

## **RESOLUTION 16-11**

### **A RESOLUTION TO ADOPT AN ACCESS MANAGEMENT POLICY ON US 31 FROM CAMPBELL STATION PARKWAY TO BUCKNER ROAD**

**WHEREAS**, the City of Spring Hill desires to be proactive in the development of future infrastructure; and

**WHEREAS**, with growth there is an increase in both traffic volumes and demand for accessibility to US 31; and

**WHEREAS**, access to a signalized arterial roadway must be planned and controlled so that the safety, capacity and operating conditions of the road will not be adversely impacted; and

**WHEREAS**, a study was completed by Volkert, Inc. and the conclusions of that study are contained herein and attached hereto, as recommended by the Transportation Advisory Commission.

**NOW, THEREFORE BE IT RESOLVED**, that the City of Spring Hill Board of Mayor and Aldermen adopts an Access Management Policy on US 31 from Buckner Road to Campbell Station Parkway as follows:

1. One (1) Traffic Signal shall be permitted at the entrance of Tanyard Springs Subdivision, which is the intersection of US 31 and Williford Court. The responsibility for warrant studies, design, easement acquisition, and construction shall be solely borne by new development in this corridor.
2. A traffic signal shall not be permitted at Wilkes Lane and US 31. Furthermore, this intersection shall be converted from a full access intersection into a right-in/right-out only intersection.
3. All new requests for direct access to US 31 in this corridor shall be right-in/right-out only.
4. The western frontage road parallel to US 31 shall be required to extend to the north and provide connectivity to the stubout at the commercial development where Starbucks is currently located. The responsibility for design, easement acquisition, and construction shall be solely borne by new development in this corridor.
5. All new developments in this corridor shall be required to dedicate Right of Way along US 31 for future widening as determined by the Infrastructure Director.

6. All new developments in this corridor shall be required to construct dedicated turn lanes into their property. Additionally, all new development shall be required to provide two (2) access points where possible. The Infrastructure Director shall have the authority to approve waivers of the requirements in this paragraph based on engineering judgement, existing conditions, and supplemental engineering data. The responsibility for design, easement acquisition, and construction shall be solely borne by new development in this corridor.
7. All new developments in this corridor shall be required to perform traffic studies. Should the traffic studies not demonstrate warrants for improvements, the City reserves the right to require improvements above and beyond the recommendations of the traffic studies provided and paid for by new development as determined by the Infrastructure Director.
8. The City shall perform regular timing updates of the traffic signals in this corridor every three to five years.

**Passed and adopted by the Board of Mayor and Aldermen of the City of Spring Hill, Tennessee on the 18<sup>th</sup> day of April, 2016.**



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Mayor Rick Graham

ATTEST:



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April Goad, City Recorder

LEGAL FORM APPROVED:



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Patrick Carter, City Attorney



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March 4, 2016

Mr. Dan Allen  
Assistant City Administrator  
City of Spring Hill  
199 Town Center Parkway  
Spring Hill, TN 37174

**RE: US 31 (Buckner Road to Campbell Station Parkway) Access Management Study**

Dear Mr. Allen:

This technical letter is being submitted to the City to provide guidance for the access management and potential traffic signalization on US 31 between Buckner Road and Campbell Station Parkway.

**General Project Information**

The US 31 corridor serves as the primary regional connection for Spring Hill to the north and south. The roadway is classified as major arterial with one travel lane in each direction. At most intersections on the corridor there are dedicated left turn lanes; however dedicated right turn lanes are not as prevalent. On the segment between Buckner Road and Campbell Station Parkway, the posted speed limit is 45 miles per hour (mph). The total distance from Buckner Road to Campbell Station Parkway is approximately 3,800 feet. Williford Court is approximately 1,250 feet south of Buckner Road and Wilkes Lane is approximately 3,100 feet south of Buckner Road.

In the latter part of 2015, a proposed development, Cadence Crossing, was presented to the City of Spring Hill for a vacant parcel of land located on the eastern side of US 31 between the Spring Hill Circle intersections. The only access for the proposed development is located directly opposite Williford Court on US 31. The traffic impact study for the proposed development was submitted to the City in January 2016.

