	
4	3	26161	261610	5	0.25	400	15		0	
5	4	26161	261610	5	0.25	200	15		0	
6	5	26161	261610	1	0	800	0		0	
7										
8										

link
County
RoadType
Zone
+
:
◀
▶

This input is now populated with project specific data (from previous slides)

Links input includes all road types including the off-network link, linkID 5 (roadTypeID 1)

Link Source Type Input

	A	B	C	D	E	F	G	H	I
1	linkID	sourceType	sourceType	HourFraction					
2	1	21	0.6						
3	1	62	0.4						
4	2	21	0.75						
5	2	62	0.25						
6	3	21	0						
7	3	62	1						
8	4	21	0						
9	4	62	1						
10									
11									

This input is used to define the fleet mix on each **running link**

Note that linkID 5, the **off-network link**, is not included

Off-Network Input

	A	B	C	D	E	F
1	zoneID	sourceTypeID	vehiclePopulation	startFraction	extendedIdleFraction	parkedVehicleFraction
2	261610	21	0	0	0	0
3	261610	62	800	0.25	0.5	0
4						
5						
6						
7						
8						
9						

offNetworkLink | SourceUseType | Zor ... (+) : |

This input is for the **off-network** link only; somewhat equivalent to Link Source Type inputs for **running** links

Operating Mode Input

opmode.xls [Compatibility Mode] - Excel

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FILE HOME INSERT PAGE LAYOUT FORMULAS DATA REVIEW VIEW DEVELOPER

F9

	A	B	C	D	E	F	G	H	I	J	K	L
1	sourceTypeID	hourDayID	linkID	polProcessID	opModelID	opModeFraction						
2	21	95	5	202	101	1						
3	62	95	5	202	104	0.5						
4	62	95	5	202	108	0.5						
5	62	95	5	290	200	1						
6	62	95	5	291	201	1						
7												
8												
9												
10												
11												
12												
13												
14												
15												
16												
17												
18												
19												
20												
21												
22												
23												
24												
25												

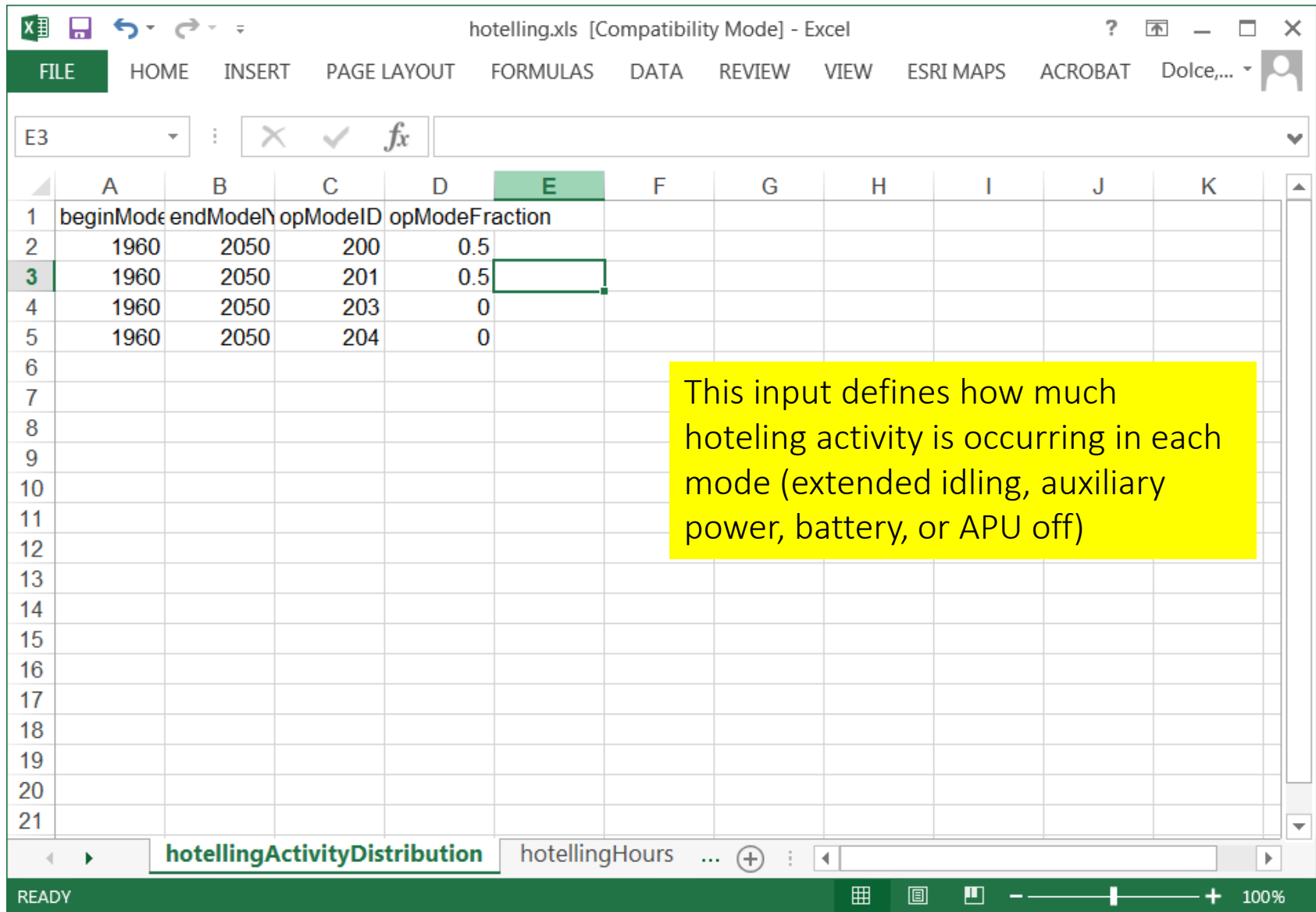
opModeDistribution HourDay OperatingMode PollutantProcessAssoc ...

