CITY OF FRANKLIN

COOL SPRINGS
Transportation Network Study

FINAL REPORT

CONTENTS

TABLES

FIGURES

EXECUTIVE SUMMARY

The principal purpose of the Transportation Network Study is to provide the City of Franklin with a coordinated plan of transportation improvements to be made as development occurs in the Cool Springs area. These improvements will improve safety of all roadway users, improve traffic flow, and preserve roadway capacity. The study objectives were to:

1. Inventory and analyze existing conditions;
2. Evaluate potential impacts to the transportation system from currently approved and future development scenarios;
3. Recommend infrastructure and operational improvements; and
4. Recommend policy strategies for achieving desired transportation outcomes.

Introduction

Part 1 of this study, the Introduction, presents the project objectives listed above as well as the study area and study intersections.

The city of Franklin is located within Williamson County in the Middle Tennessee region. The Cool Springs area is located in the northeastern part of Franklin near the southern boundary of Brentwood.

This study focuses on the operations of fifty-six signalized and eight unsignalized intersections. The fifty-eight intersections in Franklin and six intersections in Brentwood make up the majority of the Cool Springs transportation network.

Existing Conditions

Part 2 of this study, The Existing Conditions Report, includes a discussion of the existing conditions of the Cool Springs roadway network and a review of the existing development policies for the City of Franklin.

In order to evaluate the existing conditions in the study area, PTV Vistro, a traffic simulation software, was used to create a model of the transportation network that evaluated traffic operations for the study intersections.

Extensive field observations and intersection inventories were conducted for each of the study intersections to ensure that the traffic simulation model accurately reflected the existing conditions. Part 2 of this report details this process and includes the following information:

- Study Intersections
- Roadway Infrastructure
- Data Collection
- VISTRO Modeling
- Capacity Analysis
- Policy Review

Under existing conditions, the results of the capacity analysis indicate that percent of intersections operate at LOS E or better in the AM, Midday, and PM peak is as follows:

AM Peak	100%
Midday Peak	98%
PM Peak	95%

Future Conditions

Part 3 of this study, the Future Conditions Report, presents the conditions of the roadway network in Cool Springs after accounting for traffic impacts of approved and potential developments within the study area.

The Cool Springs area has experienced significant growth over the past 20 years, and this trend is expected to continue. The Future Conditions Report presents general growth projections, projections due to approved development, and projections based on future

development potential within the Cool Springs area. In order to understand the implications of future growth on the transportation network, the following four growth scenarios were tested using the Vistro model:

1. Approved Development – 50%
2. Approved Development – 100%
3. Maximized Development – 25%
4. Maximized Development – 50%

'Approved Development' represents the developments that are approved to be built within the study area, as of April 2020, for which traffic studies were completed as part of the approval process. These approved developments also include a list of recommended improvements that corresponds with each approved development.

'Maximized Development' represents potential development, redevelopment, and infill opportunities of parcels within the study area. Using a combination of land use, zoning, and property assessment data, these future development opportunities were quantified in coordination with the City of Franklin Planning Department.

Results of each scenario determined the future operations of the Cool Springs transportation network, which were then evaluated to create a coordinated plan of transportation improvements.

Under Scenario 1, the results of the capacity analysis indicate that percent of intersections operate at LOS E or better in the AM, Midday, and PM peak is as follows:

AM Peak	94%
Midday Peak	94%
PM Peak	86%

Under Scenario 2, the results of the capacity analysis indicate that percent of intersections operate at LOS E or better in the AM, Midday, and PM peak is as follows:

AM Peak	80%
Midday Peak	83%
PM Peak	63%

Under Scenario 3, the results of the capacity analysis indicate that percent of intersections operate at LOS E or better in the AM, Midday, and PM peak is as follows:

AM Peak	33%
Midday Peak	8%
PM Peak	9%

Under Scenario 4, the results of the capacity analysis indicate that percent of intersections operate at LOS E or better in the AM, Midday, and PM peak is as follows:

AM Peak	16%
Midday Peak	3%
PM Peak	3%

Recommendations

The Recommendations Report, Part 4, presents the proposed immediate, short-term, mid-term, and long-term roadway infrastructure recommendations for the study area. Additionally, policy recommendations are also presented.

Field inventories were collected for each study intersection in December 2019 and January 2020. From those inventories, an initial set of recommendations was determined for immediate roadway improvements. These improvements include refreshing striping, sidewalk repairs, sign repair/replacement, and additional observations. Recommendations for forty-seven of the study intersections are presented under immediate recommendations.

Short-term recommendations indicate improvements that could occur within the next

five years. This study presents **three short-term recommendations**. These recommendations include the addition of right-turn lanes and roadway restriping where right-of-way acquisition is minimal.

Under both Future Conditions – Scenario 1 and Future Conditions – Scenario 2 with the implementation of the short-term recommended improvements, the three study intersections are expected to operate at LOS E or better in the AM, Midday, and PM peak hour.

Mid-term recommendations indicate improvements that could occur in the next five to ten years. This report presents **seventeen mid-term recommendations**. These recommendations include the addition of turn lanes and through lanes and roadway restriping where right-of-way acquisition will be required.

Under both Future Conditions – Scenario 1 and Future Conditions – Scenario 2 with the implementation of the mid-term recommended improvements, the majority of the seventeen study intersections are expected to operate at LOS E or better in the AM, Midday, and PM peak hour.

Due to high levels of congestion from maximized development, it was determined that Future Conditions – Scenario 3 and Future Conditions – Scenario 4 would benefit more from policy improvements rather than further infrastructure improvements. Therefore, no infrastructure improvements are recommended for Future Conditions – Scenario 3 and Future Conditions – Scenario 4 under short-term and mid-term recommendations.

Long-term recommendations indicate improvements that could occur after ten years. Recommendations for corridor wide improvements and alternative intersections are presented under long-term improvements.

Functional plans for each of the proposed short-term and mid-term roadway improvements are provided in Appendix R of this report.

Recommendations for policy changes are presented in Part 4 of this report. Policy recommendations focus on three core areas. The first centers around the City's development approval practices, specifically the need to reevaluate them to find alternative ways to measure and address development impacts. The second set of recommendations focuses on strategies for reducing vehicular trips on the roadway network by incentivizing alternative modes such as walking, biking, or taking transit, or changing other travel behaviors. The final set of policy recommendations focuses on the funding, design, and implementation of multimodal infrastructure to accommodate current and future modes of travel in Cool Springs. Combined, these recommendations complement the infrastructure improvements to preserve the quality of life for Franklin residents and the economic vitality of the study area long term.

Part 1

INTRODUCTION

Project Description

Study Area

PROJECT DESCRIPTION

A properly planned transportation system plays a critical role in a community's sustainability and livability. The Cool Springs Transportation Network Study is a strategic effort to evaluate the existing and future conditions of the Cool Springs transportation network, including roadways, sidewalks, and various multimodal facilities. This document serves as a guide for community decision-makers as they respond to and anticipate future growth while guiding the smart evolution of the Cool Springs area of the City of Franklin.

This Transportation Network Study specifically:

1. Inventories and analyzes existing conditions
2. Evaluates potential impacts to the transportation system from future development scenarios
3. Recommends infrastructure and operation improvements
4. Recommends policy strategies for achieving desired transportation outcomes.

The principal purpose of the Transportation Network Study is to provide the City of Franklin with a coordinated plan of transportation improvements to be made as development occurs and to improve safety of all roadway users, improve traffic flow, and preserve roadway capacity.

Study Area

The City of Franklin is located within Williamson County in the Middle Tennessee region (Tennessee Department of Transportation (TDOT) Region 3), as illustrated in Figure 1-1. According to the U.S. Census, in 2017, Franklin was named the 8th fastest growing city in the nation. Franklin's location within the region and its proximity to the Nashville area draws new residents, industries, and visitors alike.

The Cool Springs area, outlined in red in Figure 1-1, is a mixed-use, with residential, commercial, and retail development located along the northeastern boundary of Franklin and the southwestern boundary of Brentwood. Due to its location along I-65, Cool Springs is expected to continue to see growth and development.

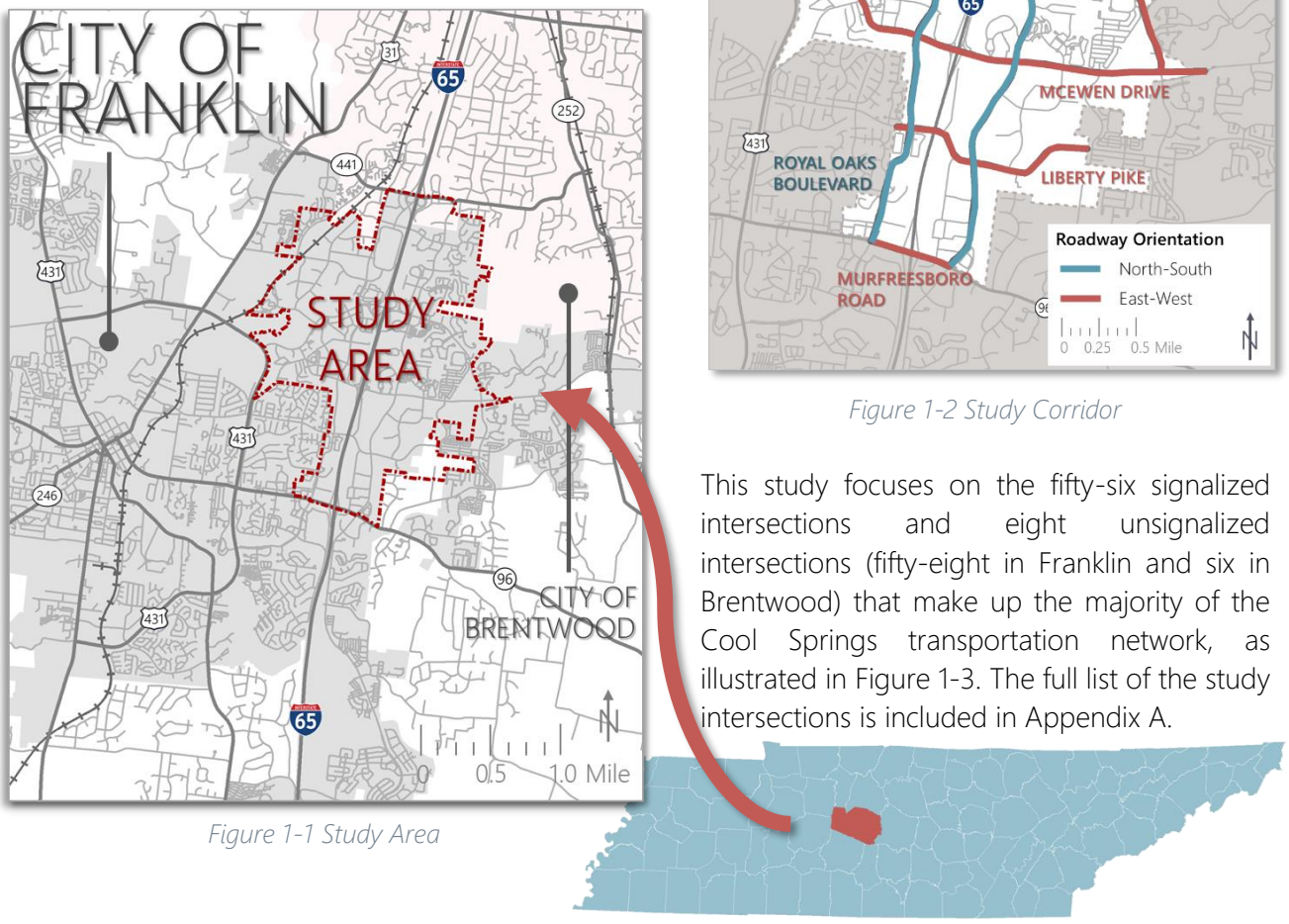


Figure 1-1 Study Area

The study area includes 19.02 miles of roadway along ten focus corridors, illustrated in Figure 1-2. Mallory Lane/Royal Oaks Boulevard, Carothers Parkway, and Galleria Boulevard are typically oriented in the north-south direction; while Moores Lane, Bakers Bridge Avenue, Mallory Station Road, Cool Springs Boulevard, McEwen Drive, Liberty Pike, and Murfreesboro Road are typically oriented in the east-west direction.

Figure 1-2 Study Corridor

This study focuses on the fifty-six signalized intersections and eight unsignalized intersections (fifty-eight in Franklin and six in Brentwood) that make up the majority of the Cool Springs transportation network, as illustrated in Figure 1-3. The full list of the study intersections is included in Appendix A.

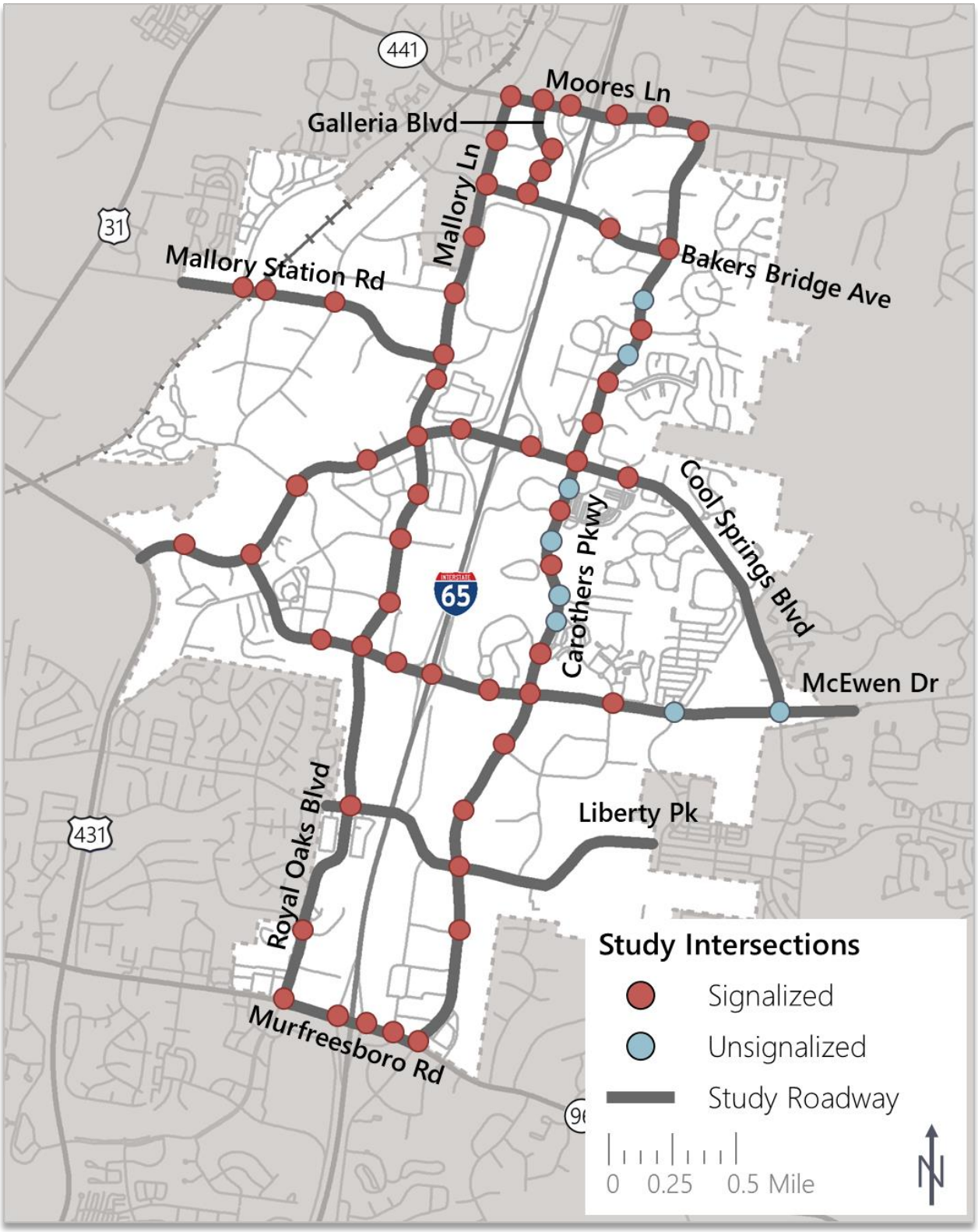


Figure 1-3 Study Intersections

Part 2

EXISTING CONDITIONS

Roadway Infrastructure

Data Collection

VISTRO Modeling

Capacity Analysis

Policy Review

Chapter 1

ROADWAY NETWORK

Due to its geographical proximity to the Nashville region, the city of Franklin has seen significant growth and development over the past couple decades. Development patterns within the city of Franklin have had a strong influence over the transportation network and how it operates today. Understanding the implications of continual growth on the transportation system is vital to the sustainability of the city of Franklin, and specifically for this study, in the Cool Springs area.

This chapter sets the stage for looking at future growth by first documenting the existing conditions in the study area. To accomplish this, the following were taken into consideration:

- Roadway Infrastructure
- Existing Traffic Patterns
- Data Collection
- Model Development
- Capacity Analysis

To evaluate the existing traffic operations within Cool Springs, a model of the network was created using the traffic simulation software PTV Vistro. To ensure that the traffic simulation model accurately reflects existing conditions, extensive field observations and intersection inventories were conducted for all sixty-three of the study intersections.

Roadway Infrastructure

Functional Classification

Roadways are assigned a functional classification based on a roadway's design function to provide regional mobility, local accessibility, or both. The Federal Highway Administration (FHWA) establishes four main classes. A description of each of these functional classifications are displayed below. Figure 2-2 illustrates the classifications of the Cool Springs roadway network.

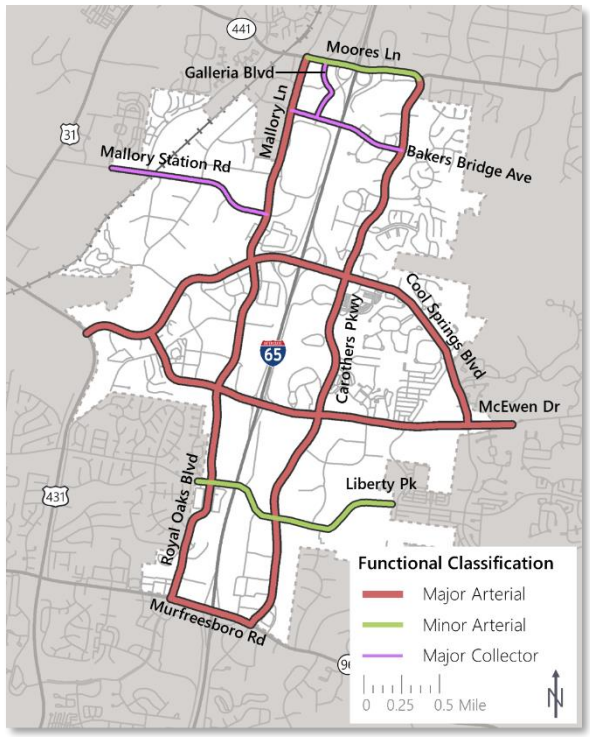


Figure 2-2 Functional Classification

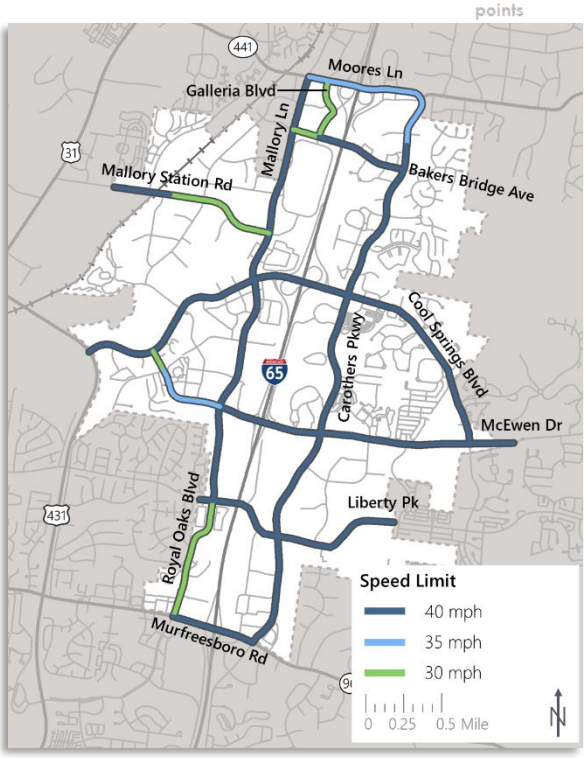


Figure 2-1 Posted Speed Limit

Speed Limits

The posted speed limits for the study corridors are presented in Figure 2-1. Detailed approach speeds for each study intersection are presented in Appendix C. According to Franklin's Code of Ordinances, where speed limits are not posted, the speed limits should be as follows:

- Highways & Non-Local Roads: 30 mph
- Alleys: 15 mph
- Residential & Local Roads: 25 mph

Data Collection

In order to develop a calibrated Vistro model of the Cool Springs area, a detailed inventory of the signal system was performed using data obtained from the City of Franklin, the City of Brentwood and field observations performed by the project team. This section details the components of the data collection.

