FEBRUARY 2013

Integrated Growth Plan

Carothers Parkway and East McEwen Drive

Prepared for:

City of Franklin, Tennessee

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1.0 INTRODUCTION

The intersection of Carothers Parkway at East McEwen Drive has the unique opportunity to function as the crossroads that will be central to future development growth in the City of Franklin. Just six (6) years ago, the McEwen Drive interchange with Interstate 65 (I-65) was under construction and the intersecting routes of Carothers Parkway and East McEwen Drive did not exist. Today, all four (4) segments of this intersection are four-lane divided facilities with curb/gutter, raised landscaped medians, and sidewalks on both sides of the roadway. This roadway infrastructure exemplifies the beneficial forethought possessed by the City of Franklin as vehicular capacity is available for future growth in traffic volumes. However, the growth in development and traffic must be properly implemented and maintained for the Carothers Parkway and East McEwen Drive corridors to continue to function as exemplary roadway facilities.

Development activities on the northeast quadrant (Resource Centre) and northwest quadrant (Franklin Park) are actively underway as this study is being prepared. Additionally, development activities may begin in the near future on the southwest quadrant (Vanderbilt) and on the southeast quadrant (Pickering property). While these four (4) properties exceed 275 acres, there are additional parcels in the vicinity that may be developed and generate additional traffic along Carothers Parkway and East McEwen Drive. This study focused on sixteen (16) parcels that total approximately 489 acres.

The purpose of this traffic analysis is to forecast traffic volumes generated by future developments, determine roadway and intersection improvements that will be needed, and develop preliminary implementation costs for these improvements. This report summarizes the methodology and results for the traffic forecasting as well as the intersection capacity analyses. This report also provides guidance on access management principles and the opportunities for transportation management in the future.

The general study area is Carothers Parkway between Cool Springs Boulevard and Liberty Pike, and McEwen Drive between Mallory Lane and Cool Springs Boulevard/Oxford Glen Drive. Nine (9) intersections have been identified as the study intersections for traffic volume forecasting and capacity analyses.

For this study, 2012 was used as the existing study year and 2025 was used as the future horizon year. These study years are consistent with the analysis contained in the Resource Centre traffic impact study (TIS) and Franklin Park TIS, and were used based on coordination with City of Franklin staff.

This Integrated Growth Plan was originally prepared in October 2012. This revision incorporates more recent peak hour turning movement counts that were collected during December 4-6, 2012. A ninth study intersection has been added along West McEwen Drive at the signalized intersection with Spring Creek Drive (Kohl's). Additionally, this revision considers an Alternative Intersection configuration for the intersection of Carothers Parkway at East McEwen Drive.

2.0 EXISTING CONDITIONS

2.1 Intersection Geometry

The study area includes the following nine (9) intersections:

- Cool Springs Boulevard at Carothers Parkway
- Carothers Parkway at Crescent Centre Drive
- Carothers Parkway at Nissan Way
- Carothers Parkway at East McEwen Drive
- Carothers Parkway at Liberty Pike
- Mallory Lane at West McEwen Drive
- West McEwen Drive at Spring Creek Drive (Kohl's)
- McEwen Drive at I-65 Interchange
- Cool Springs Boulevard/Oxford Glen Drive at East McEwen Drive

Field visits were performed to verify the existing roadway conditions. Intersection geometry, turn lane storage lengths, and traffic signal phasing were collected at the nine (9) study intersections. Additionally, the existing signal timings were obtained from the City of Franklin. The roadway capacity, posted speed limit, TDOT functional classification, and City of Franklin functional classification are summarized in **Table 1**.

Table 1, Roadway Conditions

Roadway	Number of Lanes	Median	Posted Speed Limit	TDOT Functional Classification	City of Franklin Functional Classification
Carothers Parkway	4	Curb / Gutter Landscaped	40	Collector[1] n/a[2] Minor Arterial[3]	Major Arterial
McEwen Drive	4	Curb / Gutter Landscaped	40	n/a	Major Arterial
Cool Springs Boulevard	4	Curb / Gutter Landscaped	40	Minor Arterial	Major Arterial
Liberty Pike	2 / 4	Curb / Gutter Landscaped	40	Collector	Minor Arterial
Mallory Lane	4	Curb / Gutter Landscaped	40	Collector	Major Arterial
Oxford Glen Drive	2	None	35	n/a	Major Collector

1 – Moores Lane to Cool Springs Boulevard; 2 – Cool Springs Boulevard to Liberty Pike; 3 – Liberty Pike to Murfreesboro Road

Eight (8) of the nine (9) study intersections are signalized. The largest intersection (based on total number of approach lanes) is Carothers Parkway at East McEwen Drive with 20 total approach lanes; this consists of two left-turn, two through, and one right-turn lane along each of the four (4) intersection approaches. For comparison purposes, this intersection geometry is practically identical to the intersection of Cool Springs Boulevard at Mallory Lane (outside this study network). The one (1) unsignalized intersection is the modern roundabout at the intersection of Cool Springs Boulevard/Oxford Glen Drive and East McEwen Drive.

East McEwen Drive creates offset intersections along Cool Springs Boulevard/Oxford Glen Drive. The distance between these intersections is approximately 300 feet centerline-to-centerline. The west leg forms the northern intersection with all approaches currently operating under YIELD control as a modern roundabout. The east leg forms the southern intersection which currently operates as a limited access intersection; the free-flow northbound left-turn is prohibited, and the STOP-controlled eastbound and westbound approaches operate under right-in/right-out conditions.

2.2 Traffic Volumes

Peak hour turning movement counts were obtained for the AM and PM peak periods at the nine (9) study intersections. This traffic data was collected during December 4-6, 2012 and are presented in further detail in Appendix I.

An earlier turning movement count performed for three (3) consecutive days in June 2012 was used to determine 24-hour traffic volumes along each of the road segments that form the intersection of Carothers Parkway at East McEwen Drive. These daily traffic volumes were updated to represent December 2012 volumes based on the traffic growth that has occurred. To calculate this growth, the AM and PM peak period traffic volumes from the June 2012 count were compared with the AM and PM peak period traffic volumes from the newer December 2012 count. On all approaches during each peak period, traffic volumes increased from June 2012 to December 2012. This growth was applied to estimate the December 2012 daily traffic volumes:

- 14,600 vehicles per day along East McEwen Drive, west of Carothers Parkway
- 7,400 vehicles per day along East McEwen Drive, east of Carothers Parkway
- 15,800 vehicles per day along Carothers Parkway, north of East McEwen Drive
- 12,800 vehicles per day along Carothers Parkway, south of East McEwen Drive

3.0 STUDY PARCELS AND DEVELOPMENTS

The City of Franklin identified sixteen (16) parcels to be considered within the study area. There are generally three (3) categories of parcels:

- Partially-developed parcels that are currently generating traffic but are approved for additional expansion (e.g. Nissan, Greenway Centre)
- Parcels in the process of being developed but are not currently generating traffic (e.g. Crescent Resources, Spectrum, Vanderbilt)
- Parcels that have not begun the process of being developed and generate minimal traffic from existing land uses (Pickering, Porter, Carbine)

The parcel ID (for the purposes of this study), property owner, site name, and parcel size are described in **Table 2**.

Table 2, Study Parcels and Developments

Parcel ID	Property Owner	Site Name	Acres
A	Crescent Resources	Resource Centre	36.93
B	Spectrum	Franklin Park	71.03
C	Vanderbilt	TBD	22.04
D	Pickering	TBD	147.00
E	Pinnacle	McEwen Drive Site	4.10
F	State of Tennessee	Columbia State Community College	36.00
G	Pinnacle	Waterford Crest / Mars Pet Care	20.52
H	Drury Development	Spring Creek Centre	13.86
I	Duke Realty	TBD	21.78
J	Porter Site	TBD	20.52
K	Carbine Property	TBD	10.45
L	Parcel I (McEwen 65)	TBD	4.41
M	Parcel II (Pickering)	TBD	15.72
N	Parcel III (Carothers Ezeal)	TBD	23.76
O	Partially Developed	Nissan Phase II	25.06
P	Partially Developed	Greenway Centre	16.06
TOTAL			**489.24**

The City of Franklin provided land uses and densities for future development on the sixteen (16) study parcels. Many of these projections had already been developed as part of a sewer capacity study along the Carothers Parkway corridor. The combined total densities for the various land uses within the study area are:

- 703 apartment units
- 800 condominium units
- 1,963 hotel rooms
- 6,000-student junior/community college
- 5,556,355 square feet of office space
- 445,955 square feet of retail space
- 17,692 square feet of restaurant space

A graphic depicting the location of the sixteen (16) study parcels is illustrated on **Figure 1**. The summary of parcels, land uses, and densities are presented in further detail in Appendix C.

