7.0 | Forecasting Future Travel Demand

The following chapter describes how transportation demand in the MPA was forecasted through 2045 for the MTP.

7.1 | Generalized Travel Demand Forecast Process

The 2045 MTP uses a regional travel demand model to forecast future travel demand. This generalized four-step process is described below. More detailed information can be found in the Appendix.

Step 1: Trip Generation

This is the first step of the travel demand modeling process. This step determines the number and type of trips that will be produced from, and attracted to, a TAZ. Trip generation relies on socioeconomic and land use data. While this data already exists for the base year, it must be forecasted for future years.

Step 2: Trip Distribution

This step links trip productions to trip attractions for each TAZ pair. It uses land use patterns and a gravity model. The gravity model assumes that travelers will gravitate toward the closest establishment that meets the purpose of their trip, while seeking to reduce their travel time.

Step 3: Mode Choice

This step converts person trips to vehicle trips. The step also estimates the number of trips using a particular mode of travel for each TAZ pair.

Step 4: Trip Assignment

FINAL

This is the final step in which vehicular trips are distributed across the roadway network based on a number of factors; most notably travel time.

7.2 | Forecasting Population and Employment Changes

Aside from changes to the transportation system itself, land use changes are the primary drivers of changes in travel demand over time. For modeling purposes, land use changes are measured by changes in the magnitude and distribution of population, employment, and school enrollment. Changes are forecast at the TAZ level, which is typically comprised of multiple census blocks, but is not larger than a census block group.

Data Sources and County Control Totals

Population, employment, and school enrollment information for the base year was compiled for all TAZs by the CUAMPO.

- **The population and housing information used in the MTP 2040 was adjusted by the MPO to reflect known conditions within the study area for the Montgomery County TAZs.**
- **The population and housing information for the Christian County TAZs were updated from the MTP 2040's data using aerial imagery analysis.**
- **Employment data obtained by the CUAMPO and KYTC provided detailed information on existing establishments in the MPA, including the location and number of employees.**
- **School enrollment data was obtained from the Clarksville-Montgomery County School System (CMCSS).**

The initial control totals for the forecast population and employment were developed at the county level. The population and housing forecasts were developed using data obtained from the Tennessee and Kentucky State Data Centers. The employment forecasts were obtained from Woods & Poole projections.

TAZ-Level Forecasts

After developing the county forecasts, population and employment had to be forecast for all TAZs in the MPO for the interim years and horizon year. This effort was conducted by the CUAMPO, who:

- Determined the amount of the forecast population and employment within each county that would be within the MPA.
- Determined the amount of group quarters' population and the average household sizes in the forecast years.
- Developed household control totals for the MPA.
- Allocated household and population growth from the control totals based on time periods and anticipated developments.
- Allocated employment growth from the control totals based on where commercially or industrially zoned land is vacant.
    - This assumes that employment can be allocated based on 30 jobs/acre in commercial areas, and 15 jobs/acre in industrial areas.

School enrollment forecast data was developed by Neel-Schaffer, Inc. and CMCSS. This involved increasing the school enrollment in each TAZ to match population growth until each school achieved the capacity threshold set by CMCSS. Where the MPA experiences high population growth for the forecast years, additional schools were forecasted to be built based on the CMCSS's growth plan .

Further information about the forecast methodology and control totals can be obtained from the MPO office.

Summary of Forecasted Change

The resulting changes in population and employment through 2045 are shown in Table 7.1 and illustrated in Figures 7.1 through 7.6.

Table 7.1 Change in Population and Employment Variables in MPA, 2016 to 2045

Variable	Description	2016	2026	2036	2045	Change	Percent Change
HH	Households (Occupied Dwelling Units)	75,073	96,393	113,806	130,489	55,416	73.8%
POP	Population in TAZ	196,758	250,249	295,483	339,954	143,196	72.8%
TOT_EMP	Total Employment	68,326	92,611	111,007	129,119	60,793	89.0%
RET_EMP	Retail Employment	10,692	13,987	16,378	18,721	8,029	75.1%
SE_EMP	Service Employment	38,923	53,597	64,397	74,778	35,855	92.1%
OTH_EMP	Other Employment	18,711	25,027	30,234	35,622	16,911	90.4%
SCHATT	School Enrollment	33,388	42,362	49,749	55,108	21,720	65.1%