READY 130%

This input is defined through an OpMode Distribution as represented by columns E and F

Note only for the off-network link, linkID 5

Hotelling Input



	A	B	C	D	E	F	G	H	I	J	K
1	beginMode	endMode	opModeID	opModeFraction							
2	1960	2050	200	0.5							
3	1960	2050	201	0.5							
4	1960	2050	203	0							
5	1960	2050	204	0							
6											
7											
8											
9											
10											
11											
12											
13											
14											
15											
16											
17											
18											
19											
20											
21											

This input defines how much hoteling activity is occurring in each mode (extended idling, auxiliary power, battery, or APU off)

Options for Defining On-Road Activity



Options for Entering Activity

1. Average Speed – User enters average speed
2. Link Drive Schedule – User enters a drive cycle for each link
3. Operating Mode Distribution – User directly enters OpMode distribution for each link and source type
 - Always required if Off-Network link is defined

Option 1: Run with Activity by Average Speed



Already Defined Through Links Input

links.xls [Compatibility Mode] - Excel

VanGessel, Benjamin

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	A	B	C	D	E	F	G	H	I	J	K	L	M
1	linkID	countyID	zoneID	roadType	linkLength	linkVolume	linkAvgSpe	linkDescrip	linkAvgGrade				
2	1	26161	261610	5	0.5	1000	25		0				
3	2	26161	261610	5	0.5	800	35		0				
4	3	26161	261610	5	0.25	400	15		0				
5	4	26161	261610	5	0.25	200	15		0				
6	5	26161	261610	1	0	800	0		0				
7													
8													
9													
10													
11													
12													
13													
14													
15													
16													
17													
18													
19													
20													
21													
22													
23													
24													
25													
26													

link County RoadType Zone

READY 130%

Completed Input Database

The screenshot shows the MOVES Project Data Manager window. The title bar reads "MOVES Project Data Manager". The window contains several tabs at the top, each with a green checkmark icon: "Hotelling", "I/M Programs", "Retrofit Data", "Generic", "Tools", "Operating Mode Distribution", "Age Distribution", "Fuel", "Meteorology Data", "RunSpec Summary", "Database" (which is the active tab), "Links", "Link Source Types", "Link Drive Schedules", and "Off-Network". Below the tabs, there is a section titled "Select or create a database to hold the imported data." This section includes a "Server:" label with a text box containing "localhost", a "Database:" label with a dropdown menu showing "project_exercise_in", and three buttons: "Refresh", "Create Database", and "Clear All Imported Data". Below this section is a "Log:" label followed by a large text area containing a list of log entries. Each entry starts with a timestamp and describes a data import operation, such as "2014-11-06 13:56:19.0 I/M Programs Flag No data needed" and "2014-11-06 13:50:04.0 Operating Mode Distribution Filled OpModeDistribution table". At the bottom of the window, there is a green bar with the word "Database" in white text, and a "Done" button in the bottom right corner.

MOVES Project Data Manager

Hotelling I/M Programs Retrofit Data Generic Tools

Operating Mode Distribution Age Distribution Fuel Meteorology Data

RunSpec Summary Database Links Link Source Types Link Drive Schedules Off-Network

Select or create a database to hold the imported data.

