

**Town of Thompson's Station  
Municipal Planning Commission  
Meeting Agenda  
November 17, 2015**

**Meeting Called To Order**

**Pledge Of Allegiance**

**Minutes-**

**Consideration Of Minutes Of The October 27, 2015 Meeting.**

Documents: [102715 PC MTG MINUTES.PDF](#)

**Reports-**

**Town Administrator Report**

Documents: [TA REPORT TO PC 11172015.PDF](#)

**Public Comments-**

**Unfinished Business:**

**1. Preliminary Plat**

Phase 1 of Roderick (File: PP 2015-007)

Documents: [ITEM 1 STAFF REPORT.PDF](#), [OCTOBER 2014 STAFF REPORT FOR RODERICK.PDF](#), [RODERICK TRAFFIC IMPACT STUDY.PDF](#)

**2. Site Plan**

For the development of a restaurant and convenience store on a 2.77 acre site located within Roderick (File: SP 2015-008; DR 2015-007).

Documents: [ITEM 2 STAFF REPORT.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**  
**October 27, 2015**

**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 October, 2015, at the Thompson's Station Community Center with the required quorum. Members and staff in attendance were: Chairman Jack Elder; Secretary Don Blair; Vice-Chair Mike Roberts; Commissioner Ben Dilks; Commissioner Sarah Benson; Commissioner Darren Burrus; Commissioner Debra Bender; Town Planner Wendy Deats; Town Attorney Todd Moore and Town Clerk Chandra Boughton. Town Administrator Joe Cosentini was unable to attend.

**Pledge of Allegiance.**

**Minutes:**

The minutes of the September 22, 2015 Meeting were previously submitted.

**Commissioner Roberts moved for approval of the September 22, 2015 meeting minutes. The motion was seconded and carried unanimously.**

**Public Comment:**       None

**Old Business:**

**1. Public Hearing: Update to the Town's General Plan**

Mrs. Deats reviewed the updates to the General Plan and recommended approval.

**Public Hearing:** No one came forward to speak.

**Commissioner Roberts moved to approve the update to the Town's General Plan with the growth sector map. The motion was seconded and carried unanimously.**

**New Business:**

**2. Final Plat – For the creation of 39 townhome lots within Section 9B of The Fields of Canterbury**

Mrs. Deats reviewed her staff report and recommended approval based on the project's substantial consistency with the approved Phase 9 plat, subject to the following contingencies: 1. Prior to recordation of the final plat, a letter of credit shall be submitted to the Town in the amount of \$150,000 for roadways, drainage and erosion control; 2. Prior to recordation of the final plat, a letter of credit shall be submitted to the Town in the amount of \$135,000 for sewer; 3. As built shall be required for the drainage and sewer system with a letter from the Design Engineer that they are constructed per the approved drawings and functioning as intended.

**After discussion, Commissioner Dilks moved to approve the Final Plat for the creation of 39 townhome lots within Section 9B of The Fields of Canterbury with the following contingencies:**

- 1. Prior to recordation of the final plat, a letter of credit shall be submitted to the Town in the amount of \$150,000 for roadways, drainage and erosion control.**
- 2. Prior to recordation of the final plat, a letter of credit shall be submitted to the Town in the amount of \$135,000 for sewer.**

- 3. As built shall be required for the drainage and sewer system with a letter from the Design Engineer that they are constructed per the approved drawings and functioning as intended.**

**The motion was seconded and carried unanimously.**

**3. Site Plan – For the development of 39 townhomes within Section 9B of The Fields of Canterbury**  
Mrs. Deats reviewed her staff report and recommended approval based on the project's consistency with the Town's Zoning Ordinance and 9B final plat, with the contingency that prior to the issuance of building permits, the applicant shall obtain approval for the design and landscaping from the Design Review Commission, and an added contingency that the plat must be recorded.

**Commissioner Dilks moved to approve the Final Plat for the creation of 39 townhome lots within Section 9B of The Fields of Canterbury with the following contingencies:**

- 1. Prior to the issuance of building permits, the applicant shall obtain approval for the design and landscaping from the Design Review Commission.**
- 2. Prior to the issuance of building permits, the plat must be recorded.**

**The motion was seconded and carried unanimously.**

**4. Final Plat – For the creation of 38 lots within Section 8B of The Fields of Canterbury**

Mrs. Deats reviewed her staff report and recommended approval based on the project's substantial consistency with the approved Phase 8 preliminary plat, subject to the following contingencies: 1. Prior to recordation of the final plat, a letter of credit shall be submitted to the Town in the amount of \$273,000 for roadways, drainage and erosion control; 2. Prior to recordation of the final plat, a letter of credit shall be submitted to the Town in the amount of \$190,000 for sewer; 3. As built shall be required for the drainage and sewer system with a letter from the Design Engineer that they are constructed per the approved drawings and functioning as intended.

**After discussion, Commissioner Bender moved to approve the Final Plat for the creation of 38 lots within Section 8B of The Fields of Canterbury with the following contingencies:**

- 1. Prior to recordation of the final plat, a letter of credit shall be submitted to the Town in the amount of \$273,000 for roadways, drainage and erosion control.**
- 2. Prior to recordation of the final plat, a letter of credit shall be submitted to the Town in the amount of \$190,000 for sewer.**
- 3. As built shall be required for the drainage and sewer system with a letter from the Design Engineer that they are constructed per the approved drawings and functioning as intended.**

**The motion was seconded and carried unanimously.**

**5. Site Plan – For the development a 10,300 square foot building located at 2604 Columbia Pike**

Mrs. Deats reviewed her staff report for the non-residential site plan request for a new 10,300 square foot administrative office building along the north side of the project site. Based on the project's consistency with the Town's Zoning Ordinance, Mrs. Deats recommended approval of the project with the following contingencies: 1. Prior to approval of a building permit, complete construction plans demonstrating compliance with all applicable codes shall be submitted and approved; 2. Prior to approval of a building permit, the applicant shall obtain DRC approval for the design and landscaping; 3. Prior to the issuance of building permits, the landscape plan shall be revised to incorporate foundation planting along the east and

west building elevations and to screen the mechanical equipment along the rear elevation; 4. Prior to the installation of the landscaping a pre installation meeting shall be required; 5. Prior to occupancy, the landscaping shall be installed in accordance with the approved plans.

