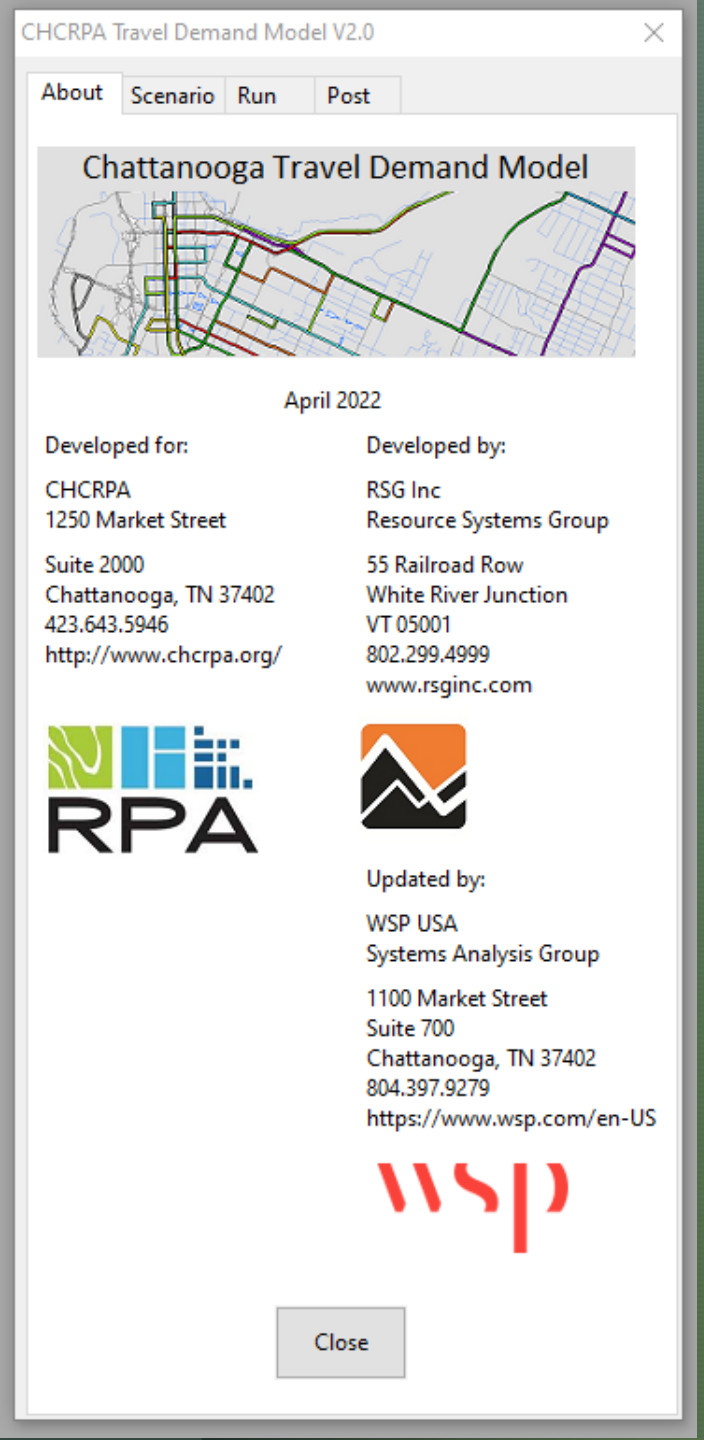


Chattanooga-Hamilton County/North Georgia TPO

2050 Travel Demand Model Update

2045 TDM (RSG) - 2014 base year

2050 TDM Update (WSP) - 2019 base year

UPDATE PROCESS:

TASK 1: NETWORK VALIDATION AND UPDATES

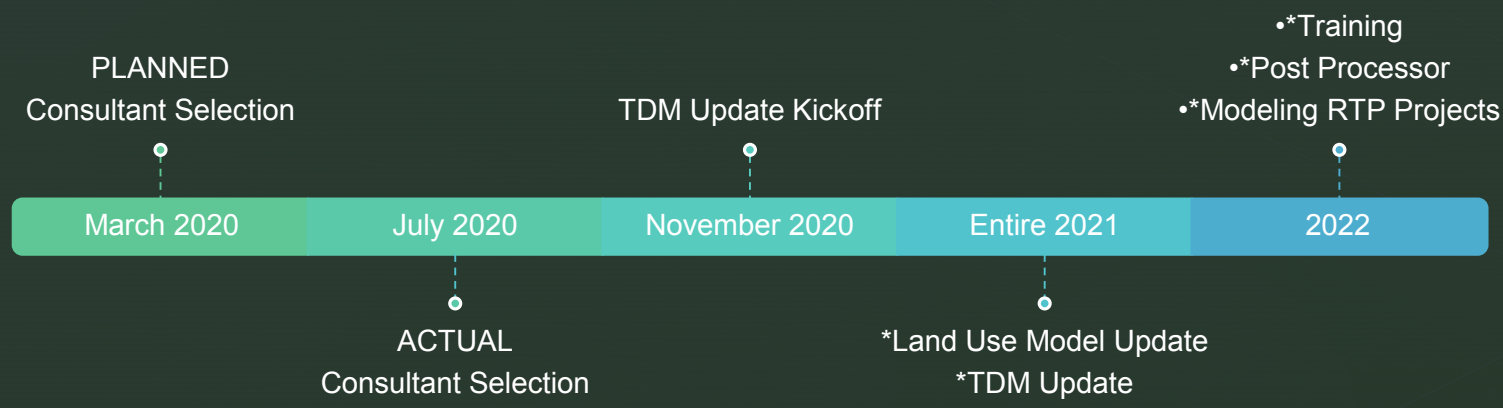
TASK 2: SOCIOECONOMIC DATA UPDATE AND REVIEW

TASK 3: MODEL VALIDATION

TASK 4: MODEL CALIBRATION

TASK 5: MODEL IMPROVEMENT PROGRAM

TASK 6: USERS' GUIDE AND TRAINING



Change in Number of Lanes

CHECK/ FIX

Check of segments where Change in 'Number of Lanes' is 3 or greater, and change in heading is slight (indicates low probability of Turn).

Change in Number of Lanes and minor change in Heading

Node Link-IN Link-OUT validation: NUMBER OF LANES and HEADING

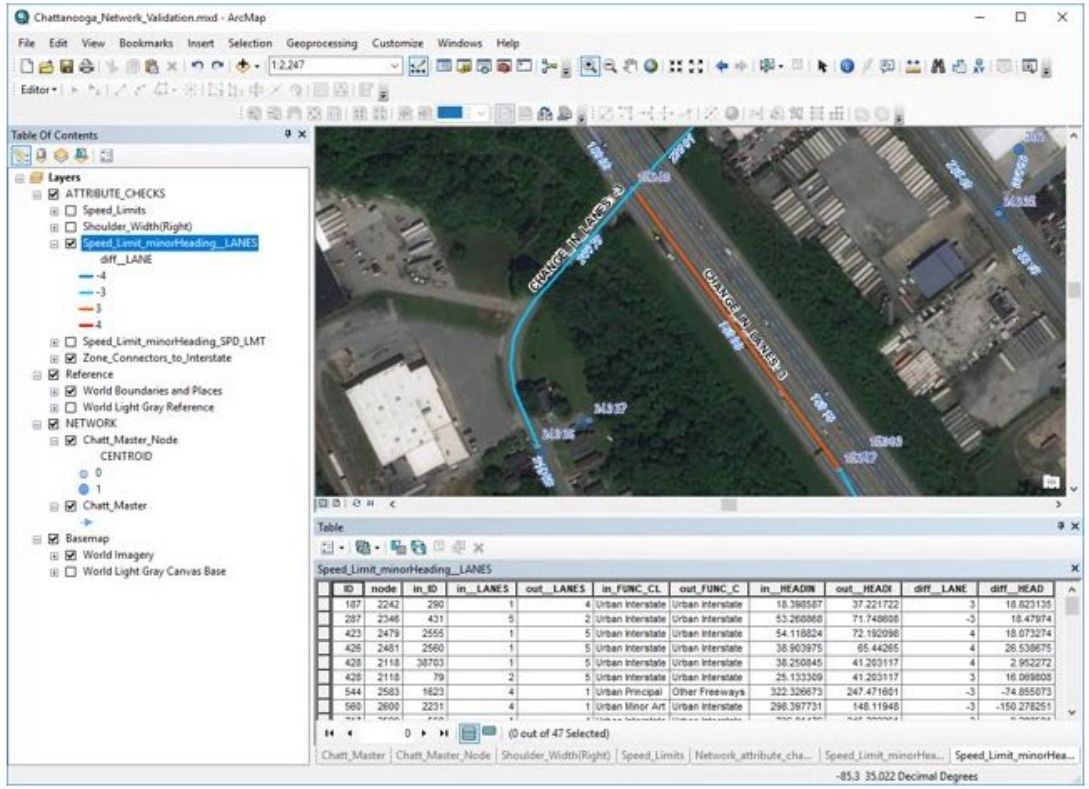
```
### SPECIFY PARAMETERS
# Attribute to validate:
attribute_names = ['_LANES', '_HEADING', "FUNC_CLASS"]
# Filter by CHANGE in attribute value (Equal to or Greater than) and Export long table:
attribute_filters = {
    '_LANES':3,
#     '_HEADING':30
}
# Summarize by Node Maximum value and Export Geo:
export_geometry = True
#Export name:
export_name = 'NumberLanes_minorHeading'


### RUN FUNCTIONS
network = compare_attributes(attribute_names, attribute_filters, export_geometry, export_name)

# ### ADDITIONAL FILTERING
network[abs(network['diff__HEADING'])<=10].drop(columns=['geometry'])
```

```
Total network links with change in _LANES, _HEADING, FUNC_CLASS: 47
Table exported to ..\data\NumberLanes_minorHeading__LANES__HEADING_FUNC_CLASS.csv
Shapefile exported to ..\data\NumberLanes_minorHeading__LANES.shp
```

