GEORGIA DOT RESEARCH PROJECT 16-12

FINAL REPORT

THE INTEGRATION OF THE REGIONAL MPO MODELS INTO THE GEORGIA STATEWIDE TRAVEL DEMAND MODEL – PHASE 1

OFFICE OF PERFORMANCE-BASED MANAGEMENT AND RESEARCH

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1. Report No.: FHWA-GA-18-1612	2. Government Accession No.:	3. Recipient's Catalog No.:

4. Title and Subtitle: The Integration of the Regional MPO Models into the Georgia Statewide Travel Demand Model – Phase 1	5. Report Date: November 2018 (Final)
	6. Performing Organization Code:
7. Author(s): Giovanni Circella, Ph.D.; Timothy Welch, Ph.D.; Ali Etezady; Alyas Widita	8. Performing Organ. Report No.: 16-12
9. Performing Organization Name and Address: School of Civil and Environmental Engineering Georgia Institute of Technology 790 Atlantic Dr NW Atlanta, GA 30322	10. Work Unit No.:
	11. PI number: 0015125
12. Sponsoring Agency Name and Address: Georgia Department of Transportation Office of Research 15 Kennedy Drive Forest Park, GA 30297-2534	13. Type of Report and Period Covered: Final; May 2016 - November 2018
	14. Sponsoring Agency Code:

15. Supplementary Notes:
Prepared in cooperation with the U.S. Department of Transportation, Federal Highway Administration.

16. Abstract:

The integration between regional and statewide travel demand models (TDMs) can often prove difficult, or even impossible, due to discrepancies in modeling assumptions, inputs, and outputs. Discrepancies in the zonal systems, socioeconomic inputs, and transportation networks limit the ability to provide external travel estimates that can be used in regional models. Similarly, state agencies cannot easily reconcile travel demand forecasts from regional agencies with the outputs of statewide models.

This research project was developed for the Georgia Department of Transportation (GDOT) and focuses on the integration of the Georgia Statewide Travel Demand Model (GSTDM) with the 14 regional TDMs used by metropolitan planning organizations (MPOs) within their respective regions and which are directly developed/managed by GDOT. To do this, the researchers propose a methodology that updates the GSTDM zonal system, socioeconomic inputs, and transportation network, and makes them consistent with the corresponding features in the MPO models. They also introduce a unified attribute table for the MPO and GSTDM networks, and a new attribute that identifies statewide-relevant links in the MPO networks, thus streamlining the process for future model updates.

This project helps GDOT streamline the travel demand modeling practice, and allows the data transfer and comparison between the statewide and MPO models to take place seamlessly. The project addresses a priority for GDOT and provides guidance to other DOTs with a solution that could be transferred to and replicated in other states and agencies. It provides an efficient way to integrate MPO models into the statewide model, compare inputs and outputs across models, and simplify future model maintenance.

17. Key Words: Travel Demand, Statewide Model, Metropolitan Planning Organization, Road Network, TAZ, GSTDM	18. Distribution Statement:		
19. Security Classification (of this report): Unclassified	20. Security Classification (of this page): Unclassified	21. Number of Pages: 131	22. Price:

Final Report

THE INTEGRATION OF THE REGIONAL MPO MODELS INTO THE GEORGIA STATEWIDE TRAVEL DEMAND MODEL – PHASE 1

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Federal Highway Administration

November 26, 2018

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Executive Summary

This report summarizes the approach used to integrate the Georgia Statewide Travel Demand Model (GSTDM) and the metropolitan planning organization (MPO) travel demand models that are currently being developed and maintained by the Georgia Department of Transportation (GDOT). It provides guidelines and recommendations to enable a streamlined, scalable, and replicable process that can be applied in future travel demand model development and updates. In doing so, the project team, with continuous coordination with GDOT, devised practical solutions to connect the GSTDM and MPO models and integrate three critical components of the travel demand forecasting models used at both the statewide and regional levels: the traffic analysis zones (TAZs), the socioeconomic input data, and the road network.

In integrating the TAZ systems, as discussed in Chapter 2, the research team in coordination with GDOT maintained the total number of TAZs constant—the GSTDM model includes a total of 3,770 TAZs, of which 3,243 are in Georgia, following the latest updates introduced in the model in 2017. However, the boundaries of the GSTDM TAZs were entirely redrawn to perfectly match those of the MPO models. This process was largely carried out using an automatic process, after which manual quality checks were applied to ensure quality of the output and consistency with higher-level geographies (e.g., state boundaries and county lines). This process ensured perfect nesting of the MPO TAZs into the GSTDM TAZs.

After the GSTDM TAZ system was synchronized with the MPO model TAZs, the comparison and transfer of model input and output data at the TAZ level became possible. Chapter 3 presents a systematic comparison of socioeconomic data between the

statewide and MPO models in each regional modeling area. Although in the majority of the MPO model areas socioeconomic data compare rather well, there are few MPOs whose socioeconomic input data noticeably differ from the GSTDM socioeconomic data. The researchers recommend that GDOT carefully revise the model input data in these MPO model areas, with the aim of eliminating the observed discrepancies.

The proposed approach to conflate the model networks is presented in Chapter 4. At the basis of the proposed approach is the awareness that the best way to ensure consistency between statewide and MPO transportation networks—and simplify future model maintenance—requires rebuilding the statewide model network using the regional MPO networks as input in each MPO model area. To identify what parts of the regional networks are relevant for statewide modeling purposes, the research team applied a traffic assignment procedure on each MPO network using the GSTDM TAZs in the area as origins/destinations of trips. The output of this step helped identify links that would not receive any traffic loads when using the coarser statewide zonal system. The output from the previous step was further pruned based on several other criteria that were identified in consultation with GDOT. In this process, a unified attribute table for all networks was developed and recommended to GDOT to further streamline future rounds of model updates.

Finally, Chapter 5 presents the conclusions and discusses how the approaches developed in this study can be used to streamline—and greatly simplify—future maintenance of the GSTDM while maintaining consistency of model inputs and outputs with the regional models. This desired outcome was identified as a central objective in the definition of the entire approach proposed in this study. Specifically, in the

development of the methods to update the statewide model components to ensure integration with the MPO models used in Georgia, the research team took special care to ensure the replicability of these methods and that future model maintenance would be as easy and simple as possible.

As a result of the approaches developed in this study, the research team presents three important recommendations and takeaways from this research:

- First, the research team recommends that GDOT adopt a protocol to use the same sources and standards to generate and maintain socioeconomic data, TAZs, and road networks, at both the statewide- and MPO-level.
- Second, in future model updates, adequate consideration should be given to the benefits offered by increasing the total number of statewide TAZs. In particular, using the same MPO-level TAZs in the GSTDM model would further simplify model maintenance and improve accuracy of the statewide model results.
- Third, all future versions of the statewide and MPO models should use the same socioeconomic and network attributes.

The research team recognizes that the adoption of these recommendations would necessarily require the engagement of multiple stakeholders within GDOT and the MPOs in Georgia. However, considering the collective interests at stake and the overall objectives of obtaining more precise and time- and cost-effective travel demand model forecasting, the researchers are confident that the implementation of these recommendations would be beneficial to all stakeholders involved.

Acknowledgements

This project builds on the previous work developed by numerous colleagues at Atkins and HNTB Corporation, who initially developed and then further updated the previous versions of the statewide travel demand model used by the Georgia Department of Transportation. We offer our gratitude to Dr. Ram Pendyala, who helped the research team during the early stages of this project and provided guidance and additional feedback throughout the course of the project. In addition, we appreciate the valuable feedback and collaboration provided by the modeling team at HNTB Corporation, who ensured coordination of this project with the other modeling activities and the maintenance process of the GSTDM and MPO models. Finally, our team extends special thanks to Mr. Habte Kassa from the GDOT Office of Planning, who proactively followed the activities of this project, provided valuable feedback and guidance throughout the project, and helped us access datasets and information needed to carry out our work. Not only did he serve as the technical/implementation manager for this project, he also acted as an active member of our research team and considerably contributed to the successful completion of the project.

Chapter 1 – Introduction

The Georgia Department of Transportation (GDOT) has developed a statewide travel demand model to assist with the formulation of statewide transportation plans. The Georgia Statewide Travel Demand Model (GSTDM) incorporates both freight and passenger travel demand forecasting components, and serves a variety of purposes including, but not limited to, the estimation of intercity passenger and truck travel volumes, interstate and state highway corridor volumes, changes in travel flows on major corridors due to changes in land use or economic policies, etc.

Despite the number of improvements in several GSTDM components, the statewide travel demand model, at this time, does not align well with metropolitan urban/regional models in the state. There are 16 regional travel demand models that are currently operated at the metropolitan planning organization (MPO) level in Georgia. While some of these models are independently developed by local MPOs and include a large number of details and fairly sophisticated modeling approaches—most notably, the Atlanta Regional Commission, or ARC, model (WSP, 2017)—many travel demand models for smaller MPOs have a more simplified scope, and are developed and maintained by GDOT and its consultants. MPO models are continuously updated to fulfill the Long Range Transportation Plan (LRTP) and conformity requirements, with the specific schedule for the MPO model updates varying by region.

The regional MPO models, in their current versions, are based on the use of zonal systems, socioeconomic inputs, and transportation networks that are independently created and maintained from those in the GSTDM framework (e.g., HNTB, 2015e). Among other limitations, this leads to a number of inconsistencies between the statewide

travel demand model and the MPO models used at the regional level, which, to date, do not allow the models to interact with each other. Inconsistencies between the GSTDM and the regional MPO models include the zonal representation, socioeconomic input data, and highway and transit networks. Such inconsistencies not only result in limitations in using the statewide model to provide external travel estimates to the regional models, but also hinder the accurate assessment of the impacts of statewide projects on travel demand and congestion patterns within the metro area boundaries.

Consequently, the need for a better integration of the GSTDM and the MPO models has been included in the top priorities identified in a peer-review report of the statewide model development (FHWA, 2012). Accordingly, the main purpose of this project is to answer the critical need of making the GSTDM consistent with the regional MPO models within their respective boundaries.

Purpose of the Research

The objective of this research study is to develop a model integration framework to incorporate the GSTDM with the regional models developed for travel demand forecasting purposes at the MPO (regional) level in Georgia. The regional models are used as analysis tool to develop the federally mandated LRTPs that MPOs are required to produce every 4–5 years. The integration framework will allow two-way comparisons of zonal structures, socioeconomic datasets, and transportation networks between the GSTDM and the MPO models. It will also provide a way to improve the performance of the statewide model through matching travel flows and relationships at the borders and external stations of the MPO models. As a result of this, GDOT will be better equipped to forecast future travel demand in the state of Georgia and make better-informed decisions

in transportation planning. Thus, the project supports the Department's strategic goals of "improving the movement of people and goods across and within the state," while enhancing the "movement of people and products in a 21st century Georgia" (FHWA, 2012). It will allow for a streamlined process for future updates of the GSTDM model, which will ensure consistency with the MPO model components also in the future versions of these models.

Overview of the GSTDM

The version of the GSTDM that was used as the input in this project covers the entire 48 continental U.S. states and includes 3,770 traffic analysis zones (TAZs), of which 3,243 are in the state of Georgia[1]. The TAZ sizes increase the farther the zones are from Georgia, since the modeling need for detailed zones outside the state diminishes the farther the zones are from the state. In developing the TAZ system, the major data sources included U.S Census Bureau data and TIGER files, the Bureau of Economic Analysis (BEA), and the Georgia Department of Labor (DOL) (Atkins, 2013a). The MPO area with the largest number of statewide TAZs is Atlanta with 930 zones, and the MPO area with the smallest number of statewide TAZs is Cartersville with 30 zones.

The highway network, including a total of 82,632 miles (of which 20,805 miles are in the state of Georgia), was developed largely based on the National Highway Planning Network (NHPN) database and cross-checked using GDOT's road

[1] An earlier version of the GSTDM TAZ system included 3,505 TAZs, of which 2,978 were in the state of Georgia. That version of the model was calibrated to the 2010 base year.

characteristics (RC) database. The developed network is based on a four-layered system, taking into account distance from Georgia, so that the details in the highway network would, similar to the TAZ system, gradually decrease the farther the roads are from the boundaries of the state. The roadway system has been categorized into urban and rural segments, with each segment further subcategorized into six functional classes to help determine the capacity and free-flow speed of links (Atkins, 2013a). More recently, however, this functional classification system has been updated to a seven-category system, essentially discarding the rural–urban segmentation of the roadway system.

The GSTDM model has been calibrated to the 2015 base year, and serves as an effective planning tool to help develop travel demand forecasts in the state until 2040. The technical staff from the GDOT Office of Planning continues to regularly update the GSTDM components in cooperation with a team of consultants contracted by GDOT, using updated information about transportation patterns, socioeconomic data, and observed traffic flows available from multiple sources. The additional sources used during the statewide model updates also include information received from other state and federal agencies and local MPOs in the state of Georgia.

Overview of the MPO Models in Georgia

The scope of the project comprises 16 MPOs in Georgia. Figure 1 illustrates the delineation of the MPO model areas with respect to GDOT districts and counties in Georgia. As Figure 1 shows, the model areas of three MPOs—specifically, Augusta: Augusta Regional Transportation Study (ARTS) (HNTB, 2015e); Columbus: Columbus–-Phenix City MPO (C-PCMPO) (HNTB, 2015b); and Chattanooga: Chattanooga–Hamilton County Regional Planning Agency (CHC-RPA)—cross into neighboring states.

Tennessee DOT is the lead agency for coordination of the CHC-RPA plan update and travel demand modeling activities. The travel demand forecasting model used for the Atlanta region is solely managed by the Atlanta Regional Commission (ARC). That leaves GDOT in charge of updating and maintaining a total of 14 MPOs in the state, i.e. Albany (Cambridge Systematics & HNTB, 2015a); Athens (HNTB, 2014); Brunswick (HNTB, 2015a); Cartersville (HNTB, 2016a); Dalton (HNTB, 2015d); Gainesville (HNTB, 2015c); Hinesville (HNTB, 2015e); Macon (Cambridge Systematics & HNTB, 2015b); Rome (HNTB, 2016b); Savannah (Atkins, 2013b); Valdosta (Cambridge Systematics & HNTB, 2015c); and Warner Robins (HNTB, 2015f), in addition to August and Columbus that were already mentioned before. These 14 MPOs are therefore the main focus of this project.

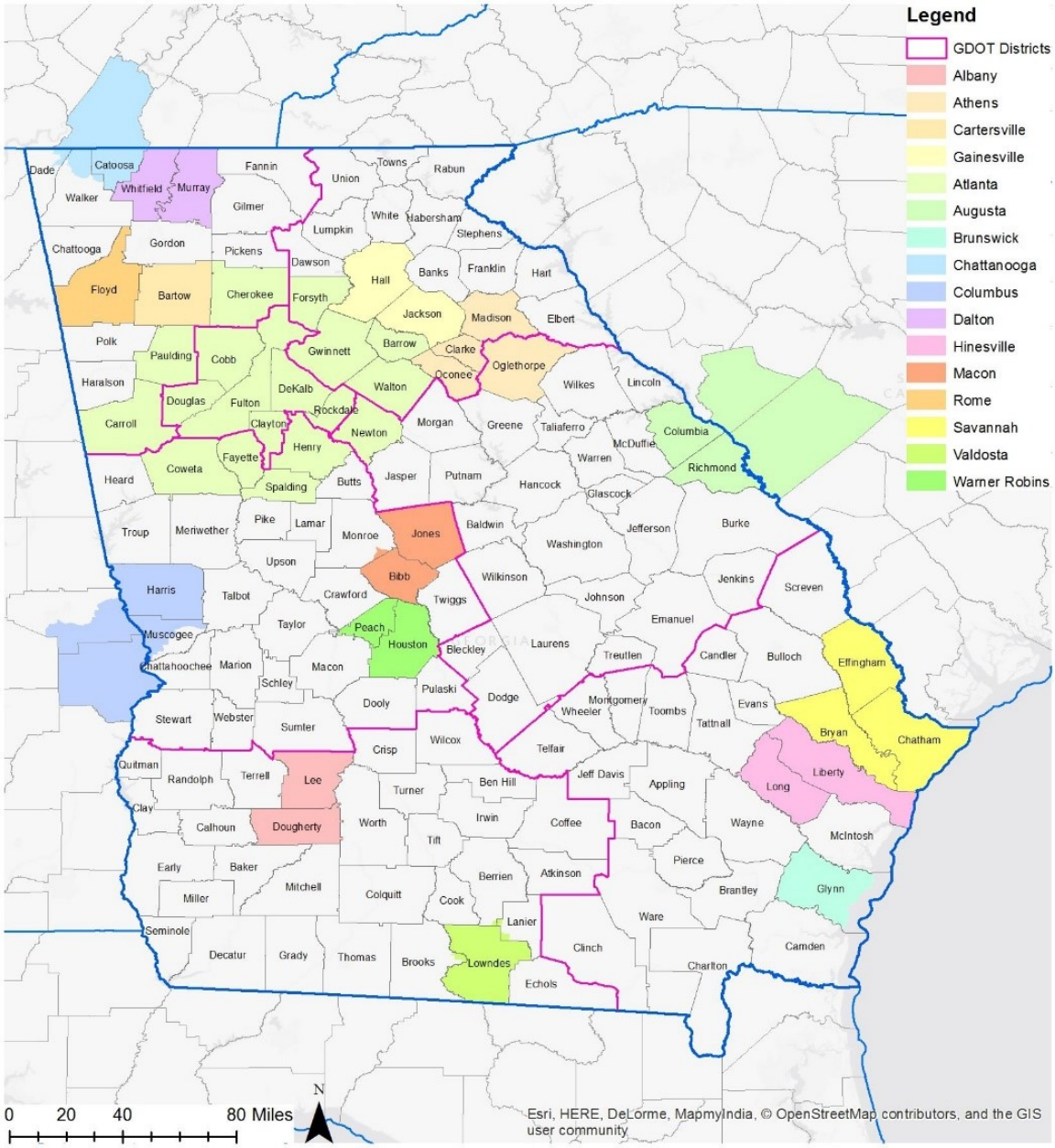


FIGURE 1

Identification of MPO Model Areas
with Respect to County Boundaries and GDOT Districts
(Source: Created by the Authors)

MPO Model Updates

Prior to conducting the main tasks of integrating the statewide and regional MPO models, the project team assessed the characteristics of each regional MPO model in the state. Understanding the characteristics of the MPO models under study is an important preliminary step for this project. This assessment included analyzing each MPO model in terms of socioeconomic data, TAZs, transportation networks, and modeling methods used to forecast travel demand. In addition, and to get a better sense of the state of the work on MPO modeling, the project team summarized when each MPO model was last updated. A summary of these model updates is presented in Table 1. As Table 1 reports, most of the regional MPO models were updated fairly recently (in 2015 or later). Only a few MPOs had their regional models updated several years back, in 2012 and 2013. The versions of the MPO models that were last updated in the years listed in Table 1 were used as input in this project.

TABLE 1

List of 16 MPO Models in Georgia and the Time of Their Most Recent Model Update (as of September 2018)

	MPO		Last Update	
	Name	Abbreviation	Year	Month
1	Albany	DARTS	2015	February
2	Athens	MACORTS	2014	October
3	Atlanta	ARC	2016	April
4	Augusta	ARTS	2015	October
5	Brunswick	BATS	2015	September
6	Cartersville	CBMPO	2016	February
7	Chattanooga	CHC-RPA	2013	February
8	Columbus	C-PCTS	2015	January
9	Dalton	GDMPO	2015	September
10	Gainesville	GHMPO	2015	January
11	Hinesville	HAMPO	2015	October
12	Macon	MATS	2012	October
13	Rome	RFCMPO	2016	March
14	Savannah	CORE	2013	December
15	Valdosta	VLMPO	2015	October
16	Warner Robins	WRATS	2015	October

Chapter 2 – Integration of MPO TAZs in the GSTDM Modeling Framework

As part of this research project, the research team at the Georgia Institute of Technology worked on the development of solutions and recommendations that would allow the integration of the MPO models' zonal systems, data, and transportation networks into the GSTDM. This chapter summarizes the methodology used for the integration of the MPO TAZs in the GSTDM modeling framework.

Methodology

The methodology used to develop the revised TAZ system for the GSTDM involves two primary stages:

I. Automation process

II. Manual checks and revisions

These two stages were employed to achieve one of the primary objectives of this project, which is creating a coherent and synchronized TAZ system between the MPO models and the GSTDM. Figure 2 conceptually summarizes the methodology the project team employed to achieve this goal.

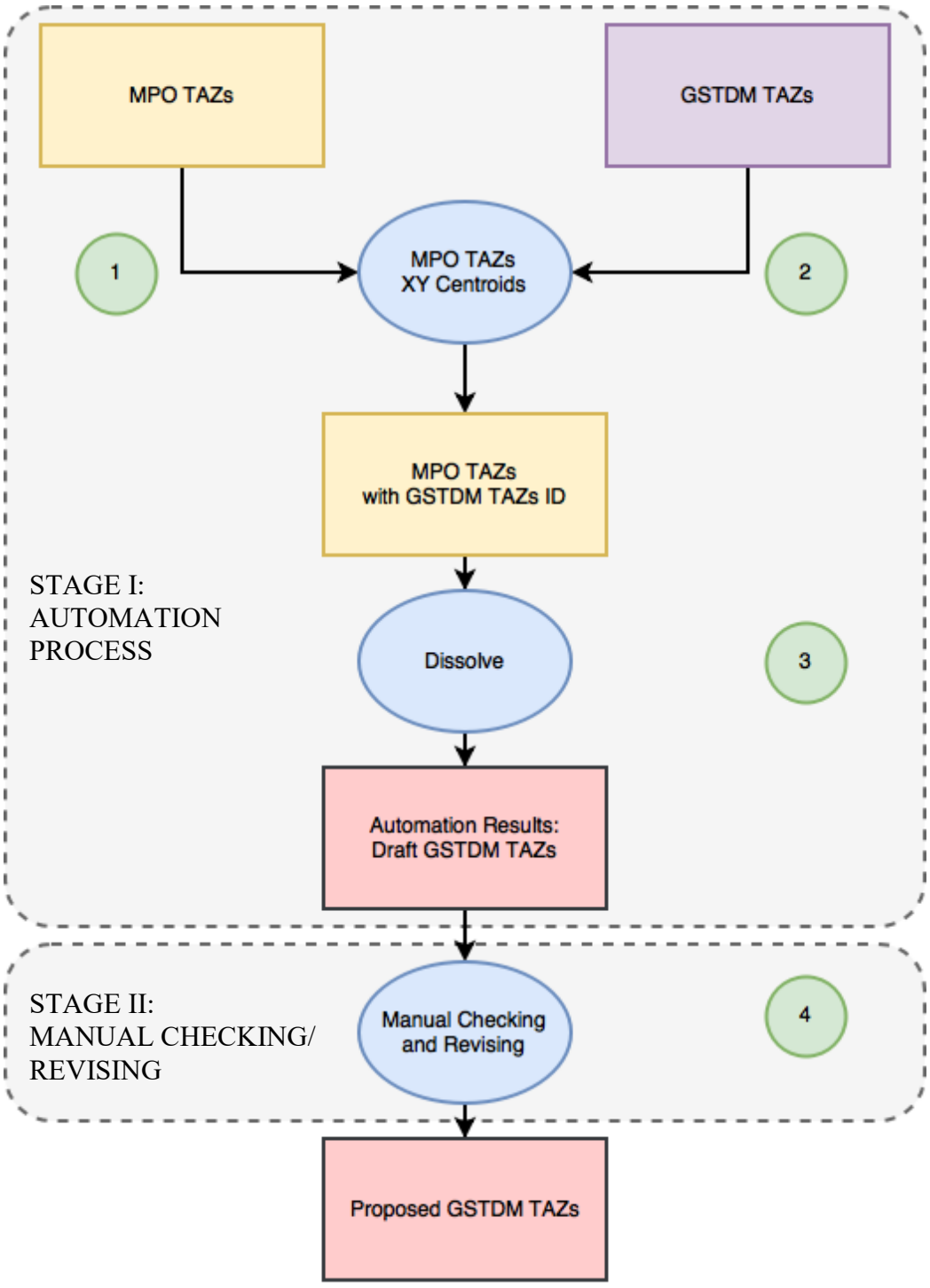


FIGURE 2

Conceptual Diagram of the Methodology to Integrate MPO and GSTDM Zonal Systems
(Source: Created by the Authors)

Stage I. Automation Process

The automation process, as the first stage, is a high-level procedure to develop a raw draft of the GSTDM TAZ system based on the existing zonal geographies of the MPO models. As expected, there is a significant number of instances where the GSTDM TAZ borders do not neatly match those of the existing MPO TAZs. The research team, therefore, geared this procedure toward producing a proposed GSTDM TAZ system that corresponds neatly with the existing MPO TAZ systems.

To this end, the research team came up with a sophisticated approach by creating a script that would handle the procedure without having to rely solely on cursory manual checking. To the researchers' knowledge, this method is novel and has not been used in any previous project. The process, as illustrated in Figure 2, can be described as follows:

- ***Step 1***. Identify the longitude (X) and latitude (Y) of the MPO TAZ spatial centroids, which will be used to obtain information from the corresponding GSTDM TAZs.
- ***Step 2***. Spatially join the GSTDM TAZ IDs to the MPO TAZ centroids that fall within their boundaries. This process is then followed by joining the new information of the MPO TAZs' *centroids* back to the MPO TAZ *polygons* so that each MPO TAZ would have its corresponding GSTDM TAZ ID. An example of the outcome of this process for part of the Albany MPO is provided in **Error! Reference source not found.**.
- ***Step 3***. Dissolve the inner boundaries of the MPO TAZs with the same GSTDM TAZ ID attribute to form the new statewide TAZs. This is the end result of the automation process.

The entire process described above was completed using a relatively short script developed in the open-source software RStudio. The script is included in Appendix A.