**After discussion, Commissioner Roberts moved to approve the Site Plan with the following contingencies:**

- 1. Prior to approval of a building permit, complete construction plans demonstrating compliance with all applicable codes shall be submitted and approved.**
- 2. Prior to approval of a building permit, the applicant shall obtain DRC approval for the design and landscaping.**
- 3. Prior to the issuance of building permits, the landscape plan shall be revised to incorporate foundation planting along the east and west building elevations and to screen the mechanical equipment along the rear elevation.**
- 4. Prior to the installation of the landscaping a pre installation meeting shall be required.**
- 5. Prior to occupancy, the landscaping shall be installed in accordance with the approved plans.**

**The motion was seconded and carried unanimously.**

#### **6. Site Development Plan – Revised Concept Plan for Whistle Stop Village**

Mrs. Deats reviewed her staff report and the revision to the Concept Plan for Whistle Stop. Mr. Greg Gamble, representative for the applicant, fielded questions pertaining to street improvements, sewer, water line and traffic studies. While there is **no action required for this item**, Mrs. Deats recommended that the following contingencies be placed on future approvals:

1. Prior to submittal for final plat, approval of all construction documents for the sewer system shall be approved by the Town and the State of Tennessee.
2. Prior to issuance of building permits, all off-site water improvements shall be completed in compliance with HB&TS requirements.
3. All improvements outlined in the traffic study for the project shall be completed by the developer. A schedule for timing shall be identified and approved for traffic improvements.
4. Prior to the approval of any final plats, a development agreement shall be prepared and executed in accordance with the Town's Land Development Ordinance.

#### **7. Preliminary Plat – Phase 1 of Roderick Place**

Mrs. Deats reviewed her staff report and the request for a preliminary plat for the development of 37.33 acres within Roderick Place consisting of 90 single family lots, one amenity lot, one commercial lot and ten open space lots. Based on the consistencies with the approvals granted for the Specific Plan, Mrs. Deats recommended approval with contingencies. Representatives of the applicant (Mr. Brett Creasman, Mr. Jeff Rosiak, Mr. Leon Herron and Mr. Ryan McMaster) fielded questions on a variety of topics pertaining to the development, most notably concerns about traffic impact.

**After discussion, Commissioner Bender moved to defer the Preliminary Plat of Phase 1 of Roderick Place to the November 17<sup>th</sup> Planning Commission meeting to provide time for a**

**work session with the Town, the Planning Commission, the developer and TDOT representatives to discuss traffic concerns. The motion was seconded and approved by a vote of 6-1, with Commissioner Burrus casting the dissenting vote.**

**8. Site Plan – For the development of a restaurant and convenience store on a 2.77 acre site located within Roderick Place**

Mrs. Deats reviewed her staff report. Based on the consistency with the approvals granted for the Specific Plan, Mrs. Deats recommended approval with contingencies. Town Attorney Todd Moore noted that if this request is deferred, it could still be presented at the scheduled Design Review Commission meeting on November 4<sup>th</sup>. Any DRC approvals would then be contingent upon Planning Commission approval.

**Commissioner Dilks moved to defer the Site Plan for the development of a restaurant and convenience store on a 2.77 acre site located within Roderick Place to the November 17th Planning Commission meeting. The motion was seconded and carried unanimously.**

**9. Annexation/Rezone – To annex by referendum 1,961 acres of land south of Coleman Road, north of State Route 840 (Map 104 Parcel 40.07 – 205.07 acres; Map 104 Parcel 39.04 – 155.26 acres; Map 119 Parcel 2.00 – 331.82 acres; Map 119 Parcel 1.0 – 1,112 acres; and Map 131 Parcel 11.03 – 157.02 acres) and to approve a plan of services for these properties upon annexation.**

Mrs. Deats reviewed the request and recommended that the Planning Commission recommend to the Board of Mayor and Aldermen to annex the property, adopt a resolution identifying a plan of services and adopt an ordinance to zone the land north of West Harpeth Road, south of Coleman Road as Transect Community (TC) and the land south of West Harpeth Road, north of State Route 840 as T2.

**After discussion, Commissioner Blair moved to recommend to the BOMA To annex by referendum 1,961 acres of land south of Coleman Road, north of State Route 840 (Map 104 Parcel 40.07 – 205.07 acres; Map 104 Parcel 39.04 – 155.26 acres; Map 119 Parcel 2.00 – 331.82 acres; Map 119 Parcel 1.0 – 1,112 acres; and Map 131 Parcel 11.03 – 157.02 acres) as Resolutions 2015-013 and 2015-014, to approve a plan of services for these properties upon annexation, and to adopt an ordinance to zone the land north of West Harpeth Road, south of Coleman Road as Transect Community (TC) and the land south of West Harpeth Road, north of State Route 840 as T2. The motion was seconded and approved unanimously.**

There being no further business, Chairman Elder made a motion to adjourn. The motion was seconded and the meeting was adjourned at 9:30 p.m.

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Jack Elder, Chairman

Attest:

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Don Blair, Secretary

Phone: (615) 794-4333  
Fax: (615) 794-3313  
www.thompsons-station.com



1550 Thompson's Station Road W.  
P.O. Box 100  
Thompson's Station, TN 37179

**DATE:** November 10, 2015  
**TO:** Thompson's Station Planning Commission  
**FROM:** Joe Cosentini, Town Administrator  
**SUBJECT:** Roderick Place

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After several comments were received during and after the Planning Commission meeting on October 27<sup>th</sup> regarding the Roderick Place subdivision a review of the record was initiated by Town staff.

History:

Roderick Place was originally zoned specific plan (SP) in 2006. A concept plan along with the envisioning book was reviewed and approved by the Board of Mayor and Aldermen and a minor revision to the concept was approved by the Planning Commission in 2007.

The plan was not acted on for the next seven years. Typical developments would have expired after being dormant for this long, however, since Roderick Place was zoned SP, the concept plan cannot expire unless a re-zoning is initiated.

