TRAFFIC IMPACT ANALYSIS

EDEN HALL
Fullwood Lane & Marion Drive
Town of Matthews, North Carolina

for

Landtec Development, Inc.

March 2014

454-002 (C-2165)
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EXECUTIVE SUMMARY

Landtec Development, Inc. intends to rezone (from R-12 & R-20 to R-VS (Innovative) [Zoning Application TBD]) approximately 16.6 Acres in order to construct a maximum of 99 townhomes. The site is located on the west side of Fullwood Lane (south of Marion Drive), in the Town of Matthews (Mecklenburg County), NC. The site is expected to be fully developed five years from present (2019).

This report provides analysis of the traffic operations within the area of influence, according to the standards set by the Town of Matthews (which follows the North Carolina Department of Transportation’s (NCDOT) “Policy on Street and Driveway Access to North Carolina Highways, Chapter 4 Part C” parameters). It provides recommended access management for the site and intersection improvements needed for mitigating traffic impacts. This study evaluates the following scenarios:

- 2014 AM & PM Peak existing traffic conditions
- 2019 AM & PM Peak No Build traffic conditions
- 2019 AM & PM Peak traffic conditions under the site buildout

The area of influence of the study site as indicated by Town of Matthews staff includes the following two existing intersections and one proposed full movement access location:

1. Fullwood Lane & NC 51 (Matthews Twp. Pkwy.) (signalized)
2. Fullwood Lane & S. Trade Street (SR 3448) (signalized)
3. Fullwood Lane & Proposed Access “A” (unsignedalized)

A funded NCDOT improvement project scheduled for 2016 includes an eastbound right turn lane on NC 51 at Fullwood Lane with 300 feet of storage (and a minimum 100-foot bay taper) and the extension of the existing northbound right turn lane on Fullwood Lane (length to be determined). For purposes of this report the improvement project was assumed to be in place for the 2019 analyses.

According to the site plan, access to the development is expected to occur via two full movement locations:
- Proposed Access “A” is located on Fullwood Lane, approximately 540 feet south of the unsignalized intersection of Fullwood Lane & Marion Drive/Church Driveway
- Proposed Access “B” is located on Marion Drive, approximately 570 feet west of the unsignalized intersection of Fullwood Lane & Marion Drive/Church Driveway. There are minimal traffic volumes on Marion Drive (only serves a few residences); therefore, no intersection analysis was performed for this access.

The proposed buildout trip generation results indicate that the residential development is expected to generate 51 AM peak hour trips and 60 PM peak hour trips.

Currently, the intersection of NC 51 & Fullwood Lane operates with a LOS “C” in the AM peak hour and a LOS “D” in the PM peak hour; the intersection of S. Trade Street & Fullwood Lane operates with a LOS “C” in the AM peak hour and a LOS “E” in the PM peak hour. Typically, an intersection is said to be operating at capacity with a volume-to-capacity (v/c) ratio of 1.00 and acceptable at a LOS “D” or better.

**NCDOT ANALYSIS REQUIREMENTS** – Chapter 5, Section J of the July 2003 NCDOT Policy on Street and Driveway Access to North Carolina Highways, the applicant shall be required to identify mitigation improvements to the roadway network if at least one of the following conditions exist when comparing the 2019 Buildout results to the 2019 No Build results:

- The total average delay at an intersection or an individual approach increases by 25% or greater, while maintaining the same level of service,
- The Level of Service (LOS) degrades by at least one level at an intersection or an individual approach,
- Or the Level of Service is “F” for an intersection or an individual approach.

This section of the driveway manual also states that, *mitigation improvements shall be identified when the analysis indicates that the 95th percentile queue exceeds the storage capacity of the existing lane.*

The intersections within the area of influence were then analyzed under the 2019 No Build and Build scenarios, with the growth in the background traffic.
2019 Build Scenario Analysis Results/Recommendations:

1. NC 51 (Matthews Twp. Pkwy.) & Fullwood Lane (signalized)

When comparing the impact of the 2019 Buildout conditions to the 2019 No Build conditions the intersection LOS remains a "C" during both peak hours. No approaches drop in LOS and all delays are within the allowed parameters. Therefore, mitigation is not required at this intersection.

The 95th % queue for the eastbound right turn lane on NC 51 (300 feet of planned storage) for the PM peak Build scenario is 498 feet (466 feet for the No Build scenario). The site only contributes 11 of the 683 vehicles to this movement (which is minimal), therefore, no improvements are recommended.

