



Executive Summary

Project: Five Forks Area Study Traffic Impact Alternatives Analysis

Background

The purpose of this study was to identify and analyze the development and redevelopment potential within the Five Forks Area, and assess the traffic impacts that changes in land use may have on the adjacent roadway network. The James City County Land Use Plan identifies Five Forks as the developed area in the immediate vicinity of the intersection of John Tyler Highway (State Route 5) and Ironbound Road (State Route 615). Kimley-Horn's role was to assist James City County by analyzing existing traffic conditions and the traffic impacts associated with four future year (i.e., 2008) land use scenarios within the Five Forks Area.

Analyses of these conditions were intended to assist in determining the threshold of development the area could accommodate from a transportation planning and land use density perspective. Additionally, the land use scenarios had to be configured such that the roadway network and/or the right-of-way limitations in this area could support the proposed development and redevelopment efforts. The four future year scenarios include: 1) no-build or no new development introduced to the area, 2) high density residential with medium density commercial development, 3) low density residential with high density commercial development, and 4) medium density residential with medium density commercial development.

Existing 2003 Traffic Conditions

For 2003 "existing" conditions, the intersection of John Tyler Highway and Ironbound Road operates at LOS C during the AM, Noon, and PM peak hours. LOS conditions for this intersection under existing land uses, existing intersection geometrics, and potential roadway improvements indicate that the roadway network can accommodate additional development and/or redevelopment of some parcels in the Five Forks Area consistent with the County's Land Use Plan (See **Figure 1**).

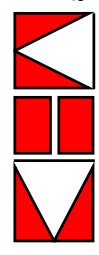
Existing 2003 Traffic Volumes



NOT TO SCALE

Legend

- xx - AM Peak Hour Traffic Volumes
- {xx} - Noon Peak Hour Traffic Volumes
- (xx) - PM Peak Hour Traffic Volumes
- - Existing Roadway Laneage



Kimley-Horn
and Associates, Inc.

Existing 2003 Peak Hour Traffic Volumes
John Tyler Highway and Ironbound Road
 Five Forks Area
 James City County, Virginia

Figure 1

John Tyler Highway

In the project vicinity, John Tyler Highway (State Route 5) is a two-lane undivided highway with a 35 MPH posted speed limit in the vicinity of Ironbound Road. 2003 traffic count data provided by James City County indicates the average daily traffic (ADT) volume along John Tyler Highway just west of Ironbound Road was approximately 10,800 vehicles per day (VPD). ADT for John Tyler Highway east of Ironbound Road was approximately 11,800 VPD in 2003. (For the purposes of this study, John Tyler Highway was assumed to have an east-west orientation.)

Ironbound Road

Ironbound Road (State Route 615) is a two-lane undivided roadway with a 45 MPH posted speed limit in the vicinity John Tyler Highway. 2003 traffic count data indicate that volumes along Ironbound Road to the south of John Tyler Highway were approximately 8,300 VPD. Ironbound Road north John Tyler Highway had an ADT of approximately 11,200 VPD in 2003. (For the purposes of this study, Ironbound Road was assumed to have a north-south orientation.)

2008 Background Traffic Volume Projections

It is estimated that John Tyler Highway will encounter 12,500 VPD west of Ironbound Road and 13,700 VPD east of Ironbound Road. Traffic projections for the year 2008 resulted in ADT volumes of 12,900 VPD for Ironbound Road north of John Tyler Highway and 9,700 VPD for Ironbound Road south of the John Tyler Highway. An annualized growth rate of 3% (or growth factor of 1.15) was applied to 2003 ADT volumes to calculate 2008 ADT traffic projections.

Land Use Scenarios

In addition to the “no-build” land use alternative for the Five Forks area, three future land use scenarios were developed and analyzed. These scenarios were consistent with the James City County Land Use Plan and with the limitations associated with the existing transportation infrastructure in the immediate vicinity of Five Fork. The intent of each scenario was to establish “build-out” conditions for the year 2008 and analyze their impacts on the adjacent transportation network.

