

Town of Thompson's Station  
Municipal Planning Commission  
Meeting Agenda  
March 27, 2018

**Meeting Called To Order**

**Pledge Of Allegiance**

**Minutes-**

**Consideration Of The Minutes Of The February 27, 2018 Meeting**

Documents:

[02272018 MINUTES.PDF](#)

**Public Comments-**

**Unfinished Business:**

**1. Land Development Amendments To Revise Table 4.4 - Permitted Uses; Section 4.6 - Building Placement Standards; Section 4.7. Height Restrictions; Table 4.13 - NC Lot Standards; Section 4.9.5 - Regulations Specific To The NC Zone; And Section 4.12.2 - Parking Standards (Zone Amend 2018-001).**

Documents:

[ITEM 1 STAFF REPORT LDO AMENDMENT RSA.PDF](#)  
[ITEM 1 - LDO AMENDMENT EXHIBIT.PDF](#)

**New Business:**

**2. Preliminary Plat For The Creation Of Phase 18 And The Re-Subdivision Of Phase 33 To Create Eight (8) Lots Within Tollgate Village (PP 2018-002).**

Documents:

[ITEM 2 STAFF REPORT PP TV 18.PDF](#)  
[ITEM 2 PRELIM PLAT PH 18 TV.PDF](#)

**3. BOMA Request For The Planning Commission To Consider A Clarification To Building Height Measurement (Zone Amend 2018-003 - Currently Before BOMA).**

Documents:

[ITEM 3 STAFF REPORT BOMA REQUEST HEIGHT.PDF](#)

**Planner Report**

- Concept Plan for Avenue Downs (CP 2018-001)
- Concept Plan for The Fields of Canterbury Expansion (CP 2018-002)
- Mars Site Plan

Documents:

PLANNER REPORT 03272018.PDF  
PLANNER REPORT - AVENUE DOWNS CONCEPT PLAN.PDF  
PLANNER REPORT - AVENUE DOWNS TRAFFIC IMPACT STUDY FEBRUARY  
16 2018.PDF  
PLANNER REPORT - CANTERBURY CONCEPT PLAN.PDF  
PLANNER REPORT - CANTERBURY TRAFFIC IMPACT STUDY FEBRUARY 16  
2018.PDF

**Adjourn**

*This meeting will be held at 7:00 p.m. at the Thompson's Station Community Center  
1555 Thompson's Station Rd West*

**Minutes of the Meeting**  
**of the Municipal Planning Commission**  
**of the Town of Thompson 's Station, Tennessee**  
**February 27, 2018**

**Call to Order:**

The meeting of the Municipal Planning Commission of the Town of Thompson's Station was called to order at 7:00 p.m. on the 27th day of February 2018 at the Thompson's Station Community Center with the required quorum. Members and staff in attendance were: Chairman Jack Elder; Vice Chairman Mike Roberts; Commissioner Shawn Alexander; Alderman Ben Dilks; Commissioner Trent Harris; Commissioner Bob Whitmer; Town Administrator Joe Cosentini; Town Planner Wendy Deats; Town Clerk Jennifer Jones and Town Attorney Todd Moore. Commissioner Brinton Davis was unable to attend.

**Pledge of Allegiance.**

**Minutes:**

The minutes of the January 23rd, 2017 meeting were previously submitted.

**Commissioner Whitmer made a motion to approve of the January 23, 2018 meeting minutes. The motion was seconded and carried unanimously.**

**Public Comment:**

None

**Unfinished Business:**

- 1. Land Development Amendments to revise Table 4.4 – Permitted Uses; Section 4.6 – Building Placement Standards; Section 4.7.1 Height Restrictions; Table 4.13 – NC lot standards; and Section 4.12.2 – Parking Standards (Zone Amend 2018-001).**

Mrs. Deats reviewed her report and is requesting the Planning Commission provide a recommendation to the Board of Mayor and Aldermen related to these amendments to the Land Development Ordinance.

Brett Smith with Ragan Smith came forward to present on behalf of the applicant.

Dave McGowan with Regent Homes, came forward to answer any questions.

**After Discussion, Commissioner Whitmer made a motion to defer Item 1 and bring back before the Planning Commission at the next meeting (March 27<sup>th</sup>, 2018). The motion was seconded and carried by all.**

**New Business:**

- 2. Rezoning request to establish the Transect Community (TC) zoning district for the 212 acres located along the west side of State Route 106/Highway 431 (Lewisburg Pike), east of Interstate 65, along the north side of Thompson's Station Road East (Rezone 2018-002).**

Mrs. Deats reviewed her report and based on the findings for General Plan consistency, Staff is supportive of a Planning Commission recommendation to the Board of Mayor and Aldermen to zone the land north of Thompson's Station Road East, east of Interstate 65, along the west side of Lewisburg Pike (State Route 106) (Map 154 50.00) for the Pleasant Creek neighborhood as Transect Community (TC).

Josh Denton, Greg Gamble and Jeff Rosiak all came forward to speak on behalf of the applicant.

**After discussion, Commissioner Roberts made a motion to recommend Item 2 to BOMA, a rezoning request to establish the Transect Community zoning district for the 212 acres located along the west side of State Route 106/Highway 431 (Lewisburg Pike), east of Interstate 65, along the North side of Thompson's Station Road East. The motion was seconded and carried by all.**

### **3. Surety Reduction for Tollgate Village Sections 14A and 14B**

Mrs. Deats reviewed her report and Based on the recommendation from the Town Engineer, Staff recommends that the Planning Commission

1. Reduce the roads, drainage and erosion control surety in Section 14B from \$175,000 to \$126,000 and the sewer surety from \$120,000 to \$44,000 for an additional year with automatic renewal each year thereafter.

**After discussion, Alderman Dilks made a motion to approve Item 3, a surety reduction for Tollgate Village Sections 14A and 14B, as recommended by Staff. The motion was seconded and carried by all.**

### **4. Surety Reduction for Tollgate Village Section 15.**

Based on the recommendation from the Town Engineer, Staff recommends that the Planning Commission

1. Reduce the roads, drainage and erosion control surety in Section 15 from \$380,000 to \$356,000 and the sewer surety from \$285,000 to \$252,000 for an additional year with automatic renewal each year thereafter.

**After discussion, Commissioner Whitmer made a motion to approve Item 4, a surety reduction for Tollgate Village Section 15, as recommended by Staff. The motion was seconded and carried by all.**

### **5. Surety Reduction for Bridgmore Village Sections 3A, 3B and 3C.**

Based on the recommendation from the Town Engineer, Staff recommends that the Planning Commission:

1. Reduce the sewer surety in Section 3A from \$24,500 to \$17,000 for an additional year with automatic renewal each year thereafter.



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2. Reduce the sewer surety in Section 3B from \$49,600 to \$20,000 for an additional year with automatic renewal each year thereafter.
3. Reduce the sewer surety in Section 3C from \$264,000 to \$36,000 for an additional year with automatic renewal each year thereafter.

**After discussion, Commissioner Roberts made a motion to approve Item 5, a Surety reduction for Bridgemore Village Sections 3A, 3B and 3C as recommended by Staff for Sewer only. The motion was seconded and carried by all.**

**6. Surety Reduction for Bridgemore Village Sections 4A and 4B/7.**

Based on the recommendation from the Town Engineer, Staff recommends that the Planning Commission

1. Reduce the roads, drainage and erosion control surety in Section 4B/7 from \$240,000 to \$119,000 and the sewer surety from \$114,000 to \$46,000 for an additional year with automatic renewal each year thereafter.

**After discussion, Alderman Dilks made a motion to approve Item 6, a surety reduction for Bridgemore Village Sections 4A and 4B/7 as recommended by Staff. The motion was seconded and carried by all.**

**7. Surety Reduction for Bridgemore Village Sections 8A and 8B**

Based on the recommendation from the Town Engineer, Staff recommends that the Planning Commission

1. Reduce the sewer surety from \$10,000 to \$2,600 for an additional year with automatic renewal each year thereafter.
2. Reduce the roads, drainage and erosion control surety in Section 8B from \$182,000 to \$94,000 and the sewer surety from \$80,000 to \$35,000 for an additional year with automatic renewal each year thereafter.

**After discussion, Commissioner Roberts made a motion to approve Item 7, a surety reduction for Bridgemore Village Sections 8A and 8B as recommended by Staff. The motion was seconded and carried by all.**

**8. Section 3.3.7 (Hillside and Steep Slope Development)**

On February 12, 2018, the Planning Commission held a work session to discuss LDO amendments. During the meeting, a local builder/property owner presented his concerns about the hillside and steep slope standards that were adopted in fall 2017. The standards permit a maximum of one story, excluding the basement with a maximum height of 25 feet. After discussion, the Commission requested the section be included on the February meeting agenda.

Mr. Jake Rains with Gregg and Rains came forward to speak on his behalf.

**After discussion, Alderman Dilks made a motion to recommend to the Board of Mayor and Aldermen that Section 3.3.7 of the Land Development Ordinance be modified to strike reference to “one story” and change the height from 25 to 32 feet. The motion was seconded and carried by all.**

There being no further business, Commissioner Roberts made a motion to adjourn. The motion was seconded and the meeting was adjourned at 9:16 p.m.

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Jack Elder, Chairman

Attest:

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Brinton Davis, Secretary

**Thompson's Station Planning Commission**  
**Staff Report – Item 1 (File: Zone Amend 2018-001)**  
**March 27, 2018**  
**Land Development Ordinance Amendments**

**PROJECT DESCRIPTION**

A request from Ragan Smith to amend the Land Development Ordinance to revise Table 4.4 - Permitted Uses; Section 4.6 - Building Placement Standards; Section 4.7 Height Restrictions; Table 4.13 - NC lot standards; Section 4.9.5 – Regulations Specific to the NC zone; and Section 4.12.2 - Parking Standards. The request is presented to the Town to “facilitate development standards of the site based on the proven expertise of the same developer of similar successful form-based design, mixed use local projects” (Applicant Statement).

**PROPOSED REVISIONS**

**Table 4.4 O2, G1, G2 Use Zones Land Use (LDO page 79).**

Permit the following uses in the NC zone:

Condominium

Live-work unit

Townhome

Staff Response:

The NC district was developed to accommodate the non-residential land uses within the front of the Tollgate Village community. Mixed use was built into the permitted use table to permit a limited number of residential units within commercial buildings. Permitting additional residential uses can be considered for this zone. Density is limited to 12 units per acre regardless of the type of residential unit. Townhomes and live work units were originally requested to be included as permitted uses, but discussion at the work session on February 12<sup>th</sup> and again at the regular meeting of February 27<sup>th</sup> included condominiums and the applicant is now proposing a separate “condominium” category. Currently, the structure of the land use table defines the use by the residential structure, therefore, an “apartment building” would include rental units (apartments) or ownership units (condominiums).

**Section 4.6 Building Placement Standards (LDO page 82).**

Correct the tables listed in Sections 4.6.1 – 4.6.5 from Table 4.3 4.6 through Table 4.13 4.16. Modify Section 4.6.5. Setbacks for principal buildings shall be as shown in Table 4.36 through 4.136. Setbacks may be adjusted by up to 10% or as necessary to accommodate easements for utilities by administrative waiver to accommodate specific site conditions.

Staff response:

Correction to the tables is appropriate. Utility easements vary in width adjacent to property lines and in some cases, may create an avoidable conflict with a setback, therefore, providing allowance to deviate from the setback to the edge of the easement is appropriate.

**Section 4.7.1 Height Restrictions (LDO page 82).**

Building height is limited according to Table 4.36 through Table 4.136 measured as follows:

Staff Response:

Correction to the tables is appropriate.

**Table 4.13 NC Lot Standards (LDO page 91).**

Modify the following standards:

*Under diagram*

Street ~~or common open civic space (residential units only).~~

~~Parking and Storage Zone — Add a footnote which states “Townhomes within the NC zone may have 5’ or 20’ driveways. Any townhome unit with a 5’ driveway shall provide overflow parking at a rate of 1.5 spaces per unit. Any townhomes unit with a 20’ driveway shall provide overflow parking at a rate of 0.5 spaces per unit.”~~

~~Lot Coverage 50% (non-residential) 90% max (residential) with a footnote that states “when residential lot coverage exceeds 50%, the balance of required lot open space must be provided in common open space.” See 4.9.5 (b)~~

~~Lot Width 50 – 200 feet (non-residential)~~

~~Lot Width ~~16~~ 20 foot min (residential) with a footnote that states “a maximum of 10% of the residential units within the NC zone are allowed to have lot widths less than 20 feet.”~~

~~Other footnotes stating, “And one more footnote stating, “Condominiums do not require garage spaces.”~~

Correct Table 4.147 under Building Frontage

~~Building Entry Requirements 1 per 50 feet of primary frontage and 1 per 80 feet of secondary frontage~~

Staff Response:

The diagram provides an illustration of the setback and frontage information for lots within the zone. Frontages are adjacent to public rights-of-way and common space is typically designated elsewhere. However, in order to create lots with courtyard frontage instead of road frontage, Staff is supportive of permitting units that front civic spaces if additional residential types are permitted within the zone.

A 20-foot lot width for townhomes is consistent with the width permitted in other zones that permit townhomes.

Correction to the table is appropriate.

Staff noted that it may be appropriate to remove this requirement to permit businesses to determine the need for entry points. However, maintaining the entry requirements would reduce the number of entry points on a building and would encourage a single entrance shared by a lobby for tenants.

**Section 4.9.5 Regulations Specific to the NC zone (LDO page 100).**

a. Driveways. Driveways may not exceed 150 feet in length without an approved turnaround unless reviewed and approved by the County Fire Marshall; 25 feet of driveway width for non-dedicated street or driveways within a lot for two-way traffic and 20 feet for one-way traffic (measured perpendicular to the direction of travel). Live/work and Townhome units shall have a 5’ or 20’ alley loaded driveway. Any live/work or townhome units with a 5’ alley loaded driveway shall have a minimum of a one-car garage, and shall provide overflow parking at a rate of 1.5 space per unit. Any live/work or townhome unit with a 20’ alley loaded driveway, shall have a minimum of a one-car garage, and shall provide overflow parking at a rate of .5 spaces

per unit. Condominiums do not require driveways or garage parking, but shall provide parking at a rate of 2.0 space per unit. Parking for all residential uses may be provided by on street parking, nearby surface parking, or a combination of the two.

b. Lot coverage. Lot coverage for non residential is 50% maximum and for residential is 90% maximum. Residential lots exceeding 50% coverage shall provide an additional area, equal to or greater than the balance of 50%, in the form of open space or civic space. The additional open space or civic space shall be contiguous to or within a walking distance of ¼ mile of the subject units.

c. Live/Work, Townhome & Condominium locations. Live/Work, Townhome & Condominium units are permitted within the NC zone, but shall be setback a minimum of 600' from US 31 (Columbia Pike).

**Staff Response:**

Permitting five-foot driveways within Tollgate Village resulted in the lack of adequate areas for parking. To address the lack of parking, any lot that had a five-foot driveway was required to have an additional parking pad. The code was then amended to require a minimum of 20 feet for the driveway length to provide area for parking.

Should condominium be added as a permitted use within the NC district, the parking standards require one and a half spaces per unit for multi-family therefore, is consistent with the parking standards.

If the Commission agrees with the applicant's proposal for driveway lengths, overflow parking and lot coverage, these standards are more appropriately located here than in footnotes throughout the code and should be acceptable within this section pertaining to the NC specifically.

**Section 4.12.2 Parking Standards (LDO page 109).**

All multi-family and non residential developments require a parking plan that will be submitted and reviewed with the site plan for development. The parking plan shall identify all parking areas, required landscaping, bicycle parking and loading areas throughout the project site. On street parking may be counted toward required parking along the subject frontage.

**Staff Response:**

On-street parking can be utilized to meet parking requirements. However, the applicant is already included this language within Section 4.9.5 and its inclusion in this section is not necessary.

**RECOMMENDATION**

Staff is requesting the Planning Commission provide a recommendation to the Board of Mayor and Aldermen related to these amendments to the Land Development Ordinance.

ZONING

LAND DEVELOPMENT ORDINANCE

Town of Thompson’s Station

**TABLE 4.3 TRANSECT ZONE NON-RESIDENTIAL USES**

USE	T1	T2	T3	T4	T4O	T5
Nature conservancy	P	P	P	P		
Park		P	P	P		
Green			P	P	P	P
Square			P	P	P	P
Plaza					P	P
Playground	P	P	P	P	P	P
Community garden	P	P	P	P	P	P
Neighborhood multipurpose field			P	P	P	
Ramble			P	P		
Recreation and sports facility		P				
Parking facilities						P
Religious institution		S	S	P	S	S
Theater					P	P
Utility substation		P	P	P	P	P
Sports stadium						
Wireless communications facility						
<b>AGRICULTURE</b>						
Beekeeping		P	P	P		
Crop production other than community gardens		P	P	P		
Dairy		S				
Equestrian facility		P	S	S		
Horticulture		P			P	P
Plant and forest nursery		P			P	
<b>AUTOMOTIVE</b>						
Automotive sales						
Auto cleaning and repair						
Auto painting						
Auto towing						
Auto wash						
Boat sales and repair						
Commercial storage						
Gasoline sales						
<b>INDUSTRIAL</b>						
Light industrial						
Medium industrial						
Recycling facilities						
Warehousing						

KEY: "P" = Permitted by Right; "S" = Special Exception (BZA Approval required); "" = Prohibited

**TABLE 4.4 O2, G1, G2 USE ZONES LAND USE**

USE	D1	D2	D3	NC	CC	IL	IM
<b>RESIDENTIAL</b>							
Accessory dwelling unit	P	P	P				
Apartment building							
Assisted living		S	S	S	P		
<b>Condominium</b>				<b>P</b>			
Convalescent care		S	S	S	P	P	
Day care in home (adult, child, group)	S	S	S	S			
Duplex		P	P				
Garden apartment							
Group home	P	P	P	P			
Live-work unit			P	<b>P</b>			
Mixed use building				P	P	P	

KEY: "P" = Permitted by Right; "S" = Special Exception (BZA Approval required); "" = Prohibited

LAND DEVELOPMENT ORDINANCE

ZONING

Town of Thompson's Station

TABLE 4.4 O2, G1, G2 USE ZONES LAND USE

USE	D1	D2	D3	NC	CC	IL	IM
Single family	P	P	P				
Senior housing	P	P	P				
Townhome			P	P			
<b>LODGING</b>							
Bed & Breakfast (up to 6 rooms)		P		S	P		
Hotel (no room limit)				P	P		
Inn (up to 12 rooms)				S	P		
<b>COMMERCIAL</b>							
Adult business							S
Animal services							
Breeding	S	S					
Day care	P	P				P	
Grooming				P	P		
Kennels						P	
Riding and livery stables	S	S					
Veterinarian hospital/clinic				P	P	P	
Commercial laundries				P	P	P	
Coin operated laundromat					P	P	
Dry cleaner				P	P	P	
Day care				P	P	P	
Drive through facility					P	P	P
Equipment rental					S	P	P
Financial service				P	P	P	
Food truck				P	P		
Funeral homes and crematory services					P	P	P
Gallery				P	P		
Kiosk					P		
Large format retail, over 50,000 sq. ft.					P	P	
Live-work unit							
Medical clinic				P	P	P	P
Microbrewery					P		
Microdistillery					P		
Mixed use building				P	P	P	
Non-banking financial services					P	P	
Office building				P	P	P	P
Open market building						P	P
Personal service				P	P	P	
Recording studios				P	P	P	P
Retail building				P	P	P	P
Restaurant				P	P	P	P
Self-storage						S	S
<b>INSTITUTIONAL</b>							
Cemetery						P	P
Clubs – public or private					P	P	
Community buildings, public or private	P	P	P	P	P		
Convention or exhibition halls					P	P	
Correction and detention institutions							P
Cultural centers				P	P		
Education							
College						P	
Elementary, middle school	P	P	P		P	P	
High school					P	P	

KEY: "P" = Permitted by Right; "S" = Special Exception (BZA Approval required); "" = Prohibited



LAND DEVELOPMENT ORDINANCE

ZONING

Town of Thompson’s Station

TABLE 4.5 BUILDING INTENSITY

Table with 4 main columns: USE, RESTRICTED, LIMITED, and OPEN. Rows include RESIDENTIAL, LODGING, OFFICE, and RETAIL with detailed descriptions of building intensity rules and associated codes (T2, T3, D1, D2, D3, T4, T40, T5, NC, CC).

4.6 Building Placement Standards

- 4.6.1 Buildings shall be setback from the boundaries of the lot as specified in Table 4.6 through Table 4.16.
4.6.2 For lots with more than one frontage, front setback requirements pertain to the primary frontage and secondary front setback requirements pertain to the secondary frontages. See Table 3.2 Facades, Elevations, and Lot Lines Illustrated.
4.6.3 Lot coverage by buildings shall not exceed the percentage of net lot area specified in Table 4.6 through Table 4.16.
4.6.4 Building facades shall occupy a minimum percentage of the primary frontage as specified in Table 4.6 through Table 4.16 as minimum frontage buildout.
4.6.5 Setbacks for principal buildings shall be as shown in Table 4.6 through Table 4.16. Setbacks may be adjusted by up to 10% or as necessary to accommodate easements for utilities by administrative waiver to accommodate specific site conditions. The Town



Planner or designee shall make the following written findings:

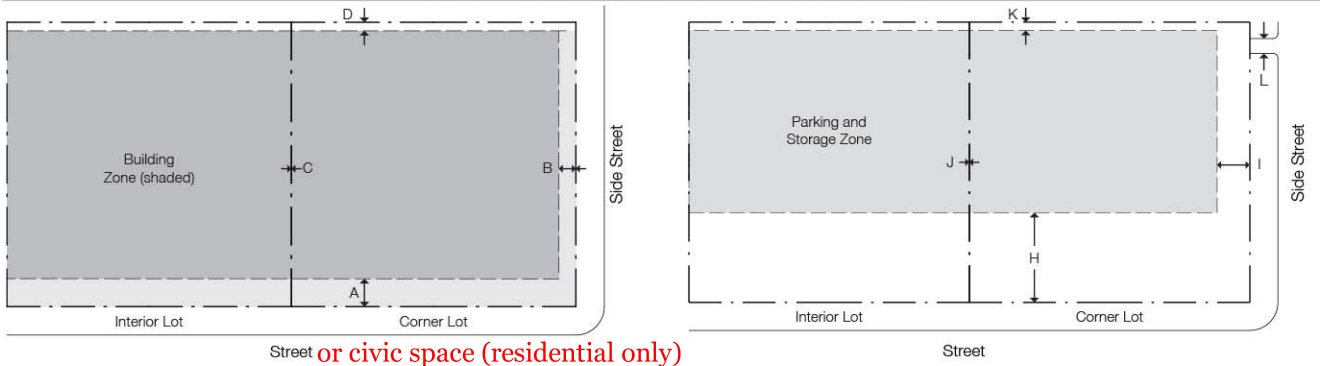
- a. The waiver is consistent with the provisions of §1.2 Intent.
  - b. The waiver is consistent with the General Plan.
  - c. The building placement will not materially endanger the public health or safety.
  - d. The building placement will not substantially injure the value of adjoining property; or that the use is a public necessity.
  - e. The location and character of the building placement, if developed according to the plans and information approved, will be in harmony with proximate land uses, and consistent with the purposes of the district.
  - f. The building placement will not adversely affect the district by altering its character.
- 4.6.6 Rear setbacks for accessory buildings shall be a minimum of 5 feet measured from the property line. In the absence of rear alley or rear lane, the rear setback shall be as shown in Table ~~4.3~~<sup>4.6</sup> through Table ~~4.13~~<sup>4.16</sup>.
- 4.6.7 Fireplaces and bay windows may encroach side setbacks up to 2.5 ft. in all zones. Distances between structures shall meet building and fire code restrictions.

#### 4.7 Height Restrictions

- 4.7.1 Building height is limited according to Table ~~4.3~~<sup>4.6</sup> through Table ~~4.13~~<sup>4.16</sup>, measured as follows:
- a. Building height is measured in above ground stories and feet.
  - b. Stories are measured from finished floor to finished ceiling.
  - c. Stories above the ground floor are limited to 14 feet after which height they are counted as two stories.
  - d. For residential uses, a ground floor story of 18 feet or less is counted as one story. Ground floors exceeding 18 feet in height are counted as two stories.
  - e. For non-residential and mixed-uses a ground floor story shall be no less than 11 feet in height. A ground floor story of 25 feet or less is counted as one story. Ground floors exceeding 25 feet in height are counted as two stories.
  - f. Height limits do not apply to unfinished attics, masts, belfries, clock towers, chimney flues, water tanks, or elevator bulkheads.
- 4.7.2 Parking structure height is measured as follows:
- a. Parking structure height is measured in feet above average adjacent grade but in no case shall exceed 45 feet in height.
  - b. Parking structures lined for a minimum of 80% along frontages may exceed height restrictions and are limited in height to the eave of lining buildings.

TABLE 4.13 NC LOT STANDARDS

BUILDING SETBACKS AND LOT REQUIREMENTS



Street or civic space (residential only)

MAIN BUILDING SETBACKS		PARKING AND STORAGE SETBACKS	
A Primary Frontage	12 ft. max.	H Primary Frontage	20 ft. min.
B Secondary Frontage	10 ft. max.	I Secondary Frontage	20 ft. min.
C Side Lot Line	0 ft. min.	J Side Lot Line	0 ft. min.
D Rear Lot Line	5 ft. min.	K Rear Lot Line	3 ft. min.

ACCESSORY BUILDING SETBACKS

Accessory buildings are subject to the setback standards of principal buildings.

LOT REQUIREMENTS

Lot Coverage	See 4.9.5(b)
Primary Building Frontage	60% min.
Density (units per acre)	12.0
Access Drive Width to setback	24 ft. max.
Lot Width	50 – 200 ft. Non-residential, 20 ft. min. Residential

BUILDING FRONTAGE 4.17

REQUIRED PRIVATE FRONTAGE TYPES (SEE TABLE 4.14 PRIVATE FRONTAGES)

Primary Frontage	stoop, terrace, common entry, gallery, forecourt, shopfront
Secondary Frontage	stoop, terrace, common entry, gallery, forecourt, shopfront
<del>Entry Requirements</del>	<del>1 per 50 ft. of primary frontage and 1 per 80 ft. of secondary frontage</del>

ENCROACHMENTS

Balcony and/or bay window	100% max. up to 6 ft.	Awning or gallery	100% max. or within
Stoop or terrace	100% max. up to 8 ft.		2 ft. of curb
Fireplace	2.5 ft. max.		

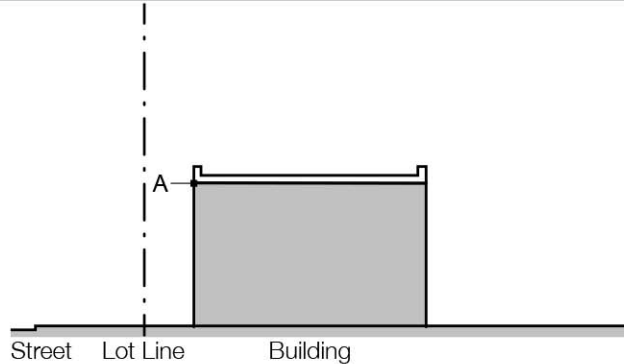
MINIMUM GLAZING

Ground Floor	50%
Upper Floors	25%

AMBIENT STANDARDS

Light Level	2 fc. max.
Noise: 12am to 7am	60 dBA
Noise: 7am to 10pm	75 dBA
Noise: 10pm to 12am	65 dBA

BUILDING HEIGHT



BUILDING HEIGHT

A. Main Building	3 stories
B. Accessory Buildings	N/A

## Town of Thompson's Station

ning Commission has no jurisdiction.

- 4.9.2 Regulations Specific to the D1 Zone. The D1 zone is primarily for residential use at a light intensity.
- 4.9.3 Regulations Specific to the D2 Zone. The D2 zone is primarily for residential use at a medium intensity.
- 4.9.4 Regulations specific to the D3 Zone. The D3 zone is primarily for residential use at a high intensity.
- a. Recreational Space. 10 percent or 20,000 ft.<sup>2</sup> of the total development, whichever is less, shall be devoted to usable space for recreational activities. Ponding and drainage areas may contribute to this recreational space.
- 4.9.5 Regulations Specific to the NC Zone. The NC zone is primarily for neighborhood commerce **and residential**.
- a. Driveways. Driveways may not exceed 150 feet in length without an approved turnaround unless reviewed and approved by the County Fire Marshal; 25 feet of driveway width for non-dedicated streets or driveways within a lot for two-way traffic and 20 feet for one-way traffic (measured perpendicular to the direction of travel). **Live/Work and Townhome units shall have a 5' or 20' alley loaded driveway. Any live/work or townhome unit with a 5' alley loaded driveway shall have a minimum of a one-car garage, and shall provide overflow parking at a rate of 1.5 spaces per unit. Any live/work or townhome unit with a 20' alley loaded driveway, shall have a minimum of a one-car garage, and shall provide overflow parking at a rate of 0.5 spaces per unit. Condominiums do not require driveways or garage parking, but shall provide parking at a rate of 2.0 spaces per unit. Parking for all residential uses may be provided by on street parking, nearby surface parking, or a combination of the two.**
  - b. Lot Coverage. Lot coverage for non-residential is 50% maximum, and for residential is 90% maximum. Residential lots exceeding 50% coverage, shall provide an additional area, equal to or greater than the balance over 50%, in the form of open space or civic space. The additional open space or civic space shall be contiguous to or within a walking distance of ¼ mile of the subject units.
  - c. **Live/Work, Townhome & Condominium locations. Live/Work, Townhome & Condominium units are permitted within the NC zone, but shall be setback a minimum of 600' from US31 (Columbia Pike) right-of-way.**
- 4.9.6 Regulations Specific to the CC Zone. The CC zone is primarily for community commerce.
- a. Driveways. Driveways may not exceed 150 feet in length without an approved turnaround unless reviewed and approved by the County Fire Marshal; 25 feet of driveway width for non-dedicated streets or driveways within a lot for two-way traffic and 20 feet for one-way traffic (measured perpendicular to the direction of travel).
- 4.9.7 Regulations General to the IL, and IM zones. The IL, and IM zones are primarily for light and medium industry, respectively. (1) The two zones differ in their uses permitted, which are listed separately in Table 5.1. Land Use Classification Matrix (2) Setbacks for loading facilities from railroad tracks or airport taxiways may be reduced to 0 feet.

#### 4.10 Use Residential Property Standards

These standards govern residential developments in the D1, D2, and D3. Multi-family developments are also subject to review and approval by the Design Review Commission.

##### 4.10.1 Single-Family Residential Standards

- a. All accessory structures shall be located within the rear yard, shall be located a minimum of 5 feet from the primary residence and shall not be located within 5 feet of the side or rear property line.
- b. Required setback areas shall be landscaped and permanently maintained in a healthy manner and should include a minimum of one (1) two (2) inch caliper tree.
- c. New single family subdivisions shall have a two (2) car garage that meets interior dimensions of 22 feet by 22 feet. This interior dimension shall be free and clear of permanent obstructions, such as water heaters, washer/dryer hook up areas, stairs, etc. Single lot site plans for the development of

- vi. Any establishment that sells beer or alcoholic beverages, including restaurants, grocery, convenience or packaged liquor stores
- b. Measurements related to this subsection shall be made in a straight line, without regard to intervening objects or structures, from the nearest portion of the building or structure used as part of the premises where an adult-oriented establishment is conducted to the nearest property line of the premises of a use listed in subsection a. above. The presence of a city jurisdictional boundary shall be irrelevant for the purposes of calculating and applying the distance requirements of this subsection. An adult-oriented establishment lawfully operating as a conforming use shall not be rendered a nonconforming use by the location, subsequent to the commencement of operations of said establishment, of a use listed in subsection a. above within 500 feet of the adult-oriented establishment.

**4.12 Parking Standards**

All multi-family and non-residential developments require a parking plan that will be submitted and reviewed with the site plan for development. The parking plan shall identify all parking areas, required landscaping, bicycle parking and loading areas throughout the project site. **On street parking may be counted toward required parking for all uses in the NC Zone.**

**4.12.1 Minimum Required Automobile Parking**

Use district parking requirements are determined by lot use(s) according to Table 4.16 Use District Parking Requirements. Transect zoning district parking requirements are governed by market demand and have no minimums.

**4.12.2 Required parking may be adjusted downward by shared parking according to Table 4.15 Parking Occupancy Rates. Shared parking is determined as follows:**

- a. Shared parking is available for two or more uses on one lot or within one block.
- b. Parking facilities may utilize shared parking for uses within 500 feet of the facility.
- c. The adjusted required parking resulting from the shared parking table is the highest daily shared parking requirement determined by completing the shared parking table.
- d. A written agreement shall be drawn to the satisfaction of the Town Attorney and executed by all parties concerned assuring the continued availability of the number of spaces designated for the joint use.

**TABLE 4.18 PARKING OCCUPANCY RATES**

USES	M - F	M - F	M - F	SAT & SUN	SAT & SUN	SAT & SUN
	8 AM-6 PM	6 PM-12 AM	12 AM-8 AM	8 AM-6 PM	6 PM-12 AM	12 AM-8 AM
RESIDENTIAL	60%	100%	100%	80%	100%	100%
LODGING	70%	100%	100%	70%	100%	100%
OFFICE	100%	20%	5%	5%	5%	5%
RETAIL	90%	80%	5%	100%	70%	5%
RESTAURANT	70%	100%	100%	70%	100%	100%
THEATER	40%	80%	10%	80%	100%	10%
ENTERTAINMENT	40%	100%	10%	80%	100%	50%
INSTITUTIONAL	100%	20%	5%	10%	10%	5%
RELIGIOUS	20%	20%	5%	100%	50%	5%

Planning Staff shall provide a spreadsheet that will perform calculations for specific applications based upon the occupancy rates in this table.

**4.12.3 Required parking may be adjusted downwards where the following provisions for cyclists are provided:**

- a. 1 automobile parking space may be reduced for every 4 bicycle parking spaces provided in excess of that required up to a 10% reduction.
- b. 1 automobile parking space may be reduced for every shower provided for non-residential uses, not

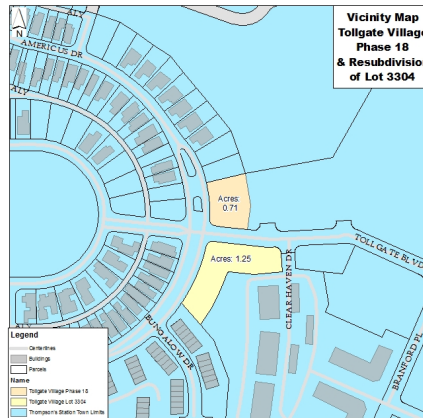


**Thompson's Station Planning Commission  
Staff Report –Item 2 (PP 2018-002)  
March 27, 2018**

**Preliminary plat for phase 18 which will create three single-family lots and re-subdivide lot 3304 within phase 33 into five lots for a total of eight (8) lots.**

**PROJECT DESCRIPTION**

A request to approve the preliminary plat for phase 18 and the re-subdivision of lot 3304 within phase 33 of Tollgate Village to create eight single family lots and one “residential” lot located at the northeast and southeast corners of Tollgate Boulevard and Americus Drive.



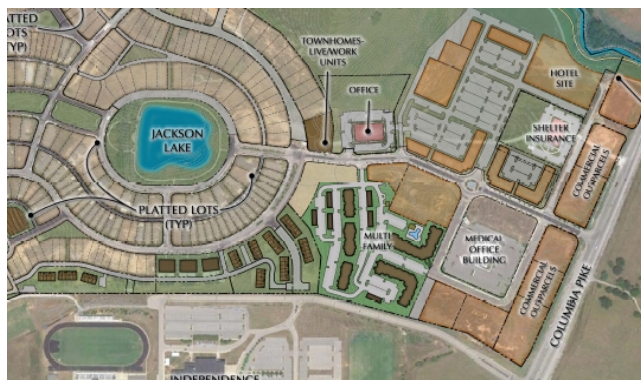
**BACKGROUND**

The Tollgate Village site development plan dated April 2014 consists of a variety of housing throughout the site with commercial/office located in proximity to Columbia Pike (State Route 6). The existing housing includes 201 apartments (located on Branford Place), 30 condominiums (located along Americus), 61 townhomes (along Bungalow Drive, Newark Lane and Rochelle Lane) and over 450 single-family residences within Sections 1-15 with preliminary plat approvals for phases 16 and 17 for another 176 lots. Existing commercial includes the medical office building and Shelter Insurance located in the front sections of the development along Tollgate Boulevard and Elliston Way.

**ANALYSIS**

**Preliminary Plat**

The preliminary plat “provides an analysis of the site’s special features and the response to those features” (LDO Section 5.4.3). This preliminary plat is for the creation of phase 18 and the resubdivision of phase 33 to establish eight single-family lots and one future lot. The layout of this plat request is modification from the approved development plan (dated 4-15-14). The changes include a revision to the type of lots at the both corners of Americus and Tollgate Boulevard. As shown below, the northeast corner of Tollgate Boulevard and Americus was townhome/live work and the southeast corner was single-family.



The developer is now proposing the single-family lots on the northeast corner instead of the townhomes and townhomes on the southeast corner fronting Tollgate Boulevard instead of single-family.

The single-family lots will vary in size from .14 acres to .25 acres with a minimum of 50 feet. Proposed setbacks are 10 feet for the front yard, seven and a half feet for the side yards and 20 feet for the rear yard with a minimum of a 20-foot driveway. Section 3.6 states that each lot should be designed as to not create any “foreseeable difficulties” for the construction and access of the lot. Access is front loaded (Americus Drive) on the northeast corner. However, given the development of the townhomes to the south and the apartments to east, access to the southeast corner is not well defined and limited. Access from Americus is obstructed by the existing median and therefore an alley is proposed via Tollgate Boulevard through the apartment site to the lots on the southeast corner.

#### Open Space

No open space is proposed with this phase. To date, Tollgate Village is 72% complete with the approval of plats and only 67% of the open space has been recorded. A significant portion of the remaining open space is located within phases 16 and 17, however, per section 5.4.7 of the Town’s LDO, all remaining open space will need to be platted prior to any future final plats.

#### Traffic Improvements

The February 2017 traffic study states that “one route of secondary access to Tollgate Village should be constructed and open to traffic prior to the final plat approval for Tollgate Village Section 16 or Section 17, whichever occurs first. If development in Tollgate Village occurs outside of Sections 15, 16 and 17, a route of secondary access should be constructed as part of that development.” At this time, a secondary access sufficient for emergency access is installed, however, the route is not open to traffic. Improvements to complete the secondary access are underway, however, staff recommends that prior to any future final plats, the secondary access is completed.

#### **RECOMMENDATION**

Staff recommends that the Planning Commission approve the preliminary plat for phase 18 which includes the re-subdivision of phase 33 with the following contingencies:

1. Prior to the submittal of a final plat, a development agreement shall be executed between the developer and the Town.
2. Prior to the submittal of a final plat, the secondary access must be completed and open to traffic.

#### **ATTACHMENT**

Preliminary Plat

**GENERAL NOTES**

- THE PURPOSE OF THIS PLAT IS TO SUBDIVIDE LOT 3304 INTO 5 SINGLE FAMILY RESIDENTIAL LOTS AND 1 FUTURE RESIDENTIAL LOT AND TO CREATE 3 SINGLE FAMILY RESIDENTIAL LOTS AT THE INTERSECTION OF TOLLGATE BOULEVARD AND AMERICUS DRIVE.
- BEARINGS SHOWN HEREON ARE BASED ON TENNESSEE COORDINATE SYSTEM OF 1983.
- ELEVATIONS SHOWN HEREON ARE BASED ON NAVD 88. CONTOURS ARE AT ONE FOOT INTERVALS AND ARE BASED ON A FIELD RUN SURVEY BY RAGAN-SMITH ASSOCIATES ON MARCH 31, 2017 USING RANDOM SPOT ELEVATIONS. CONTOURS WERE DERIVED USING SURFACE MODELING TECHNIQUES.
- BY SCALED MAP LOCATION AND GRAPHIC PLOTTING ONLY, THE PROPERTY LIES WITHIN FLOOD ZONE "X", AS DESIGNATED ON CURRENT FEDERAL EMERGENCY MANAGEMENT AGENCY MAPS NO. 47187C0335F, WITH AN EFFECTIVE DATE OF SEPTEMBER 29, 2006, WHICH MAKES UP A PART OF THE NATIONAL FLOOD INSURANCE ADMINISTRATION REPORT; COMMUNITY NO. 470424, PANEL NO. 0335, SUFFIX F, WHICH IS THE CURRENT FLOOD INSURANCE RATE MAP FOR THE COMMUNITY IN WHICH SAID PREMISES IS SITUATED. SAID MAP DEFINES ZONE "X" UNDER "OTHER AREAS" AS "AREAS DETERMINED TO BE OUTSIDE THE 0.2% ANNUAL CHANCE FLOODPLAIN."
- THIS SURVEYOR HAS NOT PHYSICALLY LOCATED THE UNDERGROUND UTILITIES. ABOVE GRADE AND UNDERGROUND UTILITIES SHOWN WERE TAKEN FROM VISIBLE APPURTENANCES, PUBLIC RECORDS, AND/OR MAPS PREPARED BY OTHERS. THE SURVEYOR MAKES NO GUARANTEE THAT THE UNDERGROUND UTILITIES SHOWN COMPRISE ALL SUCH UTILITIES IN THE AREA, EITHER IN SERVICE OR ABANDONED. THE SURVEYOR FURTHER DOES NOT WARRANT THAT THE UNDERGROUND UTILITIES SHOWN ARE IN THE EXACT LOCATION INDICATED. THEREFORE, RELIANCE UPON THE TYPE, SIZE AND LOCATION OF UTILITIES SHOWN SHOULD BE DONE SO WITH THIS CIRCUMSTANCE CONSIDERED. DETAILED VERIFICATION OF EXISTENCE, LOCATION AND DEPTH SHOULD ALSO BE MADE PRIOR TO ANY DECISION RELATIVE THERETO IS MADE. AVAILABILITY AND COST OF SERVICE SHOULD BE CONFIRMED WITH THE APPROPRIATE UTILITY COMPANY. IN TENNESSEE, IT IS A REQUIREMENT, PER "THE UNDERGROUND UTILITY DAMAGE PREVENTION ACT", THAT ANYONE WHO ENGAGES IN EXCAVATION MUST NOTIFY ALL KNOWN UNDERGROUND UTILITY OWNERS NO LESS THAN THREE (3) NOR MORE THAN TEN (10) WORKING DAYS PRIOR TO THE DATE OF THEIR INTENT TO EXCAVATE AND ALSO TO AVOID ANY POSSIBLE HAZARD OR CONFLICT. TENNESSEE ONE CALL, DIAL 811.
- THE PROPERTY IS CURRENTLY ZONED D3 (HIGH DENSITY RESIDENTIAL). MAXIMUM LOT COVERAGE - 55% MINIMUM BUILDING SETBACKS PER TOWN OF THOMPSON'S STATION LAND DEVELOPMENT ORDINANCE DATED JUNE 13, 2017:  
FRONT: 10'  
REAR: 20'  
SIDE: 7.5'

\*\* DRIVEWAYS SHALL BE A MINIMUM OF 20' IN LENGTH, EXCLUSIVE OF SIDEWALKS.

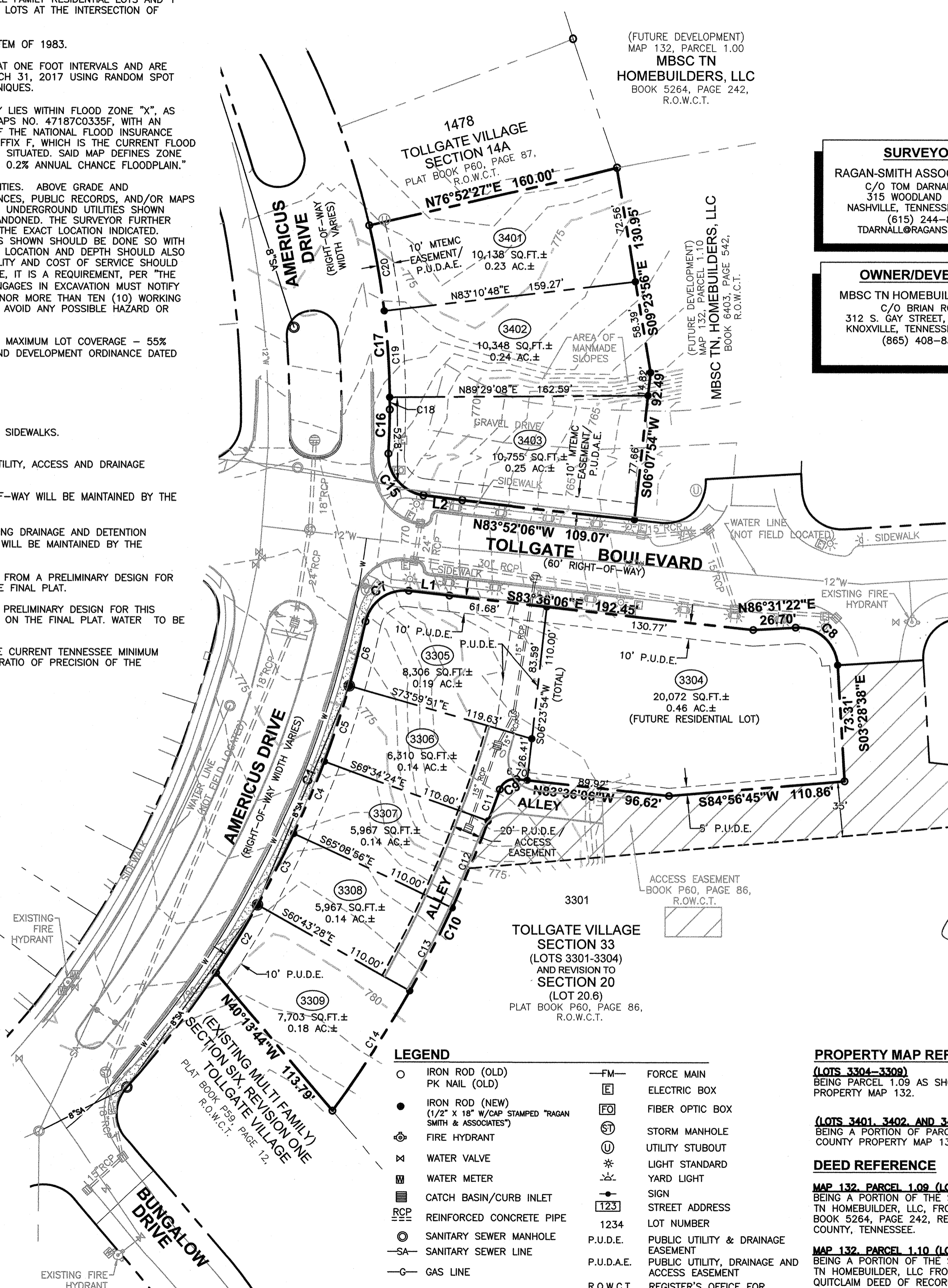
- ALL STREETS ARE DESIGNATED AS PUBLIC AND AS SUCH ARE PUBLIC UTILITY, ACCESS AND DRAINAGE EASEMENTS.
- ALL PUBLIC STREETS AND DRAINAGE STRUCTURES WITHIN THE RIGHTS-OF-WAY WILL BE MAINTAINED BY THE TOWN OF THOMPSON'S STATION.
- OPEN SPACE AREAS, PUBLIC UTILITY AND DRAINAGE EASEMENTS (INCLUDING DRAINAGE AND DETENTION STRUCTURES), ALLEYS AND ALL LANDSCAPING WITHIN ROADWAY MEDIANS WILL BE MAINTAINED BY THE HOMEOWNERS' ASSOCIATION.
- SANITARY SEWER LINES AND STORM LINES SHOWN HEREON WERE TAKEN FROM A PRELIMINARY DESIGN FOR THIS SECTION. FINAL PLACEMENT OF UTILITIES WILL BE DEPICTED ON THE FINAL PLAT.
- DOMESTIC WATER SUPPLY INFORMATION SHOWN HEREON IS BASED ON A PRELIMINARY DESIGN FOR THIS SECTION. FINAL PLACEMENT TO BE DESIGNED BY OTHERS AND INCLUDED ON THE FINAL PLAT. WATER TO BE PROVIDED BY H.B.&T.S.

12. I HEREBY STATE THAT THIS SURVEY WAS DONE IN COMPLIANCE WITH THE CURRENT TENNESSEE MINIMUM STANDARDS OF PRACTICE AND THIS IS A CATEGORY I SURVEY AND THE RATIO OF PRECISION OF THE UNADJUSTED SURVEY IS BETTER THAN 1:15,000.

