Final

BCAG 2024 RTP Travel Demand Model

Model User Guide

Prepared for:
Butte County Association of Governments

June 2025

RS22-4241

FEHR PEERS

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OVERVIEW

This document contains information on the use of the BCAG TDF Model for the most common functions of forecasting and regional planning. The details that are specific to model development, reasonableness checks, and validation are contained in the Model Development Report.

SUMMARY OF INFORMATION TO UPDATE

The table below summarizes the types of data used by the model, suggested update or review, the source of the data, and a reference to the appropriate section of the user guide.

Description	Variables	Source and Scale of current implementation	Scale of potential implementation	Update Frequency
Highway network	***Lanes, facility type, speed***	MPO RTP model Highway link	Highway link	Often; infrastructure project, RTP, etc.
Transit access	***Headway***	MPO RTP model TAZ	TAZ	Occasional; transit plan, RTP, etc.
Land use control totals	***Occupied housing units, occupied thousand square feet, school enrollment, casino slots***	DOF, EDD, MPO RTP model TAZ	TAZ	Often; development project, RTP, etc.
Developed area	***Total developed area (or residential and commercial acres)***	MPO RTP model TAZ	TAZ	Often review and occasional update; every land use scenario
Household demographics	***HHPOP, HHSize_HHIncome, HHAge, etc.***	Census (ACS) PUMA	TAZ	Often review and occasional update; every land use scenario

Description	Variables	Source and Scale of current implementation	Scale of potential implementation	Update Frequency
Percentages of employment that are high, medium, and low income, by job sector	***EMP_EDUH, EMP_EDUM, EMP_EDUL, etc.***	LODES County	TAZ	Often review and occasional update; every land use scenario
Percentages of trips produced & attracted to TAZ, by trip purpose	***HBWH_ix, HBWH_xi, HBWM_ix, HBWM_xi, etc.***	CHTS, Big Data (StreetLight) Census Place	TAZ	Often review and occasional update; every land use scenario
Trip productions and attractions by gateway	***HS_P, HS_A, etc.***	CSTDM Gateway	Gateway	Often review and occasional update; every land use scenario
Home-work gateway attractions by income group	***HWH_P, HWH_A, HWM_P, HWM_A, etc.***	CHTS Gateway	Gateway	Often review and occasional update; every land use scenario
Through Trips	***HW_XX, HS_XX, etc.***	CSTDM, Big Data (StreetLight) Gateway	Gateway	Often review and occasional update; every land use scenario
Trip Generation	***Person trips by land use category***	CHTS TAZ	TAZ	Often review and occasional update; every land use scenario
Other factors	***Auto operating cost, mode choice, etc.***	Model wide	Model wide	Rarely; model calibration based on new data

Description	Variables	Source and Scale of current implementation	Scale of potential implementation	Update Frequency
"D" Variables	***Sidewalk coverage, route directness, intersection density***	Base GIS network TAZ	TAZ	Often review and occasional update; every land use scenario

PREPARE, SETUP, AND RUN THE MODEL

This section describes preparing a computer that does not currently have Cube or the model installed, and includes an overview of the software requirements, setting up the model as received, running the scenarios that correspond to the validation year and RTP scenario as entire model or specific sub-group applications, and running the post-processors. The following chapters include instructions on creating new scenarios and preparing new scenario input data.

REQUIRED SOFTWARE

As of June 2025, the latest available version of Cube is OpenPaths Cube. However, since the current BCAG 2024 RTP/SCS model was developed and tested using Cube 6.4.3, upgrading to a different version is not recommended at this time. Future testing is recommended to assess compatibility in terms of both functionality and licensing methods before considering any version upgrades.

SOFTWARE LICENSING

- Enterprise or individual licensing
- Cube Base, Cube Voyager, and Cube Cluster

SOFTWARE REQUIREMENTS

Cube 6.4.3 Software

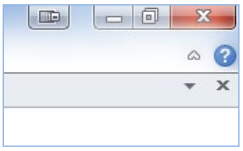
Cube is a proprietary software package developed, licensed, and marketed by Bentley Systems, Inc. (formerly Citilabs). A Cube software license is required to run the BCAG travel demand model, and must be obtained directly from Bentley.

The BCAG model was developed and applied using Cube version 6.4.3. Cube Voyager, the core computational engine of the Cube suite, operates using its own proprietary scripting language and is essential for model execution.

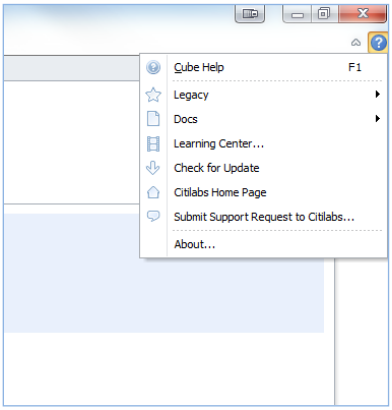
Cube Cluster, an additional component of the Cube software suite, enables distributed processing across multiple cores, significantly reducing model run times. While the BCAG model can be configured to run without Cube Cluster, doing so will result in substantially longer run times and is not recommended.

Review Software Version

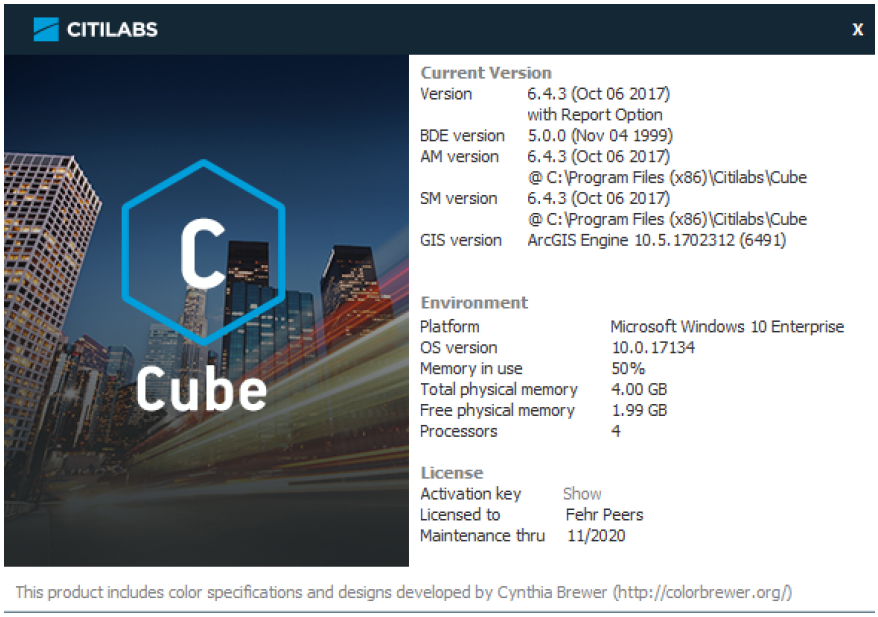
- Open Cube via the Start menu or by double-clicking the icon on your desktop
- Verify the version of your software
  - Click on the ***question mark*** at the top right corner of the program window.



  - Click ***About…*** in the drop down menu.



  - Review and note the Version, License No., and Processors of Cube 6



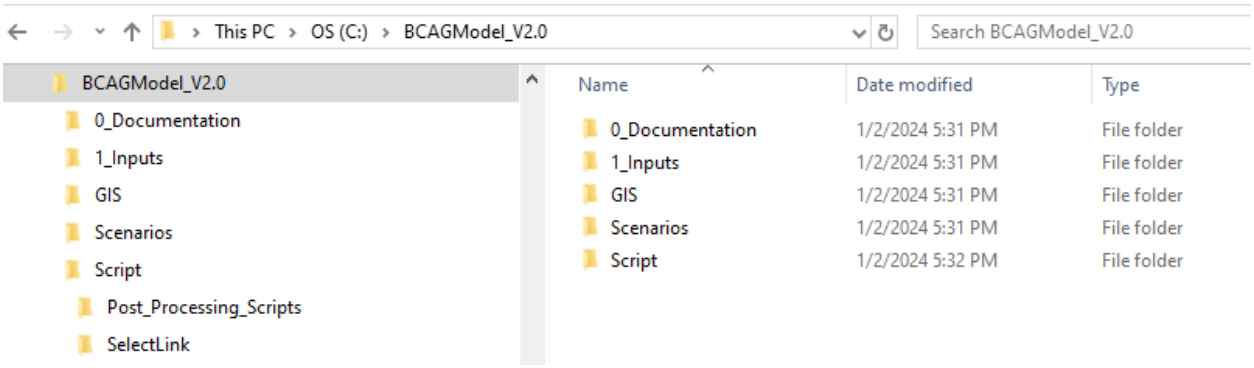
MODEL FILE SETUP

Install Model

- Unzip the contents to a directory where you would like to store the model run data.
  - This can be on a different drive or partition than the Citilabs software
  - It is recommended that the directory be local rather than on the network and have at least 10GB of storage for each scenario that you plan to run

File Descriptions

- The directory structure for the model will look similar to the image below, along with a general description of each directory and its contents. Please make sure to keep the directory structure as shown below, since it is defined in the model script. If any changes are made to the directory structure, corresponding changes should be made to the model scripts (i.e., ControlFiles.s).



  - 0_Documents – Model Development Report and Model User Guide with supporting documents not directly related to the model run itself.
  - 1_Inputs – The inputs listed by type for the validated base year and other scenario years. The following folder structure is the recommended directory structure and default input location to organize input data.
    - 1_TAZ – TAZ input data for different scenario years, saved in CSV format.
    - 2_SED – SED related input data including occupancy adjusted land use input by TAZ, gateway trip percentage, and special generator trip input (currently not used).
    - 3_Highway – Network files for each scenario year in Voyager binary .NET format. The turn penalty input tables are also stored in this directory.
    - 5_External – Through trip matrix for different scenario years.

- 5_ExternalTruck – Files from the interregional goods movement model: Auto and Truck interregional matrix files in Voyager binary .MAT format.
- 6_Static – All other files that are used for model run, including auto operating cost look up table, auto ownership parameters, cross class person trip generation rate table, cross class truck trip generation rate table, capacity look up table, diurnal factors, mode choice parameters.

- GIS – Three accessibility related inputs files: intersection density, Walk mile, and VMT seed.
- Scenarios – Model output files are saved in Scenarios folder, organized by test scenarios.
- Script – Scripts that are used to run the model, and the control files that include the directory of all input and output files. Additional scripts are included to provide post-processing model summaries.

RUNNING THE MODEL

UPDATE MODEL DIRECTORY STRUCTURE

- Open the **ControlFile.s** saved in the "Script" folder with Notepad or any other coding software.
- Update "ScenarioYear", "Scenario" and "Folder" for the planned model run.
- "ScenarioYear" represents the scenario year of the planned model run, currently the model includes 2018, 2020, 2022, 2025, 2030, 2035, 2040, 2045 scenario years. However, only the 2022, 2035, and 2045 scenarios have been updated with corresponding inputs for the 2024 RTP/SCS. All other scenario years are placeholders and can be used as needed with appropriate input updates.
- "Scenario" is the name of the model run, this name will be added to all model output files.
- "Folder" is the folder name where the model run output will be saved, this name can be different from the scenario name.

```
Zones           = 1570
ScenarioYear    = 2022
Scenario        = 'BCAG22_RTP_2022'
Folder          = 'BCAG22_RTP_2022'
ClusterNodes    = 4
ScenarioCompare = 'BCAG22_RTP'
FolderCompare   = 'BCAG22_RTP'
```

UPDATE MODEL INPUT FILES

Scenario Specific Inputs

In the **ControlFile.s**, there're details about the name and directory of different model input files. The following are the three scenario specific inputs that should be updated for the selected model run scenario.

- Scenario Years
  - Model current includes the detailed inputs for years 2022, 2035, and 2045. If a new scenario year is needed for the planned model run, the corresponding inputs need to be prepared.

```
;=============================================================================================================
; Model Input files that is connected to the control data
; If scenario Year anything other than 2018, 2020, 2022, 2030, 2035, 2040, or 2045, specify new file names here
;=============================================================================================================

    IF (ScenarioYear=2018)
        TAZData         = '1_Inputs\1_TAZ\BCAG18_TAZData.csv'
        LandUse         = '1_Inputs\2_SEData\2018_LandUse_TAZ_occupancy_adjusted.dbf'
        XXThrough       = '1_Inputs\5_External\BCAG18_Base_Through_Trips.csv'

    ELSEIF (ScenarioYear=2020)
        TAZData         = '1_Inputs\1_TAZ\BCAG20_TAZData.csv'
        LandUse         = '1_Inputs\2_SEData\2020_LandUse_TAZ_occupancy_adjusted.dbf'
        XXThrough       = '1_Inputs\5_External\BCAG20_Base_Through_Trips.csv'

    ELSEIF (ScenarioYear=2022)
        TAZData         = '1_Inputs\1_TAZ\BCAG22_TAZData.csv'
        LandUse         = '1_Inputs\2_SEData\2022_LandUse_TAZ_occupancy_adjusted.dbf'
        XXThrough       = '1_Inputs\5_External\BCAG22_Base_Through_Trips.csv'

    ELSEIF (ScenarioYear=2030)
        TAZData         = '1_Inputs\1_TAZ\BCAG30_TAZData.csv'
        LandUse         = '1_Inputs\2_SEData\2030_LandUse_TAZ_occupancy_adjusted.dbf'
        XXThrough       = '1_Inputs\5_External\BCAG30_Base_Through_Trips.csv'

    ELSEIF (ScenarioYear=2035)
        TAZData         = '1_Inputs\1_TAZ\BCAG35_TAZData.csv'
        LandUse         = '1_Inputs\2_SEData\2035_LandUse_TAZ_occupancy_adjusted_S2.dbf'
        XXThrough       = '1_Inputs\5_External\BCAG35_Base_Through_Trips.csv'

    ELSEIF (ScenarioYear=2040)
        TAZData         = '1_Inputs\1_TAZ\BCAG40_TAZData.csv'
        LandUse         = '1_Inputs\2_SEData\2040_LandUse_TAZ_occupancy_adjusted.dbf'
        XXThrough       = '1_Inputs\5_External\BCAG40_Base_Through_Trips.csv'

    ELSEIF (ScenarioYear=2045)
        TAZData         = '1_Inputs\1_TAZ\BCAG40_TAZData.csv'
        LandUse         = '1_Inputs\2_SEData\2045_LandUse_TAZ_occupancy.dbf'
        XXThrough       = '1_Inputs\5_External\BCAG45_Base_Through_Trips.csv'
    ENDIF
```

- Scenario specific inputs
  - TAZ data: This table contains the cross-classified residential factors, interregional travel percentages by purpose, simplified transit headways, parking fees, and other TAZ level information.
  - Land Use: This table contains the control total by zone in terms of occupied residential and occupied non-residential units.