A revised concept plan was submitted in September, 2014 for consideration. The item was placed on the Planning Commission agenda per the "Changes to ta Planned one District" section of the Town's zoning ordinance.

*Changes to a Planned Zone District. An application to modify a planned zone district, in whole or in part, shall be filed with and considered by, the Planning Commission according to the provisions of this section. The Town Administrator shall have the authority to grant minor modifications to the approved plan. A major modification shall include, but now be limited to, any proposed change in the geographic boundary of a planned zone district, the modification of specific performance criteria, design standard, land uses, development types or other requirements as shown, described, illustrated, identified, or noted on the last approved Board of Mayor and Aldermen development plan, and shall be considered by the Board of Mayor and Aldermen according to the procedures set forth in article VII.*

At the October, 2014 Planning Commission meeting the revised concept plan was reviewed and comments were given. No other action was taken. No determination of minor or major change and no additional direction was given to the applicant.

After the Planning Commission meeting a notice of action letter was prepared and sent to the applicant indicating the items discussed at the Planning Commission meeting. A follow-up letter was sent by me, the Town Administrator, at the request of the applicant indicating that the project was found to be in general compliance with the Town's ordinances and could proceed based on the Notice of Action letter previously sent.

Roderick Place submitted a preliminary plat for phase 1 and a site plan for a commercial parcel in September, 2015 and was placed on the Planning Commission agenda for October. The items were deferred "to provide time for a work session with the Town, the Planning Commission, the developer and TDOT representative to discuss traffic concerns."

Phone: (615) 794-4333  
Fax: (615) 794-3313  
www.thompsons-station.com



1550 Thompson's Station Road W.  
P.O. Box 100  
Thompson's Station, TN 37179

Issue:

One of the concerns raised regarding the preliminary plat was one of the roadway cross-sections. The original envisioning document set the standard for the roadways within Roderick Place and can only be changed by the Board of Mayor and Aldermen. The concept plan that was submitted in 2014 included changes to the roadways along with other modifications to the development that were described, illustrated, or noted in the original envisioning book from 2007 including the concept plan itself.

Recommendation:

The Planning Commission cannot approve the proposed plat due to the changes from the original concept plan. A motion should be made to deny the plat based on its non-conformity to the last BOMA approved concept plan and advise the applicant to submit the necessary information to the Board of Mayor and Aldermen to revise the concept plan.

In addition to the above information, I would like to personally apologize for this issue. The problem originated with the lack of action/direction in October, 2014. The recommendation I should have made would have been for the Planning Commission to refer the matter to the Board of Mayor and Aldermen for approval rather than having the Planning Commission review the concept plan for comment. This was entirely a procedural issue that I should have caught last year.

**Thompson's Station Planning Commission  
Staff Report – Item 1 (File: PP 2015-007)  
November 17, 2015**

**Preliminary Plat for the development 90 single-family lots including one amenity lot, one commercial lot and ten open space lots for Phase 1 of Roderick Place.**

**PROJECT DESCRIPTION**

The applicant, Kiser/Vogrin Design has submitted a preliminary plat application for the development of 37.33 acres within Roderick Place which consists of 90 single family lots, one amenity lot, one commercial lot and ten open space lots.

**BACKGROUND**

The project site was rezoned in November 2006 to Specific Plan and a concept plan with envisioning book was approved as part of the rezone process. A revision to the concept plan was approved by the Planning Commission in October 2007 with 174 residential units and 127,606 square feet of commercial uses.

In October 2014, the Planning Commission reviewed another revision to the concept plan changing the roadway sections and the layout and type of residential lots. However, at this meeting, no action was taken by the Planning Commission to formally approve the project as modified. Therefore, after further review of the requirements governing the Specific Plan zone, Staff has determined that changes related to the design criteria of the project are subject to review and approval by the Board of Mayor and Aldermen.

On October 27, 2015, the Planning Commission deferred the preliminary plat in order to meet with TDOT regarding the potential of a traffic signal along Columbia Pike for Roderick Place.

**RECOMMENDATION**

The project, as proposed, is not consistent with the site specific development plan and envisioning (pattern) book; therefore Staff recommends the Planning Commission deny the preliminary plat for Phase 1 in order for the applicant to present the modifications before the Board of Mayor and Alderman for approval of the changes to the concept plan.

**ATTACHMENTS**

Preliminary Plat (previously sent)  
October 2014 Staff Report  
Roderick Traffic Impact Study (revised 5/15)



**Thompson's Station Planning Commission  
Staff Report**

**Revised Site Development Plan for Roderick Place to develop a 198 housing units and a mix of commercial uses located at 4626 Columbia Pike and 4624 Columbia Pike.**

Meeting Date: October 28, 2014

Map / Parcel: 146 15.01

Zoning: Specific Plan

File Number: 1-A-14-004

**PROJECT DESCRIPTION**

The applicant, Kiser/Vogrin Design has submitted a site development plan application on behalf of Leon Heron for the development of a 79.9 acre site located along the west side of Columbia Pike, north of Thompson's Station Road, south of Critz Lane for a development consisting of a mixture of residential and commercial land uses.

**BACKGROUND**

The project site was rezoned in November 2006 to Specific Plan and a concept plan was submitted for review. After approval of the concept plan, a revised concept plan was approved in October 2007 by the Planning Commission. The concept plan included 174 residential units and 127,606 square feet of commercial uses.

**ANALYSIS**

The 79.9 acre project site is located along the east side of Columbia Pike. The request is approval of a revised site development plan that will consist of 158 single-family residences, 40 townhomes, and 127,606 square feet of non-residential/commercial uses. Surrounding land uses include: existing residential to the north, east and west, and vacant land to the south; however the land to the north and west are zoned Commercial; the land to the east and south is zoned Medium Intensity residential.

**Revised Site Development Plan**

The purpose of a site development plan within the Subdivision Regulations is to give information to the Planning Commission in order to facilitate input and direction regarding the proposal. Information regarding the land uses, infrastructure, utilities, natural resources and traffic are all evaluated as part of this process and used to provide guidance to the applicant.

