MODEL USER GUIDE

PACOG
MOVES THE REGION

2024 MODEL UPDATE

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List of Abbreviations

Abbreviation	Term/Phrase/Name
ACS	American Community Survey
ADT	Average Daily Traffic. The amount of vehicular traffic that crosses an imaginary line across a roadway in a 24-hour period. ADT information typically includes both directions of vehicle travel (if on a two-way street).
AM Peak	Refers to the morning weekday peak traffic period, which includes primarily work and school trips.
AOC	Auto Occupancy
ASN	Assignment
CDOT	Colorado Department of Transportation
DIR	Direction
DOT	Department of Transportation
EE	External to External
EI	External to Internal
FAC-Type	Facility Type
GammaParams	Gamma Parameters
GHG	Green House Gas
GIS	Geographic Information Systems
GUI	Graphical User Interface
HBO	Home Based Other
HBSE	Home Based School Elementary
HBSH	Home Based School High School
HBSS	Home Based School Secondary
HBSU	Home Based School University
HBW	Home Based Work
HBWIE	Home Based Work Internal-External
INC	Income
MOVES	Motor Vehicle Emission Simulator
MUT Flow	Multi-Unit Truck Flow (Large Trucks)
N	North
NHBO	Non-Home Base Other
NHBW	Non-Home Base Work
NoCCs	No Centroid Connectors
OD	Origin-Destination

Off Peak	Refers to the non-peak weekday traffic period, excluding morning and afternoon peak traffic periods.
PACOG	Pueblo Area Council of Governments
PM Peak	Refers to the afternoon weekday peak traffic period, including primarily work trips.
POP	Population
PPM	Pueblo Planning Model
S	South
SE	Socioeconomic
SH	State Highway
SPData	Socioeconomic and Population Data
SPDCAP	Speed and Capacity
SPGen	Special Generator
SUT Flow	Single Unit Truck Flow (Medium Trucks)
TAZ	Traffic Analysis Zone
TD	Trip Distribution
TG	Trip Generation
ToD	Time of Day
TotEmp	Total Employment
TransCAD	Refers to the software platform used for the PACOG travel demand model.
VoC	Volume to Capacity

1   Introduction

The Pueblo Planning Model (PPM) went through its second comprehensive update in 2024. This update of the model, referenced as **PPM3**, served multiple purposes:

1. To refresh all the travel demand model files with updated 2020 base year data using the now available 2020 U.S. Census, American Community Survey data files, and Colorado DOT information
2. To update the long-range planning horizon year from 2045 to 2050
3. To build the first 4-step model for PACOG integrating a mode choice module and transit network
4. To build in a Greenhouse Gas (GHG) component for both scenario testing and a built-in means of producing MOVES-ready output from each model run
5. To update the model from Caliper Corporation's TransCAD Version 8.0 to 9.0

This document will guide the user in setting up and running the enhanced 2024 PACOG model. Details regarding the default directory structure, required files, running the model, preparing, and understanding model output are described in detail in the subsequent sections. Details of the model update from a methodological standpoint are provided in a companion report "PACOG Travel Model Methodology, 2024."

2   Setting Up and Opening the PACOG Model

2.1   System Requirements

The model was built in TransCAD 9 Build 32945 and should be run only in TransCAD 9. While the model may run in previous versions of TransCAD, there is no guarantee that the results will be correct or that the model will run to completion. To verify any TransCAD version, look at the **About** tab in the model GUI. The version the model was built in and the version the model is opened in are documented in this GUI tab.

System Requirements

Operating System	Windows 7 or later
Processor	Intel Core i5 or later (i7, i9, or Xenon recommended)
Memory	4GB – 12 GB
TransCAD Software	Version 9.0 Build 32945 or later is recommended.
Disk Space (Installation and Input)	10 MB (code and reference scenario)
Disk Space (Each scenario)	150 MB for each scenario
Software Type	MS Office and TransCAD must either be 32-bit or both be 64-bit.

2.2   Installing the PPM Model

The Pueblo Planning Model (PPM) will be delivered as a zip file named PPM. You will need to first extract the zip file to a user specified location anywhere on the computer that will be used to run the model. The zip file can be extracted using 7-zip software available from www.7-zip.org. Then, to set up the full PPM directory, copy the full extracted PPM folder to a user-specified location anywhere on the computer that will be used to run the model.

C:\PPM was used in examples included in this User Guide. Although the directory does not need to be in the root directory of the computer C drive, it is recommended that the model be installed on a local hard drive rather than a network drive. This is because the use of a network drive will significantly improve model performance and processing speeds. Additionally, the PPM model should not be installed in a location that is actively synchronized, such as Dropbox or OneDrive, because these tools will interfere with TransCAD's ability to iteratively read and modify files.

Review the PPM installation to be sure it is complete. The installed PPM folder contains all model components. The **code** folder holds the compiled code and logos. The **scenarios** folder holds the inputs and outputs for each scenario created. The model will be delivered with the **reference scenario** and base scenarios for 2020, 2030, 2040 and 2050. Confirm that the PPM folder directory structure as copied to your computer is structured as shown below.
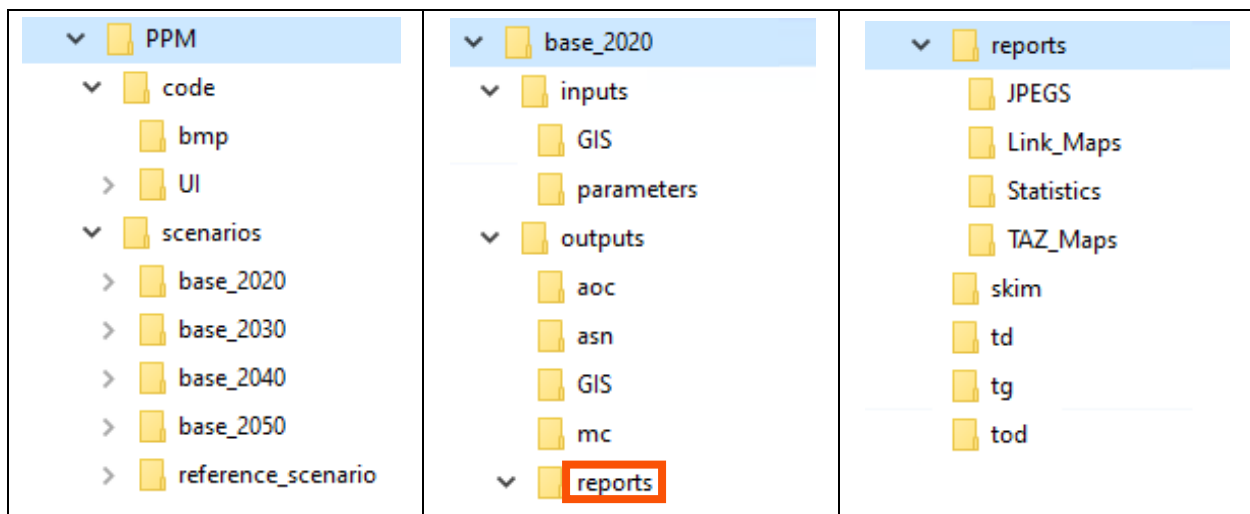
PPM Root and Scenario (base_2000) File Directories

2.3 Opening TransCAD

Open the TransCAD application installed on your computer by clicking on the startup menu listing or the desktop or startup shortcut. If you have not opted out of Quick Start for your TransCAD install, a dialog box as shown below will open. Select None (1), followed by OK (2).
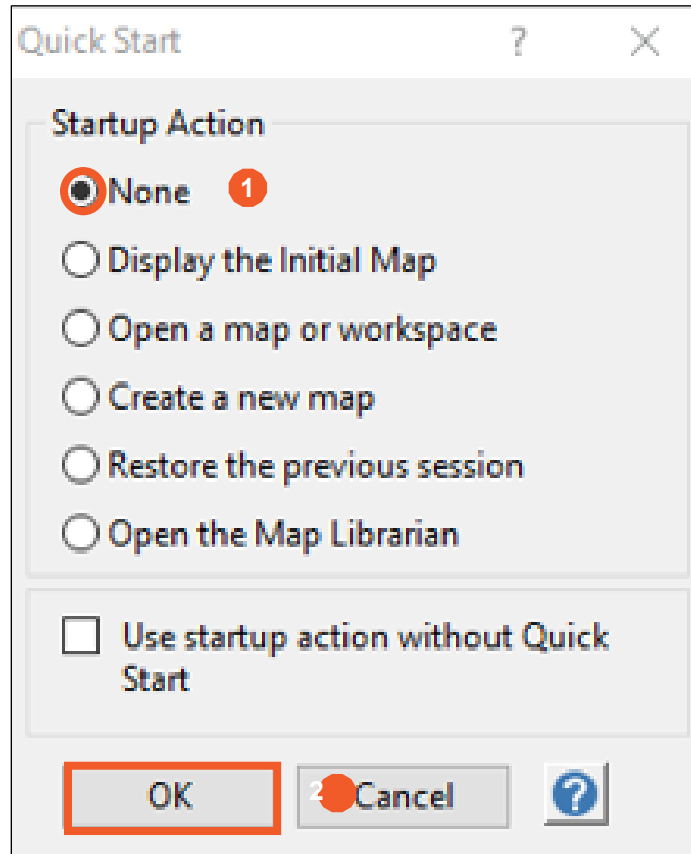

TransCAD Startup Action Dialog Box

2.4   Installing the PPM Model Add-In

2.4.1 Opening TransCAD Add-In Setup Menu

With the TransCAD software open, the next step is to create the TransCAD PPM Add-In. To set up the Add-In open up TransCAD and navigate to the Tools menu (1). Once the Tools menu is open select GIS Developer's Kit (2), followed by Setup Add-Ins (3) as shown below. Setup Add-Ins will open a dialog box that will be used to create the Add-In for the Pueblo Planning Model (PPM).
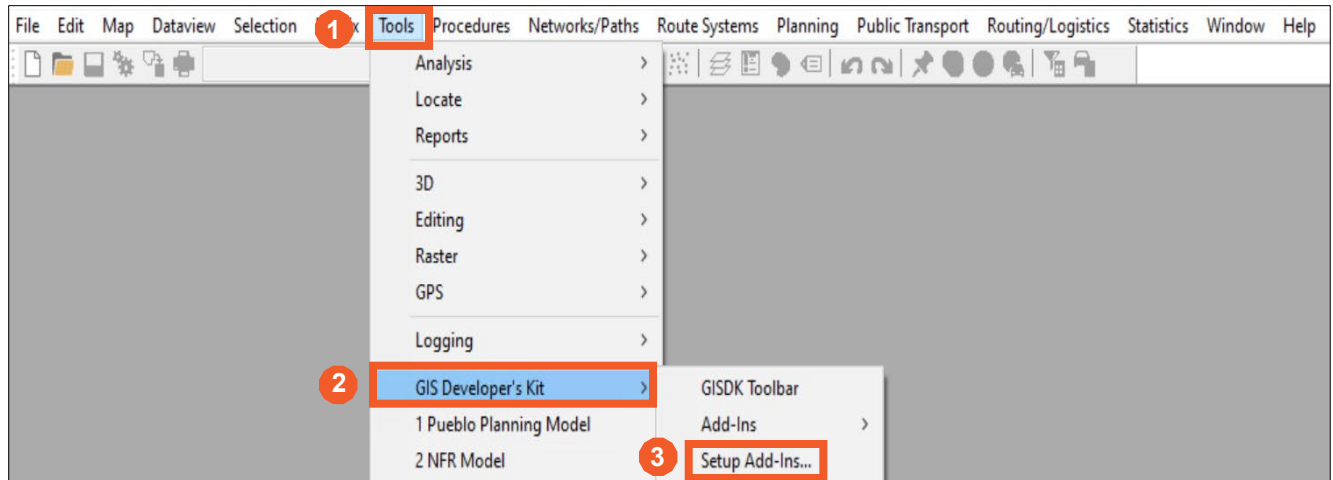
Add-In Setup Process

2.4.2 Filling the TransCAD Add-In Dialog Box

Use the steps listed below and shown in the screenshot on the following page, to fill in the Setup Add-Ins dialog box.

1) Select/Click **Add.**

2) Select/Click **Dialog Box.**

3) Fill Description with **Pueblo Planning Model.**

4) Fill Name with **PPM.**

5) Browse to and Select UI Database **ppm.dbd.**

6) Select/Click **OK.**

The **Description** can be named anything but for consistency it is named "Pueblo Planning Model" (PPM). Note that the **Name** must be "PPM." This name setting is what calls the code and must be exactly as shown; this input is case sensitive.
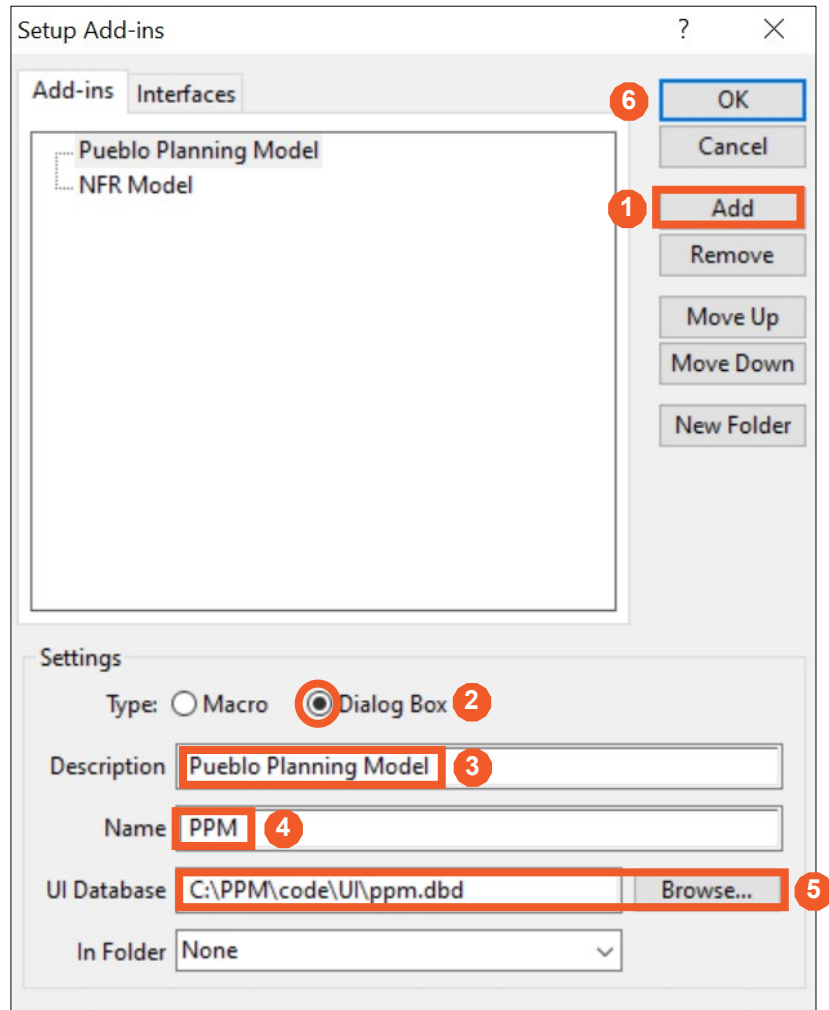
Setup Add-Ins Dialog Box

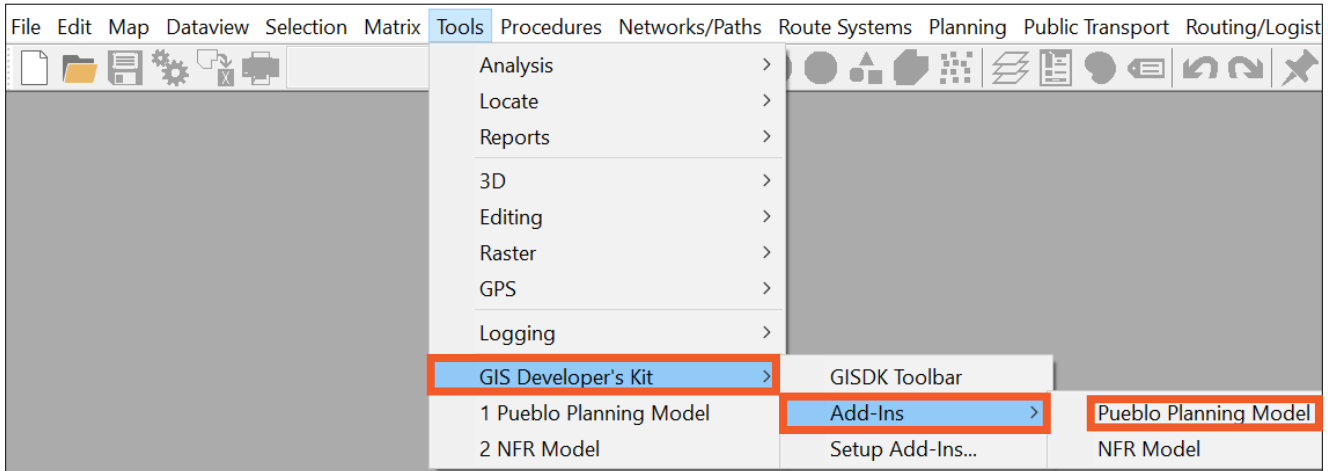## 2.5   Opening the PPM Model

2.5.1 Opening the PPM Model

To open the PACOG Model, from the Tools pull-down menu select GIS Developer's Kit > Add-Ins > Pueblo Planning Model as shown below.

