**Cleveland Urban Area Metropolitan Planning Organization Travel Demand Model**

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**Model Installation and Application Guide**

Prepared for Cleveland TN MPO

FINAL DRAFT

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# Introduction

## Model Overview

Figure 1 shows a schematic of the Cleveland Urban Area Travel Demand Model. The model structure is patterned after the standard small area model adopted by the North Carolina Department of Transportation. The model is developed and applied completely within a Graphical User Interface (GUI).

Figure 1: Travel Model System

Zonal Demographics & Land Use Data

Highway Networks

Trip Generation

Trip Distribution

Mode Choice

Trip Assignment

Level-of-Service Matrices (skims)

Commercial Vehicles and External Station Analysis

Time of Day

## Directory Structure and File Naming

Proper application of the GUI requires that a specific directory structure and set of file-naming conventions be used. This directory structure identifies the location of files for each analysis year and scenario. The required directory structure is shown in Figure 2, the required parameter files are shown in Table 1, and required input files are shown in Table 2. The TransCAD scenario manager is used to create scenarios and will by default look for these files by the names shown in the respective tables and in the relative directory structure shown in Figure 2. An optional directory for support files has also been included. The scenario manager allows flexibility for changing the file names and locations, after a scenario is created with the default names.

Figure 2: Directory Structure

The required parameter files are included in the parameters directory and are applied to all scenarios. These files are described in Table 1.

Table 1: Name and Description of Parameter Files

|  |  |
| --- | --- |
| File Name | Description |
| CAPACITYTABLE.BIN | BIN file with capacities |
| ALPHA.BIN | BIN file with standard values for alpha coefficient |
| HHSIZE.BIN | Default household size curve coefficients |
| AUTOS.BIN | Default auto ownership curve coefficients |
| JOINTDIST.BIN | Joint household size/auto ownership seed matrix |
| PRODRATES.BIN | Default trip production rates |
| ATTRRATES.BIN | Default trip attraction rates |
| CVPRODRATES.BIN | Default commercial vehicle trip production rates |
| CVATTRRATES.BIN | Default commercial vehicle trip attraction rates |
| IXATTRRATES.BIN | Default IX trip attraction rates |
| GAMMACOEFFICIENTS\_LARGE\*.BIN | Default Gamma Coefficients |
| KFACTORS.MTX | User defined matrix of K-factors (if needed) |
| MODESHARES\_LARGE.BIN | Auto mode shares |
| VEHOCCUPANCYFACTORS\_LARGE.BIN | Vehicle occupancy factors |
| HOURLY\_LARGE.BIN | PA to OD TOD conversions |
| PEAKFACTORS\_LARGE.BIN | Peak hour factors used to convert hourly capacity to time period capacity |

Table 2: Scenario Input Files

|  |  |
| --- | --- |
| File Name | Description |
| \*\_SEDATA.BIN | Zonal data inputs and external station inputs for a given year and/or scenario |
| \*\_HIGHWAY.DBD | Highway network layer for a given year and/or scenario |
| \*\_EETRIPS.mtx | Input through trip table for given year and/or scenario |

\*represents name or year of scenario

An “Interim” folder is used to store interim files that are created during the model application process. These files are needed for reporting performance measures and running interim steps but are not necessarily defined as final output. Table 3 shows list of interim files.

Table 3: Scenario Interim Files

|  |  |
| --- | --- |
| File Name | Description |
| HBWGC\_PATH.MTX | Generalized cost skims by trip purpose |
| HBOGC\_PATH.MTX |
| NHBGC\_PATH.MTX |
| BALANCE\_PA.BIN | Initial balanced productions and attractions for internal trip purposes prior to adding non-resident trips |
| PER\_TRIPS.MTX | Person trip table |
| AUTOPER\_TRIPS.MTX | Auto person trip table |
| CV\_TRIPS.MTX | Commercial vehicle trip table |
| IX\_TRIPS.MTX | IX trip table |
| AMVEH\_TRIPS.MTX | Auto vehicle trip tables by time of day |
| MDVEH\_TRIPS.MTX |
| PMVEH\_TRIPS.MTX |
| OPVEH\_TRIPS.MTX |
| OP2VEH\_TRIPS.MTX | Interim OP trip table for processing |
| AMCV\_TRIPS.MTX | Commercial vehicle trip tables by time of day |
| MDCV\_TRIPS.MTX |
| PMCV\_TRIPS.MTX |
| OPCV\_TRIPS.MTX |
| OP2CV\_TRIPS.MTX | Interim OP CV trip table for processing |
| AMEE\_TRIPS.MTX | Through trip tables by time of day |
| MDEE\_TRIPS.MTX |
| PMEE\_TRIPS.MTX |
| OPEE\_TRIPS.MTX |
| OP2EE\_TRIPS.MTX | Interim OP EE trip table for processing |
| AMIX\_TRIPS.MTX | IX trip tables by time of day |
| MDIX\_TRIPS.MTX |
| PMIX\_TRIPS.MTX |
| OPIX\_TRIPS.MTX |
| OP2IX\_TRIPS.MTX | Interim OP IX trip table for processing |
| \*\_TLD\_\*\*.MTX | Trip length distribution files by purpose and impedance |