	ID	node	in_ID	in__LANES	out__LANES	in_FUNC_CLASS	out_FUNC_CLASS	in__HEADING	out__HEADING	diff__LANES	diff__HEADING
1	17427	15012	15755	4.0	1.0	Urban Interstate	Local Street	330.013276	356.918720	-3.0	26.905443
2	15755	15011	17716	1.0	4.0	Local Street	Urban Interstate	307.840414	330.013276	3.0	22.172862
3	15747	14906	15782	4.0	1.0	Urban Interstate	Urban Interstate	299.710620	321.162841	-3.0	22.452212
4	15953	15205	16255	4.0	1.0	Urban Interstate	Urban Interstate	129.694645	146.713794	-3.0	17.109148
7	15942	15199	78744	1.0	4.0	Urban Interstate	Urban Interstate	52.748234	64.339719	3.0	11.591485
10	15751	15002	15775	4.0	1.0	Urban Interstate	Urban Interstate	42.756006	54.271635	-3.0	11.515629
11	15917	15102	15944	1.0	4.0	Urban Interstate	Urban Interstate	8.597739	30.619352	3.0	22.111613
13	428	2118	38703	1.0	5.0	Urban Interstate	Urban Interstate	38.250845	41.203117	4.0	2.952272
14	428	2118	79	2.0	5.0	Urban Interstate	Urban Interstate	25.133309	41.203117	3.0	16.069808
15	38705	2679	928	4.0	1.0	Urban Interstate	Urban Interstate	220.762322	221.783583	-3.0	1.021261
16	287	2346	431	5.0	2.0	Urban Interstate	Urban Interstate	53.268868	71.748606	-3.0	18.479741



Change in Speed

CHECK/ FIX

Check of segments where Change in 'Speed Limit' is 25 MPH or greater, and change in heading is slight (indicates low probability of Turn).

Change in Speed and minor change in Heading

Node Link-IN Link-OUT validation: SPEED LIMIT and HEADING

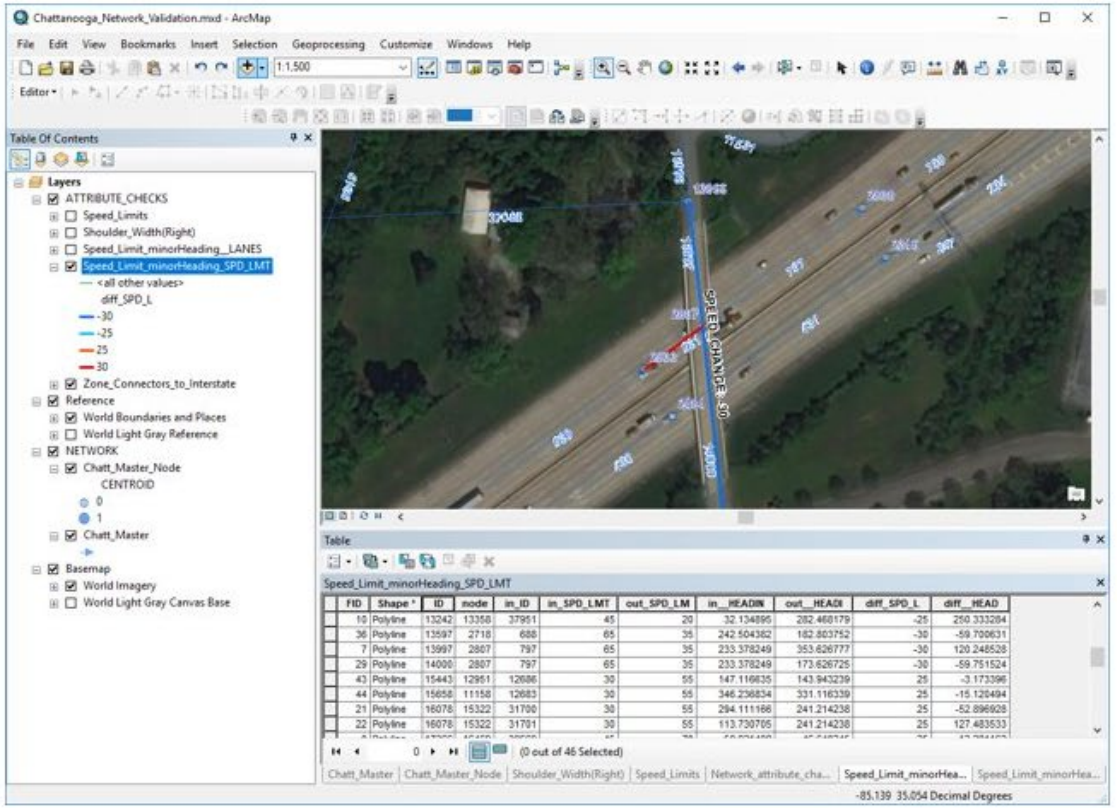
```
### SPECIFY PARAMETERS
# Attribute to validate:
attribute_names = ['SPD_LMT', '_HEADING']
# Filter by CHANGE in attribute value (Equal to or Greater than) and Export long table:
attribute_filters = {
    'SPD_LMT':25,
#     '_HEADING':30
}
# Summarize by Node Maximum value and Export Geo:
export_geometry = True
#Export name:
export_name = 'Speed_Limit_minorHeading'


### RUN FUNCTIONS
network = compare_attributes(attribute_names, attribute_filters, export_geometry, export_name)

# ### ADDITIONAL FILTERING
network[abs(network['diff__HEADING'])<=30].drop(columns=['geometry'])
```

```
Total network links with change in SPD_LMT, _HEADING: 46
Table exported to ..\data\Speed_Limit_minorHeading_SPD_LMT__HEADING.csv
Shapefile exported to ..\data\Speed_Limit_minorHeading_SPD_LMT.shp
```