Scenario 1A – High Density Residential/Medium Density Commercial

Scenario_1A proposes higher density residential development with a strong emphasis on the introduction of apartments (i.e., 216 units) to the area. In this scenario the apartment component would be in the planned moderate density residential (MDR) parcel located to the north of John Tyler Highway. Single Family Dwelling Units (SFDU) (approximately 120 units) would be located to the west of Powhatan Springs and Ingram Road.

Residential condominiums/townhouses (approximately 59 units) would be located in the MDR parcel adjacent to John Tyler Highway in the south. The commercial component of Land use Scenario_1A assumes a Floor Area Ratio (FAR) of 0.2 (i.e., 20% of the net acreage would be developed). Land use Scenario_1A has the potential to generate a total of 436 driveway trips during the AM peak hour. Of these trips, 211 would be entering their proposed development and 225 would be exiting their proposed development. During the PM peak, Scenario_1A has the potential to generate 658 driveway trips with 315 entering and 343 exiting their proposed developments.

Scenario 1_B – Low Density Residential/High Density Commercial

Scenario 1_B proposes a low density residential with a high density commercial land use plan. In this scenario SFDU density is 1 unit per acre resulting in approximately 30 residential units. Access to the single family residential development would again be provided through Powhatan Springs Road and Ingram Road. Apartment density is reduced to 60 units and would be located in the MDR parcel along the north side of John Tyler Highway. Residential condominiums/townhouses (approximately 35 units) would again be located in the MDR parcel along the south side of John Tyler Highway. The high density commercial component of Land use Scenario_1B assumes a Floor Area Ratio (FAR) of 0.6. Land use Scenario_1B has the potential to generate a total of 381 driveway trips during the AM peak hour. Of these trips, 267 would be entering their proposed development and 114 would be exiting their proposed development. During the PM peak, Scenario_1B has the potential to generate 561 driveway trips with 200 entering and 361 exiting their proposed developments.

Scenario 2 – Medium Density Residential/Medium Density Commercial

Scenario_2 is a medium density residential/medium density commercial approach. In this scenario SFDU density is slightly less than 2 units per acre resulting in a total of 40 residential units. Residential condominium/townhouse development (approximately 84 units) would locate in the MDR parcel north of John Tyler Highway. Additionally, access to Ironbound Road from both the SFDU development and the condominium/townhouse development would be provided via Powhatan Springs and Ingram Road. The condominium/townhouse development would not be provided access to the south along John Tyler Highway. The proposed apartment land use (approximately 72 units) would locate in the MDR parcel to the south of John Tyler Highway. Driveway access for the apartments would be provided along John Tyler Highway. The commercial component of Land use Scenario_2 assumes a Floor Area Ratio (FAR) of 0.2. Land use Scenario_2 has the potential to generate a total of 322 driveway trips during the AM peak hour.

Of these trips, 189 would be entering their proposed development and 133 would be exiting their proposed development. During the PM peak, Scenario_2 has the potential to generate 523 driveway trips with 222 entering and 301 exiting their proposed developments.

2008 Future Conditions Analysis with No Geometric Improvements

Future conditions analysis with no geometric improvements evaluates the level-of-service for the intersection assuming no geometric improvements, 2008 background traffic, and the varying demand of the four land use scenarios. During the AM peak hour two of the four scenarios encounter LOS D whereas during the PM peak hour all four scenarios are expected to experience a LOS D if no geometric improvements are implemented (See **Tables 1 and 2**).

No-Build/No Development

For projected 2008 “no-build” conditions, the intersection of John Tyler Highway at Ironbound Road will operate at LOS C during the AM peak and LOS D during PM peak hour.

Scenario 1A – High Density Residential/Medium Density Commercial

Scenario_1A projected 2008 “build” conditions, indicate that the intersection of John Tyler Highway at Ironbound Road will operate at LOS C/D (i.e., average control delay of 35.0 seconds) during the AM peak and LOS D (i.e., average control delay of 42.5 seconds) during PM peak hour.

