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February 20, 2015

Ms. Cindy Pionke, PE
Knox County Director of Planning & Development
205 W. Baxter Avenue
Knoxville, Tennessee 37917

RE: 49 Unit Lyons Crossing Residential Development

Dear Ms. Pionke:

In accordance with our contract agreement, CDM Smith Inc. is pleased to provide this traffic impact study (TIS) letter report for the referenced development. The developer would like to provide site access onto Knightsbridge Drive opposite Oxford Drive (base analysis condition) and an alternative is to provide access onto Northshore Drive opposite Ashland Springs Way (alternative analysis condition). Key questions that the TIS addressed included:

1. If the site access is located on Knightsbridge Drive, will a left turn lane be needed on Northshore Drive at Knightsbridge Drive?
2. If the site access is located on Northshore Drive, will a left turn lane be needed on Northshore Drive?
3. How should Knightsbridge Drive, between Oxford Drive and Northshore Drive, be reconfigured if at all to accommodate additional traffic generated by the Lyons Crossing development?
4. Is the sight distance adequate on Knightsbridge Drive at Northshore Drive?

Figure 1 depicts the proposed site location relative to the regional setting.

Data Collection

CDM installed its video traffic counting equipment on February 9, 2015 and recorded traffic movements at the study area intersections on February 10, 2015, which was a Tuesday. Counts were made from 7:00 to 9:00 AM and from 4:00 to 6:00 PM. The morning peak hour occurred from 7:30 to 8:30 AM and the afternoon peak hour from 4:00 to 5:00 PM.

Existing Conditions

Northshore Drive contains one lane per direction and has an approximately 80 foot southbound right turn lane with a 90 foot taper at Knightsbridge Drive. The posted speed limit on Northshore Drive is 40 miles per hour (MPH). Ashland Springs Way is located approximately 375 feet south of Knightsbridge Drive measured centerline to centerline. The eastbound



approach of Knightsbridge Drive at Northshore Drive contains about 22 feet of pavement but has diagonal markings restricting use to only one approach lane. We understand that the pavement markings were installed because motorists positioned side-by-side on Knightsbridge Drive at Northshore Drive were blocking each other's ability to see oncoming traffic. The distance from the Knightsbridge Drive stop line at Northshore Drive to Oxford Drive is approximately 210 feet, consequently about eight vehicles in one lane can be stored in the queue before blocking that road. **Figure 2** illustrates the existing geometry and traffic control at the study area intersections.

Figures 3 and **4** show existing (February 10, 2015) peak hour traffic volumes and levels of service at the study area intersections, respectively. Morning and afternoon peak hour traffic volumes on Northshore Drive are high resulting in LOS F conditions for motorists turning onto that road from Knightsbridge Drive. Although minimal traffic exits from Ashland Springs Way onto Northshore Drive, that movement operates at LOS F in the AM peak hour and LOS C in the PM peak hour.

Synchro estimated that the AM peak hour eastbound maximum queue on Knightsbridge Drive at Northshore Drive was 11 vehicles on February 10, 2015. All Synchro queue estimates are based on 95th percentile values. Many eastbound right turn motorists do not observe the diagonal lane markings according to our observations, thus this approach is often operating as if it has two lanes. In the AM peak hour, there were 36 vehicles turning right and 26, or about 72 percent, made the turn from the striped-out area. **Figures 5** and **6** are still shots of the AM peak hour video displaying vehicles in the marked-out area. The CDM Smith maximum observed queue on eastbound Knightsbridge Drive at Northshore Drive was four total vehicles, three in the designated lane and one in the marked-out area.

Because of the discrepancy between the observed and measured queue on Knightsbridge Drive at Northshore Drive and because most right turning vehicles were observed using the marked-out area, a morning peak hour capacity analysis was performed with separate left and right turn lanes. This analysis estimates that left turning motorists experience LOS F conditions whereas right turning motorists experience LOS C conditions. The Synchro calculated left turn queue was estimated to be seven vehicles and the right turn queue was estimated to be one vehicle. Although closer to the observed AM peak hour queue, the Synchro queue estimate is greater than the observed by three vehicles, or about 75 percent.

Trip Generation of Proposed Development

According to *Trip Generation, Ninth Edition*, the 49 unit Lyons Crossing residential development should generate approximately 545 daily new trips, 44 new AM peak hour trips,

and 55 new PM peak hour trips. A summary of the trip generation broken down by entering and exiting trips is shown in **Table 1**.