Server: localhost Refresh

Database: project_exercise_in Create Database

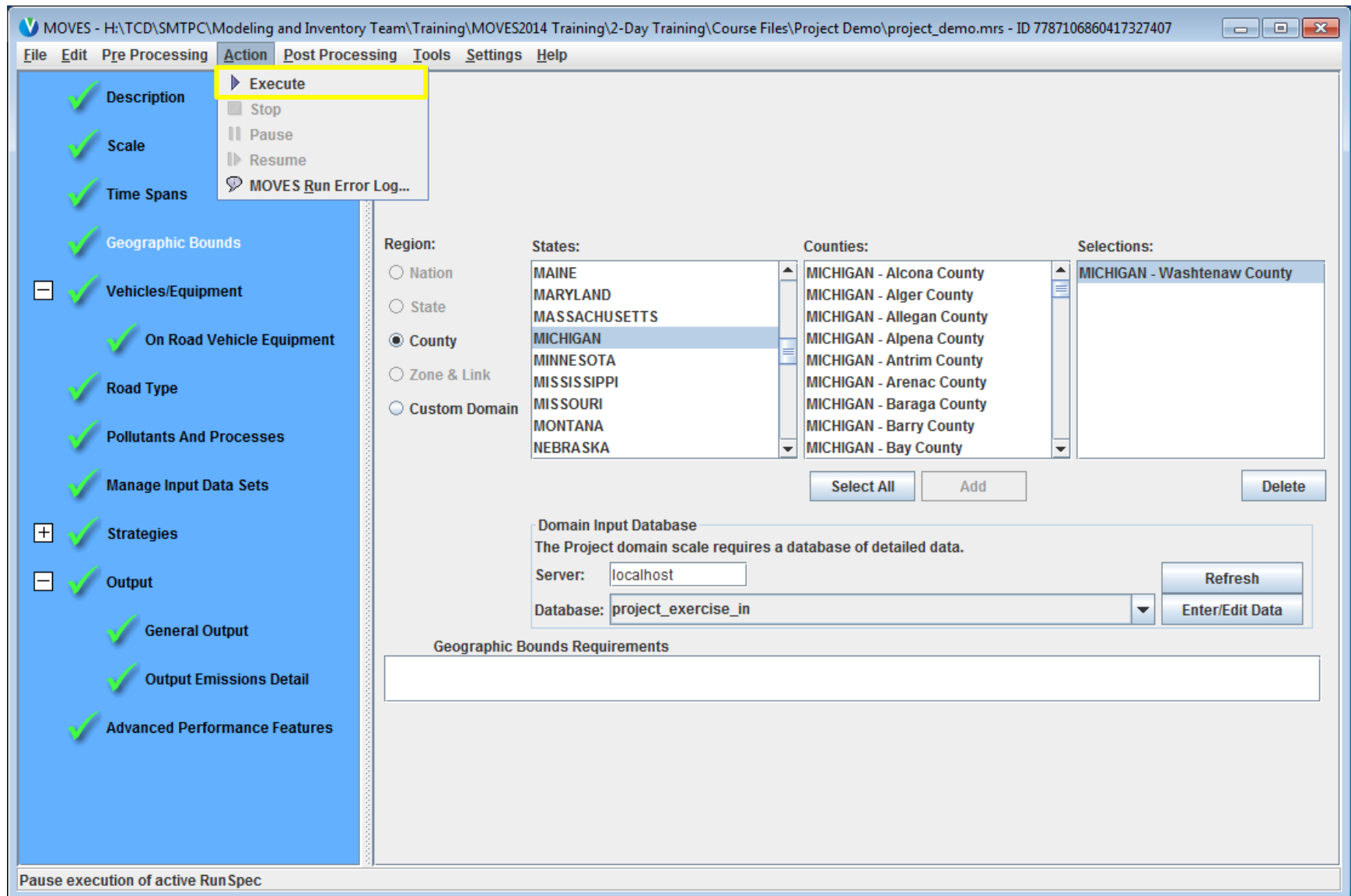
Log: Clear All Imported Data

2014-11-06 13:56:19.0 I/M Programs Flag No data needed
2014-11-06 13:51:48.0 Hotelling Filled hotellingActivityDistribution table
2014-11-06 13:51:24.0 Fuel Filled FuelSupply table
2014-11-06 13:51:24.0 Fuel Filled FuelFormulation table
2014-11-06 13:51:24.0 Fuel Filled FuelUsageFraction table
2014-11-06 13:51:24.0 Fuel Filled avft table
2014-11-06 13:50:55.0 Off-Network Filled OffNetworkLink table
2014-11-06 13:50:44.0 Link Source Types Filled LinkSourceTypeHour table
2014-11-06 13:50:34.0 Links Filled Link table
2014-11-06 13:50:25.0 Meteorology Data Filled ZoneMonthHour table
2014-11-06 13:50:14.0 Age Distribution Filled SourceTypeAgeDistribution table
2014-11-06 13:50:04.0 Operating Mode Distribution Filled OpModeDistribution table

Database

Done

Execute the RunSpec



Project Level Outputs in MySQL

The screenshot displays the MySQL Workbench interface. The top menu bar includes File, Edit, View, Query, Database, Server, Tools, Scripting, and Help. The left sidebar shows the Navigator pane with a tree view of schemas and tables. The 'movesoutput' table is selected, and its columns are listed in the Information pane: MOVESRunID, iterationID, yearID, monthID, dayID, hourID, stateID, countyID, zoneID, linkID, and pollutantID. The main query editor shows a query: `SELECT * FROM project_exercise_out.movesoutput;`. The result set is displayed in a table with 11 columns and 14 rows of data.

Query 1 Query 2 movesoutput x

```
1 • SELECT * FROM project_exercise_out.movesoutput;
```

Result Set Filter: Export: Wrap Cell Content: [fA](#)

	MOVESRunID	iterationID	yearID	monthID	dayID	hourID	stateID	countyID	zoneID	linkID	pollutantID
▶	1	1	2015	1	5	9	26	26161	261610	5	2
	1	1	2015	1	5	9	26	26161	261610	5	2
	1	1	2015	1	5	9	26	26161	261610	5	2
	1	1	2015	1	5	9	26	26161	261610	5	2
	1	1	2015	1	5	9	26	26161	261610	4	2
	1	1	2015	1	5	9	26	26161	261610	4	2
	1	1	2015	1	5	9	26	26161	261610	3	2
	1	1	2015	1	5	9	26	26161	261610	3	2
	1	1	2015	1	5	9	26	26161	261610	2	2
	1	1	2015	1	5	9	26	26161	261610	2	2
	1	1	2015	1	5	9	26	26161	261610	1	2
	1	1	2015	1	5	9	26	26161	261610	1	2