[1] https://cmcss.net/documents/operations/10yearplan.pdf

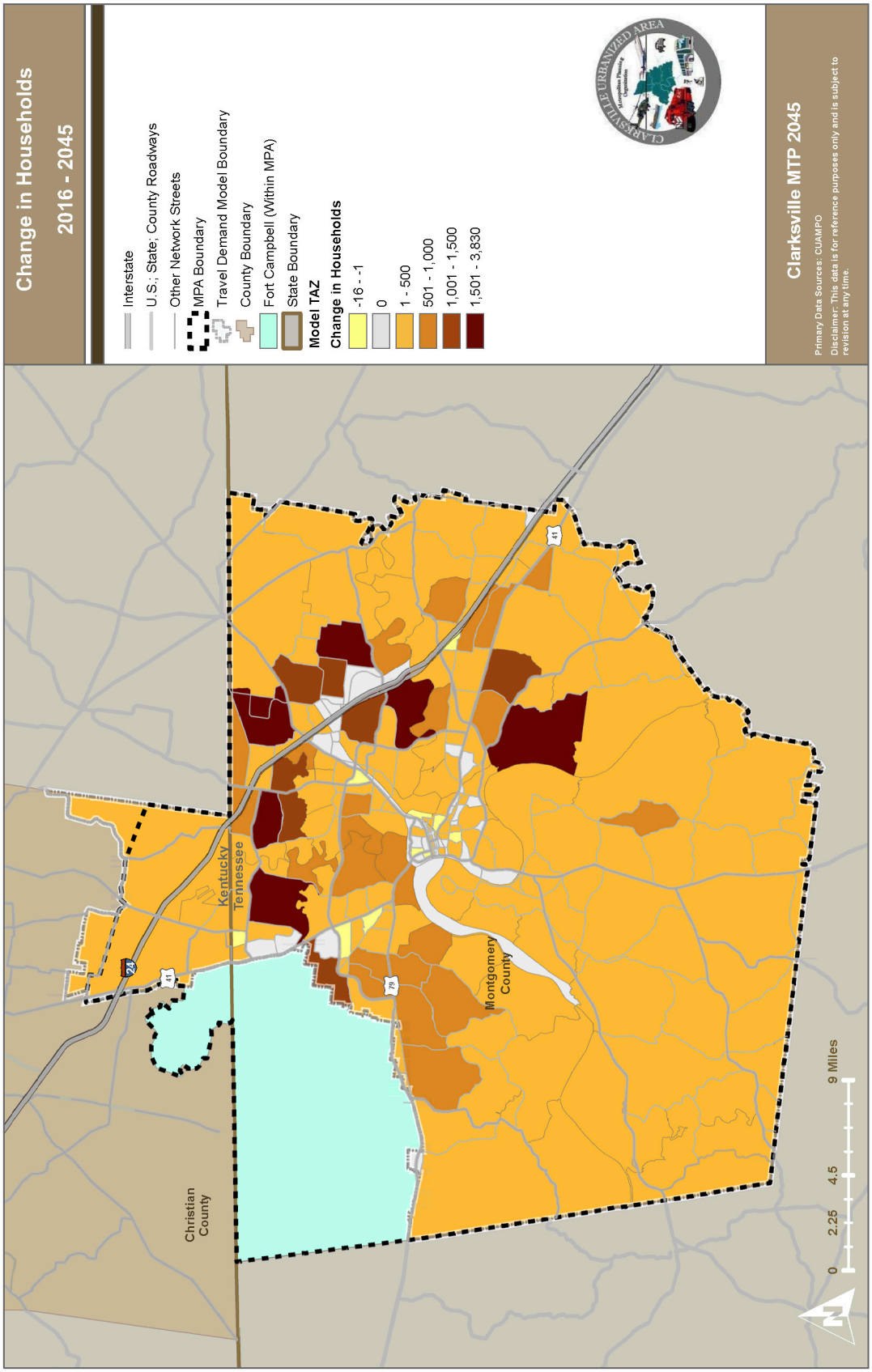


FIGURE 7.1 CHANGE IN HOUSEHOLDS, 2016-2045

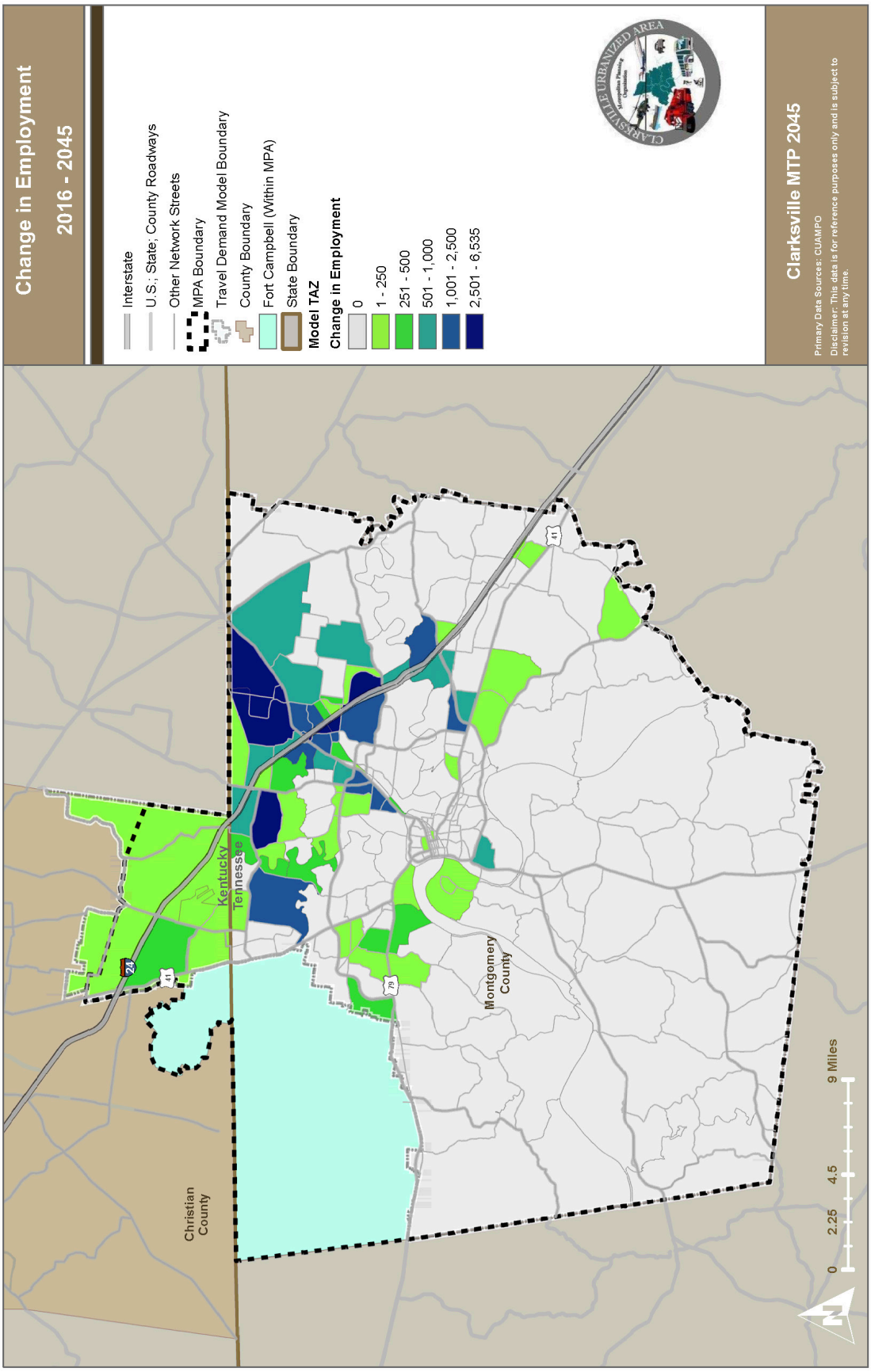


FIGURE 7.2 CHANGE IN EMPLOYMENT 2016-2045

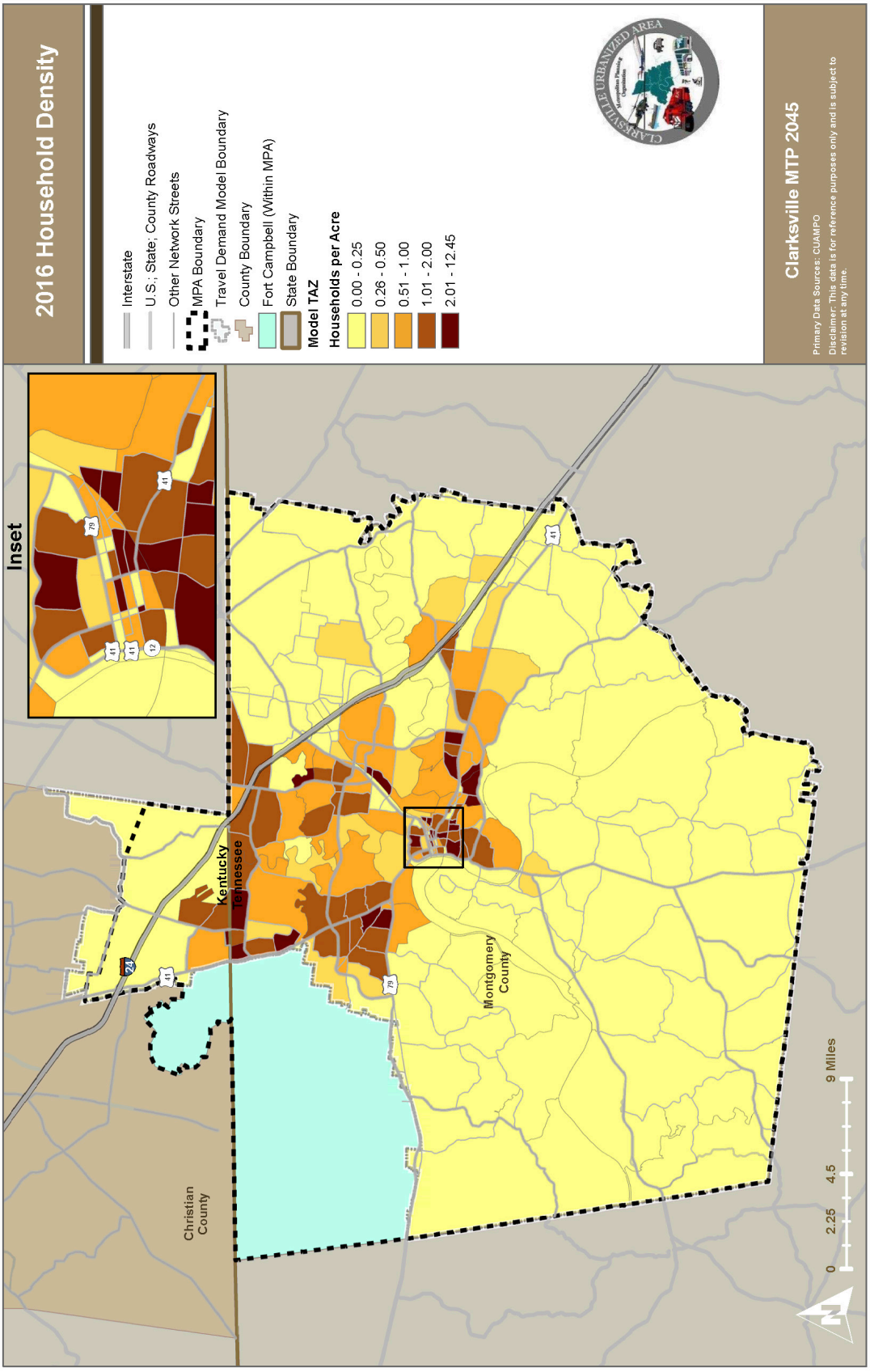


FIGURE 7.3 2016 HOUSEHOLD DENSITY

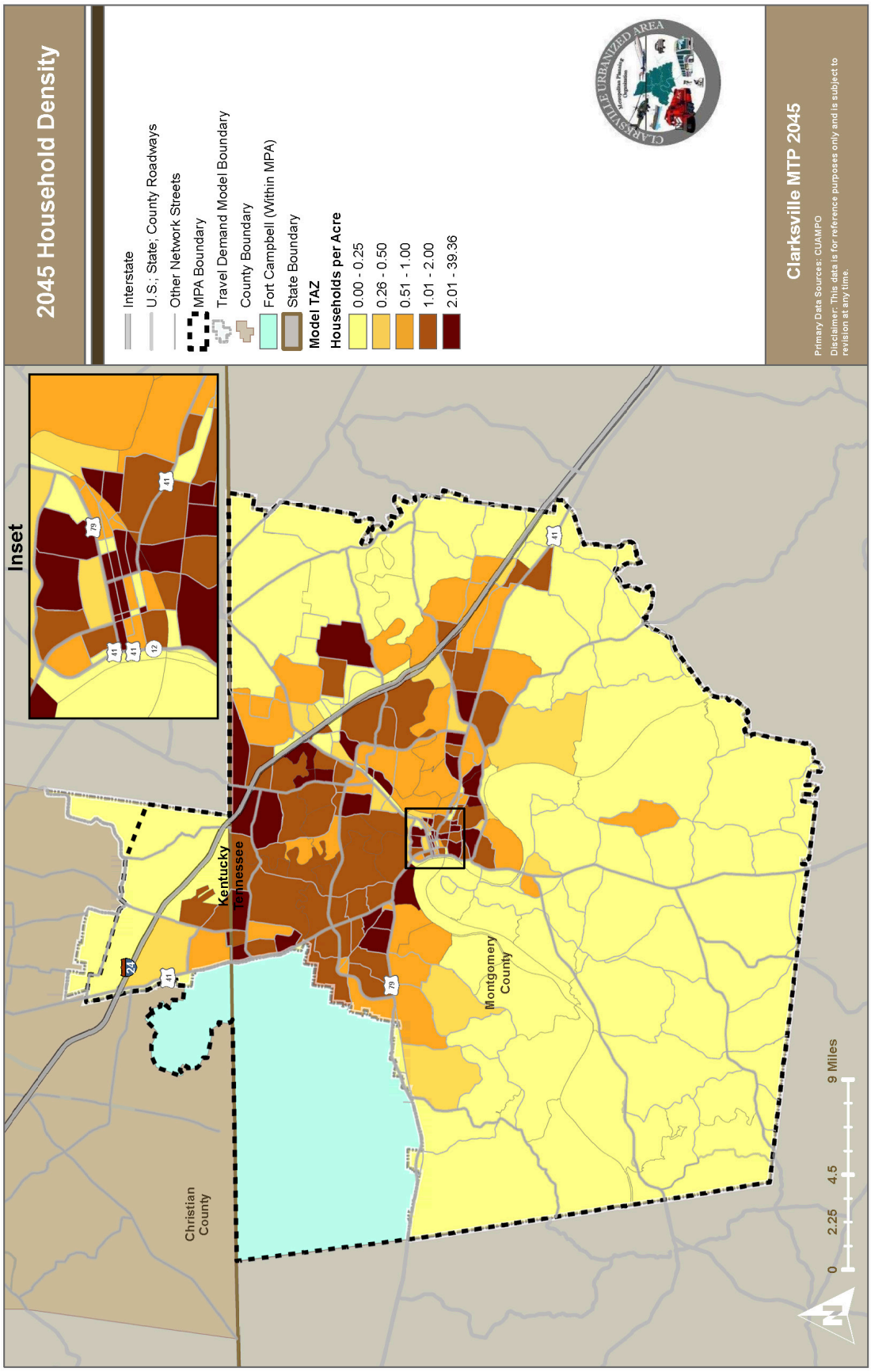


FIGURE 7.4 2045 HOUSEHOLD DENSITY

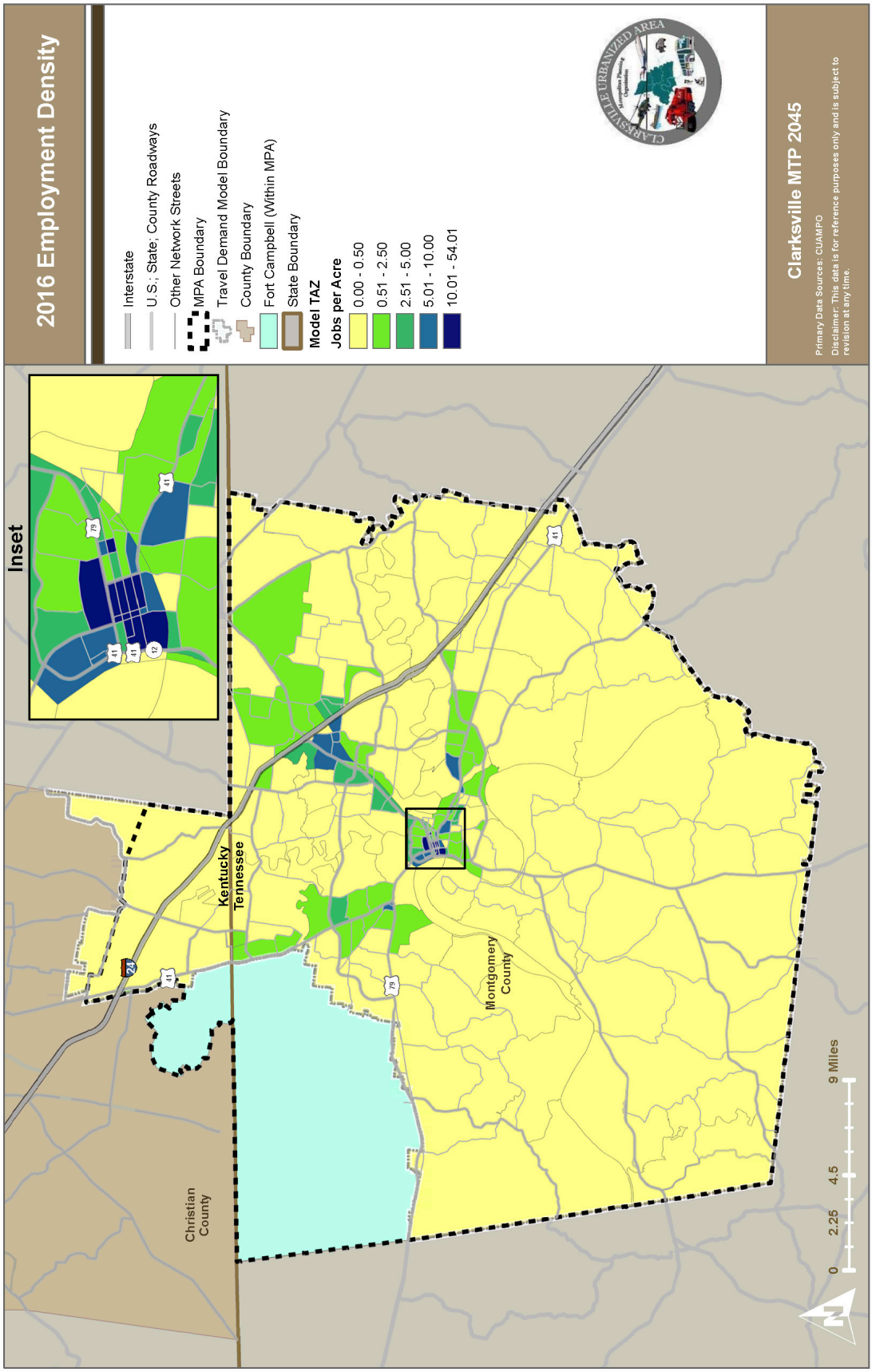


FIGURE 7.5 2016 EMPLOYMENT DENSITY

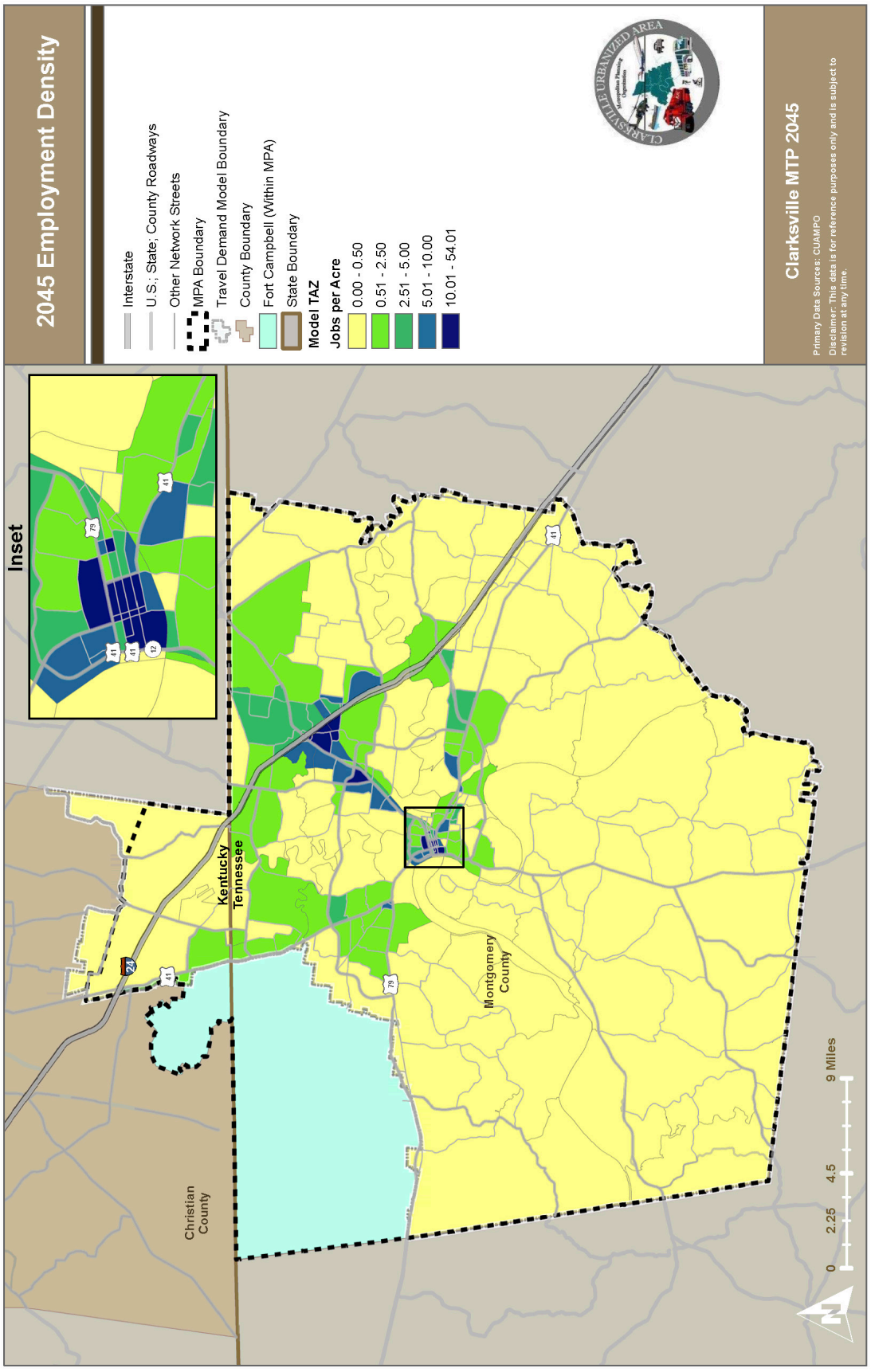


FIGURE 7.6 2045 EMPLOYMENT DENSITY

7.3 | Updating the Future Transportation Network

The MTP is a document for the purpose of planning for the MPA's future travel needs. In order to understand these needs, the expected travel in 2045 must be known.

Existing + Committed Projects

As stated previously, improvements to the transportation network also affect travel demand. In addition to the socioeconomic forecasts, transportation projects that have committed funding or have been constructed since 2016 were noted. Committed projects are those improvements for which:

- construction was either completed or begun since 2016,
- a contract for construction has been awarded,
- have completed the National Environmental Policy Act (NEPA) phase, or
- have funding for right-of-way and/or construction programmed in the MPO's Transportation Improvement Program.

These projects were then added to the model network to create a 2045 Existing plus Committed (E+C) network. This network is depicted in Figure 7.7. The E+C projects are displayed in Table 7.2.

Future Roadway Conditions without Additional Improvements

The E+C network is used to display a "No-Build" condition for the MPA. It serves to identify areas of deficiency in future years if no further transportation projects are built within the study area. These areas of deficiency can lead to increased congestion, delay, and potential environmental hazards. An analysis of the E+C network in 2045 and the identification of deficient areas are discussed in Chapter 8: Future Transportation Need.

External Station and Special Generator Growth

In addition to socio-economic growth and changes to the model network, the travel demand model forecasts growth for the external stations and special generators. The growth rate at each external station was determined through the analysis of historical traffic counts at each station. The growth rates were applied to the base year external station traffic counts to obtain the projected external station volumes. The same procedures used to develop the External-Internal (EI) and External-External (EE) trips were then applied to the forecast volumes to determine trip purposes in future years.

The amount of trips for the special generators were also projected based on their anticipated growth through the horizon year. Adjustments to the special generators for the forecast years include growth for Austin Peay State University (increasing to 17,000 students in 2045) and Draughons Junior College (increasing to 1,100 students in 2045). It was assumed that the Gateway Medical Center would not undergo a significant expansion or experience large employment growth during the MTP timeframe.

A detailed explanation of the methodology used to forecast the external station volumes and special generator trips can be found in the Appendix.

TABLE 7.2 EXISTING + COMMITTED PROJECTS

Project ID	TIP ID	Roadway	Location	Improvement
1	6	SR-374 Ext	Dotsonville Rd to US 79/SR 6 (Dover Rd)	New 4 Lane Roadway
2	5	SR-374 Ext/SR-149	Dotsonville Rd to River Rd	New 4 Lane Roadway, Widen to 5 Lane
3	66	SR-237 (Rossview Rd)	I-24 to 400 feet west of Keysburg Rd	Widen from 2 to 5 Lanes
4	13	KY-911 (Thompsonville Rd)	US 41A to KY-115 (Pembroke Rd)	Widen from 2 to 3 Lanes
5	1	SR-112/US 41A (Madison St)	SR-76 to McAdoo Rd/Sango Rd	Widen from 2 to 5 Lanes
6	65	Oakland Rd	US 79 to Oakland Rd	2 Lane Realignment
7	12	SR-48 (Trenton Rd)	SR-374 to I-24	Widen from 2 to 5 Lanes

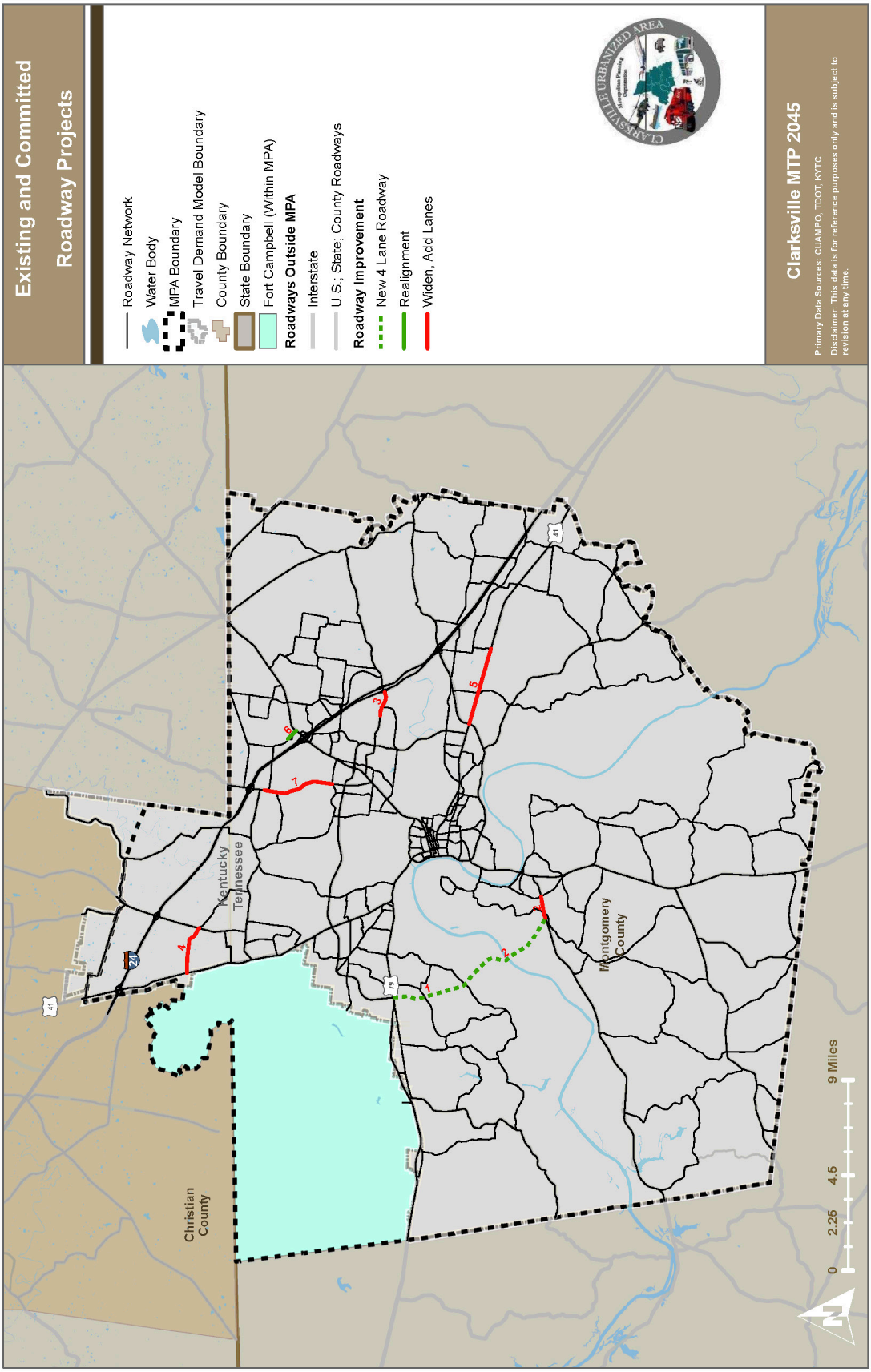


FIGURE 7.7 EXISTING AND COMMITTED ROADWAY PROJECTS

7.4 | Travel Demand Model Outputs

The primary outputs of the Travel Demand Model are:

- daily roadway volumes,
- vehicle miles traveled,
- vehicle hours traveled,
- vehicle hours of delay,
- volume/capacity ratio,
- congested speeds,
- and congested travel times.

This information, when combined with roadway capacities and other network information, informs the needs analysis in Chapter 8: Future Transportation Need.

8.0 | Future Transportation Needs

This chapter discusses transportation issues that will need to be addressed in the future. It was developed by an analysis of existing conditions and travel demand model forecasts. Additionally, existing plans, public involvement, and stakeholder input were also incorporated.

8.1 | Roadways and Bridges

Congestion Relief

Given the population and employment growth forecasted to occur by 2045, the Clarksville Travel Demand Model indicates that the number of vehicle trips in the MPA will increase by more than 71 percent. This results in about 376,000 more trips from 2016 to 2045. Most of the trip types grow by the same rate. However, trips passing through the MPA are forecasted to grow at a lower rate. These changes are summarized in Table 8.1.