\* Trip purpose \*\* Impedance value (generalized cost, travel time, or distance)

Table 4 shows list of final output files for each scenario and they are maintained in the “Output” folder.

Table 4: Scenario Output Files

|  |  |
| --- | --- |
| File Name | Description |
| NETWORK.NET | Network file for path building and assignment |
| SHORTESTPATH.MTX | Skim matrix with zone to zone minimum travel time and associated distances. |
| GENCOST.MTX | Combined generalized cost matrix used in person trip distribution |
| BALANCE\_PA2.BIN | Balanced productions and attractions for internal person trips (NHB\*\_NR trips included), CV trips, and IX trips. |
| BALANCE\_CV.BIN |
| BALANCE\_IX.BIN |
| AMTOT\_TRIPS.MTX | Total vehicle trip tables by time of day |
| MDTOT\_TRIPS.MTX |
| PMTOT\_TRIPS.MTX |
| OPTOT\_TRIPS.MTX |
| AM\_LINKFLOW.BIN | Total vehicle link flow by time of day |
| MD\_LINKFLOW.BIN |
| PM\_LINKFLOW.BIN |
| OP\_LINKFLOW.BIN |
| TOTAL\_LINKFLOW.BIN | Daily total link flow |

## Input Files

**\*\_SEDATA.BIN**

This file contains all the internal and external zone fields and input data required by the model.

**\*\_HIGHWAY.BIN**

This file contains the highway line layer fields and input data required by the model.

**\*\_HIGHWAY\_.BIN (corresponding node layer)**

This \*\_HIGHWAY\_.BIN file has a corresponding node layer.

**\*\_EETRIPS.MTX**

This is the through trip matrix for a given scenario.

# Model Setup and Installation

Cleveland MPO model was developed, calibrated and validated using the TransCAD 8 Build 22360. The user should follow the following steps to setup and install the model.

### Step 1: Copy the Model Folder

Unzip the model transmittal folder “cleveland\_tn\_model.zip” with WinZip to the desired location. This model was originally setup and tested at “C:\models\cleveland\_tn\_model” location. The user can choose to setup this model to the desired location.

### Step 2: Model\_table.bin file

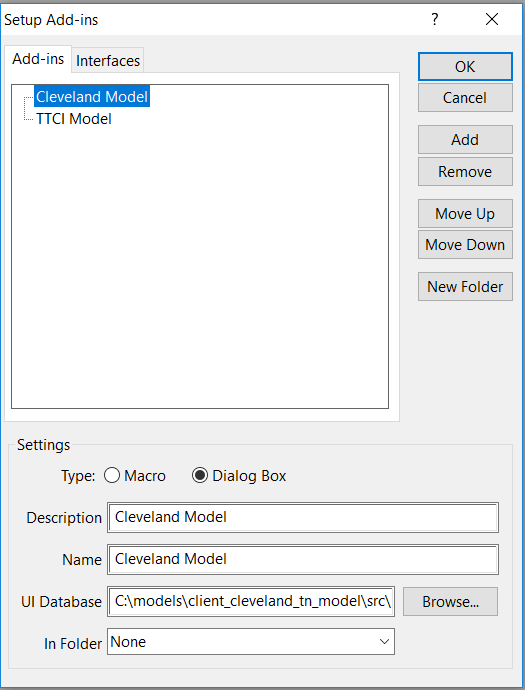
This step is for information purpose only. The user should not edit any parameters in this file, unless it’s mandatory. This model table has information about default file names, directory names and parameters are stored in the [src/model\_table.bin] file. When a new scenario is created, TransCAD will look for the BIN file and populate the new scenario with the default information. This file can be viewed from and edited within TransCAD as any binary file.