BY: *[Signature]* DATE: 2-20-18  
JOHN T. DARNALL, TN RLS #1571

LINE TABLE		
LINE	BEARING	DISTANCE
L1	S83°17'01"E	25.77'
L2	N83°36'06"W	24.56'

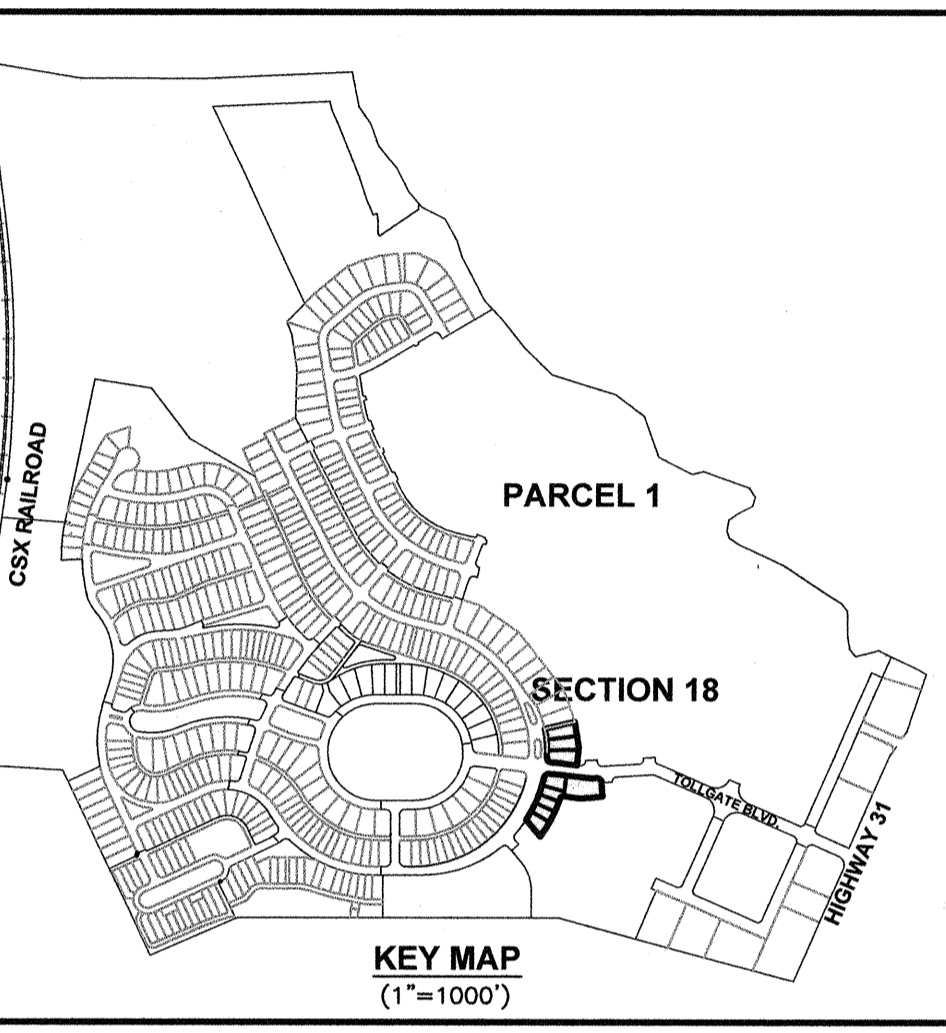
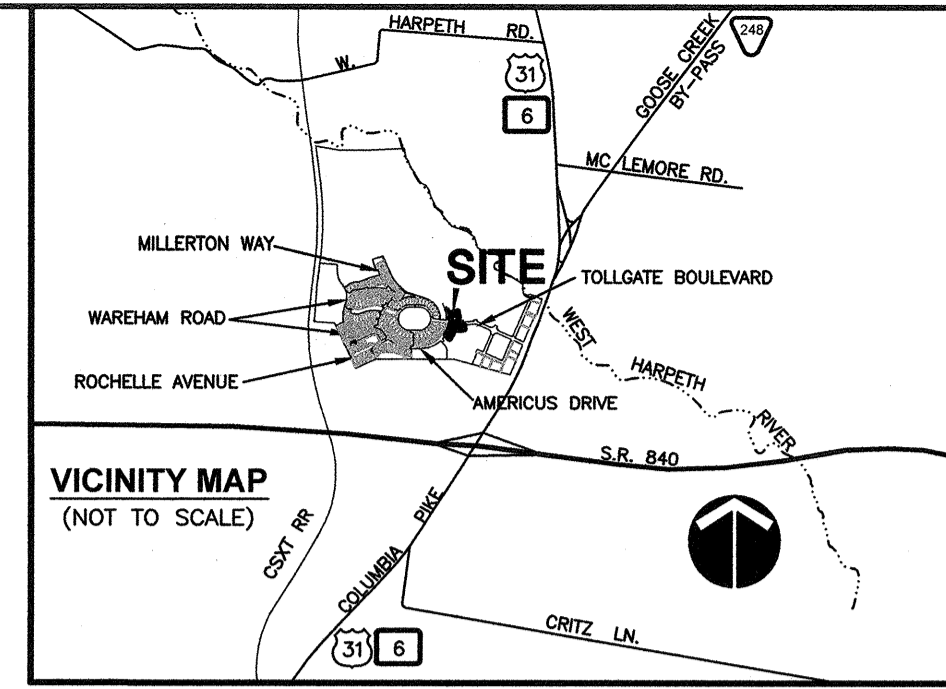
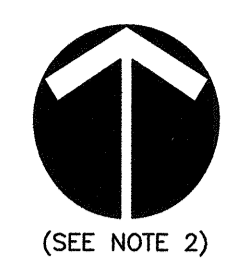
CURVE TABLE						
CURVE	RADIUS	LENGTH	DELTA	TANGENT	CHORD	CHD BRG
C1	647.50'	241.73'	21°23'26"	122.29	240.33'	N23°00'17"E
C2	647.50'	50.00'	4°25'28"	25.01	49.99'	N31°29'16"E
C3	647.50'	50.00'	4°25'28"	25.01	49.99'	N27°03'48"E
C4	647.50'	50.00'	4°25'28"	25.01	49.99'	N22°38'20"E
C5	647.50'	50.00'	4°25'28"	25.01	49.99'	N18°12'53"E
C6	647.50'	41.74'	3°41'36"	20.88	41.73'	N14°09'21"E
C7	25.00'	36.70'	84°06'12"	22.55	33.49'	N54°21'14"E
C8	25.00'	39.28'	90°00'54"	25.01	35.36'	S48°28'38"E
C9	10.00'	13.55'	77°37'53"	8.04	12.54'	S57°34'57"W
C10	757.50'	228.94'	17°18'59"	115.35	228.07'	S27°25'30"W
C11	757.50'	21.95'	1°39'36"	10.97	21.94'	S19°35'49"W
C12	757.50'	58.49'	4°25'28"	29.26	58.48'	S22°38'20"W
C13	757.50'	58.49'	4°25'28"	29.26	58.48'	S27°03'48"W
C14	757.50'	90.00'	6°48'28"	45.06	89.95'	S32°40'46"W
C15	25.00'	37.76'	86°32'04"	23.53	34.27'	N40°20'18"W
C16	647.49'	27.59'	2°26'30"	13.80	27.59'	N01°35'08"E
C17	500.00'	117.73'	13°29'26"	59.14	117.46'	N06°22'50"W
C18	500.00'	7.67'	0°52'45"	3.84	7.67'	S00°04'29"E
C19	500.00'	55.03'	6°18'21"	27.54	55.00'	S03°40'02"E
C20	500.00'	55.03'	6°18'21"	27.54	55.00'	S09°58'22"E



(FUTURE DEVELOPMENT)  
MAP 132, PARCEL 1.00  
MBSC TN  
HOMEBUILDERS, LLC  
BOOK 5264, PAGE 242,  
R.O.W.C.T.

**SURVEYOR**  
RAGAN-SMITH ASSOCIATES, INC.  
C/O TOM DARNALL, RLS  
315 WOODLAND STREET  
NASHVILLE, TENNESSEE 37206  
(615) 244-8591  
TDARNALL@RAGANSMITH.COM

**OWNER/DEVELOPER**  
MBSC TN HOMEBUILDERS, LLC  
C/O BRIAN ROWE  
312 S. GAY STREET, SUITE 200  
KNOXVILLE, TENNESSEE 37902  
(865) 408-8322



REVISED: FEBRUARY 20, 2018  
REVISED: DECEMBER 12, 2017  
REVISED: SEPTEMBER 29, 2017

**PRELIMINARY PLAT  
TOLLGATE VILLAGE  
PHASE 18  
(LOTS 3401-3403)  
AND  
RESUBDIVISION OF LOT 3304  
(LOTS 3304-3309)**

FOURTH CIVIL DISTRICT OF WILLIAMSON COUNTY, TENNESSEE  
JOB NO. 10081 W.O. 9260  
DRAWN BY: SLL/AMR DATE: SEPTEMBER 8, 2017

PRELIMINARY PLAT	
TOWN OF THOMPSON'S STATION PLANNING COMMISSION	
NET AREA: 1.96±	TOTAL LOTS: 9
ACRES NEW ROAD: 0	CIVIL DISTRICT: 4TH
MILES NEW ROAD: 0	CLOSURE ERROR: 1:10000
OWNER: MBSC TN HOMEBUILDERS, LLC	
SURVEYOR: RAGAN - SMITH - ASSOCIATES, INC.	
SCALE: 1" = 50'	

**PROPERTY MAP REFERENCE**  
(LOTS 3304-3309)  
BEING PARCEL 1.09 AS SHOWN ON WILLIAMSON COUNTY PROPERTY MAP 132.

(LOTS 3401, 3402, AND 3403)  
BEING A PORTION OF PARCEL 1.10 AS SHOWN ON WILLIAMSON COUNTY PROPERTY MAP 132.

**DEED REFERENCE**  
MAP 132, PARCEL 1.09 (LOTS 3304-3309)  
BEING A PORTION OF THE SAME PROPERTY CONVEYED TO MBSC TN HOMEBUILDERS, LLC, FROM TGF, 2010, LLC OF RECORD IN BOOK 5264, PAGE 242, REGISTER'S OFFICE FOR WILLIAMSON COUNTY, TENNESSEE.

MAP 132, PARCEL 1.10 (LOTS 3401, 3402 AND 3403)  
BEING A PORTION OF THE SAME PROPERTY CONVEYED TO MBSC TN HOMEBUILDERS, LLC FROM MBSC TN HOMEBUILDERS, LLC BY QUITCLAIM DEED OF RECORD IN BOOK 6403, PAGE 542, REGISTER'S OFFICE FOR WILLIAMSON COUNTY, TENNESSEE.

**Thompson's Station Planning Commission**  
**Staff Report – Item 3 (File: Zone Amend 2018-003)**  
**March 27, 2018**

**REQUEST**

Clarification on the measurement of building height within the Land Development Ordinance.

**BACKGROUND**

On February 12, 2018, a Planning Commission work session was held where a local builder came forward to discuss the issues related to the development of his property in compliance with the hillside and steep slope standards. After discussion, the Planning Commission requested the section be placed on the next regularly scheduled meeting to discuss changes to the standards.

On February 27, 2018, the Planning Commission reviewed the standard and recommends eliminating the requirement for “one story” and increase the allowable height to 32 feet.

On March 13, 2018, the Board of Mayor and Aldermen passed the ordinance to amend the height on first reading, however, requested Planning Commission consider how building height is measured prior to the second reading of the ordinance.

**ANALYSIS**

Currently, building height is defined as the “vertical extent of a building measured in stories,” however in Section 4.7 is also noted to be measured in “above ground stories and feet.” This section also permits an exception to height limitations for “unfinished attics, masts, belfries, clock towers, chimney flues, water tanks or elevator bulkheads.” In order to protect, preserve and minimize the visual impacts of a structures on hilltops and ridgelines, a height in feet (rather than stories) was incorporated into the standards. The interpretation for measuring height is the measurement is taken from the lowest point at finished grade to the highest point of the structure.

Staff has researched other codes and found the following:

**City of Brentwood:** “Maximum permitted height of structures, two stories (measured from the grade level at the front elevation of the structure) or a total of three stories if a full or partial underground basement level is included, provided that one-half of the perimeter walls of the basement level must be at least 50 percent below grade level. For purposes of this section, a finished or unfinished attic floor with dormer windows shall not be counted as a story. In no event shall the maximum height exceed 52 feet, measured from the lowest ground level of the structure to the highest point of the roof.”

**City of Franklin:** “Building height shall be measured in the number of complete stories above the finished grade for any building, including habitable attics, half-stories, mezzanines, and at-grade structured parking” with some exclusions for subterranean areas.

**City of Spring Hill:** “The limit of the vertical extent of a building. The building height may be prescribed as a maximum number of stories or as a dimension from the finished grade at the building.”

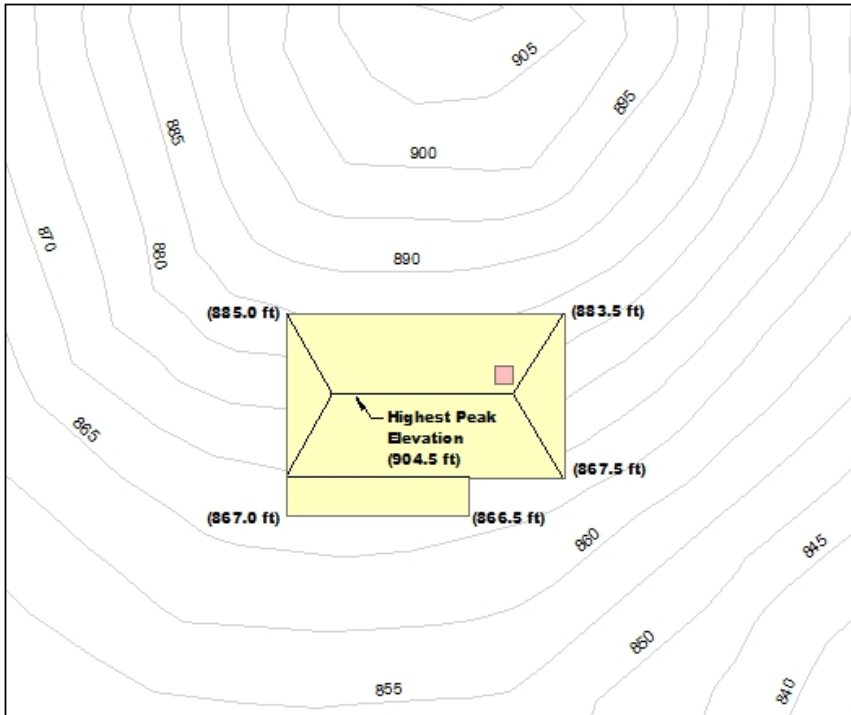
**Williamson County:** “Building height shall be measured in number of complete stories above the finished grade for any elevation fronting on a public street including attics, half-stories,



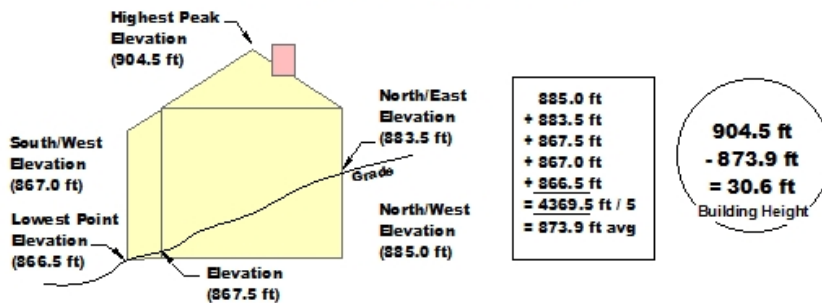
mezzanines, at-grade structured parking, but excluding features completely below grade such as basements, cellars, crawl spaces, subbasements and underground parking structures.”

Examples for measuring height.

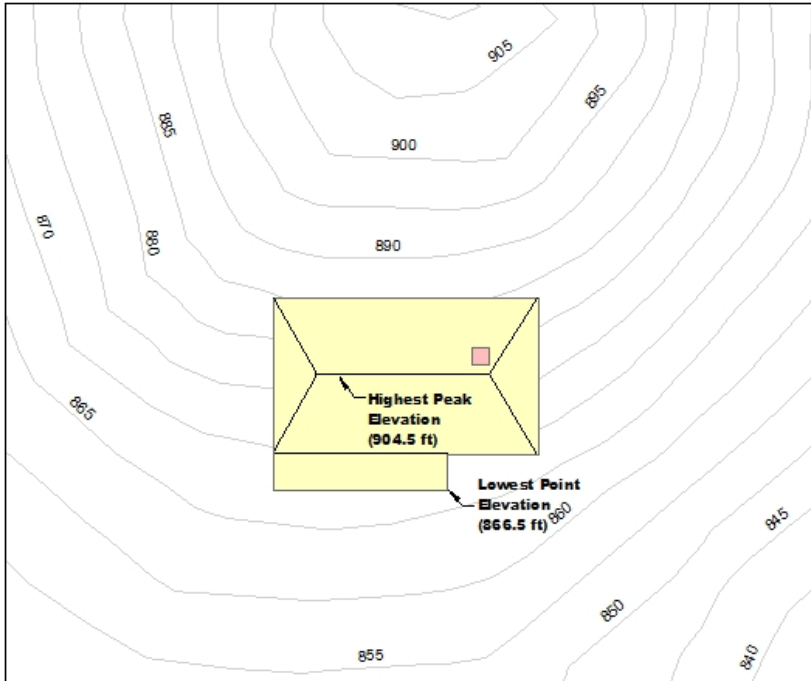
In the example below, height is determined by using the elevation at each outside corner to find the average grade and measure from the average grade.



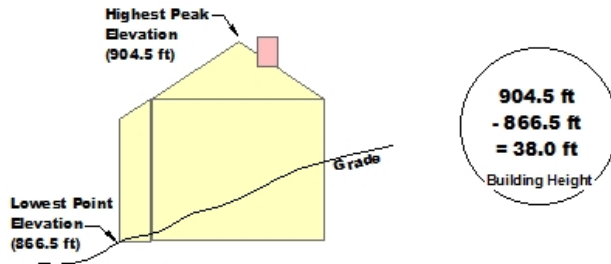
**Building Height Calculation  
Using Average Height  
(Height Measurements from every Corner)**



In the example below, the height is determined from lowest grade to highest roof peak.



**Building Height Calculation  
Using Lowest Height**



The intent of the hillside standards was to limit the visual height of structures on the hillsides, therefore, in keeping with the intent to ensure impacts to hillsides are minimized, staff would recommend utilizing the measurement that would ensure the overall height of a structure that building height be measured from the lowest point to the highest peak of the roofline.

### **RECOMMENDATION**

Staff recommends that the Planning Commission recommends that the Board of Mayor and Aldermen amend the ordinance during the second reading to include language that the building height be measured from the lowest finished grade to the highest peak of the roof.

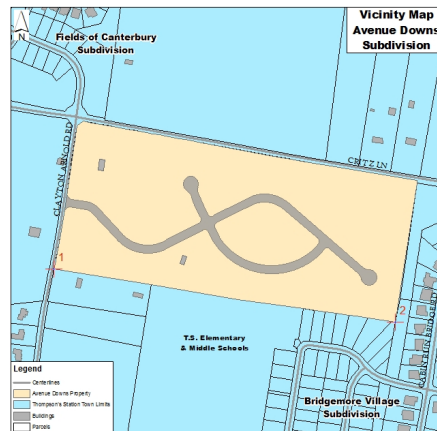


**DATE:** March 19, 2018  
**TO:** Planning Commission  
**FROM:** Wendy Deats, Town Planner  
**SUBJECT:** Planner Report 3/27/2018

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**Avenue Downs Concept Plan (CP 2018-001)**

Ragan Smith has submitted a concept plan for review for the development of 69 single-family homes on three parcels totaling 46.41 acres located along the southeast corner of Critz Lane and Clayton Arnold Road.



**Zoning/Concept Plan**

The land, consisting of three parcels is located within the G2- Intended Growth sector which anticipates growth and permits residential subdivisions. A residential subdivision should be located within a ½ mile from a collector, arterial or freeway and should be within ¼ mile of an existing residential development. The site is located on the corner of two collector roads: Critz Lane and Clayton Arnold Road and within a 1/4 mile of The Fields of Canterbury subdivision. In addition, wastewater service is required and the developer will be required to request approval of a wastewater management plan by the Board of Mayor and Aldermen prior to any development.

The subject site is zoned D2 which is intended for “low density residential development” (Section 1.2.7) and permits a density of one and a half units per acre. The project proposes 69 units on 46.41 acres for a density of 1.4 per acre. The required minimum lot width is 65 feet with block lengths a maximum of 1,000 feet. Setbacks are not identified on the concept plan; however, the zone requires a 25-foot front yard setback with 12.5 feet for a secondary frontage, a 20-foot aggregate side yard setback with a minimum of 5 feet and a 20-foot rear yard setback. Driveway widths are permitted to be a maximum of 12 feet except on the secondary frontage up to 24 feet is permitted. Driveway length is required to be a minimum of 20 feet, exclusive of sidewalks and front-loaded garages are required to be recessed behind the front façade by two feet.

The minimum open space requirement is 45% of the overall neighborhood. The concept plan proposes



21.76 acres or 47% of the project site to be set aside as open space. Residential subdivisions require 5 – 10% of the area designated as a civic space with the main type permitted to be a green, plaza or a square. The concept plan does not identify the location or area for civic spaces. The subdivision exceeds 50 units and is therefore required to have one amenity for the development. The concept plan illustrates a walking trail that will meander through the open space around the wetland area to provide an amenity to developments over 50 units. The length of the trail is conceptual at this time and will be further detailed upon completion of grading plans. Staff recommends the trail be further detailed prior to the first preliminary plat.

#### Natural Resources

##### *Ridgeline Hilltop Preservation/Slopes*

The site does not contain any land within the Ridgeline Hilltop Preservation Area and does not contain slopes in excess of 15%.

##### *Wetland*

A natural resource analysis was submitted and a wetland area is located on site. The wetland is less than an acre and a 30-foot buffer is proposed around the wetland. Therefore, the intent is to protect and have the wetland available as an amenity to the neighborhood. The wetland has a watercourse noted in the analysis that may be subject to USACE jurisdiction. While the development proposes a buffer and disturbance, if any, appears to be limited, further review by USACE is advisable to confirm determination of jurisdiction and to ensure the buffer is adequate and meets the criteria set forth by USACE. Other water courses are on site but will remain untouched by development and will have a 30-foot buffer. Recommendations from the report prepared by BDY should be included into the development agreement.

##### *Woodlands/Trees*

The site is predominantly open land with areas of tree line and wooded areas around the wetland and property boundaries. A tree inventory has not been submitted for review, however, the layout of the lots has utilized much of the open areas with limited tree impacts. A tree inventory will be required during the platting process. Any trees over 18 inches in diameter proposed for removal will be required to have a replacement ratio of one and a half inches for every inch removed. The site requires a semi opaque screen between the property to the south on Clayton Arnold and east of Critz Lane, which incorporates a minimum of a 25-foot setback with a screen of intermittent visual openings to a height of at least 20 feet. The existing tree line along the south and east will be preserved to meet the buffer requirement.

##### *Geotechnical*

A geotechnical report is submitted and under review. Any recommended mitigation should be incorporated into future approvals for the project.

##### *Storm water Considerations*

Storm water detention is proposed on site at the corner of Clayton Arnold and Critz Lane and along the east property line south of Critz Lane. Storm water will be reviewed further during the platting process.



## Traffic

The project has frontage on two collector roads, Clayton Arnold Road and Critz Lane. One access is proposed along Clayton Arnold approximately 600 feet south of Critz Lane. The International Fire Code states that “developments of one or two-family dwellings where the number of dwelling units exceeds 30 shall be provided with a separate and approved fire apparatus access road.” In addition, Section 1.2.8 of the Land Development Ordinance states “that neighboring subdivision developments will support each other with a continuous network of thoroughfares and blocks forming continuous urban fabric within their communities.” Therefore, to provide connectivity, Staff recommends that a second entrance/public road which will line up with the future extension through Canterbury be considered as additional access. A traffic study was prepared was reviewed by the Town’s Consulting Traffic Engineer. Ragan Smith is addressing the comments and will provide an updated traffic study.

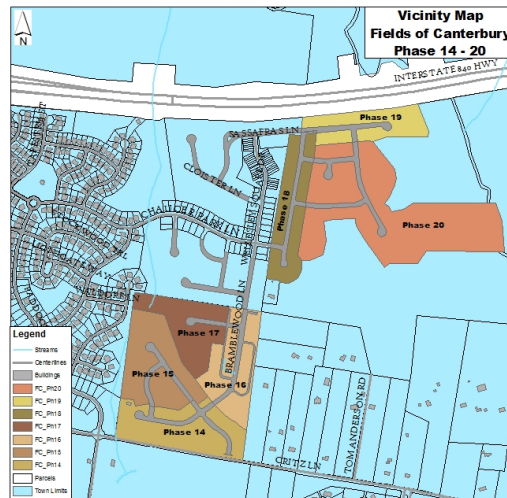
## Attachments

Proposed Development Concept Plan  
Traffic Study dated February 2018

-----

## **Fields of Canterbury Expansion Concept Plan (CP 2018-002)**

Ragan Smith has submitted a concept plan for the development of 179 single-family homes and 141 townhomes on two parcels totaling 113.26 acres located along the northeast corner of Critz Lane and Clayton Arnold Road and along the east side of Chaucer Park Drive and Wellesley Drive.



## Zoning/Concept Plan

The land, consisting of two parcels is located within the O2 – Rural Open Space and the G2- Intended Growth sector. Both growth sectors permit the development of residential subdivisions. A residential subdivision should be located within a ½ mile from a collector, arterial or freeway and should be within ¼ mile of an existing residential development. The parcel consisting of phases 14 – 17 is located along the north side of Critz Lane, a collector road and the parcel consisting of phases 18 – 20 is within ½ of Critz Lane. The project is an expansion to an existing subdivision, The Fields of Canterbury. Wastewater service is also required and The Fields of Canterbury neighborhood expansion has 318 taps available for the project. The project includes 320 units; therefore, the developer will need to seek



approval of additional sewer taps.

The subject site is zoned D3 which is intended for “higher density residential development” (Section 1.2.7) and permits a density of three units per acre. The overall acreage in the development is 383.76 acres and the proposal includes a total of 1,136 units for a density of 2.9 units per acre. The required minimum lot width is 50 feet for single-family lots and 20 feet for townhome lots with a block length of 800 feet. Setbacks are not identified on the concept plan; however, the zone requires a 10-foot front yard setback with 10 feet for a secondary frontage, a 15-foot aggregate side yard setback with a minimum of 5 feet and a 20-foot rear yard setback. Driveway widths are permitted to be a maximum of 20 feet. Driveway length is required to be a minimum of 20 feet, exclusive of sidewalks and front-loaded garages are required to be recessed behind the front façade by two feet.

The minimum open space requirement is 45%. The original master plan was not subject to the 45% requirement and therefore, the first 13 phases of the neighborhood have approximately 31% open space. The concept plan proposes the additional 113.26 acres will comply with the current standards providing 52.39 acres (46.3%) for open spaces. Residential subdivisions require 5 – 10% of the area designated as a civic space with the main type permitted to be a green, plaza or a square. The concept plan does identify a village green area; however, the acreage is not verified to meet the percentage requirement for civic spaces. Additional areas are likely to be added as the project progresses. The subdivision exceeds 100 units and is therefore required to have two amenities for the development. The concept plan proposed a walking trail that will meander through the eastern open space area for phases 18 – 20 and through the land the town has acquired for drip fields. Staff is unclear if the developer intends to construct a trail through town property or if the town will be responsible for the construction of a trail. The length of the trail is conceptual at this time and will be further detailed upon completion of grading plans. One additional amenity should be incorporated into the south site (phases 14- 17).

#### Lot Layout

Staff has concerns regarding the layout of the townhomes on the south property. Phase 16 and 17 consist of 89 townhome lots with 11 units of these lots consisting on no public road frontage. These 11 units are proposed to have alley frontage. Alleys do not meet public road requirements and are not typically named so addressing, access and possibly emergency access are issues that need to be addressed.

#### Natural Resources

##### *Ridgeline Hilltop Preservation/Slopes*

The site does not contain any land within the Ridgeline Hilltop Preservation Area, however does have slopes in excess of 15%. Approximately 14% of the lots have slopes in excess of 15% and therefore, will require additional preconstruction evaluation including a mass grading plan (Section 3.3.7) during the preliminary plat process. All lots exceeding 15% slope will also be designated as critical lots and will require site specific information.

##### *Water resources*

A natural resource map was submitted for both parcels and the West Harpeth River traverses a portion of the north expansion site. In addition, a stream and seep wetland area are shown on the south site and





shown to have a buffer. However, no development is shown in proximity to the stream and the seep wetland is proposed to remain open space in phase 17. Therefore, the intent is to protect these resources within the platted open space areas.

#### *Woodlands/Trees*

The north expansion site is predominantly open land with scattered trees. A tree inventory has not been submitted for review, however, many lots appear to have trees that may be impacted. The south expansion has substantial wooded areas. A tree inventory has not been completed for review, however, the layout of the lots does utilize much of the area with less trees. Most of the impacts to wooded areas will result from the development of phase 15 and the roadway connecting phases 14 and 15 to phases 16 and 17. A tree inventory will be required during the platting process. Any trees over 18 inches in diameter proposed for removal will be required to have a replacement ratio of one and a half inches for every inch removed.

The site requires a buffer 3 (semi opaque screen) between the D3 and the D1 zone, which incorporates a minimum of a 25-foot setback with a screen of intermittent visual openings to a height of at least 20 feet. No buffer is shown on the concept plan and will need to be considered and incorporated prior to platting.

#### *Geotechnical*

A geotechnical report was submitted and is under review. Any recommended mitigation will be incorporated into future approvals for the project.

#### *Storm water Considerations*

Storm water detention is proposed on site in several areas throughout the new phases. Storm water will be reviewed further during the platting process.

#### *Traffic*

The project has frontage on Critz Lane, a collector road with an additional access proposed along Critz Lane. A traffic study was prepared was reviewed by the Town's Consulting Traffic Engineer. Ragan Smith is addressing the comments and will provide an updated traffic study.

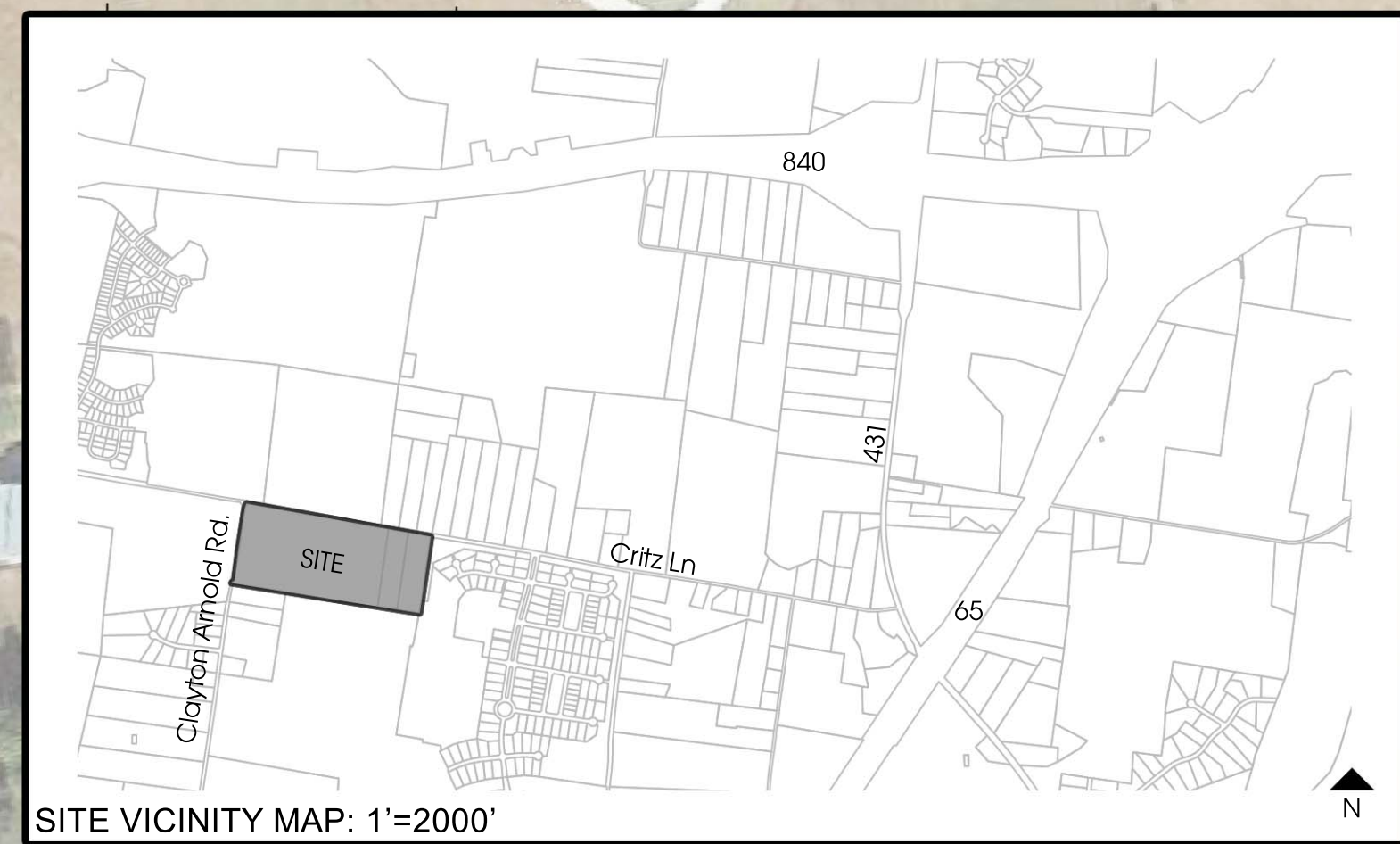
#### Attachments

Proposed Development Concept Plan  
Traffic Study dated February 2018

#### **Mars Site Plan Modification (SP 2017-008)**

Mars PetCare was approved in August 2011 for the development of a corporate campus. The campus was to be developed in two phases. Phase 1 consisted of four buildings for the office and product innovation space. A recent request to relocate a proposed driveway and enhance the front entrance was approved with the contingencies to obtain TDOT approval for the new driveway and provide landscaping.





**SITE DATA:**

**PROPERTY INFORMATION:**  
 STREET ADDRESS: CLAYTON ARNOLD RD. 145  
 TAX MAP: 6.02, 6.03, 6.04  
 PARCELS: 48.22± AC (2,100,679 SF)  
 GROSS SITE AREA: 1.81± AC.  
 LESS PRESCRIPTIVE R.O.W. AREA: 46.41± AC.

**OWNER:**  
 AMBER LANE DEVELOPMENT  
 1804 WILLIAMSON CT.  
 SUITE 107  
 BRENTWOOD, TN, 37027  
 ATTN: JORDAN CLARK  
 jordan@barlowbuilders.com

**PROJECT PLANNER:**  
 RAGAN-SMITH ASSOCIATES, INC.  
 315 WOODLAND STREET  
 NASHVILLE, TN, 37206  
 (615) 244-8591  
 ATTN: BRETT SMITH, RLA  
 bsmith@ragansmith.com

**ZONING INFORMATION:**  
 ZONING: D2 (MEDIUM INTENSITY)  
 DWELLING UNITS: 69 SINGLE FAMILY UNITS  
 DENSITY ALLOWED: 1.5 UNITS/ACRE  
 DENSITY PROPOSED: 1.49 UNITS/ACRE (69D.U./46.41AC)  
 OPEN SPACE REQUIRED: 45.0% (20.88 AC)  
 OPEN SPACE PROVIDED: 47.0% (21.76 AC)  
 MAX. BLOCK LENGTH ALLOWED: 1000'  
 MAX CUL-DE-SAC LENGTH ALLOWED: 500'

**Site Development Notes**

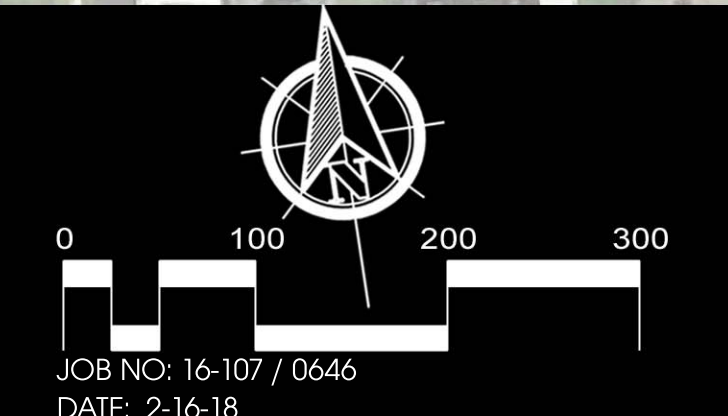
- Stormwater management facilities will be located as shown on the plan. The locations are in the northwest and northeast corners of the site, adjacent to the southerly margin of Critz Lane. A detailed hydrologic analysis will be prepared during the design phase of the project to determine the extent of stormwater detention measures warranted for the project. Water quality measures will be implemented as per best management practices recognized by Thompson's Station. An estimate of the total impervious area generated by the development of the property was determined by taking the proposed acreage occupied by proposed roadways and single family lots and applying a runoff coefficient of 0.75 as follows:  
 $27.2 \text{ acres (roadways/lots)} \times 0.75 = 20.4 \text{ acres impervious area}$
- Water service to the project will be provided by the HB&TS Utility District via a connection to the existing 12" line in the easterly margin of Clayton Arnold Road. Existing HB&TS water system flows and pressures are assumed to adequately serve the proposed 69 single family lots. Design and subsequent approvals of the water system necessary to serve the project will be the responsibility of HB&TS.
- Sanitary sewer service to the project will be provided by Thompson's Station. Avenue Downs will require an internal 8" gravity line collection system that will convey wastewater flows to two separate on site pump stations. The pump stations will be located at the northeast and northwest margins of the site, adjacent to the southerly margin of Critz Lane. The northeast pumping station will convey flows to an onsite gravity manhole and on to the northwest pumping station. A new force main will then convey flows to the northerly margin of Critz Lane via a bore and jack arrangement and on to the existing gravity manhole on the 10-inch line adjacent to the northerly margin of Critz Lane along the Canterbury project frontage. A detailed hydraulic analysis of the existing sewer system will be prepared during the design phase to determine the routing and discharge points of the new force main that results in the least amount of impact to the overall system.
- Technical studies addressing endangered species, natural and cultural resources, traffic impacts and geotechnical considerations have been prepared as applicable and will be supplemented as necessary pending evaluation of the Concept Plan submittal by Thompson's Station.
- A proposed phasing plan has been shown based upon the most logical and economical sequence of construction for the amended project.



**RAGAN-SMITH**  
 LAND PLANNERS • CIVIL ENGINEERS  
 LANDSCAPE ARCHITECTS • SURVEYORS  
 315 WOODLAND ST. P.O. BOX 60070  
 NASHVILLE, TN 37206 PH (615) 244-8591  
 FAX (615) 244-8739 WWW.RAGANSMITH.COM

# Avenue Downs

Development Concept Presentation



JOB NO: 16-107 / 0646  
 DATE: 2-16-18



**TRAFFIC IMPACT STUDY**

for

**AVENUE DOWNS**

**Thompson's Station, Tennessee**

**February 16, 2018**

**Prepared for:**

**BARLOW BUILDERS  
1804 Williamson Court, Suite 107  
Brentwood, Tennessee 37027**

**Prepared by:**

**RAGAN SMITH**

**RAGAN-SMITH ASSOCIATES, INC.  
315 Woodland Street, P.O. Box 60070  
Nashville, Tennessee 37206-0070  
(615) 244-8591**



**AVENUE DOWNS**  
**TRAFFIC IMPACT STUDY**

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**AVENUE DOWNS**  
**TRAFFIC IMPACT STUDY**

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## EXECUTIVE SUMMARY

### INTRODUCTION

Avenue Downs is located on the southeast corner of Critz Lane and Clayton Arnold Road in the Town of Thompson's Station, Tennessee. When completed, Avenue Downs will consist of 69 single family homes. The purpose of this traffic impact study is to review the traffic impact of Avenue Downs.

### BACKGROUND TRAFFIC

Based upon the proposed development schedule, the year 2021 will be used to analyze the impact of Avenue Downs.

To establish background traffic growth, TDOT historical traffic data was obtained in the project vicinity. Traffic growth due to outside developments and general population growth was based upon linear regression analysis of the historical traffic count data. Background traffic growth was established by increasing existing traffic by **2 percent annually** for the period from 2017 to 2021. In addition to the annual growth rate, specific traffic growth estimates from three (3) underway, approved, or proposed developments were included in the determination of background traffic.

### SITE TRAFFIC

The traffic impact of Avenue Downs is based upon a calculation of the number of vehicle trips that will enter and/or exit the site. The analysis periods of this report are the a.m. and p.m. peak hours of a typical weekday. Therefore, trips were generated according to the *Trip Generation Manual, 10<sup>th</sup> Edition* published by the Institute of Transportation Engineers (ITE). The total estimated trip generation for Avenue Downs is shown in the table below.

TOTAL TRIP GENERATION: AVENUE DOWNS								
Land Use	Total Units	Daily Trips	A.M. Peak Hour			P.M. Peak Hour		
			Enter	Exit	Total	Enter	Exit	Total
Single Family Homes	69 Units	739	14	40	54	45	26	71

### TRAFFIC ANALYSIS

The following public intersections were analyzed for capacity deficiencies and improvement needs:

- Critz Lane at Clayton Arnold Road
- Clayton Arnold Road at Proposed Access

For these intersections, the following traffic scenarios were analyzed, where applicable:

- 2017 Existing Traffic
- 2021 Background Traffic
- 2021 Total Traffic that contains all traffic projected in the study area, including the completion of Avenue Downs

## **CONCLUSIONS AND RECOMMENDATIONS**

### Critz Lane at Clayton Arnold Road

- The Town of Thompson's Station's proposal to construct a roundabout at this intersection is appropriate based on the operational and safety advantages that a roundabout will have over two-way stop control at this location.
- The improvements proposed to be constructed as part of the Town of Thompson's Station's Critz Lane project will continue to be appropriate after development of Avenue Downs.

### Clayton Arnold Road at Proposed Access

- The Proposed Access should consist of one lane in each direction with pavement widths in compliance with the appropriate roadway section shown in the Town's Land Development Ordinance.
- Proposed grading, landscaping, and development monumentation or signage should be designed so that AASHTO intersection sight distance is not obstructed for the proposed access.

**I. INTRODUCTION**

The purpose of this study is to review the traffic impact of the proposed Avenue Downs development in the Town of Thompson's Station, Tennessee. Avenue Downs will include 69 new residential units and one project access. This report has been requested by Town of Thompson's Station staff in order to address transportation impacts and to identify recommended mitigating measures as part of development plan review process.

In order to evaluate the traffic impact of Avenue Downs, an inventory of the existing transportation system was carried out along with an assessment of its adequacy. Based on the anticipated project schedule, a design year was established and system-wide growth rates as well as traffic growth due to specific developments in the area were applied to existing traffic volumes. Site traffic was generated, distributed and assigned to the roadway to quantify the impact of Avenue Downs. Transportation analyses were performed in order to assess any site or non-site related impacts on the system. Finally, recommendations for project access and mitigating measures related to Avenue Downs were offered.

## II. **PROJECT DESCRIPTION**

### A. Existing Development

As shown in Figure 1, Avenue Downs is located on the southeast corner of Critz Lane and Clayton Arnold Road in the Town of Thompson's Station, Tennessee. Avenue Downs Concept Plan includes a total area of 48.22 acres. The Avenue Downs proposal consists of 69 single family homes.

Figure 2 shows the concept plan for Avenue Downs.

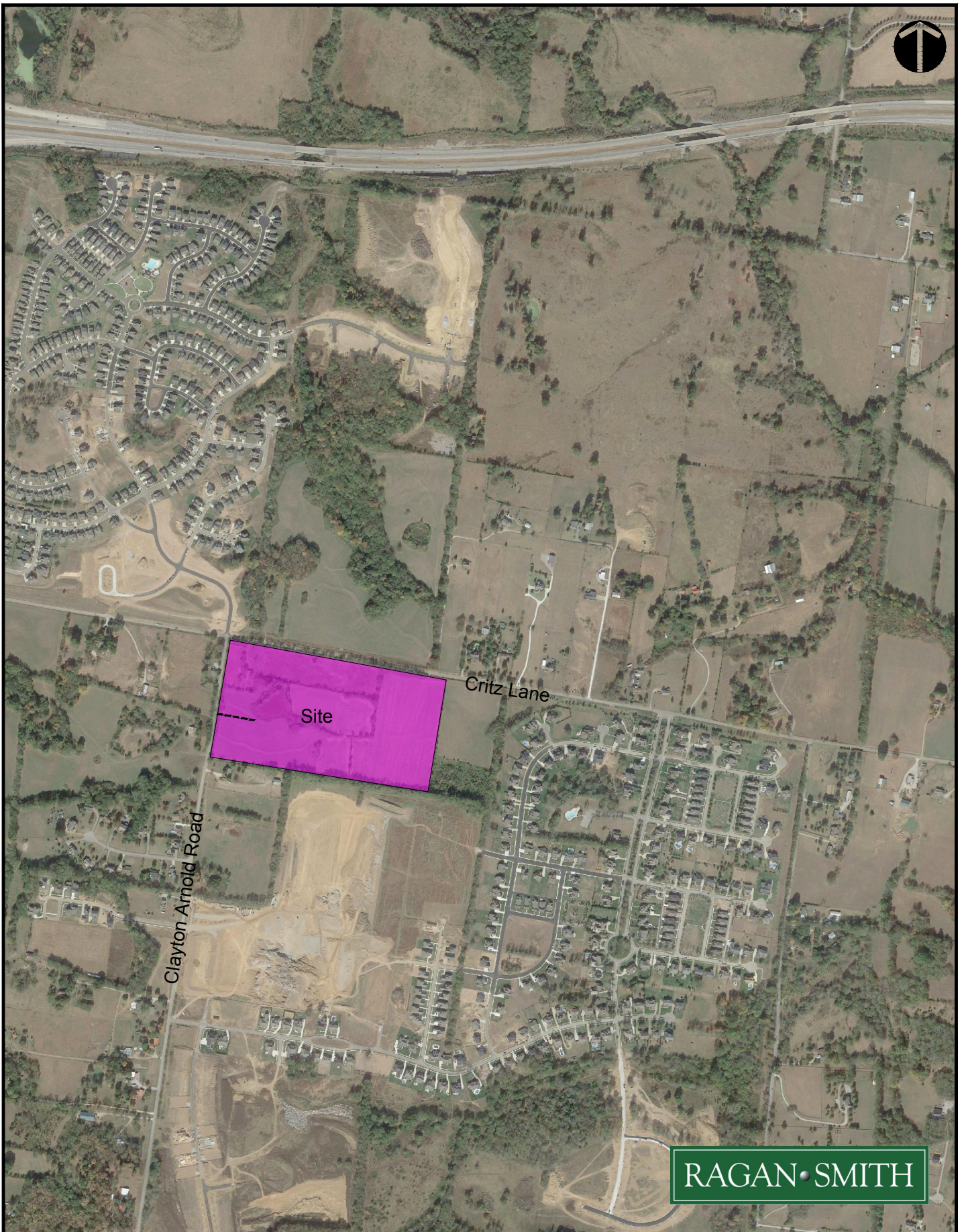
### B. Project Access

Access to Avenue Downs will be provided from one access to Clayton Arnold Road approximately 600 feet south of the intersection with Critz Lane.

### C. Phasing and Timing

For the analysis of this report, the full build-out of Avenue Downs has been assumed to occur in the year 2021. The year 2021 is established as the horizon year for this study.



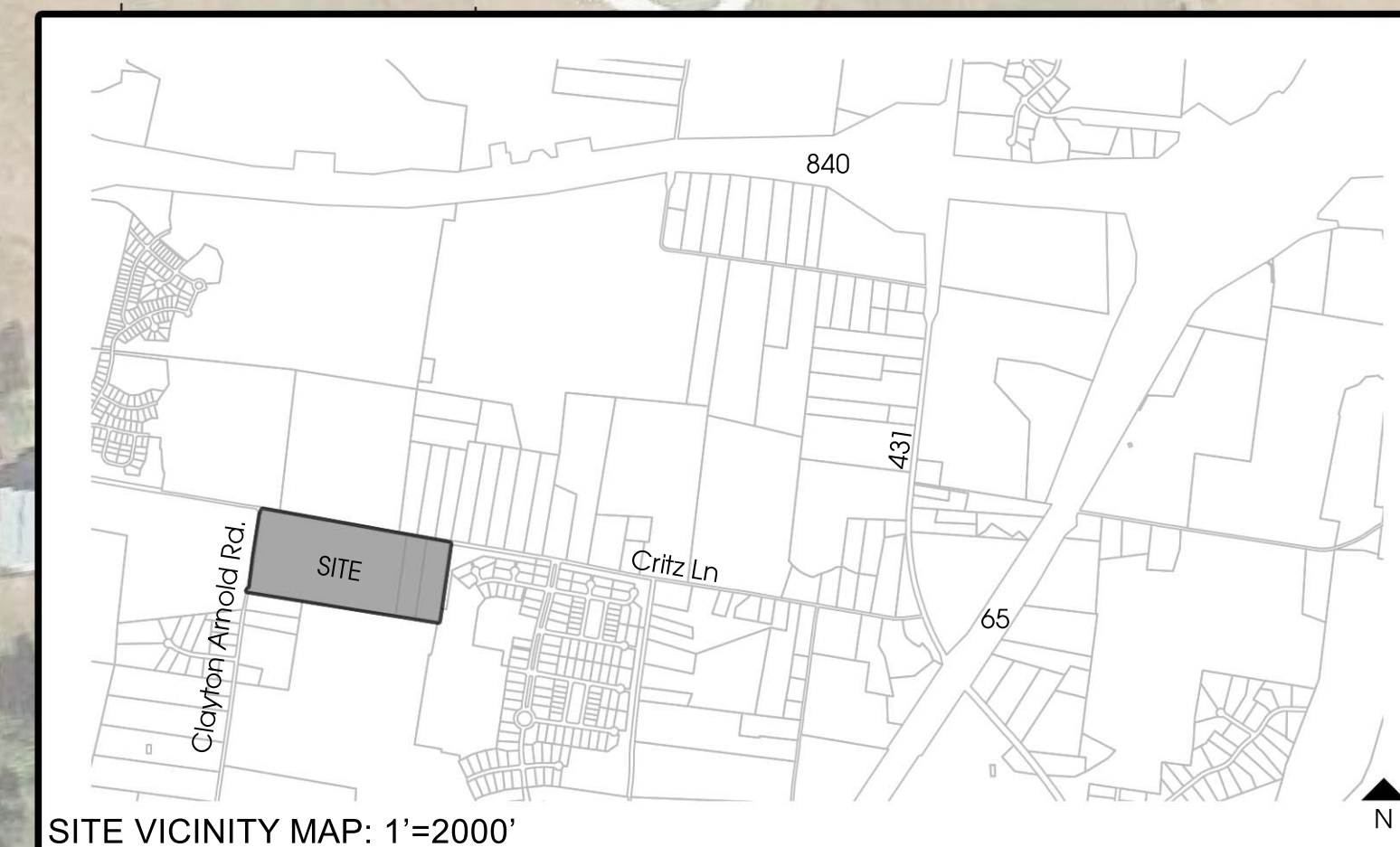


RAGAN • SMITH

Avenue Downs  
Location Map

Figure  
**1**





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 RAGAN-SMITH ASSOCIATES, INC.  
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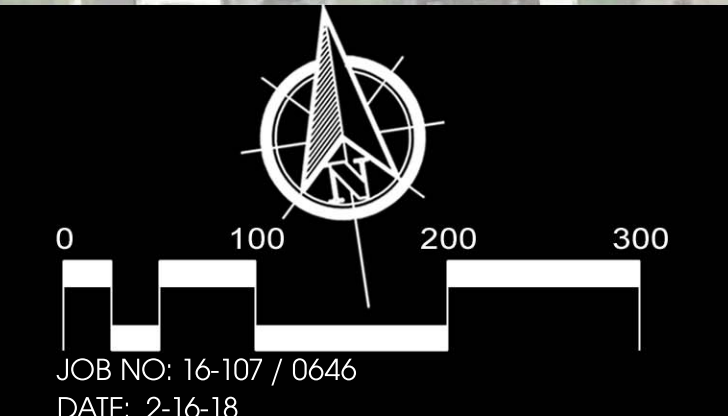
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- Water service to the project will be provided by the HB&TS Utility District via a connection to the existing 12" line in the easterly margin of Clayton Arnold Road. Existing HB&TS water system flows and pressures are assumed to adequately serve the proposed 69 single family lots. Design and subsequent approvals of the water system necessary to serve the project will be the responsibility of HB&TS.
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- A proposed phasing plan has been shown based upon the most logical and economical sequence of construction for the amended project.