The 95th % queue for the westbound left turn lane on NC 51 (465 feet of storage) for the PM peak Build scenario is 602 feet (578 feet for the No Build scenario). The site only contributes 14 of the 378 vehicles to this movement (which is minimal), therefore, no improvements are recommended.

2. S. Trade St. (SR 3448) & Fullwood Lane (signalized)

When comparing the impact of the 2019 Buildout conditions to the 2019 No Build conditions the intersection LOS remains a "D" in the AM peak hour and an "F" in the PM peak hour. However, the westbound approach dropped in LOS (from "E" to "F") during the AM peak hour. Even though the LOS for the westbound approach is not met in the AM peak hour when comparing the Build to the No Build scenario we feel no mitigation is necessary (minimal site traffic volumes associated with this or any movement at the intersection [20 of 2,552 vehicles thru the intersection]).

The 95th % queue for the eastbound left turn lane on S. Trade Street (170 feet of storage [maximum storage due to the existing cross-street/left turn lane to the west]) for the AM peak Build scenario is 1,310 feet (1,302 feet for the No Build scenario) – a similar situation occurs in the PM peak also. The site only contributes 3 of the 1,012 vehicles to this movement (which is minimal), therefore, no improvements are recommended.

The 95th % queue for the southbound left turn lane on Fullwood Lane (450 feet of storage [maximum storage due to the existing roadway bend]) for the PM peak Build scenario is 576 feet (568 feet for the No Build
scenario). The site only contributes 2 of the 94 vehicles to this movement (which is minimal), therefore, no improvements are recommended.

3. Fullwood Lane & Proposed Access “A” (unsignalized)

Under the 2019 Build conditions the intersection has an acceptable ICU LOS of “A” during the AM peak hour and a LOS “C” during the PM peak hour. The intersection layout we recommend includes:

- Construct the eastbound approach (Proposed Access “A”) for one ingress and two egress lanes (a lane that terminates as a left turn lane and a right turn lane with 100 feet of storage).
- The existing northbound inner lane on Fullwood Lane with 125 feet of storage and 110-foot bay taper (that terminates as a left turn lane at NC 51) is acceptable as a combined left-through lane (less than 20 vehicles turn left into the site during either peak hour).
- Based on the minimal southbound right turn entering volumes on Fullwood Lane (less than 20 during either peak hour), a dedicated southbound right turn lane is not required/recommended.

4. Marion Drive & Proposed Access “B” (unsignalized)

Since there are minimal traffic volumes on Marion Drive (the street only serves a few residences), no intersection analysis was performed for this access driveway. Based on this information we recommend:

- Construct the northbound approach (Proposed Access “B”) for one ingress lane and one egress lane. No turn lanes should be required on Marion Drive.

These identified improvements will improve capacity and provide an acceptable level of service at these intersections and adjacent roadway corridors during the critical peak hours of the year 2019.
PROPOSED DEVELOPMENT

Landtec Development, Inc. intends to rezone (from R-12 & R-20 to R-VS (Innovative) [Zoning Application TBD]) approximately 16.6 Acres in order to construct a maximum of 99 townhomes. The site is located on the west side of Fullwood Lane (south of Marion Drive), in the Town of Matthews (Mecklenburg County), NC (see Figure 1). The site is expected to be fully developed five years from present (2019).

According to the latest plan provided by LandDesign (see Site Plan), access to the development is expected to occur via two full movement locations:

- **Proposed Access “A”** is located on Fullwood Lane, approximately 540 feet south of the unsignalized intersection of Fullwood Lane & Marion Drive/Church Driveway
- **Proposed Access “B”** is located on Marion Drive, approximately 570 feet west of the unsignalized intersection of Fullwood Lane & Marion Drive/Church Driveway. There are minimal traffic volumes on Marion Drive (only serves a few residences); therefore, no intersection analysis was performed for this access.
DEVELOPMENT SUMMARY

DEVELOPER: GRAHAM ENTERPRISES OF CHARLOTTE LLC
2701 COLTSGATE ROAD
SUITE 300
CHARLOTTE, NC 28211
CONTACT: MEL GRAHAM
(704) 552-5338
mel@grahamenterprises.org

EXISTING PARCEL SIZE: 16.57 ACRES (COMBINED)

JURISDICTION: MATTHEWS

EXISTING ZONING: R-12 AND R-20

PROPOSED ZONING: R-VS (RESIDENTIAL VARIED STYLE DISTRICT)

PROPOSED USE: MULTI-FAMILY (TOWNHOMES)

NUMBER OF LOTS PROPOSED: 90

MAXIMUM ALLOWABLE DENSITY: NO MAXIMUM

PROPOSED DENSITY: 5.43 DUA

CONSTRUCTION SCHEDULE:...