The continued growth along the corridor, as evidenced by this proposed Cadence Crossing, along with the continued concerns about traffic congestion and safety along this vital corridor, led the City staff and the Transportation Advisory Committee (TAC) to consider developing and adopting an Access Management Policy for the segment of US 31 from Buckner Road to Campbell Station Parkway. As such, the City staff contracted with Volkert to complete a review of the corridor between Buckner Road and Campbell Station Parkway, which includes consideration of the Policy Points in Resolution 16-11. These Points include:

1. One (1) traffic signal shall be permitted at the entrance of Tanyard Springs subdivision, which is the intersection of US 31 and Williford Court.
2. One (1) traffic signal shall be permitted within the zone identified in Figure 1. The zone is described as beginning approximately 950 feet north from the center of Campbell Station Parkway and US 31 and ending approximately 1,275 feet north from the center of Campbell Station Parkway and US 31.

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FIGURE 1  
US 31 ACCESS MANAGEMENT STUDY AREA

3. A traffic signal shall not be permitted at Wilkes Lane and US 31. Furthermore, this intersection shall be converted from a full access intersection into a right-in/right-out only intersection.
4. All new requests for direct access to US 31 in this corridor shall be right-in/right-out only.
5. The western frontage road parallel to US 31 shall be required to extend to the north and provide connectivity to the stubout at the commercial development where Starbucks is currently located.
6. All new developments in this corridor shall be required to dedicate Right-of-Way along US 31 for future widening as determined by the Infrastructure Director.
7. All new developments in this corridor shall be required to construct dedicated turn lanes into their property. Additionally, all new developments shall be required to provide two (2) access points.
8. All new developments in this corridor shall be required to perform traffic studies.

This technical letter will provide the City staff, TAC and BOMA, the information needed to make a sound decision on the adoption of an Access Management Policy for US 31 from Buckner Road to Campbell Station Parkway.

### **Traffic Signal Spacing and Access Management**

Traffic signal spacing and access management studies are not a new focus area for governmental agencies. There are numerous studies that have been conducted and many resources available to help guide the development of policies and assist in the decision making process.

First, the basic principles of access management should be considered when evaluating a corridor(s). As noted in the *Traffic Engineering Handbook, 7<sup>th</sup> Edition* published by Institute of Transportation Engineers (ITE), the basic principles are:

1. Provide a specialized roadway system in which different roads are planned, designed and managed to ensure appropriate levels of safety and mobility for all users.
2. Promote intersection hierarchy.
3. Locate signals to favor through movements. Signalized access connections should fit into an overall traffic signal coordination plan. Long, uniform spacing of full-movement signalized intersections on major roadways improves the ability to coordinate signals for continuous movement of traffic at desired speeds.
4. Preserve the functional area of intersections and interchanges.
5. Limit the number of conflict points.
6. Separate conflict areas through appropriate access spacing.
7. Remove turning vehicles from through traffic lanes.
8. Use nontraversable medians on major roadways.
9. Provide a supporting street network along arterials and other major travel routes.
10. Provide unified site access and circulation systems within and between development sites along major travel routes.

Several of these should be heavily considered in regards to the US 31 corridor. In regards to #3 above, as quoted from *Traffic Engineering Handbook*, "Closely spaced or irregularly spaced traffic signal on arterial roadways result in frequent stops, unnecessary delay, increased fuel consumption, excessive vehicular emissions and high crash rates. Alternatively, long and uniform signal spacing allows timing plans that can efficiently accommodate varying traffic conditions during peak and off-peak periods."

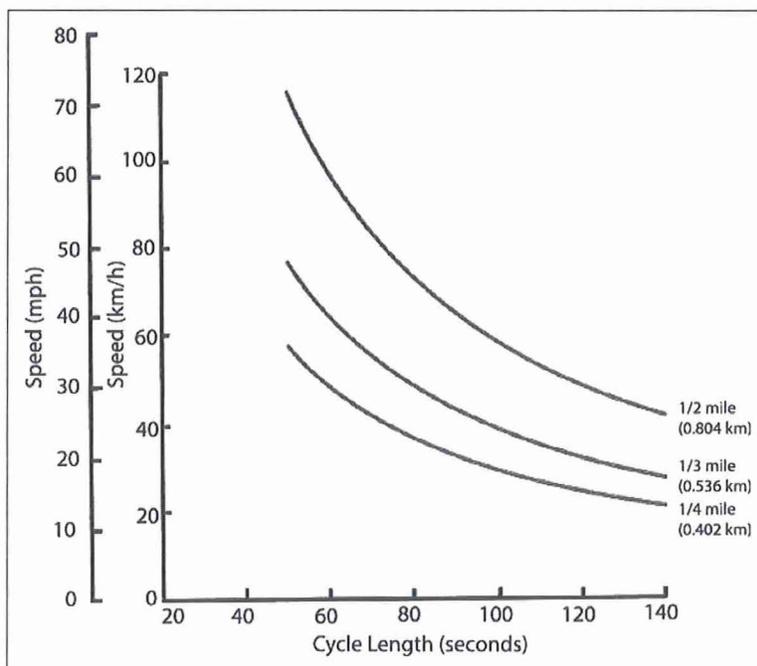
There are several references that provide guidance on spacing and documented studies with data presented to show the impacts of the various traffic signal spacing. However, there is not a written standard that fits every scenario.