4.0 FUTURE CONDITIONS

4.1 Future Roadway Projects

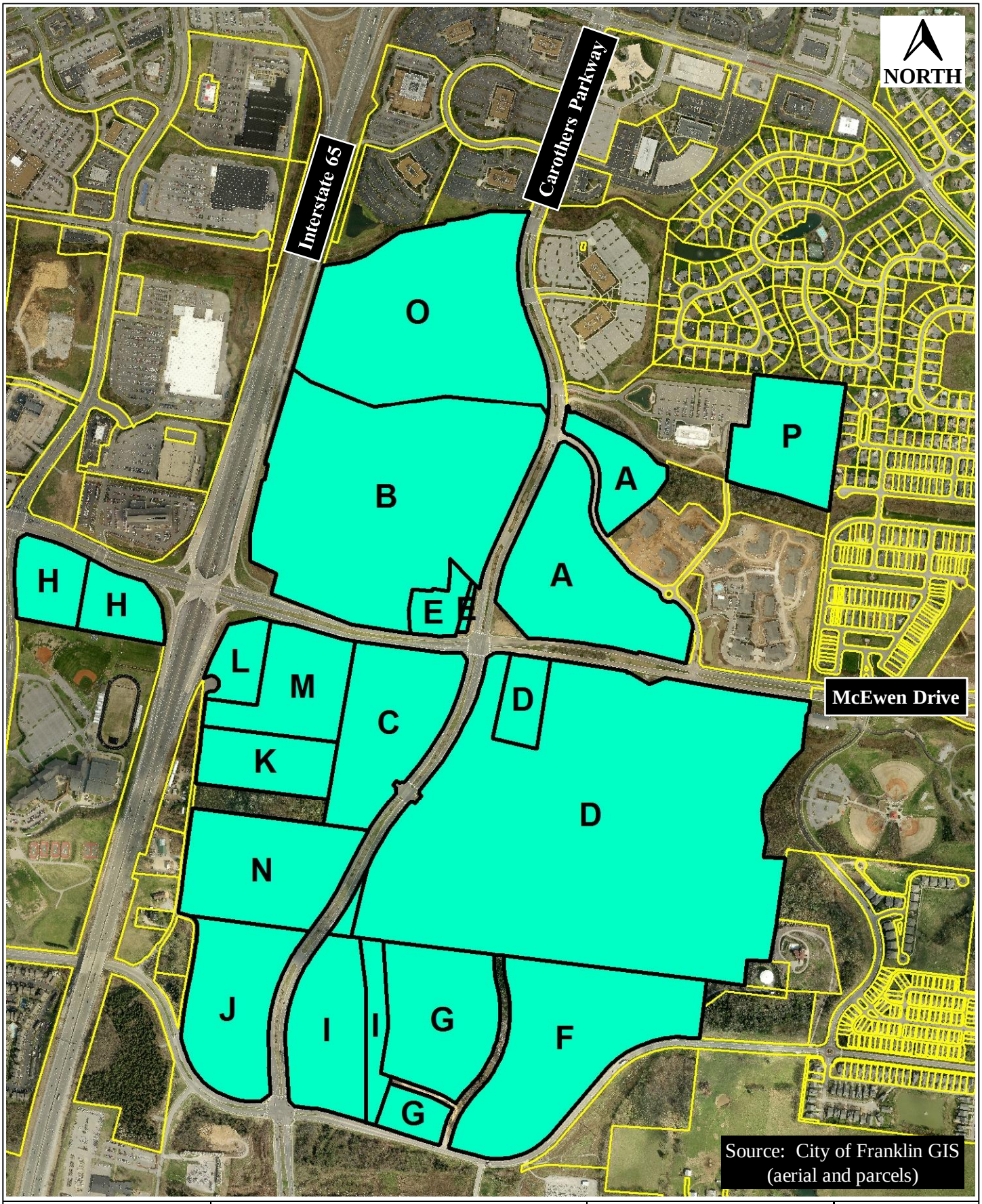
Several roadway projects are planned, programmed, or under construction within the study area.

The intersection of Cool Springs Boulevard at Carothers Parkway is currently under construction. A second southbound right-turn lane is currently being installed along Carothers Parkway, along with right-turn overlap signal phasing for the southbound right-turn movement.

East McEwen Drive will be improved and widened between Cool Springs Boulevard/Oxford Glen Drive and Wilson Pike. This project is similar to the recently completed improvements along East McEwen Drive between Carothers Parkway and Cool Springs Boulevard/Oxford Glen Drive. The existing two-lane facility will be improved to a four-lane facility with a raised median including curb/gutter and landscaping. As part of this project, the existing signalized intersection of Wilson Pike at East McEwen Drive will also be improved.

Prior to the full construction of improvements along the East McEwen Drive corridor to Wilson Pike, a temporary connector will be constructed to re-align the east leg of McEwen Drive with the modern roundabout. This will create a 4-leg roundabout and remove the offset intersections along Cool Springs Boulevard/Oxford Glen Drive. The temporary connector will include approximately 1,700 feet of new alignment; a four-lane facility with a raised median including curb/gutter and landscaping will be constructed approximately 1,000 feet from the roundabout, and the remaining 700 feet will merge into a two-lane facility and tie into the existing alignment. The intersection configuration of Cool Springs Boulevard/Oxford Glen Drive will also be modified as part of this improvement project. There will be two circulating lanes within the modern roundabout and all approaches will have two lanes.

The Huffines Ridge Road Connector is a new roadway facility proposed between Huffines Ridge Road and Carothers Parkway. This alignment was designed as part of the construction plans for Carothers Parkway between East McEwen Drive and Liberty Pike. However, this roadway was not constructed and right-of-way does not appear to have been purchased. This two-lane facility would extend approximately 1,700 feet between an existing median opening along Carothers Parkway and Huffines Ridge Road near the northern cul-de-sac terminus.



Kimley-Horn and Associates, Inc.	Carothers Parkway Integrated Growth Plan	Study Parcels	Figure 1

Knoll Top Lane is a new roadway facility proposed between Liberty Pike and the southern property line of the 147-acre Pickering property. A 75-foot right-of-way appears to have been reserved for a future roadway and travels through the Waterford Crest property. It is speculated that this roadway would be extended northward to intersection with either Carothers Parkway or East McEwen Drive at the location of an existing median opening.

4.2 Background Growth

A background growth of 1.0% per year for thirteen (13) years was applied to the existing traffic volumes. This additional increase was included to account for other future developments that may produce traffic along Carothers Parkway and McEwen Drive. This is consistent with the Resource Centre TIS and Franklin Park TIS.

4.3 Trip Generation

Site traffic for the various land uses and densities associated with the sixteen (16) study parcels was calculated using *Trip Generation, 8th Edition: An ITE Informational Report* prepared by the Institute of Transportation Engineers. These study parcels comprise approximately 490 acres, which provide vast opportunities for future developments and increased traffic volumes. Due to the proximity of the study parcels and the large-scale size of the study area, the densities for the several parcels were summed and the generated trips were calculated for the entire study area as a whole. This methodology yields more reasonable trip generation results than if calculations were performed for each individual parcel and then summed.

Internal capture (mixed-use reductions) was applied to the gross trip generation to account for vehicular trips that travel between an origin and a destination both located within the study area. Reductions for internal capture typically account for trips that occur between separate land uses that are internal to the site. The *Trip Generation Handbook, 2nd Edition: An ITE Recommend Practice* was used to calculate the reductions to apply to the residential, hotel, office, and retail land uses (junior/community college was excluded). This procedure yields a trip reduction of 7.27% for daily, 2.08% for AM peak hour, and 4.92% for PM peak hour.

Pass-by reductions were applied to the trip generation forecasts following the reduction of internal capture trips. The concept of pass-by trips accounts for vehicles that already travel on the public street network adjacent to a proposed development; a fraction of these vehicles will become trips generated by the proposed development, but will not add new trips to the public street network. The *Trip Generation Handbook, 2nd Edition: An ITE Recommend Practice* was used to calculate the reductions to apply to the retail land uses. The fitted curve equation located on Figure 5.5 of this reference material and the anticipated density of retail and restaurant land uses within the study area were used to calculate the pass-by rate. This procedure yields a trip reduction of 25.02% for the daily, AM peak hour, and PM peak hour for the retail and restaurant land uses.

Alternative mode reductions were not applied, although it is possible that some vehicular trips may be replaced by pedestrian, bicycle, carpool, and/or transit modes of transportation.

For each land use, the trip generation and applicable trip reductions were proportionally distributed to the study parcels. This procedure ensured that the relationship among the several parcels remained consistent between both land use density and traffic volumes generated. An example is Parcel A which includes 253 apartment units, or approximately 36% (253 / 703) of the future apartment units in the study area. Consequently, for its apartment land use, Parcel A receives 1,578 (4,384 x 0.36) daily trips, 125 (348 x 0.36) AM peak hour trips, and 145 (404 x 0.36) PM peak hour trips. This methodology was performed for all land uses and all study parcels.