### Step 3: Scen\_file.arr file

This step is for information purpose only. When a scenario is created, specific information about that scenario is stored in the ARR file. This file contains specific information about all scenarios that have been created through the model GUI. This file is not editable except through the user interface.

### Step 4: Compile the Code and Install Add-In

1. Compile the [src/cleveland\_model.rsc] file to [src/ui.dbd] using the GISDK developer’s toolbar.
2. Tools – GIS Developer’s Kit - Setup Add-Ins
3. Add – Fill out the window as shown below
4. OK - This adds the program to the Add-In list (See Tools – GIS Developer’s Kit - Add-Ins)



This MUST be “Cleveland Model” exactly

Browse to the directory where you stored the compiled program

You can give the Add-in any description

Dialog Box

First select this button to add a new Add-in

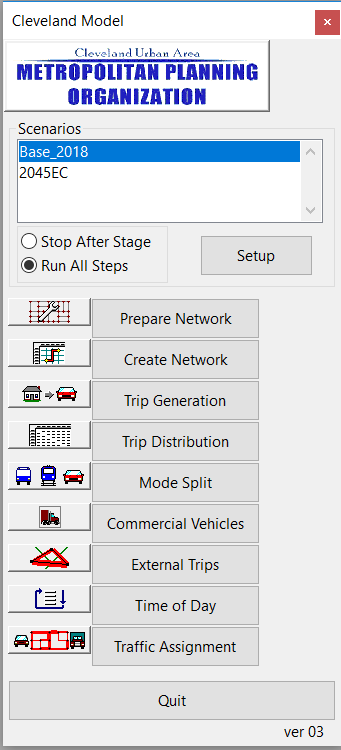
### Step 5: Open the GUI

1. Tools – GIS Developer’s Kit - Add-Ins – Cleveland Model
2. The model GUI will be displayed, and you are now ready to set up scenarios and run the model.

# Running the Existing Scenarios

The user can run the existing “Base\_2018” or “2045EC” scenarios as per the instructions below.

The user can also view the files associated with each scenario by highlighting the scenario in question and selecting the “Setup” button. This opens the Project Scenarios window. From there the user can highlight a specific step and view the input and output files by selecting the “Contents” button.



Select the scenarios that needs to be run

Check this box to run all steps [NOTE: if you want to run step by step check the other box instead.

These buttons are selected for running each step. If the box to run all steps is selected, clicking on prepare network will run all steps of the model, otherwise only the step selected will run.

# Model Report File

A model report file is generated for each scenario that is specified and run. The base year scenario report file is “Base\_2018\_report.txt” located at [\\Base\_Year](file:///\\Base_Year). The report file is a text file that includes model performance outputs from each model stage where model performance output is required. The output from each subsequent stage is simply appended to the end of the report file.

# Scenario Planning

Scenarios are created and edited by selecting the “Setup” button from the user interface. All information about default file names, directory names, and parameters are stored in the model\_table.bin file as described earlier. When a new scenario is created, TransCAD will look for the model\_table.bin file and populate the new scenario with the default information. This file can be viewed from and edited within TransCAD as any binary file. Specific information about all scenarios that a user has created is stored in the scen\_file.arr file. This file is not editable except through the user interface.

## Scenario Inputs

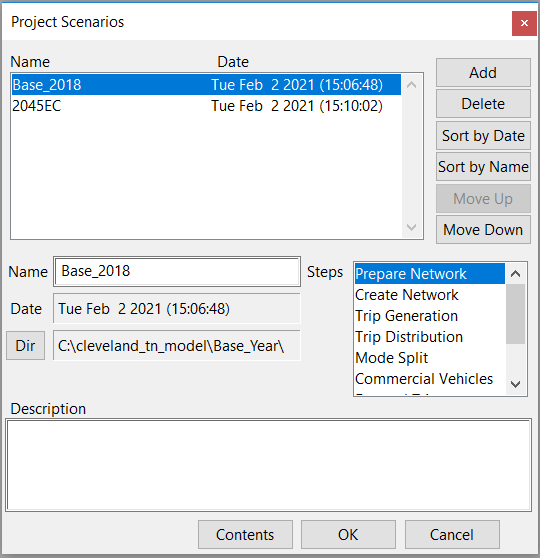
The required files for running a new scenario include model parameter files and model input files. The model parameter files, listed in Table 1, contain model constants, coefficients, rates, and other parameters that should not be changed for a given scenario. Only the input files listed in Table 2 can be updated without recalibrating the model set.