- “spacing between coordinated signals should be no less than 1,000 feet.” - *2009 Edition of the Manual on Uniform Traffic Control Devices (MUTCD)*
- “for most arterial streets with signal spacing between 500 feet to 0.5 mile (2,640 feet), coordinated operation can often yield benefits by improving progression between signals” - *US Department of Transportation Federal Highway Administration’s Signal Timing Manual*
- “In a system of closely or irregularly spaced traffic signals, each traffic signal per mile added to a roadway reduces speeds by about 2 to 3 mph. Several studies have found that the number of crashes and crash rates increase as the frequency of traffic signal increases.” - *ITE’s Traffic Engineering Handbook, 7<sup>th</sup> Edition*

Figure 2, obtained from *Traffic Engineering Handbook*, shows the impacts on vehicle speeds along a corridor as the signal spacing changes from 0.5 miles to 0.25 miles and Table 1 shows the percent increase in travel time as the density signalized intersections increase.

As shown In Figure 2, assuming a standard cycle length of 120 seconds, signals spaced at uniform intervals of 0.25 miles (1,320 feet), 0.33 miles (1,760 feet) and 0.5 miles (2,640 feet) result in a progression speed of approximately 16 mph, 21 mph and 30 mph, respectively.

FIGURE 2  
PROGRESSION SPEED AS A FUNCTION OF SIGNAL SPACING AND CYCLE LENGTH



Source: Stover and Koepke (2002).

The baseline for the US 31 corridor is two existing traffic signals (Buckner Road and Campbell Station Parkway). As shown in Table 1, if one traffic signal is added between the two existing traffic signals there is an expected nine (9) percent increase in travel time over this mile. Additionally, if two traffic signals are added in this same stretch of the corridor, there is an expected 16 percent increase in travel time over this mile.

TABLE 1  
PERCENTAGE INCREASE IN TRAVEL TIMES AS SIGNALIZED DENSITY INCREASES

Signals per Mile	Percent Increase in Travel Times (Compared with Two Signals per Mile)
2.0	0
3.0	9
4.0	16
5.0	23
6.0	29
7.0	34
8.0	39

Source: NCHRP Report 420 (Cluck, Levinson, and Stover, 1999).

In summary of this section, traffic signal spacing and access management are critical to the operational characteristics and safety of a corridor. As additional traffic signals or conflict points are introduced in the system, there can be negative safety impacts and negative operational impacts.

### Traffic Analyses

The review and evaluation of this segment of the US 31 corridor included operational analyses utilizing Synchro 9 Traffic Signal Coordination Software and HCS 2010. The base model from the US 31 Signal Optimization Study, completed in January 2015, was used to compare the US 31 segment (Buckner Road to Campbell Station Parkway) with current traffic control conditions to proposed traffic control conditions. The No-Build conditions is the corridor with the existing traffic control configuration in place – traffic signals at Buckner Road and Campbell Station Parkway and the other intersections as two-way stop controlled.

There were three proposed traffic control conditions evaluated.