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# Avenue Downs

Development Concept Presentation



JOB NO: 16-107 / 0646  
 DATE: 2-16-18



### III. EXISTING CONDITIONS

#### A. Transportation System

The existing transportation system in the area that provides access to Avenue Downs consists of collector and local roadways. The following roadways will comprise the study area for consideration of traffic mitigation measures at Avenue Downs.

- **Critz Lane** is listed as a collector roadway in the General Plan for Thompson's Station. Critz Lane is a two-lane roadway that connects Columbia Pike and Lewisburg Pike with a total length of approximately 2.6 miles. The posted speed limit on Critz Lane is 40 mph.
- **Clayton Arnold Road** is listed as a collector roadway in the General Plan for Thompson's Station. Clayton Arnold Road is a two-lane roadway that connects Critz Lane and Thompson's Station Road with a total length of approximately 1.3 miles. The posted speed limit on Clayton Arnold Road is 35 mph.

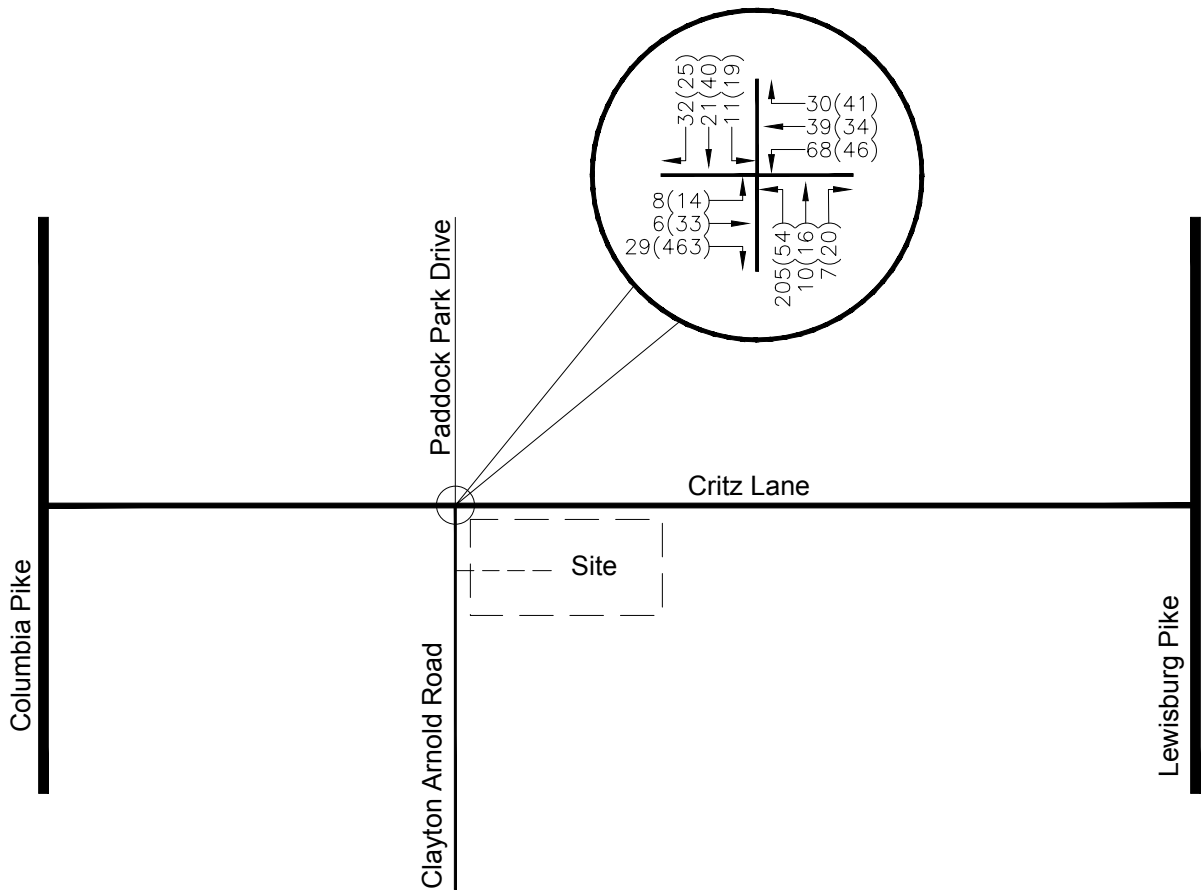
The Town of Thompson's Station is currently preparing a project to improve Critz Lane between Columbia Pike and Lewisburg Pike including widening Critz Lane to provide 11' travel lanes and 4' shoulders, constructing roundabout intersections at Clayton Arnold Road and Pantall Road, constructing turn lanes at other appropriate intersections, and correcting vertical alignment deficiencies. Survey work for this project was initiated in the fall of 2016 and a preliminary set of construction plans was provided by the Town in November 2017. The current construction schedule is not known for this project but previously the Town did anticipate bidding the project and awarding a contract in 2018. Based on the work that is underway and the previously available schedules for this project, it is anticipated that the Critz Lane improvements will be complete prior to the horizon year of this study.

#### B. Traffic Volumes

In order to assess the adequacy of the local transportation system, an evaluation of the current operational quality of intersections within the study area was required.

The peak hour of the adjacent street traffic was used to evaluate the traffic operations for Avenue Downs. In order to identify the peak periods for analysis, traffic counts were conducted in December 2017 at the intersection of Critz Lane at Clayton Arnold Road. The peak hours for analysis are 6:30 – 7:30 a.m. and 4:30 – 5:30 p.m.

Figure 3 shows the existing peak hour traffic volumes for the intersections in the study area.



Peak Hours  
AM (PM)



Avenue Downs  
2017 Existing Traffic Volumes

Figure  
**3**

**IV. FORECASTED BACKGROUND TRAFFIC**

A. Introduction

Before any impacts to the study area can be addressed, some estimate of background traffic volumes for the horizon year 2021 must be established. Background traffic volumes were established by segregating potential growth into two categories:

- Specific development traffic growth within the immediate study area
- Growth due to small scale development and/or general population growth

B. Specific Development Growth

Traffic growth from the three (3) specific developments described below was included in the background traffic forecasts for the analysis of this report.

- The Fields at Canterbury – The existing approved portions of The Fields at Canterbury include approximately 90 single family homes and 54 townhomes that are not yet constructed or occupied. Site traffic from these units has been included in the background traffic growth forecast of this report.
- Thompson's Station Elementary and Middle Schools – Williamson County Schools is currently constructing a new campus on Clayton Arnold Road south of Critz Lane that will include a new Elementary School and a new Middle School, each with a capacity of 800 students. While it is unlikely that both schools will have arrival or dismissal times coinciding with the peak hour of the adjacent streets, the analysis of this report conservatively applies trips for both schools to the peak hour analysis.
- Proposed Additions to The Fields at Canterbury – The proposed additions to The Fields at Canterbury are proposed, but not yet approved, for east of the existing sections of The Fields at Canterbury. The proposed additions to The Fields at Canterbury will consist of 179 single family homes and 141 townhomes. Due to the proximity of The Fields at Canterbury to Avenue Downs, site traffic from the proposed additions has been included in the background traffic growth forecast of this report.

Trip generation for the specific background developments is shown in Table 1. The trip distribution for these background developments is shown in the appendix of this report.

TABLE 1							
TRIP GENERATION: BACKGROUND SPECIFIC DEVELOPMENTS							
Land Use and Total Units	Daily Trips	A.M. Peak Hour			P.M. Peak Hour		
		Enter	Exit	Total	Enter	Exit	Total
The Fields at Canterbury Approved but not Constructed Units (90 Single Family and 54 Townhomes)	1,311	23	73	96	79	47	126
Proposed School 1,600 Students	3,216	540	460	1,000	132	140	272
50% of Proposed Additions to The Fields at Canterbury	1,401	24	75	99	81	48	129
<b>TOTAL</b>	<b>5,928</b>	<b>587</b>	<b>608</b>	<b>1,195</b>	<b>292</b>	<b>235</b>	<b>527</b>

C. Annual Growth

To establish traffic growth due to population growth or small scale development, TDOT historical traffic count data was obtained at locations within the general project vicinity. The TDOT historical traffic count data includes traffic volume counts conducted annually on Columbia Pike beginning in 1985. The available historical count data was tabulated and analyzed to identify patterns or growth trends.

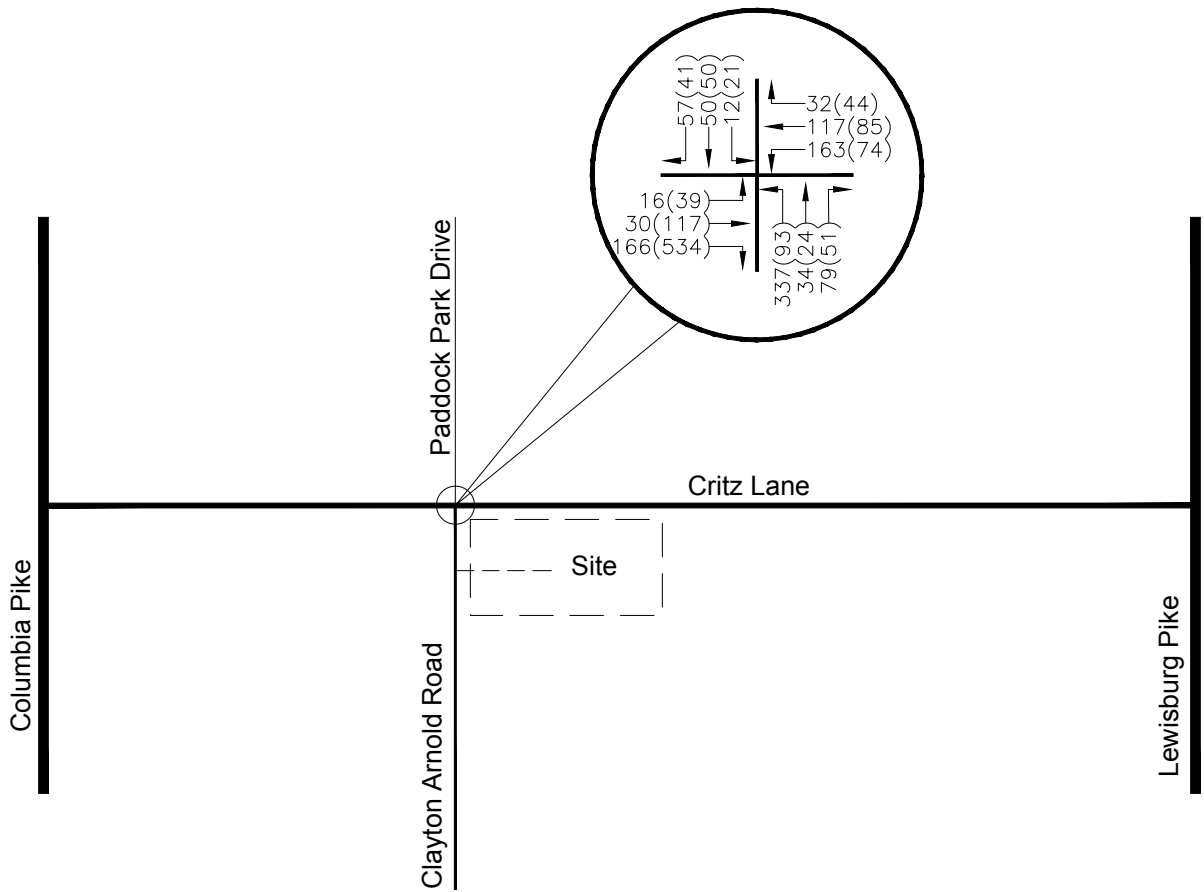
Based upon linear regression analysis of this data, we will use a **2 percent annual growth rate** as the base growth for the existing traffic volumes. This annual growth rate is consistent with the Comprehensive Traffic Impact Study prepared by RPM Transportation Consultants, LLC for the Town of Thompson's Station.

D. Background Traffic

Background traffic for the future traffic forecasts was compiled based on the following:

- 2017 existing traffic data
- Specific development expected traffic volumes
  - The Fields at Canterbury – approved but not yet constructed units
  - Thompson's Station Elementary and Middle Schools
  - Proposed Additions to The Fields at Canterbury
- 2% annual increase of traffic volumes for the period from 2017 to 2021

Background traffic volumes on the future roadway, representing existing traffic volumes plus background growth, for the year 2021 are shown in Figure 4.



Peak Hours  
AM (PM)



Avenue Downs  
2021 Background Traffic Volumes

Figure  
4



**V. PROPOSED SITE TRAFFIC**

**A. Site Trip Generation**

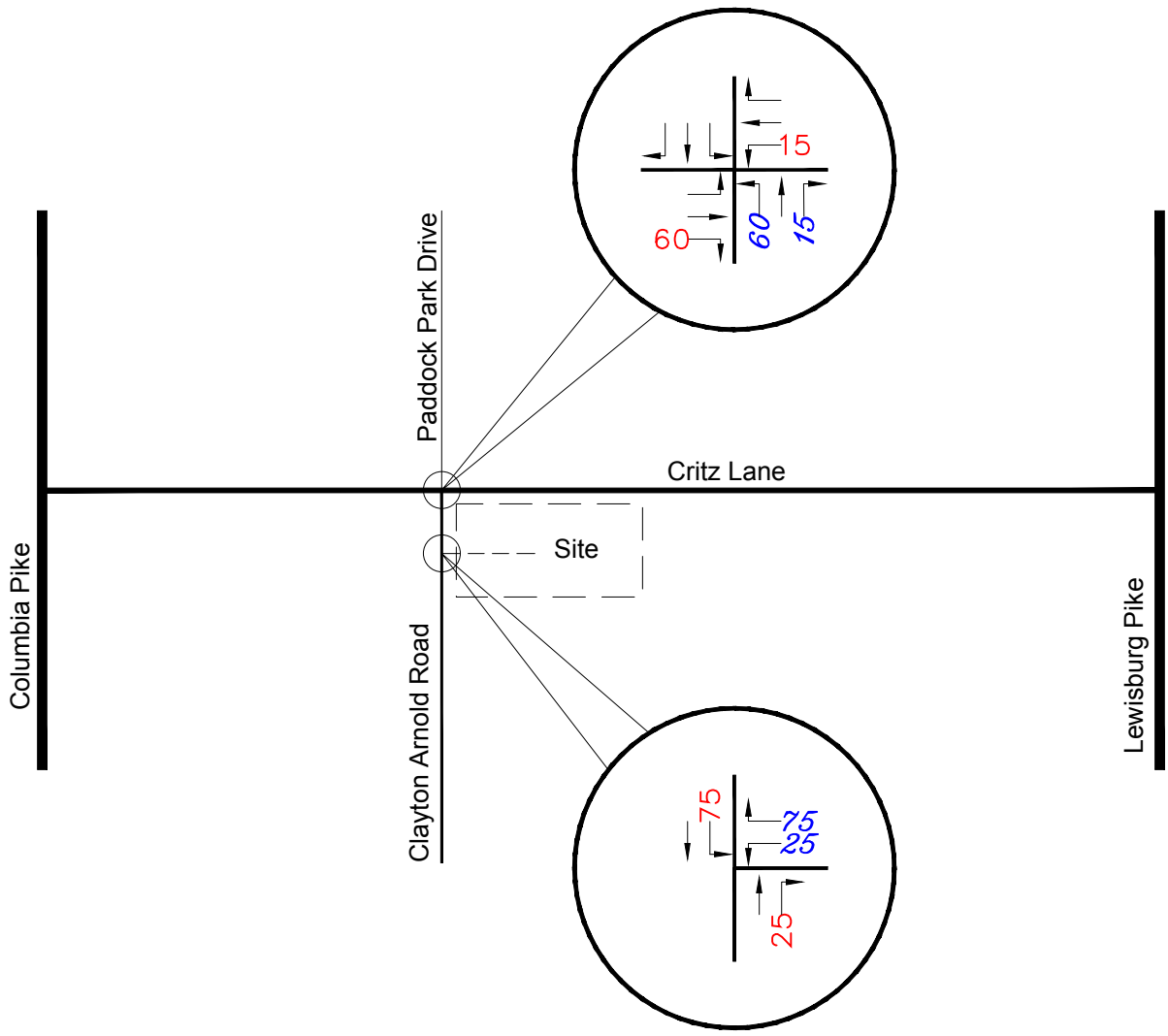
In order to quantify site-related impacts within the study area, some estimates of site trip generation and traffic assignment had to be established. Trip generation rates for the development were established using information for the weekday a.m. and p.m. peak hour of the adjacent street as shown in the *Trip Generation Manual, 10<sup>th</sup> Edition* published by the Institute of Transportation Engineers (ITE). For this study, horizon year 2021 will include the completion of Avenue Downs. Trip generation for Avenue Downs is shown in Table 2.

TABLE 2								
TRIP GENERATION: AVENUE DOWNS								
Land Use	Total Units	Daily Trips	A.M. Peak Hour			P.M. Peak Hour		
			Enter	Exit	Total	Enter	Exit	Total
Single Family Homes	69 units	739	14	40	54	45	26	71

**B. Site Trip Distribution and Assignment**

Site trips were distributed based primarily upon the prevalent commuter patterns in the area and the proximity and routes to major transportation facilities. Figure 5 shows the distribution of the residential trips for Avenue Downs on the adjacent roadway.

Site traffic volumes generated by Avenue Downs in the horizon year 2021 are shown in Figure 6. The accumulation of existing, background growth, and site-generated traffic for the horizon year 2021 is shown in Figure 7.

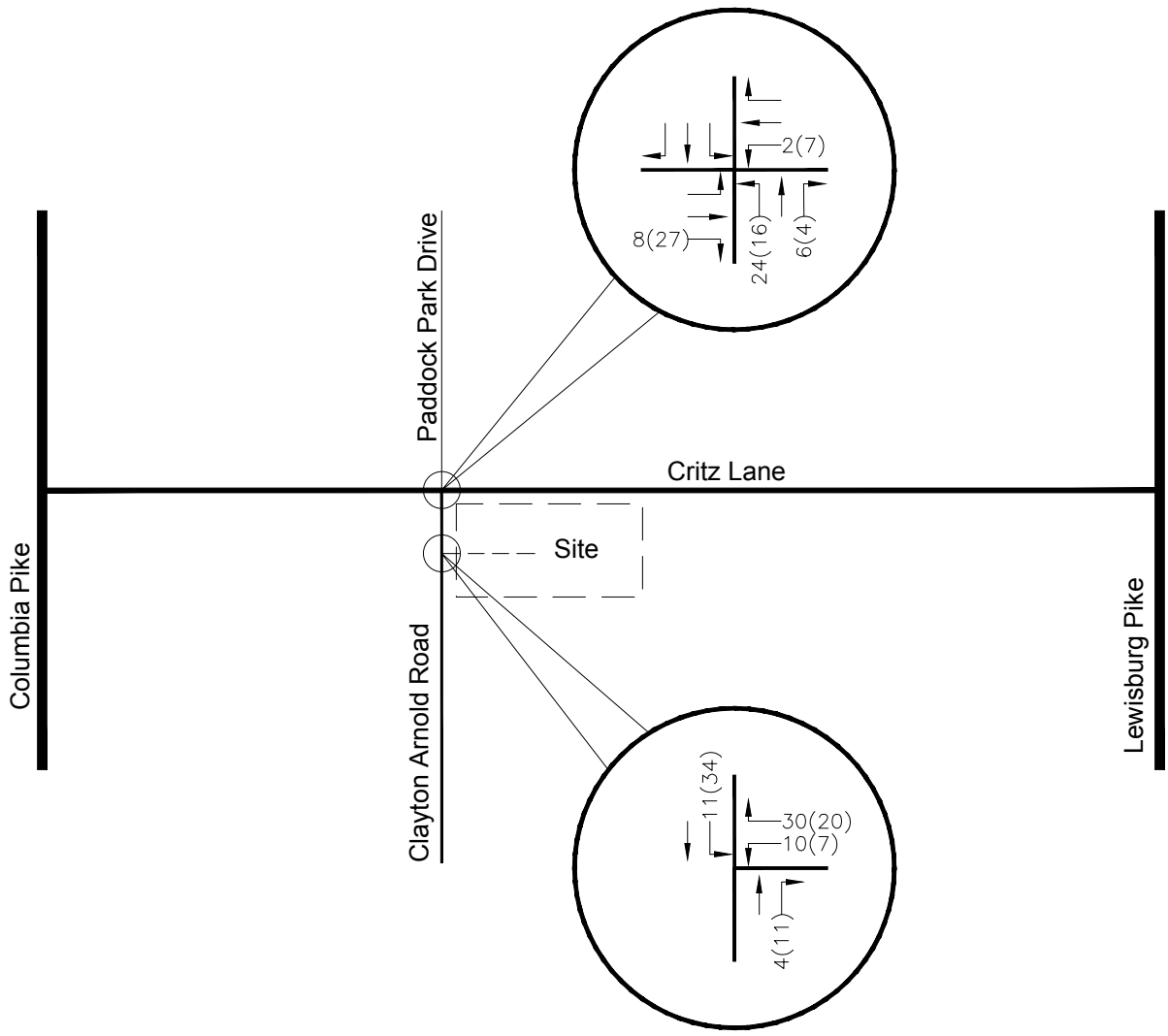


XX INBOUND  
XX OUTBOUND



Avenue Downs  
Site Trip Distribution

Figure  
**5**

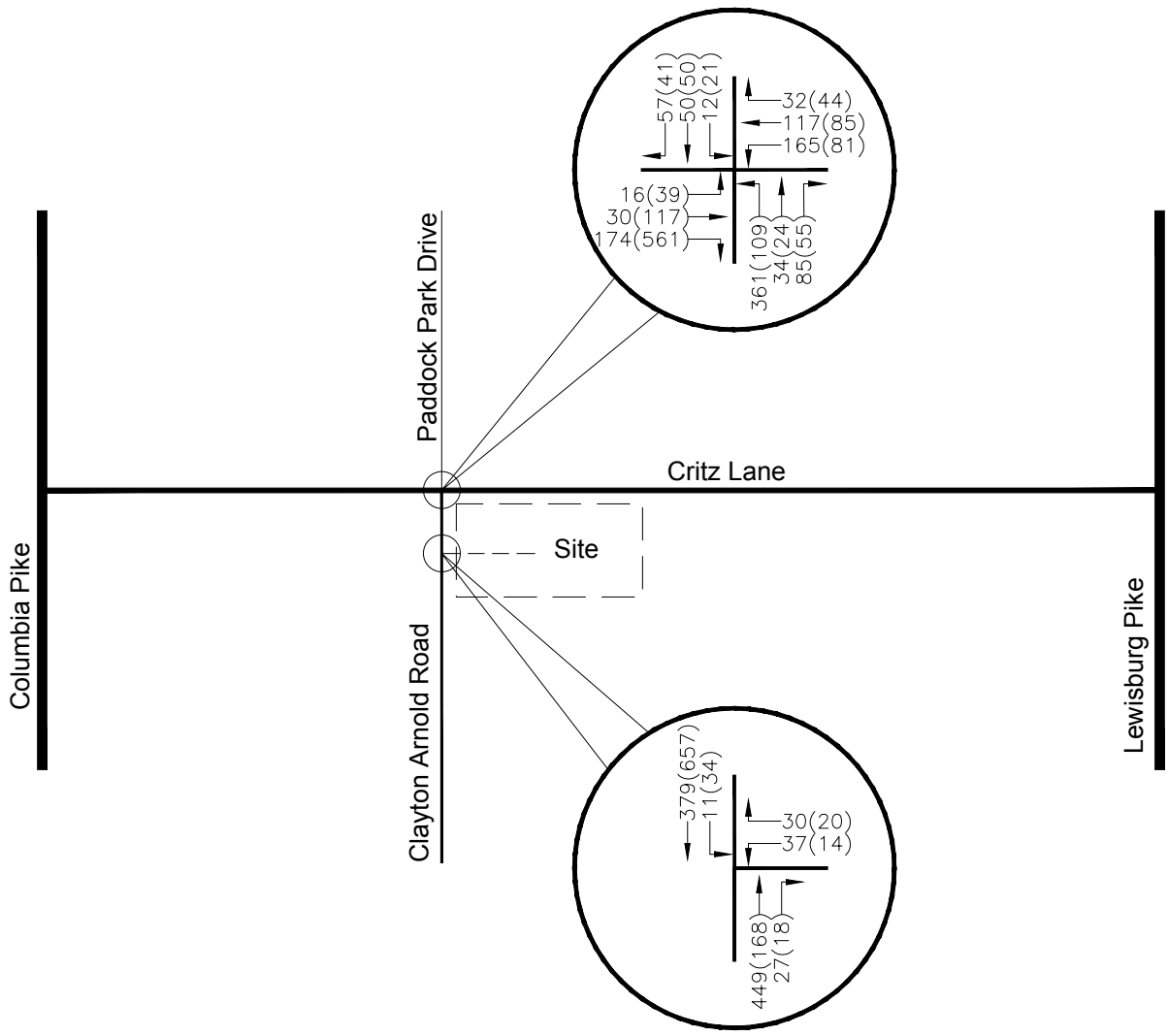


Peak Hours  
AM (PM)



Avenue Downs  
Site Traffic Volumes

Figure  
**6**



Peak Hours  
AM (PM)



Avenue Downs  
2021 Total Traffic Volumes

Figure  
**7**

**VI. TRANSPORTATION ANALYSIS**

**A. Intersection Capacity Analysis**

In order to determine the quality of existing traffic operations and identify capacity deficiencies, intersection capacity analyses were conducted at the following intersections.

- Critz Lane at Clayton Arnold Road
- Clayton Arnold Road at Proposed Access

Capacity analyses were conducted according to the methodology and procedures outlined in the *Highway Capacity Manual*, HCM 2010, published by Transportation Research Board. Capacity analysis results for the a.m. peak hour are shown in Table 3.

TABLE 3				
INTERSECTION CAPACITY ANALYSIS RESULTS – A.M. PEAK HOUR				
Intersection	Condition <sup>(1)</sup>	Level of Service (avg. delay/vehicle – sec.)		
		2017 Existing	2021 Background	2021 Total
Critz Lane at Clayton Arnold Road	EB Left	A (7.4)	-	-
	WB Left	A (7.4)	-	-
	TWSC NB	C (16.3)	-	-
	TWSC SB	B (10.4)	-	-
	Overall Roundabout	-	B (10.8)	B (11.4)
Clayton Arnold Road at Project Access	SB Left	-	-	A (8.5)
	TWSC WB	-	-	C (17.1)
<sup>(1)</sup> TWSC = Two-way Stop Control				

Capacity analysis results for the p.m. peak hour are shown in Table 4.

TABLE 4				
INTERSECTION CAPACITY ANALYSIS RESULTS – P.M. PEAK HOUR				
Intersection	Condition <sup>(1)</sup>	Level of Service (avg. delay/vehicle – sec.)		
		2017 Existing	2021 Background	2021 Total
Critz Lane at Clayton Arnold Road	EB Left	A (7.4)	-	-
	WB Left	A (8.7)	-	-
	TWSC NB	C (15.2)	-	-
	TWSC SB	C (15.3)	-	-
	Overall Roundabout	-	B (14.7)	C (16.5)
Clayton Arnold Road at Project Access	SB Left	-	-	A (7.7)
	TWSC WB	-	-	B (13.8)
<sup>(1)</sup> TWSC = Two-way Stop Control				

Level of service (LOS) criteria for unsignalized intersections is shown in Table 5.

TABLE 5		
LEVEL OF SERVICE DESCRIPTIONS FOR UNSIGNALIZED INTERSECTIONS		
Level of Service	Description	Control Delay (sec. /veh.)
A	Usually no conflicting traffic	0 - 10
B	Occasionally some delay due to conflicting traffic	> 10 - 15
C	Delay is noticeable but not inconveniencing	> 15 - 25
D	Delay is noticeable and irritating, increased risk taking	> 25 - 35
E	Delay approaches tolerance level, risk taking likely	> 35 - 50
F	Delay exceeds tolerance level, high likelihood of risk taking	> 50
Source: <u>Highway Capacity Manual</u> , HCM 2010		

**B. Analysis Impact Thresholds**

The Town of Thompson's Station has developed traffic impact thresholds for this project to determine the quality of future traffic operations and identify capacity deficiencies. The following thresholds indicate unsatisfactory conditions that would require mitigation:

- Overall intersections or intersection approaches operating at or below LOS E.
- Individual turning movements operating at LOS F.
- 95<sup>th</sup> percentile turn lane queues exceeding the available storage length.
- 95<sup>th</sup> percentile thru movement queues stretching back far enough to block an adjacent intersection or major driveway.

After conducting the capacity analysis, the intersections and individual turning movements are expected to operate at acceptable level of service based on the guidelines presented above and the queue lengths are not expected to exceed the storage length provided.

**C. Turn Lane Warrants**

The National Cooperative Highway Research Program (NCHRP) Report 457 provides guidance for evaluating intersection improvements at unsignalized intersections. Specific volume-based warrants have been checked to evaluate the need for right turn and left turn deceleration and storage lanes.

Table 6 below details pertinent right turn lane warrant information for applicable intersections in the study area.

TABLE 6					
RIGHT TURN LANE WARRANT ANALYSIS					
Location	Peak Hour	Speed	Major-Road Volume	Right-Turn Volume	Right-Turn Bay Warranted
Clayton Arnold Road (NB) at Project Access	A.M.	30	476	27	No
	P.M.		186	18	No



Table 7 below details pertinent left turn lane warrant information for applicable intersections in the study area.

TABLE 7						
LEFT TURN LANE WARRANT ANALYSIS						
Location	Peak Hour	Speed	Opposing Volume	Advancing Volume	L%	Left-Turn Bay Warranted
Clayton Arnold Road (SB) at Project Access	A.M.	30	476	390	3	No
	P.M.		186	691	5	No

D. Safety Analysis

A summary of historic crash data on Critz Lane between Columbia Pike and Lewisburg Pike for the period between 2010 and 2017 is shown below in Table 11.

TABLE 8					
HISTORIC CRASH SUMMARY					
Year	Crash Type				Total Crashes
	Fatal	Incapacitating Injury	Other Injury	Property Damage	
2010	0	0	0	1	1
2011	0	0	2	1	3
2012	0	0	3	1	4
2013	0	1	2	7	10
2014	0	0	1	3	4
2015	0	0	1	7	8
2016	0	0	2	3	5
2017	1	0	2	5	8

Source: TDOT Enhanced Tennessee Roadway Information Management System (E-TRIMS)

Even though there are not sufficient historical traffic counts available on Critz Lane to determine average crash rates and make comparisons to regional or statewide averages, the Highway Safety Manual and Crash Modification Factors Clearinghouse indicated that the planned improvements to Critz Lane can improve safety as described below.

- The crash reduction factor for increasing the lane width is 28 percent. The lane width on Critz Lane is being increased to 11 feet.
- The reduction factor for property damage crashes when providing a new shoulder that is 4 feet wide is 19 percent. The Critz Lane improvements will provide a shoulder with a width of 4 feet.
- The reduction factor for all crash types is 25 percent and the reduction factor for injury and fatal crashes is 35% when replacing a two-way stop intersection with a roundabout. On Critz Lane, the two-way stop intersections at Clayton Arnold Road / Paddock Park Drive and at Pantall Road will be replaced with roundabouts.

## VII. CONCLUSIONS AND RECOMMENDATIONS

### A. Introduction

Based upon a review of the existing and future proposed conditions within the study area, recommendations have been developed to provide efficient ingress and egress for Avenue Downs while managing the impact to non-site trips on the roadway network. Additionally, recommendations for offsite intersections have also been provided to confirm improvement plans underway by others or to provide specific improvements that will mitigate a development impact.

### B. Critz Lane at Clayton Arnold Road

The Critz Lane improvements proposed by the Town of Thompson's Station include a single lane roundabout at this intersection with one lane entrances and exits on all four approaches. The roundabout layout provided by the Town appears to incorporate many of the accepted methods of modern roundabout design.

Traffic operations in the horizon year 2021 for total traffic conditions at the intersection of Critz Lane at Clayton Arnold Road are expected to be characterized by level of service D during the a.m. peak hour and level of service B in the p.m. peak hour.

The following improvements are recommended at the intersection of Critz Lane at Clayton Arnold Road:

- The Town of Thompson's Station's proposal to construct a roundabout at this intersection is appropriate based on the operational and safety advantages that a roundabout will have over two-way stop control at this location.
- The improvements proposed to be constructed as part of the Town of Thompson's Station's Critz Lane project will continue to be appropriate after development of Avenue Downs.

### C. Clayton Arnold Road at Proposed Access

Traffic operations in the horizon year 2021 for total traffic conditions at the unsignalized intersection of Critz Lane at the proposed access is expected to be characterized by level of service C during the a.m. peak hour and level of service B during the p.m. peak hour.

Right turn and left turn lane warrants were conducted at the intersection of Critz Lane at the proposed access. It was concluded that turn lanes are not warranted at this intersection based on the forecasted traffic volumes.

The following improvements are recommended at the intersection of Critz Lane at the proposed access:

- The Proposed Access should consist of one lane in each direction with pavement widths in compliance with the appropriate roadway section shown in the Town's Land Development Ordinance.
- Proposed grading, landscaping, and development monumentation or signage should be designed so that AASHTO intersection sight distance is not obstructed for the proposed access.

## **APPENDIX**

- A. TRAFFIC COUNT DATA**
- B. TRIP GENERATION & FUTURE TRAFFIC DERIVATION**
- C. 2017 EXISTING CONDITIONS CAPACITY ANALYSIS WORKSHEETS**
- D. 2021 BACKGROUND CONDITIONS CAPACITY ANALYSIS WORKSHEETS**
- E. 2021 TOTAL CONDITIONS CAPACITY ANALYSIS WORKSHEETS**

**APPENDIX A**

**TRAFFIC COUNT DATA**







Date: 13-Dec-17  
 Location: Critz Lane at Clayton Arnold Road / Paddock

A.M. Peak Hour (6:00 - 9:00)

Time	Clayton Arnold Road			Paddock Park Drive			Critz Lane			Critz Lane		
	NB Left	NB Thru	NB Right	SB Left	SB Thru	SB Right	EB Left	EB Thru	EB Right	WB Left	WB Thru	WB Right
6:30 - 6:45	55	1	1	0	1	6	2	2	3	14	7	3
6:45 - 7:00	47	0	0	1	6	13	1	1	7	15	13	11
7:00 - 7:15	56	2	5	2	12	9	1	2	7	26	13	6
7:15 - 7:30	47	7	1	8	2	4	4	1	12	13	6	10
<b>6:30 - 7:30</b>	<b>205</b>	<b>10</b>	<b>7</b>	<b>11</b>	<b>21</b>	<b>32</b>	<b>8</b>	<b>6</b>	<b>29</b>	<b>68</b>	<b>39</b>	<b>30</b>

Peak Hour Factor: 0.826

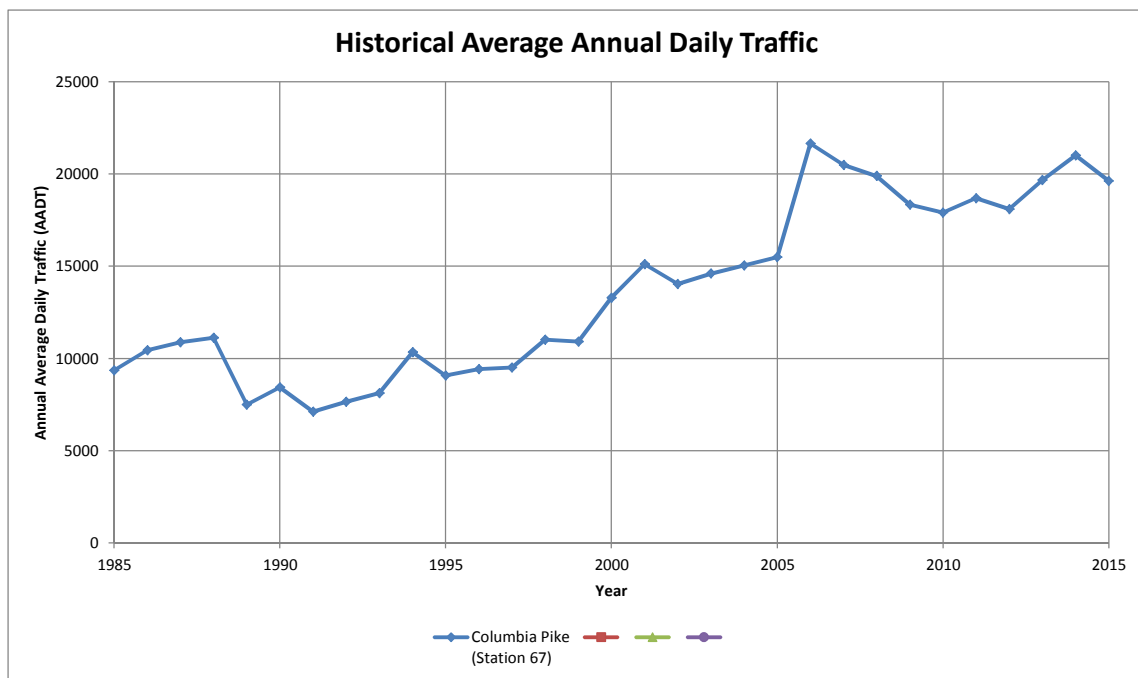
P.M. Peak Hour (4:00 - 7:00)

Time	Clayton Arnold Road			Paddock Park Drive			Critz Lane			Critz Lane		
	NB Left	NB Thru	NB Right	SB Left	SB Thru	SB Right	EB Left	EB Thru	EB Right	WB Left	WB Thru	WB Right
16:30 - 16:45	13	2	2	1	12	11	1	5	121	16	7	11
16:45 - 17:00	16	6	3	4	8	3	5	7	108	9	6	8
17:00 - 17:15	16	7	9	8	9	7	3	14	114	9	17	6
17:15 - 17:30	9	1	6	6	11	4	5	7	120	12	4	16
<b>16:30 - 17:30</b>	<b>54</b>	<b>16</b>	<b>20</b>	<b>19</b>	<b>40</b>	<b>25</b>	<b>14</b>	<b>33</b>	<b>463</b>	<b>46</b>	<b>34</b>	<b>41</b>

Peak Hour Factor: 0.919



HISTORICAL TRAFFIC COUNT DATA				
Year	Columbia Pike (Station 67)			
1985	9342			
1986	10443			
1987	10883			
1988	11127			
1989	7490			
1990	8427			
1991	7117			
1992	7654			
1993	8121			
1994	10337			
1995	9079			
1996	9418			
1997	9499			
1998	11015			
1999	10915			
2000	13289			
2001	15108			
2002	14037			
2003	14599			
2004	15037			
2005	15488			
2006	21645			
2007	20488			
2008	19891			
2009	18342			
2010	17900			
2011	18685			
2012	18101			
2013	19666			
2014	21013			
2015	19620			
2016	19816			



		Columbia Pike (Station 67)	-	-	-
Analysis Period	Begin	2011	2008	-	-
	End	2016	2015	-	-
	Future Year	2021	2017	-	-
Forecasted Traffic Volume		21960	-	-	-
Annual Growth Rate		2.08%	-	-	-
Growth Factor		1.108	-	-	-

## **APPENDIX B**

# **TRIP GENERATION & FUTURE TRAFFIC DERIVATION**

TRAFFIC VOLUME WORKSHEET  
 SPECIFIC NON-SITE TRIP GENERATION &  
 PROPOSED DEVELOPMENT TRIP GENERATION



SPECIFIC NON-SITE DEVELOPMENT TRIP GENERATION							
Development	Daily	A.M. Peak Hour			P.M. Peak Hour		
		Enter	Exit	Total	Enter	Exit	Total
Remaining Canterbury (Phase 12B, 12C, 13: 90 SF, 54 TH)	1,311	23	73	96	79	47	126
K-8 Proposed School on Clayton Arnold (1,600 Students)	3,216	540	460	1,000	132	140	272
Proposed Canterbury (50%)	1,401	24	75	99	81	48	129
				0			0
<b>TOTAL</b>	<b>5,928</b>	<b>587</b>	<b>608</b>	<b>1,195</b>	<b>292</b>	<b>235</b>	<b>527</b>

AVENUE DOWNS TRIP GENERATION 2021 HORIZON YEAR							
Development	Daily	A.M. Peak Hour			P.M. Peak Hour		
		Enter	Exit	Total	Enter	Exit	Total
Avenue Downs (69 Single Family)	739	14	40	54	45	26	71
<b>TOTAL</b>	<b>739</b>	<b>14</b>	<b>40</b>	<b>54</b>	<b>45</b>	<b>26</b>	<b>71</b>

## TRIP GENERATION - 10th EDITION - REMAINING CANTERBURY

### Single-Family Detached Housing - 90 Dwelling Units

Use ITE Land Use Code 210 (Single-Family Detached Housing) and associated trip generation rates for 24-hour total trips and peak hour trips.

#### Average Daily Traffic

$$\ln(T) = 0.92 \ln(X) + 2.71$$

$$\ln(T) = 0.92 \ln(90) + 2.71$$

$$T = 944$$

#### A.M. Peak Hour of Adjacent Street Traffic

$$T = 0.71(X) + 4.8$$

$$T = 0.71(90) + 4.8$$

$$T = 69$$

$$\text{Enter} = 0.25(69) = 17$$

$$\text{Exit} = 0.75(69) = 52$$

#### P.M. Peak Hour of Adjacent Street Traffic

$$\ln(T) = 0.96 \ln(X) + 0.20$$

$$\ln(T) = 0.96 \ln(90) + 0.20$$

$$T = 92$$

$$\text{Enter} = 0.63(92) = 58$$

$$\text{Exit} = 0.37(92) = 34$$

## TRIP GENERATION - 10th EDITION - REMAINING CANTERBURY

### Multifamily H 54 Dwelling Units

Low-rise multifamily housing includes apartments, townhouses, and condominiums located within the same building with at least three other dwelling units and that have one or two levels.

#### Average Daily Traffic

$$T = 7.56(X) - 40.86$$

$$T = 7.56(54) - 40.86$$

$$T = 367$$

#### A.M. Peak Hour of Adjacent Street Traffic

$$\ln(T) = 0.95 \ln(X) - 0.51$$

$$\ln(T) = 0.95 \ln(54) - 0.51$$

$$T = 27$$

$$\text{Enter} = 0.23(27) = 6$$

$$\text{Exit} = 0.77(27) = 21$$

#### P.M. Peak Hour of Adjacent Street Traffic

$$\ln(T) = 0.89 \ln(X) - 0.02$$

$$\ln(T) = 0.89 \ln(54) - 0.02$$

$$T = 34$$

$$\text{Enter} = 0.63(34) = 21$$

$$\text{Exit} = 0.37(34) = 13$$

## TRIP GENERATION - 10th EDITION

**Elementary School - 800 Students**

Use ITE Land Use Code 520 (Elementary School) and associated trip generation rates for 24-hour total trips and peak hour trips.

### Average Daily Traffic

$$T = 1.89(X)$$

$$T = 1.89(800)$$

$$T = 1512$$

### A.M. Peak Hour

$$T = 0.67(X)$$

$$T = 0.67(800)$$

$$T = 536$$

$$\text{Enter} = 0.54(536) = 289$$

$$\text{Exit} = 0.46(536) = 247$$

### P.M. Peak Hour of Adjacent Street Traffic

$$T = 0.17(X)$$

$$T = 0.17(800)$$

$$T = 136$$

$$\text{Enter} = 0.48(136) = 65$$

$$\text{Exit} = 0.52(136) = 71$$

## TRIP GENERATION - 10th EDITION

**Middle School/Junior High School - 800 Students**

Use ITE Land Use Code 522 (Middle School/Junior High School) and associated trip generation rates for 24-hour total trips and peak hour trips.

### Average Daily Traffic

$$T = 2.13(X)$$

$$T = 2.13(800)$$

$$T = 1704$$

### A.M. Peak Hour

$$T = 0.58(X)$$

$$T = 0.58(800)$$

$$T = 464$$

$$\text{Enter} = 0.54(464) = 251$$

$$\text{Exit} = 0.46(464) = 213$$

### P.M. Peak Hour of Adjacent Street Traffic

$$T = 0.17(X)$$

$$T = 0.17(800)$$

$$T = 136$$

$$\text{Enter} = 0.49(136) = 67$$

$$\text{Exit} = 0.51(136) = 69$$



## TRIP GENERATION - 10th EDITION - AVENUE DOWNS

### Single-Family Detached Housing - 69 Dwelling Units

Use ITE Land Use Code 210 (Single-Family Detached Housing) and associated trip generation rates for 24-hour total trips and peak hour trips.

#### Average Daily Traffic

$$\begin{aligned}\ln(T) &= 0.92 \ln(X) + 2.71 \\ \ln(T) &= 0.92 \ln(69) + 2.71 \\ T &= 739\end{aligned}$$

#### A.M. Peak Hour of Adjacent Street Traffic

$$\begin{aligned}T &= 0.71(X) + 4.8 \\ T &= 0.71(69) + 4.8 \\ T &= 54\end{aligned}$$

$$\begin{aligned}\text{Enter} &= 0.25(54) = 14 \\ \text{Exit} &= 0.75(54) = 40\end{aligned}$$

#### P.M. Peak Hour of Adjacent Street Traffic

$$\begin{aligned}\ln(T) &= 0.96 \ln(X) + 0.20 \\ \ln(T) &= 0.96 \ln(69) + 0.20 \\ T &= 71\end{aligned}$$

$$\begin{aligned}\text{Enter} &= 0.63(71) = 45 \\ \text{Exit} &= 0.37(71) = 26\end{aligned}$$

## TRIP GENERATION - 10th EDITION - PROPOSED CANTERBURY

### Single-Family Detached Housing - 179 Dwelling Units

Use ITE Land Use Code 210 (Single-Family Detached Housing) and associated trip generation rates for 24-hour total trips and peak hour trips.

#### Average Daily Traffic

$$\ln(T) = 0.92 \ln(X) + 2.71$$

$$\ln(T) = 0.92 \ln(179) + 2.71$$

$$T = 1776$$

#### A.M. Peak Hour of Adjacent Street Traffic

$$T = 0.71(X) + 4.8$$

$$T = 0.71(179) + 4.8$$

$$T = 132$$

$$\text{Enter} = 0.25(132) = 33$$

$$\text{Exit} = 0.75(132) = 99$$

#### P.M. Peak Hour of Adjacent Street Traffic

$$\ln(T) = 0.96 \ln(X) + 0.20$$

$$\ln(T) = 0.96 \ln(179) + 0.20$$

$$T = 178$$

$$\text{Enter} = 0.63(178) = 112$$

$$\text{Exit} = 0.37(178) = 66$$

## TRIP GENERATION - 10th EDITION - PROPOSED CANTERBURY

### Multifamily H 141 Dwelling Units

Low-rise multifamily housing includes apartments, townhouses, and condominiums located within the same building with at least three other dwelling units and that have one or two levels.

