Appendix
ACRP 03-23 Air/Rail Diversion Model: User's Guide

Outline

This user's guide for the ACRP 03-23 Air/Rail Diversion Model providers instructions on how to install and use the model to evaluate scenarios. The input files are described in detail in the input files specification section, while the final section of the user's guide provides an overview of the code structure of the model for advanced users who might wish to edit the model.

- **Introduction**
- **Model files and Installation**
- **Creating Scenarios**
- **Editing Inputs**
- **Running the Model**
- **Viewing Output**
- **Input File Specifications**
- **Code Guide**

Introduction

The ACRP 03-23 Air/Rail Diversion Model is a sketch planning model to provide model users with a quick response tool capable of evaluating a range of policy interventions that affect choice of air or rail for long distance travel in a mega region sized corridor.

The model is intended to provide a framework for managing scenarios, editing inputs, running the model, and viewing outputs. All inputs and outputs are in .csv format to also allow viewing and analysis in software other than the ACRP 03-23 Air/Rail Diversion Model.

This users' guide does not describe the model structure; this is covered in the technical appendix to the project report found on the enclosed CD.

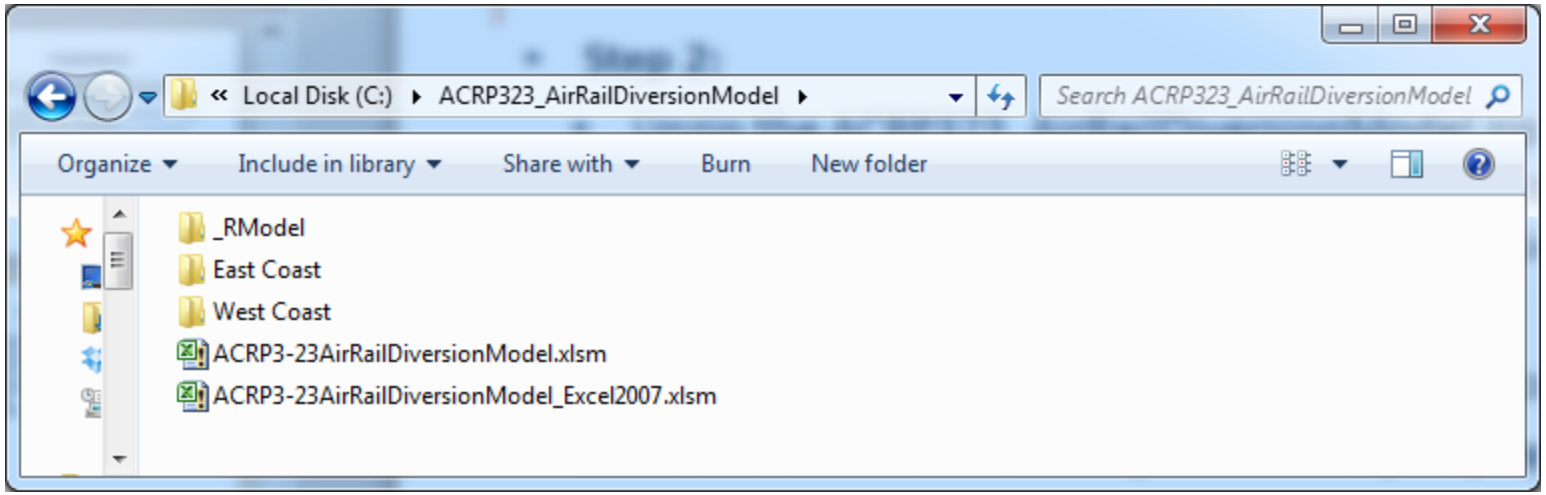
Model Files and Installation

Installation

- **Requirements**
  - The ACRP 03-23 Air/Rail Diversion Model is designed to work on a PC computer that has a recent version of Microsoft Excel installed (2007 or later).
- **Step 1: Save ZIP folder to Computer**
  - The **ACRP323_AirRailDiversionModel.zip** folder includes all of the necessary files to run the model. To install the model, click on the Air/Rail Diversion Model menu button. Save the zip folder labeled ACRP323_AirRailDiversionModel.zip to the appropriate location by clicking "ok."

Installation (Contd.)

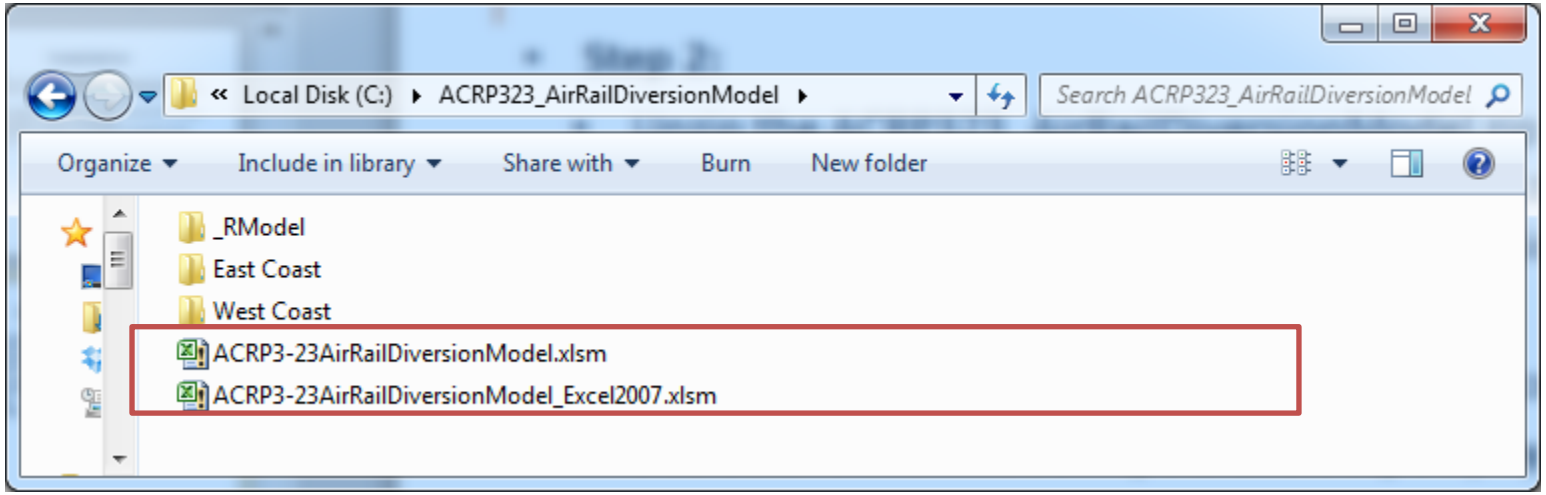
- **Step 2: Unzip the ZIP folder**
  - Unzip the ACRP323_AirRailDiversionModel.zip using a zip utility installed on your computer (e.g., WinZIP). The zip file's contents are inside a directory call "ACRP323_AirRailDiversionModel"
  - That directory contains:
    - R model scripts and R application in the "_RModel" folder
    - File structure with model inputs and outputs, by scenario, in the "East Coast" and "West Coast" folders
    - Two spreadsheets: Excel spreadsheet graphical user interface (GUI) for current versions of Excel, and also Excel 2007



Open the Excel GUI

- **Step 3: Open the Excel GUI**

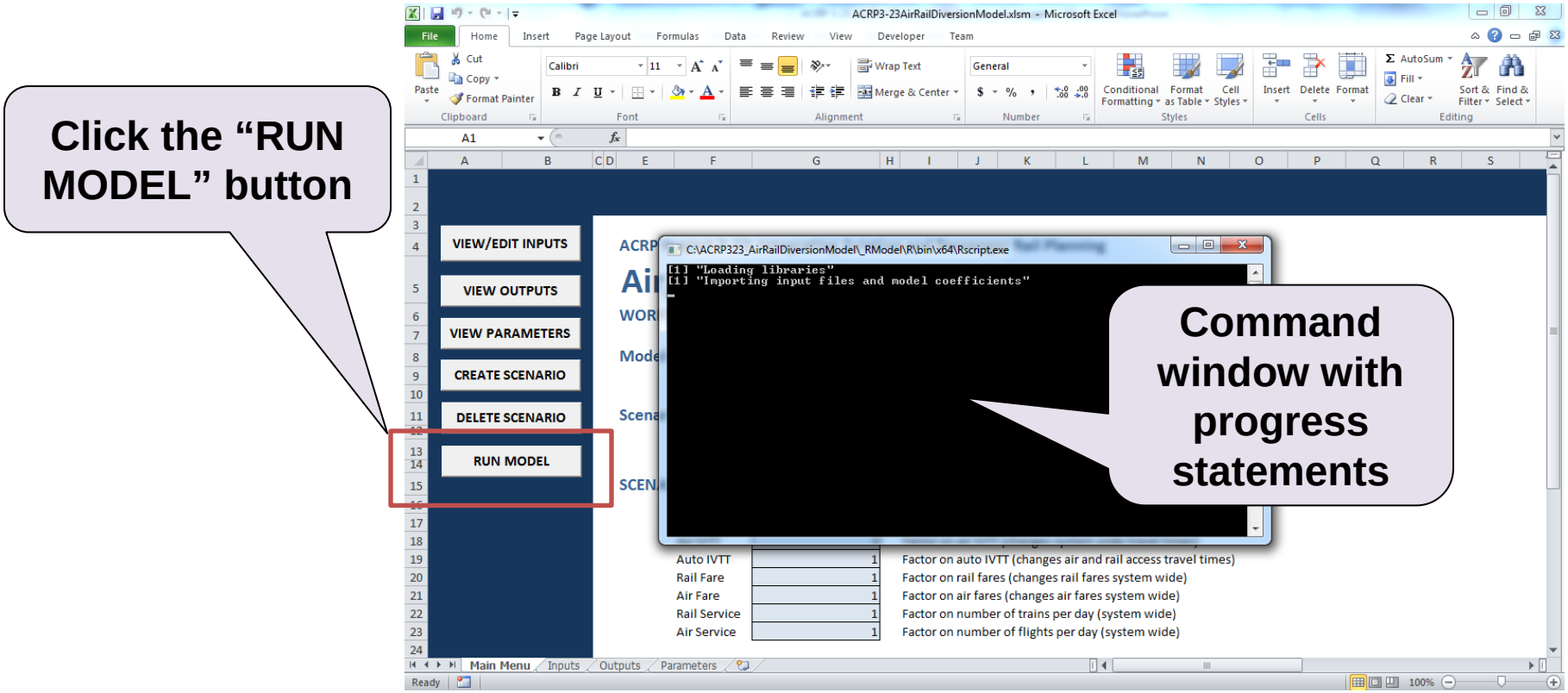
  There are two versions of the excel GUI, one for Excel 2007 and one for more recent versions of Excel. Open the one that conforms to the version of Excel on your computer.



Test the installation

Step 4: Test the Installation

Test the installation and connection between the Excel GUI and R (open source software that runs the model's simulation and is included with the model zip file). On the Main Menu sheet in the excel GUI, click on the Run Model button to launch a run. A command window will launch and the model's progress statements will start to appear.

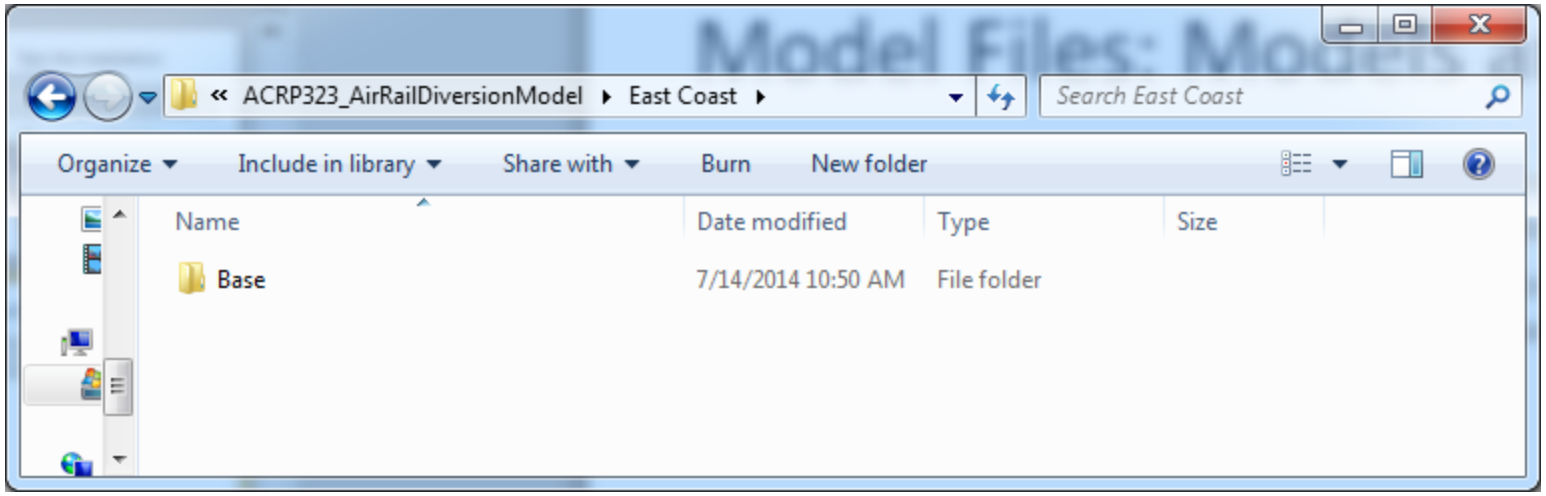


Model Files: Models and Scenarios

The model comes with two pre-developed models, for the East Coast and West Coast regions, which are contained in the “East Coast” and “West Coast” folders, respectively.

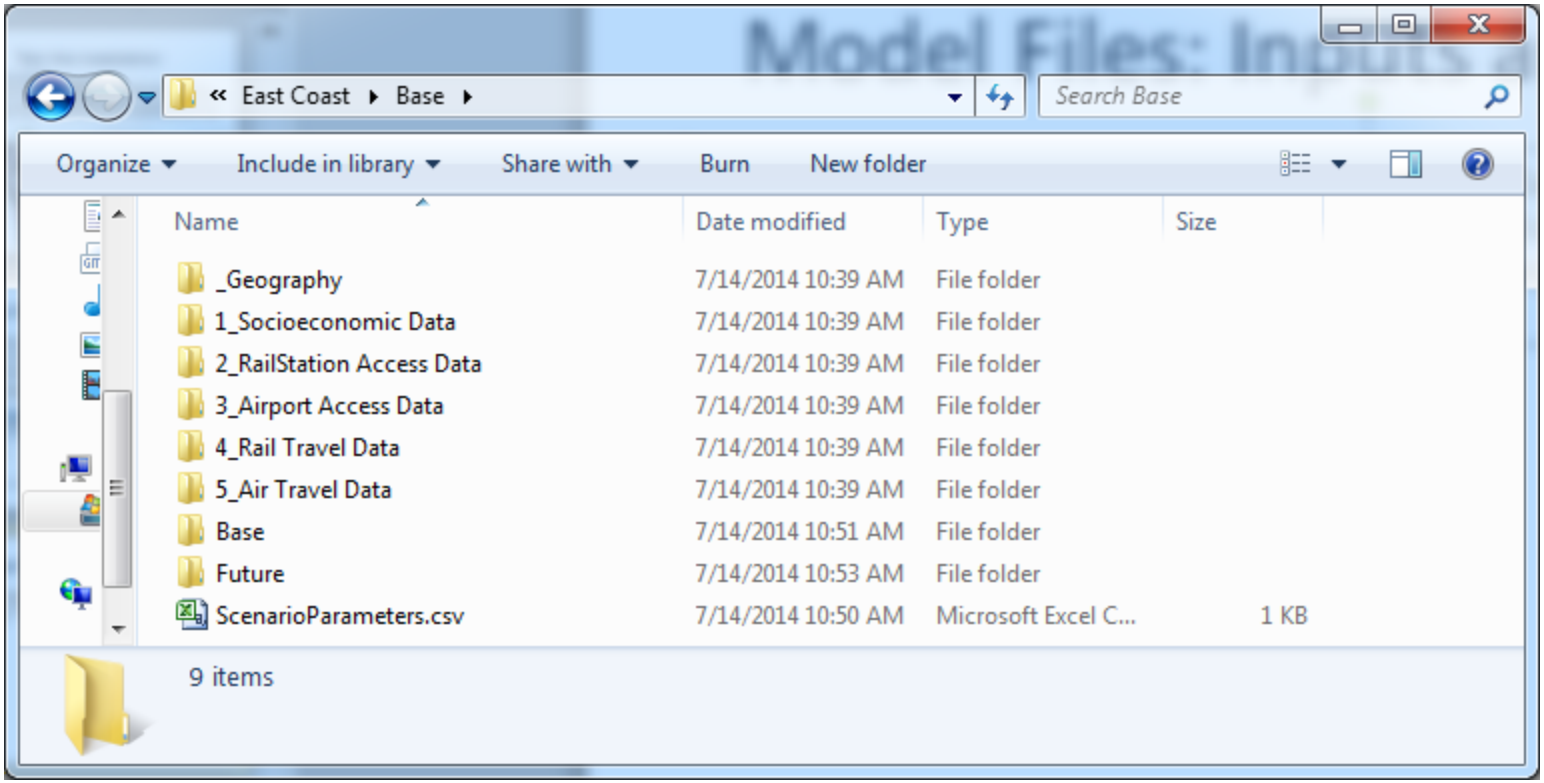
Within each of those two folders are a list of scenarios. Initially, there is only a “Base” scenario folder, but as scenarios are created (described in the following pages), additional scenario folders will appear here.

The screenshot below shows the contents of the “East Coast” folder – just the “Base” scenario folder at the moment.