Table: movesoutput

Columns:

- MOVESRunID smallint(5) UN
- iterationID smallint(5) UN
- yearID smallint(5) UN
- monthID smallint(5) UN
- dayID smallint(5) UN
- hourID smallint(5) UN
- stateID smallint(5) UN
- countyID int(10) UN
- zoneID int(10) UN
- linkID int(10) UN
- pollutantID int(10) UN

Object Info Session movesoutput 1 x Read Only

Calculating Link Emissions

The screenshot shows the MySQL Workbench interface. On the left, the Navigator pane displays the 'project_exercise_out' database schema, with the 'movesoutput' table selected. Below the Navigator, the 'Information' pane shows the columns of the 'movesoutput' table, including MOVESRunID, linkID, and emissionQuant.

In the center, the Query Editor shows a SQL query labeled 'Query 1' in the 'movesoutput' tab. The query is:

```
SELECT MOVESRunID, linkID, sum(emissionQuant)
FROM project_exercise_out.movesoutput
GROUP BY MOVESRunID, linkID
```

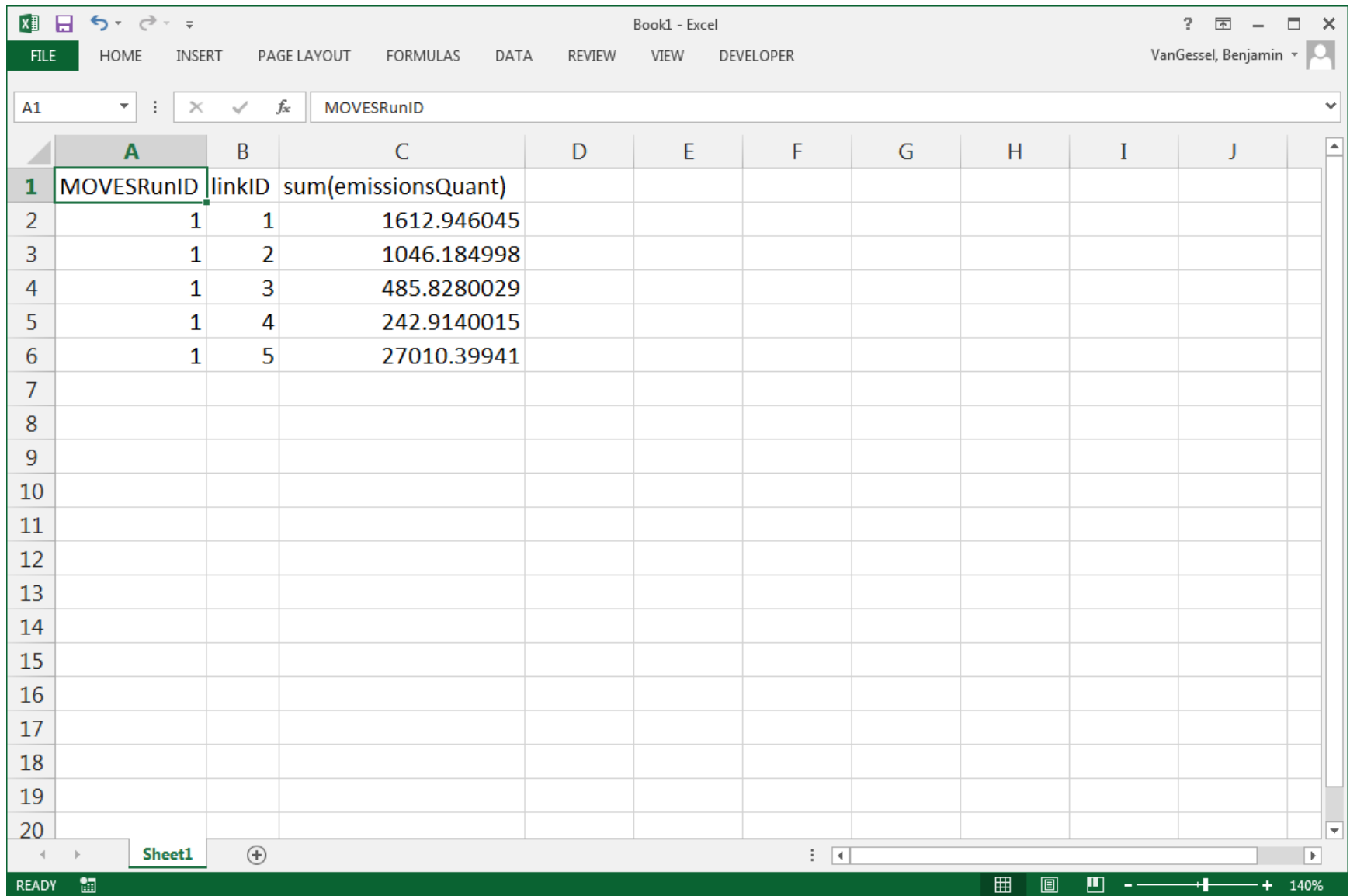
A yellow text box is overlaid on the query editor, containing the same SQL script:

Script:
SELECT MOVESRunID, linkID, sum(emissionQuant)
FROM project_exercise_out.movesoutput
GROUP BY MOVESRunID, linkID;

At the bottom, the 'Result Grid' pane displays the results of the query. It shows a table with three columns: MOVESRunID, linkID, and sum(emissionQuant). The results are as follows:

MOVESRunID	linkID	sum(emissionQuant)
1	1	1612.946044921875
1	2	1046.1859741210938
1	3	485.8280029296875
1	4	242.91400146484375
1	5	27010.3994140625

CO grams/hour Emissions



The screenshot shows a Microsoft Excel window titled "Book1 - Excel". The ribbon at the top includes FILE, HOME, INSERT, PAGE LAYOUT, FORMULAS, DATA, REVIEW, VIEW, and DEVELOPER. The status bar at the bottom indicates "READY" and a zoom level of "140%".

The active worksheet is "Sheet1", which contains a table with the following data:

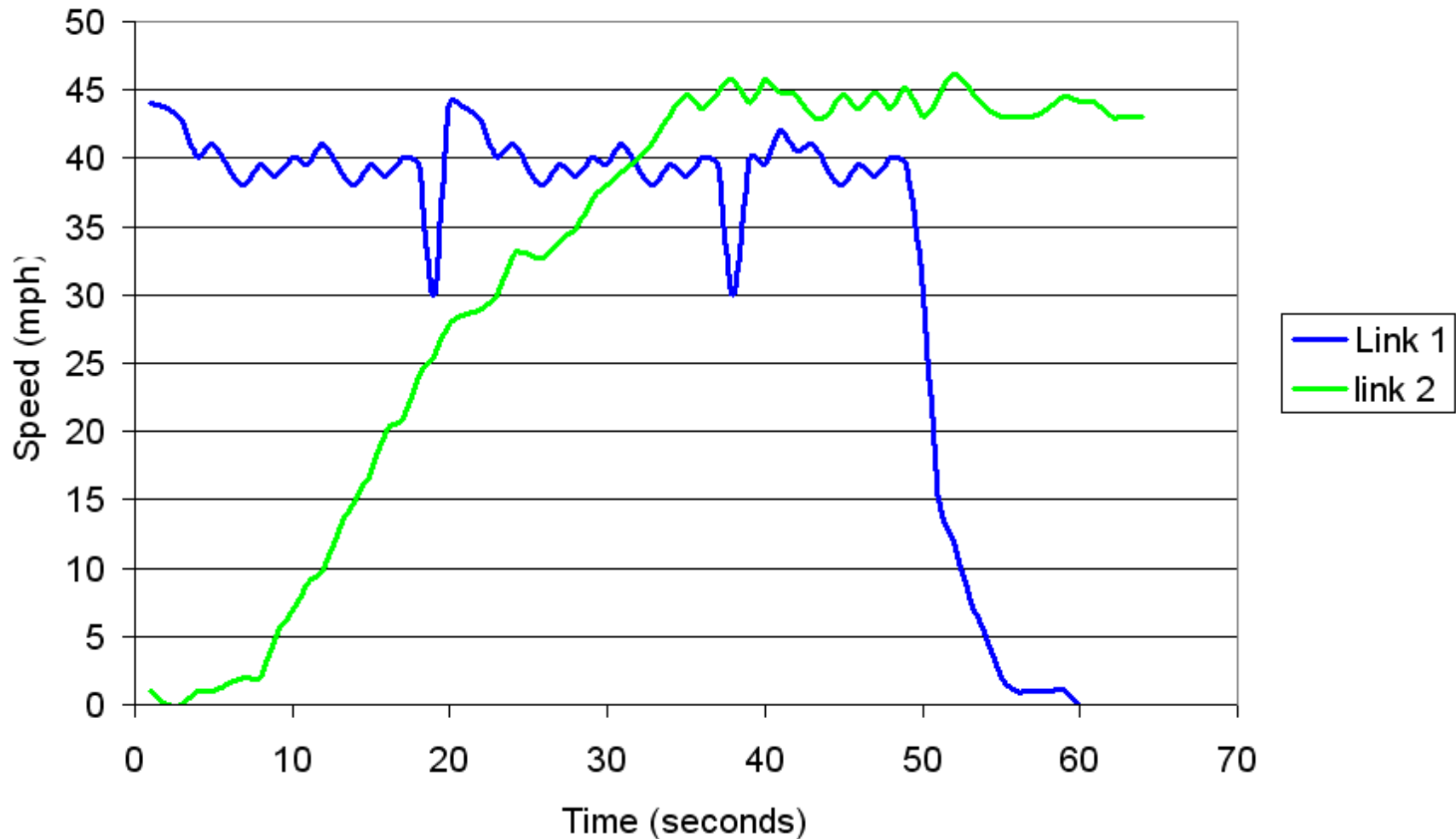
	A	B	C	D	E	F	G	H	I	J
1	MOVESRunID	linkID	sum(emissionsQuant)							
2		1	1	1612.946045						
3		1	2	1046.184998						
4		1	3	485.8280029						
5		1	4	242.9140015						
6		1	5	27010.39941						
7										
8										
9										
10										
11										
12										
13										
14										
15										
16										
17										
18										
19										
20										