	ID	node	in_ID	in_SPD_LMT	out_SPD_LMT	in__HEADING	out__HEADING	diff_SPD_LMT	diff__HEADING
0	17366	16469	38589	45.0	70.0	58.921408	46.640245	25.0	-12.281162
1	17366	16469	17368	45.0	70.0	24.889821	46.640245	25.0	21.750424
5	33530	29066	33518	70.0	45.0	301.826323	306.957526	-25.0	5.831203
6	33600	29065	33531	45.0	70.0	289.653387	298.987783	25.0	9.334416
8	17401	16608	38599	45.0	70.0	322.237216	315.104885	25.0	-7.132330
14	12686	12951	15443	55.0	30.0	323.943239	327.116635	-25.0	3.173396
15	38568	16801	17648	70.0	45.0	222.502069	236.525828	-25.0	14.022958
17	38598	16803	17769	70.0	45.0	136.384845	141.761863	-25.0	5.377019
27	33621	29160	33640	45.0	70.0	111.481814	119.091001	25.0	7.609187



SOCIOECONOMIC DATA UPDATE

Table 1: Summary of Household and Population Growth

	Households			Population		
	2014	2019	Change	2014	2019	Change
Hamilton County	135,471	145,139	7%	340,953	361,328	6%
Catoosa County	23,958	24,752	3%	64,584	66,619	3%
Walker County	14,468	13,930	-4%	36,768	36,702	0%
Dade County[1]	1,079	1,202	11%	3,487	3,456	-1%
Total	174,976	185,023	6%	445,792	468,105	5%

Table 2: Summary of Households (TPO Estimate vs. 2015-2019 ACS)

	TPO Households	2015-2019 ACS Households	ACS Margin of Error	Low Confidence Interval	High Confidence Interval
Hamilton County	145,139	145,213	1,162	144,051	146,375
Catoosa County	24,752	24,778	522	24,256	25,300
Walker County	13,930*	-	-	-	-
Dade County	1,202*	-	-	-	-

Table 5: 2019 Population Synthesis Output Summary

Control	Geography	Target	Generated	Difference
Number of HHs	MAZ	185,023	185,023	-
Total population (NGQ)	MAZ	454,390	454,413	23
GQ population	MAZ	13,715	13,715	-
HH size 1	Tract	58,277	58,247	(30)
HH size 2	Tract	67,616	67,590	(26)
HH size 3	Tract	27,537	27,526	(11)
HH size 4+	Tract	31,670	31,660	(10)
HHs income [0,25k)	Tract	40,363	40,349	(14)
HHs income [25k,50k)	Tract	45,611	45,595	(16)
HHs income [50k,75k)	Tract	33,257	33,243	(14)
HHs income [75k,100k)	Tract	22,498	22,491	(7)
HHs income 100k+	Tract	43,373	43,345	(28)
HH workers 0	Tract	55,453	55,433	(20)
HH workers 1	Tract	69,867	69,827	(40)
HH workers 2	Tract	50,476	50,453	(23)
HH workers 3+	Tract	9,304	9,310	6
HH with children	Tract	50,266	50,231	(35)
HH without children	Tract	134,836	134,792	(44)
Age 0-17	Tract	97,772	97,785	13
Age 18-34	Tract	98,937	98,884	(53)
Age 35-64	Tract	178,373	178,323	(50)
Age 65+	Tract	79,441	79,421	(20)
Female	Tract	235,136	235,070	(66)
Male	Tract	219,383	219,343	(40)
Total Population (NGQ)	Region	454,390	454,413	23
Total GQ Population	Region	13,715	13,715	-

MODEL VALIDATION \ CALIBRATION

- Static Model Validation
  - Ran DaySim with updated networks and socioeconomic data.
  - Calibrated work location, school location, daily activity pattern, tour mode, tour schedule, trip mode and trip schedule to the 2010 Household Survey
- Third Party Data Purchase Recommendation
  - INRX
- Dynamic Model Validation