Similarly, internal capture and pass-by reductions were applied to the study parcels by proportionally distributing the reductions. Internal capture was only applied to the residential, hotel, office, and retail land uses; pass-by was only applied to the retail land uses.

The trip generation exercise was performed for several land use and density thresholds defined by the percentage of completed development. Daily trips, AM peak hour trips, and PM peak hour trips were calculated for 25%, 50%, 75%, and 100% development on the study parcels. The detailed trip generation results for 100% development are shown in **Table 3**; the summarized results for 25%, 50%, 75%, and 100% development are shown in **Table 4**.

Table 3, Trip Generation (Detailed)

ITE Code	Land Use	Density	Daily Trips	AM Peak Hour Trips	PM Peak Hour Trips
220	Apartment	703 d.u.	4,384	348	404
230	Condominium	800 d.u.	3,927	272	331
310	Hotel	1,963 rooms	17,196	1,638	1,158
540	Junior/Community College	6,000 students	7,963	970	964
710	Office	5,556,355 s.f.	29,421	4,667	6,302
820	Retail	445,955 s.f.	17,946	370	1,732
932	Restaurant	17,692 s.f.	2,250	204	197
GROSS TOTAL			**83,087**	**8,469**	**11,088**
Internal Capture			- 6,042	- 176	- 546
Pass-By			- 5,052	- 144	- 482
NET TOTAL			**71,993**	**8,149**	**10,060**

d.u. = dwelling units; s.f. = square feet

Table 4, Trip Generation (Summarized)			
Forecasted Development Completion Percentage	**Daily Trips**	**AM Peak Hour Trips**	**PM Peak Hour Trips**
25% Developed	21,428	2,485	2,867
50% Developed	39,355	4,471	5,326
75% Developed	56,044	6,337	7,712
100% Developed	71,993	8,149	10,060

The trip generation calculations are presented in further detail in Appendix D, and the intersection volume calculations are presented in further detail in Appendix E.

4.4 Trip Distribution

A separate trip distribution was prepared for each of the sixteen (16) study parcels. The trip distribution was applied to the net total trip generation to develop the trip assignment for individual movements at the study intersections. While trip distribution varies between each parcel, the following trip distribution origin/destination were agreed upon and utilized:

- 35% to/from the north
- 25% to/from the south
- 15% to/from the east
- 25% to/from the west

Several factors contributed to the establishment of the trip distributions: review of traffic impact studies for study parcels, evaluation of existing traffic patterns, overview of surrounding land uses, engineering judgment, and coordination with the City of Franklin. The trip distributions within the intersection volume calculations are presented in further detail in Appendix E.

4.5 Forecasted Traffic Volumes

Combining the existing traffic volumes, background growth, and the site traffic calculated from the trip generation and trip distribution, future year 2025 traffic volumes were developed for the AM and PM peak hours at the nine (9) study intersections. Turning movement volumes were considered for the following scenarios:

- Existing 2012
- Future 2025 with 0% Build-Out
- Future 2025 with 25% Build-Out
- Future 2025 with 50% Build-Out
- Future 2025 with75 % Build-Out
- Future 2025 with 100% Build-Out

Turning movement volume exhibits for the AM and PM peak hours are presented in Appendix A.

The central intersection of this study is Carothers Parkway at East McEwen Drive. The future daily traffic volumes associated with the sixteen (16) study parcels were calculated along each of the four (4) intersection approach segments by applying the trip distribution to the daily site traffic calculated as part of the trip generation exercise. The daily site traffic volumes were added to the existing daily traffic volumes with the applied background growth rate. This is summarized for Existing 2012 and Future 2025 (0%, 25%, 50%, 75%, and 100% developed) in **Table 5**.

Table 5, Forecasted Daily Traffic Volumes

Road Segment	Existing 2012	Future 2025 (0%)	Future 2025 (25%)	Future 2025 (50%)	Future 2025 (75%)	Future 2025 (100%)
Carothers Parkway, south of East McEwen Drive	12,800	14,600	19,900	24,200	28,200	32,000
Carothers Parkway, north of East McEwen Drive	15,800	18,000	22,100	25,400	28,400	31,300
East McEwen Drive, west of Carothers Parkway	14,600	16,600	23,200	28,600	33,500	38,200
East McEwen Drive, east of Carothers Parkway	7,400	8,400	11,400	13,700	15,900	17,900

5.0 INTERSECTION CAPACITY ANALYSIS

The Synchro 8 software was utilized to evaluate several scenarios and determine level of service (LOS) and vehicular delay in seconds. The intersection capacity analyses were performed using methodology contained in the *Highway Capacity Manual, Fifth Edition (HCM 2010)* prepared by the Transportation Research Board. The only exception is the intersection of McEwen Drive at I-65 Interchange, which is a single-point diamond interchange; it was determined that the *Highway Capacity Manual, Fourth Edition (HCM 2000)* evaluates traffic operations more appropriately at single-point diamond interchanges.

Several future 2025 analysis scenarios were performed to measure the need for roadway and intersection improvements at various thresholds for development completion. The following six (6) scenarios were analyzed for both AM and PM peak hours:

- Existing 2012
- Future 2025 – 0% developed
- Future 2025 – 25% developed
- Future 2025 – 50% developed
- Future 2025 – 75% developed
- Future 2025 – 100% developed

5.1 Methodology

The Existing 2012 scenario includes the existing intersection and roadway geometry, as well as the existing traffic signal timings. For each Future 2025 scenario, capacity analyses were performed for three (3) iterations:

A. Future 2025 includes two (2) programmed improvements: the 2nd southbound right-turn lane along Carothers Parkway at Cool Springs Boulevard, and the realignment of East McEwen Drive to create the 4th leg of the roundabout at Cool Springs Boulevard. The existing traffic signal timings remain unchanged.
B. Future 2025 Improved Timings includes the two (2) programmed improvements plus improved traffic signal timings. Many of the existing signalized intersections do not currently operate as part of a coordinated signal system, resulting in worse vehicular delay. Improved signal timings and coordination between signalized intersections can provide better vehicle platoons and decreased vehicular delay.
C. Future 2025 Improved Geometry and Timings includes the two (2) programmed improvements, the improved traffic signal timings, and additional improvements needed to achieve LOS E or better due to the forecasted site traffic from the sixteen (16) study parcels.

Section 5.10 (Mobility and Circulation) within the Zoning Ordinance of the City of Franklin states that intersections shall maintain at least LOS C, and individual approach lanes must maintain a minimum LOS D. However, if LOS C or LOS D was pursued for the overall intersection minimum standard, an even larger number of intersection improvements would be needed at the study intersections. Due to the combination of a horizon year 2025 and the large amount of anticipated development, an overall intersection standard of LOS E was applied for the purposes of the capacity analyses within this study.

The capacity analysis results summarizing intersection level of service and vehicular delay are located in Appendix B.

5.2 Mitigation

The results of the capacity analyses indicate that several intersection and roadway improvements are needed for Future Year 2025 with 100% development of the sixteen (16) study parcels. These improvements are summarized:

1. Cool Springs Boulevard @ Carothers Parkway
    a. Construct a 2nd southbound right-turn lane and provide protected-overlap right-turn phasing (programmed improvement, under construction)
    b. Widen Carothers Parkway from 4 to 6 lanes through this intersection
    c. Construct a 3rd eastbound left-turn lane along Cool Springs Boulevard
    d. Construct a 2nd eastbound right-turn lane along Cool Springs Boulevard
    e. Construct a 3rd northbound left-turn lane along Carothers Parkway
    f. Construct a northbound right-turn lane along Carothers Parkway
    g. Construct a 2nd southbound left-turn lane along Carothers Parkway
2. Carothers Parkway @ Crescent Centre Drive
    a. Widen Carothers Parkway from 4 to 6 lanes through this intersection
3. Carothers Parkway @ Nissan Way
    a. Widen Carothers Parkway from 4 to 6 lanes through this intersection
4. Carothers Parkway @ East McEwen Drive
    a. Widen Carothers Parkway from 4 to 6 lanes through this intersection
    b. Widen East McEwen Drive from 4 to 6 lanes through this intersection
    c. Construct a 3rd eastbound left-turn lane along East McEwen Drive
    d. Construct a 2nd eastbound right-turn lane along East McEwen Drive
    e. Construct a 3rd northbound left-turn lane along Carothers Parkway
    f. Construct a 2nd southbound right-turn lane along Carothers Parkway
    g. Construct a 3rd southbound right-turn lane along Carothers Parkway
5. Carothers Parkway @ Liberty Pike
    a. Widen Carothers Parkway from 4 to 6 lanes through this intersection
6. Mallory Lane @ West McEwen Drive
    a. Construct a 3rd eastbound through lane along West McEwen Drive
    b. Construct an eastbound right-turn lane along West McEwen Drive
    c. Construct a southbound right-turn lane along Mallory Lane
7. West McEwen Drive @ Spring Creek Drive (Kohl's)
    a. Construct a 3rd westbound through lane along West McEwen Drive
8. McEwen Drive @ I-65 Interchange
    a. Construct a 2nd westbound left-turn lane along East McEwen Drive
    b. Construct a 2nd westbound right-turn lane along East McEwen Drive
    c. Construct a 2nd northbound left-turn lane along I-65 Northbound Ramp
    d. Construct a 3rd southbound left-turn lane along I-65 Southbound Ramp