Table 1- Lyons Crossing Trip Generation

TIME PERIOD	Entering	Exiting	TOTAL
Weekday	273	273	546
AM Peak	11	33	44
PM Peak	35	20	55

Trip Distribution and Traffic Assignment- Knightsbridge Drive Access

Morning and afternoon peak hour turning movement volumes at the intersection of Northshore Drive and Knightsbridge Drive were used to estimate the trip distribution pattern for the Lyons Crossing residential development. Based on the existing traffic pattern, approximately 62 percent of the trips will be oriented to the north and 38 percent to the south on Northshore Drive as illustrated in **Figure 7**. If the Lyons Crossing development access is on Knightsbridge Drive, an occasional motorist may make a left turn onto Knightsbridge Drive or progress onto Oxford Drive, however these movements should be negligible. **Figure 8** shows the traffic assignment of the proposed Lyons Crossing residential development if access is via Knightsbridge Drive.

2015 Conditions with Lyons Crossing Development- Knightsbridge Drive Access

Figure 9 presents site generated traffic from the Lyons Crossing development base condition (access onto Knightsbridge Drive) superimposed on year 2015 traffic volumes. **Figure 10** depicts the resulting LOSs. The eastbound approach on Knightsbridge Drive will continue to operate at LOS F in the morning peak hour with long delays created by left turning traffic. The projected AM peak hour single lane queue is 17 vehicles and the left turn queue by itself is projected to be 10 vehicles. Note that the Synchro calculated queue was approximately 75 percent greater than the observed queue so we would expect these projections to be longer than the actual queues experienced by motorists.

2020 Background Traffic

Background traffic will consist of that generated from the Wallace Road apartment complex and general growth from unidentified developments. The Wallace Road apartment develop will generate 10 AM peak hour and 16 PM peak hour trips along Northshore Drive near Knightsbridge Road.

TDOT has two count stations on Northshore Drive—Station 287 near Whittington Creek Boulevard and Station 121 near Woodridge Drive—that measure daily traffic, and that have historical count data to estimate future traffic growth. Over the last ten years at both count stations, traffic has remained relatively constant or has declined. Instead of projecting no traffic growth, it was decided to use a one percent annual growth rate for five years, or a total of five percent to estimate the general growth of traffic in 2020, the selected design year.

The Wallace Road apartment traffic study included a proposed 39,000 square foot office development in its future traffic projections. This development should, according to the traffic impact study, generate 23 AM peak hour and 30 PM peak hour new trips on Northshore Drive. It was assumed that the background traffic increases projected in this Lyons Crossing study will account for that development, so a separate assignment of this office complex traffic was not undertaken. **Figure 11** illustrates projected year 2020 background traffic comprised of a five percent general growth of traffic and the Wallace Road apartment complex trips.

2020 Conditions with Lyons Crossing Development- Knightsbridge Drive Access

Figure 12 presents site generated traffic from the Lyons Crossing development base condition (access onto Knightsbridge Drive) superimposed on year 2020 traffic volumes. **Figure 13** depicts the resulting LOSs. As with 2015 conditions and the Lyons Crossing development, the eastbound approach on Knightsbridge Drive will continue to operate at LOS F in the morning peak hour with long delays created by left turning traffic. The projected AM peak hour single lane queue 18 vehicles and the left turn queue by itself is projected to be 10 vehicles. Note that the Synchro calculated queue was approximately 75 percent greater than the observed queue so we would expect these projections to be longer than the actual queues experienced by motorists.

Trip Distribution and Traffic Assignment- Northshore Drive Access

Based on the existing traffic pattern, approximately 62 percent of the trips will be oriented to the north and 38 percent to the south on Northshore Drive as illustrated in **Figure 14**. **Figure 15** shows the traffic assignment of the proposed Lyons Crossing residential development if access is via Northshore Drive.

2015 Conditions with Lyons Crossing Development- Northshore Drive Access

Figure 16 presents site generated traffic from the Lyons Crossing development alternative condition (access onto Northshore Drive) superimposed on year 2015 traffic volumes. **Figure 17** depicts the resulting LOSs. The eastbound approach on Knightsbridge Drive will continue to operate at LOS F in the morning peak hour with long delays created by left turning traffic. At the Lyons Crossing access road approach to Northshore Drive, two lanes were assumed with the left turn lane operating at LOS F in the AM and PM peak hours.

2020 Conditions with Lyons Crossing Development- Northshore Drive Access

Figure 18 shows year 2020 projected total traffic volumes with background plus site generated traffic on a street network consisting of the Lyons Crossing development access directly onto Northshore Drive. **Figure 19** is the LOS associated with this condition. The results are similar to year 2015 traffic conditions on the same access scheme.