Add-In Pull-down Menu

2.5.2 Selecting the PPM Base Folder

Opening the Pueblo Planning Model Add-In will then prompt the user to select the base folder as shown below. The folder it is looking for is the PPM folder. For this example, the PPM folder is in **C:/PPM**. Note that choosing any other folder will result in the GUI not opening correctly. A clear sign that the wrong folder was chosen is a black box at the top of the GUI instead of the PACOG logo. To remedy this just close the model and open it again this time making sure to choose the correct PPM folder location. After selecting the correct base folder, the Model GUI will open.
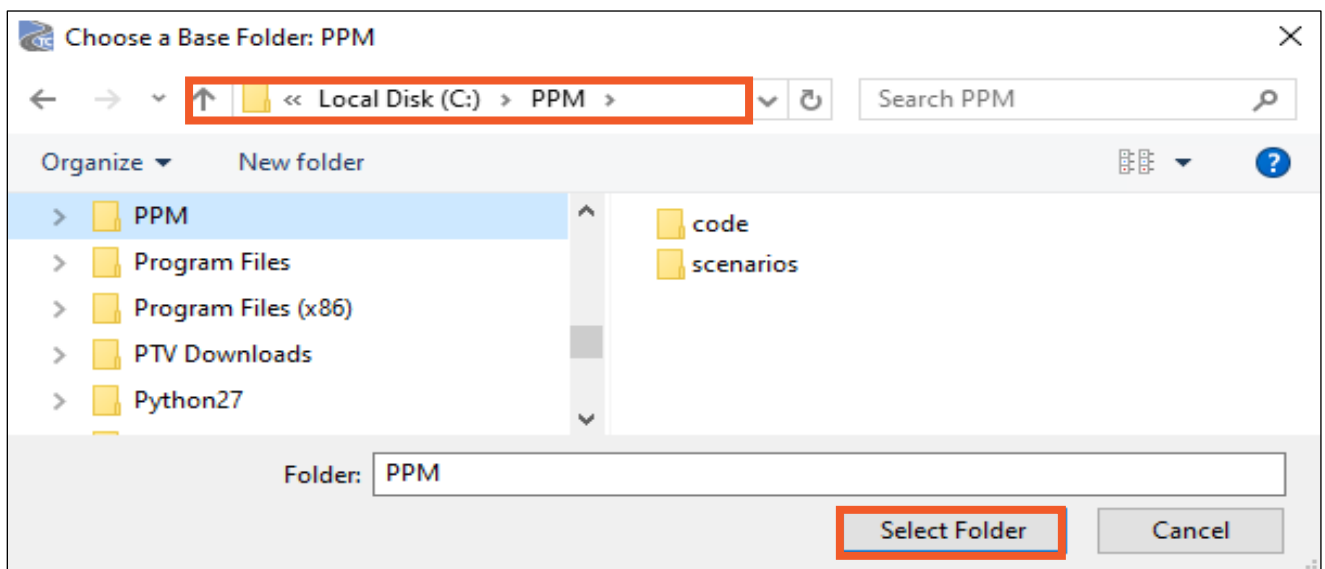
PPM Root Directory Prompt

3   PACOG Model Structure
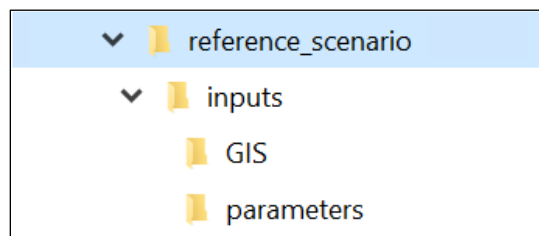
3.1   Directory Structure

As noted in the installation instructions, the PPM does not require a specific root directory location. The model package can be set up in any directory. However, following the default structure will reduce the need to revise file paths. Below the root directory files are organized in two folders (code and scenarios). Inside the **code** folder the compiled code that will be used to set up the Add-In for TransCAD 9 can be found. The directory structure shown below is set up on the C: drive inside a folder called **PPM**.
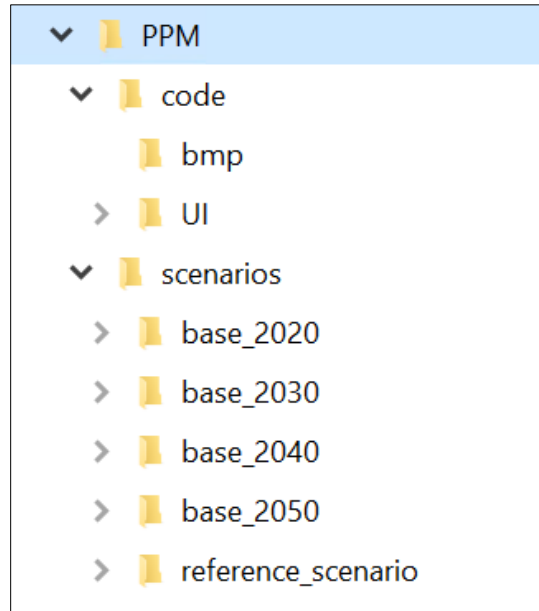
PPM Main Folder Structure

3.2   Reference Scenario

The scenarios folder contains the **reference scenario** folder, four base folders (for 2020, 2030, 2040 and 2050) and will contain all model scenarios created by the user. The **reference scenario** folder contains all the input files and parameter files needed to run both the 2020 and the 2050 base models. Each time a new scenario is created the **reference scenario** "inputs" folders and contents are copied and renamed with the name of the new scenario.

Reference Scenario Folder Structure
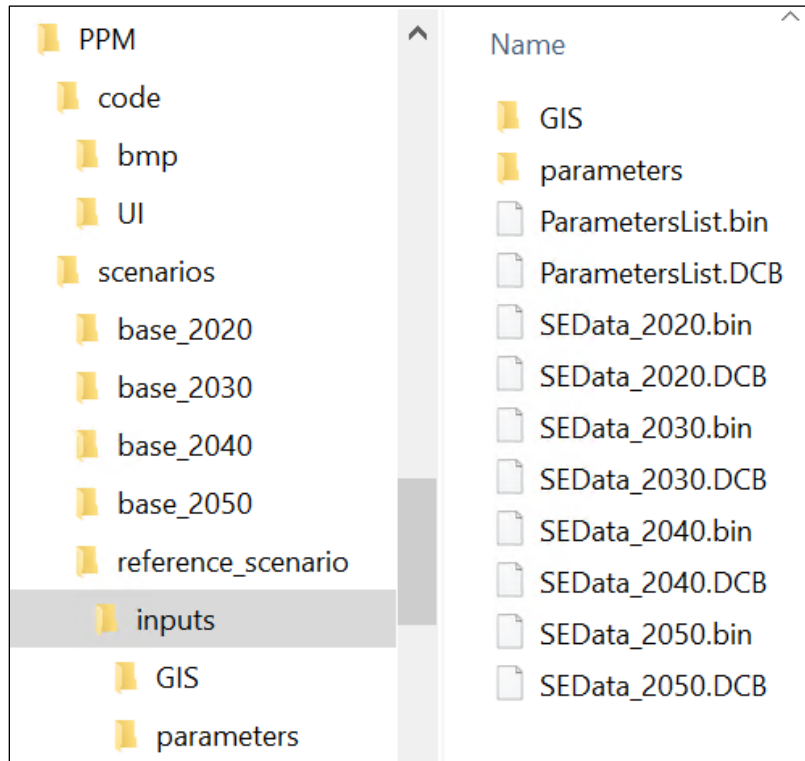
Reference Scenario Inputs Folder Content
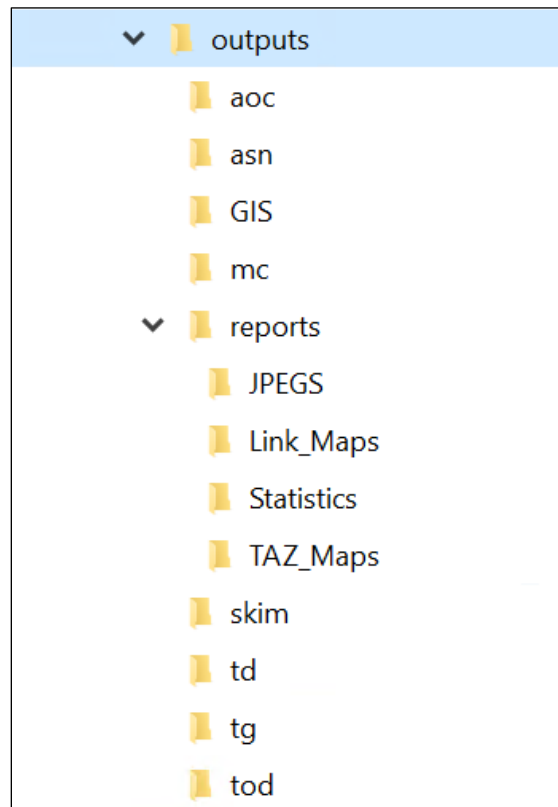
Scenario Builder Outputs Folder Directory

3.3   Required Files

All the base year files required to run the model are provided with the model setup. The base year can be run with no modifications to the files if the directory structure is the same as described in the Directory Structure section. To run the future year scenarios, most of the required files will remain unchanged. A list of the files is provided below.

Required PPM Model Input Files

File Name	File Extension	File Type
2020_BaseNetwork	.dbd	TransCAD
Routes_2020	,dbd	TransCAD
TAZ_Final	.dbd	TransCAD
SEData_2020	.bin	TransCAD
ParametersList	.bin	TransCAD
Production_Rates	.bin	TransCAD
Attraction_Rates	.bin	TransCAD
SPGEN2020	.bin	TransCAD
HBWIE_2020	.bin	TransCAD
SPDCAP	.bin	TransCAD
GammaParams	.bin	TransCAD
VOC	.bin	TransCAD
EI_IE_Targets_2020	.bin	TransCAD
EE_2020	.mtx	TransCAD
TOD	.bin	TransCAD
PPM_MCv3	.mdl	TransCAD

Each of the required input files is described below.

- **2020_BaseNetwork** – TransCAD highway/streets network line layer.
- **Routes_2020** – TransCAD Transit routes system network line layer.
- **TAZ_Final** – 227 internal zones plus 8 external zones.
- **SEData_2020** – 2020 population and employment data.
- **ParametersList** – List of all parameter files. Used as an input to the scenario builder tab in the model GUI.
- **Production_Rates** – Calibrated trip generation rates for productions.
- **Attraction_Rates** – Calibrated trip generation rates for attractions.
- **SPGEN2020** – Zones with special generators.
- **HBWIE_2020** – The number of HBWIE trips to be removed to avoid double count.
- **SPDCAP** – Speed and capacity by functional class and area type lookup table.
- **GammaParams** – Trip distribution gravity model gamma parameters.
- **VOC** – Auto occupancy shares used to convert person trips into vehicle trips.
- **EI_IE_Targets_2020** – Internal to External and External to Internal trip targets used to calculate these trips.

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- **EE_2020** – External to external trips to be added into the trip tables.
- **ToD –** Time of Day factors to be applied before the trips are assigned.
- **PPM_MCv3 –** Mode choice model that replaces the earlier mode split approach.

3.4   Scenario Input Files

The input files are all files that are needed to run the model. To run the 2020, 2030, 2040 or 2050 base scenarios, these inputs should not be modified. However, these files can be updated to create user-specified alternative scenarios by using the **Scenario Builder**. As an example, inputs for the 2020 base year scenario are described here.