TABLE 2

Example of the MPO TAZs Matched with a GSTDM TAZ in the Albany MPO Region

MPO TAZ ID	GSTDM TAZ ID	County
233	1420	Dougherty
234	1420	Dougherty
235	1420	Dougherty
236	1420	Dougherty
237	1420	Dougherty
239	1420	Dougherty
240	1420	Dougherty
241	1420	Dougherty
242	1420	Dougherty
243	1420	Dougherty
244	1420	Dougherty
245	1420	Dougherty
246	1420	Dougherty
247	1420	Dougherty

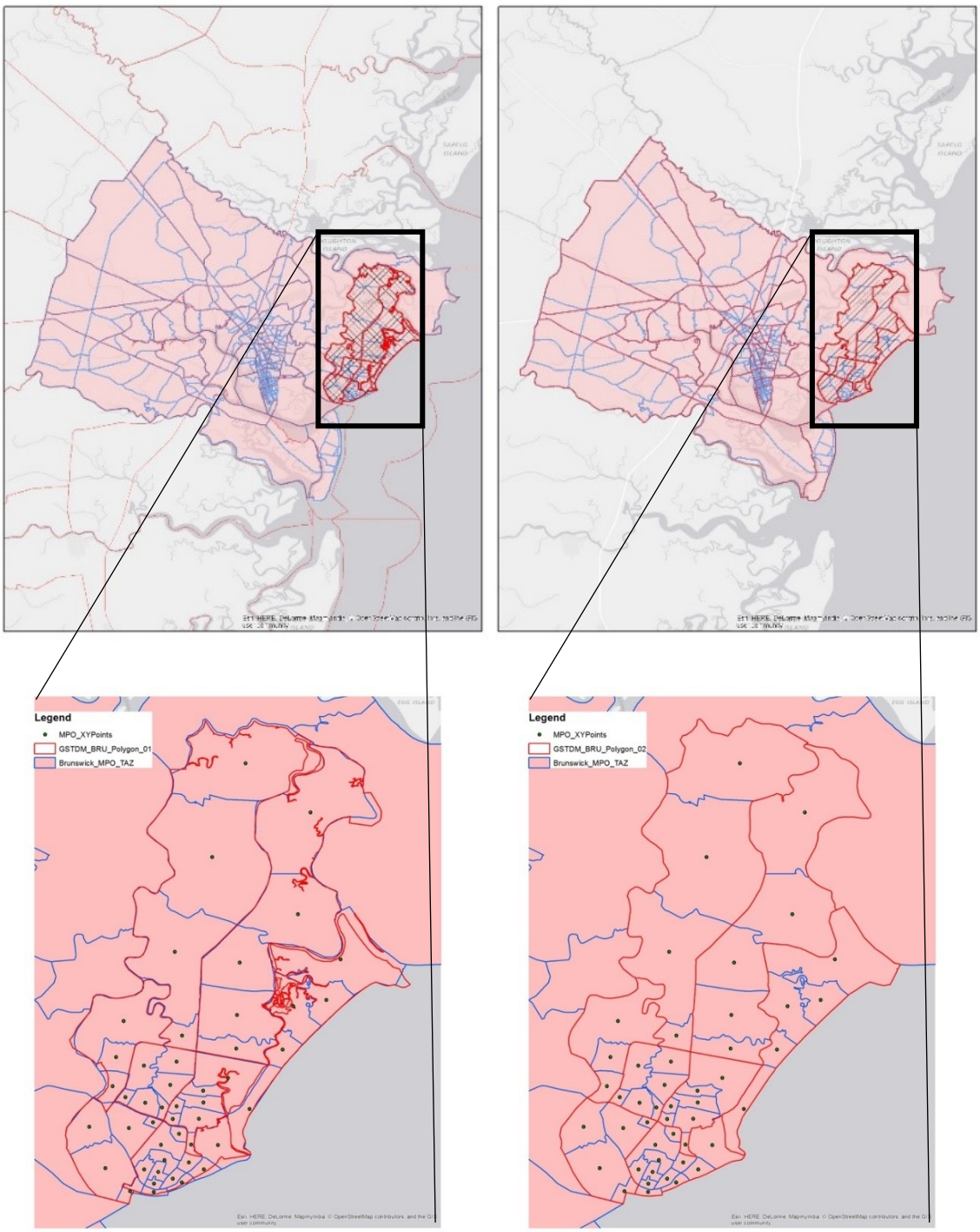
Example of Automation Process

This section describes an example of the application of the automation process to redraw GSTDM TAZs that are synchronized with MPO TAZs inside an MPO model area. The example focuses on a cluster of MPO TAZs in the Brunswick MPO region (Figure 3). As shown in Figure 3(a), there are a number of discrepancies between the old GSTDM TAZ

system and the MPO TAZs; the GSTDM TAZ borders do not match neatly with the MPO TAZ borders in the region.

As discussed in the previous section regarding the step-by-step automation process, the creation of XY centroids of the MPO TAZs plays an important role in obtaining the information on the GSTDM TAZ IDs. The *centroids* that fall within each GSTDM TAZ will be assigned that GSTDM TAZ ID, which will later be attached back to the information of the MPO TAZ *polygons*. This piece of information is used to dissolve the MPO TAZs into the proposed GSTDM TAZ system.

Assigning back the MPO TAZ centroids with the information of the GSTDM TAZ IDs to the MPO TAZ polygons is an intermediate step before dissolving the MPO TAZ polygons into a raw draft output of the automation process. Figure 3(b) shows the result after the MPO TAZ polygons are dissolved based on the GSTDM TAZ IDs, and how the draft proposed GSTDM TAZ system now matches neatly with the MPO TAZ boundaries. Appendix A contains additional examples of the application of the automation process.



(a) (b)

FIGURE 3

Example of MPO TAZs (Blue Line) and GSTDM TAZs (Red Line) within the Brunswick MPO Region: (a) Before and (b) After Steps in Stage I (Source: Created by the Authors)

Stage II. Manual Checking/Revising

After the application of the automation process, the research team employed an additional step to manually check and control the results:

- ***Step 4***. Manual checks are employed to correct any potential issues and adjust the final outcome to respect higher hierarchy boundaries (e.g., state and county boundaries).

The automation process is helpful as the main step to produce the draft version of the proposed GSTDM TAZs. Manual checks and revisions, however, are necessary to complement the automation process and produce the final revised GSTDM TAZ system that is consistent not only with the existing MPO TAZ geographies, but that also aligns well, to the degree possible, with administrative boundaries, geographical features, and the transportation network.

In accordance with the primary objective of developing a proposed GSTDM TAZ system that matches neatly with the MPO TAZ geographies, the research team updated the GSTDM TAZ boundaries mainly using the MPO TAZs as reference. However, the researchers also considered ensuring minimal discrepancies with the census geographies, e.g., census tracts, block groups, and blocks (and also the Census Transportation Planning Products,[1] or CTPP, as described in the following section) wherever possible.

There are a few instances in which relying solely on the automation process did not lead to a final acceptable solution. For example, the researchers manually revised the draft GSTDM TAZ system (output of the automation process) in the Augusta MPO

[1] https://ctpp.transportation.org/ctpp-data-set-information/

region to better match the GSTDM TAZ boundaries with the state-level boundaries. Moreover, the research team revised one proposed GSTDM TAZ in the Chattanooga MPO region by dividing it into two TAZs because the original one included two physically separated areas located on the opposite sides of a river (and not connected by any bridge) in a single TAZ.

As another example, Figure 4 shows an area in Brunswick, Georgia, where a residential neighborhood is mixed with the port area. In the manual checking stage, the researchers investigated the population and sociodemographic characteristics of the blocks in the area. This observation warranted a change in the boundaries so that the GSTDM TAZ contains more homogeneous land uses, which is somewhat essential for travel demand modeling purposes.

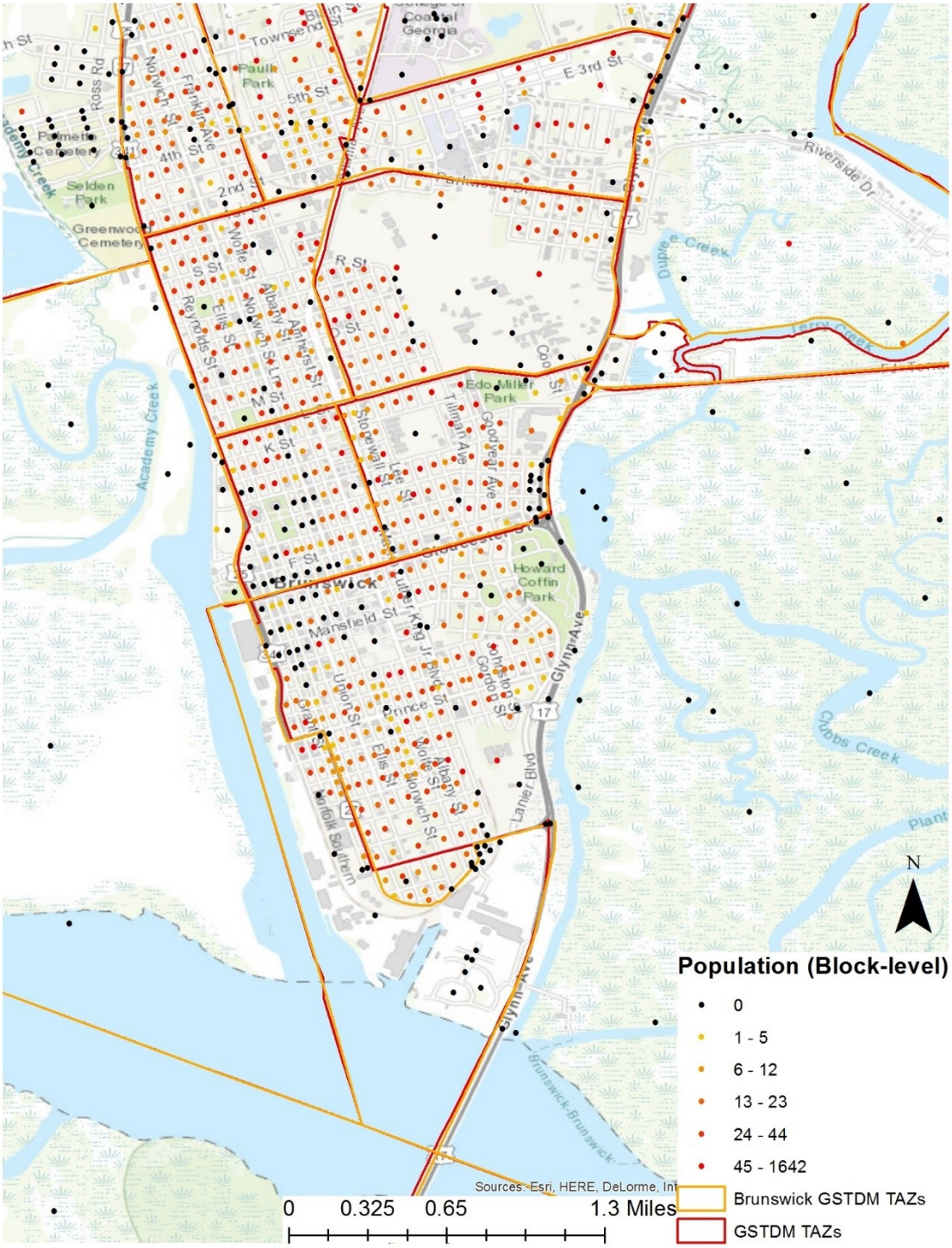


FIGURE 4

Changing the Boundaries of TAZs in Brunswick Based on Population and Land Use Distributions
(Source: Created by the Authors)

Proposed GSTDM TAZ System and CTPP Geographies

As previously mentioned, although the main goal of this project was to resolve the discrepancies between the current GSTDM TAZ system and the MPO TAZ systems, the consistency between the proposed GSTDM TAZ system and the block-level census geographies as well as the CTPP TAZ system was also checked (as illustrated in Figure 5 and Figure 6, respectively). This process was accomplished through the spatial join tool in ArcGIS to identify any discrepancies, and the results of this process were manually checked to decide whether further modifications were needed and to ensure the quality of the output.

In checking the conformity of the census geographies with the proposed GSTDM TAZs, minor discrepancies were exhibited, most of which could be disregarded with minimal to no actual effect on the accuracy of the proposed GSTDM TAZ system. In all these cases, the research team prioritized ensuring the consistency of the GSTDM TAZ system with the MPO TAZs, even if this meant retaining very minor discrepancies with the census block geographies. We recommend that such discrepancies with the census geographies be resolved during the next round of updates of the MPO travel demand models, so that their updated TAZs will follow census boundaries neatly in future versions of these models, and this perfect nesting of the census geographies will be carried over to the GSTDM model through the synchronization of the GSTDM-MPO TAZ systems that has been introduced as part of this project.

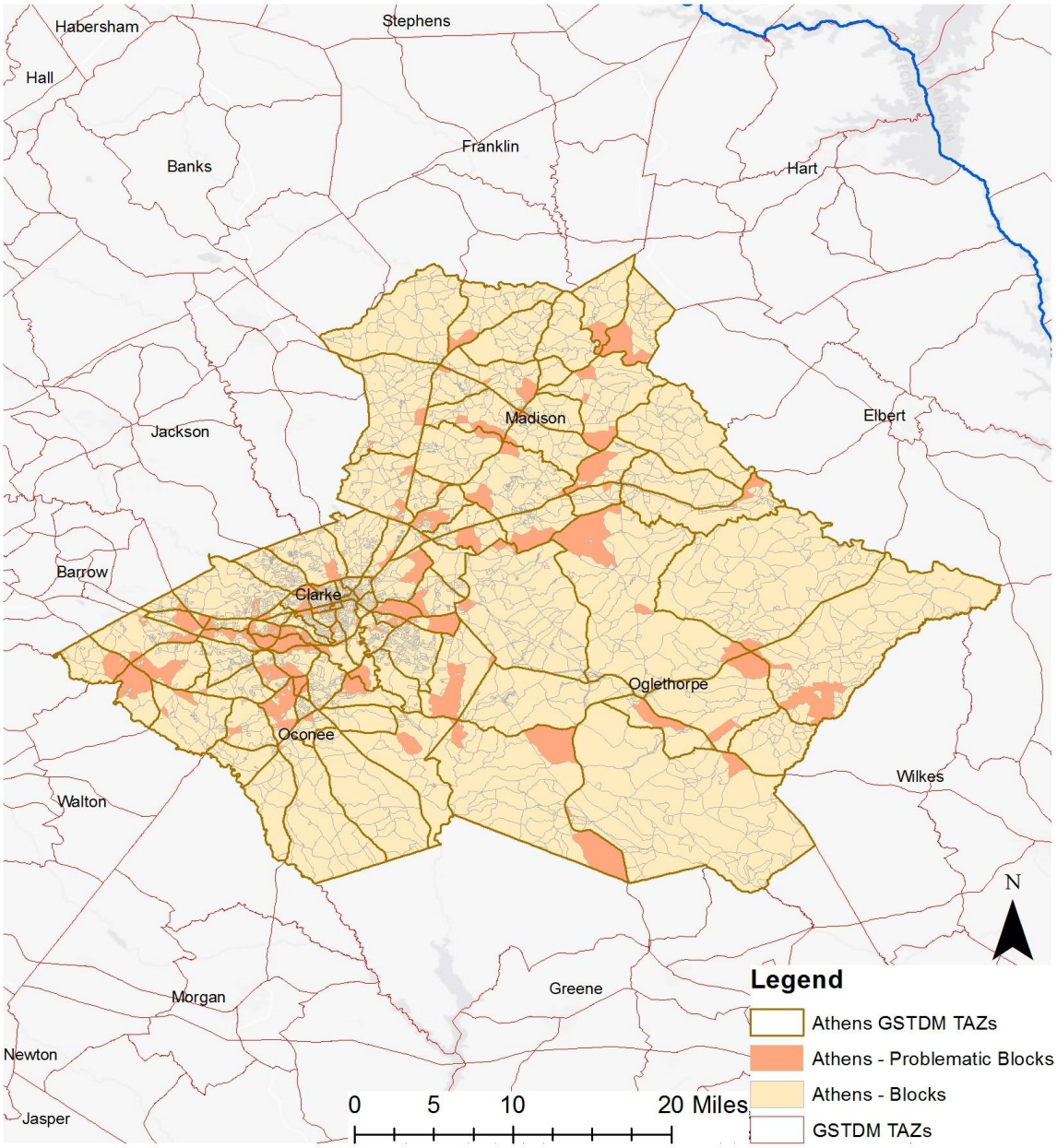


FIGURE 5

Checking the Conformity of the GSTDM TAZ System in the MPO Region of Athens with the Census Blocks (Source: Created by the Authors)

By incorporating this manual checking process based on the census geographies, the research team created a correspondence table linking the census block identification numbers to the corresponding GSTDM TAZ IDs. This measure ensures the two-way

synchronization between the GSTDM and MPO TAZs, and between the GSTDM TAZs and the census blocks, and provides easier comparison of inputs and outputs between the models. The GSTDM-MPO TAZ correspondence tables for all MPO model areas in the state were provided to GDOT as part of the deliverables for the project.

In terms of conformity with the CTPP TAZ system, the researchers often encountered several major discrepancies, specifically in non-urban areas. Figure 6 below shows an example of such discrepancies for the case of the Athens MPO model area. Since the CTPP TAZs were of secondary importance to the main objective of this project, the researchers did not try to resolve those issues, as implementing such a change would have resulted in discrepancies with the MPO TAZ system. However, consistency with the CTPP boundaries was searched, and obtained, in the GSTDM TAZs for all non-MPO areas in the state.

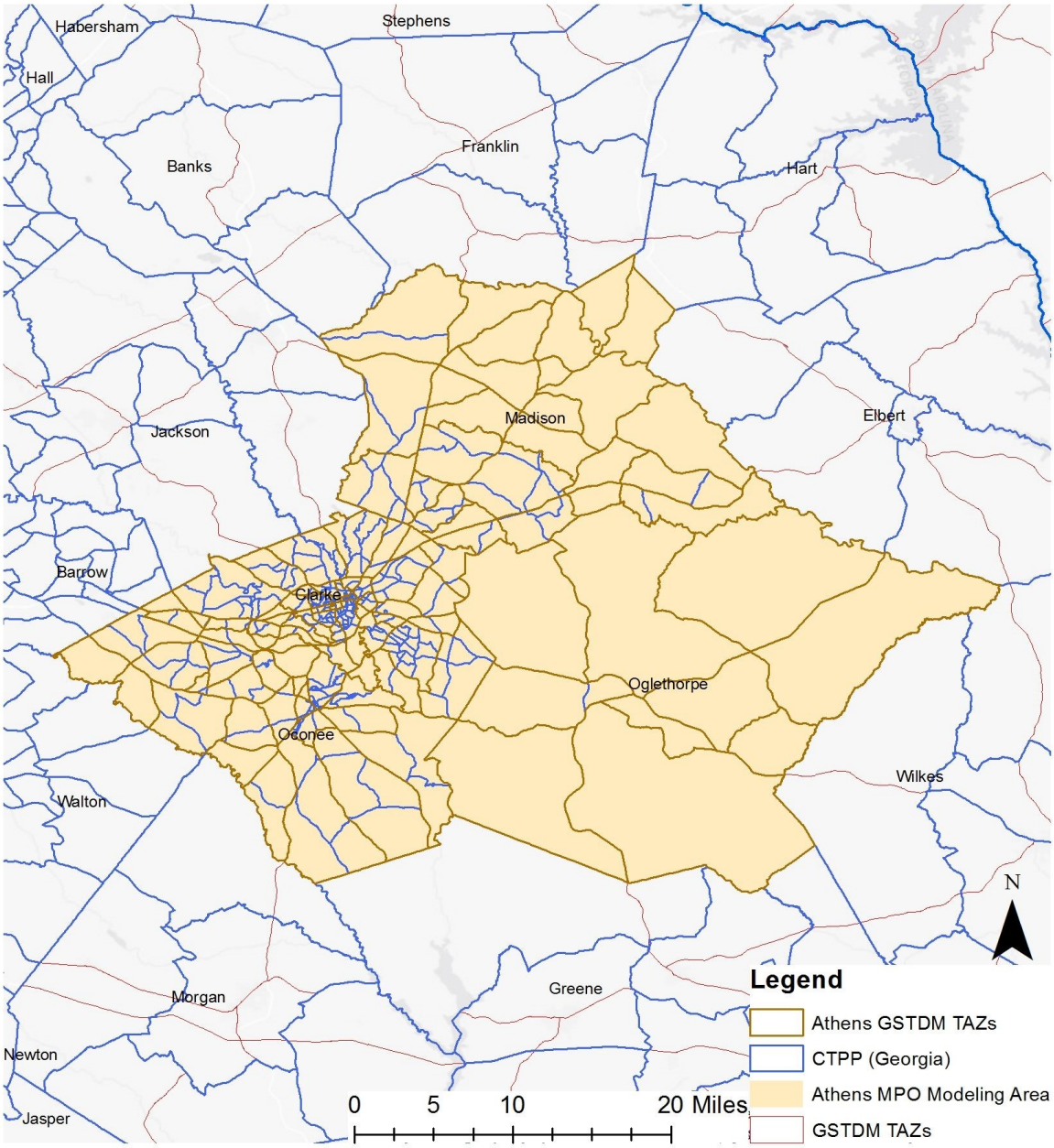


FIGURE 6

Checking the Conformity of the GSTDM TAZ System in the MPO Region of Athens with the CTPP TAZ System (Source: Created by the Authors)

GSTDM TAZ Numbering System

Following the application of the integrated automation and manual checking process described previously, new GSTDM TAZ numbers were assigned as the next step. Also,

as part of this step, the MPO model area in which a TAZ is located (if any) is clearly identified, and the location information appended to the TAZ boundaries. In doing this, MPO model regions were listed alphabetically (as shown in Table 3), and the corresponding MPO code was assigned to each TAZ located in its model area.

TABLE 3

MPO Codes and Corresponding MPO Model Area

MPO Code	MPO	MPO Code	MPO
1	Albany	9	Dalton
2	Athens	10	Gainesville
3	Atlanta	11	Hinesville
4	Augusta	12	Macon
5	Brunswick	13	Rome
6	Cartersville	14	Savannah
7	Chattanooga	15	Valdosta
8	Columbus	16	Warner Robins

A Python script in ArcGIS was employed to assign TAZ numbers to the GSTDM TAZs in each MPO region, updating the attribute field 'GSTDM_TAZ' in the attribute table of the respective shapefile. The researchers first used the script for the MPO region of Atlanta, and then assigned subsequent TAZ numbers to the following MPO model regions.

Specifically, the Python script employed by the research team assigned numbers to the GSTDM TAZs starting from '1' in the Atlanta model area. The script then generated sequential numbers for all TAZs in the Atlanta model region from '1' to '930', indicating that there are 930 TAZs in the region. We then used the same script for the

remaining MPO regions, changing the *pStart* value according to the last TAZ number of the previous MPO region. During this process, in agreement with the GDOT Office of Planning, the research team followed a sequence that is different from the alphabetical order used for the MPO codes reported in Table 3.[1] Thus, the GSTDM TAZs included in the Atlanta MPO model region are numbered from '1' to '930', and the GSTDM TAZs in the Gainesville model area, which is the second MPO based on the ordering as specified in Table 4, start with '931'.

The process yielded new GSTDM TAZ numbers for all MPO model regions, as illustrated in Table 4. For the TAZs located in the rural areas that do not fit in any MPO model region, researchers assigned TAZ numbers starting from '2061', since the last GSTDM TAZ located in an MPO model region has a number of '2060'. There is a total of 3,770 TAZs in the GSTDM after the work done by Georgia Tech and the consultant teams.

[1] The MPO codes were revised to follow an alphabetical order later during this project, and to make these codes consistent across TAZ and road networks.

TABLE 4

TAZ Numbering System Used in GSTDM

MPO	From	To	# of TAZs	MPO Code
Atlanta	1	930	930	3
Gainesville	931	1052	122	10
Cartersville	1053	1082	30	6
Rome	1083	1135	53	13
Athens	1136	1243	108	2
Dalton	1244	1316	73	9
Augusta	1317	1422	106	4
Macon	1423	1506	84	12
Columbus	1507	1598	92	8
Warner Robins	1599	1658	60	16
Albany	1659	1707	49	1
Hinesville	1708	1751	44	11
Savannah	1752	1901	150	14
Brunswick	1902	1963	62	5
Valdosta	1964	2014	51	15
Chattanooga	2015	2060	46	16

Output Table and Documentation

Following the automation, manual checking, and revision processes, and then the TAZ numbering procedure, the output of the TAZ updating process included a shapefile with the proposed GSTDM TAZ geographies, and an attribute table containing the fields summarized in Table 5. Per recommendations received from GDOT, the research team included the following additional attributes to identify for each TAZ:

- *Georgia Department of Transportation District Code* and *District Name*. Each TAZ is assigned a code and district name indicating its location within a specific district in Georgia.
- *MPO Code* and *Region*. Each TAZ is assigned an MPO code from 0 to 16, following the order of MPOs reported in Table 3, where the value of '0' indicates that the TAZ is not located within any specific MPO model region.
- *State*. Each MPO is assigned a state code to identify its location; the model also includes TAZs located in neighboring states.

Table 5 summarizes the attribute fields included in the updated GSTDM TAZ system.

TABLE 5

Updated Attribute Table of the Proposed GSTDM TAZ System

Variable	Description	Value
GDOT_DISTR	Georgia Department of Transportation district code	1 2 3 4 5 6 7
DISTRICT_N	District name	District One- Gainesville District Two- Tennille District Three- Thomaston District Four- Tifton District Five- Jesup District Six- Cartersville District Seven- Chamblee

Variable	Description	Value
MPO Code	MPO code	0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16
GSTDM_TAZ	Georgia statewide TAZ number	1–3770
STATE	State where the TAZ is located	GA AL FL NC SC TN
Region	MPO region	N/A Atlanta Gainesville Cartersville Rome Athens Dalton Augusta Macon Columbus Warner Robins Albany Hinesville Savannah Brunswick Valdosta Chattanooga

Chapter 3 – Socioeconomic Data

Socioeconomic data are an important input and the primary driver of the travel demand model. The socioeconomic data of the 14 MPOs, which were extracted from each MPO model documentation and/or model files, provide information at the TAZ level on total population, total number of households, number of jobs (total and by category, e.g., retail, industrial, service), income, and school and university enrollment, where applicable. A comparison of these data between the GSTDM and MPO models was not possible before this project but can now be performed after redrawing the GSTDM TAZs to match the MPO TAZ boundaries so that MPO TAZs perfectly nest into GSTDM TAZs. This comparison can assist GDOT in better assessing the accuracy and consistency of the data at the statewide and regional levels and, if needed, take action to resolve observed differences/discrepancies.

In the remainder of this chapter, as well as in the following chapter that focuses on the integration of the model networks, this report primarily focuses on the 14 MPOs that are directly maintained by GDOT. In-depth analyses for Atlanta and Chattanooga were not carried out. The project team and GDOT agreed to exclude these two MPOs due to the following reasons:

1. Atlanta has its own model characteristics that are remarkably different from those of the other MPOs in Georgia. That is, while the 14 MPO models developed and maintained by GDOT use a traditional four-step transportation modeling approach, the model that is developed and maintained by the Atlanta Regional Commission is built on activity-based travel demand modeling. Moreover, the

model is not directly maintained and managed by GDOT, thus the integration with the GSTDM is a lower priority for GDOT.

2. Even though a portion of the Chattanooga MPO model region is located in Georgia, this MPO is based in Tennessee and directly reports to the Tennessee Department of Transportation.

Summary of Socioeconomic Variables by MPO

Table 6 provides a summary of the total population and number of households within each MPO area and MPO model region. The research team specifically focused on the total population and number of households since these two variables are consistently present in both GSTDM and MPO socioeconomic datasets. Other socioeconomic variables, particularly employment, did not show such consistency.

Most MPOs have model regions that expand beyond their administrative MPO area boundaries. Only for a few MPOs—Brunswick, Cartersville, Macon, Rome, Savannah, and Valdosta—the model region coincides with the MPO administrative boundaries. For these MPOs, the total population and number of households do not differ between MPO administrative boundaries and model areas.

TABLE 6

Total Population and Number of Households in Each MPO Area and Model Region

Model	MPO	Population		Households	
		Total Model Area	Total MPO	Total Model Area	Total MPO
Albany	DARTS	121,176	118,835	48,861	48,045
Athens	MACO	191,929	153,220	75,182	60,784
Augusta	ARMPO	510,946	444,098	200,151	175,572
Brunswick	BATSMPO	79,494		37,886	
Cartersville	CBMPO	99,167		35,781	
Columbus	C-PCMPO	308,863	255,731	122,677	102,727
Dalton	GDMPO	142,215	118,044	49,221	40,561
Gainesville	GHMPO	238,355	191,861	92,602	74,079
Hinesville	HAMPO	75,998	66,634	27,116	23,973
Macon	MATS	179,994		70,881	
Rome	RFCMPO	94,854		39,974	
Savannah	CORE	342,653		139,801	
Valdosta	VLMPO	110,781		45,040	
Warner Robins	WRATS-MPO	167,626	139,824	63,055	53,028

* Gray cells indicate that the total population and number of households in a given MPO are the same for the MPO area and MPO model region, because these MPO models operate inside the same MPO administrative boundaries.