Table 8.1 Vehicle Trips by Purpose, 2016 to 2045

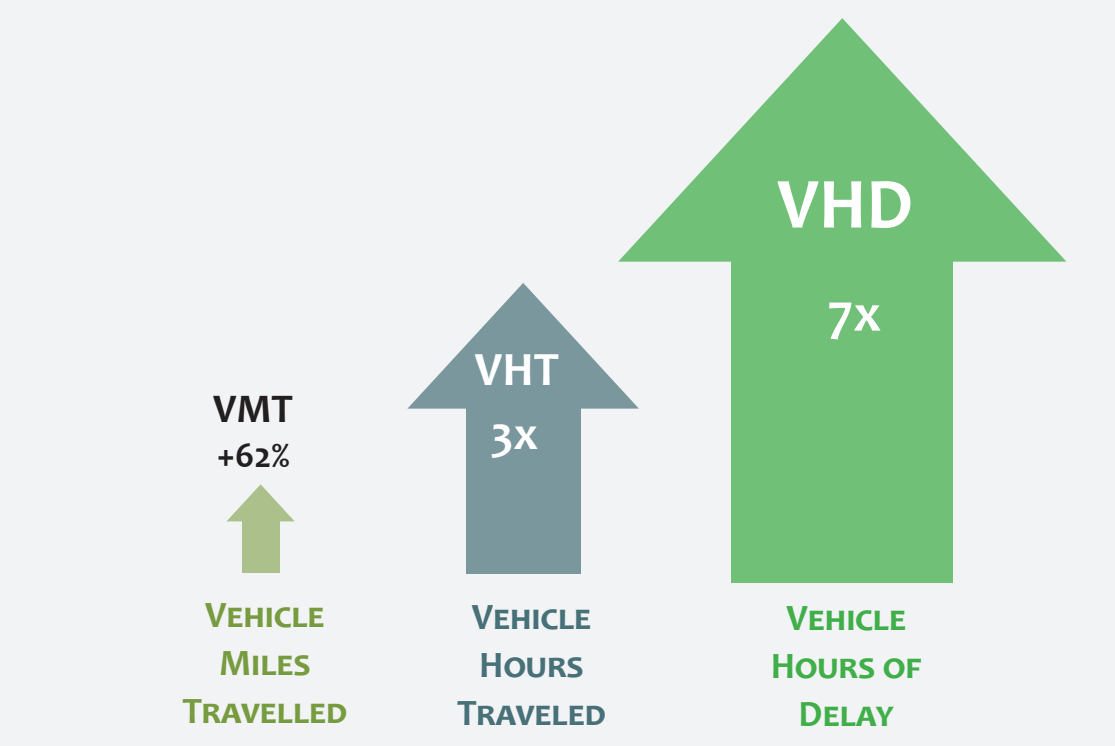
Trip Process	2016	2045 (E+C)	Change	Percent Change
Home-Based Work	111,652	189,684	78,032	69.9%
Home-Based Other	190,402	321,104	130,702	68.6%
Non-Home Based	113,353	201,776	88,423	78.0%
Commercial Vehicle	63,214	113,844	50,630	80.1%
Freight	12,366	21,654	9,288	75.1%
External-External	36,673	55,519	18,846	51.4%
Total	**527,659**	**903,581**	**375,921**	**71.2%**

Note: E+C is future scenario with only Existing and Committed transportation projects.

Source: Clarksville Travel Demand Model, NSI

Table 8.2 shows that if the transportation projects that currently have committed funding are constructed, the centerline miles of the roadway network will increase by 1.6 percent. The table also shows the forecast change in Vehicle Miles Traveled (VMT), Vehicle Hours Traveled (VHT), and Vehicle Hours of Delay (VHD) if only those projects are constructed.

This data indicates that, by 2045, the VMT will increase by about 62 percent. However, during this same time period, the VHT will nearly triple, and the VHD will be more than seven (7) times current delay. During the public survey, congestion reduction on the roadway network was identified as the top priority for residents and workers. This results in a high emphasis placed on congestion reduction during the project scoring process discussed in Chapter 10. Projects that will help reduce the large increase in the VHD from 2016 to 2045 therefore receive a higher score.



These changes are the result of a large growth in vehicle trips and comparatively slow growth of the roadway network.

Table 8.2 Travel Demand Impact of Growth and Existing and Committed Projects, 2016 to 2045

Centerline Miles of Roadways

Centerline Miles of Roadways				
Classification	**2016 (Base)**	**2045 (E+C Projects)**	**Change**	**Percent Difference**
Interstate	25.6	25.6	0	0.00%
Principal Arterial	54.5	61.6	7.1	13.00%
Minor Arterial	115.7	115.7	0	0.00%
Collector	223	222.7	-0.3	-0.10%
Total	**418.8**	**425.6**	**6.8**	**1.60%**
Daily Vehicle Miles Traveled (VMT)				
Classification	**2016 (Base)**	**2045 (E+C Projects)**	**Change**	**Percent Difference**
Interstate	1,210,751	1,726,719	515,968	42.62%
Principal Arterial	1,258,285	1,950,292	692,007	55.00%
Minor Arterial	1,272,585	2,230,573	957,988	75.28%
Collector	528,892	1,015,652	486,760	92.03%
Total	**4,270,513**	**6,923,236**	**2,652,723**	**62.12%**
Daily Vehicle Hours Traveled (VHT)				
Classification	**2016 (Base)**	**2045 (E+C Projects)**	**Change**	**Percent Difference**
Interstate	33,294	228,960	195,666	587.69%
Principal Arterial	40,998	107,577	66,579	162.40%
Minor Arterial	43,326	128,386	85,060	196.33%
Collector	18,375	58,040	39,665	215.86%
Total	**135,993**	**522,963**	**386,970**	**284.55%**

Note: E+C is future scenario with only Existing and Committed transportation projects.
Source: Clarksville Travel Demand Model, NSI

continued

Daily Vehicle Hours of Delay (VHD)				
Classification	2016 (Base)	2045 (E+C Projects)	Change	Percent Difference
Interstate	13,832	201,806	187,974	1358.98%
Principal Arterial	14,181	66,053	51,872	365.79%
Minor Arterial	14,131	77,057	62,926	445.30%
Collector	4,564	30,806	26,242	574.98%
Total	**46,708**	**375,722**	**329,014**	**704.41%**

Note: E+C is future scenario with only Existing and Committed transportation projects.

Source: Clarksville Travel Demand Model, NSI

CURRENTLY, CONGESTION IS CONCENTRATED MOSTLY NEAR INTERSECTIONS IN THE CLARKSVILLE MPA. BY 2045, CONGESTION IS FORECAST TO BECOME MORE WIDESPREAD IF ONLY THE E+C PROJECTS ARE IMPLEMENTED.

The number of roadway segments with a LOS of F would increase significantly, as shown in Table 8.3 and illustrated in Figure 8.1.

It is important to note that not all congested street and highway segments should be widened with additional through lanes or turning lanes. In urban settings, it may be more appropriate to consider ITS improvements or Travel Demand Management (TDM) strategies. Congestion may also be reduced by improving pedestrian, bicycle, and/or transit conditions that will encourage alternative means of transportation.

Table 8.3 Roadway Corridors with Volumes Exceeding Capacity (E+C)

Route	Limits	Length (miles)
I-24	Southern Study Area Boundary to Dunlop Lane	11.05
I-24	US 79/SR-13 to SR-48	2.88
I-24 NB	SR-237 to US 79	3.58
I-24 SB Off Ramp	@ SR-76	0.25
I-24 NB On Ramp	@ SR-76	0.33
I-24 SB On Ramp	@ SR-76	0.42
I-24 NB Off Ramp	@ SR-76	0.34
I-24 SB On Ramp	@ SR-237	0.27
I-24 NB Off Ramp	@ SR-237	0.23
I-24 SB On Ramp	@ SR-48	0.21
I-24 SB Off Ramp	@ US 41A	0.47
US 41A/Fort Campbell Boulevard	0.83 miles north of Britton Springs Road to Britton Springs Road	0.83
US 41A/US 79	0.30 miles west of Peachers Mill Road to US 79/Kraft Street	1.50
US 41A/Madison Street	6th Street to 0.11 miles east	0.11
US 41A/Madison Street	10th Street to Pageant Lane	0.54
US 41A/Madison Street	Porters Bluff Road to Golf Club Lane	0.05
US 41A/Madison Street	Crossland Ave to 0.36 miles east of SR-76	2.98
US 41A/Madison Street	Sango Rd to 0.95 miles east of Shady Grove Road	3.69
US 41A Bypass	Crossland Avenue to SR-48	0.63
US 79/SR-13	N 8th Street to Solar Way	7.56
US 79/SR-13	Jim Johnson Rd to 1.63 miles east	1.63

continued **TABLE 8.3 ROADWAY CORRIDORS WITH VOLUMES EXCEEDING CAPACITY (E+C)**

ROUTE	LIMITS	LENGTH (MILES)
US 41A Bypass	0.29 miles west of Hawkins Road to US 41A/Madison Street	4.77
SR-13/SR-48	Old Hwy 48 to US 41A Bypass	4.93
SR-374/101st Airborne Division Parkway/ Richview Road	Britton Springs Road to US 41A	12.90
SR-374/101st Airborne Division Parkway EB Off Ramp	@ US 79	0.07
SR-374/101st Airborne Division Parkway WB On Ramp	@ US 79	0.12
SR-48/College Road	9th Street to Red River Street	0.15
SR-48/College Road	Hornerger Lane to US 79	0.30
SR-48/Trenton Road	US 79 to 0.21 miles north of SR-249	5.28
SR-236/Tiny Town Road	0.82 miles west Peachers Mill Road to SR-48	3.88
SR-149	SR-374 Extension to River Road	0.85
SR-76	Old Farmers Road to N Woodson Road	2.80
SR-249/Tylertown Road	SR-48 to Jim Johnson Road	3.78
SR-237/Rossview Road	US 79 to 0.55 miles east of Rollow Lane	5.04
SR-237/Rossview Road	Kirkwood Road to Port Royal Road	2.92
SR-374/101st Airborne Division Parkway Extension	SR-149 to Dotsonville Road	4.25
SR-12/Ashland City Road	US 41A Bypass to 1.10 miles east	1.10
KY-115/Pembroke Oak Grove Road	0.86 miles south of I-24 to I-24	0.86
KY-911	KY-115 to 0.52 mile east	0.52
Hornerger Lane	Franklin Street to SR-48	0.10
Zinc Plant Road	Briarwood Road to SR-13	0.97

continued **TABLE 8.3 ROADWAY CORRIDORS WITH VOLUMES EXCEEDING CAPACITY (E+C)**

ROUTE	LIMITS	LENGTH (MILES)
7 Mile Ferry Road	Mayhew Road to 0.10 miles east	0.10
Peacher's Mill Road	0.12 miles south of Hillsboro Drive to 0.42 miles south of Hillsboro Drive	0.30
10th Street	US 41A to Franklin Street	0.29
Jim Johnson Road	0.05 miles east of Solar Way to SR-249	1.65
Oakland Road	US 79 to Merriweather Road	1.17
Merriweather Road	SR-48 to Oakland Road	1.73
Solar Way	US 79 to 1.71 miles north	1.71
Alfred Thun Road	Corporate Parkway Boulevard to US 79	0.56
Ted Crozier Boulevard	SR-374 to Dunlop Lane	1.01
International Boulevard	SR-237 to 0.58 miles north	0.58
Rollow Lane	SR-237 to 0.74 miles north	0.74
Dotsonville Road	0.57 miles south of US 79 to US 79	0.58
Sango Road	0.42 miles south of Trough Springs Road to SR-76	1.12
Memorial Drive	Golf Club Lane to US 41A	0.06
Memorial Drive	0.35 miles east of SR-374 to SR-76	2.21
Crossland Avenue	Cumberland Drive to Golf Club Lane	1.51
Porters Bluff Road	US 41A to Reynolds Street	0.66
Reynolds Street	Porters Bluff Road to Franklin Street	0.43
N 8th Street	Main Street to SR-48	0.09
N 9th Street	Main Street to SR-48	0.09
Franklin Street	N 9th Street to 10th Street	0.05

continued **TABLE 8.3 ROADWAY CORRIDORS WITH VOLUMES EXCEEDING CAPACITY (E+C)**

ROUTE	LIMITS	LENGTH (MILES)
Main Street	Cedar Street to Reynolds Street	0.35
Red River Street/Frosty Morn Drive	0.39 miles south of US 79 to US 79	0.39
Greenwood Avenue	Woodmont Boulevard to Daniel Street	0.02
Old Ashland City Road	US 41A Bypass to Memorial Drive	1.28
Old Farmers Road	0.63 miles south of US 41A to US 41A	0.63
Port Royal Road	SR-76 to SR-237	3.04
Cunningham Lane	Lafayette Road to Fort Campbell Boulevard/US-41A	1.25
Corporate Parkway Boulevard	0.56 miles west of International Boulevard to International Boulevard	0.56

Note: E+C is future scenario with only Existing and Committed transportation projects.

Source: Clarksville Travel Demand Model, NSI

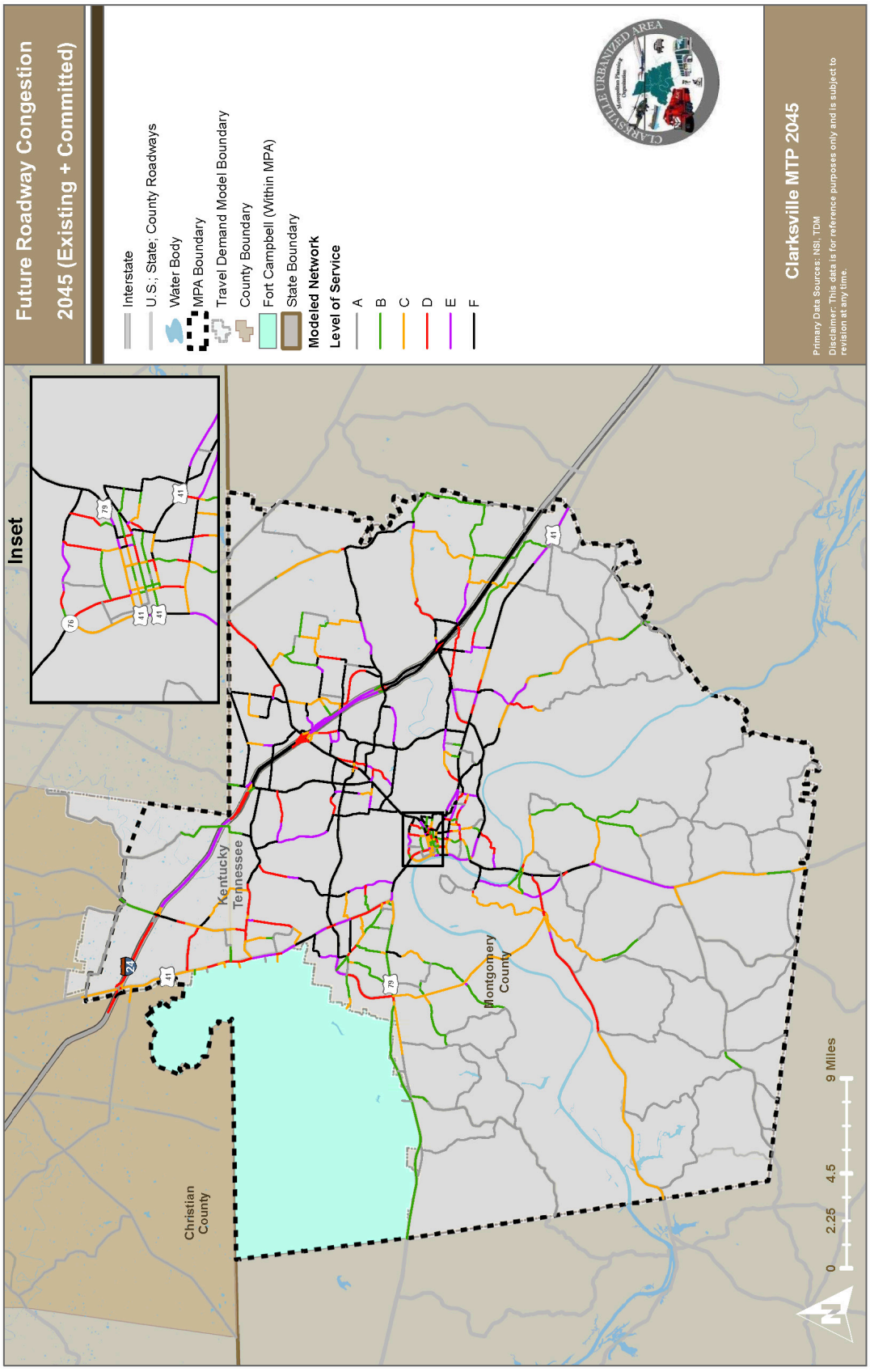
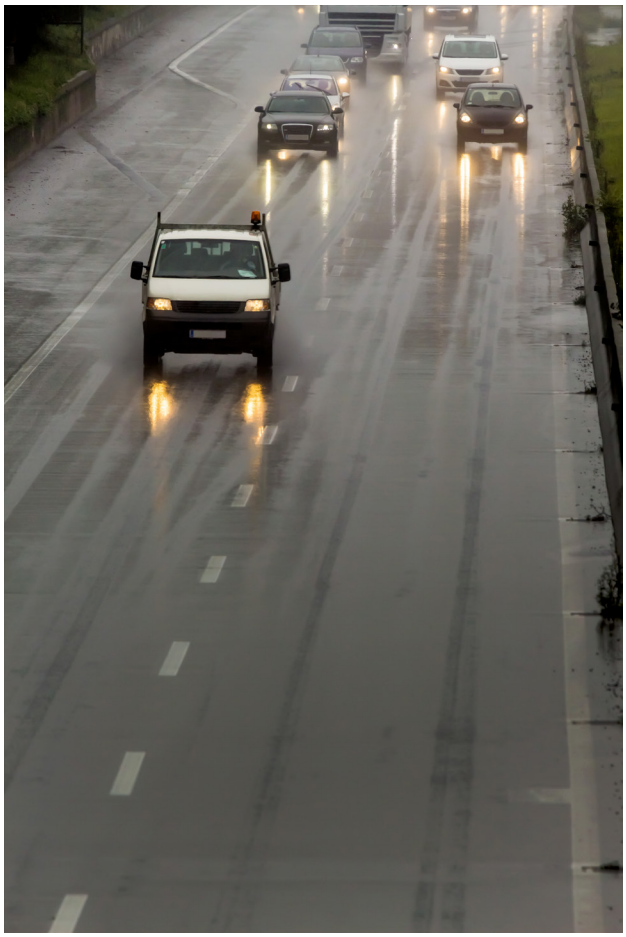


FIGURE 8.1 FUTURE ROADWAY CONGESTION, 2045 (EXISTING + COMMITTED)

Roadway Safety Needs

Within the MPA, a total of 29,728 crashes occurred between 2012 and 2016. During that timeframe, there were 121 fatal crashes and 7,331 injury-causing crashes. Less than two (2) percent of the crashes that occurred in the MPA involved alcohol. This resulted in nearly six (6) percent of total fatal crashes being alcohol related. Hence, this study recommends continuing to promote and enforce programs that aim to eliminate drunk driving. The public survey places a great emphasis on roadway safety in the MPA. Project scoring discussed in Chapter 10 reflects that need, and projects that promote safety or will reduce crashes receive more points. As traffic increase from 2016 to 2045, so too will the number of crashes. Projects that will reduce the number of crashes will become another need for safety and receive more points during the project scoring process.