Turning Movement Count (TMC)

In order to provide data for the study, vehicle, pedestrian, and bicycle count data was collected for the study area. Manual turning movement counts were collected at the study area intersections for a typical weekday while schools were in session from 6:00 – 9:00 AM, 11:00 AM – 1:00 PM, and 4:00 – 6:00 PM. From the turning movement counts, AM, Midday, and PM peak hour traffic volumes were determined. Detailed peak hour turning movement counts and a figure depicting the turning movement counts can be found in Appendix B. The majority of the turning movements counts were completed in January 2020, however, counts conducted within the past two years were utilized for some intersections. Counts conducted before 2020 were factored up to represent 2020 volumes.

Field Inventory

A detailed inventory of each intersection was conducted between December 2019 and January 2020. The following information was included in the field inventory of each intersection:

- Approach Speed
- Intersection Geometry and Laneage
- Storage/Taper Lengths
- Turn Lane Treatments
- Pedestrian Treatments
- Pertinent Signing/Markings
- Approach Grade
- Queue Observations
- Vehicle Detection
- Signal Heads and Phasing

Detailed field inventory sheets for each study intersection are included in Appendix C.

Peak Hour Observations

On Wednesday, January 29, 2020, peak hour observations of the Cool Springs area network were conducted. In the AM, Midday, and PM peak hours, multiple teams traversed the network recording the following observations:

- Queue Lengths
- Queue Clearance
- Lane Utilization
- General Patterns and Observations

One example observation includes:

- McEwen Drive and Carothers Parkway
    - 7:24 AM – ~100% of northbound left-turns were using the right-most left-lane.
    - 8:07 AM – Eastbound left-turn queue was 20+ cars. Two cars failed to clear.

Detailed peak hour observations are included in Appendix D.

Signal Timing Data

Existing signal timing plans were obtained from the City of Franklin and the City of Brentwood. Signal timing plans typically include the following information:

- Minimum Green, Yellow, and Red Time
- Pedestrian Timings
- Time of Day (TOD) Plans
- Coordination Information

Detailed signal timing plans for each of the signalized study intersections are presented in Appendix E.

Drone Footage

The project team captured drone footage of the study area to provide a high-quality aerial view of how study intersections operate. Video was collected on February 2, 2020 between 7:30 AM and 4:30 PM. The drone footage was used to aid in the validation of the results from the existing conditions Vistro model. Figure 2-3 presents captures from the drone footage. The drone footage was electronically provided to the City for their future reference.

Figure 2-3 Stills from Drone Footage

Multimodal Accommodations

Sidewalks are provided throughout the study area. Figure 2-4 depicts the existing sidewalk infrastructure within the study area, and Table 2-1 presents the miles of sidewalk on at least one side of the roadway in relation to the total roadway mileage. It should be noted that, within the study area, there are a low number of pedestrian trips for utilitarian trip purposes; therefore, pedestrian counts were not taken into account for this study. Most observed pedestrian trips were for presumedly recreational purposes.

Table 2-1 Existing Roadway with Sidewalk

Roadway with Sidewalk	16.34 mi
Total Roadway	19.02 mi

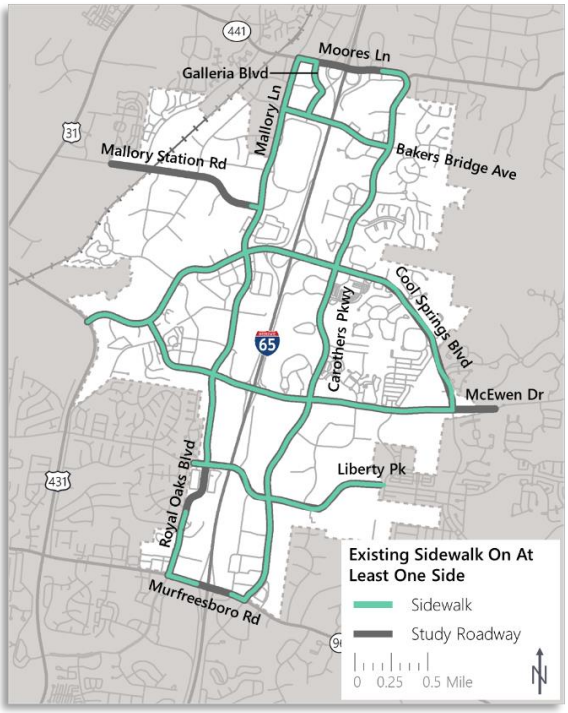


Figure 2-4 Existing Sidewalk

In addition to sidewalks, fifty-two of the sixty-four intersections have pedestrian infrastructure (i.e. pedestrian signals crossing the major and/or minor roadway, crosswalks crossing the major and/or minor roadway). The pedestrian infrastructure for each study intersections is shown in Figure 2-5 with a symbol. The symbol is divided into four sections which when filled in with color indicate a pedestrian facility provided at the intersection. For example, the intersection of Cool Springs Boulevard and Carothers Parkway, indicated by in Figure 2-5, includes the following pedestrian facilities:

- Signals – To Cross the Major Road
  - Indicated By:
- Signals – To Cross the Minor Road
  - Indicated By:
- Crosswalk – To Cross the Major Road
  - Indicated By:
- Crosswalk – To Cross the Minor Road
  - Indicated By:

Symbols which are only partially filled in with color, , indicate study intersections with limited pedestrian facilities. Symbols which are blank indicate that no pedestrian infrastructure is currently provided at the study intersection.

Table 2-2 details the number of intersections that utilize each type of pedestrian infrastructure. It should be noted that the table and figure both indicate pedestrian infrastructure on at least one side of the roadway.

Table 2-2 Tally of Pedestrian Infrastructure

Major Road - Signal	39
Minor Road - Signal	43
Major Road - Crosswalk	44
Minor Road - Crosswalk	47
No Infrastructure	12

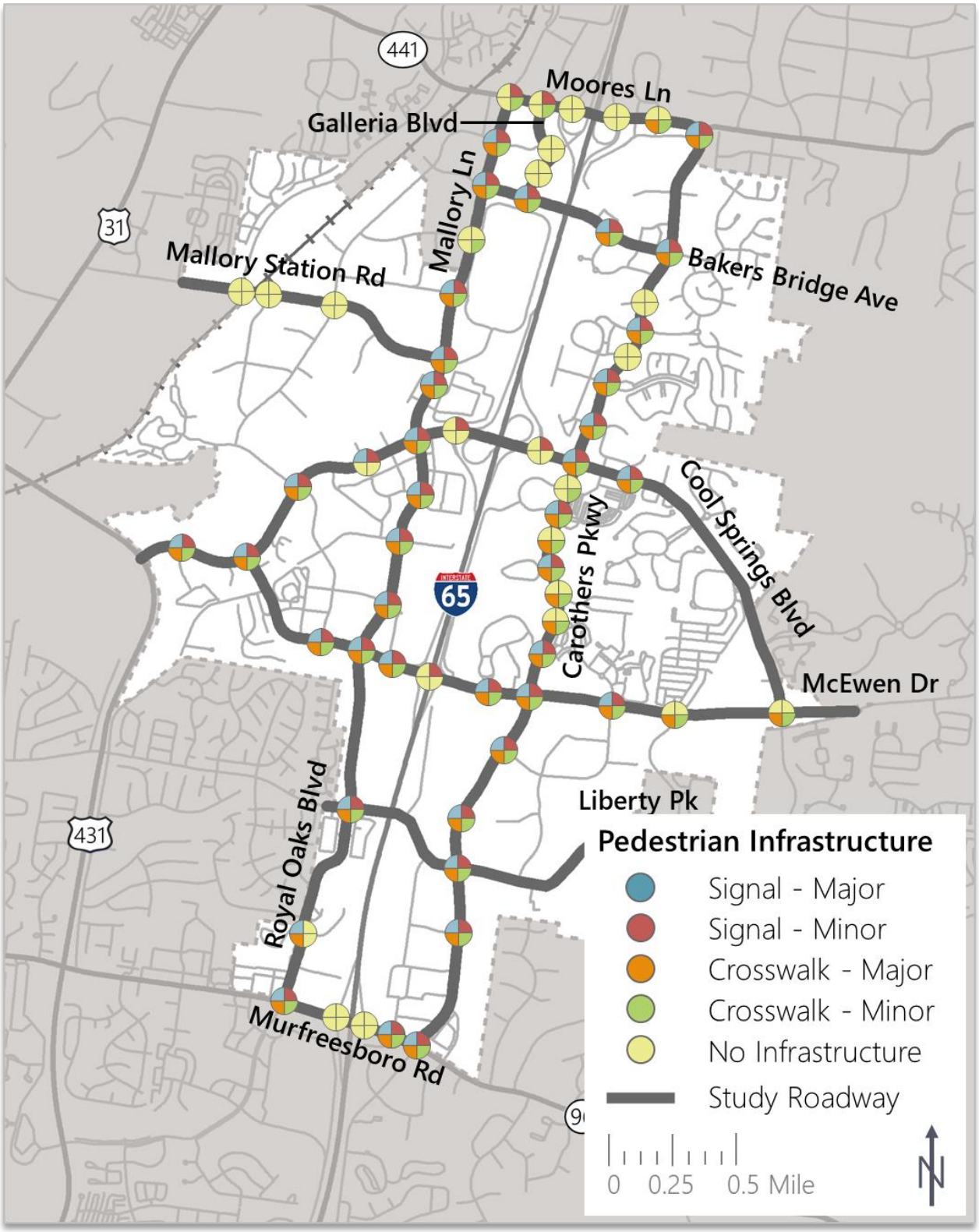


Figure 2-5 Pedestrian Infrastructure

Within the project area, there are bicycle facilities along McEwen Drive, Carothers Parkway, and Liberty Pike. West of Mallory Lane, McEwen Drive is categorized as a signed shared roadway, and east of Mallory Lane, McEwen Drive has bike lanes in each direction. Carothers Parkway is categorized as a multi-use path to the south of Cool Springs Boulevard. Liberty Pike has bike lanes in each direction. These facilities are illustrated in Figure 2-6, and Table 2-3 describes the associated mileage. It should be noted that Figure 2-6 and Table 2-3 includes multi-use paths that are within the study area, but not on the study roadways. Additionally, within the study area, there are a low number of bicycle trips for utilitarian trip purposes. Most observed bicycle trips were for recreational purposes.

Table 2-3 Bicycle Facilities Mileage

Bike Lane	3.52 mi
Multi-Use Path	5.26 mi

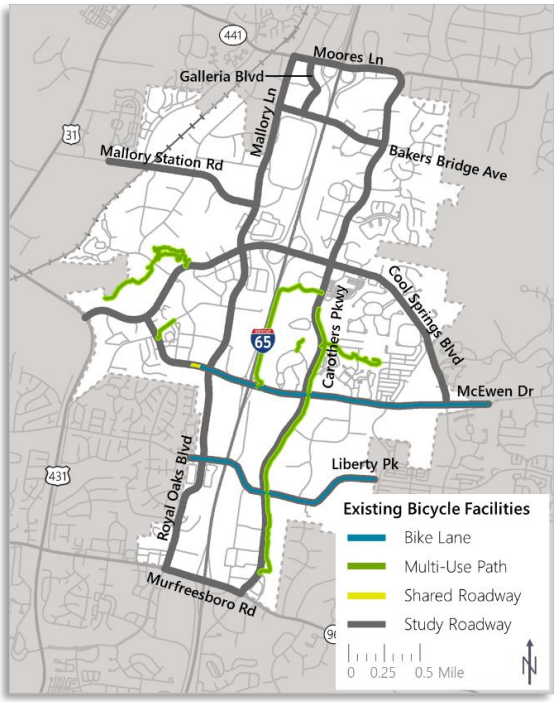


Figure 2-6 Bicycle Facilities

The Franklin Transit Authority (FTA) offers two transit lines within the city of Franklin; Red Route and Blue Route. The Blue Route and the Blue Route 2 run through the Cool Springs area along Mallory Lane and Carothers Parkway, respectively. Figure 2-7shows the bus stops and transit route that travel through the study area. Table 2-4 details the number of bus stops for each route within the study area. For both routes, stops occur every thirty minutes on weekdays. For the Blue Route only, stops occur every sixty minutes on Saturdays. No service is provided on Sundays for either route.

Table 2-4 Public Transit Stops within Study Area

Blue Route	8
Blue Route 2	14

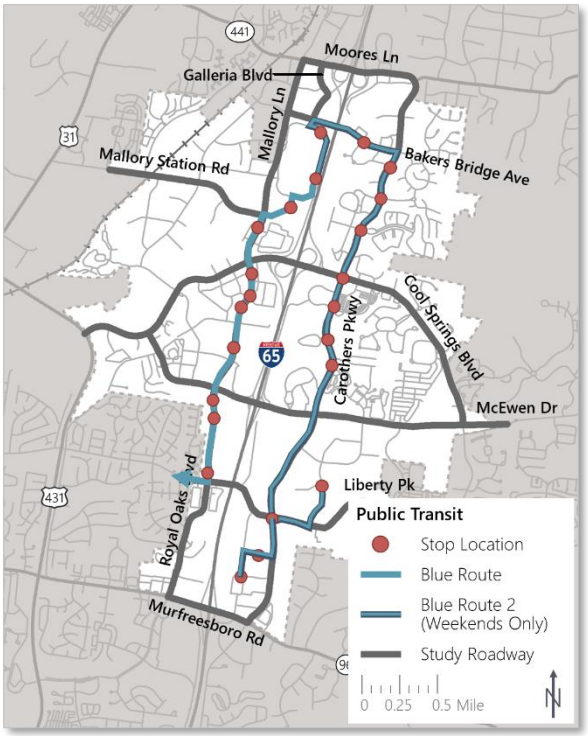


Figure 2-7 Public Transit

VISTRO Modeling

Studying roadway networks in the field can often be difficult and time consuming, especially when considering future developments within an area. Therefore, simulation software is typically used to model roadway networks for traffic studies. This study specifically utilized PTV Vistro to model the Cool Springs area.

According to PTV Group, "PTV Vistro is an all-in-one solution for conducting traffic analyses, evaluating new development impact, and optimizing signal timing." Roadways can be drawn to mimic existing facilities, and new developments can be incorporated into the model. Vistro is an excellent tool for analyzing the impacts of future developments within an area. In addition to having capacity analysis capabilities, Vistro can be used to analyze the cumulative impacts of development over time.

The lane geometry, speed limits, turning movement counts, and signal timing data described above were used to develop the Vistro model, shown in Figure 2-8. The drone footage and field observations were used to aid in the calibration and validation of the Vistro model based on the comparison between observed queuing and delay and the reported Vistro queuing and delay.

In addition to the above information, the following inputs were also considered:

- Peak Hour Factors
- Heavy Vehicle Factors
- Lost Time
- Turn Bay Lengths

These inputs are described in greater detail in Appendix F.

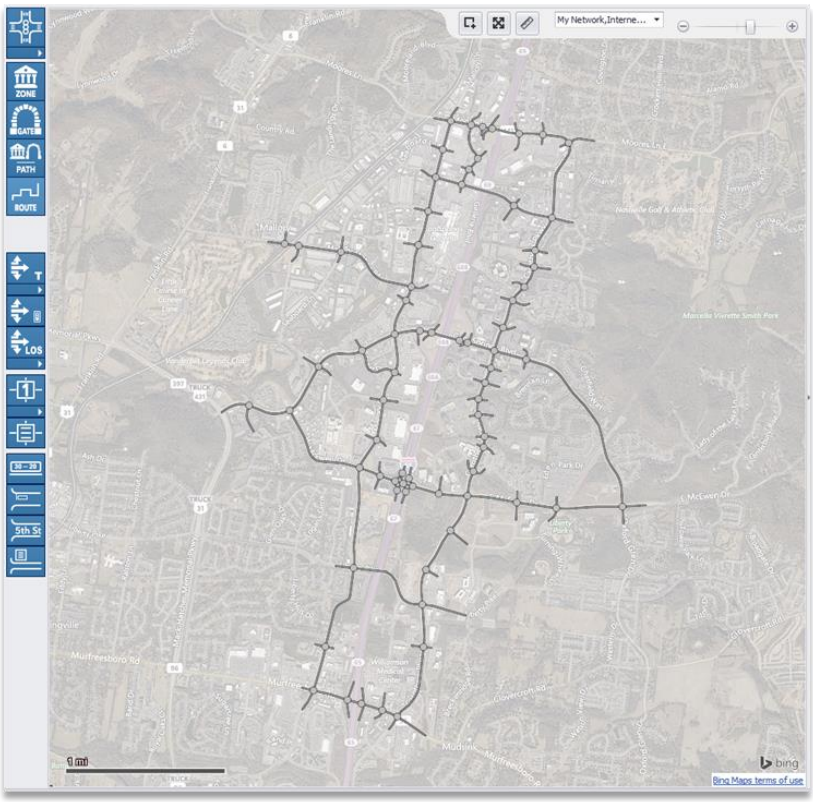


Figure 2-8 Cool Springs Vistro Model

Capacity Analysis

Operations

Capacity describes the maximum number of vehicles that can utilize a roadway segment or intersection under a given set of conditions. This measurement is typically expressed as number of vehicles per unit of time (i.e. vehicles per hour).

Vehicle Level of Service (LOS) is a measurement used to identify how well a roadway segment or intersection is able to accommodate traffic volumes with the roadway's capacity. This measurement is generally expressed as a function of vehicular delay, or how much time a driver spends at that location. Pedestrian and Bicycle Level of Service (PLOS and BLOS, respectively) express the degree of satisfaction of sidewalk or bicycle facilities offered to the pedestrian or cyclist with respect to safety, comfort, and convenience.

Based on the amount of delay experienced, LOS is assigned a "grade" between LOS A and LOS F. LOS A is the highest condition rating with vehicles experiencing minimal delay, while LOS F is considered the worst with vehicles experiencing excessive delay.

Figure 2-10, Figure 2-11, and Figure 2-12 depict the vehicle LOS for each of the study intersections in the AM, Midday, and PM peaks, respectively. Table 2-5 details the number of intersections for each vehicle LOS grade for each respective peak.

Figure 2-13 depicts the PLOS provided by the Nashville MPO. The BLOS for the study are is not included within this report; however, detailed BLOS for the study area can be found on the Nashville MPO website.