Model Files: Inputs and Outputs

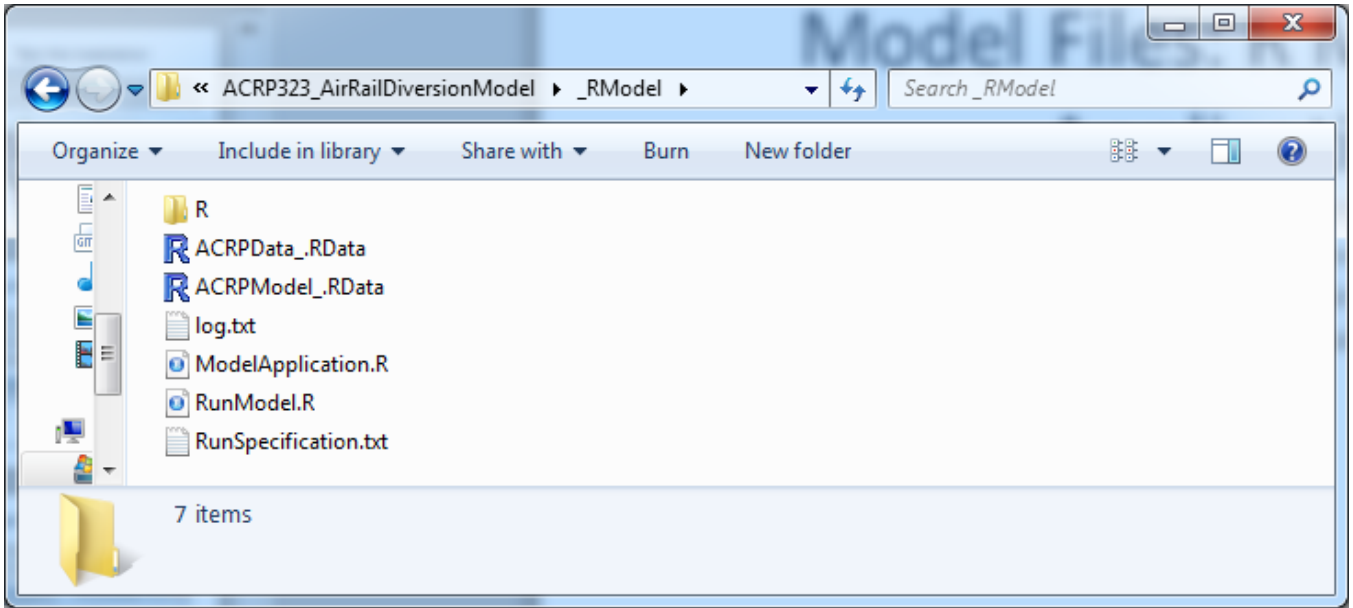
Each scenario folder, for example, within the East Coast/Base folder as shown here, contains folders containing .csv files for several different categories of inputs, and the "Base" and "Future" folders which contain outputs (once the scenario has been run). The ScenarioParameters.csv file contains several top level policy variables (described later in the user's guide)



Model Files: R Model, Application

The _RModel folder contains the R folder, which is a version of the R application that is used to run the model. The files in that folder are as follows:

- ACRPData_.Rdata – R binary folder containing several input tabulations
- ACRPModel_.Rdata – R binary folder containing model coefficients
- Log.txt – log file from a model run (added when the model is run in installation)
- ModelApplication.R – R script containing the model code
- RunModel.R – R script to run the model (added when the model is run in installation)
- RunSpecification.txt – text file written by the Excel GUI providing variables to R (added when the model is run in installation)



The Model’s GUI

GUI Workflow

As noted above, the ACRP 03-23 Air/Rail Diversion Model is a sketch planning model to provide model users with a quick response tool capable of evaluating a range of policy interventions that affect choice of air or rail for long distance travel in a mega region sized corridor.

Model users do this by running different scenarios. A typical workflow is as follows:

1. Run the base scenario (This represents the current situation – the business as usual case or reference case)
2. Create an alternative scenario
3. Edit the alternative scenario's inputs to represent the policy to be tested
4. Run the alternative scenario
5. View the alternative scenario's results
6. Repeat steps 2-5 for all of the policies to be tested
7. Compare the results of the policy runs

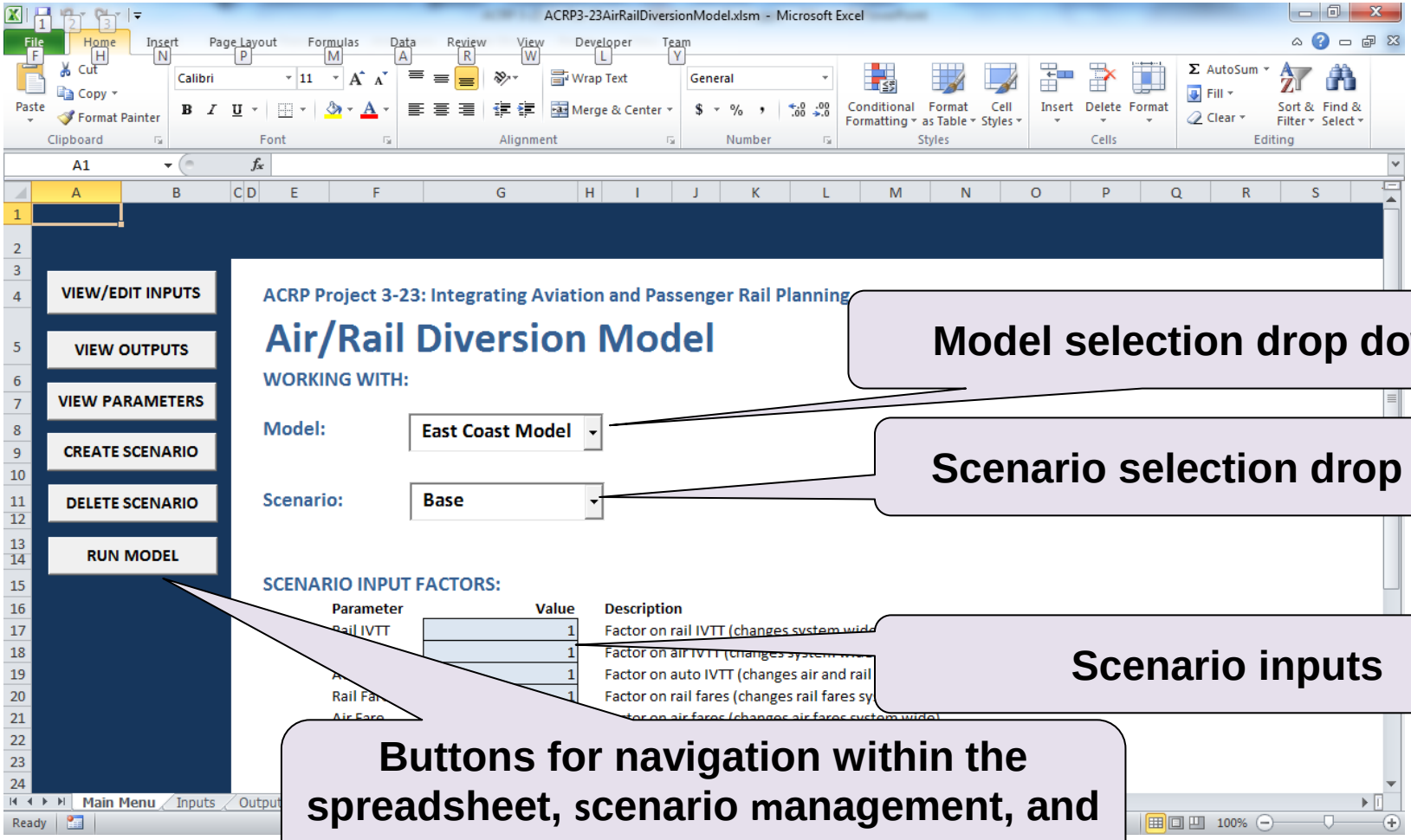
Elements of the GUI

The following pages show screenshots from different components of the GUI and demonstrate the functionality of the GUI, following the workflow described above:

- Main Menu
- Creating Scenarios
- Viewing and Editing Inputs
- Running the Model
- Reviewing Results

Main Menu: GUI on Opening

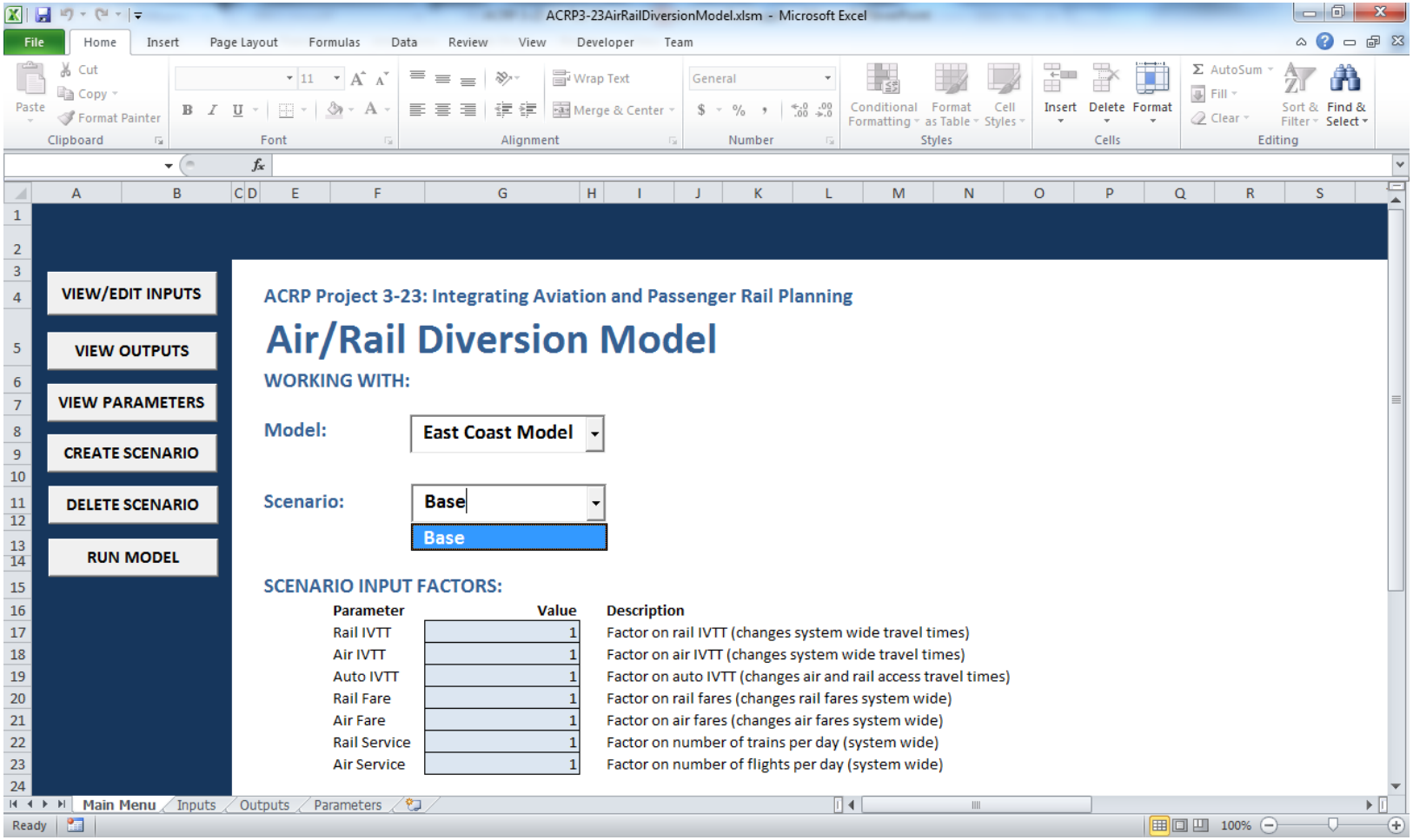
The GUI is a macro-enabled spreadsheet (an .xlsm file) and opens to a simple Main Menu



Creating Scenarios

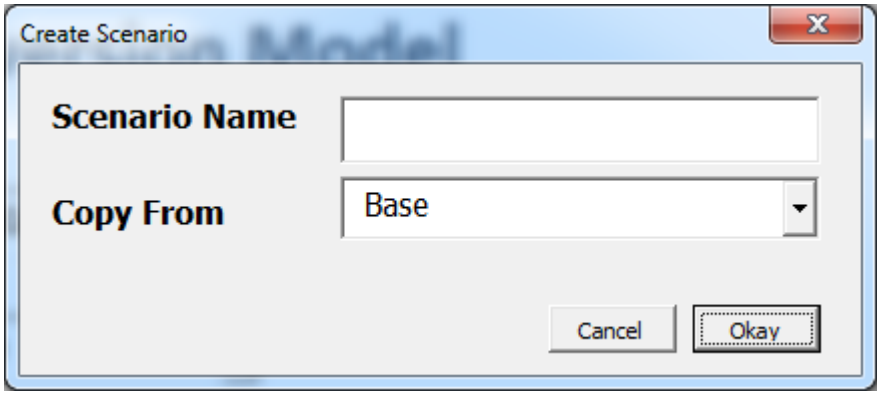
Creating a Scenario

The scenario drop down list on the Main Menu shows the current list of scenarios for the selected model. At first, just the Base scenario exists

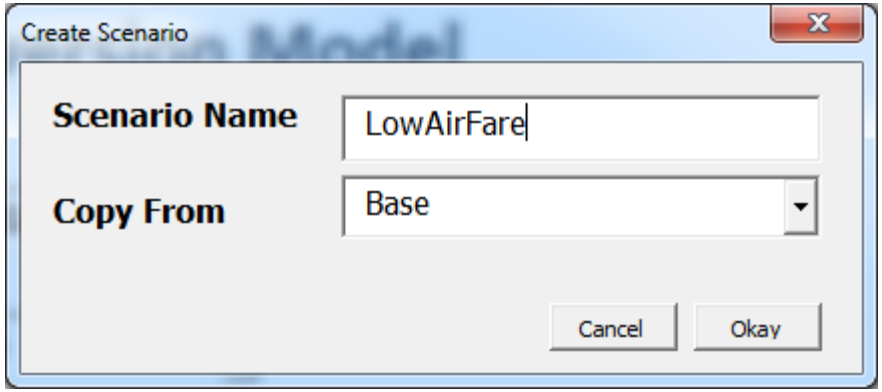


Creating a Scenario

Clicking the “Create Scenario” button launches the Create Scenario Dialog.

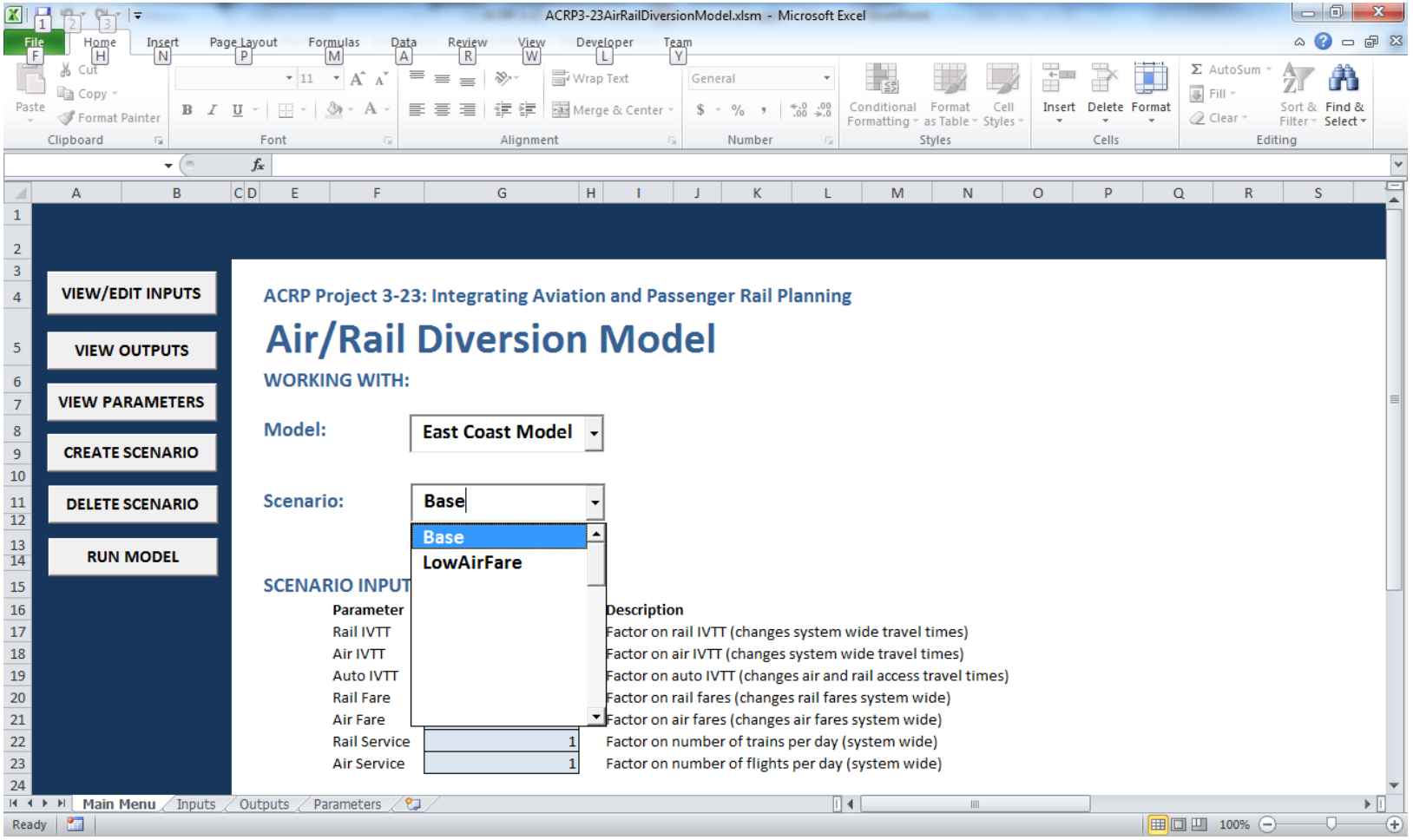


The model user names their scenario in the “Scenario Name” box. They can also specify which existing scenario to use as a template for the new scenario using the “Copy From” drop down. In this case, the Base scenario will be copied and, until the user edits the inputs to their new scenario, it will be identical to the Base scenario.