Any safety projects designed to improve the high frequency, or crash rate, segments or intersections outlined in Chapter 6: Existing Conditions must consider the types of collisions occurring. Recommendations for reducing the most common types of crashes are outlined below:



Rear-End Collisions

Rear-end crashes can be attributed to a number of factors, such as:

- driver inattentiveness
- large turning volumes
- slippery pavement
- inadequate roadway lighting
- crossing pedestrians
- poor visibility of a traffic signal
- congestion
- inadequate signal timing
- an unwarranted signal

In general, the recommendations for reducing rear-end crashes include:

- Analyze turning volumes to determine if a right-turn lane or left-turn lane is warranted. Providing a turning lane separates the turning vehicles from the through vehicles, preventing through vehicles from rear ending turning vehicles. If a large right turn volume exists, increasing the corner radius for right turns is an option.
- Checking the pavement conditions. Rear-end collisions caused by slippery pavement can be reduced by lowering the speed limit with enforcement, providing overlay pavement, adequate drainage, groove pavement, or with the addition of a "Slippery When Wet" sign.
- Ensure roadway lighting is sufficient for drivers to see the roadway and surroundings.
- Determine if there is a large amount of pedestrian traffic. Pedestrians crossing the roads may impede traffic and force drivers to stop suddenly. If crossing pedestrians are an issue, options include installing or improving crosswalk devices and providing pedestrian signal indications.
- Check the visibility of the traffic signals at all approaches. In order to provide better visibility of the traffic signal, options include installing or improving warning signs, overhead signal heads, installing 12" signal lenses, visors, back plates, or relocating/adding signal heads.
- Verify that the signal timing is adequate to serve the traffic volumes at the trouble intersections. Options include adjusting phase-change interval, providing or increasing a red-clearance interval, providing progression, and utilizing signal actuation with dilemma zone protection.
- Verify that a signal is warranted at the given intersection.

Angle Crashes

Angle crashes can be caused by a number of factors, such as:

- restricted sight distance
- excessive speed
- inadequate roadway lighting
- poor visibility of a traffic signal
- inadequate signal timing

- inadequate advance warning signs
- running a red light
- large traffic volumes.

In general, the recommendations for reducing right angle collisions include:

- Verify that the sight distance at all intersection approaches is not restricted. Options to alleviate restricted sight distance include removing the sight obstruction and/or installing or improving warning signs.
- Conduct speed studies to determine whether or not speed was a contributing factor. In order to reduce crashes caused by excessive speeding, the speed limit can be lowered with enforcement, the phase change interval can be adjusted, or rumble strips can be installed.
- Ensure roadway lighting is sufficient for drivers to see the roadway and surrounding area.
- Check the visibility of the traffic signal at all approaches. In order to provide better visibility of the traffic signal, options include installing or improving warning signs, overhead signal heads, installing 12" signal lenses, visors, back plates, and/or relocating or adding signal heads.
- Verify that the signal timing is adequate to serve the traffic volumes. Options include adjusting phase change interval, providing or increasing a red-clearance interval, providing progression, and/or utilizing signal actuation with dilemma zone protection.
- Verify that the intersection is designed to handle the traffic volume. If the traffic volumes are too large for the intersection's capacity, options include adding a lane(s) and retiming the signal.

Sideswipes

Sideswipes may be caused by factors such as:

- excessive speed,
- inadequate roadway lighting,
- poor pavement markings,
- large traffic volumes, and
- driver inattentiveness.

The recommendations for reducing sideswipes include:

- Check for proper signage around the intersection, especially if the roadway geometry may be confusing for the driver. Verify that all one-way streets are marked "One-Way" and "No Turn" signs are placed at appropriate locations.
- Verify that pavement markings are visible during day and night hours.
- Verify that the roadway geometry can be easily maneuvered by drivers.
- Evaluate left and right turning volumes to determine if a right turn and/or left turn lane is warranted.
- Ensure roadway lighting is sufficient for drivers to see roadway and surroundings.
- Verify that lanes are marked properly and provide turning and through movement directions on lanes as well as signage that indicates lane configurations. This will prevent cars from dangerously switching lanes at the last minute.

Other Collision Types

Recommendations for increasing the safety and reducing the number of crashes for other crash types include:

- Determine if the speed limit is too high or if vehicles in the area are traveling over the speed limit. Reducing the speed can reduce the severity of crashes and make drivers more attentive to their surroundings.
- Verify the clearance intervals for all signalized intersection approaches and ensure that there is an all red clearance. For larger intersections, it is particularly important to have a long enough clearance interval for vehicles to safely make it through the intersection before the light turns red.
- Check for proper intersection signage, especially if the roadway geometry may be confusing for the driver. Verify that all one-way streets are marked "One-Way" and "No Turn" signs are placed at appropriate locations.
- Verify that pavement markings are visible during day and night hours.
- Verify that the roadway geometry can be easily maneuvered by drivers.
- Evaluate left and right turning volumes to determine if a right turn and/or left turn lane is warranted.

- Ensure roadway lighting is sufficient for drivers to see roadway and surroundings.
- Check the visibility of the traffic signals from all approaches.
- Verify that lanes are marked properly and provide turning and through movement directions, as well as signage that indicates lane configurations. This will prevent cars from dangerously switching lanes at the last minute and reduces crash potential.

Develop a Safety Management System (SMS)

Traffic safety programs are relatively uniform from state to state in their approach to making the highway system safer for their users. The typical traffic safety program combines several different features from a SMS, which all states were mandated to have under the federal transportation bill known as ISTEA in 1991. Under ISTEA, the SMS was required to address:

- Coordinating and integrating safety features for the various modes of travel.
- Identifying hazardous locations, investigating them, and establishing countermeasures to increase safety.
- Early consideration for safety in all highway projects and programs.
- Identifying safety needs of special user groups (handicapped, elderly, etc.).
- Routinely maintaining and upgrading the safety features on the roadways.
- Marketing safety programs to encourage community involvement.

The SMS mandate was later withdrawn due to the 1995 National Highway System Designation Act. However, MAP-21 Section 1203 requires that each state and MPO have a planning process that addresses the safety performance measure to "achieve a significant reduction in traffic fatalities and serious injuries on all public roads. MAP-21 also retained the SAFETEA-LU requirement that the planning process address the need to "increase the safety of the transportation system for motorized and non-motorized users." The FAST Act builds upon MAP-21 and these requirements are still in place. The FAST Act also requires states to create and maintain an HSIP, which a SMS would work in conjunction with. A traffic safety program involves several steps.

The typical traffic safety program includes:

- A crash record system
- Identification of hazardous locations
- Engineering studies
- Selection of countermeasures
- Prioritization of improvement projects
- Planning and implementation of improvement projects
- Evaluation of the implemented projects

The crash record system should contain data on individual crashes that occur in the area. The crash data should include information on:

- time
- date
- weather condition
- pavement condition
- driver
- roadway

The primary source for crash data is usually police reports from local jurisdictions. In order for this record system to be useful, the data has to be processed and available on a timely basis so that it can be analyzed.

The identification of hazardous locations is based on the actual crashes that have occurred, and/or the potential of an area to have a high number of crashes. The severity of these crashes must also be considered in order to prioritize the locations and develop solutions for them. Once the hazardous locations have been identified, engineering studies can be conducted using the crash record system data. An analysis can use crash frequency, crash rate, Equivalent Property Damage Only (EPDO) rates, and other methods. Supplemental data from police comments and citizen complaints can also be used in the analysis process in order to find the causes of the crashes.

Once the causes of the crashes have been determined, countermeasures can be proposed and evaluated. Improvement projects are then selected based on the benefits they provide compared to the cost to implement them. Sometimes, enforcement and education may be all that is necessary to reduce the number of crashes. Other times, multiple projects may be needed to mitigate a particular problem area.

Once projects have been selected, they need to be prioritized based on their cost and benefits. Not all improvement projects will be able to be implemented due to funding limitations. After the projects have been selected and prioritized, an implementation plan should be developed to help ensure that resources and finances are available to complete the improvement projects in a timely manner. Implementation of projects should occur as soon as possible to avoid cost increases and prevent potential crashes that may occur without the project in place.

Safety projects must be evaluated to determine if they are effective or can be used to address similar problems in the future. This is typically done in a before-and-after analysis. This is accomplished by observing the frequency and severity of the crashes several years before the implementation of the project, and then for several years after the project has been completed.

Two issues can arise in this method of analysis. First, if enforcement and/or education change from before to after conditions, it can affect the number of crashes at that location. Second, "regression to the mean", a statistical phenomenon that can make natural variation in repeated data look like real change, must be taken into account to ensure that change in crash patterns and/or frequency can be attributable to the safety projects. In order to correct these two issues, control sites should be established that are similar to the study locations, but have not had any changes made to them.

Roadway Maintenance Needs

According to the data from the FHWA's Highway Performance Monitoring System, most of the pavements on major roadways in the MPA are in good or fair condition, as measured by the International Roughness Index (IRI).

Table 8.4 shows the major roadway segments in the MPA that were in poor condition in 2016 and have not been repaved.

Table 8.4 Roadway Segments in MPA with Poor Pavement Conditions

Route	FROM	To	Miles	Functional Class	Average Daily Traffic
US 79/SR-13	Rockwood Heights	Gill Street	0.18	Arterial	10,300
US 79/SR-13	0.12 mi west of Dunbar Cave Road	Dunbar Cave Road	0.12	Arterial	35,300

Source: KYTC, TDOT

Bridge Deficiencies

The existing conditions analysis revealed that there are currently 15 bridges in poor condition within the Clarksville MPA. Table 8.5 displays the MPA's bridges in poor condition, sorted by their sufficiency ratings, which contribute to the National Bridge Inspection Standards (NBIS) ratings. Addressing the needs of these bridges will improve safety, reduce maintenance costs, and avoid future bridge shutdowns. Bridges are rated by the NBIS based on the conditions of their decks, superstructure, substructure, and stream channel and channel protection. A bridge is considered to be in poor condition if any of the above categories are rated "Poor".

Some of these deficient bridges may be improved via the MTP through other transportation projects, such as a roadway widening. Other bridges could instead be improved through line item funding for operations and maintenance. The MPO, KYTC, and TDOT should prioritize these bridges for improvements as funding becomes available.

Table 8.5 Worst Performing Bridges in Poor Condition by Sufficiency Rating

Bridge ID	Roadway	Feature Intersecting	County	Year Built	Sufficiency Rating
63SR0130007	SR-13	*Cumberland River	Montgomery	1966	28.5
63SR0480001	SR-48	Little Barton's Creek	Montgomery	1930	33.5
63SR0480003	SR-48	**Louise Creek	Montgomery	1930	37.9
63K31480003	Dunbar Cave Rd.	Branch	Montgomery	1950	45.4
630A0090001	Sulphur Springs Rd.	Sulphur Branch	Montgomery	1974	47.8
63S62690001	Dotsonville Rd.	Cummings Creek	Montgomery	1942	49.0
63018880001	Shady Grove Rd.	Mcadoo Creek	Montgomery	1945	51.8
630A3940001	Akin Rd.	Louise Creek	Montgomery	1982	64.7
630A6060003	St. Paul Rd.	Branch	Montgomery	1970	68.1
63SR0120001	State Hwy. 12	Brush Creek	Montgomery	1958	71.3
63018610001	Budds Creek Rd.	Budd's Creek	Montgomery	1978	78.4
630A4470001	Watkins Ford Rd.	Bartons Creek	Montgomery	1976	80.5
630A6280001	Moody Rd.	Antioch Creek	Montgomery	1974	86.0
630A6160003	Poplar Springs Rd.	Eldridge Creek	Montgomery	1982	93.9
630A6150001	Rawlings Rd.	Blooming Grove Creek	Montgomery	1976	94.9

* As of 2016, bridge replacement under construction.
**As of 2016, bridge is scheduled for replacement.
Source: KYTC, TDOT

Alternative Fuel Vehicle Infrastructure Needs

For the last several years, the U.S. Energy Information Administration's Annual Energy Outlook has anticipated that the AFV market share will grow to about 16 percent by 2040. The EIA has forecasted a roughly threefold increase in light-duty vehicles, from approximately 15.8 million vehicles now to 45.4 million vehicles in 2040.

The two vehicle types anticipated to grow the most amongst AFVs are ethanol vehicles (+16.9 million) and electric vehicles (+12.1 million). Together, these two vehicles types account for about 98 percent of the forecasted growth in light-duty AFVs through 2040. Currently, electric vehicles are forecasted to grow at a much faster rate than ethanol vehicles. However, the MPO should be ready to accommodate the increase in both types of AFVs. This will require that the regional transportation system be able to provide additional infrastructure (i.e. fuel/charging stations).

The Clarksville MPA currently has four publicly accessible electric vehicle charging stations. This means that there are about 2.03 charging stations per 100,000 residents in the MPA. Half of the MPA's 14 AFV stations are for ethanol. There are about 3.55 ethanol fuel stations per 100,000 residents in the MPA.

The CUAMPO should further study the regional demand for AFVs in order to meet the current and future infrastructure needs for these two growing types of AFVs. The MPO should also examine the most appropriate role it should take in encouraging and accommodating the increase in AFV use.

8.2 | Bicycle and Pedestrian Needs

Bicycle Needs

The Clarksville-Montgomery County Greenway and Blueway Master Plan provides an in-depth evaluation of the existing bicycle and pedestrian facilities in Montgomery County. It also contains recommendations for future needs. The recommendations are shown in Figure 6.11. In addition to the physical improvements, the plan recommends the following priorities:

- The City of Clarksville
    - A Fort Campbell connection.
    - Bicycle signage improvement along existing roadways that are primary cyclist routes.
    - Inclusion of sidewalks and bicycle facilities in all road expansion projects.
- Montgomery County
    - Creation of a regional greenway corridor by utilizing the north/south rail corridor that connects to the Bicentennial Trail in Cheatham County.
    - Bicycle signage improvement on county roads.

The Downtown Clarksville Parking and Street Network Study suggested a street framework plan. This plan would guide future street standards in the city to promote multimodal use. The plan focuses on improvements to the dense urban street network in downtown Clarksville, and provides design guidelines based on the "Complete Streets" principles.

General recommendations from *The Downtown Clarksville Parking and Street Network Study* related to bicycle improvements include:

- Bike lanes and shared lane markings should be built per the recommended bike route map and street standards.
- A wayfinding master plan should be created to make it easier for downtown users to find public parking lots, garages, on-street parking, and bike facilities.
- Adopt bicycle parking requirements and retrofit existing streets.

Specific bicycle projects from *The Downtown Clarksville Parking and Street Network Study* are shown in Chapter 10: Project Development and Prioritization.

There are no bicycle plans available for the Kentucky portion of the MPA from KYTC. A "Rails to Trails Greenway Plan" exists for the City of Hopkinsville, but there are no proposed trails located within the MPA.

The public outreach survey revealed that less than 15 percent of the population in the MPA used a bike to travel within the study area. The vast majority, 73 percent, feel there is poor, or very poor, availability of bicycle lanes and paths. This reflects an unfulfilled need for bicycle lanes and paths. Many residents desire the ability to use a bicycle or to walk to destinations, but do not have access to facilities.

The Clarksville Cycling club provided a detailed list of recommendations, shown in the Appendix D, for bicycle lane improvements in the MPA. The recommendations reflect a need for well-maintained bicycle lanes on high traffic roadways and near schools. It is important that future route improvements include signage and are included in roadway maintenance plans.

Pedestrian Needs

The installation of sidewalks adjacent to schools and connecting to existing sidewalk infrastructure is a current priority of the CMCSS. This need was also a recurring comment during the public survey period. The County has been the recipient of Safe Routes to School grants in past years, as shown in Table 8.6. Of the 38 schools in the District, 30 are on streets without sidewalks. Seven of the schools with sidewalks have received Safe Routes to Schools grants.

"Children from surrounding areas should be able to walk to school on a paved sidewalk. There have been incidents with children being hit by cars" Clarksville MTP 2045 Transportation Survey 2018

Table 8.6 Safe Routes to School Recipients Montgomery County

School	Year
Kenwood Middle	2016
Kenwood Elementary	2008
Northeast Elementary and Middle	2008
Ringgold Elementary	2008
Richview Middle	2008
Moore Magnet	2007
Minglewood Elementary	2007

Other priority areas for the installation of sidewalks are near public transit stops. The CTS has identified the need for sidewalks near transit stops in both their Comprehensive Operations Analysis and Strategic Plan. Over half of all persons riding the bus walk to the bus stop[1] . In Clarksville, transit stops are located along streets with high levels of vehicular traffic posing a safety risk for pedestrians.

Montgomery County and the City of Clarksville have codified a "Sidewalk Priority Indicator", shown in Table 8.7. This indicator is used to quantitatively, and objectively, prioritize the construction and repair of sidewalks. The matrix prioritizes sidewalk infrastructure in the CBD, near certain trip generators. This will serve to "fill in" gaps in the existing sidewalk network. No similar plan exists for Christian County and the City of Oak Grove.

The City of Clarksville performed spatial analysis on the sidewalk network using the "Sidewalk Priority Indicator" and produced the "Sidewalk Construction Priority Map 2016," which is shown in Figure 8.2 Many of the sidewalks with the highest priority indicators are in or near the CBD.