Table 7 summarizes the number of MPO TAZs within the MPO administrative region, outside of the MPO administrative boundaries, and the total number of TAZs in the model area for each MPO model. In most cases, MPOs tend to use model areas that are bigger than the MPO administrative region, and therefore include a number of TAZs outside of the MPO administrative boundaries. Table 7 also reports the number of external stations that connect the transportation network of each MPO model to outside areas.

TABLE 7

Number of MPO TAZs within Each MPO Area and Model Region

MPO Name	MPO Agency	TAZs within MPO Area	Additional TAZs in MPO Model Region	Total TAZs in MPO Model	External Stations
Albany	DARTS	438	20	458	31
Athens	MACO	312	136	448	38
Augusta	ARMPO	842	265	1,107	35
Brunswick	BATSMPO	397		397	10
Cartersville	CBMPO	215		215	19
Columbus	C-PCMPO	500	198	698	46
Dalton	GDMPO	262	31	293	23
Gainesville	GHMPO	397	112	509	48
Hinesville	HAMPO	193	28	221	12
Macon	MATS	483		483	34
Rome	RFCMPO	190		190	26
Savannah	CORE	796		796	20
Valdosta	VLMPO	419		419	26
Warner Robins	WRATS-MPO	330	93	423	21

* The gray cells indicate that there are no additional TAZs as the MPO model boundaries coincide with the MPO administrative region.

Comparison of Socioeconomic Data between GSTDM and MPO Models

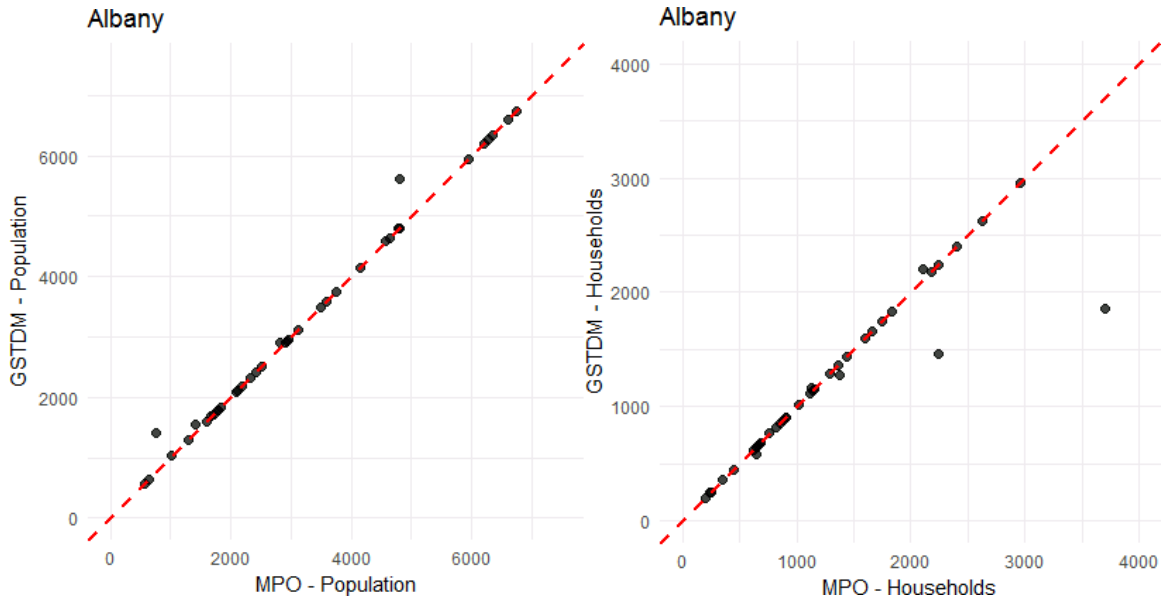
This section focuses on the comparison of TAZ-level socioeconomic data between the statewide and the MPO models. These comparisons allow GDOT to identify MPOs where significant discrepancies in the distribution of these data exist, and take appropriate measures to resolve such issues. The following graphs systematically compare total population and household counts for the GTSDM and MPO models aggregated at the GSTDM TAZ level (using the correspondence tables between GSTDM

and MPO TAZs to aggregate MPO model data). In the comparisons reported in the remainder of this chapter (and in Appendix B), the research team used data from the 2010 GSTDM TAZ system (not the newer TAZs from the 2015 model update) to make the data more comparable to the corresponding socioeconomic data in the MPO models. While 2010 socioeconomic data were available for all MPOs, only a subset of the MPO models had already been updated to the 2015 base year at the time of this project. The full details of these comparisons are provided in the set of tables included in Appendix B.

As a summary, the socioeconomic data for most MPOs match the GSTDM socioeconomic data reasonably well. A slight discrepancy was found for the Macon model area where the scatterplot of the aggregated MPO model data and the corresponding GSTDM data did not fall neatly along the desired 45-degree line, indicating that there is a sub-optimal match level for this MPO. The following sections further elaborate the findings for each MPO.

Albany

Figure 7(a) compares total population and Figure 7(b) compares household counts between the GSTDM TAZs and the MPO TAZs that nest into them for the Albany MPO model area. The data points on the 45-degree dotted line identify a perfect match between the two models. The larger the deviation from this line, the larger the discrepancy between GSTDM- and MPO-level data. As Figure 7 shows, differences in the TAZ-level data between the GSTDM and Albany MPO model are rather minor, with only a few TAZs having total population higher in the GSTDM than in the MPO model, and a few with household counts higher in the MPO model.



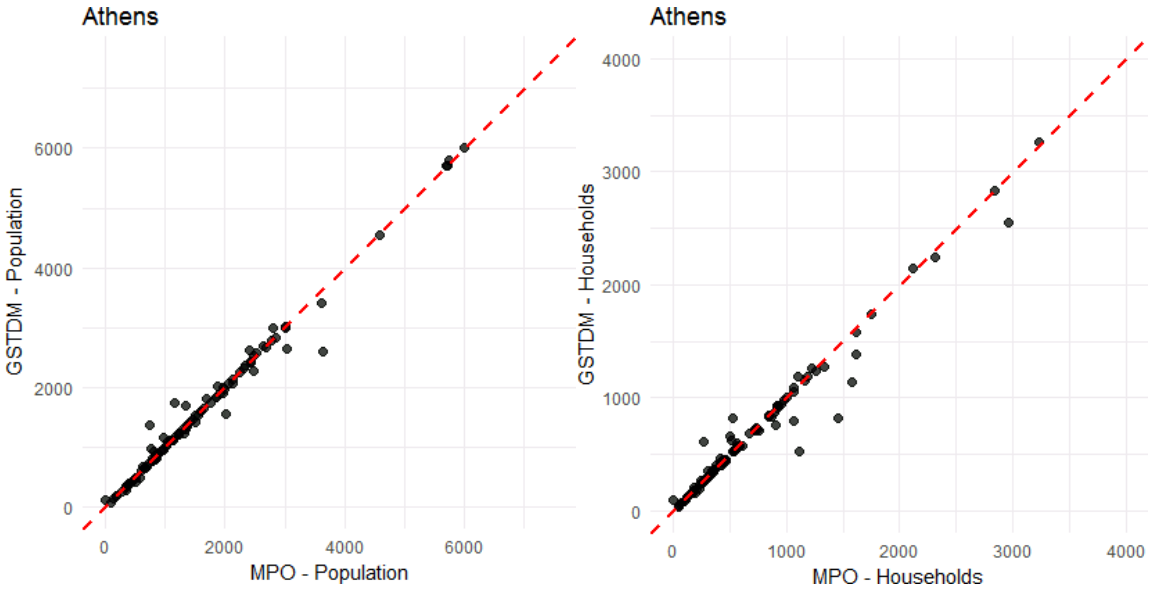
(a) (b)

FIGURE 7

Distribution in GSTDM and MPO Socioeconomic Data: (a) Total Population and (b) Number of Households at GSTDM TAZ Level in Albany (Source: Created by the Authors)

Athens

Figure 8 illustrates how population and household data compare between the GSTDM and Athens MPO model. In this case, most points also fall on or near the 45-degree line, thus indicating a rather good match of data between the two models. Some TAZs have larger estimates (in particular for the household counts) in the MPO model.



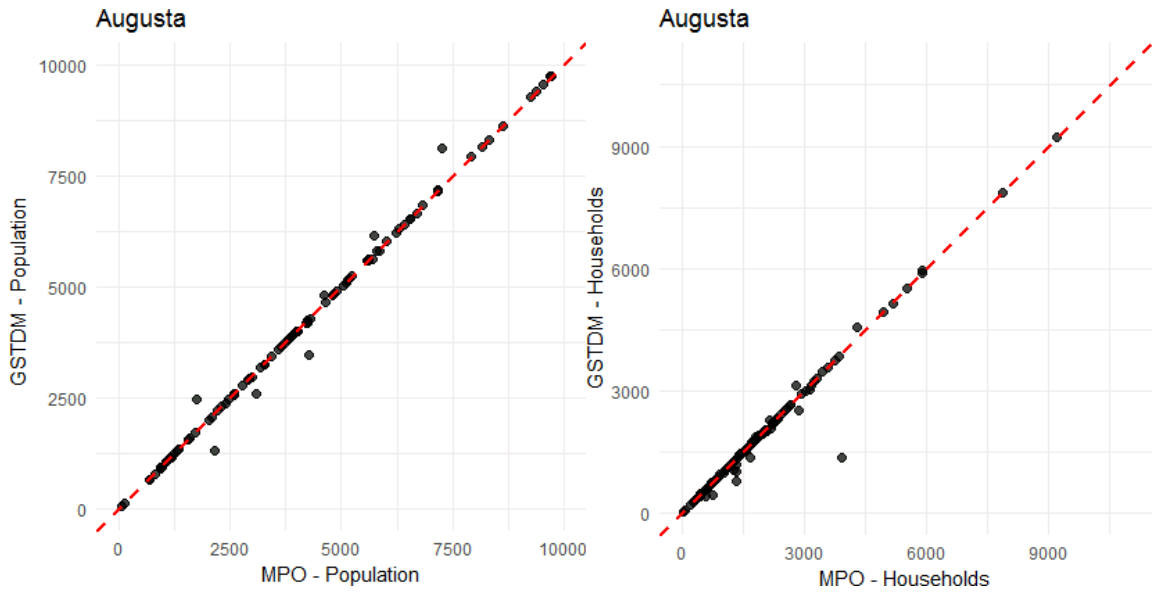
(a) (b)

FIGURE 8

Distribution in GSTDM and MPO Socioeconomic Data: (a) Total Population and (b) Number of Households at GSTDM TAZ Level in Athens (Source: Created by the Authors)

Augusta

Figure 9 presents total population and household data for the GSTDM and MPO model in Augusta. The TAZ-level data generally compare well, with only a few TAZs showing some deviation from the dotted line with the 1:1 match.



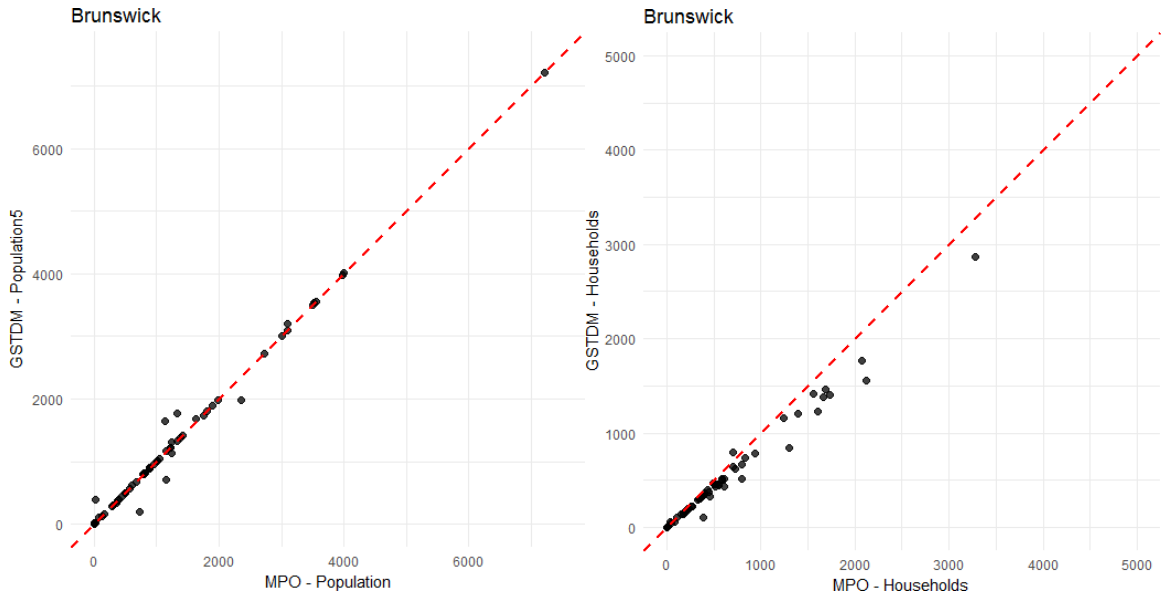
(a) (b)

FIGURE 9

Distribution in GSTDM and MPO Socioeconomic Data: (a) Total Population and (b) Number of Households at GSTDM TAZ Level in Augusta (Source: Created by the Authors)

Brunswick

The TAZ-level assessment in the case of Brunswick indicates that the GSTDM and MPO data generally compare well, as shown in Figure 10. This is especially relevant in terms of the number of population where the data clusters along the 45-degree line. However, the assessment of the number of households suggests that MPO data appear to overestimate the number of households relative to the GSTDM data, to some extent.



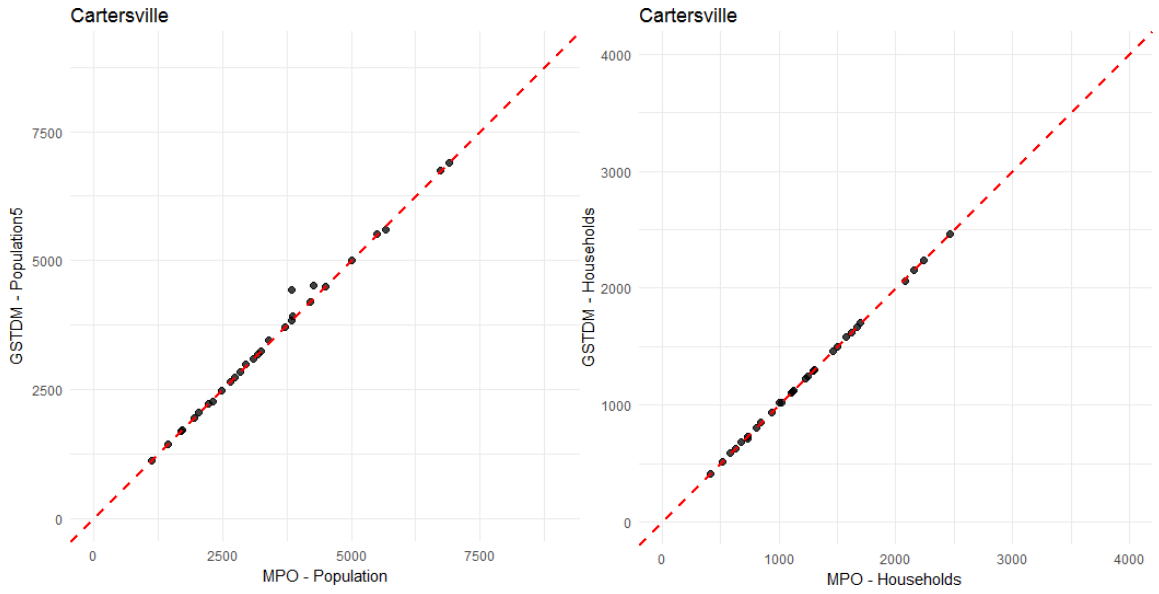
(a) (b)

FIGURE 10

Distribution in GSTDM and MPO Socioeconomic Data: (a) Total Population and (b) Number of Households at GSTDM TAZ Level in Brunswick (Source: Created by the Authors)

Cartersville

The case of Cartersville indicates a noticeably good match between the GSTDM and MPO data, as shown in Figure 11. Both population and household data fall neatly along the 45-degree line. A few TAZs show a very minor discrepancy in terms of the number of population. The overall TAZ-level assessment in the case of Cartersville, nevertheless, shows consistent socioeconomic data across the GSTDM and MPO models.



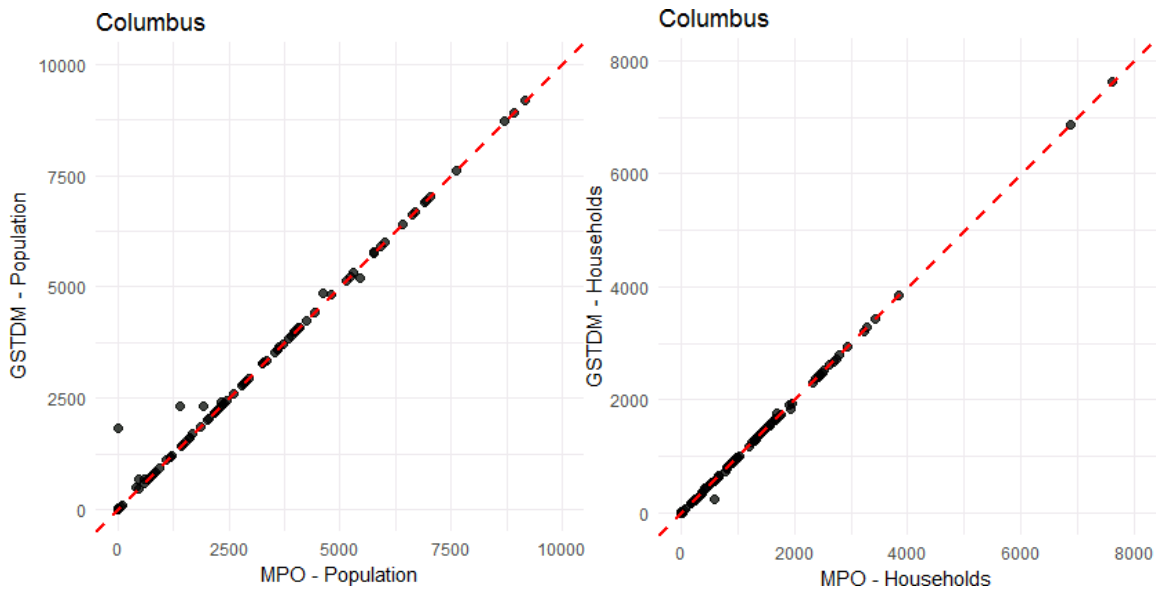
(a) (b)

FIGUR E 11

Distribution in GSTDM and MPO Socioeconomic Data: (a) Total Population and (b) Number of Households at GSTDM TAZ Level in Cartersville (Source: Created by the Authors)

Columbus

Figure 12 shows a good match of the population and household data between the GSTDM and the Columbus MPO model. With the exception of a handful of outliers, most cases fall on or very close to the 45-degree line.



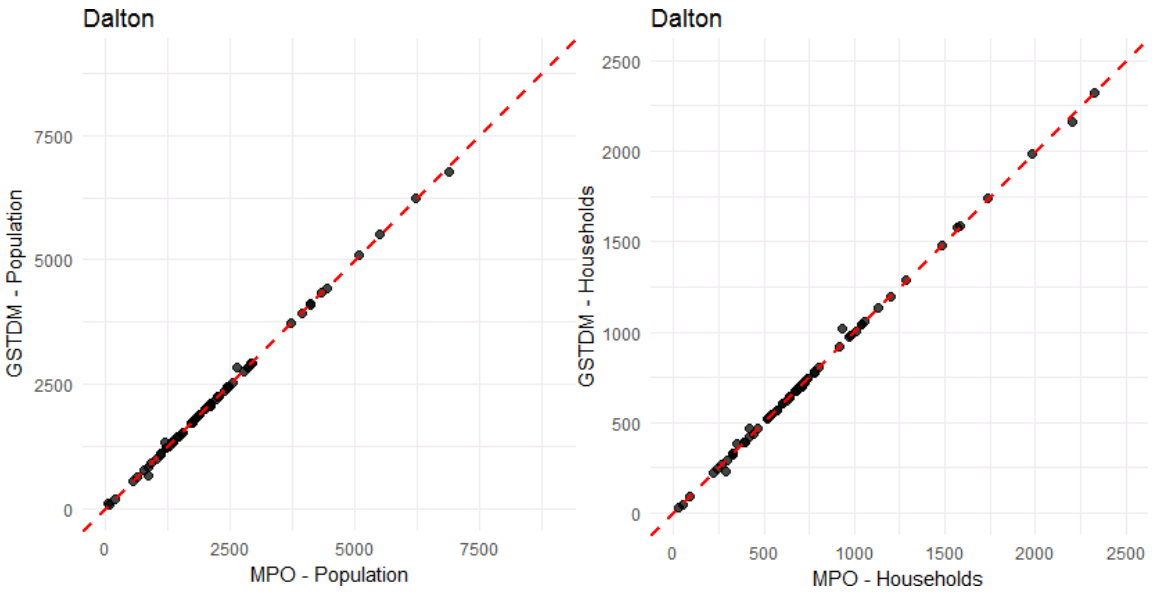
(a) (b)

FIGURE 12

Distribution in GSTDM and MPO Socioeconomic Data: (a) Total Population and (b) Number of Households at GSTDM TAZ Level in Columbus (Source: Created by the Authors)

Dalton

Figure 13 shows the scatterplots of population and household data for the GSTDM and MPO model in the Dalton region. The scatterplots show a very good match, indicating that in this MPO model area the data from the MPO model match the GSTDM socioeconomic data well.



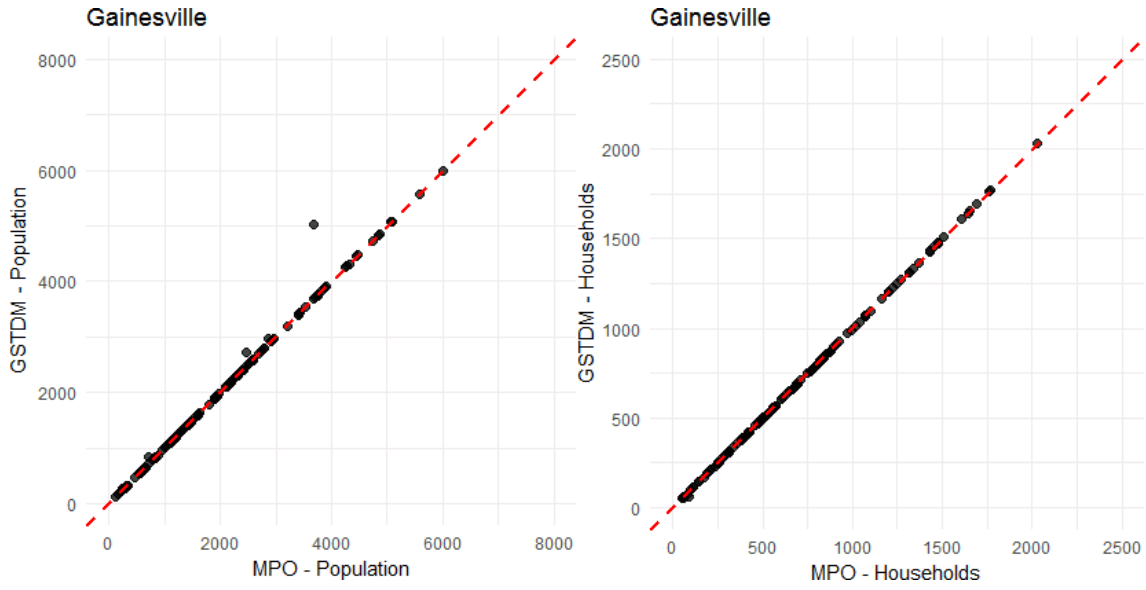
(a) (b)

FIGURE 13

Distribution in GSTDM and MPO Socioeconomic Data: (a) Total Population and (b) Number of Households at GSTDM TAZ Level in Dalton (Source: Created by the Authors)

Gainesville

As shown in Figure 14, except for a few outliers, population and household counts match quite well between the GSTDM and MPO model in the Gainesville region.



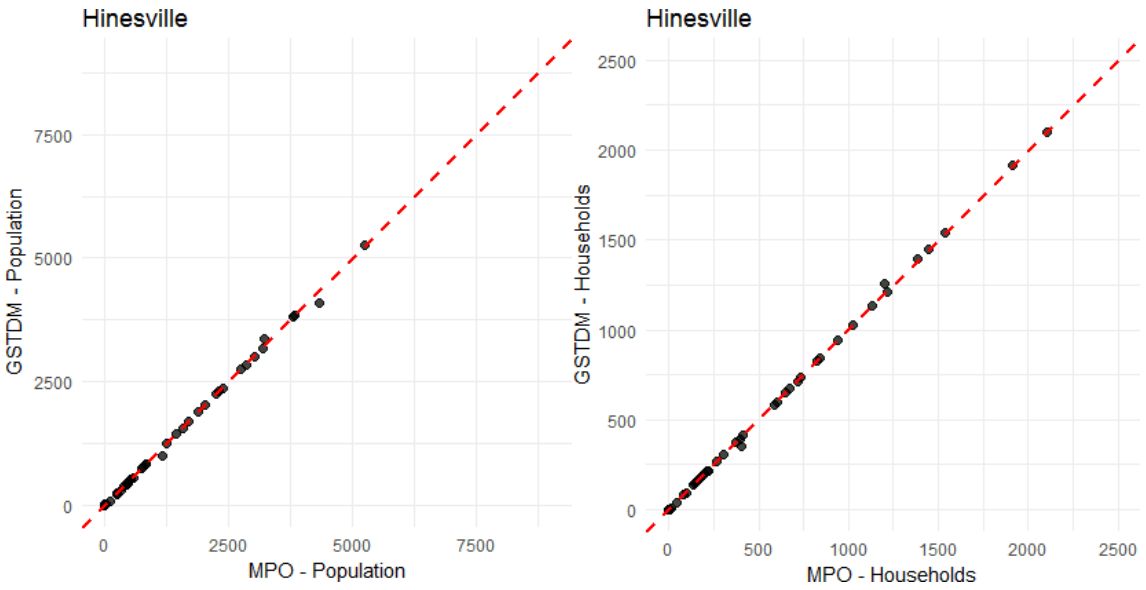
(a) (b)

FIGURE 14

Distribution in GSTDM and MPO Socioeconomic Data: (a) Total Population and (b) Number of Households at GSTDM TAZ Level in Gainesville (Source: Created by the Authors)

Hinesville

Figure 15 shows the comparison of population and household data between the Hinesville MPO model and the GSTDM. In this MPO, there is a good match between the data from the two models, with most cases falling on or very close to the 45-degree line.