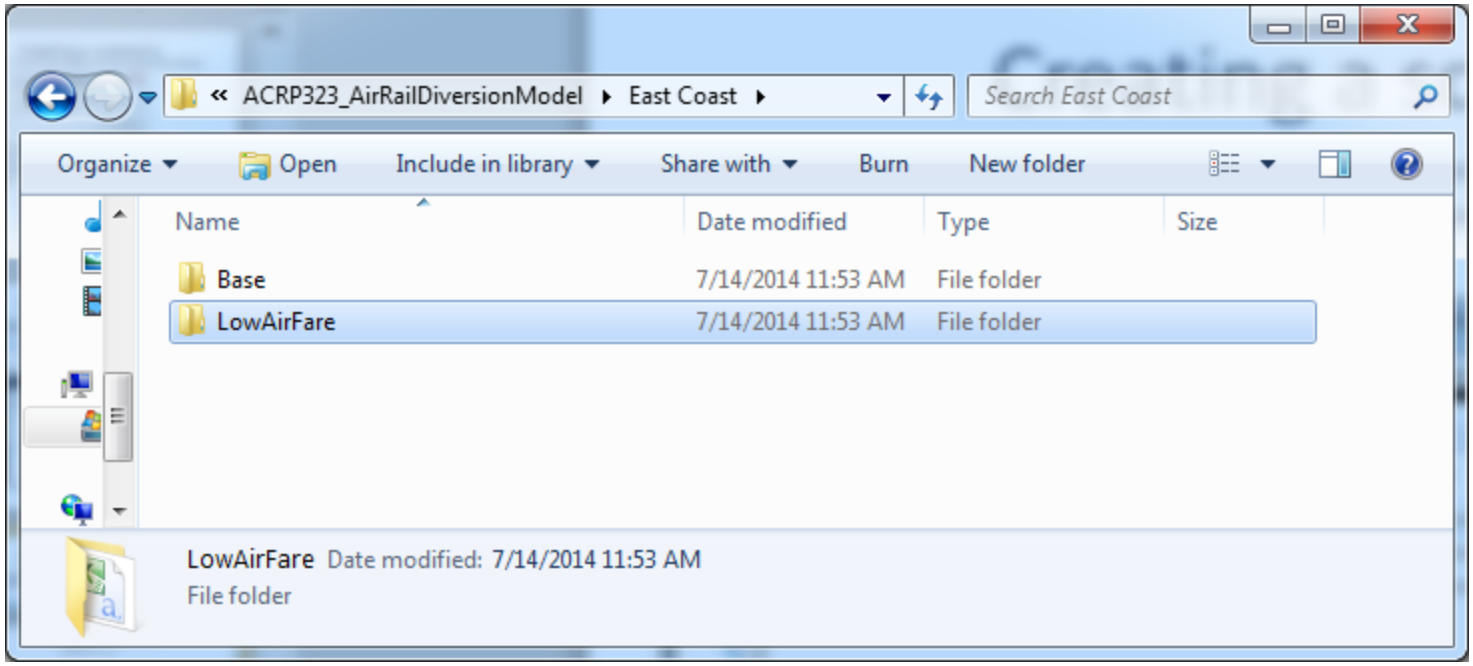
Creating a Scenario

The model user then clicks “okay” to create the new scenario. It is added to the scenario drop down as shown.



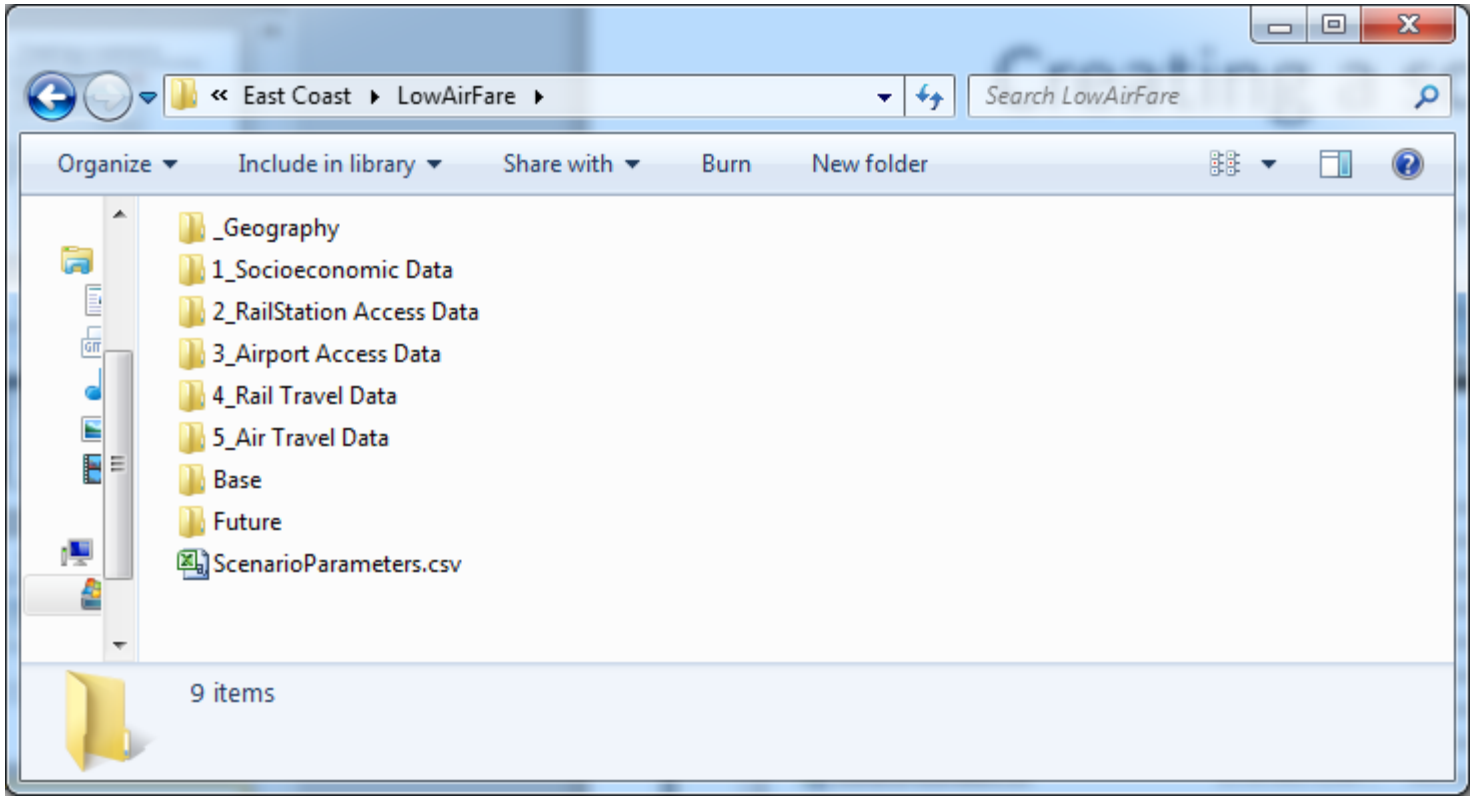
Creating a Scenario

In addition, the new scenario folder is also added to the file system, in this case to \East Coast\LowAirFare.



Creating a scenario

The file structure within the new scenario folder is identical to that within the Base scenario folder (shown earlier in the user's guide).



Editing Inputs

Editing Inputs

The GUI provides access to two types of scenario inputs

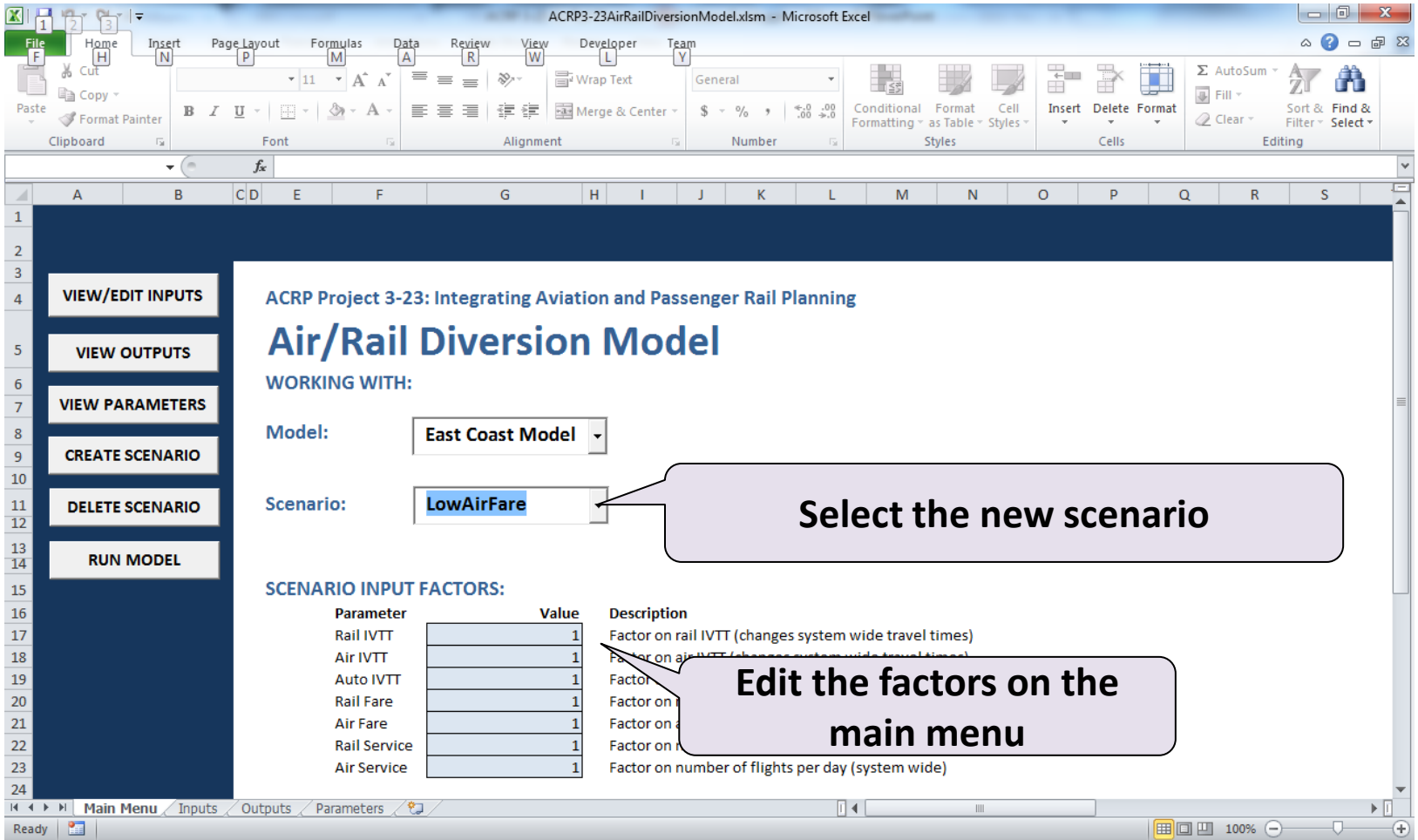
- Main scenario assumptions that can be set on the Main Menu tab
- More detailed inputs that can viewed and edited on the Inputs tab

These are described in turn on the following pages.

It is these edits to inputs that allow a model user to distinguish their new scenario from the base and other scenarios that they have already evaluated.

Editing Main Scenario Assumptions

The GUI contains 7 scenario input factors on the main menu. These allow the model user to make system level changes quickly in order to create the inputs for new scenarios quickly.



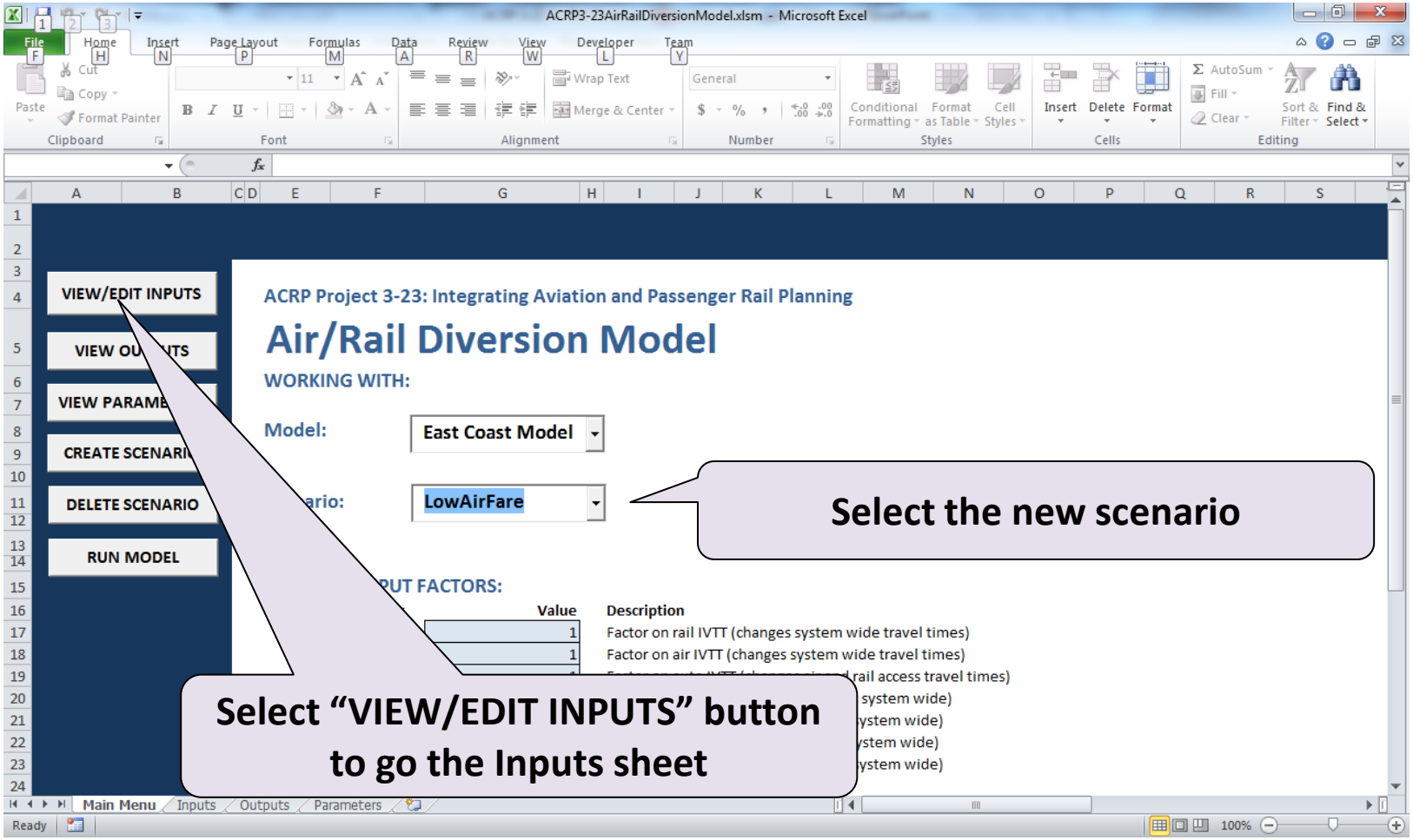
Editing Main Scenario Assumptions

The scenario inputs factors are all system wide effects that factor up or down proportionally a particular input.
For example, setting Rail Fare to a value higher than 1, such as 1.2, increases all rail fares by that factor. So 1.2 multiplies all rail fares by 1.2, resulting in a 20% increase.

Parameter	Description
Rail IVTT	Factor on rail in vehicle travel time (changes system wide travel times)
Air IVTT	Factor on air in vehicle travel time (changes system wide travel times)
Auto IVTT	Factor on auto in vehicle travel time (changes air and rail access travel times)
Rail Fare	Factor on rail fares (changes rail fares system wide)
Air Fare	Factor on air fares (changes air fares system wide)
Rail Service	Factor on number of trains per day (system wide)
Air Service	Factor on number of flights per day (system wide)

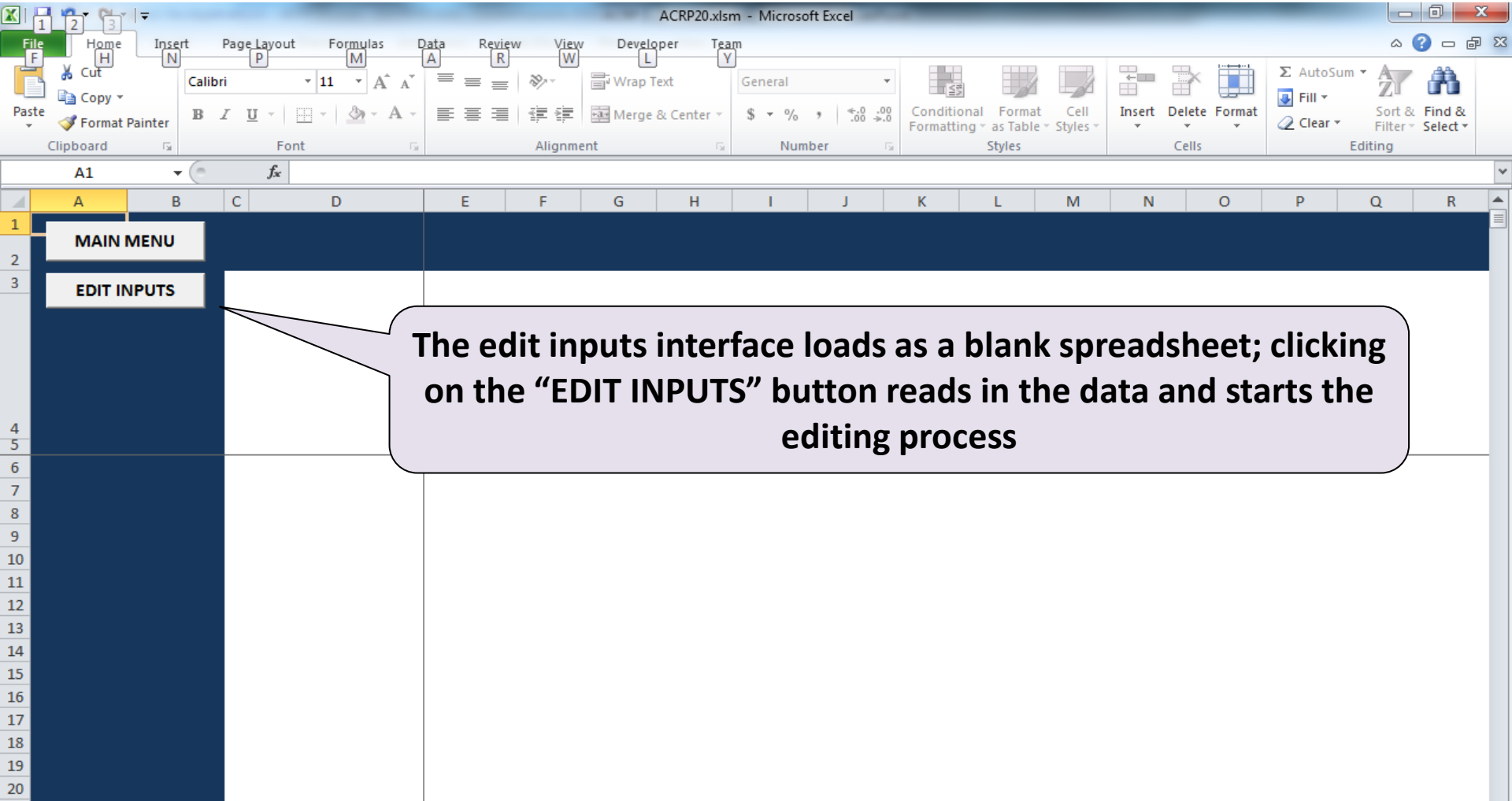
Editing Inputs

The GUI also includes the capability to edit the more detailed input files to a scenario, specifically the various inputs describing the rail services.