1 Who's on Board: What Today's Riders Teach Us about Transit that Works. 2016. Transit Center. www.transitcenter.org.

TABLE 8.7 SIDEWALK PRIORITY INDICATOR, CITY OF CLARKSVILLE AND MONTGOMERY COUNTY

FACTOR	PRIORITY RANK (1-5)
In Central Business Improvement District (a designated pedestrian district)	5
WITHIN A HALF-MILE OF THESE TRIP GENERATORS:	
Elementary, Middle & High Schools	5
Colleges & Universities	4
Parks & Greenways	4
Public Housing	4
Multi-Family Development	3
Civic Centers (post office, library, government offices, etc.)	3
Commercial or Mixed-Use Development	2
Single-Family Development	2
WITHIN A QUARTER-MILE OF THESE TRIP GENERATORS:	
Transit Routes	3
Senior Housing	2
OTHER FACTORS	
Missing Segment (within ¼ mile of existing sidewalk)	5
Damaged Segment of Existing Sidewalk	4
Missing Segment (within ½ mile of existing sidewalk)	3
Available Right-of-Way	2
Daily Traffic Volumes >20,000 vehicles per day (vpd)	3
Daily Traffic Volumes 5,000 to 20,000 vpd	2
Posted Speed Limit > 40 mph	3
Posted Speed Limit 30-40 mph	2

Source: City of Clarksville and Montgomery County Sidewalk Ordinance/Resolution, 2004

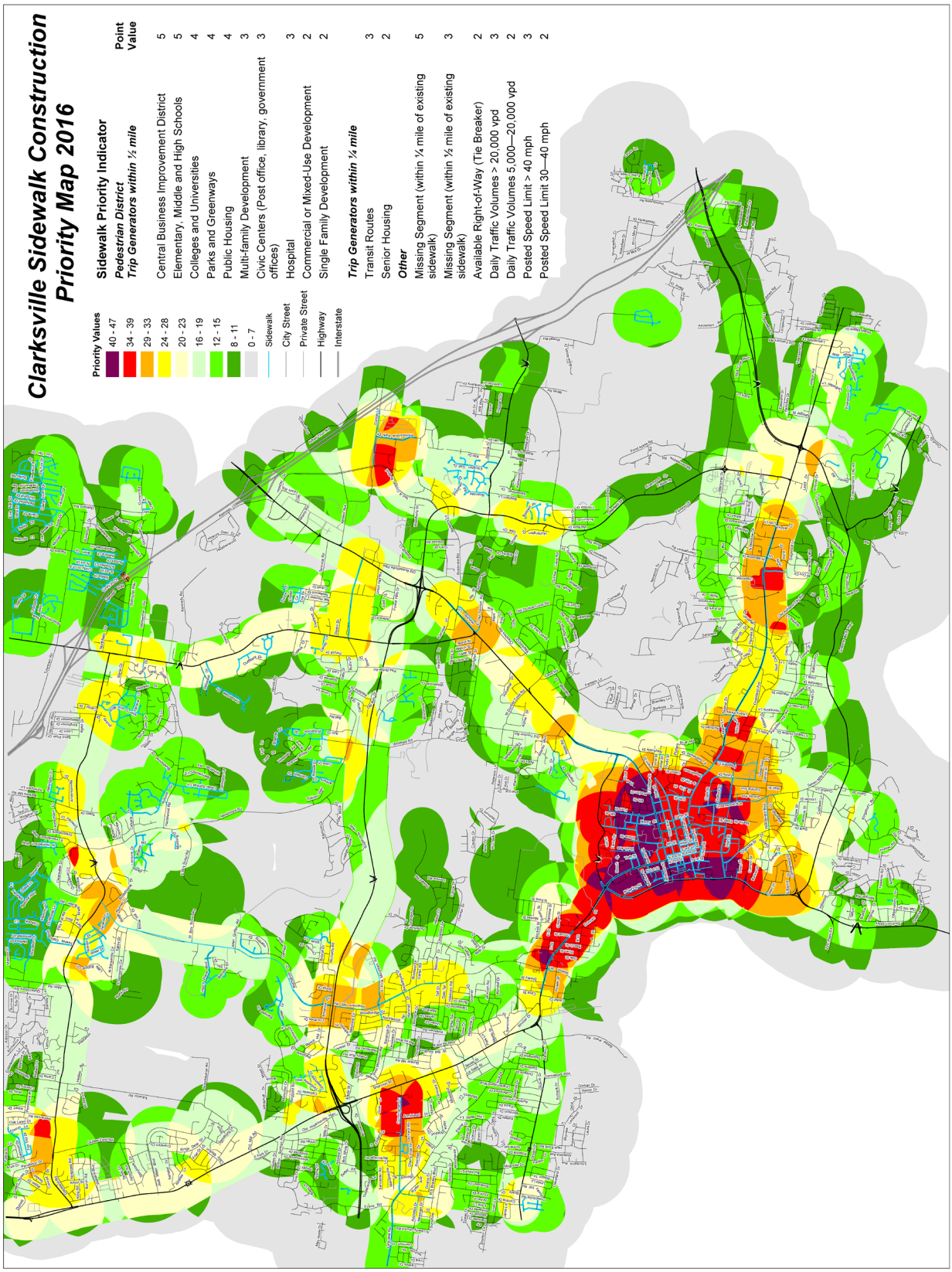


FIGURE 8.2 SIDEWALK CONSTRUCTION PRIORITY MAP

The *Clarksville-Montgomery County Greenway and Blueway Master Plan* provided an analysis of pedestrian connectivity. It contains recommended improvements that are partially illustrated in "Figure 6.15 Existing and Proposed Pedestrian Improvements". These improvements are designed to improve the functionality of the greenway and blueway systems, and may not highlight or include improvements recommended in the Downtown Clarksville Parking and Street Network Study or those identified by the Sidewalk Priority Matrix. The following general recommendations for pedestrian improvements were identified in the *Clarksville Montgomery County Greenway and Blueway Master Plan*:

- A Fort Campbell connection.
- Implementation of sidewalk connections to existing greenways, especially where off-road greenways and/or dedicated on-road bicycle lanes cannot be developed.
- Inclusion of sidewalks and bicycle facilities in all road expansion projects.

The *Downtown Clarksville Parking and Street Network Study* (2010) suggested a street framework plan to guide the city on future street standards to promote multimodal use. The standard cross-sections were designed with features such as on-street parking, bike routes, street trees, pedestrian scaled lights, crosswalks, sidewalks, multi-use trails, and bioswales. General recommendations related to pedestrian usage include:

- Pedestrian signal heads and mid-block crossings should be employed where volumes are high
- Sidewalks should be added at Kraft Street and Red River Street where CTS serves this predominately industrial area and other residential areas per the street standards

Specific pedestrian improvements recommended by The Downtown Clarksville Parking and Street Network Study are located in Chapter 10: Project Development and Prioritization.

Public input demonstrated that the availability of sidewalks and safety for pedestrians are a large concern within the MPA. Of the transportation issues ranked in the public input Clarksville MTP 2045 Transportation Survey, sidewalks were ranked the worst. Most, 79 percent of respondents, felt the availability of sidewalks and pedestrian trails was poor or very poor. Forty-five percent of survey respondents saw "inadequate or no sidewalks" as a major safety concern. Survey participants also noted the lack of sidewalks near schools and bus stops as a safety concern.

Trails and Greenways Needs

In addition to the bicycle and pedestrian improvements noted in the previous sections, the following multimodal recommendations were provided by the Downtown Clarksville Parking and Street Network Study:

- Street trees should be used in future streetscapes.
- Medians should be used in certain street sections to reduce lane width or converting center turn lanes to a median with left turn lanes at intersections per the street standards.
- Road diets should be implemented per the street standards.

Along with these specific physical improvements, the Blueway and Greenway Master Plan recommends:

- Continued addition of new greenway sections that connect to existing greenways.
- A Fort Campbell connection.
- Creation of a north/south greenway corridor within the city limits.
- Implementation of sidewalk connections to existing greenways, especially where off-road greenways and/or dedicated on-road bicycle lanes cannot be developed.
- Continuation of primary city greenway and blueway corridors into the County.
- Creation of a regional greenway corridor by utilizing the north/south rail corridor that connects to the Bicentennial Trail in Cheatham County.
- Creation of a major east/west greenway corridor along Spring Creek.
- Creation of an overland greenway corridor, connecting northwest Montgomery County to the city.

Additional Needs

The region has shown great interest and care in improving bicycle and pedestrian facilities over the past 15 years. Multiple plans and studies exist to guide implementation and a strong bicycle and pedestrian culture is emerging. Improvements to facilities are fiscally constrained, but the region continues to plan for future active transportation needs which help to leverage opportunities for improvements as they arise.

The analysis provided as part of the Clarksville Montgomery County Greenway and Blueway Master Plan, the The Downtown Clarksville Parking and Street Network Study, and the Sidewalk Construction Priority Map identify specific improvements to the pedestrian networks. An overview of these plans and studies is included to provide a basic understanding of the content. Each document should be consulted for specific recommendations to identify high-need projects worthy of pursuing federal funding.

As previously stated, the FHWA, TDOT, and KYTC require the consideration of multimodal improvements as part of any federally funded roadway reconstruction or widening. Public input suggests that the City of Clarksville, Montgomery County, the City of Oak Grove, and Christian County should consider additional measures to build sidewalks in areas near public transit routes. Public input revealed that this is particularly desired near heavily traveled routes, major stops, and in areas surrounding schools. While these factors are considered in the sidewalk priority matrix, the City of Clarksville and Montgomery County should consider adjusting the sidewalk priority matrix to give these areas more precedence.

Improvements in bicycle and pedestrian facilities along the Fort Campbell Boulevard (US-41A) corridor, from Providence Boulevard to the Tennessee/Kentucky state line, are recommended in most of the current approved plans and studies in the MPA. No further widening is planned for this 7-lane highway, meaning the addition of bicycle/pedestrian facilities will likely require standalone, retrofit projects. This corridor serves transit riders for Route 1/Fort Campbell, which is among the routes with highest ridership.

Similar needs exist on other transit routes to varying degrees. Outside Clarksville's Central Business District, only Routes 5 and 6 (Hilldale and Madison Street) have sidewalks along one-third of their routes. It is recommended that the City of Clarksville and Montgomery County evaluate sidewalk needs for these two routes, along with Route 3 (Cunningham Loop) and Route 7 (Wilma Rudolph/Gateway Medical Center). The following routes rely on "critical corridors" identified in previous plans for sidewalk improvements:

- Wilma Rudolph Boulevard (US-79/SR-13),
- Madison Street (US-41A), and
- Fort Campbell Boulevard (US-41A).

Zoning policies in the region will predicate the construction of sidewalks within new commercial development in the MPA. In Clarksville and Montgomery County, new residential areas will be required to construct sidewalks. Due to future population projections for the region, the City of Oak Grove should consider a similar policy requiring sidewalk construction for any new residential subdivision.

Zoning policies do not require bicycle parking or bicycle route connections as a part of new development. These policies should be reviewed to require or incentivize bicycle parking as part of new development. For example, in some municipalities, required vehicular parking is reduced with the addition of bicycle parking.

The Clarksville-Montgomery County Greenway and Blueway Master Plan includes recommendations for improvements to bicycle connectivity, but it is also important that future route improvements include signage and are included in roadway maintenance plans. Bicycle routes must remain clean and in good repair to ensure usability and safety for cyclists.

Projects that address the needs of bicyclists, pedestrians, and other system users promote maintaining the natural environment and better air quality. They also provide an equal opportunity to low-income and minority populations. These projects receive better scores during the project prioritization process.

8.3 | Public Transit Needs

Maintaining and Improving the Existing System

The recent COA from CTS, and their Strategic Plan, have provided measures of frequency and travel time. These reports also support improvements to walkability adjacent to transit stops. The MTP reiterates the importance of those improvements.

Additionally, the CTS must begin preparing for the increase in the area's elderly population, which will require additional resources to provide adequate service. This will also apply to riders that are aged 18-34, a prominent group of transit riders within the MPA due to Fort Campbell.

Transit Policies

Transit policies can increase transit ridership in three main ways:

- Concentrate development around transit corridors and make the walk to transit safe, easy and pleasant.
- Concentrate transit improvements in walkable places with large numbers of residents and destinations.
- Pay special attention to increasing frequency and reducing transit travel time.

The MPO should work with CTS to research and develop a transit stop improvement program that identifies integral bus stops for sidewalk and amenities improvement. In addition, the MPO should assist CTS with implementing the recommendations in its Strategic Plan, including:

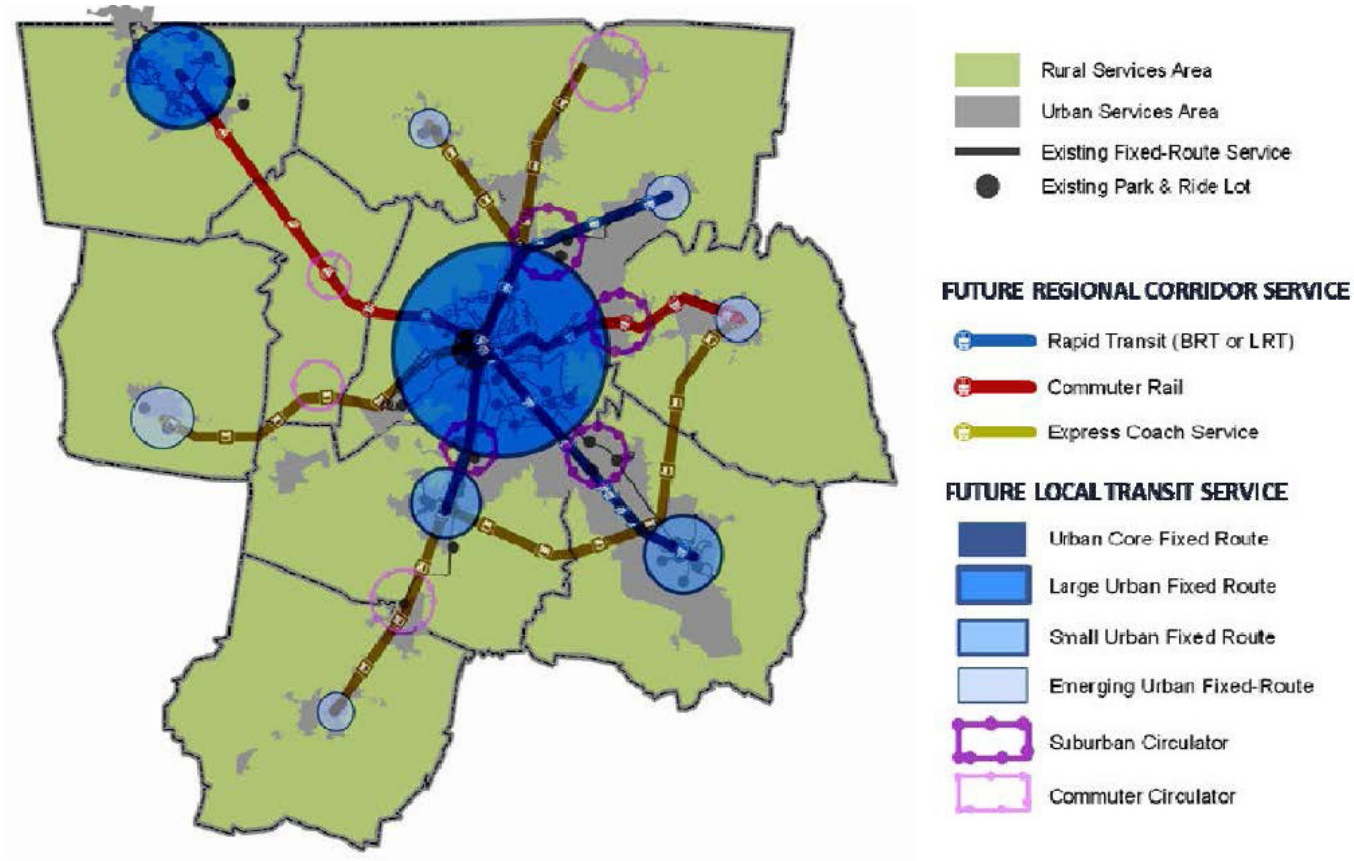
- Continue to monitor the performance of each route (number of passengers, on-time performance, etc.) and adjust the schedule to maintain on-time performance goals of 85% during peak and 90% during off-peak;
- Work with the RTA and other regional service providers to find more cost-effective options for CTS patrons;
- Explore the creation and use of a Riders' Advisory Committee or similar group who would meet periodically with CTS management and operations supervisors to give feedback and suggestion for improved operations;

- If staffing and resources permit, consider opening paratransit/dial-a-ride service to general public to increase efficiency of service and charging service at cost.
- Continue with existing travel training programs.
- Offer free fixed-route rides to passengers who are somewhat ambulatory but would otherwise qualify for ADA services.
- Continue to monitor the number of trips and costs; revisit service area, qualifications and other policies to combat cost escalation if necessary.
- Work towards a more robust "State of Good Repair" for CTS vehicles and buildings.
- Apply for additional grant funds to address critical sidewalk needs along transit routes, working in partnership with the City of Clarksville and the CUAMPO.
- Monitor the number of buses using the downtown transit center currently, or as proposed by a COA or other studies, being cognizant of the fact that the facility cannot accommodate increased vehicles due to space constraints.
- Partner with Austin Peay State University to develop a CTS next bus real-time information app for iOS and Android devices.
- Consider deployment of real time arrival information at the proposed mini hubs.
- Provide necessary data required to provide transit trip directions via Google Transit.
- Market and publicize the "free rides for seniors" program funded by AARP.
- Continue to sell bus transit advertising and bus wrapping.
- Continue to partner with employers to examine potential service expansion(s).
- Continue existing partnerships with Austin Peay State University and other educational entities.

Regional Transit

The Middle Tennessee 2040 Regional Transportation Plan recommends a fixed commuter rail service from Nashville to Clarksville in the future[2]. The cities are within the top five population centers in Tennessee. The general alignment of the route is shown in Figure 8.3. The Northwest Corridor Transit Study is currently evaluating options for implementation. The RTP recommends that the corridor include rail service using Diesel Multiple Unit vehicles. These vehicles could use the existing freight alignment or operate a new track built along dedicated right-of-way or down the center of an existing street. The service would be oriented to commuters along the corridor. A planning level cost estimate is $150M to $300M in capital costs, and $6M in annual operating costs.

Figure 8.3 Middle Tennessee Regional Transit Vision



Source: Middle Tennessee 2040 Regional Transportation Plan

2 Middle Tennessee 2040 Regional Transportation Plan

8.4 | Freight Needs

Freight needs vary by mode. However, all freight projects within the MPA can improve roadway safety and increase economic development of the region.

Trucking Needs

Forecast Growth

Table 8.8 shows the projected growth in freight tonnage for trucks in Montgomery County from 2012 to 2040. This data was developed using the Transearch data provided by TDOT, which has coverage of each county in Tennessee up to the year 2040. As such, freight data was unavailable for Christian County.

Table 8.8 Change in Truck Freight Tonnage in Montgomery County, 2012-2040

	2012	2040	Change	Percent Change
Montgomery County, TN	6,911,929	12,359,918	5,447,989	78.8%

Note: Excludes through-traffic

Source: Transearch

Table 8.9 compares freight trucking trends from 2012 through 2040 for freight being transported on trucks. The following observations emerge:

- Export tonnage to other counties in Tennessee from Montgomery County is projected to grow more than eight times as fast as import tonnage from other counties in Tennessee.
- Import tonnage to Montgomery County from other Tennessee counties is expected to grow at the slowest rate for all truck freight movements.
- Export tonnage to areas outside of Tennessee from Montgomery County is projected to grow more than twice as fast as import tonnage from other areas outside of Tennessee.