- Through Trip Matrix: trough trip matrix is saved in tabular layout in the table with personal vehicles traveling through the model area.
- Update the table name or replace the data in the table with changes for planned model run. When default setup is used, the model will run the selected scenario based on the off-the-shelf model inputs.

Additional Model Inputs

In the **ControlFile.s**, following the scenario specific inputs, there're details about the name and directory of other model input files that are rarely changed.

- Additional model input files

```
;================================================================================
; Additional Model Input Files
; These are static data that do not change between scenarios
;================================================================================

    MasterNetwork       = '1_Inputs\3_Highway\BCAG_2024RTP_Master_Network.net'
    GatewayZone         = '1_Inputs\2_SEData\BCAG22_Base_Gateways.csv'
    SpecialGenerators   = '1_Inputs\2_SEData\BCAG22_Base_SpecialGenerators.csv'
    MXDParameters       = '1_Inputs\6_Static\Base_SmartGrowthParam_NoReduction.csv'
    TurnPenalties       = '1_Inputs\3_Highway\BCAG22_TURNPEN.csv'
    Truck_FutureMatrix  = '1_Inputs\5_ExternalTruck\BCAG40_ExternalTruckTripTable_F.MAT'
    Truck_BaseMatrix    = '1_Inputs\5_ExternalTruck\BCAG07_ExternalTruckTripTable_F.MAT'
    Turns               = '1_Inputs\3_Highway\TURNS.txt'
```

- Master Network: The model network file includes key details such as the number of lanes, speed, facility type, and other network attributes for various model scenario years. However, it is important to note that the 2024 RTP/SCS includes multiple land use and network alternatives, each with its own corresponding network input files. Be sure to use the correct version of the network input file as specified in the "Control File" for the scenario being run. If the model is being run for a scenario year that is not among the pre-prepared years (e.g., 2028 or 2036), the corresponding network details must be added to the master network file prior to running the model.
- Gateway Zone: This table contains the initial trip through each gateway. Keep the default value unless special changes are needed.
- Special Generators: There are trips by purpose that cannot be accurately reflected by multiplying the trip generation and the land use. Note that special generators are additive to the land use generated trips. There's no value in the current input file, but additional data can be added.
- MXD Parameters: Smart growth function that is not used by the off-the-shelf model.
- Turn Penalties: This table usually includes prohibitions for turning.
- Truck Matrix: Fixed truck trip matrix for existing and future scenarios.

- Turns: This table can be used if turning movement outputs are needed for selected study areas.

- Calibration Factor Files

```
;================================================================================
; Calibration Factor Files
; These are static files that do not change between scenarios
;================================================================================

    TripGenRates        = '1_Inputs\6_Static\BCAG_2022CrossClass_TripRates.csv'
    TruckGenRates       = '1_Inputs\6_Static\CrossClass_TripRates_Trucks.csv'
    SpdCapLookup        = '1_Inputs\6_Static\Capacity_Assignment.csv'
    AutoOpCosts         = '1_Inputs\6_Static\AutoOperatingCost.csv'
    ModeChoice          = '1_Inputs\6_Static\ModeChoiceParam.csv'
    AutoOwnership       = '1_Inputs\6_Static\AutoOwnParam.csv'
    FrictionFactors     = '1_Inputs\6_Static\FFParam.csv'
    DiurnalFactors      = '1_Inputs\6_Static\DiurnalFactors.csv'
```

- Trip Generation Rates: This table contains person trip generation rates by trip purposes, land use types and area types.
- Truck Trip Generation Rates: This table contains truck trip generation rates.
- Speed Capacity Look Up: This look up table is used to calculate roadway lane capacity based on number of lane, facility type, posted speed and other network related inputs.
- Auto Operation Costs: This is a look up table providing AOC by year.
- Mode Choice Parameters: This table includes mode choice parameters.
- Auto Ownership: This table includes auto ownership parameters.
- Friction Factors: This table includes friction factors used for trip distribution model.
- Diurnal Factors: This table includes diurnal factors used to develop assignment outputs for different time periods.

- Accessibility related files

```
;================================================================================
; Calculate Accessibility
; These are static files that do not change between scenarios
;================================================================================

    Intersections       = 'GIS\Intersections.dbf'
    RoadwayMiles        = 'GIS\Walk_MI.dbf'
    CommuteVMTSeed      = 'GIS\VMTseed.csv'
```

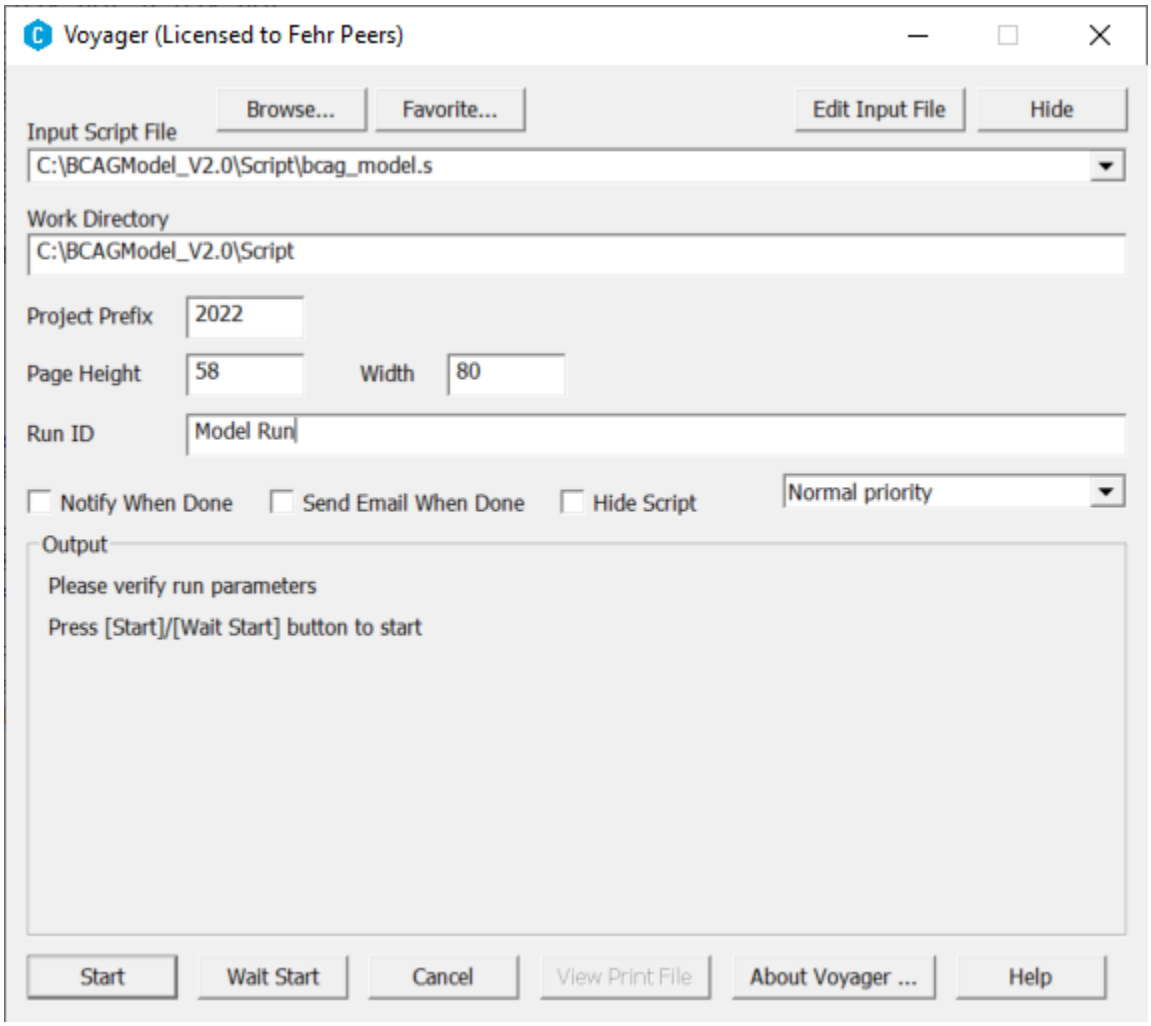
- These three files contain intersection density, roadway mileage, and VMT estimation details by TAZ to estimate accessibility by TAZs.

SET UP MODEL RUN

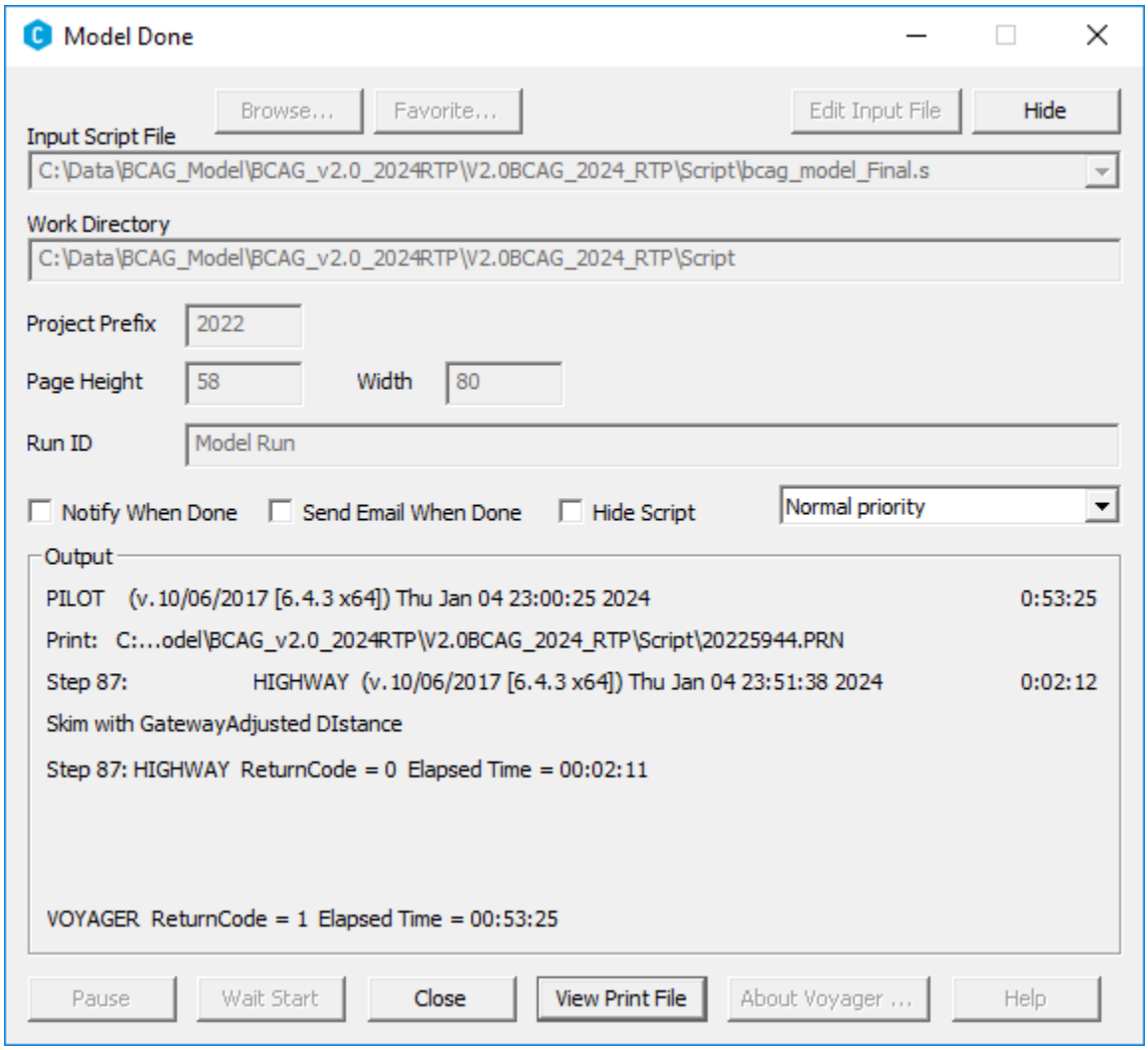
Once all mode input files are updated, and **ControlFile.s** is updated with the correct input files. Open the **bcag_model.s** saved in the "Script" folder with Notepad or any other coding softwares.

```
;=============================================================================
;  ****** Read Control File ******
;=============================================================================

 READ FILE= "ControlFile.s"
```