#### Average Daily Traffic

$$T = 7.56(X) - 40.86$$

$$T = 7.56(141) - 40.86$$

$$T = 1025$$

#### A.M. Peak Hour of Adjacent Street Traffic

$$\ln(T) = 0.95 \ln(X) - 0.51$$

$$\ln(T) = 0.95 \ln(141) - 0.51$$

$$T = 66$$

$$\text{Enter} = 0.23(66) = 15$$

$$\text{Exit} = 0.77(66) = 51$$

#### P.M. Peak Hour of Adjacent Street Traffic

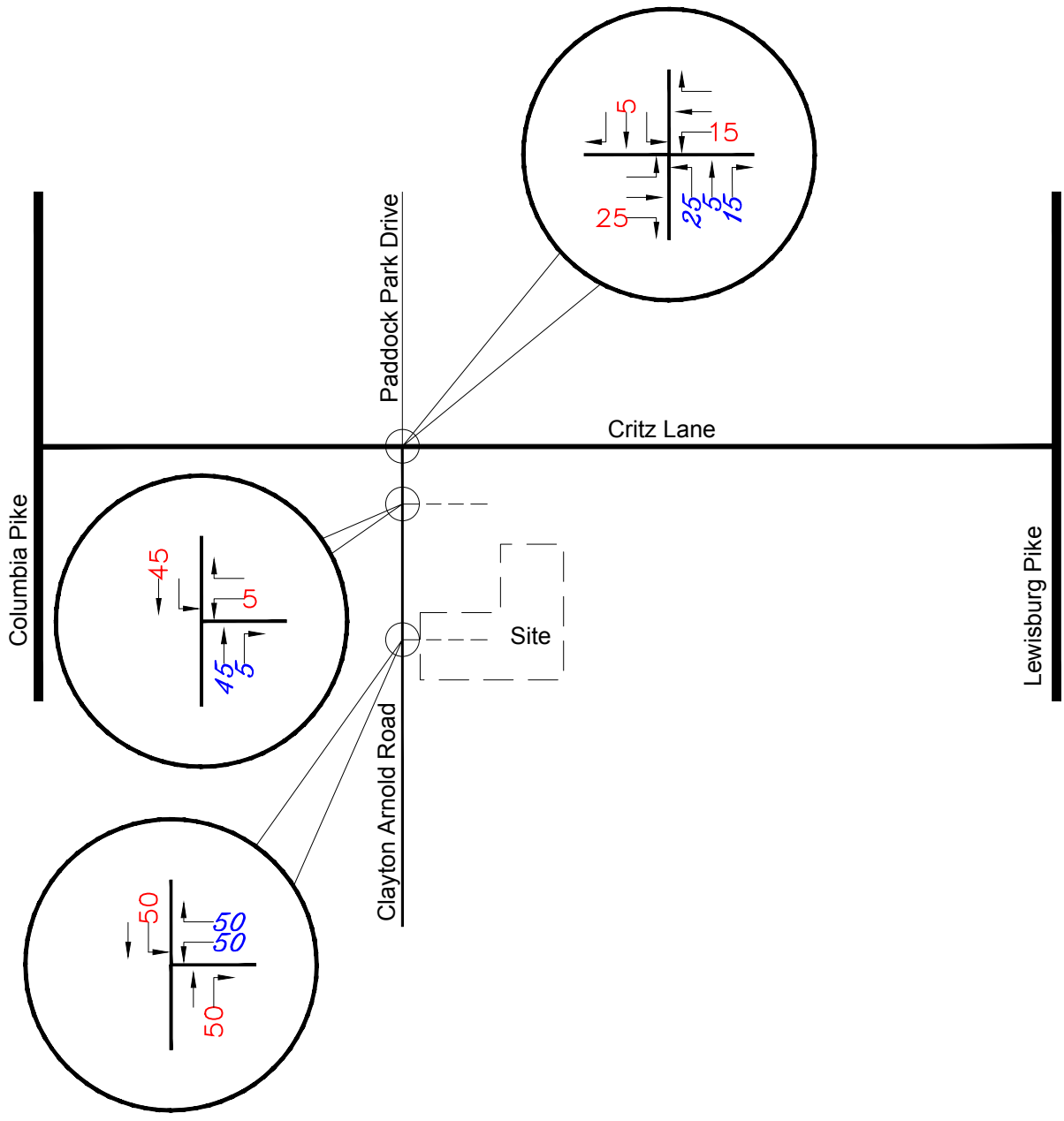
$$\ln(T) = 0.89 \ln(X) - 0.02$$

$$\ln(T) = 0.89 \ln(141) - 0.02$$

$$T = 80$$

$$\text{Enter} = 0.63(80) = 50$$

$$\text{Exit} = 0.37(80) = 30$$

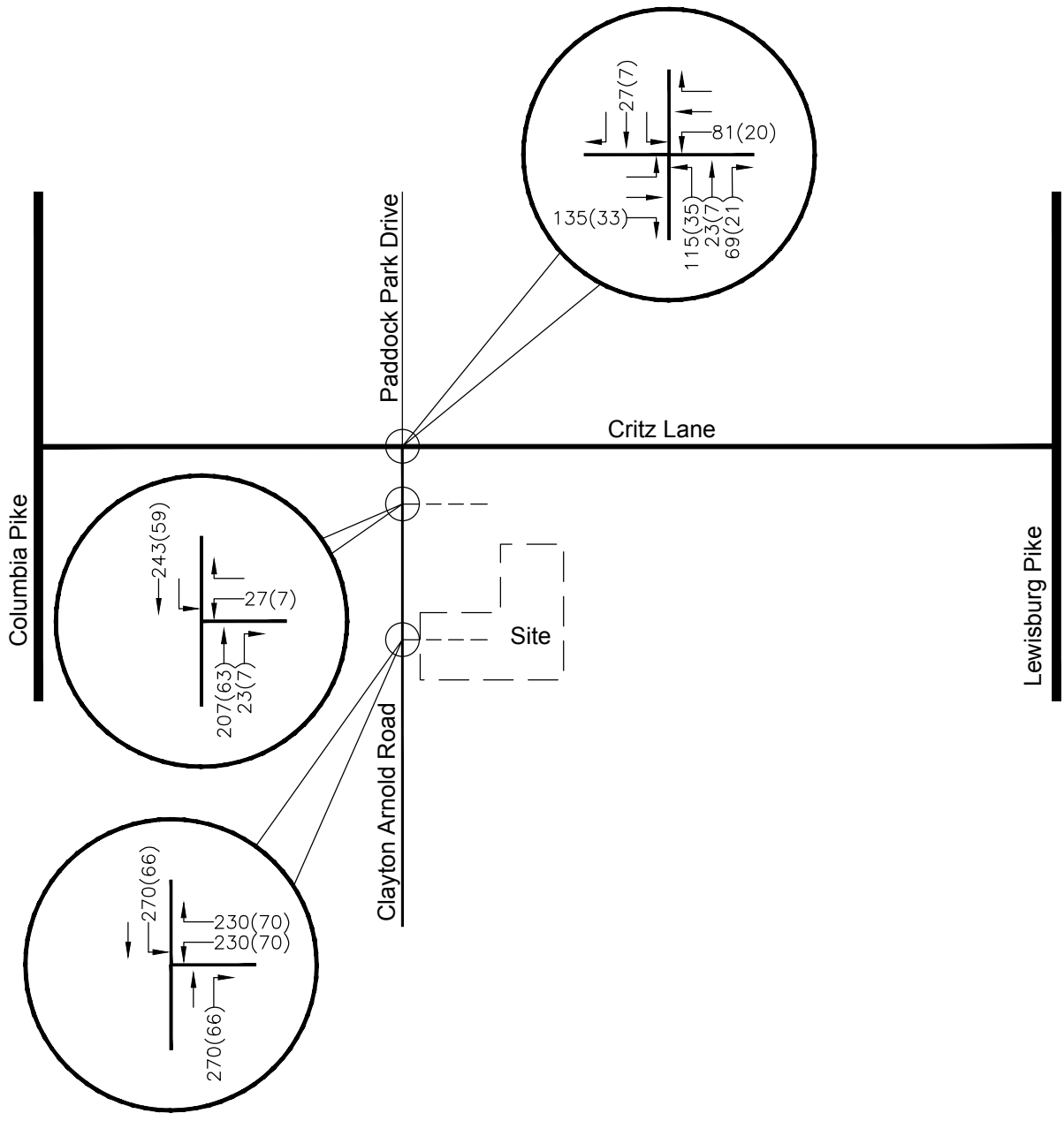


XX INBOUND  
XX OUTBOUND



# Clayton Arnold Road School Trip Distribution

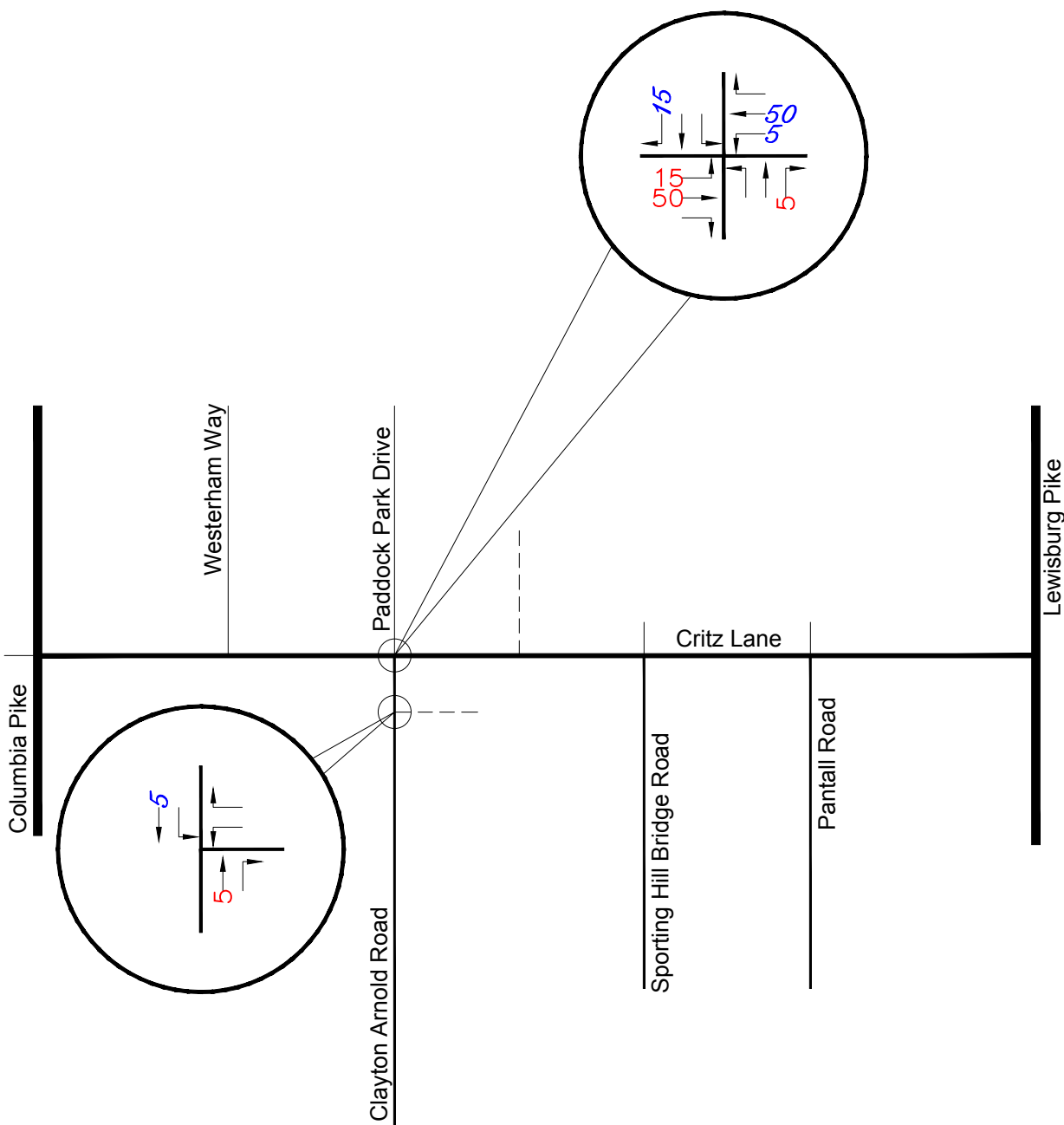




Peak Hours  
AM (PM)

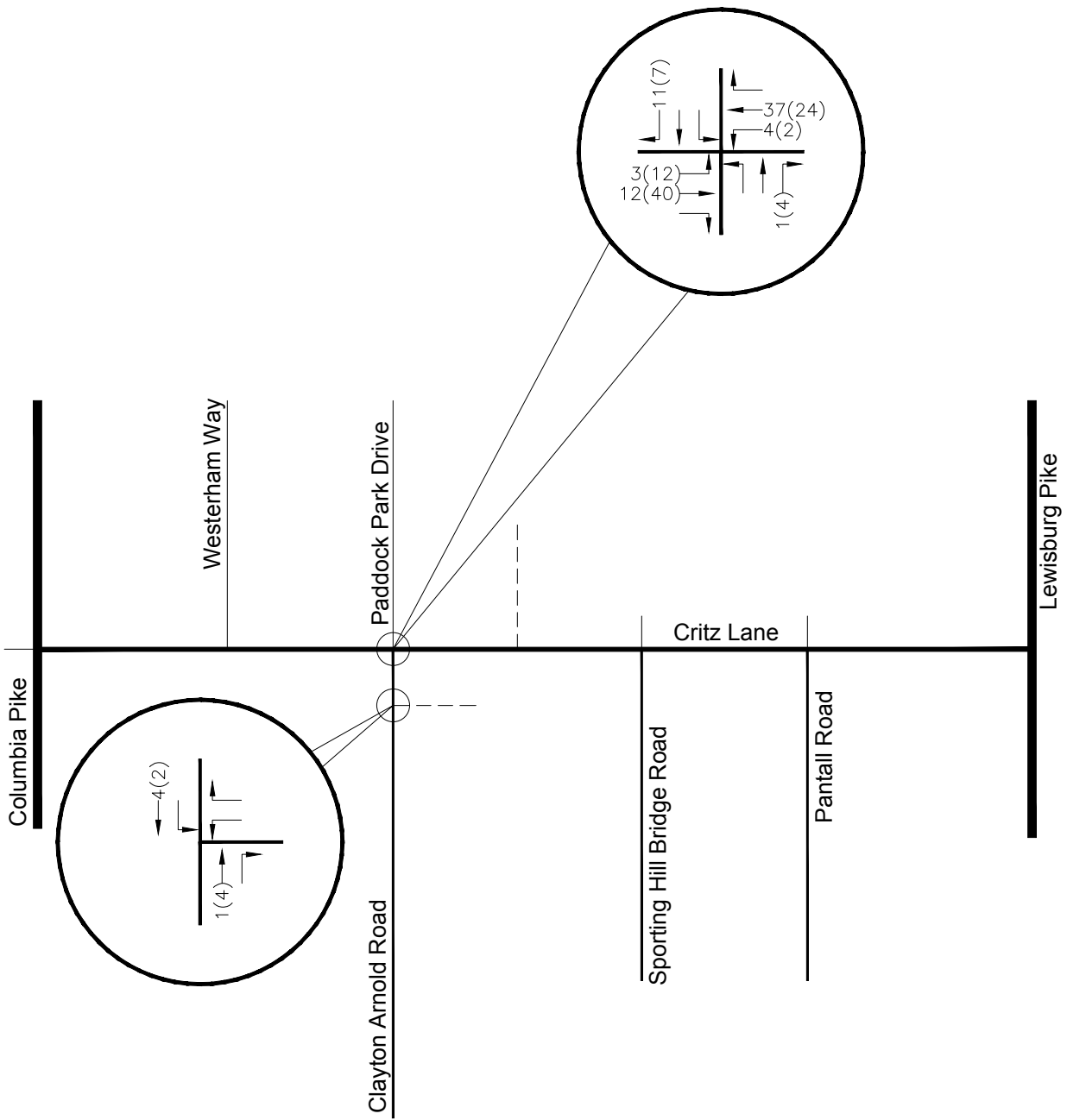


# Clayton Arnold Road School Site Volumes



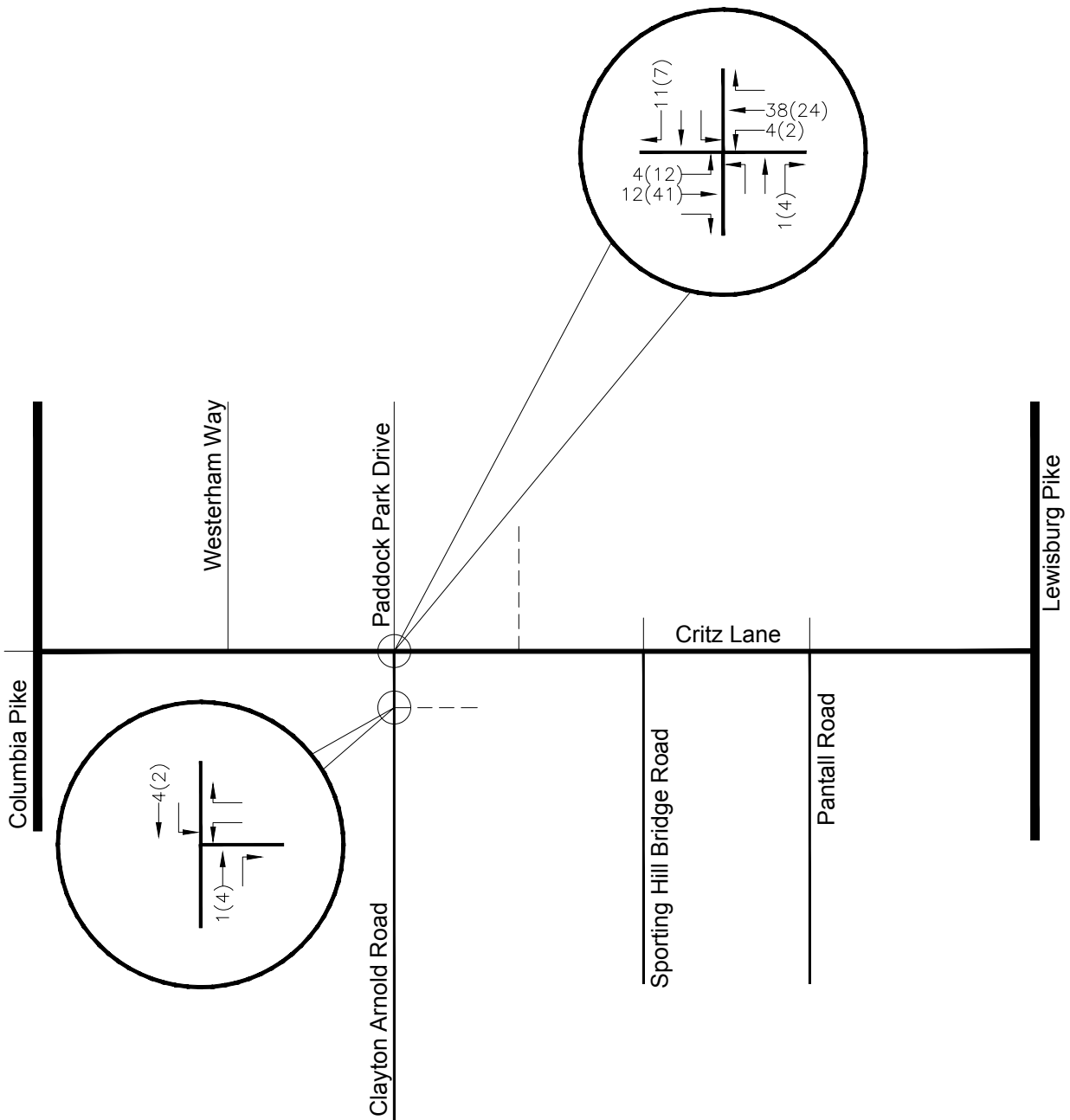
XX INBOUND  
XX OUTBOUND

RAGAN SMITH



Peak Hours  
AM (PM)





Peak Hours  
AM (PM)



Proposed Fields of Canterbury (50%)  
Site Volumes



**TRAFFIC VOLUME WORKSHEET  
CRITZ LANE AT CLAYTON ARNOLD ROAD  
A.M. PEAK HOUR**



Description	Northbound Clayton Arnold Road			Southbound Paddock Park Drive			Eastbound Critz Lane			Westbound Critz Lane		
	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
2017 EXISTING TRAFFIC VOLUMES	205	10	7	11	21	32	8	6	29	68	39	30
2021 BACKGROUND TRAFFIC VOLUMES												
<i>Annual Background Growth</i>												
Growth Rate (%/year)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Growth Factor	1.08	1.08	1.08	1.08	1.08	1.08	1.08	1.08	1.08	1.08	1.08	1.08
Annual Background Growth Trips	17	1	1	1	2	3	1	0	2	6	3	2
<i>Specific Development Background Growth</i>												
Remaining Canterbury (Phase 12B, 12C, 13: 90 SF, 54 TH)			5			15	15	50		5	50	
% In Trips	0	0	1	0	0	11	3	12	0	4	37	0
% Out Trips												
K-8 Proposed School on Clayton Arnold (1,600 Students)	25	5	15	0	27	0	0	0	135	81	0	0
% In Trips	115	23	69	0	27	0	0	0	135	81	0	0
% Out Trips												
Proposed Canterbury (50%)			5			15	15	50		5	50	
% In Trips	0	0	1	0	0	11	4	12	0	4	38	0
% Out Trips												
Specific Development Background Growth Trips	115	23	71	0	27	22	7	24	135	89	75	0
2021 Background Traffic Volumes	337	34	79	12	50	57	16	30	166	163	117	32
2021 SITE TRAFFIC VOLUMES												
Avenue Downs (69 Single Family)	60		15						60	15		
% In Trips	24	0	6	0	0	0	0	0	8	2	0	0
% Out Trips												
2021 Site Traffic Volumes	24	0	6	0	0	0	0	0	8	2	0	0
2021 TOTAL TRAFFIC VOLUMES	361	34	85	12	50	57	16	30	174	165	117	32

**TRAFFIC VOLUME WORKSHEET  
CRITZ LANE AT CLAYTON ARNOLD ROAD  
P.M. PEAK HOUR**



Description	Northbound Clayton Arnold Road			Southbound Paddock Park Drive			Eastbound Critz Lane			Westbound Critz Lane		
	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
2017 EXISTING TRAFFIC VOLUMES	54	16	20	19	40	25	14	33	463	46	34	41
2021 BACKGROUND TRAFFIC VOLUMES												
<i>Annual Background Growth</i>												
Growth Rate (%/year)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Growth Factor	1.08	1.08	1.08	1.08	1.08	1.08	1.08	1.08	1.08	1.08	1.08	1.08
Annual Background Growth Trips	4	1	2	2	3	2	1	3	38	4	3	3
<i>Specific Development Background Growth</i>												
Remaining Canterbury (Phase 12B, 12C, 13: 90 SF, 54 TH)			5			15	15	50		5	50	
% In Trips	0	0	4	0	0	7	12	40	0	2	24	0
% Out Trips												
K-8 Proposed School on Clayton Arnold (1,600 Students)	25	5	15	0	7	0	0	0	33	20	0	0
% In Trips	35	7	21									
% Out Trips												
Proposed Canterbury (50%)			5			15	15	50		5	50	
% In Trips	0	0	4	0	0	7	12	41	0	2	24	0
% Out Trips												
Specific Development Background Growth Trips	35	7	29	0	7	14	24	81	33	24	48	0
2021 Background Traffic Volumes	93	24	51	21	50	41	39	117	534	74	85	44
2021 SITE TRAFFIC VOLUMES												
Avenue Downs (69 Single Family)	60		15						60	15		
% In Trips	16	0	4	0	0	0	0	0	27	7	0	0
% Out Trips												
2021 Site Traffic Volumes	16	0	4	0	0	0	0	0	27	7	0	0
2021 TOTAL TRAFFIC VOLUMES	109	24	55	21	50	41	39	117	561	81	85	44

**TRAFFIC VOLUME WORKSHEET  
CLAYTON ARNOLD ROAD AT PROJECT ACCESS  
A.M. PEAK HOUR**



Description	Northbound Clayton Arnold Road			Southbound Clayton Arnold Road			Eastbound			Westbound Project Access		
	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
2017 EXISTING TRAFFIC VOLUMES	222			118								
2021 BACKGROUND TRAFFIC VOLUMES												
<i>Annual Background Growth</i>												
Growth Rate (%/year)	2.0			2.0								
Growth Factor	1.00	1.08	1.00	1.00	1.08	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Annual Background Growth Trips	0	18	0	0	10	0	0	0	0	0	0	0
<i>Specific Development Background Growth</i>												
Remaining Canterbury (Phase 12B, 12C, 13: 90 SF, 54 TH)	% In % Out Trips			5			5					
	0	1	0	0	4	0	0	0	0	0	0	0
K-8 Proposed School on Clayton Arnold (1,600 Students)	% In % Out Trips			45			45			5		
	0	45	5	0	243	0	0	0	0	27	0	0
Proposed Canterbury (50%)	% In % Out Trips			5			5					
	0	1	0	0	4	0	0	0	0	0	0	0
Specific Development Background Growth Trips	0	209	23	0	251	0	0	0	0	27	0	0
2021 Background Traffic Volumes	0	449	23	0	379	0	0	0	0	27	0	0
2021 SITE TRAFFIC VOLUMES												
Avenue Downs (69 Single Family)	% In % Out Trips			25			75			25 10 0 30		
	0	0	4	11	0	0	0	0	0	10	0	30
2021 Site Traffic Volumes	0	0	4	11	0	0	0	0	0	10	0	30
2021 TOTAL TRAFFIC VOLUMES	0	449	27	11	379	0	0	0	0	37	0	30

TRAFFIC VOLUME WORKSHEET  
 CLAYTON ARNOLD ROAD AT PROJECT ACCESS  
 P.M. PEAK HOUR



Description	Northbound Clayton Arnold Road			Southbound Clayton Arnold Road			Eastbound			Westbound Project Access		
	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
2017 EXISTING TRAFFIC VOLUMES	90			549								
2021 BACKGROUND TRAFFIC VOLUMES												
<i>Annual Background Growth</i>												
Growth Rate (%/year)	2.0			2.0								
Growth Factor	1.00	1.08	1.00	1.00	1.08	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Annual Background Growth Trips	0	7	0	0	45	0	0	0	0	0	0	0
<i>Specific Development Background Growth</i>												
Remaining Canterbury (Phase 12B, 12C, 13: 90 SF, 54 TH)	% In % Out Trips			5			5			5		
	0	4	0	0	2	0	0	0	0	0	0	0
K-8 Proposed School on Clayton Arnold (1,600 Students)	% In % Out Trips			45			45			5		
	0	45	5	0	59	0	0	0	0	7	0	0
Proposed Canterbury (50%)	% In % Out Trips			5			5			0		
	0	4	0	0	2	0	0	0	0	0	0	0
Specific Development Background Growth Trips	0	71	7	0	63	0	0	0	0	7	0	0
2021 Background Traffic Volumes	0	168	7	0	657	0	0	0	0	7	0	0
2021 SITE TRAFFIC VOLUMES												
Avenue Downs (69 Single Family)	% In % Out Trips			25			75			25		
	0	0	11	34	0	0	0	0	0	7	0	20
2021 Site Traffic Volumes	0	0	11	34	0	0	0	0	0	7	0	20
2021 TOTAL TRAFFIC VOLUMES	0	168	18	34	657	0	0	0	0	14	0	20



# **APPENDIX C**

## **2017 EXISTING CONDITIONS CAPACITY ANALYSIS WORKSHEETS**

HCM 2010 TWSC  
3: Clayton Arnold Road & Critz Lane

01/15/2018

**Intersection**

Int Delay, s/veh 10.4

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Traffic Vol, veh/h	8	6	29	68	39	30	205	10	7	11	21	32
Future Vol, veh/h	8	6	29	68	39	30	205	10	7	11	21	32
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	83	83	83	83	83	83	83	83	83	83	83	83
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	10	7	35	82	47	36	247	12	8	13	25	39

Major/Minor	Major1	Major2	Minor1	Minor2
Conflicting Flow All	83	0	0	42
Stage 1	-	-	-	-
Stage 2	-	-	-	-
Critical Hdwy	4.12	-	-	4.12
Critical Hdwy Stg 1	-	-	-	-
Critical Hdwy Stg 2	-	-	-	-
Follow-up Hdwy	2.218	-	-	2.218
Pot Cap-1 Maneuver	1514	-	-	1567
Stage 1	-	-	-	-
Stage 2	-	-	-	-
Platoon blocked, %	-	-	-	-
Mov Cap-1 Maneuver	1514	-	-	1567
Mov Cap-2 Maneuver	-	-	-	-
Stage 1	-	-	-	-
Stage 2	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	1.4	3.7	16.3	10.4
HCM LOS			C	B

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	582	1514	-	-	1567	-	-	746
HCM Lane V/C Ratio	0.46	0.006	-	-	0.052	-	-	0.103
HCM Control Delay (s)	16.3	7.4	0	-	7.4	0	-	10.4
HCM Lane LOS	C	A	A	-	A	A	-	B
HCM 95th %tile Q(veh)	2.4	0	-	-	0.2	-	-	0.3

HCM 2010 TWSC  
 3: Clayton Arnold Road & Critz Lane

01/15/2018

**Intersection**

Int Delay, s/veh 3.9

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Traffic Vol, veh/h	14	33	463	46	34	41	54	16	20	19	40	25
Future Vol, veh/h	14	33	463	46	34	41	54	16	20	19	40	25
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	15	36	503	50	37	45	59	17	22	21	43	27

Major/Minor	Major1	Major2	Minor1	Minor2
Conflicting Flow All	82	0	0	539
Stage 1	-	-	-	-
Stage 2	-	-	-	-
Critical Hdwy	4.12	-	-	4.12
Critical Hdwy Stg 1	-	-	-	-
Critical Hdwy Stg 2	-	-	-	-
Follow-up Hdwy	2.218	-	-	2.218
Pot Cap-1 Maneuver	1515	-	-	1029
Stage 1	-	-	-	-
Stage 2	-	-	-	-
Platoon blocked, %	-	-	-	-
Mov Cap-1 Maneuver	1515	-	-	1029
Mov Cap-2 Maneuver	-	-	-	-
Stage 1	-	-	-	-
Stage 2	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0.2	3.3	15.2	15.3
HCM LOS			C	C

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	449	1515	-	-	1029	-	-	439
HCM Lane V/C Ratio	0.218	0.01	-	-	0.049	-	-	0.208
HCM Control Delay (s)	15.2	7.4	0	-	8.7	0	-	15.3
HCM Lane LOS	C	A	A	-	A	A	-	C
HCM 95th %tile Q(veh)	0.8	0	-	-	0.2	-	-	0.8

## **APPENDIX D**

# **2021 BACKGROUND CONDITIONS CAPACITY ANALYSIS WORKSHEETS**

HCM 2010 Roundabout  
 3: Clayton Arnold Road & Critz Lane

02/14/2018

Intersection				
Intersection Delay, s/veh	10.8			
Intersection LOS	B			
Approach	EB	WB	NB	SB
Entry Lanes	1	1	1	1
Conflicting Circle Lanes	1	1	1	1
Adj Approach Flow, veh/h	255	376	542	143
Demand Flow Rate, veh/h	260	384	553	145
Vehicles Circulating, veh/h	275	475	70	758
Vehicles Exiting, veh/h	628	148	465	101
Follow-Up Headway, s	3.186	3.186	3.186	3.186
Ped Vol Crossing Leg, #/h	0	0	0	0
Ped Cap Adj	1.000	1.000	1.000	1.000
Approach Delay, s/veh	7.6	14.1	9.9	10.9
Approach LOS	A	B	A	B
Lane	Left	Left	Left	Left
Designated Moves	LTR	LTR	LTR	LTR
Assumed Moves	LTR	LTR	LTR	LTR
RT Channelized				
Lane Util	1.000	1.000	1.000	1.000
Critical Headway, s	5.193	5.193	5.193	5.193
Entry Flow, veh/h	260	384	553	145
Cap Entry Lane, veh/h	858	703	1054	529
Entry HV Adj Factor	0.982	0.980	0.980	0.985
Flow Entry, veh/h	255	376	542	143
Cap Entry, veh/h	843	688	1033	521
V/C Ratio	0.303	0.546	0.525	0.274
Control Delay, s/veh	7.6	14.1	9.9	10.9
LOS	A	B	A	B
95th %tile Queue, veh	1	3	3	1



HCM 2010 Roundabout  
 3: Clayton Arnold Road & Critz Lane

02/14/2018

Intersection				
Intersection Delay, s/veh	14.7			
Intersection LOS	B			
Approach	EB	WB	NB	SB
Entry Lanes	1	1	1	1
Conflicting Circle Lanes	1	1	1	1
Adj Approach Flow, veh/h	749	220	182	122
Demand Flow Rate, veh/h	765	225	186	124
Vehicles Circulating, veh/h	160	173	196	279
Vehicles Exiting, veh/h	243	209	729	119
Follow-Up Headway, s	3.186	3.186	3.186	3.186
Ped Vol Crossing Leg, #/h	0	0	0	0
Ped Cap Adj	1.000	1.000	1.000	1.000
Approach Delay, s/veh	20.7	6.3	5.9	5.7
Approach LOS	C	A	A	A
Lane	Left	Left	Left	Left
Designated Moves	LTR	LTR	LTR	LTR
Assumed Moves	LTR	LTR	LTR	LTR
RT Channelized				
Lane Util	1.000	1.000	1.000	1.000
Critical Headway, s	5.193	5.193	5.193	5.193
Entry Flow, veh/h	765	225	186	124
Cap Entry Lane, veh/h	963	950	929	855
Entry HV Adj Factor	0.980	0.978	0.981	0.983
Flow Entry, veh/h	749	220	182	122
Cap Entry, veh/h	943	930	911	841
V/C Ratio	0.794	0.237	0.200	0.145
Control Delay, s/veh	20.7	6.3	5.9	5.7
LOS	C	A	A	A
95th %tile Queue, veh	9	1	1	1

## **APPENDIX E**

# **2021 TOTAL CONDITIONS CAPACITY ANALYSIS WORKSHEETS**

HCM 2010 Roundabout  
 3: Clayton Arnold Road & Critz Lane

02/14/2018

Intersection				
Intersection Delay, s/veh	11.4			
Intersection LOS	B			
Approach	EB	WB	NB	SB
Entry Lanes	1	1	1	1
Conflicting Circle Lanes	1	1	1	1
Adj Approach Flow, veh/h	265	379	578	143
Demand Flow Rate, veh/h	270	387	590	145
Vehicles Circulating, veh/h	278	505	70	791
Vehicles Exiting, veh/h	658	155	478	101
Follow-Up Headway, s	3.186	3.186	3.186	3.186
Ped Vol Crossing Leg, #/h	0	0	0	0
Ped Cap Adj	1.000	1.000	1.000	1.000
Approach Delay, s/veh	7.8	15.1	10.6	11.3
Approach LOS	A	C	B	B
Lane	Left	Left	Left	Left
Designated Moves	LTR	LTR	LTR	LTR
Assumed Moves	LTR	LTR	LTR	LTR
RT Channelized				
Lane Util	1.000	1.000	1.000	1.000
Critical Headway, s	5.193	5.193	5.193	5.193
Entry Flow, veh/h	270	387	590	145
Cap Entry Lane, veh/h	856	682	1054	512
Entry HV Adj Factor	0.982	0.980	0.980	0.985
Flow Entry, veh/h	265	379	578	143
Cap Entry, veh/h	841	668	1032	505
V/C Ratio	0.316	0.568	0.560	0.283
Control Delay, s/veh	7.8	15.1	10.6	11.3
LOS	A	C	B	B
95th %tile Queue, veh	1	4	4	1

HCM 2010 Roundabout  
 3: Clayton Arnold Road & Critz Lane

02/14/2018

Intersection				
Intersection Delay, s/veh	16.5			
Intersection LOS	C			
Approach	EB	WB	NB	SB
Entry Lanes	1	1	1	1
Conflicting Circle Lanes	1	1	1	1
Adj Approach Flow, veh/h	779	228	204	122
Demand Flow Rate, veh/h	795	233	208	124
Vehicles Circulating, veh/h	168	190	196	304
Vehicles Exiting, veh/h	260	214	767	119
Follow-Up Headway, s	3.186	3.186	3.186	3.186
Ped Vol Crossing Leg, #/h	0	0	0	0
Ped Cap Adj	1.000	1.000	1.000	1.000
Approach Delay, s/veh	23.8	6.5	6.2	5.9
Approach LOS	C	A	A	A
Lane	Left	Left	Left	Left
Designated Moves	LTR	LTR	LTR	LTR
Assumed Moves	LTR	LTR	LTR	LTR
RT Channelized				
Lane Util	1.000	1.000	1.000	1.000
Critical Headway, s	5.193	5.193	5.193	5.193
Entry Flow, veh/h	795	233	208	124
Cap Entry Lane, veh/h	955	934	929	834
Entry HV Adj Factor	0.980	0.979	0.983	0.983
Flow Entry, veh/h	779	228	204	122
Cap Entry, veh/h	937	915	913	820
V/C Ratio	0.832	0.249	0.224	0.149
Control Delay, s/veh	23.8	6.5	6.2	5.9
LOS	C	A	A	A
95th %tile Queue, veh	10	1	1	1

HCM 2010 TWSC  
7: Clayton Arnold Road & Evans Farm Access

02/14/2018

**Intersection**

Int Delay, s/veh 1.3

**Movement** WBL WBR NBT NBR SBL SBT

Lane Configurations	Y		B			A
Traffic Vol, veh/h	37	30	449	27	11	379
Future Vol, veh/h	37	30	449	27	11	379
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	40	33	488	29	12	412

**Major/Minor** Minor1 Major1 Major2

Conflicting Flow All	939	503	0	0	517	0
Stage 1	503	-	-	-	-	-
Stage 2	436	-	-	-	-	-
Critical Hdwy	6.42	6.22	-	-	4.12	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	-	-	2.218	-
Pot Cap-1 Maneuver	293	569	-	-	1049	-
Stage 1	607	-	-	-	-	-
Stage 2	652	-	-	-	-	-
Platoon blocked, %			-	-		
Mov Cap-1 Maneuver	289	569	-	-	1049	-
Mov Cap-2 Maneuver	289	-	-	-	-	-
Stage 1	607	-	-	-	-	-
Stage 2	642	-	-	-	-	-

**Approach** WB NB SB

HCM Control Delay, s	17.1	0	0.2
HCM LOS	C		

**Minor Lane/Major Mvmt** NBT NBRWBLn1 SBL SBT

Capacity (veh/h)	-	-	371	1049	-
HCM Lane V/C Ratio	-	-	0.196	0.011	-
HCM Control Delay (s)	-	-	17.1	8.5	0
HCM Lane LOS	-	-	C	A	A
HCM 95th %tile Q(veh)	-	-	0.7	0	-



HCM 2010 TWSC  
 7: Clayton Arnold Road & Evans Farm Access

02/14/2018

Intersection						
Int Delay, s/veh	0.8					
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations	W	R	T	R	L	T
Traffic Vol, veh/h	14	20	168	18	34	657
Future Vol, veh/h	14	20	168	18	34	657
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	15	22	183	20	37	714

Major/Minor	Minor1	Major1	Major2		
Conflicting Flow All	980	192	0	0	202
Stage 1	192	-	-	-	-
Stage 2	788	-	-	-	-
Critical Hdwy	6.42	6.22	-	-	4.12
Critical Hdwy Stg 1	5.42	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-
Follow-up Hdwy	3.518	3.318	-	-	2.218
Pot Cap-1 Maneuver	277	850	-	-	1370
Stage 1	841	-	-	-	-
Stage 2	448	-	-	-	-
Platoon blocked, %			-	-	-
Mov Cap-1 Maneuver	265	850	-	-	1370
Mov Cap-2 Maneuver	265	-	-	-	-
Stage 1	841	-	-	-	-
Stage 2	428	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	13.8	0	0.4
HCM LOS	B		

Minor Lane/Major Mvmt	NBT	NBRWBLn1	SBL	SBT
Capacity (veh/h)	-	-	445	1370
HCM Lane V/C Ratio	-	-	0.083	0.027
HCM Control Delay (s)	-	-	13.8	7.7
HCM Lane LOS	-	-	B	A
HCM 95th %tile Q(veh)	-	-	0.3	0.1





**Site Development Notes**

- Stormwater management facilities will be located as shown on the plan for both the Alexander and Evans property additions to the project. The locations are adjacent to the westerly margin of the West Harpeth River for Alexander and adjacent to both sides of the existing stream for Evans. A detailed hydrologic analysis will be prepared during the design phase of the project to determine the extent of stormwater detention measures warranted for each additional property. Water quality measures will be implemented as per best management practices recognized by Thompson's Station. An estimate of the total impervious area generated by the development of each additional property was determined by taking the proposed acreage occupied by proposed roadways and lots/townhomes and applying a runoff coefficient of 0.75. Estimates are summarized as follows:

Property	Acreage Occupied by proposed roadways, lots/townhomes	Impervious Acreage
Alexander	30	22.5
Evans	27.5	20.6

- Water service to the project will be provided by the HB&TS Utility District. Service to Alexander will be accomplished via an extension of the existing 8" lines in Canterbury Sections 11 and 12C. Service to Evans will be accomplished via an extension of the existing 8" line in Canterbury Section 13 and a connection to existing or proposed lines in Critz Lane as determined by HB&TS. Existing HB&TS water system flows and pressures are assumed to be adequate to serve the proposed 320 ± dwelling units brought on line by the addition of both properties.
- Sanitary sewer service to the project will be provided by Thompson's Station. The Alexander property will require a new pumping station located at the northeast corner of the site. Wastewater flows will be conveyed from this pump to a proposed gravity line on the Evans property. The Evans property will convey flows via an onsite gravity collection system to a proposed pump station on the northwesterly portion of the Evans property. This pump station will pump to an existing manhole in the trunk main along the northerly ROW of Critz Lane along the Canterbury frontage. A detailed hydraulic analysis of the existing sewer system will be prepared during the design phase to determine the routing and discharge points of the new force main that results in the least amount of impact to the overall system.
- Technical studies addressing endangered species, natural and cultural resources, traffic impacts and geotechnical considerations have been prepared as applicable and will be supplemented as necessary pending evaluation of the Concept Plan submitted by Thompson's Station.
- A proposed phasing plan has been shown based upon the most logical and economical sequence of consideration for the amended project.

	CURRENT	PROPOSED ADDITIONS	TOTAL
<b>SITE AREA:</b>	270.5 ACRES	113.26 ACRES	383.76 ACRES
<b>OPEN SPACE:</b>	85.76 ACRES (31.7%)	52.39 ACRES (46.3%)	138.15 ACRES (36.0%)
<b>DWELLING UNITS:</b>	816 UNITS 612 SINGLE FAMILY 204 TOWNHOMES	320 UNITS 179 SINGLE FAMILY 141 TOWNHOMES	1,136 UNITS 791 SINGLE FAMILY 345 TOWNHOMES
<b>DWELLING UNITS PER ACRE:</b>	3.0 D.U./ACRE	2.83 D.U./ACRE	2.96 D.U./ACRE



**TRAFFIC IMPACT STUDY**

for

**THE FIELDS OF CANTERBURY PROPOSED ADDITIONS**

**Thompson's Station, Tennessee**

**February 16, 2018**

**Prepared for:**

**CROSSFIRE DEVELOPMENT  
121 First Avenue South, Suite 210  
Franklin, Tennessee 37064**



**Prepared by:**

**RAGAN SMITH**

**RAGAN-SMITH ASSO  
315 Woodland Street, P.O. Box 60070  
Nashville, Tennessee 37206-0070  
(615) 244-8591**

**05-043 / 7878**

**THE FIELDS OF CANTERBURY PROPOSED ADDITIONS**  
**TRAFFIC IMPACT STUDY**

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**THE FIELDS OF CANTERBURY PROPOSED ADDITIONS**  
**TRAFFIC IMPACT STUDY**

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**EXECUTIVE SUMMARY**

**INTRODUCTION**

The Fields of Canterbury is located along Critz Lane between Columbia Pike and Lewisburg Pike in the Town of Thompson’s Station, Tennessee. Currently, a total of 816 homes have been approved for development and approximately 672 of these homes are currently complete and occupied in The Fields at Canterbury. An addition of 320 homes is proposed for two new sections that would be added to The Fields at Canterbury. The purpose of this traffic impact study is to review the traffic impact of the proposed additional sections to The Fields of Canterbury community.

**BACKGROUND TRAFFIC**

Based upon the anticipated development schedule, the year 2024 will be used to analyze the impact of The Fields of Canterbury proposed addition.

To establish background traffic growth, TDOT historical traffic data was obtained in the project vicinity. Traffic growth due to outside developments and general population growth was based upon linear regression analysis of the historical traffic count data. Background traffic growth was established by increasing existing traffic by **2 percent annually** for the period from 2017 to 2024. In addition to the annual growth rate, specific traffic growth estimates from three (3) underway, approved, or proposed developments were included in the determination of background traffic.

**SITE TRAFFIC**

The traffic impact of The Fields of Canterbury proposed addition is based upon a calculation of the number of vehicle trips that will enter and/or exit the site. The analysis periods of this report are the a.m. and p.m. peak hours of a typical weekday. Therefore, trips were generated according to the *Trip Generation Manual, 10<sup>th</sup> Edition* published by the Institute of Transportation Engineers (ITE). The total estimated trip generation for The Fields of Canterbury proposed addition is shown in the table below.

<b>TOTAL TRIP GENERATION: THE FIELDS OF CANTERBURY PROPOSED ADDITION</b>								
<b>Land Use</b>	<b>Total Units</b>	<b>Daily Trips</b>	<b>A.M. Peak Hour</b>			<b>P.M. Peak Hour</b>		
			<b>Enter</b>	<b>Exit</b>	<b>Total</b>	<b>Enter</b>	<b>Exit</b>	<b>Total</b>
Single Family Homes	179 units	1,776	33	99	132	112	66	178
Townhomes	141 units	1,025	15	51	66	50	30	80
<b>TOTAL</b>	<b>320 units</b>	<b>2,801</b>	<b>48</b>	<b>150</b>	<b>198</b>	<b>162</b>	<b>96</b>	<b>258</b>

**TRAFFIC ANALYSIS**

The following public intersections were analyzed for capacity deficiencies and improvement needs:

- Columbia Pike at Critz Lane
- Critz Lane at Westerham Way
- Critz Lane at Clayton Arnold Road
- Critz Lane at Sporting Hill Bridge Road
- Critz Lane at Pantall Road
- Lewisburg Pike at Critz Lane
- Critz Lane at Proposed Section 14 Access

For these intersections, the following traffic scenarios were analyzed, where applicable:

- 2017 Existing Traffic Volumes
- 2024 Background Traffic that contains anticipated traffic growth from sources other than the proposed addition to The Fields at Canterbury
- 2024 Total Traffic that contains all traffic projected in the study area, including the completion of The Fields of Canterbury

## **CONCLUSIONS AND RECOMMENDATIONS**

### Columbia Pike at Critz Lane

- The lane assignments on the approach of Critz Lane to Columbia Pike should be modified to consist of one eastbound travel lane, one westbound shared lane for left turn and right turn movements, and one westbound right turn lane. The traffic signal head displays for the Critz Lane approach should be modified to accommodate this lane assignment modification and to provide a right turn overlap during the southbound left turn phase. This improvement should be required to be installed by The Fields at Canterbury developer with the request to plat the 100<sup>th</sup> unit in the proposed additions to The Fields at Canterbury.

### Critz Lane at Westerham Way

- The Town of Thompson's Station's proposal to include a left turn lane with a length of 335 feet and a taper of 225 feet is appropriate for this intersection. This turn lane is proposed as part of the Town's Critz Lane improvement project.
- The Town of Thompson's Station's proposal to include a right turn lane with a length of 260 feet and a taper of 160 feet is appropriate for this intersection. This turn lane is proposed as part of the Town's Critz Lane improvement project.
- The improvements proposed to be constructed as part of the Town of Thompson's Station's Critz Lane project will continue to be appropriate after development of the proposed additions to The Fields of Canterbury.

### Critz Lane at Clayton Arnold Road

- The Town of Thompson's Station's proposal to construct a roundabout at this intersection is appropriate based on the operational and safety advantages that a roundabout will have over two-way stop control at this location.
- The improvements proposed to be constructed as part of the Town of Thompson's Station's Critz Lane project will continue to be appropriate after development of the proposed additions to The Fields of Canterbury.

### Critz Lane at Sporting Hill Bridge Road

- The Town of Thompson's Station proposed improvements to Critz Lane at this intersection are appropriate. These improvements will widen the existing lanes and shoulders but will not provide any turn lanes or intersection control modifications.
- The improvements proposed to be constructed as part of the Town of Thompson's Station's Critz Lane project will continue to be appropriate after development of the proposed additions to The Fields of Canterbury.

### Critz Lane at Pantall Road

- The Town of Thompson's Station's proposal to construct a roundabout at this intersection is appropriate based on the operational and safety advantages that a roundabout will have over two-way stop control at this location.
- The improvements proposed to be constructed as part of the Town of Thompson's Station's Critz Lane project will continue to be appropriate after development of the proposed additions to The Fields of Canterbury.

Lewisburg Pike at Critz Lane

- TDOT's proposal to construct a southbound right turn lane with 375 feet of storage and a taper of 175 feet is appropriate for this intersection. This project was bid by TDOT in December 2017 and the contract has been awarded.
- TDOT's proposal to construct a northbound left turn lane with 100 feet of storage and a taper of 175 feet is appropriate for this intersection. This project was bid by TDOT in December 2017 and the contract has been awarded.
- TDOT's proposal to construct separate eastbound right and left turn lanes with 250 feet of storage and a taper of 125 feet is appropriate for this intersection. This project was bid by TDOT in December 2017 and the contract has been awarded.
- TDOT's proposal to construct a traffic signal at this intersection is appropriate. This project was bid by TDOT in December 2017 and the contract has been awarded.
- The improvements being constructed by TDOT at this intersection will continue to be appropriate after development of the proposed additions to The Fields of Canterbury.

Critz Lane at Proposed Section 14 Access

- The proposed access to Critz Lane from the proposed additions to The Fields at Canterbury should be constructed as part of Section 14 as shown on The Fields of Canterbury Concept Plan.
- The Proposed Section 14 Access should consist of one lane in each direction with pavement widths in compliance with the appropriate roadway section shown in the Town's Land Development Ordinance.
- An eastbound left turn lane should be installed on Critz Lane when the Proposed Section 14 Access is constructed. The left turn lane should have a length of 225 feet with tapers based on applicable AASHTO, MUTCD, and TDOT design guidelines.



**I. INTRODUCTION**

The purpose of this study is to review the traffic impact of proposed additional sections to The Fields of Canterbury community in the Town of Thompson's Station, Tennessee. The proposed additional sections at The Fields of Canterbury will include 320 new residential units and one new project access. This report has been requested by Town of Thompson's Station staff in order to address transportation impacts and to identify recommended mitigating measures as part of development plan review process.

In order to evaluate the traffic impact of the additional sections at The Fields of Canterbury, an inventory of the existing transportation system was carried out along with an assessment of its adequacy. Based on the anticipated project schedule, a design year was established and system-wide growth rates as well as traffic growth due to specific developments in the area were applied to existing traffic volumes. Site traffic was generated, distributed and assigned to the roadway to quantify the impact of The Fields at Canterbury additional sections. Transportation analyses were performed in order to assess any site or non-site related impacts on the system. Finally, recommendations for project access and mitigating measures related to the additional sections at The Fields at Canterbury were offered.

## II. **PROJECT DESCRIPTION**

### A. **Existing Development**

As shown in Figure 1, The Fields of Canterbury is located on the north side of Critz Lane between Columbia Pike (US Highway 31 / State Route 6) and Lewisburg Pike (US Highway 431 / State Route 106) in the Town of Thompson's Station, Tennessee. The Fields of Canterbury currently includes approvals for 612 single family homes and 204 townhomes (816 total units) on approximately 270.5 acres. At the time of this study, approximately 672 total units have been constructed and are occupied. Remaining approved sections that are not yet constructed or occupied include approximately 90 single family homes and approximately 54 townhomes.

Access to the existing portion of The Fields at Canterbury is provided at two locations on Critz Lane as described below.

- **Westerham Way** – Westerham Way intersects Critz Lane approximately 2,300 feet west of Clayton Arnold Road. Westerham Way consists of one (1) lane for traffic entering The Fields of Canterbury and one (1) lane for traffic exiting The Fields of Canterbury. Critz Lane is a two-lane roadway and does not include a right turn lane or left turn lane at Westerham Way. Two-way stop control is in place at this access for traffic on Westerham Way approaching Critz Lane.
- **Paddock Park Drive** – Paddock Park Drive intersects Critz Lane at a location that aligns with Clayton Arnold Road to the south. Paddock Park Drive consists of one (1) lane for traffic entering The Fields of Canterbury and one (1) lane for traffic exiting The Fields of Canterbury. Critz Lane is a two-lane roadway and does not include a right turn lane or left turn lane at Paddock Park Drive / Clayton Arnold Road. Two-way stop control is in place at this access for traffic on Paddock Park Drive and Clayton Arnold Road approaching Critz Lane.

Figure 2 shows the concept plan, including the existing approved portions of the community, for The Fields of Canterbury.

### B. **Proposed Development**

As shown in Figure 2, the proposed additions to The Fields of Canterbury are located along the eastern boundary of the existing community. The proposed additions will consist of 179 single family homes and 141 townhomes (320 total units) on approximately 113.26 acres. With the proposed additions, The Fields at Canterbury will consist of 791 single family homes and 345 townhomes (1,136 total units) on approximately 383.76 acres.

Access to the proposed additions to The Fields at Canterbury will be provided at two locations as described below.