Table 8.9 Change in Freight Truck Movement in Montgomery County, 2012-2040

Year	From Outside Tennessee	To Outside Tennessee	From Other Tennessee County	To Other Tennessee County	Within County	Total
2012	2,746,997	1,816,627	1,177,231	1,133,545	37,529	6,911,929
2040	4,049,617	3,877,004	1,398,198	2,975,734	59,364	12,359,918
Change	**1,302,620**	**2,060,377**	**220,967**	**1,842,189**	**21,835**	**5,447,989**
Percent Change	**47.4%**	**113.4%**	**18.8%**	**162.5%**	**58.2%**	**78.8%**

Note: Excludes through-traffic

Source: Transearch/IHS Freight Finder

THE LARGEST AREAS OF TRUCK VOLUME GROWTH ARE LOCATED ON INTERNATIONAL BOULEVARD/SOLAR WAY FROM ROSSVIEW ROAD TO JIM JOHNSON ROAD, AND US 79 FROM KRAFT STREET TO INTERNATIONAL BOULEVARD. OTHER AREAS OF FREIGHT GROWTH INCLUDE THE I-24, US 41A, AND US 79/SR-13 FREIGHT CORRIDORS.

Figure 8.4 shows the estimated 2045 truck volumes on the MPA's roadway network.

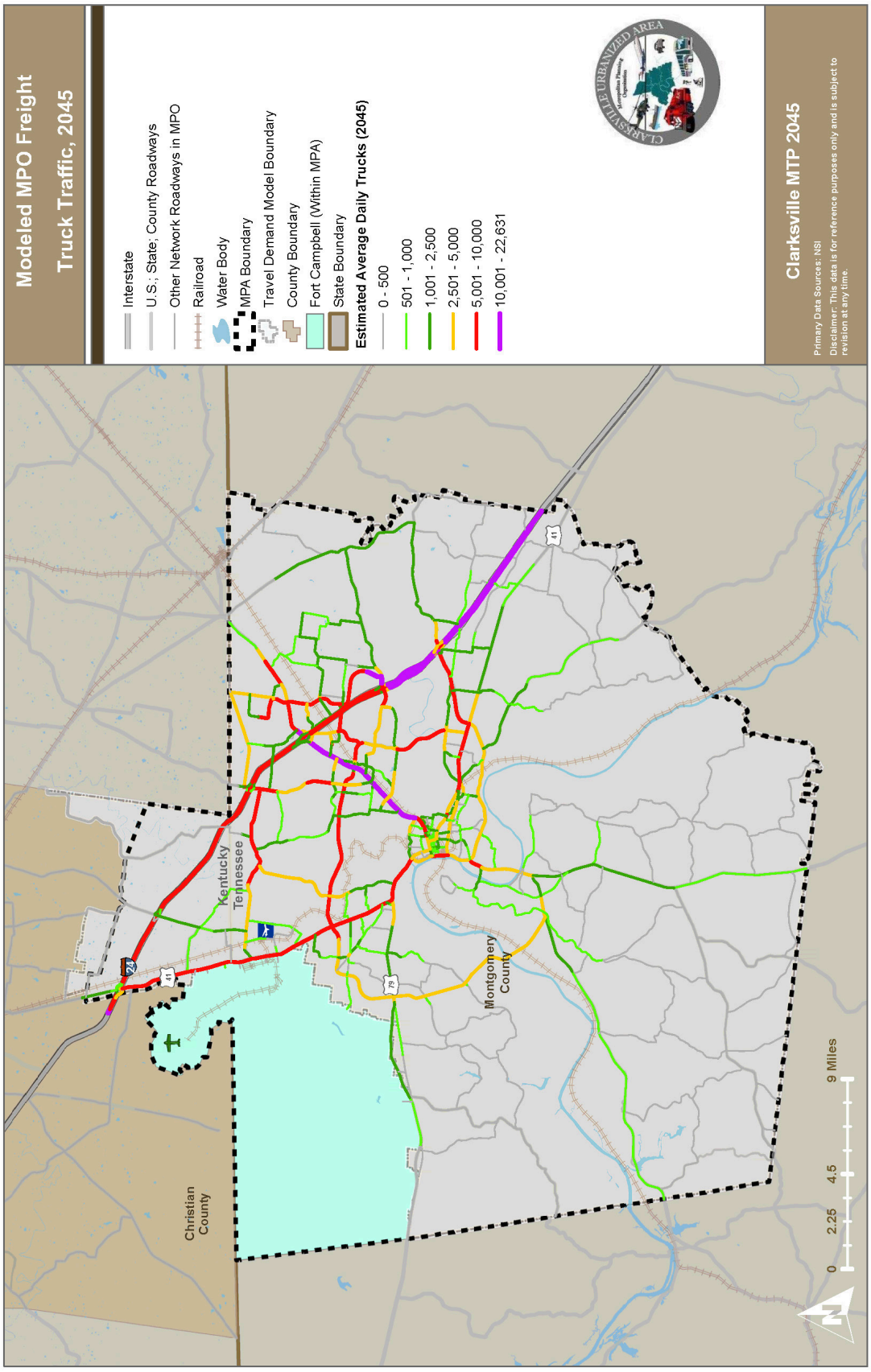


FIGURE 8.4 MODELED MPO FREIGHT TRUCK TRAFFIC, 2045

Roadway Capacity and Reliability

One method to address freight truck travel time reliability is through ITS improvements. Beyond ITS improvements, traditional capacity improvements can alleviate congestion-related delay.

Table 8.10 shows the roadway segments that accommodate a large number of daily truck trips (500 trucks or more) and experience congestion in the base year. These segments possess the greatest need for capacity/reliability improvements to improve future freight conditions in the short-term.

By 2045, congestion along corridors that possess a large number of daily truck trips will correspond to the same congested segments shown in Table 8.3. Figure 8.5 displays the roadway segments that are anticipated to have greater than 500 truck trips per day and experience a LOS of F in the year 2045.

TABLE 8.10 MAJOR FREIGHT ROADWAYS WITH CONGESTION ISSUES

FACILITY	FROM	FACILITY	ESTIMATED DAILY TRUCKS (2016)
US 79/Wilma Rudolph Road	Kraft Street	Old Trenton Road	7,700
US 79/Wilma Rudolph Road	I-24 West Ramps	I-24 East Ramps	8,300
US 79/SR-13	Jim Johnson Road	1.67 miles east	3,500
US 79/US 41A	0.32 miles west of Peachers Mill Road	Kraft Street	5,300-5,700
US 41A Bypass	Old Ashland City Rd	SR-12	2,600
SR-236/Tiny Town Road	Peachers Mill Road	Needmore Road	4,100
SR-48/Trenton Road	Needmore Road	0.98 miles north	1,900
SR-48/Trenton Road	I-24 West Ramps	SR-249	2,500-2,800
SR-249/Tylertown Road	SR-48	0.94 miles east	1,500
SR-13/SR-48/Cumberland Drive	Old Hwy 48	US 41A Bypass	1,600-5,000
Zinc Plant Road	Bridgwood Road	SR-13/SR-48	1,300-2,200
Peachers Mill Road	Mill Creek Road	101st Airborne Division Parkway	2,200-3,400

Source:TDM

continued

TABLE 8.10 MAJOR FREIGHT ROADWAYS WITH CONGESTION ISSUES

FACILITY	FROM	FACILITY	ESTIMATED DAILY TRUCKS (2016)
Madison Street	10th Street	0.21 miles east	2,500-2,900
Dunlop Lane	Ted Crozier Boulevard	International Blvd.	3,200-3,600
Hornerger Lane	Main Street	SR-48	2,000
SR-374/Richview Road	Memorial Drive	Old Russellville Pike	3,500-3,700
Needmore Road	SR-48	US 79/SR-13	1,200-1,600
Old Trenton Road	W Dunbar Cave Road	Needmore Road	1,100-1,300
Dunbar Cave Road	US 79	0.32 miles east	1,300

Source:TDM

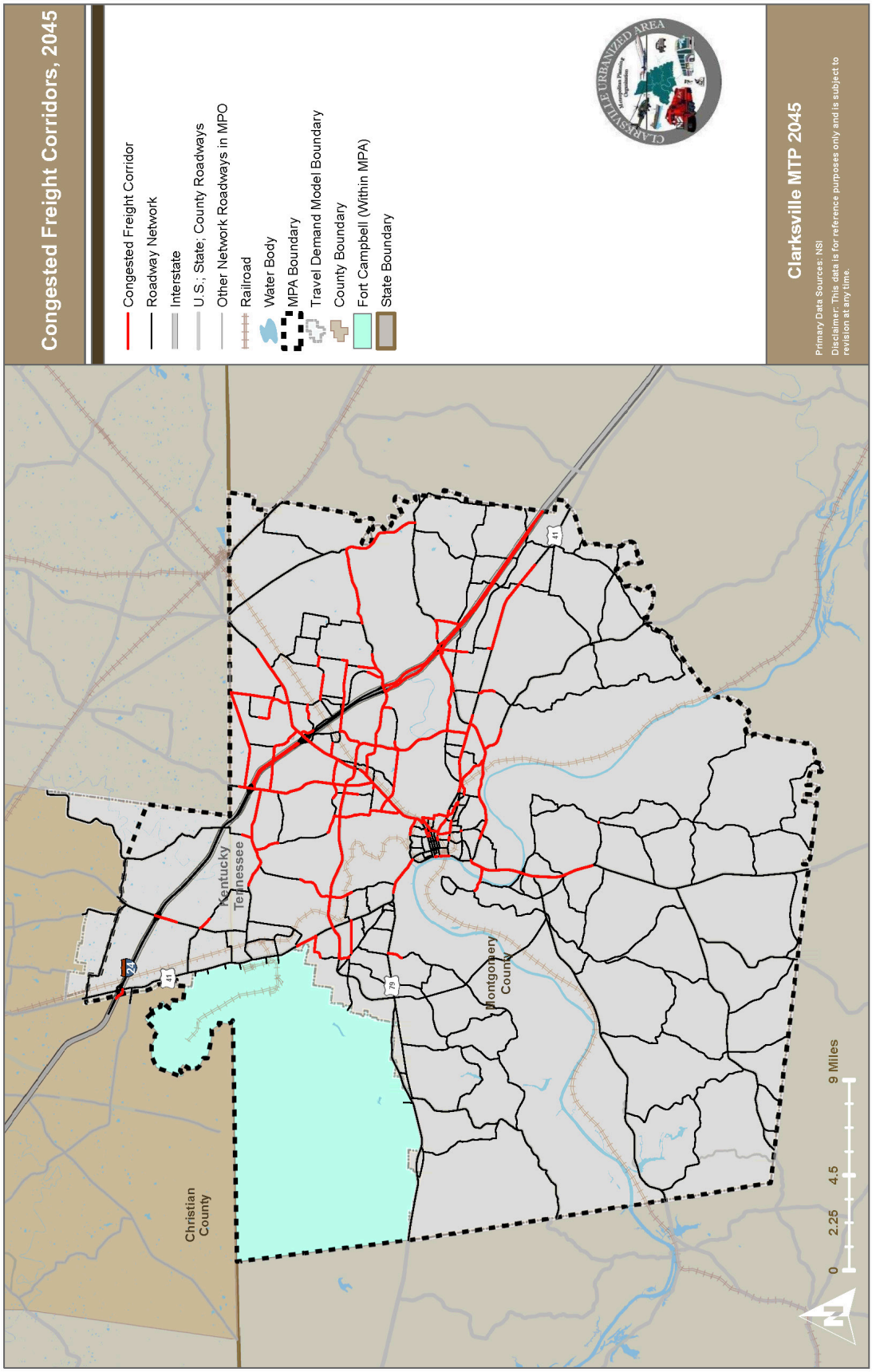


FIGURE 8.5 CONGESTED FREIGHT CORRIDORS, 2045

Rail Needs

Forecast Growth

Table 8.11 shows the projected growth in freight tonnage for rail in Montgomery County from 2012 to 2040. This data was provided by Transearch, which has coverage of each county in Tennessee up to the year 2040.

Table 8.11 Change in Rail Freight Tonnage in Montgomery County, 2012-2040

	2012	2040	Change	Percent
Montgomery County, TN	68,640	84,102	15,462	22.5%

Note: Excludes through-traffic
Source: Transearch

Rail Capacity and Future Projects

Future rail capacity and related needs can be measured in many ways. However, actual volumes and capacities are not known for all rail segments in the Clarksville MPA; it is not possible to forecast future capacity utilization rates and needs by segment. The use of rail as a means of freight transportation is becoming a more popular alternative due to increasing roadway congestion. The 2018 Tennessee Statewide Multimodal Freight Plan and 2015 Kentucky Statewide Rail Plan outline the future efforts anticipated by each state.

The Tennessee plan has identified three goals:

- Define strategic goals for the Tennessee freight system
- Establish a strategy to achieve freight-related goals that align with TDOT's guiding principles; and
- Fulfill the requirements of the FAST Act.

Sections 1.3 and 1.4 of the 2018 Tennessee Statewide Multimodal Freight Plan define the freight goals in more detail, as well as how TDOT's plan will support reaching those goals.

The Kentucky plan has identified four goals:

- Encouraging the preservation of the existing rail system, which is largely privately owned by the corporations using them.
- Support economic development by providing connectivity to state and federal systems and intermodal facilities.
- Strengthening customer relationships and information exchanging during the KYTC planning process.
- Enhancing highway-railroad at-grade safety crossing and reliability.

Passenger Rail Needs

CURRENTLY, ALL RAIL USED IN THE MPA IS STRICTLY FOR FREIGHT.

Both KYTC and TDOT have expressed an interest in passenger rail as an alternative for moving people. However, passenger rail faces financial and logistical challenges due to limited funds and the necessary infrastructure requirements.

High Speed Passenger Rail

During the public outreach survey period, members of the public expressed interest in a passenger rail system that connects Clarksville to other areas. In 2012, a study was conducted by the Georgia Department of Transportation (GDOT) that contained the possibility of a high-speed passenger rail corridor from Atlanta, GA to Louisville, KY. If this route is constructed, Clarksville residents would be able to access it via a terminal in Nashville. However, this project has yet to be built and GDOT is continuing to study feasible passenger rail corridors.

Regional Commuter Rail Service

For the last two decades, there has been interest in the introduction of commuter rail service between Clarksville and Nashville. This service would complement the commuter bus service that was launched in 2012. The RTA of Middle Tennessee conducted the Northwest Corridor Study which assessed the viability of a regional commuter rail service, with a terminus in Clarksville.

Future Waterways Transport

There are no general-purpose water ports in the CUAMPO area. Freight needs in the MPA are currently served by four single-purpose ports that are owned by major, private companies in the area. The City of Clarksville is located on the Cumberland River, a navigable waterway which gives the MPA the opportunity to expand on water-based freight shipping and barge transfer. The addition of a port would allow the MPA to increase its intermodal profile and increase the utility of the trucking and freight networks in the area. This will also assist in reducing wear on the roadways from truck traffic.

Port Service

The MPA is dependent upon its roadways and railways for the movement of freight within the area. In recent years, discussions have been held regarding the addition of a port with a general commodities terminal. This addition has also been identified as a project in TDOT's state freight plan. This port would be expected to have almost equal amounts of inbound and outbound freight. Several companies within the MPA currently use trucks traveling on I-24 to transport their commodities to the Nashville barge terminal. The inclusion of a general-purpose port would shift the mode of travel for a number of these trips and reduce traffic.

Airport Needs

Currently, the Clarksville Regional Airport has no commercial service flights. Flight training and aircraft maintenance for these flights are conducted by independent operators under the supervision of the airport authority. There is no full-service Fixed Base Operator to provide full time maintenance and aircraft rental with flight instruction.

IN 2017 THE CLARKSVILLE-MONTGOMERY COUNTY REGIONAL AIRPORT AUTHORITY COMPLETED A THREE STEP LOOK AT THE POTENTIAL TO ATTRACT AN AIR CARRIER SERVICE PROVIDER.

Three studies were conducted as part of this effort:

- A Regional Market Study
- An Economic Impact Study
- An Air Service Master Plan

These plans detail the challenges related to community development of air carrier service. This service would require several million dollars of capital investment at the start in order to accommodate:

- air carrier ticketing and baggage functions,
- ramp operations/parking,
- TSA passenger screening,
- sufficient automobile parking, and
- concessions for passengers.

Air carriers often expect subsidies from smaller communities in order to provide service. This would extend the amount of time for the service to break even on cost. The proximity of Nashville International Airport (KBNA), which already has all of these facilities, would also be competition to this service.

Further planned updates for the Clarksville Regional Airport can be found in the Airport Strategic Plan.

8.5 | Management and Operations

The MPOs and transportation departments across the United States have increasingly been asked to perform more tasks with each successive piece of transportation legislation. This is in addition to their existing work, often with stagnant or dwindling funds available. The FAST Act, like the MAP-21 and SAFETEA-LU bills before it, require that planning efforts seek to create and maintain an efficient transportation system. These increasing needs, while dealing with stagnant funding, require the MPOs and their partners to create leaner operations. It also places greater emphasis on the maintenance of the existing infrastructure. This section introduces several strategies that can be utilized in order to achieve this need.

The strategies in this section also help the MPO to achieve its objectives to:

- provide a safe transportation system,
- provide a well-maintained system, and
- provide a reliable transportation system.

Travel Demand Management (TDM)

THE GROWING BELIEF AMONG TRANSPORTATION PLANNERS AND PROFESSIONALS IS THAT A LOCATION CANNOT "BUILD ITSELF OUT OF CONGESTION."

The use of TDM involves the creation of a system that provides travelers with options to change their:

- mode of travel,
- amount of time spent in travel, or
- the route they choose in order to avoid congested roadways.

TDM focuses on strategies that reduce travel volumes and increase reliability within the roadway network. This can be accomplished by:

- Increasing the number of high-occupancy vehicle trips by promoting carpooling, shuttle buses to major employment centers, etc.
    - About 91 percent of the commuting trips within the MPA are made in Single-Occupancy vehicles.
    - This will reduce congestion and improve air quality without adding any additional capacity to the roadway system.
    - In Middle Tennessee, VanStar operates a vanpool service that has recently added vehicles to its fleet to expand its operations.
    - TDOT promotes the use of the RTA Ridematch, which allows Tennessee residents interested in vanpooling to contact the Regional Transportation Authority (RTA) about match options with other travelers looking to reach the same destination around the same time.
- Supporting Flex-time work schedules with employers to reduce congestion at peak times.
- Encouraging major employers to cooperate with other major employers in the area to stagger their normal working hours.
    - This will disperse commuting trips over a longer period of time.
    - Local Chambers of Commerce can provide many employers a location and medium through which to discuss these efforts.
- Supporting for efforts to allow employees to telecommute when possible.
- Establishing Park and Ride facilities.