BEGIN CONSTRUCTION:...

COMPLETED INFRASTRUCTURE:...

FULL BUILD-OUT:...

SUPPLEMENTAL REGULATIONS:

MINIMUM LOT AREA: 3,000 SF/DU

MINIMUM LOT WIDTH: 30 FEET/DU

MINIMUM LOT WIDTH PROPOSED: 31 FEET

MINIMUM SETBACK: 20 FEET

MINIMUM SIDE YARD: 0 FEET AND 8 FEET FOR END UNIT OPEN SIDE

MINIMUM REAR YARD: 20 FEET

MINIMUM UNOBSTRUCTED OPEN SPACE (% OF LOT): 20%

MAXIMUM HEIGHT: 35 FEET

MINIMUM BUILDING SEPARATION: 16 FEET

PARKING REQUIREMENTS:

RESIDENCES REQUIRED: 225 SPACES

PROVIDED:

DWELLING, MULTI-FAMILY (2.25 SPACES PER IN EXCESS OF 1,250 SF DWELLING UNIT)

CLUBHOUSE REQUIRED: 15 SPACES

COMMUNITY CENTER 1 SPACE PER 200 SF PROJECTED

PROVIDED:

PROCESSING CENTER PROVIDES

GReENBRIAR
MATTHEWS, NORTH CAROLINA
GRAHAM ENTERPRISES (704) 552-5338
AREA CONDITIONS

The area of influence of the study site as indicated by Town of Matthews staff includes the following two existing intersections and one proposed full movement access location:

1. Fullwood Lane & NC 51 (Matthews Twp. Pkwy.) (signalized)
2. Fullwood Lane & S. Trade Street (SR 3448) (signalized)
3. Fullwood Lane & Proposed Access “A” (unsignalized)

According to the CRPTO Thoroughfare Plan, Fullwood Lane is a minor thoroughfare with a posted speed limit of 45 mph (located along the east side of the proposed site). Fullwood Lane is a two-way roadway two lanes wide and includes a northbound left turn lane for NC 51 that extends 125 beyond the proposed site access location. Curb/gutter, planting strip, and sidewalk is present on the east side of Fullwood Lane south of the site; planting strip and sidewalk is present on the west (site) side of the roadway. Sight distance at the proposed full movement access location on Fullwood Lane is adequate, meeting or exceeding normal NCDOT requirements for a 45 mph posted roadway (50 mph design speed = 500 feet of sight distance).

Marion Drive is a local residential street (located along the north side of the proposed site) that dead ends to the west of the proposed site access location. The roadway is two lanes wide with a posted speed limit of 25 mph. No pavement markings, curb/gutter, planting strips, or sidewalks are present. Sight distance at the proposed full movement access location on Marion Drive is adequate, meeting or exceeding normal NCDOT requirements for a 25 mph posted roadway (30 mph design speed = 300 feet of sight distance).
As indicated on the most current Charlotte Regional Transportation Planning Organization (CRTPO) Thoroughfare Plan, NC 51 (Matthews Township Pkwy.) is a major thoroughfare with a posted speed limit of 45 mph (located north of the site). NC 51 is a two-way median-divided roadway four lanes wide (two lanes in each direction with occasional left and right turn lanes). The roadway includes curb/gutter on both sides; sidewalk is present on the south side and occasionally on the north side.

A funded NCDOT improvement project scheduled for 2016 includes an eastbound right turn lane on NC 51 at Fullwood Lane with 300 feet of storage (and a minimum 100-foot bay taper) and the extension of the existing northbound right turn lane on Fullwood Lane (length to be determined). For purposes of this report the improvement project was assumed to be in place for the 2019 analyses.

Peak period turning movement counts were conducted at the two existing intersections on Tuesday February 18, 2014. Figure 2 shows the 2014 existing and 2019 No Build traffic volumes for the AM and PM peak hours.

**AADT Volumes and Accident Data:**

In addition to the intersection turning movement counts, NCDOT is the source for average annual two-way daily traffic (AADT) volumes within the area of influence. The AADT volumes are depicted in Table 1.