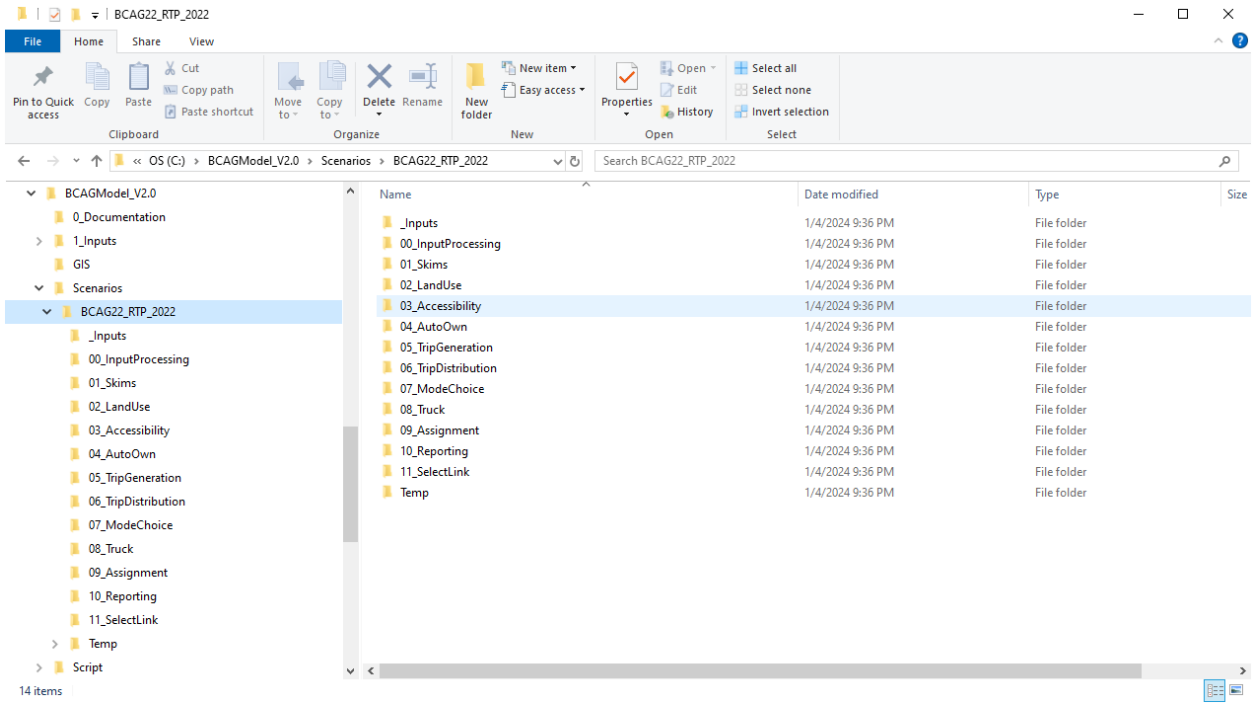
- Make sure the correct **ControlFile.s** is read into the **bcag_model.s** script. If the control file is saved into a different name, update the file name in the bcag_model.s file.
- Make sure **ControlFile.s** and **bcag_model.s** are saved in the same folder.
- Once the **ControlFile.s** and **bcag_model.s** are both ready, drag bcag_model.s into Cube Voyager to open the script.



- The correct "Input Script File" and "Work Directory" should be automatically updated when opening bcag_model.s in Cube Voyager. If not, manually update the directory of the input script and work folder.
- Click on **Start** to run the script.
- Once the model run is finished, the following window will pop up.



- Close the window and all the output files should be saved in the corresponding scenario folder.
- The full model run takes about 45 minutes to 1 hour to finish.



POST PROCESSORS

After the model is run there are a number of post-processors that can be run to prepare model data. The post-processors can be found under **Script\Post_Processing_Scripts**. Many of these post-processor results are used in model validation and scenario comparison.

RUNNING POST PROCESSOR SCRIPTS

Similar to how full model run is set up and run, post processor scripts also need to run through Cube Voyager.

- Open one post processor script and confirm the correct control file is read into the script.

```
;=============================================================================
;  ****** Read Control File ******
;=============================================================================

READ FILE= "..\ControlFile.s"
```

- Drag the updated post processor script into Cube Voyager and follow the same steps as how full model run is setup.
- Click on **Start** to run the selected post processor script.

- Once the post processor script is run successfully, close Cube Voyager. The post processing outputs are saved in Scenario_Name\10_Reporting.
- The running time varies by the post processor scripts, but the total run time for each script should be less than 30 minutes (some post processor scripts might run within 1-2 minutes).

SB 743 VMT SUMMARY

Outputs SB 743 VMT matrices, i.e., vehicle trips and VMT summarized by production and attraction, by trip purposes and by TAZ.

- Run "03_Post_Processing_SB743_VMT"
- The following summary is generated in Scenario_Name\10_Reporting
  - Scenario_Name_VMT_SB743.DBF
  - Scenario_Name_VMT_SB743.MTX

OD VMT SUMMARY

Outputs OD VMT matrices, i.e., vehicle trips and VMT summarized by origin and destination, by II, IX and XI and by TAZ.

- Run "04_Post_Processing_OD_VMT"
- The following summary is generated in Scenario_Name\10_Reporting
  - Scenario_Name_VMT_ODVMT_Model.DBF
  - Scenario_Name_VMT_ODVMT_Model.MTX

MODE SPLIT AND TRIP DISTRIBUTION SUMMARY

Outputs detailed mode split and trip distribution summary information.

- Run "07_Post_Processing_Trip_Mode_Choice_Summary"
- The following ten summaries are generated in Scenario_Name\10_Reporting
  - MODE_CHOICE_SUMMARY
  - MODE_CHOICE_SUMMARY_II
  - MODE_CHOICE_SUMMARY_IX
  - MODE_CHOICE_SUMMARY_XI

- MODE_CHOICE_SUMMARY_XX
- DISTRIBUTION_SUMMARY
- DISTRIBUTION_SUMMARY_II
- DISTRIBUTION_SUMMARY_IX
- DISTRIBUTION_SUMMARY_XI
- DISTRIBUTION_SUMMARY_XX

TRIP LENGTH FREQUENCY SUMMARY

Outputs trip length frequency summary information.

- Run "09_Post_Processing_TripDurationSummary"
- The following summary is generated in Scenario_Name\10_Reporting
  - TripDurationSummary.DBF

NETWORK AND SED COMPARISON

Compare user-defined network and SED against model scenario network and SED.

- In the control file, make sure to update the name of the user-defined network and SED for comparison.

```
;================================================================================
; Post Processing Parameters/Files
; These are static data that do not change between scenarios
;================================================================================

    ITEZones            = '101-105'
    GatewayAdjust       = '1_Inputs\5_External\BCAG18_Base_GatewayAdj.csv'
    BaseNetworkComp     = 'Scenarios\BCAG22_RTP_2022_Run1\09_ASSIGNMENT\BCAG22_RTP_2022_Run1_LOADEDNETWORK.NET'
    BaseSEDetailComp    = 'Scenarios\BCAG22_RTP_2022_Run1\02_LandUse\BCAG22_RTP_2022_Run1_SEDetail.CSV'
```

- Run "06_Post_Processing_Compare_Network_SED"
- The following summary is generated in Scenario_Name\10_Reporting
  - Scenario_Name_CompareLoading.NET
  - CompareSEDetail.DBF

SELECT LINK ANALYSIS / FRATAR TO ITE CONTROL TOTALS

Creates select link or zone analysis for review. The select link/zone script is saved: Script\SelectLink. If desired, select zone can be adjusted to match ITE control totals for easier review of select zone. The high level steps for this process are:

- Full model run with land use representing the project
- Prepare trip generation target and input file
- Run select link/zone script using Cube Voyager
- Review results

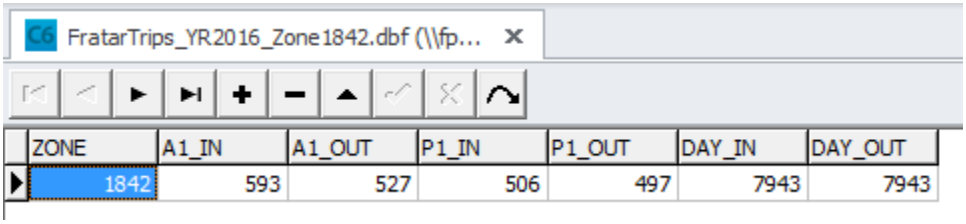
Full Model Run Preparing for Select Link/Fratar

The Select Link and Fratar post-process is based on a full model run for a given scenario and tracks the route/distribution of auto trips for a single zone or a group of zones. Before running the model, it is recommended to review the TAZ boundary to determine which zone(s) reflect the project, the land use in the zone(s), and if additional zones should be created.

- Appendix A contains maps of the TAZ numbers.
- Review the land use in the zone and compare with the project land use. Typical projects fall into one of the following cases.
  - Case A: The land use is similar in type and magnitude and if the project represents the entire zone. No additional changes are needed.
  - Case B: The land use is not similar in type and magnitude, but represents the entire TAZ. Update the land use to reflect the project.
  - Case C: The land use is similar in type and magnitude, but does not represent the entire TAZ. Identify a vacant TAZ within the same zone range, modify the land use in the original zone and project zone to match the type and magnitude of land use, add a centroid and connector to the master network using the same attributes as the original zone.
  - Case D: The land use is not similar in type and magnitude and the project does not represent the entire original zone, or the entire project is in addition to the existing land use in the zone. Identify a vacant TAZ within the same zone range, leave the land use in the original zone and add the project land use to the vacant zone, add a centroid and connector to the master network using the same attributes as the original zone.

Prepare trip generation target and input file

- Determine the net new project vehicle trips for AM Peak 1hr, PM Peak 1hr, and Daily using empirical data, regionally validated trip generation rates, ITE, MXD+, or other methods.
- Copy and rename the 1_Inputs_Support\Tools\FratarTrips.DBF to a project specific name, and open in Cube or Excel.
- Edit the Zone number(s) and inbound/outbound trips by time of day to reflect the project. Save the file and close.



ZONE	A1_IN	A1_OUT	P1_IN	P1_OUT	DAY_IN	DAY_OUT
1842	593	527	506	497	7943	7943

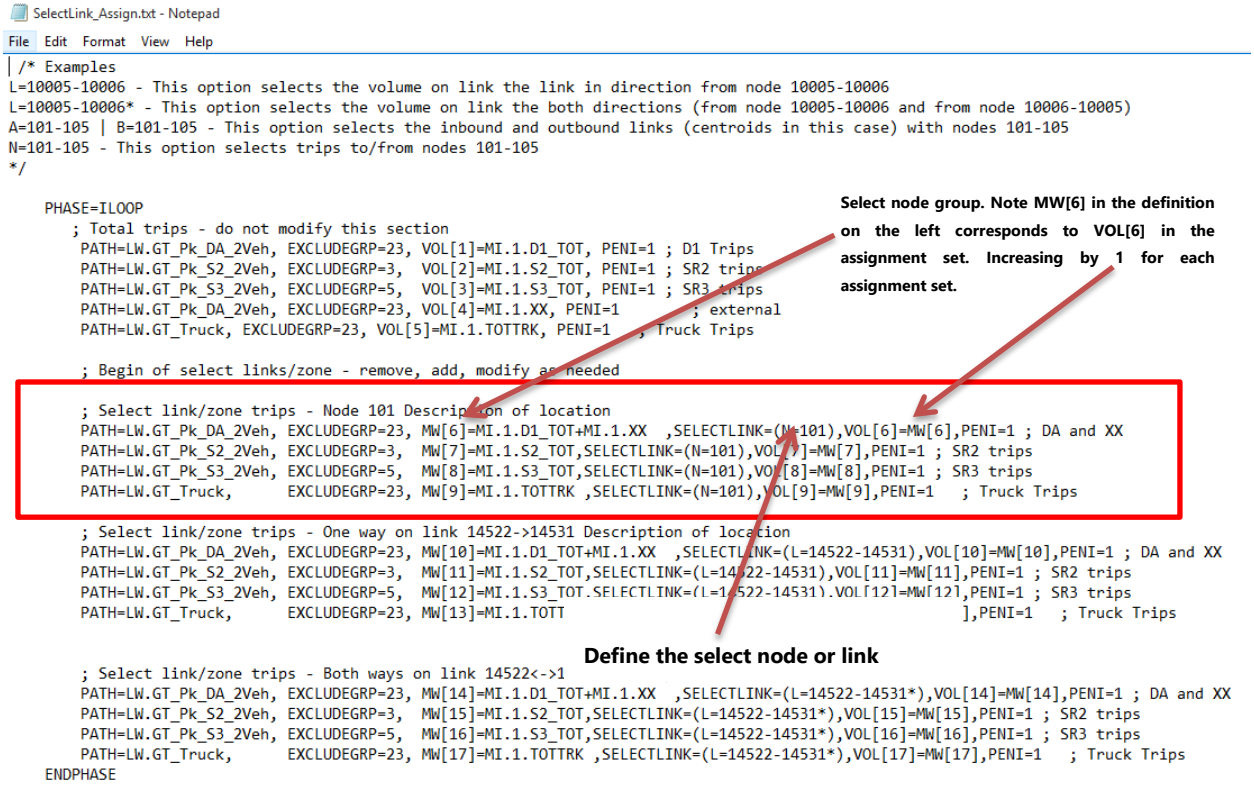
Define Scenario detail in Control File and run the post-processor script