9. East McEwen Drive @ Cool Springs Boulevard / Oxford Glen Drive
    a. Realign the east leg of East McEwen Drive to create a 4-leg modern roundabout (programmed improvement)
    b. Convert the modern roundabout from 1-lane circulation to 2-lane circulation (programmed improvement)
    c. Provide two (2) through lanes along the eastbound, westbound, and northbound approaches (programmed improvement)
    d. Provide a separate left-turn lane and a shared left-turn/through/right-turn lane along the southbound approach of Cool Springs Boulevard (programmed improvement)
    e. Construct a westbound bypass right-turn lane along East McEwen Drive (programmed improvement)
    f. Construct an eastbound bypass right-turn lane along East McEwen Drive

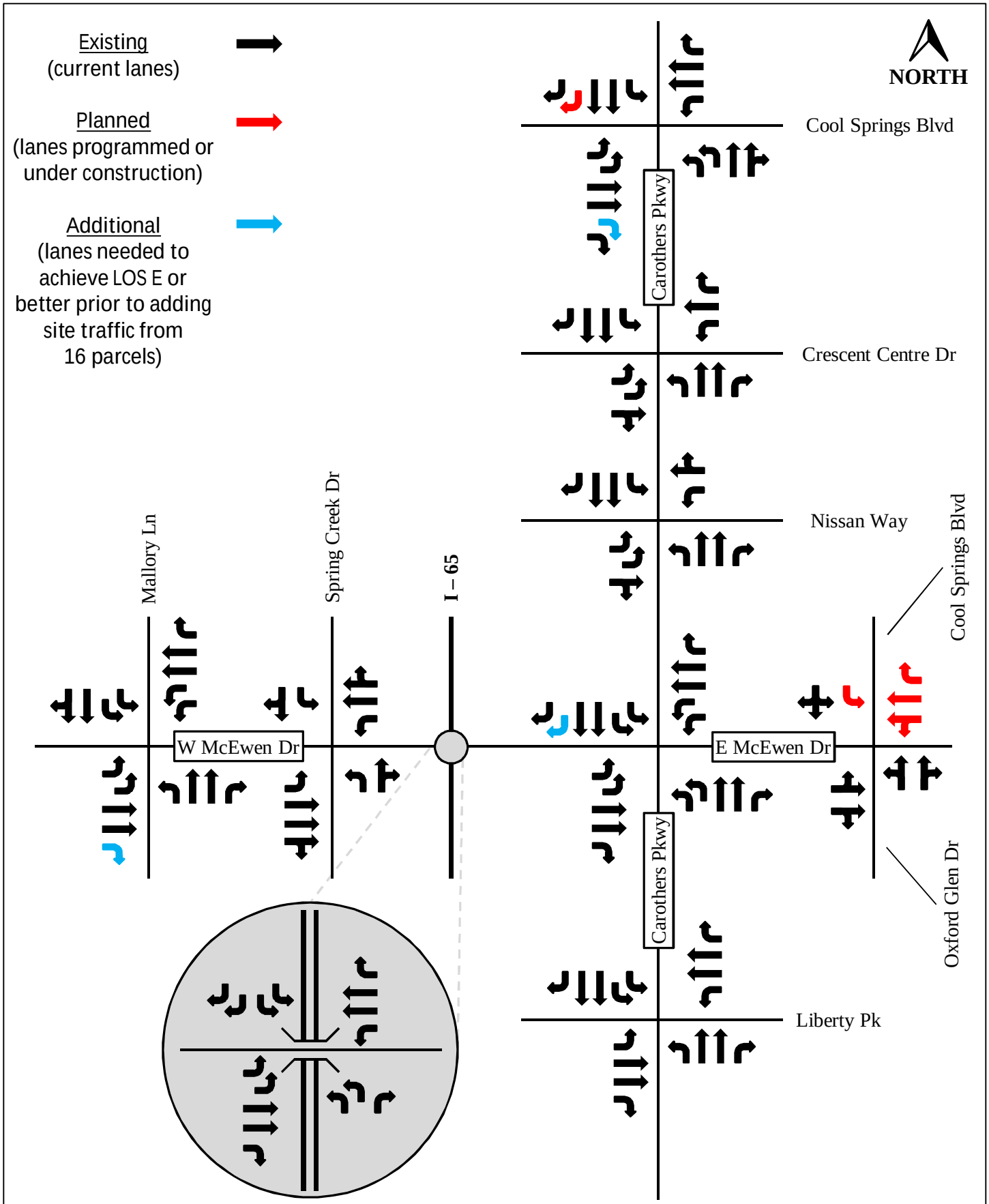
The programmed improvements and additional improvements needed to achieve LOS E or better are illustrated in **Figures 2-7**.

Several mitigation iterations were performed for the capacity analyses to determine the approximate development thresholds for when the roadway and intersection improvements may be needed to achieve LOS E or better. The number of intersection approach lanes, combining all nine (9) study intersections, is shown in **Table 6** for the development thresholds that were analyzed.