<table>
<thead>
<tr>
<th>Roadway</th>
<th>2012</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fullwood Ln., south of site</td>
<td>13,000</td>
</tr>
<tr>
<td>NC 51, east of Fullwood Ln.</td>
<td>33,000</td>
</tr>
<tr>
<td>S. Trade St., west of Fullwood Ln.</td>
<td>21,000</td>
</tr>
</tbody>
</table>

Table 2 lists the latest high frequency crash data collected by NCDOT for 2007–2011:

**Table 2: High Frequency Crash Locations**

<table>
<thead>
<tr>
<th>Intersection/Roadway</th>
<th># of Reported Accidents Between 2007–2011</th>
</tr>
</thead>
<tbody>
<tr>
<td>Section of NC 51 near Fullwood Ln.</td>
<td>16</td>
</tr>
<tr>
<td>S. Trade St. &amp; Fullwood Ln.</td>
<td>28</td>
</tr>
<tr>
<td>Section of S. Trade St. east of Fullwood Ln.</td>
<td>12</td>
</tr>
</tbody>
</table>
PROJECTED TRAFFIC

The projected background peak hour traffic volumes used in the analyses were developed from the existing (2014) peak-hour-turning-movement-count data. The existing intersection turning-movement volumes were increased using a 2 percent per year growth rate for the area to obtain 2019 background volumes, and was approved by the Town of Matthews.

The daily and peak-hour-trip-generation data for the development is presented in Table 3. The trips generated by the site are obtained from the Institute of Transportation Engineers, Trip Generation Manual, 9th Edition, 2012.

Table 3: Trip Generation

<table>
<thead>
<tr>
<th>Land Use [ITE Code]</th>
<th>Daily</th>
<th>AM Peak Hour</th>
<th>PM Peak Hour</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Enter</td>
<td>Exit</td>
</tr>
<tr>
<td>Townhomes [230]</td>
<td>99 DUs</td>
<td>638</td>
<td>42</td>
</tr>
</tbody>
</table>

Reference:

The proposed buildout trip generation results indicate that the residential development is expected to generate 51 AM peak hour trips and 60 PM peak hour trips.

The directional trip distribution of the site traffic is provided in Figure 3, which was approved by the Town of Matthews. The trip assignments for the 2019 AM and PM peak Build traffic volumes are presented in Figures 4 and 5. The background traffic is indicated to the far left of the movement arrows followed by the site traffic in parentheses. The two volumes are added to obtain the projected total traffic for that movement: Background + (Site) = Total.
TRAFFIC ANALYSIS

The intersections identified within the area of influence were analyzed to identify the traffic impact that the development has under the 2019 scenario. Recommendations for roadway improvements to accommodate the traffic are a result of the analysis. The traffic analysis is based on the LOS analysis at the identified intersections. The intersections were analyzed assuming full development in 2019. The laneage required for the intersections within the study area to operate at acceptable levels of service in the years 2019 with site traffic added to the background volumes were determined by the analysis.

Base assumptions (commonly accepted NCDOT and Town of Matthews parameters) for the analysis scenarios include:

- A 2% per year background growth rate between the existing 2014 and future 2019 conditions
- 12-foot wide travel lanes
- A heavy truck percentage of 2% for all movements
- A peak hour factor of 0.90 for all movements
- Total lost time of 5 seconds for all movements at the signalized intersections

LOS is a qualitative measurement of traffic operations. It is a measure of delay time. The Transportation Research Board’s Highway Capacity Manual\(^1\) (HCM) defines six levels of service for intersections with LOS “A” representing the best operating condition and LOS “F” the worst. Table 16-2 of the HCM gives the criteria for signalized intersections.

<table>
<thead>
<tr>
<th>Signal Level of Service</th>
<th>Signal Delay per Vehicle (sec/vehicle)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>&lt;10.0</td>
</tr>
<tr>
<td>B</td>
<td>&gt; 10.0 and ≤ 20.0</td>
</tr>
<tr>
<td>C</td>
<td>&gt; 20.0 and ≤ 35.0</td>
</tr>
<tr>
<td>D</td>
<td>&gt; 35.0 and ≤ 55.0</td>
</tr>
<tr>
<td>E</td>
<td>&gt; 55.0 and ≤ 80.0</td>
</tr>
<tr>
<td>F</td>
<td>&gt;80.0</td>
</tr>
</tbody>
</table>

SYNCHRO Pro 7.0 was the software tool used in determining the delay, capacity and corresponding level of service at the study intersections. The intersection worksheet reports are provided in the Appendix.

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For the analysis of unsignalized intersections, Intersection Capacity Utilization\(^2\) (ICU) methodology is used to predict how often an intersection will experience congestion (i.e., volume/capacity [v/c]). The ICU can be used on unsignalized intersections to determine the capacity utilization as if the intersection was signalized.