- Open the Control File, and update the following fields as needed.

```
;=============================================================================
; Post Processing Parameters/Files
; These are static data that do not change between scenarios
;=============================================================================

    ITEZones            = '101-105'
    GatewayAdjust       = '1_Inputs\5_External\BCAG18_Base_GatewayAdj.csv'
    BaseNetworkComp     = 'Scenarios\BCAG22_RTP_2022_Run1\09_ASSIGNMENT\BCAG22_RTP_2022_Run1_LOADEDNETWORK.NET'
    BaseSEDetailComp    = 'Scenarios\BCAG22_RTP_2022_Run1\02_LandUse\BCAG22_RTP_2022_Run1_SEDetail.CSV'

;=============================================================================
; SelectLink or Selectzone Parameters/Files
; These are static files that do not change between scenarios
; Update AdjustTrips if desired
;=============================================================================

    TargetTrips         = '1_Inputs\_Support\Tools\FratarTrips.dbf'         ; Target Trips by zones for ITE
    SZScript            = 'SelectLink_Assign.txt'       ; SelectLink or Selectzone assignment scripts
    SZSummary           = 'SelectLink_Summary.txt'      ; SelectLink or Selectzone summary scripts
    RailRidership       = '1_Inputs\_Support\Tools\RailStationTrips.dbf'    ; External Rail Riders
    OriginZones         = 101-1570                                          ; Range of origin zones for summary
    DestZones           = 101-1570                                          ; Range of origin zones for summary
```

  - ITE Zones: If Fratar trip adjustments are used for the project TAZs, identify the project TAZs here. If Fratar trip adjustments are not used, leave the number as default.
  - Target Trips: update the name of the fratar trip input file.
- Update the Select Link text file for assignment (Script\SelectLink\SelectLink_Assign.txt)
  - Copy or Save As the current example file
  - Copy and paste the block of text for the number of select links/nodes desired

- Update the matrix numbers incrementing by 1 and keeping the matrix and assignment values consistent
- Update the select link/node value
- Save the file



- Update the Select Link summary file (Script\SelectLink\SelectLink_Summary.txt)
- Copy or Save As the current example file
- Copy and paste the block of text for the number of select links/nodes desired
- Update the volume set numbers with the clean name to refer to the appropriate Select Link volume group
- Save the file

SelectLink_Summary.txt - Notepad

File Edit Format View Help

```
; Select Link 1 Trips
; AM Peak Period
; Directional
A03_DA_SL1=LI.1.V6_1
A03_SR2_SL1=LI.1.V7_1
A03_SR3_SL1=LI.1.V8_1
A03_TRK_SL1=LI.1.V9_1
A03_PAS_SL1=A03_DA_SL1+A03_SR2_SL1+A03_SR3_SL1
A03_VOL_SL1=A03_PAS_SL1+A03_TRK_SL1

; Non-Directional
TOT_A03_DA_SL1=LI.1.V6T_1
TOT_A03_SR2_SL1=LI.1.V7T_1
TOT_A03_SR3_SL1=LI.1.V8T_1
TOT_A03_TRK_SL1=LI.1.V9T_1
TOT_A03_PAS_SL1=TOT_A03_DA_SL1+TOT_A03_SR2_SL1+TOT_A03_SR3_SL1
TOT_A03_VOL_SL1=TOT_A03_PAS_SL1+TOT_A03_TRK_SL1

; Mid-Day Period
; Directional
M07_DA_SL1=LI.1.V6_2
M07_SR2_SL1=LI.1.V7_2
M07_SR3_SL1=LI.1.V8_2
M07_TRK_SL1=LI.1.V9_2
M07_PAS_SL1=M07_DA_SL1+M07_SR2_SL1+M07_SR3_SL1
M07_VOL_SL1=M07_PAS_SL1+M07_TRK_SL1

; Non-Directional
TOT_M07_DA_SL1=LI.1.V6T_2
TOT_M07_SR2_SL1=LI.1.V7T_2
TOT_M07_SR3_SL1=LI.1.V8T_2
TOT_M07_TRK_SL1=LI.1.V9T_2
TOT_M07_PAS_SL1=TOT_M07_DA_SL1+TOT_M07_SR2_SL1+TOT_M07_SR3_SL1
TOT_M07_VOL_SL1=TOT_M07_PAS_SL1+TOT_M07_TRK_SL1
```

Define the text description and the volume set to be summarized based on the assignment. For AM peak period (_1 in the assignment), V6 is Drive Alone for Select Link 1

The total volume is the same as the directional, with the addition of T in the volume set name. V6 is directional, V6T is non-directional.

Define the text description and the volume set to be summarized based on the assignment. For Mid-Day period (_2 in the assignment), V6 is Drive Alone for Select Link 1

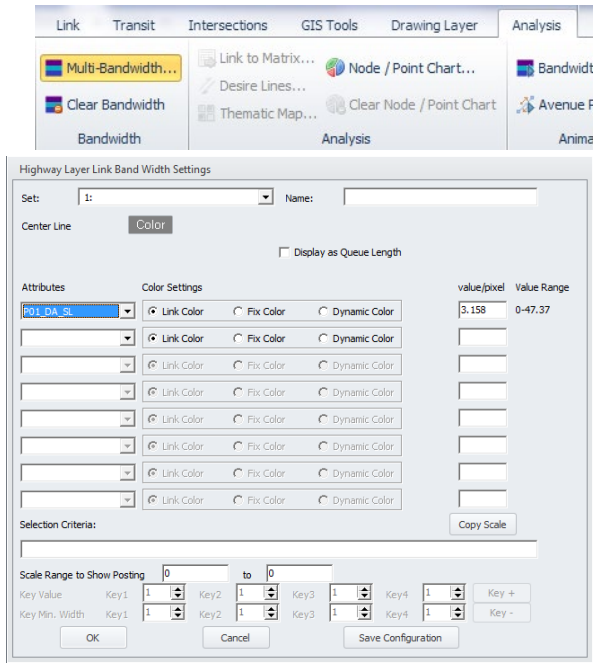
- IMPORTANT: the number of select link/zone defined in the "SelectLink_Assign.txt" should be consistent with the number of select link/zone summaries in the "SelectLink_Summary.txt" (i.e., if two select zones are run separately, there should be two sets of select zone output summaries, SL1 and SL2).

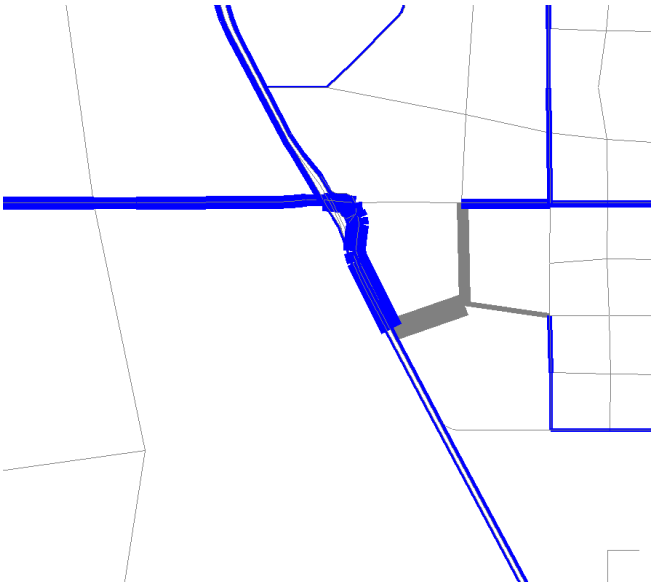
- If Fratar trip input is used, run "SelectLink_SelectZone_with_ITE_Adjust.s".
- If Fratar trip input is not used, run "SelectLink_SelectZone_without_ITE_Adjust.s".
- Run either select zone/link script using Cube Voyager. Depending on the number of select zone/link is run, the run time will vary.

Review select zone/link run outputs

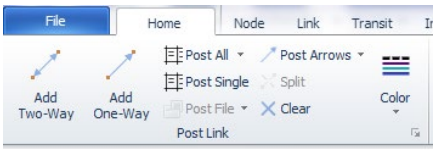
To view results on the Cube Network, open 11_SelectLink\Scenario_Name_SL_LinkVolumes.NET

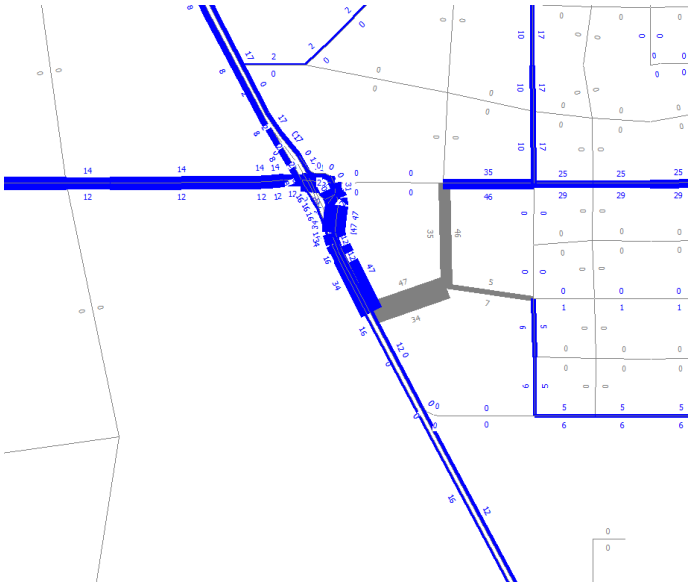
- The variables can be posted using multi-bandwidth and/or labels and use the same naming convention as the full assignment, with the exception that project trip variables include _SL at the end. For example, P01_DA_SL is the PM peak 1hr (P01) Drive Alone (DA) select link (SL) volumes.
- For multi-bandwidth, select Analysis and then Multi-Bandwidth, and one or more variables to be posted. Click ok and zoom to the study zone(s) to view the results.





- Next, to post the values, select Home and then Post All in the Link section, and one or more variables to be posted. Click ok and zoom to the study zone(s) to view the results.





- Percentage of project trip distributions can be calculated using the Link Calculation functions, as needed.
- If the result are not matching the target, verify that the Control File and the Fratar input file are correct. The ITEFratar step applies the targets to the AM 1hr, PM 1hr, and proportional to the times of day that add to create daily.
  - Review the inputs and outputs of this step to confirm the results match what is expected for the row and column totals.
  - The auto trips (drive alone, shared ride 2, and shared ride 3+) and truck trips are all adjusted based on the land use trip generation. Only XX trips are not adjusted.
  - The example below, the AM 1hr row total (outbound) and column total (inbound) for the original matrix file (left) was adjusted to match the target values, as shown on the output matrix file (right).
  - Although comparing each mode is possible, the total on the first tab for each time period is the most effective in QA since mode share by zone may vary and quickly determining if the trips match by mode is more difficult than total vehicles.

TU17_DOF_VEHTRIPS_AM1_FRATIN.mat...

*1 AM1 | 2 D1_Tot | 3 S2_Tot | 4 S3_Tot | 5 XX

	Sum	1842	1843	1844
	55361.24	4.97	19.12	1.53
1842	4.56	0.00	0.00	0.00
1843	13.44	0.00	0.01	0.00
1844	1.16	0.00	0.00	0.00
1845	3.33	0.00	0.00	0.00

TU17_DOF_VEHTRIPS_AM1_SL.mat-*1 A...

*1 AM1 | 2 D1_Tot | 3 S2_Tot | 4 S3_Tot | 5 XX

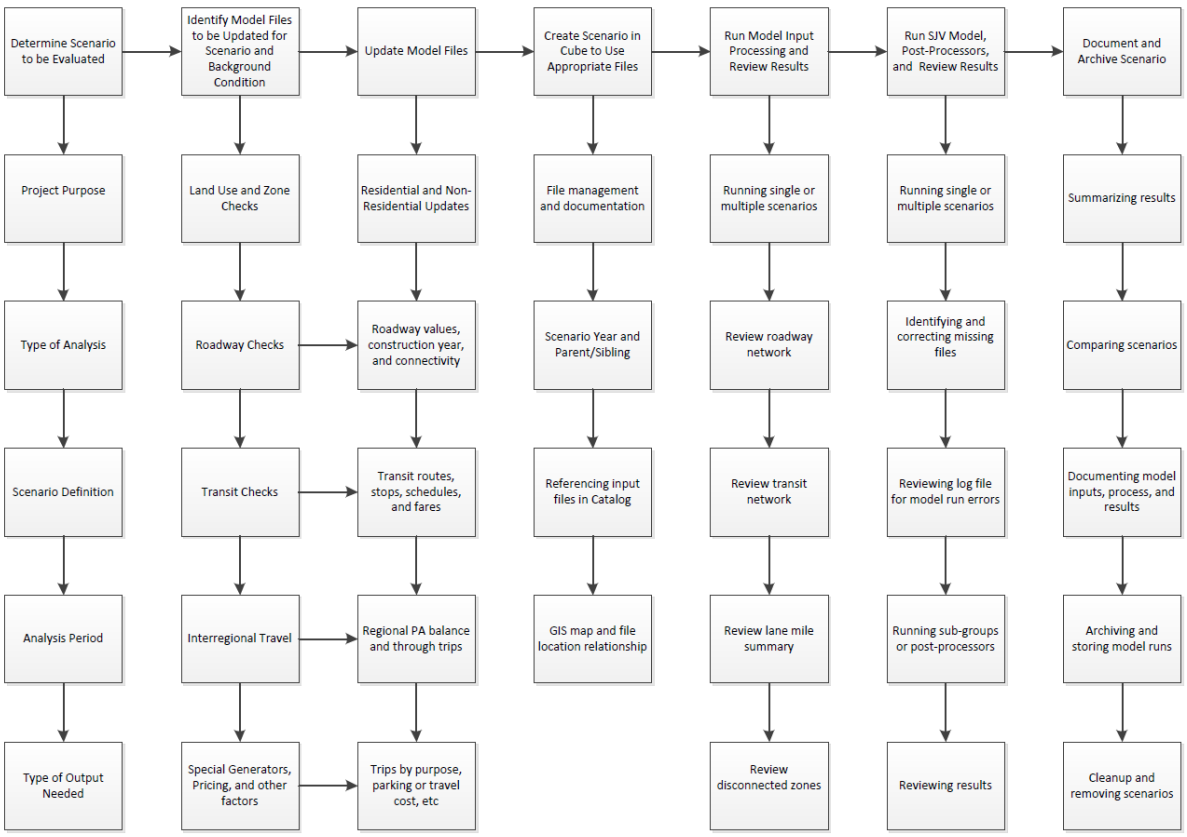
	Sum	1842	1843	1844
	56471.73	592.64	19.12	1.53
1842	527.38	0.00	0.00	0.00
1843	13.44	0.00	0.01	0.00
1844	1.16	0.00	0.00	0.00
1845	3.33	0.00	0.00	0.00

CREATING A NEW SCENARIO

RECOMMENDED PROJECT WORKFLOW

Although each project, application, and modeler may have a different approach to modeling, a recommended practice is to clearly define the scenario, type of analysis needed, sample work product, review inputs and outputs, and then document and archive the data. Evaluating scenario input data should be conducted prior to running the model.