Scenario 1B – Low Density Residential/High Density Commercial

Under this land use scenario, projected 2008 “build” conditions for Scenario_1B indicate that the intersection of John Tyler Highway at Ironbound Road will operate at LOS C (i.e., average control delay of 34.8 seconds) during the AM peak and LOS D (i.e., average control delay of 41.8 seconds) during PM peak hour.

Scenario 2 – Medium Density Residential/Medium Density Commercial

Projected 2008 “build” conditions for Scenario_2 reflect that the intersection of John Tyler Highway at Ironbound Road will operate at LOS C (i.e., average control delay of 33.7 seconds) during the AM peak and LOS D (i.e., average control delay of 40.6 seconds) during PM peak hour.

| Table 1: 2008 AM Peak Hour Conditions LOS and Average Vehicle Delay (sec/veh) No Geometric Improvements | | | | |
|--|-----------------|--------------------|--------------------|-------------------|
| Movement | No-Build | Scenario_1A | Scenario_1B | Scenario_2 |
| Northbound | | | | |
| Left | C (21.7) | C (23.6) | C (22.4) | C (22.2) |
| Through-Right | D (39.6) | D (43.8) | D (44.0) | D (43.1) |
| Southbound | | | | |
| Left | C (24.8) | C (30.1) | C (29.3) | C (28.9) |
| Through-Right | C (35.0) | D (38.3) | D (36.1) | D (36.7) |
| Eastbound | | | | |
| Left | B (18.7) | C (21.2) | C (21.6) | C (20.2) |
| Through-Right | D (37.2) | D (42.1) | D (42.3) | D (39.4) |
| Westbound | | | | |
| Left | C (20.2) | C (22.6) | C (22.8) | C (21.1) |
| Through | C (27.7) | C (28.0) | C (28.9) | C (27.8) |
| Right | C (25.8) | C (27.1) | C (28.0) | C (26.8) |
| Total | C (32.2) | D (35.0) | D (35.1) | C (33.7) |

| Table 2: 2008 PM Peak Hour Conditions LOS and Average Vehicle Delay (sec/veh) No Geometric Improvements | | | | |
|--|-----------------|--------------------|--------------------|-------------------|
| Movement | No-Build | Scenario_1A | Scenario_1B | Scenario_2 |
| Northbound | | | | |
| Left | C (26.8) | D (45.9) | D (42.5) | C (35.3) |
| Through-Right | D (36.4) | C (33.6) | C (33.7) | C (35.1) |
| Southbound | | | | |
| Left | C (25.2) | C (26.4) | C (25.5) | C (27.2) |
| Through-Right | D (41.8) | D (47.0) | D (48.9) | D (47.8) |
| Eastbound | | | | |
| Left | C (24.5) | C (36.6) | C (33.1) | C (31.1) |
| Through-Right | D (37.6) | D (51.5) | D (47.5) | D (47.2) |
| Westbound | | | | |
| Left | C (23.6) | C (32.5) | C (30.8) | C (29.5) |
| Through | C (37.3) | D (49.6) | D (47.8) | D (45.7) |
| Right | C (32.9) | D (42.3) | D (40.8) | D (39.8) |
| Total | D (35.1) | D (42.5) | D (41.7) | D (40.6) |

2008 Future Conditions Analysis with Geometric Improvements

From a planning perspective, VDOT and James City County both try to achieve or sustain LOS C for signalized intersections. With the three “build” scenarios, geometric improvements are necessary to achieve LOS C for the intersection (See **Tables 3 and 4**). In considering potential geometric improvements for the intersection one must account for the limited right-of-way (i.e., ranging from 60’ to 65’) offered at each approach to the intersection. Therefore, the geometric improvements evaluated and included in the analysis/recommendations reflect the maximum geometric improvements that could be accommodated by each approach to the intersection without significant impacts to the existing property owners.