Table 2-5 Intersection Tally by Existing LOS

LOS	A	B	C	D	E	F
AM	23	19	11	8	3	0
Mid	14	18	21	8	2	1
PM	9	18	22	7	5	3

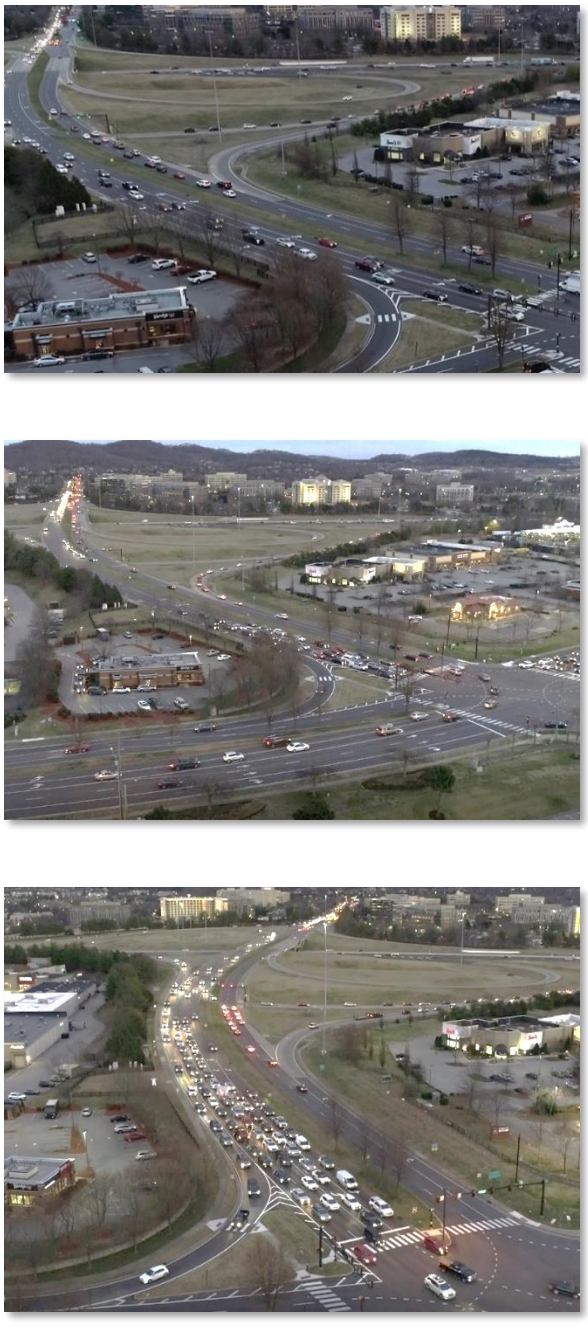


Figure 2 - 9 Mallory Lane and Cool Springs Boulevard

Figure 2-10 Existing Vehicle LOS - AM Peak

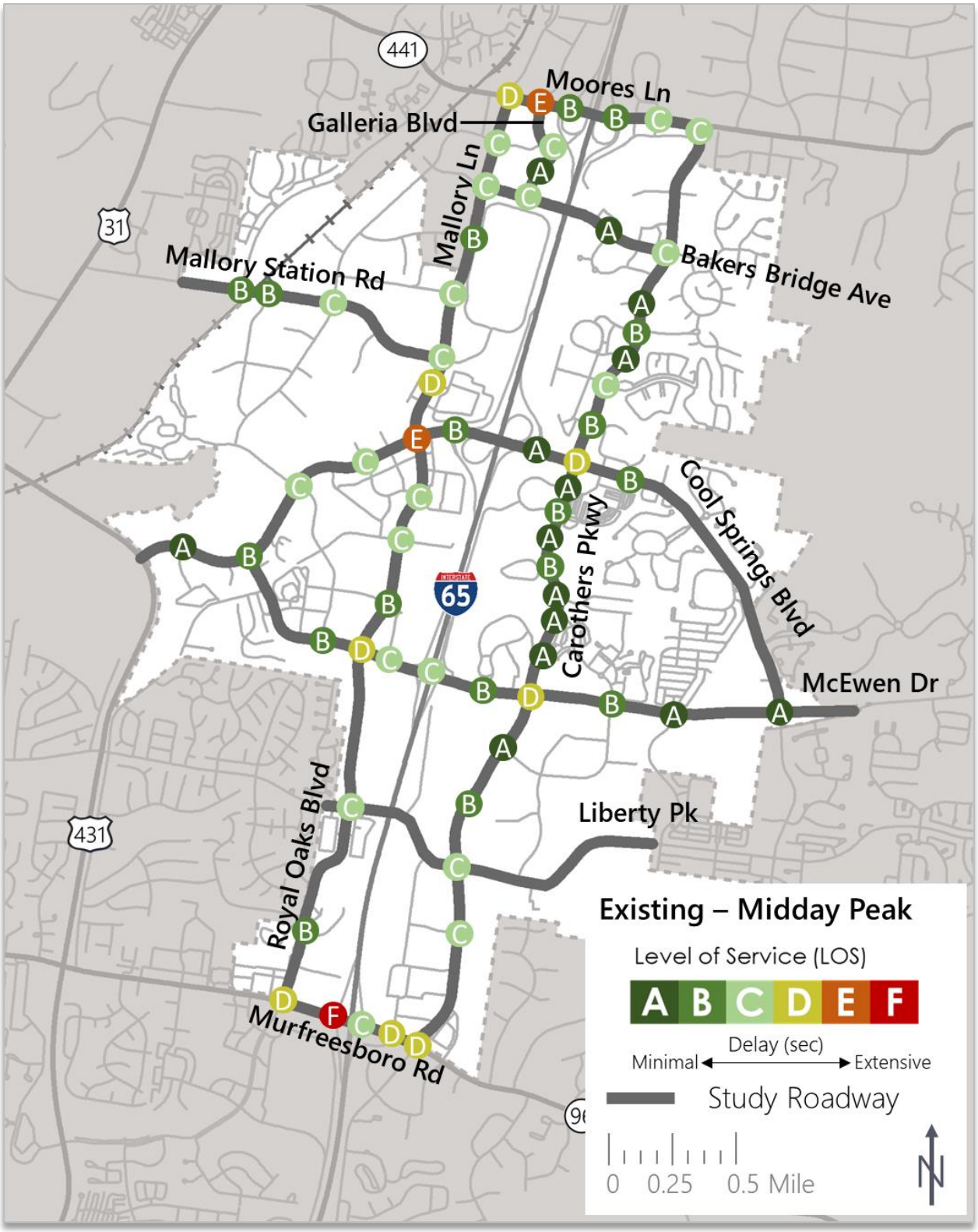


Figure 2-11 Existing Vehicle LOS - Midday Peak

Figure 2-12 Existing Vehicle LOS - PM Peak

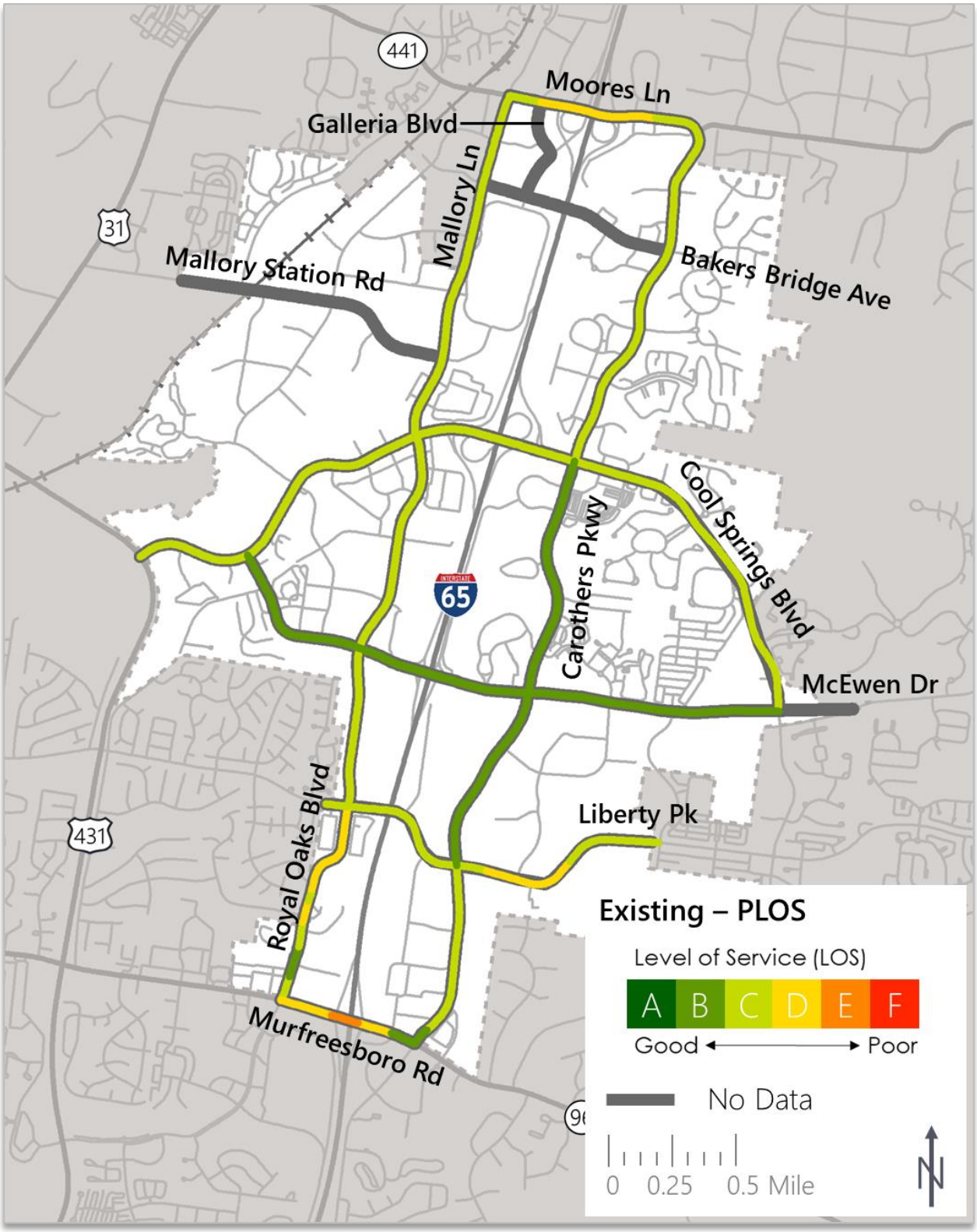


Figure 2-13 Existing Pedestrian LOS, Nashville MPO

Volume-to-capacity ratio (v/c ratio) is a measurement used to indicate how an intersection is operating in terms of capacity, where capacity is defined as the maximum number of vehicles that can utilize an intersection per hour. According to the *Highway Capacity Manual* (HCM), an intersection with a v/c ratio less than 0.85 is operating under capacity, an intersection with a v/c ratio at 1.0 is operating at capacity, and an intersection with a v/c ratio greater than 1.0 is operating over capacity. Figure 2-14, Figure 2-15, and Figure 2-16 depict the Vistro model results for the v/c ratio of each study intersection in the AM, Midday, and PM peaks, respectively.

In addition to LOS and v/c ratio, this study considered the queue lengths for each study intersection. Tables detailing the LOS and v/c ratio and queue lengths for each study intersection are included in Appendix K and Appendix L, respectively. The detailed Vistro model outputs from this operations analysis is included in Appendix M.

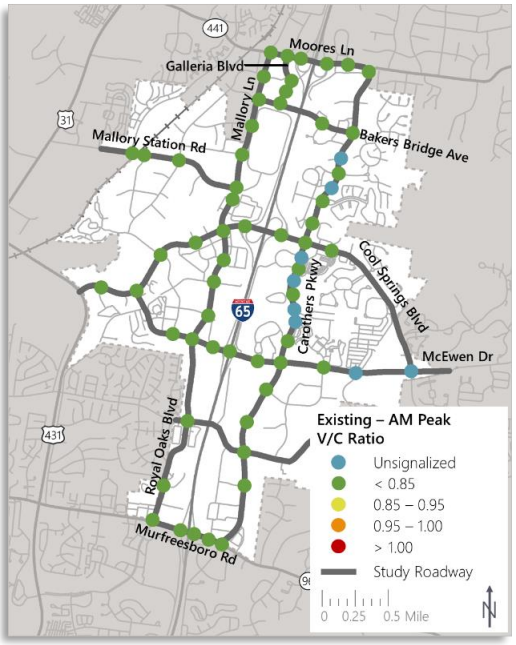


Figure 2-14 Existing V/C Ratio - AM Peak

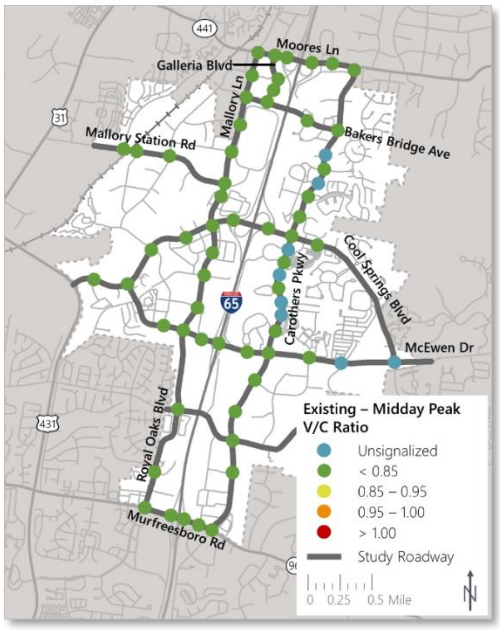


Figure 2-15 Existing V/C Ratio - Midday Peak

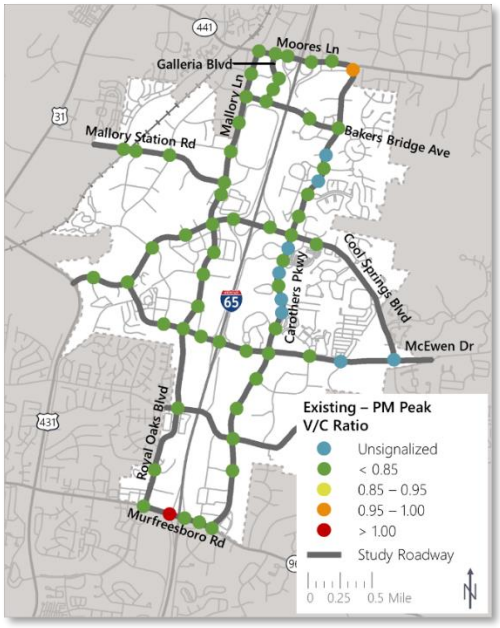


Figure 2-16 Existing V/C Ratio - PM Peak

Under existing conditions, the results of the capacity analysis indicate that at least 95% of intersections operate at LOS E or better in the AM, Midday, and PM peaks. Additionally, the results of the capacity analysis indicate that at least 97% of intersections operate below capacity in the AM, Midday, and PM peaks.

Chapter 2

POLICY REVIEW

Knowing that land use and development patterns directly impact the transportation system, the City of Franklin has undertaken the following recent planning efforts that impact the Cool Springs area:

- Envision Franklin
- Connect Franklin Comprehensive Transportation Network Plan
- Cool Springs Multimodal Transportation Network Study
- Franklin's Greenway and Open Space Master Plan
- Integrated Growth Plan

These plans, as well as the regulatory frameworks they institute and investment priorities they identify, set the stage for the future character, purpose, and operation of the study area.

To complement the technical analysis of the transportation system, this section provides a high-level review of the existing plans that drive growth and development, the policies that guide how that growth is to occur, and the projects identified for addressing the anticipated growth within the Cool Springs area.

This chapter details the previously completed planning efforts including land use plans, growth plans and policies, transportation plans, and presents the responsiveness to growth potential.

Previously Completed Planning Efforts

The City of Franklin has undertaken a number of recent planning efforts related to growth and development, spanning from 2010 to more recent efforts completed in 2019. These efforts can be broken into three primary categories – land use plans, growth plans and policies, and multimodal transportation plans. Each relevant study is documented along with the intentions, outcomes, and the impact on the Cool Springs area.

Land Use Plans

Envision Franklin reflects the most recent update to land use policy. Adopted in 2017, this document seeks to balance the historical preservation of Franklin's natural and community assets with the ability to address impending growth pressures stemming from its desirability as a place to live, work and play. Envision Franklin seeks to align the long-term vision of Franklin with the character, development, and transportation needs throughout its unique areas. Envision Franklin concludes by laying out the steps for implementing this land use vision through regulatory tools, existing and new partnerships, and policy decision-making frameworks.

Specific to the Cool Springs area, perhaps one of the most notable impacts of Envision Franklin is the designation of much of the study area for the Cool Springs Transportation Study as centers for 'Regional Commerce'. Defined as high-intensity activity centers, Regional Commerce areas are those that are intended to

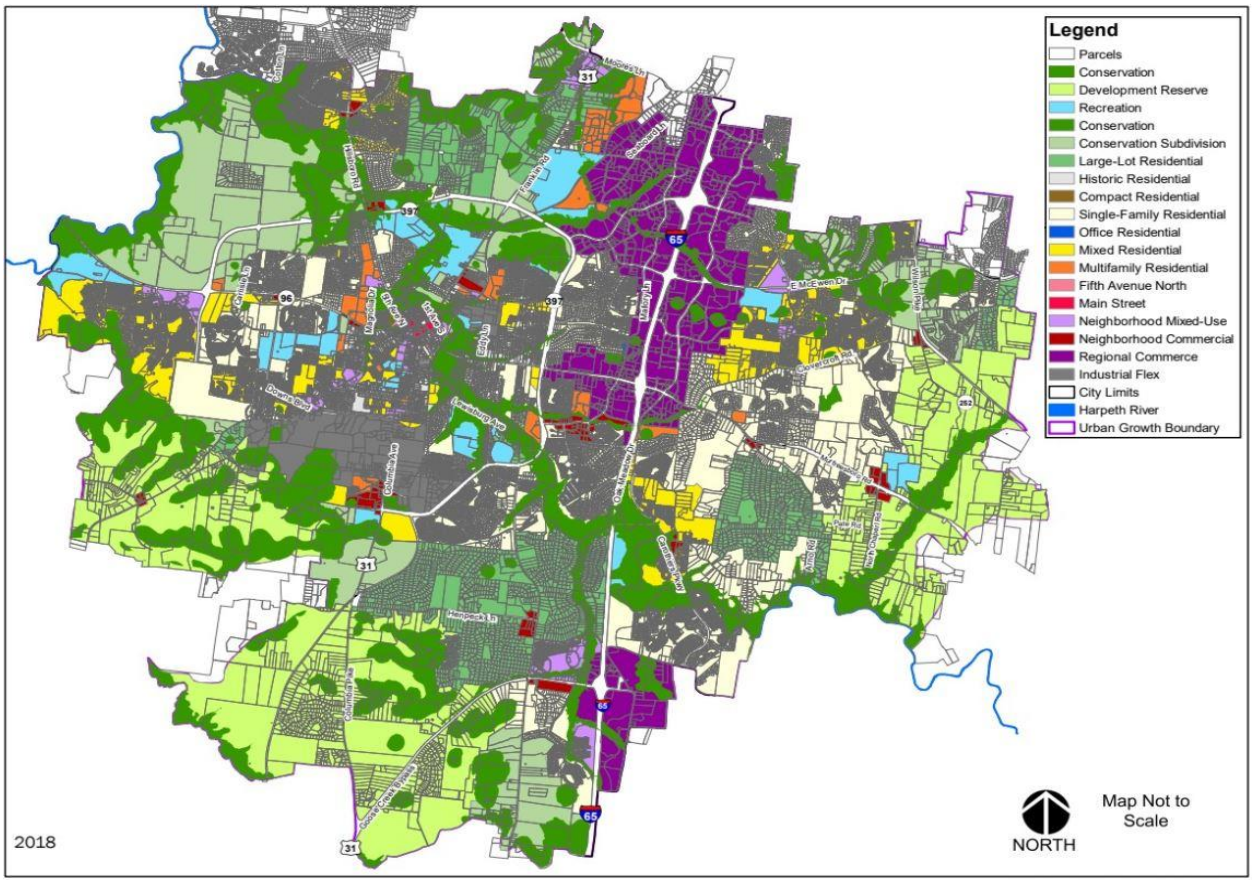


Figure 2 - 17 Design Concepts Map from Envision Franklin

attract a significant number of visitors and employers, either with current development patterns or with future development design. The main focus of land use in these areas is economically driven; in the Cool Springs area, the intention is to take advantage of the proximity to the I-65 corridor and its interchanges, which provide a high level of accessibility to draw a larger regional population. As such, the primary land uses are employment-based and include office, research and development, and commercial, all of which are designed to be high-density developments.

Noting that land use and transportation are directly related, Envision Franklin also lays out the character to be imposed on major roadway facilities based on the functional classification, the types of surrounding land uses, and geometric attributes of the roadways. Within the study area, Carothers Road, Mallory Lane, Highway 96/Murfreesboro Road, McEwen Drive, Cool Springs Boulevard, and Moores Lane are all identified as 'Mixed-Use' corridor areas. Within this designation, all of these corridors are envisioned to have multimodal accommodations including provisions for pedestrians, cyclists, and transit users to varying degrees based on the roadway classification.

In short, the Envision Franklin planning document identifies the Cool Springs area as an area for more growth, specifically in employment-related land uses, and at much higher densities than those that currently exist. Coupled with those land use visions are high-level desires for transportation options and accommodations along major corridors

Growth Plans and Policies

To enact the vision set forth by Envision Franklin, the City revised to its zoning ordinance, an effort that concluded in late 2019 after significant engagement of stakeholders and residents. As a result of this process, much of the Cool Springs area lies within a few specific zoning districts, namely the Regional Commerce 6 (RC6), Regional Commerce 12 (RC12), Planned District (PD), General Office (GO), Civic Institutional (CI), Residential 2 (R2), and Light Industrial (LI) districts. The breakout of acreage in the study area by these zoning classifications is shown in Table 2-6. Consistent with the Envision Franklin plan, the newly adopted zoning ordinance allows for higher density development patterns in the Cool Springs area.

Table 2-6 Zoning Classification by Acreage

Zoning Classification	Acreage (%)
Regional Commerce 6	847 (24%)
Regional Commerce 12	732 (21%)
Planned District	923 (27%)
General Office	87 (2%)
Civic Institutional	251 (7%)
Residential 2	235 (7%)
Light Industrial	414 (12%)
Total	**3,489**

Transportation Plans

There are a number of transportation plans that have been completed in recent years by the City of Franklin. Some of these take a long-term look at transportation needs across the city while others focus on the short-term programming of local dollars to fund capital roadway projects.