- Providing a community education program on the costs and benefits of high-occupancy trips and options available to the public.
- Providing motorists with "live" data on which routes are the least congested at the time.
    - KYTC and TDOT offer real-time travel and emergency data through the use of the 511 system, which can be accessed online or by dialing 511 from a phone.
    - Recent advancements from free and paid services also allow real-time roadway data to be provided to motorists through their smartphones.

Systems Management and Operation

THE RETIMING OF TRAFFIC SIGNALS PROVIDES AREAS WITH AN OPPORTUNITY TO REDUCE CONGESTION AND LESSEN EMISSIONS BY MAKING THE ROADWAY SYSTEM MORE EFFICIENT.

These projects are low cost and result in savings from reduced delay. Signal coordination can also decrease intersection crash rates, reduce rear-end conflicts, and reduce crashes during turning movements at signalized intersections. These events add to congestion and cost drivers and local jurisdictions time and money. This will lead to increased safety and reliability of the roadway network within the MPA.

However, traffic signals require regular maintenance and the timings must be updated periodically, especially when new signals or major access points are added to a roadway. Often, the benefit to cost ratio of these projects is 20 to 1 or greater due to the reduction in lost time, reduced crashes, and more. Signal changes can also avoid the need for costly intersection modifications by increasing their efficiency.

The MPO and its partner agencies can also use ITS technologies to monitor the status of the roadway network in real-time. Using the ITS system allows the different agencies to monitor traffic, provide travelers information through dynamic message signs, and more.

Incident Management

The FHWA states that many additional highway congestion sources come from:

- traffic crashes,
- work zones,
- bad weather,
- traffic control devices,
- bottlenecks, and
- special events.

Many times, congestion is increased as a primary incident can cause secondary incidents. Secondary incidents are events such as rear-end crashes from inattentive drivers who are observing the stopped traffic from the primary incident, or vehicles that become stranded due to overheating or running out of fuel while waiting for the primary incident to be cleared. These secondary incidents further increase the cost and delay on the system, and further increase the need for roadway incident management.

As mentioned in Chapter 6, KYTC and TDOT maintain programs that help with incident management called "Safe Patrol" and "HELP" respectively. These programs do not operate in the MPA at all times; however, they will assist with large incidents. These programs operate on the freeways and involve trained staff who help to:

- protect emergency personnel and motorists from moving traffic,
- alert other drivers to the incidents and hazards while guiding them safely through and avoiding secondary incidents, and
- coordinate clearance of the roadways in order to establish regular traffic flow as quickly as possible.

Intelligent Transportation Systems (ITS)

Cost effective ITS technologies which can be integrated within the transportation network have become an increasing trend over the last few years. The benefit/cost of applying these technologies is frequently related to the travel characteristics of the roadway network. Urban roadway networks are the most likely to benefit from ITS technology. ITS is the use of advanced technologies to effectively and efficiently manage the existing transportation system. ITS technologies include:

- closed circuit television cameras,
- the use of fiber optic cable,
- dynamic message signs, and
- automatic vehicle locator (AVL) systems on transit buses,
- vehicle video detection, and
- several other emergent technologies.

Agencies that seek federal transportation funding for ITS projects must show that the project is part of, or conforms to, the Regional ITS Architecture. The MPA's Regional ITS Architecture, which was updated in 2015, is developed and maintained by the CUAMPO. This document, the Clarksville Regional Intelligent Transportation System Architecture and Deployment Plan[3], identifies the types of ITS services that are planned for implementation in the region. This document provides all involved agencies, such as emergency responders, law enforcement, transit agencies, and pertinent transportation agencies, the ability to share resources and information necessary to ensure the operation of the transportation system. As part of the process, MPO staff and TCC members review potential TIP projects to help ensure coordination with the Architecture.

The stakeholders that participated in the update of the CUAMPO Regional ITS Architecture are:

- Christian County Road Department
- City of Hopkinsville
- City of Oak Grove
- Clarksville Street Department
- Clarksville Transit System
- CUAMPO
- FHWA- Kentucky Division
- FHWA- Tennessee Division
- Fort Campbell Directorate of Public Works
- KYTC- District 2
- Mid-Cumberland HRA
- Montgomery County Emergency Management Agency
- Montgomery County Highway Department
- TDOT Long Range Planning Division
- TDOT Region 3
- TDOT Traffic Operations Division

3 http://www.cuampo.com/files/Architecture020715.pdf

Access Management

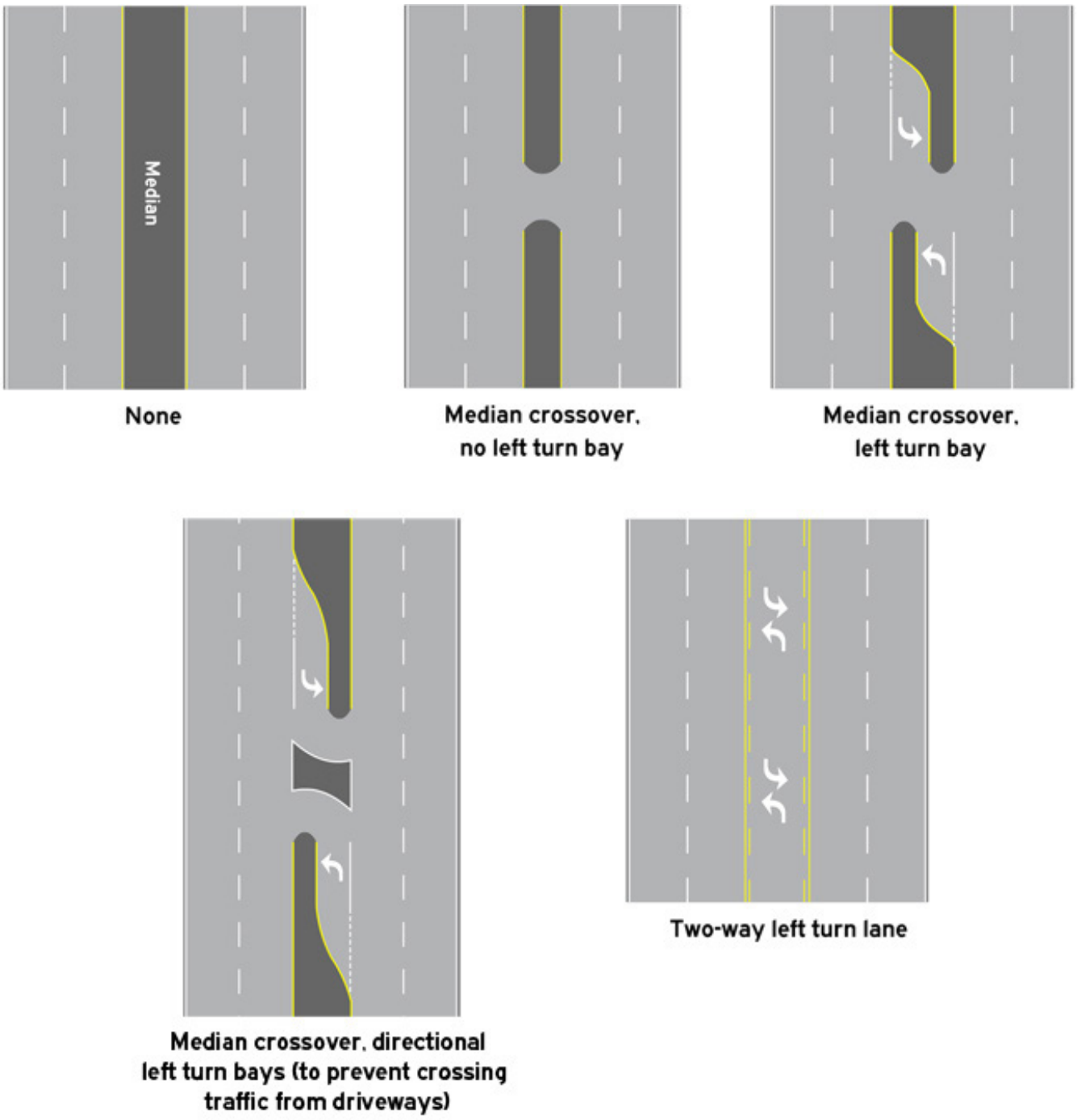
Access management is the regulation of direct accessibility to a roadway via interchanges, intersections, and medians. Poor access management on a heavily built up roadway can lead to congestion from turning vehicles blocking traffic or slowing down other vehicles. Poor access management can also increase the risk of crashes.

Several multi-lane highways in the MPA, especially those with dense commercial development along one or both sides of the road, possess a center two-way left turn lane (TWLTL). These lanes allow left-turning vehicles to be taken out of the through traffic, thus reducing the delay for through-moving vehicles and providing a safe place for left-turning vehicles. However, there is a risk posed by vehicles using TWLTLs as potential collisions with other drivers becomes possible. This can occur if an oncoming driver from the opposite direction wishes to use the lane at the same time and near the same location. Another risk of the turn lanes is that the vehicles using them must reduce their speed, which increases the possibility of a rear-end collision. The reduction of TWLTLs, driveways, and access points to roadways are key targets of access management.

Medians

Medians provide a physical separation for traffic going in opposite directions on multi-lane roadways. These roadway features improve traffic flow by limiting left turns across oncoming traffic to specific designated points where left turns can be made. Where left turn traffic is considerable, turning bays should be provided within the median. The turning bays allow left-turning traffic to be removed from the through travel lane until there is a safe opportunity to turn, thus increasing safety and traffic flow. Figure 8.6 shows various median crossover designs.

Figure 8.6 Median Crossover Designs5



Source: FHWA

Driveway Management

Roadways that serve higher traffic volumes need more access control in order to preserve their traffic function; meaning that they should have fewer direct access points or driveways. When frequent direct access is permitted to these roadways they experience slower traffic speeds, increased congestion, reduced efficiency, and increased crash risks. Frequent and direct property access is more appropriate for local and collector roadways. The FHWA[4] states that "a research synthesis found that roadway speeds were reduced an average of 2.5 miles per hour for every 10 access points per mile, up to a maximum of 10 miles per hour reduction."

As part of its "Congestion Toolbox", KYTC maintains an access management section. This program provides a report on the recommended practices needed to conduct access management. The program also contains an implementation plan. More information can be found at:

https://transportation.ky.gov/Congestion-Toolbox/Pages/Access-Management.aspx

Currently, TDOT is working on a review of their access management policy. The City of Clarksville adopted and maintains a local access management ordinance. This ordinance established an access management plan which is aimed at preserving the operational capacity and safety on its roads. Site development plan applications in the City of Clarksville must include an access plan to be reviewed by the City Street Department in order to ensure that it meets the standards of the ordinance. The standards that are applied are determined by the roadway's functional classification and the type of development that the roadway serves. Further information can be found at:

http://www.cityofclarksville.com/modules/showdocument.aspx?documentid=487

4 https://ops.fhwa.dot.gov/access_mgmt/docs/benefits_am_trifold.htm

Land Development Policies

The efficiency of a roadway can be influenced by the land around it and how it develops. Land use ordinances and subdivision regulations give local governments a degree of control over a roadway's operations. The use of lot frontage requirements can be a form of access management. It can also be used to prevent the need for approving undesirable driveway conditions on roadways in the future.

These policies may also make use of service roads or frontage roads along arterial roadways. Instead of the arterial being accessible by driveways, the service roads would carry the direct access. Vehicles on the service roads would later access the arterial at major intersections or median crossovers.

Standards for driveway width and curb radius may impact traffic on a road that serves a property. These standards are affected by local ordinances and locations that allow the use of smaller curb radii and/or narrower driveways. These factors result in vehicles having to slow down to make tight turns, which then impacts the flow of traffic on arterial and collector streets. While not an issue on residential streets, this limits the effectiveness of a major arterial road, negatively impacts traffic flow, and reduces safety by increasing the likelihood of crashes.

Guidelines should be established by local jurisdictions on the location and spacing of access points along arterials and collectors. These guidelines must additionally address the spacing of traffic signals and full-movement intersections. Doing so will ensure that traffic signal coordination is effective and that adequate turning movement and storage movement space exists between public road intersections.

8.6 | Enhancing Travel and Tourism

Not all trips on a roadway network are for the purposes of work, school, or shopping. Leisure and tourism trips often make use of an area's roadways, transit, and pedestrian facilities. Tourism promotes economic vitality and can be a driver of regional development. A developing trend in many states is the encouragement for people to "become a tourist within their own state" and to travel to other local areas. There are several potential means by which travel and tourism might be encouraged within the MPA.

State and Local Websites

The State of Kentucky places an emphasis on tourism using a portion of the state website[5], devoting several sections to the various attractions within the state. The website provides links to related agencies, upcoming events, travel guides, and roadway maps. The Tennessee Department of Tourism maintains a separate website, tnvacation.com. This site introduces travelers to the regions to visit, various categories of activities to do while in the state, and provides trip planning resources. The City of Clarksville tourism webpage can be found at:

http://www.cityofclarksville.com/index.aspx?page=4

5 http://kentucky.gov/Tourism/Pages/default.aspx

Welcome Centers

Welcome Centers are among the first sights that greet travelers when entering a new state. The MPA's location on the Kentucky-Tennessee State Line makes these establishments an opportunity to promote the region and encourage tourism and travel. There are two Welcome Centers within the MPA:

- The I-24 Welcome Center Clarksville/Montgomery County in Tennessee
- The Christian County Welcome Center in Kentucky

Both of these Welcome Centers are located on I-24, on either side of the State Line in the MPA. The I-24 Welcome Center has a website[6] on tnvacation.com and provides information about attractions in the City of Clarksville such as food, places to stay, and local attractions. The I-24 Welcome Center also provides:

- free reservations on site for hotels, motels, campgrounds, and attractions;
- a free Tennessee Vacation Guide;
- a free highway map; and
- free brochures and coupons to be used throughout the State of Tennessee.

Complete Streets

Complete streets is a design philosophy that provides transportation users with multiple, safe travel options along a roadway, including both motorized and non-motorized users. Often, complete streets designed facilities may physically share routes, while in other cases a parallel facility is used. This design process allows those who prefer to walk and bicycle to have a safer and more comfortable experience, while still having access to mobility and the ability to conduct their business. Examples of complete streets include:

- The addition of greenways and trails parallel to roadways
- The addition of pedestrian sidewalks
- The creation of a combined bike and pedestrian path
- Installation of median crossing islands

6 https://www.tnvacation.com/local/clarksville-i-24-welcome-center-clarksvillemontgomery-county

- Traffic calming measures
- The addition of bike lanes
- Road diets with the addition of bicycle/pedestrian lanes with streetscape beautification

The use of complete streets would enhance travel throughout the region by providing users with multiple options of travel, reducing roadway congestion, and increasing safety. These design philosophies will also promote tourism by encouraging potential visitors to drive to the region, park their vehicle, and use pedestrian or bike facilities to experience the area in full.

Currently, none of the jurisdictions or agencies within the MPA have a Complete Streets Policy. The City of Clarksville, KYTC, and TDOT have been studying the possibility of these policies, but nothing has yet been established.

9.0 | Forecasting Future Available Funding

Under federal regulations, fiscal constraint is required of MTPs.

In order to be fiscally constrained, the costs of programmed projects must not exceed the amount of funding that is reasonably expected to be available. This chapter provides an analysis of the funding that is expected to be available for transportation projects and programs in the MPA, following the regulations established in 23 CFR 450.324. **It should be noted that the forecast figures used in this chapter are for planning purposes only and do not commit any jurisdiction or agency to provide a specific level of funding.**

9.1 | Roadway Funding

Potential Federal Funding Sources

The FAST Act is the current transportation bill for the four year period from 2016 through 2020. **During this time, it will provide a total funding of $305 billion for the nation's transportation needs.** This legislation includes several categories of funding, under which many of the projects in the financially constrained plan will be eligible for federal funding assistance. These categories are:

National Highway Performance Program (NHPP)

This is a new program under MAP-21. The NHPP provides support for the condition and performance of the NHS and the construction of new facilities on the NHS. The NHPP also ensures that the investment of federal-aid funds in highway construction is directed to support progress toward the achievement of the performance targets established in a state's asset management plan for the NHS.

Funds used from the NHPP may only be used for the construction of a public transportation project that supports progress toward the achievement of national performance goals for improving the:

- infrastructure condition,
- safety,
- mobility, or
- freight movement on the NHS.

The funds can only be used on projects that are eligible for assistance under chapter 53 of title 49, if:

- the project is in the same corridor as, and in proximity to, a fully access-controlled NHS route;
- the construction is more cost-effective (as determined by a cost-benefit analysis) than an NHS improvement; and
- the project will reduce delays or produce travel time savings on the NHS, as well as improve regional traffic flow.

The local match requirement for NHPP funded projects varies. The standard federal/state funding ratio for arterial and interstate routes is 80/20. However, the interstate system receives funding at a 90/10 ratio when a project adds HOV or auxiliary lanes.

Two percent of the funding in this category must be set aside for State Planning and Research as defined by [23 U.S.C. 505].

According to [23 U.S.C. 126], a state has the ability to transfer up to 50 percent of its NHPP funds in a fiscal year to:

- the National Highway Freight Program,
- Surface Transportation Block Grant Program,
- Transportation Alternatives,
- Highway Safety Improvement Program, and/or
- CMAQ Program.

Surface Transportation Block Grant Program (STBGP)

The STBGP is a new funding program that was created from a conversion of the Surface Transportation Program (STP). The STBGP contains subcategories of funding for states and urban areas.

This funding category is the most flexible among all federal-aid highway programs.

Two percent of the funding in this category must be set aside for State Planning and Research as defined by [23 U.S.C. 505]. The other set-aside requirements for the STBGP are funding for bridges not on federal-aid highways and transportation alternatives. Transportation alternatives' funding is sub-allocated based on an area's population in a manner identical to the now-defunct Transportation Alternatives Program (TAP).