An example workflow is below.



PREPARE SCENARIO INPUT DATA

Network Links

A recommended practice is to check the highway network for accurate information and link connectivity before running model scenarios. The master network should be checked and compared to the RTP project list. After running the model, the scenario network outputs in tabular form (lane miles by facility type, changes from 2022) and network form (.NET) should be reviewed.

Each model has a master network file called *BCAG_2024RTP_Master_Network.NET saved in 1_Inputs\3_Highway folder*. The master network file contains links and nodes, which can be checked for accuracy within Cube.

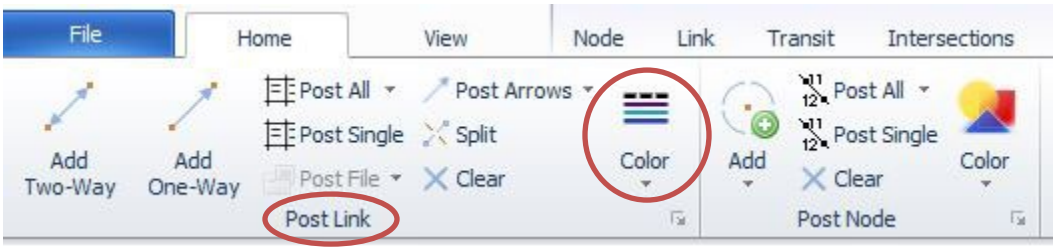
The first step is to open the master network file in Cube and visually inspect the density of the network file in rural, suburban, and urban areas. Cube automatically visualizes the network links as blue and the centroid connectors as grey. The information below describes how to color code the link by variable values (i.e. Functional Type).

Highway Network

Changes to any network link attribute are described below using Facility Types and a .NET file as the primary example.

Facility types categorize the network according to the type of service provided by the roadway. Examples of facility types include freeways, highways, expressways, and arterials. During assignment, the facility type is used to determine link capacity and volume delay functions, and ultimately impacts total volumes assigned to the links.

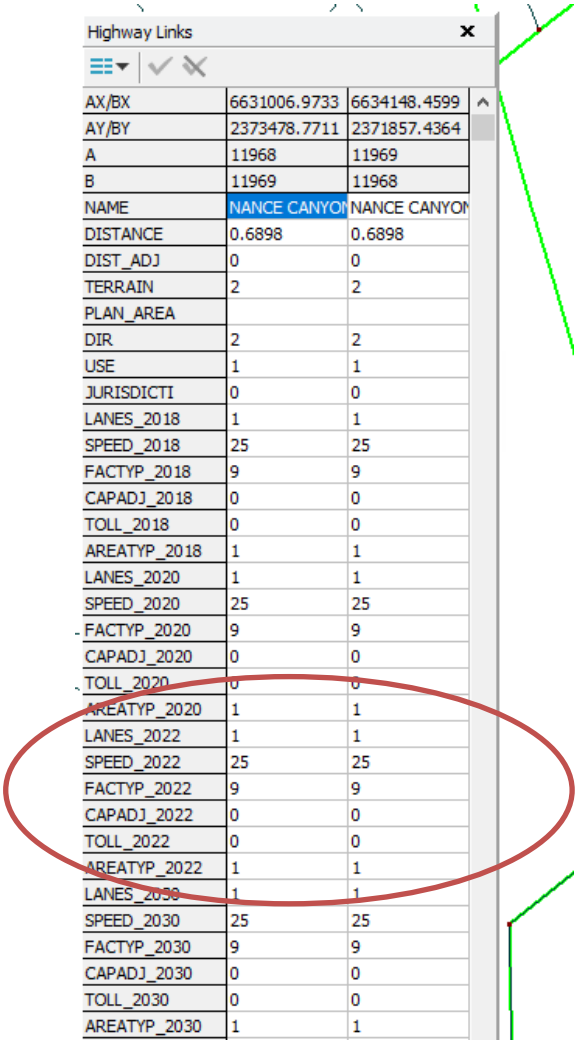
Facility types can be checked by color-coding the links with the facility type categories. This can be done in Cube under the **Home** tab**,** and clicking on **Post Link Color**.



Any errors in facility types can be fixed in two ways.

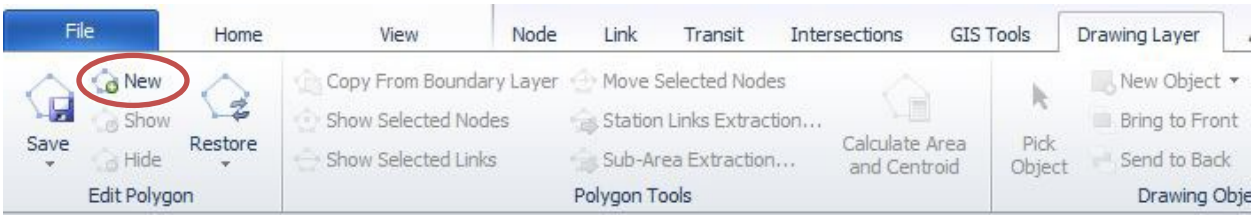
1. Fixing facility type errors manually – best for editing a few links

By clicking on the link, Cube opens a window with the link attributes. Located the facility type field and input the correct facility type for the base year and any future scenario year facility types if applicable. Note this is only for errors in facility types, not upgrades.

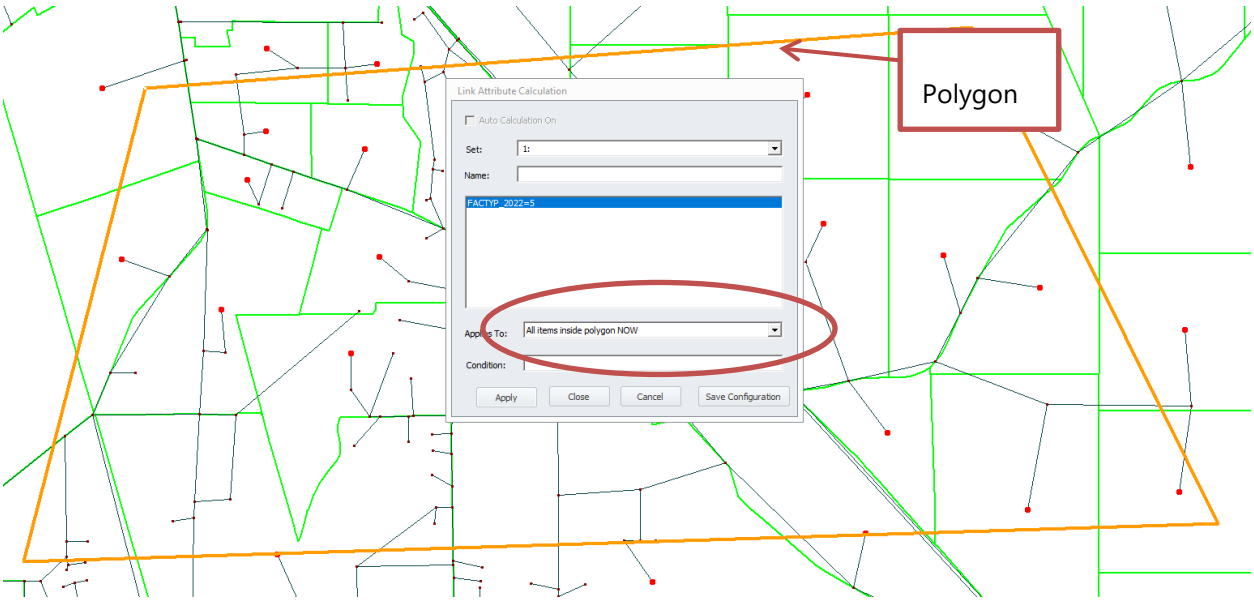


2. Fixing facility type errors by calculation – best for editing many links

Under the **Link** tab is **Compute**, in which the change to facility type is entered as an equation. This method is best used with a polygon boundary. A polygon boundary can be drawn around the incorrect links by clicking on New under the Drawing Layer Tab.



Once the polygon is drawn, the facility types can be changed using **Link, Compute** and applying changes inside/outside the polygon boundaries. Additional conditions can be added if needed.

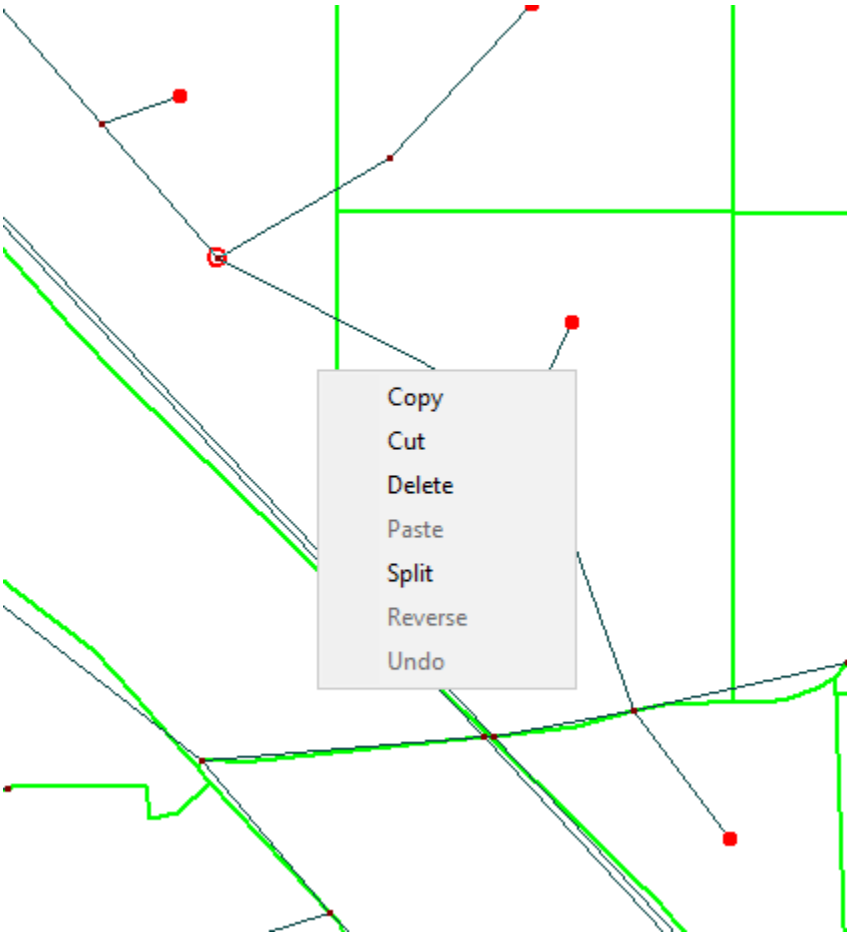


The same process can be repeated for **speeds**, **number of lanes**, and **area type**.

Copy link attributes in Cube

Cube allows copy/paste link attributes to ease the procedure in network editing.

- Prior to drawing a new link, first select a link with the attributes to copy.
- Right click on the selected link, and choose Copy



- Right click on the network and click on Paste. The arrow will be changed to a cross. Draw the new link(s) and the values from the template will be applied to the new links.

Network Nodes

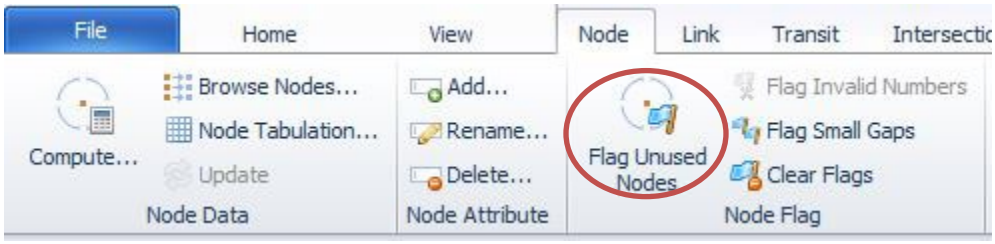
Cleaning network nodes is recommended for the model development team but not recommended for MPO staff. If incorrect nodes are removed, the model will not complete a full estimation.