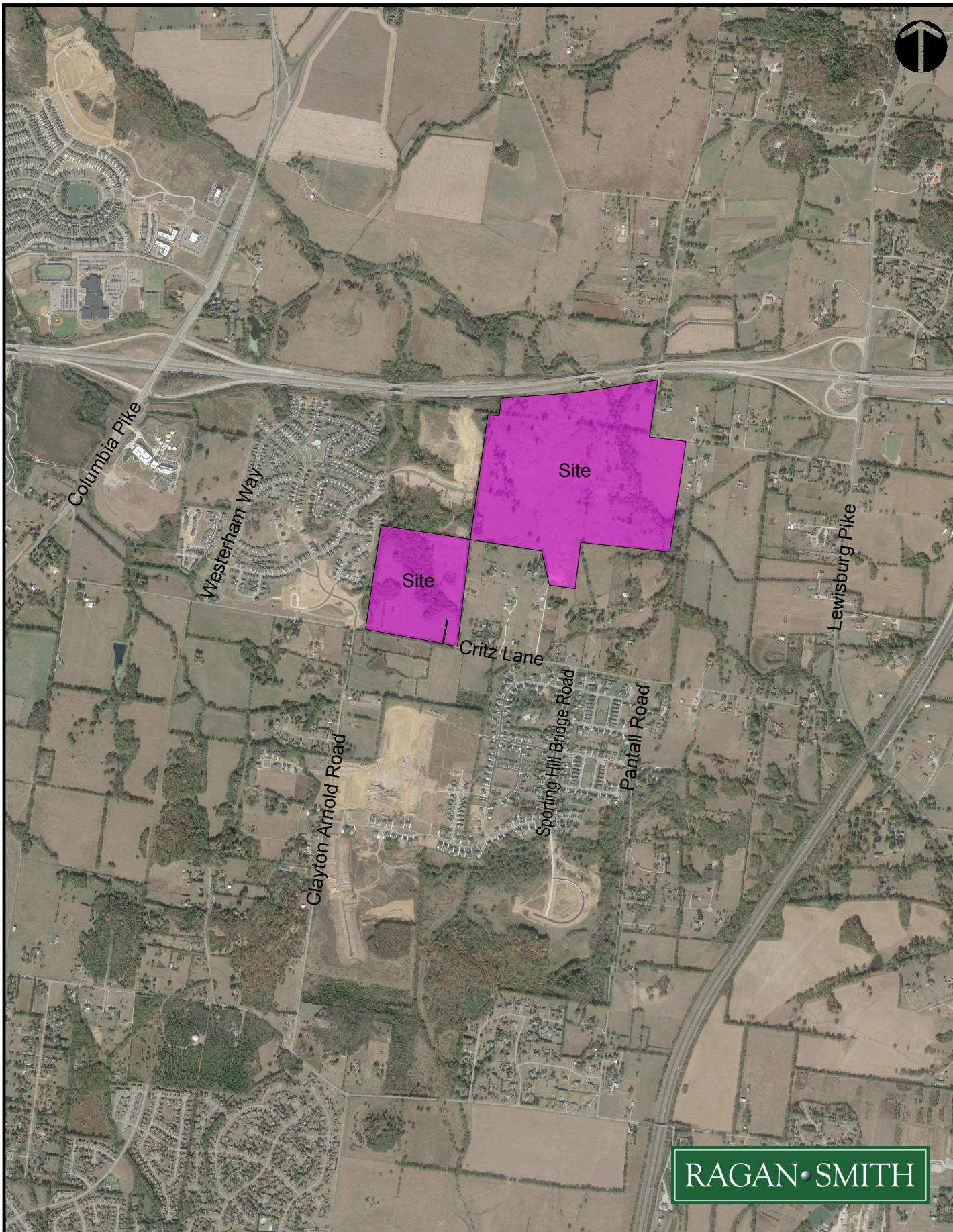
- **Section 14 Access** – An access to Critz Lane is proposed at a location approximately 1,400 feet east of Clayton Arnold Road. This access is currently shown as part of Section 14 on the concept plan and will provide access to the proposed additions and existing portions of The Fields at Canterbury.
- **Internal Connections** – The proposed additions to The Fields at Canterbury will connect to the following roadways within the existing, approved portions of the community.
  - Bramblewood Lane (Section 13)
  - Chaucer Park Lane (Section 11)
  - Sassafras Lane (Section 12C)

C. Phasing and Timing

Based on the layout shown on the concept plan for the proposed additions at The Fields of Canterbury, what is known about the existing features of these areas, and what an expected or desired pace of development will be in this area, the anticipated build-out period for the proposed additions at The Fields of Canterbury is approximately six (6) years. For the analysis of this report, the full build-out of The Fields of Canterbury has been assumed to occur in the year 2024.

The year 2024 is established as the horizon year for the analysis of this study.





RAGAN • SMITH

Fields of Canterbury  
Location Map

Figure  
**1**





**Site Development Notes**

- Stormwater management facilities will be located as shown on the plan for both the Alexander and Evans property additions to the project. The locations are adjacent to the westerly margin of the West Harpeth River for Alexander and adjacent to both sides of the existing stream for Evans. A detailed hydrologic analysis will be prepared during the design phase of the project to determine the extent of stormwater detention measures warranted for each additional property. Water quality measures will be implemented as per best management practices recognized by Thompson's Station. An estimate of the total impervious area generated by the development of each additional property was determined by taking the proposed acreage occupied by proposed roadways and lots/townhomes and applying a runoff coefficient of 0.75. Estimates are summarized as follows:
 

Property	Acreage Occupied by proposed roadways, lots/townhomes	Impervious Acreage
Alexander	30	22.5
Evans	27.5	20.6
- Water service to the project will be provided by the HB&TS Utility District. Service to Alexander will be accomplished via an extension of the existing 8" lines in Canterbury Sections 11 and 12C. Service to Evans will be accomplished via an extension of the existing 8" line in Canterbury Section 13 and a connection to existing or proposed lines in Critz Lane as determined by HB&TS. Existing HB&TS water system flows and pressures are assumed to be adequate to serve the proposed 320 ± dwelling units brought on line by the addition of both properties.
- Sanitary sewer service to the project will be provided by Thompson's Station. The Alexander property will require a new pumping station located at the northeast corner of the site. Wastewater flows will be conveyed from this pump to a proposed gravity line on the Evans property. The Evans property will convey flows via an onsite gravity collection system to a proposed pump station on the northwesterly portion of the Evans property. This pump station will pump to an existing manhole in the trunk main along the northerly ROW of Critz Lane along the Canterbury frontage. A detailed hydraulic analysis of the existing sewer system will be prepared during the design phase to determine the routing and discharge points of the new force main that results in the least amount of impact to the overall system.
- Technical studies addressing endangered species, natural and cultural resources, traffic impacts and geotechnical considerations have been prepared as applicable and will be supplemented as necessary pending evaluation of the Concept Plan submitted by Thompson's Station.
- A proposed phasing plan has been shown based upon the most logical and economical sequence of consideration for the amended project.

	CURRENT	PROPOSED ADDITIONS	TOTAL
<b>SITE AREA:</b>	270.5 ACRES	113.26 ACRES	383.76 ACRES
<b>OPEN SPACE:</b>	85.76 ACRES (31.7%)	52.39 ACRES (46.3%)	138.15 ACRES (36.0%)
<b>DWELLING UNITS:</b>	816 UNITS 612 SINGLE FAMILY 204 TOWNHOMES	320 UNITS 179 SINGLE FAMILY 141 TOWNHOMES	1,136 UNITS 791 SINGLE FAMILY 345 TOWNHOMES
<b>DWELLING UNITS PER ACRE:</b>	3.0 D.U./ACRE	2.83 D.U./ACRE	2.96 D.U./ACRE



### III. EXISTING CONDITIONS

#### A. Transportation System Description

The existing transportation system in the area that provides access to The Fields of Canterbury consists of local, collector, and arterial roadways. The following roadways will comprise the study area for consideration of the traffic impact of the proposed additions at The Fields of Canterbury.

- **Columbia Pike (US Highway 31 / State Route 6)** in the study area is shown as a principal arterial on the Tennessee Department of Transportation (TDOT) functional classification system and is listed as an arterial in the General Plan for Thompson's Station. The Columbia Pike corridor connects the Cities of Nashville, Brentwood, Franklin, Thompson's Station, Spring Hill, and Columbia in Davidson, Williamson, and Maury Counties. Within the study area, Columbia Pike is a five-lane roadway with a posted speed limit of 45 mph.
- **Lewisburg Pike (US Highway 431 / State Route 106)** in the study area is shown as a principal arterial on the TDOT functional classification system and is listed as an arterial in the General Plan for Thompson's Station. The Lewisburg Pike corridor connects the Cities of Nashville, Franklin, Thompson's Station, and Lewisburg. Within the study area, Lewisburg Pike is a two-lane roadway with a posted speed limit of 55 mph.
- **Critz Lane** is listed as a collector roadway in the General Plan for Thompson's Station. Critz Lane is a two-lane roadway that connects Columbia Pike and Lewisburg Pike with a total length of approximately 2.6 miles. The posted speed limit on Critz Lane is 40 mph.
- **Clayton Arnold Road** is listed as a collector roadway in the General Plan for Thompson's Station. Clayton Arnold Road is a two-lane roadway that connects Critz Lane and Thompson's Station Road with a total length of approximately 1.3 miles. The posted speed limit on Clayton Arnold Road is 35 mph.
- **Sporting Hill Bridge Road** is listed as a local roadway in the General Plan for Thompson's Station and provides access to the Bridgemore Village community. Sporting Hill Bridge Road includes one travel lane in each direction and a raised median approximately 50 feet in width. The posted speed limit on Sporting Hill Bridge Road is 20 mph.
- **Pantall Road** is listed as a collector roadway in the General Plan for Thompson's Station. Pantall Road is a two-lane roadway that connects Critz Lane and Thompson's Station Road with a total length of approximately 1.3 miles. The posted speed limit on Pantall Road is 40 mph.

#### B. Transportation System Improvements

Within the study area there are transportation system improvement projects that are planned, underway, or that have been recently completed. The following projects will impact the study area during the horizon period for this report.

- Columbia Pike Widening – Columbia Pike was widened from two (2) lanes to five (5) lanes by TDOT as part of a State Industrial Access (SIA) project that accompanied the development of industrial/commercial property on Columbia Pike near the I-840 interchange. The limits of the project begin south of Critz Lane and end by joining the section of Columbia Pike that was already five (5) lanes. Construction on the

Columbia Pike widening was completed in the Fall of 2017 shortly before the study was initiated.

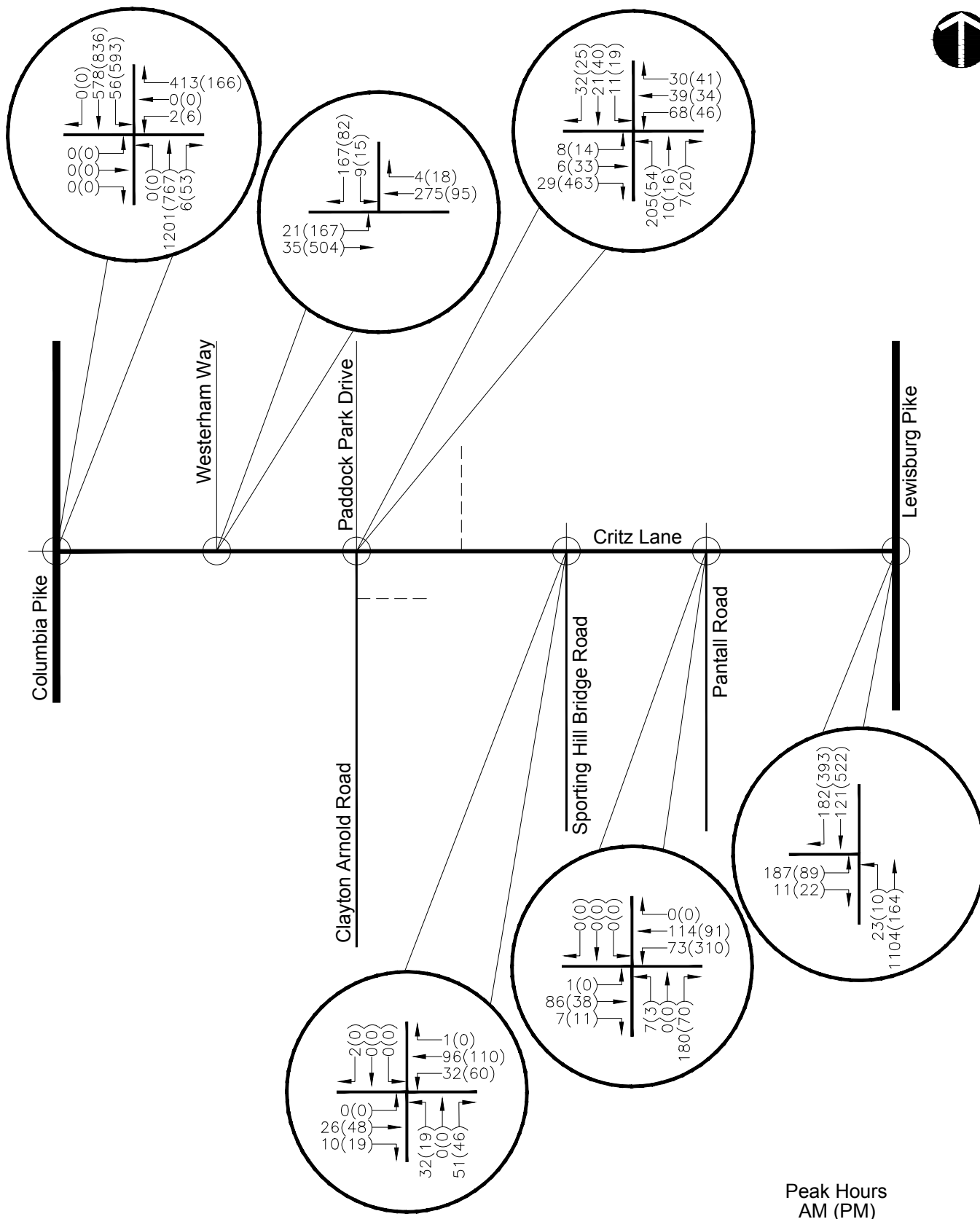
- Critz Lane Realignment – In conjunction with the widening of Columbia Pike by TDOT, the Town of Thompson’s Station is realigning approximately 1,400 feet of Critz Lane to provide improved roadway geometry and a signalized intersection on Columbia Pike at Critz Lane. The Critz Lane realignment was under construction at the time of the study and is currently anticipated to be complete in April 2018.
- Lewisburg Pike at Critz Lane Intersection Improvements – The intersection of Lewisburg Pike at Critz Lane is begin improved by TDOT in order to provide a northbound left turn lane on Lewisburg Pike, a southbound right turn lane on Lewisburg Pike, separate right turn and left turn lanes on Critz Lane approaching Lewisburg Pike, and a traffic signal. The project was included in TDOT’s December 2017 bid letting and the contract has been awarded at the time of this study. The completion of this project is expected to occur prior to the horizon year of this study.
- Critz Lane Improvements – The Town of Thompson’s Station is currently preparing a project to improve Critz Lane between Columbia Pike and Lewisburg Pike including widening Critz Lane to provide 11’ travel lanes and 4’ shoulders, constructing roundabout intersections at Clayton Arnold Road and Pantall Road, constructing turn lanes at other appropriate intersections, and correcting vertical alignment deficiencies. Survey work for this project was initiated in the fall of 2016 and a preliminary set of construction plans was provided by the Town in November 2017. The current construction schedule is not known for this project but previously the Town did anticipate bidding the project and awarding a contract in 2018. Based on the work that is underway and the previously available schedules for this project, it is anticipated that the Critz Lane improvements will be complete prior to the horizon year of this study.

C. Traffic Volumes

In order to assess the adequacy of the local transportation system, an evaluation of the current operational quality of intersections within the study area was required. The peak hour of the adjacent street traffic was used to evaluate the traffic operations for The Fields of Canterbury. In order to identify the peak periods for analysis, traffic counts were conducted in December 2017. Table 1 below shows the a.m. and p.m. peak hour for each of the intersections where traffic was counted.

TABLE 1		
INTERSECTION PEAK HOURS		
Intersection	A.M. Peak Hour	P.M. Peak Hour
Columbia Pike at Critz Lane	6:45 – 7:45 a.m.	4:30 – 5:30 p.m.
Critz Lane at Westerham Way	6:30 – 7:30 a.m.	4:30 – 5:30 p.m.
Critz Lane at Clayton Arnold Road	6:30 – 7:30 a.m.	4:30 – 5:30 p.m.
Critz Lane at Sporting Hill Bridge Road	7:00 – 8:00 a.m.	4:15 – 5:15 p.m.
Critz Lane at Pantall Road	7:15 – 8:15 a.m.	4:15 – 5:15 p.m.
Lewisburg Pike at Critz Lane	6:30 – 7:30 a.m.	4:00 – 5:00 p.m.

Figure 3 shows the existing peak hour traffic volumes for the intersections in the study area.



Fields of Canterbury  
2017 Existing Traffic Volumes

Figure  
**3**



**IV. FORECASTED BACKGROUND TRAFFIC**

A. Introduction

Before any impacts to the study area can be addressed, some estimate of background traffic volumes for the horizon year 2024 must be established. Background traffic volumes were established by segregating potential growth into two categories:

- Specific development traffic growth within the immediate study area
- Growth due to small scale development and/or general population growth

B. Specific Development Growth

Traffic growth from the three (3) specific developments described below was included in the background traffic forecasts for the analysis of this report.

- The Fields at Canterbury – The existing approved portions of The Fields at Canterbury include approximately 90 single family homes and 54 townhomes that are not yet constructed or occupied. Site traffic from these units has been included in the background traffic growth forecast of this report.
- Thompson's Station Elementary and Middle Schools – Williamson County Schools is currently constructing a new campus on Clayton Arnold Road south of Critz Lane that will include a new Elementary School and a new Middle School, each with a capacity of 800 students. While it is unlikely that both schools will have arrival or dismissal times coinciding with the peak hour of the adjacent streets, the analysis of this report conservatively applies trips for both schools to the peak hour analysis.
- Avenue Downs – The Avenue Downs development is proposed, but not yet approved, for the southeast corner of the intersection at Critz Lane and Clayton Arnold Road. Avenue Downs will consist of 69 single family homes. Due to the proximity of Avenue Downs to The Fields at Canterbury, site traffic from Avenue Downs has been included in the background traffic growth forecast of this report.

Trip generation for the specific background developments is shown in Table 2. The trip distribution for these background developments is shown in the appendix of this report.

TABLE 2							
TRIP GENERATION: BACKGROUND SPECIFIC DEVELOPMENTS							
Land Use and Total Units	Daily Trips	A.M. Peak Hour			P.M. Peak Hour		
		Enter	Exit	Total	Enter	Exit	Total
The Fields at Canterbury Approved but not Constructed Units (90 Single Family and 54 Townhomes)	1,311	23	73	96	79	47	126
Proposed School 1,600 Students	3,216	540	460	1,000	132	140	272
Avenue Downs 69 Single Family	739	14	40	54	45	26	71
<b>TOTAL</b>	<b>5,266</b>	<b>577</b>	<b>573</b>	<b>1,150</b>	<b>256</b>	<b>213</b>	<b>469</b>

C. Annual Growth

To establish traffic growth due to population growth or small scale development, TDOT historical traffic count data was obtained at locations within the general project vicinity. The TDOT historical traffic count data includes traffic volume counts conducted annually on Columbia Pike beginning in 1985. The available historical count data was tabulated and analyzed to identify patterns or growth trends.

Based upon linear regression analysis of this data, we will use a **2 percent annual growth rate** as the base growth for the existing traffic volumes. This annual growth rate is consistent with the Comprehensive Traffic Impact Study prepared by RPM Transportation Consultants, LLC for the Town of Thompson's Station.

Additionally, it is important to recognize that while the Town's Comprehensive Traffic Impact Study completed in 2015 included a 2 percent annual growth rate as the only source of traffic growth, the background traffic forecasts in this report conservatively include specific development traffic in addition to the annual growth rate. When considered collectively, the effective annual growth rate of background traffic in this report is 12 percent per year during the a.m. peak hour and 5.5 percent per year during the p.m. peak hour.

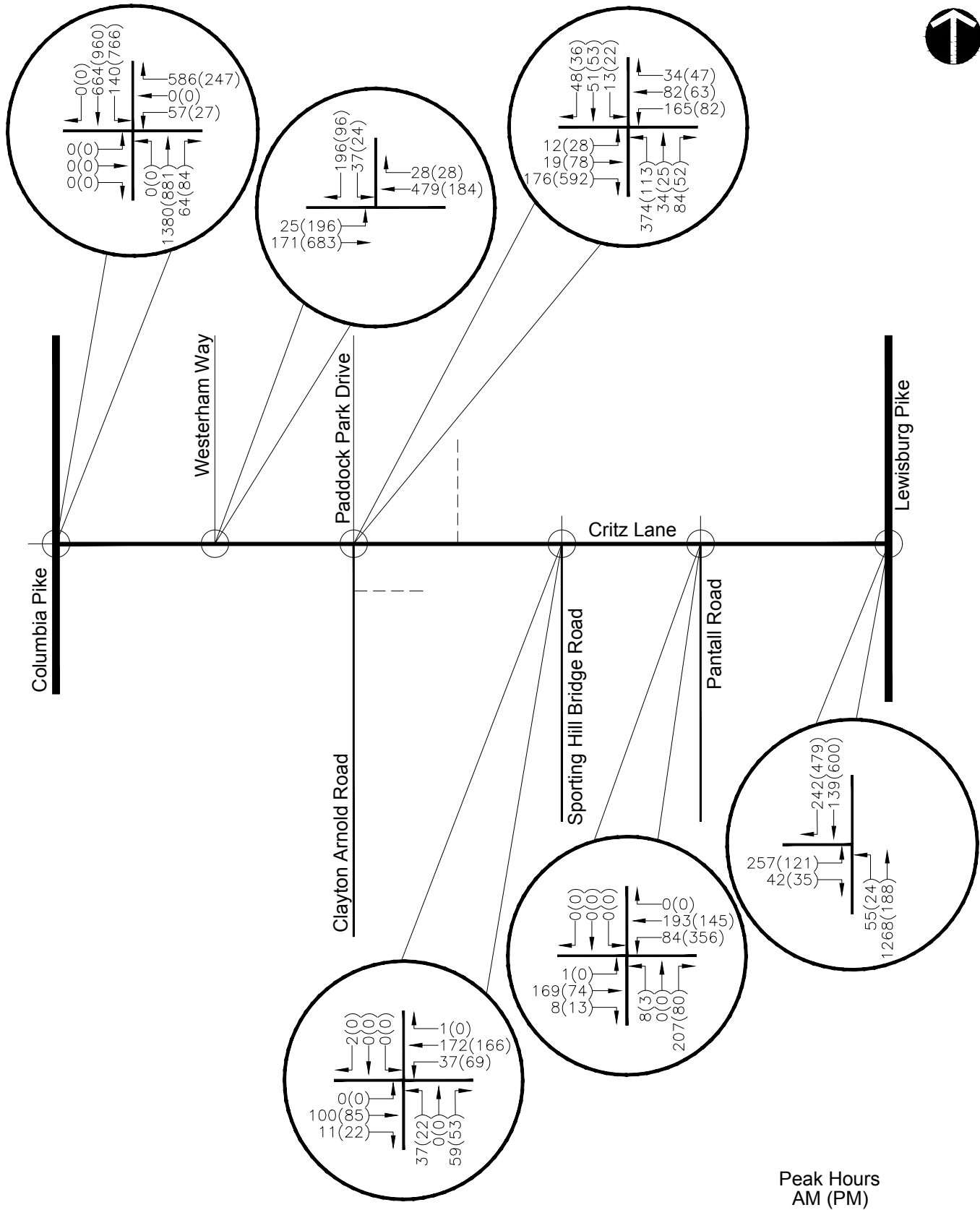
D. Background Traffic

Background traffic for the future traffic forecasts was compiled based on the following:

- 2017 existing traffic data
- Specific development expected traffic volumes
  - The Fields at Canterbury – approved but not yet constructed units
  - Thompson's Station Elementary and Middle Schools
  - Avenue Downs
- 2% annual increase of traffic volumes for the period from 2017 to 2024

Background traffic volumes on the future roadway, representing existing traffic volumes plus background growth, for the year 2024 are shown in Figure 4.





Fields of Canterbury  
2024 Background Traffic Volumes

Figure  
4

**V. PROPOSED SITE TRAFFIC**

**A. Site Trip Generation**

In order to quantify site-related impacts within the study area, some estimates of site trip generation and traffic assignment had to be established. Trip generation rates for the development were established using information for the weekday a.m. and p.m. peak hour of the adjacent street as shown in the *Trip Generation Manual, 10<sup>th</sup> Edition* published by the Institute of Transportation Engineers (ITE). For this study, horizon year 2024 will include the completion of The Fields of Canterbury. Trip generation for The Fields of Canterbury proposed additions is shown in Table 3.

TABLE 3								
TRIP GENERATION: THE FIELDS OF CANTERBURY PROPOSED ADDITIONS								
Land Use	Total Units	Daily Trips	A.M. Peak Hour			P.M. Peak Hour		
			Enter	Exit	Total	Enter	Exit	Total
Single Family Homes	179 units	1,776	33	99	132	112	66	178
Townhomes	141 units	1,025	15	51	66	50	30	80
<b>TOTAL</b>	<b>320 units</b>	<b>2,801</b>	<b>48</b>	<b>150</b>	<b>198</b>	<b>162</b>	<b>96</b>	<b>258</b>

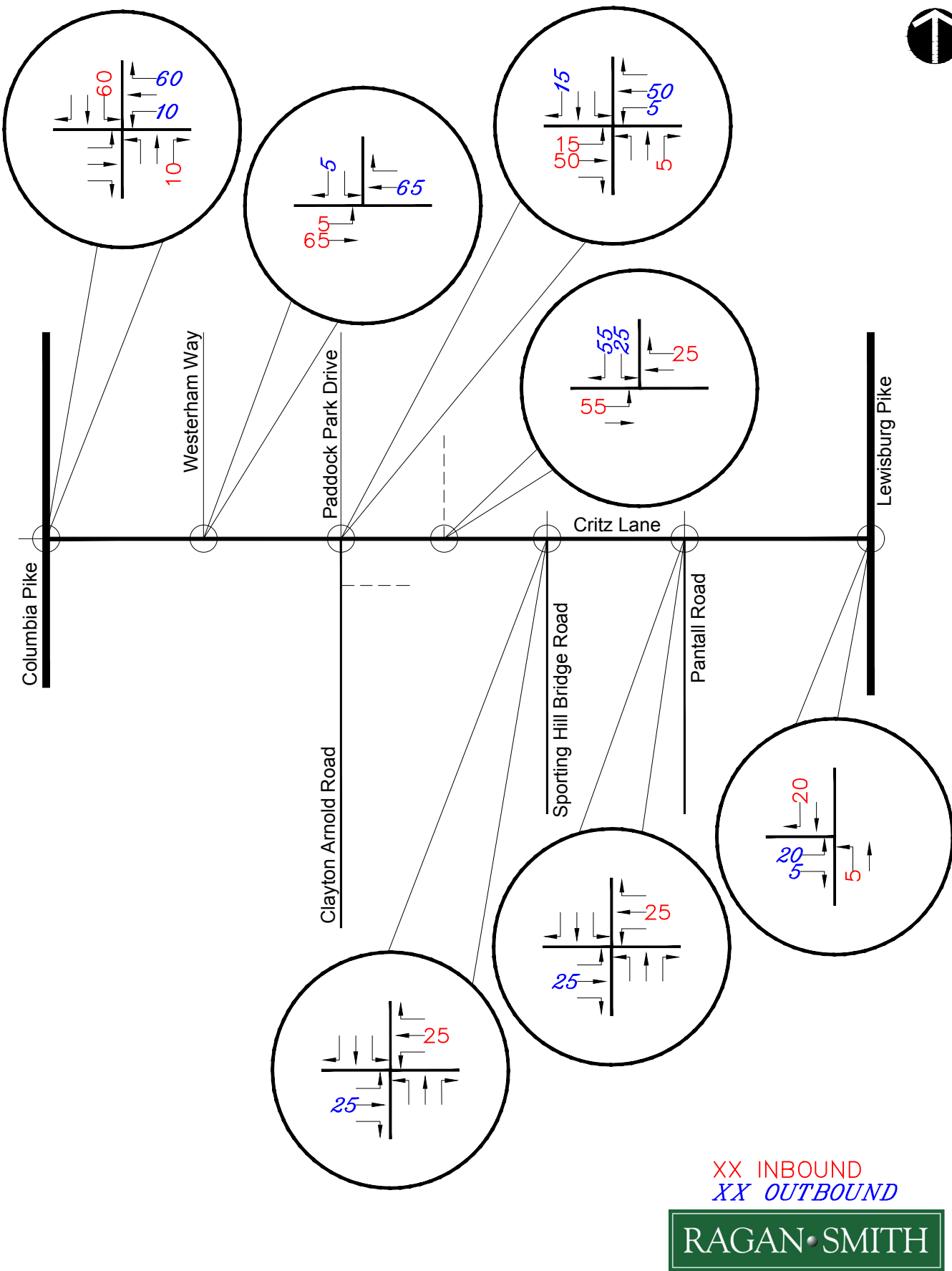
The traffic counts conducted in December 2017 on Critz Lane at Westerham Way and at Paddock Park Drive indicated that the actual peak hour traffic generated by The Fields at Canterbury is lower than the trip generation rates presented by ITE. However, the ITE trip generation estimates presented for the analysis in this report have conservatively not been reduced.

**B. Site Trip Distribution and Assignment**

Site trips were distributed based primarily upon the prevalent commuter patterns in the area and the proximity and routes to major transportation facilities. Figure 5 shows the distribution of the residential trips for The Fields of Canterbury proposed addition on the adjacent roadway.

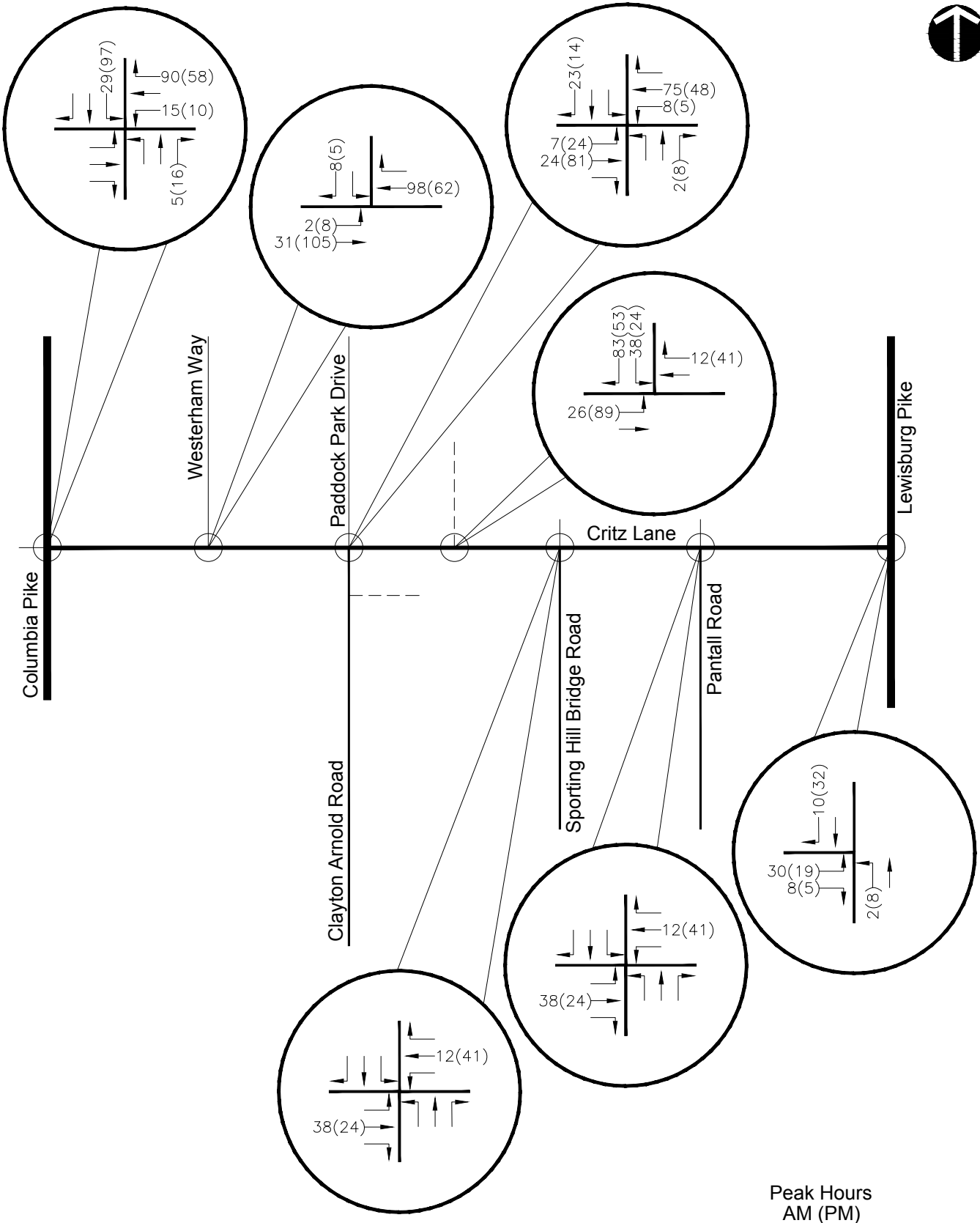
Site traffic volumes generated by The Fields of Canterbury proposed addition in the horizon year 2024 are shown in Figure 6. The accumulation of existing, background growth, and site-generated traffic for the horizon year 2024 is shown in Figure 7.





Fields of Canterbury  
Trip Distribution

Figure  
5



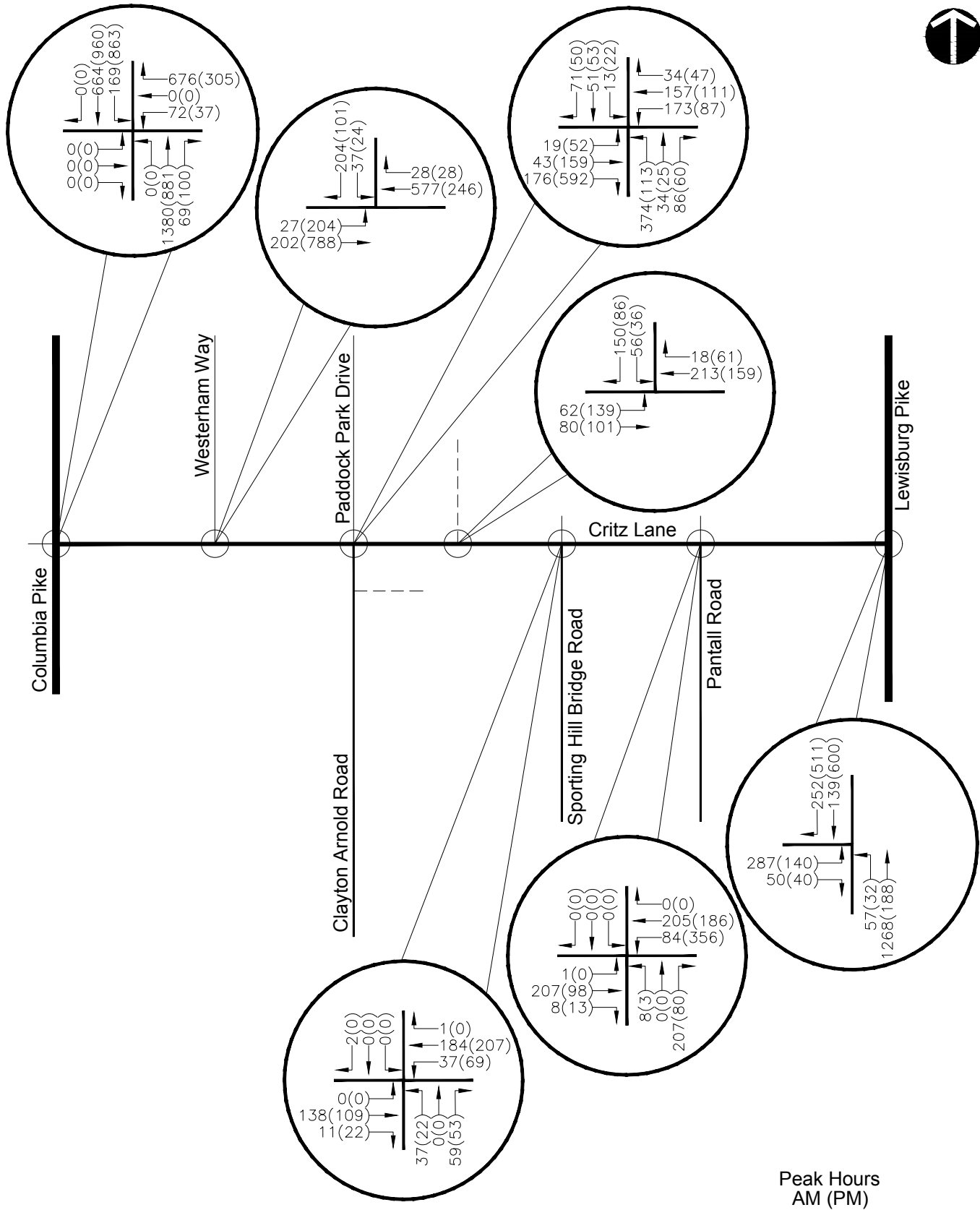
Peak Hours  
AM (PM)



Proposed Fields of Canterbury  
2024 Site Volumes

Figure  
**6**





Fields of Canterbury  
2024 Total Traffic Volumes

Figure  
**7**

## VI. TRANSPORTATION ANALYSIS

### A. Intersection Capacity Analysis

In order to determine the quality of existing traffic operations and identify capacity deficiencies, intersection capacity analyses were conducted at the following intersections.

- Columbia Pike at Critz Lane
- Critz Lane at Westerham Way
- Critz Lane at Clayton Arnold Road
- Critz Lane at Sporting Hill Bridge Road
- Critz Lane at Pantall Road
- Lewisburg Pike at Critz Lane
- Critz Lane at Proposed Section 14 Access

Capacity analyses were conducted according to the methodology and procedures outlined in the *Highway Capacity Manual*, HCM 2010, published by Transportation Research Board. Capacity analysis results for the a.m. peak hour are shown in Table 4.

TABLE 4				
INTERSECTION CAPACITY ANALYSIS RESULTS – A.M. PEAK HOUR				
Intersection	Condition <sup>(1)</sup>	Level of Service (avg. delay/vehicle – sec.)		
		2017 Existing	2024 Background	2024 Total
Columbia Pike at Critz Lane	SB Left	B (12.3)	-	-
	TWSC WB	F (82.7)	-	-
	Overall Signal	-	C (28.3)	D (38.8)
	Overall Signal With Recommendation	-	-	C (24.2)
Critz Lane at Westerham Way	EB Left	A (7.9)	A (8.5)	A (8.9)
	TWSC SB	B (11.6)	C (18.3)	C (23.7)
Critz Lane at Clayton Arnold Road	EB Left	A (7.4)	-	-
	WB Left	A (7.4)	-	-
	TWSC NB	C (16.3)	-	-
	TWSC SB	B (10.4)	-	-
	Overall Roundabout	-	B (10.8)	B (13.4)
Critz Lane at Sporting Hill Bridge Road	WB Left	A (7.3)	A (7.5)	A (7.6)
	TWSC NB	A (9.5)	B (10.6)	B (11.0)
Critz Lane at Pantall Road	WB Left	A (7.5)	-	-
	TWSC NB	A (9.9)	-	-
	Overall Roundabout	-	A (6.0)	A (6.2)
Critz Lane at Lewisburg Pike	NB Left	A (8.0)	-	-
	TWSC EB	F (261.6)	-	-
	Overall Signal	-	C (31.9)	D (37.2)
Critz Lane at Project Access	EB Left	-	-	A (7.9)
	TWSC SB	-	-	B (12.5)

<sup>(1)</sup> TWSC = Two-way Stop Control



Capacity analysis results for the p.m. peak hour are shown in Table 5.

<b>TABLE 5</b>				
<b>INTERSECTION CAPACITY ANALYSIS RESULTS – P.M. PEAK HOUR</b>				
<b>Intersection</b>	<b>Condition<sup>(1)</sup></b>	<b>Level of Service (avg. delay/vehicle – sec.)</b>		
		<b>2017 Existing</b>	<b>2024 Background</b>	<b>2024 Total</b>
Columbia Pike at Critz Lane	SB Left	C (24.6)	-	-
	TWSC WB	E (39.0)	-	-
	Overall Signal	-	C (20.2)	C (28.5)
	<i>Overall Signal With Recommendation</i>	-	-	C (29.5)
Critz Lane at Westerham Way	EB Left	A (7.8)	A (8.1)	A (8.3)
	TWSC SB	B (11.7)	C (16.5)	C (20.3)
Critz Lane at Clayton Arnold Road	EB Left	A (7.4)	-	-
	WB Left	A (8.7)	-	-
	TWSC NB	C (15.2)	-	-
	TWSC SB	C (15.3)	-	-
	Overall Roundabout	-	C (15.6)	D (25.3)
Critz Lane at Sporting Hill Bridge Road	WB Left	A (7.5)	A (7.6)	A (7.7)
	TWSC NB	A (9.8)	B (10.7)	B (11.2)
Critz Lane at Pantall Road	WB Left	A (8.0)	-	-
	TWSC NB	A (9.5)	-	-
	Overall Roundabout	-	A (8.4)	A (9.2)
Critz Lane at Lewisburg Pike	NB Left	B (10.5)	-	-
	TWSC EB	D (29.2)	-	-
	Overall Signal	-	B (10.1)	B (10.9)
Critz Lane at Project Access	EB Left	-	-	A (8.1)
	TWSC SB	-	-	B (12.2)
<sup>(1)</sup> TWSC = Two-way Stop Control				

Level of service (LOS) criteria for unsignalized intersections is shown in Table 6.

TABLE 6		
LEVEL OF SERVICE DESCRIPTIONS FOR UNSIGNALIZED INTERSECTIONS		
Level of Service	Description	Control Delay (sec. /veh.)
A	Usually no conflicting traffic	0 - 10
B	Occasionally some delay due to conflicting traffic	> 10 - 15
C	Delay is noticeable but not inconveniencing	> 15 - 25
D	Delay is noticeable and irritating, increased risk taking	> 25 - 35
E	Delay approaches tolerance level, risk taking likely	> 35 - 50
F	Delay exceeds tolerance level, high likelihood of risk taking	> 50

Source: Highway Capacity Manual, HCM 2010

Level of service (LOS) criteria for signalized intersections is shown in Table 7.

TABLE 7		
LEVEL OF SERVICE DESCRIPTIONS FOR SIGNALIZED INTERSECTIONS		
Level of Service	Description	Control Delay (sec. /veh.)
A	Volume-to-capacity ratio is low, progression is extremely favorable, most vehicles travel through intersection without stopping.	0 - 10
B	Volume-to-capacity ratio is low, progression is good and/or short cycle lengths is present, more vehicles stop than for LOS A.	> 10 – 20
C	Progression is favorable and/or cycle length is moderate, number of vehicles stopping is significant although many still pass through intersection without stopping.	> 20 – 35
D	Volume-to-capacity ratio is high, progression is ineffective, cycle length is long, many vehicles stop.	> 35 – 55
E	Volume-to-capacity ratio is high, progression is unfavorable, cycle length is long, many vehicles stop.	> 55 – 80
F	Volume-to-capacity ratio is very high, progression is very poor, cycle length is long, most cycles fail to clear the queue.	> 80

Source: Highway Capacity Manual, HCM 2010

## B. Analysis Impact Thresholds

The Town of Thompson's Station has developed traffic impact thresholds for this project to determine the quality of future traffic operations and identify capacity deficiencies. The following thresholds indicate unsatisfactory conditions that would require mitigation:

- Overall intersections or intersection approaches operating at or below LOS E.
- Individual turning movements operating at LOS F.
- 95<sup>th</sup> percentile turn lane queues exceeding the available storage length.
- 95<sup>th</sup> percentile thru movement queues stretching back far enough to block an adjacent intersection or major driveway.

After conducting the capacity analysis, the intersections and individual turning movements are expected to operate at acceptable level of service based on the guidelines presented above.

Table 8 provides the 95<sup>th</sup> percentile queue lengths for approaches where the queue exceeds 250 feet in either the A.M. or P.M. peak hour.



TABLE 8					
95 <sup>th</sup> PERCENTILE QUEUE ANALYSIS					
Location	Approach	Available Storage <sup>(1)</sup>	95 <sup>th</sup> Percentile Queue Length (feet)		Sufficient Storage?
			A.M. Peak / P.M. Peak		
			2024 Background	2024 Total	
Columbia Pike at Critz Lane	WB Right	250 feet	315 / 0	573 / 0	No
	NB Thru / Right	6,500 feet	715 / 480	913 / 640	Yes
	SB Left	2,000 feet	93 / 650	148 / 1008	Yes
<i>Columbia Pike at Critz Lane With Recommendations</i>	<i>WB Right</i>	<i>250 feet</i>	-	<i>215 / 88</i>	Yes
	<i>NB Thru / Right</i>	<i>6,500 feet</i>	-	<i>685 / 663</i>	Yes
	<i>SB Left</i>	<i>2,000 feet</i>	-	<i>103 / 1025</i>	Yes
Critz Lane at Clayton Arnold Road	EB	2,300 feet	25 / 225	50 / 375	Yes
Critz Lane at Lewisburg Pike	EB Left	1,200 feet	310 / 100	355 / 115	Yes
	NB Thru	1,100 feet	1,170 / 48	1,275 / 50	No
	SB Thru	3,800 feet	65 / 270	68 / 285	Yes

<sup>(1)</sup> Available distance is based on length of turn lane or on distance to next upstream intersection or major driveway

C. Turn Lane Warrants

The National Cooperative Highway Research Program (NCHRP) Report 457 provides guidance for evaluating intersection improvements at unsignalized intersections. Specific volume-based warrants have been checked to evaluate the need for right turn and left turn deceleration and storage lanes.

Table 9 below details pertinent right turn lane warrant information for applicable intersections in the study area.

TABLE 9					
RIGHT TURN LANE WARRANT ANALYSIS					
Location	Peak Hour	Speed	Major-Road Volume	Right-Turn Volume	Right-Turn Bay Warranted
Critz Lane (WB) at Project Access	A.M.	40	231	18	No
	P.M.		220	61	No

Table 10 below details pertinent left turn lane warrant information for applicable intersections in the study area.

TABLE 10						
LEFT TURN LANE WARRANT ANALYSIS						
Location	Peak Hour	Speed	Opposing Volume	Advancing Volume	L%	Left-Turn Bay Warranted
Critz Lane (EB) at Project Access	A.M.	40	231	142	44	No
	P.M.		220	240	58	No

D. Safety Analysis

The Fields of Canterbury began development in 2007. A summary of historic crash data on Critz Lane between Columbia Pike and Lewisburg Pike for the period between 2010 and 2017 is shown below in Table 11.

<b>TABLE 11</b>					
<b>HISTORIC CRASH SUMMARY</b>					
<b>Year</b>	<b>Crash Type</b>				<b>Total Crashes</b>
	<b>Fatal</b>	<b>Incapacitating Injury</b>	<b>Other Injury</b>	<b>Property Damage</b>	
2010	0	0	0	1	1
2011	0	0	2	1	3
2012	0	0	3	1	4
2013	0	1	2	7	10
2014	0	0	1	3	4
2015	0	0	1	7	8
2016	0	0	2	3	5
2017	1	0	2	5	8

Source: TDOT Enhanced Tennessee Roadway Information Management System (E-TRIMS)

Even though there are not sufficient historical traffic counts available on Critz Lane to determine average crash rates and make comparisons to regional or statewide averages, the Highway Safety Manual and Crash Modification Factors Clearinghouse indicated that the planned improvements to Critz Lane can improve safety as described below.

- The crash reduction factor for increasing the lane width is 28 percent. The lane width on Critz Lane is being increased to 11 feet.
- The reduction factor for property damage crashes when providing a new shoulder that is 4 feet wide is 19 percent. The Critz Lane improvements will provide a shoulder with a width of 4 feet.
- The reduction factor for all crash types is 25 percent and the reduction factor for injury and fatal crashes is 35% when replacing a two-way stop intersection with a roundabout. On Critz Lane, the two-way stop intersections at Clayton Arnold Road / Paddock Park Drive and at Pantall Road will be replaced with roundabouts.



## VII. CONCLUSIONS AND RECOMMENDATIONS

### A. Introduction

Based upon a review of the existing and future proposed conditions within the study area, recommendations have been developed to provide efficient ingress and egress for The Fields of Canterbury while managing the impact to non-site trips on the roadway network. Additionally, recommendations for offsite intersections have also been provided to confirm improvement plans underway by others or to provide specific improvements that will mitigate a development impact.

### B. Columbia Pike at Critz Lane

Traffic operations in the horizon year 2024 for total traffic conditions at the signalized intersection of Columbia Pike at Critz Lane are expected to be characterized by level of service D during the a.m. peak hour and level of service C in the p.m. peak hour. While the level of service results for this intersection satisfy the Town's impact thresholds, the analysis indicates that the queue length for the westbound right turn lane will exceed the available storage prior to the build-out of the proposed additions to The Fields at Canterbury. This lengthening queue can be mitigated by modifying the lane assignments on the Critz Lane approaching Columbia Pike as described by the recommendation below.

The following improvements are recommended at the intersection of Columbia Pike at Critz Lane:

- The lane assignments on the approach of Critz Lane to Columbia Pike should be modified to consist of one eastbound travel lane, one westbound shared lane for left turn and right turn movements, and one westbound right turn lane. The traffic signal head displays for the Critz Lane approach should be modified to accommodate this lane assignment modification and to provide a right turn overlap during the southbound left turn phase. This improvement should be required to be installed by The Fields at Canterbury developer with the request to plat the 100<sup>th</sup> unit in the proposed additions to The Fields at Canterbury.

### C. Critz Lane at Westerham Way

The Critz Lane improvement proposed by the Town of Thompson's Station include turn lane improvements at this intersection consisting of an eastbound left turn lane with 335 feet of storage and a westbound right turn lane with 260 feet of storage. Approach and departure tapers for the proposed turn lanes will also be provided and appear to be in accordance with industry standards such as AASHTO and the MUTCD.

Traffic operations in the horizon year 2024 for total traffic conditions at the unsignalized intersection of Critz Lane at Westerham Way are expected meet the impact thresholds established in the Town's traffic study scope and will be characterized by level of service C during the a.m. and p.m. peak hour.