3.4.1 Highway Network Line Layer - Line Work

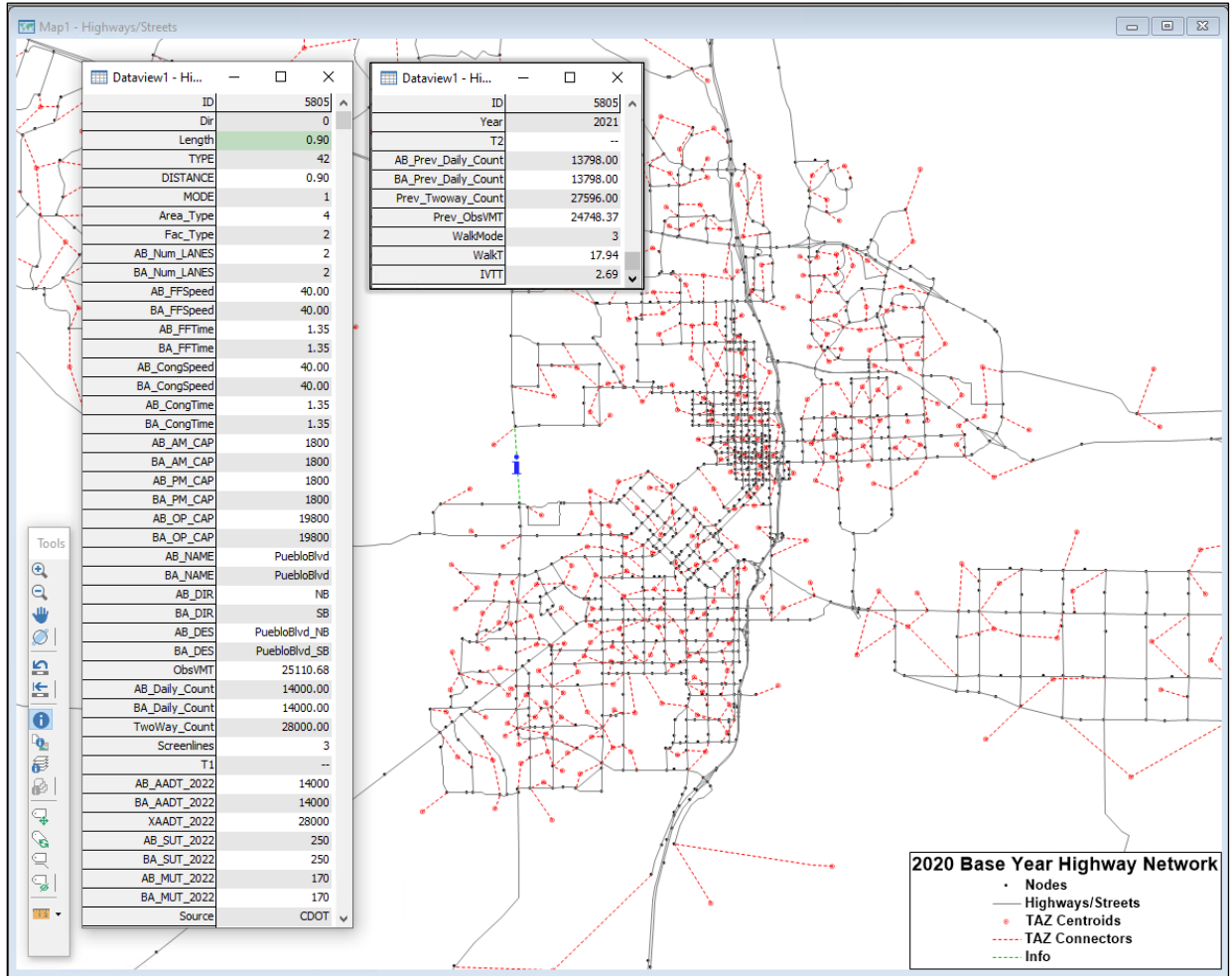The Highway Network Line Layer for the 2020 base year scenario is named **2020_BaseNetwork**. This file is read when creating the ***.net** file and used as the base to which modeled traffic flows are assigned. The network is also used to create the loaded network by joining assignment results to the network. Loaded networks can be found in outputs folders.
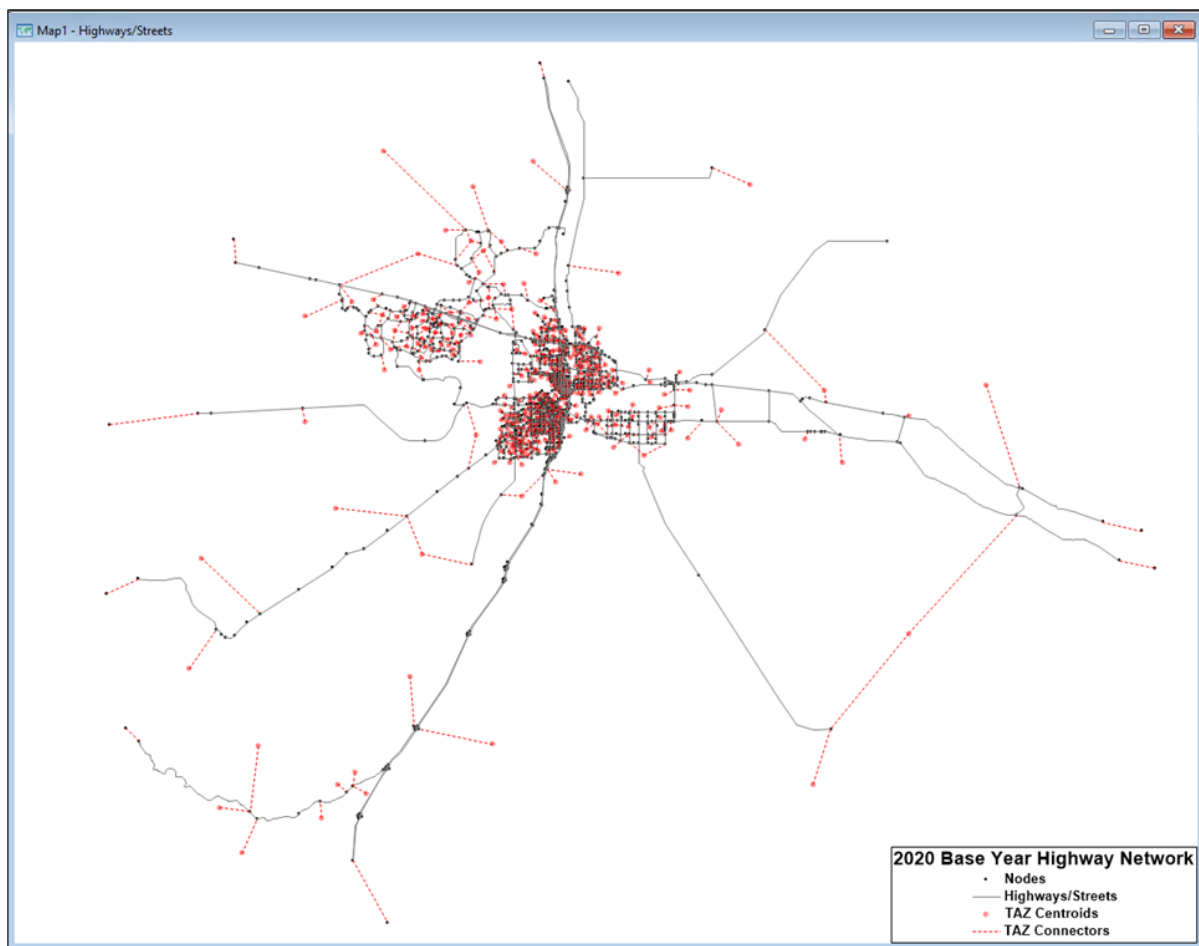
PPM Model 2020 Base Year Highway Network – Full Extents

3.4.2 Highway Network Line Layer – Base Attribute Table

The insert view of the Highway Network Line Layer for the 2020 base year scenario, as shown below, presents the Dataview attributes from the line layer for Pueblo Boulevard for the segment posted with an **"i"** (information). Some attributes are coded by the users and others are calculated based on look-up tables incorporated in the model code or are calculated based on user input.

PPM Model 2020 Base Year Highway Network – Zoom

3.4.3 Transit Routes Line Layer

The Routes Line Layer for the 2020 base year scenario is named Routes_2020. The insert view of the Routes Line Layer shown below presents the Dataview attributes from the line layer for the Irving Place Route (Route #3) posted with an **"i"** (information). Data for all 22 of the 2020 base year routes is shown on the following page.
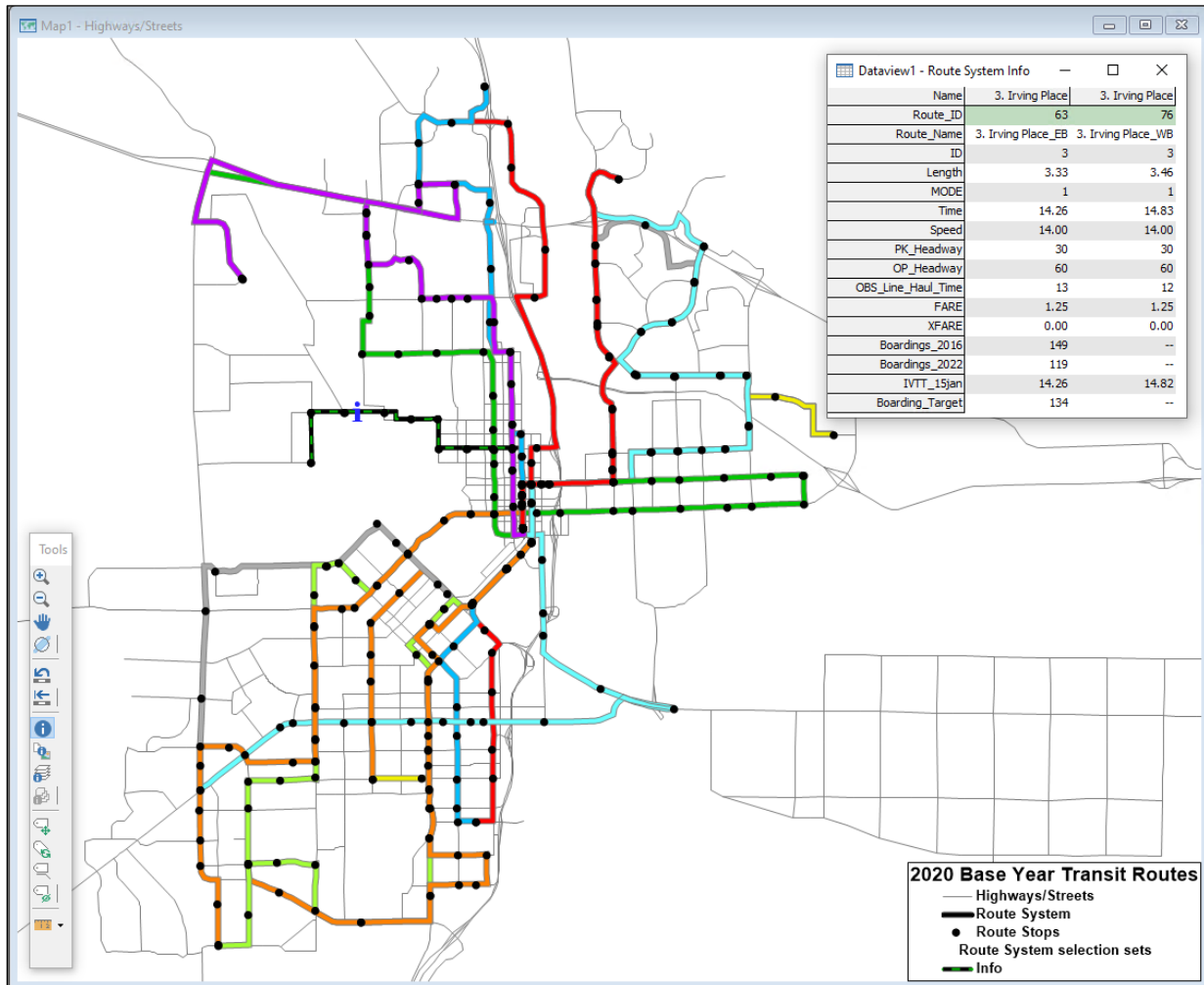

PPM Model 2020 Base Year Transit Routes - Zoom

Route_ID	Route_Name	ID	Name	Length	MODE	Time	Speed	PK_Headway	OP_Headway	OBS_Line_Haul_Time	FARE	XFARE	Boardings_2016	Boardings_2022	IVTT_15jan	Boarding_Target
61	4. Berkley-Beulah_NB	4	4. Berkley-Beulah	3.60	1	15.44	14.00	30	60	13	1.25	0.00	139	15	15.44	77
63	3. Irving Place_EB	3	3. Irving Place	3.33	1	14.26	14.00	30	60	13	1.25	0.00	149	119	14.26	134
67	1. Eastside_EB	1	1. Eastside	3.16	1	13.55	14.00	30	60	13	1.25	0.00	217	148	13.56	182
68	2. Bessemer_SB	2	2. Bessemer	3.15	1	13.51	14.00	30	60	12	1.25	0.00	--	--	13.51	--
69	2. Bessemer_NB	2	2. Bessemer	3.25	1	13.93	14.00	30	60	13	1.25	0.00	200	29	13.93	114
70	4. Berkley-Beulah_SB	4	4. Berkley-Beulah	3.50	1	14.99	14.00	30	60	12	1.25	0.00	--	--	14.99	--
71	11. Red Creek Ride_WB	11	11. Red Creek Ride	5.81	1	24.88	14.00	60	60	22	1.25	0.00	--	--	24.88	--
72	11. Red Creek Ride_EB	11	11. Red Creek Ride	7.04	1	30.18	14.00	60	60	33	1.25	0.00	244	134	30.19	189
73	12. Lake Avenue_SB	12	12. Lake Avenue	6.33	1	27.12	14.00	30	60	20	1.25	0.00	--	--	27.12	--
75	12. Lake Avenue_NB	12	12. Lake Avenue	7.14	1	30.57	14.00	30	60	35	1.25	0.00	301	165	30.58	233
76	3. Irving Place_WB	3	3. Irving Place	3.46	1	14.83	14.00	30	60	12	1.25	0.00	--	--	14.82	--
82	8. Highway 50 West_EB	8	8. Highway 50 West	7.13	1	30.56	14.00	60	60	26	1.25	0.00	260	141	30.57	200
83	6. Pueblo Mall_NB	6	6. Pueblo Mall	5.14	1	26.25	14.00	60	30	19	1.25	0.00	483	311	22.03	397
84	6. Pueblo Mall_SB	6	6. Pueblo Mall	5.48	1	27.69	14.00	60	30	31	1.25	0.00	--	--	23.48	--
87	10. Belmont_SB	10	10. Belmont	7.98	1	33.85	14.00	60	60	30	1.25	0.00	--	--	34.19	--
88	10. Belmont_NB	10	10. Belmont	4.98	1	21.36	14.00	60	60	20	1.25	0.00	257	164	21.36	210
89	9. University_NB	9	9. University	7.82	1	33.50	14.00	60	60	24	1.25	0.00	297	187	33.50	242
90	7. Highland Park_SB	7	7. Highland Park	6.69	1	28.68	14.00	30	30	20	1.25	0.00	--	--	28.68	--
91	7. Highland Park_NB	7	7. Highland Park	6.60	1	28.27	14.00	30	30	35	1.25	0.00	437	202	28.27	319
92	8. Highway 50 West_WB	8	8. Highway 50 West	9.31	1	39.84	14.00	60	60	24	1.25	0.00	--	--	39.91	--
93	1. Eastside_WB2	1	1. Eastside	2.87	1	--	14.00	30	60	12	1.25	0.00	--	--	12.29	--
94	9. University_SB2	9	9. University	4.27	1	--	14.00	60	60	31	1.25	0.00	--	--	18.32	--

2020 Base Year Routes Dataview Information (i)

3.4.4 TAZ Layer

TAZ Geography - PPM Model includes 385 internal and 8 external zones as shown.
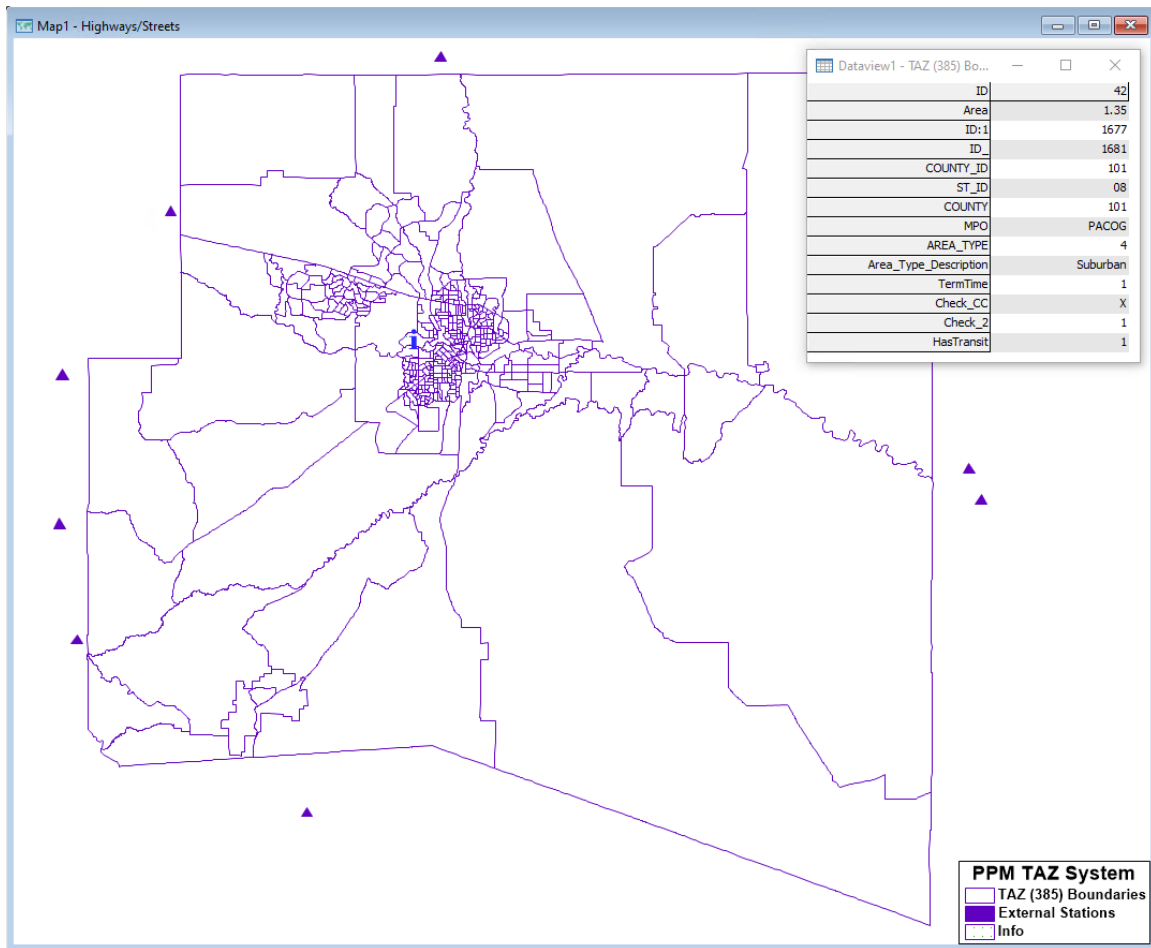
PPM Model Traffic Analysis Zones System

TAZ Attributes - TAZ-level population and employment data used for the trip generation step of the PACOG Model are provided separately in a TransCAD binary file. For the 2020 base year scenario this file is named **SEData_2020**. Socioeconomic attribution of the population and employment totals by category comprise this PACOG Model input with values for these attributes varying by scenario year (e.g., 2020, 2030, 2040, 2050). A portion of the **SEData_2020** file for the PACOG Model is shown below.