## Adding a New Scenario

To add a new scenario, click the “Setup” button on the user interface. The Project Scenarios window will be displayed. From this window scenarios can be added, deleted, and sorted. All available scenarios will be listed in the list box with the date and time of creation. A box is provided for a detailed description of the scenario.

Each scenario must have its own directory, and the directory and required subdirectories (See Figure 2) must already exist. If the directories exist, the user can select the DIR button and, using the Windows-like browser, select the location of the scenario data files and subdirectories.

Each stage of the model application is listed in the “Parameters for Step…” list box as described previously. These are the same Stages listed on the model user interface. As demonstrated previously, selecting the Contents button will display the input and output data files, and any applicable parameter for the highlighted Stage.



Select to choose directory

The user can select to view either the input or the output files by selecting the appropriate radio button under the file listing scroll box. The status column indicates whether the file already exists. As with the base year scenario, the user should check to see that all input files exist before executing the model. Further, if performance testing and output files from previous runs need to be saved, the user can change the name and/or location of the output files to avoid overwriting existing files. The highlighted file can be changed with the File button. The Dir button allows for global changes to file locations. The Open button allows the user to open and view the TransCAD file that is highlighted to verify the contents.

## Running a New Scenario

Once all input files for the new scenario are ready and the scenario has been set up the user can then run through all of the model stages to prepare new model outputs for the scenario. The user must review the reasonableness of the results and compare the base year and other scenarios to verify that the model has been run correctly and the results are in line with the underlying changes in land use and transportation networks.

# Appendix

Table 5: SE Data Required Inputs

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Field Name | Field Type | Width | Decimal | Description |
| TAZ | Integer (4 bytes) | 10 | 0 | Traffic analysis zone |
| Households | Integer (4 bytes) | 11 | 0 | Households in zone |
| HHPopulation | Integer (4 bytes) | 11 | 0 | Population in zone |
| GQPopulation | Integer (4 bytes) | 11 | 0 | Population in zone for Group Quarters |
| Vehicles | Integer (4 bytes) | 10 | 0 | Autos in zone |
| Industry | Integer (4 bytes) | 11 | 0 | Industry employees |
| Retail | Integer (4 bytes) | 11 | 0 | Retail employees |
| HwyRet | Integer (4 bytes) | 11 | 0 | High traffic retail employees |
| Service | Integer (4 bytes) | 11 | 0 | Service employees |
| Office | Integer (4 bytes) | 11 | 0 | Office employees |
| TotEmp | Integer (4 bytes) | 11 | 0 | Total employment |
| Students | Integer (4 bytes) | 11 | 0 | Students |
| ixp | Real (8 bytes) | 10 | 2 | IX productions |

Table 6: Highway Line Layer Required Inputs

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Field Name | Field Type | Width | Decimal | Description |
| ID | Integer (4 bytes) | 10 | 0 | Link ID |
| Dir | Integer (2 bytes) | 2 | 0 | Link DIR |
| Length | Real (8 bytes) | 10 | 2 | Link length |
| Posted Speed | Real (8 bytes) | 10 | 2 | Link posted speed |
| Facility Type | Character | 24 | 0 | Facility Type Description |
| FACTYPE\_CD | Integer (4 bytes) | 8 | 0 | Link facility type code |
| DIVIDED\_CD | Integer (4 bytes) | 8 | 0 | Cross-section code |
| AB Lanes | Integer (4 bytes) | 8 | 0 | Number of lanes AB |
| BA Lanes | Integer (4 bytes) | 8 | 0 | Number of lanes BA |
| FUNCL\_CDtorem | Integer (4 bytes) | 8 | 0 | Functional class code |
| Terrain\_CD | Integer (4 bytes) | 8 | 0 |  |
| AB Count | Integer (4 bytes) | 10 | 0 | Link count AB and BA |
| BA Count | Integer (4 bytes) | 10 | 0 |  |
| DailyCount | Integer (4 bytes) | 10 | 0 | Link daily count |
| Screenline | Integer (4 bytes) | 10 | 0 | Screenline link indicator |