The Connect Franklin Comprehensive Transportation Network Plan, completed in 2016, served as a major update to the City's previous Major Thoroughfare Plan of 2010. Encompassed within this effort was a comprehensive approach to the entire multimodal transportation system that identifies priority transportation investments needed to maintain acceptable levels of service and

protect the livability of Franklin. Technical analysis as well as a public engagement process were used to determine where existing issues in the network needed to be addressed, including:

- Roadway capacity deficiencies,
- Improvements to bicycle and pedestrian network connectivity,
- Safety,
- Land use compatibility with multimodal options, and
- Shortcomings in transit capital and operations funding.

In addition, policy recommendations were put forth to guide future development reviews, the update to the previous zoning ordinance, and access management requests. For each recommended improvement project, planning level costs were developed, and projects were prioritized into short-, medium-, and long-term implementation horizons. Within the study area, the projects presented in Table 2-7 are recommended as part of the Connect Franklin plan and account for a significant amount of capital funds to allocated to multimodal improvements in the study area over the next 20 years.

Table 2-7 Connect Franklin Recommendations within Cool Springs Study Area

SHORT-TERM RECOMMENDATIONS
North Royal Oaks Boulevard Widening from Lakeview Drive to Liberty Pike
Murfreesboro Road (SR-96) Widening from Western I-65 Ramp to Eastern I-65 Ramp
Jordan Road Widening from Aspen Grove Drive to Mallory Lane
Liberty Pike Widening from Carothers Parkway to Columbia State Community College
Carothers Pkwy Multi-Use Path from Northern Nissan Access to Northern City Limits
Mallory Lane Multi-Use Path from Liberty Pike to Moores Lane
Cool Springs Boulevard Multi-Use Path from Mack Hatcher Parkway (SR-397) to I-65
MEDIUM-TERM RECOMMENDATIONS
Mallory Lane Widening from Mallory Station Road to Moores Lane (SR-441)
Cool Springs Blvd Widening from Mack Hatcher Parkway (SR-397) to Mallory Lane
Mallory Lane Widening from Liberty Pike to West McEwen Drive
Mallory Station Road Widening from Seaboard Lane to Mallory Lane
Seaboard Lane Upgrade from Mallory Station Road to Crossroads Boulevard
North Royal Oaks Blvd Multi-Use Path from Murfreesboro Rd (SR-96) to Lakeview Dr
LONG-TERM RECOMMENDATIONS
Cool Springs Boulevard Widening from Mallory Lane to Carothers Parkway
Carothers Parkway Widening from McEwen Drive to Bakers Bridge Avenue
Seaboard Lane and Aspen Grove Drive Sidewalk and Multi-Use Path from Cool Springs Boulevard to Mallory Station Road
Bakers Bridge Avenue Multi-Use Path from Mallory Lane to Carothers Parkway

Feeding the Connect Franklin plan were two separate multimodal transportation efforts. The first, the Cool Springs Multimodal Transportation Network Study (CSMTNS), was a transit-focused effort completed by the Franklin Transit Authority (FTA) in 2015. Interestingly, the study area for the CSMTNS aligns well with the Cool Springs Transportation Network Study, making its recommendations very much applicable to this study. The intention of the CSMTNS was to address the growing congestion issue in the Cool Springs area using investments in alternative modes and transportation demand management (TDM) strategies in order to preserve the quality of life that residents and employees within the area are drawn to.

The recommendations resulting from the CSMTNS are grouped into short-, medium-, and long-term improvements, similar to many other planning efforts. However, the overall recommendations for the study area include the following with a focus on first addressing local service, then regional connections, and finally, service enhancements:

- Reconfiguring the existing transit routes through Cool Springs and providing a lunch time shuttle service to create greater flexibility for potential transit users
- Improving multimodal connections between transit, pedestrian, and bicycle modes to reduce the need for vehicles in short-distance trips
- Working with area employers on TDM strategies
- Adding more and different transit vehicles to better meet anticipated demand
- Working with the Nashville Regional Transit Authority (RTA) on addressing commuter traffic through park and ride lots, connecting FTA service, and a new transit center off I-65
- Infrastructure and operational improvements to make transit a more competitive mode by improving service levels and supportive accommodations (e.g., transit signal priority, express bus service, pedestrian access, etc.)

The existing FTA Blue Route and Blue Route 2, shown graphically in Part 2 – Chapter 1, currently run on Mallory Lane and Carothers Road, respectively, and directly reflect the locally focused recommendations from this study.

The second multimodal study is Franklin's Greenway and Open Space Master Plan, completed in 2010. With the goal of focusing on sustainability in the city, the Greenway and Open Space Master Plan is intended to guide the implementation and funding of alternative mode facilities as development occurs in the urban growth boundary. In short, this document proposes a variety of capital investments in bike routes, bike lanes, sidewalks, and multi-use paths that would create a comprehensive and connected network throughout the city. Within the Cool Springs study area, this plan identifies the following investments:

- Proposed bike lanes on Carothers Parkway and Liberty Pike
- Proposed multi-use paths on Cool Springs Boulevard and McEwen Drive

Finally, the Integrated Growth Plan (IGP) was a transportation planning effort most recently updated in 2013 that examined the Carothers Parkway and East McEwen Drive area as it relates to growth potential and transportation improvements. Embedded within this study was a detailed analysis of the trips to be generated by likely land uses along the Carothers Parkway

corridor, near McEwen Drive, and the improvements needed to sustain that growth.

This study included turning movement counts and projections to support existing and future capacity analyses of many intersections throughout the study area. This analysis led to the development of needed improvements for key intersections in the area, complete with conceptual designs and cost estimates. This document has been used to primarily guide infrastructure improvements as development occurs near the intersection of Carothers Parkway and East McEwen Drive and has been influential in the proactive build out of intersections along Carothers Parkway in advance of growth.

In addition to infrastructure improvements, the existing plans in place for the City of Franklin also make a variety of recommendations related to policies and strategies that could be useful in managing growth. Many of these relate to expansion of the sidewalk and bikeway network to promote transit accessibility, access management policies, demand management strategies, more frequent transit service in the Cool Springs area, connectivity between developments, and traffic calming measures. These various strategies have been evaluated for inclusion within the final recommendations of the Cool Springs Transportation Study.

Responsiveness to Growth Potential

Existing Priorities

Ultimately, the investments identified in the aforementioned planning documents feed the development of specific projects to be funneled into the design, right-of-way, and construction phases. The City of Franklin's Capital Improvement Plan (CIP) programs the dollars for making such progression in the project development process. The current CIP allocates funding for the fiscal years of 2019 – 2028; within this time frame, the following projects are funded within the study area:

- Jordan Road Reconstruction (ST16006)
- East McEwen Drive Roundabout – Right Turn Bypass Lane (ST16008)
- Mallory Lane/Royal Oaks Boulevard and Liberty Pike Roundabout (ST16011)
- Aspen Grove and Seaboard Lane Intersection Improvements (ST16013)
- North Royal Oaks Boulevard Widening (ST1619)
- McEwen Drive Interchange Improvements (ST19004)

The projects listed above have been selected by Franklin's Board of Mayor and Alderman (BOMA) to reflect the priorities for infrastructure investments in the Cool Springs area. However, the development potential afforded by the new zoning allowances within the study area presents challenges to the City in adequately responding to growth in traffic volumes generated by future development on vacant land and redevelopment of existing parcels. As such, the next section includes a high-level review of tools at the City's disposal for addressing the many impacts of growth.

Existing Tools

There are three primary tools that the City can use to influence the development of land and how it impacts the collective transportation network – the Traffic Impact Analysis (TIA) Guidelines, the Transportation and Street Technical Standards, and the City's Road Impact Fee.

The TIA Guidelines are currently located within the City's Transportation and Street Technical Standards and outline the conditions that necessitate a TIA for new developments. Of

note is that it is intended for these guidelines to become a standalone document in 2021. The standards establish requirements for TIAs based on daily and PM peak hour trip generation thresholds, proximity to existing or planned traffic signals, and the potential for negative impacts to traffic flow or safety. These criteria, as well as the items that must be included in a TIA, are similar to what can be found in TIA guidelines from other municipalities. The primary outcome from TIAs is the identification of infrastructure improvements needed to mitigate the traffic impacts of development. The cost of these improvements is often born by the developer of the site or in some cases, shared with the municipality. Due to the additive nature of traffic, this process makes it so that small scale improvements are typically assigned to developers while larger scale capital improvements tend to become the responsibility of the City.

As a means of implementing these necessary improvements, the City of Franklin was given authority from the State Legislature in 1987 to collect road impact fees, which were first established in 2000 with subsequent adjustments throughout the years. The intention of the road impact fee is to collect monetary compensation from developers to ensure the provision of adequate collector and arterial road improvements. In step with TIA principles, the code requires that the fees collected are directly proportional to the needs generated by new development and cannot be legally used to address existing deficiencies.

Worth noting is that the TIA process tends to focus heavily on the vehicle with some consideration given to alternative modes and how they can mitigate impacts of development. In areas where congestion cannot be addressed by roadway improvements, either due to physical or fiscal feasibility, investments in alternative modes such as walking, biking, and transit can be utilized as a means of providing mobility options to reduce the number of vehicular trips on a network. All multimodal improvements to the transportation system, must be consistent with the City's Transportation and Street Technical Standards, which lay out the desired cross section elements of streets based on their primary function, mobility, access, or a combination. The functional classification is linked to the City's Major Thoroughfare Plan, which is the Connect Franklin plan mentioned previously in this report. These classifications directly relate to the design criteria and principles used to build out the street network as development occurs, including sidewalk widths, types of bicycle facilities, and multi-use path considerations for all roadway types.

Knowing that there are challenges and limitations with the traditional growth management tools mentioned above, recommendations for this Cool Springs Transportation Study will include alternative strategies for further evaluation and consideration by the City of Franklin.

Part 3

FUTURE CONDITIONS

Background Growth

Approved Development

Future Conditions: Scenario 1 and Scenario 2

Maximized Development

Future Conditions: Scenario 3 and Scenario 4

Scenario Comparison

Chapter 1

BACKGROUND GROWTH

Within the Cool Springs area, development trends play an essential role in the transportation network and how it operates. Understanding the effect of continual growth on the transportation system is vital to the sustainability of the Cool Springs area. This chapter sets the stage for analyzing future growth by first documenting the background growth in the study area.

To accomplish this, the following historic traffic data sets were taken into consideration:

- TDOT AADT Growth Data
- StreetLight Growth Data
- Turning Movement Count Growth Data

Growth trends determined from the historic traffic data were then used to estimate the potential background growth within the study area.

This chapter details the methodology used to determine an appropriate background growth rate for each of the study intersections by analyzing historical growth trends and development potential for individual zones within the study area.

Growth Rates

TDOT AADT Growth Rates

TDOT collects information on daily traffic volumes for major roadway corridors across the state. Reported as Annual Average Daily Traffic (AADT) volumes, this data represents the number of vehicles that are on a particular roadway every day of the year on average.

There are seventeen locations within the Cool Springs area where this data is collected. The TDOT data for 2018 was compared to the TDOT data for 2014 to determine the approximate growth per year for four years. This data is presented in Appendix G, and the count stations and corresponding growth rates within the study area are presented in Figure 3-1.

For example, TDOT Count Location 2, located along Moores Lane, has experienced a decrease in traffic of less than 2% per year for four years. In contrast, TDOT Count Location 12, located along Liberty Pike, has experienced an increase in vehicle traffic of between 2% and 5% per year for four years.

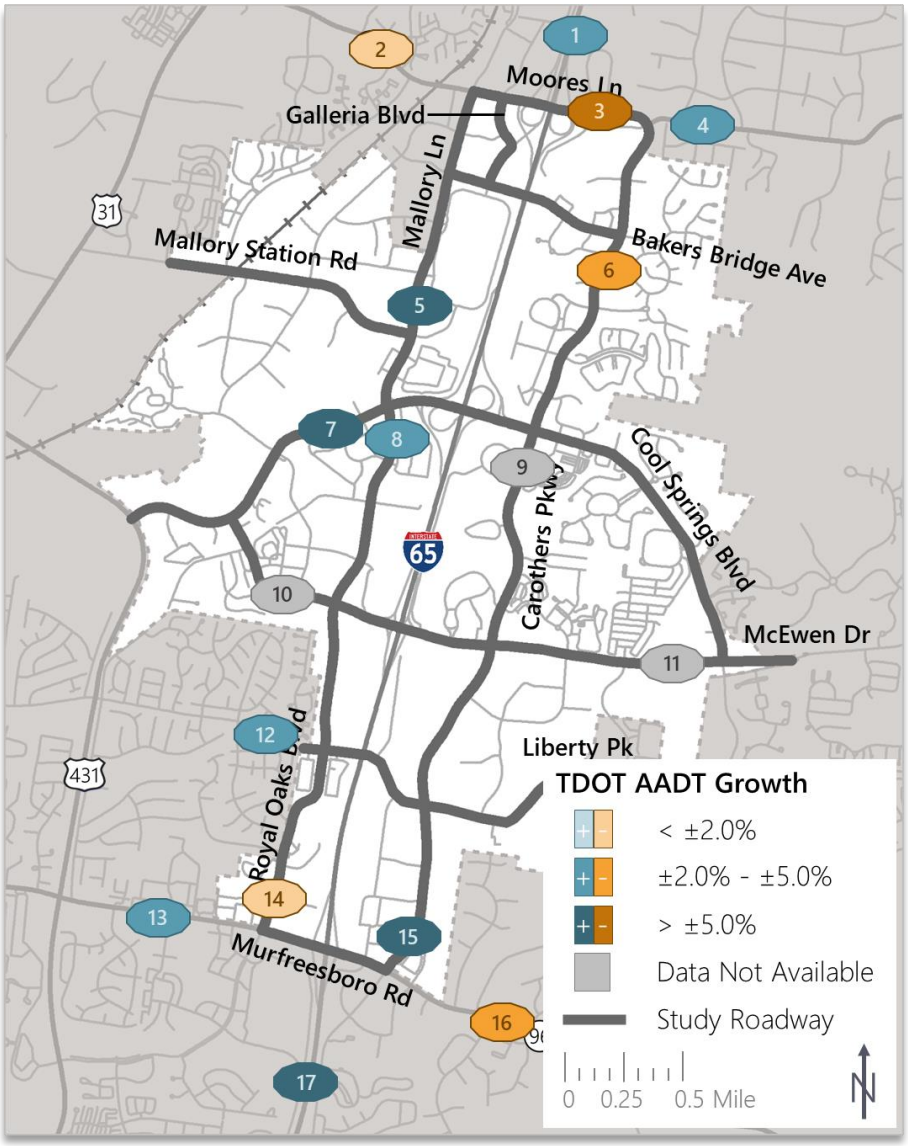


Figure 3-1 TDOT AADT Growth

StreetLight Growth Rates

StreetLight Data, Inc. is a private data firm that collects third party location and crowd source data such as automated vehicle location devices. Once the data is collected, it is then converted into traffic volumes broken down by hour. The data can then be used to determine the year to year growth on their streets.

There are twenty-five locations within the Cool Springs area where this data is collected. These locations correspond with the entry/exit points of the study area. The StreetLight data for 2020 was compared to the StreetLight data for 2016 to determine the approximate growth per year for four years. The growth rates from this data is shown in Figure 3-2 and additional information is included in Appendix G.

Compared to TDOT Count Location 2, StreetLight Location B, located along Moores Lane, has experienced an increase in traffic of less than 2% per year for four years. Compared to TDOT Location 12, StreetLight Location Q, located along Liberty Pike, has also experienced an increase in vehicle traffic; however, this increase is less than 2% per year for four years.

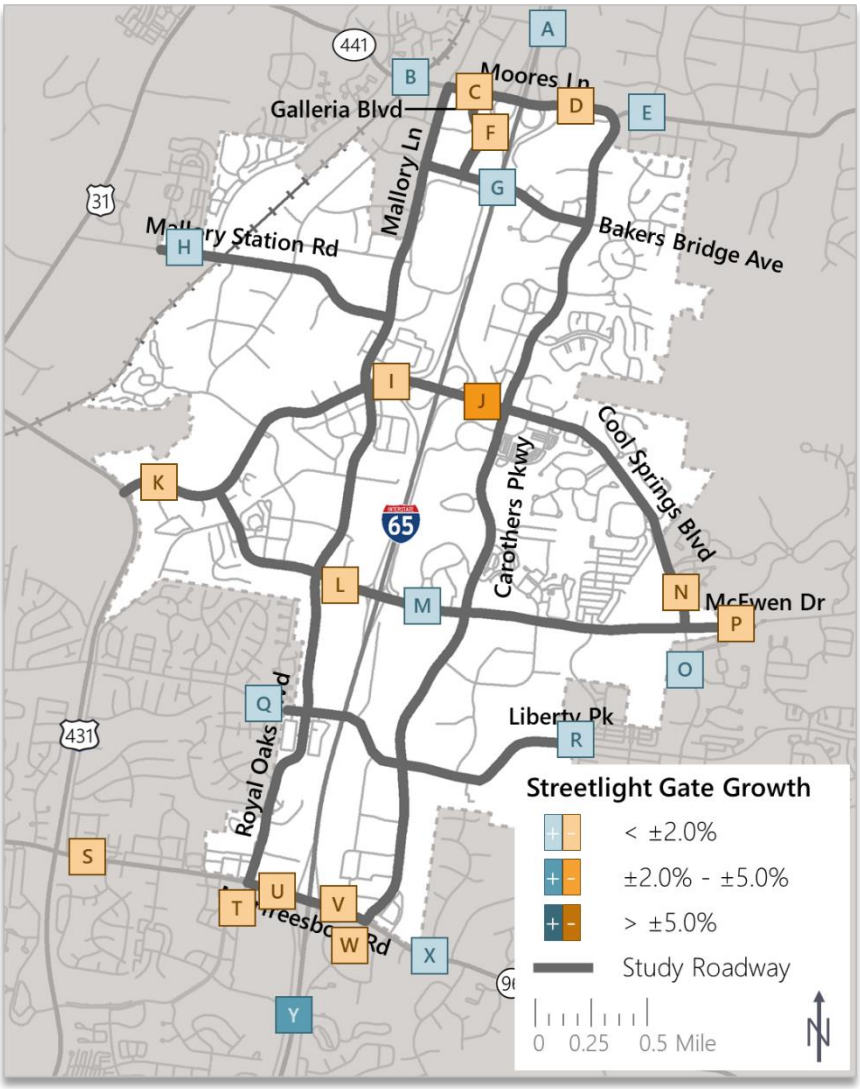


Figure 3-2 StreetLight Annual Growth

Turning Movement Count Growth Rates by Intersection

As traffic studies are conducted within the area, turning movement counts are required for study intersections. The City of Franklin has collected these historical turning movement counts at various intersections across multiple years.

These counts were compiled and the annual growth rates per year for the individual intersections were determined. The results of the calculated growth rates are presented in Figure 3-3. This historical growth data for each intersection is included in Appendix G.

It should be noted that the study intersections along Moores Lane are located within Brentwood, and historical turning movement counts for these study intersections were not available. Additionally, the majority of the available historical counts are for signalized intersections; therefore, the growth rates for unsignalized intersections were not calculated.

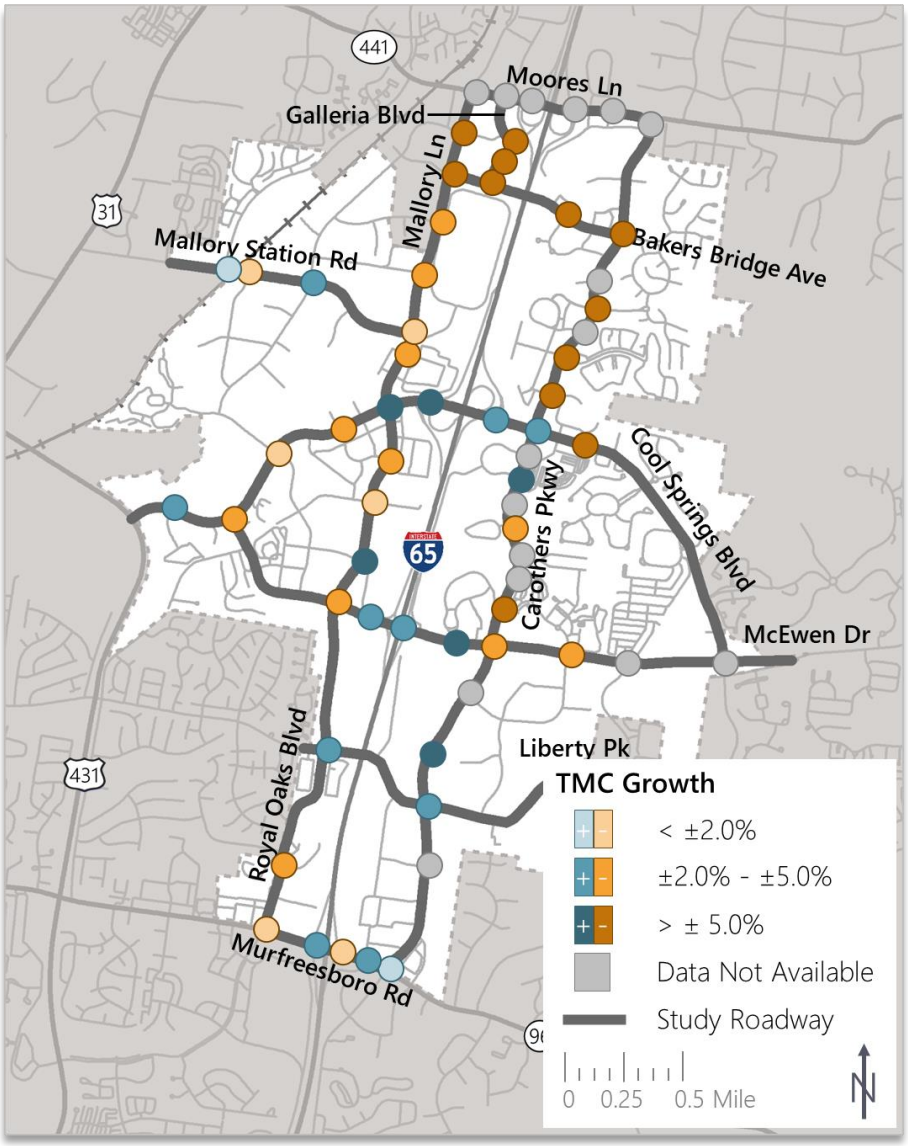


Figure 3-3 TMC Growth

Growth Regions

Cool Springs encompasses a large area of diverse land uses and travel patterns, and different areas/regions within the Cool Springs area are expected to grow at different rates.