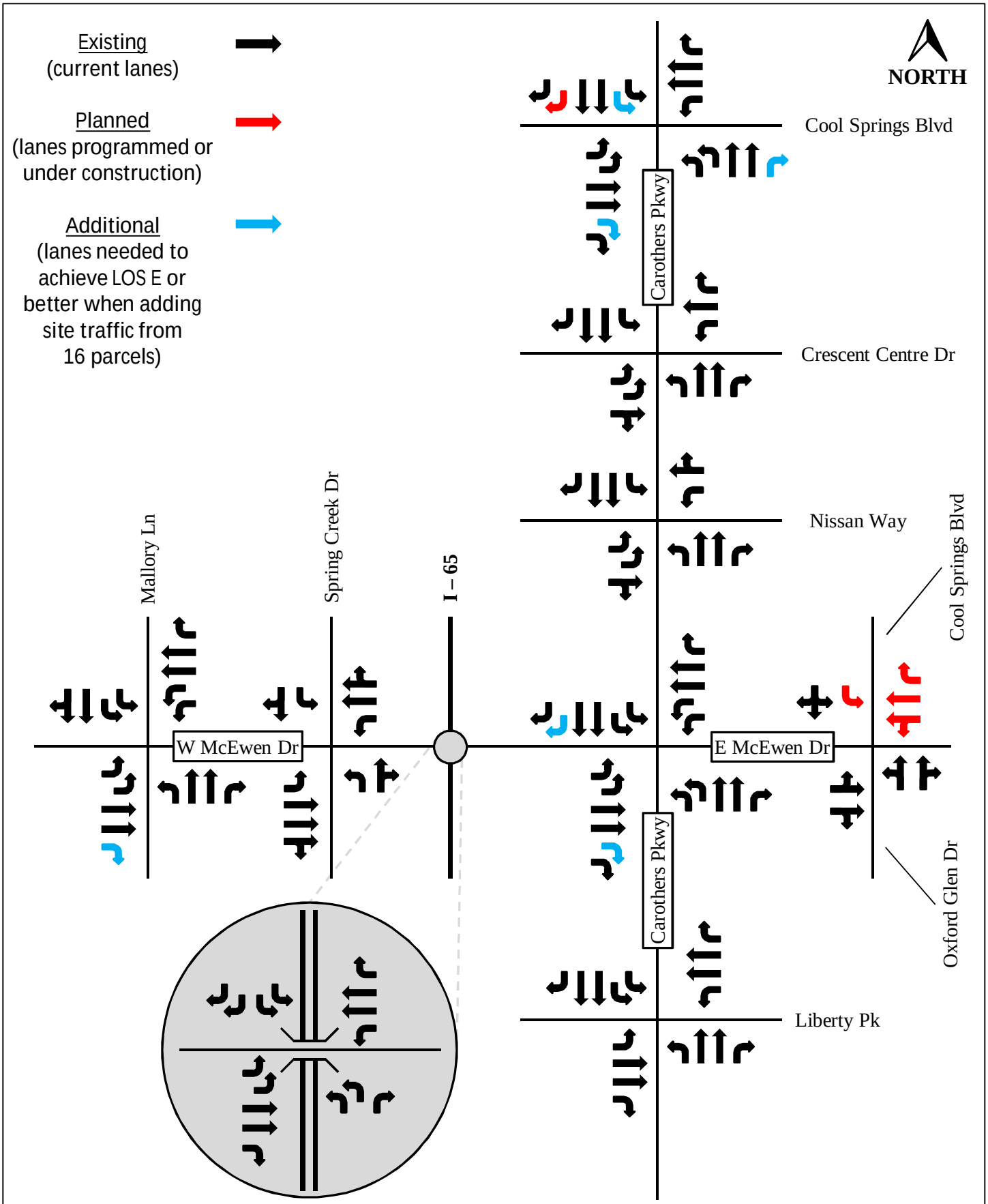
Table 6, Intersection Approach Lanes

Threshold	Number of Intersection Approach Lanes	Daily Site Traffic from Developments
Existing	130	n/a
Programmed	+ 5	n/a
0% Developed	+ 3	0 trips per day
25% Developed	+ 3	21,428 trips per day
50% Developed	+ 6	39,355 trips per day
75% Developed	+ 9	56,044 trips per day
100% Developed	+ 10	71,993 trips per day
TOTAL	= 166	n/a

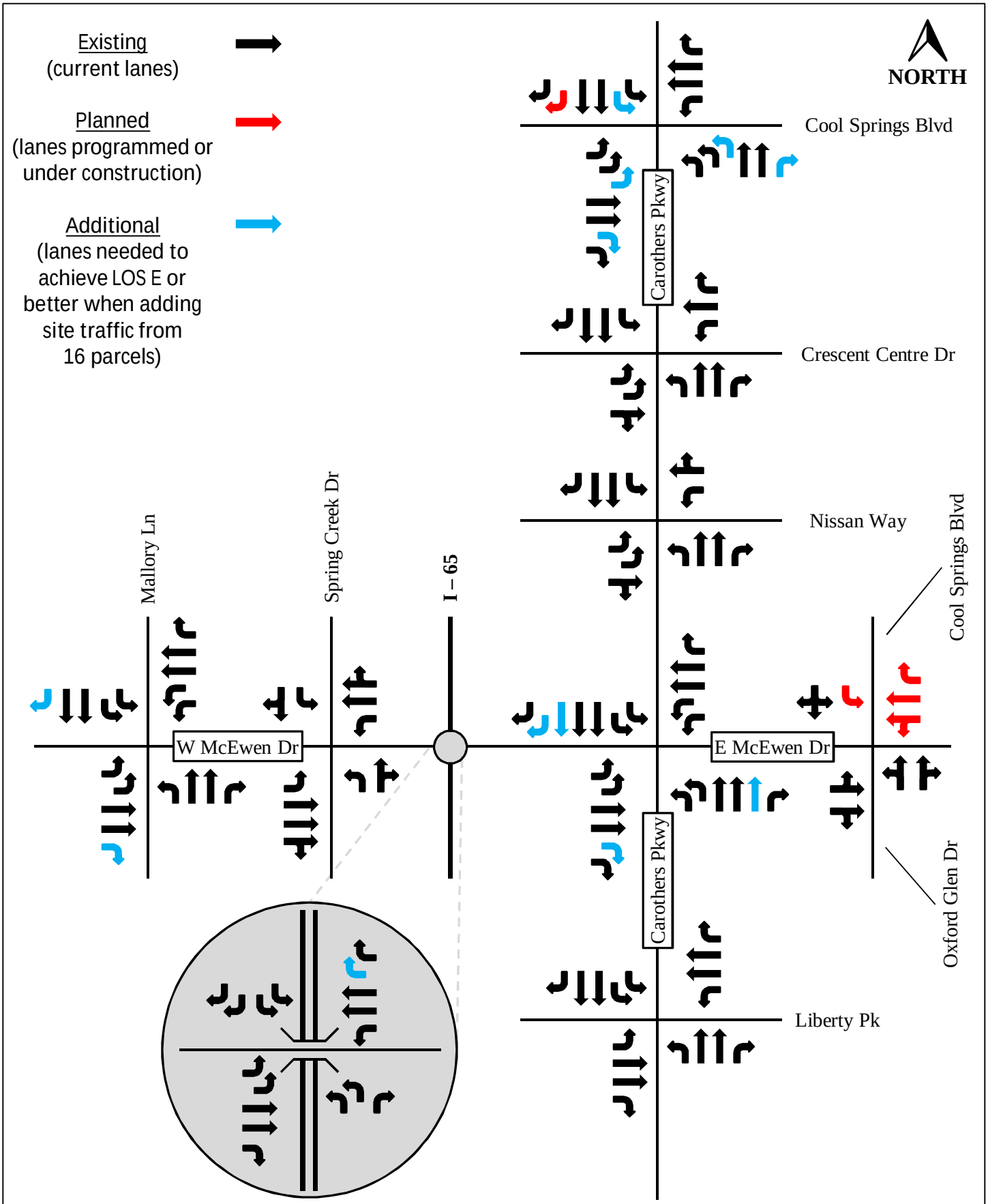
Kimley-Horn and Associates, Inc.	Carothers Parkway Integrated Growth Plan	Existing 2012 Geometry	Figure 2



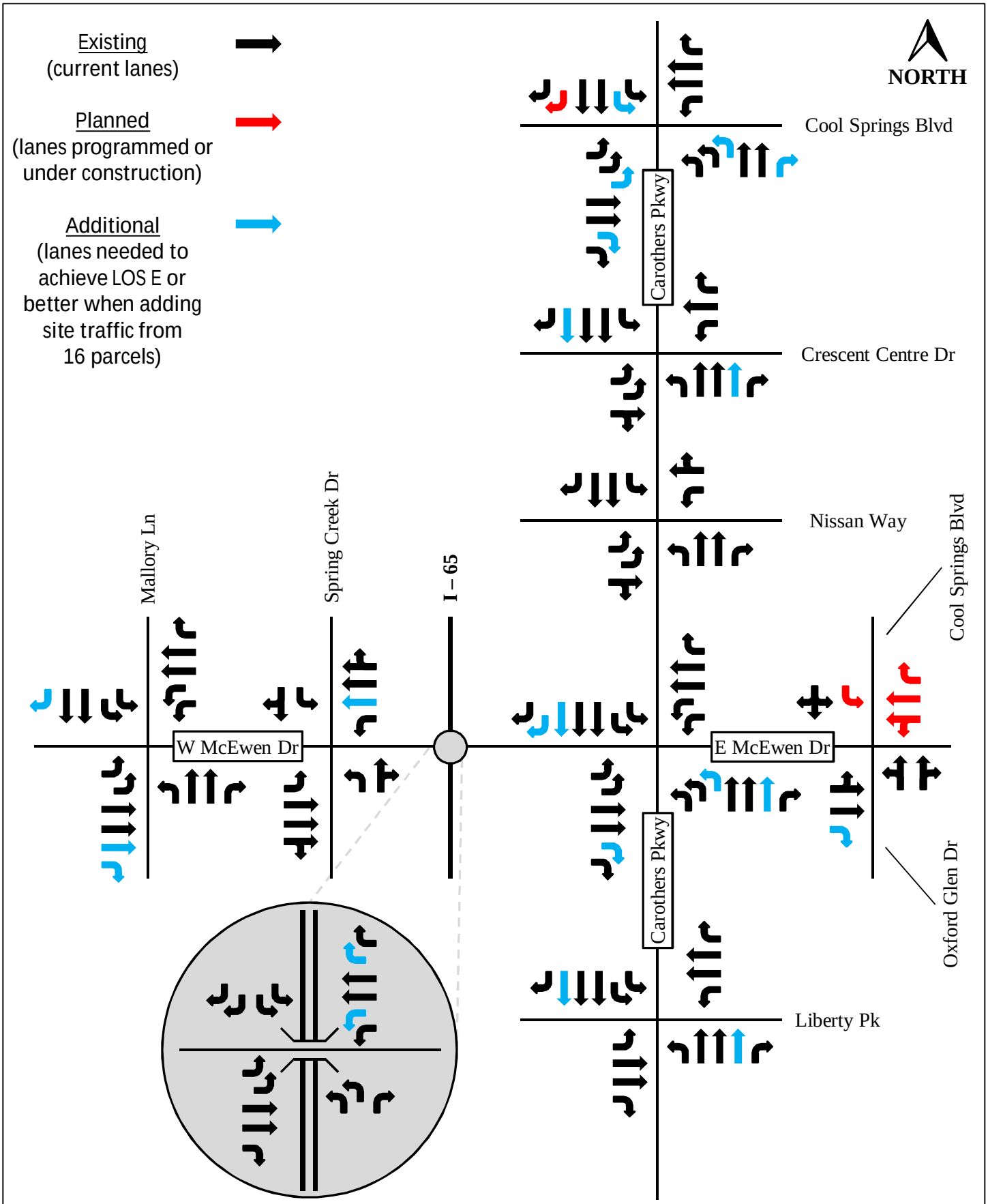
Kimley-Horn and Associates, Inc.	Carothers Parkway Integrated Growth Plan	Future 2025 Geometry 0% Build-Out	Figure 3