***Zoning***

The applicant is proposing multiple uses on the project site: single-family residential, townhomes and commercial uses which include a country inn, wellness and day spa center and other retail uses. This mix of uses was considered during the original approval of the rezone/concept plan and is permitted within the Specific Plan zoning district. A preliminary plat for all residential and a site plan for all commercial development will require review by the Planning Commission to ensure compliance with all applicable standards.

### ***Open Space***

Open space requirements within the Specific Plan zone are 40% for residential land uses and 50% for non-residential land uses. The applicant is proposing 29.4 acres of the 66.9 acres planned for residential uses, which totals 43.9% open space and 6.9 acres of the 13 acres planned for commercial as open space, which totals 53%. Therefore, the proposal does meet the Zoning Ordinance requirements for open space within the Specific Plan zoning district.

### ***Circulation/Roads***

The proposed project includes three access points along Columbia Pike, which require approval from TDOT. The project has one connection shown to the south, however due to the number of housing units and the potential for commercial development to the north, two additional connections should be considered. One connection to the north and one connection to the east would provide appropriate connectivity between future developments. Therefore, Staff recommends that two additional connections to the north and east be incorporated into the overall plan.

A traffic study was prepared for the original project in 2006, however an updated traffic study is necessary to ensure that current existing conditions and all traffic related impacts are identified and mitigated. In addition, roadway improvements are in process with TDOT along Columbia Pike just north of this project site as part of another development. Therefore, Staff recommends that the traffic study be updated.

### ***Slopes***

The Subdivision Regulations and the Zoning Ordinance seek to protect slopes in excess of 15% by requiring additional evaluation prior to development. The Zoning Ordinance states that “generally slopes in excess of 20% should remain undeveloped as required or common open space,” and that “construction shall be discouraged on slopes in excess of 25%.” A resource map is prepared and identifies slope areas that are subject to the hillside development regulations within the Zoning Ordinance. The slopes are predominantly located within the open space areas except within the northern area of the site where an alley loaded section is proposed. All regulations applicable to hillside development will be enforced as any project proceeds on this site.

### ***Sewer***

Connection to the Town’s sewer is necessary and the developer will be required to meet all requirements in order to obtain future entitlements. However, the project site was granted 385 sewer taps with the original approval. At this time, there is limited infrastructure available to connect to the Town’s system, therefore; the applicant will be required to evaluate the infrastructure in proximity to the site, prepare a plan to install and connect to the system in a manner that will meet the needs of the proposed project and conform to the Town’s requirements. The information will be provided to the Town during the construction plan process and all improvements shall be required to be completed by the applicant.

### **Future Land Use Approvals**

The project will be subject to all Town planning requirements, including, but not limited to, preliminary and final plats, site plan review, design review, etc.

### **RECOMMENDATION**

The project, as proposed, is consistent with the Zoning Ordinance; however additional analysis will be required prior to approvals granting any entitlements on the property:

1. A complete traffic study is necessary to identify traffic impacts as a result of the project and determine all necessary mitigation measures to reduce those impacts to a level of insignificance.
2. A plan for utilities is necessary to identify how all utilities will be provided to the site.
  - a. A water availability letter will be required from HB&TS prior to the submittal of any applications for future entitlements including but not limited to preliminary plats, site plans, etc.
  - b. A plan for sewer will be required to identify how the entire project will be served.
3. Modifications to the overall development plan will include a road dedication/connection to the east and the north properties for future connectivity.
4. The project will be subject to all hillside development regulations. A slope analysis will be required with each preliminary plat and any lots exceeding 15% will be identified and developed as a critical lot. Any lots exceeding 25% will not be permitted for development.
5. Prior to approval of preliminary plats, the applicant shall obtain approval from the Tennessee Department of Transportation (TDOT) for all access points along Columbia Pike.
6. Prior to issuance of grading permits, construction plans shall be submitted and approved. Any upgrades to the utility infrastructure necessary for the project shall be incorporated into the construction plans and shall be completed by the applicant. A construction entrance shall be installed and utilized throughout the construction of the overall project site.
7. Any change of use or expansion of the project site shall conform to the requirements set forth within the Zoning Ordinance and shall be approved prior to the implementation of any changes to the project.

## **ATTACHMENTS**

Applicant Summary  
Site Plan Packet

**F i s c h b a c h**  
**Transportation Group, LLC**  
**Traffic Engineering and Planning**

## **Traffic Impact Study**

**Roderick Place**  
**Columbia Pike**  
**Thompson's Station, TN**

Prepared October 2014  
(Revised May 2015)

Ms. Gillian L. Fischbach, P.E., PTOE  
P.O. Box 682736  
Franklin, TN 37068  
(615) 771-8022 phone  
Gillian@FTGtraffic.com

**Traffic Impact Study**

**Roderick Place  
Columbia Pike**

**Thompson's Station, Tennessee**

**Prepared October 2014  
(Revised May 2015)**

**PREPARED FOR:**

Mr. Leon Heron, Jr.  
C&L Development  
P.O. Box 241  
Thompson's Station, TN 37179

**PREPARED BY:**

Ms. Gillian L. Fischbach, P.E., PTOE  
Fischbach Transportation Group (FTG, LLC)  
P.O. Box 682736  
Franklin, TN 37068  
Phone: (615) 771-8022  
FTG Project Number: 10621



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## **1. INTRODUCTION**

This traffic study has been prepared in order to identify the traffic impacts of a mixed-use development that is proposed to be constructed on the east side of Columbia Pike, approximately half way between State Route 840 and Thompson's Station Road, in Thompson's Station, Tennessee.

For the purposes of this study, existing traffic volumes were established. Also, trip generation calculations were performed, and the trips which are expected to be generated by the proposed project were distributed to the roadway system and added to the existing traffic volumes. The intersections which provide access to the site were then re-evaluated to determine the traffic impacts of the proposed project. Access needs for the project were evaluated, and the necessary roadway and/or traffic control improvements were identified. This report presents the results of these analyses and the subsequent recommendations.

## 2. PROJECT DESCRIPTION

The location of the proposed project is shown in [Figure 1](#). As shown, the project site is located on the east side of Columbia Pike, approximately half way between State Route 840 and Thompson's Station Road, in Thompson's Station, Tennessee.