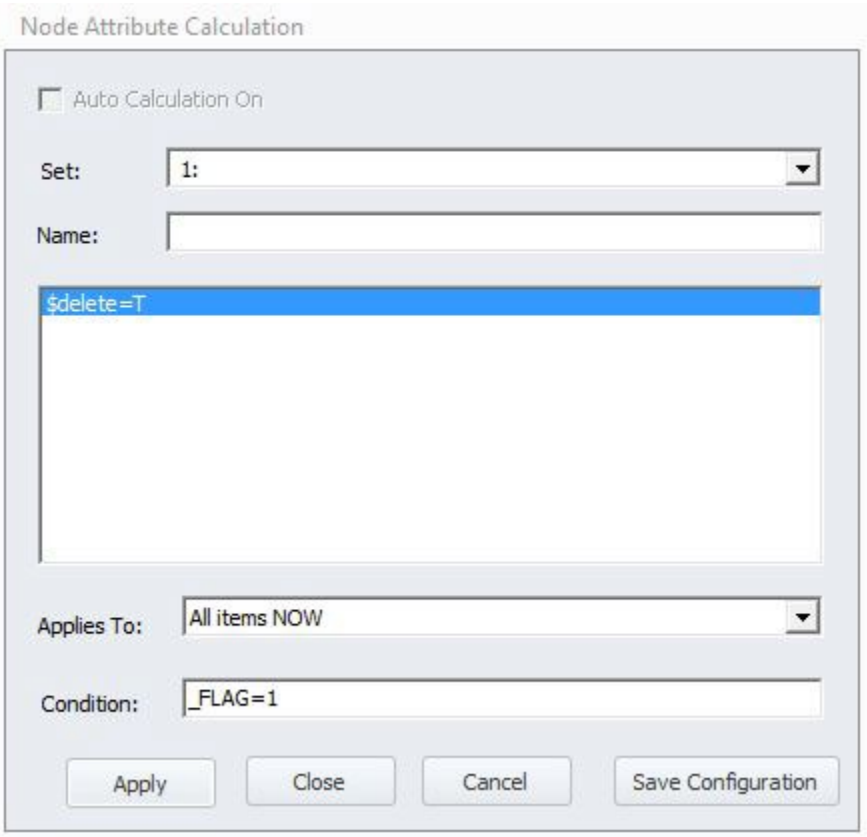
A common error is the presence of 'overlapping' nodes where one node is not connected and therefore an 'unused' node. If scenario land use is associated to the unused node, the model will run, but it will estimate no impact from the scenario inputs. Since the land use inputs are located in a separate parameter workbook, it is important to have the correct node attached to the roadway.

1. The first step is to check if the unused nodes have the same ID as the underlying TAZ.

Save the network file as a test network.

Flag unused nodes in the Node tab and delete all flagged nodes under the Node, Compute tab. The formula is $delete=T, the condition is _FLAG=1. This removes all unused nodes from the dataset.





CREATE A SCENARIO IN CUBE

Setting up a new scenario can be very helpful to test the effects of variations in your input data (i.e., land use, network). In the Control File, update the scenario name, scenario folder and any updated input files. The model outputs will be saved in the new scenario folder that is defined in the Control File.

CREATING SUBAREA MODELS

The model structure is intended to be transferable to other areas and used in easily developing subarea models for individual projects or jurisdictions. The process below describes the tasks specific to the subarea model development, with references to the previous sections of the user guide when the steps are similar.

Due to the geographic scale of the model and the focus on regional VMT forecasts for air quality conformity and greenhouse gas analysis in the RTP/SCS, local-scale project applications should verify the model's performance within the local study area. Normally, this will be done by performing a subarea validation in recognition that use of regional MPO models for purposes other than regional planning should ensure that the model provides the appropriate scale and sensitivity for applications at a sub-regional level such as corridor, sub-area, or local planning studies. Below the regional level, model refinements are likely necessary to ensure the model meets the validation targets and is appropriately sensitive to smaller scale changes associated with sub-regional studies.

Common checks for subarea models include all the same type of checks described in the Creating a New Scenario section of this user guide. In addition, the model sensitivity to the type of project being evaluated should be conducted. This often includes splitting TAZs, adding roadway network detail, refining land use inputs and comparing square-footages to employees, modifying demographics of the project, and validating overall trip magnitude (trip generation rates) and trips for specific times of day (diurnal factors).

PREPARING THE SUBAREA MODEL INPUT FILES

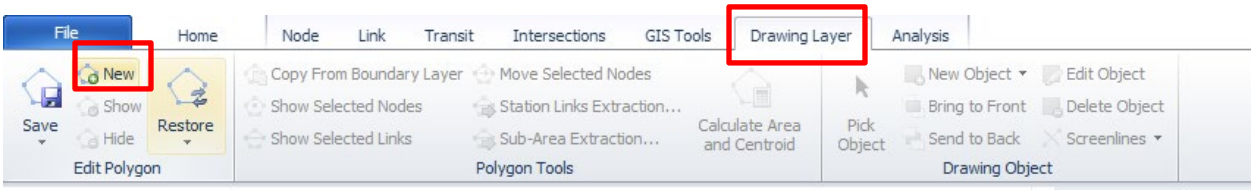
The input file structure and content for the subarea model should be identical to the overall model, but more specific to the details and values of the model. The required changes are the highway network, transit system, external gateways, and interregional trips. Other changes to land use and socioeconomics, zone system, and calibration factors are optional but recommended to at least confirm the reasonableness.

CREATING SUBAREA ROADWAY NETWORK

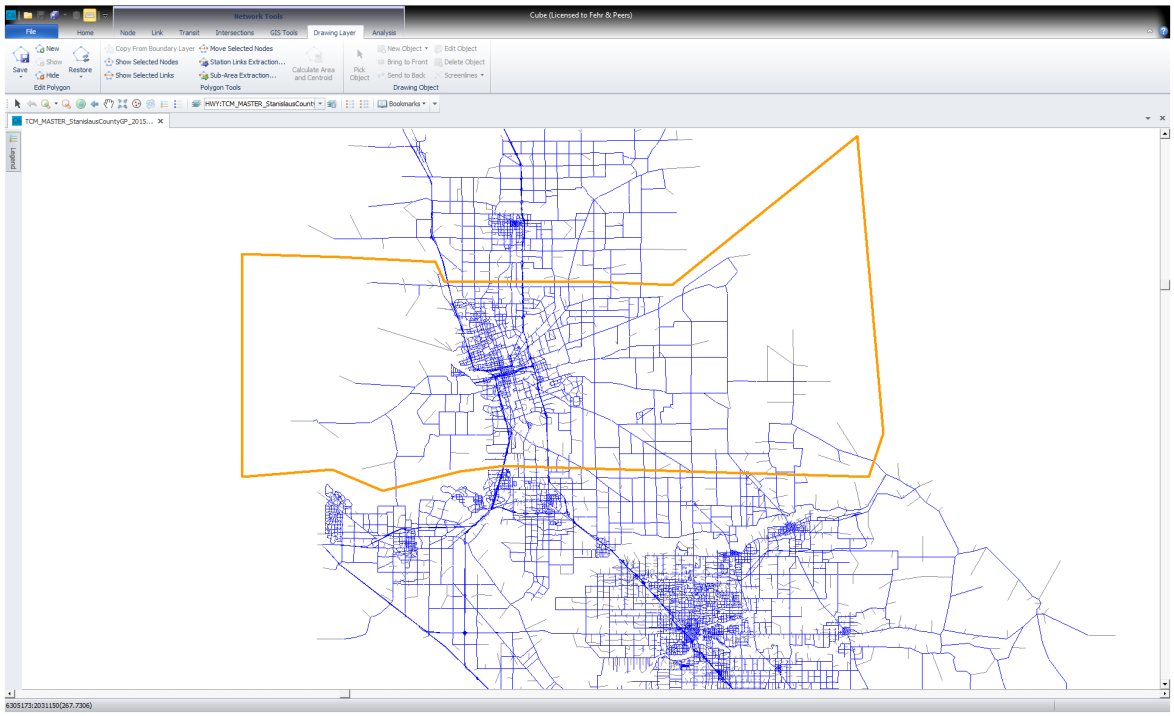
The example below uses the .NET format.

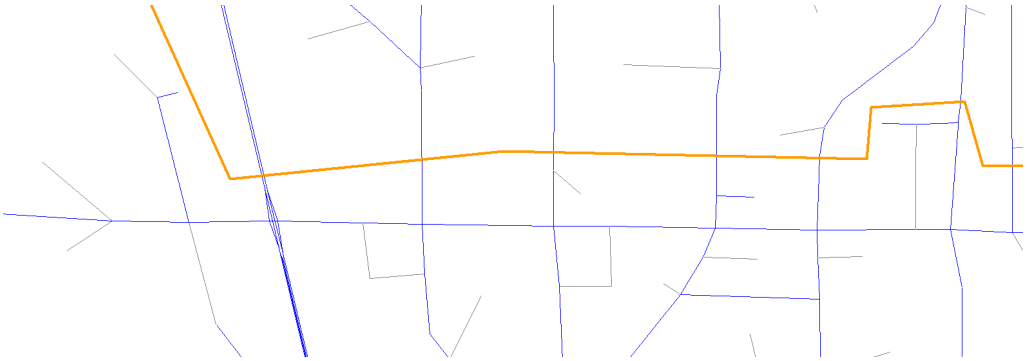
1. Copy all original model files to a new directory
2. Open the master highway network
3. Identify the geographic coverage of the sub-area model and create a polygon from the Drawing Layer menu and then select New. A boundary file from a planning area, city limits, etc could also

be used and loaded to select from instead and loading the model TAZ boundary file may also be useful.



4. Draw a polygon around the sub area, making sure all centroids that you wish to remain in the model are connected to roadways and minimizing gateways. Click to make the vertices of the polygon and double click to close. Zoom in to refine the lines as needed, then save with a name for later use.

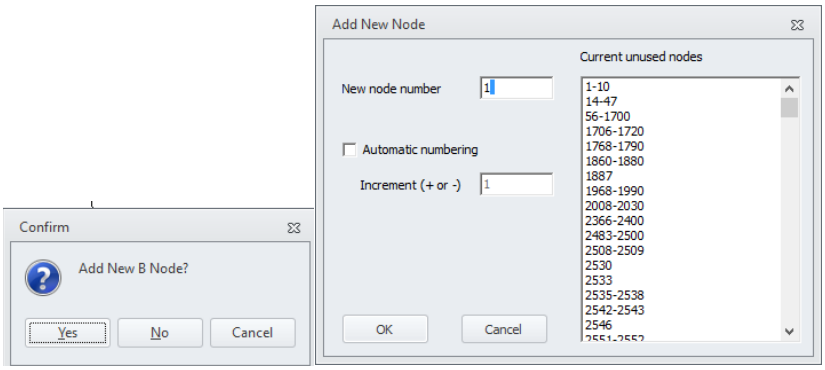




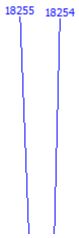
UPDATING GATEWAYS FOR SUBAREA

The highway network that was previously internal to the model and is not external to the model is represented by gateways at the point the model network was extracted in the step above. To create new gateways:

1. Determine the gateway numbers to be used (1-99 are used for externals).
2. Copy an existing centroid connector and paste the link, connecting to the network link and having the new node be the gateway number selected, drawing the centroid connector in the direction of travel.
3. The endpoint of the new centroid connector will prompt for a node number from the unused zone numbers. Use the node number determined in Step 1 for each location.



Before **After**



4. Save the network

UPDATING INTERREGIONAL TRAVEL FOR SUBAREA

Although the model will run without updating these files, the model should not be used without updating the values or the results will be meaningless.

Subarea Gateway Station Weights

The station weights are productions and attractions by purpose at each gateway that interact with the trips generated within the study area. Full model run outputs or big data can be used to develop the subarea gateway station weights, with the exception that the gateways are different at locations and should have different values.

Subarea Through Trips

The other piece of information needed for the new subarea network is the through trips. Since the model is a subarea from a larger model, the through trips can be obtained by running select link on the original model (or a larger model containing the subarea like the statewide model) and outputting the OD matrix, using big data, or assumed to be similar to the original model depending on the scale difference between the original and subarea model.

UPDATING OTHER DETAILS FOR SUBAREA

Although the model will run without updating these files, the current values were determined for regional planning and should not be used within confirming they are appropriate for subarea model.

TAZs

Keeping the zone number of externals 1-99 and the internals from 100 to the max number needed is required. It is recommended internal zones be renumbered and TAZs split/joined as needed. Keeping a relationship between the subarea zone number and the new zone number is also recommended. If zone numbers are going to be changed, the relationship to the previous land use/TAZ number are critical to maintain so the land use is allocated back in the same place. If the number of zones exceeds the previous model, renumbering the nodes will also be required. Renumbering non-centroids is only recommended if needed and is recommended as the final step in the process since turn penalty and A-B link designations with counts may also need to be updated.