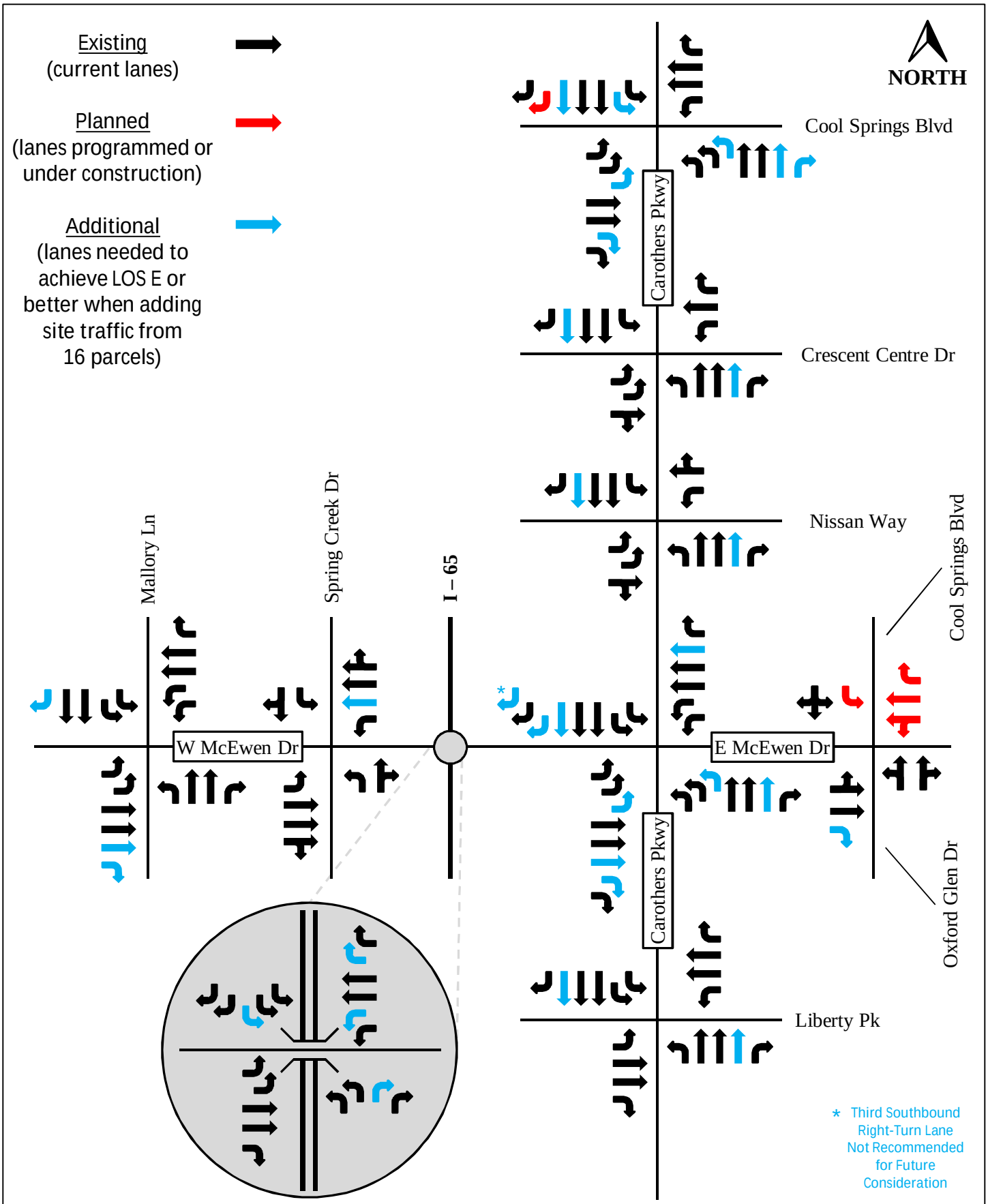
Kimley-Horn and Associates, Inc.	Carothers Parkway Integrated Growth Plan	Future 2025 Geometry 25% Build-Out	Figure 4



Kimley-Horn and Associates, Inc.	Carothers Parkway Integrated Growth Plan	Future 2025 Geometry 50% Build-Out	Figure 5



Kimley-Horn and Associates, Inc.	Carothers Parkway Integrated Growth Plan	Future 2025 Geometry 75% Build-Out	Figure 6



Kimley-Horn and Associates, Inc.	Carothers Parkway Integrated Growth Plan	Future 2025 Geometry 100% Build-Out	Figure 7

6.0 CONSIDERATION OF ALTERNATIVE INTERSECTIONS

Alternative Intersection configurations were considered for the intersection of Carothers Parkway at East McEwen Drive for the purposes of comparing the forecasted traffic operations with that of a conventional at-grade intersection that allows left-turn, through, and right-turn movements along each intersection approach. A typical purpose of Alternative Intersection configurations is to modify or remove left-turn movements from the primary intersection. This can be accomplished by routing vehicles to perform a different turning movement through the primary intersection, and providing secondary intersections for the same vehicles to perform a u-turn or left-turn movement.

The Federal Highway Administration (FHWA) published *Alternative Intersections/Interchanges: Information Report (AIIR)* in April 2010. This document provided a valuable resource to research the various configurations and ultimately select alternative treatments to analyze at the intersection of Carothers Parkway at East McEwen Drive. Following coordination with the City of Franklin, two (2) Alternative Intersection configurations were selected for consideration through a traffic operations analysis:

- Median U-Turn intersection (a.k.a. "Michigan Left") – Refer to FHWA *AIIR*, Chapter 3
- Through About – Refer to FHWA *AIIR*, Chapter 6.3.2

For the conventional at-grade intersection layout, the same AM and PM peak hour turning movement volumes were used. However, for each of the two (2) selected Alternative Intersection configurations, the AM and PM peak hour traffic volumes were re-routed based on the available turning movements for each treatment. The Synchro 8 software was utilized to evaluate the Existing 2012 and Future 2025 (100% developed) scenarios. The capacity analysis effort yielded that the *Highway Capacity Manual, Fourth Edition (HCM 2000)* evaluates traffic operations more appropriately at Alternative Intersection configurations. As a result, the *HCM 2000* methodology was applied to determine level of service (LOS) and vehicular delay in seconds. Additionally, the Synchro 8 methodology was employed to develop Measures of Effectiveness (MOE).

The following six (6) scenarios were analyzed for both AM and PM peak hours:

- Existing Traffic Pattern, Existing 2012
- Existing Traffic Pattern, Future 2025 – 100% developed
- Median U-Turn, Existing 2012
- Median U-Turn, Future 2025 – 100% developed
- Through About, Existing 2012
- Through About, Future 2025 – 100% developed

The vehicle delay and MOE were compared between the conventional at-grade intersection layout and the two (2) selected Alternative Intersection configurations. These quantitative measures of traffic operations were used to determine if considering an Alternative Intersection for Carothers Parkway at East McEwen Drive could be reasonable based on the results of the traffic operations analysis.

The Alternative Intersection configuration, assumed intersection geometry, and AM and PM peak hour turning movement volumes are illustrated in Exhibits A-F in Appendix P. Additionally, the *HCM 2000* capacity analysis results and MOE results are included in Appendix P.

The methodologies and results of this consideration for Alternative Intersection configurations were summarized and presented to the City of Franklin. Based on the forecasted future traffic volumes and the results of the traffic operations analysis, the existing conventional at-grade intersection appears more reasonable and feasible than implementation of an Alternative Intersection treatment.

7.0 ROUGH ORDER OF MAGNITUDE COST PROJECTIONS

Rough Order of Magnitude (ROM) cost projections were calculated for the roadway and intersection improvements needed to achieve LOS E or better at the study intersections. ROM cost projections associated with Preliminary Engineering and Construction were calculated and documented. However, costs relating to right-of-way and utilities were not estimated as the City of Franklin has agreed to develop these ROM cost projections.