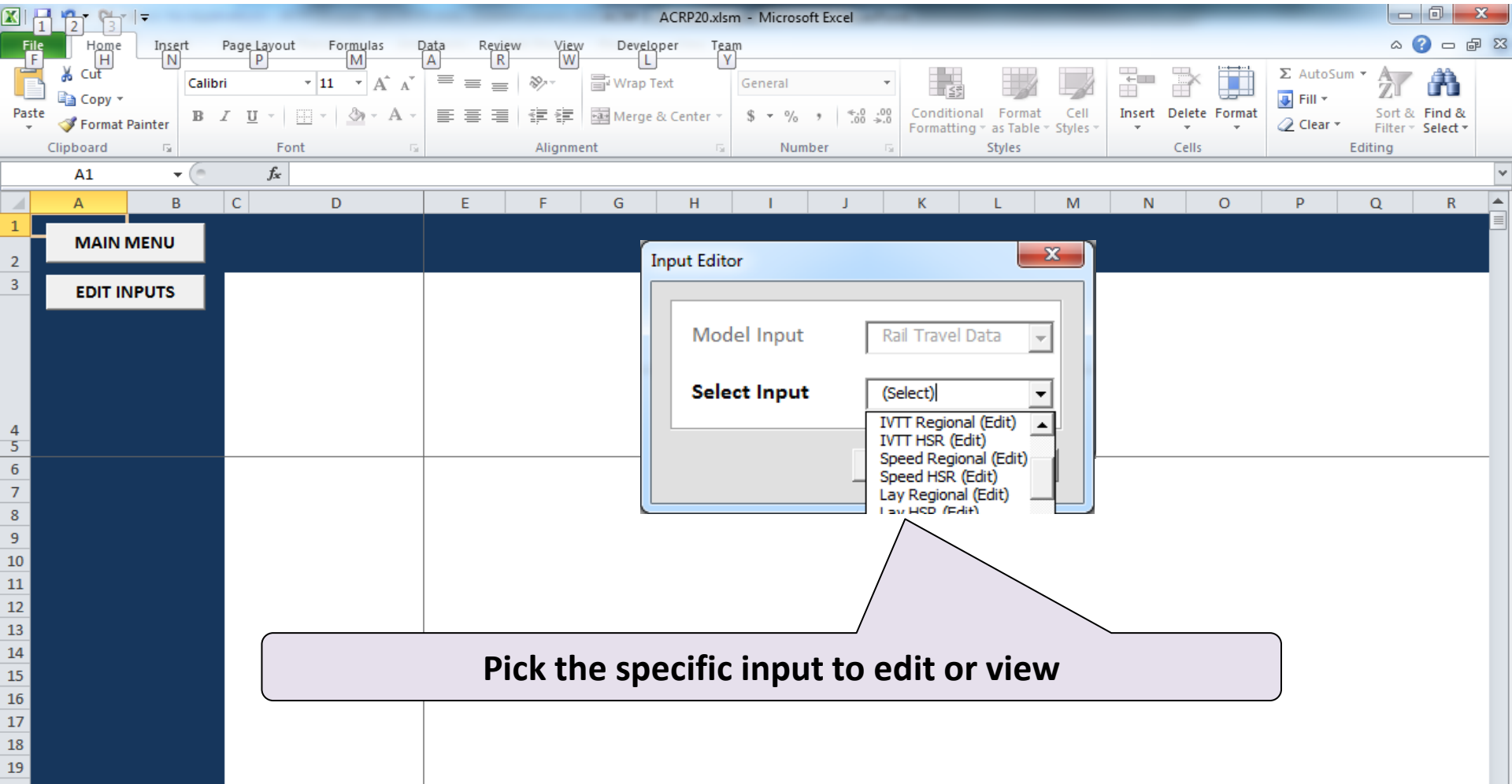
Editing Inputs

The Inputs sheet is a standard interface that allows the model user to load inputs for the scenario into memory and then view and edit specific inputs using dialog boxes and the spreadsheet.



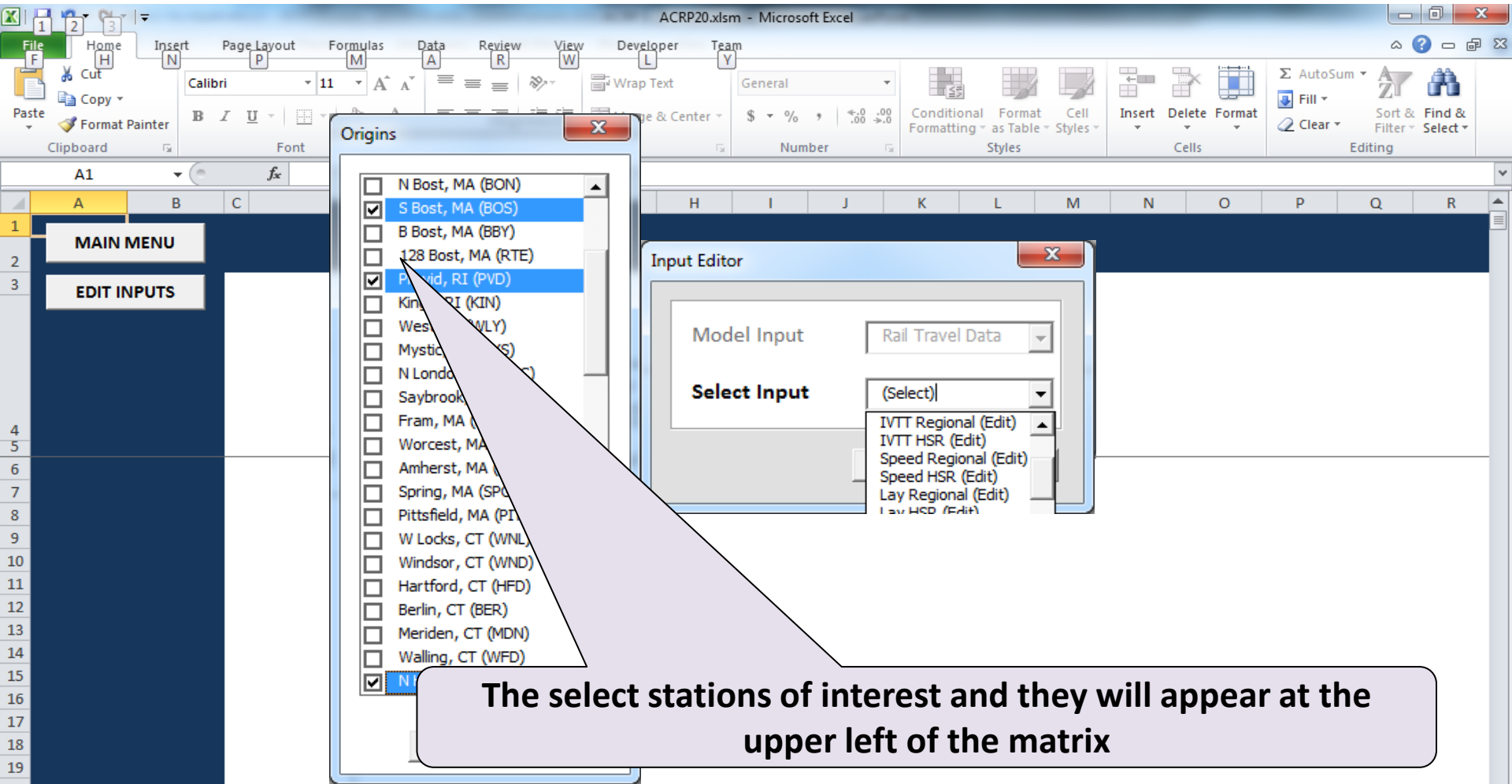
Editing Inputs

One the Edit Inputs button has been clicked, a wizard takes the model user through the process of picking which particular input they wish to view or edit



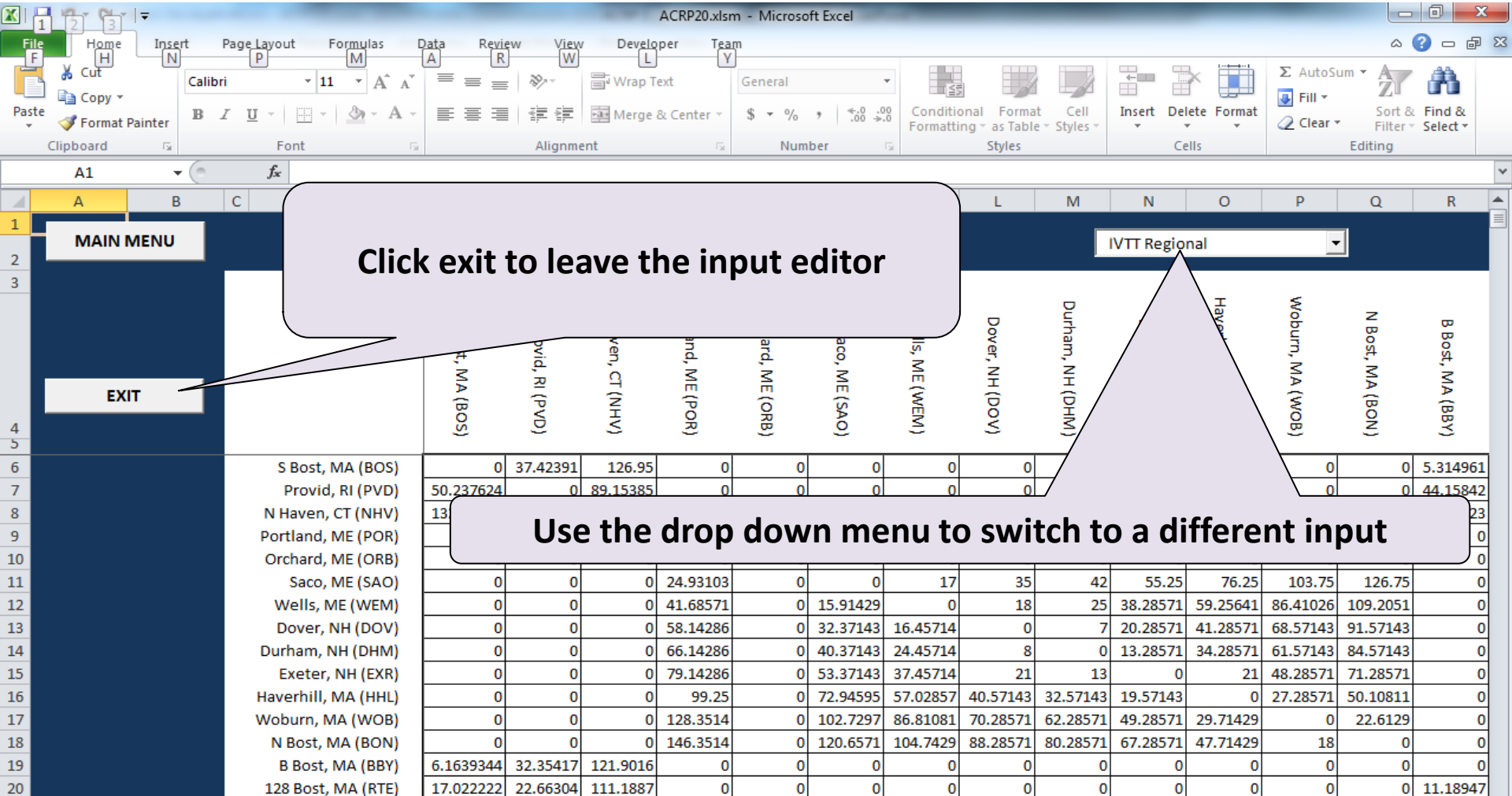
Editing Inputs

The model user can choose particular stations to appear at the upper left of the viewing/editing matrix, so they are easy to find.



Editing inputs

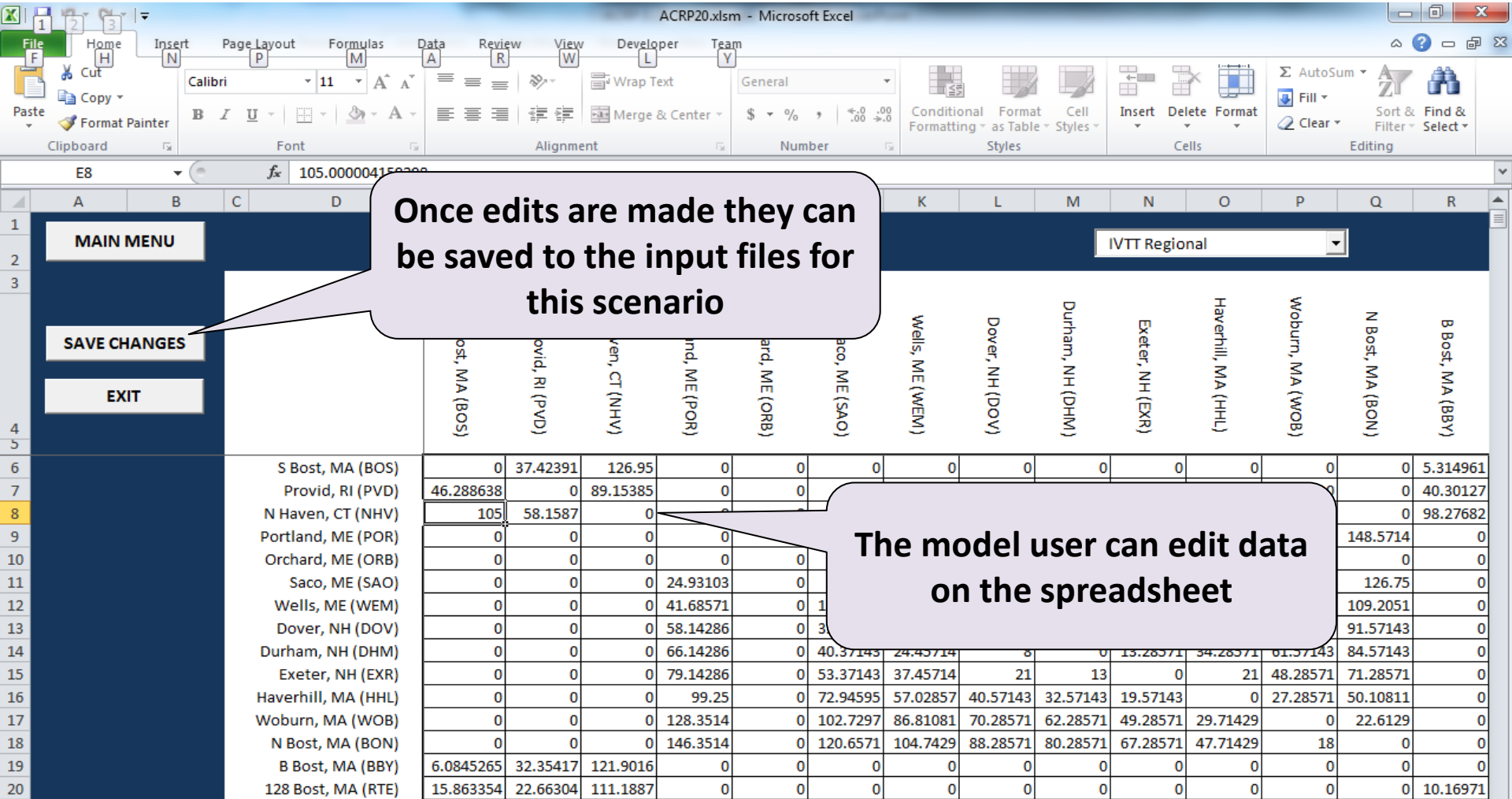
Model users can use the buttons and drop downs to switch to different inputs or exit if they have finishing viewing files.



	S Bost, MA (BOS)	Provid, RI (PVD)	N Haven, CT (NHV)	Portland, ME (POR)	Orchard, ME (ORB)	Saco, ME (SAO)	Wells, ME (WEM)	Dover, NH (DOV)	Durham, NH (DHM)	Exeter, NH (EXR)	Haverhill, MA (HHL)	Woburn, MA (WOB)	N Bost, MA (BON)	B Bost, MA (BBY)
S Bost, MA (BOS)	0	37.42391	126.95	0	0	0	0	0				0	0	5.314961
Provid, RI (PVD)	50.237624	0	89.15385	0	0	0	0	0				0	0	44.15842
N Haven, CT (NHV)	13													23
Portland, ME (POR)														0
Orchard, ME (ORB)														0
Saco, ME (SAO)	0	0	0	24.93103	0	0	17	35	42	55.25	76.25	103.75	126.75	0
Wells, ME (WEM)	0	0	0	41.68571	0	15.91429	0	18	25	38.28571	59.25641	86.41026	109.2051	0
Dover, NH (DOV)	0	0	0	58.14286	0	32.37143	16.45714	0	7	20.28571	41.28571	68.57143	91.57143	0
Durham, NH (DHM)	0	0	0	66.14286	0	40.37143	24.45714	8	0	13.28571	34.28571	61.57143	84.57143	0
Exeter, NH (EXR)	0	0	0	79.14286	0	53.37143	37.45714	21	13	0	21	48.28571	71.28571	0
Haverhill, MA (HHL)	0	0	0	99.25	0	72.94595	57.02857	40.57143	32.57143	19.57143	0	27.28571	50.10811	0
Woburn, MA (WOB)	0	0	0	128.3514	0	102.7297	86.81081	70.28571	62.28571	49.28571	29.71429	0	22.6129	0
N Bost, MA (BON)	0	0	0	146.3514	0	120.6571	104.7429	88.28571	80.28571	67.28571	47.71429	18	0	0
B Bost, MA (BBY)	6.1639344	32.35417	121.9016	0	0	0	0	0	0	0	0	0	0	0
128 Bost, MA (RTE)	17.022222	22.66304	111.1887	0	0	0	0	0	0	0	0	0	0	11.18947

Editing inputs

Once the data are loaded, the model user can edit them directly on the spreadsheet and then save the changes using the SAVE CHANGES button.
The model user can then return to the main menu by clicking on MAIN MENU.