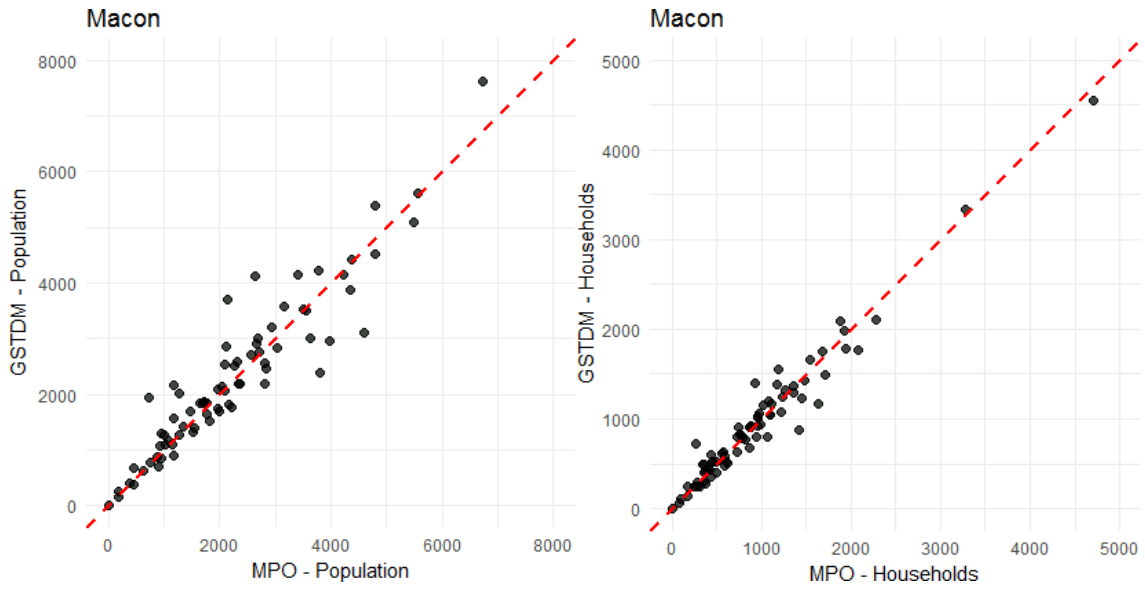
(a) (b)

FIGURE 15

Distribution in GSTDM and MPO Socioeconomic Data: (a) Total Population and (b) Number of Households at GSTDM TAZ Level in Hinesville (Source: Created by the Authors)

Macon

In the case of Macon, as shown in Figure 16, a relatively large number of TAZs does not fall neatly along the 45-degree line, indicating some deviation of the MPO model data from the GSTDM socioeconomic data for some TAZs in this model area.



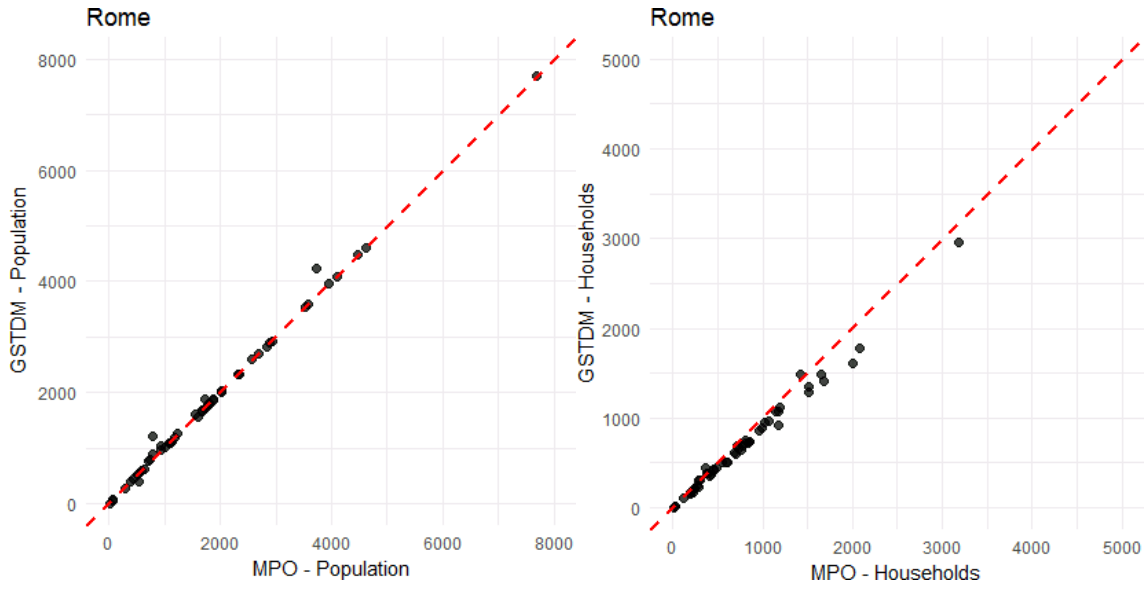
(a) (b)

FIGURE 16

Distribution in GSTDM and MPO Socioeconomic Data: (a) Total Population and (b) Number of Households at GSTDM TAZ Level in Macon (Source: Created by the Authors)

Rome

As shown in Figure 17, both population and household data from the statewide and MPO model have a good fit for the Rome MPO, with only a few minor deviations.



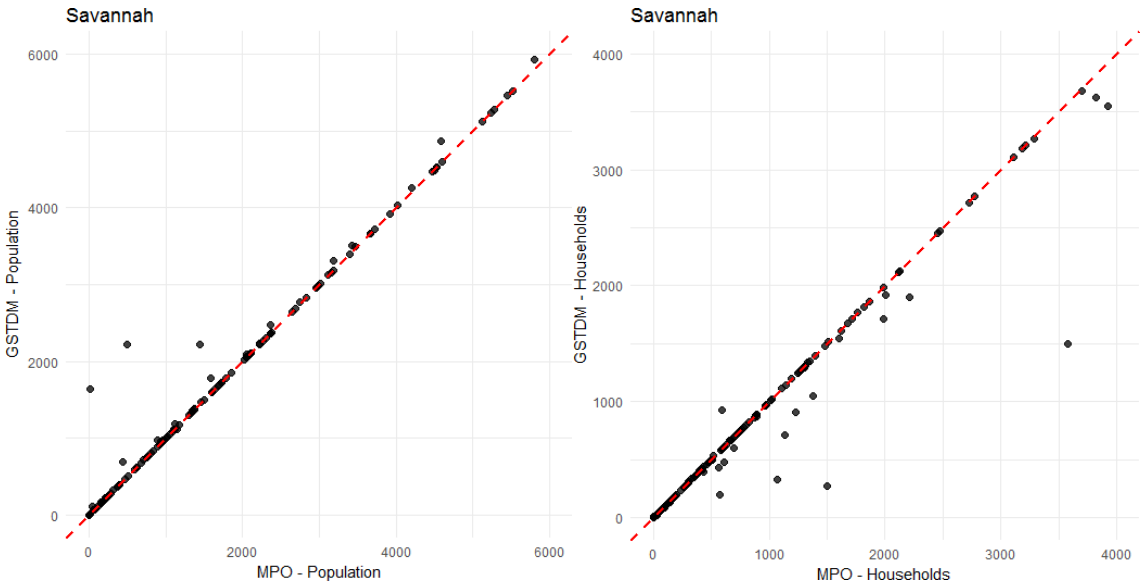
(a) (b)

FIGURE 17

Distribution in GSTDM and MPO Socioeconomic Data: (a) Total Population and (b) Number of Households at GSTDM TAZ-Level in Rome (Source: Created by the Authors)

Savannah

The analysis of the socioeconomic data in the Savannah MPO region suggests that the MPO model and the GSTDM share reasonably comparable socioeconomic data, as shown in Figure 18. While a few minor deviations appear in both the population and household comparisons, the case of Savannah points to a good match between GSTDM and MPO data where most observations fall neatly along the 45-degree line.



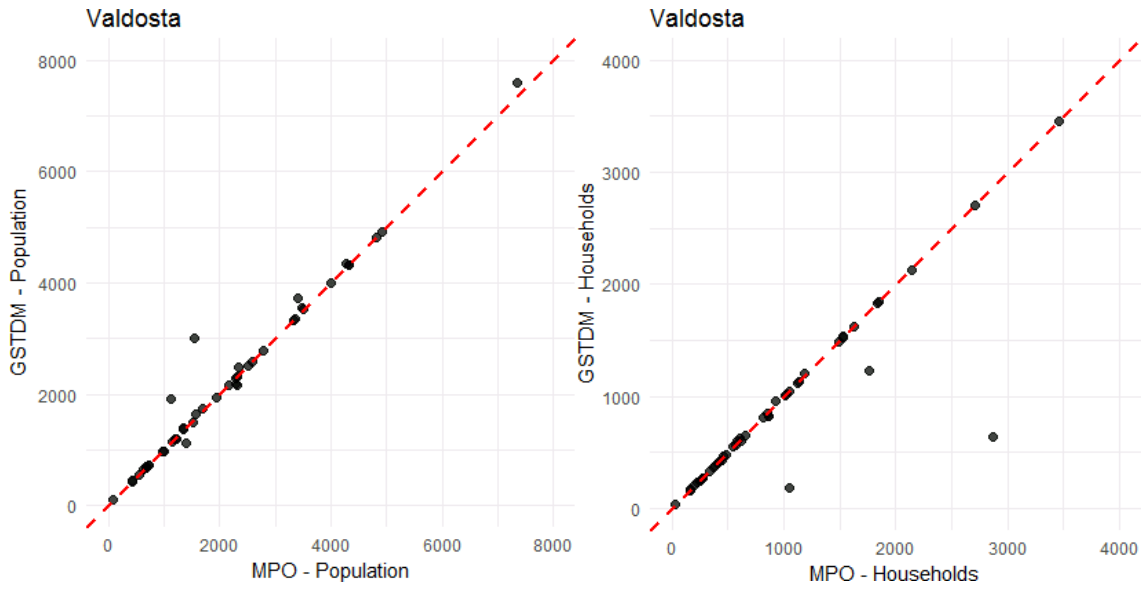
(a) (b)

FIGURE 18

Distribution in GSTDM and MPO Socioeconomic Data: (a) Total Population and (b) Number of Households at GSTDM TAZ Level in Savannah (Source: Created by the Authors)

Valdosta

As shown in Figure 19, the socioeconomic data of the Valdosta MPO model area match the GSTDM socioeconomic data rather well, with the majority of the TAZs that fall neatly along the 45-degree line.



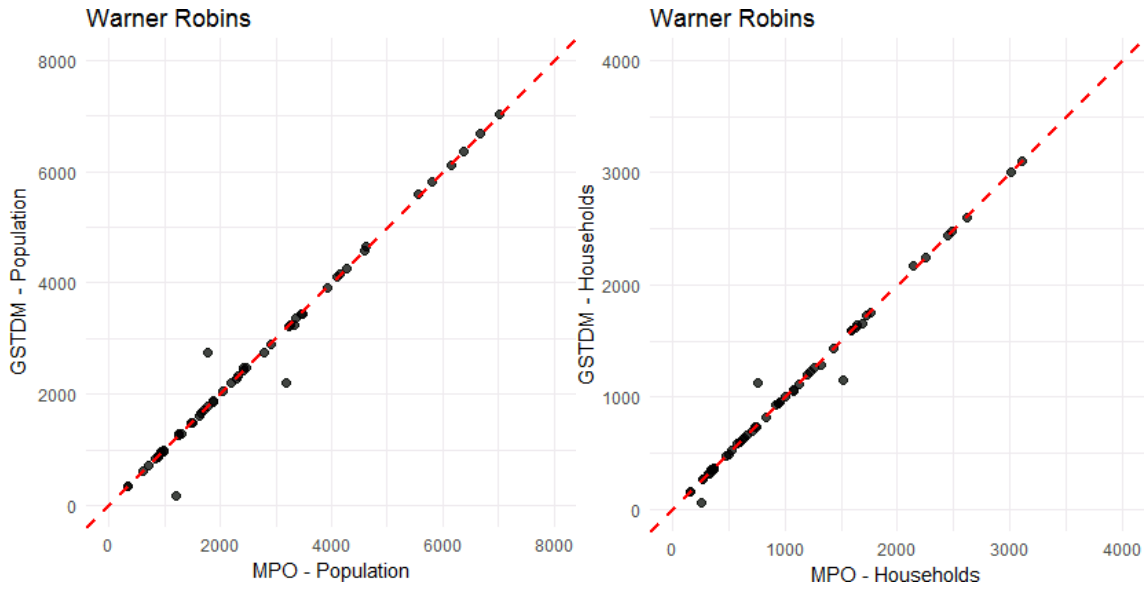
(a) (b)

FIGURE 19

Distribution in GSTDM and MPO Socioeconomic Data: (a) Total Population and (b) Number of Households at GSTDM TAZ Level in Valdosta (Source: Created by the Authors)

Warner Robins

The analysis of the Warner Robins MPO indicates that the MPO model data have a good fit with the GSTDM data. As shown in Figure 20, there are only noticeable deviations in a few TAZs.



(a) (b)

FIGURE 20

Distribution in GSTDM and MPO Socioeconomic Data: (a) Total Population and (b) Number of Households at GSTDM TAZ Level in Warner Robins (Source: Created by the Authors)

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Chapter 4 – Integration of MPO Networks in the GSTDM Framework

An important part of this phase of the research involved the integration of the MPO and statewide networks. The research team explored various approaches to complete this task. One of these included integrating the full MPO road networks *as a whole* into the statewide model. However, after consultation with GDOT, it was decided not to consider this approach, since the coarser statewide TAZ system (which was updated during the previous step in this project) would not justify the use of the more detailed MPO-level network. The project team, therefore, considered alternative approaches to identify which parts of the MPO network can effectively work with the statewide TAZ system and import them into the statewide model network.

The approach that was ultimately used rebuilds the GSTDM road network using portions of the MPO model networks as inputs in each MPO model region. This chapter elaborates on the details of the methodology that were used to achieve the aforementioned goal, and further discusses the output of this process, and how it can be used in the future to simplify updating the statewide network. Chapter 5 explains how, as a result of the process used in this part of the project, the future model maintenance will be much simplified.

Methodology

The project team used a nine-step approach to conflate the statewide and regional MPO networks and ensure consistency in network representation and future updates in the GSTDM network. Figure 21 provides a flowchart with the nine steps followed in this process. All tasks that were carried out in the Citilabs Cube software are marked in green.

The tasks that were run in ESRI ArcGIS are marked in yellow. The nine steps include the following:

- **Step 1**: *Deleting the portions of the GSTDM network inside the MPO model areas*. This step is accomplished using ArcGIS software.[1]
- **Step 2**: *Preparing the MPO network for a traffic assignment to identify links relevant to the statewide scope*. The MPO network and the updated GSTDM TAZs in each MPO model area are linked to generate new centroids and centroid connectors. The team used the Cube (Voyager) software package to complete this step. Also, where applicable, the project team corrected the MPO network coordinate system to allow matching the geographical location of the zonal and road systems. Appendix C provides further information on this topic.
- **Step 3**: *Carrying out a traffic assignment procedure.* The research team used a hypothetical origin–destination (OD) matrix using the GSTDM TAZ system to run a traffic assignment on the MPO network using Citilabs Cube Voyager.[2] Additional details on how Cube processes are run according to travel demand forecasting assumptions can be found in Ortuzar & Willumsen (2011), which serves as the underlying modeling theory reference for this software package.
- **Step 4**: *Identifying the MPO subnetwork to be imported into the statewide network.* The results from Step 3 and additional criteria—including considerations of traffic volumes, road class hierarchy, connectivity of the statewide network,

[1] Version 10.3
[2] Version 6.4

and the eventual presence of a link from the MPO network in the previous version of the statewide network—are used to identify the MPO subnetwork that is considered relevant for statewide modeling purposes.

- **Step 5**: *Renumbering MPO nodes to prevent conflict with existing nodes in the GSTDM network*. The node numbers in the MPO subnetworks are recoded into certain ranges to prevent conflicts. This step is done in ArcGIS.
- **Step 6**: *Synchronizing MPO attribute tables with the statewide attribute table*. This step involves: (1) matching the field names for attributes that are included in both the GSTDM and MPO networks, and (2) joining additional data from external sources for attributes that are needed in the statewide model but are not currently present in the MPO models.
- **Steps 7 and 8**: *Joining the GSTDM network and MPO subnetwork for each MPO model region*. This task is accomplished in Cube Voyager. Afterward, the project team manually edited the draft statewide network that includes the selected MPO subnetworks by connecting MPO external stations to the rest of the GSTDM network. This task is accomplished using the ArcGIS engine in the Citilabs Cube software.
- **Step 9:** *Generating new centroid connectors in the GSTDM*. New centroid connectors are generated to connect the GSTDM TAZ centroids to the updated GSTDM network.

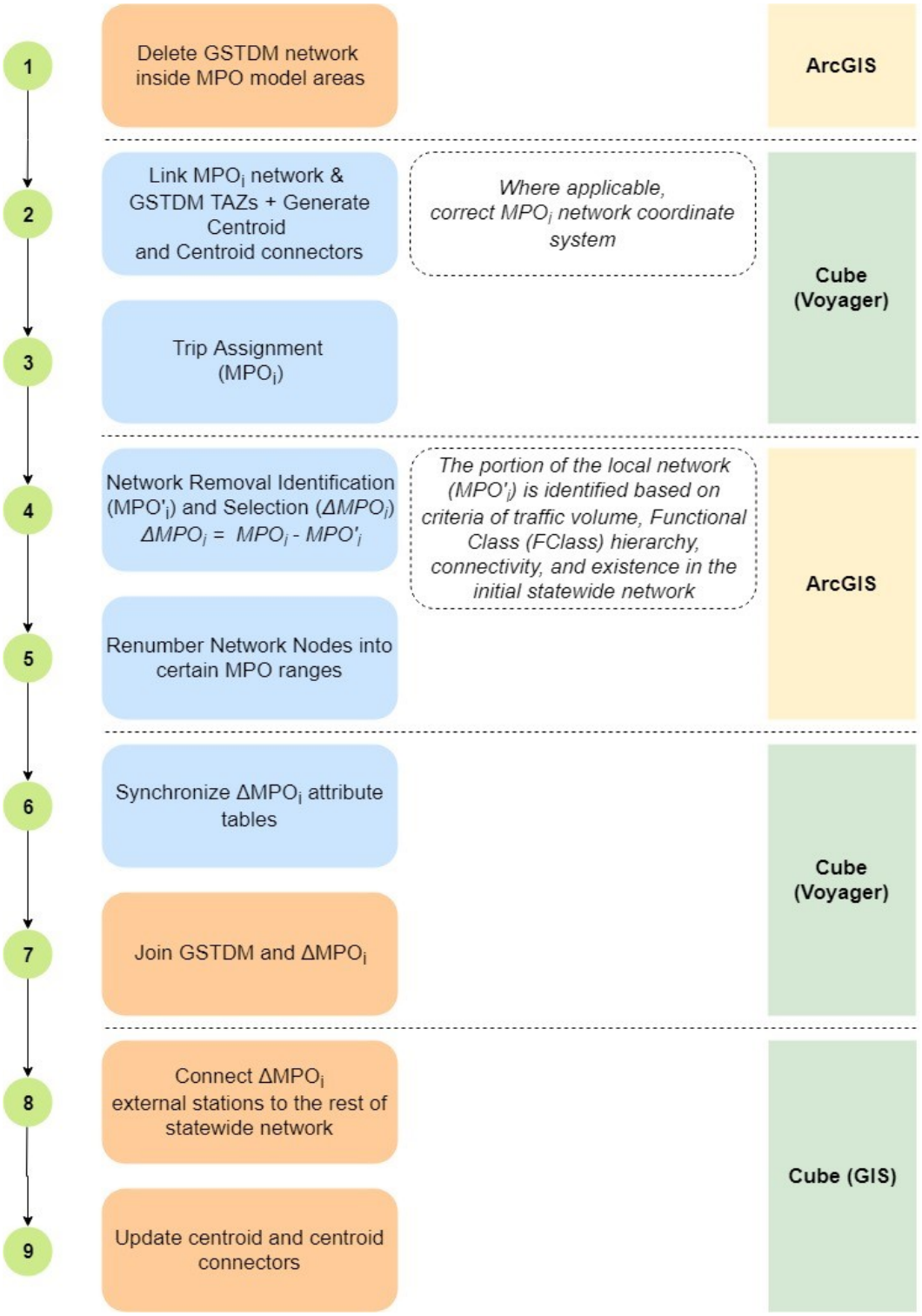

FIGURE 21

Conceptual Diagram of the Methodologies Employed to Integrate the Statewide and Regional MPO Networks (Source: Created by the Authors)

Step 1: Deleting the Portions of the GSTDM Network inside the MPO Model Areas

To enrich the current statewide network using information from the MPO networks, the project team first needed to delete the portions of the statewide road network currently in the MPO model areas. The team carried out a location-based selection in the MPO model areas using ArcGIS, and then deleted the selected links. The output of this step is a statewide network ready to receive new networks for the MPO model areas, as shown in Figure 22. As a note, the research team, upon consultation with the GDOT Office of Planning, decided not to work on the Atlanta MPO model network, considering that the ARC maintains a very different model structure from the rest of the MPOs, and Chattanooga MPO model network, as this MPO is based in Tennessee and directly reports to the Tennessee Department of Transportation. For this reason, and as shown in Figure 22, the GSTDM model network was not modified in these MPO model areas.

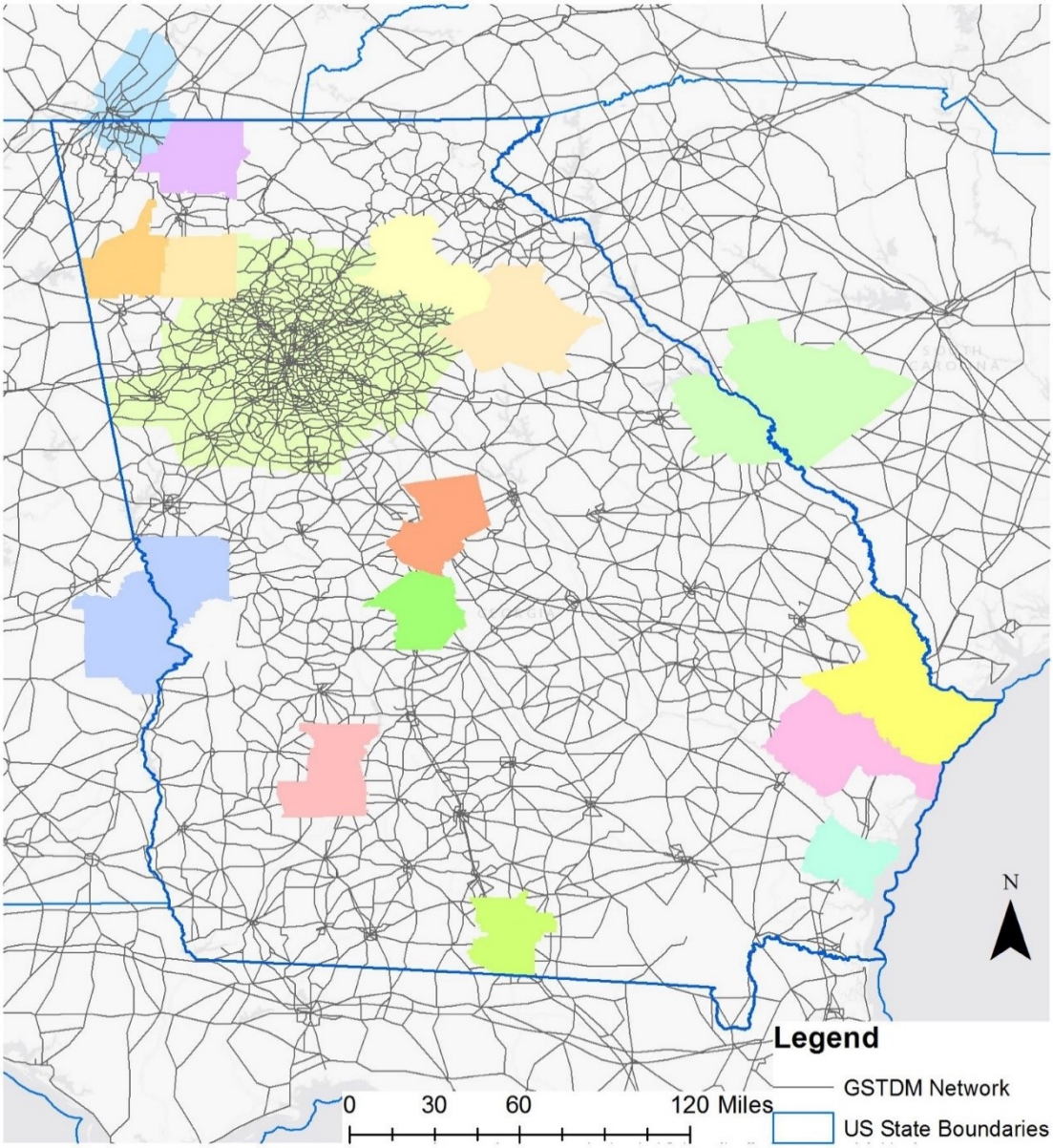

FIGURE 22

Overview of Areas of the Original Statewide Network that were Removed within the MPO Model Areas
(Source: Created by the Authors)

Steps 2 and 3: Preparing the MPO Network and Carrying Out a Traffic Assignment

To prepare the MPO network for a traffic assignment procedure using the statewide TAZs in this area as origins and destinations of the trips, the team had to first delete the

MPO zonal-based centroid and centroid connectors in each MPO network. The team carried out this part of the task using a Cube script file. After deleting the MPO-based centroids and centroid connectors, the research team generated new centroids and connectors using the statewide TAZ system in each MPO model area using the Citilabs Cube software. We then used the output of this step as input into the traffic assignment. Figure 23 shows an example from the Athens MPO model area.