Geometric and operational improvements considered for these analyses include: exclusive right-turn lanes for northbound and southbound Ironbound Road, providing one-way westbound access to east Ingram Road off of John Tyler Highway, and modification of the signalized intersection cycle length for both the AM and PM peak hours.

| Table 3: 2008 AM Peak Hour Conditions LOS and Average Vehicle Delay (sec/veh) With Geometric Improvements | | | | |
|--|-----------------|--------------------|--------------------|-------------------|
| Movement | No-Build | Scenario_1A | Scenario_1B | Scenario_2 |
| Northbound | | | | |
| Left | C (21.3) | C (22.7) | C (21.7) | C (21.4) |
| Through | D (36.6) | D (36.9) | D (36.5) | D (36.0) |
| Right | C (30.0) | C (30.4) | C (29.8) | C (29.5) |
| Southbound | | | | |
| Left | C (23.7) | C (26.7) | C (25.7) | C (25.6) |
| Through | C (32.9) | C (33.6) | C (32.3) | C (32.3) |
| Right | C (29.7) | C (30.5) | C (29.4) | C (29.5) |
| Eastbound | | | | |
| Left | B (16.1) | C (21.2) | C (21.6) | C (20.2) |
| Through-Right | C (33.6) | D (42.1) | D (42.3) | D (39.4) |
| Westbound | | | | |
| Left | B (17.3) | C (22.6) | C (22.8) | C (21.1) |
| Through | C (24.8) | C (28.0) | C (28.9) | C (27.8) |
| Right | C (22.9) | C (26.2) | C (27.0) | C (25.9) |
| Total | C (29.0) | C (32.4) | C (32.4) | C (31.0) |

Scenario 1A – High Density Residential/Medium Density Commercial

Scenario_1A analyses with geometric improvements indicate that the intersection of John Tyler Highway at Ironbound Road will operate at LOS C (i.e., average control delay of 32.4 seconds) during the AM peak and LOS C (i.e., average control delay of 34.7 seconds) during PM peak hour.

Scenario 1B Build – Low Density Residential/High Density Commercial

Under this land use scenario and with the proposed geometric improvements, the intersection of John Tyler Highway at Ironbound Road will operate at LOS C (i.e., average control delay of 32.3 seconds) during the AM peak and LOS C (i.e., average control delay of 34.5 seconds) during PM peak hour.

Scenario 2 – Medium Density Residential/Medium Density Commercial

Scenario_2 reflects that with geometric improvements the intersection of John Tyler Highway at Ironbound Road will operate at LOS C (i.e., average control delay of 31.0 seconds) during the AM peak and LOS C (i.e., average control delay of 33.8 seconds) during PM peak hour.

| Table 4: 2008 PM Peak Hour Conditions LOS and Average Vehicle Delay (sec/veh) With Geometric Improvements | | | | |
|--|-----------------|--------------------|--------------------|-------------------|
| Movement | No-Build | Scenario_1A | Scenario_1B | Scenario_2 |
| Northbound | | | | |
| Left | C (20.7) | C (28.9) | C (28.6) | C (26.0) |
| Through | C (32.0) | C (34.0) | C (34.5) | C (34.0) |
| Right | C (25.3) | C (26.5) | C (27.0) | C (26.4) |
| Southbound | | | | |
| Left | C (21.1) | C (27.0) | C (25.7) | C (26.3) |
| Through | C (32.9) | D (36.1) | D (38.6) | D (36.0) |
| Right | C (26.6) | C (29.5) | C (29.5) | C (28.8) |
| Eastbound | | | | |
| Left | C (23.2) | C (30.1) | C (28.8) | C (27.1) |
| Through-Right | D (37.2) | D (42.7) | D (41.5) | D (40.7) |
| Westbound | | | | |
| Left | C (22.3) | C (27.6) | C (27.1) | C (25.9) |
| Through | D (36.9) | D (41.6) | D (41.7) | D (39.7) |
| Right | C (31.7) | C (34.8) | C (34.7) | C (35.5) |
| Total | C (30.7) | C (34.7) | C (32.8) | C (33.8) |

Recommendations

The signalized intersection of John Tyler Highway and Ironbound Road has the potential to function at an acceptable level-of-service (i.e., LOS D) under the three future land use scenarios with no geometric improvements. However, based on the potential traffic impacts associated with the proposed land use scenarios for the Five Forks area under both “no-build” and “build” conditions and in an best effort to achieve LOS C requirements under the three land use scenarios, the following adjacent network modifications are recommended.