TAZ	DISTRICT	AREA_TYPE	POP	POPINHH	GQPOP	HH	INC	HHSize	TOTEMP	RETAIL	BASIC	SERVICE
1	10	5	0	0	0	0	64586	--	0	0	0	0
2	10	5	478	478	0	149	99722	3.21	14	0	13	1
3	9	5	625	625	0	196	80947	3.19	5	0	4	1
4	7	5	453	453	0	171	60625	2.65	4	0	4	0
5	7	4	352	352	0	134	60625	2.63	10	0	7	3
6	7	5	579	579	0	224	60625	2.58	37	0	22	15
7	8	5	221	221	0	83	68611	2.66	94	1	3	24
8	7	5	53	53	0	13	66250	4.08	1416	0	1270	146
9	8	5	712	712	0	295	68611	2.41	360	4	355	1
10	8	5	259	259	0	95	68611	2.73	21	0	20	1
11	8	5	273	273	0	140	68611	1.95	58	0	7	5
12	8	5	652	652	0	324	68750	2.01	26	0	21	2
13	8	5	711	711	0	451	68611	1.58	85	6	20	59
14	8	5	273	273	0	119	68750	2.29	10	0	2	8
15	8	5	600	600	0	242	68750	2.48	60	0	0	54
16	8	5	627	627	0	439	68750	1.43	81	0	2	72
17	8	4	718	718	0	313	68750	2.29	191	12	129	49
18	8	5	677	677	0	286	68750	2.37	14	0	7	0
19	8	4	491	491	0	211	68750	2.33	195	61	57	77
20	8	5	327	327	0	120	68750	2.73	10	0	1	9
21	8	5	318	318	0	222	68750	1.43	93	4	78	11
22	7	4	623	623	0	229	60625	2.72	20	0	13	7
23	7	4	434	434	0	193	60625	2.25	31	6	25	0

PACOG 2020 Socioeconomic Data

3.5   Parameter Files

The parameters files consist of inputs that were calibrated and are **not to be modified for any model runs**. When running the 2050 future year model run these parameter files are part of the model installation as part of the reference scenario. These files will be included in all user created scenarios.

3.5.1 ParametersList Parameter File

The ParamtersList parameter file all parameter files used as basic input to PACOG Model scenarios. The full **ParametersList** parameter file is presented below.

ParametersList Parameter File

3.5.2 Production_Rates Parameter File

Production rates are the estimated cross-classified trip generation rates used by the model to calculate trip production trip ends for household size/income categories. The **Production_Rates** parameter file is presented below.

Production_Rates Parameter File

3.5.3 Attraction_Rates Parameter File

Attraction rates are the estimated cross-classified trip generation rates used by the model to calculate trip ends for trip attractions by trip purpose for cross classified household size/income categories. These trip attraction rates comprise the **Attraction_Rates** parameter file presented below.

Dataview1 - Attraction_Rates

PURPOSE	HH	Retail	Basic	Service	Government	Elem_Enroll	Sec_Enroll	Coll_Enroll
HBW1_A	0.0060	0.3670	0.2300	0.5000	0.2700	0.0000	0.0000	0.0000
HBW2_A	0.0060	0.7190	0.3200	0.6310	0.6310	0.0000	0.0000	0.0000
HBW3_A	0.0060	0.5090	0.4600	0.3610	0.6310	0.0000	0.0000	0.0000
HBW4_A	0.0200	0.2840	0.3600	0.2390	0.5900	0.0000	0.0000	0.0000
HBSE_A	0.0000	0.0000	0.0000	0.0000	0.0000	1.1000	0.0000	0.0000
HBSS_A	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.8000	0.0000
HBSU_A	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	1.3000
HBSH_A	0.0000	5.5000	0.2840	2.3000	0.1000	0.0000	0.0000	0.0000
HBO_A	0.9000	2.1000	0.2080	2.1000	0.1840	0.1000	0.1000	0.1000
NHBW_A	0.1240	1.8770	0.7930	0.1000	0.2000	0.1000	0.1000	0.1000
NHBO_A	0.3270	3.7350	1.5330	0.1980	0.2000	0.1000	0.1000	0.1000
SUT_A	0.0420	0.1000	0.0240	0.1900	0.0900	0.0300	0.0300	0.0300
MUT_A	0.0220	0.0800	0.0150	0.0130	0.0090	0.0100	0.0100	0.0100
EXT_AUTC	0.1710	0.1881	0.1458	0.0729	0.1458	0.0000	0.0000	0.0000

Attraction_Rates Parameter File
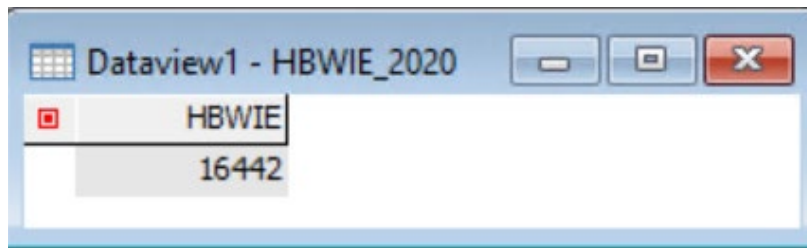
3.5.4 SPGEN2020 Parameter File

Trip end productions and attractions for special generator zones by trip purpose and vehicle class comprise the **SPDGEN2020** parameter file. The special generator zones receive focused treatment in the travel model. Trip ends for these zones for the 2020 base year scenario are presented below. Special generator production and attraction trip ends for these zones vary by scenario year (e.g., 2020, 2030, 2040, 2050).

Dataview1 - SPGEN2020

ID1	TAZ	SG_NAME	SG_NHBO_P	SG_SUT_P	SG_HBO_A	SG_NHBW_A	SG_NHBO_A	SG_SUT_A	SG_EI
11	20	Hollydot Golf Course	350	13	690	350	378	13	135
9	30	Northern Plains_North Shore	411	13	795	411	432	13	132
7	36	Juniper Breaks_Rock Canyon	234	7	453	234	246	7	76
8	38	Arkansas Point_South Shore	242	7	469	242	255	7	78
1	46	City Park	1743	16	3040	1600	1743	16	784
2	86	Elmwood Golf Course	260	5	480	240	260	5	110
6	137	Lake Minnequa	160	5	330	160	180	5	60
5	235	Walking Stick Golf Course	270	10	500	250	270	10	90
10	286	Desert Hawk Golf Course	233	8	460	233	252	8	90
12	297	YMCA	0	0	0	0	0	0	0
4	333	Pueblo Country Club	225	10	400	200	225	10	70
3	344	Mineral Palace Park	590	30	1090	560	590	30	80

SPGEN2020 Parameter File

3.5.5 HBWIE_2020 Parameter File

The **HBWIE_2020** parameter file includes a single value that represents the number of Home-Based Work trips traveling outside of Pueblo County (HBWIE) for the 2020 base year model scenario. This number is removed from calculated (through trip generation rates) Home-Based Works trips to ensure that these trips are not double counted. This parameter file, shown below of the 2020 base year, varies by scenario year (e.g., 2020, 2030, 2040, 2050) and thus is unique for each scenario year.
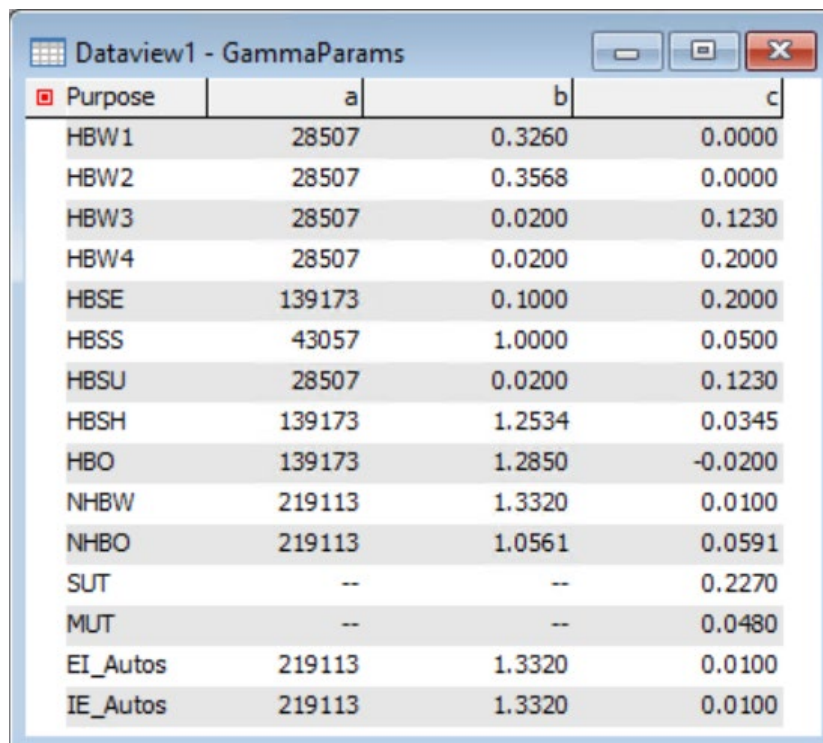
Dataview1 - HBWIE_2020	
HBWIE	
16442	

HBWIE_2020 Parameter File

3.5.6 Gamma_Params Parameter File

Trip distribution gravity model gamma parameters by purpose comprise the **GammaParams** tabular parameter file as shown below. The **included values are calibrated and should not be modified.** These parameters are the same for all scenarios.

Purpose	a	b	c
HBW1	28507	0.3260	0.0000
HBW2	28507	0.3568	0.0000
HBW3	28507	0.0200	0.1230
HBW4	28507	0.0200	0.2000
HBSE	139173	0.1000	0.2000
HBSS	43057	1.0000	0.0500
HBSU	28507	0.0200	0.1230
HBSH	139173	1.2534	0.0345
HBO	139173	1.2850	-0.0200
NHBW	219113	1.3320	0.0100
NHBO	219113	1.0561	0.0591
SUT	--	--	0.2270
MUT	--	--	0.0480
EI_Autos	219113	1.3320	0.0100
IE_Autos	219113	1.3320	0.0100

Gamma_Params Distribution Gamma Parameter File

3.5.7 SPCAP Lookup Table Parameter File

The values in the **SPCAP** lookup table parameter file ae used to fill highway network speed and capacity attributes based on functional class and area type as shown below. These parameters are the same for each scenario year, including for the base year calibration scenario.

TYPE	AT	FC	CONG	FF	CAP
11	1	1	55	55	1600
12	1	2	22	22	650
13	1	3	17	17	500
14	1	4	17	17	450
15	1	5	15	15	450
16	1	6	10	10	350
17	1	7	40	40	1200
21	2	1	48	48	1700
22	2	2	30	30	700
23	2	3	28	28	600
24	2	4	28	28	500
25	2	5	25	25	500
26	2	6	10	10	350
27	2	7	40	40	1200
31	3	1	50	50	1900
32	3	2	35	35	900
33	3	3	30	30	800
34	3	4	30	30	700
35	3	5	25	25	650
36	3	6	20	20	400
37	3	7	50	50	1500
41	4	1	55	55	1900
42	4	2	40	40	900
43	4	3	38	38	800
44	4	4	35	35	700
45	4	5	30	30	600
46	4	6	20	20	400
47	4	7	50	50	1500
51	5	1	60	60	1900
52	5	2	50	50	800
53	5	3	46	46	700
54	5	4	45	45	750
55	5	5	35	35	600
56	5	6	20	20	450
57	5	7	60	60	1500
61	6	1	60	60	1900
62	6	2	50	50	1000
63	6	3	46	46	900
71	7	1	99	99	1900

Dataview1 - SPDCAP

PACOG Model Speed/Capacity Link Lookup Table

3.5.8 VOC Vehicle Occupancy Lookup Table Parameter File

Vehicle occupancy rates, as shown below, are used by the PACOG Model to convert person trips into vehicle trips by purpose for highway assignment for those trips not input to mode choice. These trips are comprised of non-home-based trips. These parameters are the same for each scenario year, including for the base year scenario.

Purpose	VOC
HBW1	1.0792
HBW2	1.0662
HBW3	1.0520
HBW4	1.0223
HBSE	2.0000
HBSS	1.9487
HBSU	1.0741
HBSH	1.3369
HBO	1.4148
NHBW	1.0800
NHBO	1.5121
SUT	1.0000
MUT	1.0000

VOC Vehicle Occupancy Table Parameter File

3.5.9 EI_IE_Targets_2020 Parameter File

The **EI_IE_Targets_2020** parameter file includes External to Internal and Internal to External trip targets for auto, medium truck, and heavy truck categories for the 2020 base year scenario. These targets vary by scenario year (e.g., 2020, 2030, 2040, 2050) and thus are unique for each scenario year.

	382	383	384	385	401	402	403	404	405	406	407	408
378	--	--	--	--	--	--	--	--	--	--	--	--
379	--	--	--	--	--	--	--	--	--	--	--	--
380	--	--	--	--	--	--	--	--	--	--	--	--
381	--	--	--	--	--	--	--	--	--	--	--	--
382	--	--	--	--	--	--	--	--	--	--	--	--
383	--	--	--	--	--	--	--	--	--	--	--	--
384	--	--	--	--	--	--	--	--	--	--	--	--
385	--	--	--	--	--	--	--	--	--	--	--	--
401	--	--	--	--	0.00	108.00	306.00	3197.00	60.00	76.00	76.00	646.00
402	--	--	--	--	108.00	0.00	3.00	29.00	1.00	1.00	1.00	6.00
403	--	--	--	--	306.00	3.00	0.00	78.00	1.00	2.00	2.00	15.00
404	--	--	--	--	3197.00	29.00	78.00	0.00	15.00	19.00	19.00	159.00
405	--	--	--	--	60.00	1.00	1.00	15.00	0.00	0.00	0.00	3.00
406	--	--	--	--	76.00	1.00	2.00	19.00	0.00	0.00	0.00	4.00
407	--	--	--	--	76.00	1.00	2.00	19.00	0.00	0.00	0.00	4.00
408	--	--	--	--	646.00	6.00	15.00	159.00	3.00	4.00	4.00	0.00

EI_IE_Targets_2020

3.5.10 EE_2020_Parameter File

The **EE_2020** parameter file is a matrix that includes External to External trips to be added into the trip tables for auto, medium truck, and heavy truck categories for the 2020 base year scenario. These targets vary by scenario year (e.g., 2020, 2030, 2040, 2050) and thus are unique for each scenario year.

EE_2020 External-External Trips Parameter File

3.5.11 ToD Time-of-Day Lookup Table Parameters File

The **ToD** lookup table parameter file includes Time-of-Day factors to be applied before the trips are assigned. These factors are shown below for AM Peak (one-hour), PM Peak (one-hour) and Off-Peak (22-hour) time periods. These parameters are the same for each scenario year, including for the base year calibration scenario.