MODEL VALIDATION

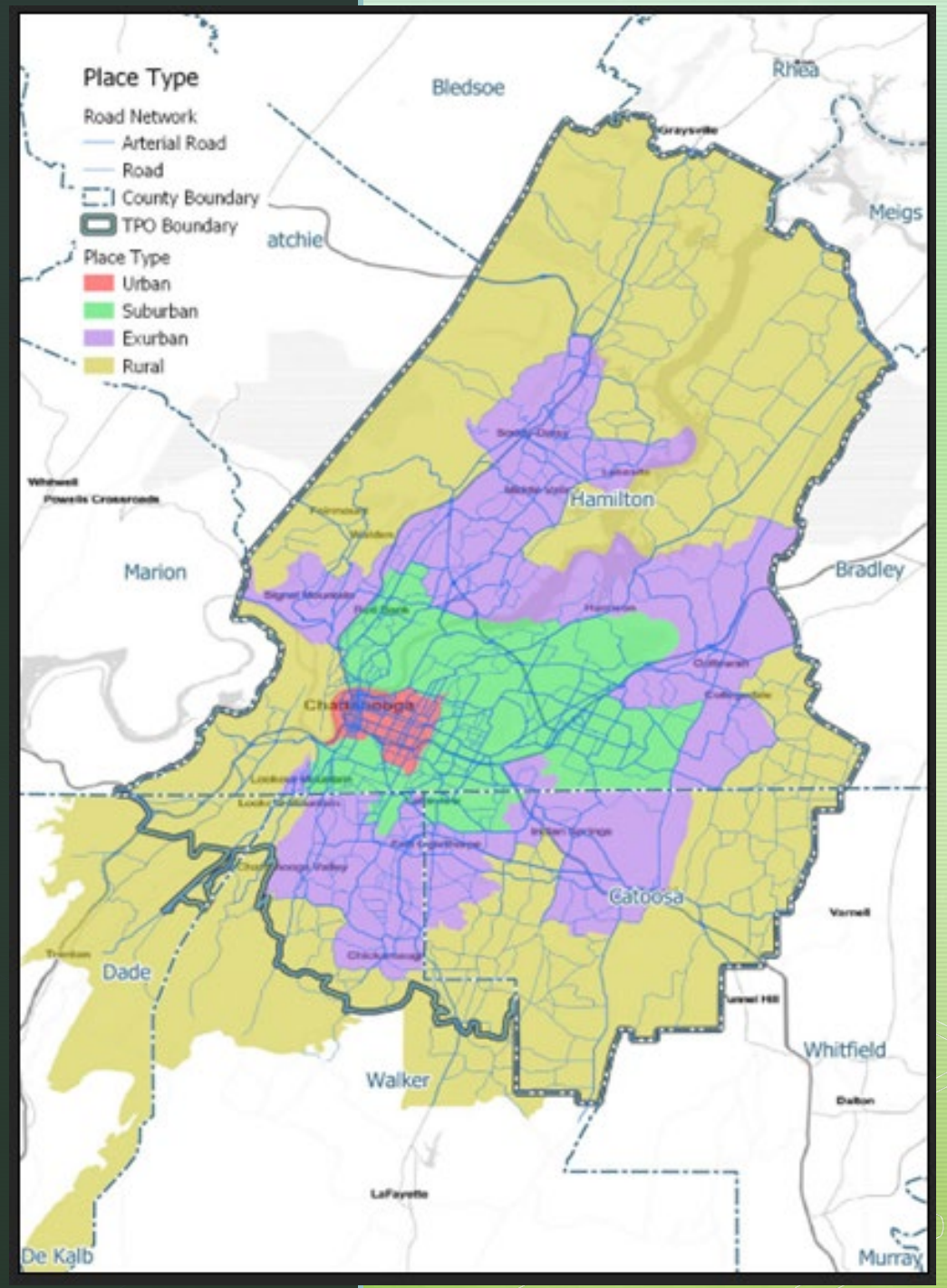
- Dynamic Model Validation
  - Land Use Sensitivity
  - Roadway Capacity Change

Table 57: Assigned Volumes and Speeds, Model Area

	Reduced Urban Density	Baseline	Increased Urban Density
VMT	12,508,823	12,505,591	12,518,040
VHT	355,164	357,188	360,614
Speed	35.75	35.74	35.70
VMT In Congested Conditions[10]	45,554	49,237	53,288

Table 58: Assigned Volumes and Speeds, Urban Area

	Reduced Urban Density	Baseline	Increased Urban Density
VMT	1,098,582	1,164,107	1,230,469
VHT	38,600	42,121	45,856
Speed	31.11	30.78	30.37
VMT In Congested Conditions	17,123	18,973	19,717



MODEL VALIDATION

- Dynamic Model Validation
  - Land Use Sensitivity
  - Roadway Capacity Change (bridges)