In addition to focusing on the nine (9) study intersections, costs were also prepared for widening the Carothers Parkway corridor (approximately 17,900 feet) between Bakers Bridge Avenue and Murfreesboro Road /SR 96, and widening the East McEwen Drive corridor (approximately 3,700 feet) between I-65 and Resource Parkway. Two cost options were provided for each corridor, with benefits and detriments for each. The 'Widen to Outside' alternative assumes that widening will occur to the outside of the roadway, leaving the existing raised median intact. This alternative will retain the current median landscaping, but will likely result in a greater impact to right-of-way and utilities. The 'Widen to Inside' alternative assumes that widening will occur to the inside of the roadway, impacting the existing raised median. This alternative will likely result in a lesser impact to right-of-way and utilities, but will minimize or remove the current median landscaping, thereby reducing aesthetics along the corridor.

The preliminary ROM cost projections are summarized in **Table 7**.

Table 7, Rough Order of Magnitude Cost Projections

Intersection/Corridor	Preliminary Engineering	Right Of Way Acquisition	Utility Relocation / Expansion	Construc-tion	Total
Cool Springs Blvd @ Carothers Pkwy	$171,000	To Be Determined by the City of Franklin		$1,143,000	$1,314,000
Carothers Pkwy @ Crescent Centre Dr	$0			$0	$0
Carothers Pkwy @ Nissan Way	$0			$0	$0
Carothers Pkwy @ East McEwen Dr	$89,000			$596,000	$685,000
Carothers Pkwy @ Liberty Pk	$0			$0	$0
Mallory Ln @ West McEwen Dr	$107,000			$711,000	$818,000
West McEwen Dr @ Spring Creek Dr (Kohl's)	$0			$0	$0
McEwen Dr @ I-65 Interchange	$200,000			$1,334,000	$1,534,000
Cool Springs Blvd @ East McEwen Dr	$24,000			$163,000	$187,000
Carothers Pkwy Widening (Widen to Outside)	$1,656,000	To Be Determined by the City of Franklin		$11,039,000	$12,695,000
Carothers Pkwy Widening (Widen to Inside)	$1,303,000			$8,685,000	$9,988,000
East McEwen Dr Widening (Widen to Outside)	$430,000	To Be Determined by the City of Franklin		$2,865,000	$3,295,000
East McEwen Dr Widening (Widen to Inside)	$447,000			$2,980,000	$3,427,000
GRAND TOTAL (with Widen to Outside)	**$2,677,000**	To Be Determined by the City of Franklin		**$17,851,000**	**$20,528,000**
GRAND TOTAL (with Widen to Inside)	**$2,341,000**			**$15,612,000**	**$17,953,000**

These costs assume that all improvements are constructed simultaneously. The ROM cost projections have been developed for planning purposes. A detailed engineering design has not been performed, and the estimated quantities and costs have been developed based on past experience, typical unit costs, and engineering judgment. Cost projections for right-of-way relocation and utility relocation/expansion were not estimated as the City of Franklin has agreed to develop these ROM cost projections.

The preliminary ROM cost projections are presented in further detail in Appendix F.

8.0 ROADWAY IMPACT FEES

Developments within the City of Franklin are subject to road impact fees as described within Title 22, Chapter 16 of the Code of Ordinances. Based on the 'New Fee Schedule' table identified in the Road Impact Fees section, the estimated revenue generated by the sixteen (16) study parcels is just less than $34,500,000. While the road impact fees are applied on a "per dwelling" and "per 1,000 square feet" basis, this anticipated revenue equates to approximately $70,000 per acre.

The road impact fee calculations are presented in further detail in Appendix G.

9.0 TRAVEL DEMAND MODEL

The travel demand model maintained by the Nashville Area Metropolitan Planning Organization (MPO) was used as a reference tool for this study. This model includes socioeconomic data (population, housing, employment) that is used to project future year traffic volumes on area roads. This data is aggregated into small geographic areas called traffic analysis zones (TAZ) that are generally bounded by arterial roads or natural geographic features, such as bodies of water. Roadway network data (capacity, functional classification) is then used to calculate the capacity of roadway segments under existing and future scenarios.

A majority of the sixteen (16) study parcels are located within the same TAZ #187085. This TAZ is bounded by I-65, the South Prong of Spencer Creek, McEwen Drive, Wilson Pike, Clovercroft Road, Murfreesboro Road, Carothers Parkway, and Liberty Pike. The TAZ area totals approximately 2,100 acres compared to the sixteen (16) study parcels that total approximately 489 acres. A graphic of these TAZ boundaries obtained from the travel demand model is included in Appendix H.

Socioeconomic data within this TAZ was collected for 2008, 2015, 2025, and 2035 modeling. For this study, the 2008 and 2025 models were reviewed to determine population, housing, and employment in the vicinity of the Carothers Parkway at East McEwen Drive intersection. A summary of the data included within the Nashville Area MPO travel demand model is summarized in **Table 8**.

Table 8, Forecasts from Nashville Area MPO Travel Demand Model

	2008	**2015**	**2025**	**2035**
Total Population[1]	3,617	3,883	**4,637**	5,402
Households[2]	1,333	1,494	**1,784**	2,078
Total Employment[3]	450	1,408	**5,603**	16,626
Retail[3]	26	167	**671**	2,179
Industrial[3]	92	92	**92**	92
Office[3]	332	1,148	**4,840**	14,355

Units: [1]Number of People; [2]Number of Households; [3]Number of Jobs

Based on the socioeconomic data in the travel demand model, the TAZ that includes a majority of the sixteen (16) study parcels is forecasted to experience a 28% increase in population, a 34% increase in housing, and a 1,145% increase in employment by year 2025. Comparatively, the travel demand model forecasts that the entire Williamson County will experience a 76% increase in population, an 87% increase in housing, and a 70% increase in employment by year 2025. The travel demand model data for both TAZ 187085 and Williamson County are included in Appendix H.

The City of Franklin has provided land uses and densities for specific parcels within the study area. For the purposes of this study, it is anticipated that the sixteen (16) study parcels comprising approximately 489 acres will be fully built-out by year 2025. This information was converted into population, households, and employment for the purposes of comparing the growth anticipated by the City with the growth forecasted in the travel demand model. **Table 9** summarizes the assumptions and calculations for this conversion.

Table 9, Forecasts from City Projections

Density	Factor	Population	Households	Employment
703 apartments	2.6 population per household*	1,828	703	n/a
800 condominiums		2,080	800	
1,963 hotel rooms	0.7 employees per hotel room	n/a		1,374
6,000 college students	12 students per employee			500
5,556,355 square feet of office space	250 square feet per employee**			22,225
445,955 square feet of retail space	333 square feet per employee**			1,339
17,692 square feet of restaurant space				53
TOTAL		**3,908**	**1,503**	**25,491**

*Source: Nashville Area MPO Travel Demand Model
**Source: Tri-County Transportation/Land Use Study, Economic & Market Analysis, June 2008

The socioeconomic data calculated from the City of Franklin projections was added to the existing 2008 data contained within the Nashville Area MPO travel demand model to develop 2025 conditions based on the City forecasts. The year 2025 forecasts from the travel demand model were then compared with the year 2025 forecasts from the City projections. This comparison is summarized in **Table 10**.

Table 10, Comparison of Forecasted Growth

	Increase during Year 2008-2025 based on Travel Demand Model	**Increase during Year 2012-2025 based on City Projections**
Boundary Area	Approx. 2,100 acres	Approx. 489 acres
Total Population	+ 1,020	+ 3,908
Households	+ 451	+ 1,503
Total Employment	+ 5,153	+ 25,491

By year 2025, the City of Franklin is anticipating approximately 283% more population growth on the sixteen (16) study parcels than the Nashville Area MPO travel demand model is currently forecasting in the entire TAZ. Furthermore, the City is anticipating approximately 233% more retail employment growth and 395% more office employment growth on the sixteen (16) study parcels than the travel demand model is currently forecasting in the entire TAZ.

While the forecasts vary between the City projections and the Nashville Area MPO travel demand model, neither is necessarily wrong. The travel demand model projections are based on national data pertaining to expected growth in the entire MPO region, whereas the City projections are based on local knowledge focusing on the vicinity of the Carothers Parkway at East McEwen Drive intersection. The review of the Nashville Area MPO travel demand model was performed to compare the future population, households, and employment projections with the land uses and densities that are anticipated on the sixteen (16) study parcels.

10.0 ACCESS MANAGEMENT

The official definition of access management from the Federal Highway Administration (FHWA) is "the process that provides access to land development while simultaneously preserving the flow of traffic on the surrounding system in terms of safety, capacity, and speed." The Transportation Research Board *Access Management Manual* defines access management as "the systematic control of the location, spacing, design, and operation of driveways, median openings, interchanges, and street connections to a roadway."