PURPOSE	AMO	AMI	PMO	PMI	OPO	OPI
HBW1	0.1419	0.0054	0.0127	0.1185	0.3802	0.3414
HBW2	0.1419	0.0054	0.0127	0.1185	0.3802	0.3414
HBW3	0.1419	0.0054	0.0127	0.1185	0.3802	0.3414
HBW4	0.1419	0.0054	0.0127	0.1185	0.3802	0.3414
HBSE	0.3560	0.0000	0.0000	0.0402	0.1950	0.4087
HBSS	0.4158	0.0000	0.0099	0.0297	0.1782	0.3663
HBSU	0.1034	0.0172	0.0345	0.0345	0.3448	0.4655
HBSH	0.0193	0.0054	0.0391	0.0632	0.3907	0.4822
HBO	0.0947	0.0213	0.0350	0.0420	0.3774	0.4296
NHBW	0.0106	0.0541	0.0888	0.0125	0.3755	0.4585
NHBO	0.0680	--	0.0710	--	0.8610	--
TRUCKS	0.1000	--	0.1000	--	0.8000	--
SUT	0.1000	--	0.1000	--	0.8000	--
MUT	0.1000	--	0.1000	--	0.8000	--
EXT_TRUCKS	0.0608	--	0.0455	--	0.8936	--
EXT_AUTOS	0.1000	--	0.1000	--	0.8000	--
EXT_SUT	0.0608	--	0.0455	--	0.8936	--
EXT_MUT	0.0608	--	0.0455	--	0.8936	--

ToD Time-of-Day Lookup Table Parameters File

4 Overview of the PPM Model GUI

The Graphic User Interface (GUI) of the Pueblo Planning Model has three main active tabs: **Scenario Builder**, **Run Model/GHG**, **Maps and Reports** as well as an informational tab: **About**. Each tab is described in detail in the following sections. Of note is the option shown called "GHG Analysis." This option allows the user to evaluate Greenhouse Gas scenarios as part of the modeling process. Selecting this option will open a **GHG** subtab that allows the user to evaluate GHG mitigation strategies for the model run defined by the user in the **Run Model** tab.

4.1 Scenario Builder Tab

The scenario builder tab allows the user to create new scenarios, and to edit scenario inputs for alternatives analysis. This tab is on top when the model first opens. An overview of the options available for building a new scenario is presented below. **Section 5** details how to create a new scenario or edit existing scenario inputs using the **Scenario Builder**.

Scenario Builder Tab Overview

4.2   Run Model Tab

4.2.1 Base Run Model Tab

The Run Model tab will run the model for any scenario that is selected. It also has buttons to run each piece of the model individually, and to run the model with and without the feedback loop. Running the Model requires the scenario, the network line layer and the transit routes layer to be selected, as shown below.

The first thing that must be done to run the model is to select which scenario to run. Select the scenario from the drop-down menu in the **Select Scenario** section (1). All available scenarios will be listed, and any can be chosen. Once the scenario is selected the highway network layer (2) and transit routes layer (3) must be chosen. Finally, the run option (stepwise, with feedback or without feedback) is selected by clicking on the chosen radio button. In this example the **2030_base** scenario was run with the Run All w Feedback (4) option and GHG Analysis was not implemented.

Run Model Tab Overview

4.2.3 Running a Model Scenario with GHG Analysis

Details on the development of the work from home (WFH) percentages by income category are available in the Methodology Report. The base year conditions were identified as 1% WFH for income level 1, 3% WFH for income level 2, 6% WFH for income level 3, and 11% WFH for income level 4. This baseline was estimated from the 2019 and 2021 U.S. Census American Community Survey journey to work data. Home to work trips for these four groups have been removed from the model trip tables.

Model runs can be quickly created for alternative WFH, transit frequency, and transit running speed scenarios. This is done by implementing alteration of these base year condition from the **GHG** subtab, followed by a model run with the GHG Analysis radio button checked. First setup your model run in the **Run Model** tab and check GHG Analysis (6). This will open the **GHG** subtab in which GHG mitigation to be tested can be selected. For this example, WFH is increased in the GHG tab to 10% (1) and 20% (2) for the HBW3 and HBW4 household income categories. Once the GHG strategies have been selected, the user must return to the **Run Model** tab to complete the model run. In the example the **Run All with Feedback** (7) option selected with GHG Analysis radio button checked (6).
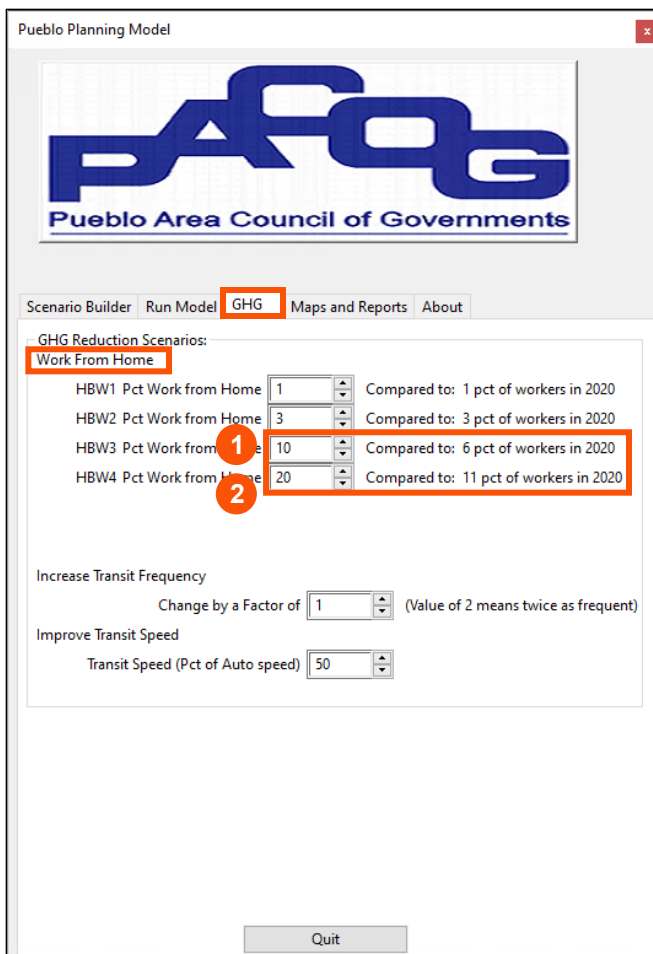
Model Run with GHG Analysis

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4.3 Maps and Reports Tab

The Maps and Reports Tab provides the user with TAZ maps, link maps, and model reports for mode choice, trip length, and transit boardings. It also includes a box to view and generate links level output ready for input to CDOT-approved GHG programs. For base year 2020 validation checking, a set of reports on highway traffic by volume class, facility type, screenline, and all counted records is also provided. Running the maps requires the scenario (1) and the desired map or report (2) to be selected as shown below. Next the selected maps or reports are run (3) and opened (4).

The user can choose from a set of maps at the zonal level or at the network level. Note also that the output is available for each of the three time periods in the model: AM Peak (7:30 -8:30 am), PM Peak (4:30 - 5:30 pm) and Off-Peak. These three time periods are summed to produce daily modeled traffic which is also provided. The PACOG model GUI will name the standard reports using the scenario name selected in the Scenario builder tab. As an example, if a scenario is named **base_2020** its reports will be named with the same prefix. Each scenario has its own folder with a uniform set of input and output folders allowing the user to keep track of multiple runs.

Maps and Reports Tab

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4.4   About Tab

The About Tab is basic. It contains the developer information and TransCAD versioning information. The Model was built using **TransCAD 9 Build 32945**.Using this version and build, or a more recent Build version of TransCAD 9 should prevent any unforeseen TransCAD software issues. The About Tab of the GUI reports the version and build in which the Model has been opened.
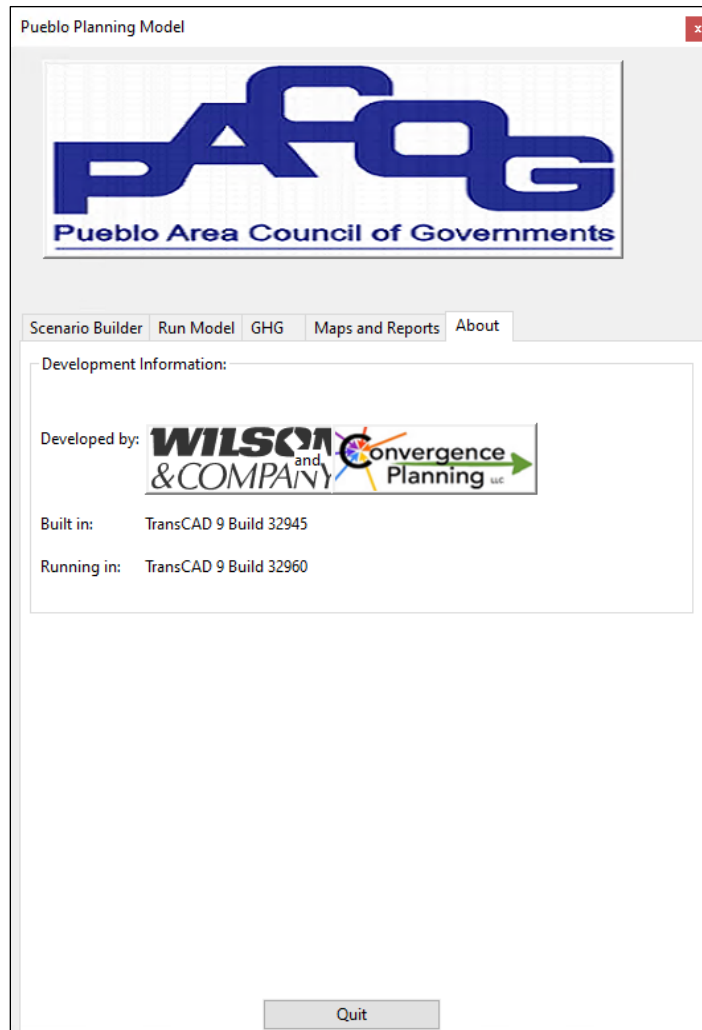
About Tab

5 Creating and Editing a New Scenario

5.1 Creating a New Scenario

As presented below, to create a new scenario, **Select the Scenario Year** (1) from the drop-down menu. Next **Enter the Scenario Name** (2) for the new scenario. The year will be appended to the scenario name, so it does not need to be included in the name for the new scenario. Once a year and the name are entered, click on the **Create** (3) radio button. A command prompt will appear and the files from the reference scenario will be copied into the newly created folder. If an intermediate year is created, all parameter files will be interpolated to match the expected growth for that year. See the methodology report for more details on the interpolation process.
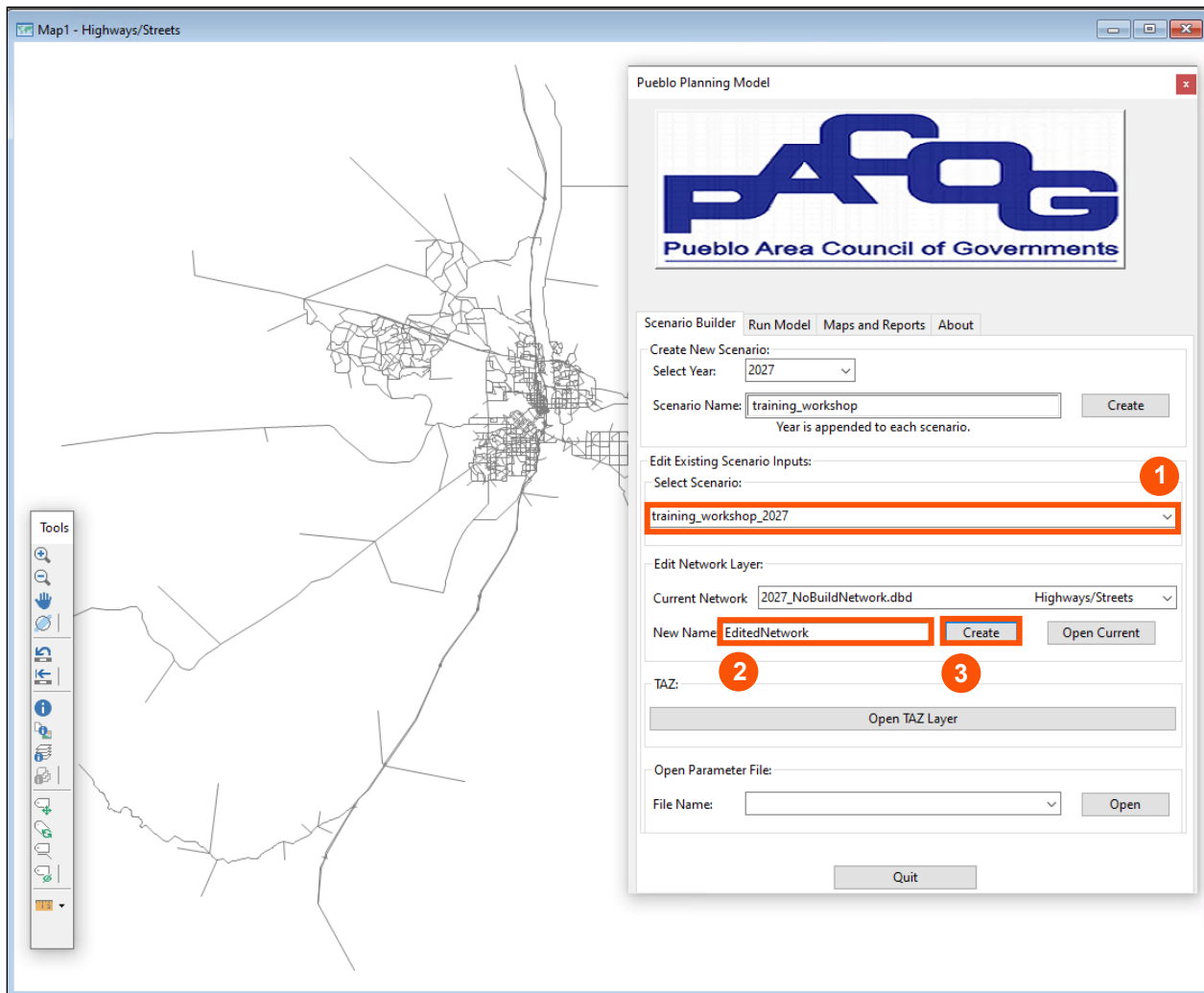

Creating New Scenario

5.2 Creating a New Highway Network Layer

Once a scenario has been created, input files for the new scenario can be modified. The Edit Existing Scenario Inputs section will allow editing the of the highway network line layer and opening both the TAZ file and the parameters files. Any edits made to the Scenario Inputs will only modify those files in the selected scenario. If an edit is made by mistake the scenario can be recreated or the file can be copied to the new scenario from the reference scenario.

To set up the new scenario for edits, it is useful to create a new, scenario-specific highway network. In the Edit Existing Scenario Inputs/Select Scenario section, first select the new scenario (1) using the pull-down menu. Then enter the New Name (2) for the network and finally, click the **Create** (3) radio button. The new network layer should be used for all network editing for the New Scenario.