Currently, the project site includes an historic single-family house that is included on the National register. Also, the site includes several outbuildings and a second single-family home, which is not historic. The developer of the proposed project plans to construct the following land uses:

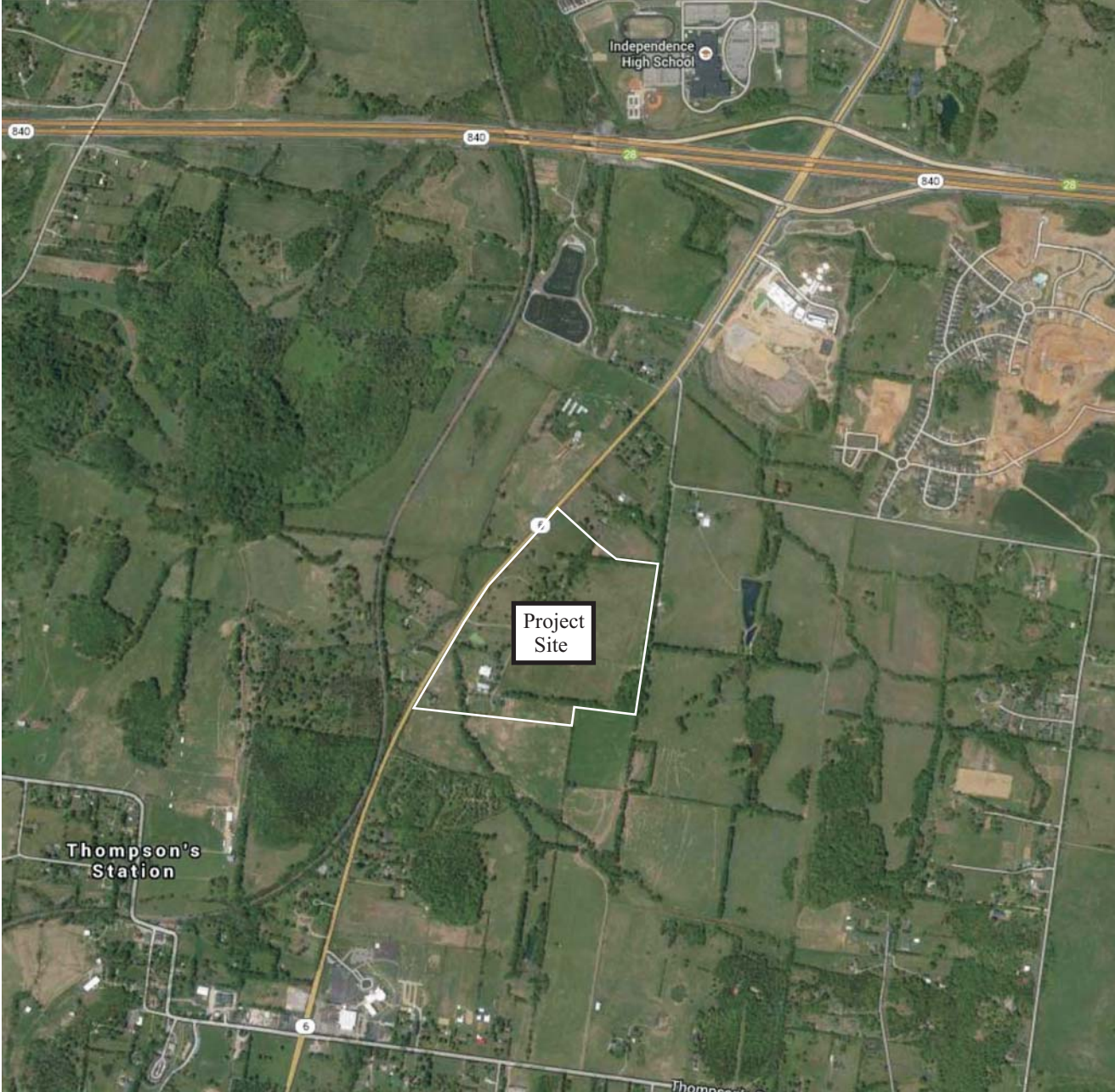
- 157 single-family homes
- 40 townhomes
- A restaurant with 25,400 sq.ft. of space
- An inn with 75 rooms and a total of 64,100 sq.ft.
- A day spa with 29,000 sq.ft. of space
- A market / restaurant with a total of 4,587 sq.ft. of space

Access to this development is proposed to be provided at three locations on Columbia Pike. The current project site plan is shown in [Figure 2](#).

In large part, economic and market considerations will dictate the pace and timing with which the proposed project is actually completed. For the purposes of this study, it was assumed that the proposed project will be completed in six years.



F i s c h b a c h  
Transportation Group, LLC  
Traffic Engineering and Planning



**No Scale**

XX - AM Peak Hour Volumes  
(XX) - PM Peak Hour Volumes

**Figure 1.**  
**Location of the Project Site**

**MASTER PLAN TABULAR DATA:**

EXISTING ZONING: Specific Plan-High Intensity District  
 PROPOSED ZONING: No Change  
 GROSS SITE AREA: 79.90 AC

**PROPOSED ZONING: Specific Plan, High Intensity District (Cluster Option)**

**GENERAL PLAN REQUIREMENTS**

- Maximum Density: 3.0 DU/AC
- Maximum Height: 3 Stories
- Required Open Space: 45%
- Area Permitted as Residential: 100%
- Area Permitted as Commercial: 100%

**COMMERCIAL AREA: (The Knoll & The Barn and Village)**

Commercial Area: 13 AC  
 Total Square Footage: 127,606 sf  
 FAR Provided: 0.21  
 FAR Permitted: 0.23  
 Open Space within Commercial: 6.9 AC

**RESIDENTIAL AREAS:**

Residential Area: 66.9 AC  
 Total Units: 197  
 Provided Density: 2.94 DU/AC  
 Permitted Density: 3.0 DU/AC  
 Open Space within Residential: 29.4 AC

**OPEN SPACE:**

Required: 36.0 AC (45.0% of gross area)

OS Commercial: 6.9 AC  
 OS Residential: 29.4 AC  
 Total OS provided: 36.3 AC (45.4% of gross area)