ICU defines 8 levels of service for intersection with LOS “A” representing the best operating condition and LOS “H” the worst. The following table gives the intersection capacity utilization:

<table>
<thead>
<tr>
<th>LOS</th>
<th>ICU v/c</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>&lt;55.0%</td>
</tr>
<tr>
<td>B</td>
<td>&gt;55% to 64.0%</td>
</tr>
<tr>
<td>C</td>
<td>&gt;64% to 73.0%</td>
</tr>
<tr>
<td>D</td>
<td>&gt;73% to 82.0%</td>
</tr>
<tr>
<td>E</td>
<td>&gt;82% to 91.0%</td>
</tr>
<tr>
<td>F</td>
<td>&gt;91% to 100.0%</td>
</tr>
<tr>
<td>G</td>
<td>&gt;100% to 109.0%</td>
</tr>
<tr>
<td>H</td>
<td>&gt;109%</td>
</tr>
</tbody>
</table>

A brief description of the conditions expected for each ICU LOS follows:

**LOS A, ICU ≤55%:** The intersection has no congestion. A cycle length of 80 seconds or less will move traffic efficiently. All traffic should be served on the first cycle. Traffic fluctuations, accidents, and lane closures can be handled with minimal congestion. This intersection can accommodate up to 40% more traffic on all movements.

**LOS B, >55% to 64%:** The intersection has very little congestion. Almost all traffic will be served on the first cycle. A cycle length of 90 seconds or less will move traffic efficiently. Traffic fluctuations, accidents, and lane closures can be handled with minimal congestion. This intersection can accommodate up to 30% more traffic on all movements.

**LOS C, >64% to 73%:** The intersection has no major congestion. The majority of traffic should be served on the first cycle. A cycle length of 100 seconds or less will move traffic efficiently. Traffic fluctuations, accidents, and lane closures may cause some congestion. This intersection can accommodate up to 20% more traffic on all movements.

**LOS D, >73% to 82%:** The intersection normally has no congestion. Most of the traffic should be served on the first cycle. A cycle length of 110 seconds or less will move traffic efficiently. Traffic fluctuations, accidents, and lane closures can cause significant congestion. Sub optimal signal timings can cause congestion. This intersection can accommodate up to 10% more traffic on all movements.

LOS E, >82% to 91%: The intersection is right on the verge of congested conditions. Many vehicles are not served on the first cycle. A cycle length of 120 seconds is required to move all traffic. Minor traffic fluctuations, accidents, and lane closures can cause significant congestion. Suboptimal signal timings can cause significant congestion. This intersection has less than 10% reserve capacity available.

LOS F, >91% to 100%. The intersection is over capacity and likely experiences congestion periods of 15 to 60 consecutive minutes. Residual queues at the end of green are common. A cycle length over 120 seconds is required to move all traffic. Minor traffic fluctuations, accidents, and lane closures can cause increased congestion. Suboptimal signal timings can cause increased congestion.

LOS G, >100% to 109%. The intersection is up to 9% over capacity and likely experiences congestion periods of 60 to 120 consecutive minutes. Long queues are common. A cycle length over 120 seconds is required to move all traffic. Motorists may be choosing alternate routes, if they exist, or making fewer trips during the peak hour. Signal timings can be used to distribute capacity to the priority movements.

LOS H, >109%. The intersection is 9% or greater over capacity and could experience congestion periods of over 120 minutes per day. Long queues are common. A cycle length over 120 seconds is required to move all traffic. Motorists may be choosing alternate routes, if they exist, or make fewer trips during the peak hour. Signal timings can be used to distribute capacity to the priority movements.

This report provides analysis of the traffic operations within the area of influence, according to the standards set by the Town of Matthews (which follows NCDOT’s “Policy on Street and Driveway Access to North Carolina Highways, Chapter 4 Part C” parameters). It provides recommended access management for the site and intersection improvements needed for mitigating traffic impacts. This study evaluates the following scenarios:

- 2014 AM & PM Peak existing traffic conditions
- 2019 AM & PM Peak No Build traffic conditions
- 2019 AM & PM Peak traffic conditions under the site buildout