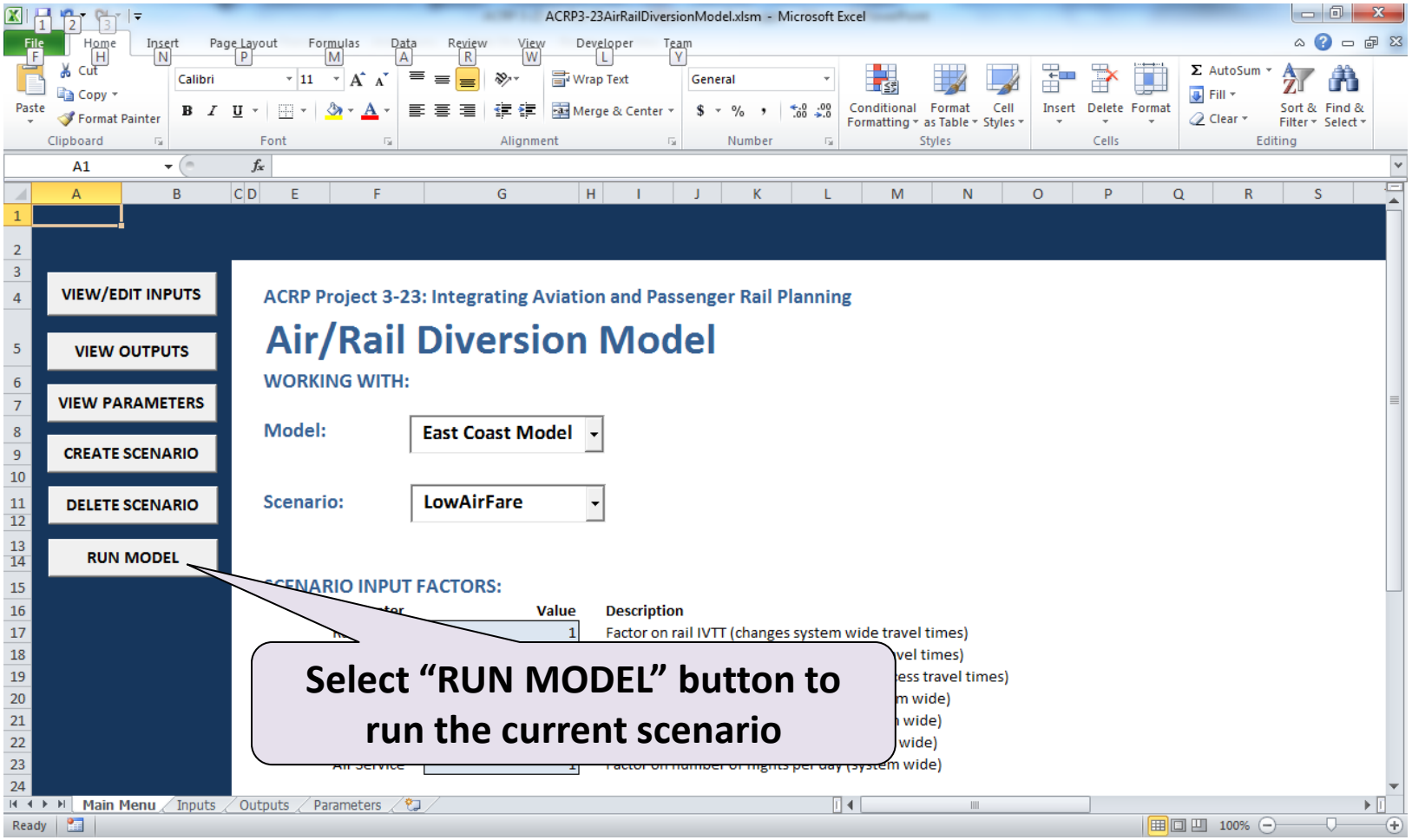


	S Bost, MA (BOS)	Provid, RI (PVD)	N Haven, CT (NHV)	Portland, ME (POR)	Orchard, ME (ORB)	Saco, ME (SAO)	Wells, ME (WEM)	Dover, NH (DOV)	Durham, NH (DHM)	Exeter, NH (EXR)	Haverhill, MA (HHL)	Woburn, MA (WOB)	N Bost, MA (BON)	B Bost, MA (BBY)
S Bost, MA (BOS)	0	37.42391	126.95	0	0	0	0	0	0	0	0	0	0	5.314961
Provid, RI (PVD)	46.288638	0	89.15385	0	0								0	40.30127
N Haven, CT (NHV)	105	58.1587	0										0	98.27682
Portland, ME (POR)	0	0	0	0									148.5714	0
Orchard, ME (ORB)	0	0	0	0	0								0	0
Saco, ME (SAO)	0	0	0	24.93103	0								126.75	0
Wells, ME (WEM)	0	0	0	41.68571	0	1							109.2051	0
Dover, NH (DOV)	0	0	0	58.14286	0	3							91.57143	0
Durham, NH (DHM)	0	0	0	66.14286	0	40.37143	24.45714	8	0	13.28571	34.28571	61.57143	84.57143	0
Exeter, NH (EXR)	0	0	0	79.14286	0	53.37143	37.45714	21	13	0	21	48.28571	71.28571	0
Haverhill, MA (HHL)	0	0	0	99.25	0	72.94595	57.02857	40.57143	32.57143	19.57143	0	27.28571	50.10811	0
Woburn, MA (WOB)	0	0	0	128.3514	0	102.7297	86.81081	70.28571	62.28571	49.28571	29.71429	0	22.6129	0
N Bost, MA (BON)	0	0	0	146.3514	0	120.6571	104.7429	88.28571	80.28571	67.28571	47.71429	18	0	0
B Bost, MA (BBY)	6.0845265	32.35417	121.9016	0	0	0	0	0	0	0	0	0	0	0
128 Bost, MA (RTE)	15.863354	22.66304	111.1887	0	0	0	0	0	0	0	0	0	0	10.16971

Running a Scenario

Running a Scenario

Once any file editing is done, the model user can run a scenario. A model run is started by clicking on the “RUN MODEL” button.



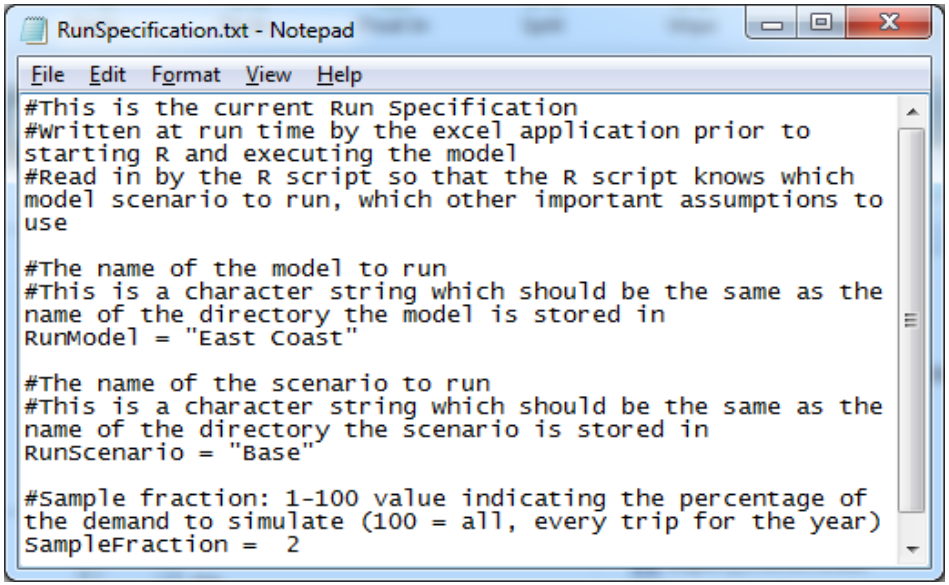
Running a scenario

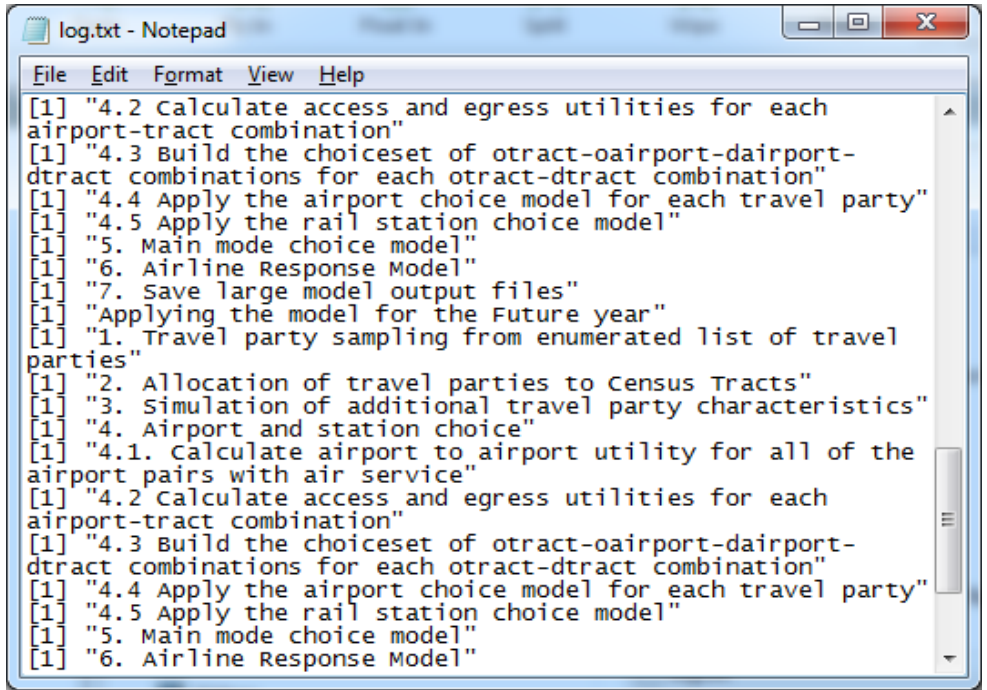
When the model user clicks on the "RUN MODEL" button, several steps are initiated:

1. Creation of the "RunSpecification.txt" file, which describes the model and scenario to run.

2. R is launched via a command shell and the main R script containing the model application code, ModelApplication.R, is executed.

3. The simulation is carried out with logging of progress to a log file ("log.txt").

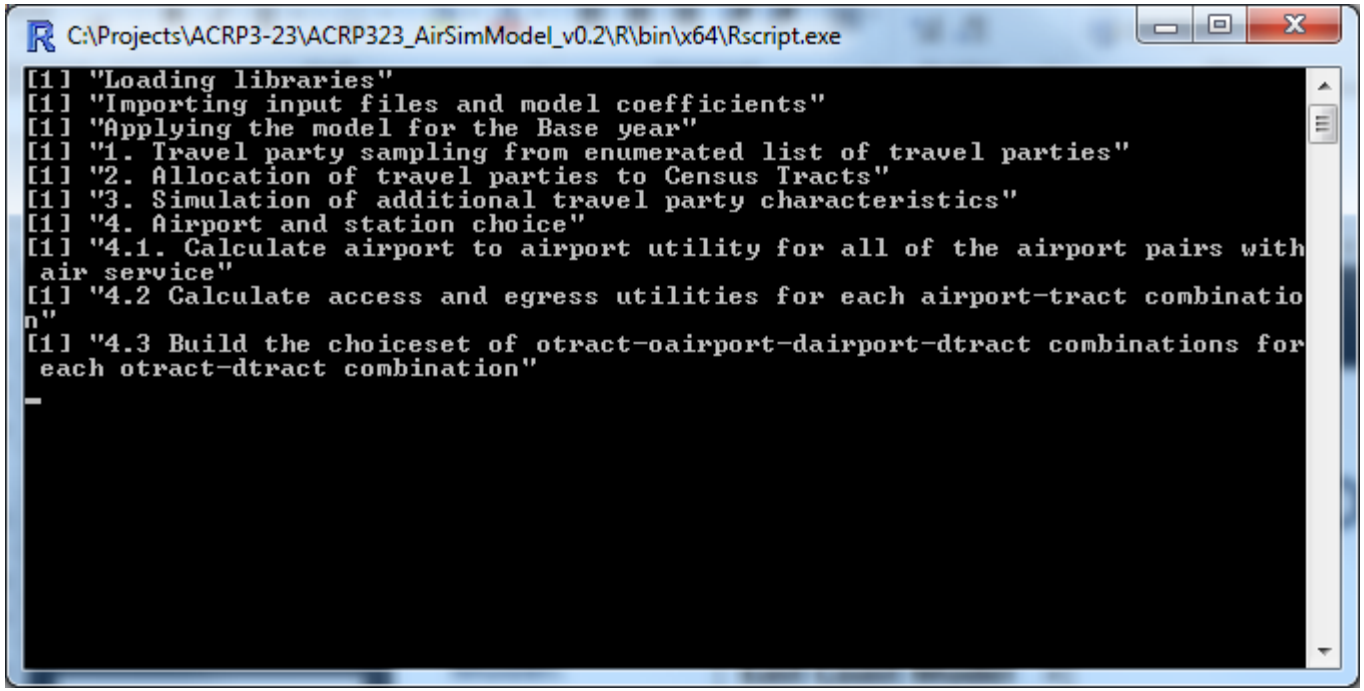




Running a scenario

During a scenario run the command shell window also shows and prints progress to the screen so that the user can see how the simulation is progressing.

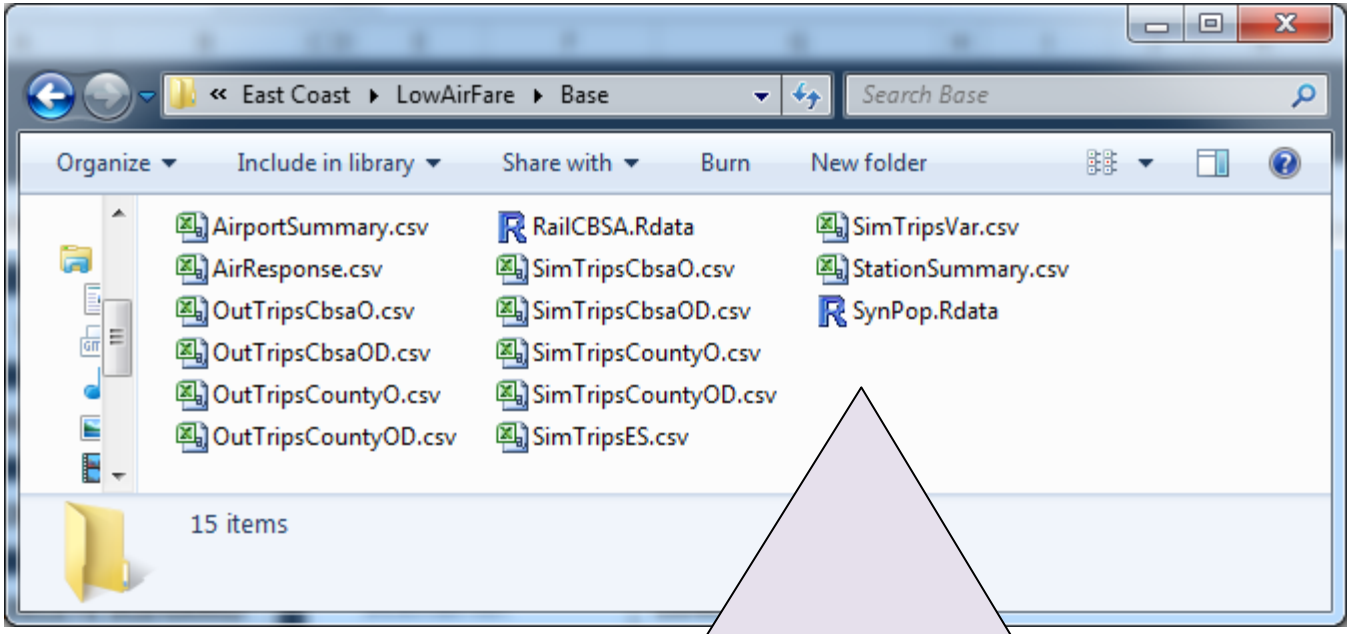
Once command shell window closes, the run is complete and the mode user can processed to view the results.



Viewing Results

Reviewing Results

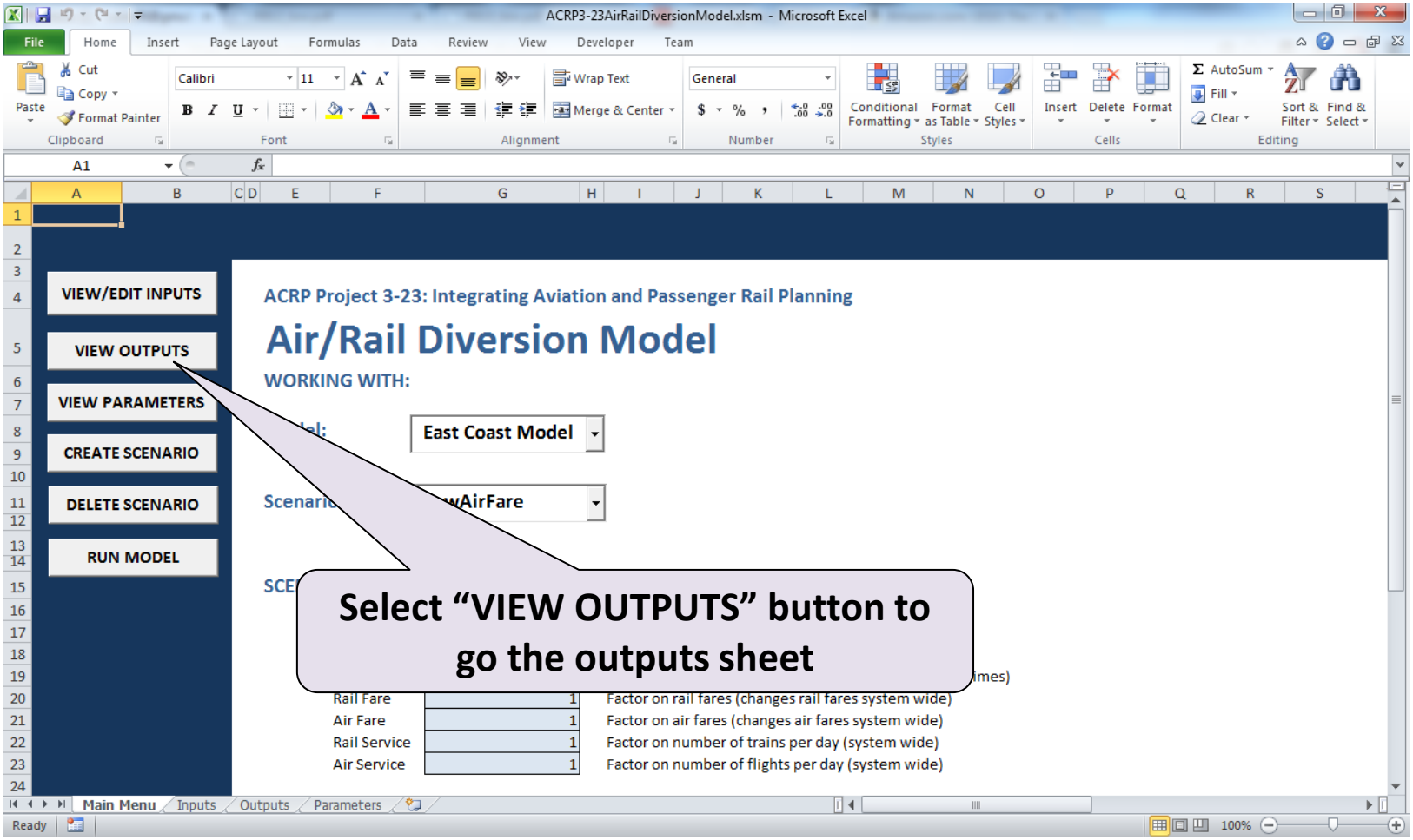
At the end of a run the results are written into the Base and Future folders within the scenario.