Knightsbridge Drive at Northshore Drive Sight Distance

On Knightsbridge Drive at Northshore Drive the sight distance was measured to be approximately 500 feet looking south from the “legal lane” and 1,200 feet looking north. With a posted speed limit of 40 MPH, these values are adequate based on the Knox County corner sight distance criteria. Sight distance looking south can be obstructed by trees along Northshore Drive and westbound traffic, especially if it is in the vicinity of Ashland Springs Way. Moreover, the sight distance looking south is very sensitive to the exact position of the vehicle relative to Northshore Drive. A tree line on the west side of Northshore Drive along the development’s frontage limits sight distance somewhat, but acceptable distances were still achieved.

Left Turn Lane Evaluation- Northshore Drive

Heavy traffic volumes on Northshore Drive result in a left turn volume threshold of only 15 vehicles per hour (VPH) to meet the criteria for a left turn lane. At Knightsbridge Drive, the existing PM peak hour volume is 18 VPH so the criteria is met today. Lyons Crossing development access off of Knightsbridge Road will generate 13 more peak hour left turning vehicles, bringing the total to 31 VPH in the PM peak hour.

If direct access to Northshore Drive is provided to Lyons Crossing, the 13 projected PM peak hour left turn trips from Northshore Drive into Lyons Crossing fall short of meeting the criteria for a left turn lane.

Left Turn Radius- Knightsbridge Drive to Lyons Crossing Access Road

The westbound left turn radius from Knightsbridge Drive to the site access road was analyzed using a single unit truck with a 30 foot wheel base (SU-30). This analysis indicates that the median tip on Knightsbridge Drive at Oxford Drive/proposed access road will probably need to be cut slightly to accommodate the left turn. The site plan does not precisely locate the access road relative to Oxford Drive, but instead shows it generally opposite its centerline extension. Oxford Drive intersects Knightsbridge Drive at a slight obtuse angle, making the exact location of the proposed access road even more difficult to pinpoint. A scaled sketch of the turning radius created in Google Pro is provided in the Appendix. If the Lyons Crossing access road is located exactly opposite Oxford Drive, the median will need to be trimmed as shown in the



sketch. Slightly offsetting the Lyons Crossing access road by moving it westwards might help with the turning radius, but a severe offset is not recommended.

Summary and Recommendations

One of the most significant issues that this TIS addressed is where to locate the Lyons Crossing access with two options considered: on Knightsbridge Road or on Northshore Drive. The site plan has it located on Knightsbridge Road. If the access were to be located on Northshore Drive, traffic would be more dispersed and Knox County would avoid more traffic on a problematic intersection. Conversely, if the access were to be located on Knightsbridge Drive, traffic would be more concentrated at one intersection, but the problematic intersection would require some improvements. This core issue is further complicated by Synchro queue estimates that were inconsistent with field observations. It is our professional opinion that future queues on Knightsbridge Drive will not extend back to or beyond the proposed Lyons Crossing access/Oxford Drive if two approach lanes are provided.

It is recommended that the Lyons Crossing access be located on Knightsbridge Drive and that the following improvements be made:

1. Widen the eastbound approach of Knightsbridge Drive at Northshore Drive from 22 to at least 24 feet from Northshore Drive to Oxford Drive/Lyons Crossing access road. The widening should occur to the south so that the median can be preserved.
2. Eliminate the striped out-area and allow left and right turns to occur side-by-side. The widening of Knightsbridge Way along with adding a Northshore Drive left turn lane should eliminate the sight distance restriction caused by left and right turning vehicles being positioned side-by-side.
3. Construct a 50 foot left turn lane on Northshore Drive at Knightsbridge Drive with an approximately 320 foot transition. The left turn lane transition would begin just north of Ashland Springs Way.
4. Remove vegetation and trees along the south side of Northshore Drive adjacent to the site to maximize sight distance.
5. Trim the Knightsbridge Drive median at the Lyons Crossing access road to accommodate SU-30 trucks.
6. Based on an approximation of the Lyons Crossing access road relative to the Knightsbridge Drive median noise and Oxford Drive, a single unit truck can make a left turn from Knightsbridge Drive onto the Lyons Crossing access road without striking the median noise. Thus, no modifications to the median noise are required to accommodate a single unit truck.



Thank you for the opportunity to conduct this study.

Sincerely,

A handwritten signature in black ink that reads "W. Hollis Loveday". The signature is written in a cursive style with a long, sweeping tail on the letter "y".

W. Hollis Loveday, P.E.
Principal
CDM Smith Inc.