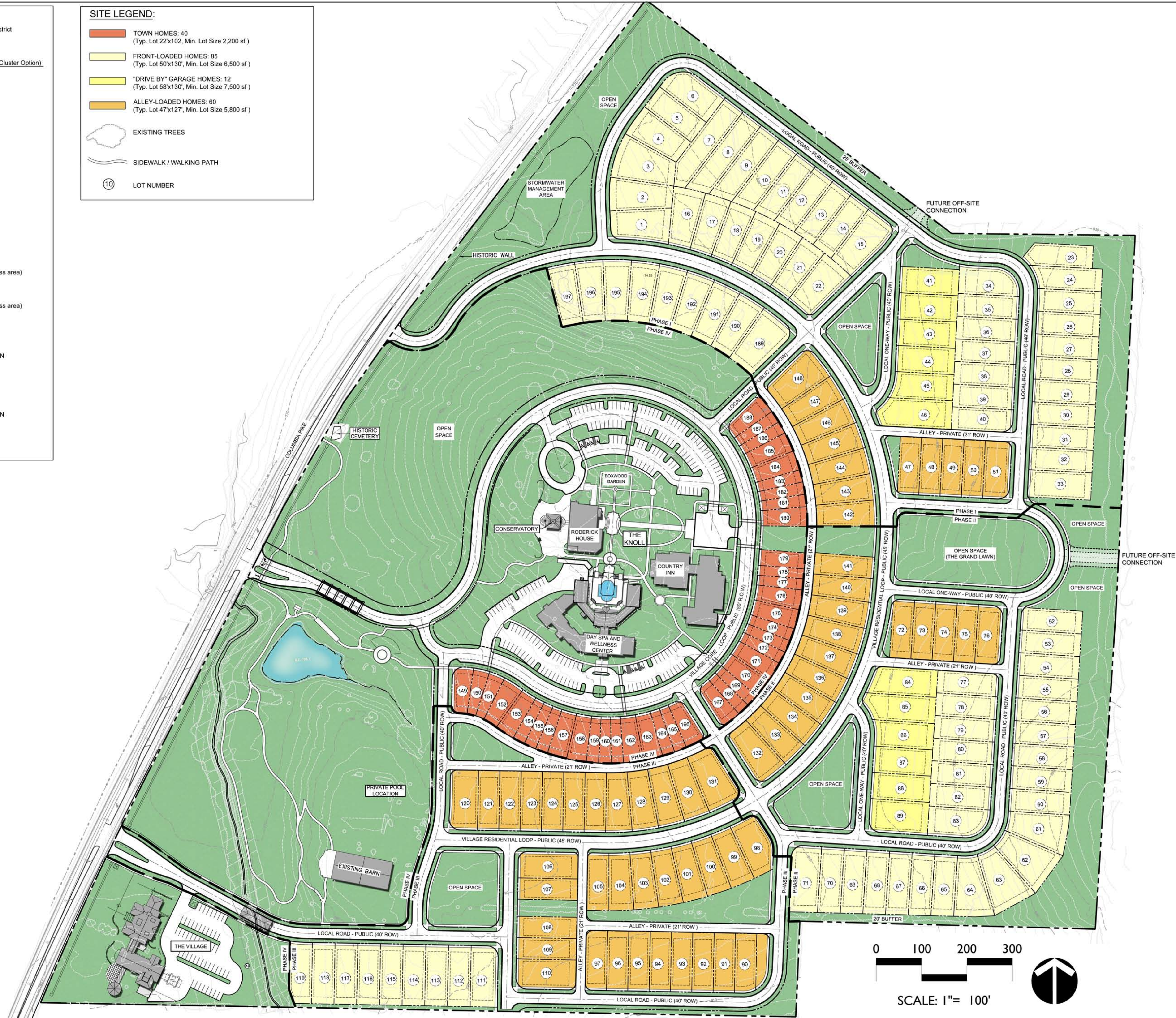
**PARCEL INFO:**

Parcel A : 4626 Columbia Pike  
 Thompson's Station, TN  
 Owner: Leon C. Heron, Jr.  
 Deed Book & Page #: DB 6186, Pg. 657  
 Tax Map & Parcel #: Map 146, Par. 15.01  
 Size: 13.6 AC

Parcel B: 4624 Columbia Pike  
 Thompson's Station, TN  
 Owner: KMK Acres, LLC  
 Deed Book & Page #: DB 1500, Pg. 191  
 Tax Map & Parcel #: Map 146, Par. 15.01  
 Size: 66.3 AC

**SITE LEGEND:**

- TOWN HOMES: 40 (Typ. Lot 22'x102', Min. Lot Size 2,200 sf)
- FRONT-LOADED HOMES: 85 (Typ. Lot 50'x130', Min. Lot Size 6,500 sf)
- "DRIVE BY" GARAGE HOMES: 12 (Typ. Lot 58'x130', Min. Lot Size 7,500 sf)
- ALLEY-LOADED HOMES: 60 (Typ. Lot 47'x127', Min. Lot Size 5,800 sf)
- EXISTING TREES
- SIDEWALK / WALKING PATH
- LOT NUMBER



**RODERICK PLACE**  
 THOMPSON'S STATION, TENNESSEE  
 REVISED DEVELOPMENT SITE PLAN

REVISIONS:  
 10.15.14 DEVELOPMENT PLAN RESUBMITTAL  
 05.15.15 REVISED OFF-SITE CONNECTIONS

DATE: 10-15-14  
 DESIGNED BY: DK  
 DRAWN BY: KL  
 CHECKED BY: JR  
 SCALE: 1"=100'  
 PROJECT #: 14046  
 SHEET NUMBER:  
**LI.0**