John Tyler Highway/Ironbound Road Intersection

The VDOT Road Design Manual and the Minimum Standards of Entrances to State Highways indicates that the right-turn traffic volumes (i.e., eastbound, westbound, and southbound right-turn traffic traversing the intersection) warrant exclusive right-turn lanes. However, based on the approximate existing 60’-65’ right-of-way at the approaches, alignment of northbound-southbound laneage as well as eastbound-westbound laneage, limitations present themselves when attempting to provide exclusive movement lanes for each approach. Therefore, the geometric improvements proposed account for the realistic limitations currently in place

- Reconfigure pavement markings/laneage delineation to accommodate exclusive right-turn lane for southbound Ironbound Road.
- Construct a 150’ full width right-turn lane along the northbound approach of Ironbound Road.
- Investigate AM, Noon, PM and Off-Peak signal timing modifications to best process traffic and sustain acceptable level of operations for the isolated signalized intersection.

Five Forks Area Roadway Network

- Reduce speed along both Ironbound Road approaches (i.e., northbound and southbound) to 35 mph within Five Forks area.
- Reopen/provide westbound access to east Ingram Road between John Tyler Highway and Ironbound Road. The segment between John Tyler Highway and the driveway entrance to the Ingram Road Commerce Park should be one-way westbound. This will reduce a portion of the westbound traffic currently making right-turns through the John Tyler Highway/Ironbound Road intersection accessing the Ingram Road Commerce Park as well as the existing and potential office space located along this segment of Ingram Road.

New Trip Generation Thresholds

Trip generation thresholds identify the maximum number of new trips that should be allowed within the Five Forks Area during either the AM or PM peak hours without and with geometric improvements. AM peak hour thresholds are lower than the PM peak hour thresholds as the AM peak hour is often more defined within a specific period of time compared with that of the PM peak. These trip generation thresholds assume that VDOT and the County will accept some lane groups operating at LOS D during peak hours while the signalized intersection LOS continues to achieve overall LOS C.

- *Without Geometric Improvements*
 - AM peak should not exceed 350 new trips
 - PM peak should not exceed 500 new trips

- *With Geometric Improvements*
 - AM peak should not exceed 500 new trips
 - PM peak should not exceed 650 new trips

| Trip Generation Thresholds in relation to 2008 Projected Traffic Volumes | | | | | | |
|---|-------------|-----------|--------------------------------|-----------------------|-----------------------------|-----------------------|
| | Time Period | New Trips | Threshold Without Improvements | New Trips - Threshold | Threshold With Improvements | New Trips - Threshold |
| Scenario_1A | AM | 436 | 350 | + 86 | 500 | - 64 |
| | PM | 658 | 500 | + 158 | 650 | + 8 |
| Scenario_1B | AM | 381 | 350 | + 31 | 500 | - 119 |
| | PM | 561 | 500 | + 61 | 650 | - 89 |
| Scenario_2 | AM | 322 | 350 | - 28 | 500 | - 178 |
| | PM | 523 | 500 | + 23 | 650 | - 127 |

Ingram Road Improvements west of Ironbound Road

In an effort to efficiently accommodate new traffic along Ingram Road west of Ironbound Road, the following roadway modifications are recommended:

- Two lane divided roadway (1-lane each direction) separated by a 12' – 16' landscaped median or median islands
- 12-14' lanes to include roadway and both curb and gutter
- 4' buffer between curb and sidewalk both directions
- 6' sidewalks paralleling the roadway in both directions
- 25 mph posted speed limit

This type of facility has been referred to as a residential boulevard or commercial collector as it accommodates both local traffic (i.e., both residential and office) and pedestrian movements.

Develop Master Plan for the Five Forks Area

- Establish and define the public participation process
- Capture neighborhood consensus prior to implementation
- Develop Master Plan to define land use plan and incorporate trip generation thresholds, level-of-service thresholds, and environmental considerations.
- Adopt LOS D for turn lane groups as acceptable during 1-hour peak periods (i.e., AM, noon, or PM) for signalized uncoordinated intersections
- Ensure adherence to defined and agreed upon thresholds