The following improvements are recommended at the intersection of Critz Lane at Westerham Way:

- The Town of Thompson's Station's proposal to include a left turn lane with a length of 335 feet and a taper of 225 feet is appropriate for this intersection. This turn lane is proposed as part of the Town's Critz Lane improvement project.

- The Town of Thompson's Station's proposal to include a right turn lane with a length of 260 feet and a taper of 160 feet is appropriate for this intersection. This turn lane is proposed as part of the Town's Critz Lane improvement project.
- The improvements proposed to be constructed as part of the Town of Thompson's Station's Critz Lane project will continue to be appropriate after development of the proposed additions to The Fields of Canterbury.

D. Critz Lane at Clayton Arnold Road / Paddock Park Drive

The Critz Lane improvements proposed by the Town of Thompson's Station include a single lane roundabout at this intersection with one lane entrances and exits on all four approaches. The roundabout layout provided by the Town appears to incorporate many of the accepted methods of modern roundabout design.

Traffic operations in the horizon year 2024 for total traffic conditions at the intersection of Critz Lane at Clayton Arnold Road are expected to be characterized by level of service D during the a.m. peak hour and level of service B in the p.m. peak hour.

The following improvements are recommended at the intersection of Critz Lane at Clayton Arnold Road:

- The Town of Thompson's Station's proposal to construct a roundabout at this intersection is appropriate based on the operational and safety advantages that a roundabout will have over two-way stop control at this location.
- The improvements proposed to be constructed as part of the Town of Thompson's Station's Critz Lane project will continue to be appropriate after development of the proposed additions to The Fields of Canterbury.

E. Critz Lane at Sporting Hill Bridge Road

The Critz Lane improvements proposed by the Town of Thompson's Station do not include any additional laneage or intersection control modifications at this intersection.

Traffic operations in the horizon year 2024 for total traffic conditions at the intersection of Critz Lane at Sporting Hill Bridge Road is expected to be characterized by level of service B during the a.m. and p.m. peak hour.

The following recommendation is offered at the intersection of Critz Lane at Sporting Hill Bridge Road:

- The Town of Thompson's Station proposed improvements to Critz Lane at this intersection are appropriate. These improvements will widen the existing lanes and shoulders but will not provide any turn lanes or intersection control modifications.
- The improvements proposed to be constructed as part of the Town of Thompson's Station's Critz Lane project will continue to be appropriate after development of the proposed additions to The Fields of Canterbury.



F. Critz Lane at Pantall Road

The Critz Lane improvements proposed by the Town of Thompson's Station include a single lane roundabout at this intersection with one lane entrances and exits on all three approaches. The roundabout layout provided by the Town appears to incorporate many of the accepted methods of modern roundabout design.

Traffic operations in the horizon year 2024 for total traffic conditions at the intersection of Critz Lane at Pantall Road is expected to be characterized by level of service A during the a.m. and p.m. peak hour.

The following improvements are recommended at the intersection of Critz Lane at Pantall Road:

- The Town of Thompson's Station's proposal to construct a roundabout at this intersection is appropriate based on the operational and safety advantages that a roundabout will have over two-way stop control at this location.
- The improvements proposed to be constructed as part of the Town of Thompson's Station's Critz Lane project will continue to be appropriate after development of the proposed additions to The Fields of Canterbury.

G. Lewisburg Pike at Critz Lane

An improvement project is currently underway at this intersection that will provide a southbound right turn lane with 375 feet of storage, a northbound left turn lane with 100 feet of storage, separate right and left turn lanes on the eastbound approach with 250 feet of storage, and a traffic signal installation.

Traffic operations in the horizon year 2024 for total traffic conditions at the signalized intersection of Lewisburg Pike at Critz Lane is expected to be characterized by level of service D during the a.m. peak hour and level of service B in the p.m. peak hour.

The following improvements are recommended at the intersection of Lewisburg Pike at Critz Lane:

- TDOT's proposal to construct a southbound right turn lane with 375 feet of storage and a taper of 175 feet is appropriate for this intersection. This project was bid by TDOT in December 2017 and the contract has been awarded.
- TDOT's proposal to construct a northbound left turn lane with 100 feet of storage and a taper of 175 feet is appropriate for this intersection. This project was bid by TDOT in December 2017 and the contract has been awarded.
- TDOT's proposal to construct separate eastbound right and left turn lanes with 250 feet of storage and a taper of 125 feet is appropriate for this intersection. This project was bid by TDOT in December 2017 and the contract has been awarded.
- TDOT's proposal to construct a traffic signal at this intersection is appropriate. This project was bid by TDOT in December 2017 and the contract has been awarded.
- The improvements being constructed by TDOT at this intersection will continue to be appropriate after development of the proposed additions to The Fields of Canterbury.

H. Critz Lane at Proposed Section 14 Access

Traffic operations in the horizon year 2024 for total traffic conditions at the unsignalized intersection of Critz Lane at the proposed access is expected to be characterized by level of service B during the a.m. and p.m. peak hour.

Right turn and left turn lane warrants were conducted at the intersection of Critz Lane at the proposed access. It was concluded that turn lanes are not warranted at this intersection based on the forecasted traffic volumes. However, this intersection will be located approximately 450 feet east of a crest vertical curve on Critz Lane. From a practical safety review perspective, a left turn lane on Critz Lane at this proposed access will allow eastbound vehicles to exit the travel lane when decelerating to turn left into the Proposed Section 14 Access. This will prevent following vehicles traveling eastbound from cresting the vertical curve on Critz Lane and finding the eastbound lane obstructed by a decelerating or stopped vehicle at the Proposed Section 14 Access.

The following improvements are recommended at the intersection of Critz Lane at the proposed access:

- The proposed access to Critz Lane from the proposed additions to The Fields at Canterbury should be constructed as part of Section 14 as shown on The Fields of Canterbury Concept Plan.
- The Proposed Section 14 Access should consist of one lane in each direction with pavement widths in compliance with the appropriate roadway section shown in the Town's Land Development Ordinance.
- An eastbound left turn lane should be installed on Critz Lane when the Proposed Section 14 Access is constructed. The left turn lane should have a length of 225 feet with tapers based on applicable AASHTO, MUTCD, and TDOT design guidelines.



**APPENDIX**

- A. TRAFFIC COUNT DATA**
- B. TRIP GENERATION & FUTURE TRAFFIC DERIVATION**
- C. 2017 EXISTING CONDITIONS CAPACITY ANALYSIS WORKSHEETS**
- D. 2024 BACKGROUND CONDITIONS CAPACITY ANALYSIS WORKSHEETS**
- E. 2024 TOTAL CONDITIONS CAPACITY ANALYSIS WORKSHEETS**

**APPENDIX A**  
**TRAFFIC COUNT DATA**











Date: 13-Dec-17  
 Location: Columbia Pike at Critz Lane

A.M. Peak Hour (6:00 - 9:00)

Time	Columbia Pike			Columbia Pike			Local Access			Critz Lane		
	NB Left	NB Thru	NB Right	SB Left	SB Thru	SB Right	EB Left	EB Thru	EB Right	WB Left	WB Thru	WB Right
6:45 - 7:00	0	316	0	9	121	0	0	0	0	1	0	106
7:00 - 7:15	0	320	0	15	133	0	0	0	0	0	0	112
7:15 - 7:30	0	287	2	16	161	0	0	0	0	0	0	121
7:30 - 7:45	0	278	4	16	163	0	0	0	0	1	0	74
<b>6:45 - 7:45</b>	<b>0</b>	<b>1201</b>	<b>6</b>	<b>56</b>	<b>578</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>2</b>	<b>0</b>	<b>413</b>

Peak Hour Factor: 0.961

P.M. Peak Hour (4:00 - 7:00)

Time	Columbia Pike			Columbia Pike			Local Access			Critz Lane		
	NB Left	NB Thru	NB Right	SB Left	SB Thru	SB Right	EB Left	EB Thru	EB Right	WB Left	WB Thru	WB Right
16:30 - 16:45	0	199	14	156	215	0	0	0	0	0	0	39
16:45 - 17:00	0	188	7	157	194	0	0	0	0	1	0	43
17:00 - 17:15	0	193	19	142	231	0	0	0	0	3	0	44
17:15 - 17:30	0	187	13	138	196	0	0	0	0	2	0	40
<b>16:30 - 17:30</b>	<b>0</b>	<b>767</b>	<b>53</b>	<b>593</b>	<b>836</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>6</b>	<b>0</b>	<b>166</b>

Peak Hour Factor: 0.958









Date: 13-Dec-17  
 Location: Critz Lane at Westerham Way

A.M. Peak Hour (6:00 - 9:00)

Time	0			Westerham Way			Critz Lane			Critz Lane		
	NB Left	NB Thru	NB Right	SB Left	SB Thru	SB Right	EB Left	EB Thru	EB Right	WB Left	WB Thru	WB Right
6:30 - 6:45	0	0	0	2	0	51	6	5	0	0	67	1
6:45 - 7:00	0	0	0	2	0	41	5	8	0	0	74	1
7:00 - 7:15	0	0	0	2	0	45	4	8	0	0	78	1
7:15 - 7:30	0	0	0	3	0	30	6	14	0	0	56	1
<b>6:30 - 7:30</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>9</b>	<b>0</b>	<b>167</b>	<b>21</b>	<b>35</b>	<b>0</b>	<b>0</b>	<b>275</b>	<b>4</b>

Peak Hour Factor: 0.926

P.M. Peak Hour (4:00 - 7:00)

Time	0			Westerham Way			Critz Lane			Critz Lane		
	NB Left	NB Thru	NB Right	SB Left	SB Thru	SB Right	EB Left	EB Thru	EB Right	WB Left	WB Thru	WB Right
16:30 - 16:45	0	0	0	4	0	17	52	129	0	0	22	5
16:45 - 17:00	0	0	0	3	0	21	40	116	0	0	21	4
17:00 - 17:15	0	0	0	1	0	21	35	129	0	0	36	6
17:15 - 17:30	0	0	0	7	0	23	40	130	0	0	16	3
<b>16:30 - 17:30</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>15</b>	<b>0</b>	<b>82</b>	<b>167</b>	<b>504</b>	<b>0</b>	<b>0</b>	<b>95</b>	<b>18</b>

Peak Hour Factor: 0.962











Date: 13-Dec-17  
 Location: Critz Lane at Clayton Arnold Road / Paddock

A.M. Peak Hour (6:00 - 9:00)

Time	Clayton Arnold Road			Paddock Park Drive			Critz Lane			Critz Lane		
	NB Left	NB Thru	NB Right	SB Left	SB Thru	SB Right	EB Left	EB Thru	EB Right	WB Left	WB Thru	WB Right
6:30 - 6:45	55	1	1	0	1	6	2	2	3	14	7	3
6:45 - 7:00	47	0	0	1	6	13	1	1	7	15	13	11
7:00 - 7:15	56	2	5	2	12	9	1	2	7	26	13	6
7:15 - 7:30	47	7	1	8	2	4	4	1	12	13	6	10
<b>6:30 - 7:30</b>	<b>205</b>	<b>10</b>	<b>7</b>	<b>11</b>	<b>21</b>	<b>32</b>	<b>8</b>	<b>6</b>	<b>29</b>	<b>68</b>	<b>39</b>	<b>30</b>

Peak Hour Factor: 0.826

P.M. Peak Hour (4:00 - 7:00)

Time	Clayton Arnold Road			Paddock Park Drive			Critz Lane			Critz Lane		
	NB Left	NB Thru	NB Right	SB Left	SB Thru	SB Right	EB Left	EB Thru	EB Right	WB Left	WB Thru	WB Right
16:30 - 16:45	13	2	2	1	12	11	1	5	121	16	7	11
16:45 - 17:00	16	6	3	4	8	3	5	7	108	9	6	8
17:00 - 17:15	16	7	9	8	9	7	3	14	114	9	17	6
17:15 - 17:30	9	1	6	6	11	4	5	7	120	12	4	16
<b>16:30 - 17:30</b>	<b>54</b>	<b>16</b>	<b>20</b>	<b>19</b>	<b>40</b>	<b>25</b>	<b>14</b>	<b>33</b>	<b>463</b>	<b>46</b>	<b>34</b>	<b>41</b>

Peak Hour Factor: 0.919









Date: 13-Dec-17  
 Location: Critz Lane at Sporting Hill Bridge Road / Loc:

A.M. Peak Hour (6:00 - 9:00)

Time	Sporting Hill Bridge Road			Local Access			Critz Lane			Critz Lane		
	NB Left	NB Thru	NB Right	SB Left	SB Thru	SB Right	EB Left	EB Thru	EB Right	WB Left	WB Thru	WB Right
7:00 - 7:15	10	0	7	0	0	1	0	5	2	5	32	0
7:15 - 7:30	6	0	12	0	0	0	0	9	2	13	22	0
7:30 - 7:45	7	0	15	0	0	1	0	4	2	6	21	1
7:45 - 8:00	9	0	17	0	0	0	0	8	4	8	21	0
<b>7:00 - 8:00</b>	<b>32</b>	<b>0</b>	<b>51</b>	<b>0</b>	<b>0</b>	<b>2</b>	<b>0</b>	<b>26</b>	<b>10</b>	<b>32</b>	<b>96</b>	<b>1</b>

Peak Hour Factor: 0.933

P.M. Peak Hour (4:00 - 7:00)

Time	Sporting Hill Bridge Road			Local Access			Critz Lane			Critz Lane		
	NB Left	NB Thru	NB Right	SB Left	SB Thru	SB Right	EB Left	EB Thru	EB Right	WB Left	WB Thru	WB Right
16:15 - 16:30	3	0	6	0	0	0	0	12	2	18	38	0
16:30 - 16:45	2	0	12	0	0	0	0	5	3	18	31	0
16:45 - 17:00	5	0	9	0	0	0	0	14	3	11	18	0
17:00 - 17:15	9	0	19	0	0	0	0	17	11	13	23	0
<b>16:15 - 17:15</b>	<b>19</b>	<b>0</b>	<b>46</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>48</b>	<b>19</b>	<b>60</b>	<b>110</b>	<b>0</b>

Peak Hour Factor: 0.821











Date: 13-Dec-17  
 Location: Critz Lane at Pantall Road / Local Access

A.M. Peak Hour (6:00 - 9:00)

Time	Pantall Road			Local Access			Critz Lane			Critz Lane		
	NB Left	NB Thru	NB Right	SB Left	SB Thru	SB Right	EB Left	EB Thru	EB Right	WB Left	WB Thru	WB Right
7:15 - 7:30	1	0	34	0	0	0	0	18	3	21	37	0
7:30 - 7:45	2	0	54	0	0	0	0	20	0	25	26	0
7:45 - 8:00	3	0	42	0	0	0	1	23	0	13	26	0
8:00 - 8:15	1	0	50	0	0	0	0	25	4	14	25	0
<b>7:15 - 8:15</b>	<b>7</b>	<b>0</b>	<b>180</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>1</b>	<b>86</b>	<b>7</b>	<b>73</b>	<b>114</b>	<b>0</b>

Peak Hour Factor: 0.921

P.M. Peak Hour (4:00 - 7:00)

Time	Pantall Road			Local Access			Critz Lane			Critz Lane		
	NB Left	NB Thru	NB Right	SB Left	SB Thru	SB Right	EB Left	EB Thru	EB Right	WB Left	WB Thru	WB Right
16:15 - 16:30	4	0	12	0	0	0	0	16	2	122	49	0
16:30 - 16:45	5	0	22	0	0	0	0	13	5	115	44	0
16:45 - 17:00	3	0	16	0	0	0	0	20	2	92	24	0
17:00 - 17:15	0	0	22	0	0	0	0	30	7	84	36	0
<b>16:15 - 17:15</b>	<b>12</b>	<b>0</b>	<b>72</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>79</b>	<b>16</b>	<b>413</b>	<b>153</b>	<b>0</b>

Peak Hour Factor: 0.909









Date: 13-Dec-17  
 Location: Critz Lane at Lewisburg Pike

A.M. Peak Hour (6:00 - 9:00)

Time	Lewisburg Pike			Lewisburg Pike			Critz Lane			0		
	NB Left	NB Thru	NB Right	SB Left	SB Thru	SB Right	EB Left	EB Thru	EB Right	WB Left	WB Thru	WB Right
6:30 - 6:45	6	326	0	0	16	25	41	0	5	0	0	0
6:45 - 7:00	3	284	0	0	30	46	59	0	2	0	0	0
7:00 - 7:15	11	244	0	0	23	55	37	0	1	0	0	0
7:15 - 7:30	3	250	0	0	52	56	50	0	3	0	0	0
<b>6:30 - 7:30</b>	<b>23</b>	<b>1104</b>	<b>0</b>	<b>0</b>	<b>121</b>	<b>182</b>	<b>187</b>	<b>0</b>	<b>11</b>	<b>0</b>	<b>0</b>	<b>0</b>

Peak Hour Factor: 0.960

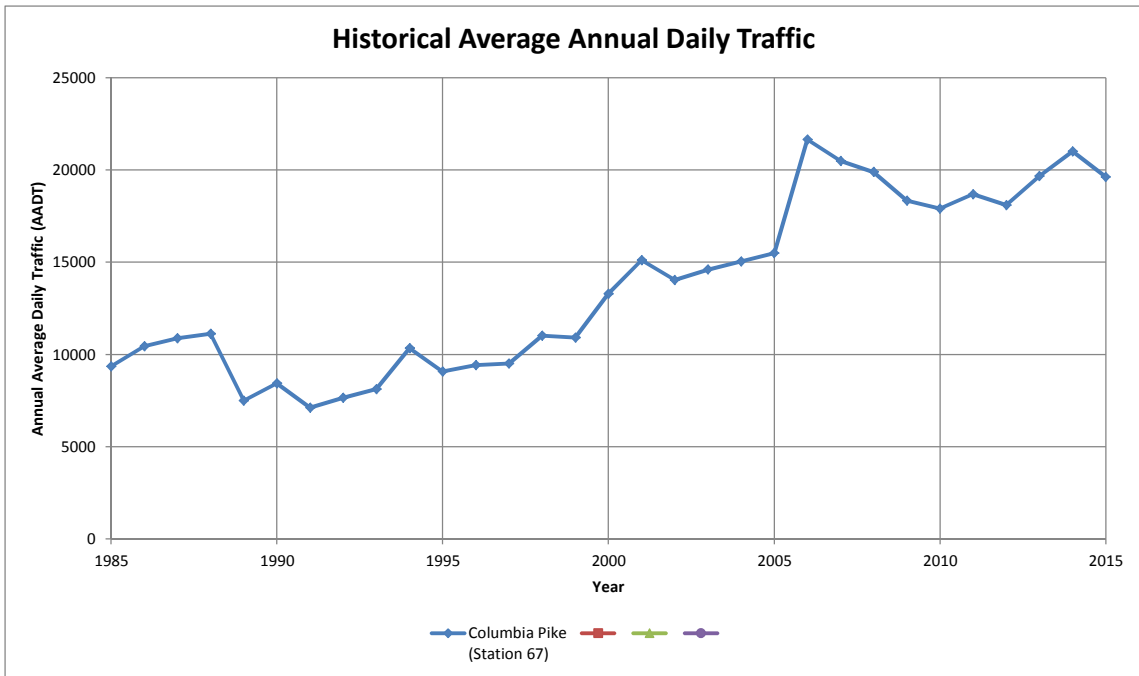
P.M. Peak Hour (4:00 - 7:00)

Time	Lewisburg Pike			Lewisburg Pike			Critz Lane			0		
	NB Left	NB Thru	NB Right	SB Left	SB Thru	SB Right	EB Left	EB Thru	EB Right	WB Left	WB Thru	WB Right
16:00 - 16:15	15	75	0	0	169	145	18	0	8	0	0	0
16:15 - 16:30	11	54	0	0	176	167	17	0	6	0	0	0
16:30 - 16:45	4	68	0	0	167	153	31	0	7	0	0	0
16:45 - 17:00	4	73	0	0	177	116	30	0	6	0	0	0
<b>16:00 - 17:00</b>	<b>34</b>	<b>270</b>	<b>0</b>	<b>0</b>	<b>689</b>	<b>581</b>	<b>96</b>	<b>0</b>	<b>27</b>	<b>0</b>	<b>0</b>	<b>0</b>

Peak Hour Factor: 0.984



HISTORICAL TRAFFIC COUNT DATA				
Year	Columbia Pike (Station 67)			
1985	9342			
1986	10443			
1987	10883			
1988	11127			
1989	7490			
1990	8427			
1991	7117			
1992	7654			
1993	8121			
1994	10337			
1995	9079			
1996	9418			
1997	9499			
1998	11015			
1999	10915			
2000	13289			
2001	15108			
2002	14037			
2003	14599			
2004	15037			
2005	15488			
2006	21645			
2007	20488			
2008	19891			
2009	18342			
2010	17900			
2011	18685			
2012	18101			
2013	19666			
2014	21013			
2015	19620			
2016	19816			



		Columbia Pike (Station 67)	-	-	-
Analysis Period	Begin	2011	2008	-	-
	End	2016	2015	-	-
Future Year		2021	2017	-	-
Forecasted Traffic Volume		21960	-	-	-
Annual Growth Rate		2.08%	-	-	-
Growth Factor		1.108	-	-	-

## **APPENDIX B**

# **TRIP GENERATION & FUTURE TRAFFIC DERIVATION**



TRAFFIC VOLUME WORKSHEET  
 SPECIFIC NON-SITE TRIP GENERATION &  
 PROPOSED DEVELOPMENT TRIP GENERATION



SPECIFIC NON-SITE DEVELOPMENT TRIP GENERATION							
Development	Daily	A.M. Peak Hour			P.M. Peak Hour		
		Enter	Exit	Total	Enter	Exit	Total
Remaining Canterbury (Phase 12B, 12C, 13: 90 SF, 54 TH)	1,311	23	73	96	79	47	126
K-8 Proposed School on Clayton Arnold (1,600 Students)	3,216	540	460	1,000	132	140	272
Avenue Downs (69 Single Family)	739	14	40	54	45	26	71
				0			0
<b>TOTAL</b>	<b>5,266</b>	<b>577</b>	<b>573</b>	<b>1,150</b>	<b>256</b>	<b>213</b>	<b>469</b>

CANTERBURY TRIP GENERATION 2024 HORIZON YEAR							
Development	Daily	A.M. Peak Hour			P.M. Peak Hour		
		Enter	Exit	Total	Enter	Exit	Total
Canterbury Proposed (179 SF, 141 TH)	2,801	48	150	198	162	96	258
<b>TOTAL</b>	<b>2,801</b>	<b>48</b>	<b>150</b>	<b>198</b>	<b>162</b>	<b>96</b>	<b>258</b>

## TRIP GENERATION - 10th EDITION - REMAINING CANTERBURY

### Single-Family Detached Housing - 90 Dwelling Units

Use ITE Land Use Code 210 (Single-Family Detached Housing) and associated trip generation rates for 24-hour total trips and peak hour trips.

#### Average Daily Traffic

$$\begin{aligned}\ln(T) &= 0.92 \ln(X) + 2.71 \\ \ln(T) &= 0.92 \ln(90) + 2.71 \\ T &= 944\end{aligned}$$

#### A.M. Peak Hour of Adjacent Street Traffic

$$\begin{aligned}T &= 0.71(X) + 4.8 \\ T &= 0.71(90) + 4.8 \\ T &= 69\end{aligned}$$

$$\begin{aligned}\text{Enter} &= 0.25(69) = 17 \\ \text{Exit} &= 0.75(69) = 52\end{aligned}$$

#### P.M. Peak Hour of Adjacent Street Traffic

$$\begin{aligned}\ln(T) &= 0.96 \ln(X) + 0.20 \\ \ln(T) &= 0.96 \ln(90) + 0.20 \\ T &= 92\end{aligned}$$

$$\begin{aligned}\text{Enter} &= 0.63(92) = 58 \\ \text{Exit} &= 0.37(92) = 34\end{aligned}$$



## TRIP GENERATION - 10th EDITION - REMAINING CANTERBURY

### Multifamily H 54 Dwelling Units

Low-rise multifamily housing includes apartments, townhouses, and condominiums located within the same building with at least three other dwelling units and that have one or two levels.

#### Average Daily Traffic

$$T = 7.56(X) - 40.86$$

$$T = 7.56(54) - 40.86$$

$$T = 367$$

#### A.M. Peak Hour of Adjacent Street Traffic

$$\ln(T) = 0.95 \ln(X) - 0.51$$

$$\ln(T) = 0.95 \ln(54) - 0.51$$

$$T = 27$$

$$\text{Enter} = 0.23(27) = 6$$

$$\text{Exit} = 0.77(27) = 21$$

#### P.M. Peak Hour of Adjacent Street Traffic

$$\ln(T) = 0.89 \ln(X) - 0.02$$

$$\ln(T) = 0.89 \ln(54) - 0.02$$

$$T = 34$$

$$\text{Enter} = 0.63(34) = 21$$

$$\text{Exit} = 0.37(34) = 13$$

## TRIP GENERATION - 10th EDITION

**Elementary School - 800 Students**

Use ITE Land Use Code 520 (Elementary School) and associated trip generation rates for 24-hour total trips and peak hour trips.

### Average Daily Traffic

$$T = 1.89(X)$$

$$T = 1.89(800)$$

$$T = 1512$$

### A.M. Peak Hour

$$T = 0.67(X)$$

$$T = 0.67(800)$$

$$T = 536$$

$$\text{Enter} = 0.54(536) = 289$$

$$\text{Exit} = 0.46(536) = 247$$

### P.M. Peak Hour of Adjacent Street Traffic

$$T = 0.17(X)$$

$$T = 0.17(800)$$

$$T = 136$$

$$\text{Enter} = 0.48(136) = 65$$

$$\text{Exit} = 0.52(136) = 71$$



## TRIP GENERATION - 10th EDITION

**Middle School/Junior High School - 800 Students**

Use ITE Land Use Code 522 (Middle School/Junior High School) and associated trip generation rates for 24-hour total trips and peak hour trips.

### Average Daily Traffic

$$T = 2.13(X)$$

$$T = 2.13(800)$$

$$T = 1704$$

### A.M. Peak Hour

$$T = 0.58(X)$$

$$T = 0.58(800)$$

$$T = 464$$

$$\text{Enter} = 0.54(464) = 251$$

$$\text{Exit} = 0.46(464) = 213$$

### P.M. Peak Hour of Adjacent Street Traffic

$$T = 0.17(X)$$

$$T = 0.17(800)$$

$$T = 136$$

$$\text{Enter} = 0.49(136) = 67$$

$$\text{Exit} = 0.51(136) = 69$$

## TRIP GENERATION - 10th EDITION - AVENUE DOWNS

### Single-Family Detached Housing - 69 Dwelling Units

Use ITE Land Use Code 210 (Single-Family Detached Housing) and associated trip generation rates for 24-hour total trips and peak hour trips.

#### Average Daily Traffic

$$\ln(T) = 0.92 \ln(X) + 2.71$$

$$\ln(T) = 0.92 \ln(69) + 2.71$$

$$T = 739$$

#### A.M. Peak Hour of Adjacent Street Traffic

$$T = 0.71(X) + 4.8$$

$$T = 0.71(69) + 4.8$$

$$T = 54$$

$$\text{Enter} = 0.25(54) = 14$$

$$\text{Exit} = 0.75(54) = 40$$

#### P.M. Peak Hour of Adjacent Street Traffic

$$\ln(T) = 0.96 \ln(X) + 0.20$$

$$\ln(T) = 0.96 \ln(69) + 0.20$$

$$T = 71$$

$$\text{Enter} = 0.63(71) = 45$$

$$\text{Exit} = 0.37(71) = 26$$



## TRIP GENERATION - 10th EDITION - PROPOSED CANTERBURY

### Single-Family Detached Housing - 179 Dwelling Units

Use ITE Land Use Code 210 (Single-Family Detached Housing) and associated trip generation rates for 24-hour total trips and peak hour trips.

#### Average Daily Traffic

$$\ln(T) = 0.92 \ln(X) + 2.71$$

$$\ln(T) = 0.92 \ln(179) + 2.71$$

$$T = 1776$$

#### A.M. Peak Hour of Adjacent Street Traffic

$$T = 0.71(X) + 4.8$$

$$T = 0.71(179) + 4.8$$

$$T = 132$$

$$\text{Enter} = 0.25(132) = 33$$

$$\text{Exit} = 0.75(132) = 99$$

#### P.M. Peak Hour of Adjacent Street Traffic

$$\ln(T) = 0.96 \ln(X) + 0.20$$

$$\ln(T) = 0.96 \ln(179) + 0.20$$

$$T = 178$$

$$\text{Enter} = 0.63(178) = 112$$

$$\text{Exit} = 0.37(178) = 66$$

## TRIP GENERATION - 10th EDITION - PROPOSED CANTERBURY

### Multifamily H 141 Dwelling Units

Low-rise multifamily housing includes apartments, townhouses, and condominiums located within the same building with at least three other dwelling units and that have one or two levels.

#### Average Daily Traffic

$$T = 7.56(X) - 40.86$$

$$T = 7.56(141) - 40.86$$

$$T = 1025$$

#### A.M. Peak Hour of Adjacent Street Traffic

$$\ln(T) = 0.95 \ln(X) - 0.51$$

$$\ln(T) = 0.95 \ln(141) - 0.51$$

$$T = 66$$

$$\text{Enter} = 0.23(66) = 15$$

$$\text{Exit} = 0.77(66) = 51$$

#### P.M. Peak Hour of Adjacent Street Traffic

$$\ln(T) = 0.89 \ln(X) - 0.02$$

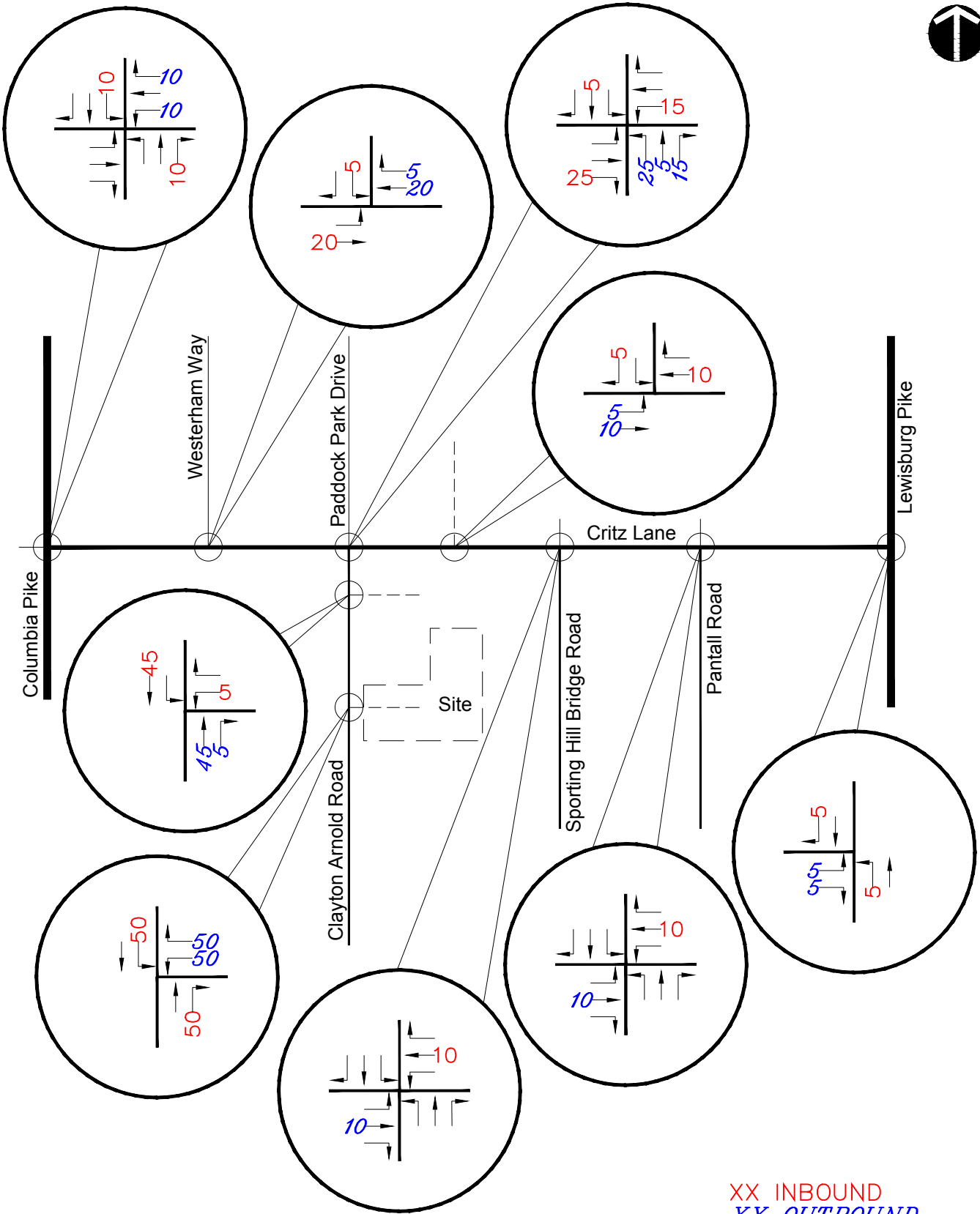
$$\ln(T) = 0.89 \ln(141) - 0.02$$

$$T = 80$$

$$\text{Enter} = 0.63(80) = 50$$

$$\text{Exit} = 0.37(80) = 30$$

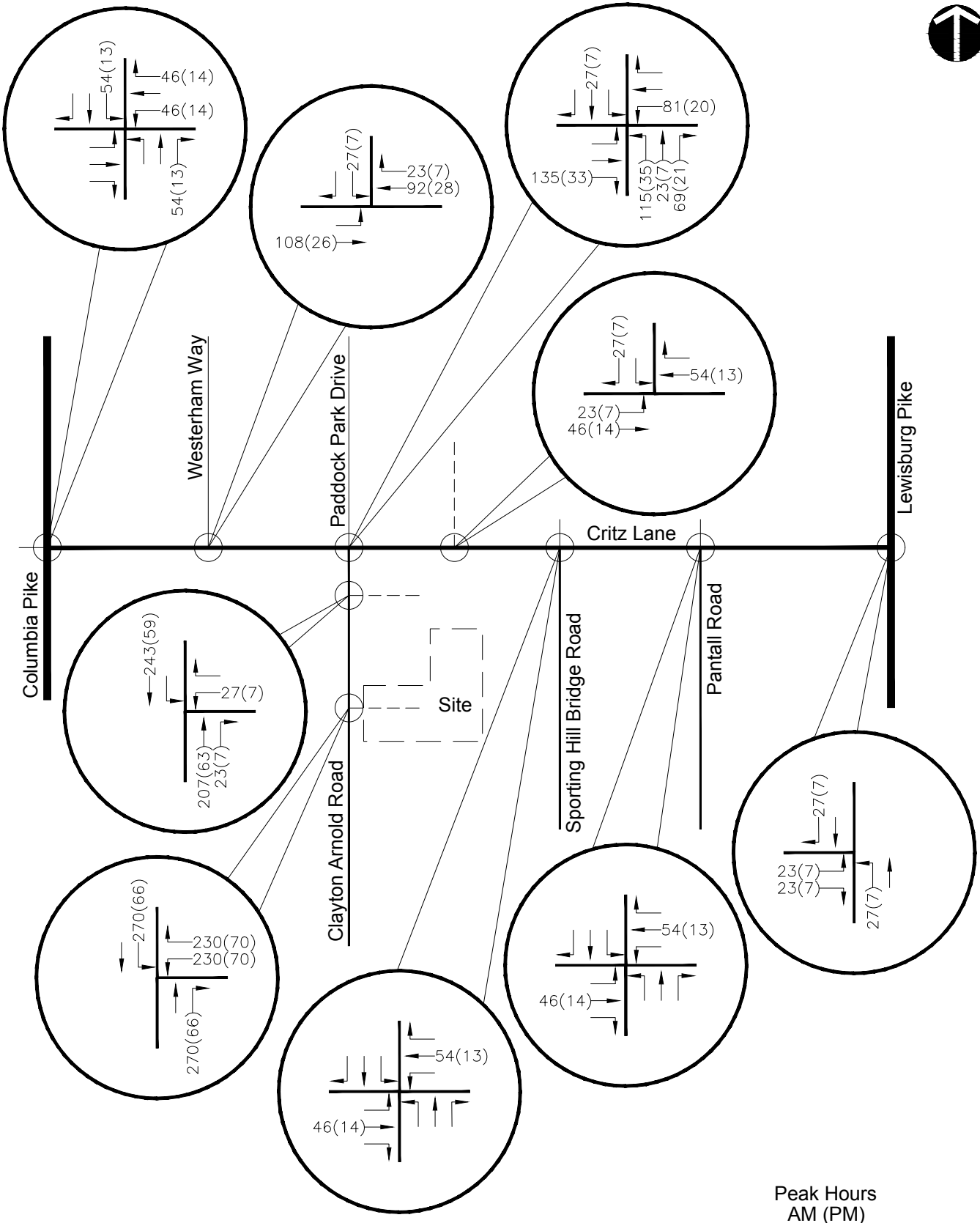




XX INBOUND  
XX OUTBOUND

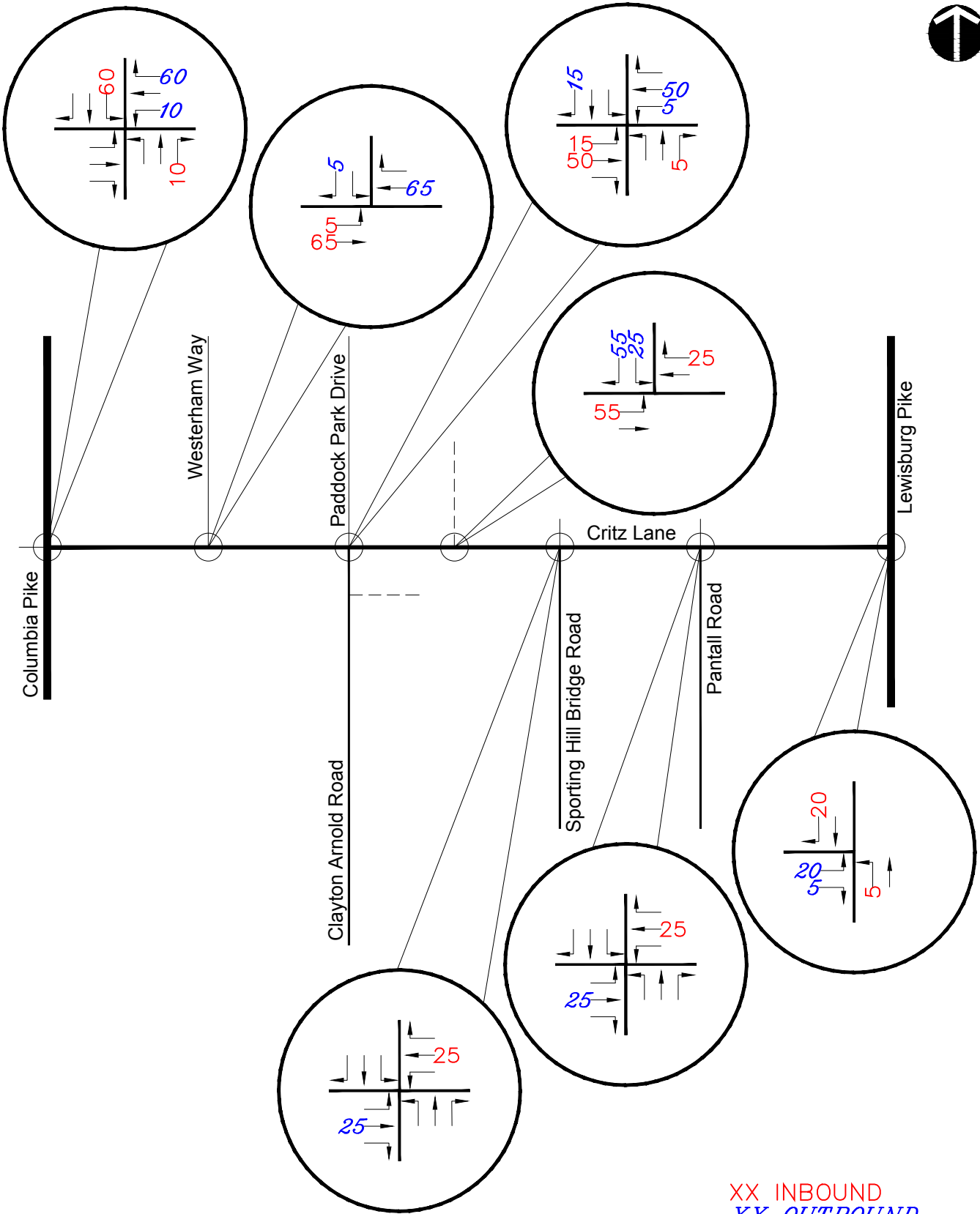


# Clayton Arnold Road School Trip Distribution



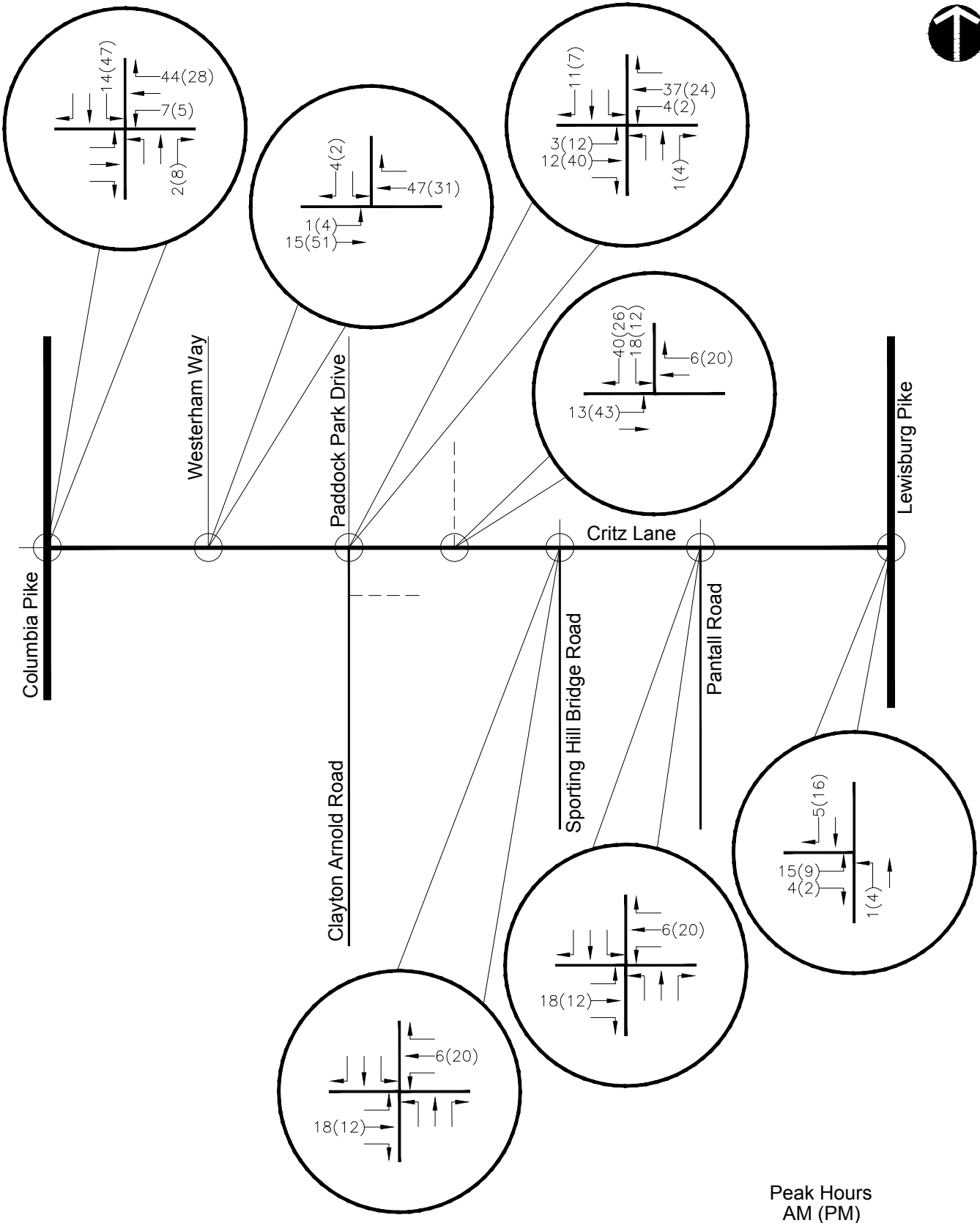
# Clayton Arnold Road School Site Volumes





XX INBOUND  
XX OUTBOUND

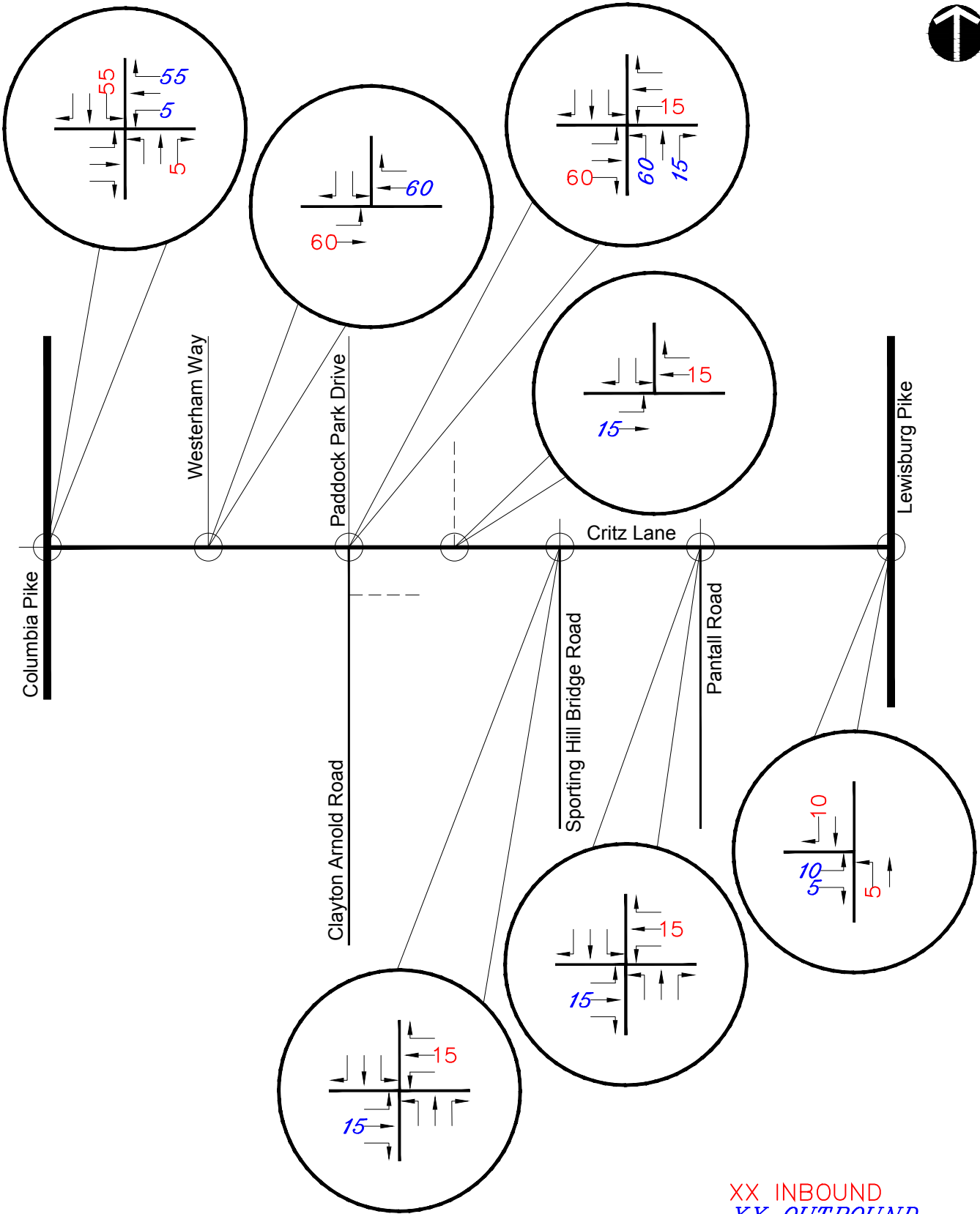




Peak Hours  
AM (PM)



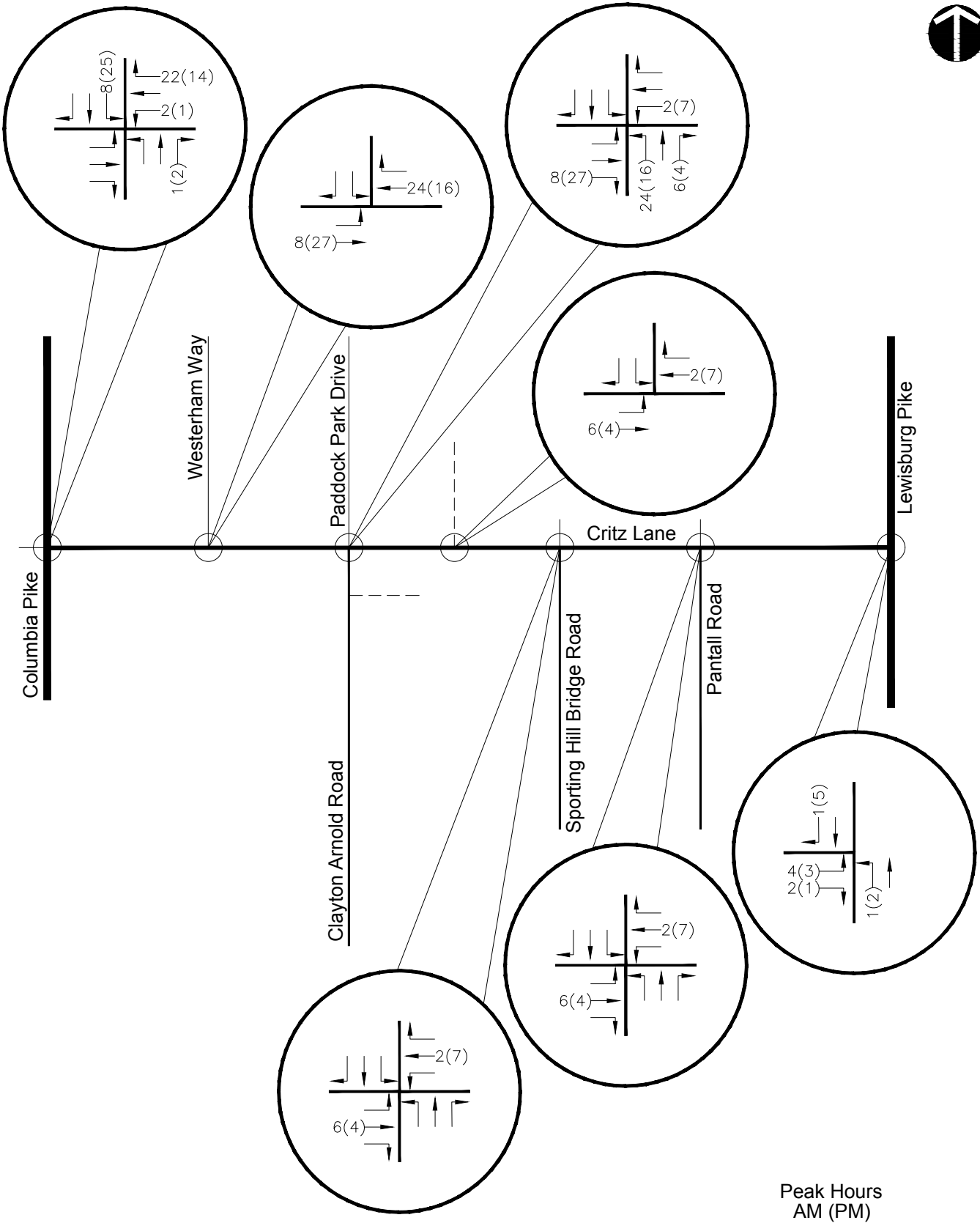




XX INBOUND  
XX OUTBOUND



# Avenue Downs Trip Distribution



Peak Hours  
AM (PM)