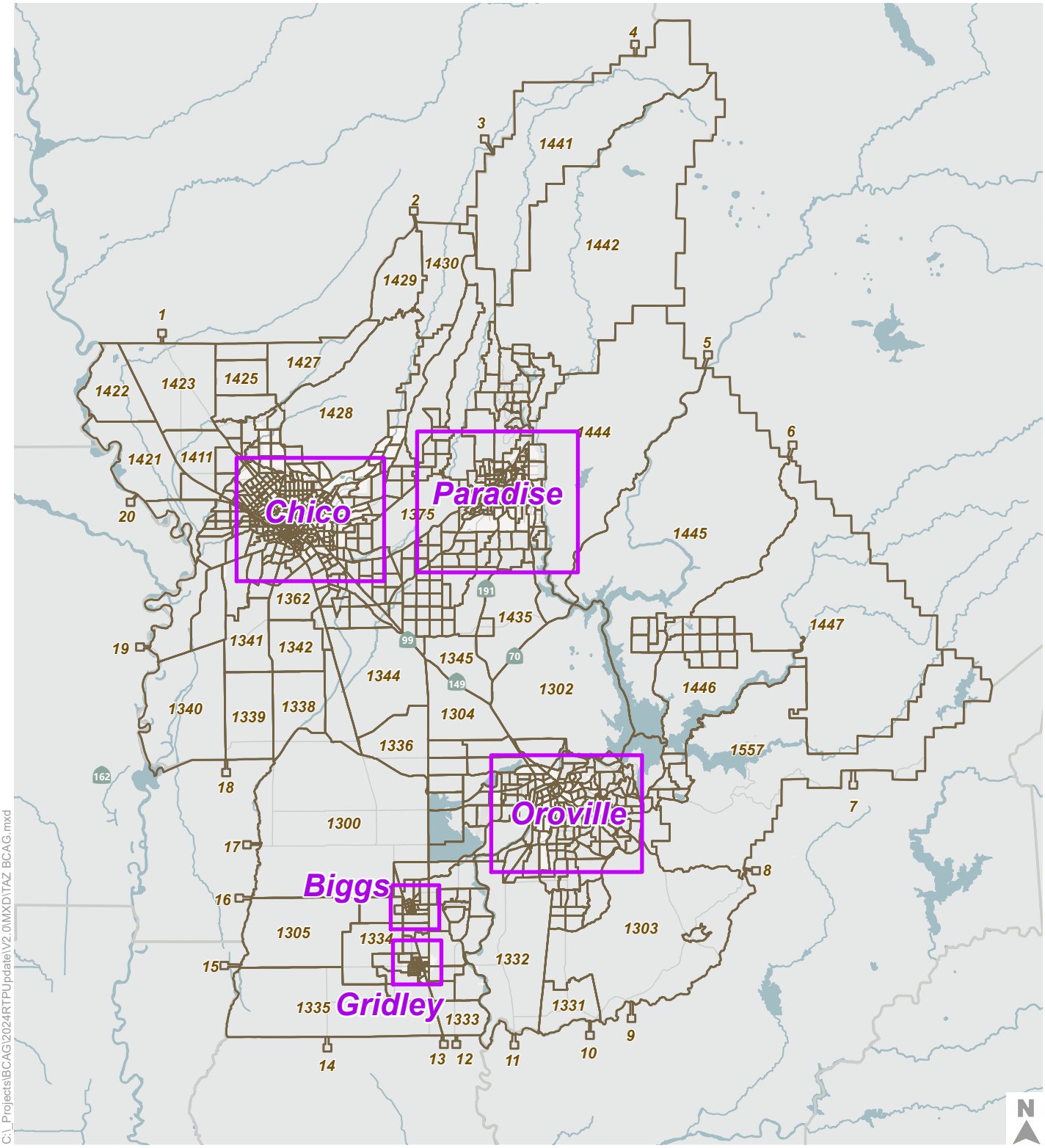
Land Use and Special Generators

At a minimum, updating the control totals for each zone and verifying special generators are accurate for each zone. If zone changes are made from the original model, verify the control totals are the same before updating with refined data to ensure that the split\aggregation of zones is working properly.

RUNNING THE SUBAREA MODEL

One benefit of having the BCAG model v2.0 upgraded from Catalog to Voyager script model is the ease to run the model. After the input files are prepared for the subarea model, the same model run scripts can be used to run the subarea model, with minimal changes to file names in the Control File. All other sections in this model user guide apply to both the original model and the user-defined subarea model.