The model writes a complete set of outputs including the full simulation results into an R binary file and exports key summary tabulations into .csv files

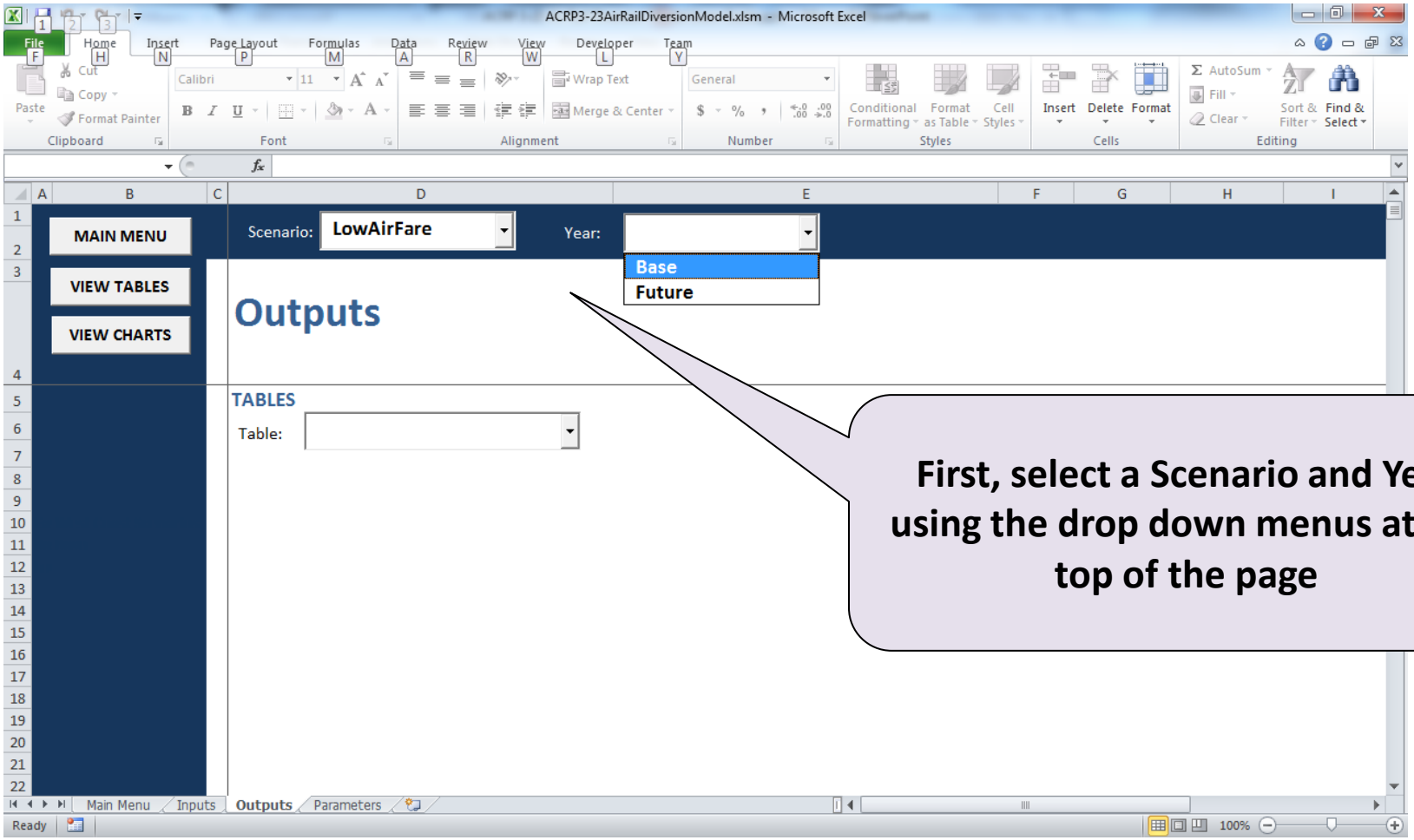
Reviewing Results

Click on the “VIEW OUTPUTS” button on the main menu to navigate to the outputs page.



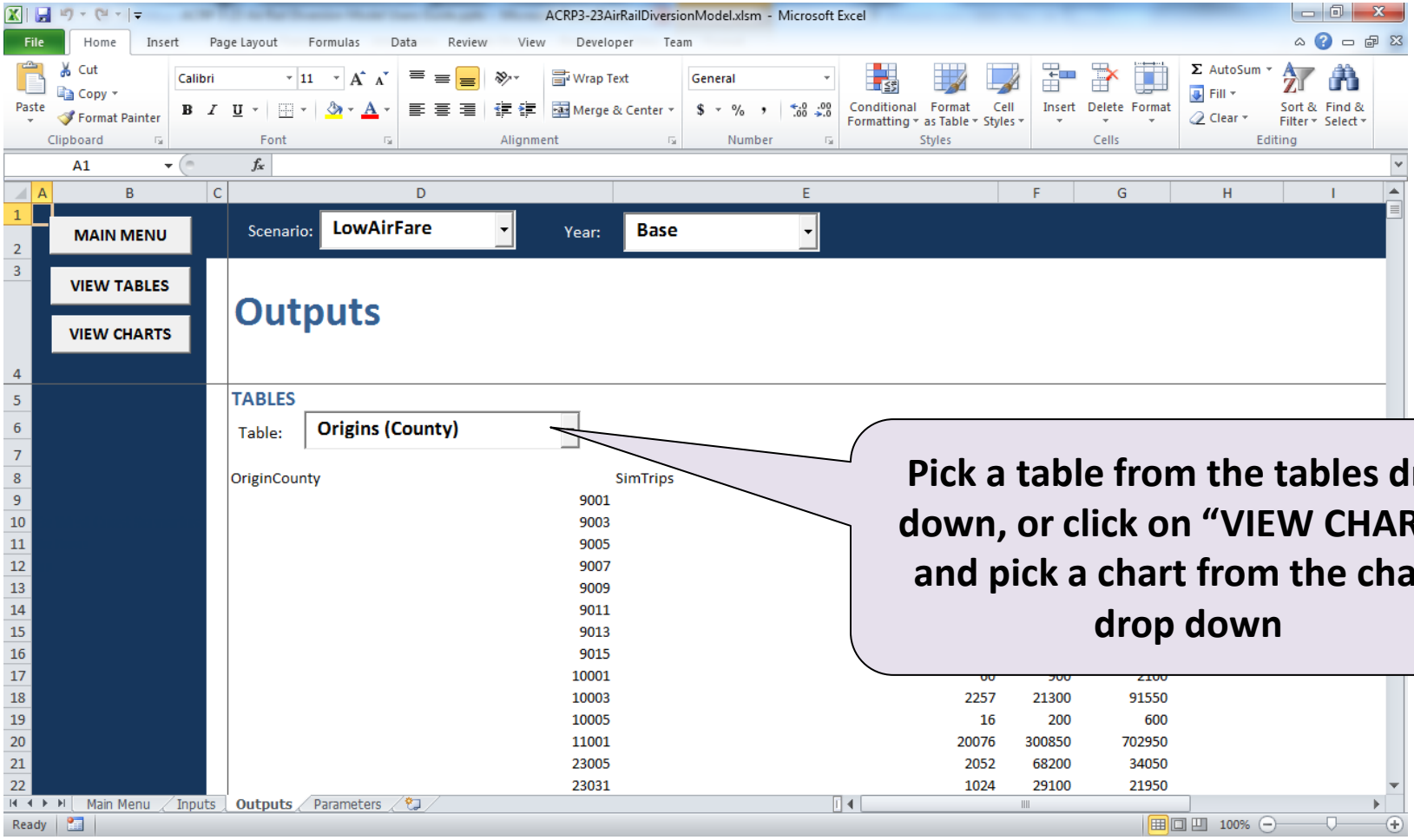
Reviewing Results

The outputs page allows the user to open results from any scenario that has been run, to view base and future results, and to view various tabulations and charts.



Reviewing Results

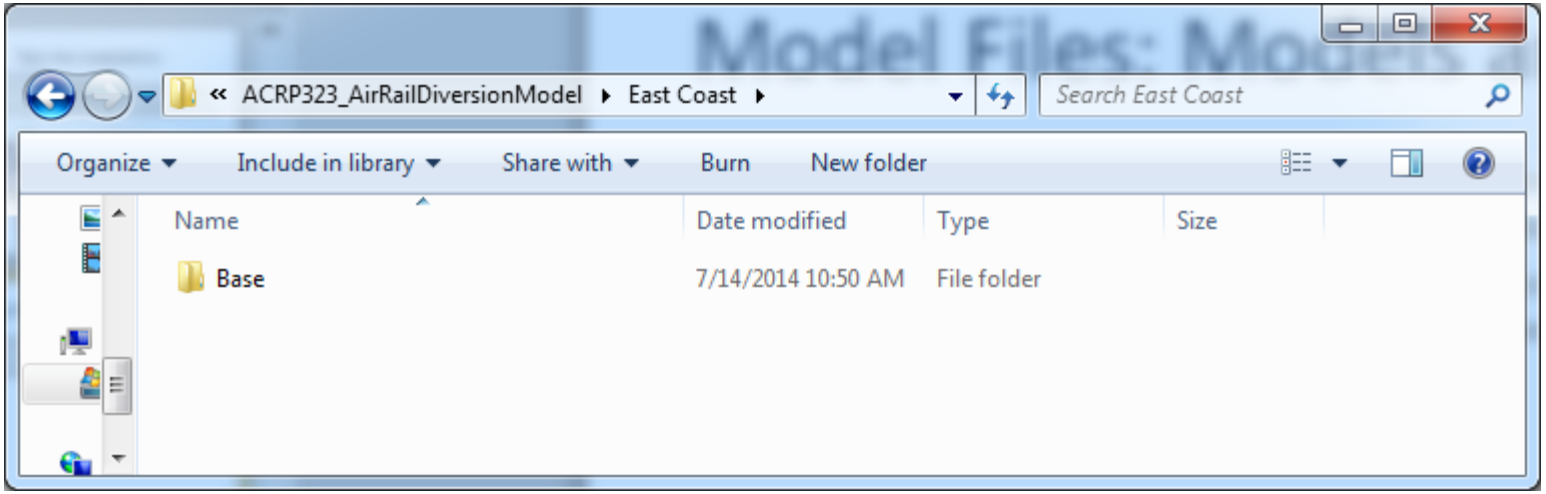
Once the user selects a table or chart to view the results loaded and the data are displayed. Additional results including very detailed outputs are available via the file system.



Input File Specifications

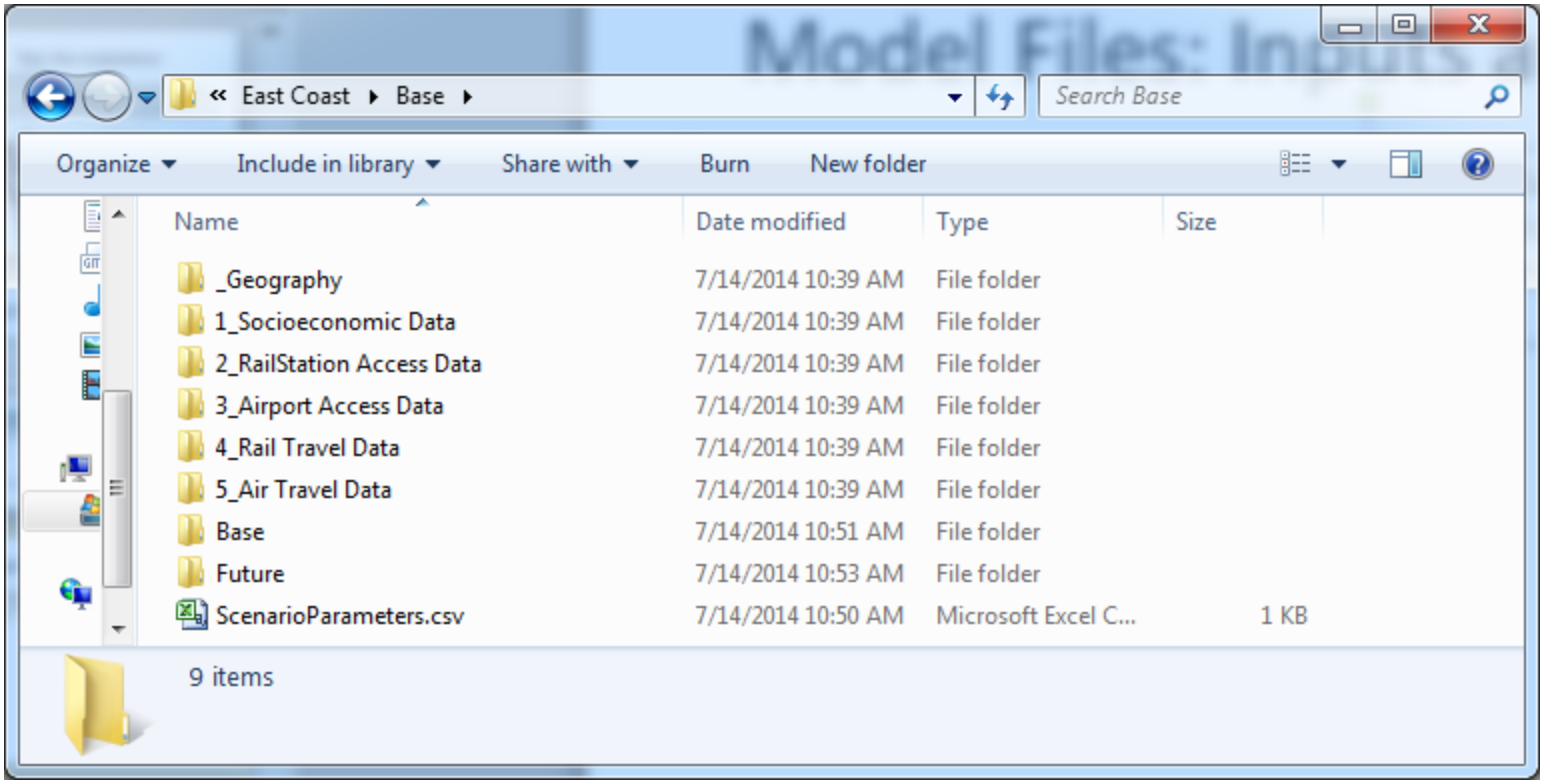
Input File Specifications

This section of the user's guides provides a complete description of the input files for the model. As noted above, the model comes with two pre-developed models, for the East Coast and West Coast regions, which are contained in the "East Coast" and "West Coast" folders, respectively. Within each of those two folders are a list of scenarios. Initially, there is only a "Base" scenario folder, but as scenarios are created, additional scenario folders will appear here. The screenshot below shows the contents of the "East Coast" folder – just the "Base" scenario folder when the model is installed.



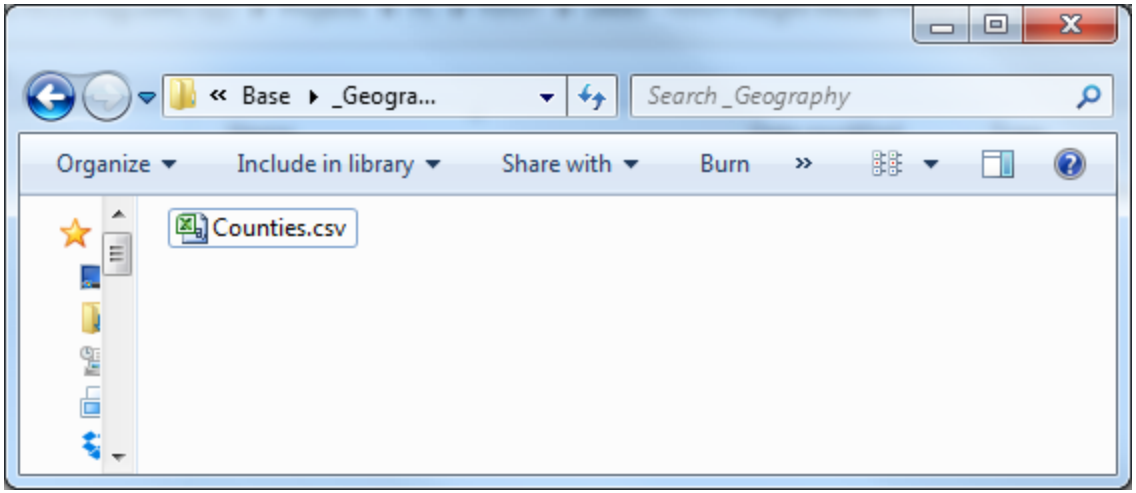
Model Files: Inputs and Outputs

Each scenario folder--for example, within the East Coast/Base folder as shown here--contains folders containing .csv files for several different categories of inputs, and the "Base" and "Future" folder which contain outputs (once the scenario has been run). The ScenarioParameters.csv file contains several top level policy variables and is edited using the GUI's main menu.



Model Files: _Geography

The geography folder contains one file, Counties.csv. This file describes the extent of the study area for this model and is simply a list of county and state names. The first 10 rows are shown in the table below.