Currently, the intersection of NC 51 & Fullwood Lane operates with a LOS “C” in the AM peak hour and a LOS “D” in the PM peak hour; the intersection of S. Trade Street & Fullwood Lane operates with a LOS “C” in the AM peak hour and a LOS “E” in the PM peak hour. Typically, an intersection is said to be operating at capacity at a volume-to-capacity (v/c) ratio of 1.00 and acceptable at a LOS “D” or better.
Chapter 5, Section J of the July 2003 NCDOT Policy on Street and Driveway Access to North Carolina Highways, the applicant shall be required to identify mitigation improvements to the roadway network if at least one of the following conditions exist when comparing the 2019 Buildout results to the 2019 No Build results:

- The total average delay at an intersection or an individual approach increases by 25% or greater, while maintaining the same level of service,
- The Level of Service (LOS) degrades by at least one level at an intersection or an individual approach,
- Or the Level of Service is “F” for an intersection or an individual approach.

This section of the driveway manual also states that, mitigation improvements shall be identified when the analysis indicates that the 95th percentile queue exceeds the storage capacity of the existing lane.

The intersections within the area of influence were then analyzed under the 2019 No Build and Build scenarios, with the growth in the background traffic. The LOS results of the scenarios are presented in Tables 4 and 5.
Table 4: Signalized Intersection Levels of Service

<table>
<thead>
<tr>
<th>Intersection and Approach</th>
<th>AM Peak</th>
<th></th>
<th>PM Peak</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Delay (sec/veh)</td>
<td>Capacity (v/c)</td>
<td>Level of Service</td>
</tr>
<tr>
<td>Existing Conditions</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. NC 51 &amp; Fullwood Ln.</td>
<td>34.4</td>
<td>0.89</td>
<td>C</td>
</tr>
<tr>
<td>2. S. Trade St. &amp; Fullwood Ln.</td>
<td>23.3</td>
<td>0.87</td>
<td>C</td>
</tr>
</tbody>
</table>

2019 No Build w/Future Planned Improvements

<table>
<thead>
<tr>
<th>Intersection</th>
<th>AM Peak</th>
<th></th>
<th>PM Peak</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Delay (sec/veh)</td>
<td>Capacity (v/c)</td>
<td>Level of Service</td>
</tr>
<tr>
<td>1. NC 51 &amp; Fullwood</td>
<td>34.3</td>
<td>0.86</td>
<td>C</td>
</tr>
<tr>
<td>Northbound</td>
<td>51.9</td>
<td>-</td>
<td>D</td>
</tr>
<tr>
<td>Eastbound</td>
<td>27.7</td>
<td>-</td>
<td>C</td>
</tr>
<tr>
<td>Westbound</td>
<td>29.0</td>
<td>-</td>
<td>C</td>
</tr>
<tr>
<td>2. S. Trade St. &amp; Fullwood Ln./Driveway</td>
<td>35.2</td>
<td>0.96</td>
<td>D</td>
</tr>
<tr>
<td>Northbound</td>
<td>67.0</td>
<td>-</td>
<td>E</td>
</tr>
<tr>
<td>Southbound</td>
<td>16.5</td>
<td>-</td>
<td>B</td>
</tr>
<tr>
<td>Eastbound</td>
<td>29.0</td>
<td>-</td>
<td>C</td>
</tr>
<tr>
<td>Westbound</td>
<td>77.6</td>
<td>-</td>
<td>E</td>
</tr>
</tbody>
</table>

2019 Build w/Future Planned Improvements

<table>
<thead>
<tr>
<th>Intersection</th>
<th>AM Peak</th>
<th></th>
<th>PM Peak</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Delay (sec/veh)</td>
<td>Capacity (v/c)</td>
<td>Level of Service</td>
</tr>
<tr>
<td>1. NC 51 &amp; Fullwood</td>
<td>34.9</td>
<td>0.86</td>
<td>C</td>
</tr>
<tr>
<td>Northbound</td>
<td>52.7</td>
<td>-</td>
<td>D</td>
</tr>
<tr>
<td>Eastbound</td>
<td>28.3</td>
<td>-</td>
<td>C</td>
</tr>
<tr>
<td>Westbound</td>
<td>29.4</td>
<td>-</td>
<td>C</td>
</tr>
<tr>
<td>2. S. Trade St. &amp; Fullwood Ln./Driveway</td>
<td>37.8</td>
<td>0.96</td>
<td>D</td>
</tr>
<tr>
<td>Northbound</td>
<td>65.2</td>
<td>-</td>
<td>E</td>
</tr>
<tr>
<td>Southbound</td>
<td>17.6</td>
<td>-</td>
<td>B</td>
</tr>
<tr>
<td>Eastbound</td>
<td>31.6</td>
<td>-</td>
<td>C</td>
</tr>
<tr>
<td>Westbound</td>
<td>82.1</td>
<td>-</td>
<td>F</td>
</tr>
</tbody>
</table>

Footnotes:
1. Future planned improvements by NCDOT include an EB right turn lane on NC 51 and an extension of the NB right turn lane storage on Fullwood.