Therefore, the study area was subdivided into sixteen growth regions to allow for different growth rates based on individual regions. The subdivided regions are shown in Figure 3-4.

Regional Growth Rates

Based on the TDOT, StreetLight, and TMC historical growth rates and the existing land uses within each region, a background growth rate for each region was determined using the following considerations:

- A minimum of 1.0% per year growth
- The percentage of growth based on TDOT, StreetLight, and TMC historic data.
- The amount of "free" land within each region where potential or planned development could occur.

The growth rate for each region is presented in Table 3-1 and shown in Figure 3-4.

Table 3-1 Background Growth Rate by Region

Region	Growth Rate	Region	Growth Rate
A	2.0%	I	1.5%
B	1.5%	J	1.5%
C	1.5%	K	1.5%
D	1.0%	L	1.5%
E	1.0%	M	1.5%
F	1.0%	N	1.0%
G	1.0%	O	1.0%
H	1.5%	P	1.0%

Intersection Growth Rates

Utilizing the regional background growths presented in Table 3-1 and Figure 3-4, background growths for each approach of each study intersection were determined. The following assumptions were used to determine these growth rates:

- Approaches with limited connectivity were assumed to have 0% growth.
    - Forty-one study intersections include at least one approach with an assumed 0% growth.
    - For example, the eastbound and westbound approaches of Carothers Parkway and Corporate Centre Drive have limited connectivity and/or potential growth; therefore, both approaches were assumed to have a 0% growth.
- Approaches that bridge two regions were assumed to be an average of those two regions.
    - For example, the intersection of Carothers Parkway and Cool Springs Boulevard is located between Region C (1.5% growth) and Region D (1.0% growth). Therefore, the eastbound and westbound approaches were assumed to have a growth rate of 1.25% while the northbound approach was assumed to be 1.5% and the southbound approach was assumed to be 1.0%.

The growth rates for each study intersection approach are presented in Appendix G. These growth rates represent the annual average growth rate expected to occur at each of study intersections.

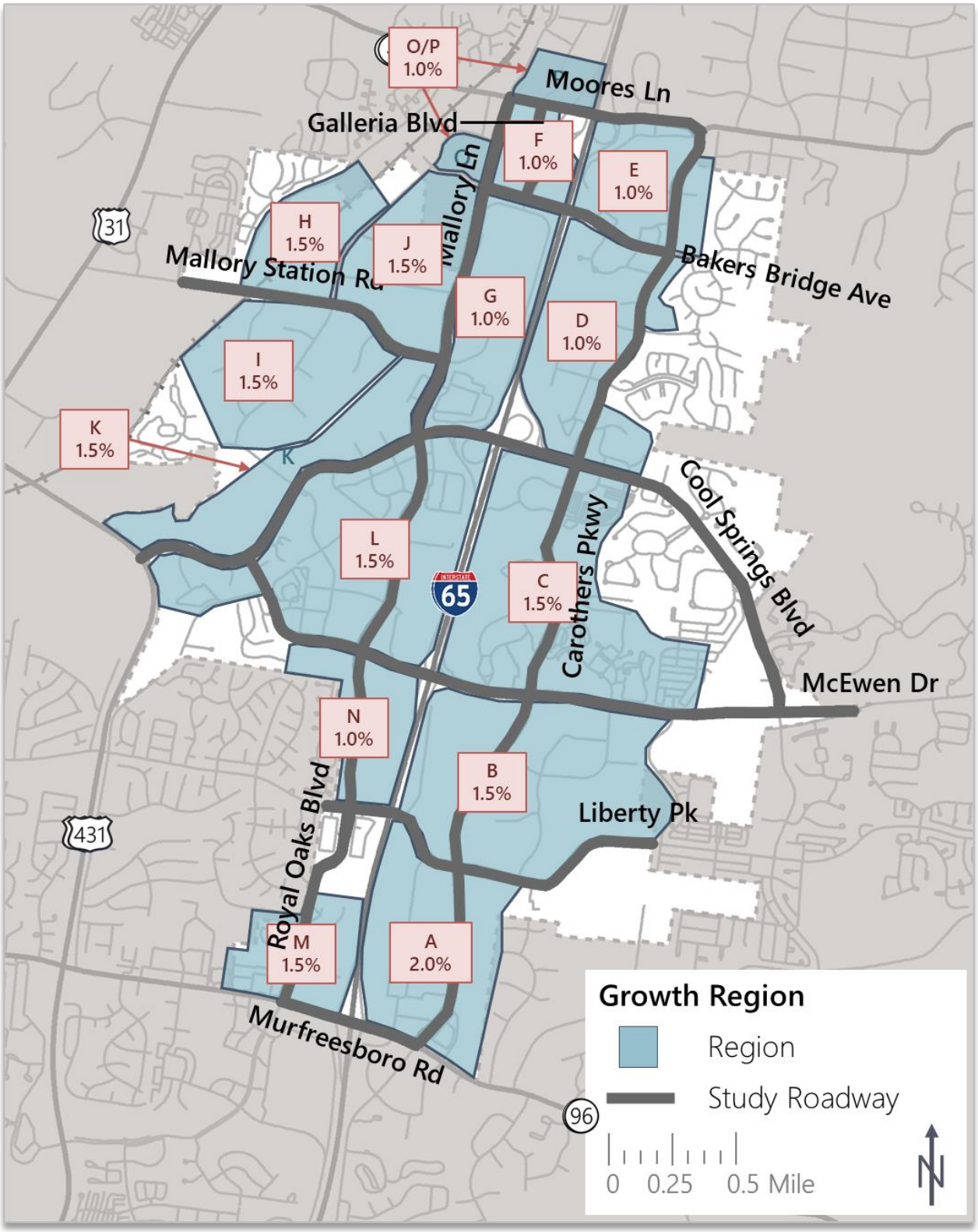


Figure 3-4 Growth Regions

Chapter 2

APPROVED DEVELOPMENT

When developments are planned within the city limits, the proposed land uses are evaluated by city staff to estimate the number of trips expected to be generated by the project site. If the estimated daily trips exceed 1,000 vehicles per day, then developers are required to complete a Traffic Impact Study (TIS) /Traffic Impact Analysis (TIA) that details the proposed development and the effects the development will have on the surrounding roadway network.

This chapter presents the approved developments within the study area, as of April 2020, for which traffic studies were completed as part of the approval process. In addition to detailing the effects of the proposed development on the existing roadway network, traffic studies also provide recommendations for roadway improvements to mitigate the impacts that these developments have on the surrounding roadway network. This chapter details those recommendations, as well as, funded or planned roadway improvements planned by the City of Franklin.

This chapter details the approved land developments and their associated current occupancy, expected daily trips, and recommended roadway infrastructure improvements. Also included in this chapter are additional roadway infrastructure improvements currently funded or planned by the City of Franklin.

Land Development

There are sixteen approved developments within or near the Cool Springs area that were identified for this study. The locations of the approved land developments, indicated in red, are presented in Figure 3-5.

The traffic analysis, presented in the TIS/TIA for each development, used factors taken from ITE's *Trip Generation* to estimate the amount of traffic expected to be generated by the project site. The combined daily trips for the approved developments are 222,270 trips.

Additional information, such as name, percent of development occupied as of January 2020 (when data was collected), and expected daily trips, is included in Table 3-2. The land use breakdown, expected peak hour trips, and infrastructure related recommendations for each development are included in Appendix H.

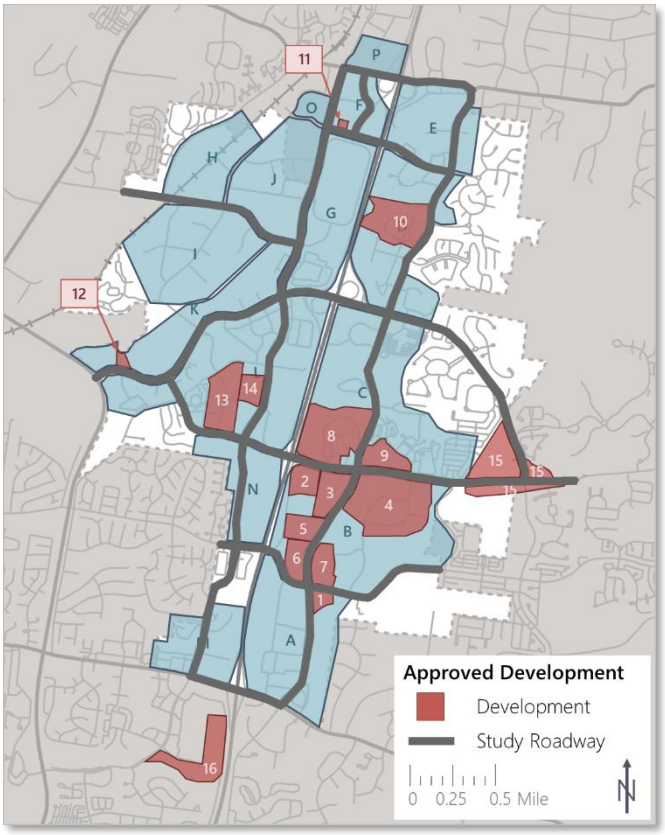


Figure 3-5 Approved Land Development

Table 3-2 Approved Land Development

Zone	Development No.	Development Name	Percent Occupancy	Daily Trips (vpd)
A	1	Liberty Station	0%	1,403
B	2	Franklin Summit	0%	6,354
	3	Aureum	0%	20,715
	4	Ovation	0%	32,058
	5	Huffines Ridge	0%	5,365
	6	Carothers Crossing West	0%	4,061
	7	Carothers Crossing East	70%	19,646
C	8	Apex Village	0%	12,796
	9	Franklin Park	40%	23,765
D	10	East Works	0%	30,309
F	11	7086 Bakers Bridge Avenue	0%	1,560
K	12	The Franklin at Legends	40%	1,102
L	13	Mallory Green	33%	3,963
	14	McEwen Town Center	5%	26,976
No Zone	15	Avalon Square	0%	27,502
	16	Vintage Franklin	0%	4,695

Roadway Development

Approved Land Development Improvements

One of the by-products of traffic studies/analyses is a list of recommended improvements to mitigate the impacts of the proposed development on the existing roadway network. The recommended study intersection improvements, as determined by the studies conducted for the approved developments, are presented in Table 3-3. It should be noted Table 3-3 only includes approved developments where recommendations for the study intersections were provided. Additionally, unless otherwise noted, these improvements have not been completed to date. Additional recommended improvement details are presented in Appendix H.

Table 3-3 Recommendations from Approved Development Studies

Dev No.	Intersection	Recommendations
3	East McEwen Drive and Tower Circle	An eastbound right-turn lane with 300 feet of storage and 200 feet of taper should be provided.
		Two westbound left-turn lanes with 225 feet of storage and 200 feet of taper should be provided.
		The northbound approach should be designed to include two ingress lanes and four egress lanes. The egress lanes should include two left-turn lanes with 200 feet of storage, one through lane, and one right-turn lane with 200 feet of storage.
		Pedestrian facilities should be provided.
	East McEwen Drive and Carothers Parkway	Widen the eastbound approach to provide two right-turn lanes. These lanes should operate as signalized.
		Pedestrian facilities and signal control should be modified/updated to incorporate the additional laneage.
	Carothers Parkway and Ovation Parkway	A southbound right-turn lane with 250 feet of storage and 160 feet of taper should be provided.
		Two northbound left-turn lanes with 300 feet of storage and 150 feet of taper should be provided.
		The eastbound approach should be designed to include two ingress lanes and four egress lanes. The egress lanes should include two left-turn lanes with 100 feet of storage, one through lane, and one right-turn lane with 100 feet of storage.
		Pedestrian facilities should be provided.
6	Carothers Parkway and Liberty Pike	A 2nd northbound left-turn lane should be constructed. (NOTE: This improvement was constructed in May/June 2020)
	Carothers Parkway and Southstar Drive	A northbound left-turn lane with 200 feet of storage should be provided.
		A southbound right-turn lane with 125 feet of storage should be provided.
		A westbound through lane should be provided.

Dev No.	Intersection	Recommendations
6	Carothers Parkway and Southstar Drive	The eastbound approach should be designed to include one ingress lane and three egress lanes. The egress lanes include one left-turn lane, one through lane, and one right-turn lane.
		The existing traffic signal should be modified to include the addition of the eastbound approach.
8	Carothers Parkway and East McEwen Drive	Two southbound right-turn lanes with 600 feet of storage should be provided.
10	Carothers Parkway and Bakers Bridge	Two eastbound left-turn lanes with 250 feet of storage should be provided.
		Pull back the medians on the north and south approaches to allow eastbound and westbound left-turns to operate simultaneously (remove split phasing).
		A southbound right-turn lane with 200 feet of storage should be provided.
	Carothers Parkway and Mayfield Drive	The eastbound approach should be widened and restriped to include two left-turn lanes and one through/right-turn lane.
		Two northbound left-turn lanes with 200 feet of storage and 125 feet of taper should be provided.
		The existing southbound right-turn channelization should be removed.
		The traffic signal should be modified to remove the split phasing.
	Cool Springs Boulevard and Carothers Parkway	Triple northbound left-turn lanes with 250 feet of storage should be provided. The outside lane will be dedicated for I-65 northbound on ramp, the middle lane will be for both Cool Springs Boulevard westbound and I-65 northbound on ramp, the inside lane will be dedicated for Cool Springs Boulevard westbound only.
		A northbound right-turn lane with 150 feet of storage should be provided.
		A westbound right-turn lane with 250 feet of storage should be provided. The existing right-turn lane should be restriped as a shared through/right-turn lane.
		Two eastbound right-turn lanes with 300 feet of storage should be provided. The existing shared through/right-turn lane should be restriped as an exclusive through lane.
	Carothers Parkway and Private Drive North of Mayfield Drive	The north/south median along Carothers Parkway shall be modified to only allow a northbound left-turn movement.
	Carothers Parkway and Private Drive South of Mayfield Drive	The north/south median along Carothers Parkway shall be modified to only allow a northbound left-turn movement.

Dev No.	Intersection	Recommendations
10	Cool Springs Boulevard and I-65 Northbound On-Ramp	Add an additional dedicated westbound right-turn lane. This lane will begin as an additional westbound through lane from Carothers Parkway.
		The westbound right-turn lanes should be signalized.
		The I-65 On Ramps will be moved to the west approximately 150 feet to the west. The existing 300 feet of storage for the eastbound left-turn lanes should be maintained.
	Cool Springs Boulevard and I-65 Southbound On-Ramp	Two westbound left-turn lanes with 500 feet of storage should be provided.
12	Cool Springs Boulevard and Windcross Court	The southbound approach should be designed to include one ingress lane and two egress lanes. The egress lanes should include one left-turn lane and one through/right-turn lane.
		The northbound approach should be restriped to include one shared through/left-turn lane and one right-turn lane. The northbound left-turn should operate under permissive-only phasing. A protected right-turn arrow interval concurrent with the westbound left-turn phase is recommended.
		An eastbound left-turn lane with 175 feet of storage should be provided. The left-turn should operate under protected-permissive signal phasing.
13 14	McEwen Drive and Spring Creek Drive	Two southbound left-turn lanes should be provided.
16	Murfreesboro Road and Royal Oaks Boulevard	The northbound approach should be restriped to include one left-turn lane, two through lanes, and three right-turn lanes. (NOTE: This improve was removed after completion of the analysis for this study)

Planned City Improvements

In addition to the recommendations from the traffic studies for each of the approved developments, the City of Franklin has three planned roadway improvements within the study area. Those improvements are as follows:

- The intersection of Liberty Pike and Mallory Lane/Royal Oaks Boulevard is planned to be reconstructed as a multi-lane roundabout.
- The McEwen Drive at I-65 interchange is planned to be modified to include additional laneage. The modifications will require the southbound on-ramp to be widened or restriped to include the additional lanes.
- The roundabout at the intersection of McEwen Drive and Cool Springs Boulevard is planned to be modified to include additional laneage. These improvements were completed in the summer 2020.

Chapter 3

FUTURE CONDITIONS:
SCENARIO 1 AND SCENARIO 2

A principal purpose of the Cool Springs Transportation Network Study is to provide the City of Franklin with an outlook on future development potential and the resulting traffic operations in the study area.

To achieve this, traffic projections were determined based on future conditions with the general background growth, as well as, the approved development presented in the previous chapter of this report.

For the future plus approved developments conditions, two scenarios were developed to determine potential infrastructure improvements needed to accommodate the additional growth resulting from the approved developments located within the study area:

- Scenario 1 – 50% completion of approved development
- Scenario 2 – 100% completion of approved development

This section details the incorporation of these two scenarios into the Vistro model.

To evaluate the future traffic operations within Cool Springs, the existing Vistro model of the network was updated to include the background growths and approved developments. Two scenarios were tested to determine the effects of the growth resulting from the approved developments.

Estimating Regional Trip Distribution

StreetLight data was used to help determine the directional distribution of vehicles currently entering and exiting the Cool Springs study area, with specific attention given to the seven growth regions where approved developments are located. More specifically, vehicle volumes were analyzed across the entire study area to determine how vehicles enter and exit each of the individual growth regions.

Using this information, directional distributions of the entering and exiting traffic for each growth region were determined. Gates, which represent the locations where traffic enters and exits the study area, were established as part of the StreetLight analyses.

A combination of StreetLight Data and engineering judgement was used to determine the path vehicles would take to reach each Gate from the starting region. It was assumed vehicles generally follow the same path when entering and exiting the study area.

The overall directional distribution for study area is presented in Figure 3-6. The directional distributions for the individual growth regions are included in Appendix I.

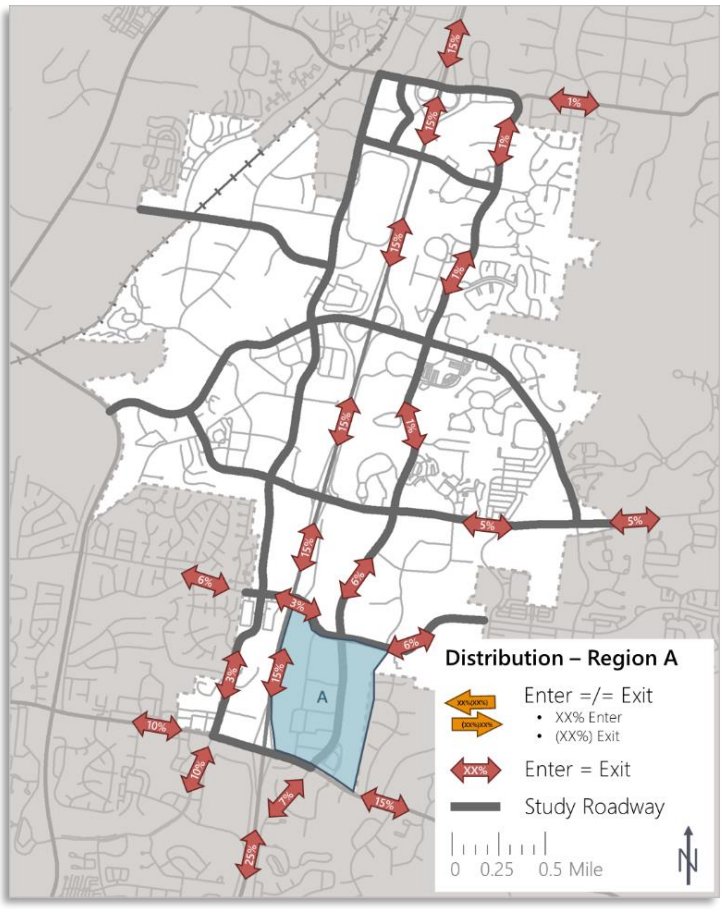


Figure 3-6 StreetLight Trip Distribution - Region A

VISTRO Modeling

The traffic simulation software, PTV Vistro, was used to model the existing and future traffic projections for the Cool Springs roadway network. The Existing Conditions Report detailed specifics regarding the PTV Vistro software and steps utilized in establishing the existing conditions Vistro model.