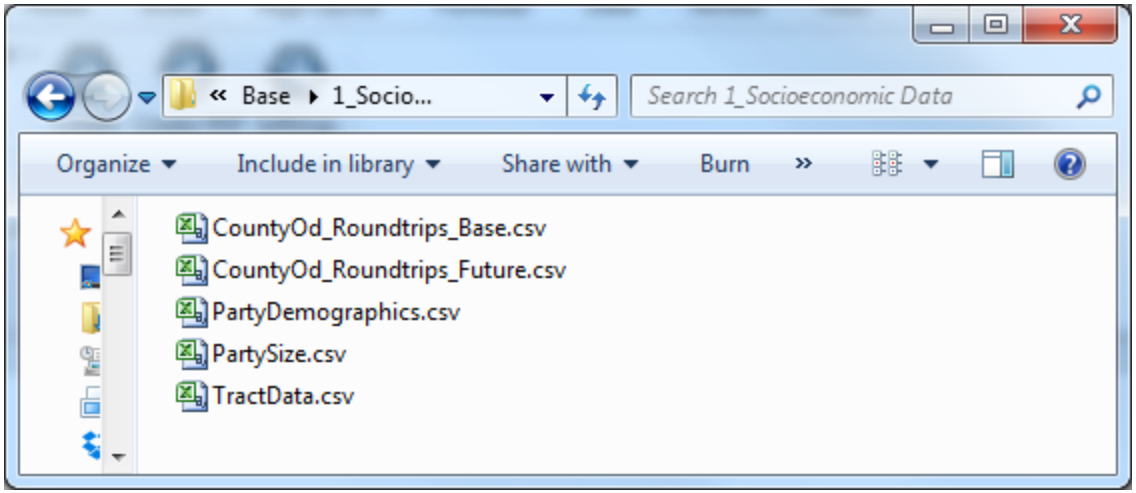
Counties.csv
Describes the extent of the study area

Field Descriptions:
NAME – county name in text
STATE_NAME – state name in text

NAME	STATE_NAME
fairfield	connecticut
hartford	connecticut
litchfield	connecticut
middlesex	connecticut
new haven	connecticut
new london	connecticut
tolland	connecticut
windham	connecticut
kent	delaware
new castle	delaware

Model Files: 1_Socioeconomic Data (1)

The 1_Socioeconomic Data folder contains 5 files describing total air and rail travel and the demographics of travelers and more detailed spatial information about the study area.



CountyOd_Roundtrips_Base.csv
Describes existing OD travel in the study area
Field Descriptions:
orgfips – FIPS code for the origin county
desfips – FIPS code for the destination county
air_trips – annual air passenger trips in 2008 between the counties
rail_trips – annual rail passengber trips in 2008 between the counties
GCD – great circle distance between the counties
hwydist – distance over the highway network between the counties

orgfips	desfips	air_trips	rail_trips	GCD	hwydist
9001	9001	0	13	0	23.8
9001	9003	0	1142	50.8	88.6
9001	9005	0	96	38.1	74.4
9001	9007	0	223	45.4	82.6
9001	9009	0	1209	24.8	65.8
9001	9011	0	810	67.6	94.4
9001	9013	0	276	68	102.6
9001	9015	0	124	82.8	131.5
9001	10001	8	47	187.3	276.6
9001	10003	67	2636	158.5	228.1

Model Files: 1_Socioeconomic Data (2)

CountyOd_Roundtrips_Future.csv

Describes future year OD travel in the study area

Field Descriptions:

orgfips – FIPS code for the origin county

desfips – FIPS code for the destination county

air_trips – annual air passenger trips in 2040 between the counties

rail_trips – annual rail passenger trips in 2040 between the counties

GCD – great circle distance between the counties

hwydist – distance over the highway network between the counties

orgfips	desfips	air_trips	rail_trips	GCD	hwydist
9001	9001	0	18	0	23.8
9001	9003	0	1516	50.8	88.6
9001	9005	0	132	38.1	74.4
9001	9007	0	317	45.4	82.6
9001	9009	0	1608	24.8	65.8
9001	9011	0	1097	67.6	94.4
9001	9013	0	404	68	102.6
9001	9015	0	179	82.8	131.5
9001	10001	8	76	187.3	276.6
9001	10003	64	3700	158.5	228.1

Model Files: 1_Socioeconomic Data (3)

PartyDemographics.csv
Describes the joint income, vehicle availability and trip purpose distributions for air and rail travel parties

Field Descriptions:
Purpose – trip purpose groups (Business and NonBusiness)
Income – household income groups (<$25,000, $25,000 to $75,000, $75,000 to $125,000, and $125,000 or more)
VehicleAvailability – whether the travel party has a vehicle available or not (No, Yes)
AirProp – the proportion of air travel parties in each joint category of Purpose, Income, and Vehicle Availability. Sums to 1.0
RailProp – the proportion of rail travel parties in each joint category of Purpose, Income, and Vehicle Availability. Sums to 1.0

Purpose	Income	VehicleAvailability	AirProp	RailProp
Business	$125,000 or more	No	0	0
Business	$125,000 or more	Yes	0.22	0.12
Business	$75,000 to $125,000	No	0	0
Business	$75,000 to $125,000	Yes	0.11	0.18
Business	$25,000 to $75,000	No	0	0
Business	$25,000 to $75,000	Yes	0.09	0.09
Business	<$25,000	No	0	0
Business	<$25,000	Yes	0.01	0
NonBusiness	$125,000 or more	No	0	0
NonBusiness	$125,000 or more	Yes	0.17	0.07
NonBusiness	$75,000 to $125,000	No	0	0.01
NonBusiness	$75,000 to $125,000	Yes	0.13	0.21
NonBusiness	$25,000 to $75,000	No	0.01	0.01
NonBusiness	$25,000 to $75,000	Yes	0.21	0.25
NonBusiness	<$25,000	No	0.01	0
NonBusiness	<$25,000	Yes	0.03	0.06

Model Files: 1_Socioeconomic Data (4)

PartySize.csv
Describes the party size distribution for air and rail travel parties by trip purpose

Field Descriptions:
Purpose – trip purpose groups (Business and NonBusiness)
PartySize – party size of the travel party (1, 2, 3, 4, 5 or more)
AirProp – the proportion of air travel parties in each party size category. Sums to 1.0 for each purpose group, 2.0 overall.
RailProp – the proportion of rail travel parties in each party size category. Sums to 1.0 for each purpose group, 2.0 overall.

Purpose	PartySize	AirProp	RailProp
Business	1	0.8	0.75
Business	2	0.14	0.17
Business	3	0.03	0.05
Business	4	0.02	0.02
Business	5 or more	0.02	0.02
NonBusiness	1	0.49	0.29
NonBusiness	2	0.37	0.34
NonBusiness	3	0.06	0.13
NonBusiness	4	0.04	0.15
NonBusiness	5 or more	0.04	0.1

Model Files: 1_Socioeconomic Data (5)

TractData.csv
Describes the characteristics of each Census tract in the study area

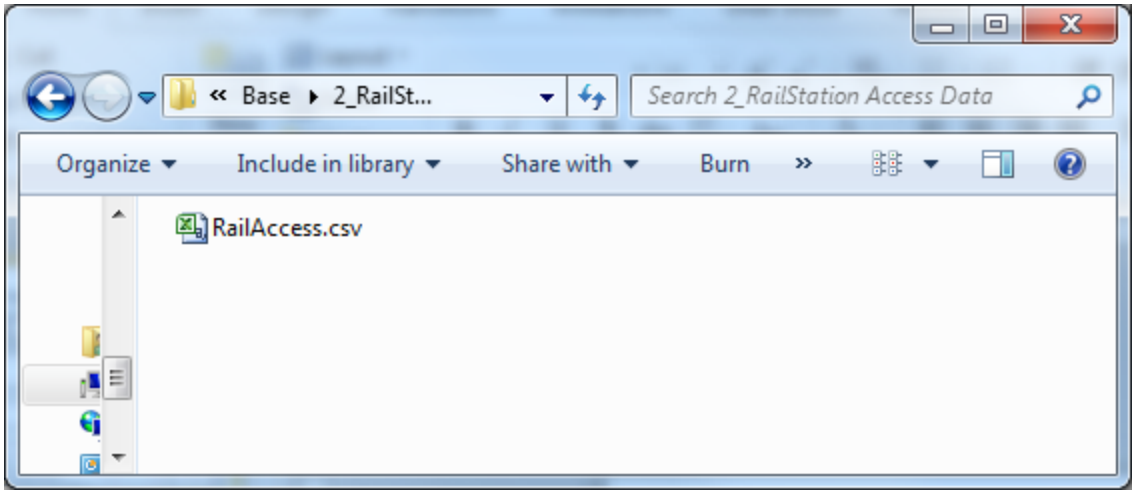
Field Descriptions:

TractNum – Census Bureau tract identification number
TractID – sequential tract identification number used in the model, 1:n tracts
CtyNum – county FIPS code
CtyName – text county name
StNum – state FIPS code
StName – text state name
Pop – tract population
HHMedInc – tract household median income ($)
AveHHVeh – tract average household vehicle availability
Emp_Tot – tract total employment
Emp_Hosp – tract employment in the hospitality industry

TractNum	TractID	CtyNum	CtyName	StNum	StName	Pop	HHMedInc	AvgHHVeh	Emp_Tot	Emp_Hosp
9001010101	1	9001	fairfield county	9	connecticut	4476	154421	2.342049	2913	147
9001010102	2	9001	fairfield county	9	connecticut	4330	241944	2.293716	913	13
9001010201	3	9001	fairfield county	9	connecticut	3421	250001	2.537137	839	10
9001010202	4	9001	fairfield county	9	connecticut	5359	175625	2.202524	414	0
9001010300	5	9001	fairfield county	9	connecticut	4010	152321	2.084577	4952	191
9001010400	6	9001	fairfield county	9	connecticut	5290	83036	1.78829	2198	170
9001010500	7	9001	fairfield county	9	connecticut	5494	88750	1.548553	2848	129
9001010600	8	9001	fairfield county	9	connecticut	1845	90909	1.331522	10852	699
9001010700	9	9001	fairfield county	9	connecticut	3579	65682	1.34878	336	7
9001010800	10	9001	fairfield county	9	connecticut	3388	135204	1.885401	1230	150

Model Files: 2_RailStation Access Data

The 2_RailStation Access Data folder contains one file, RailAccess.csv. This file describes the accessibility of each station to each tract in the study area.



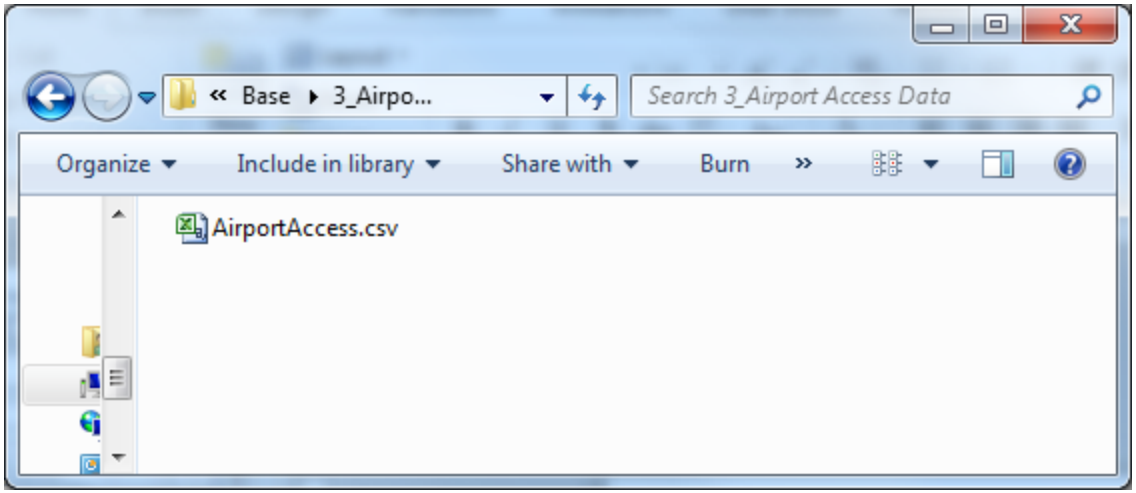
RailAccess.csv
Describes the accessibility of each rail station to each tract in the study area

Field Descriptions:
RailAccInd – unique identifier for the combination of tract and station, 1:n
TractInd – sequential tract identification number used in the model, 1:n tracts
StationInd - sequential rail station identification number used in the model, 1:n stations
AutoTT – auto travel time from tract to station
HwyDist – highway distance from tract to station
Transit – transit accessibility index, tract station combination

RailAccInd	TractInd	StationInd	AutoTT	HwyDist	Transit
1	1	1	256.38	270.59	0.011
2	1	2	251.63	262.24	0.008
3	1	3	247.9	258.44	0.008
4	1	4	233.1	243.79	0.01
5	1	5	222.25	228.7	0.012
6	1	6	223.4	224.22	0.008
7	1	7	209.77	212.32	0.008
8	1	8	188.21	194.96	0.024
9	1	9	173.29	178.7	0.018
10	1	10	169.36	178.2	0.008

Model Files: 3_Airport Access Data

The 3_Airport Access Data folder contains one file, AirportAccess.csv. This file describes the accessibility of each airport to each tract in the study area.



AirAccess.csv
Describes the accessibility of each airport station to each tract in the study area

Field Descriptions:
AccInd – unique identifier for the combination of tract and airport, 1:n
TractInd – sequential tract identification number used in the model, 1:n tracts
AirportInd - sequential airport identification number used in the model, 1:n airports
AutoTT – auto travel time from tract to airport
HwyDist – highway distance from tract to airport
Transit – transit accessibility index, tract airport combination

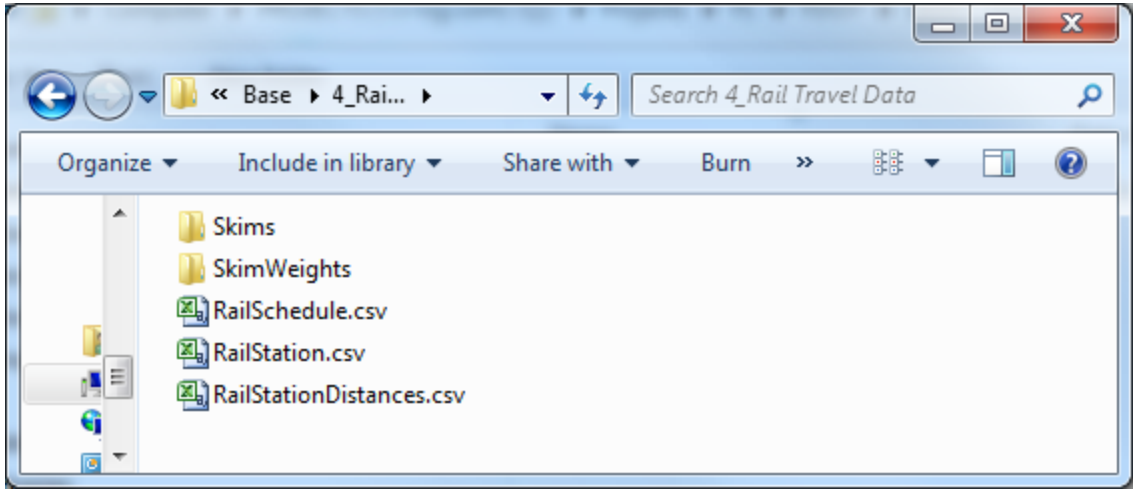
AccInd	TractInd	AirportInd	AutoTT	HwyDist	Transit
1	1	1	51.54	50.31	0.014
2	1	2	96.52	94.39	0.008
3	1	3	245.38	253.24	0.008
4	1	4	260.57	270.68	0.008
5	1	5	174.11	172.43	0.011
6	1	6	171.36	180.94	0.008
7	1	7	207.76	209.67	0.008
8	1	8	330.13	246.89	0.008
9	1	9	263.96	255.02	0.008
10	1	10	242.49	219.75	0.011

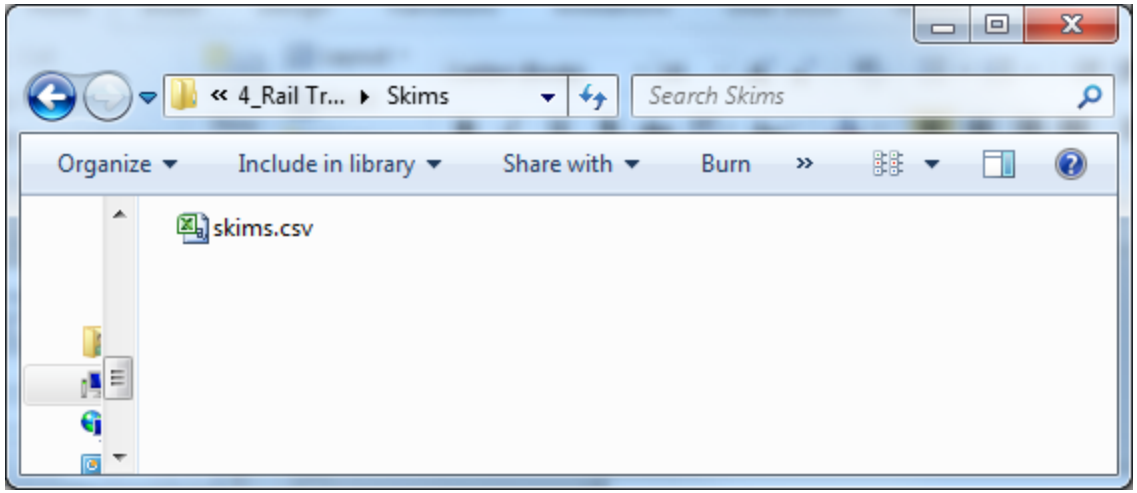
Model Files: 4_Rail Travel Data (1)

The 4_Rail Travel Data folder contains three files and two subfolders that contain files describing the rail station locations and rail service between them.

The Skims folder contains a single file, skims.csv.

The SkimWeights folder contains a set of files used by the model to support adjustments to the station to station travel times and should not be edited by the model user.