Table 5: Unsignalized Intersection Levels of Service

<table>
<thead>
<tr>
<th>Intersection</th>
<th>AM Peak</th>
<th></th>
<th>PM Peak</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>ICU Capacity (v/c)</td>
<td>Level Of Service</td>
<td>ICU Capacity (v/c)</td>
</tr>
<tr>
<td>2019 Build</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

3. Fullwood Lane & Proposed Access "A" ² | 43.1% | A | 64.1% | C |

Footnotes:
2. Lanes on Prop. Access "A" includes one WB entering lane, one EB left exit lane, and an EB right exit lane. A de-facto NB left turn lane currently exists on Fullwood (term. at NC 51).

Table 6 shows the 2019 95th % queue lengths calculated by SimTraffic 7, a traffic simulation software application for unsignalized and signalized intersections (results are based on an average of four corridor simulations), or Synchro 7, - whichever produced the higher 95th % queue length.
Table 6: 2019 95th % Queue Lengths

<table>
<thead>
<tr>
<th>Intersection and Approach</th>
<th>Storage (feet)</th>
<th>AM Peak 95th % Queue Length (feet)</th>
<th>PM Peak 95th % Queue Length (feet)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Left</td>
<td>Right</td>
<td>Left</td>
</tr>
<tr>
<td>2019 No Build w/สำคัญ Planned Improvements</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 NC 51 &amp; Fullwood Ln.</td>
<td>NB</td>
<td>1050'</td>
<td>TBD</td>
</tr>
<tr>
<td></td>
<td>EB</td>
<td>105'</td>
<td>300'</td>
</tr>
<tr>
<td></td>
<td>WB</td>
<td>465'</td>
<td>-</td>
</tr>
<tr>
<td>2. S. Trade St. &amp; Fullwood Ln. Driveway</td>
<td>NB</td>
<td>Term.</td>
<td>175'</td>
</tr>
<tr>
<td></td>
<td>SB</td>
<td>450'</td>
<td>Term.</td>
</tr>
<tr>
<td></td>
<td>EB</td>
<td>170'</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>WB</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

2019 Build w/สำคัญ Planned Improvements

| 1 NC 51 & Fullwood Ln. | NB | 1050' | TBD | 522'x2 | - | 337' | 234'x2 | 145' |
| 2. S. Trade St. & Fullwood Ln. Driveway | NB | Term. | 175' | - | 27' | 0' | 65' | 0' | - |
|                           | SB | 450' | Term. | 46' | - | 264' | 576' | 0 | 3196' |
|                           | EB | 170' | - | 1310' | 229' | - | 273' | 262' | - |
|                           | WB | - | - | - | - | - | - | - | - |
| 3 Fullwood Ln. & Access "A" | NB | 125' | - | 6' | 0' | - | 37' | 0' | - |
|                           | SB | - | - | - | - | - | - | - | - |

1 Future planned improvements by NCDOT include an EB right turn lane on NC 51 and an extension of the NB right turn lane storage on Fullwood

2 Laneage on Prop. Access "A" includes one WB entering lane, one EB left exit lane, and an EB right exit lane. A de facto NB left turn lane currently exists on Fullwood (term. at NC 51).

2019 Build Scenario Analysis Results:

1. NC 51 (Matthews Twp. Pkwy.) & Fullwood Lane (signalized)

When comparing the impact of the 2019 Buildout conditions to the 2019 No Build conditions the intersection LOS remains a "C" during both peak hours. No approaches drop in LOS and all delays are within the allowed parameters. Therefore, mitigation is not required at this intersection.

The 95th % queue for the eastbound right turn lane on NC 51 (300 feet of planned storage) for the PM peak Build scenario is 498 feet (466 feet for the No Build scenario). The site only contributes 11 of the 683 vehicles to this movement (which is minimal), therefore, no improvements are recommended.