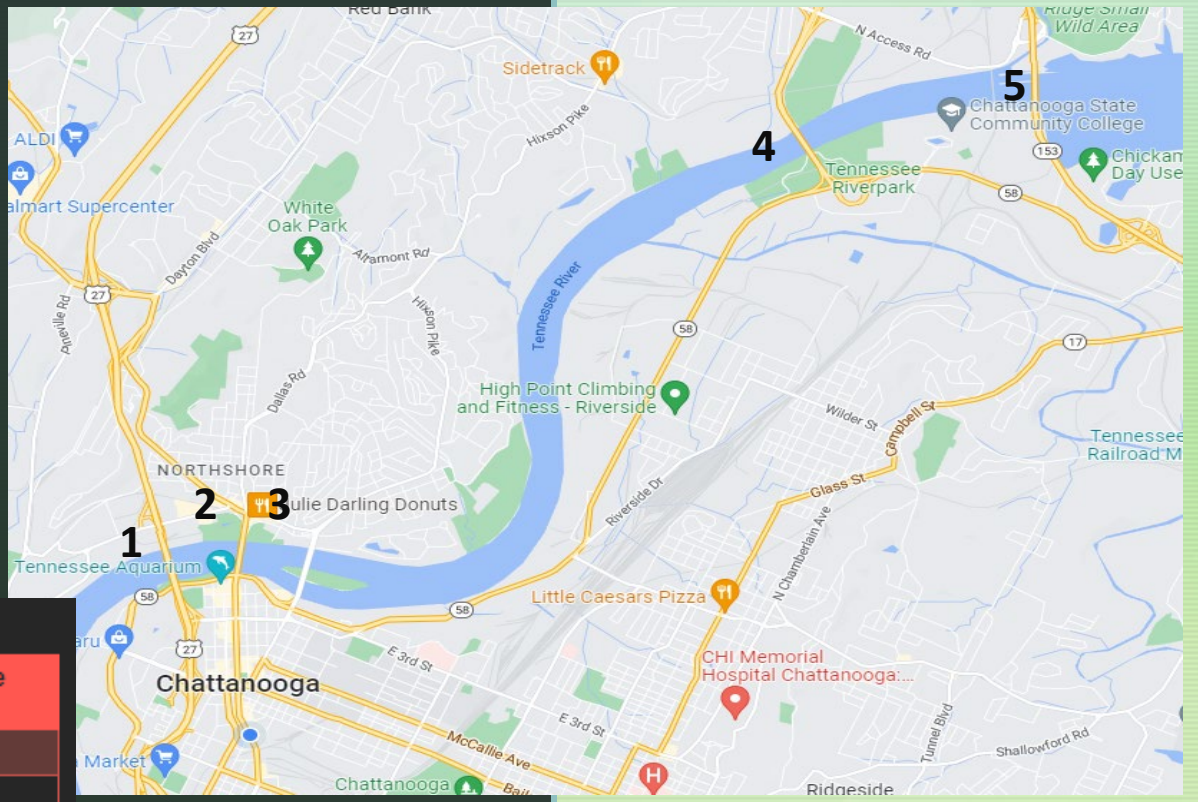


Table 60: Assigned Volumes and Speeds, Model Area

	Reduced Bridge Capacity	Baseline	Increased Bridge Capacity
VMT	12,506,370	12,505,591	12,514,050
VHT	357,864	357,188	356,696
Speed	35.73	35.74	35.73
VMT In Congested Conditions[11]	53,999	49,237	47,017

Table 61: Assigned Volumes and Speeds, 2-mile Buffer Area of the Bridges

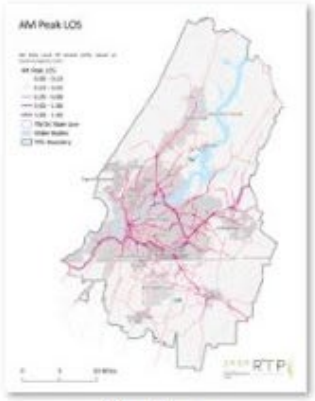
	Reduced Bridge Capacity	Baseline	Increased Bridge Capacity
VMT	744,993	750,220	755,033
VHT	28,560	28,297	28,091
Speed	30.76	30.81	30.76
VMT In Congested Conditions[12]	15,027	11,814	11,472

Coordination Agreement Deliverable:
Existing Conditions & Trends: *2019 Model Output*

2.	**Existing Conditions & Trends:** *2019 Model Outputs* *Definition of 2019 Model: 2015 model network updated to 2019 with 2019 socioeconomic data (land use and demographic data in activity-based model) and calibrated and validated. RTP team with proceed with dat while TDOT is review g for concurrence but R&A team will need t resubmit files if majo comments provided b TDOT during review)*	10. **2019** loaded network exported from TransCAD to GIS layer (see definition of 2019 model) 11. 2019 model trip table exported from TransCAD (aggregated to district Maps (including GIS layer and .mxd files and .png image files) using GIS template provided by RTP team, as follows for **2019 validated model**: 12. Map: AM Peak LOS (based on volume/capacity ratio) 13. Map: PM Peak LOS (based on volume/capacity ratio) 14. Map: VMT (graduated color and bandwidth) 15. Map: Vehicle Hours of Delay (graduated color and bandwidth) 16. Map: Congested Speeds (graduated color and bandwidth) 17. Map: Transit Route Ridership (graduated color and bandwidth) 18. Map: Origin of Passenger Vehicle Trips by TAZ (graduated color) 19. Map: Origin of Transit Trips by TAZ (graduated color) 20. Map: Origin of Truck Trips by TAZ (graduated color) 21. Map: Destination of Passenger Vehicle Trips by TAZ (graduated color) 22. Map: Destination of Transit Trips by TAZ (graduated color) 23. Map: Destination of Truck Trips by TAZ (graduated color) Summary tables in Excel format, as follows: 24. Table: VMT by HPMS Functional Class and County 25. Table: Vehicle Hours of Delay by HPMS Functional Class and County 26. Table: Congested Speeds by HPMS Functional Class and County *(Note: RTP group will still need the model data, regardless of if we have a contingency plan to deploy if the model is not done in time for RTP.)*	3/1/21 (R&A to discuss model certification ocess with OT) 30/21 (ubmitted to OT for ncurrence/ proval and to RP team ultaneously)	R&A	Yes