# Avenue Downs Site Volumes



**TRAFFIC VOLUME WORKSHEET**  
**COLUMBIA PIKE AT CRITZ LANE / LOCAL ACCESS**  
**A.M. PEAK HOUR**



Description	Northbound Columbia Pike			Southbound Columbia Pike			Eastbound Local Access			Westbound Critz Lane		
	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
2017 EXISTING TRAFFIC VOLUMES	0	1201	6	56	578	0	0	0	0	2	0	413
<b>2024 BACKGROUND TRAFFIC VOLUMES</b>												
<i>Annual Background Growth</i>												
Growth Rate (%/year)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Growth Factor	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15
Annual Background Growth Trips	0	179	1	8	86	0	0	0	0	0	0	61
<i>Specific Development Background Growth</i>												
Remaining Canterbury (Phase 12B, 12C, 13: 90 SF, 54 TH)	% In % Out Trips		10	60					10		60	
	0	0	2	14	0	0	0	0	0	7	0	44
K-8 Proposed School on Clayton Arnold (1,600 Students)	% In % Out Trips		10	10					10		10	
	0	0	54	54	0	0	0	0	0	46	0	46
Avenue Downs (69 Single Family)	% In % Out Trips		5	55					5		55	
	0	0	1	8	0	0	0	0	0	2	0	22
Specific Development Background Growth Trips	0	0	57	76	0	0	0	0	0	55	0	112
2024 Background Traffic Volumes	0	1380	64	140	664	0	0	0	0	57	0	586
<b>2024 SITE TRAFFIC VOLUMES</b>												
Canterbury Proposed (179 SF, 141 TH)	% In % Out Trips		10	60					10		60	
	0	0	5	29	0	0	0	0	0	15	0	90
2024 Site Traffic Volumes	0	0	5	29	0	0	0	0	0	15	0	90
2024 TOTAL TRAFFIC VOLUMES	0	1380	69	169	664	0	0	0	0	72	0	676

**TRAFFIC VOLUME WORKSHEET  
COLUMBIA PIKE AT CRITZ LANE / LOCAL ACCESS  
P.M. PEAK HOUR**



Description	Northbound Columbia Pike			Southbound Columbia Pike			Eastbound Local Access			Westbound Critz Lane		
	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
2017 EXISTING TRAFFIC VOLUMES	0	767	53	593	836	0	0	0	0	6	0	166
<b>2024 BACKGROUND TRAFFIC VOLUMES</b>												
<i>Annual Background Growth</i>												
Growth Rate (%/year)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Growth Factor	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15
Annual Background Growth Trips	0	114	8	88	124	0	0	0	0	1	0	25
<i>Specific Development Background Growth</i>												
Remaining Canterbury (Phase 12B, 12C, 13: 90 SF, 54 TH)	% In % Out Trips		10	60					10		60	
	0	0	8	47	0	0	0	0	0	5	0	28
K-8 Proposed School on Clayton Arnold (1,600 Students)	% In % Out Trips		10	10					10		10	
	0	0	13	13	0	0	0	0	0	14	0	14
Avenue Downs (69 Single Family)	% In % Out Trips		5	55					5		55	
	0	0	2	25	0	0	0	0	0	1	0	14
Specific Development Background Growth Trips	0	0	23	85	0	0	0	0	0	20	0	56
2024 Background Traffic Volumes	0	881	84	766	960	0	0	0	0	27	0	247
<b>2024 SITE TRAFFIC VOLUMES</b>												
Canterbury Proposed (179 SF, 141 TH)	% In % Out Trips		10	60					10		60	
	0	0	16	97	0	0	0	0	0	10	0	58
2024 Site Traffic Volumes	0	0	16	97	0	0	0	0	0	10	0	58
<b>2024 TOTAL TRAFFIC VOLUMES</b>	<b>0</b>	<b>881</b>	<b>100</b>	<b>863</b>	<b>960</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>37</b>	<b>0</b>	<b>305</b>



**TRAFFIC VOLUME WORKSHEET  
CRITZ LANE AT WESTERHAM WAY  
A.M. PEAK HOUR**



Description	Northbound			Southbound Westerham Way			Eastbound Critz Lane			Westbound Critz Lane		
	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
2017 EXISTING TRAFFIC VOLUMES				9		167	21	35			275	4
2024 BACKGROUND TRAFFIC VOLUMES												
<i>Annual Background Growth</i>												
Growth Rate (%/year)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Growth Factor	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15
Annual Background Growth Trips	0	0	0	1	0	25	3	5	0	0	41	1
<i>Specific Development Background Growth</i>												
Remaining Canterbury (Phase 12B, 12C, 13: 90 SF, 54 TH)						5	5	65			65	
% In Trips	0	0	0	0	0	4	1	15	0	0	47	0
% Out Trips												
K-8 Proposed School on Clayton Arnold (1,600 Students)				5				20			20	5
% In Trips	0	0	0	27	0	0	0	108	0	0	92	23
% Out Trips												
Avenue Downs (69 Single Family)								60			60	
% In Trips	0	0	0	0	0	0	0	8	0	0	24	0
% Out Trips												
Specific Development Background Growth Trips	0	0	0	27	0	4	1	131	0	0	163	23
2024 Background Traffic Volumes	0	0	0	37	0	196	25	171	0	0	479	28
2024 SITE TRAFFIC VOLUMES												
Canterbury Proposed (179 SF, 141 TH)						5	5	65			65	
% In Trips	0	0	0	0	0	8	2	31	0	0	98	0
% Out Trips												
2024 Site Traffic Volumes	0	0	0	0	0	8	2	31	0	0	98	0
2024 TOTAL TRAFFIC VOLUMES	0	0	0	37	0	204	27	202	0	0	577	28

**TRAFFIC VOLUME WORKSHEET  
CRITZ LANE AT WESTERHAM WAY  
P.M. PEAK HOUR**



Description	Northbound			Southbound Westerham Way			Eastbound Critz Lane			Westbound Critz Lane		
	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
2017 EXISTING TRAFFIC VOLUMES				15		82	167	504		95		18
2024 BACKGROUND TRAFFIC VOLUMES												
<i>Annual Background Growth</i>												
Growth Rate (%/year)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Growth Factor	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15
Annual Background Growth Trips	0	0	0	2	0	12	25	75	0	0	14	3
<i>Specific Development Background Growth</i>												
Remaining Canterbury (Phase 12B, 12C, 13: 90 SF, 54 TH)						5	5	65			65	
% In Trips	0	0	0	0	0	2	4	51	0	0	31	0
% Out Trips												
K-8 Proposed School on Clayton Arnold (1,600 Students)				5				20			20	5
% In Trips	0	0	0	7	0	0	0	26	0	0	28	7
% Out Trips												
Avenue Downs (69 Single Family)								60			60	
% In Trips	0	0	0	0	0	0	0	27	0	0	16	0
% Out Trips												
Specific Development Background Growth Trips	0	0	0	7	0	2	4	104	0	0	75	7
2024 Background Traffic Volumes	0	0	0	24	0	96	196	683	0	0	184	28
2024 SITE TRAFFIC VOLUMES												
Canterbury Proposed (179 SF, 141 TH)						5	5	65			65	
% In Trips	0	0	0	0	0	5	8	105	0	0	62	0
% Out Trips												
2024 Site Traffic Volumes	0	0	0	0	0	5	8	105	0	0	62	0
2024 TOTAL TRAFFIC VOLUMES	0	0	0	24	0	101	204	788	0	0	246	28

**TRAFFIC VOLUME WORKSHEET  
CRITZ LANE AT CLAYTON ARNOLD ROAD  
A.M. PEAK HOUR**



Description	Northbound Clayton Arnold Road			Southbound Paddock Park Drive			Eastbound Critz Lane			Westbound Critz Lane		
	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
2017 EXISTING TRAFFIC VOLUMES	205	10	7	11	21	32	8	6	29	68	39	30
2024 BACKGROUND TRAFFIC VOLUMES												
<i>Annual Background Growth</i>												
Growth Rate (%/year)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Growth Factor	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15
Annual Background Growth Trips	30	1	1	2	3	5	1	1	4	10	6	4
<i>Specific Development Background Growth</i>												
Remaining Canterbury (Phase 12B, 12C, 13: 90 SF, 54 TH)			5			15	15	50		5	50	
% In Trips	0	0	1	0	0	11	3	12	0	4	37	0
% Out Trips												
K-8 Proposed School on Clayton Arnold (1,600 Students)	25	5	15	0	27	0	0	0	135	81	0	0
% In Trips	115	23	69	0	27	0	0	0	135	81	0	0
% Out Trips												
Avenue Downs (69 Single Family)	60	0	15	0	0	0	0	0	8	2	0	0
% In Trips	24	0	6	0	0	0	0	0	8	2	0	0
% Out Trips												
Specific Development Background Growth Trips	139	23	76	0	27	11	3	12	143	87	37	0
2024 Background Traffic Volumes	374	34	84	13	51	48	12	19	176	165	82	34
2024 SITE TRAFFIC VOLUMES												
Canterbury Proposed (179 SF, 141 TH)			5			15	15	50		5	50	
% In Trips	0	0	2	0	0	23	7	24	0	8	75	0
% Out Trips												
2024 Site Traffic Volumes	0	0	2	0	0	23	7	24	0	8	75	0
2024 TOTAL TRAFFIC VOLUMES	374	34	86	13	51	71	19	43	176	173	157	34



**TRAFFIC VOLUME WORKSHEET  
CRITZ LANE AT CLAYTON ARNOLD ROAD  
P.M. PEAK HOUR**



Description	Northbound Clayton Arnold Road			Southbound Paddock Park Drive			Eastbound Critz Lane			Westbound Critz Lane		
	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
2017 EXISTING TRAFFIC VOLUMES	54	16	20	19	40	25	14	33	463	46	34	41
2024 BACKGROUND TRAFFIC VOLUMES												
<i>Annual Background Growth</i>												
Growth Rate (%/year)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Growth Factor	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15
Annual Background Growth Trips	8	2	3	3	6	4	2	5	69	7	5	6
<i>Specific Development Background Growth</i>												
Remaining Canterbury (Phase 12B, 12C, 13: 90 SF, 54 TH)			5			15	15	50		5	50	
% In Trips	0	0	4	0	0	7	12	40	0	2	24	0
% Out Trips												
K-8 Proposed School on Clayton Arnold (1,600 Students)	25	5	15	0	7	0	0	0	33	20	0	0
% In Trips	35	7	21									
% Out Trips												
Avenue Downs (69 Single Family)	60	0	15	0	0	0	0	0	27	7	0	0
% In Trips	16	0	4									
% Out Trips												
Specific Development Background Growth Trips	51	7	29	0	7	7	12	40	60	29	24	0
2024 Background Traffic Volumes	113	25	52	22	53	36	28	78	592	82	63	47
2024 SITE TRAFFIC VOLUMES												
Canterbury Proposed (179 SF, 141 TH)			5			15	15	50		5	50	
% In Trips	0	0	8	0	0	14	24	81	0	5	48	0
% Out Trips												
2024 Site Traffic Volumes	0	0	8	0	0	14	24	81	0	5	48	0
2024 TOTAL TRAFFIC VOLUMES	113	25	60	22	53	50	52	159	592	87	111	47

**TRAFFIC VOLUME WORKSHEET**  
**CRITZ LANE AT SPORTING HILL BRIDGE ROAD**  
**A.M. PEAK HOUR**



Description	Northbound Sporting Hill Bridge			Southbound Local Access			Eastbound Critz Lane			Westbound Critz Lane		
	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
2017 EXISTING TRAFFIC VOLUMES	32	0	51	0	0	2	0	26	10	32	96	1
2024 BACKGROUND TRAFFIC VOLUMES												
<i>Annual Background Growth</i>												
Growth Rate (%/year)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Growth Factor	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15
Annual Background Growth Trips	5	0	8	0	0	0	0	4	1	5	14	0
<i>Specific Development Background Growth</i>												
Remaining Canterbury (Phase 12B, 12C, 13: 90 SF, 54 TH)								25			25	
% In Trips	0	0	0	0	0	0	0	18	0	0	6	0
% Out Trips												
K-8 Proposed School on Clayton Arnold (1,600 Students)								10			10	
% In Trips	0	0	0	0	0	0	0	46	0	0	54	0
% Out Trips												
Avenue Downs (69 Single Family)								15			15	
% In Trips	0	0	0	0	0	0	0	6	0	0	2	0
% Out Trips												
Specific Development Background Growth Trips	0	0	0	0	0	0	0	70	0	0	62	0
2024 Background Traffic Volumes	37	0	59	0	0	2	0	100	11	37	172	1
2024 SITE TRAFFIC VOLUMES												
Canterbury Proposed (179 SF, 141 TH)								25			25	
% In Trips	0	0	0	0	0	0	0	38	0	0	12	0
% Out Trips												
2024 Site Traffic Volumes	0	0	0	0	0	0	0	38	0	0	12	0
2024 TOTAL TRAFFIC VOLUMES	37	0	59	0	0	2	0	138	11	37	184	1

**TRAFFIC VOLUME WORKSHEET  
CRITZ LANE AT SPORTING HILL BRIDGE ROAD  
P.M. PEAK HOUR**



Description	Northbound Sporting Hill Bridge			Southbound Local Access			Eastbound Critz Lane			Westbound Critz Lane		
	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
2017 EXISTING TRAFFIC VOLUMES	19	0	46	0	0	0	0	48	19	60	110	0
2024 BACKGROUND TRAFFIC VOLUMES												
<i>Annual Background Growth</i>												
Growth Rate (%/year)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Growth Factor	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15
Annual Background Growth Trips	3	0	7	0	0	0	0	7	3	9	16	0
<i>Specific Development Background Growth</i>												
Remaining Canterbury (Phase 12B, 12C, 13: 90 SF, 54 TH)	% In % Out Trips						25			25		
	0	0	0	0	0	0	0	12	0	0	20	0
K-8 Proposed School on Clayton Arnold (1,600 Students)	% In % Out Trips						10			10		
	0	0	0	0	0	0	0	14	0	0	13	0
Avenue Downs (69 Single Family)	% In % Out Trips						15			15		
	0	0	0	0	0	0	0	4	0	0	7	0
Specific Development Background Growth Trips	0	0	0	0	0	0	0	30	0	0	40	0
2024 Background Traffic Volumes	22	0	53	0	0	0	0	85	22	69	166	0
2024 SITE TRAFFIC VOLUMES												
Canterbury Proposed (179 SF, 141 TH)	% In % Out Trips						25			25		
	0	0	0	0	0	0	0	24	0	0	41	0
2024 Site Traffic Volumes	0	0	0	0	0	0	0	24	0	0	41	0
2024 TOTAL TRAFFIC VOLUMES	22	0	53	0	0	0	0	109	22	69	207	0



**TRAFFIC VOLUME WORKSHEET  
CRITZ LANE AT PANTALL ROAD  
A.M. PEAK HOUR**



Description	Northbound Pantall Road			Southbound Local Access			Eastbound Critz Lane			Westbound Critz Lane		
	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
2017 EXISTING TRAFFIC VOLUMES	7	0	180	0	0	0	1	86	7	73	114	0
2024 BACKGROUND TRAFFIC VOLUMES												
<i>Annual Background Growth</i>												
Growth Rate (%/year)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Growth Factor	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15
Annual Background Growth Trips	1	0	27	0	0	0	0	13	1	11	17	0
<i>Specific Development Background Growth</i>												
Remaining Canterbury (Phase 12B, 12C, 13: 90 SF, 54 TH)			% In % Out Trips					25		25		
	0	0	0	0	0	0	0	18	0	0	6	0
K-8 Proposed School on Clayton Arnold (1,600 Students)			% In % Out Trips					10		10		
	0	0	0	0	0	0	0	46	0	0	54	0
Avenue Downs (69 Single Family)			% In % Out Trips					15		15		
	0	0	0	0	0	0	0	6	0	0	2	0
Specific Development Background Growth Trips	0	0	0	0	0	0	0	70	0	0	62	0
2024 Background Traffic Volumes	8	0	207	0	0	0	1	169	8	84	193	0
2024 SITE TRAFFIC VOLUMES												
Canterbury Proposed (179 SF, 141 TH)			% In % Out Trips					25		25		
	0	0	0	0	0	0	0	38	0	0	12	0
2024 Site Traffic Volumes	0	0	0	0	0	0	0	38	0	0	12	0
2024 TOTAL TRAFFIC VOLUMES	8	0	207	0	0	0	1	207	8	84	205	0

**TRAFFIC VOLUME WORKSHEET  
CRITZ LANE AT PANTALL ROAD  
P.M. PEAK HOUR**



Description	Northbound Pantall Road			Southbound Local Access			Eastbound Critz Lane			Westbound Critz Lane		
	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
2017 EXISTING TRAFFIC VOLUMES	3	0	70	0	0	0	0	38	11	310	91	0
<b>2024 BACKGROUND TRAFFIC VOLUMES</b>												
<i>Annual Background Growth</i>												
Growth Rate (%/year)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Growth Factor	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15
Annual Background Growth Trips	0	0	10	0	0	0	0	6	2	46	14	0
<i>Specific Development Background Growth</i>												
Remaining Canterbury (Phase 12B, 12C, 13: 90 SF, 54 TH)			% In % Out Trips					25		25		
	0	0	0	0	0	0	0	12	0	0	20	0
K-8 Proposed School on Clayton Arnold (1,600 Students)			% In % Out Trips					10		10		
	0	0	0	0	0	0	0	14	0	0	13	0
Avenue Downs (69 Single Family)			% In % Out Trips					15		15		
	0	0	0	0	0	0	0	4	0	0	7	0
Specific Development Background Growth Trips	0	0	0	0	0	0	0	30	0	0	40	0
2024 Background Traffic Volumes	3	0	80	0	0	0	0	74	13	356	145	0
<b>2024 SITE TRAFFIC VOLUMES</b>												
Canterbury Proposed (179 SF, 141 TH)			% In % Out Trips					25		25		
	0	0	0	0	0	0	0	24	0	0	41	0
2024 Site Traffic Volumes	0	0	0	0	0	0	0	24	0	0	41	0
<b>2024 TOTAL TRAFFIC VOLUMES</b>	<b>3</b>	<b>0</b>	<b>80</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>98</b>	<b>13</b>	<b>356</b>	<b>186</b>	<b>0</b>

**TRAFFIC VOLUME WORKSHEET  
LEWISBURG PIKE AT CRITZ LANE  
A.M. PEAK HOUR**



Description	Northbound Lewisburg Pike			Southbound Lewisburg Pike			Eastbound Critz Lane			Westbound		
	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
2017 EXISTING TRAFFIC VOLUMES	23	1104		121	182		187		11			
2024 BACKGROUND TRAFFIC VOLUMES												
<i>Annual Background Growth</i>												
Growth Rate (%/year)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Growth Factor	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15
Annual Background Growth Trips	3	164	0	0	18	27	28	0	2	0	0	0
<i>Specific Development Background Growth</i>												
Remaining Canterbury (Phase 12B, 12C, 13: 90 SF, 54 TH)	% In 5					20						
% Out Trips	1	0	0	0	0	5	20		5			
							15	0	4	0	0	0
K-8 Proposed School on Clayton Arnold (1,600 Students)	% In 5					5						
% Out Trips	27	0	0	0	0	27	5		5	0	0	0
							23	0	23			
Avenue Downs (69 Single Family)	% In 5					10						
% Out Trips	1	0	0	0	0	1	10		5	0	0	0
							4	0	2			
Specific Development Background Growth Trips	29	0	0	0	0	33	42	0	29	0	0	0
2024 Background Traffic Volumes	55	1268	0	0	139	242	257	0	42	0	0	0
2024 SITE TRAFFIC VOLUMES												
Canterbury Proposed (179 SF, 141 TH)	% In 5					20						
% Out Trips	2	0	0	0	0	10	20		5	0	0	0
							30	0	8			
2024 Site Traffic Volumes	2	0	0	0	0	10	30	0	8	0	0	0
2024 TOTAL TRAFFIC VOLUMES	57	1268	0	0	139	252	287	0	50	0	0	0



**TRAFFIC VOLUME WORKSHEET  
LEWISBURG PIKE AT CRITZ LANE  
P.M. PEAK HOUR**



Description	Northbound Lewisburg Pike			Southbound Lewisburg Pike			Eastbound Critz Lane			Westbound		
	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
2017 EXISTING TRAFFIC VOLUMES	10	164		522	393		89		22			
2024 BACKGROUND TRAFFIC VOLUMES												
<i>Annual Background Growth</i>												
Growth Rate (%/year)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Growth Factor	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15
Annual Background Growth Trips	1	24	0	0	78	58	13	0	3	0	0	0
<i>Specific Development Background Growth</i>												
Remaining Canterbury (Phase 12B, 12C, 13: 90 SF, 54 TH)	% In 5					20						
% Out Trips	4	0	0	0	0	16	20		5	0	0	0
							9	0	2	0	0	0
K-8 Proposed School on Clayton Arnold (1,600 Students)	% In 5					5						
% Out Trips	7	0	0	0	0	7	5		5	0	0	0
							7	0	7	0	0	0
Avenue Downs (69 Single Family)	% In 5					10						
% Out Trips	2	0	0	0	0	5	10		5	0	0	0
							3	0	1	0	0	0
Specific Development Background Growth Trips	13	0	0	0	0	28	19	0	10	0	0	0
2024 Background Traffic Volumes	24	188	0	0	600	479	121	0	35	0	0	0
2024 SITE TRAFFIC VOLUMES												
Canterbury Proposed (179 SF, 141 TH)	% In 5					20						
% Out Trips	8	0	0	0	0	32	20		5	0	0	0
							19	0	5	0	0	0
2024 Site Traffic Volumes	8	0	0	0	0	32	19	0	5	0	0	0
2024 TOTAL TRAFFIC VOLUMES	32	188	0	0	600	511	140	0	40	0	0	0

**TRAFFIC VOLUME WORKSHEET  
CRITZ LANE AT CANTERBURY ACCESS  
A.M. PEAK HOUR**



Description	Northbound			Southbound Canterbury Access			Eastbound Critz Lane			Westbound Critz Lane		
	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
2017 EXISTING TRAFFIC VOLUMES							24			137		
2024 BACKGROUND TRAFFIC VOLUMES												
<i>Annual Background Growth</i>												
Growth Rate (%/year)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Growth Factor	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15
Annual Background Growth Trips	0	0	0	0	0	0	0	4	0	0	20	0
<i>Specific Development Background Growth</i>												
Remaining Canterbury (Phase 12B, 12C, 13: 90 SF, 54 TH)							55					25
% In Trips	0	0	0	25	18	0	13	0	0	0	0	6
% Out Trips												
K-8 Proposed School on Clayton Arnold (1,600 Students)							5					10
% In Trips	0	0	0	0	0	0	27	5	10	23	46	0
% Out Trips												
Avenue Downs (69 Single Family)									15			15
% In Trips	0	0	0	0	0	0	0	0	6	0	0	0
% Out Trips												
Specific Development Background Growth Trips	0	0	0	18	0	67	36	52	0	0	56	6
2024 Background Traffic Volumes	0	0	0	18	0	67	36	80	0	0	213	6
2024 SITE TRAFFIC VOLUMES												
Canterbury Proposed (179 SF, 141 TH)							55					25
% In Trips	0	0	0	25	38	0	26	0	0	0	0	12
% Out Trips												
2024 Site Traffic Volumes	0	0	0	38	0	83	26	0	0	0	0	12
2024 TOTAL TRAFFIC VOLUMES	0	0	0	56	0	150	62	80	0	0	213	18

**TRAFFIC VOLUME WORKSHEET  
CRITZ LANE AT CANTERBURY ACCESS  
P.M. PEAK HOUR**



Description	Northbound			Southbound Canterbury Access			Eastbound Critz Lane			Westbound Critz Lane		
	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
2017 EXISTING TRAFFIC VOLUMES							72			121		
2024 BACKGROUND TRAFFIC VOLUMES												
<i>Annual Background Growth</i>												
Growth Rate (%/year)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Growth Factor	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15
Annual Background Growth Trips	0	0	0	0	0	0	0	11	0	0	18	0
<i>Specific Development Background Growth</i>												
Remaining Canterbury (Phase 12B, 12C, 13: 90 SF, 54 TH)							55					25
% In Trips	0	0	0	25	12	0	55	43	0	0	0	20
% Out Trips	0	0	0	0	0	0	7	5	10	14	0	0
K-8 Proposed School on Clayton Arnold (1,600 Students)												10
% In Trips	0	0	0	0	0	0	7	5	10	14	0	0
% Out Trips	0	0	0	0	0	0	0	0	4	0	0	0
Avenue Downs (69 Single Family)									15			15
% In Trips	0	0	0	0	0	0	0	0	4	0	0	0
% Out Trips	0	0	0	0	0	0	0	0	4	0	0	0
Specific Development Background Growth Trips	0	0	0	12	0	33	50	18	0	0	20	20
2024 Background Traffic Volumes	0	0	0	12	0	33	50	101	0	0	159	20
2024 SITE TRAFFIC VOLUMES												
Canterbury Proposed (179 SF, 141 TH)							55					25
% In Trips	0	0	0	25	24	0	55	89	0	0	0	41
% Out Trips	0	0	0	24	0	53	89	0	0	0	0	41
2024 Site Traffic Volumes	0	0	0	24	0	53	89	0	0	0	0	41
2024 TOTAL TRAFFIC VOLUMES	0	0	0	36	0	86	139	101	0	0	159	61



# **APPENDIX C**

## **2017 EXISTING CONDITIONS CAPACITY ANALYSIS WORKSHEETS**

HCM 2010 TWSC  
1: Columbia Pike & Local Access/Critz Lane

01/16/2018

Intersection												
Int Delay, s/veh	15.5											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕		↕	↕	
Traffic Vol, veh/h	0	0	0	2	0	413	0	1201	6	56	578	0
Future Vol, veh/h	0	0	0	2	0	413	0	1201	6	56	578	0
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	165	-	-
Veh in Median Storage, #	-	0	-	-	1	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	96	96	96	96	96	96	96	96	96	96	96	96
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	0	0	0	2	0	430	0	1251	6	58	602	0

Major/Minor	Minor2		Minor1		Major1		Major2					
Conflicting Flow All	1345	1976	301	1672	1973	629	602	0	0	1257	0	0
Stage 1	719	719	-	1254	1254	-	-	-	-	-	-	-
Stage 2	626	1257	-	418	719	-	-	-	-	-	-	-
Critical Hdwy	7.54	6.54	6.94	7.54	6.54	6.94	4.14	-	-	4.14	-	-
Critical Hdwy Stg 1	6.54	5.54	-	6.54	5.54	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.54	5.54	-	6.54	5.54	-	-	-	-	-	-	-
Follow-up Hdwy	3.52	4.02	3.32	3.52	4.02	3.32	2.22	-	-	2.22	-	-
Pot Cap-1 Maneuver	110	61	695	63	62	~ 425	971	-	-	549	-	-
Stage 1	386	431	-	182	242	-	-	-	-	-	-	-
Stage 2	439	241	-	583	431	-	-	-	-	-	-	-
Platoon blocked, %	-	-	-	-	-	-	-	-	-	-	-	-
Mov Cap-1 Maneuver	-	55	695	58	55	~ 425	971	-	-	549	-	-
Mov Cap-2 Maneuver	-	55	-	142	159	-	-	-	-	-	-	-
Stage 1	386	385	-	182	242	-	-	-	-	-	-	-
Stage 2	-	241	-	521	385	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0	82.7	0	1.1
HCM LOS	A	F		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1WBLn1	SBL	SBT	SBR
Capacity (veh/h)	971	-	-	-	421	549	-
HCM Lane V/C Ratio	-	-	-	-	1.027	0.106	-
HCM Control Delay (s)	0	-	-	0	82.7	12.3	-
HCM Lane LOS	A	-	-	A	F	B	-
HCM 95th %tile Q(veh)	0	-	-	-	13.5	0.4	-

Notes  
 -: Volume exceeds capacity    \$: Delay exceeds 300s    +: Computation Not Defined    \*: All major volume in platoon

HCM 2010 TWSC  
 1: Columbia Pike & Local Access/Critz Lane

01/16/2018

Intersection												
Int Delay, s/veh	8.8											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕		↕	↕	
Traffic Vol, veh/h	0	0	0	6	0	166	0	767	53	593	836	0
Future Vol, veh/h	0	0	0	6	0	166	0	767	53	593	836	0
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	165	-	-
Veh in Median Storage, #	-	0	-	-	1	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	96	96	96	96	96	96	96	96	96	96	96	96
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	0	0	0	6	0	173	0	799	55	618	871	0

Major/Minor	Minor2		Minor1		Major1		Major2					
Conflicting Flow All	2505	2960	435	2498	2933	427	871	0	0	854	0	0
Stage 1	2106	2106	-	827	827	-	-	-	-	-	-	-
Stage 2	399	854	-	1671	2106	-	-	-	-	-	-	-
Critical Hdwy	7.54	6.54	6.94	7.54	6.54	6.94	4.14	-	-	4.14	-	-
Critical Hdwy Stg 1	6.54	5.54	-	6.54	5.54	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.54	5.54	-	6.54	5.54	-	-	-	-	-	-	-
Follow-up Hdwy	3.52	4.02	3.32	3.52	4.02	3.32	2.22	-	-	2.22	-	-
Pot Cap-1 Maneuver	14	14	569	15	15	576	770	-	-	781	-	-
Stage 1	53	91	-	332	384	-	-	-	-	-	-	-
Stage 2	598	373	-	100	91	-	-	-	-	-	-	-
Platoon blocked, %								-	-	-	-	-
Mov Cap-1 Maneuver	3	3	569	~ 5	3	576	770	-	-	781	-	-
Mov Cap-2 Maneuver	3	3	-	18	17	-	-	-	-	-	-	-
Stage 1	53	19	-	332	384	-	-	-	-	-	-	-
Stage 2	418	373	-	21	19	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0	39	0	10.2
HCM LOS	A	E		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1WBLn1	SBL	SBT	SBR
Capacity (veh/h)	770	-	-	-	277	781	-
HCM Lane V/C Ratio	-	-	-	-	0.647	0.791	-
HCM Control Delay (s)	0	-	-	0	39	24.6	-
HCM Lane LOS	A	-	-	A	E	C	-
HCM 95th %tile Q(veh)	0	-	-	-	4.1	8.1	-

Notes  
 -: Volume exceeds capacity    \$: Delay exceeds 300s    +: Computation Not Defined    \*: All major volume in platoon



Intersection						
Int Delay, s/veh	4.3					
Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↶	↷		↶	
Traffic Vol, veh/h	21	35	275	4	9	167
Future Vol, veh/h	21	35	275	4	9	167
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	93	93	93	93	93	93
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	23	38	296	4	10	180

Major/Minor	Major1	Major2	Minor2		
Conflicting Flow All	300	0	-	0	381
Stage 1	-	-	-	-	298
Stage 2	-	-	-	-	83
Critical Hdwy	4.12	-	-	-	6.42
Critical Hdwy Stg 1	-	-	-	-	5.42
Critical Hdwy Stg 2	-	-	-	-	5.42
Follow-up Hdwy	2.218	-	-	-	3.518
Pot Cap-1 Maneuver	1261	-	-	-	621
Stage 1	-	-	-	-	753
Stage 2	-	-	-	-	940
Platoon blocked, %		-	-	-	
Mov Cap-1 Maneuver	1261	-	-	-	609
Mov Cap-2 Maneuver	-	-	-	-	609
Stage 1	-	-	-	-	753
Stage 2	-	-	-	-	922

Approach	EB	WB	SB
HCM Control Delay, s	3	0	11.6
HCM LOS			B

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	1261	-	-	-	733
HCM Lane V/C Ratio	0.018	-	-	-	0.258
HCM Control Delay (s)	7.9	0	-	-	11.6
HCM Lane LOS	A	A	-	-	B
HCM 95th %tile Q(veh)	0.1	-	-	-	1

**Intersection**

Int Delay, s/veh 2.7

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↶	↷		↶	
Traffic Vol, veh/h	167	504	95	18	15	82
Future Vol, veh/h	167	504	95	18	15	82
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	96	96	96	96	96	96
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	174	525	99	19	16	85

Major/Minor	Major1	Major2	Minor2
Conflicting Flow All	118	0	0
Stage 1	-	-	108
Stage 2	-	-	873
Critical Hdwy	4.12	-	6.42
Critical Hdwy Stg 1	-	-	5.42
Critical Hdwy Stg 2	-	-	5.42
Follow-up Hdwy	2.218	-	3.518
Pot Cap-1 Maneuver	1470	-	277
Stage 1	-	-	916
Stage 2	-	-	409
Platoon blocked, %	-	-	-
Mov Cap-1 Maneuver	1470	-	231
Mov Cap-2 Maneuver	-	-	231
Stage 1	-	-	916
Stage 2	-	-	341

Approach	EB	WB	SB
HCM Control Delay, s	1.9	0	11.7
HCM LOS			B

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	1470	-	-	-	640
HCM Lane V/C Ratio	0.118	-	-	-	0.158
HCM Control Delay (s)	7.8	0	-	-	11.7
HCM Lane LOS	A	A	-	-	B
HCM 95th %tile Q(veh)	0.4	-	-	-	0.6

**Intersection**

Int Delay, s/veh 10.4

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Traffic Vol, veh/h	8	6	29	68	39	30	205	10	7	11	21	32
Future Vol, veh/h	8	6	29	68	39	30	205	10	7	11	21	32
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	83	83	83	83	83	83	83	83	83	83	83	83
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	10	7	35	82	47	36	247	12	8	13	25	39

Major/Minor	Major1	Major2	Minor1	Minor2
Conflicting Flow All	83	0	0	42
Stage 1	-	-	-	-
Stage 2	-	-	-	-
Critical Hdwy	4.12	-	-	4.12
Critical Hdwy Stg 1	-	-	-	-
Critical Hdwy Stg 2	-	-	-	-
Follow-up Hdwy	2.218	-	-	2.218
Pot Cap-1 Maneuver	1514	-	-	1567
Stage 1	-	-	-	-
Stage 2	-	-	-	-
Platoon blocked, %	-	-	-	-
Mov Cap-1 Maneuver	1514	-	-	1567
Mov Cap-2 Maneuver	-	-	-	-
Stage 1	-	-	-	-
Stage 2	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	1.4	3.7	16.3	10.4
HCM LOS			C	B

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	582	1514	-	-	1567	-	-	746
HCM Lane V/C Ratio	0.46	0.006	-	-	0.052	-	-	0.103
HCM Control Delay (s)	16.3	7.4	0	-	7.4	0	-	10.4
HCM Lane LOS	C	A	A	-	A	A	-	B
HCM 95th %tile Q(veh)	2.4	0	-	-	0.2	-	-	0.3



HCM 2010 TWSC  
 3: Clayton Arnold Road & Critz Lane

01/16/2018

Intersection												
Int Delay, s/veh	3.9											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Traffic Vol, veh/h	14	33	463	46	34	41	54	16	20	19	40	25
Future Vol, veh/h	14	33	463	46	34	41	54	16	20	19	40	25
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	15	36	503	50	37	45	59	17	22	21	43	27

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	82	0	0	539	0	0	513	500	288	497	729	59
Stage 1	-	-	-	-	-	-	318	318	-	159	159	-
Stage 2	-	-	-	-	-	-	195	182	-	338	570	-
Critical Hdwy	4.12	-	-	4.12	-	-	7.12	6.52	6.22	7.12	6.52	6.22
Critical Hdwy Stg 1	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Follow-up Hdwy	2.218	-	-	2.218	-	-	3.518	4.018	3.318	3.518	4.018	3.318
Pot Cap-1 Maneuver	1515	-	-	1029	-	-	472	473	751	483	350	1007
Stage 1	-	-	-	-	-	-	693	654	-	843	766	-
Stage 2	-	-	-	-	-	-	807	749	-	676	505	-
Platoon blocked, %	-	-	-	-	-	-	-	-	-	-	-	-
Mov Cap-1 Maneuver	1515	-	-	1029	-	-	392	442	751	432	327	1007
Mov Cap-2 Maneuver	-	-	-	-	-	-	392	442	-	432	327	-
Stage 1	-	-	-	-	-	-	683	644	-	830	727	-
Stage 2	-	-	-	-	-	-	701	711	-	629	497	-

Approach	EB			WB			NB			SB		
HCM Control Delay, s	0.2			3.3			15.2			15.3		
HCM LOS							C			C		

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	449	1515	-	-	1029	-	-	439
HCM Lane V/C Ratio	0.218	0.01	-	-	0.049	-	-	0.208
HCM Control Delay (s)	15.2	7.4	0	-	8.7	0	-	15.3
HCM Lane LOS	C	A	A	-	A	A	-	C
HCM 95th %tile Q(veh)	0.8	0	-	-	0.2	-	-	0.8

HCM 2010 TWSC  
4: Sporting Hill Bridge Road & Critz Lane

01/16/2018

Intersection												
Int Delay, s/veh	4.2											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Traffic Vol, veh/h	0	26	10	32	96	1	32	0	51	0	0	2
Future Vol, veh/h	0	26	10	32	96	1	32	0	51	0	0	2
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	93	93	93	93	93	93	93	93	93	93	93	93
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	0	28	11	34	103	1	34	0	55	0	0	2

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	104	0	0	39	0	0	207	206	33	234	212	104
Stage 1	-	-	-	-	-	-	33	33	-	173	173	-
Stage 2	-	-	-	-	-	-	174	173	-	61	39	-
Critical Hdwy	4.12	-	-	4.12	-	-	7.12	6.52	6.22	7.12	6.52	6.22
Critical Hdwy Stg 1	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Follow-up Hdwy	2.218	-	-	2.218	-	-	3.518	4.018	3.318	3.518	4.018	3.318
Pot Cap-1 Maneuver	1488	-	-	1571	-	-	751	691	1041	721	685	951
Stage 1	-	-	-	-	-	-	983	868	-	829	756	-
Stage 2	-	-	-	-	-	-	828	756	-	950	862	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	1488	-	-	1571	-	-	736	675	1041	671	669	951
Mov Cap-2 Maneuver	-	-	-	-	-	-	736	675	-	671	669	-
Stage 1	-	-	-	-	-	-	983	868	-	829	739	-
Stage 2	-	-	-	-	-	-	807	739	-	900	862	-

Approach	EB			WB			NB			SB		
HCM Control Delay, s	0			1.8			9.5			8.8		
HCM LOS							A			A		

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	898	1488	-	-	1571	-	-	951
HCM Lane V/C Ratio	0.099	-	-	-	0.022	-	-	0.002
HCM Control Delay (s)	9.5	0	-	-	7.3	0	-	8.8
HCM Lane LOS	A	A	-	-	A	A	-	A
HCM 95th %tile Q(veh)	0.3	0	-	-	0.1	-	-	0

HCM 2010 TWSC  
 4: Sporting Hill Bridge Road & Critz Lane

01/16/2018

Intersection												
Int Delay, s/veh	3.6											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Traffic Vol, veh/h	0	48	19	60	110	0	19	0	46	0	0	0
Future Vol, veh/h	0	48	19	60	110	0	19	0	46	0	0	0
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	82	82	82	82	82	82	82	82	82	82	82	82
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	0	59	23	73	134	0	23	0	56	0	0	0

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	134	0	0	82	0	0	350	350	70	378	362	134
Stage 1	-	-	-	-	-	-	70	70	-	280	280	-
Stage 2	-	-	-	-	-	-	280	280	-	98	82	-
Critical Hdwy	4.12	-	-	4.12	-	-	7.12	6.52	6.22	7.12	6.52	6.22
Critical Hdwy Stg 1	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Follow-up Hdwy	2.218	-	-	2.218	-	-	3.518	4.018	3.318	3.518	4.018	3.318
Pot Cap-1 Maneuver	1451	-	-	1515	-	-	605	574	993	580	565	915
Stage 1	-	-	-	-	-	-	940	837	-	727	679	-
Stage 2	-	-	-	-	-	-	727	679	-	908	827	-
Platoon blocked, %	-	-	-	-	-	-	-	-	-	-	-	-
Mov Cap-1 Maneuver	1451	-	-	1515	-	-	581	544	993	525	536	915
Mov Cap-2 Maneuver	-	-	-	-	-	-	581	544	-	525	536	-
Stage 1	-	-	-	-	-	-	940	837	-	727	644	-
Stage 2	-	-	-	-	-	-	689	644	-	857	827	-

Approach	EB			WB			NB			SB		
HCM Control Delay, s	0			2.6			9.8			0		
HCM LOS							A			A		

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	823	1451	-	-	1515	-	-	-
HCM Lane V/C Ratio	0.096	-	-	-	0.048	-	-	-
HCM Control Delay (s)	9.8	0	-	-	7.5	0	-	0
HCM Lane LOS	A	A	-	-	A	A	-	A
HCM 95th %tile Q(veh)	0.3	0	-	-	0.2	-	-	-



HCM 2010 TWSC  
5: Pantall Road & Critz Lane

01/16/2018

Intersection												
Int Delay, s/veh	5.1											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Traffic Vol, veh/h	1	86	7	73	114	0	7	0	180	0	0	0
Future Vol, veh/h	1	86	7	73	114	0	7	0	180	0	0	0
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	1	93	8	79	124	0	8	0	196	0	0	0

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	124	0	0	101	0	0	382	382	97	480	386	124
Stage 1	-	-	-	-	-	-	99	99	-	283	283	-
Stage 2	-	-	-	-	-	-	283	283	-	197	103	-
Critical Hdwy	4.12	-	-	4.12	-	-	7.12	6.52	6.22	7.12	6.52	6.22
Critical Hdwy Stg 1	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Follow-up Hdwy	2.218	-	-	2.218	-	-	3.518	4.018	3.318	3.518	4.018	3.318
Pot Cap-1 Maneuver	1463	-	-	1491	-	-	576	551	959	496	548	927
Stage 1	-	-	-	-	-	-	907	813	-	724	677	-
Stage 2	-	-	-	-	-	-	724	677	-	805	810	-
Platoon blocked, %	-	-	-	-	-	-	-	-	-	-	-	-
Mov Cap-1 Maneuver	1463	-	-	1491	-	-	550	519	959	377	516	927
Mov Cap-2 Maneuver	-	-	-	-	-	-	550	519	-	377	516	-
Stage 1	-	-	-	-	-	-	906	812	-	723	638	-
Stage 2	-	-	-	-	-	-	683	638	-	640	809	-

Approach	EB			WB			NB			SB		
HCM Control Delay, s	0.1			2.9			9.9			0		
HCM LOS							A			A		

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	933	1463	-	-	1491	-	-	-
HCM Lane V/C Ratio	0.218	0.001	-	-	0.053	-	-	-
HCM Control Delay (s)	9.9	7.5	0	-	7.5	0	-	0
HCM Lane LOS	A	A	A	-	A	A	-	A
HCM 95th %tile Q(veh)	0.8	0	-	-	0.2	-	-	-

HCM 2010 TWSC  
5: Pantall Road & Critz Lane

01/16/2018

Intersection

Int Delay, s/veh 6.1

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Traffic Vol, veh/h	0	38	11	310	91	0	3	0	70	0	0	0
Future Vol, veh/h	0	38	11	310	91	0	3	0	70	0	0	0
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	86	86	86	86	86	86	86	86	86	86	86	86
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	0	44	13	360	106	0	3	0	81	0	0	0

Major/Minor	Major1	Major2	Minor1	Minor2
Conflicting Flow All	106	0	0	57
Stage 1	-	-	-	-
Stage 2	-	-	-	-
Critical Hdwy	4.12	-	-	4.12
Critical Hdwy Stg 1	-	-	-	-
Critical Hdwy Stg 2	-	-	-	-
Follow-up Hdwy	2.218	-	-	2.218
Pot Cap-1 Maneuver	1485	-	-	1547
Stage 1	-	-	-	-
Stage 2	-	-	-	-
Platoon blocked, %	-	-	-	-
Mov Cap-1 Maneuver	1485	-	-	1547
Mov Cap-2 Maneuver	-	-	-	-
Stage 1	-	-	-	-
Stage 2	-	-	-	-




Approach	EB	WB	NB	SB
HCM Control Delay, s	0	6.2	9.5	0
HCM LOS			A	A

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	883	1485	-	-	1547	-	-	-
HCM Lane V/C Ratio	0.096	-	-	-	0.233	-	-	-
HCM Control Delay (s)	9.5	0	-	-	8	0	-	0
HCM Lane LOS	A	A	-	-	A	A	-	A
HCM 95th %tile Q(veh)	0.3	0	-	-	0.9	-	-	-

**Intersection**

Int Delay, s/veh 32

**Movement** EBL EBR NBL NBT SBT SBR

Lane Configurations						
Traffic Vol, veh/h	187	11	23	1104	121	182
Future Vol, veh/h	187	11	23	1104	121	182
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	96	96	96	96	96	96
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	195	11	24	1150	126	190

**Major/Minor** Minor2 Major1 Major2

Conflicting Flow All	1419	221	316	0	-	0
Stage 1	221	-	-	-	-	-
Stage 2	1198	-	-	-	-	-
Critical Hdwy	6.42	6.22	4.12	-	-	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	2.218	-	-	-
Pot Cap-1 Maneuver	~ 151	819	1244	-	-	-
Stage 1	816	-	-	-	-	-
Stage 2	286	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	~ 143	819	1244	-	-	-
Mov Cap-2 Maneuver	~ 143	-	-	-	-	-
Stage 1	816	-	-	-	-	-
Stage 2	271	-	-	-	-	-

**Approach** EB NB SB

HCM Control Delay, s	261.6	0.2	0
HCM LOS	F		

**Minor Lane/Major Mvmt** NBL NBT EBLn1 SBT SBR

Capacity (veh/h)	1244	-	150	-	-
HCM Lane V/C Ratio	0.019	-	1.375	-	-
HCM Control Delay (s)	8	0	261.6	-	-
HCM Lane LOS	A	A	F	-	-
HCM 95th %tile Q(veh)	0.1	-	13	-	-

**Notes**

~: Volume exceeds capacity    \$: Delay exceeds 300s    +: Computation Not Defined    \*: All major volume in platoon



Intersection						
Int Delay, s/veh	2.8					
Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations	W			W	W	
Traffic Vol, veh/h	89	22	10	164	522	393
Future Vol, veh/h	89	22	10	164	522	393
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	88	88	88	88	88	88
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	101	25	11	186	593	447

Major/Minor	Minor2	Major1	Major2			
Conflicting Flow All	1025	816	1040	0	-	0
Stage 1	816	-	-	-	-	-
Stage 2	209	-	-	-	-	-
Critical Hdwy	6.42	6.22	4.12	-	-	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	2.218	-	-	-
Pot Cap-1 Maneuver	260	377	669	-	-	-
Stage 1	435	-	-	-	-	-
Stage 2	826	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	255	377	669	-	-	-
Mov Cap-2 Maneuver	255	-	-	-	-	-
Stage 1	435	-	-	-	-	-
Stage 2	811	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	29.2	0.6	0
HCM LOS	D		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	669	-	272	-	-
HCM Lane V/C Ratio	0.017	-	0.464	-	-
HCM Control Delay (s)	10.5	0	29.2	-	-
HCM Lane LOS	B	A	D	-	-
HCM 95th %tile Q(veh)	0.1	-	2.3	-	-












## **APPENDIX D**

# **2024 BACKGROUND CONDITIONS CAPACITY ANALYSIS WORKSHEETS**

# HCM 2010 Signalized Intersection Summary

## 1: Columbia Pike & Critz Lane












02/13/2018

								
Movement	WBL	WBR	NBT	NBR	SBL	SBT		
Lane Configurations								
Traffic Volume (veh/h)	57	586	1380	64	140	664		
Future Volume (veh/h)	57	586	1380	64	140	664		
Number	3	18	2	12	1	6		
Initial Q (Qb), veh	0	0	0	0	0	0		
Ped-Bike Adj(A_pbT)	1.00	1.00		1.00	1.00			
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00		
Adj Sat Flow, veh/h/ln	1863	1863	1863	1900	1863	1863		
Adj Flow Rate, veh/h	59	267	1438	61	146	692		
Adj No. of Lanes	1	1	2	0	1	2		
Peak Hour Factor	0.96	0.96	0.96	0.96	0.96	0.96		
Percent Heavy Veh, %	2	2	2	2	2	2		
Cap, veh/h	341	304	1619	69	454	2516		
Arrive On Green	0.19	0.19	0.47	0.47	0.19	0.71		
Sat Flow, veh/h	1774	1583	3553	146	1774	3632		
Grp Volume(v), veh/h	59	267	734	765	146	692		
Grp Sat Flow(s),veh/h/ln	1774	1583	1770	1837	1774	1770		
Q Serve(g_s), s	2.6	15.2	35.1	35.3	2.6	6.5		
Cycle Q Clear(g_c), s	2.6	15.2	35.1	35.3	2.6	6.5		
Prop In Lane	1.00	1.00		0.08	1.00			
Lane Grp Cap(c), veh/h	341	304	828	859	454	2516		
V/C Ratio(X)	0.17	0.88	0.89	0.89	0.32	0.28		
Avail Cap(c_a), veh/h	475	424	828	859	454	2516		
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00		
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00		
Uniform Delay (d), s/veh	31.4	36.5	22.5	22.6	15.3	4.8		
Incr Delay (d2), s/veh	0.2	14.1	13.4	13.4	1.9	0.3		
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0		
%ile BackOfQ(95%),veh/ln	2.3	12.5	27.4	28.6	3.7	5.9		
LnGrp Delay(d),s/veh	31.6	50.6	35.9	35.9	17.2	5.1		
LnGrp LOS	C	D	D	D	B	A		
Approach Vol, veh/h	326		1499			838		
Approach Delay, s/veh	47.1		35.9			7.2		
Approach LOS	D		D			A		
Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2				6		8
Phs Duration (G+Y+Rc), s	22.6	48.0				70.6		22.4
Change Period (Y+Rc), s	4.5	4.5				4.5		4.5
Max Green Setting (Gmax), s	18.1	43.5				66.1		24.9
Max Q Clear Time (g_c+I1), s	4.6	37.3				8.5		17.2
Green Ext Time (p_c), s	0.3	5.2				25.4		0.6
<b>Intersection Summary</b>								
HCM 2010 Ctrl Delay			28.3					
HCM 2010 LOS			C					