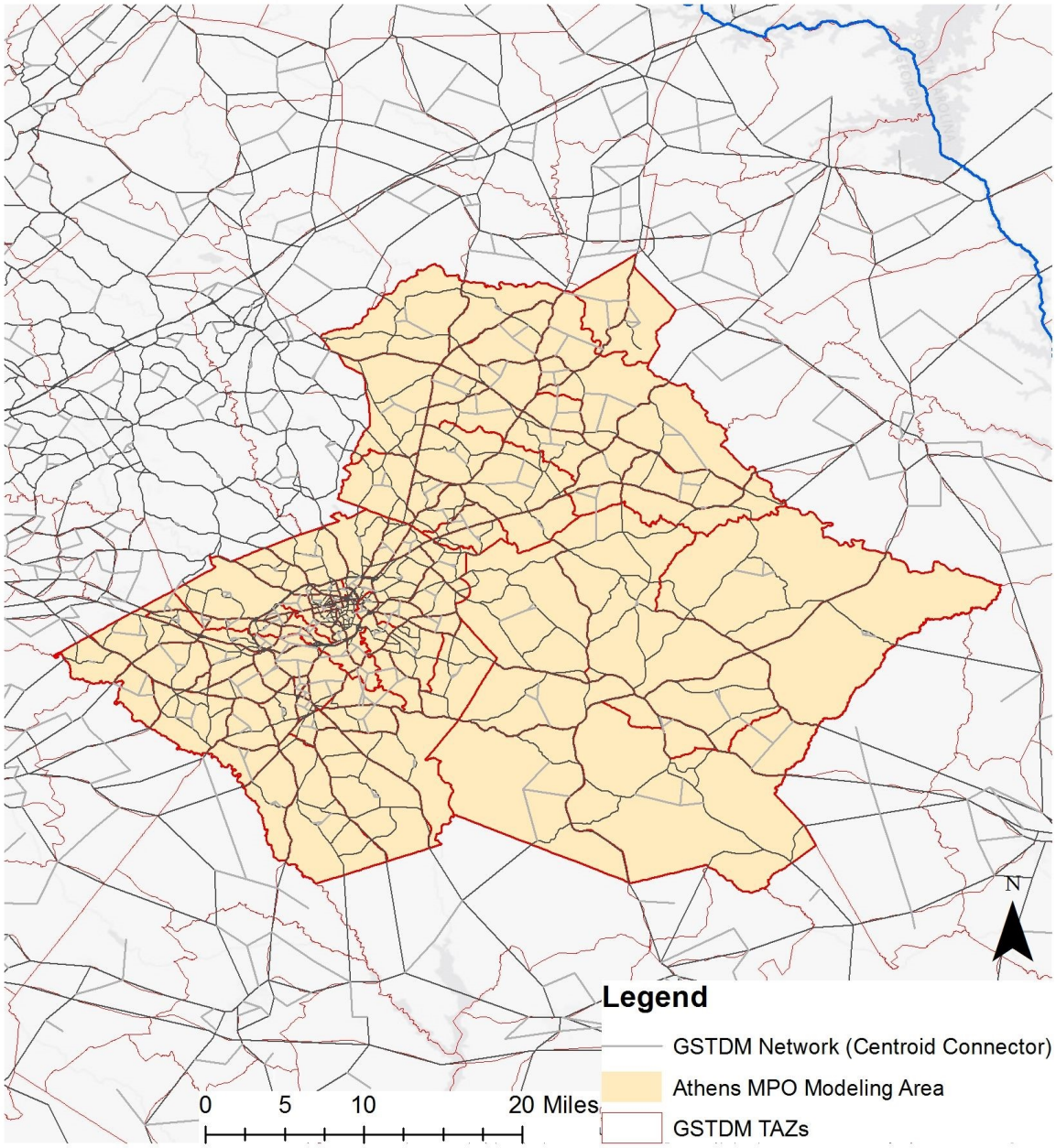

FIGURE 23

Athens MPO Network Overlaid on the Statewide TAZs within Athens MPO Model Area (Source: Created by Authors)

One of the challenges the project team faced in integrating the statewide and the regional MPO networks was defining a unique projection system to be used for both the statewide and the MPO networks. Using the same projection system in the GSTDM and a given MPO model is of particular importance to complete the following steps in this process. Table 8 summarizes the MPO models in which different projection systems were detected, precluding a faster integration with the GSTDM model.

TABLE 8

List of MPOs with Issues in Using GSTDM Projection System

MPO Code	MPO	Projection Issue
1	Albany	
2	Athens	
3	Atlanta	×
4	Augusta	
5	Brunswick	
6	Cartersville	×
7	Chattanooga	
8	Columbus	×
9	Dalton	×
10	Gainesville	
11	Hinesville	
12	Macon	
13	Rome	×
14	Savannah	
15	Valdosta	×
16	Warner Robins	×

To address this issue, the research team developed a script-based automated process in the open-source RStudio platform. Appendix C contains a summary of the code and further discussion of this issue.

In all the MPO model areas with a projection issue, using this script-based process, the research team saved an updated MPO network in a GIS shapefile format using the same projection system of the GSTDM. Afterward, the research team imported the updated MPO networks into the Cube software to run the traffic assignment process.

Steps 4 and 5: Identifying Relevant Portions of the MPO Network for Statewide Modeling Purposes and Renumbering Nodes

The output of the traffic assignment step identifies the portions of an MPO network that, considering the coarser statewide TAZ system, would not receive any traffic load and can be considered for exclusion from the GSTDM model. The project team used the output of the traffic assignment step and considered a number of additional criteria to suggest whether certain links in the MPO road network should be excluded from the updated statewide model network.

The additional criteria that were selected in consultation with the GDOT staff include the following:

- *Road class hierarchy:* The project team made sure that road links with higher road classifications would not be excluded from the proposed network, even in the case of zero traffic load in the traffic assignment. They, therefore, decided to keep all roads classified as *minor arterial*, or higher, in the updated GSTDM road network.
- *Network connectivity:* The team ensured that there would be no dangling links or portions of a through route that was removed from the final proposed GSTDM

road network. In addition to simple graph connectivity, they also kept roads to the degree that made sense in terms of traffic flows and uninterrupted routes in a region. For example, if a segment of a road after an intersection was flagged as having zero-load in the traffic assignment but excluding that segment from the network seemed non-natural in terms of replicating a realistic representation of traffic flows in real life, they decided to retain those links in the road network.

- *Existence in the current statewide model:* Since the aim is to enrich, rather than modify, the statewide model network, the researchers kept all road links that were already included in the previous version of the GSTDM network in the modified statewide network.
- *Statewide zonal system and base maps:* The research team further checked the road network selection against base maps and the statewide TAZ system to make well-informed decisions on the links to keep in the final road network.

Figure 24 shows an example of the identified portion of the Athens network based on the procedure described above.

MPO network nodes were renumbered to prevent conflicts with other node numbers when merging the MPO networks into the revised statewide network. To do this, the researchers reserved an interval of 20,000 node numbers to each MPO. This provides a range of node numbers large enough to accommodate further model updates, as well. Table 9 summarizes the range of node numbers for all nodes imported from the various MPO model networks.

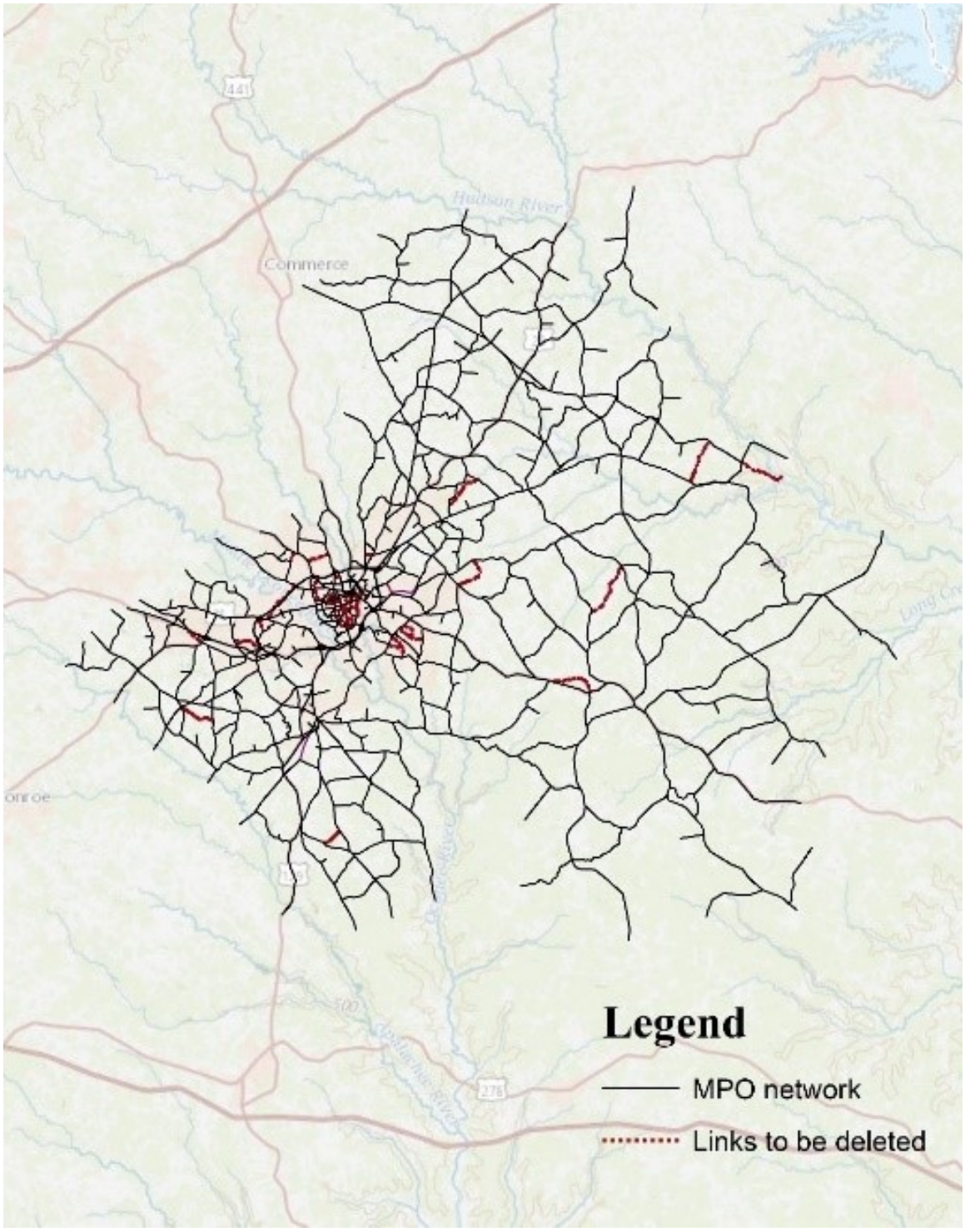

FIGURE 24

Portions of the Athens MPO Network (Red Line) to be Deleted in the GSTDM Network (Source: Created by the Authors)

TABLE 9

MPO Node Renumbering System

MPO Name	Starting Node Number
Albany	80000
Athens	100000
Atlanta	120000
Augusta	140000
Brunswick	160000
Cartersville	180000
Chattanooga	200000
Columbus	220000
Dalton	240000
Gainesville	260000
Hinesville	280000
Macon	300000
Rome	320000
Savannah	340000
Valdosta	360000
Warner Robins	380000

Step 6: Synchronizing the Attribute Tables of the GSTDM and MPO Model

Before joining the selected portions of the MPO model networks into the updated GSTDM road network, the project team modified the attribute table of the MPO networks to make it consistent with the statewide model. As part of this task, the research team renamed the MPO attribute fields to match the attribute names in the statewide network (the following section of this report, and Table 10, provides more details on the GSTDM and MPO network attributes).

However, the attribute table of the GSTDM road network also contains a number of attributes that are not present in the MPO model networks. These attributes include 2015 passenger and truck counts, state route indicator, NHS road classification, strategic highway network classification, and state screenline. These attributes were added to the MPO model networks using external datasets provided by GDOT.

Moving forward, a modified attribute table was defined to standardize the attribute fields in the GSTDM and MPO model networks. The researchers recommend that future versions of the MPO models adopt this attribute table, which will greatly simplify transferring these pieces of information into future versions of the GSTDM.

Steps 7 and 8: Joining the Selected Portions of the MPO Networks with the GSTDM Network

After completing Steps 1–6, and updating the attribute tables for all MPO model networks, the selected portions of the MPO networks that were considered relevant for statewide modeling purposes were joined with the statewide network from Step 1. Using a Cube script, the team joined the selected subnetworks from all MPO models to the remaining portions of the statewide network for non-MPO areas from Step 1. After joining the network components to form the updated GSTDM network, they still had to stitch the external stations of the MPO subnetworks to the rest of the statewide model, therefore allowing full connectivity across all areas of the statewide network. The project team completed this part of the task manually using the GIS engine in Cube.

Step 9: Generating New Centroid Connectors

Using Cube Voyager, new centroid connectors were generated for the new portions of the GSTDM network that were imported from the MPO model networks. The automatic

centroid connector generation function was used in the Cube platform, followed by additional manual adjustments, to complete this task.

Output

The output of the methodology described above is a unified GSTDM transportation network that is based on the MPO model network components inside all MPO model areas. This outcome brings several advantages compared to the old GSTDM network. First, the statewide model network is now fully consistent with the MPO model networks and is based on the same data sources. This allows better comparison of traffic flows on the components of the road networks between the models. Second, the updated GSTDM network benefits from a much larger number of details imported from the MPO models in all MPO model areas. These include: (1) greater density of the road network and a larger set of road links included in the statewide network; (2) better representation of road intersections, e.g. with proper representation of freeway ramps; and (3) adoption of the "true shape" of roads in the GTSDM network.[1] It facilitates future updates of the statewide network, in addition to the MPO networks sharing the same attribute table as the GSTDM network. Future updates of the GSTDM network will be much simplified as they will benefit from the process of updating the MPO model networks, with all updates in the MPO road networks being transferred and consistently imported also into the GSTDM network.

---

[1] The true shape of roads was imported for all road links inside MPO model areas as part of the processed used for the integration of the MPO model networks in the GSTDM network. In future updates of the GSTDM, true road shapes for the remaining non-MPO areas could be imported with a relatively modest effort.

Proposed Unified Attribute Table

As discussed, the updated unified road network attribute table (see Table 10) resolves the discrepancies between the attribute tables of GSTDM and MPO models. While MPOs might require additional attributes tailored to their needs and area to be included in their models, the research team recommends that, at minimum, future updates of the MPO models adopt the attribute fields used by the GSTDM and include all information summarized in this table.

The updated attribute table also includes one new binary attribute, "GSTDM-MPO," that was added to identify links in the MPO model networks that are relevant for statewide purposes and should be included in the GSTDM network. Future updates of these model networks will rely on this attribute to identify links in the MPO networks that should be included in the GSTDM; modelers will focus on updating the MPO model networks in all MPO model areas, and through updating this field appropriately, these changes will be carried over also to the GSTDM transportation network (for both the base year and future scenario networks).

TABLE 10

Proposed Attribute Table for Revised GSTDM and MPO Model Networks

Proposed Attribute Name	Previous GSTDM Attribute	Previous MPO Model Attribute	Description
A	A	A *(modified)*	Beginning node number
B	B	B *(modified)*	Ending node number
Road_name	PRIMARY_NA, SECONDARY_, LOCAL_NAME	ROAD_NAME	Road name
Distance	Distance	DISTANCE	Link length
FCLASS	FCLASS	FTYPE, uab2010	Old road functional classification (keeping for compatibility purposes)
FC2015	FC2015	FTYPE	New road functional classification
LANES	LANES	LANES, LANESAM, LANESPM, TOTAL_LANE	Number of lanes
STATUS	STATUS	-	Status of current road
NHS	NHS, NHS2010	-	NHS category (latest)
STRAHNET	STRAHNET	-	Strategic highway system
County	COUNTY	-	County name
AADT2015	AADT2015	-	AADT 2015 count

Proposed Attribute Name	Previous GSTDM Attribute	Previous MPO Model Attribute	Description
TRK2015	TRK2015	-	Truck 2015 count
STATEROUTE	STATEROUTE	-	State route indicator
EXT_STATIO	EXT_STATIO	CSTATION FOR THE BOUNDARY MPOS	State external station *(applicable to MPOs on the boundary only)*
EXT_DIRECT	EXT_DIRECT	-	State external location by orientation *(applicable to MPOs on the boundary only)*
PCTOLL	PCTOLL	-	Passenger toll section
TKTOLL	TKTOLL	-	Truck toll section
Use	Use	-	Truck-only lane indicator
Remi2016	Remi2016	-	Remi districts
MPO_CODE	MPO_CODE	-	MPO code
MPO_MODEL	MPO_MODEL	-	MPO model area code
MPO_NAME	MPO_NAME	-	MPO name
FIPS	FIPS	COUNTY	FIPS code
SCREENLINE	SCREENLINE	-	Screenline indicator
TC_NUMBER	TC_NUMBER	CSTATION	Traffic count station number

Proposed Attribute Name	Previous GSTDM Attribute	Previous MPO Model Attribute	Description
MPOSTATION	MPOSTATION	-	MPO external station number
SCLSTATION	SCLSTATION	-	Screenline station
GSTDM-MPO	-	-	MPO link included in GSTDM *(new attribute)*

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Chapter 5 – Conclusions and Future Maintenance of the GSDTM

In this report, the project team stated the need for the conflation of the TAZ and network system of the GSTDM and MPO models, and summarized the methods the team used to carry out each task required to accomplish this goal. The research team redrew the GSTDM TAZ boundaries from scratch using an automatic process and resolved discrepancies between the MPO-level and state-level TAZs. After discussion with GDOT and their consultant, it was decided to keep the number of TAZs constant to a total of 3,770 TAZs, of which 3,243 are in Georgia. The result of this process allows for the easy transfer and comparison of data between the models, and it makes the maintenance of the GSTDM straightforward. As MPO TAZs are now uniquely linked to GSTDM TAZs, future modifications of MPO TAZ boundaries will be translated into corresponding modifications in the GSTDM TAZs, and the process of integration of the zonal system will be maintained in future versions of the model.

The statewide network in the MPO model areas was also updated with the portions of the more detailed MPO-level networks that are relevant to the GSTDM scope. To identify the relevant portions of the MPO networks, the research team carried out a traffic assignment on the MPO networks using the statewide TAZ system in their areas as origins and destinations of the trips. This approach helped identify what parts of the more detailed MPO networks are relevant for statewide purposes and what other portions of the networks would not receive traffic load due to the coarser-level statewide TAZ system. The team, subsequently, added a binary attribute to each MPO network file to flag whether a link is statewide relevant. Future updates of the network (as discussed in

details below) can use this attribute to carry over any MPO network updates into the GSTDM network system.

As a result of the approaches developed in this research project, the research team presents three important recommendations and takeaways from this work:

- First, we recommend that GDOT adopt a protocol to use the same sources and standards to generate and maintain socioeconomic data, TAZs, and road networks, at both the statewide and MPO level.
- Second, in future model updates, adequate consideration should be given to the benefits offered by increasing the total number of statewide TAZs. In particular, using the same MPO-level TAZs and networks in the GSTDM model would further simplify model maintenance and improve the accuracy of the statewide model results.
- Third, all future versions of the statewide and MPO models should use the same socioeconomic and network attributes.

Future Maintenance of the GSTDM

One of the primary challenges in development and maintenance of travel demand models is developing scalable and replicable methods that can be easily applied (and updated) during future maintenance of the model. Maintaining a complex travel demand model such as the Georgia Statewide Travel Demand Model (GSTDM) may prove to be a daunting assignment if replicability of tasks during future modeling updates is not possible. In this research, the project team developed a process to integrate the MPO models in the GSTDM that will ensure consistency among the models during future model updates and allow for easier maintenance of the model. The remainder of this

section describes the steps that will be required to ensure that the integration of the MPO models with the GSTDM is retained during future model updates, and that the benefits from this integration are maximized.

Maintaining Consistency of TAZs and Socioeconomic Data

As an outcome of this project, the research team delivered a revised TAZ system for the GSTDM that ensures consistency of the GSTDM TAZs with the zonal system used by the MPO models. By redrawing the GSTDM TAZ boundaries to perfectly align with the MPO TAZs, the two zonal systems were synchronized; correspondence tables uniquely linked the list of MPO TAZs that now nest perfectly inside GSTDM TAZs. Through maintaining this synchronization in future model updates, if MPO TAZ boundaries are modified in the future, the boundaries of the corresponding GSTDM TAZs will change accordingly. Similarly, the process developed in this project ensured that socioeconomic data (and any other input/output data) can now be easily compared between MPO and GSTDM TAZs. Thus, the research team recommends that GDOT review carefully any eventual discrepancies in the current distribution of the socioeconomic data between these models.

Moving forward, only one master set of current socioeconomic data, obtained from official sources (e.g., U.S. decennial census and American Community Survey, or ACS, data), and of future estimates (for future model scenarios) would be required. These data can be generated for the MPO TAZs. Through a process of aggregation of these data, using the correspondence tables between MPO and GSTDM TAZs, they can be merged to provide input to the statewide travel demand model.

Maintaining Consistency of Model Networks

Figure 25 illustrates the combined conceptual approach, indicating the research workflow the project team employed over the course of this project on the left and the streamlined maintenance process that GDOT would require to maintain the GSTDM network on the right. As shown in the figure, the proposed GDOT maintenance process has significantly fewer steps than the research workflow that was originally carried out for this project, making it simpler to adopt and implement during future maintenance of the model. Specifically, while the research workflow employed by the project team has nine steps, the model maintenance process would only require four steps, at maximum, assuming that MPO networks are maintained using a configuration compatible with the proposed approach and use the unified attribute table that was defined. Specifically, no traffic assignment or other demanding procedures that were carried out as part of this project will need to be replicated during the future model updates.

Central to the future maintenance of the GSTDM network is the attribute flagging the GSTDM relevance for road links included in the MPO networks, as described in the preceding chapter. This attribute can be used during future MPO model network updates to identify the portion of the network that is considered relevant for statewide modeling purposes, and that will be automatically imported in future versions of the GSTDM.

Once the MPO model networks are updated during future MPO model updates, the proposed GSTDM network maintenance process will only require working on the statewide model (orange boxes in Figure 25) without the need to carry out and replicate heavy tasks on the MPO model components (blue boxes in Figure 25) as long as the latter maintain the structure (i.e., attribute table, node numbering system, and updated MPO–GSTDM relevance attribute) as proposed in this report.

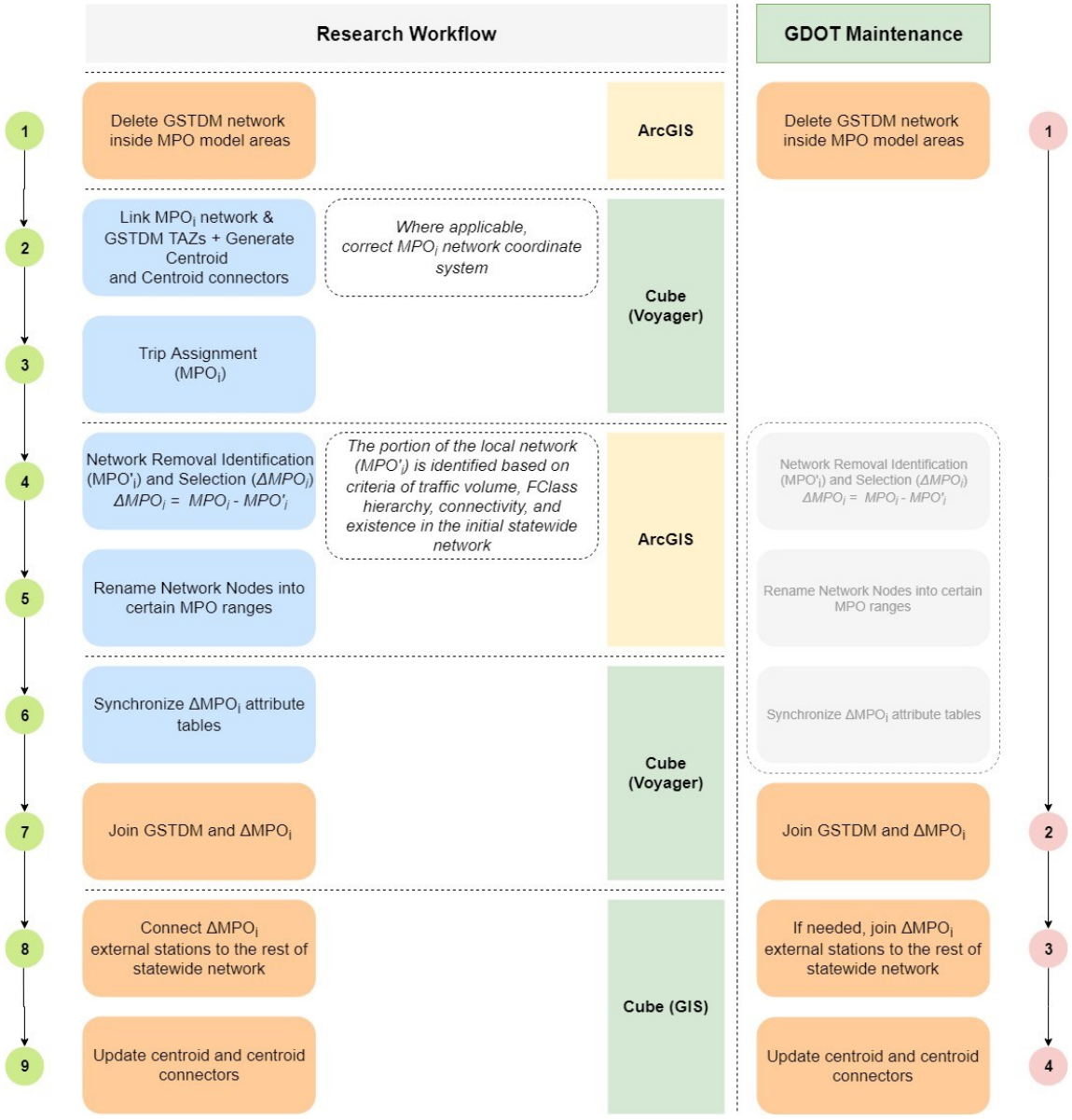

FIGURE 25

Future Maintenance Process for GSTDM Transportation Network (Source: Created by the Authors)

The four-step process for future GSTDM network maintenance requires the following steps:

- **Step 1:** *Deleting portions of the existing GSTDM network within MPO model areas.* As described in Chapter 4, this step is considerably straightforward; the

existing statewide network within the MPO model areas are deleted, technically creating "holes" in the network. This step is easy to accomplish and the project team has developed a series of replicable script using the Cube programming language, which can be easily integrated into a Cube "catalog" to ease the maintenance process.

- **Steps 2 and 3:** *Joining the MPO subnetworks to the GSTDM network and connecting the MPO external stations with the rest of the network*. These steps require joining the MPO subnetworks (e.g., the portions of the MPO networks considered relevant for statewide modeling purposes and identified through the new MPO–GSTDM attribute) to the remaining portions of the GSTDM network for non-MPO areas. The statewide-relevant portions of the MPO model networks would fill the "holes" produced in the GSTDM network during Step 1. This process would be followed by manual checks to ensure proper connectivity at the MPO external boundary crossings to make sure that the entire GSTDM transportation network is properly connected. The researchers expect that no additional manual modifications would actually be required, as long as the new MPO node numbering system is maintained and no additional MPO external crossings are added.[1] Steps 2 and 3 are the most critical steps to be run during the future model maintenance, but they will ensure that the integration between the GSTDM and MPO model networks is maintained without additional tasks. For

[1] If new external stations are added to the MPO model area boundaries, some modifications would be required to ensure connectivity of these new links in the updated GSTDM network.

the successful application of this approach, the project team stresses the importance of adopting a unified structure (i.e., attribute tables, non-overlapping node numbers) between the GSTDM and MPO model networks.

- **Step 4:** *Updating centroids and centroid connectors*. As indicated in the previous chapter, the project team has developed a replicable script to allow updating the statewide centroids and centroid connectors only within MPO areas or for a specific MPO of interest, which is a necessary process to obtain a working statewide model network.

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Chapter 6 – References

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Appendix A – Additional Details on the Automation Process for TAZ Synchronization

The following pages present additional examples of the TAZ integration process between the GSTDM and MPO models.