Model Files: 4_Rail Travel Data (2)

RailStation.csv
Describes the location of rail stations in the study area

Field Descriptions:
StationInd – sequential station identification number used in the model, 1:n stations
StationCod – 3 letter code for the station
StationName – text name for the station
TractID – sequential tract identification number used in the model, 1:n tracts; this is the tract containing the station
NAME – Name of the county the station is located in
STATE_NAME – Name of the state the station is located in
Latitude – latitude of the station
Longitude – longitude of the station
KeyStation - * identifying major stations (e.g. ,South Boston Station)

StationInd	StationCod	StationName	TractID	NAME	STATE_NAME	Latitude	Longitude	KeyStation
1	POR	Portland, ME (POR)	1257	Cumberland	Maine	43.63549	-70.2949	
2	ORB	Orchard, ME (ORB)	1303	York	Maine	43.51731	-70.3776	
3	SAO	Saco, ME (SAO)	1299	York	Maine	43.50092	-70.4428	
4	WEM	Wells, ME (WEM)	1330	York	Maine	43.32203	-70.5809	
5	DOV	Dover, NH (DOV)	4353	Strafford	New Hampshire	43.19786	-70.8737	
6	DHM	Durham, NH (DHM)	4347	Strafford	New Hampshire	43.13397	-70.9265	
7	EXR	Exeter, NH (EXR)	4337	Rockingham	New Hampshire	42.98148	-70.9478	
8	HHL	Haverhill, MA (HHL)	3073	Essex	Massachusetts	42.7762	-71.0773	
9	WOB	Woburn, MA (WOB)	3355	Middlesex	Massachusetts	42.47926	-71.1523	
10	BON	N Bost, MA (BON)	3853	Suffolk	Massachusetts	42.36558	-71.0613	
11	BOS	S Bost, MA (BOS)	3887	Suffolk	Massachusetts	42.35152	-71.0553	*

Model Files: 4_Rail Travel Data (3)

Skims.csv
Describes the rail level of service between station pairs in the study area (each of these fields can be edited in the GUI as described earlier in the user's guide)

Field Descriptions:

From – StationInd (station identification number used in the model, 1:n stations) for the origin station

To – StationInd (station identification number used in the model, 1:n stations) for the destination station

Time – average rail travel time (minutes)

Speed – average rail speed (mph)

Cost – average ticket cost ($)

Distance – average rail distance (miles)

Regional IVTT – regional rail service in vehicle travel time (minutes)

HSR IVTT – high speed rail in vehicle travel time (minutes)

Regional Speed – regional rail service average speed (mph)

HSR Speed – high speed rail average speed (mph)

Regional Layover – time transferring on regional rail services (minuteS)

HSR Layover - time transferring on high speed rail services (minutes)

Regional Cost – average ticket cost on regional rail service ($)

HSR Cost – average ticket cost on high speed rail service ($)

Regional Distance – distance on regional rail service (miles)

HSR Distance – distance on high speed rail service (miles)

Transfers – average number of transfers for service between origin and destination station

nPaths – number of alternative itineraries per week

nRegPaths – number of alternative regional rail service itineraries per week

nHSRPaths – number of alternative high speed rail service itineraries per week

Model Files: 4_Rail Travel Data (4)

RailSchedule.csv
Matrix describing each train service and its schedule, with one column describing the schedule for each service. This file is processed into Skims.csv by the model in conjunction with RailStationDistances.csv

Field and row Descriptions:
Mode (row) – code for service type, 1-Regional Rail, 2-Existing Higher Speed Rail, 3-High Speed Rail, 4-Bus
Distance Group (row) – code to identify service groups (e.g. Northeast Regional service)
Bound (row) – direction of travel (N,S)
TrainName (row) - name of the train service (Amtrak)
TrainNumber (row) - Amtrak train number
Operation (row) – string describing the days the train operates (e.g., 1_2_3_4_5_6_7 operates every day, 6_7 operates on weekends only)
StationNum (column) - StationInd (station identification number used in the model, 1:n stations) for the station
StationCod - 3 letter code for the station
StationName – text name for the station

Cell values:
Each cell in the table encodes information about the rail service, including sequence for that train, whether passengers can board, alight, or both, and the time of arrival and departure

01--R--0930P—0
01 indicates that this is the first station for this train
R indicates boarding only (B is both boarding and alighting, D is alighting only)
0930P is the arrival time at the station, 9:30 PM
0 is the time that that station stops at the station, i.e., the scheduled departure time at the station is also 9:30 PM

Model Files: 4_Rail Travel Data (5)

RailStationDistances.csv

Matrix describing the station to station distances for each train service group, with one column describing the distances for each service group. This file is processed into Skims.csv by the model in conjunction with RailSchedule.csv

Field and row Descriptions:

Service (row) – name of the train service group (services with similar stopping pattern)

Group (row) – code to identify service groups

StationNum (column) - StationInd (station identification number used in the model, 1:n stations) for the station

StationCode - 3 letter code for the station

StationName – text name for the station

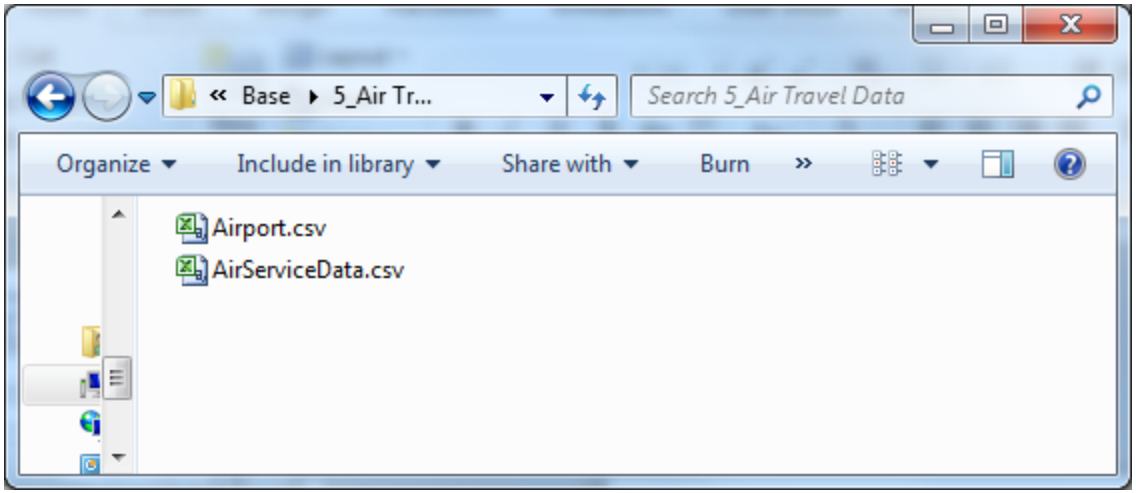
Cell values:

Each cell value represents the train distance travelled for that service. The value is 0 at the first station and increases with each subsequent station in the sequence of stops

-	-	-	Service	Northeast Regional SB
StationInd	StationCode	StationName	Group	1
1	POR	Portland, ME		
2	ORB	Old Orchard Beach, ME		
3	SAO	Saco, ME		
4	WEM	Wells, ME		
5	DOV	Dover, NH		
6	DHM	Durham-UNH, NH		
7	EXR	Exeter, NH		
8	HHL	Haverhill, MA		
9	WOB	Woburn, MA		
10	BON	Boston, MA-North Station		
11	BOS	Boston, MA-South Station		0
12	BBY	Boston, MA-Back Bay Station		1
13	RTE	Route 128, MA		11
14	PVD	Providence, RI		43
15	KIN	Kingston, RI		70
16	WLY	Westerly, RI		87
17	MYS	Mystic, CT		96
18	NLC	New London, CT (Casino)		105
19	OSB	Old Saybrook, CT		123

Model Files: 5_Air Travel Data (1)

The 5_Air Travel Data folder contains two files that describe airport location and air service.



Model Files: 5_Air Travel Data (2)

Airport.csv
Describes the location of airports in the study area

Field Descriptions:
AirportInd – sequential airport identification number used in the model, 1:n airports
AirportCod – 3 letter code for the airport
AirportName – text name for the airport

TractID – sequential tract identification number used in the model, 1:n tracts; this is the tract containing the airport
NAME – Name of the county the airport is located in
STATE_NAME – Name of the state the airport is located in
Latitude – latitude of the airport
Longitude – longitude of the airport

AirportInd	AirportCod	AirportName	TractID	NAME	STATE_NAME	Latitude	Longitude
1	HVN	TWEED-NEW HAVEN	634	New Haven	CONNECTICUT	41.26375	-72.8868
2	BDL	BRADLEY INTL	435	Hartford	CONNECTICUT	41.93889	-72.6832
3	DCA	RONALD REAGAN WASHINGTON NATIONAL	11888	Arlington	DIST. OF COLUMBIA	38.85208	-77.0377
4	IAD	WASHINGTON DULLES INTL	12486	Loudoun	DIST. OF COLUMBIA	38.94744	-77.4599
5	BED	LAURENCE G HANSCOM FLD	3489	Middlesex	MASSACHUSETTS	42.46995	-71.289
6	BOS	GENERAL EDWARD LAWRENCE LOGAN INTL	4014	Suffolk	MASSACHUSETTS	42.36297	-71.0064
7	HYA	BARNSTABLE MUNI-BOARDMAN/POLANDO FIELD	2770	Barnstable	MASSACHUSETTS	41.66933	-70.2804
8	ACK	NANTUCKET MEMORIAL	3583	Nantucket	MASSACHUSETTS	41.25311	-70.0603
9	PVC	PROVINCETOWN MUNI	2715	Barnstable	MASSACHUSETTS	42.07228	-70.2207
10	MVY	MARTHAS VINEYARD	2940	Dukes	MASSACHUSETTS	41.39342	-70.6139

Model Files: 5_Air Travel Data (3)

Airport.csv
Describes the location of airports in the study area

Field Descriptions:
ORIGIN – origin airport code (3 letter)
DEST – destination airport code (3 letter)
Numpersons – number of persons traveling between airports (from DB1B)
N_direct – number of persons traveling direct between the two airports (from DB1B)
N_transfer – number of persons traveling between the airports with one or more transfers in between (from DB1B)
N_oneway – number of one way itineraries (from DB1B)
N_round – number of round trip itineraries (from DB1B)
Numdays – number of day reported for this airport pair in the on time performance data (OTP)
Numflights – number of flights (OTP)
Cancelled - number of cancelled flights (OTP)
Dep_delay – average departure delay in minutes (OTP)
Arr_delay – average arrival delay in minutes (OTP)
Sche_time – scheduled travel time in minutes (OTP)
Actual_time - actual travel time in minutes (OTP)
Distance - distance between airports (OTP)
Tran_days – days reported for transfer flight routes in the OTP
Tran_flight – number of transfer flights reported (OTP)
Tran_cancelled – number of transfer flights cancelled (OTP)
Tran_flight_time – tranfer flight travel time in minutes (OTP)
Tran_layover – layover time in minutes (OTP)
Mean_cost – average ticket cost (from DB1B, in $)
p0:p100 – 0 percentile to 100 percentile ticket costs in 10 percentile increments (from DB1B, in $)

Code Guide

Code Guide

This section of the user's guide provides a guide to the code of the model and the files containing model parameters.

The information in this section of the user's guide is intended for advanced users of the model who wish to modify the model – from making adjustments to individual parameters, to making fundamental changes to the structure of individual model components or the overall model framework.

R Resources

The R application comes packaged with the ACRP 3-23 Air/Rail Diversion Model. To work with the R scripts and R binary files outside of the model's GUI, using an integrated development environment (IDE), such as R Studio, is recommended.

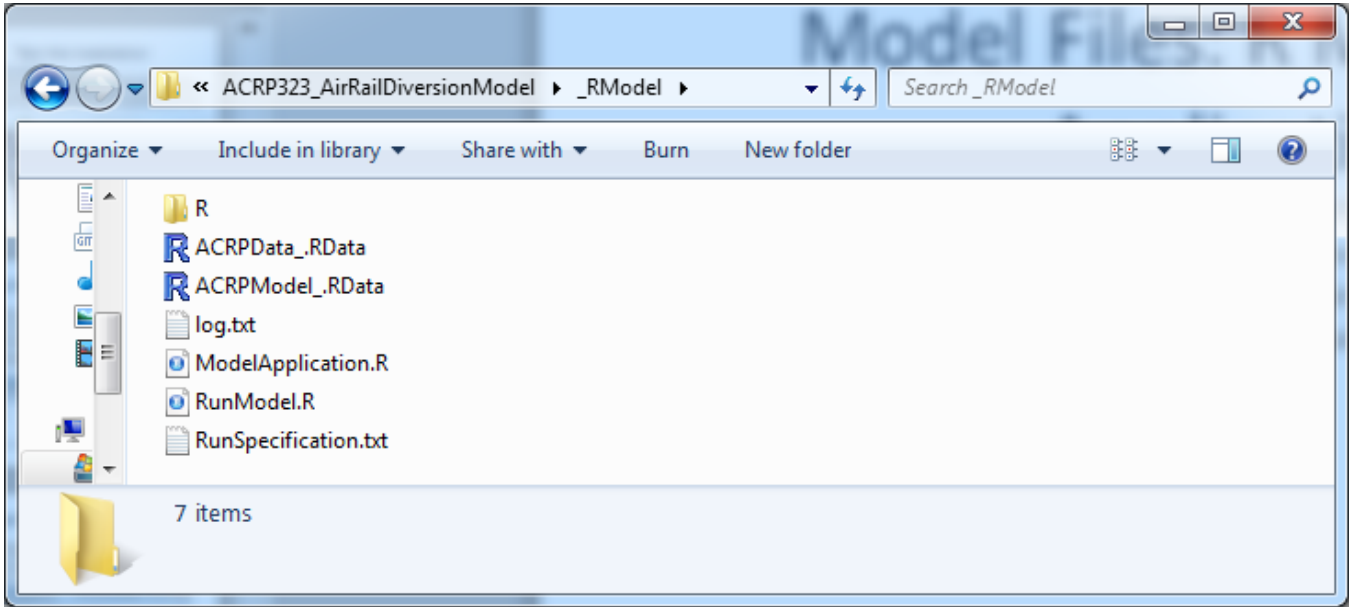
R Studio is an open source application and can be downloaded at http://www.rstudio.com/.

For new R users, model users are recommended to familiarize themselves with the R language prior to attempting to edit the model's R scripts. Resources such as http://www.r-project.org/ and http://www.r-bloggers.com/ are good places to start.

Model Files: R Model, Application

The _RModel folder contains the R folder, which is a version of the R application that is used to run the model. The files in that folder are as follows:

- ACRPData_.Rdata – R binary folder containing several input tabulations.
- ACRPModel_.Rdata – R binary folder containing model coefficients.
- Log.txt – log file from a model run (added when the model is run in installation).
- ModelApplication.R – R script containing the model code.
- RunModel.R – R script to run the model (added when the model is run in installation).
- RunSpecification.txt – text file written by the Excel GUI providing variables to R (added when the model is run in installation).



Model Files: ModelApplication.R (1)

ModelApplication.R is the R script containing the model code and encompasses all of the R code to run the model. Editing this script will allow the structure of individual model components or the overall model structure to be changed.

The overall structure of the file is as follows:

- Header (Lines 1-14): file meta data (e.g., author, version), and code to begin logging and timing.
- Functions (Lines 15-58): defined functions used later in the script to load R packages and to simulate logit models give a dataset and model specification/coefficients.
- Libraries (Line 59-67): load R packages required by the model (note: R packages are separate libraries of additional functions).
- Directories, input files, output files, models (Lines 68-226): loads in the input data, model coefficients, and creates directories for the outputs.
    - Make a list to store the directory references (Lines 73-111): creates a list structure to hold the directory references for inputs and outputs.
    - Read in input data (Lines 112 – 167): reads into memory all of the input data for the model being executed.
    - Load the tabulations of model coefficients (Lines 168-200): loads the model coefficients and applies calibration adjustments to them.

Model Files: ModelApplication.R (2)

- Directories, input files, output files, models (Lines 68-226): loads in the input data, model coefficients, and creates directories for the outputs
  - Load validation/general correspondence data (Lines 201-226): loads in tables of correspondences, and also applies the parameters from the run specification to the inputs data.
- Model Simulation (Lines 228-881): The simulation applies the 6 model steps.
  - Line 243 start the loop on years: the model is sequentially applied first for the base year and then for the future year. This loop runs until line 1031 and includes the next main section of code from line 882 to 1031 where summary model outputs are produced.
  - 1. Travel party sampling from enumerated list of travel parties (Lines 247-313) produces a travel party sampling from enumerated list of travel parties.
  - 2. Allocation of travel parties to Census Tracts (Lines 314-338) assigns each travel party to a census origin and destination tract.
  - 3. Simulation of additional travel party characteristics (Lines 339-354) adds income category and vehicle availability for each travel party.
  - 4. Airport and station choice and access and egress mode choice model (Lines 355-661) applies in turn the airport and station choice models:
    - Calculate airport to airport utility for all of the airport pairs with air service (Lines 360-402).

Model Files: ModelApplication.R (3)

- Model Simulation (Lines 228-881): The simulation applies the 6 model steps.
  - 4. Airport and station choice and access and egress mode choice model (Lines 355-661) applies in turn the airport and station choice models:
    - Calculate access and egress utilities for each airport-tract combination (Lines 403-413).
    - Builds the choiceset of otract-oairport-dairport-dtract combinations for each otract-dtract combination (Lines 414-442).
    - Apply the choice model for each party in the SynPop.. (Lines 443-490)
    - Station Choice (Lines 491-574).
    - HSR Station Choice (Lines 575-660).
  - 5. Main mode choice model (Lines 661-783) applies the main mode choice model between air and rail.
  - 6. Airline Response Model (Lines 784-871) applies the airline response model including reapplying the main mode choice model.
  - Save large model output files (Lines 872-876) . Save R binary files containing the detailed tables of results for each travel party.
- Produce Summary Model Outputs (Lines 882-1031) writes summary results.
  - County Summaries (Lines 896-960) are produced in memory.
  - Airport and Station summaries (Lines 961-990) are produced in memory.
  - Airline Response Summaries (Lines 991-1001) are produced in memory.
  - Results, including summaries for GUI are written to file (Line 1001-1031).

Model Files: ACRPData_.Rdata

ACRPData_.Rdata is an R binary folder containing several input tabulations that include geographical correspondence and validation data. It is loaded into memory in the Load validation/general correspondence data section of the simulation at line 203:

- Apeast is a table of observed passenger trips in 2008 between airports in the East coast study area.
- Apwest is a table of observed passenger trips in 2008 between airports in the West coast study area
- Countymsa is a correspondence table between counties and metropolitan statistical areas.
- Steast is a table of observed passenger trips in 2008 between rail stations in the east coast study area.
- Stwest is a table of observed passenger trips in 2008 between rail stations in the west coast study area.

Model Files: R Model, Application

ACRPModel_.Rdata is an R binary folder containing model coefficients. It is loaded into memory in the Load the tabulations of model coefficients section of the simulation at line 170. The file contains an R list object that contains 5 elements:

- MainModeChoiceBusiness: a table of coefficients for the business segment in the main mode choice model
- MainModeChoiceNonBusiness: a table of coefficients for the non-business segment in the main mode choice model
- AirportAccessChoice: a table of coefficients for the airport choice model
- CensusTractAllocation: a list of coefficients of the census tract allocation model
- AirlineResponse: a table of coefficients for the airline response model