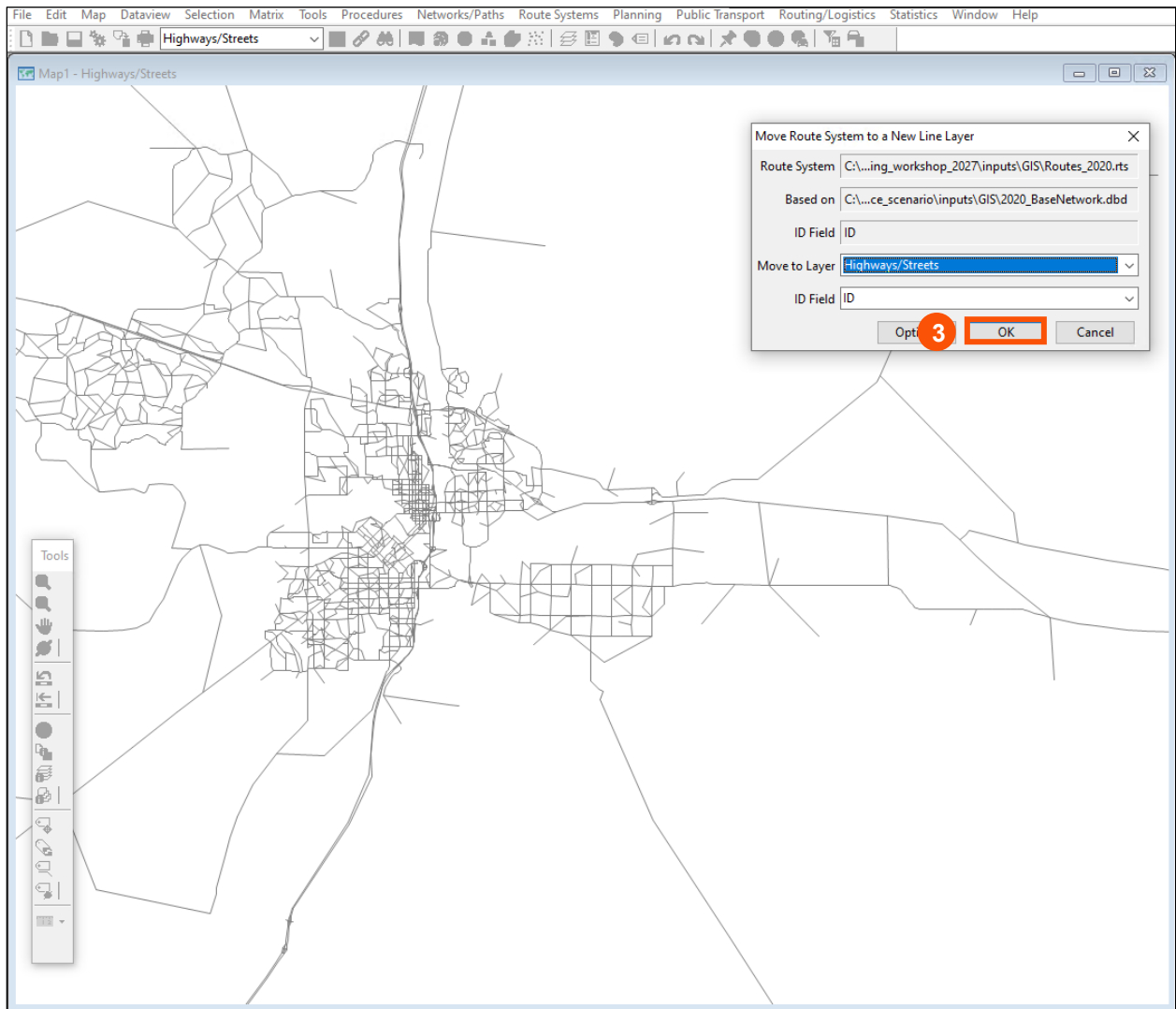**Create New Highway Network Line Layer**

5.3 Connecting Highway Network and Routes Layers

Before running the model for the new scenario, including the new /edited network, a routes layer must be connected to the new highway network line layer. To do this, with the new highway network line layer open, the Move function from the Route Systems Utilities tool must be used to connect the routes layer from the base scenario to the new highway network layer. To do this, first open the **Route Systems** pull-down menu. Next select **Utilities** and then select **Move**. After selecting **Move** (1), a file directory menu will pop up; confirm that it is the correct file directory for the inputs\GIS folder for your new scenario and click on the **Open** radio button (2).
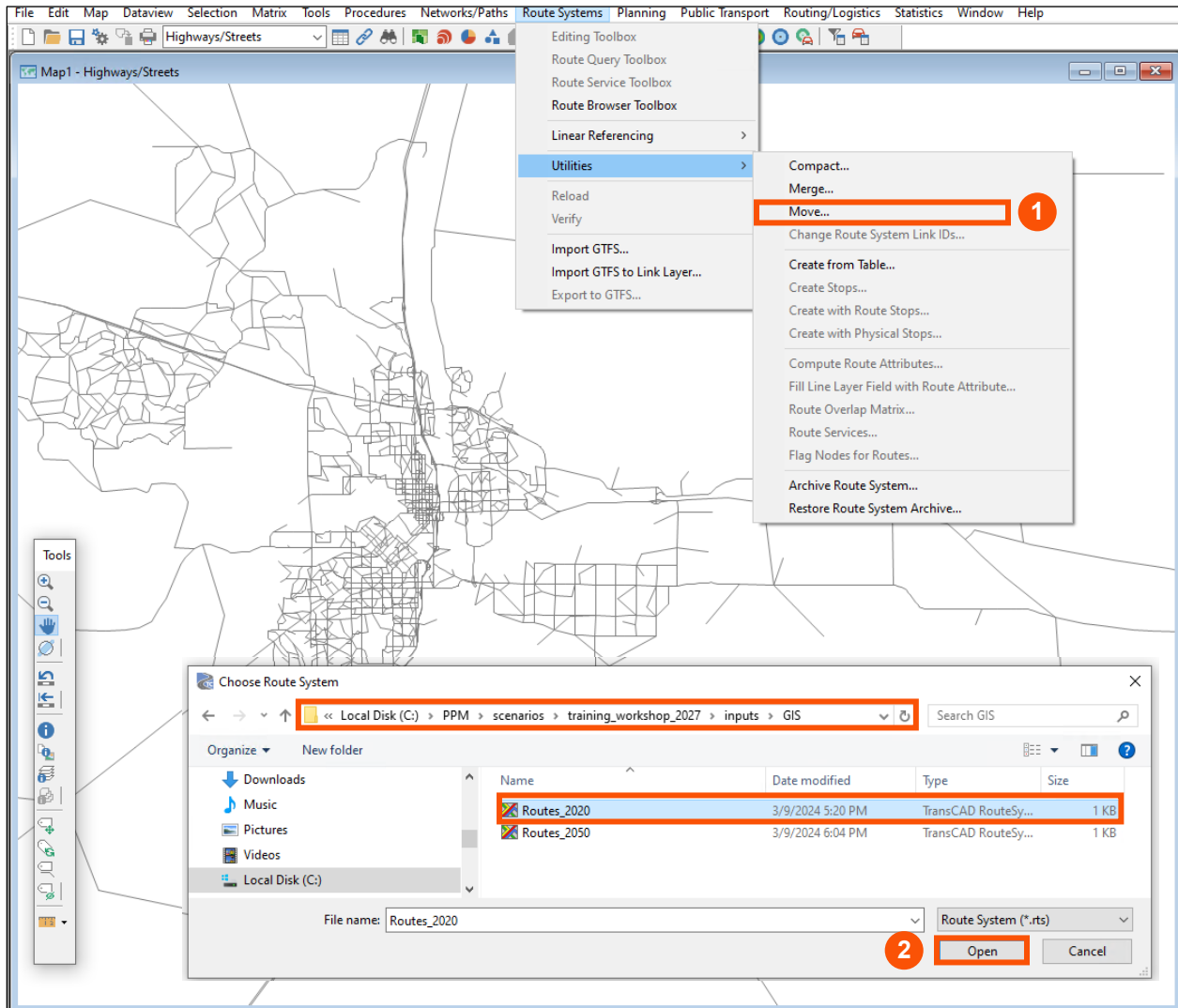

Move Routes Line Layer to Highway Network Line Layer (1,2)

A second dialog box will then pop up showing the Route System to be connected to the new Highway Network as well as the basis for the new Highway Network (2020_base Network). Click on the **OK** (3) radio button.


Move Routes System to New Highway Line Layer (3)

To confirm that the correct highway network line layer and transit routes line layer are now connected, first close the new highway network line layer. Next use **File>Open** from the TransCAD main menu to browse within the new scenario folder to find and open the routes line layer file (go to C:\PPM*new scenario name*\inputs\GIS). Click on the routes line layer file to open the file. In this example that will be **Routes_2020**. Then use the TransCAD main menu multilayer tool (stacked sheets icon) to confirm that the correct highway network layer, **EditedNetwork.DBD**, and transit line file layer, **Routes_2020.DBD**, are now connected. First, click on the **Highway/Streets** layer (4) and read the Geographic File path at the bottom of the dialog box. Then click on the Route System layer (5) and read the Geographic File path at the bottom of the dialog box. The paths for both files should begin with the following path: C\PPM\ *new scenario name*\inputs\GIS.
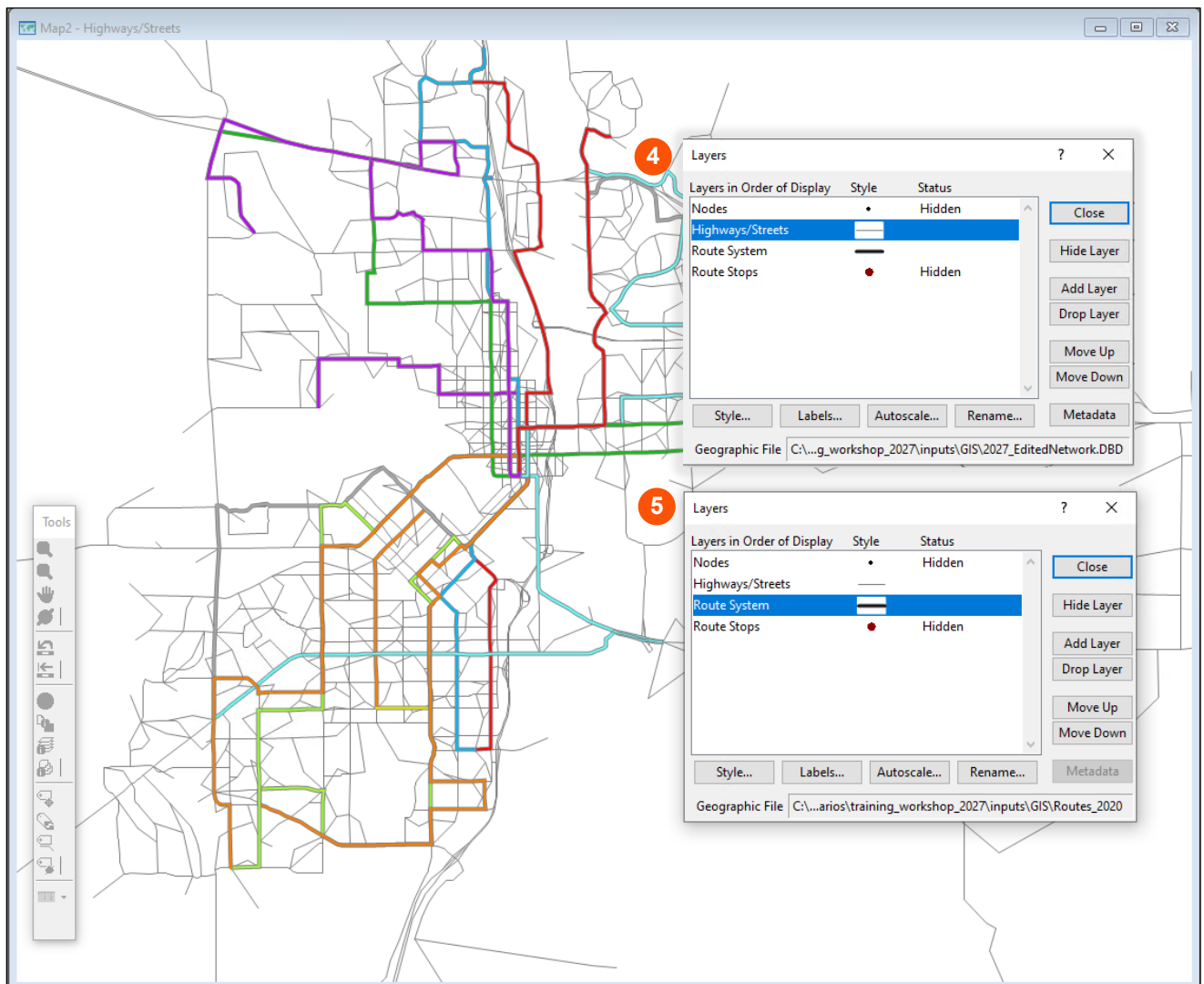
Confirm Routes and Highway Network Layers

Finally, verify that the transit routes system, **Routes_2020.DBD**, as connected to the highway network, **EditedNetwork.DBD**, is valid. To do this, select **Verify** from the Routes Systems pull-down menu (6). This will bring up a dialog box showing the Connectivity (for all routes), Links Direction, and Route Stops are verified for all 22 routes included in the 2020 base year routes system. Note that the 2030 base scenario routes system included 24 routes and could also have been used for the new 2027 scenario. Click the **OK** radio button (7). This will bring up a second dialog box sonfirming that the Route System is valid. Click the **OK** radio button.
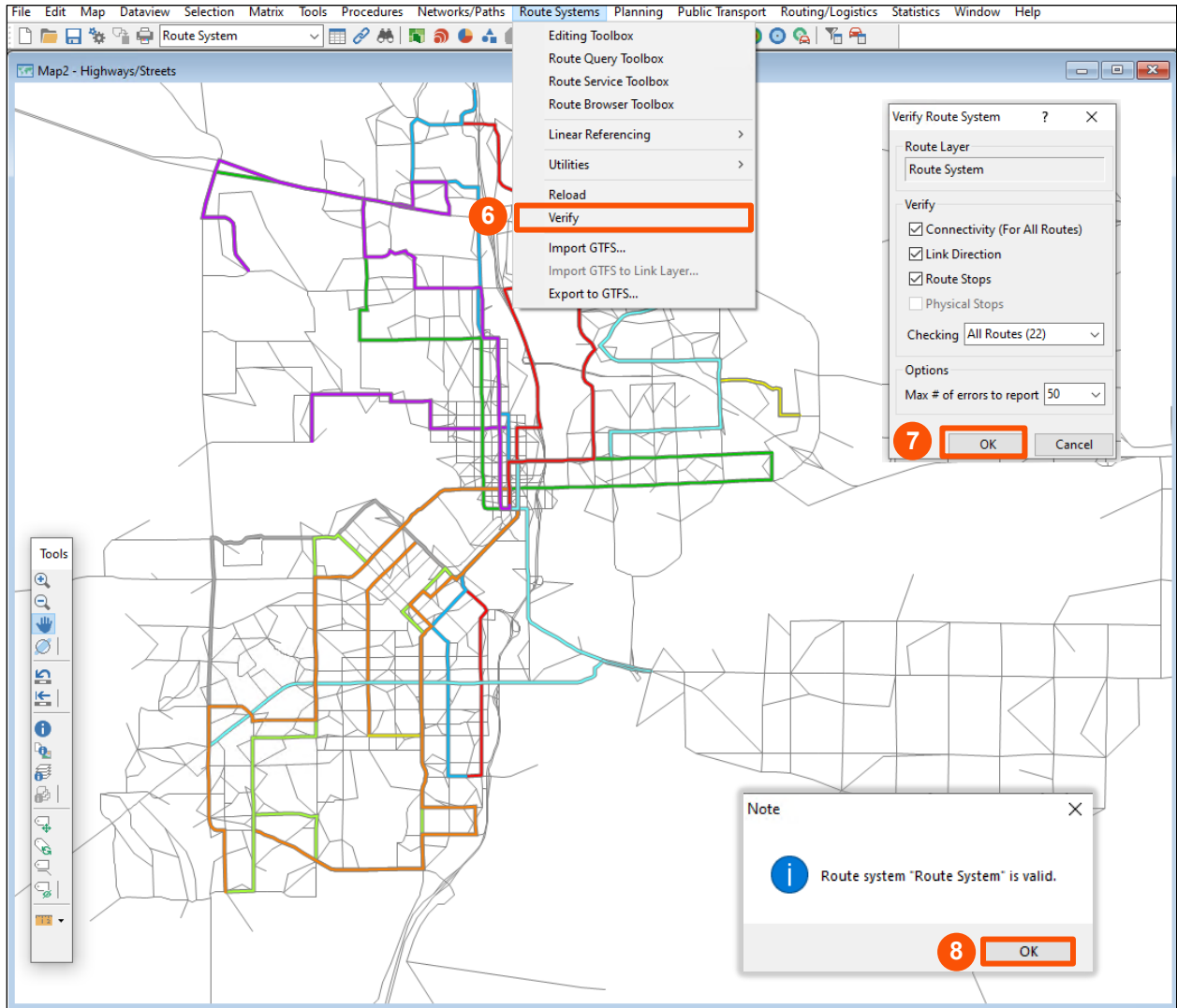
Verify Connected Routes Layer File

6 Creating/Editing Auto-Generated Maps and Reports

6.1 Creating/Editing Auto-Generated Maps

The Maps and Reports tab facilitates the creation of a variety of maps and reports using automatic formatting. The automatic map/report formatting uses the abbreviated attribute names from model coding in the legends as well as fixed color schemes that you may want to modify for clarity. Both legends and color schemes can be easily modified to match a report color scheme and clarify contents.

