

September 5, 2018

Carl Baughman  
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109 3rd Avenue South  
P.O. Box 305  
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**APPROVED AS NOTED***By Carl Baughman at 1:02 pm, Sep 17, 2018*

**Re: Carothers Crossing West  
Traffic Impact Analysis  
Review Comments**

Dear Carl:

This memorandum provides the findings of the independent review of the Carothers Crossing West Traffic Impact Analysis (TIA). Our review includes the traffic projections and the operational analyses; evaluation of the proposed roadway network; review and evaluation of the recommended infrastructure improvements; and identification of any recommended modifications or additions to the recommended infrastructure improvements identified in the TIA.

**General Project Information**

The Carothers Crossing West TIA, dated August 2018, was completed by Kimley Horn for Embrey Partners, Ltd. The proposed development is a mixed-use development that is proposed to be constructed on the northwest corner of Liberty Pike and Carothers Parkway, in Franklin, Tennessee. Access will be provided by a new driveway on Carothers Parkway across from Southstar Drive and another new driveway on Carothers Parkway between Southstar Drive and Liberty Pike. Also, a new driveway will be provided on Liberty Pike across from Edward Curd Lane. The proposed development is expected to be constructed and completed by 2021.

**Trip Generation and Trip Distribution**

Future trips generated by Carothers Crossing West were calculated using ITE's *Trip Generation*, 10th Edition based on the future land use. The land use used to determine the project-generated trips was 338 dwelling units of Multifamily Housing (Mid-Rise), 24,065 s.f. of General Office Building, 34,565 s.f. of Shopping Center, a 3,900 s.f. Drive-In Bank, and a 4,800 s.f. High-Turnover (Sit-Down) Restaurant. The total development is expected to produce 4,061 new trips per day with 271 new trips in the AM peak hour and 272 new trips in the PM peak hour. The new trips below reflect the reductions made for internal trips and pass-by trips.

	Total Entering Trips	Total Exiting Trips
AM	151	120
PM	142	130

These trips were distributed throughout the study area based on proposed accesses and existing travel patterns. Approximately 20% of the project-generated traffic was determined to come from Liberty Pike to the west and 15% from Liberty Pike to the east. Approximately 30% of the new traffic will come from Carothers Parkway to the north and 30% from the south along Carothers Parkway. The remaining 5% will come from Edward Curd Lane south of Liberty Pike.

### Capacity/Level of Service Analyses

The operational analyses for the intersections within the study area were all completed utilizing HCS7 software, which uses the methods from the Highway Capacity Manual 2010 (HCM2010). Each intersection was evaluated for the weekday AM and PM existing, background, and projected traffic conditions.

#### Intersection Capacity Analysis

In the projected 2021 conditions, the analyses indicate that the signalized intersections will operate at LOS D or better during both the AM and PM peak hour. At the unsignalized intersection of Liberty Pike at Edward Curd Lane/Driveway 3, the northbound and southbound approaches will operate at LOS E or F during both peak hours.

#### Turn Lane Warrant Analysis

The total projected peak hour traffic volumes were analyzed to determine the need for the following dedicated turn lanes:

- Eastbound left turn lane at Liberty Pike and Edward Curd Lane/Driveway 3
- Westbound right turn lane at Liberty Pike and Edward Curd Lane/Driveway 3
- Southbound right turn lane at Carothers Parkway and Driveway 2

These analyses were based on the methods outlined in *NCHRP Report 457: Engineering Study Guide for Evaluating Intersection Improvements*. The analyses indicate that the total projected traffic volumes warrant an eastbound left turn lane at Driveway 3 and a southbound right turn lane at Driveway 2.

**Staff Comment:** An NCHRP warrant analysis was not performed for a northbound left turn lane or southbound right turn lane on Carothers Parkway at Driveway 1. However, this intersection was included in the evaluations using the Franklin Transportation & Street Technical Standards. Also, the report states, "A left-turn lane is warranted at Driveway 2 and Driveway 3 for the Future 2021 scenario." This statement is not accurate based on Tables 6 and 7.

Per Table 8, left turn lane warranted finding appears intended for Driveway 1. Also per Table 9, right turn lanes are found to be warranted at all three Driveways.

#### Traffic Signal Warrant Analysis

A traffic signal warrant was evaluated for the intersection of Liberty Pike at Edward Curd Lane/Driveway 3. For the traffic signal warrant analysis, available data was limited to the AM and PM peak hours. No warrants are met, not even the peak hour warrant. It is possible that additional hours would satisfy traffic signal warrants; however, additional data collection and analysis would be required to evaluate this possibility.

**Staff Comment:** A traffic signal warrant analysis can only reasonably be evaluated for Warrant 3 (Peak Hour) based on peak hour volumes. There is no way to determine if the remaining volume warrants are met with such limited data.

Insufficient spacing for signalization, do not pursue warrant analysis.