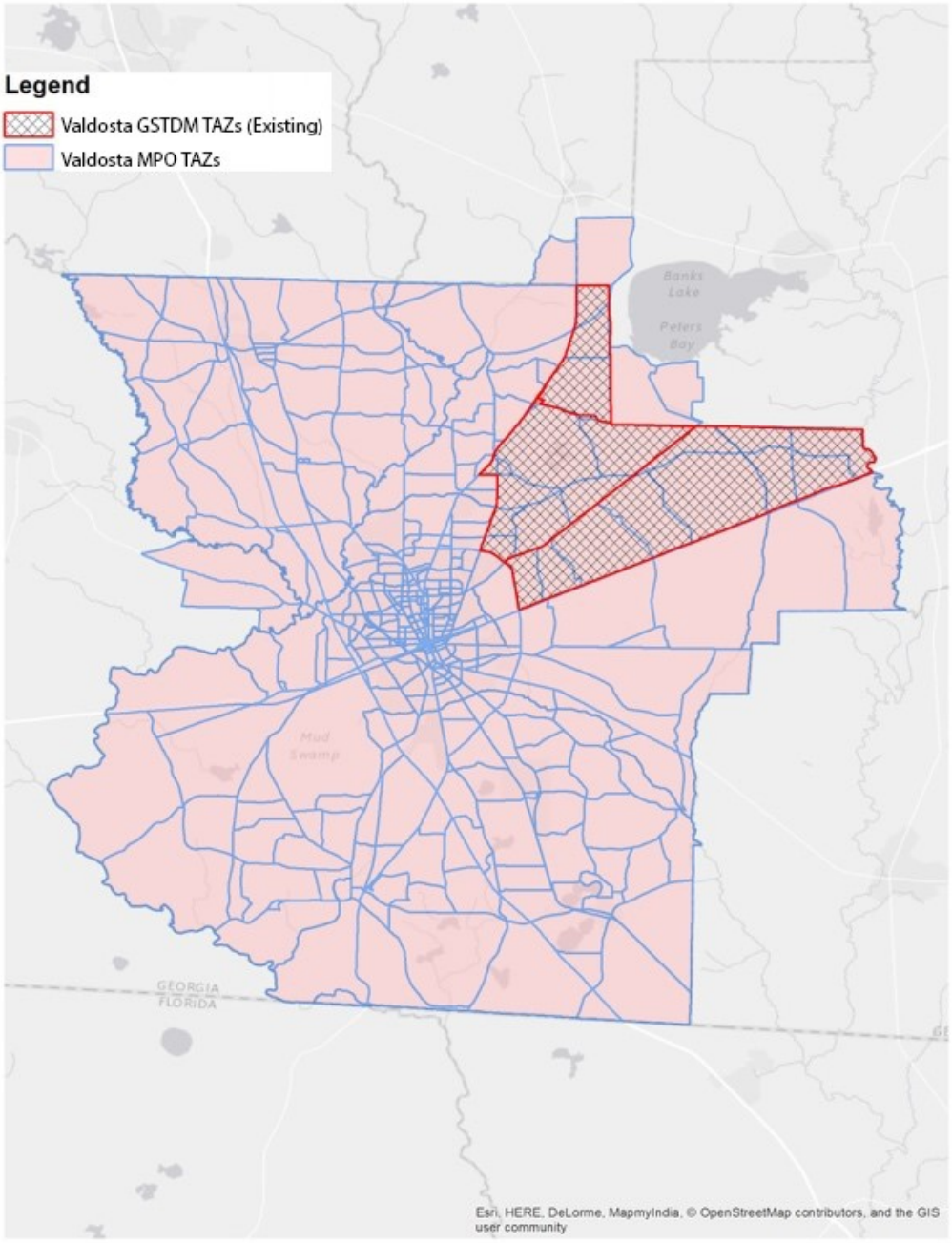

FIGURE 26

Example of MPO TAZs (Blue Line) and GSTDM TAZs (Red Line) within the Valdosta MPO Model Region (Source: Created by the Authors)

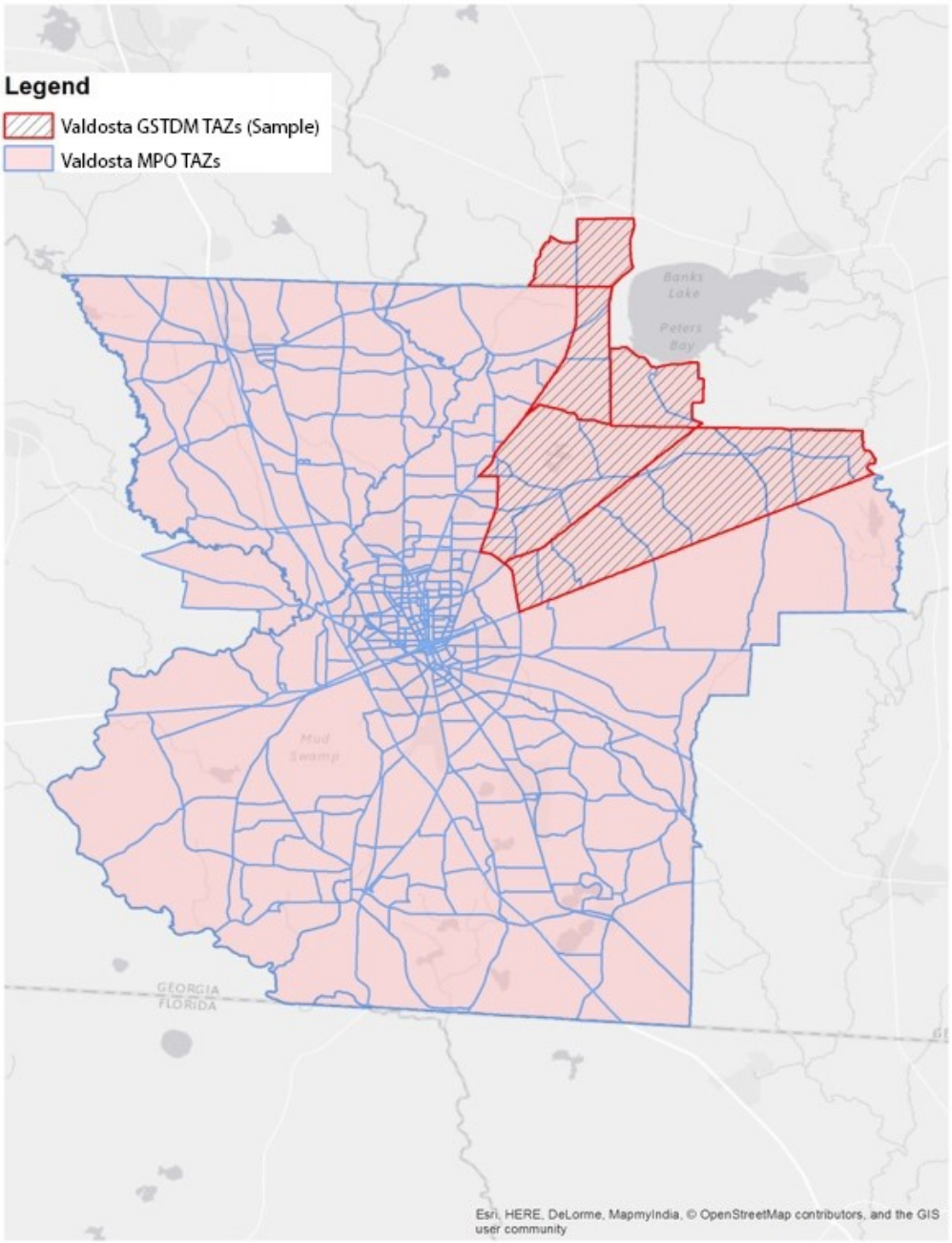

FIGURE 26 (Continued)

Example of MPO TAZs (Blue Line) and GSTDM TAZs (Red Line) within the Valdosta MPO Model Region (Source: Created by the Authors)

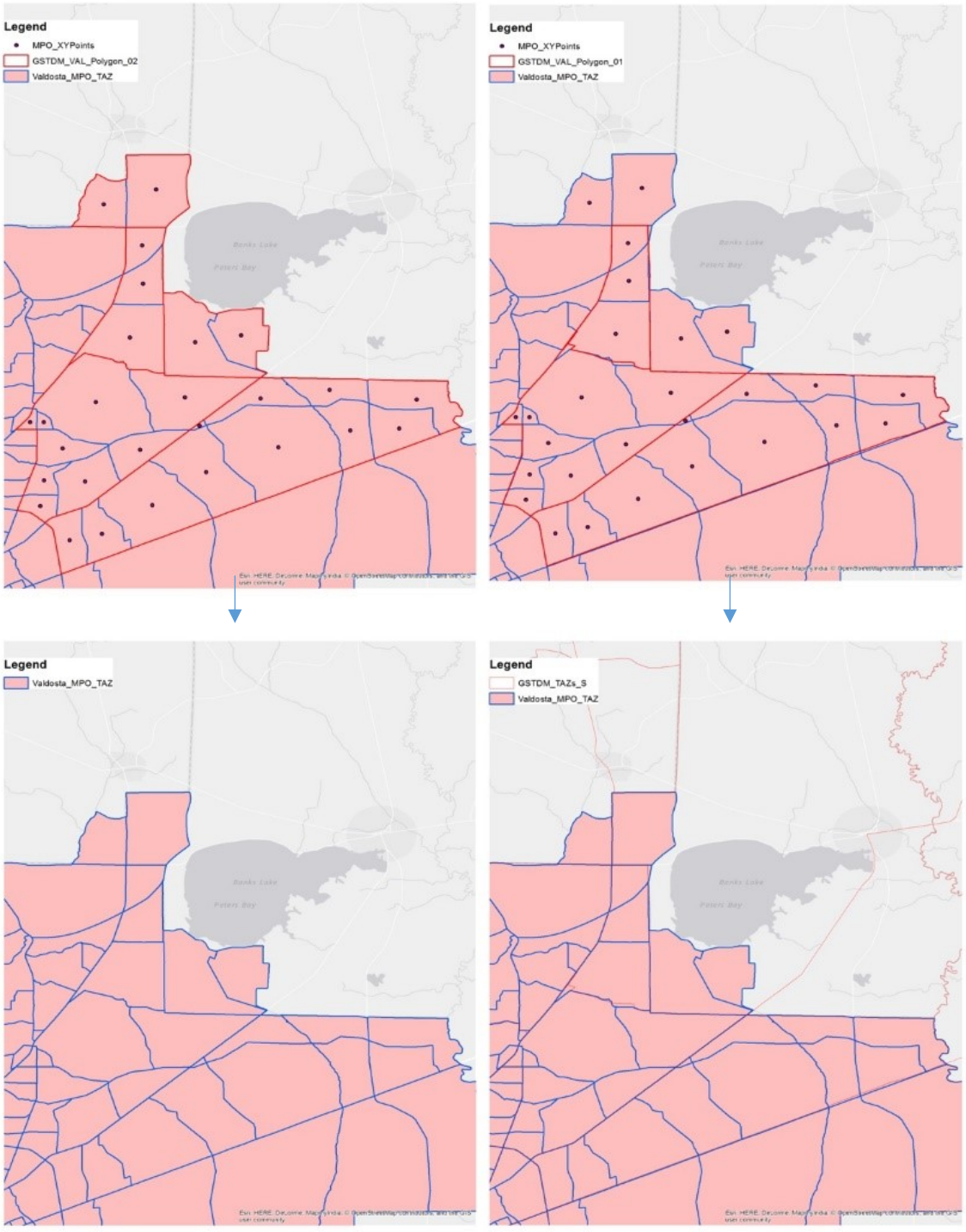

FIGURE 27

Example of Existing MPO TAZs (Left) and GSTDM TAZs (Right)
(Source: Created by the Authors)

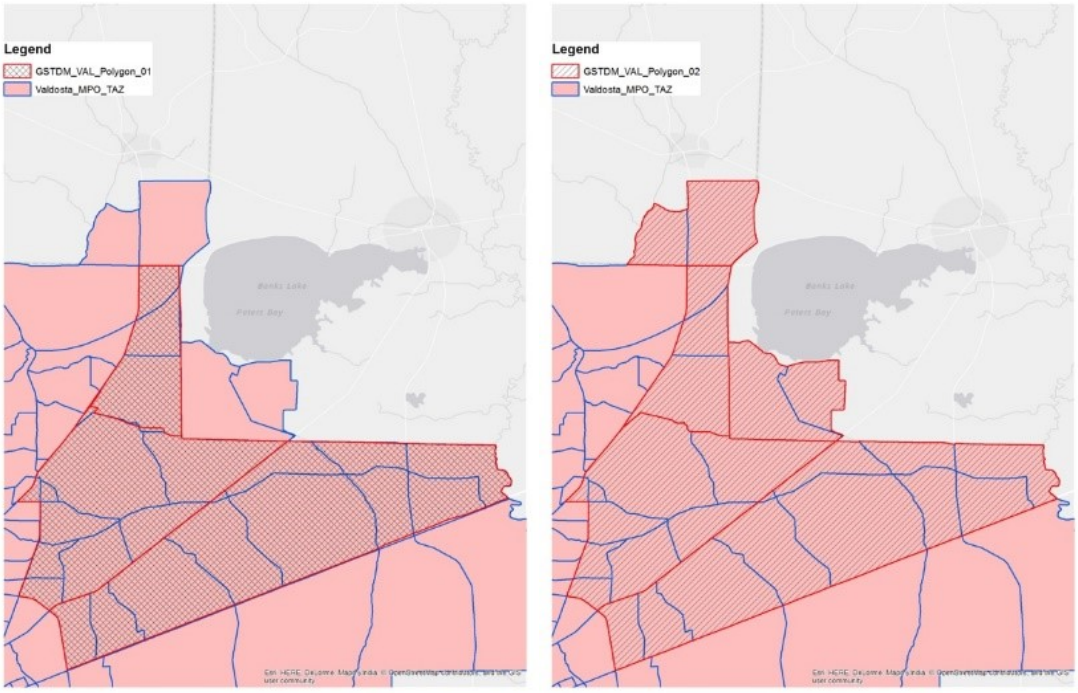

FIGURE 28

Comparison between the Existing (Left) and Revised GSTDM TAZs (Right) (Source: Created by the Authors)

The following script was used in RStudio to automate the MPO and GSTDM TAZs integration process.

```
mpos<-read.csv("(1)",header = T,stringsAsFactors=FALSE)


for(i in 1:nrow(mpos)){
  loc=mpos[i,1]
  lyr=mpos[i,2]
  tname=mpos[i,3]
  mpo_s<-readOGR(dsn=paste0("(2)",loc), layer=lyr)
  mpo_s<-mpo_s[,tname]
  mpo_s.df<-data.frame(mpo_s[,tname])
  mpo_c = data.frame(gCentroid(mpo_s,byid=TRUE))


  mpo_c.spdf <- SpatialPointsDataFrame(coords = mpo_c, data =mpo_s.df,
                                       proj4string = CRS(projection(stw)))
  #Join points layer to polygons
  mpo_sp<-point.in.poly(mpo_c.spdf, stw)


  #Merge back with MPO TAZs polygon
  mpo_s@data<-merge(mpo_s@data, mpo_sp@data, by.x=tname, by.y=tname)


  #Dissolve
  mpo_s.dis<-unionSpatialPolygons(mpo_s,ID=mpo_s@data$TAZ_ID,threshold = 0)
  mpo_df<-as(mpo_s, "data.frame")
  mpo_df_agg<-aggregate(as.numeric(mpo_df[,2]), list(mpo_df$TAZ_ID), sum)
  row.names(mpo_df_agg)<-as.character(mpo_df_agg$Group.1)


  mpo_s.dis<-SpatialPolygonsDataFrame(mpo_s.dis,mpo_df_agg)


  writeOGR(obj=mpo_s.dis,dsn="(3)",layer=paste0(loc,"D"), driver="ESRI Shapefil
e",overwrite_layer=T,check_exists=T)
}
```

Notes:
(1) Location directory for a CSV table indicating the name of each MPO TAZ shapefile
(2) Location directory for the GSTDM TAZ shapefile
(3) Location directory to save the output MPO TAZ shapefile

Appendix B – Socioeconomic Data Comparison

This section provides the comparison of population and household data (at the GSTDM TAZ level) between the statewide and MPO models. In the comparisons reported in this appendix, the research team used data from the 2010 GSTDM TAZ system (and not the newer TAZs from the 2015 model update) to make the data more comparable to the corresponding socioeconomic data in the MPO models. While 2010 socioeconomic data were available for all MPOs, only selected MPO models had been updated with the 2015 base year at the time of this project. This explains why the total number of statewide TAZs in each MPO model area in the comparisons of the socioeconomic data in this Appendix B is slightly different than the total number of statewide TAZs in each MPO model area resulting from the process of TAZ synchronization described in Chapter 2 (Table 4).

Albany

TABLE 11

Comparison of Socioeconomic Data between the GSTDM and MPO Models, by GSTDM TAZ, in the Albany MPO Model Area (# TAZs = 38)

TAZ_ID	# Population			# Households		
	MPO	GSTDM	% diff.	MPO	GSTDM	% diff.
1414	1708	1708	0.00	661	661	0.00
1415	2173	2173	0.00	854	854	0.00
1416	6215	6215	0.00	2402	2402	0.00
1417	3491	3491	0.00	1284	1284	0.00
1418	6606	6606	0.00	2630	2630	0.00
1419	4798	4798	0.00	2181	2181	0.00
1420	6276	6276	0.00	2961	2961	0.00
1421	2938	2938	0.00	1364	1364	0.00
1422	1783	1783	0.00	820	820	0.00
1423	4151	4151	0.00	1837	1837	0.00

TAZ_ID	# Population			# Households		
	MPO	GSTDM	% diff.	MPO	GSTDM	% diff.
1424	2106	2106	0.00	877	877	0.00
1425	2082	2082	0.00	910	910	0.00
1426	1607	1607	0.00	646	646	0.00
1427	1419	1557	-8.86	644	585	10.09
1428	2825	2896	-2.45	1133	1161	-2.41
1429	2520	2520	0.00	1013	1013	0.00
1430	4798	5627	-14.73	1657	1657	0.00
1431	3123	3123	0.00	1154	1154	0.00
1432	5944	5944	0.00	2244	2244	0.00
1433	4580	4580	0.00	2239	1463	53.04
1434	1831	1831	0.00	669	669	0.00
1435	6748	6748	0.00	3696	1851	99.68
1436	2953	2953	0.00	1135	1135	0.00
1437	2423	2423	0.00	900	900	0.00
1438	3751	3751	0.00	1442	1442	0.00
1439	1780	1780	0.00	686	686	0.00
1440	2898	2898	0.00	1121	1121	0.00
1441	579	561	3.21	206	200	3.00
1442	1008	1026	-1.75	354	360	-1.67
1443	639	639	0.00	250	250	0.00
1444	2325	2325	0.00	763	763	0.00
1445	759	1408	-46.09	243	248	-2.02
1446	1299	1299	0.00	443	443	0.00
1447	4645	4645	0.00	1593	1593	0.00
1448	4792	4792	0.00	1751	1751	0.00
1449	1680	1680	0.00	618	618	0.00
1450	3586	3586	0.00	1377	1272	8.25
1451	6337	6337	0.00	2103	2208	-4.76
Total	121176	122863	-1.37	48861	46214	5.73

Athens

TABLE 12

Comparison of Socioeconomic Data between the GSTDM and MPO Models, by GSTDM TAZ, in the Athens MPO Model Area (# TAZs = 105)

TAZ_ID	# Population			# Households		
	MPO	GSTDM	% diff.	MPO	GSTDM	% diff.
1001	657	657	0.00	229	229	0.00
1002	2419	2442	-0.94	841	848	-0.83
1003	576	495	16.36	234	202	15.84
1004	1504	1417	6.14	1114	530	110.19
1005	2426	2426	0.00	1454	823	76.67
1006	1963	2003	-2.00	670	683	-1.90
1007	352	352	0.00	117	117	0.00
1008	1680	1821	-7.74	556	601	-7.49
1009	495	432	14.58	190	165	15.15
1010	1853	1844	0.49	609	575	5.91
1011	1351	1704	-20.72	505	621	-18.68
1012	178	178	0.00	58	58	0.00
1013	333	333	0.00	118	118	0.00
1014	1157	1164	-0.60	424	427	-0.70
1015	935	944	-0.95	341	352	-3.13
1016	1312	1232	6.49	459	459	0.00
1017	799	799	0.00	274	274	0.00
1018	265	265	0.00	104	104	0.00
1019	1497	1527	-1.96	564	564	0.00
1020	1541	1535	0.39	547	544	0.55
1021	2060	2060	0.00	724	724	0.00
1022	2674	2672	0.07	976	980	-0.41
1023	1334	1292	3.25	456	441	3.40
1024	721	721	0.00	261	261	0.00
1025	1593	1593	0.00	571	571	0.00
1026	0	124	-100.00	0	95	-100.00
1027	7798	7869	-0.90	3229	3258	-0.89
1028	1213	1213	0.00	530	530	0.00
1029	2138	2076	2.99	869	840	3.45
1030	737	1365	-46.01	263	617	-57.37
1031	2335	2365	-1.27	1183	1195	-1.00
1032	1226	1226	0.00	563	563	0.00
1033	1753	1753	0.00	580	580	0.00
1034	2788	2788	0.00	1002	1002	0.00

TAZ_ID	# Population			# Households		
	MPO	GSTDM	% diff.	MPO	GSTDM	% diff.
1035	84	84	0.00	43	43	0.00
1036	3629	2603	39.42	1579	1139	38.63
1037	1414	1419	-0.35	541	542	-0.18
1038	11984	11956	0.23	5319	4909	8.35
1039	1978	1978	0.00	931	928	0.32
1040	6005	6005	0.00	2835	2835	0.00
1041	12557	11901	5.51	2964	2555	16.01
1042	2252	2252	0.00	1061	1061	0.00
1043	765	975	-21.54	410	463	-11.45
1044	2852	2824	0.99	1258	1244	1.13
1045	3025	2646	14.32	1619	1392	16.31
1046	1909	1909	0.00	837	837	0.00
1047	1115	1128	-1.15	439	451	-2.66
1048	1233	1233	0.00	435	435	0.00
1049	2416	2615	-7.61	1228	1264	-2.85
1050	2803	3001	-6.60	1104	1193	-7.46
1051	1016	1016	0.00	329	329	0.00
1052	2008	1566	28.22	1059	798	32.71
1053	1636	1640	-0.24	746	729	2.33
1054	819	789	3.80	364	364	0.00
1055	1356	1344	0.89	450	450	0.00
1056	1596	1596	0.00	736	735	0.14
1057	2642	2685	-1.60	1062	1086	-2.21
1058	2136	2136	0.00	910	910	0.00
1059	2474	2287	8.18	891	871	2.30
1060	834	872	-4.36	184	206	-10.68
1061	2317	2317	0.00	520	820	-36.59
1062	3002	3002	0.00	1156	1156	0.00
1063	1369	1369	0.00	580	580	0.00
1064	471	471	0.00	184	184	0.00
1065	590	595	-0.84	234	236	-0.85
1066	3017	3017	0.00	946	946	0.00
1067	4577	4548	0.64	1610	1588	1.39
1068	975	1153	-15.44	430	402	6.97
1069	776	776	0.00	256	256	0.00
1070	5718	5709	0.16	1749	1743	0.34
1071	5735	5804	-1.19	2308	2242	2.94
1072	1966	1904	3.26	751	715	5.03
1073	1882	2025	-7.06	905	762	18.77

TAZ_ID	# Population			# Households		
	MPO	GSTDM	% diff.	MPO	GSTDM	% diff.
1074	1149	1748	-34.27	503	665	-24.36
1075	1017	1017	0.00	367	367	0.00
1076	2479	2535	-2.21	921	934	-1.39
1077	654	664	-1.51	248	248	0.00
1078	336	290	15.86	99	80	23.75
1079	789	804	-1.87	316	321	-1.56
1080	1031	1092	-5.59	381	403	-5.46
1081	925	926	-0.11	327	328	-0.30
1082	683	683	0.00	283	283	0.00
1083	844	809	4.33	320	305	4.92
1084	470	470	0.00	164	164	0.00
1085	804	928	-13.36	306	353	-13.31
1086	190	190	0.00	72	72	0.00
1087	965	965	0.00	352	352	0.00
1088	1076	1125	-4.36	410	430	-4.65
1089	422	408	3.43	164	161	1.86
1090	1841	1841	0.00	714	714	0.00
1091	2524	2570	-1.79	915	934	-2.03
1092	612	676	-9.47	245	268	-8.58
1093	779	772	0.91	299	296	1.01
1094	371	371	0.00	162	162	0.00
1095	470	470	0.00	180	180	0.00
1096	451	451	0.00	177	174	1.72
1987	379	391	-3.07	139	143	-2.80
1988	1462	1462	0.00	558	558	0.00
1989	1283	1295	-0.93	519	524	-0.95
1990	885	896	-1.23	345	349	-1.15
1991	3603	3420	5.35	1333	1272	4.80
1992	137	137	0.00	45	45	0.00
1993	505	492	2.64	205	199	3.02
1994	1128	1108	1.81	412	409	0.73
2972	5697	5698	-0.02	2117	2148	-1.44
Total	192557	192541	0.01	75176	73191	2.71

Augusta

TABLE 13

Comparison of Socioeconomic Data between the GSTDM and MPO Models, by GSTDM TAZ, in the Augusta MPO Model Area (# TAZs = 101)

TAZ_ID	# Population			# Households		
	MPO	GSTDM	% diff.	MPO	GSTDM	% diff.
1148	1162	1162	0.00	420	420	0.00
1149	935	935	0.00	345	345	0.00
1150	950	950	0.00	391	391	0.00
1151	3835	3835	0.00	1463	1463	0.00
1152	1597	1597	0.00	577	577	0.00
1153	917	917	0.00	220	220	0.00
1154	5615	5615	0.00	2048	2048	0.00
1155	2145	1305	64.37	773	434	78.11
1156	7275	8115	-10.35	2781	3120	-10.87
1157	6534	6534	0.00	2275	2275	0.00
1158	5042	5042	0.00	1876	1876	0.00
1159	3893	3893	0.00	1340	1340	0.00
1160	2386	2386	0.00	756	756	0.00
1161	7923	7923	0.00	2417	2417	0.00
1162	4005	4005	0.00	1418	1418	0.00
1163	5800	5800	0.00	1896	1896	0.00
1164	7174	7174	0.00	2568	2568	0.00
1165	9740	9740	0.00	3745	3745	0.00
1166	4199	4199	0.00	1652	1652	0.00
1167	6413	6413	0.00	2525	2525	0.00
1168	668	668	0.00	300	300	0.00
1169	9539	9539	0.00	3587	3587	0.00
1170	1224	1224	0.00	467	467	0.00
1171	4295	4295	0.00	1611	1611	0.00
1172	4240	4240	0.00	1453	1453	0.00
1173	6714	6655	0.88	2346	2322	1.02
1174	802	802	0.00	278	278	0.00
1175	2985	2985	0.00	1085	1085	0.00
1176	1559	1559	0.00	590	590	0.00
1177	1175	1175	0.00	474	474	0.00
1178	1340	1340	0.00	503	503	0.00
1179	2019	2019	0.00	738	738	0.00
1180	9694	9753	-0.60	3911	1365	186.52
1181	3263	3263	0.00	1340	790	69.92