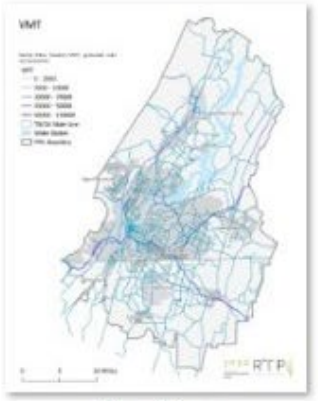
Working Schema

- A **QGIS Project**, which collects the data and their symbology as Layers. This is an intermediate file.
- The **Python Scripts** which includes the Template information and generate the Maps, populate them into the QGIS Map document and export them as Map deliverables.
- A **Data** directory is a repository for all data used, in Shapefile format.
- A **Map Definitions** directory with YAML file that contains parameters and specifications for each Map to be produced.
- A **Map Deliverables** directory, that serves as repository for finalized Maps in Image format.

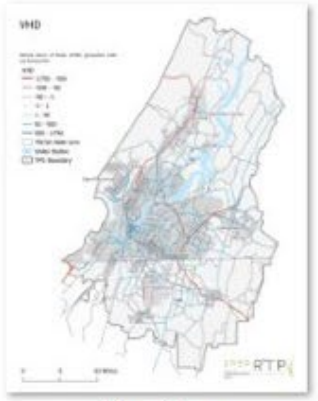


Map_12.png

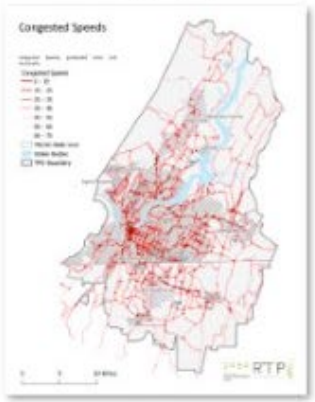
Map_13.png



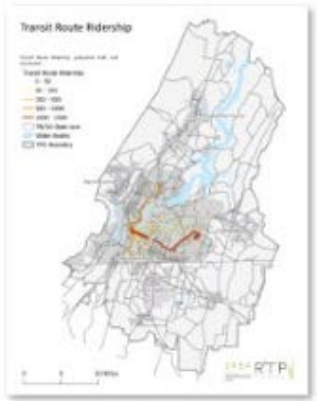
Map_14.png



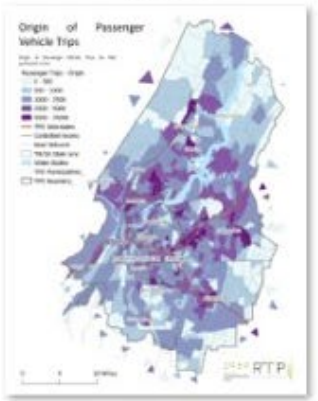
Map_15.png



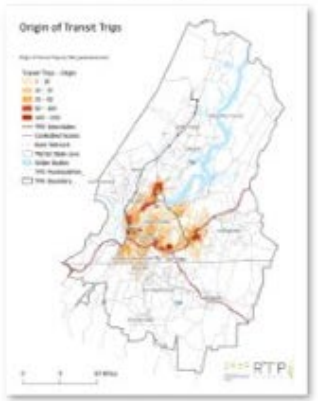
Map_16.png



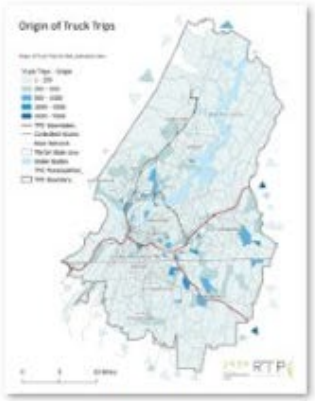
Map_17.png



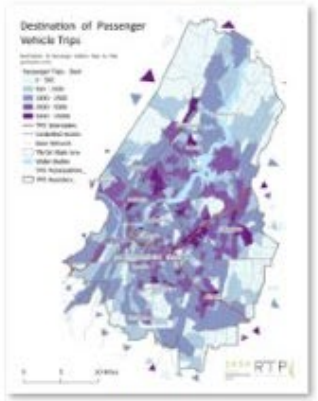
Map_18.png



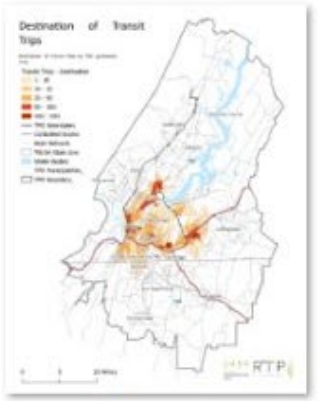
Map_19.png



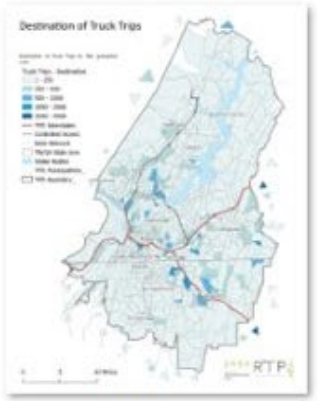
Map_20.png



Map_21.png



Map_22.png



Map_23.png

DATA SOURCES

2010 Household Travel Survey

2015 CARTA On-Board Survey

2015-2019 5-year US Census Bureau American Community Survey Data

2014-2019 County Building Permits

RPA 2050 Land Use Model future growth and employment

Employment :

- Infogroup Business Data,
- Quarterly Census of Employment and Wages (QCEW) from TN Dept of Labor and Workforce Development
- Chamber of Commerce's major employers
- US Census Longitudinal Employment-Household Dynamics (LEHD)

Network:

- 2014 highway network updated to 2019 based on observed conditions and Google imagery
- TN DOT Annual Average Daily Traffic Maps
- GA DOT Traffic Analysis & Data Application
- FHWA 2018 HPMS Data Release
- 2019 INRX Vehicle Flow Data

MODEL IMPROVEMENT PROGRAM

- Update TAZ / MicroZones
- Model Software
  - Update TransCAD from v7 to v10
  - Add to GISDK ability to start from intermediate locations of the model?
  - ABM Software:
    - Stay in DaySim (check for newer version?)
    - ActivitySim
    - CT-RAMP2
    - TransCAD ABM if want to maintain all in one package
- Work From Home
  - How can it be incorporated?
  - New model component?
  - Off-model process?
- Mode Choice - Add Passenger Rail component

USER GUIDE AND TRAINING

Sessions:

- 7 initial sessions and 1 follow up session

Duration: 2:00 hour sessions

Dates: March 21, 2022, through April 26, 2022

Location: Zoom Based

Topics	General questions