6.1.1 Creating/Editing a TAZ Total Employment Density Map

To create the auto-generated **Total Employment Density** TAZ map, first run and open a TAZ Map of **Total Employment Density** as shown below. To do this, first select the scenario (1); then choose the map (2) and then click on the **Run Selected Maps or Reports** radio button (3). After Step 3 has run, click on the **Open Selected Maps or Reports** radio button (4). This will run and open the TAZ map for the selected scenario.


**Total Employment Density Map Run/Open**

The auto formatted version of the resulting Total Employment Density TAZ map is shown below. After you have run this report, it can also be found in the **Outputs > Reports > TAZ MAPS** folder for the selected scenario.

To edit the automatically created legend, right click on the Legend. Then click on the **Properties** option (1) in the pop-up menu. This will open the **Legend Settings Dialog Box**. From the Dialog Box edit the default legend implementing options form the **General**, **Contents** and **Fonts** tab options (2). From the **General** tab (3), you can add a title, remove, or reformat the scale bar, or set the legend to be a separate image to be repositioned on the map.
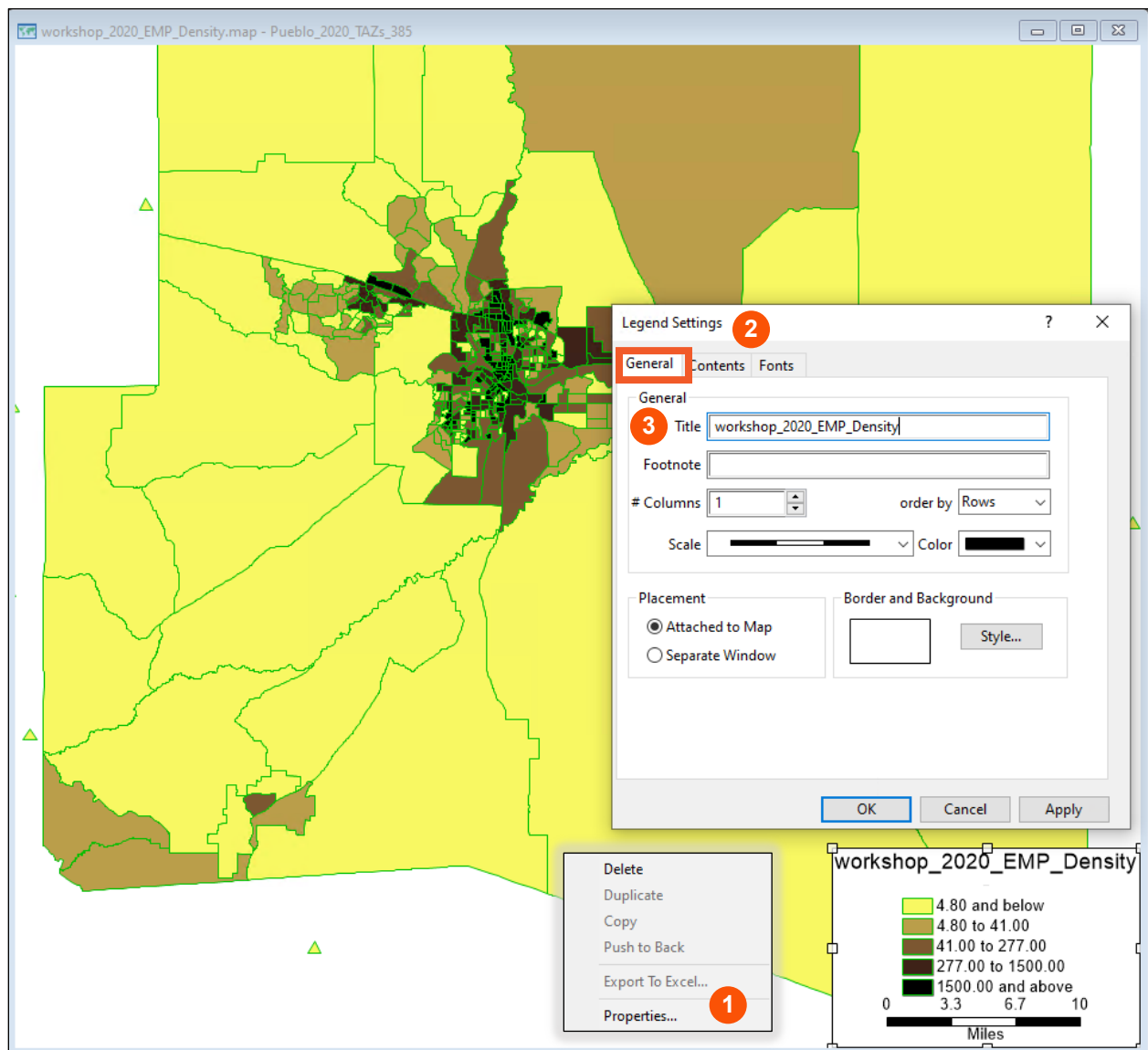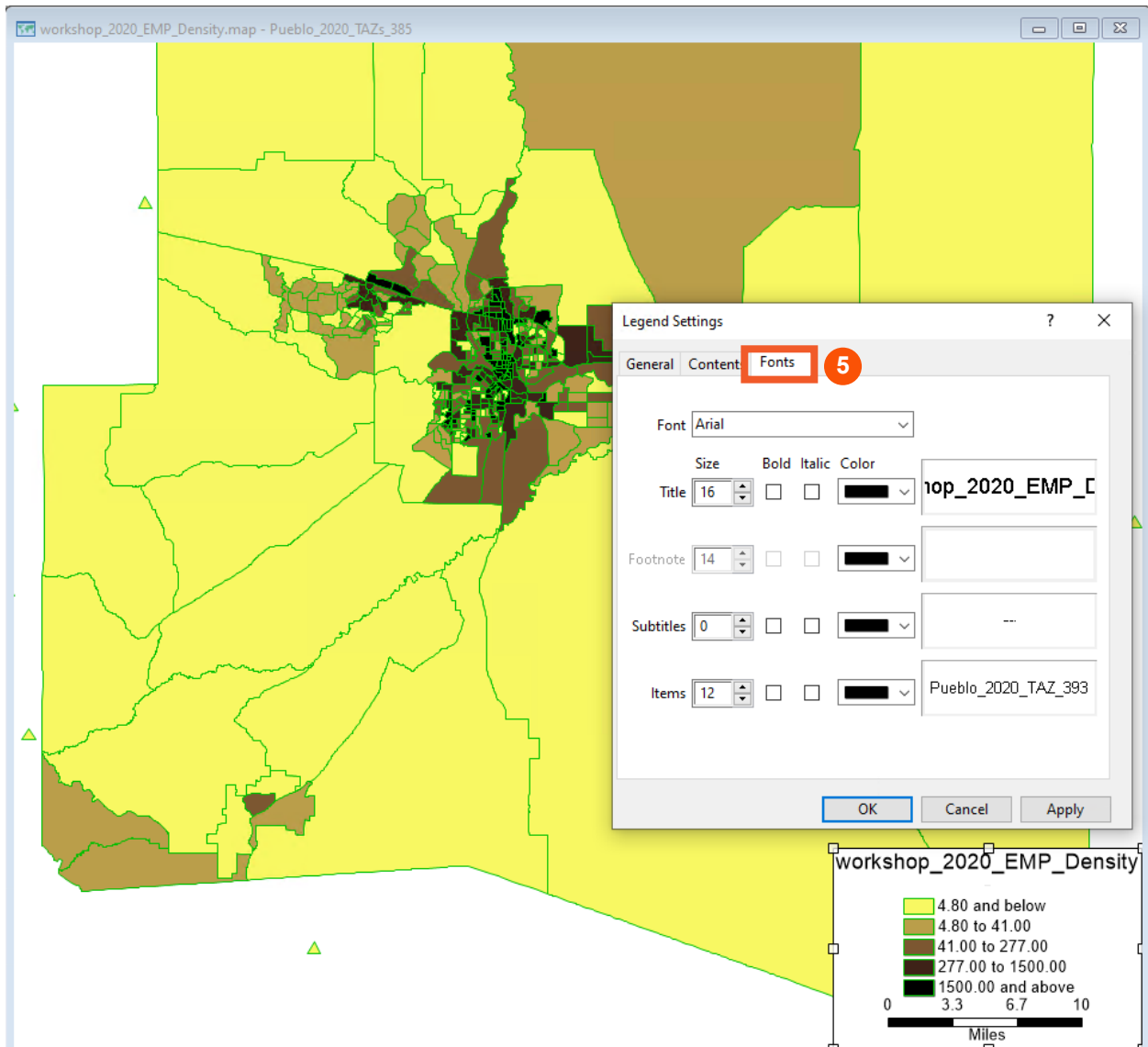

Editing the Map Legend Using Legend Properties

From the **Contents** tab (4), you can manage legend content, hiding or showing titles or elements and/or renaming them.
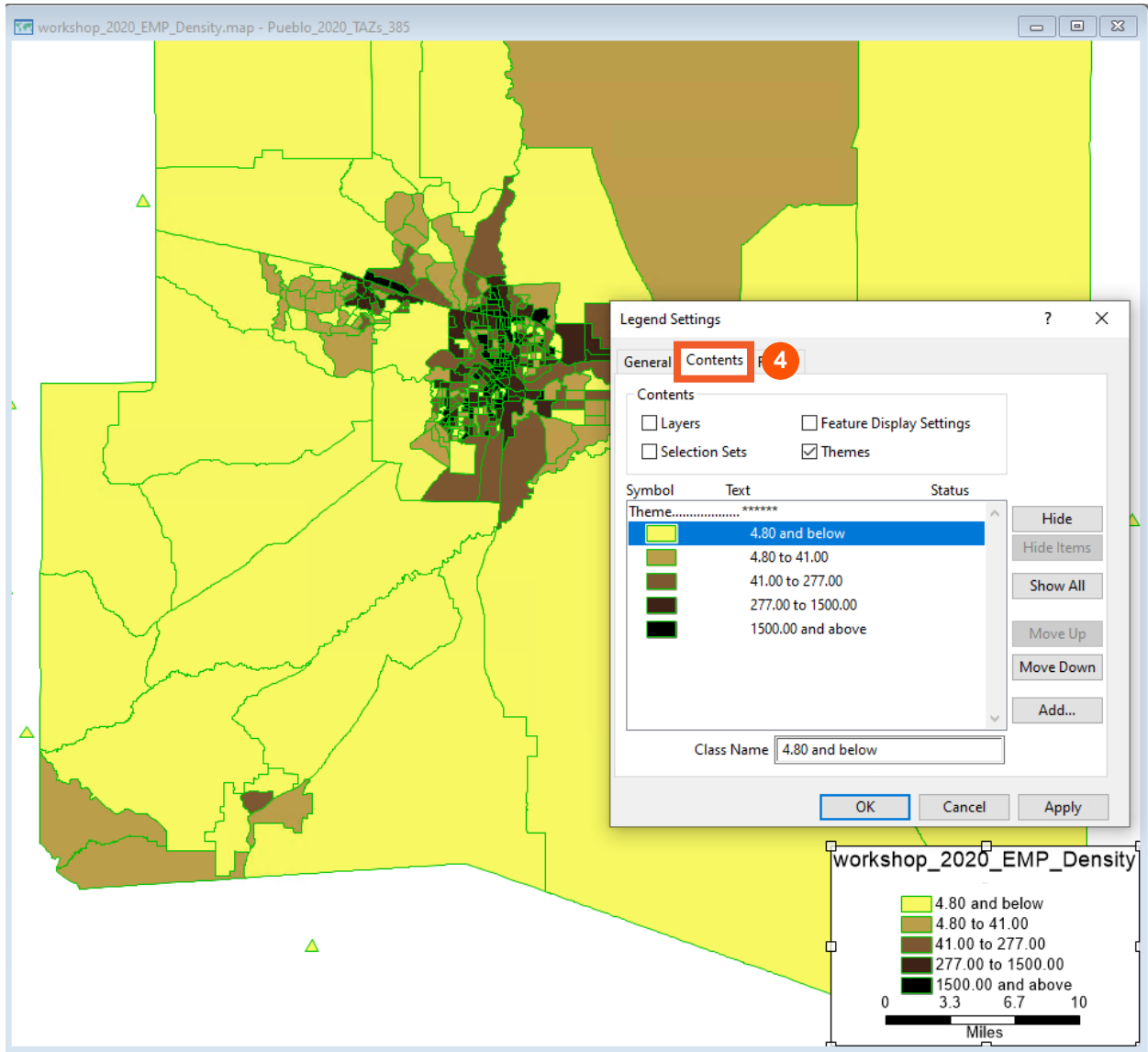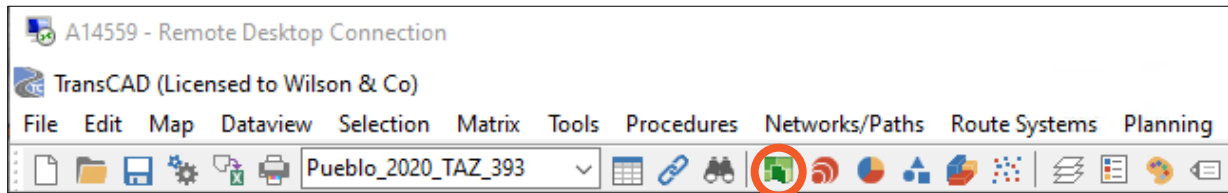

Contents Tab Map Legend Edits

From the **Fonts** tab (5), you can change font size and font style for legend elements.


Fonts Tab Map Legend Edits

To edit the thematic map color scheme or more efficiently edit legend text, go to the TransCAD main menu, and use the pull-down menu for the thematic mapping options.

In this example, text for the legend classes is modified and the classes are reset and recolored. Using the **Color Theme** thematic mapping toolbar (circled above) applied to the auto-generated map (open) will allow you to efficiently adjust the ranges for mapped categories, change legend text and change the color palette used as shown below.
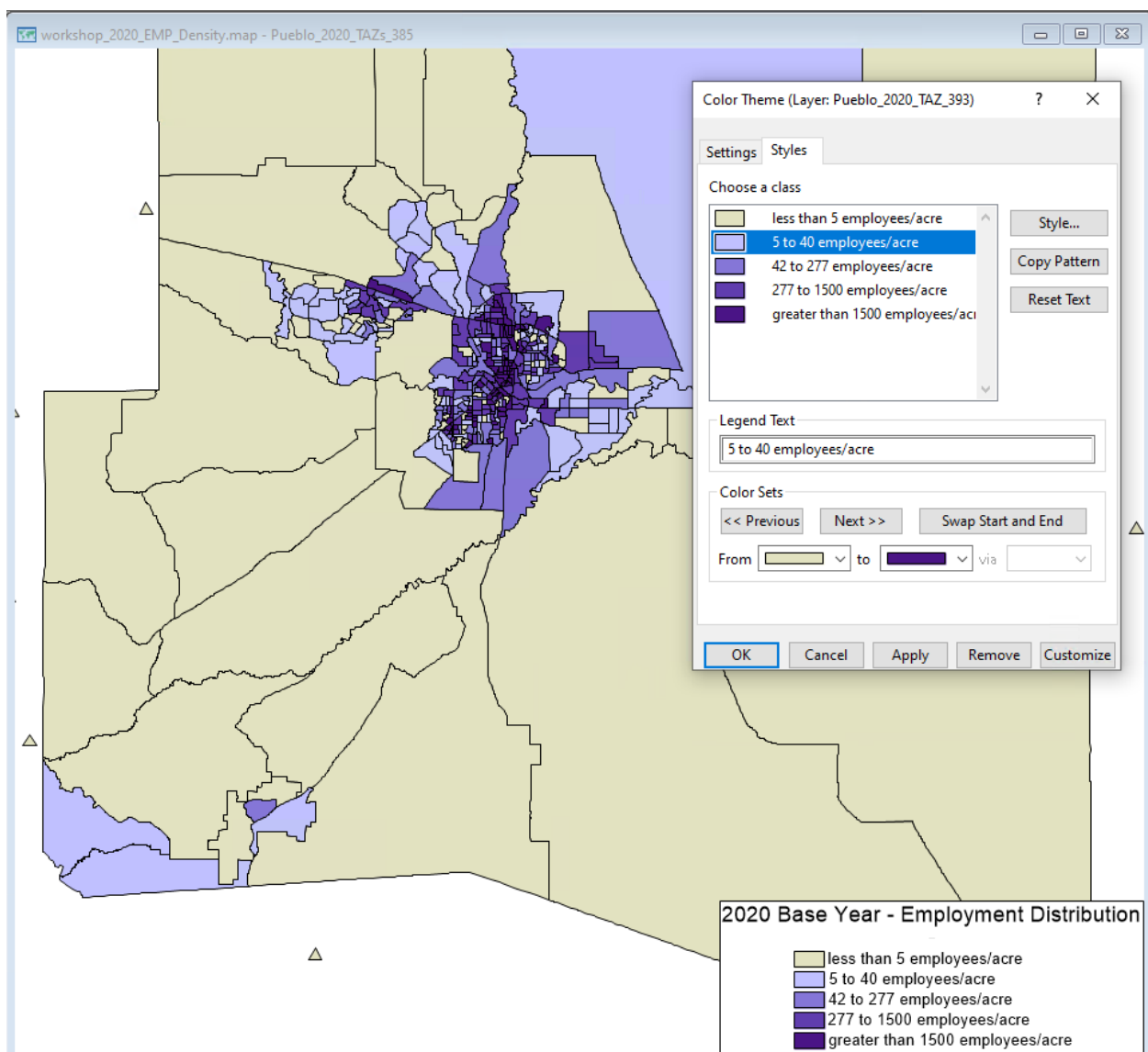
Customized Employment Density Thematic Map

6.1.2 Creating/Retrieving a PM Peak Volume/Capacity Bandwidths Link Map

Auto-generated Link Map options are also available. To create an auto-generated **Volume/Capacity Bandwidths** Link Map, first select a scenario (1), a Network Option (with/without centroid connectors) (2) and a Link Map option (3). Next click on the **Run Selected Maps or Reports** radio button (4). After Step 3 has run, click on the **Open Selected Maps or Reports** radio button (5). This will run and open the selected Link Map(s) for the selected scenario. In this example the PM peak hour option is selected, but multiple maps could be created in a single run for all time-of-day periods.