TAZ_ID	# Population			# Households		
	MPO	GSTDM	% diff.	MPO	GSTDM	% diff.
1182	4796	4796	0.00	1758	1753	0.29
1183	5594	5594	0.00	3140	3020	3.97
1184	5153	5153	0.00	2294	2243	2.27
1185	3987	3987	0.00	2041	2015	1.29
1186	5183	5183	0.00	2646	2646	0.00
1187	3816	3816	0.00	1706	1706	0.00
1188	6303	6303	0.00	2858	2531	12.92
1189	6541	6527	0.21	3254	3223	0.96
1190	3588	3588	0.00	1726	1726	0.00
1191	11286	11300	-0.12	4932	4936	-0.08
1192	2303	2303	0.00	1015	1006	0.89
1193	3723	3723	0.00	1744	1744	0.00
1194	5106	5106	0.00	2319	2267	2.29
1195	4904	4904	0.00	1997	1941	2.89
1196	2081	2081	0.00	943	943	0.00
1197	6019	6019	0.00	2073	2027	2.27
1198	5600	5600	0.00	2203	2203	0.00
1199	8158	8158	0.00	3309	3299	0.30
1200	6841	6841	0.00	2326	2323	0.13
1201	8625	8625	0.00	3026	3012	0.46
1202	11280	11280	0.00	3854	3847	0.18
1203	5243	5243	0.00	1763	1759	0.23
1204	6226	6226	0.00	2195	2082	5.43
1205	2907	2907	0.00	1048	1048	0.00
1206	1072	1072	0.00	385	377	2.12
1207	3908	3908	0.00	1383	1372	0.80
1208	3441	3441	0.00	1212	1198	1.17
1209	5594	5594	0.00	2004	2001	0.15
1210	2590	2590	0.00	832	832	0.00
1211	1718	1718	0.00	613	613	0.00
1212	2578	2578	0.00	903	903	0.00
1213	2208	2208	0.00	813	811	0.25
1214	124	124	0.00	70	70	0.00
1215	1743	2457	-29.06	642	637	0.78
1216	4013	4013	0.00	1541	1532	0.59
1217	2935	2935	0.00	1088	1086	0.18
1218	1103	1103	0.00	424	424	0.00
1219	1312	1312	0.00	495	491	0.81
1220	3185	3185	0.00	1263	1261	0.16

TAZ_ID	# Population			# Households		
	MPO	GSTDM	% diff.	MPO	GSTDM	% diff.
1221	62	62	0.00	26	26	0.00
1222	3845	3845	0.00	1564	1539	1.62
1223	935	935	0.00	571	400	42.75
1224	2471	2471	0.00	1333	1184	12.58
1225	2785	2785	0.00	1348	1036	30.12
1226	672	672	0.00	441	414	6.52
1227	3262	3262	0.00	1267	1262	0.40
3393	9396	9401	-0.05	2944	2943	0.03
3394	4651	4660	-0.19	1750	1757	-0.40
3395	3653	3648	0.14	1187	1189	-0.17
3396	9272	9276	-0.04	3455	3459	-0.12
3397	13601	13593	0.06	5892	5886	0.10
3398	12699	12692	0.06	5536	5531	0.09
3399	20319	20328	-0.04	7867	7872	-0.06
3400	20520	20584	-0.31	9193	9222	-0.31
3401	13063	12973	0.69	5194	5156	0.74
3402	15432	15587	-0.99	5905	5966	-1.02
3403	4832	4830	0.04	1855	1854	0.05
3404	5871	5817	0.93	2217	2197	0.91
3405	4230	4193	0.88	1573	1561	0.77
3406	7154	7150	0.06	2674	2673	0.04
3407	8320	8312	0.10	3157	3151	0.19
3408	5707	5635	1.28	2010	1980	1.52
3409	4625	4815	-3.95	1804	1877	-3.89
3410	3084	2589	19.12	1259	1073	17.33
3411	5728	6149	-6.85	2139	2295	-6.80
3412	10642	11388	-6.55	4292	4577	-6.23
3413	4271	3464	23.30	1691	1382	22.36
Total	510946	511674	-0.14	200151	195419	2.42

Brunswick

TABLE 14

Comparison of Socioeconomic Data between the GSTDM and MPO Models, by GSTDM TAZ, in the Brunswick MPO Model Area (# TAZs = 61)

TAZ_ID	# Population			# Households		
	MPO	GSTDM	% diff.	MPO	GSTDM	% diff.
1619	880	880	0.00	384	335	14.63
1620	885	885	0.00	377	327	15.29
1621	789	789	0.00	348	305	14.10
1622	285	285	0.00	111	106	4.72
1623	131	131	0.00	51	48	6.25
1624	895	895	0.00	344	306	12.42
1625	1376	1376	0.00	587	519	13.10
1626	3986	3986	0.00	1682	1467	14.66
1627	3013	3013	0.00	1240	1155	7.36
1628	1144	1164	-1.72	493	467	5.57
1629	1749	1729	1.16	708	647	9.43
1630	1	1	0.00	1	1	0.00
1631	0	0	0.00	0	0	0.00
1632	1016	1016	0.00	397	365	8.77
1633	377	377	0.00	155	138	12.32
1634	1221	1221	0.00	508	460	10.43
1635	496	496	0.00	238	204	16.67
1636	448	448	0.00	196	172	13.95
1637	384	384	0.00	182	156	16.67
1638	4007	4007	0.00	1562	1417	10.23
1639	490	490	0.00	220	195	12.82
1640	804	805	-0.12	609	435	40.00
1641	0	0	0.00	0	0	0.00
1642	499	499	0.00	213	183	16.39
1643	3551	3551	0.00	1729	1404	23.15
1644	2	2	0.00	1	1	0.00
1645	1330	1776	-25.11	527	454	16.08
1646	1811	1811	0.00	794	669	18.68
1647	1632	1675	-2.57	731	625	16.96
1648	1978	1984	-0.30	933	789	18.25
1649	612	612	0.00	266	225	18.22
1650	1423	1423	0.00	614	513	19.69
1651	1238	1318	-6.07	555	455	21.98
1652	1010	1010	0.00	436	396	10.10

TAZ_ID	# Population			# Households		
	MPO	GSTDM	% diff.	MPO	GSTDM	% diff.
1653	1219	1219	0.00	509	457	11.38
1654	1155	705	63.83	462	324	42.59
1655	7207	7207	0.00	3276	2869	14.19
1656	1047	1047	0.00	546	441	23.81
1657	954	954	0.00	517	437	18.31
1658	352	340	3.53	203	169	20.12
1659	573	573	0.00	254	219	15.98
1660	812	812	0.00	331	297	11.45
1661	1333	1333	0.00	584	500	16.80
1662	806	806	0.00	373	343	8.75
1663	2354	1987	18.47	833	732	13.80
1664	23	390	-94.10	12	10	20.00
1665	3103	3103	0.00	1395	1206	15.67
1666	165	165	0.00	84	53	58.49
1667	3527	3530	-0.08	1662	1383	20.17
1668	673	671	0.30	441	375	17.60
1669	25	25	0.00	13	17	-23.53
1670	1237	1132	9.28	796	517	53.97
1671	3089	3194	-3.29	2070	1770	16.95
1672	1141	1651	-30.89	704	792	-11.11
1673	2730	2732	-0.07	1608	1229	30.84
1674	305	305	0.00	173	140	23.57
1675	724	188	285.11	384	102	276.47
1676	3507	3507	0.00	2122	1556	36.38
1677	1889	1890	-0.05	1301	841	54.70
1678	0	11	-100.00	0	0	0.00
1679	81	110	-26.36	41	56	-26.79
Total	79494	79626	-0.17	37886	31774	19.24

Cartersville

TABLE 15

Comparison of Socioeconomic Data between the GSTDM and MPO Models, by GSTDM TAZ, in the Cartersville MPO Model Area (# TAZs = 29)

TAZ_ID	# Population			# Households		
	MPO	GSTDM	% diff.	MPO	GSTDM	% diff.
830	6895	6895	0.00	2461	2461	0.00
831	2048	2058	-0.49	807	807	0.00
832	3091	3091	0.00	1103	1103	0.00
833	5507	5511	-0.07	2155	2155	0.00
834	3403	3458	-1.59	1294	1295	-0.08
835	4260	4512	-5.59	1618	1624	-0.37
836	2744	2744	0.00	1117	1117	0.00
837	3254	3254	0.00	1128	1128	0.00
838	1964	1964	0.00	679	679	0.00
839	1125	1125	0.00	412	412	0.00
840	1694	1694	0.00	631	631	0.00
841	2845	2845	0.00	1023	1023	0.00
842	1444	1444	0.00	515	515	0.00
843	4494	4494	0.00	1578	1578	0.00
844	3838	4425	-13.27	1463	1457	0.41
845	3859	3936	-1.96	1669	1669	0.00
846	5008	5008	0.00	1700	1700	0.00
847	3189	3189	0.00	1227	1227	0.00
848	4195	4195	0.00	1501	1501	0.00
849	6732	6737	-0.07	2243	2243	0.00
850	1714	1714	0.00	586	586	0.00
851	2231	2231	0.00	728	728	0.00
852	3846	3846	0.00	1245	1245	0.00
853	2325	2279	2.02	728	711	2.39
854	2947	2993	-1.54	999	1016	-1.67
855	3713	3713	0.00	1303	1303	0.00
856	5659	5594	1.16	2083	2058	1.21
857	2657	2657	0.00	937	937	0.00
858	2486	2486	0.00	848	848	0.00
Total	99167	100092	-0.92	35781	35757	0.07

Columbus

TABLE 16

Comparison of Socioeconomic Data between the GSTDM and MPO Models, by GSTDM TAZ, in the Columbus MPO Model Area (# TAZs = 89)

TAZ_ID	# Population			# Households		
	MPO	GSTDM	% diff.	MPO	GSTDM	% diff.
1295	1690	1690	0.00	777	748	3.88
1296	3896	3896	0.00	1352	1350	0.15
1297	837	837	0.00	349	351	-0.57
1298	2007	2007	0.00	882	882	0.00
1299	3590	3590	0.00	1424	1424	0.00
1300	0	0	0.00	0	0	0.00
1301	931	931	0.00	362	362	0.00
1302	0	0	0.00	0	0	0.00
1303	1212	1212	0.00	539	539	0.00
1304	1471	1471	0.00	575	575	0.00
1305	66	66	0.00	51	51	0.00
1306	22	22	0.00	8	8	0.00
1307	601	601	0.00	198	198	0.00
1308	1609	1609	0.00	795	795	0.00
1309	5773	5773	0.00	2412	2412	0.00
1310	699	699	0.00	224	224	0.00
1311	2797	2797	0.00	1182	1182	0.00
1312	5311	5311	0.00	1946	1946	0.00
1313	2231	2231	0.00	926	926	0.00
1314	1104	1104	0.00	405	434	-6.68
1315	3269	3269	0.00	1308	1308	0.00
1316	753	753	0.00	305	305	0.00
1317	2461	2461	0.00	952	952	0.00
1318	1191	1191	0.00	458	458	0.00
1319	2841	2841	0.00	1323	1323	0.00
1320	2354	2354	0.00	991	991	0.00
1321	6394	6394	0.00	2686	2686	0.00
1322	1426	1426	0.00	664	664	0.00
1323	4415	4415	0.00	1751	1751	0.00
1324	1910	2317	-17.57	810	810	0.00
1325	3530	3530	0.00	1663	1663	0.00
1326	2176	2176	0.00	824	824	0.00
1327	462	462	0.00	166	166	0.00
1328	2931	2931	0.00	968	968	0.00

TAZ_ID	# Population			# Households		
	MPO	GSTDM	% diff.	MPO	GSTDM	% diff.
1329	1511	1511	0.00	569	569	0.00
1330	5757	5757	0.00	2627	2627	0.00
1331	9	1843	-99.51	3	33	-90.91
1332	3604	3604	0.00	1302	1302	0.00
1333	9174	9174	0.00	3232	3216	0.50
1334	8921	8921	0.00	3290	3290	0.00
1335	3981	3981	0.00	1561	1561	0.00
1336	3298	3298	0.00	1376	1376	0.00
1337	5912	5912	0.00	2375	2375	0.00
1338	2377	2377	0.00	930	930	0.00
1339	2823	2823	0.00	1497	1497	0.00
1340	3268	3268	0.00	1648	1648	0.00
1341	2612	2612	0.00	1016	1016	0.00
1342	2045	2045	0.00	970	970	0.00
1343	2331	2402	-2.96	901	901	0.00
1344	475	695	-31.65	173	173	0.00
1345	416	492	-15.45	170	170	0.00
1346	104	104	0.00	66	66	0.00
1347	593	690	-14.06	573	250	129.20
1348	809	809	0.00	506	506	0.00
1349	1406	2326	-39.55	641	641	0.00
1350	0	0	0.00	0	0	0.00
1351	1611	1611	0.00	620	620	0.00
1352	5223	5223	0.00	2314	2314	0.00
1353	2878	2878	0.00	1285	1285	0.00
1354	3827	3827	0.00	1552	1552	0.00
1355	3640	3640	0.00	1372	1372	0.00
1356	4073	4073	0.00	1657	1657	0.00
1357	4814	4814	0.00	1725	1725	0.00
1358	2338	2338	0.00	927	927	0.00
1359	8709	8709	0.00	3427	3427	0.00
1360	5995	5995	0.00	2440	2440	0.00
1361	1189	1189	0.00	436	436	0.00
1363	682	682	0.00	235	235	0.00
2293	811	809	0.25	324	323	0.31
2294	2163	2165	-0.09	892	893	-0.11
2295	2193	2193	0.00	885	885	0.00
2296	3335	3335	0.00	1247	1247	0.00
2297	5149	5149	0.00	1904	1904	0.00

TAZ_ID	# Population			# Households		
	MPO	GSTDM	% diff.	MPO	GSTDM	% diff.
2298	4085	4085	0.00	1439	1439	0.00
2299	4242	4242	0.00	1511	1511	0.00
2300	5444	5196	4.77	1937	1844	5.04
2301	4602	4850	-5.11	1684	1777	-5.23
3585	15805	15805	0.00	6880	6880	0.00
3586	6903	6903	0.00	2735	2735	0.00
3587	6672	6672	0.00	2451	2451	0.00
3588	7031	7031	0.00	2799	2799	0.00
3589	6946	6946	0.00	2486	2486	0.00
3590	3727	3727	0.00	1439	1439	0.00
3591	1873	1873	0.00	855	855	0.00
3592	3990	3990	0.00	1584	1584	0.00
3599	7623	7623	0.00	2936	2936	0.00
3600	20814	20814	0.00	7630	7630	0.00
3601	6621	6621	0.00	2518	2518	0.00
3602	10469	10469	0.00	3849	3849	0.00
Total	308863	312488	-1.16	122677	122368	0.25

Dalton

TABLE 17

Comparison of Socioeconomic Data between the GSTDM and MPO Models, by GSTDM TAZ, in the Dalton MPO Model Area (# TAZs = 65)

TAZ_ID	# Population			# Households		
	MPO	GSTDM	% diff.	MPO	GSTDM	% diff.
1097	4438	4438	0.00	1567	1581	-0.89
1098	1737	1737	0.00	605	605	0.00
1099	2266	2266	0.00	697	697	0.00
1100	2856	2856	0.00	1057	1057	0.00
1101	1199	1333	-10.05	420	466	-9.87
1102	1994	1994	0.00	710	710	0.00
1103	2259	2259	0.00	780	780	0.00
1104	2450	2450	0.00	741	741	0.00
1105	1716	1716	0.00	624	624	0.00
1106	5515	5515	0.00	1984	1984	0.00
1107	2921	2923	-0.07	918	919	-0.11
1108	772	770	0.26	266	265	0.38

TAZ_ID	# Population			# Households		
	MPO	GSTDM	% diff.	MPO	GSTDM	% diff.
1109	2438	2438	0.00	979	979	0.00
1110	920	920	0.00	324	324	0.00
1111	2771	2771	0.00	1041	1041	0.00
1112	646	646	0.00	243	243	0.00
1113	2846	2846	0.00	1040	1040	0.00
1114	1364	1364	0.00	518	518	0.00
1115	1107	1107	0.00	389	389	0.00
1116	1899	1899	0.00	709	709	0.00
1117	4100	4100	0.00	1483	1483	0.00
1118	1353	1353	0.00	677	677	0.00
1119	2545	2545	0.00	970	970	0.00
1120	2105	2112	-0.33	643	637	0.94
1121	1459	1459	0.00	537	537	0.00
1122	2460	2460	0.00	981	981	0.00
1123	2075	2075	0.00	777	777	0.00
1124	3722	3722	0.00	1288	1287	0.08
1125	2086	2088	-0.10	606	606	0.00
1126	85	85	0.00	47	47	0.00
1127	62	111	-44.14	30	30	0.00
1128	4111	4111	0.00	1199	1199	0.00
1129	2115	2114	0.05	693	693	0.00
1130	1215	1216	-0.08	351	385	-8.83
1131	3934	3934	0.00	1132	1132	0.00
1132	2382	2382	0.00	733	733	0.00
1133	2255	2255	0.00	676	676	0.00
1134	1229	1229	0.00	392	392	0.00
1135	1747	1747	0.00	569	569	0.00
1136	2114	2059	2.67	711	698	1.86
1137	1340	1340	0.00	419	419	0.00
1138	1260	1260	0.00	440	440	0.00
1139	1101	1101	0.00	330	330	0.00
1140	1858	1858	0.00	545	545	0.00
1141	1017	1017	0.00	329	329	0.00
1142	2078	2078	0.00	643	643	0.00
1143	1521	1514	0.46	522	520	0.38
1144	1441	1441	0.00	526	526	0.00
1145	846	679	24.59	292	229	27.51
1146	844	826	2.18	298	292	2.05
1147	2004	2004	0.00	690	690	0.00

TAZ_ID	# Population			# Households		
	MPO	GSTDM	% diff.	MPO	GSTDM	% diff.
1786	1227	1227	0.00	465	465	0.00
1787	1807	1807	0.00	675	675	0.00
1788	553	553	0.00	219	219	0.00
1789	2212	2212	0.00	736	736	0.00
1790	6901	6758	2.12	2208	2162	2.13
1791	1843	1843	0.00	722	722	0.00
1792	200	199	0.50	90	89	1.12
1793	2111	2117	-0.28	804	807	-0.37
1794	1541	1536	0.33	571	569	0.35
1795	6240	6240	0.00	2324	2324	0.00
1796	5087	5087	0.00	1740	1740	0.00
1797	4348	4348	0.00	1584	1584	0.00
1798	2939	2939	0.00	1008	1008	0.00
1799	2628	2838	-7.40	934	1016	-8.07
Total	142215	142227	-0.01	49221	49260	-0.08

Gainesville

TABLE 18

Comparison of Socioeconomic Data between the GSTDM and MPO Models, by GSTDM TAZ, in the Gainesville MPO Model Area (# TAZs = 113)

TAZ_ID	# Population			# Households		
	MPO	GSTDM	% diff.	MPO	GSTDM	% diff.
678	4734	4734	0.00	1770	1770	0.00
679	544	544	0.00	192	192	0.00
680	2453	2453	0.00	823	823	0.00
681	4312	4312	0.00	1366	1366	0.00
682	3703	3703	0.00	1200	1200	0.00
683	4483	4483	0.00	1428	1428	0.00
684	1311	1311	0.00	460	460	0.00
685	2096	2096	0.00	799	799	0.00
686	0	951	-100.00	0	373	-100.00
687	2867	2964	-3.27	1201	1201	0.00
688	1922	1922	0.00	799	799	0.00
689	2111	2111	0.00	793	793	0.00
690	2588	2588	0.00	1014	1014	0.00
691	2180	2180	0.00	868	868	0.00

TAZ_ID	# Population			# Households		
	MPO	GSTDM	% diff.	MPO	GSTDM	% diff.
692	4280	4280	0.00	1508	1508	0.00
693	1011	1011	0.00	381	381	0.00
694	2224	2224	0.00	770	770	0.00
695	1889	1889	0.00	691	691	0.00
696	2919	2919	0.00	829	829	0.00
697	790	790	0.00	232	232	0.00
698	325	325	0.00	145	145	0.00
699	1305	1305	0.00	569	569	0.00
700	2270	2270	0.00	876	876	0.00
701	3436	3436	0.00	1072	1072	0.00
702	1378	1378	0.00	490	490	0.00
703	6002	6002	0.00	2030	2030	0.00
704	2184	2184	0.00	750	750	0.00
705	1413	1413	0.00	485	485	0.00
706	568	568	0.00	192	192	0.00
707	3690	5017	-26.45	1067	1067	0.00
708	551	551	0.00	144	144	0.00
709	1469	1469	0.00	361	361	0.00
710	2590	2590	0.00	689	689	0.00
711	333	333	0.00	113	113	0.00
712	2974	2974	0.00	783	783	0.00
713	4832	4832	0.00	1273	1273	0.00
714	228	228	0.00	80	80	0.00
715	2415	2415	0.00	668	668	0.00
716	3879	3879	0.00	1098	1098	0.00
717	1595	1595	0.00	515	515	0.00
718	1201	1201	0.00	415	415	0.00
719	606	606	0.00	90	65	38.46
720	1897	1897	0.00	710	710	0.00
721	617	617	0.00	273	273	0.00
722	715	836	-14.47	334	334	0.00
723	835	835	0.00	314	314	0.00
724	1142	1142	0.00	423	423	0.00
725	646	646	0.00	253	253	0.00
726	2310	2310	0.00	841	841	0.00
727	815	815	0.00	298	298	0.00
728	1630	1630	0.00	570	570	0.00
729	1328	1328	0.00	470	470	0.00
730	1923	1917	0.31	693	691	0.29

TAZ_ID	# Population			# Households		
	MPO	GSTDM	% diff.	MPO	GSTDM	% diff.
731	127	127	0.00	53	53	0.00
732	658	658	0.00	255	255	0.00
733	876	876	0.00	309	309	0.00
734	1100	1100	0.00	389	389	0.00
735	248	248	0.00	99	99	0.00
736	470	470	0.00	172	172	0.00
737	827	827	0.00	290	290	0.00
738	284	284	0.00	114	114	0.00
739	1084	1084	0.00	421	421	0.00
740	2521	2521	0.00	821	821	0.00
741	1888	1888	0.00	761	761	0.00
742	2296	2296	0.00	839	839	0.00
743	3206	3206	0.00	1038	1038	0.00
744	3746	3746	0.00	1457	1457	0.00
745	1253	1253	0.00	555	555	0.00
746	0	28	-100.00	0	16	-100.00
747	248	274	-9.49	57	57	0.00
748	2477	2720	-8.93	604	604	0.00
749	2743	2743	0.00	611	611	0.00
750	3827	3827	0.00	848	848	0.00
751	1418	1418	0.00	505	505	0.00
752	5578	5578	0.00	1653	1653	0.00
753	2947	2947	0.00	1312	1312	0.00
754	719	719	0.00	207	207	0.00
755	1356	1356	0.00	562	562	0.00
756	3883	3883	0.00	1474	1474	0.00
757	3409	3409	0.00	1226	1226	0.00
758	1788	1788	0.00	663	663	0.00
759	1603	1603	0.00	557	557	0.00
760	2570	2570	0.00	1067	1067	0.00
761	3535	3535	0.00	1250	1250	0.00
762	4452	4452	0.00	1608	1608	0.00
763	3914	3914	0.00	1430	1430	0.00
764	2321	2321	0.00	912	912	0.00
1954	1982	1982	0.00	678	678	0.00
1955	961	961	0.00	377	377	0.00
1956	1231	1231	0.00	400	400	0.00
1957	3399	3399	0.00	1165	1165	0.00
1958	4858	4858	0.00	1643	1643	0.00

TAZ_ID	# Population			# Households		
	MPO	GSTDM	% diff.	MPO	GSTDM	% diff.
1959	614	614	0.00	214	214	0.00
1960	4261	4261	0.00	1477	1477	0.00
1961	170	170	0.00	62	62	0.00
1962	3760	3760	0.00	1312	1312	0.00
1963	1164	1164	0.00	475	475	0.00
1964	1603	1603	0.00	650	650	0.00
1965	2391	2391	0.00	895	895	0.00
1966	830	830	0.00	314	314	0.00
1967	2796	2796	0.00	971	971	0.00
1968	2698	2698	0.00	990	990	0.00
1969	3681	3681	0.00	1336	1336	0.00
1970	5078	5084	-0.12	1759	1762	-0.17
1971	1413	1413	0.00	635	635	0.00
1972	1554	1554	0.00	523	523	0.00
1973	5073	5073	0.00	1694	1694	0.00
1974	2525	2525	0.00	858	858	0.00
2973	2791	2791	0.00	925	925	0.00
2974	1943	1943	0.00	691	691	0.00
2975	1489	1489	0.00	540	540	0.00
2976	1184	1178	0.51	512	509	0.59
2977	1036	1036	0.00	247	247	0.00
Total	237376	240163	-1.16	81670	82032	-0.44

Hinesville

TABLE 19

Comparison of Socioeconomic Data between the GSTDM and MPO Models, by GSTDM TAZ, in the Hinesville MPO Model Area (# TAZs = 44)

TAZ_ID	# Population			# Households		
	MPO	GSTDM	% diff.	MPO	GSTDM	% diff.
1452	752	752	0.00	268	268	0.00
1453	382	382	0.00	158	158	0.00
1454	4336	4093	5.94	1383	1397	-1.00
1455	2748	2750	-0.07	943	944	-0.11
1456	2383	2383	0.00	840	840	0.00
1457	2856	2856	0.00	1024	1024	0.00
1458	1248	1248	0.00	392	392	0.00

TAZ_ID	# Population			# Households		
	MPO	GSTDM	% diff.	MPO	GSTDM	% diff.
1459	0	0	0.00	0	0	0.00
1460	0	0	0.00	0	0	0.00
1461	0	0	0.00	0	0	0.00
1462	0	0	0.00	0	0	0.00
1463	2	39	-94.87	2	2	0.00
1464	7171	9382	-23.57	2102	2102	0.00
1465	0	0	0.00	0	0	0.00
1466	3015	3007	0.27	1214	1211	0.25
1467	837	837	0.00	373	373	0.00
1468	834	834	0.00	411	411	0.00
1469	5265	5265	0.00	1915	1915	0.00
1470	3217	3358	-4.20	1204	1256	-4.14
1471	1151	1012	13.74	406	355	14.37
1472	463	463	0.00	173	173	0.00
1473	782	782	0.00	306	306	0.00
1474	2253	2251	0.09	674	673	0.15
1475	531	531	0.00	212	212	0.00
1476	2300	2300	0.00	827	827	0.00
1477	10415	10537	-1.16	3617	3667	-1.36
1478	3846	3846	0.00	1446	1446	0.00
1479	1446	1446	0.00	600	600	0.00
1480	574	574	0.00	216	216	0.00
1481	240	240	0.00	85	85	0.00
1482	3187	3187	0.00	1133	1133	0.00
1483	1896	1896	0.00	733	733	0.00
1484	100	100	0.00	41	41	0.00
1485	427	427	0.00	145	145	0.00
1486	526	526	0.00	198	198	0.00
1487	2028	2028	0.00	652	652	0.00
1488	3819	3819	0.00	1541	1541	0.00
1489	1574	1574	0.00	585	585	0.00
1490	473	473	0.00	188	188	0.00
1491	319	319	0.00	137	137	0.00
1492	432	432	0.00	151	151	0.00
1493	249	249	0.00	95	95	0.00
1494	1691	1691	0.00	716	716	0.00
1495	28	28	0.00	10	10	0.00
Total	75796	77917	-2.72	27116	27178	-0.23

Macon

TABLE 20

Comparison of Socioeconomic Data between the GSTDM and MPO Models, by GSTDM TAZ, in the Macon MPO Model Area (# TAZs = 77)