Option 2: Run with Activity by Link Drive Schedule



Vehicle Trajectory Data from Micro- Simulation Model (links 1 and 2 only)

Speed / Time Trace for Example Links



Second-by-Second Link Drive Schedule

linkdrive.xls [Compatibility Mode] - Excel

FILE HOME INSERT PAGE LAYOUT FORMULAS DATA REVIEW VIEW DEVELOPER

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F10

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q
1	linkID	secondID	speed	grade													
2	1	1	44	0													
3	1	2	43.7	0													
4	1	3	42.6	0													
5	1	4	40	0													
6	1	5	41	0													
7	1	6	39	0													
8	1	7	38	0													
9	1	8	39.5	0													
10	1	9	38.7	0													
11	1	10	40	0													
12	1	11	39.6	0													
13	1	12	41	0													
14	1	13	39	0													
15	1	14	38	0													
16	1	15	39.5	0													
17	1	16	38.7	0													
18	1	17	40	0													
19	1	18	39.6	0													
20	1	19	30	0													
21	1	20	44	0													
22	1	21	43.7	0													
23	1	22	42.6	0													
24	1	23	40	0													
25	1	24	41	0													
26	1	25	39	0													
27	1	26	38	0													
28	1	27	39.5	0													
29	1	28	38.7	0													
30	1	29	40	0													
31	1	30	39.6	0													
32	1	31	41	0													
33	1	32	39	0													

driveScheduleSecondLink

READY 100%

Import Link Drive Schedule

The screenshot shows the 'MOVES Project Data Manager' application window. The 'Link Drive Schedules' tab is selected in the top navigation bar. Below the tabs, there is a section for 'Description of Imported Data' with a large empty text area. Underneath, the 'driveScheduleSecondLink Data Source:' section contains a 'File: (please select a file)' label, a 'Browse...' button, and 'Clear Imported Data' and 'Create Template...' buttons. An 'Import' button is located below this section. A 'Messages:' label is followed by another large empty text area. At the bottom, there are 'Export Most Recent Execution Data' and 'Export Imported Data' buttons. A pink banner at the very bottom reads 'Link Drive Schedules', and a 'Done' button is in the bottom right corner.

MOVES Project Data Manager

Hotelling I/M Programs Retrofit Data Generic Tools

Operating Mode Distribution Age Distribution Fuel Meteorology Data

Run Spec Summary Database Links Link Source Types Link Drive Schedules Off-Network

Description of Imported Data:

driveScheduleSecondLink Data Source:

File: (please select a file) Browse...

Clear Imported Data Create Template...

Import

Messages:

Export Most Recent Execution Data Export Imported Data

Link Drive Schedules

Done

Completed Input Database

The screenshot shows the MOVES Project Data Manager window. The title bar reads "MOVES Project Data Manager". The window contains several tabs at the top, each with a green checkmark icon: "Hotelling", "I/M Programs", "Retrofit Data", "Generic", "Tools", "Operating Mode Distribution", "Age Distribution", "Fuel", "Meteorology Data", "RunSpec Summary", "Database" (which is the active tab), "Links", "Link Source Types", "Link Drive Schedules", and "Off-Network". Below the tabs, there is a section titled "Select or create a database to hold the imported data." This section includes a "Server:" label with a text box containing "localhost", a "Database:" label with a dropdown menu showing "project_exercise_in", and three buttons: "Refresh", "Create Database", and "Clear All Imported Data". Below this section is a "Log:" label followed by a large text area containing a list of log entries. Each entry starts with a timestamp and describes a data import operation, such as "2014-11-06 13:56:19.0 I/M Programs Flag No data needed" and "2014-11-06 13:50:04.0 Operating Mode Distribution Filled OpModeDistribution table". At the bottom of the window, there is a green bar with the word "Database" in white text, and a "Done" button in the bottom right corner.

MOVES Project Data Manager

Hotelling I/M Programs Retrofit Data Generic Tools

Operating Mode Distribution Age Distribution Fuel Meteorology Data

RunSpec Summary Database Links Link Source Types Link Drive Schedules Off-Network

Select or create a database to hold the imported data.