Session# 1 General setup and structure of the TDM Date 3/21 Duration 1:30	
• Introduction	
Session #2 Validation & Calibration Date 3/23 Duration 2:00	
• Model Use Case Studies	• Project the external station counts.
Session #3 Model Code and Sub-Model Components Date 4/1 Duration 2:00	
• TDM Validation &Calibration *(Continued)* o Assignment and Skimming	• How to compare the AADT and the model run results since not every
Session #4 DaySim & PopSyn Date 4/12 Duration 2:00	
• Sub-Model components: *(Continued)*	• How to generate the buffer file, set up and what is its function?
Session #5 Model Debugging Date 4/13 Duration 1:30	
• Performance Metric Reporting	• Common Errors
Session #6 Model Improvements & Enhancements Date 4/25 Duration 2:00	
• Interactive setup of Select Link Analysis	• The current model is for workdays
Session #7 Model Improvements & Enhancements, Date 4/26 Duration 2:00	
• Mapping of Select Link Analysis from Session #6 • Model and Data Management o Data Management	• How to use TDM to evaluate project proposal and policies, like change of transit fare and work from home, etc.

Session – General Questions Date 4/26 Duration 2:00	
• General questions o Attributes and Formulas o Facility Class, Ramps and Roundabouts o Weekday vs Weekend Modeling o Gas prices o Network Creation o Employment Crosswalk table o Additional Questions ▪ Work from Home proposal ▪ Post-process tool ▪ JAR files in Server ▪ Documentation	• The role of various data fields (variables) such as employment sectors, parking, school enrollment, group quarter population, age groups and income in the mathematical formula of the model. • The current model is for workdays only, will is involved to expand the model to 7 days? • How do you modify Gas prices? What model components does it change? What are the final impacts? • How are Highway Network, Transit Network and Walk Network created?

Chattanooga-Hamilton County/North Georgia TPO

2050 Travel Demand Model Update

Aleeta Zeller

Transportation Analyst, Research & Analysis

Chattanooga-Hamilton County Regional Planning Agency

Chattanooga-Hamilton County/North Georgia Transportation Planning Organization

(423) 643-5900 main

What's up in Chattanooga:

- RITSA – Approved August 24
  (Regional Intelligent Transportation System Architecture and Deployment Plan)
- 2023-26 TIP – anticipated Board approval Nov 9
- CMP - anticipated Board approval Nov 9
- TDM Update – complete
- LRTP – project evaluation, final model runs in Dec
- Safe Streets for All (SS4A) – Applied for in September
  - Comprehensive Safety Action Plan
- StoryMaps and Dashboards
  - LUM
  - TDM
  - CMP