This section details the development of Future Conditions – Scenario 1 and Future Conditions – Scenario 2 for the Cool Springs Vistro model.

The following steps were used to expand the existing conditions Vistro model to include the future conditions:

1. Background Growth
2. Establish Zones and Gates
3. Add Site Accesses
4. Define Paths
5. Apply Trip Generation
6. Input Trip Distribution
7. Determine Trip Assignment

Background Growths

The annual average growth rate for each approach of each study intersection was presented in Part 3 – Chapter 1. The existing traffic volumes for each study intersection approach were grown by the determined growth rate per year for 10 years. The growth rates are presented in Appendix H.

Establish Zones and Gates

Within Vistro, Zones are used to represent the development sites. Therefore, sixteen Zones were established within the Vistro model to represent the sixteen approved developments located in or near the Cool Springs area. It should be noted that the Zone number within the Vistro model corresponds with the project number associated with the approved development (as presented in Table 3-2 of this report). In Vistro, Zones are indicated by a purple circle, as seen in Figure 3-7.

According to Vistro documentation, "traffic for development Zones is routed to and from traffic 'Gates'". As previously mentioned, the Gates represent the entry/exit points for the study area. As shown in Figure 3-7, Gates are indicated in the Vistro model by blue squares.

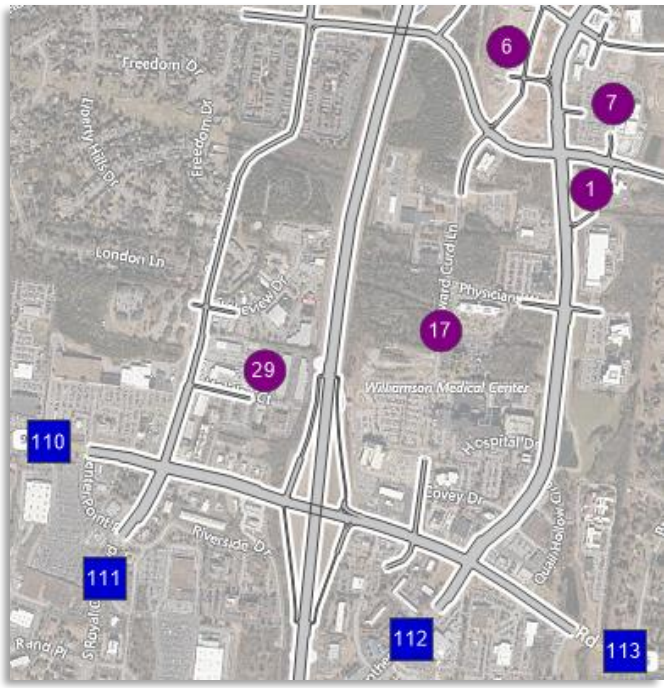


Figure 3-7 Vistro Model Zones and Gates

Add Site Accesses

To properly define the Paths that connect the Zones and the Gates, site accesses for each of the approved developments were added to the Vistro model. The site plans for each of the approved developments were reviewed, and each site access included in the site plan was added to the model. It should be noted that this included the addition of a fourth leg at four of the study intersections. The site plans for the approved developments are provided in Appendix H.

Define Paths

Once the Zone and Gates were established within the Vistro model, the next step was to define the Paths that link Zones and Gates. Paths indicate potential routes vehicles could use to travel between a development Zone and the Gates of the study area or between the Gates of the study area and a development Zone.

StreetLight distributions were used to determine which Gates were utilized by each Zone. Then, all potential Paths were defined between each Zone and their corresponding Gates.

It should be noted that Paths are used to represent both the egress (Zone to Gate) and ingress (Gate to Zone) between Zones and Gates. Additionally, based on the type of site access (full access vs. right-in/right-out only) the number of egress Paths might not be equal to the number of ingress Paths.

While the StreetLight distributions were the primary source for determining which Paths were used by each development/Zone, GoogleMaps and engineering judgement were also used to estimate preferential Paths based on the time of day.

In Vistro, Paths are indicated by a light blue highlighted Zone and Gate and connected by a red line with arrows indicating the direction of the Path. An example of one of the Paths is shown in Figure 3-8. This represents one potential path from Zone 7 to Gate 111.

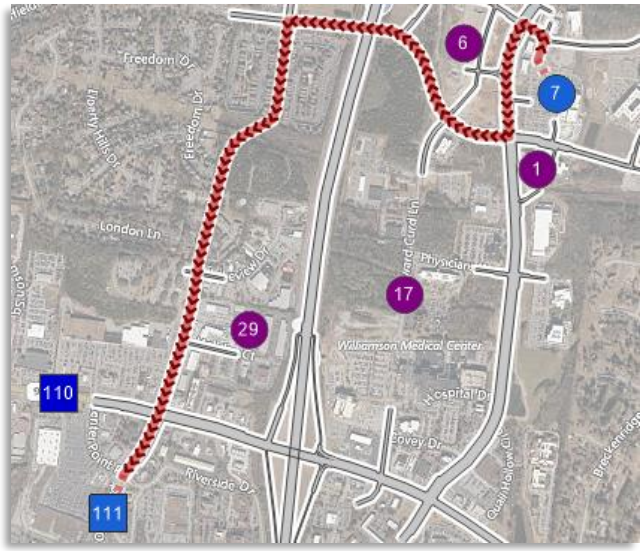


Figure 3-8 Vistro Model Path

Apply Trip Generation

Vistro uses two methodologies to apply ITE's *Trip Generation* to the model:

1. Proposed land uses are input into the model, and the model calculates the entering and exiting trips
2. Entering and exiting trips are input directly into the Vistro model

To maintain consistency with the traffic studies presented in Table 3-2, the method 2 was used. The trip generation for the AM, Midday, and PM peaks for each of the approved developments is included in Appendix H.

Input Trip Distribution

The trip distribution for each development Zone, as discussed above, was input into the Vistro model. The Gate distribution for each growth region is presented in Appendix I.

Determine Trip Assignment

In Vistro, trip assignment indicates the percentage of trips associated with each Path. For example, if two Paths exist between Zone 7 and Gate 111, and neither path is preferential, then the trip assignment for each path would be 50%. If Path 1 is preferred, however, then Path 1 might be 75% and Path 2 would be 25%.

Trip assignment was estimated using StreetLight distribution data, GoogleMaps and engineering judgement.

Capacity Analysis

As previously mentioned, two future conditions with approved development scenarios were tested within this portion of the study. This section presents the following Vistro model results for those scenarios:

- Level of Service (LOS) and Delay
- V/C Ratio
- 95th Percentile Queue Lengths

Level of Service (LOS) identifies how well an intersection is operating based on the ability for an intersection to accommodate vehicle volumes in relation to the available capacity. Based on the amount of vehicular delay, LOS is assigned a "grade" between LOS A and LOS F, where LOS A indicates minimal delay and LOS F indicates excessive delay.

Volume-to-capacity ratio (v/c ratio) indicates how an intersection is operating in terms of capacity, where capacity is the maximum number of vehicles per hour that can utilize an intersection. A v/c ratio less than 0.85 is under capacity, a v/c ratio between 0.85 and 1.0 is approaching capacity, a v/c ratio at 1.0 is at capacity, and a v/c ratio greater than 1.0 is over capacity.

For all scenarios, the improvements presented in Table 3-3 were included in the model. Additionally, Sidra, a roundabout modeling software, was used to evaluate the existing and proposed roundabouts, which, in turn, validated the Vistro results. Tables detailing LOS and queue lengths are presented in Appendix K and Appendix L, respectively. Detailed Vistro and Sidra results for Scenario 1 and Scenario 2 are included in Appendix N and Appendix O, respectively.

Scenario 1: 50% Approved Development

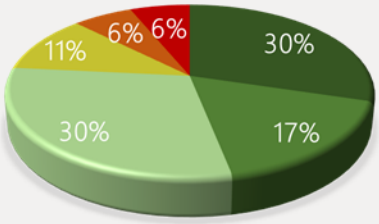
Under Scenario 1, the Vistro model included the existing traffic volumes, background growth, and 50% of the remaining occupancy of the approved developments.

Level of Service (LOS)

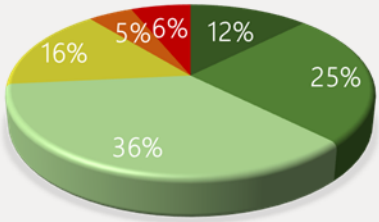
LOS A indicates minimal delay
LOS F indicates excessive delay

	A	B	C	D	E	F
AM	19	11	19	7	4	4
Mid	8	16	23	10	3	4
PM	5	9	21	10	10	9

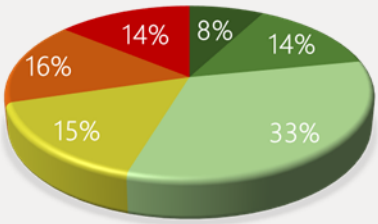
AM Peak



Midday Peak



PM Peak

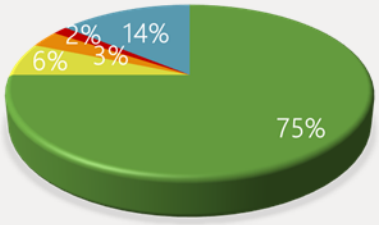


	AM	Mid	PM
< 0.85	48	49	34
0.85 – 0.95	4	2	12
0.95 – 1.00	2	2	4
> 1.00	1	2	5
Unsignalized	9	9	9

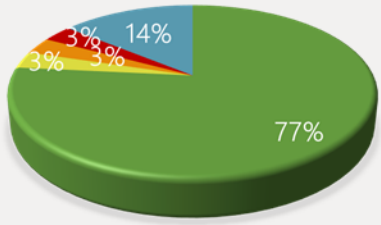
V/C Ratio

<0.85 is operating under capacity
1.0 is operating at capacity
>1.0 is operating over capacity

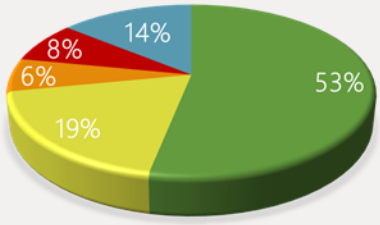
AM Peak



Midday Peak



PM Peak



95th Percentile Queue Length

Tally of intersections where queue length exceeds capacity on at least one approach

AM	22
Mid	30
PM	44

50% of approved developments was considered due to the fluctuating nature of development. Economic conditions, developer finances, changes in workspace/land uses can all lead to a reduction in the final number of trips produced by a proposed development.

Scenario 2: 100% Approved Development

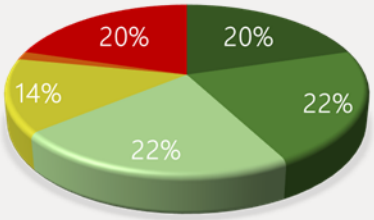
Under Scenario 2, the Vistro model included the existing traffic volumes, background growth, and 100% of the remaining occupancy of the approved developments.

Level of Service (LOS)

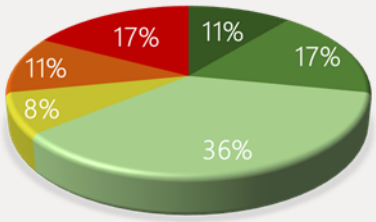
LOS A indicates minimal delay
LOS F indicates excessive delay

	A	B	C	D	E	F
AM	13	14	14	9	1	13
Mid	7	11	23	5	7	11
PM	4	6	16	6	8	24

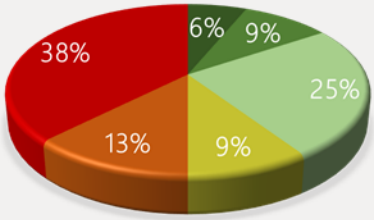
AM Peak



Midday Peak



PM Peak

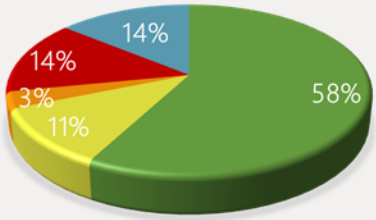


	AM	Mid	PM
< 0.85	37	39	25
0.85 – 0.95	7	6	10
0.95 – 1.00	2	4	3
> 1.00	9	6	17
Unsignalized	9	9	9

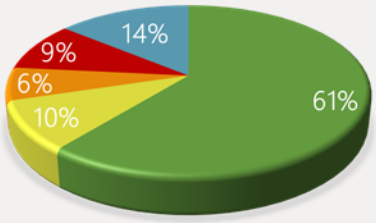
V/C Ratio

<0.85 is operating under capacity
1.0 is operating at capacity
>1.0 is operating over capacity

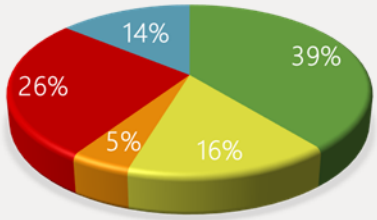
AM Peak



Midday Peak



PM Peak



95th Percentile Queue Length

Tally of intersections where queue length exceeds capacity on at least one approach

AM	24
Mid	38
PM	47

Seldom are developments developed out to 100% of the plan. For the purpose of this study and the approved obligation associated with each approved development, however, the 100% build of the approved developments was taken into consideration and analyzed for this study.

Chapter 4

MAXIMIZED DEVELOPMENT

A key component of assessing future transportation conditions in the Cool Springs area is the development of a future build out scenario. This process entailed determining the maximum development potential within the study area, which helps to identify potential infrastructure improvements that could be needed to accommodate the maximum build out of the study area.

Knowing that there are few truly vacant parcels remaining in the study area, it was assumed that the majority of future development will be comprised of redevelopment and infill opportunities. Using a combination of land use, zoning, and property assessment data, these future development opportunities were quantified in coordination with the City of Franklin Planning Department.

This chapter details the maximized potential land development for each development region and the associated expected trip generation based on existing land uses and available land for development and/or redevelopment.

Land Redevelopment

There were two main redevelopment opportunities explored as part of this effort, both of which were limited to areas zoned as non-residential uses. The first utilized assessment and market values to determine where businesses or building structures were valued significantly less than the land they sit upon. This is a common situation in high-growth areas in which a specific location gradually becomes more valuable than the business that resides there, making it oftentimes more profitable for the property to be redeveloped with a higher land use or intensity. The second redevelopment opportunity involved identifying areas where a significant amount of open space or surface parking was initially constructed with a low-density development in what are now areas that allow for relatively high-density development. Due to the allowable building height in some zoning classifications, previously constructed landscaping and surface parking offers the opportunity to convert potentially underutilized space to a future development with increased density.

With the goal of converting future development potential to vehicular trips, the potential for redevelopment and infill opportunities were aggregated to a regional system related to the Vistro traffic model. In total, there were an estimated 695 acres identified in the study area that could have varying degrees of redevelopment and infill potential in the upcoming years. Allowable densities and uses by zoning classification were applied to these acreages, which resulted in a potential future increase in development and thereby vehicular trips. These assumptions are shown in Table 3-4.

Table 3-4 Maximum Potential Land Development

Region	Redevelopment Acreage	Allowable Building Height	Land Uses
A	102.99	6 stories	Office, Restaurant, and Retail
B	11.93	9 stories	Residential Restaurant, and Retail
C	113.83	9 stories	Office, Residential, Restaurant, and Retail
D	75.60	9 stories	Office, Hotel, Restaurant, and Retail
E	10.34	6 stories	Office, Restaurant, and Retail
F	53.61	6 stories	Office, Residential, Hotel, Restaurant, and Retail
G	110.26	12 stories	Office, Hotel, Restaurant, and Retail
H	--	--	--
I	26.08	3 stories	Office
J	7.24	3 stories	Office
K	97.59	6 stories	Office, Restaurant, and Retail
L	64.51	9 stories	Office, Restaurant, and Retail
M	12.71	6 stories	Office, Restaurant, and Retail
N	8.59	12 stories	Office, Restaurant, and Retail
O	--	--	--
P	--	--	--

Trip Generation

Trip generation estimates for the maximized development scenarios were first established based on assumptions related to the relative proportion of building footprints to open space and surface parking. Based on a sample of properties in the Cool Springs area, it was calculated that generally 40% of each acre identified for redevelopment or infill would be utilized for parking and open space, and the remaining 60% would represent the potential building footprint.

Using Franklin Zoning Ordinance and future land use policy outlined in Envision Franklin, an assumed mix of land uses and densities were developed for each region. The land use mix is as shown in Table 3-4. Each unique land use mix was developed and scaled to a 1-acre lot, which was then applied to the total acreage available by region as shown in Figure 3-9.

ITE trip generation calculations were then applied to determine the expected future traffic volumes generated by each region should the maximized development potential within the study area be realized.

The total trip generation for the AM, Midday, and PM peaks for each of the study area regions is included in Table 3-5 with additional trip generation information included in Appendix J.

Should the maximum redevelopment potential for the study area be realized, approximately 129,980 AM peak hour trips, 204,004 Midday peak hour trips, and 162,190 PM peak hour trips could potentially be added to the network.

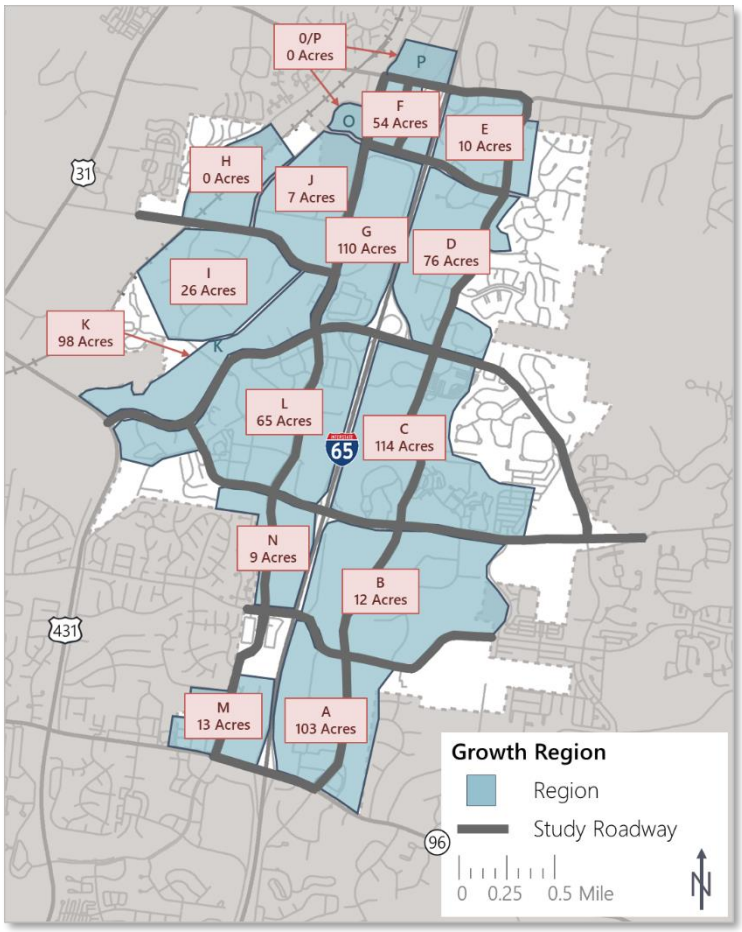


Figure 3-9 Total Redevelopment Potential

Table 3-5 Maximum Development Trip Generation

Region	Trip Generation (vph)		
	AM	Midday	PM
A	11,827	18,883	17,334
B	1,007	1,521	1,288
C	10,260	15,925	14,634
D	8,994	13,946	13,329
E	1,121	1,733	1,756
F	9,546	13,409	10,323
G	50,161	84,831	58,677
H	--	--	--
I	1,652	1,735	1,707
J	448	468	473
K	22,511	33,297	25,209
L	10,519	14,783	13,807
M	1,754	2,743	2,717
N	180	730	936
O	--	--	--
P	--	--	--

Chapter 5

FUTURE CONDITIONS:
SCENARIO 3 AND SCENARIO 4

The Cool Springs Transportation Network Study intends to provide the City of Franklin with a coordinated plan of recommended improvements to be made as development occurs within the study area.