Server: localhost Refresh

Database: project_exercise_in Create Database

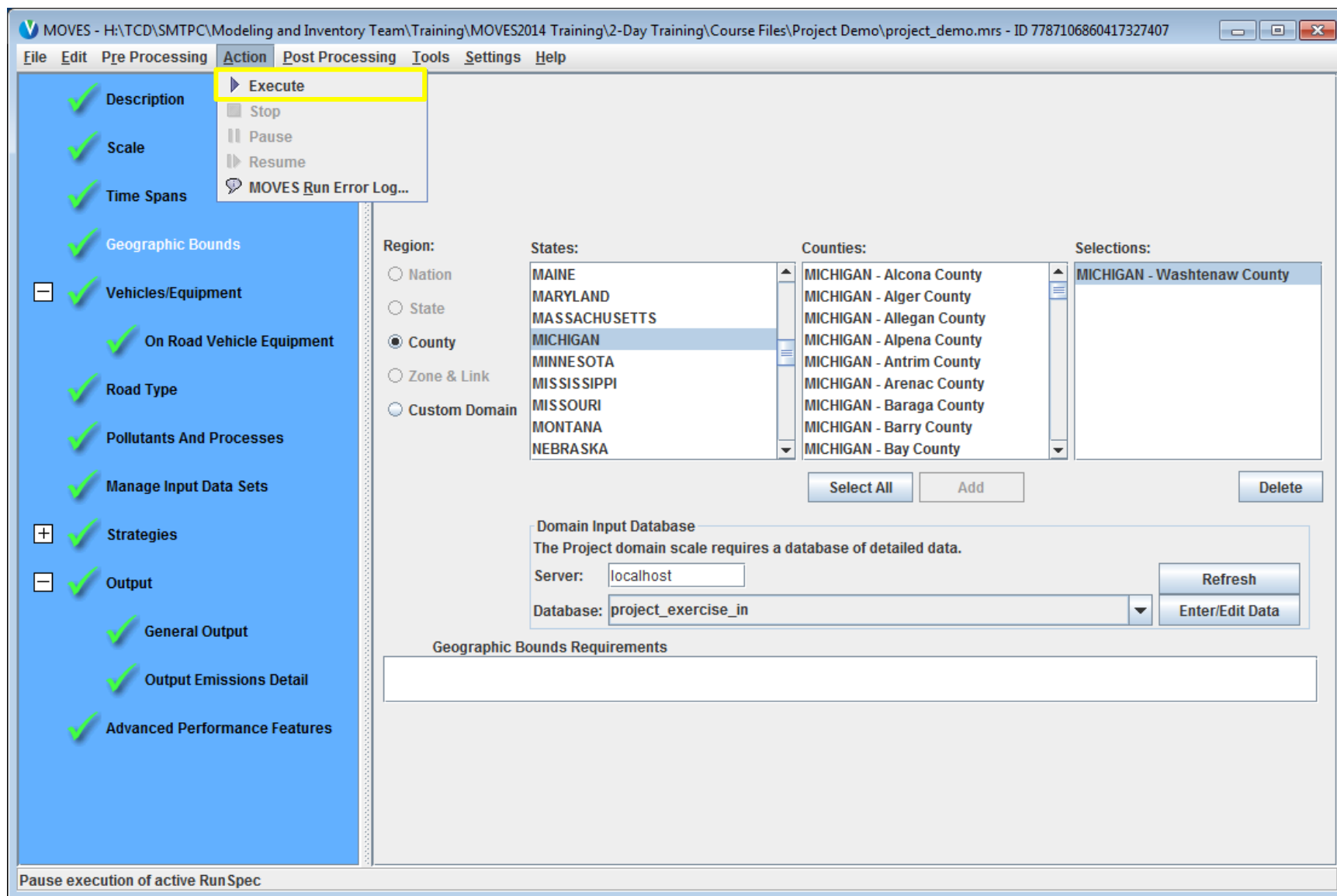
Log: Clear All Imported Data

2014-11-06 13:56:19.0 I/M Programs Flag No data needed
2014-11-06 13:51:48.0 Hotelling Filled hotellingActivityDistribution table
2014-11-06 13:51:24.0 Fuel Filled FuelSupply table
2014-11-06 13:51:24.0 Fuel Filled FuelFormulation table
2014-11-06 13:51:24.0 Fuel Filled FuelUsageFraction table
2014-11-06 13:51:24.0 Fuel Filled avft table
2014-11-06 13:50:55.0 Off-Network Filled OffNetworkLink table
2014-11-06 13:50:44.0 Link Source Types Filled LinkSourceTypeHour table
2014-11-06 13:50:34.0 Links Filled Link table
2014-11-06 13:50:25.0 Meteorology Data Filled ZoneMonthHour table
2014-11-06 13:50:14.0 Age Distribution Filled SourceTypeAgeDistribution table
2014-11-06 13:50:04.0 Operating Mode Distribution Filled OpModeDistribution table