The resulting Volume/Capacity Bandwidths Link Map for the PM peak hour condition is shown on the following page.

Volume/Capacity Bandwidths Map Run/Open
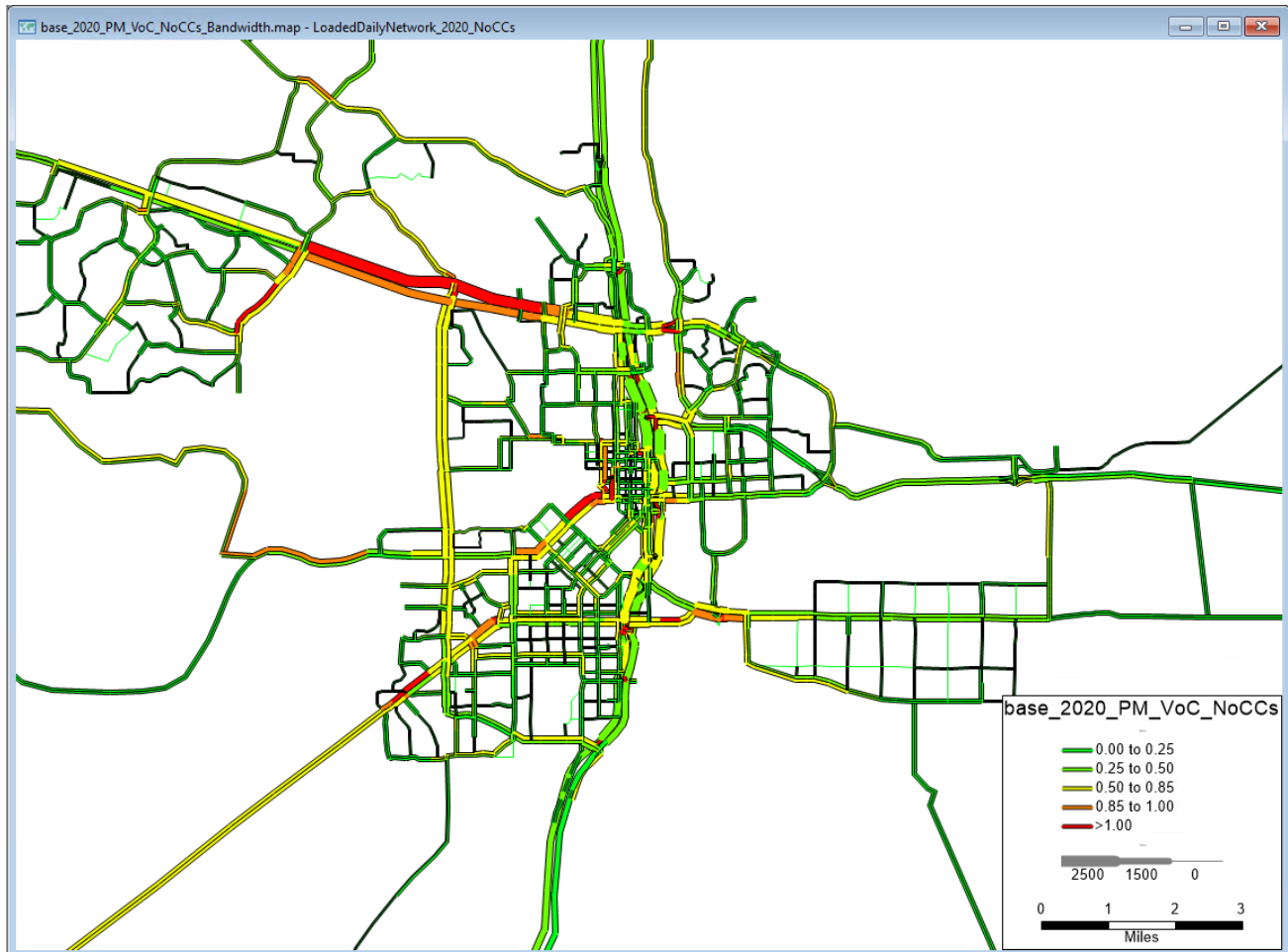
Volume/Capacity Bandwidth Map

6.2   Creating/Retrieving Auto-Generated Reports

6.2.1 Creating/Retrieving an Auto-Generated Mode Shares Report

To create and retrieve an auto-generated Mode Shares report, first select the scenario (1), choose the Mode Shares report from the Other Outputs list (2), and then click on the **Run Selected Maps or Reports** radio button (3). After Step 3 has run, click on the **Open Selected Maps or Reports** radio button (4), as shown on the following page.

This process will run and open the Mode Shares Report for the selected scenario as shown on the following page. After you have run this report, it can also be found in the **Outputs > Reports > Statistics** folder for the selected scenario.

Transit Mode Shares Report Run/Open

Transit Mode Shares Report

6.2.2 Creating/Retrieving Model Validation Statistics Reports

To create and retrieve an auto-generated **Model Validation Reports**, first select the **base_2020** scenario (1), choose the desired statistics (e.g., Facility Type Statistics) (2). Then click on the **Run Selected Maps or Reports** radio button (3) and click on the **Open Selected Maps or Reports** radio button (4), as shown below. This report can also be found in the **Outputs > Reports > Statistics** folder for the selected scenario.

Model Validation by Facility Type Report Run/Open

Facility Type	# of Obs.	Observed Vehicle Miles	Assigned Vehicle Miles	Absolute Difference	Percent Difference	RMSE	Percent RMSE
1	22	424506	467832	43326	10.21	2750.09	11.27
2	39	453002	511003	58002	12.80	4925.14	26.23
3	66	196500	210738	14237	7.25	4974.62	35.39
4	19	63181	86664	23483	37.17	3445.66	51.62
5	1	18733	4045	14688	-78.41	17249.67	78.41
--	147	1155923	1280282	124359	10.76	4715.61	29.55

Model Validation by Facility Type Report

6.2.3 Creating/Retrieving GHG Modeling Transportation Datasets

To create and retrieve **GHG Link Data** for input into MOVES4, first select a scenario (1), choose GHG Link Data (2) and then click on the **Run Selected Maps or Reports** radio button (3); then click on the **Open Selected Maps or Reports** radio button (4). This report can also be found in the selected scenario **Outputs > Reports > Statistics** folder.

The first 52 (of 11,379) GHG link data records for the 2020 base year scenario, sorted by link ID, are shown on the following page. Note that both a TransCAD binary file (*.bin) and a comma separated file (*.cvs) are output.

GHG Link Data Run/Open

LINK_ID	LENGTH	PERIOD	DIR	Fac_Type	Area_Type	AUTO_flow	SUT_flow	MUT_flow	Speed
902	0.62	AM	AB	2	4	2584.27	41.02	29.63	22.45
902	0.62	PM	AB	2	4	2584.27	41.02	29.63	22.45
902	0.62	OP	AB	2	4	2584.27	41.02	29.63	22.45
903	0.31	AM	AB	2	4	1481.39	26.92	20.40	36.78
903	0.31	AM	BA	2	4	876.92	22.53	16.98	39.53
903	0.31	PM	AB	2	4	1481.39	26.92	20.40	36.78
903	0.31	PM	BA	2	4	876.92	22.53	16.98	39.53
903	0.31	OP	AB	2	4	1481.39	26.92	20.40	36.78
903	0.31	OP	BA	2	4	876.92	22.53	16.98	39.53
905	0.11	AM	AB	2	4	675.06	18.08	13.83	37.48
905	0.11	AM	BA	2	4	867.01	22.49	15.75	33.94
905	0.11	PM	AB	2	4	675.06	18.08	13.83	37.48
905	0.11	PM	BA	2	4	867.01	22.49	15.75	33.94
905	0.11	OP	AB	2	4	675.06	18.08	13.83	37.48
905	0.11	OP	BA	2	4	867.01	22.49	15.75	33.94
908	0.26	AM	AB	2	4	2584.27	41.02	29.63	22.45
908	0.26	AM	BA	2	4	1223.51	49.32	37.41	37.97
908	0.26	PM	AB	2	4	2584.27	41.02	29.63	22.45
908	0.26	PM	BA	2	4	1223.51	49.32	37.41	37.97
908	0.26	OP	AB	2	4	2584.27	41.02	29.63	22.45
908	0.26	OP	BA	2	4	1223.51	49.32	37.41	37.97
909	0.13	AM	AB	2	4	2750.16	46.07	32.97	33.33
909	0.13	AM	BA	2	4	1318.85	55.10	40.84	39.43
909	0.13	PM	AB	2	4	2750.16	46.07	32.97	33.33
909	0.13	PM	BA	2	4	1318.85	55.10	40.84	39.43
909	0.13	OP	AB	2	4	2750.16	46.07	32.97	33.33
909	0.13	OP	BA	2	4	1318.85	55.10	40.84	39.43
910	0.10	AM	AB	5	4	206.80	5.40	3.48	29.91
910	0.10	AM	BA	5	4	145.49	4.77	3.44	29.98
910	0.10	PM	AB	5	4	206.80	5.40	3.48	29.91
910	0.10	PM	BA	5	4	145.49	4.77	3.44	29.98
910	0.10	OP	AB	5	4	206.80	5.40	3.48	29.91
910	0.10	OP	BA	5	4	145.49	4.77	3.44	29.98
913	0.14	AM	AB	2	4	2746.20	45.86	32.59	33.37
913	0.14	AM	BA	2	4	1257.76	54.91	40.46	39.52
913	0.14	PM	AB	2	4	2746.20	45.86	32.59	33.37
913	0.14	PM	BA	2	4	1257.76	54.91	40.46	39.52
913	0.14	OP	AB	2	4	2746.20	45.86	32.59	33.37
913	0.14	OP	BA	2	4	1257.76	54.91	40.46	39.52

Partial GHG Link Data Table Run/Open – Input to MOVES4 Modeling

## 6.2.4 Creating/Retrieving Automatically Generated GIS Files

Of note to model users is the automatically generated highway network output in TransCAD GIDS format. Known as a "loaded network" this file contains attributes for traffic as well as volume to capacity ratios for the three time periods, 2020 count information and daily vehicle miles traveled. The user navigates to the outputs folder "GIS" and, for 2020, will find a TransCAD file called "LoadedDailyNetwork_2020.DBD". This file is available with or without centroid connectors for ease of analysis. Key attributes from the loaded network can be found in the table below.

Selected Loaded Highway Network Attributes

Attribute Name	Description
AB_Daily_Count	2020 Directional Daily Traffic Count
BA_Daily_Count	2020 Directional Daily Traffic Count
TwoWay_Count	2020 Two Way Daily Traffic Count
AB_AM_Flow	Directional One Hour AM Traffic
BA_AM_Flow	Directional One Hour AM Traffic
AB_OP_Flow	Directional 22 Hour Off Peak Traffic
BA_OP_Flow	Directional 22 Hour Off Peak Traffic
AB_PM_Flow	Directional One Hour PM Traffic
BA_PM_Flow	Directional One Hour PM Traffic
AB_Daily_Flow	Directional Daily Traffic
BA_Daily_Flow	Directional Daily Traffic
TwoWay_Daily	Two Way Daily Traffic
VMT_Daily	Daily Vehicle Miles Traveled
AB_AM_VC	Directional AM Volume/Capacity Ratio
BA_AM_VC	Directional AM Volume/Capacity Ratio
AB_OP_VC	Directional Off-peak Volume/Capacity Ratio
BA_OP_VC	Directional Off-peak Volume/Capacity Ratio
AB_PM_VC	Directional PM Volume/Capacity Ratio
BA_PM_VC	Directional PM Volume/Capacity Ratio

6.2.5 Retrieving Other Model Output

Additional useful information, some preprocessed and some not, can be found in the outputs folders, as shown below. Caliper TransCAD error message, warnings, and run statistics reports can be found in the root **reports subfolder**.
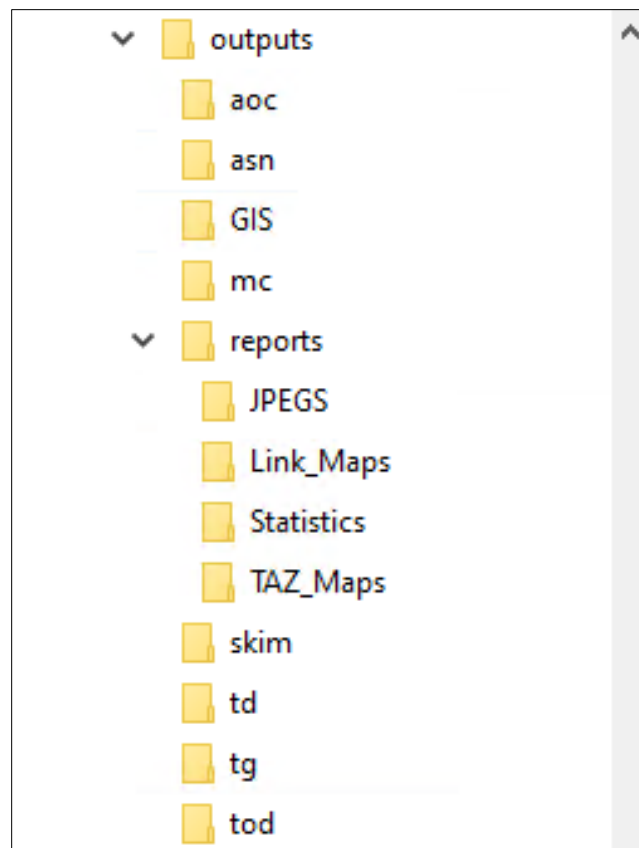
Outputs Folder Directory Structure

Of note is the fact that the reports folder contains four subfolders: JPEGS, Link_Maps, Statistics, and TAZ_Maps. These subfolders are empty until the user generates the automated map/report of interest. The maps and reports can be safely written over without error. The usefulness of the PACOG model can be seen by review and understanding of the automated maps and reports. These maps and reports can also be exported to a GIS program or a spreadsheet for further analysis and mapping.

Pueblo Area Council of Governments

Model User Guide