To achieve this, traffic projections were determined based on future conditions with the general background growth, the approved development, as well as, with development that has yet to be planned as presented in the previous chapters of this report.

Two additional scenarios were tested to evaluate the impacts of maximized (re)development within the Cool Springs area:

- Scenario 3 – 25% of maximum development
- Scenario 4 – 50% of maximum development

This section details the steps used to incorporate the maximized development into the Vistro model.

To evaluate the maximized potential future traffic conditions within Cool Springs, the existing Vistro model was updated to include background growth, approved developments, and potential land development. Two scenarios were tested to determine the effects of growth and maximized development on the Cool Springs transportation network.

VISTRO Modeling for Maximized Development Analysis

Part 3 – Chapter 3 of this study detailed the addition of the approved developments into the Vistro model. A similar process was used to add the maximum potential development into the Vistro model. The following steps were taken to incorporate the maximum development scenarios into the Vistro model:

- Zones representing each of the growth regions where development is expected to occur were added to the model. It should be noted that additional Gates were not needed since there are no new major connectors, arterials, or freeways planned that do not already exist.
- Where needed, site accesses were added to the study roadway near the center of each of the growth regions to simulate potential site accesses.
- Paths were defined between each of the potential development Zones and the existing Gates.
- The trip generations for the maximum potential development described in Part 3 – Chapter 4 were input directly into the trip generation section of the Vistro model.
- StreetLight data was used to determine the distribution of vehicles entering and exiting the nine remaining growth regions. These distributions were incorporated into the trip distribution and traffic assignment sections of the model.

Capacity Analysis

As discussed, two future conditions with maximum development scenarios were tested within this portion of the study. This section presents the following Vistro model results for those scenarios:

- Level of Service (LOS) and Delay
- V/C Ratio
- 95th Percentile Queue Lengths

It should be noted that the 100% maximum development scenario was also taken into consideration. When the 50% and 100% maximum development scenarios were tested; however, it was discovered that the majority of study intersections were failing with poor LOS and extensive vehicular delays for both scenarios.

For 50% and 100% development approximately 44% and 78%, respectively, of the study intersections were determined to operate at LOS F with delay exceeding 1,000 seconds (over 16 minutes).

Following discussions with the City of Franklin, it was determined that the 100% maximum development scenario may be unrealistic. Instead, the 25% and 50% scenarios were determined to be a better representation of the market-driven development expected within the Cool Springs area. Therefore, the 100% maximum development scenario was not included within this report.

As previously mentioned, Sidra, a roundabout modeling software, was used to evaluate the existing and proposed roundabouts, which, in turn, validated the Vistro results. Tables detailing LOS and queue lengths are presented in Appendix K and Appendix L, respectively. Detailed Vistro and Sidra results for Scenario 3 and Scenario 4 are included in Appendix P and Appendix Q, respectively.

Scenario 3: 25% Maximum Development

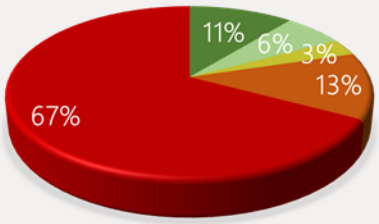
Under Scenario 3, the Vistro model included the existing traffic volumes, background growth, 100% of the remaining occupancy of the approved developments, and 25% of the potential maximized developments.

Level of Service (LOS)

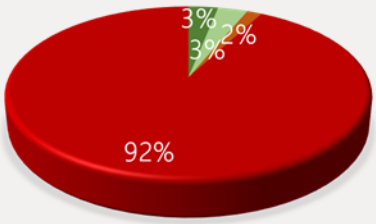
LOS A indicates minimal delay
LOS F indicates excessive delay

	A	B	C	D	E	F
AM	0	7	4	2	8	43
Mid	0	2	2	0	1	59
PM	0	0	3	3	0	58

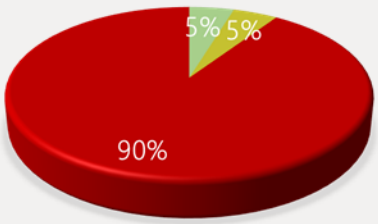
AM Peak



Midday Peak



PM Peak

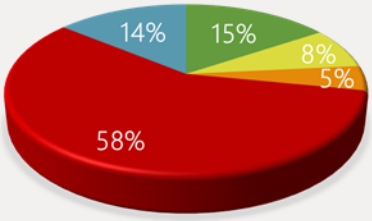


	AM	Mid	PM
< 0.85	10	3	4
0.85 – 0.95	5	1	0
0.95 – 1.00	3	1	0
> 1.00	37	50	51
Unsignalized	9	9	9

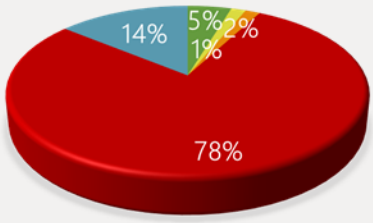
V/C Ratio

<0.85 is operating under capacity
1.0 is operating at capacity
>1.0 is operating over capacity

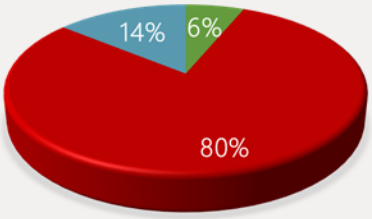
AM Peak



Midday Peak



PM Peak



95th Percentile Queue Length

Tally of intersections where queue length exceeds capacity on at least one approach

AM	50
Mid	61
PM	62

Scenario 4: 50% Maximum Development

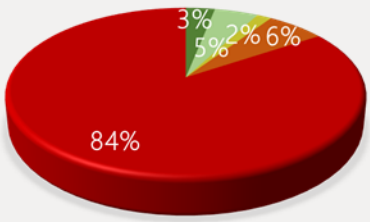
Under Scenario 4, the Vistro model included the existing traffic volumes, background growth, 100% of the remaining occupancy of the approved developments, and 50% of the potential maximized developments.

Level of Service (LOS)

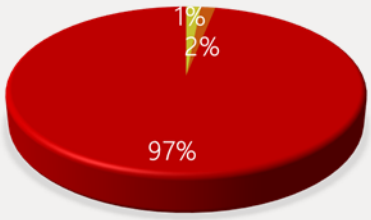
LOS A indicates minimal delay
LOS F indicates excessive delay

	A	B	C	D	E	F
AM	0	2	3	1	4	54
Mid	0	0	0	1	1	62
PM	0	0	0	0	2	62

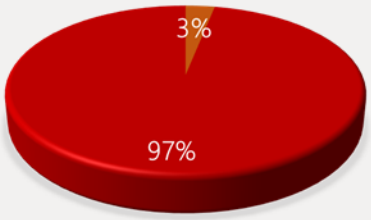
AM Peak



Midday Peak



PM Peak

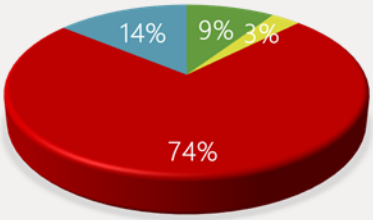


	AM	Mid	PM
< 0.85	6	0	0
0.85 – 0.95	2	1	0
0.95 – 1.00	0	1	0
> 1.00	47	53	55
Unsignalized	9	9	9

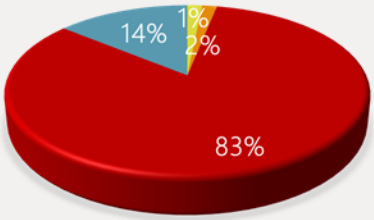
V/C Ratio

<0.85 is operating under capacity
1.0 is operating at capacity
>1.0 is operating over capacity

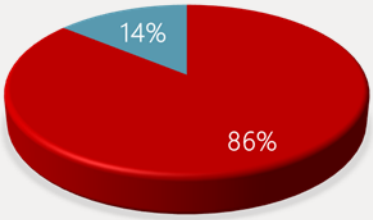
AM Peak



Midday Peak



PM Peak



95th Percentile Queue Length

Tally of intersections where queue length exceeds capacity on at least one approach

AM	56
Mid	62
PM	63

Chapter 6

SCENARIO COMPARISON

Throughout this study, four approved and potential development scenarios were tested. The results of these scenarios were then utilized to determine which study intersections would benefit from infrastructure and/or traffic signal improvements under each scenario. This section details a comparison of the Vistro model results for those scenarios, as well as, the results determined within the Existing Conditions Report.

The four scenarios were as follows:

- Scenario 1 – 50% of approved development
- Scenario 2 – 100% of approved development
- Scenario 3 – 25% of maximum development
- Scenario 4 – 50% of maximum development

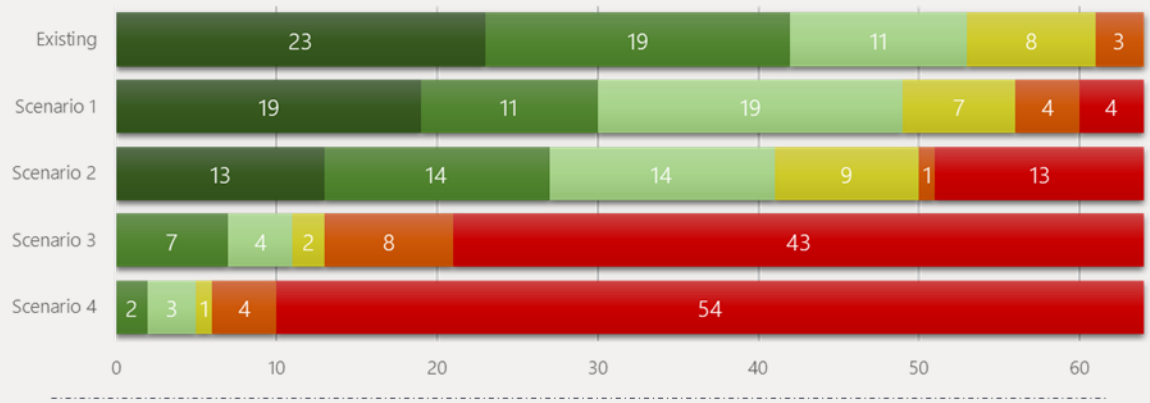
The following Vistro model results were used to compare the tested scenarios and determine which study intersections would benefit from improvements under each of the study scenarios. The following measures were used:

Delay
LOS
V/C Ratio
95th Percentile Queue Length

AM Peak Hour

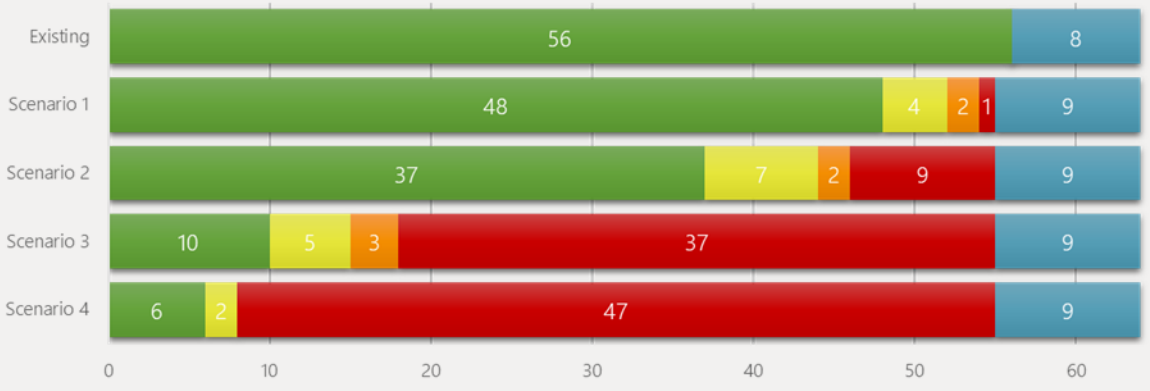
Level of Service (LOS)

	EXIST	FUTURE SCENARIO 1	2	3	4
A	23	19	13	0	0
B	19	11	14	7	2
C	11	19	14	4	3
D	8	7	9	2	1
E	3	4	1	8	4
F	0	4	13	43	54



V/C Ratio

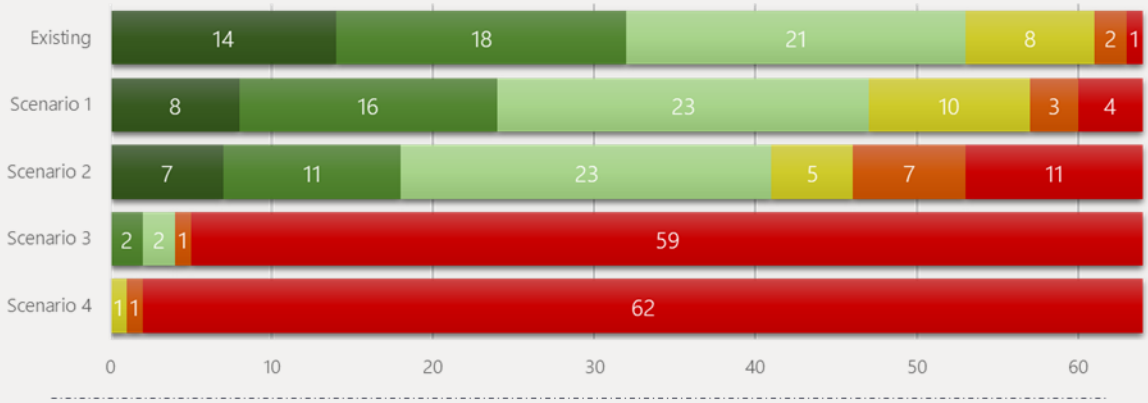
	EXIST	FUTURE SCENARIO 1	2	3	4
< 0.85	56	48	37	10	6
0.85 – 0.95	0	4	7	5	2
0.95 – 1.00	0	2	2	3	0
> 1.00	0	1	9	37	47
Unsignalized	8	9	9	9	9



Midday Peak Hour

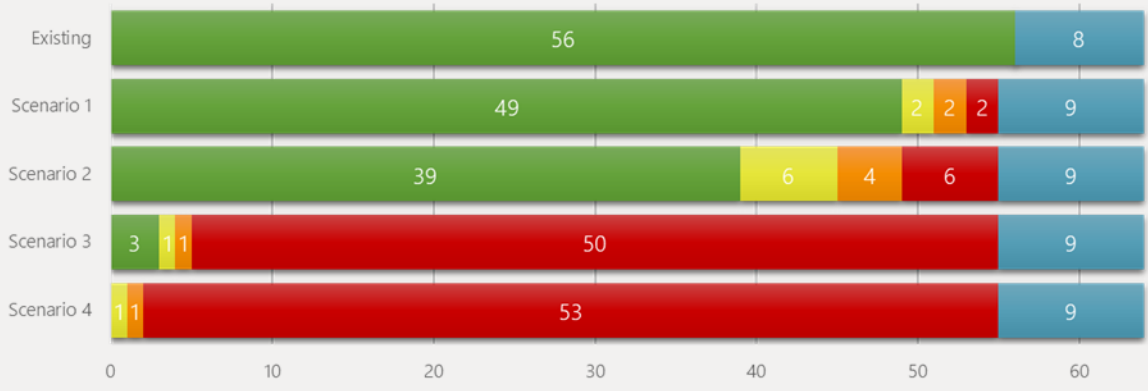
Level of Service (LOS)

	EXIST	FUTURE SCENARIO 1	2	3	4
A	14	8	7	0	0
B	18	16	11	2	0
C	21	23	23	2	0
D	8	10	5	0	1
E	2	3	7	1	1
F	1	4	11	59	62



V/C Ratio

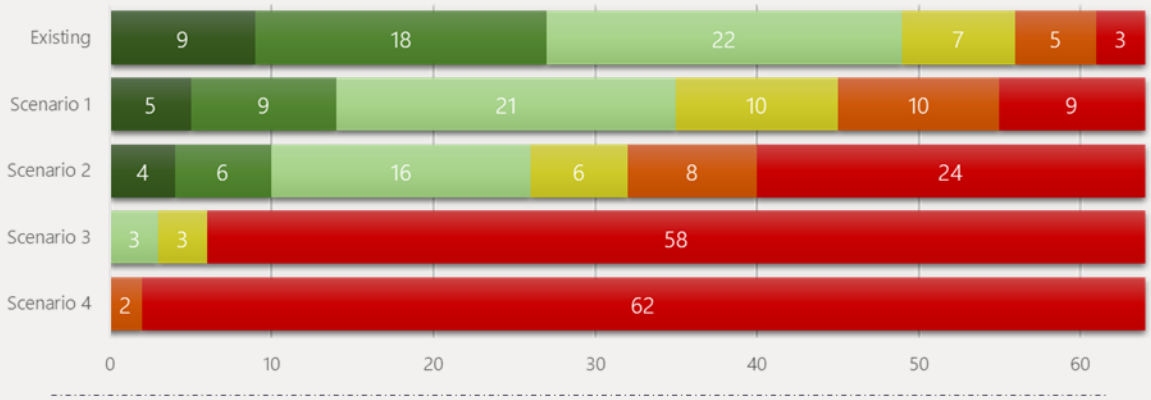
	EXIST	FUTURE SCENARIO 1	2	3	4
< 0.85	56	49	39	3	0
0.85 – 0.95	0	2	6	1	1
0.95 – 1.00	0	2	4	1	1
> 1.00	0	2	6	50	53
Unsignalized	8	9	9	9	9



PM Peak Hour

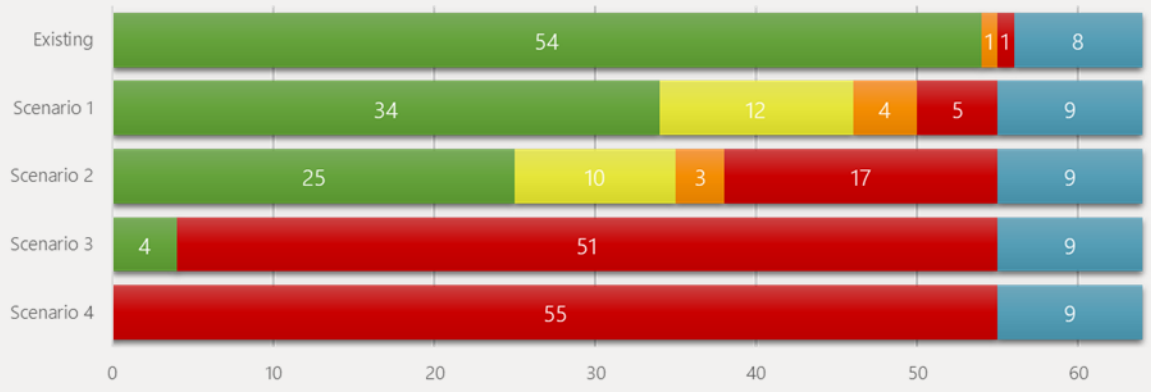
Level of Service (LOS)

	EXIST	FUTURE SCENARIO 1	2	3	4
A	9	5	4	0	0
B	18	9	6	0	0
C	22	21	16	3	0
D	7	10	6	3	0
E	5	10	8	0	2
F	3	9	24	58	62



V/C Ratio

	EXIST	FUTURE SCENARIO 1	2	3	4
< 0.85	54	34	25	4	0
0.85 – 0.95	0	12	10	0	0
0.95 – 1.00	1	4	3	0	0
> 1.00	1	5	17	51	55
Unsignalized	8	9	9	9	9



Part 4

RECOMMENDATIONS

Infrastructure Improvements

Policy Improvements

Transportation Guidelines

Pedestrian Improvements

Travel Demand Management Strategies

Chapter 1

ROADWAY IMPROVEMENTS

The principal purpose of the Cool Springs Transportation Network Study is to provide the City of Franklin with a coordinated plan of transportation improvements to be made as development occurs and to improve safety of all roadway users, improve traffic flow, and preserve roadway capacity.

To support this effort, the four future scenarios were analyzed to determine anticipated and potential growth, and improvements are recommended based on the needs of each scenario.

Infrastructure recommendations were determined based on maintaining LOS E. The recommendations presented in this chapter are for the study intersections operating at LOS F or worse under either Future Conditions – Scenario 1 or Future Conditions – Scenario 2.

When the below improvements are implemented, nearly all of the study intersections are expected to operate at LOS E or better under both Future Conditions – Scenario 1 and Future Conditions – Scenario 2.

This chapter details the roadway infrastructure improvements for the Cool Springs Transportation Network Study, and organizes them into immediate, short-term, mid-term, and long-term recommended infrastructure improvements.

Immediate Improvements

Field inventories were collected for each study intersection in December 2019 and January 2020. From those inventories, an initial set of recommendations was determined for immediate roadway improvements. These improvements include refreshing striping, sidewalk repairs, sign repair/replacement, and additional observations. These recommendations included in Appendix R.