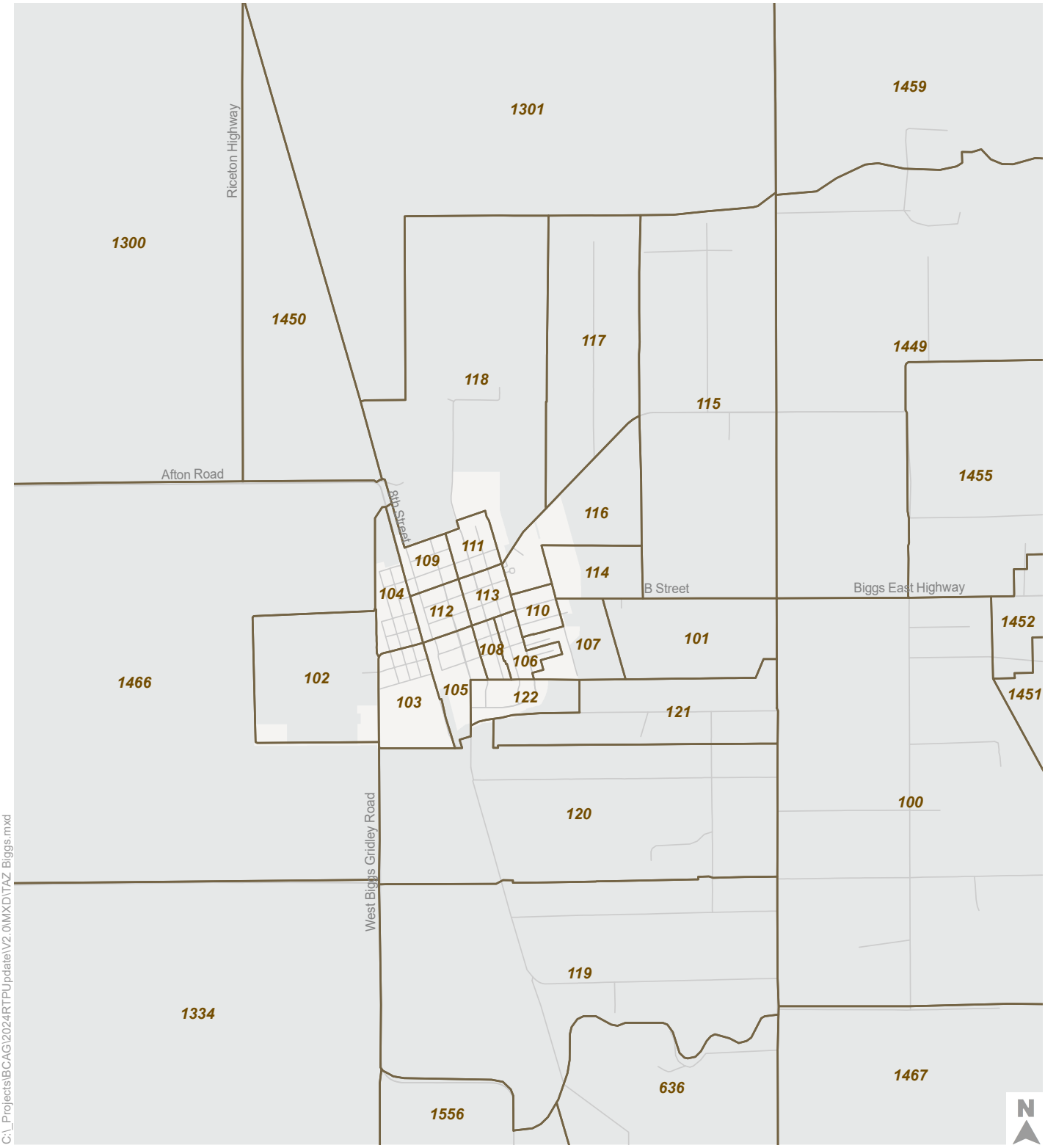
Appendix A:
TAZ Maps



Traffic Analysis Zone Boundaries

City Limits

BCAG Model V2.0 - Traffic Analysis Zone Boundaries

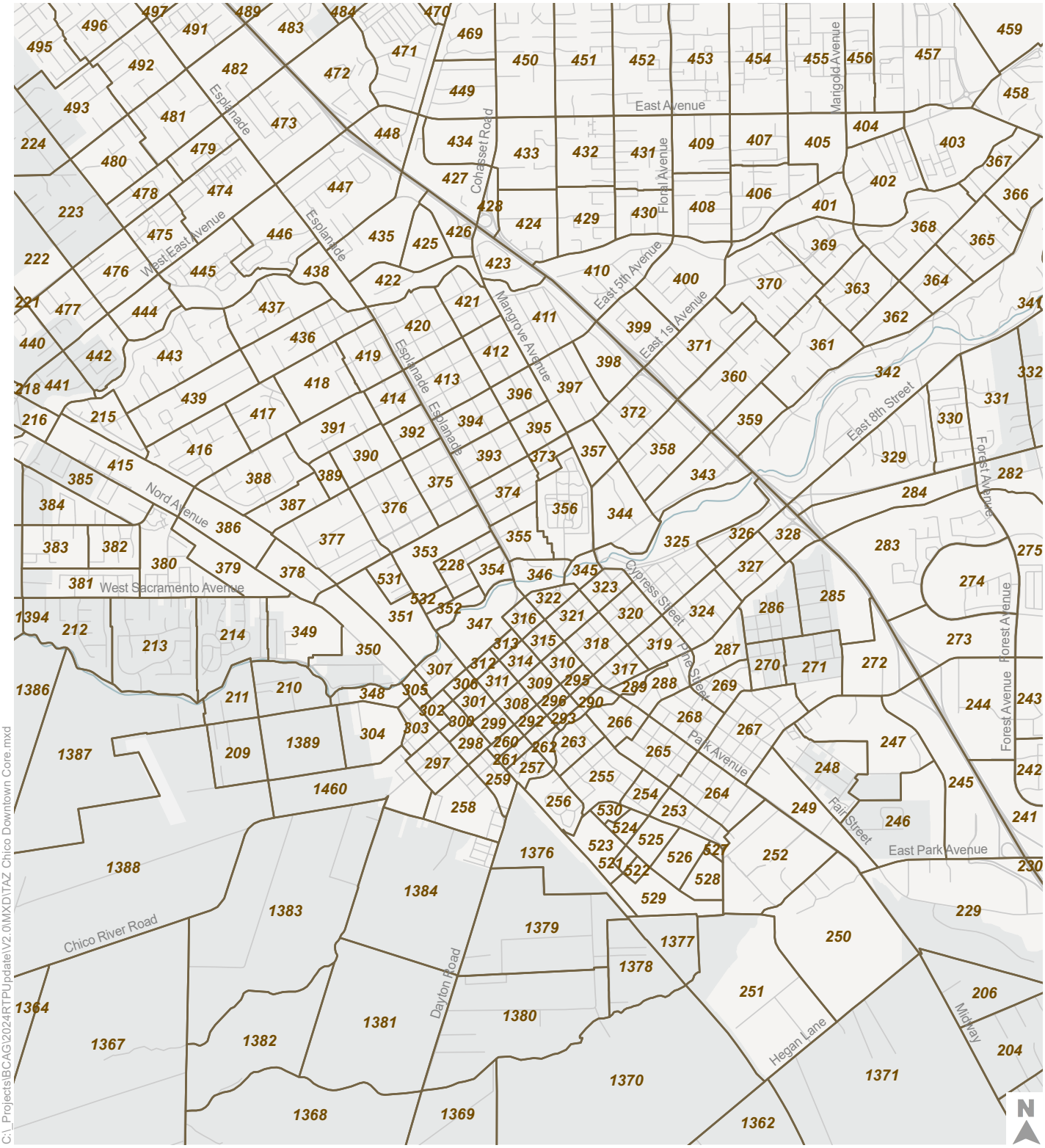


C:_Projects\BCAG\2024RTPUpdate\V2.0\MXD\TAZ Biggs.mxd

Traffic Analysis Zone Boundaries

City Limits

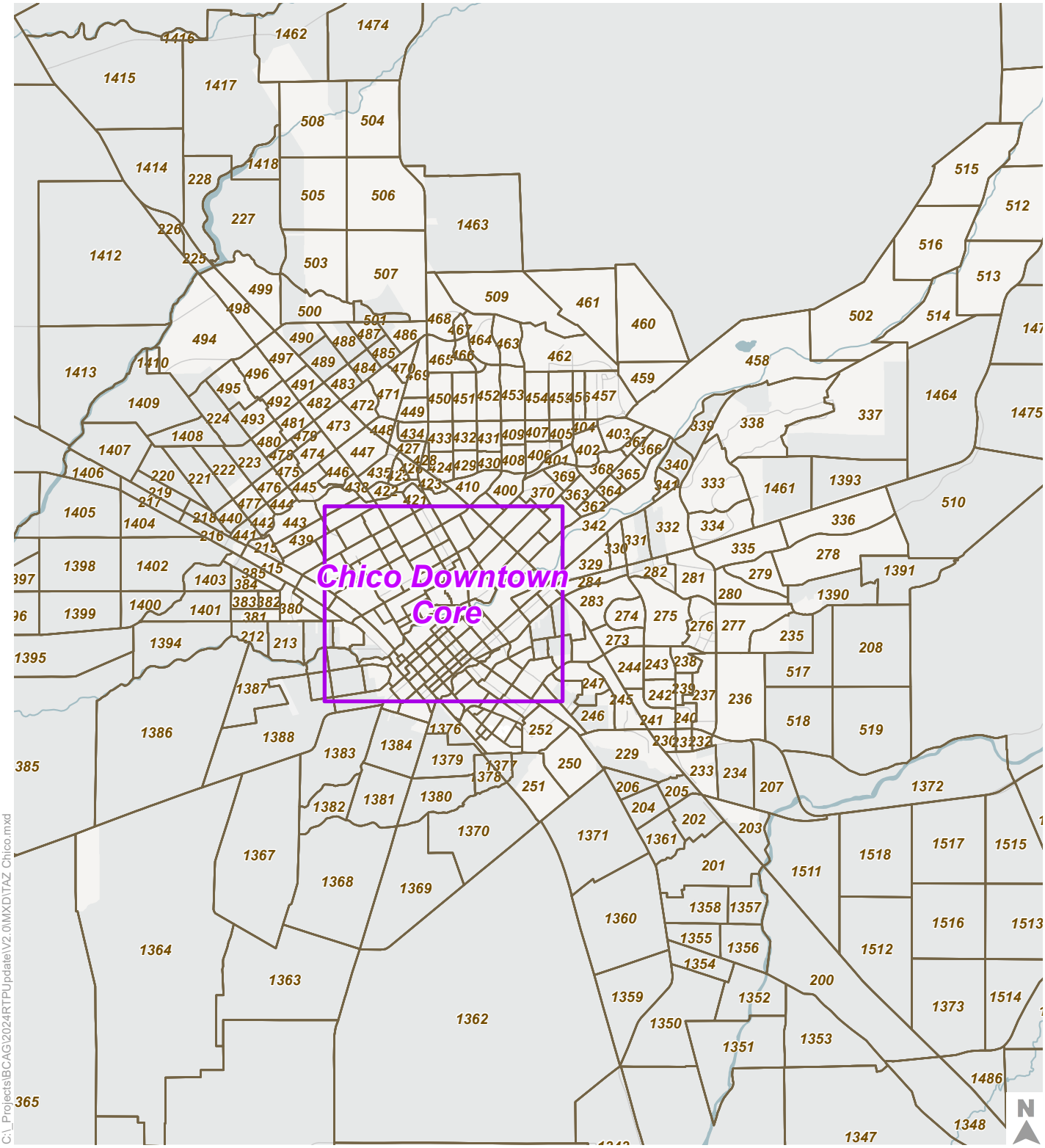
BCAG Model V2.0 - Biggs TAZ Boundaries



Traffic Analysis Zone Boundaries

City Limits

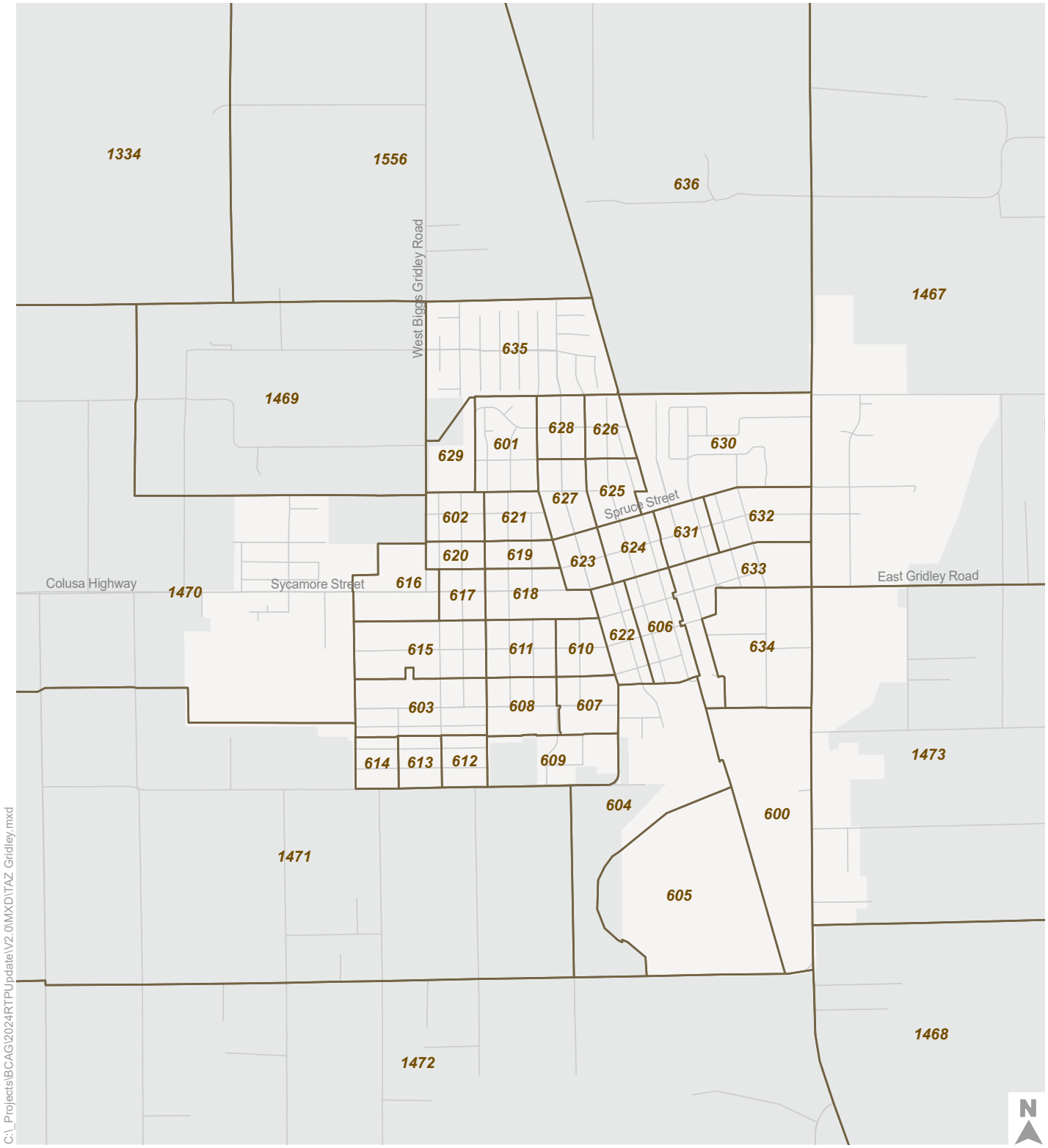
BCAG Model V2.0 - Chico Downtown Core TAZ Boundaries



Traffic Analysis Zone Boundaries

City Limits

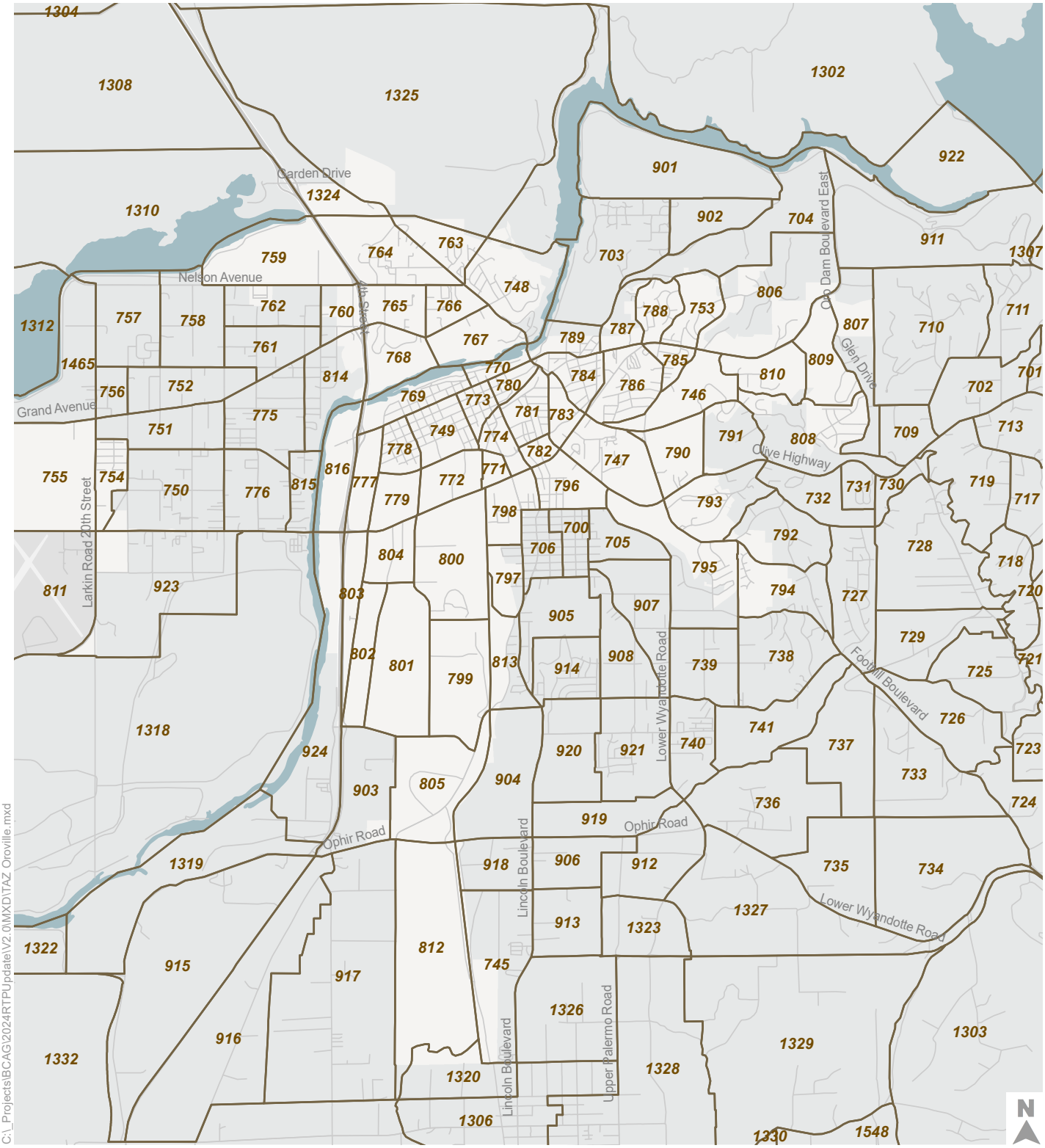
BCAG Model V2.0 - Chico TAZ Boundaries



Traffic Analysis Zone Boundaries

City Limits

BCAG Model V2.0 - Gridley TAZ Boundaries

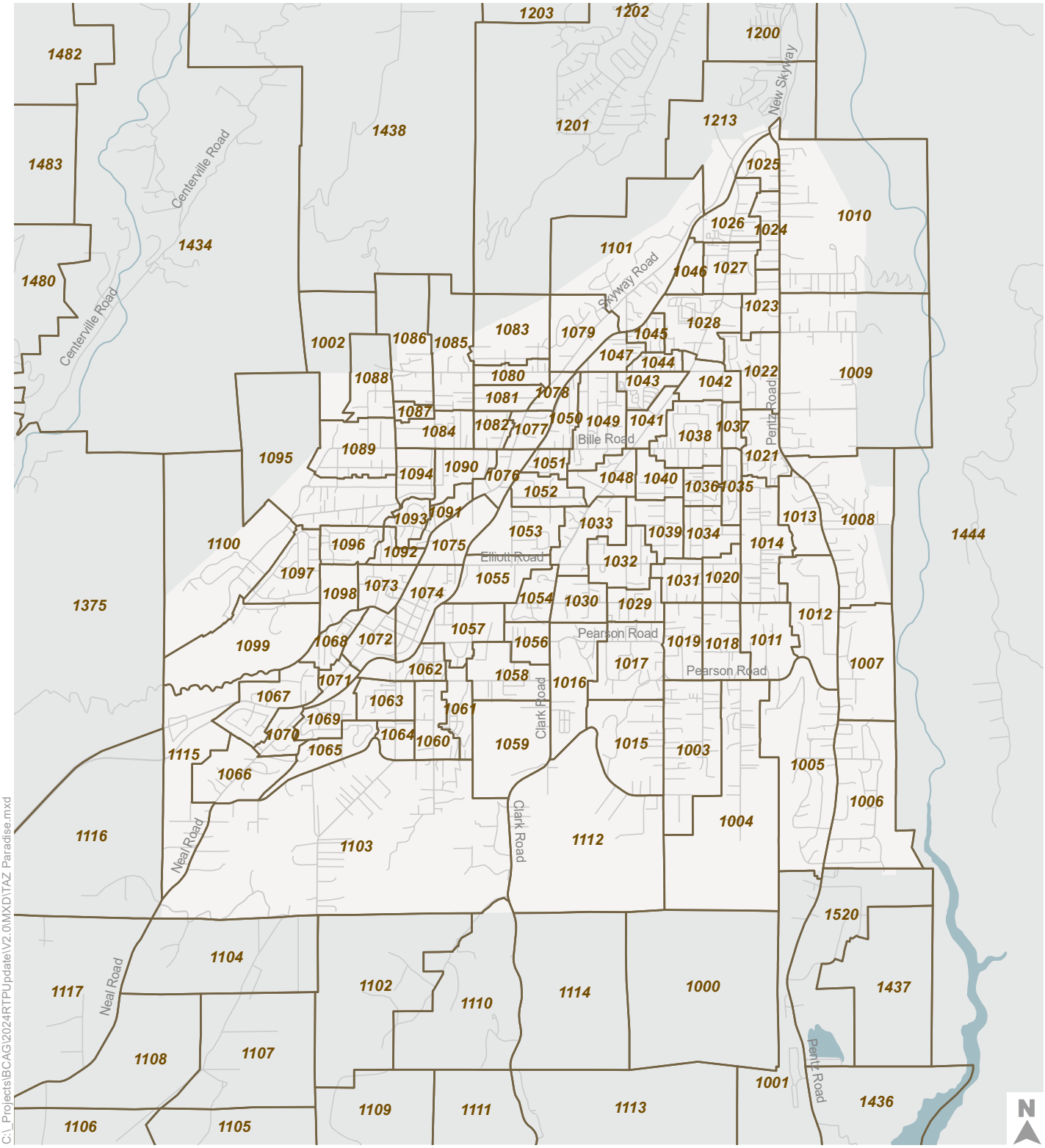


C:_Projects\BCAG\2024RTPUpdate\V2.0\MXD\TAZ Oroville.mxd

Traffic Analysis Zone Boundaries

City Limits

BCAG Model V2.0 - Oroville TAZ Boundaries



C:_Projects\BCAG\2024RTPUpdate\V2.0\MXD\TAZ Paradise.mxd

Traffic Analysis Zone Boundaries

City Limits

BCAG Model V2.0 - Paradise TAZ Boundaries