TAZ_ID	# Population			# Households		
	MPO	GSTDM	% diff.	MPO	GSTDM	% diff.
1228	3976	2950	34.78	1703	1485	14.68
1229	1144	1089	5.05	368	410	-10.24
1230	4371	4420	-1.11	1538	1664	-7.57
1231	3788	4229	-10.43	1678	1758	-4.55
1232	2094	2057	1.80	863	913	-5.48
1233	1270	1265	0.40	444	517	-14.12
1234	2168	1821	19.06	820	774	5.94
1235	3399	4143	-17.96	1188	1559	-23.80
1236	3160	3589	-11.95	1172	1391	-15.74
1237	1711	1865	-8.26	726	806	-9.93
1238	752	784	-4.08	282	296	-4.73
1239	640	631	1.43	247	242	2.07
1240	5569	5618	-0.87	2282	2103	8.51
1241	1008	1273	-20.82	346	488	-29.10
1242	1035	1087	-4.78	413	436	-5.28
1243	1475	1685	-12.46	572	626	-8.63
1244	1264	2009	-37.08	490	396	23.74
1245	2364	2177	8.59	792	785	0.89
1246	13495	13411	0.63	4714	4556	3.47
1247	3493	3533	-1.13	1354	1296	4.48
1248	2122	2853	-25.62	978	1055	-7.30
1249	1167	1561	-25.24	431	603	-28.52
1250	2703	2766	-2.28	1099	1048	4.87
1251	3553	3506	1.34	1354	1371	-1.24
1252	3638	3017	20.58	1447	1230	17.64
1253	1986	1698	16.96	944	807	16.98
1254	4804	4526	6.14	1939	1788	8.45
1255	3029	2843	6.54	1099	1042	5.47
1256	2266	2519	-10.04	878	918	-4.36
1257	1978	2090	-5.36	962	1016	-5.31
1258	2327	2583	-9.91	1112	1167	-4.71
1259	6721	7619	-11.79	3272	3344	-2.15
1260	4215	4137	1.89	1929	1981	-2.62
1261	2339	2196	6.51	1268	1320	-3.94

TAZ_ID	# Population			# Households		
	MPO	GSTDM	% diff.	MPO	GSTDM	% diff.
1262	371	409	-9.29	284	248	14.52
1263	1175	2156	-45.50	454	526	-13.69
1264	2136	3697	-42.22	950	918	3.49
1265	1547	1401	10.42	597	517	15.47
1266	1764	1649	6.97	593	590	0.51
1267	5487	5097	7.65	2072	1762	17.59
1268	2035	2144	-5.08	763	825	-7.52
1269	4802	5376	-10.68	1877	2093	-10.32
1270	2930	3199	-8.41	1077	1194	-9.80
1271	190	163	16.56	78	67	16.42
1272	2203	1773	24.25	868	679	27.84
1273	895	711	25.88	303	252	20.24
1274	880	874	0.69	366	280	30.71
1275	192	257	-25.29	95	103	-7.77
1276	0	4	-100.00	0	0	0.00
1277	465	375	24.00	165	137	20.44
1278	1525	1320	15.53	585	483	21.12
1279	1706	1849	-7.73	559	611	-8.51
1280	2817	2571	9.57	994	936	6.20
1281	4351	3872	12.37	1471	1427	3.08
1282	2082	2539	-18.00	742	901	-17.65
1283	2832	2455	15.36	1211	1084	11.72
1284	1828	1513	20.82	610	506	20.55
1285	1778	1845	-3.63	876	901	-2.77
1286	2666	2912	-8.45	1237	1251	-1.12
1287	1644	1836	-10.46	764	813	-6.03
1288	1079	1179	-8.48	399	448	-10.94
1289	1347	1424	-5.41	497	517	-3.87
1290	935	1059	-11.71	353	407	-13.27
1291	946	851	11.16	357	312	14.42
1292	718	1941	-63.01	269	729	-63.10
1293	2561	2711	-5.53	961	1035	-7.15
1294	3798	2397	58.45	1423	880	61.70
1768	447	683	-34.55	165	245	-32.65
1769	1172	891	31.54	432	347	24.50
1770	1966	1745	12.66	725	632	14.72
1771	2626	4125	-36.34	932	1394	-33.14
1772	4606	3107	48.25	1637	1175	39.32
1773	952	1291	-26.26	358	488	-26.64

TAZ_ID	# Population			# Households		
	MPO	GSTDM	% diff.	MPO	GSTDM	% diff.
1774	2698	2997	-9.98	1016	1148	-11.50
1775	2818	2180	29.27	1062	800	32.75
Total	179994	184128	-2.25	70881	70852	0.04

Rome

TABLE 21

Comparison of Socioeconomic Data between the GSTDM and MPO Models, by GSTDM TAZ, in the Rome MPO Model Area (# TAZs = 52)

TAZ_ID	# Population			# Households		
	MPO	GSTDM	% diff.	MPO	GSTDM	% diff.
949	1736	1874	-7.36	708	688	2.91
950	2574	2589	-0.58	1016	947	7.29
951	2018	2019	-0.05	814	722	12.74
952	1555	1613	-3.60	731	664	10.09
953	1607	1552	3.54	705	600	17.50
954	1013	1013	0.00	417	367	13.62
955	591	591	0.00	292	236	23.73
956	398	398	0.00	186	149	24.83
957	1794	1794	0.00	782	693	12.84
958	1226	1256	-2.39	481	449	7.13
959	2932	2932	0.00	1194	1122	6.42
960	1674	1674	0.00	609	499	22.04
961	2690	2690	0.00	1170	926	26.35
962	3537	3537	0.00	1684	1417	18.84
963	4621	4613	0.17	2077	1785	16.36
964	3585	3585	0.00	1654	1483	11.53
965	1720	1720	0.00	688	609	12.97
966	937	1053	-11.02	385	391	-1.53
967	63	63	0.00	26	22	18.18
968	1185	1185	0.00	539	513	5.07
969	1080	1080	0.00	586	507	15.58
970	2319	2319	0.00	1064	970	9.69
971	2338	2338	0.00	991	886	11.85
972	795	1220	-34.84	355	438	-18.95
973	2896	2896	0.00	1140	1066	6.94
974	1097	1097	0.00	457	407	12.29

TAZ_ID	# Population			# Households		
	MPO	GSTDM	% diff.	MPO	GSTDM	% diff.
975	536	536	0.00	233	216	7.87
976	4472	4472	0.00	2009	1616	24.32
977	638	632	0.95	409	353	15.86
978	1667	1667	0.00	960	866	10.85
979	722	770	-6.23	270	241	12.03
980	4091	4091	0.00	1507	1352	11.46
981	3725	4223	-11.79	1414	1491	-5.16
982	1870	1870	0.00	801	759	5.53
983	7685	7685	0.00	3181	2963	7.36
984	3956	3956	0.00	1515	1282	18.17
985	11	11	0.00	4	4	0.00
986	1884	1884	0.00	233	214	8.88
987	795	900	-11.67	282	300	-6.00
988	2830	2830	0.00	1170	1073	9.04
989	511	511	0.00	209	190	10.00
990	1790	1790	0.00	840	728	15.38
991	1804	1804	0.00	761	642	18.54
992	67	67	0.00	22	21	4.76
993	445	445	0.00	198	176	12.50
994	1768	1768	0.00	854	729	17.15
995	2024	2024	0.00	856	738	15.99
996	280	280	0.00	113	102	10.78
997	526	405	29.88	230	165	39.39
998	1121	1121	0.00	460	430	6.98
999	725	791	-8.34	297	300	-1.00
1000	930	962	-3.33	395	376	5.05
Total	94854	96196	-1.40	39974	35883	11.40

Savannah

TABLE 22

Comparison of Socioeconomic Data between the GSTDM and MPO Models, by GSTDM TAZ, in the Savannah MPO Model Area (# TAZs = 147)

TAZ_ID	# Population			# Households		
	MPO	GSTDM	% diff.	MPO	GSTDM	% diff.
1496	370	370	0.00	131	131	0.00
1497	917	917	0.00	352	352	0.00
1498	463	463	0.00	187	187	0.00
1499	170	170	0.00	64	64	0.00
1500	1381	1381	0.00	591	591	0.00
1501	3913	3913	0.00	1311	1311	0.00
1502	88	88	0.00	37	37	0.00
1503	66	66	0.00	23	23	0.00
1504	382	382	0.00	141	141	0.00
1505	183	183	0.00	68	68	0.00
1506	971	971	0.00	372	372	0.00
1507	245	245	0.00	104	104	0.00
1508	592	592	0.00	193	193	0.00
1509	2984	2984	0.00	1022	1022	0.00
1510	3430	3514	-2.39	1275	1275	0.00
1511	1603	1603	0.00	695	695	0.00
1512	1091	1091	0.00	594	594	0.00
1513	510	510	0.00	182	182	0.00
1514	755	755	0.00	293	293	0.00
1515	161	161	0.00	58	58	0.00
1516	5116	5116	0.00	2120	2120	0.00
1517	4526	4526	0.00	1676	1676	0.00
1518	1113	1113	0.00	398	398	0.00
1519	717	717	0.00	297	297	0.00
1520	626	626	0.00	259	259	0.00
1521	229	229	0.00	92	92	0.00
1522	683	683	0.00	285	285	0.00
1523	894	979	-8.68	391	391	0.00
1524	79	79	0.00	29	29	0.00
1525	0	0	0.00	0	0	0.00
1526	17	1638	-98.96	9	9	0.00
1527	0	0	0.00	0	0	0.00
1528	398	398	0.00	138	131	5.34
1529	1679	1679	0.00	706	703	0.43

TAZ_ID	# Population			# Households		
	MPO	GSTDM	% diff.	MPO	GSTDM	% diff.
1530	2693	2693	0.00	969	963	0.62
1531	1380	1380	0.00	579	579	0.00
1532	116	116	0.00	51	51	0.00
1533	320	320	0.00	128	128	0.00
1534	1303	1303	0.00	436	436	0.00
1535	8	8	0.00	3	3	0.00
1536	750	750	0.00	419	417	0.48
1537	497	2228	-77.69	279	279	0.00
1538	1049	1049	0.00	458	458	0.00
1539	9698	9698	0.00	3699	3678	0.57
1540	761	761	0.00	265	265	0.00
1541	222	222	0.00	91	91	0.00
1542	2369	2369	0.00	870	865	0.58
1543	164	164	0.00	75	75	0.00
1544	258	258	0.00	116	116	0.00
1545	2089	2089	0.00	756	756	0.00
1546	1326	1326	0.00	481	481	0.00
1547	1647	1647	0.00	734	734	0.00
1548	953	953	0.00	408	408	0.00
1549	2962	2962	0.00	1009	1009	0.00
1550	7827	7827	0.00	3110	3107	0.10
1551	2977	2977	0.00	1254	1254	0.00
1552	159	159	0.00	74	74	0.00
1553	1127	1187	-5.05	513	532	-3.57
1554	11657	11756	-0.84	5203	4293	21.20
1555	7550	7550	0.00	3185	3185	0.00
1556	3120	3120	0.00	1299	1294	0.39
1557	1594	1594	0.00	694	597	16.25
1558	4026	4026	0.00	1987	1710	16.20
1559	3717	3717	0.00	1602	1547	3.56
1560	2075	2075	0.00	1072	330	224.85
1561	1465	1465	0.00	631	631	0.00
1562	5453	5453	0.00	2215	1902	16.46
1563	1787	1787	0.00	880	880	0.00
1564	3016	3016	0.00	1353	1353	0.00
1565	1173	1173	0.00	609	477	27.67
1566	975	975	0.00	567	430	31.86
1567	2306	2306	0.00	889	889	0.00
1568	1335	1335	0.00	500	500	0.00

TAZ_ID	# Population			# Households		
	MPO	GSTDM	% diff.	MPO	GSTDM	% diff.
1569	2358	2358	0.00	963	963	0.00
1570	1015	1015	0.00	504	493	2.23
1571	2104	2104	0.00	1232	907	35.83
1572	4604	4604	0.00	2130	2130	0.00
1573	2361	2476	-4.64	886	871	1.72
1574	3395	3395	0.00	1247	1243	0.32
1575	2380	2380	0.00	886	886	0.00
1576	2058	2058	0.00	796	796	0.00
1577	1722	1722	0.00	592	592	0.00
1578	217	217	0.00	90	83	8.43
1579	1704	1704	0.00	663	663	0.00
1580	443	701	-36.80	161	161	0.00
1581	3160	3160	0.00	1381	1050	31.52
1582	5	5	0.00	3	3	0.00
1583	831	831	0.00	305	305	0.00
1584	2	2	0.00	2	0	-
1585	0	0	0.00	0	0	0.00
1586	1352	1352	0.00	481	481	0.00
1587	2051	2098	-2.24	1501	270	455.93
1588	937	937	0.00	572	201	184.58
1589	1580	1777	-11.09	1137	709	60.37
1590	6650	6650	0.00	3827	3622	5.66
1591	4202	4252	-1.18	2006	1919	4.53
1592	3187	3187	0.00	1282	1282	0.00
1593	1495	1495	0.00	597	597	0.00
1594	2	2	0.00	2	0	0.00
1595	11	11	0.00	5	5	0.00
1596	42	121	-65.29	27	15	80.00
1597	289	289	0.00	148	148	0.00
1598	932	957	-2.61	333	333	0.00
1599	2230	2230	0.00	884	884	0.00
1600	7093	7093	0.00	2726	2716	0.37
1601	8294	8294	0.00	3217	3214	0.09
1602	1120	1120	0.00	482	482	0.00
1603	1605	1605	0.00	661	661	0.00
1604	0	0	0.00	0	0	0.00
1605	3187	3306	-3.60	1513	1513	0.00
1606	15138	15138	0.00	6385	6378	0.11
1607	2966	2966	0.00	1144	1144	0.00

TAZ_ID	# Population			# Households		
	MPO	GSTDM	% diff.	MPO	GSTDM	% diff.
1608	2825	2825	0.00	1301	1301	0.00
1609	5796	5922	-2.13	3583	1497	139.35
1610	4586	4872	-5.87	1716	1716	0.00
1611	3666	3666	0.00	1398	1398	0.00
1612	2226	2226	0.00	821	821	0.00
1613	1439	2225	-35.33	588	923	-36.29
1614	1005	1005	0.00	432	392	10.20
1615	2742	2778	-1.30	1110	1110	0.00
1616	4523	4523	0.00	1766	1766	0.00
1617	8384	7598	10.34	3929	3553	10.58
1618	0	0	0.00	0	0	0.00
1776	624	624	0.00	238	238	0.00
1777	803	803	0.00	296	296	0.00
1778	899	899	0.00	350	350	0.00
1779	2021	2020	0.05	742	741	0.13
1780	3669	3670	-0.03	1335	1336	-0.07
1782	0	0	0.00	0	0	0.00
1783	0	0	0.00	0	0	0.00
1784	1858	1858	0.00	666	666	0.00
1785	9485	9425	0.64	3290	3271	0.58
2919	1151	1125	2.31	418	409	2.20
2920	2054	2061	-0.34	775	778	-0.39
2921	3474	3500	-0.74	1191	1200	-0.75
2922	8690	8690	0.00	2769	2769	0.00
2923	5242	5235	0.13	1864	1861	0.16
2924	4476	4476	0.00	1480	1480	0.00
2925	5511	5511	0.00	1982	1982	0.00
2926	4500	4490	0.22	1620	1615	0.31
2927	2647	2647	0.00	972	972	0.00
2928	5277	5277	0.00	1821	1821	0.00
2950	6883	6883	0.00	2458	2458	0.00
2951	2269	2269	0.00	753	753	0.00
2952	7117	7127	-0.14	2471	2476	-0.20
2953	2111	2111	0.00	729	729	0.00
2954	1722	1722	0.00	610	610	0.00
Total	342653	347611	-1.43	139801	131868	6.02

Valdosta

TABLE 23

Comparison of Socioeconomic Data between the GSTDM and MPO Models, by GSTDM TAZ, in the Valdosta MPO Model Area (# TAZs = 51)

TAZ ID	# Population			# Households		
	MPO	GSTDM	% diff.	MPO	GSTDM	% diff.
1680	733	733	0.00	268	268	0.00
1681	1554	3015	-48.46	571	571	0.00
1682	2290	2181	5.00	858	822	4.38
1683	1558	1647	-5.40	580	605	-4.13
1684	4318	4318	0.00	1492	1491	0.07
1685	1949	1949	0.00	653	653	0.00
1686	981	981	0.00	337	335	0.60
1687	4285	4341	-1.29	1524	1533	-0.59
1688	3352	3352	0.00	1118	1118	0.00
1689	2581	2581	0.00	1044	1044	0.00
1690	2305	2305	0.00	1131	1130	0.09
1691	1393	1120	24.38	1049	188	457.98
1692	3479	3543	-1.81	1180	1206	-2.16
1693	4925	4925	0.00	1834	1834	0.00
1694	1008	983	2.54	388	379	2.37
1695	421	421	0.00	167	167	0.00
1696	4322	4322	0.00	1628	1628	0.00
1697	7343	7594	-3.31	2709	2705	0.15
1698	673	673	0.00	244	242	0.83
1699	9157	9157	0.00	3457	3454	0.09
1700	3399	3737	-9.04	1523	1523	0.00
1701	3995	3995	0.00	1846	1846	0.00
1702	3515	3515	0.00	2868	641	347.43
1703	2283	2283	0.00	1014	1011	0.30
1704	4818	4818	0.00	2137	2128	0.42
1705	3339	3339	0.00	1756	1227	43.11
1706	2782	2782	0.00	1024	1023	0.10
1707	736	736	0.00	373	373	0.00
1708	677	677	0.00	273	272	0.37
1709	547	547	0.00	229	229	0.00
1710	92	92	0.00	32	32	0.00
1711	1127	1922	-41.36	411	411	0.00
1712	2173	2173	0.00	817	817	0.00
1713	1149	1149	0.00	415	415	0.00

TAZ ID	# Population			# Households		
	MPO	GSTDM	% diff.	MPO	GSTDM	% diff.
1714	1359	1360	-0.07	463	464	-0.22
1715	640	640	0.00	205	205	0.00
1716	1234	1193	3.44	443	429	3.26
1717	1353	1393	-2.87	539	552	-2.36
1718	2518	2518	0.00	852	852	0.00
1719	441	441	0.00	166	166	0.00
1720	1200	1200	0.00	485	485	0.00
1721	1528	1481	3.17	619	603	2.65
1722	2345	2484	-5.60	921	962	-4.26
1723	2305	2175	5.98	859	819	4.88
1724	1691	1735	-2.54	609	624	-2.40
1725	688	707	-2.69	259	265	-2.26
Total	106561	109233	-2.45	43370	39747	9.12

Warner Robins

TABLE 24

Comparison of Socioeconomic Data between the GSTDM and MPO Models, by GSTDM TAZ, in the Warner Robins MPO Model Area (# TAZs = 55)

TAZ_ID	# Population			# Households		
	MPO	GSTDM	% diff.	MPO	GSTDM	% diff.
1369	2414	2469	-2.23	920	938	-1.92
1370	4586	4586	0.00	1641	1641	0.00
1371	4099	4099	0.00	1730	1730	0.00
1372	5812	5812	0.00	2249	2249	0.00
1373	3255	3255	0.00	1433	1433	0.00
1374	4149	4149	0.00	1595	1595	0.00
1375	983	983	0.00	368	368	0.00
1376	1869	1869	0.00	734	734	0.00
1377	6673	6673	0.00	2480	2480	0.00
1378	2479	2479	0.00	957	957	0.00
1379	1786	1786	0.00	741	741	0.00
1380	350	350	0.00	155	155	0.00
1381	5548	5599	-0.91	2147	2167	-0.92
1382	3445	3445	0.00	1222	1222	0.00

TAZ_ID	# Population			# Households		
	MPO	GSTDM	% diff.	MPO	GSTDM	% diff.
1383	1216	178	583.15	249	64	289.06
1385	1620	1620	0.00	624	624	0.00
1386	3481	3451	0.87	1126	1114	1.08
1387	2205	2217	-0.54	824	827	-0.36
1388	4621	4642	-0.45	1585	1595	-0.63
1389	8139	8139	0.00	3007	3007	0.00
1390	3224	3224	0.00	1260	1260	0.00
1391	1490	1490	0.00	523	523	0.00
1392	3175	2211	43.60	1521	1151	32.15
1393	1778	2742	-35.16	761	1131	-32.71
1394	6164	6113	0.83	2624	2604	0.77
1395	3918	3918	0.00	1621	1621	0.00
1396	8198	8200	-0.02	3106	3107	-0.03
1397	14133	14133	0.00	4929	4929	0.00
1398	7023	7023	0.00	2444	2444	0.00
1399	843	843	0.00	322	322	0.00
1400	1493	1493	0.00	595	595	0.00
1401	2324	2324	0.00	1000	1000	0.00
1402	1701	1701	0.00	657	657	0.00
1403	613	613	0.00	265	265	0.00
1404	1256	1291	-2.71	577	590	-2.20
1405	711	711	0.00	268	268	0.00
1406	2777	2755	0.61	1070	1059	1.04
1407	935	967	-3.31	338	350	-3.43
1408	1880	1880	0.00	634	634	0.00
1409	3357	3360	-0.09	1202	1203	-0.08
1410	985	979	0.61	369	367	0.54
1411	1259	1259	0.00	474	474	0.00
1412	884	884	0.00	315	315	0.00
1413	938	938	0.00	353	353	0.00
2162	2429	2429	0.00	940	940	0.00
2163	349	347	0.58	157	156	0.64
2164	3329	3247	2.53	1322	1294	2.16
2165	1297	1283	1.09	500	495	1.01
2166	4267	4267	0.00	1684	1652	1.94
2167	881	880	0.11	359	358	0.28
2168	1663	1664	-0.06	601	602	-0.17
2169	2046	2046	0.00	701	701	0.00
2170	2904	2904	0.00	1072	1072	0.00

TAZ_ID	# Population			# Households		
	MPO	GSTDM	% diff.	MPO	GSTDM	% diff.
2171	2286	2286	0.00	941	941	0.00
2172	6386	6351	0.55	1763	1750	0.74
Total	167626	166557	0.64	63055	62824	0.37

Appendix C – Projection Issues

Figure 29 illustrates the projection issues as detected in the case of the Cartersville MPO model network. As shown in the figure, the geographic location of the Cartersville MPO network (blue) is mistakenly projected far away from its intended location relative to the statewide TAZs (green). Similar projection issues were found in the Valdosta and Columbus MPO network.

The projection issue was handled with the following approach:

- ***Step 1***. Prepare the MPO network file (usually in CUBE binary .NET format) and export it to a GIS shapefile format. The Citilabs Cube software can handle this step.
- ***Step 2***. Import the statewide TAZs for the corresponding MPO model region, e.g., Cartersville in this example, into RStudio.
- ***Step 3***. Import the GIS shapefile of the MPO network into RStudio.
- ***Step 4***. Ascertain the MPO TAZs projection system.
- ***Step 5***. Assign the MPO TAZs projection system to the MPO network.

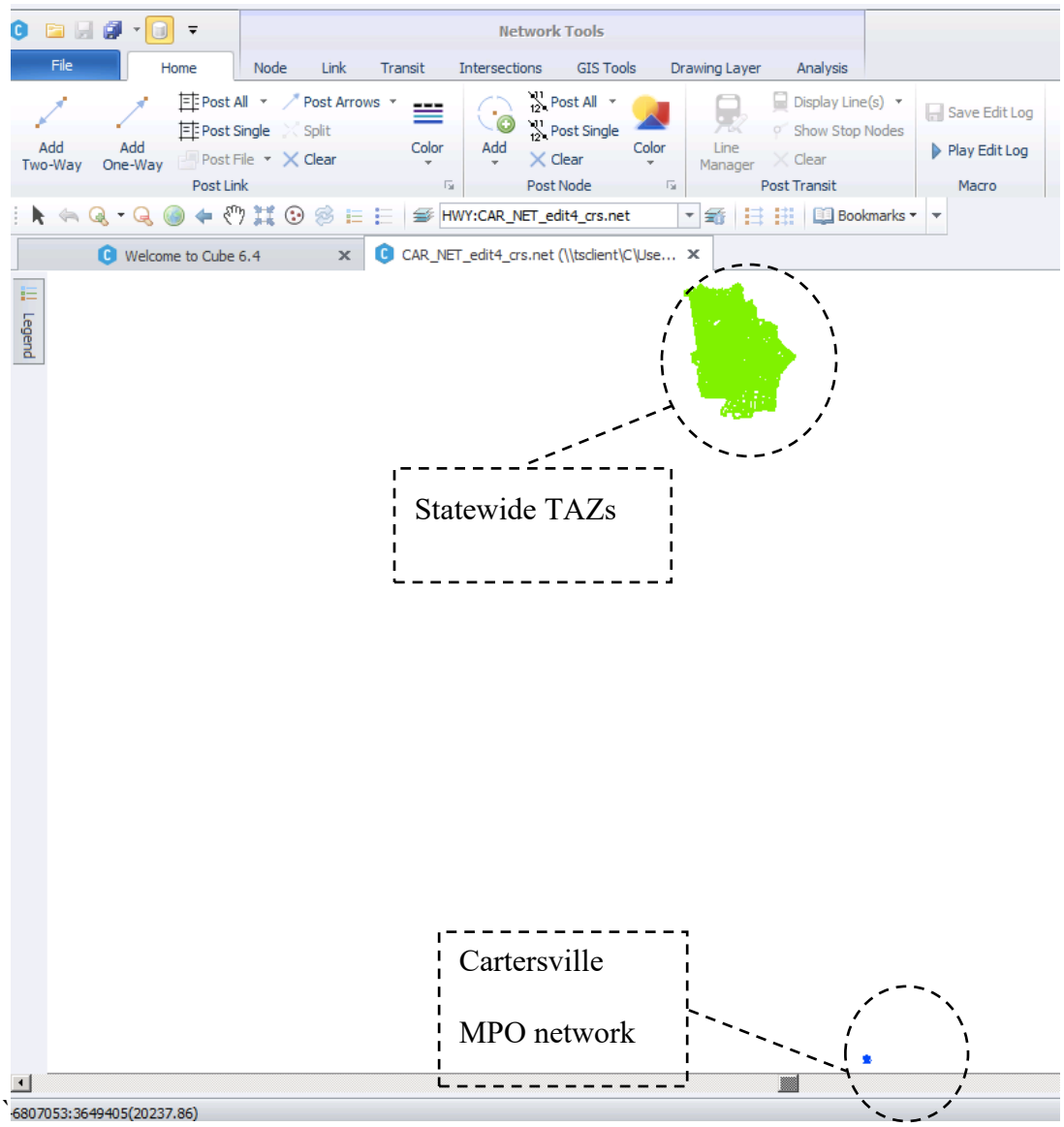

FIGURE 29

Projection Issue as Detected in the Case of Cartersville MPO Network

This process can be handled using the following script. Note that the process is not particularly lengthy.

1. net_shp < - readOGR(dsn = "(Fill with the file's pathname)", layer = "(Fill with layer name)") *#Open MPO network shapefile.*
2. net_shp < - net_shp[!(net_shp$FTYPE == 32),] #Delete centroid connectors, which are represented as network segments with attribute value 32 in the FTYPE column

3. taz_shp < -readOGR(dsn = ".", layer = ".") #Open MPO TAZs derived from the statewide TAZs
4. taz_shp$TAZ_SEQ < - seq(1, nrow(taz_shp@ data)) #[Optional] Create new column to number the TAZs sequentially
5. summary(taz_shp) #Use the summary command to obtain the MPO TAZ projection system
6. proj4string(net_shp) < -CRS(".") #Assign the MPO TAZ projection system to the MPO network
7. writeOGR(net_shp, dsn = "(Fill with the destination pathname)", layer = "(Fll with intended new file name)", driver = "ESRI Shapefile") *#Write a new MPO network shapefile with the correct projection system as output of the process*