#### Queue Analysis

A queue analysis was performed for using the Synchro software to evaluate and determine the forecasted 50<sup>th</sup> percentile queue lengths and 95<sup>th</sup> percentile queue lengths. The queue lengths are summarized in Tables 15 and 16 of the report. The queue analyses demonstrate significant queuing for vehicles making an eastbound left turn during both the AM and PM peak hours at Carothers Parkway at Liberty Pike. These queues are mainly the result of existing and background conditions as queue lengths increase by less than one car between the Background 2021 and Future 2021 conditions. Westbound left turn queues at Carothers Parkway at Liberty Pike also exceed existing storage lengths in both the AM and PM peak hours. However, these queues are also mainly attributed to background volumes, as queue lengths increase by less than one car between Background 2021 and Future 2021 conditions. Additionally, in the PM peak hour, future southbound right turn queues exceed existing storage lengths.

### Analysis with Improvements

An alternate traffic analysis was performed for the intersections of Liberty Pike at Edward Curd Lane/Driveway 3. These improvements were identified due to the expected Level of Service (LOS) F during the Background 2021 and Future 2021 scenarios. "Improved" scenario is to convert the existing two-way stop-controlled intersection into a signalized intersection. NOTE: The distance along Liberty Pike between Carothers Parkway and Edward Curd Lane is approximately 650 feet. Traffic signal spacing of 650 feet is considered less desirable.

**Concur** **Staff Comment:** A stop-controlled intersection cannot be "converted" into a signalized intersection without satisfying the required traffic signal warrants. A traffic signal is not expected to be warranted at this intersection. Furthermore, the proximity of the signalized intersection of Liberty Pike and Carothers Parkway is not adequate for spacing between signals.

### Sight Distance Analysis

Field measurements were obtained for intersection sight distance at Driveway 2 and Driveway 3. Sight distance is available at Driveway 2. To improve the intersection sight distance for Driveway 3, looking to the left (east), existing grass and vegetation along the north side of Liberty Pike (between Driveway 3 and Carothers Parkway) should be trimmed or removed. Looking to the right (west), the existing earth along the north side of Liberty Pike (between Driveway 3 and Huffines Ridge Drive) should be lowered. However, the existing vertical crest along Liberty Pike may obstruct the minimum intersection sight distance.

**Concur** **Staff Comment:** Since Liberty Pike is median divided, drivers will have a refuge area to split the left turn movements into two stages. It is not clear in the report if the sight distance was measured from the driveway or from the median divide.

### **Recommendations Identified in the TIS**

The following are the infrastructure improvements recommended in the study and our response to each.

#### **Carothers Parkway at Liberty Pike**

- Unrelated to the proposed development, the following mitigation improvements will improve traffic operations under the Background 2021 scenario. Extend the eastbound left-turn lane along Liberty Pike to have a storage length of 250 feet. The queue lengths for the Existing 2018 and Background 2021 scenarios exceed the existing storage length; however, the increase in queue length from Background 2021 to Future 2021 is minimal.

**Concur** **Staff Response:** *This is a beneficial improvement to the existing left turn lane which has approximately 100 feet of storage. This would require reconstructing the existing grass median. Unless it has been previously identified by an approved development in the area, this improvement should be constructed as part of the Carothers Crossing West development. It should be designed according to the Manual on Uniform Traffic Control Devices (MUTCD), American Association of State Highway and Transportation Officials (AASHTO), Tennessee Department of Transportation (TDOT), and City of Franklin standards.*

#### **Liberty Pike at Edward Curd Lane/Driveway 3**

- NOTE: If this intersection remains unsignalized, the minimum intersection sight distance may not be achievable for motorists along Driveway 3, looking right (to the west). Furthermore, the Edward Curd Lane (northbound) approach and Driveway 3 (southbound) approach are forecasted to operate at Level of Service (LOS) F during the Background 2021 scenario and will continue to operate at LOS F during the Future 2021 scenario. The installation of a traffic signal would alleviate the insufficient intersection sight

distance – however, a traffic signal may not be warranted at this intersection, and a new traffic signal would result in less desirable spacing between traffic signals along Liberty Pike.