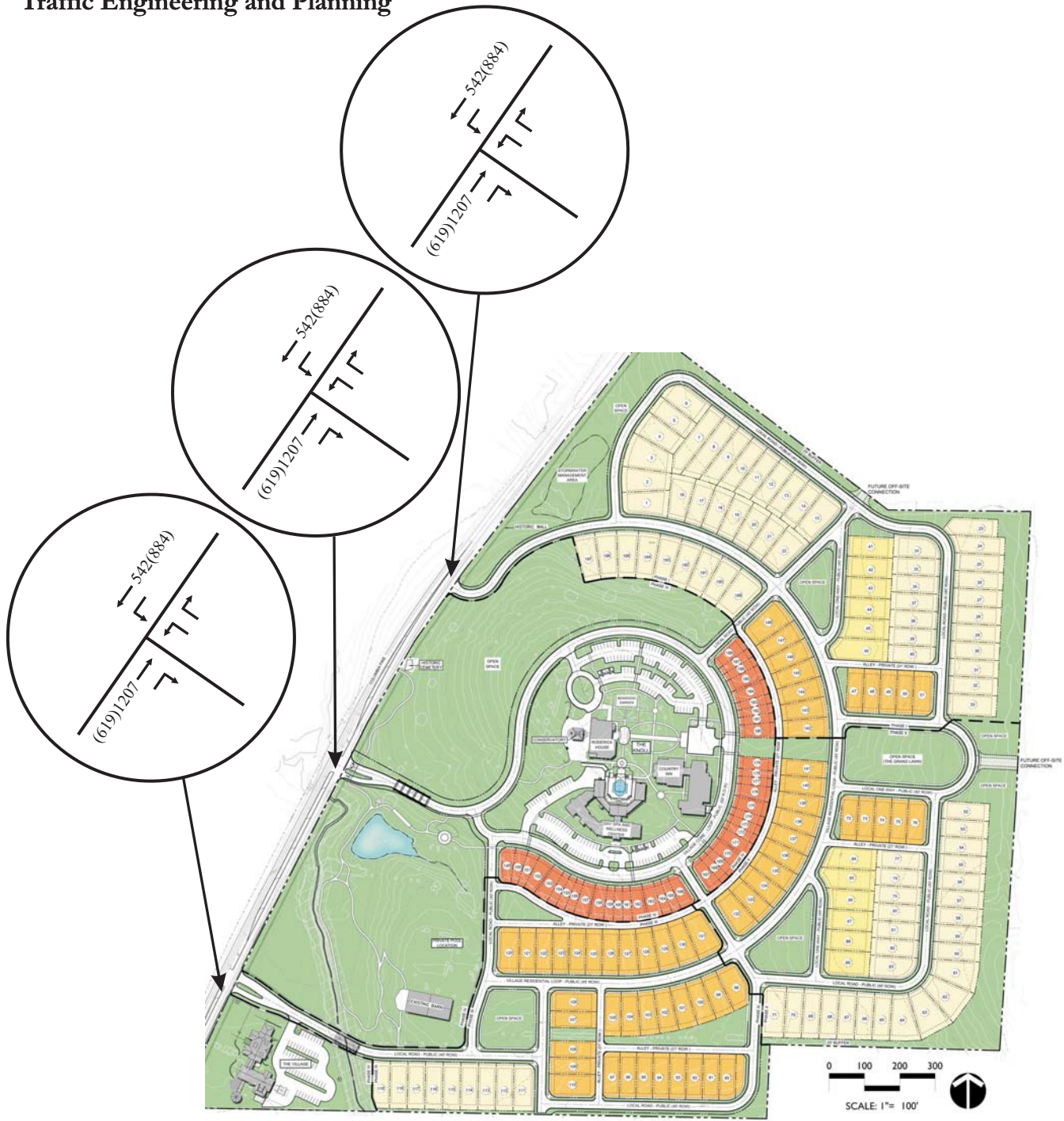
### 3. EXISTING TRAFFIC VOLUMES

In order to provide data for the traffic impact analysis, current peak hour traffic volumes were identified for Columbia Pike in the vicinity of the project site.

Specifically, hourly, directional data was collected on this roadway segment in March 2014 by the Tennessee Department of Transportation (TDOT). This raw count data is included in [Appendix A](#), and the existing peak hour traffic volumes are shown in [Figure 3](#).

It is important to note that, currently, Columbia Pike includes one travel lane in each direction through the Town of Thompson's Station. However, the Tennessee Department of Transportation (TDOT) is currently developing plans to widen this roadway segment to a five-lane cross-section from south of State Route 840 to Thompson's Station Road. Specifically, TDOT has included this segment of Columbia Pike in its State Industrial Access (SIA) Program, which, according to TDOT's website, "provides funding and technical assistance for highway access to new and expanding industries across the state."

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**No Scale**

XX - AM Peak Hour Volumes  
 (XX) - PM Peak Hour Volumes

**Figure 3.**  
**Existing Peak Hour Traffic Volumes**

#### 4. PROJECTION OF BACKGROUND TRAFFIC VOLUMES

In order to account for the traffic growth which will occur within the study area because of typical growth, historical volumes within the study area were considered. Specifically, the Tennessee Department of Transportation (TDOT) conducts an annual count program throughout the state, and this count program includes the annual collection of average daily traffic (ADT) counts at numerous fixed locations. As shown in [Table 1](#), the daily traffic volumes on Columbia Pike, between State Route 840 and Thompson's Station Road, has remained relatively stable since State Route 840 opened in 2005. Based on this information, the existing traffic volumes were considered adequate to represent the background conditions in 2020.

**TABLE 1. HISTORICAL TRAFFIC VOLUMES IN THE STUDY AREA**

<b>Year</b>	<b>Station 67 Columbia Pike ADT</b>	<b>Annual Growth</b>	
2006	21,645		
2007	20,488	-5.35%	
2008	19,891	-2.91%	
2009	18,342	-7.79%	
2010	17,900	-2.41%	
2011	18,685	4.39%	
2012	18,101	-3.13%	
2013	19,666	8.65%	<b>Overall Growth</b>
2014	21,013	6.85%	<b>-0.36%</b>

## 5. IMPACTS OF PROPOSED DEVELOPMENT

### 5.1 TRIP GENERATION

Trip generation calculations were conducted in order to identify how much traffic will be generated by the proposed project. Trip generation data for daily and peak hour trips were identified from Trip Generation, Ninth Edition, which was published by the Institute of Transportation Engineers (ITE) in 2012. [Tables 2A and 2B](#) presents the daily and peak hour trip generations for proposed project, and these calculations are included in [Appendix B](#).