The City has the unique opportunity with both Carothers Parkway and East McEwen Drive to start with a "clean slate" and implement a successful access management plan. The presence of a raised median provides a means to apply positive access management methods since the possibility of left-turn movements are restricted to specific locations. Median openings have already been installed as part of the construction of both roadway corridors; this helps define the future locations of development access, providing the foundation for a well-managed plan for driveways along a corridor. These existing median openings should be promoted while simultaneously minimizing the quantity of limited access (right-in/right-out) driveways that are installed between median openings. Fewer conflict points combined with larger distances between conflict points can result in safer traffic flow conditions.

As development occurs along these roadway facilities, inter-parcel connectivity and a local street network can help reduce vehicular traffic flow along the arterial corridors. Inter-parcel connectivity allows vehicles to access several land uses without entering the arterial roadway; the vehicular connections between developments bounded by I-65, Cool Springs Boulevard, Carothers Parkway, and Bakers Bridge Avenue provide an example of good inter-parcel connectivity. A local street network between arterial and collector corridors provides several route alternatives for vehicles and more-evenly distributes congestion; Frazier Drive on the southwest quadrant of Cool Springs Boulevard at Mallory Lane is an example of a public street providing access between several land uses and the arterial corridors. A conceptual schematic for a local street network surrounding the Carothers Parkway and East McEwen Drive intersection is illustrated on **Figure 8**.

The installation of traffic signals along a corridor can provide both a benefit and a hindrance for traffic congestion. A traffic signal typically improves the minor street LOS and deteriorates the major street LOS. All aspects should be considered before installing a traffic signal at an unsignalized intersection. For intersections where a traffic signal is installed, emphasis should be placed on maximizing capacity by providing additional approach lanes along the minor street. This can be achieved by providing exclusive lanes for each of the movements (left, through, and right) entering the arterial. Having separate lanes for the minor street movements provides greater flexibility when selecting traffic signal phasing options at these intersections. This will also allow a higher percentage of the green time to be allocated to the major arterial.

Kimley-Horn and Associates, Inc.	Carothers Parkway Integrated Growth Plan	Proposed Roadway Network	Figure 8

11.0 TRANSPORTATION MANAGEMENT AND TRANSIT

The Middle Tennessee Regional Transportation Authority (RTA) provides two (2) regional bus service routes between Downtown Nashville and Williamson County:

- Route Number 91X (Franklin/Brentwood Express) includes stops at the Williamson Square Kroger in Franklin and the Civitan Ball Park in Brentwood. Route 91X consists of three (3) northbound trips in the AM peak period and three (3) southbound trips in the PM peak period.
- Route Number 95X (Spring Hill Express) includes stops at the Baptist Church in Thompson's Station and the Kroger in Spring Hill. Route 95X consists of two (2) northbound trips in the AM peak period and two (2) southbound trips in the PM peak period.

Current transit users and future ridership could benefit from a regional bus stop in the Cool Springs vicinity, possibly near the intersection of Carothers Parkway at East McEwen Drive. Route 91X could provide a transit opportunity for Cool Springs residents that are employed in Downtown Nashville, especially as the Cool Springs area population continues to increase. Additionally, Route 95X could provide this same opportunity while simultaneously providing a transit alternative for Thompson's Station and Spring Hill residents that are employed in the Cool Springs area.

The Transportation Management Association (TMA) Group is a public-private partnership whose goal is "for everyone…to have affordable and convenient travel options available to them". Employers can choose to become a member of the TMA Group in order to take advantage of resources that can alleviate traffic congestion and improve the commutes of employees. Incentive programs can encourage both workers and customers to seek transportation choices other than commuting alone; these can include carpool, vanpool, walking, bicycling, and transit. Employers can also offer staggered work hours to alleviate the peak arrivals and departures that are often associated with office land uses. As growth occurs along Carothers Parkway and East McEwen Drive, developments should be encouraged to participate in the TMA Group and develop an incentive program that can lessen the projected traffic volumes along the roadway infrastructure.

The Franklin Transit Authority provides transit services throughout the City of Franklin including the Cool Springs area. The transit services are managed by the TMA Group and provide three (3) fixed route bus services on Monday-Saturday. The East Bound Route connects Downtown Franklin with the Cool Springs area and includes stops at the Factory, the Transit Center, Cool Springs Galleria Mall, and the Williamson Medical Center. However, with the exception of Carothers Parkway between Liberty Pike and Highway 96, the fixed route service is only provided on the west side of I-65. The Franklin Transit Authority also provides a Cool Springs Express service to function as a pre-arranged curb-to-curb pick-up and drop-off service originating in the Cool Springs area.

The City of Franklin could benefit from expanding the Franklin Transit service area to include roads on the east side of I-65 such as Cool Springs Boulevard, Carothers Parkway, and East McEwen Drive. Expanding the local bus service to include the Carothers Parkway/East McEwen Drive area would provide transit alternatives to residents, workers, and shoppers throughout Cool Springs.

12.0 RECOMMENDATIONS

The nine (9) study intersections combined have a total number of 130 approach lanes. Five (5) supplementary approach lanes are either under construction or programmed; and 31 additional approach lanes are needed to achieve LOS E or better due to the forecasted year 2025 volumes that include trip generation potential from the sixteen (16) study parcels. Rather than recommending that all 31 additional approach lanes be constructed, this study has considered alternative measures that can be applied to manage the development growth and its associated impacts on the roadway infrastructure. The recommendations have been divided into four (4) categories: Roadway and Intersection Improvements, Access Management, Transportation Management, and Transit.

Roadway and Intersection Improvements

- **Develop a process for preserving right-of-way** that will allow construction of the improvements needed to achieve LOS E or better. Additional right-of-way is expected to be needed if the 28 additional approach lanes are constructed. Right-of-way dedication for future local streets through land parcels, similar to what has partially occurred for Knoll Top Lane, should also be considered.
- **Perform preliminary engineering** to more accurately determine the impacts and costs of constructing the improvements needed to achieve LOS E or better. This additional evaluation includes estimating the impacts to right-of-way and utilities, conceptual engineering exhibits, and cost estimates for design, right-of-way acquisition, utility relocation, and construction.
- **Analyze alternative intersection configurations** for Carothers Parkway at East McEwen Drive. This central intersection will be fundamental to maintaining an acceptable level of traffic congestion along both the Carothers Parkway and East McEwen Drive corridors. Based on the forecasted trip generation from the sixteen (16) study parcels, creative "outside the box" solutions should be considered as alternatives. Examples of alternative intersection configurations include the Displaced Left-Turn, the Quadrant Roadway and the Center Turn Overpass Interchange.

Access Management

- **Promote local street connectivity** between Carothers Parkway, East McEwen Drive, Liberty Pike, and Huffines Ridge Road. Some new roadway connections have already been identified (Huffines Ridge Road Connector, Knoll Top Lane), and additional roadway connections can improve vehicular traffic flow between parcels and arterial roads.
- **Emphasize the use of existing median openings** along Carothers Parkway and East McEwen Drive. Future developments should be required to locate site driveways at existing median opening locations and along the future local street network. Minimizing both the number of additional median openings and the number of limited access (right-in/right-out) driveways will improve traffic flow along the arterial roads.
- **Consider carefully the installation of new traffic signals** along Carothers Parkway, East McEwen Drive, and Liberty Pike. Inevitably, additional traffic signals will be installed along the arterial roads as local streets and site driveways are constructed. Two (2) concepts should be applied when a traffic signal is being considered:
    - Evaluate non-signalized options to verify that the installation of a traffic signal is the best alternative.
    - Maximize capacity by providing additional approach lanes along the minor street, thereby allowing a higher percentage of the green time to be allocated to the major arterial.

Transportation Management

- **Encourage involvement with the TMA Group** to provide property owners with resources that can alleviate traffic congestion and improve the commutes of employees. Incentive programs can be established that make alternative methods of commuting appear more attractive. Carpool, bicycling, and transit are examples of alternative methods that lessen the traffic congestion during the peak travel periods. Employers that offer staggered work hours can alleviate the peak period traffic volumes along the roadway network.
- **Expand the sidewalk network** as development occurs. The presence of existing pedestrian infrastructure on both sides of major arterial roadways is an asset for offering alternative modes of transportation. The pedestrian network can be strengthened by development if sidewalks are constructed within developments, connecting to adjacent parcels, and joining with existing sidewalks along the arterial roads.

Transit

- **Pursue a park-n-ride lot and bus stop in the Cool Springs area** for the RTA regional bus service. Linking to the Route 91X would provide a regional bus connection with Franklin, Brentwood, and Downtown Nashville; linking to Route 95X would provide a regional bus connection with Thompson's Station, Spring Hill, and Downtown Nashville.
- **Evaluate the addition of a dedicated Cool Springs route for the Franklin Transit**. This 4th route could include Mallory Lane, Carothers Parkway, and/or any combination of east-west roadways that cross I-65. Riders desiring to travel to Downtown Franklin or the Factory could still use the existing East Bound Route.