The STBGP continues all the provisions of the former STP. As such, these funds can be used for any road, including NHS routes, which is not functionally classified as a local road or rural minor collector. However, there are exceptions to this rule[1]. A percentage of a state's STBGP apportionment (after set-asides for Transportation Alternatives) is allocated to the areas it serves based on population size groupings. These groupings are:

- Urbanized areas with population greater than 200,000.
    - This portion is to be divided among those areas based on their relative share of population, unless the Secretary approves a joint request from the State and relevant MPO(s) to use other factors.
- Areas with population greater than 5,000 but no more than 200,000
    - The State is to identify projects in these areas for funding, in consultation with regional planning organizations, if any.
- Areas with population of 5,000 or less. [23 U.S.C. 133(d)]

The funding ratio is 80/20. However, interstate projects that add HOV or auxiliary lanes have a funding ratio of 90/10.

Under the FAST Act, STBGP funds can be used to create and operate a state office to help design, implement, and oversee public-private partnerships (P3) that are eligible to receive Federal highway or transit funding. These funds can also be used to pay a stipend to unsuccessful P3 bidders in certain circumstances [23 U.S.C. 133(b)(14)]. Through the USDOT, the funds can, upon a state's request, be used to pay the subsidy and administrative costs for TIFIA credit assistance for an eligible STBGP project or group of projects. [23 U.S.C. 133(b)(13)]. The FAST Act also provides the STBGP with mention of the eligibility of the installation of vehicle-to-infrastructure communication equipment. [FAST Act §1407, 23 U.S.C. 133(b)(1)(D)]

1 https://www.fhwa.dot.gov/fastact/factsheets/stbgfs.cfm

Highway Safety Improvement Program (HSIP)

The HSIP is designed to achieve a significant reduction in traffic fatalities and serious injuries on all public roads. This includes non-State-owned public roads and those on tribal lands. Except as provided in 23 U.S.C. 120 and 130, the Federal share for projects using HSIP funding is 90 percent. The use of HSIP funds under the FAST Act are a continuation of those from MAP-21.

Funding from the HSIP can be used for safety projects that are consistent with the State's Strategic Highway Safety Plan (SHSP). The projects must correct/improve a hazardous road location, feature, or address a highway safety problem.

Under MAP-21, HSIP funds were used for many types of projects due to the non-exhaustive nature of the list of eligible projects. The FAST Act imposes a more stringent use of HSIP funds. The funds may be used only on the activities specifically listed in the HSIP statute itself. Additional inclusions to HSIP from the FAST Act are:

- Installation of vehicle-to-infrastructure communication equipment.
- Pedestrian hybrid beacons.
- Roadway improvements that provide separation between pedestrians and motor vehicles, including medians and pedestrian crossing islands.
- Other physical infrastructure projects not specifically enumerated in the list of eligible projects.

The FAST Act continues the prohibition of the use of HSIP funds for the purchase, operation, or maintenance of an automated traffic enforcement system (except in school zones). [FAST Act § 1401]. However, workforce development, training, and education activities remain an eligible use of HSIP funds. [23 U.S.C. 504(e)]

Railway-Highway Crossings Program

The Railway-Highway Crossings program provides funds for safety improvements to reduce the number of fatalities, injuries, and crashes at public railway-highway grade crossings. The Federal share for projects using funding from this category is 90 percent. The program requires that at least 50 percent of each state's railway-highway crossings funds be set aside for the installation of protective devices at railway-highway crossings.

All prior program eligibilities for this funding have continued under the FAST Act. The FAST Act also extend eligibility to two new activities [FAST Act § 1412]:

- The relocation of highways to eliminate railway-highway grade crossings.
- Projects at railway-highway grade crossings to eliminate hazards posed by blocked crossings due to idling trains.

Congestion Mitigation and Air Quality (CMAQ)

Funding under the CMAQ program continues to provide a flexible funding source to state and local governments for transportation projects and programs in order to meet the requirements established by the Clean Air Act. CMAQ funding is used to reduce congestion and improve air quality for areas that are in nonattainment for ozone, carbon monoxide, or particulate matter. Former nonattainment areas that are now in compliance, and maintenance areas, are eligible for CMAQ funds as well. The funding ratio is 80/20. However, interstate projects that add HOV or auxiliary lanes have a funding ratio of 90/10.

National Highway Freight Program (NHFP)

The National Highway Freight Program is a new funding category that was created by the FAST Act. This program is designed to improve the efficient movement of freight on the National Highway Freight Network (NHFN.) The FHWA states that the goals of this program are:

- Investing in infrastructure and operational improvements that strengthen economic competitiveness, reduce congestion, reduce the cost of freight transportation, improve reliability, and increase productivity.
- Improving the safety, security, efficiency, and resiliency of freight transportation in rural and urban areas.
- Improving the state of good repair of the NHFN.
- Using innovation and advanced technology to improve NHFN safety, efficiency, and reliability.
- Improving the efficiency and productivity of the NHFN.
- Improving state flexibility to support multi-State corridor planning and address highway freight connectivity.
- Reducing the environmental impacts of freight movement on the NHFN. [23 U.S.C. 167 (a), (b)]

The funding ratio is 80/20. However, interstate projects that add HOV or auxiliary lanes have a funding ratio of 90/10.

NHFP funds must be used in order to contribute to the efficient movement of freight on the NHFN. Projects using NHFP funds must be identified in a freight investment plan that is included in a state's freight plan.

Potential Local Funding Sources

Property Taxes

Any costs not covered by federal and/or state programs will be the responsibility of the local governmental jurisdictions. Local funding can come from a variety of sources, such as property taxes, sales taxes, user fees, special assessments, and impact fees.

Each of these potential sources is important and warrants further discussion.

Property taxation has historically been the primary source of revenue for local governments in the United States. According to the Tax Policy Center[2] from the Urban Institute & Brookings Institution, property taxes account for just over 76 percent of all local tax revenues. These taxes make up approximately 30 percent of all locally generated revenue. Property is not subject to taxation at the federal level. State governments have, in recent years, shown an increasing willingness to leave this important source of funding to local governments.

Property Taxes

Approximately 30% all Locally Generated Revenue

General Sales Taxes

The general sales and use tax is another important revenue source for local governments. The most commonly known form of the general sales tax is the retail sales tax. The retail sales tax is imposed on a wide range of commodities. The rate is usually a uniform percentage of the selling price. Sales taxes account for approximately seven (7) percent of all locally generated revenue. The remaining revenue sources for local government include transfers, individual income taxes, other taxes, and other charges and miscellaneous income.

User Fees

User fees are fees, taxes, or impost payments that are collected from those who utilize a service or facility. The fees are collected to pay for the cost of a facility, its operations, and/or generate revenue for other uses. User fees are commonly charged for public parks, water and sewer services, transit systems, and solid waste facilities. The intent behind user fees is that those who directly benefit from these public services pay for the costs.

2 http://www.taxpolicycenter.org/briefing-book/what-are-sources-revenue-local-governments

Special Assessments

A special assessment is a method of generating funds for public improvements, whereby the cost of the improvement is collected from those who directly benefit from it. However, special assessments are different from user fees. The owners of property located adjacent to the new facility are assessed a portion of the cost, based on the amount of frontage they own along the new facility. In many instances, new streets are financed by special assessment.

Special assessments have also been used to generate funds for general improvements within special districts, such as central business districts. In some cases, these assessments are paid over a period of time, rather than as a lump sum payment.

Impact Fees

Development impact fees have been generally well received in other states and municipalities in the United States. New developments create increased traffic volumes on the streets around them. Development impact fees seek to place a portion of the cost of funding improvements on the developers that are creating, or adding to, the need for improvements. None of the municipalities within the MSA currently make use of these fees.

Bond Issues

Bonds can be issued by local governments upon the approval of the voting public. When approved, the bonds allow the local government additional spending to build projects. Property tax and sales tax funds can be used on a pay-as-you-go basis. As a result, the revenues from those taxes can be used to pay off general obligation or revenue bonds.

2045 MTP Funding Forecast

Excluding Fort Campbell (which conducts its own planning), an average of $37 million per year in 2017 dollars is forecasted to be available for all jurisdictions in the MPA, assuming that future funding for transportation improvements will be consistent with the level of expenditure indicated by recent historical data. These state and federal funds for transportation improvements in the MPA will use MPO designated funding, KYTC, and TDOT funds. By factoring in an inflation rate of three percent for Tennessee, and four percent for Kentucky, ***the total amount forecasted to be available through 2045 is $1.9 billion.*** The annual amounts available each year are aggregated to the three time periods of the MTP. The historic and forecast funding for roadway projects in the MPA are shown in Appendix F. Note that the funding for the years 2018, 2019, and 2020 is determined by the MPO's TIP since those values are already known.

This results in the following levels of state and federal funding to be available for each stage:

1. **Stage 1 (2018-2026) - $433,784,550**
   $349,097,818 from Tennessee, and $84,686,732 from Kentucky
2. **Stage 2 (2027-2036) - $655,646,925**
   $518,900,103 from Tennessee, and $136,746,822 from Kentucky
3. **Stage 3 (2037-2045) - $796,409,962**
   $617,987,792 from Tennessee, and $178,422,171 from Kentucky

9.2 | Public Transit Funding

Potential Federal Funding Sources

There are many federal funding sources for public transit. Most of these sources are programs funded by the Federal Transit Administration (FTA) or the Federal Highway Administration (FHWA). While funded by federal agencies, these programs are administered by the states. The following federal funding programs are formula-based or discretionary grants that are funded by the federal government and available for transit providers in the Clarksville MPA to utilize.

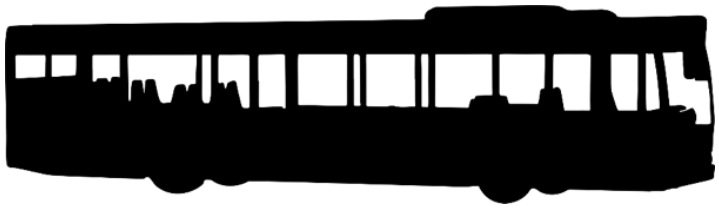
Metropolitan Transportation Planning (Section 5303)

This formula-based funding program provides funding and procedural requirements for multimodal transportation planning in metropolitan areas. The planning efforts must follow the 3C process and result in long-range plans and short-range programs of transportation investment priorities. The maximum federal share for this funding category is 80 percent, with a required local match minimum of 20 percent. This funding category is only available to Metropolitan Planning Organizations. The funds are first apportioned to the state DOTs, which are then allocated to the MPOs.

Urbanized Area Formula Grants (Section 5307)

This formula-based funding program provides funds for capital and operating assistance for transit operations in urbanized areas and for transportation-related planning. The funds can be used for:

- planning, engineering, design and evaluation of transit projects, and other technical transportation-related studies;
- capital investments in bus and bus-related activities such as:
    - replacement of buses,
    - overhaul of buses,
    - rebuilding of buses,
    - crime prevention and security equipment,
    - construction of maintenance and passenger facilities;



- computer hardware/software; and
- operating assistance in urbanized areas under 200,000 in population, or with 100 or fewer fixed-route buses operating in peak hours.

Activities eligible under the former Job Access and Reverse Commute (JARC) program, which provided services to low-income individuals to access jobs, are now eligible under the Urbanized Area Formula program. The maximum federal share is 80 percent for capital projects, 50 percent for operating assistance, and 80 percent for ADA non-fixed route paratransit service.

Capital Investment Grants (CIG) (Section 5309)

Capital Investment Grants are the FTA's primary grant program for funding major transit capital investments. These investments include:

- heavy rail,
- commuter rail,
- light rail,
- streetcars, and
- bus rapid transit.

There is an annual call for applications and selection of awardees by the FTA. The law requires that projects seeking CIG funding complete a series of steps over several years to be eligible for funding. New Starts and Core Capacity projects require the completion of the Project Development and Engineering phases in advance of the receipt of a construction grant agreement. Small Starts projects require only the completion of the Project Development phase. The projects are required to be rated by the FTA at various points in the process according to statutory criteria used for evaluating project justification and local financial commitment.

Enhanced Mobility of Seniors and Individuals with Disabilities (Section 5310)

Grants for this funding category are made by the states to private non-profit organizations (and certain public bodies) to increase the mobility of seniors and persons with disabilities. The former New Freedom program (Section 5317) has been folded into this program. The New Freedom program provided grants for

services for individuals with disabilities that went above and beyond the requirements of the Americans with Disabilities Act (ADA). Activities that were eligible under New Freedom are now eligible under the Enhanced Mobility of Seniors and Individuals with Disabilities program. Eligible capital costs include buses, vans, radios, computers, engines, and transmissions.

Section 5310 funds are apportioned among the states by a formula. The formula is based on the number of seniors and people with disabilities in each state according to the latest available U.S. Census data. The maximum federal share is 80 percent for eligible capital costs, and 50 percent for operating assistance. The 10 percent that is eligible to fund program administrative costs including administration, planning, and technical assistance may be funded at a 100 percent federal share.

Rural Area Formula Grants (Section 5311)

This formula-based funding program provides funding that can be used for:

- administration,
- planning,
- capital,
- operating,
- job access and reverse commute projects, and
- the acquisition of public transportation services.

Eligible recipients for the grants include states and federally recognized Indian Tribes. Subrecipients may include state or local government authorities, nonprofit organizations, and operators of public transportation or intercity bus service. The federal share is 80 percent for capital projects, 50 percent for operating assistance, and 80 percent for ADA non-fixed route paratransit service.

Bus and Bus Facilities Formula Grants (Section 5339a)

This program provides funds to replace, rehabilitate, and purchase buses and related equipment. The funds may also be used to construct bus-related facilities. Eligible recipients include:

- designated recipients that operate fixed route bus service or that allocate funding to fixed route bus operators,
- state or local governmental entities, and
- federally recognized Indian tribes that operate fixed route bus service that are eligible to receive direct grants under 5307 and 5311.

A designated recipient that receives a grant under this section may allocate amounts of the grant to sub-recipients that are public agencies or private non-profit organizations engaged in public transportation. This is a capital grant program which requires a minimum 20 percent local match. However, the federal share may exceed 80 percent for certain projects related to the ADA, the Clean Air Act, and certain bicycle projects.

Other FTA Grant Programs

The FTA has several other funding sources for special programs, including:

- Public Transportation Emergency Relief Program (Section 5324)
- Public Transportation Innovation (Section 5312)
- Human Resources & Training (Section 5314b)
- Low and No-Emission Component Assessment Program
- Low or No-Emission Vehicle Program (Section 5339c)
- Mobility on Demand (MOD) Sandbox Program (Section 5312)
- Rural Transportation Assistance Program {Section 5311(b)(3)}
- Safety and Research Demonstration Program
- State of Good Repairs Grants (Section 5337)
- Technical Assistance & Standards Development - 5314(a)
- Tribal Transit Formula Grants - 5311(c)(2)(B)
- Zero Emission Research Opportunity (ZERO)
- CMAQ (FAST Act § 1114; 23 U.S.C. 149)

Surface Transportation Block Group Program (STBGP)

The STBGP provides funding that may be used by states and localities for a wide range of projects, including transit and intercity bus. The local match requirements vary based on the project and facility type. Funds that were previously available through the TAP have been created as a set-aside in the STBGP.

National Highway Performance Program (NHPP)

The NHPP funds for transit apply in the same manner as described in Section 9.1: Roadway Funding. However, with transit projects, the local match requirement varies.

Potential Local Funding Sources

Local funding sources include the same potential sources as local roadways revenue, outlined previously. Fare revenue, a user fee, is an important but relatively small local funding source.

IMPROVE Act

The State of Tennessee approved the IMPROVE Act[3] in 2017. This legislation changed Tennessee tax laws for fuel, vehicle registration, and other revenue sources. A major provision in the IMPROVE Act is the ability for local governments to increase revenue for public transit by levying surcharges on a variety of local taxes. This includes sales, business tax, and rental car taxes. These surcharges may only be applied after a local referendum approves the changes.

3 http://www.comptroller.tn.gov/Repository/RE/OREA%20IMPROVE%20Act_July%202017.pdf

2045 MTP Funding Forecast

The Clarksville Transit System currently receives funds from:

- federal programs and grants,
- the States of Tennessee and Kentucky,
- the City of Clarksville,
- fare box charges,
- advertising,
- investment income, and
- other non-transportation funds.

Additional Information about the federal programs and grants used by CTS can be obtained from their office. Historic funding from 2010 through 2016 CTS COA was provided to the MPO. It contained the funding received from federal, state, and local sources; as well as fare box charges. Based on the historic funding, an average of $5.9 million per year in 2017 dollars is forecasted to be available for transit. **By using the same inflation rate of three percent used for Tennessee portion of the MPO roadway funding, the total amount forecast to be available through 2045 is $261.1 million. The historic and forecast funding for transit operations in the MPA are shown in Appendix F.**

Based on these assumptions, the following levels of state and federal funding for public transit in the MPO can be expected to be available through 2045:

1. Stage 1 (2018-2026) - $61,784,942
2. Stage 2 (2027-2036) - $90,969,074
3. Stage 3 (2037-2045) - $108,340,270

9.3 | Bicycle and Pedestrian Funding

Future federally funded transportation projects will present many opportunities for bicycling and pedestrian facilities to be incorporated, unless exceptional circumstances exist. In order to assess the project-specific bicycle and pedestrian needs, the surrounding context will be considered, including:

- land use patterns;
- existing, informal bicycle or pedestrian activities;
- any reference to bicycle or pedestrian needs in the planning process; and
- public, agency, or other comments requesting bicycle or pedestrian facilities.

This approach is consistent with federal guidance.

Potential Federal Funding Sources

Many of the major federal roadway and public transit funding sources described in previous sections of this chapter are flexible enough to fund construction of bicycle and pedestrian facilities. However, the MTP forecasted the available independent bicycle and pedestrian funding based on the set-aside STBGP funding available. This funding represents the now-defunct TAP program under MAP-21 that previously funded such projects.

Potential Local Funding Sources

Local funding sources include the same potential sources as local roadways revenue, outlined in Section 9.1.

2045 MTP Funding Forecast

Bicycle and pedestrian improvements are funded through the set asides in the STBGP for the Transportation Alternatives. Additional bicycle and pedestrian improvements can be funded through a transfer of NHPP funds. For MPAs with a population of 5,000 to 200,000 persons, such as the Clarksville MPA, the transfer of funds for Transportation Alternatives is discretionary by the state and is determined on an annual basis. Forecast funding for Transportation Alternatives is included in the overall federal funding forecast shown earlier.