- Scenario 1 – Two additional traffic signals within the study corridor. The first at US 31 and Williford Court. The second at US 31 and the approximate center of the red box overlay shown on Figure 1. This is generally at the Saint Thomas Heart and Spring Hill Business Park driveways. Additionally, this option also includes converting US 31 and Wilkes Lane/Spedale Court into a right-in/right-out only intersection.
- Scenario 2 – Two additional traffic signals within the study corridor. The first at US 31 and Williford Court. The second at US 31 and the approximate center of the red box overlay shown on Figure 1. This is generally at the Saint Thomas Heart and Spring Hill Business Park driveways. Additionally, this option includes abandonment of Wilkes Lane from the newly designed western frontage road to US 31. The newly designed frontage road would run parallel to US 31, providing a connection to the stubout at the commercial development where Starbucks is currently located. The abandonment of Wilkes Lane is needed to assist in diverting traffic to potential signalized intersection to help warrant the signal.

- Scenario 3 – One additional signal at the intersection of US 31 and Williford Court. In addition to this improvement, it is proposed for US 31 and Wilkes Lane/Spedale Court to be converted from a full access intersection into a right-in/right-out only intersection.

The analyses were conducted for existing 2016 AM and PM, the 2021 AM, PM and Off-Peak No-Build conditions, and the 2021 AM, PM and Off-Peak Build conditions for each of the three scenarios.

2016 Existing and 2021 No Build Conditions

As shown Table 2, the 2021 No Build scenario will experience a significant increase in delay and travel time over the 2016 existing conditions and will have speeds significantly lower than the posted 45 mph speed limit. This can be contributed to the continued overall traffic growth along the corridor.

2021 Conditions

As shown Table 2, the 2021 No Build scenario or 2021 Build Scenario 3 will tend to have the lower overall delay and travel time when compared with the other 2021 scenarios. Each of these will also tend to have the highest arterial speed of all of the conditions analyzed. The only exceptions will be the PM and Off-Peak travel time for northbound US 31 with Build Scenario 2.

TABLE 2  
ARTERIAL LEVEL OF SERVICE SUMMARY TABLE

		AM			PM			Off Peak		
		Delay (s/veh)	Travel time (s)	Arterial Speed	Delay (s/veh)	Travel time (s)	Arterial Speed	Delay (s/veh)	Travel time (s)	Arterial Speed
NB US 31	2016 Existing	62.9	197.3	34	60.9	125.8	24			
	2021 No Build	252	369.3	18	130.4	569.2	16	<b>33.5</b>	167.7	40
	2021 Build Scenario 1	231.7	364.5	19	174.3	591.1	13	48.8	178.6	38
	2021 Build Scenario 2	230.7	364	20	171.1	<b>416.3</b>	13	38.2	<b>166.8</b>	40
	2021 Build Scenario 3	<b>228.4</b>	<b>356.2</b>	20	<b>114.3</b>	446.9	17	46.9	177	38
SB US 31	2016 Existing	46.9	132.6	32	59.9	149.2	29			
	2021 No Build	<b>161.6</b>	<b>247.8</b>	17	236.7	625.9	13	<b>27</b>	<b>114.7</b>	37
	2021 Build Scenario 1	198.3	315.8	15	206.6	526.2	15	40.9	127.4	33
	2021 Build Scenario 2	211.9	351.6	14	221.2	634.8	14	32.9	121.2	35
	2021 Build Scenario 3	199.6	331.7	15	<b>203.1</b>	<b>521.7</b>	15	38.2	124.6	14

\*The bold-italicized number indicates the minimum of the 2021 Scenarios

**Traffic Signal Warrant Analysis**

Throughout this technical letter the discussion has centered around the location of future traffic signals and access management. The other piece to the overall puzzle is the warranting of the traffic signal at either of the locations evaluated on this segment of US 31. The MUTCD provides support for engineering decision making by setting quantitative criteria and specific thresholds that can be applied to evaluate the potential need for a traffic signal. These criteria are referred to as Traffic Signal Warrants. There are nine (9) warrants to consider when evaluating

the need for a traffic signal; however it should be noted that satisfying the warrants does not itself indicate that a traffic signal should be installed.

As noted in the *Traffic Engineering Handbook* and in the *MUTCD*, traffic signal can eliminate or at least substantially reduce the number and severity of conflicts. They also provide regular interruptions to heavy traffic streams, allowing other vehicular traffic to enter or cross the traffic stream. Therefore, traffic signals are considered, especially by the general public, “a panacea for all traffic problems at intersections”. This belief, however ignores the potential disadvantages of traffic signals, especially those that are not warranted. Some of these disadvantages are:

- Excessive delay
- Excessive disobedience of the signal indications
- Increased use of less adequate routes as road users attempt to avoid the traffic control signals
- Significant increases in the frequency of collisions (especially rear-end collisions)

As part of the review of the corridor, the traffic signal warrant information provided in the Cadence Crossing Traffic Impact Study was evaluated for the intersection of US 31 and Williford Court along with a preliminary evaluation of the potential for a traffic signal to be warranted at the second location near the Spring Hill Business Park driveway.