Short-Term Improvements

This section details the proposed short-term recommended improvements. These indicate recommendations that could occur within the next five years. Functional plans for the short-term roadway improvements are presented in Appendix R. Additionally, Vistro model outputs for Future Conditions – Scenario 1 with Improvements and Future Conditions – Scenario 2 with Improvements are presented in Appendix S and Appendix T, respectively. The short-term improvements are included in Table 4-1 and are as follows:

Table 4- 1 Short-Term Recommended Improvements

Intersection	Short-Term Recommendations	LOS and Delay Comparison (Scenario 2) [Improved]		
		AM	MID	PM
Moores Lane and Carothers Parkway (City of Brentwood)	o Add a northbound right-turn lane.	D (36.7)	D (44.4)	F (92.8)
		D [36.2]	**D [39.9]**	**E [61.3]**
Carothers Parkway and Mayfield Drive	o Add an eastbound right-turn lane. This could be incorporated as part of the Eastworks development.	D (54.4)	D (49.2)	F (89.4)
		C [32.8]	**C [32.0]**	**D [39.9]**
Mallory Station Road and Seaboard Lane	o Add a southbound right-turn lane. o Restripe the southbound shared through/right-turn lane to a through lane.	C (22.7)	C (34.9)	E (69.2)
		C [21.6]	**C [23.1]**	**D [43.2]**

Mid-Term Improvements

This section details the proposed mid-term recommended improvements. These indicate recommendations that could occur in the next five to ten years. Functional plans for the mid-term roadway improvements are presented in Appendix R. Additionally, Vistro model outputs for Future Conditions – Scenario 1 with Improvements and Future Conditions – Scenario 2 with Improvements are presented in Appendix S and Appendix T, respectively. The mid-term improvements are included in Table 4-2 and are as follows:

Table 4- 2 Mid-Term Recommended Improvements

Corridor/Intersection	Mid-Term Recommendations	LOS and Delay Comparison (Scenario 2) [Improved] AM	MID	PM
Carothers Parkway	○ Add a southbound through lane between Private Drive south of Mayfield Drive and just south of Physicians Way. ○ Add a northbound through lane between just south of Liberty Pike to just north of Ovation Parkway.	N/A		
McEwen Drive	○ Add an eastbound and westbound through lane between the I-65 Interchange and Turning Wheel Lane.	N/A		
Carothers Parkway and Gillespie Drive/Meridian Boulevard	○ Add a southbound through lane and a southbound receiving lane. ○ The through lane should extend from the intersection of Carothers Parkway and Private Drive south of Mayfield Drive (approximately 500 feet).	D (53.3)	E (57.4)	E (69.9)
		D [35.3]	**C [29.9]**	**D [36.6]**
Carothers Parkway and Corporate Centre Drive	○ Add a southbound through lane and a southbound receiving lane.	C (29.7)	C (34.0)	F (106.9)
		C [23.5]	**B [19.9]**	**C [32.3]**
Carothers Parkway and Tower Circle	○ Add a southbound through lane, a southbound receiving lane, and a westbound left-turn lane.	D (41.8)	C (27.4)	F (148.6)
		C [31.8]	**C [21.5]**	**D [37.7]**
Carothers Parkway and Ovation Way	○ Add a northbound through lane, a northbound receiving lane, a southbound through lane, a southbound receiving lane, and an eastbound right-turn lane.	F (85.3)	E (74.5)	F (176.1)
		D [35.3]	**D [38.5]**	**E [70.7]**
Carothers Parkway and Southstar Drive	○ Add a northbound through lane, a northbound receiving lane, a southbound through lane, and a southbound receiving lane.	F (127.6)	D (50.0)	F (165.6)
		C [33.1]	**C [22.1]**	**D [51.2]**

Corridor/Intersection	Mid-Term Recommendations	LOS and Delay Comparison (Scenario 2) [Improved] AM	MID	PM
Carothers Parkway and Liberty Pike	○ Add a northbound through lane, a northbound receiving lane, a southbound through lane, a southbound receiving lane, and an eastbound left-turn lane.	F (272.7)	F (141.7)	F (176.1)
		E [74.3]	**D [49.7]**	**E [79.7]**
Carothers Parkway and Physicians Way	○ Add a southbound through lane and a southbound receiving lane.	D (48.0)	C (31.8)	F (86.2)
		D [47.0]	**C [27.7]**	**C [25.8]**
Mallory Lane and Cool Springs Boulevard	○ Add a northbound right-turn lane and a southbound left-turn lane. ○ Restripe the northbound through/right-turn lane to a through lane. ○ Based on the final intersection configuration, the left-turn signals may need to operate lead/lag.	D (44.7)	F (84.3)	F (110.2)
		D [42.1]	**D [53.8]**	**E [73.2]**
West McEwen Drive and Mallory Lane	○ Add a southbound left-turn lane. ○ Restripe the outside eastbound left-turn lane to a through lane.	D (45.3)	E (66.3)	F (103.3)
		D [46.9]	**D [52.1]**	**E [78.0]**
Cool Springs Boulevard and I-65 Northbound Ramp	○ Add an eastbound left-turn lane and a westbound right-turn lane. ○ Restripe the westbound shared through/right-turn lane to a through lane.	B (12.8)	D (35.5)	F (156.6)
		A [9.7]	**B [12.6]**	**D [51.8]**
East McEwen Drive and Tower Circle	○ Add an eastbound through lane, an eastbound receiving lane, a westbound through lane, and a westbound receiving lane. ○ Due to the large number of projected vehicles at this intersection, the recommended improvements at this intersection should be reevaluated as development occurs.	F (129.7)	F (181.7)	F (319.0)
		D [45.3]	**E [57.1]**	**F [151.9]**
East McEwen Drive and Carothers Parkway	○ Add a northbound through lane, a northbound receiving lane, an eastbound through lane, an eastbound receiving lane, a southbound through lane, a southbound receiving lane, a westbound through lane, and a westbound receiving lane.	F (84.2)	E (69.4)	F (251.4)
		F [94.4]	**F [99.5]**	**F [180.2]**

Corridor/Intersection	Mid-Term Recommendations	LOS and Delay Comparison (Scenario 2) [Improved] AM	MID	PM
East McEwen Drive and Ovation Parkway	○ Add a southbound right-turn lane, an eastbound through lane, an eastbound receiving lane, a westbound though lane, and a westbound receiving lane. ○ Restripe the northbound through lane to a shared through/left-turn lane. ○ Update the signal phasing to operate as split phasing on the northbound and southbound approaches.	F (84.2)	E (69.4)	F (251.4)
		D [46.5]	**C [28.2]**	**E [61.5]**
Murfreesboro Road and Royal Oaks Boulevard	○ Add a southbound right-turn lane, an eastbound right-turn lane, a westbound left-turn lane, and a southbound receiving lane. ○ Restripe the southbound shared through/right-turn lane to a through lane. ○ Restripe the eastbound shared through/right-turn lane to a through lane.	E (56.5)	F (116.8)	F (137.4)
		D [44.5]	**E [75.5]**	**F [83.7]**
Murfreesboro Road and Edward Curd Lane	○ Add an eastbound through lane and an eastbound receiving lane.	D (44.0)	D (51.9)	F (96.1)
		D [39.6]	**D [37.4]**	**D [39.3]**
Murfreesboro Road and Carothers Parkway	○ Add eastbound through lane and an eastbound receiving lane.	F (164.8)	F (95.1)	F (145.2)
		F [164.6]	**F [94.4]**	**F [117.0]**

Long-Term Improvements

This section details the proposed long-term recommended improvements. These indicate recommendations that could occur after ten years. It should be noted that capacity analysis and functional plans were not developed for the long-term improvements due to the speculative nature of the traffic volumes in the maximized density scenarios. Additional analysis should be conducted as traffic conditions change within the Cool Springs area. These long-term improvements include corridor level improvements and alternative intersection recommendations. The long-term improvements are presented in Table 4-3 and are as follows:

Table 4- 3 Long-Term Recommended Improvements

Corridor/Intersection	Long-Term Recommendations
Carothers Parkway	○ As development occurs, Carothers Parkway should be widened to a six-lane cross-section between Cool Springs Boulevard and Murfreesboro Road. ○ As additional lanes are added to the roadway, consideration should be made into the addition of bicycle facilities along Carothers Parkway.
McEwen Drive	○ As development occurs, McEwen Drive should be widened to a six-lane cross-section between I-65 Interchange and Cool Springs Boulevard.
Cool Springs Boulevard and Carothers Parkway	○ Add two southbound right-turn lanes as bypass lanes that run freely to the northbound I-65 ramp. ○ Displaced Left-Turn Intersection (DLT)/Continuous Flow Intersection (CFI)
Moores Lane and Carothers Parkway	○ Roundabout
East McEwen Drive and Carothers Parkway	○ Center-Turn Overpass Intersection
Carothers Parkway and Ovation Parkway	○ Restricted Crossing U-Turn Intersection (RCUT)/Superstreet
Carothers Parkway and Southstar Drive	○ Restricted Crossing U-Turn Intersection (RCUT)/Superstreet
Carothers Parkway and Liberty Pike	○ Displaced Left-Turn Intersection (DLT)/Continuous Flow Intersection (CFI)
Murfreesboro Road and Carothers Parkway	○ Displaced Left-Turn Intersection (DLT)/Continuous Flow Intersection (CFI) or Jug handle with southbound left-turns utilizing Quail Hollow Road.
Mallory Lane and Cool Springs Boulevard	○ Displaced Left-Turn Intersection (DLT)/Continuous Flow Intersection (CFI)
McEwen Drive and I-65 Interchange	○ Diverging Diamond Interchange (DDI)
East McEwen Drive and Tower Circle	○ Restricted Crossing U-Turn Intersection (RCUT)/Superstreet
Murfreesboro Road and I-65 Ramps	○ Diverging Diamond Interchange (DDI)

As previously mentioned, when the above improvements are implemented, nearly all of the study intersections are expected to operate at LOS E or better under both Future Conditions – Scenario 1 and Future Conditions – Scenario 2. Due to maximum development traffic volumes, it was determined that Future Conditions – Scenario 3 and Future Conditions – Scenario 4 would benefit more from policy improvements rather than further infrastructure improvements. Therefore, no infrastructure improvements are recommended at this time.

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Chapter 2

POLICY RECOMMENDATIONS

Based on the analysis of future scenarios described in Part 3, it is easily discerned that infrastructure improvements alone will not be able to address the operational deficiencies of the study area's transportation system should significant development and redevelopment occur over the next 10 years.

The ultimate goal of the policy strategies and the Cool Springs Transportation Network Study more generally is to ensure that the quality of life for Franklin residents and the economic vitality of the study area are both maintained long term.

This chapter provides an overview of potential policies that could be implemented by the City of Franklin to mitigate traffic impacts of development in tandem with infrastructure improvements. More details on these recommendations can be found in Appendix R.

The City of Franklin has a number of key policies in place to guide how development occurs and impacts the multimodal transportation system, namely the Road Impact Fee, Traffic Impact Study (TIS) requirements, and the Transportation and Street Standards. While these tools are functioning as intended, there are opportunities to modify and expand the suite of strategies available as growth continues to ensure the City's transportation system addresses the needs of roadway users, transit users, bicyclists, and pedestrians. Looking ahead, the intention is that any changes to existing policies or new policies would aid City staff in ensuring that traffic impacts of development are adequately assessed and that appropriate mitigation solutions are explored. In total, the policy recommendations revolve around three key strategies as highlighted in the following pages.

Development Approval Practices

As documented in the Policy Review in Part 2, the City of Franklin assesses the impact of new development using the Highway Capacity Manual (HCM) definition of level-of-service (LOS). Currently, arterial intersections within the City are required to maintain a LOS D before, during, and after development/redevelopment of a particular site with the intention of moving both personal and transit vehicles through the City as efficiently as possible. This standard has become difficult to uphold citywide, but particularly for intersections located at or near interstate ramps and in high-growth areas like Cool Springs. As is common in many urban and suburban areas, many of these key intersections are already operating at LOS E during peak hours with significant physical and fiscal barriers to improving that LOS.

For these reasons, it is recommended that the City's development approval practices be reevaluated to find alternative ways to measure and address development impacts. As a first step, the City should retain a LOS target for intersections affected by development. However, with the recognition that LOS D is not always achievable, development-related impacts will need to be mitigated as much as possible, potentially with different methods than have been used before. In addition, where the LOS metric is not as meaningful, as is the case with over-capacity intersections, the City should explore the use of alternative metrics such as Vehicle Miles Traveled (VMT) to assess systemwide impacts and explore a broader range of mitigation options. The routine use of VMT as a metric of development impact is relatively new, with California leading the way in 2018 with state legislation requiring its use to achieve targets for reduced greenhouse gas emissions. As such, the City should look to monitor the effectiveness reported from such efforts in the near-term to determine the usefulness and applicability of this measure for Franklin long-term.

Trip Reduction Strategies

As a complement to the City's development approval practices, its recently updated zoning ordinance encourages mixed-use development in strategic areas and allows for shared parking arrangements where appropriate. These can be effective tools for encouraging denser and more people-oriented development patterns. However, continued growth in the Cool Springs area will make maintaining the City's quality of life increasingly difficult unless the number of vehicles on the roadways can be significantly reduced. Therefore, it is recommended that in addition to the existing zoning tools, the City create a toolbox of TDM strategies.

TDM strategies are employed with the primary goal of reducing single-occupant-vehicle (SOV) trips during peak periods, typically accomplished through shifts in travel mode or time. Many municipalities have elected to impose requirements for TDM programs or strategies on incoming developments, particularly for those that are expected to generate a significant number of trips. However, the effectiveness of TDM strategies can be difficult to assess and track. For instance, aggressive TDM strategies that combine incentives and improved commute alternatives can report up to 25% trip reduction while separate incentives and improved commute alternatives resulted in only 17% and 9% trip reduction, respectively. This calls for a comprehensive and multipronged approach to TDM. As such, the City's toolbox of strategies should:

- Include a variety of both TDM programs and infrastructure investments that can help reduce vehicular trips;
- Be tailored to Franklin's workforce, development patterns, and existing infrastructure; and
- Be discussed with incoming applicants as the City works through the site development and approval process.

The intention is that increased adoption of these strategies over time will not only reduce SOV trips, but also help the City hone in on the most effective strategies for Cool Springs long-term.

More Multimodal Options

The Cool Springs area has a variety of multimodal transportation infrastructure that accommodates vehicles, transit users, bicyclists, and pedestrians. However, these facilities are often designed, funded, and functioning as independent pieces of a larger system. Though a significant amount of infrastructure exists in Cool Springs specifically, there is still room to improve how it is designed, the purpose it serves, and how it can be funded in the future.

The design of transportation facilities in Cool Springs in many cases complements the largely suburban development patterns with the primary focus on personal vehicles. As Cool Springs continues to grow and become more urban, the design of City streets should reflect the needs and expectations of residents, employees, and visitors alike. Therefore, it is recommended that the City's standard cross sections be evaluated to ensure that they safely and efficiently accommodate various forms of travel, knowing that travel patterns and the needs of roadway users are likely to change in tandem with development patterns. Figure 4-1 presents an example of one of the City's standard cross sections

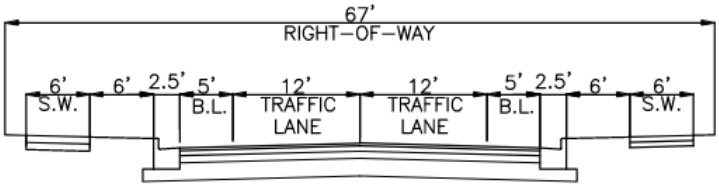

Figure 4- 1 Example of a Roadway Cross Section

In addition, there are new technologies disrupting the transportation industry each year, one of which is the host of micromobility options that are available and being tested across the country. Micromobility is a general term that typically includes a range of transportation options (e.g., bikes, e-bikes, scooters, etc.) available to individuals either personally or through a shared business model. These lightweight vehicles typically travel at low speeds and are particularly suited for trips that may be considered too long to walk, but that are also impractical for driving because of distance or parking availability at a trip destination for instance. In this way,

micromobility options fill a niche in the range of transportation modes. Providing accommodations for micromobility can remove vehicles from the road, reduce the need for surface parking, and improve connectivity between previously inaccessible trip origins and destinations. With the emergence of these options, the benefits are frequently quantified through research efforts, user surveys, etc. For instance, some research has shown that between 35-50% of trips made by e-bikes, a popular micromobility option, would have otherwise been made by automobile, exemplifying the potential for these modes. The City's current regulations limit the possibilities for micromobility in Cool Springs. As this is one area of the City with significant potential for micromobility success, it is recommended that the City explore pilot programs as a means to temporarily test innovative technologies like micromobility options (e.g., e-bikes, scooters, etc.) and assess their long-term potential for reducing trips.

The City of Franklin currently uses its Road Impact Fee ordinance to ensure that new developments are responsible for their pro-rata share of arterial and collector roadway improvements. This fee is calculated based on a development's addition of VMT to the roadway system and the average cost of adding roadway capacity to address that VMT increase. Innovative at the time of inception, this fee structure has served the City well in planning for the financial commitments associated with capital infrastructure improvements. However, as it exists currently, this fee is typically used for capital roadway improvements including but not limited to, new roads, additional lanes, widened lanes, turn lanes, bridges, traffic signals, intelligent transportation system (ITS) improvements, street lighting and associated drainage facilities. It is unlikely that the growth potential in the Cool Springs area can be accommodated with roadway infrastructure alone. Therefore, the City should evaluate the need for dedicating funding to address the growing multimodal transportation needs.

In addition to the specific and actionable policy recommendations presented above, the technical analysis and policy analysis resulted in the development of other high-level considerations for the future transportation network in the Cool Springs area. Though not modeled and primarily development-driven, the improvements outlined below should be considered as a means of developing Cool Springs as a regional activity center. These recommendations are intended to create additional multimodal connectivity across the interstate, capitalize on redevelopment opportunities, and prioritize the efficient movement of people over vehicles.

- Transit Opportunities – The City of Franklin should coordinate with the Tennessee Department of Transportation (TDOT), the Regional Transit Authority (RTA), and the Franklin Transit Authority (FTA) to explore opportunities for increasing the accessibility of the Cool Springs area by both regional and local transit service. At a regional scale, the portion of I-65 between the Moores Cool Springs Boulevard and Moores Lane interchanges is positioned for high-density redevelopment, which presents an opportunity to make the area more accessible for regional transit users. For example, reconfiguring the Cool Springs Boulevard interchange or creating bus pull-offs along the corridor are opportunities to make use of potentially underutilized right-of-way and spur transit-oriented development patterns. In tandem with such improvements, local transit service with

acceptable headway would need to provide connectivity to the area's trip attractions.

- Roadway Opportunities – As redevelopment continues to occur and more vehicular trips are added to the roadway network, the existing infrastructure will inevitably become overburdened. Further complicating this issue is the difference in land uses on either side of I-65, where retail and restaurant uses on the west will continue to impact mid-day and weekend traffic operations and office and residential uses on the east will continue to impact the traditional AM and PM traffic operations. To the extent feasible, the City should look to make additional connections across the interstate that do not involve interchanges. More specifically, connections using Mallory Station Road, Nichol Mill Lane, Crossroads Boulevard, and Jordan Road should be explored as the Cool Springs area redevelops. Furthermore, outside the study area, a new cross-interstate roadway connection should be considered in the vicinity of Fulwood Drive and Carothers Parkway and along Oak Meadow Drive near the Elks Lodge No. 72. This could potentially divert trips from Murfreesboro Road. Finally, the City should explore the opportunity for connections that facilitate only transit, bicycle, and pedestrian movements across the interstate.
- Bicycle and Pedestrian Opportunities – As the land uses in the Cool Springs area become more diverse and intermingled with redevelopment, the City should continue to pursue opportunities for making both local and regional bicycle connections. For example, the City should explore partnering with other municipalities on the creation of a greenway connection to Smith Park that would allow for commuters from Brentwood or Nolensville to park there and commute by bike into the Cool Springs area. Additionally, the City should consider creating long-term bike connectivity between Downtown Franklin and Cool Spring via Bakers Bridge Avenue, Seaboard Lane, General George Patton Drive, or Mallory Station Road using road diets where feasible. As mentioned, consideration should be given to facilitating bicycle and pedestrian movements across the interstate with connections not accessible to vehicles.

The policy initiatives included in this chapter document high-level strategies to help the City of Franklin address increasing growth pressures while actively preserving the quality of life for which the City of Franklin is so well known. Appendix R documents the actionable steps associated with these recommendations and outlines a general timeframe for implementation. All of these recommendations are rooted in promoting smart growth principles, finding innovative ways to manage current and future traffic volumes, and expanding multimodal options.