- Recommendations (regardless of whether minimum intersection sight distance CAN or CANNOT be provided looking to the right/west)
  - Construct an eastbound left-turn lane along Liberty Pike with 150 feet of storage.
  - Construct a westbound right-turn lane along Liberty Pike with 125 feet of storage.
  - Convert the existing northbound right-turn lane along Edward Curd Lane to a shared northbound through/right turn lane.
  - Provide STOP control along the southbound approach of Driveway 3.
  - Provide adequate intersection sight distance in accordance with the criteria provided in A Policy on Geometric Design of Highways and Streets. Looking to the left (east), trim and/or remove existing grass and vegetation along the north side of Liberty Pike that is located within the site boundary.
- Recommendations (If minimum intersection sight distance CAN be provided looking to the right/west)
  - Construct Driveway 3 with three (3) lanes for vehicular movement: one (1) lane for vehicle ingress and two (2) southbound approach lanes for vehicle egress: one (1) left turn lane and one (1) shared through / right-turn lane.
  - Provide adequate intersection sight distance in accordance with the criteria provided in A Policy on Geometric Design of Highways and Streets. Looking to the right (west), lower the ground elevation along the north side of Liberty Pike that is located within the site boundary. However, the presence of a utility easement in this vicinity may prevent the modification of the ground elevation. Furthermore, the existing vertical crest along Liberty Pike may continue to obstruct the minimum intersection sight distance.
- Recommendations (If minimum intersection sight distance CANNOT be provided looking to the right/west)
  - Construct Driveway 3 with two (2) lanes for vehicular movement: one (1) lane for vehicle ingress and one (1) southbound approach lane for vehicle egress: one (1) right-turn lane.
  - Left turn and through movements along the Driveway 3 (southbound) approach will be prohibited. Right turn movements along Driveway 3 will be allowed. Eastbound left-turn, northbound through, and westbound right-turn movements will be allowed for vehicles desiring to enter Driveway 3.

**Staff Response:** *A traffic signal is not recommended at this intersection. Since Liberty Pike is median divided, drivers will have a refuge area to split the left turn movements into two stages. Sight distance may be available if measured from the median refuge. It is recommended a new sight distance analysis be conducted to determine if sight distance is provided when looking to the west from the median divide. All improvements should be designed according to the MUTCD, AASHTO, TDOT, and City of Franklin standards.*

Concur

#### **Carothers Parkway at Southstar Drive/Driveway 1**

- Construct a northbound left-turn lane along Carothers Parkway with 200 feet of storage.
- Construct a southbound right-turn lane along Carothers Parkway with 125 feet of storage.
- Provide a westbound through lane along Southstar Drive. This can be achieved by removing the existing white chevron markings in the neutral area between the two (2) westbound left-turn lanes and the one (1) westbound right-turn lane.
- Construct Driveway 1 with four (4) lanes for vehicular movement: one (1) lane for vehicle ingress and three (3) eastbound approach lanes for vehicle egress: one (1) left-turn lane, one (1) through lane, and one (1) right-turn lane.
- Modify the existing traffic signal, since Driveway 1 will function as the western leg (i.e. eastbound approach) at the signalized intersection of Carothers Parkway at Southstar Drive/Driveway 1.

**Staff Response:** *All improvements should be designed according to the MUTCD, AASHTO, TDOT, and City of Franklin standards. Furthermore, Driveway 1 should be constructed so that the through movements to/from Southstar Drive are properly aligned with the intersection.*

**Concur,** *also left turns occur simultaneously.*

## Carothers Parkway at Driveway 2

- Construct a southbound right-turn lane along Carothers Parkway with 125 feet of storage.
- Construct Driveway 2 with two (2) lanes for vehicular movement: one (1) lane for vehicle ingress and one (1) eastbound approach lane for vehicle egress: one (1) right-turn lane.
- Provide STOP control along the eastbound approach of Driveway 2, which shall function as a right-in/right-out intersection.
- Provide adequate intersection sight distance in accordance with the criteria provided in *A Policy on Geometric Design of Highways and Streets*.

**Concur** **Staff Response:** *All improvements should be designed according to the MUTCD, AASHTO, TDOT, and City of Franklin standards.*

## Concur Additional Staff Comments and Recommendations

- The existing and future traffic volumes show northbound U-turn at the intersection of Carothers Parkway and Southstar Drive/Driveway 1. To prevent/reduce conflicts at this proposed four-leg intersection, it is recommended a “No U-turn” sign be provided for the northbound and southbound approaches on Carothers Parkway.
- The TIA recommendations do not include pedestrian accommodations. Pedestrian access and connectivity should be included as part of the development’s plans and infrastructure improvements. The accommodations should apply to sidewalks and traffic signals.
- A recommended improvements figure that includes the recommended lane configuration and traffic control for the proposed project should be prepared and submitted to the review team for evaluation. This figure should include conceptual-level improvements, preferably using the latest aerial as a base. This is a figure that should be included in all future traffic studies.

## Conclusion

The Carothers Crossing West Traffic Impact Analysis submitted August 2018 covers the typical required traffic impact study components and identifies several feasible and beneficial infrastructure improvements. Additional evaluation and analysis, as identified above, should be completed and submitted for review and approval.

Should you have any questions or need additional information, please contact me.

Sincerely,



Dyan C. Damron, PE, PTP  
Traffic Engineering & Planning Manager  
Volkert, Inc.

cc: Jimmy Wiseman – City of Franklin  
Josh King – City of Franklin  
Lance Fritto – City of Franklin  
Kevin Long – City of Franklin