As detailed in the Cadence Crossing Traffic Impact Study, it was concluded that “at full build-out, the Cadence Crossing project site will satisfy seven of the eight hours required for Warrant 1 – Condition B and are very close to satisfying this warrant for an eighth hour. Also, the existing traffic volumes from Cadence Crossing will satisfy Warrant 2 – Four Hour Volume. Based on these results, it would be appropriate to collect new traffic counts and conduct a Traffic Signal Warrant analysis for the intersection when the project is complete and fully occupied”.

Based on the review of the information in the traffic impact study and the operational analysis completed as part of this study, it is anticipated that traffic volumes from the Cadence Crossing development should meet some of the traffic signal warrant criteria; however this will be dependent on the side street design (one exiting lane vs. two exiting lanes) and the actual trip distribution from the site.

As for the second potential traffic signal evaluated for this segment of US 31. The future developments on the vacant parcels along the western boundary of US 31 will create several new trips on the network and the realignment of Wilkes Lane will divert trips to the potential new intersection. However, it is not anticipated that the side street traffic volumes will meet the thresholds for the traffic signal volume warrants.

## Conclusions

As noted above and in the Access Management Policy, consideration should be given to the guidance of locating up to two new traffic signals on US 31 between Buckner Road and Campbell Station Parkway.

### Traffic Signal Spacing

- **US 31 and Williford Court** – located 1,250 feet south of Buckner Road, 1,300 feet north of US 31 and Existing Driveways (Saint Thomas Heart/Spring Hill Business Park), and 2,600 feet north of Campbell Station Parkway.
- **US 31 and Existing Driveways (Saint Thomas Heart/Spring Hill Business Park)** – located 2,550 feet south of Buckner Road, 1,300 feet south of US 31 and Williford Court, and 1,300 feet north of Campbell Station Parkway.

### Traffic Analysis

Although it is acceptable to add two additional signals to this coordinated signal system while maintaining appropriate traffic signal spacing, the operational analysis showed that the addition of two traffic signals had a reasonably significant negative impact on delay and travel time and a reduction in the arterial speed for this segment of US 31.

As shown in Table 2, the 2021 No-Build and the 2021 Build Scenario 3 (only one new traffic signal) have similar operational results and tend to split which operates with the lower delay and travel of the 2021 scenarios.

### Traffic Signal Warrant Analysis

It is anticipated the traffic generated by the Cadence Crossing development should meet some of the traffic signal warrant criteria; however this will be dependent on the side street design (one exiting lane vs. two exiting lanes) and the actual trip distribution from the site.

The potential traffic generated by future development of the vacant parcels along the western boundary of US 31 will create several new trips on the network and the realignment of Wilkes Lane will divert trips to the potential new intersection. However, it is not anticipated that the side street traffic volumes will meet the thresholds for the traffic signal volume warrants.

## Recommendations

- The only potential signalization considered for this segment of US 31 between Buckner Road and Campbell Station Parkway should be at US 31 and Williford Court. This location should not be approved for a traffic signal until the appropriate traffic warrants are satisfied and an engineering study is completed that shows there will be negligible negative impacts to the operational characteristics and no negative safety impacts to the US 31 corridor.
- The City should minimize additional access locations on US 31. If an access is granted, the access should be designed as a right-in/right-out only configuration.
- The City should redesign Wilkes Lane as a right-in/right-out only configuration

- The City should continue the frontage road concept from Wilkes Lane to the existing stubout at Starbucks.
- The City should conduct regular traffic signal timing reviews/optimization of the entire US 31 corridor. The recommended timeframe for signal timing updates for major corridors is every 3-5 years.
- Due to the heavy congestion during the peak periods and the unknown timeframe for major improvements to US 31, the City should evaluate alternative connections parallel to US 31. This is in support of the basic principles of access management.

Please contact me at your convenience should you have any questions.

Respectfully Submitted,  
Volkert, Inc.



Gerald Bolden, PE, PTOE  
Transportation Design Manager

CC: File