The 95th % queue for the westbound left turn lane on NC 51 (465 feet of storage) for the PM peak Build scenario is 602 feet (578 feet for the No Build scenario). The site only contributes 14 of the 378 vehicles to this movement (which is minimal), therefore, no improvements are recommended.
2. S. Trade St. (SR 3448) & Fullwood Lane (signalized)

When comparing the impact of the 2019 Buildout conditions to the 2019 No Build conditions the intersection LOS remains a “D” in the AM peak hour and an “F” in the PM peak hour. However, the westbound approach dropped in LOS (from “E” to “F”) during the AM peak hour. **Even though the LOS for the westbound approach is not met in the AM peak hour when comparing the Build to the No Build scenario we feel no mitigation is necessary (minimal site traffic volumes associated with this or any movement at the intersection [20 of 2,552 vehicles thru the intersection]).**

The 95th % queue for the eastbound left turn lane on S. Trade Street (170 feet of storage [maximum storage due to the existing cross-street/left turn lane to the west]) for the AM peak Build scenario is 1,310 feet (1,302 feet for the No Build scenario) - a similar situation occurs in the PM peak also. The site only contributes 3 of the 1,012 vehicles to this movement (which is minimal), therefore, no improvements are recommended.

The 95th % queue for the southbound left turn lane on Fullwood Lane (450 feet of storage [maximum storage due to the existing roadway bend]) for the PM peak Build scenario is 576 feet (568 feet for the No Build scenario). The site only contributes 2 of the 94 vehicles to this movement (which is minimal), therefore, no improvements are recommended.

3. Fullwood Lane & Proposed Access “A” (unsignalized)

Under the 2019 Build conditions the intersection has an acceptable ICU LOS of “A” during the AM peak hour and a LOS “C” during the PM peak hour. The intersection layout we recommend includes:

- Construct the eastbound approach (Proposed Access “A”) for one ingress and two egress lanes (a lane that terminates as a left turn lane and a right turn lane with 100 feet of storage).
- The existing northbound inner lane on Fullwood Lane with 125 feet of storage and 110-foot bay taper (that terminates as a left turn lane at NC 51) is acceptable as a combined left-through lane (less than 20 vehicles turn left into the site during either peak hour).
- Based on the minimal southbound right turn entering volumes on Fullwood Lane (less than 20 during either peak hour), a dedicated southbound right turn lane is not required/recommended.
The existing and recommended laneage is shown in Figure 6. Figure 7 illustrates the conceptual intersection design of Fullwood Lane and Proposed Access "A".
120' Existing Storage - Lane Term. as Left Turn Lane at NC 51

90' Taper

FULLWOOD LN

100' Storage

Full Width Lane to Internal Cross-Street (Min. 150')

MARCH 2014
PROJECT # 454-002
DRAWN BY JCZ
CHECKED BY REG

SCALE: 1" = 30'
CONCLUSIONS

2019 Build Scenario Analysis Results/Recommendations:

1. NC 51 (Matthews Twp, Pkwy.) & Fullwood Lane (signalized)

When comparing the impact of the 2019 Buildout conditions to the 2019 No Build conditions the intersection LOS remains a "C" during both peak hours. No approaches drop in LOS and all delays are within the allowed parameters. Therefore, mitigation is not required at this intersection.

The 95th % queue for the eastbound right turn lane on NC 51 (300 feet of planned storage) for the PM peak Build scenario is 498 feet (466 feet for the No Build scenario). The site only contributes 11 of the 683 vehicles to this movement (which is minimal), therefore, no improvements are recommended.

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3. Fullwood Lane & Proposed Access “A” (unsignaled)

Under the 2019 Build conditions the intersection has an acceptable ICU LOS of “A” during the AM peak hour and a LOS “C” during the PM peak hour. The intersection layout we recommend includes:

- Construct the eastbound approach (Proposed Access “A”) for one ingress and two egress lanes (a lane that terminates as a left turn lane and a right turn lane with 100 feet of storage).
- The existing northbound inner lane on Fullwood Lane with 125 feet of storage and 110-foot bay taper (that terminates as a left turn lane at NC 51) is acceptable as a combined left-through lane (less than 20 vehicles turn left into the site during either peak hour).
- Based on the minimal southbound right turn entering volumes on Fullwood Lane (less than 20 during either peak hour), a dedicated southbound right turn lane is not required/recommended.

4. Marion Drive & Proposed Access “B” (unsignaled)

Since there are minimal traffic volumes on Marion Drive (the street only serves a few residences), no intersection analysis was performed for this access driveway. Based on this information we recommend:

- Construct the northbound approach (Proposed Access “B”) for one ingress lane and one egress lane. No turn lanes should be required on Marion Drive.

These identified improvements will improve capacity and provide an acceptable level of service at these intersections and adjacent roadway corridors during the critical peak hours of the year 2019.