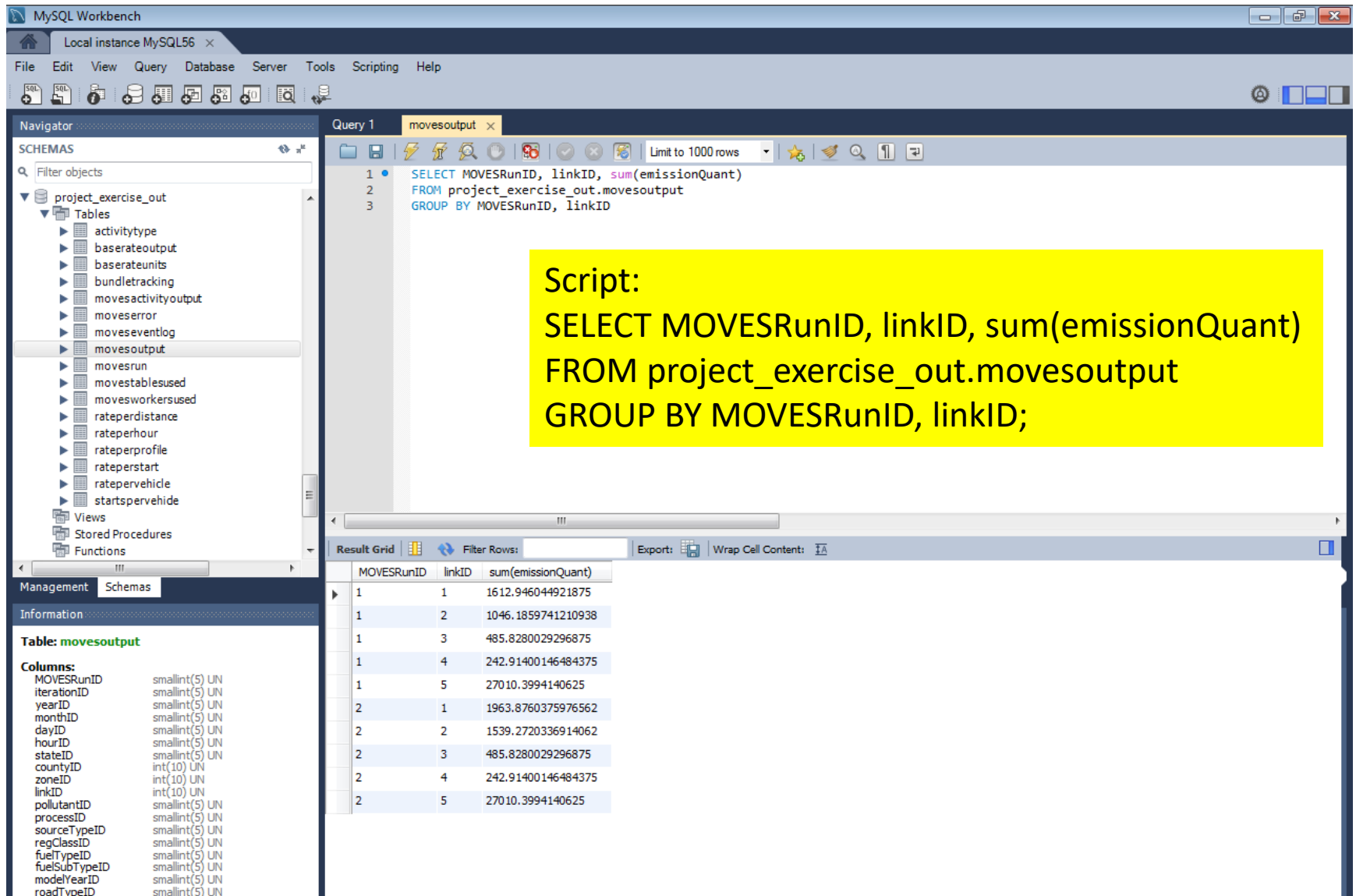
Database

Done

Execute the RunSpec



Calculating Link Emissions



The screenshot shows the MySQL Workbench interface. On the left, the 'Navigator' pane displays the 'project_exercise_out' database schema, with the 'movesoutput' table selected. Below the navigator, the 'Information' pane shows the columns and data types for the 'movesoutput' table. The main query editor displays a SQL query that calculates the sum of 'emissionQuant' for each combination of 'MOVESRunID' and 'linkID'. The 'Result Grid' at the bottom shows the output of this query, with columns 'MOVESRunID', 'linkID', and 'sum(emissionQuant)'. A yellow box highlights the SQL script used in the query.

Script:

```
SELECT MOVESRunID, linkID, sum(emissionQuant)
FROM project_exercise_out.movesoutput
GROUP BY MOVESRunID, linkID;
```

Table: movesoutput

Columns:

- MOVESRunID smallint(5) UN
- iterationID smallint(5) UN
- yearID smallint(5) UN
- monthID smallint(5) UN
- dayID smallint(5) UN
- hourID smallint(5) UN
- stateID smallint(5) UN
- countyID int(10) UN
- zoneID int(10) UN
- linkID int(10) UN
- pollutantID smallint(5) UN
- processID smallint(5) UN
- sourceTypeID smallint(5) UN
- regClassID smallint(5) UN
- fuelTypeID smallint(5) UN
- fuelSubTypeID smallint(5) UN
- modelYearID smallint(5) UN
- roadTypeID smallint(5) UN

MOVESRunID	linkID	sum(emissionQuant)
1	1	1612.946044921875
1	2	1046.1859741210938
1	3	485.8280029296875
1	4	242.91400146484375
1	5	27010.3994140625
2	1	1963.8760375976562
2	2	1539.2720336914062
2	3	485.8280029296875
2	4	242.91400146484375
2	5	27010.3994140625

Results

Recall from slide 77 that a link drive schedule was provided for Links 1 and 2 only

- Results for Links 1 and 2 differ between the two runs
- Results for Links 3, 4, and 5 are identical in the two runs

	MOVESRunID	linkID	sum(emissionQuant)
▶	1	1	1612.946044921875
	1	2	1046.1859741210938
	1	3	485.8280029296875
	1	4	242.91400146484375
	1	5	27010.3994140625
	2	1	1963.8760375976562
	2	2	1539.2720336914062
	2	3	485.8280029296875
	2	4	242.91400146484375
	2	5	27010.3994140625

Questions?