HCM 2010 Signalized Intersection Summary  
 1: Columbia Pike & Critz Lane

02/13/2018

								
Movement	WBL	WBR	NBT	NBR	SBL	SBT		
Lane Configurations								
Traffic Volume (veh/h)	27	247	881	84	766	960		
Future Volume (veh/h)	27	247	881	84	766	960		
Number	3	18	2	12	1	6		
Initial Q (Qb), veh	0	0	0	0	0	0		
Ped-Bike Adj(A_pbT)	1.00	1.00		1.00	1.00			
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00		
Adj Sat Flow, veh/h/ln	1863	1863	1863	1900	1863	1863		
Adj Flow Rate, veh/h	28	0	918	79	798	1000		
Adj No. of Lanes	1	1	2	0	1	2		
Peak Hour Factor	0.96	0.96	0.96	0.96	0.96	0.96		
Percent Heavy Veh, %	2	2	2	2	2	2		
Cap, veh/h	49	44	1179	101	975	3104		
Arrive On Green	0.03	0.00	0.36	0.36	0.47	0.88		
Sat Flow, veh/h	1774	1583	3392	284	1774	3632		
Grp Volume(v), veh/h	28	0	493	504	798	1000		
Grp Sat Flow(s),veh/h/ln	1774	1583	1770	1813	1774	1770		
Q Serve(g_s), s	1.5	0.0	23.4	23.4	27.4	4.6		
Cycle Q Clear(g_c), s	1.5	0.0	23.4	23.4	27.4	4.6		
Prop In Lane	1.00	1.00		0.16	1.00			
Lane Grp Cap(c), veh/h	49	44	632	648	975	3104		
V/C Ratio(X)	0.57	0.00	0.78	0.78	0.82	0.32		
Avail Cap(c_a), veh/h	344	307	632	648	975	3104		
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00		
Upstream Filter(I)	1.00	0.00	1.00	1.00	1.00	1.00		
Uniform Delay (d), s/veh	45.3	0.0	27.0	27.0	15.2	1.0		
Incr Delay (d2), s/veh	10.1	0.0	9.2	9.0	7.6	0.3		
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0		
%ile BackOfQ(95%),veh/ln	1.5	0.0	18.9	19.2	26.0	4.0		
LnGrp Delay(d),s/veh	55.4	0.0	36.2	36.0	22.8	1.3		
LnGrp LOS	E		D	D	C	A		
Approach Vol, veh/h	28		997			1798		
Approach Delay, s/veh	55.4		36.1			10.8		
Approach LOS	E		D			B		
Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2				6		8
Phs Duration (G+Y+Rc), s	49.0	38.2				87.2		7.1
Change Period (Y+Rc), s	4.5	4.5				4.5		4.5
Max Green Setting (Gmax), s	44.5	33.7				82.7		18.3
Max Q Clear Time (g_c+I1), s	29.4	25.4				6.6		3.5
Green Ext Time (p_c), s	2.6	6.4				22.1		0.0
<b>Intersection Summary</b>								
HCM 2010 Ctrl Delay			20.2					
HCM 2010 LOS			C					

**Intersection**

Int Delay, s/veh 4.8

**Movement** EBL EBT WBT WBR SBL SBR

Lane Configurations						
Traffic Vol, veh/h	25	171	479	28	37	196
Future Vol, veh/h	25	171	479	28	37	196
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	355	-	-	260	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	93	93	93	93	93	93
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	27	184	515	30	40	211

**Major/Minor** Major1 Major2 Minor2

Conflicting Flow All	515	0	-	0	753	515
Stage 1	-	-	-	-	515	-
Stage 2	-	-	-	-	238	-
Critical Hdwy	4.12	-	-	-	6.42	6.22
Critical Hdwy Stg 1	-	-	-	-	5.42	-
Critical Hdwy Stg 2	-	-	-	-	5.42	-
Follow-up Hdwy	2.218	-	-	-	3.518	3.318
Pot Cap-1 Maneuver	1051	-	-	-	377	560
Stage 1	-	-	-	-	600	-
Stage 2	-	-	-	-	802	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	1051	-	-	-	367	560
Mov Cap-2 Maneuver	-	-	-	-	367	-
Stage 1	-	-	-	-	600	-
Stage 2	-	-	-	-	781	-

**Approach** EB WB SB

HCM Control Delay, s	1.1	0	18.3
HCM LOS			C

**Minor Lane/Major Mvmt** EBL EBT WBT WBR SBLn1

Capacity (veh/h)	1051	-	-	-	517
HCM Lane V/C Ratio	0.026	-	-	-	0.485
HCM Control Delay (s)	8.5	-	-	-	18.3
HCM Lane LOS	A	-	-	-	C
HCM 95th %tile Q(veh)	0.1	-	-	-	2.6

Intersection						
Int Delay, s/veh	2.9					
Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	196	683	184	28	24	96
Future Vol, veh/h	196	683	184	28	24	96
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	355	-	-	260	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	96	96	96	96	96	96
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	204	711	192	29	25	100

Major/Minor	Major1	Major2	Minor2		
Conflicting Flow All	192	0	-	0	1312 192
Stage 1	-	-	-	-	192 -
Stage 2	-	-	-	-	1120 -
Critical Hdwy	4.12	-	-	-	6.42 6.22
Critical Hdwy Stg 1	-	-	-	-	5.42 -
Critical Hdwy Stg 2	-	-	-	-	5.42 -
Follow-up Hdwy	2.218	-	-	-	3.518 3.318
Pot Cap-1 Maneuver	1381	-	-	-	175 850
Stage 1	-	-	-	-	841 -
Stage 2	-	-	-	-	312 -
Platoon blocked, %		-	-	-	
Mov Cap-1 Maneuver	1381	-	-	-	149 850
Mov Cap-2 Maneuver	-	-	-	-	149 -
Stage 1	-	-	-	-	841 -
Stage 2	-	-	-	-	266 -

Approach	EB	WB	SB
HCM Control Delay, s	1.8	0	16.5
HCM LOS			C

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	1381	-	-	-	438
HCM Lane V/C Ratio	0.148	-	-	-	0.285
HCM Control Delay (s)	8.1	-	-	-	16.5
HCM Lane LOS	A	-	-	-	C
HCM 95th %tile Q(veh)	0.5	-	-	-	1.2



HCM 2010 Roundabout  
 3: Clayton Arnold Road & Critz Lane

02/13/2018

Intersection				
Intersection Delay, s/veh	10.8			
Intersection LOS	B			
Approach	EB	WB	NB	SB
Entry Lanes	1	1	1	1
Conflicting Circle Lanes	1	1	1	1
Adj Approach Flow, veh/h	249	339	593	135
Demand Flow Rate, veh/h	253	346	605	137
Vehicles Circulating, veh/h	281	516	53	764
Vehicles Exiting, veh/h	620	142	481	98
Follow-Up Headway, s	3.186	3.186	3.186	3.186
Ped Vol Crossing Leg, #/h	0	0	0	0
Ped Cap Adj	1.000	1.000	1.000	1.000
Approach Delay, s/veh	7.6	13.6	10.6	10.7
Approach LOS	A	B	B	B
Lane	Left	Left	Left	Left
Designated Moves	LTR	LTR	LTR	LTR
Assumed Moves	LTR	LTR	LTR	LTR
RT Channelized				
Lane Util	1.000	1.000	1.000	1.000
Critical Headway, s	5.193	5.193	5.193	5.193
Entry Flow, veh/h	253	346	605	137
Cap Entry Lane, veh/h	853	674	1072	526
Entry HV Adj Factor	0.982	0.980	0.980	0.984
Flow Entry, veh/h	249	339	593	135
Cap Entry, veh/h	838	661	1051	518
V/C Ratio	0.297	0.513	0.565	0.260
Control Delay, s/veh	7.6	13.6	10.6	10.7
LOS	A	B	B	B
95th %tile Queue, veh	1	3	4	1

HCM 2010 Roundabout  
 3: Clayton Arnold Road & Critz Lane

02/13/2018

Intersection				
Intersection Delay, s/veh	15.6			
Intersection LOS	C			
Approach	EB	WB	NB	SB
Entry Lanes	1	1	1	1
Conflicting Circle Lanes	1	1	1	1
Adj Approach Flow, veh/h	758	208	207	121
Demand Flow Rate, veh/h	774	212	211	123
Vehicles Circulating, veh/h	174	184	142	285
Vehicles Exiting, veh/h	234	169	806	111
Follow-Up Headway, s	3.186	3.186	3.186	3.186
Ped Vol Crossing Leg, #/h	0	0	0	0
Ped Cap Adj	1.000	1.000	1.000	1.000
Approach Delay, s/veh	22.5	6.2	5.8	5.8
Approach LOS	C	A	A	A
Lane	Left	Left	Left	Left
Designated Moves	LTR	LTR	LTR	LTR
Assumed Moves	LTR	LTR	LTR	LTR
RT Channelized				
Lane Util	1.000	1.000	1.000	1.000
Critical Headway, s	5.193	5.193	5.193	5.193
Entry Flow, veh/h	774	212	211	123
Cap Entry Lane, veh/h	949	940	980	850
Entry HV Adj Factor	0.980	0.979	0.983	0.982
Flow Entry, veh/h	758	208	207	121
Cap Entry, veh/h	930	921	964	835
V/C Ratio	0.815	0.226	0.215	0.145
Control Delay, s/veh	22.5	6.2	5.8	5.8
LOS	C	A	A	A
95th %tile Queue, veh	9	1	1	1

HCM 2010 TWSC  
 4: Sporting Hill Bridge Road & Critz Lane

02/13/2018

Intersection												
Int Delay, s/veh	3.1											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Traffic Vol, veh/h	0	100	11	37	172	1	37	0	59	0	0	2
Future Vol, veh/h	0	100	11	37	172	1	37	0	59	0	0	2
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	93	93	93	93	93	93	93	93	93	93	93	93
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	0	108	12	40	185	1	40	0	63	0	0	2

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	186	0	0	119	0	0	379	379	113	410	384	185
Stage 1	-	-	-	-	-	-	113	113	-	265	265	-
Stage 2	-	-	-	-	-	-	266	266	-	145	119	-
Critical Hdwy	4.12	-	-	4.12	-	-	7.12	6.52	6.22	7.12	6.52	6.22
Critical Hdwy Stg 1	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Follow-up Hdwy	2.218	-	-	2.218	-	-	3.518	4.018	3.318	3.518	4.018	3.318
Pot Cap-1 Maneuver	1388	-	-	1469	-	-	579	553	940	552	550	857
Stage 1	-	-	-	-	-	-	892	802	-	740	689	-
Stage 2	-	-	-	-	-	-	739	689	-	858	797	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	1388	-	-	1469	-	-	564	536	940	503	534	857
Mov Cap-2 Maneuver	-	-	-	-	-	-	564	536	-	503	534	-
Stage 1	-	-	-	-	-	-	892	802	-	740	668	-
Stage 2	-	-	-	-	-	-	715	668	-	800	797	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0	1.3	10.6	9.2
HCM LOS			B	A

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	748	1388	-	-	1469	-	-	857
HCM Lane V/C Ratio	0.138	-	-	-	0.027	-	-	0.003
HCM Control Delay (s)	10.6	0	-	-	7.5	0	-	9.2
HCM Lane LOS	B	A	-	-	A	A	-	A
HCM 95th %tile Q(veh)	0.5	0	-	-	0.1	-	-	0



HCM 2010 TWSC  
4: Sporting Hill Bridge Road & Critz Lane

02/13/2018

Intersection												
Int Delay, s/veh	3.2											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Traffic Vol, veh/h	0	85	22	69	166	0	22	0	53	0	0	0
Future Vol, veh/h	0	85	22	69	166	0	22	0	53	0	0	0
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	82	82	82	82	82	82	82	82	82	82	82	82
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	0	104	27	84	202	0	27	0	65	0	0	0

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	202	0	0	130	0	0	488	488	117	520	501	202
Stage 1	-	-	-	-	-	-	117	117	-	371	371	-
Stage 2	-	-	-	-	-	-	371	371	-	149	130	-
Critical Hdwy	4.12	-	-	4.12	-	-	7.12	6.52	6.22	7.12	6.52	6.22
Critical Hdwy Stg 1	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Follow-up Hdwy	2.218	-	-	2.218	-	-	3.518	4.018	3.318	3.518	4.018	3.318
Pot Cap-1 Maneuver	1370	-	-	1455	-	-	490	480	935	467	472	839
Stage 1	-	-	-	-	-	-	888	799	-	649	620	-
Stage 2	-	-	-	-	-	-	649	620	-	854	789	-
Platoon blocked, %	-	-	-	-	-	-	-	-	-	-	-	-
Mov Cap-1 Maneuver	1370	-	-	1455	-	-	466	449	935	413	441	839
Mov Cap-2 Maneuver	-	-	-	-	-	-	466	449	-	413	441	-
Stage 1	-	-	-	-	-	-	888	799	-	649	580	-
Stage 2	-	-	-	-	-	-	607	580	-	795	789	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0	2.2	10.7	0
HCM LOS			B	A

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	722	1370	-	-	1455	-	-	-
HCM Lane V/C Ratio	0.127	-	-	-	0.058	-	-	-
HCM Control Delay (s)	10.7	0	-	-	7.6	0	-	0
HCM Lane LOS	B	A	-	-	A	A	-	A
HCM 95th %tile Q(veh)	0.4	0	-	-	0.2	-	-	-

Intersection			
Intersection Delay, s/veh	6.0		
Intersection LOS	A		
Approach	EB	WB	NB
Entry Lanes	1	1	1
Conflicting Circle Lanes	1	1	1
Adj Approach Flow, veh/h	193	301	234
Demand Flow Rate, veh/h	197	307	239
Vehicles Circulating, veh/h	93	9	188
Vehicles Exiting, veh/h	223	417	102
Follow-Up Headway, s	3.186	3.186	3.186
Ped Vol Crossing Leg, #/h	0	0	0
Ped Cap Adj	1.000	1.000	1.000
Approach Delay, s/veh	5.4	5.9	6.5
Approach LOS	A	A	A
Lane	Left	Left	Left
Designated Moves	TR	LT	LR
Assumed Moves	TR	LT	LR
RT Channelized			
Lane Util	1.000	1.000	1.000
Critical Headway, s	5.193	5.193	5.193
Entry Flow, veh/h	197	307	239
Cap Entry Lane, veh/h	1030	1120	936
Entry HV Adj Factor	0.981	0.980	0.979
Flow Entry, veh/h	193	301	234
Cap Entry, veh/h	1010	1097	917
V/C Ratio	0.191	0.274	0.255
Control Delay, s/veh	5.4	5.9	6.5
LOS	A	A	A
95th %tile Queue, veh	1	1	1

Intersection			
Intersection Delay, s/veh	8.4		
Intersection LOS	A		
Approach	EB	WB	NB
Entry Lanes	1	1	1
Conflicting Circle Lanes	1	1	1
Adj Approach Flow, veh/h	101	583	96
Demand Flow Rate, veh/h	103	594	98
Vehicles Circulating, veh/h	422	3	88
Vehicles Exiting, veh/h	175	183	437
Follow-Up Headway, s	3.186	3.186	3.186
Ped Vol Crossing Leg, #/h	0	0	0
Ped Cap Adj	1.000	1.000	1.000
Approach Delay, s/veh	6.4	9.5	4.4
Approach LOS	A	A	A
Lane	Left	Left	Left
Designated Moves	TR	LT	LR
Assumed Moves	TR	LT	LR
RT Channelized			
Lane Util	1.000	1.000	1.000
Critical Headway, s	5.193	5.193	5.193
Entry Flow, veh/h	103	594	98
Cap Entry Lane, veh/h	741	1127	1035
Entry HV Adj Factor	0.983	0.981	0.980
Flow Entry, veh/h	101	583	96
Cap Entry, veh/h	729	1105	1014
V/C Ratio	0.139	0.527	0.095
Control Delay, s/veh	6.4	9.5	4.4
LOS	A	A	A
95th %tile Queue, veh	0	3	0



# HCM 2010 Signalized Intersection Summary

## 6: Critz Lane & Lewisburg Pike

02/13/2018



Movement	EBL	EBR	NBL	NBT	SBT	SBR		
Lane Configurations								
Traffic Volume (veh/h)	257	42	55	1268	139	242		
Future Volume (veh/h)	257	42	55	1268	139	242		
Number	7	14	5	2	6	16		
Initial Q (Qb), veh	0	0	0	0	0	0		
Ped-Bike Adj(A_pbT)	1.00	1.00	1.00			1.00		
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00		
Adj Sat Flow, veh/h/ln	1863	1863	1863	1863	1863	1863		
Adj Flow Rate, veh/h	268	0	57	1321	145	0		
Adj No. of Lanes	1	1	1	1	1	1		
Peak Hour Factor	0.96	0.96	0.96	0.96	0.96	0.96		
Percent Heavy Veh, %	2	2	2	2	2	2		
Cap, veh/h	306	341	899	1348	1172	1270		
Arrive On Green	0.17	0.00	0.04	0.72	0.63	0.00		
Sat Flow, veh/h	1774	1583	1774	1863	1863	1583		
Grp Volume(v), veh/h	268	0	57	1321	145	0		
Grp Sat Flow(s),veh/h/ln	1774	1583	1774	1863	1863	1583		
Q Serve(g_s), s	12.8	0.0	0.9	58.6	2.7	0.0		
Cycle Q Clear(g_c), s	12.8	0.0	0.9	58.6	2.7	0.0		
Prop In Lane	1.00	1.00	1.00			1.00		
Lane Grp Cap(c), veh/h	306	341	899	1348	1172	1270		
V/C Ratio(X)	0.87	0.00	0.06	0.98	0.12	0.00		
Avail Cap(c_a), veh/h	367	396	927	1348	1172	1270		
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00		
Upstream Filter(I)	1.00	0.00	1.00	1.00	1.00	0.00		
Uniform Delay (d), s/veh	35.1	0.0	4.3	11.4	6.5	0.0		
Incr Delay (d2), s/veh	18.0	0.0	0.0	20.1	0.2	0.0		
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0		
%ile BackOfQ(95%),veh/ln	12.4	0.0	0.8	46.8	2.6	0.0		
LnGrp Delay(d),s/veh	53.0	0.0	4.3	31.5	6.7	0.0		
LnGrp LOS	D		A	C	A			
Approach Vol, veh/h	268			1378	145			
Approach Delay, s/veh	53.0			30.4	6.7			
Approach LOS	D			C	A			
Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4	5	6		
Phs Duration (G+Y+Rc), s		67.5		19.5	8.2	59.3		
Change Period (Y+Rc), s		4.5		4.5	4.5	4.5		
Max Green Setting (Gmax), s		63.0		18.0	5.1	53.4		
Max Q Clear Time (g_c+I1), s		60.6		14.8	2.9	4.7		
Green Ext Time (p_c), s		2.0		0.2	0.0	21.6		
<b>Intersection Summary</b>								
HCM 2010 Ctrl Delay			31.9					
HCM 2010 LOS			C					

# HCM 2010 Signalized Intersection Summary

## 6: Critz Lane & Lewisburg Pike

02/13/2018



Movement	EBL	EBR	NBL	NBT	SBT	SBR		
Lane Configurations								
Traffic Volume (veh/h)	121	35	24	188	600	479		
Future Volume (veh/h)	121	35	24	188	600	479		
Number	7	14	5	2	6	16		
Initial Q (Qb), veh	0	0	0	0	0	0		
Ped-Bike Adj(A_pbT)	1.00	1.00	1.00			1.00		
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00		
Adj Sat Flow, veh/h/ln	1863	1863	1863	1863	1863	1863		
Adj Flow Rate, veh/h	138	-5	27	214	682	0		
Adj No. of Lanes	1	1	1	1	1	1		
Peak Hour Factor	0.88	0.88	0.88	0.88	0.88	0.88		
Percent Heavy Veh, %	2	2	2	2	2	2		
Cap, veh/h	180	210	483	1353	1135	1126		
Arrive On Green	0.10	0.00	0.03	0.73	0.61	0.00		
Sat Flow, veh/h	1774	1583	1774	1863	1863	1583		
Grp Volume(v), veh/h	138	-5	27	214	682	0		
Grp Sat Flow(s),veh/h/ln	1774	1583	1774	1863	1863	1583		
Q Serve(g_s), s	4.0	0.0	0.3	1.9	11.8	0.0		
Cycle Q Clear(g_c), s	4.0	0.0	0.3	1.9	11.8	0.0		
Prop In Lane	1.00	1.00	1.00			1.00		
Lane Grp Cap(c), veh/h	180	210	483	1353	1135	1126		
V/C Ratio(X)	0.77	-0.02	0.06	0.16	0.60	0.00		
Avail Cap(c_a), veh/h	610	594	597	1353	1135	1126		
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00		
Upstream Filter(I)	1.00	0.00	1.00	1.00	1.00	0.00		
Uniform Delay (d), s/veh	22.9	0.0	4.6	2.2	6.3	0.0		
Incr Delay (d2), s/veh	6.7	0.0	0.0	0.2	2.4	0.0		
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0		
%ile BackOfQ(95%),veh/ln	4.0	0.0	0.2	1.9	10.8	0.0		
LnGrp Delay(d),s/veh	29.5	0.0	4.7	2.5	8.7	0.0		
LnGrp LOS	C		A	A	A			
Approach Vol, veh/h	133			241	682			
Approach Delay, s/veh	30.7			2.7	8.7			
Approach LOS	C			A	A			
Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4	5	6		
Phs Duration (G+Y+Rc), s		42.5		9.8	6.1	36.4		
Change Period (Y+Rc), s		4.5		4.5	4.5	4.5		
Max Green Setting (Gmax), s		38.0		18.0	5.0	28.5		
Max Q Clear Time (g_c+I1), s		3.9		6.0	2.3	13.8		
Green Ext Time (p_c), s		6.2		0.2	0.0	4.8		
<b>Intersection Summary</b>								
HCM 2010 Ctrl Delay			10.1					
HCM 2010 LOS			B					












## **APPENDIX E**

# **2024 TOTAL CONDITIONS CAPACITY ANALYSIS WORKSHEETS**














HCM 2010 Signalized Intersection Summary  
 1: Columbia Pike & Critz Lane

02/13/2018

								
Movement	WBL	WBR	NBT	NBR	SBL	SBT		
Lane Configurations								
Traffic Volume (veh/h)	72	676	1380	69	169	664		
Future Volume (veh/h)	72	676	1380	69	169	664		
Number	3	18	2	12	1	6		
Initial Q (Qb), veh	0	0	0	0	0	0		
Ped-Bike Adj(A_pbT)	1.00	1.00		1.00	1.00			
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00		
Adj Sat Flow, veh/h/ln	1863	1863	1863	1900	1863	1863		
Adj Flow Rate, veh/h	75	418	1438	67	176	692		
Adj No. of Lanes	1	1	2	0	1	2		
Peak Hour Factor	0.96	0.96	0.96	0.96	0.96	0.96		
Percent Heavy Veh, %	2	2	2	2	2	2		
Cap, veh/h	503	449	1577	73	345	2275		
Arrive On Green	0.28	0.28	0.46	0.46	0.15	0.64		
Sat Flow, veh/h	1774	1583	3537	160	1774	3632		
Grp Volume(v), veh/h	75	418	737	768	176	692		
Grp Sat Flow(s),veh/h/ln	1774	1583	1770	1834	1774	1770		
Q Serve(g_s), s	3.9	31.4	47.3	47.6	5.2	10.6		
Cycle Q Clear(g_c), s	3.9	31.4	47.3	47.6	5.2	10.6		
Prop In Lane	1.00	1.00		0.09	1.00			
Lane Grp Cap(c), veh/h	503	449	810	840	345	2275		
V/C Ratio(X)	0.15	0.93	0.91	0.91	0.51	0.30		
Avail Cap(c_a), veh/h	617	551	810	840	345	2275		
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00		
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00		
Uniform Delay (d), s/veh	32.7	42.6	30.8	30.9	23.1	9.7		
Incr Delay (d2), s/veh	0.1	20.4	16.1	16.1	5.3	0.3		
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0		
%ile BackOfQ(95%),veh/ln	3.4	22.9	35.0	36.5	5.9	9.1		
LnGrp Delay(d),s/veh	32.9	63.0	46.8	47.0	28.4	10.0		
LnGrp LOS	C	E	D	D	C	B		
Approach Vol, veh/h	493		1505			868		
Approach Delay, s/veh	58.4		46.9			13.8		
Approach LOS	E		D			B		
Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2				6		8
Phs Duration (G+Y+Rc), s	22.6	60.4				83.0		39.1
Change Period (Y+Rc), s	4.5	4.5				4.5		4.5
Max Green Setting (Gmax), s	18.1	55.9				78.5		42.5
Max Q Clear Time (g_c+I1), s	7.2	49.6				12.6		33.4
Green Ext Time (p_c), s	0.3	5.3				26.8		1.2
<b>Intersection Summary</b>								
HCM 2010 Ctrl Delay			38.8					
HCM 2010 LOS			D					

HCM 2010 Signalized Intersection Summary  
 1: Columbia Pike & Critz Lane

02/13/2018

								
Movement	WBL	WBR	NBT	NBR	SBL	SBT		
Lane Configurations								
Traffic Volume (veh/h)	37	305	881	100	863	960		
Future Volume (veh/h)	37	305	881	100	863	960		
Number	3	18	2	12	1	6		
Initial Q (Qb), veh	0	0	0	0	0	0		
Ped-Bike Adj(A_pbT)	1.00	1.00		1.00	1.00			
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00		
Adj Sat Flow, veh/h/ln	1863	1863	1863	1900	1863	1863		
Adj Flow Rate, veh/h	39	0	918	95	899	1000		
Adj No. of Lanes	1	1	2	0	1	2		
Peak Hour Factor	0.96	0.96	0.96	0.96	0.96	0.96		
Percent Heavy Veh, %	2	2	2	2	2	2		
Cap, veh/h	53	47	1096	113	1030	3179		
Arrive On Green	0.03	0.00	0.34	0.34	0.52	0.90		
Sat Flow, veh/h	1774	1583	3331	335	1774	3632		
Grp Volume(v), veh/h	39	0	502	511	899	1000		
Grp Sat Flow(s),veh/h/ln	1774	1583	1770	1804	1774	1770		
Q Serve(g_s), s	2.7	0.0	32.7	32.7	46.8	5.0		
Cycle Q Clear(g_c), s	2.7	0.0	32.7	32.7	46.8	5.0		
Prop In Lane	1.00	1.00		0.19	1.00			
Lane Grp Cap(c), veh/h	53	47	599	610	1030	3179		
V/C Ratio(X)	0.74	0.00	0.84	0.84	0.87	0.31		
Avail Cap(c_a), veh/h	265	237	599	610	1030	3179		
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00		
Upstream Filter(I)	1.00	0.00	1.00	1.00	1.00	1.00		
Uniform Delay (d), s/veh	60.2	0.0	38.2	38.2	20.8	0.9		
Incr Delay (d2), s/veh	18.3	0.0	13.2	12.9	10.2	0.3		
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0		
%ile BackOfQ(95%),veh/ln	2.9	0.0	25.2	25.6	40.3	4.5		
LnGrp Delay(d),s/veh	78.4	0.0	51.3	51.1	31.0	1.2		
LnGrp LOS	E		D	D	C	A		
Approach Vol, veh/h	39		1013			1899		
Approach Delay, s/veh	78.4		51.2			15.3		
Approach LOS	E		D			B		
Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2				6		8
Phs Duration (G+Y+Rc), s	70.0	46.8				116.8		8.2
Change Period (Y+Rc), s	4.5	4.5				4.5		4.5
Max Green Setting (Gmax), s	65.5	42.3				112.3		18.7
Max Q Clear Time (g_c+I1), s	48.8	34.7				7.0		4.7
Green Ext Time (p_c), s	3.2	5.9				23.4		0.0
<b>Intersection Summary</b>								
HCM 2010 Ctrl Delay			28.5					
HCM 2010 LOS			C					

HCM 2010 TWSC  
2: Critz Lane & Westerham Way

02/13/2018

Intersection						
Int Delay, s/veh	5.5					
Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	27	202	577	28	37	204
Future Vol, veh/h	27	202	577	28	37	204
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	355	-	-	260	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	93	93	93	93	93	93
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	29	217	620	30	40	219

Major/Minor	Major1	Major2	Minor2		
Conflicting Flow All	620	0	-	0	895 620
Stage 1	-	-	-	-	620 -
Stage 2	-	-	-	-	275 -
Critical Hdwy	4.12	-	-	-	6.42 6.22
Critical Hdwy Stg 1	-	-	-	-	5.42 -
Critical Hdwy Stg 2	-	-	-	-	5.42 -
Follow-up Hdwy	2.218	-	-	-	3.518 3.318
Pot Cap-1 Maneuver	960	-	-	-	311 488
Stage 1	-	-	-	-	536 -
Stage 2	-	-	-	-	771 -
Platoon blocked, %		-	-	-	
Mov Cap-1 Maneuver	960	-	-	-	302 488
Mov Cap-2 Maneuver	-	-	-	-	302 -
Stage 1	-	-	-	-	536 -
Stage 2	-	-	-	-	748 -

Approach	EB	WB	SB
HCM Control Delay, s	1	0	23.7
HCM LOS			C

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	960	-	-	-	446
HCM Lane V/C Ratio	0.03	-	-	-	0.581
HCM Control Delay (s)	8.9	-	-	-	23.7
HCM Lane LOS	A	-	-	-	C
HCM 95th %tile Q(veh)	0.1	-	-	-	3.6



HCM 2010 TWSC  
2: Critz Lane & Westerham Way

02/13/2018

Intersection						
Int Delay, s/veh	3					
Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	204	788	246	28	24	101
Future Vol, veh/h	204	788	246	28	24	101
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	355	-	-	260	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	96	96	96	96	96	96
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	213	821	256	29	25	105

Major/Minor	Major1	Major2	Minor2		
Conflicting Flow All	256	0	-	0	1502
Stage 1	-	-	-	-	256
Stage 2	-	-	-	-	1246
Critical Hdwy	4.12	-	-	-	6.42
Critical Hdwy Stg 1	-	-	-	-	5.42
Critical Hdwy Stg 2	-	-	-	-	5.42
Follow-up Hdwy	2.218	-	-	-	3.518
Pot Cap-1 Maneuver	1309	-	-	-	134
Stage 1	-	-	-	-	787
Stage 2	-	-	-	-	271
Platoon blocked, %		-	-	-	
Mov Cap-1 Maneuver	1309	-	-	-	112
Mov Cap-2 Maneuver	-	-	-	-	112
Stage 1	-	-	-	-	787
Stage 2	-	-	-	-	227

Approach	EB	WB	SB
HCM Control Delay, s	1.7	0	20.3
HCM LOS			C

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	1309	-	-	-	364
HCM Lane V/C Ratio	0.162	-	-	-	0.358
HCM Control Delay (s)	8.3	-	-	-	20.3
HCM Lane LOS	A	-	-	-	C
HCM 95th %tile Q(veh)	0.6	-	-	-	1.6

HCM 2010 Roundabout  
 3: Clayton Arnold Road & Critz Lane

02/13/2018

Intersection				
Intersection Delay, s/veh	13.4			
Intersection LOS	B			
Approach	EB	WB	NB	SB
Entry Lanes	1	1	1	1
Conflicting Circle Lanes	1	1	1	1
Adj Approach Flow, veh/h	287	438	596	163
Demand Flow Rate, veh/h	292	447	608	166
Vehicles Circulating, veh/h	290	525	92	865
Vehicles Exiting, veh/h	741	175	490	107
Follow-Up Headway, s	3.186	3.186	3.186	3.186
Ped Vol Crossing Leg, #/h	0	0	0	0
Ped Cap Adj	1.000	1.000	1.000	1.000
Approach Delay, s/veh	8.3	19.2	11.5	13.5
Approach LOS	A	C	B	B
Lane	Left	Left	Left	Left
Designated Moves	LTR	LTR	LTR	LTR
Assumed Moves	LTR	LTR	LTR	LTR
RT Channelized				
Lane Util	1.000	1.000	1.000	1.000
Critical Headway, s	5.193	5.193	5.193	5.193
Entry Flow, veh/h	292	447	608	166
Cap Entry Lane, veh/h	845	668	1031	476
Entry HV Adj Factor	0.983	0.980	0.981	0.981
Flow Entry, veh/h	287	438	596	163
Cap Entry, veh/h	831	655	1011	467
V/C Ratio	0.345	0.669	0.590	0.349
Control Delay, s/veh	8.3	19.2	11.5	13.5
LOS	A	C	B	B
95th %tile Queue, veh	2	5	4	2

HCM 2010 Roundabout  
 3: Clayton Arnold Road & Critz Lane

02/13/2018

Intersection				
Intersection Delay, s/veh	25.3			
Intersection LOS	D			
Approach	EB	WB	NB	SB
Entry Lanes	1	1	1	1
Conflicting Circle Lanes	1	1	1	1
Adj Approach Flow, veh/h	873	267	215	136
Demand Flow Rate, veh/h	890	272	219	138
Vehicles Circulating, veh/h	180	211	258	345
Vehicles Exiting, veh/h	303	266	812	138
Follow-Up Headway, s	3.186	3.186	3.186	3.186
Ped Vol Crossing Leg, #/h	0	0	0	0
Ped Cap Adj	1.000	1.000	1.000	1.000
Approach Delay, s/veh	38.4	7.2	6.8	6.4
Approach LOS	E	A	A	A
Lane	Left	Left	Left	Left
Designated Moves	LTR	LTR	LTR	LTR
Assumed Moves	LTR	LTR	LTR	LTR
RT Channelized				
Lane Util	1.000	1.000	1.000	1.000
Critical Headway, s	5.193	5.193	5.193	5.193
Entry Flow, veh/h	890	272	219	138
Cap Entry Lane, veh/h	944	915	873	800
Entry HV Adj Factor	0.980	0.980	0.984	0.984
Flow Entry, veh/h	873	267	215	136
Cap Entry, veh/h	925	897	859	788
V/C Ratio	0.943	0.297	0.251	0.172
Control Delay, s/veh	38.4	7.2	6.8	6.4
LOS	E	A	A	A
95th %tile Queue, veh	15	1	1	1



HCM 2010 TWSC  
 4: Sporting Hill Bridge Road & Critz Lane

02/13/2018

Intersection												
Int Delay, s/veh	2.9											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Traffic Vol, veh/h	0	138	11	37	184	1	37	0	59	0	0	2
Future Vol, veh/h	0	138	11	37	184	1	37	0	59	0	0	2
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	93	93	93	93	93	93	93	93	93	93	93	93
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	0	148	12	40	198	1	40	0	63	0	0	2

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	199	0	0	160	0	0	433	432	154	464	438	198
Stage 1	-	-	-	-	-	-	154	154	-	278	278	-
Stage 2	-	-	-	-	-	-	279	278	-	186	160	-
Critical Hdwy	4.12	-	-	4.12	-	-	7.12	6.52	6.22	7.12	6.52	6.22
Critical Hdwy Stg 1	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Follow-up Hdwy	2.218	-	-	2.218	-	-	3.518	4.018	3.318	3.518	4.018	3.318
Pot Cap-1 Maneuver	1373	-	-	1419	-	-	533	516	892	508	512	843
Stage 1	-	-	-	-	-	-	848	770	-	728	680	-
Stage 2	-	-	-	-	-	-	728	680	-	816	766	-
Platoon blocked, %	-	-	-	-	-	-	-	-	-	-	-	-
Mov Cap-1 Maneuver	1373	-	-	1419	-	-	519	499	892	460	496	843
Mov Cap-2 Maneuver	-	-	-	-	-	-	519	499	-	460	496	-
Stage 1	-	-	-	-	-	-	848	770	-	728	658	-
Stage 2	-	-	-	-	-	-	703	658	-	758	766	-

Approach	EB			WB			NB			SB		
HCM Control Delay, s	0			1.3			11			9.3		
HCM LOS							B			A		

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	699	1373	-	-	1419	-	-	843
HCM Lane V/C Ratio	0.148	-	-	-	0.028	-	-	0.003
HCM Control Delay (s)	11	0	-	-	7.6	0	-	9.3
HCM Lane LOS	B	A	-	-	A	A	-	A
HCM 95th %tile Q(veh)	0.5	0	-	-	0.1	-	-	0

HCM 2010 TWSC  
4: Sporting Hill Bridge Road & Critz Lane

02/13/2018

Intersection												
Int Delay, s/veh	2.8											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Traffic Vol, veh/h	0	109	22	69	207	0	22	0	53	0	0	0
Future Vol, veh/h	0	109	22	69	207	0	22	0	53	0	0	0
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	82	82	82	82	82	82	82	82	82	82	82	82
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	0	133	27	84	252	0	27	0	65	0	0	0

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	252	0	0	160	0	0	567	567	146	600	581	252
Stage 1	-	-	-	-	-	-	146	146	-	421	421	-
Stage 2	-	-	-	-	-	-	421	421	-	179	160	-
Critical Hdwy	4.12	-	-	4.12	-	-	7.12	6.52	6.22	7.12	6.52	6.22
Critical Hdwy Stg 1	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Follow-up Hdwy	2.218	-	-	2.218	-	-	3.518	4.018	3.318	3.518	4.018	3.318
Pot Cap-1 Maneuver	1313	-	-	1419	-	-	434	433	901	413	425	787
Stage 1	-	-	-	-	-	-	857	776	-	610	589	-
Stage 2	-	-	-	-	-	-	610	589	-	823	766	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	1313	-	-	1419	-	-	411	403	901	363	396	787
Mov Cap-2 Maneuver	-	-	-	-	-	-	411	403	-	363	396	-
Stage 1	-	-	-	-	-	-	857	776	-	610	548	-
Stage 2	-	-	-	-	-	-	568	548	-	764	766	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0	1.9	11.2	0
HCM LOS			B	A

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	668	1313	-	-	1419	-	-	-
HCM Lane V/C Ratio	0.137	-	-	-	0.059	-	-	-
HCM Control Delay (s)	11.2	0	-	-	7.7	0	-	0
HCM Lane LOS	B	A	-	-	A	A	-	A
HCM 95th %tile Q(veh)	0.5	0	-	-	0.2	-	-	-

Intersection			
Intersection Delay, s/veh	6.2		
Intersection LOS	A		
Approach	EB	WB	NB
Entry Lanes	1	1	1
Conflicting Circle Lanes	1	1	1
Adj Approach Flow, veh/h	234	314	234
Demand Flow Rate, veh/h	239	320	239
Vehicles Circulating, veh/h	93	9	229
Vehicles Exiting, veh/h	236	458	102
Follow-Up Headway, s	3.186	3.186	3.186
Ped Vol Crossing Leg, #/h	0	0	0
Ped Cap Adj	1.000	1.000	1.000
Approach Delay, s/veh	5.8	6.0	6.9
Approach LOS	A	A	A
Lane	Left	Left	Left
Designated Moves	TR	LT	LR
Assumed Moves	TR	LT	LR
RT Channelized			
Lane Util	1.000	1.000	1.000
Critical Headway, s	5.193	5.193	5.193
Entry Flow, veh/h	239	320	239
Cap Entry Lane, veh/h	1030	1120	899
Entry HV Adj Factor	0.981	0.980	0.979
Flow Entry, veh/h	234	314	234
Cap Entry, veh/h	1010	1097	880
V/C Ratio	0.232	0.286	0.266
Control Delay, s/veh	5.8	6.0	6.9
LOS	A	A	A
95th %tile Queue, veh	1	1	1



Intersection			
Intersection Delay, s/veh	9.2		
Intersection LOS	A		
Approach	EB	WB	NB
Entry Lanes	1	1	1
Conflicting Circle Lanes	1	1	1
Adj Approach Flow, veh/h	129	630	96
Demand Flow Rate, veh/h	131	642	98
Vehicles Circulating, veh/h	422	3	116
Vehicles Exiting, veh/h	223	211	437
Follow-Up Headway, s	3.186	3.186	3.186
Ped Vol Crossing Leg, #/h	0	0	0
Ped Cap Adj	1.000	1.000	1.000
Approach Delay, s/veh	6.9	10.3	4.5
Approach LOS	A	B	A
Lane	Left	Left	Left
Designated Moves	TR	LT	LR
Assumed Moves	TR	LT	LR
RT Channelized			
Lane Util	1.000	1.000	1.000
Critical Headway, s	5.193	5.193	5.193
Entry Flow, veh/h	131	642	98
Cap Entry Lane, veh/h	741	1127	1006
Entry HV Adj Factor	0.983	0.981	0.980
Flow Entry, veh/h	129	630	96
Cap Entry, veh/h	728	1105	986
V/C Ratio	0.177	0.570	0.097
Control Delay, s/veh	6.9	10.3	4.5
LOS	A	B	A
95th %tile Queue, veh	1	4	0

# HCM 2010 Signalized Intersection Summary

## 6: Critz Lane & Lewisburg Pike

02/13/2018



Movement	EBL	EBR	NBL	NBT	SBT	SBR		
Lane Configurations								
Traffic Volume (veh/h)	287	50	57	1268	139	252		
Future Volume (veh/h)	287	50	57	1268	139	252		
Number	7	14	5	2	6	16		
Initial Q (Qb), veh	0	0	0	0	0	0		
Ped-Bike Adj(A_pbT)	1.00	1.00	1.00			1.00		
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00		
Adj Sat Flow, veh/h/ln	1863	1863	1863	1863	1863	1863		
Adj Flow Rate, veh/h	299	0	59	1321	145	0		
Adj No. of Lanes	1	1	1	1	1	1		
Peak Hour Factor	0.96	0.96	0.96	0.96	0.96	0.96		
Percent Heavy Veh, %	2	2	2	2	2	2		
Cap, veh/h	334	367	880	1323	1148	1274		
Arrive On Green	0.19	0.00	0.04	0.71	0.62	0.00		
Sat Flow, veh/h	1774	1583	1774	1863	1863	1583		
Grp Volume(v), veh/h	299	0	59	1321	145	0		
Grp Sat Flow(s),veh/h/ln	1774	1583	1774	1863	1863	1583		
Q Serve(g_s), s	14.6	0.0	1.0	62.7	2.9	0.0		
Cycle Q Clear(g_c), s	14.6	0.0	1.0	62.7	2.9	0.0		
Prop In Lane	1.00	1.00	1.00			1.00		
Lane Grp Cap(c), veh/h	334	367	880	1323	1148	1274		
V/C Ratio(X)	0.89	0.00	0.07	1.00	0.13	0.00		
Avail Cap(c_a), veh/h	360	390	906	1323	1148	1274		
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00		
Upstream Filter(I)	1.00	0.00	1.00	1.00	1.00	0.00		
Uniform Delay (d), s/veh	35.1	0.0	4.8	12.8	7.1	0.0		
Incr Delay (d2), s/veh	22.7	0.0	0.0	24.4	0.2	0.0		
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0		
%ile BackOfQ(95%),veh/ln	4.2	0.0	0.8	51.0	2.7	0.0		
LnGrp Delay(d),s/veh	57.8	0.0	4.8	37.3	7.3	0.0		
LnGrp LOS	E		A	D	A			
Approach Vol, veh/h	299			1380	145			
Approach Delay, s/veh	57.8			35.9	7.3			
Approach LOS	E			D	A			
Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4	5	6		
Phs Duration (G+Y+Rc), s		67.5		21.2	8.3	59.2		
Change Period (Y+Rc), s		4.5		4.5	4.5	4.5		
Max Green Setting (Gmax), s		63.0		18.0	5.1	53.4		
Max Q Clear Time (g_c+I1), s		64.7		16.6	3.0	4.9		
Green Ext Time (p_c), s		0.0		0.1	0.0	21.6		
<b>Intersection Summary</b>								
HCM 2010 Ctrl Delay			37.2					
HCM 2010 LOS			D					

# HCM 2010 Signalized Intersection Summary

## 6: Critz Lane & Lewisburg Pike

02/13/2018



Movement	EBL	EBR	NBL	NBT	SBT	SBR		
Lane Configurations								
Traffic Volume (veh/h)	140	40	32	188	600	511		
Future Volume (veh/h)	140	40	32	188	600	511		
Number	7	14	5	2	6	16		
Initial Q (Qb), veh	0	0	0	0	0	0		
Ped-Bike Adj(A_pbT)	1.00	1.00	1.00			1.00		
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00		
Adj Sat Flow, veh/h/ln	1863	1863	1863	1863	1863	1863		
Adj Flow Rate, veh/h	159	0	36	214	682	0		
Adj No. of Lanes	1	1	1	1	1	1		
Peak Hour Factor	0.88	0.88	0.88	0.88	0.88	0.88		
Percent Heavy Veh, %	2	2	2	2	2	2		
Cap, veh/h	208	247	471	1329	1099	1121		
Arrive On Green	0.12	0.00	0.04	0.71	0.59	0.00		
Sat Flow, veh/h	1774	1583	1774	1863	1863	1583		
Grp Volume(v), veh/h	159	0	36	214	682	0		
Grp Sat Flow(s),veh/h/ln	1774	1583	1774	1863	1863	1583		
Q Serve(g_s), s	4.6	0.0	0.4	2.0	12.6	0.0		
Cycle Q Clear(g_c), s	4.6	0.0	0.4	2.0	12.6	0.0		
Prop In Lane	1.00	1.00	1.00			1.00		
Lane Grp Cap(c), veh/h	208	247	471	1329	1099	1121		
V/C Ratio(X)	0.76	0.00	0.08	0.16	0.62	0.00		
Avail Cap(c_a), veh/h	600	597	569	1329	1099	1121		
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00		
Upstream Filter(I)	1.00	0.00	1.00	1.00	1.00	0.00		
Uniform Delay (d), s/veh	22.8	0.0	5.1	2.5	7.1	0.0		
Incr Delay (d2), s/veh	5.7	0.0	0.1	0.3	2.6	0.0		
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0		
%ile BackOfQ(95%),veh/ln	4.6	0.0	0.3	2.0	11.4	0.0		
LnGrp Delay(d),s/veh	28.5	0.0	5.2	2.7	9.7	0.0		
LnGrp LOS	C		A	A	A			
Approach Vol, veh/h	159			250	682			
Approach Delay, s/veh	28.5			3.1	9.7			
Approach LOS	C			A	A			
Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4	5	6		
Phs Duration (G+Y+Rc), s		42.5		10.8	6.6	35.9		
Change Period (Y+Rc), s		4.5		4.5	4.5	4.5		
Max Green Setting (Gmax), s		38.0		18.0	5.0	28.5		
Max Q Clear Time (g_c+I1), s		4.0		6.6	2.4	14.6		
Green Ext Time (p_c), s		6.2		0.3	0.0	4.6		
<b>Intersection Summary</b>								
HCM 2010 Ctrl Delay			10.9					
HCM 2010 LOS			B					



Intersection						
Int Delay, s/veh	5.3					
Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↔	↔		↔	
Traffic Vol, veh/h	62	80	213	18	56	150
Future Vol, veh/h	62	80	213	18	56	150
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	67	87	232	20	61	163

Major/Minor	Major1	Major2	Minor2		
Conflicting Flow All	251	0	-	0	463
Stage 1	-	-	-	-	241
Stage 2	-	-	-	-	222
Critical Hdwy	4.12	-	-	-	6.42
Critical Hdwy Stg 1	-	-	-	-	5.42
Critical Hdwy Stg 2	-	-	-	-	5.42
Follow-up Hdwy	2.218	-	-	-	3.518
Pot Cap-1 Maneuver	1314	-	-	-	557
Stage 1	-	-	-	-	799
Stage 2	-	-	-	-	815
Platoon blocked, %		-	-	-	
Mov Cap-1 Maneuver	1314	-	-	-	527
Mov Cap-2 Maneuver	-	-	-	-	527
Stage 1	-	-	-	-	799
Stage 2	-	-	-	-	771

Approach	EB	WB	SB
HCM Control Delay, s	3.4	0	12.5
HCM LOS			B

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	1314	-	-	-	700
HCM Lane V/C Ratio	0.051	-	-	-	0.32
HCM Control Delay (s)	7.9	0	-	-	12.5
HCM Lane LOS	A	A	-	-	B
HCM 95th %tile Q(veh)	0.2	-	-	-	1.4

Intersection						
Int Delay, s/veh	4.5					
Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↶	↷		↶	↷
Traffic Vol, veh/h	139	101	159	61	36	86
Future Vol, veh/h	139	101	159	61	36	86
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	151	110	173	66	39	93

Major/Minor	Major1	Major2	Minor2		
Conflicting Flow All	239	0	-	0	618 206
Stage 1	-	-	-	-	206 -
Stage 2	-	-	-	-	412 -
Critical Hdwy	4.12	-	-	-	6.42 6.22
Critical Hdwy Stg 1	-	-	-	-	5.42 -
Critical Hdwy Stg 2	-	-	-	-	5.42 -
Follow-up Hdwy	2.218	-	-	-	3.518 3.318
Pot Cap-1 Maneuver	1328	-	-	-	453 835
Stage 1	-	-	-	-	829 -
Stage 2	-	-	-	-	669 -
Platoon blocked, %		-	-	-	
Mov Cap-1 Maneuver	1328	-	-	-	398 835
Mov Cap-2 Maneuver	-	-	-	-	398 -
Stage 1	-	-	-	-	829 -
Stage 2	-	-	-	-	588 -

Approach	EB	WB	SB
HCM Control Delay, s	4.7	0	12.2
HCM LOS			B

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	1328	-	-	-	631
HCM Lane V/C Ratio	0.114	-	-	-	0.21
HCM Control Delay (s)	8.1	0	-	-	12.2
HCM Lane LOS	A	A	-	-	B
HCM 95th %tile Q(veh)	0.4	-	-	-	0.8