**TABLE 2A. TRIP GENERATION – RESIDENTIAL DEVELOPMENT**

LAND USE	SIZE	DAILY TRAFFIC	GENERATED TRAFFIC			
			AM PEAK HOUR		PM PEAK HOUR	
			ENTER	EXIT	ENTER	EXIT
Single-Family (LUC 210)	157 homes	1,494	29	88	99	58
Townhomes (LUC 230)	40 homes	290	4	21	19	9
<b>TOTAL</b>	<b>197 homes</b>	<b>1,784</b>	<b>33</b>	<b>109</b>	<b>118</b>	<b>67</b>

**TABLE 2B. TRIP GENERATION – COMMERCIAL DEVELOPMENT**

LAND USE	SIZE	DAILY TRAFFIC	GENERATED TRAFFIC			
			AM PEAK HOUR		PM PEAK HOUR	
			ENTER	EXIT	ENTER	EXIT
Quality Restaurant (LUC 210)	25,400 sq.ft.	2,284	14	7	127	63
Hotel (LUC 310)	75 rooms (64,100 sq.ft.)	670	29	21	26	27
Spa	29,000 sq.ft.	1,460	0	0	82	64
Market / Restaurant (LUC 826)	4,587 sq.ft.	204	15	16	13	10
<b>TOTAL</b>	<b>123,087</b>	<b>4,618</b>	<b>58</b>	<b>44</b>	<b>248</b>	<b>164</b>

For the purposes of this study, it was estimated that none of the traffic generated by the proposed development will be captured, or "pass-by" trips from the adjacent street system. Also, even though studies have shown that it is common for a portion of the trips generated by mixed-use developments will be internal to the site, it was assumed for the purposes of this study that none of the traffic generated by the proposed project will be internal. These assumptions were made because the proposed land use mixed includes relatively small-scale development, and so the potential for diverted trips and/or shared trips is reduced. Also, the conservative approach leads to projected traffic volumes and capacity analyses that will include ample storage for dedicated turn lanes. This is particularly important for intersections on major arterial roadways such as Columbia Pike.

## 5.2 TRIP DISTRIBUTION AND TRAFFIC ASSIGNMENT

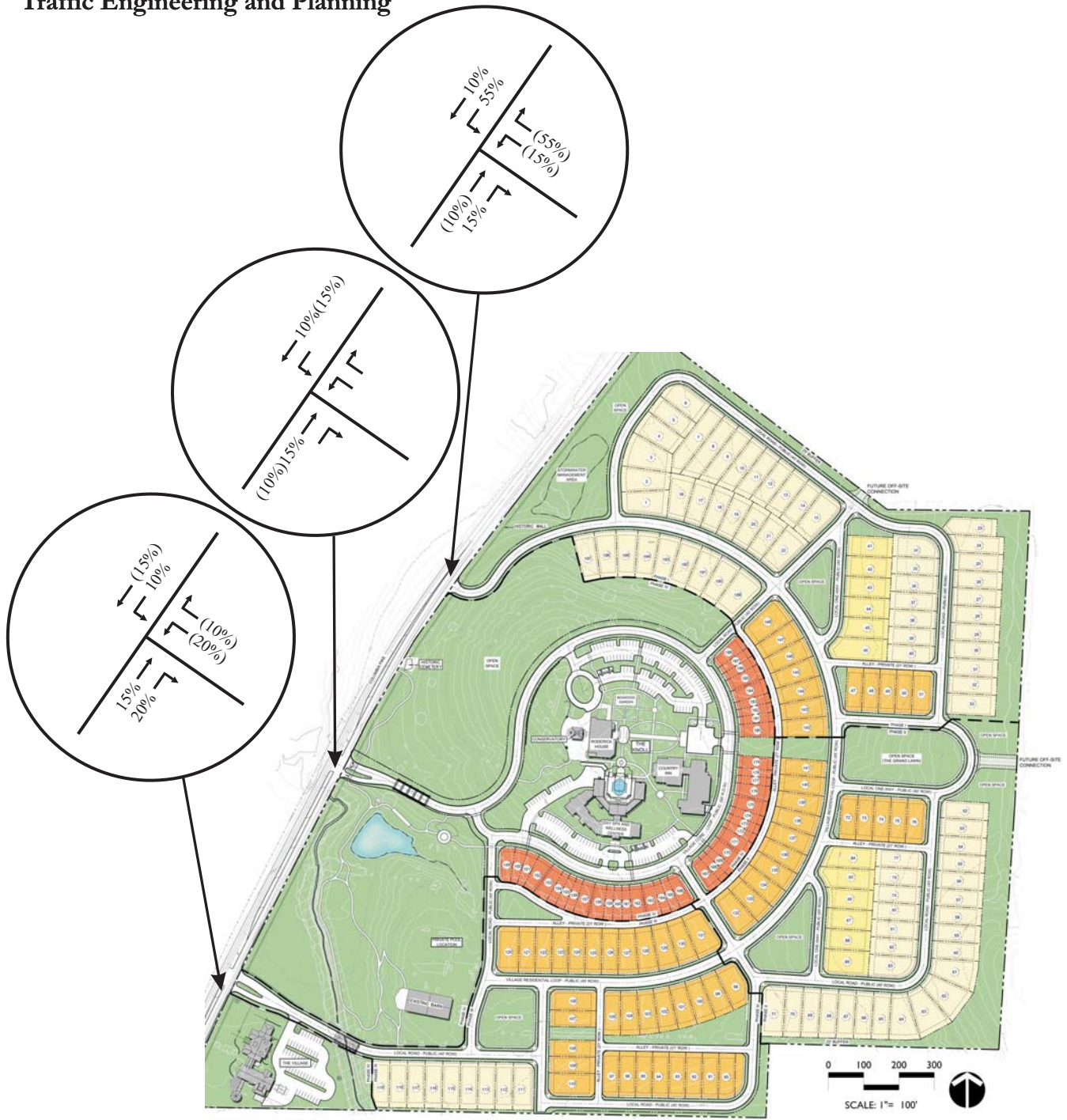
For the purposes of this study, it was estimated that the trips generated by the proposed development will access the project site according to the directional distributions shown in [Figures 4A and 4B](#). The development of these distributions was based on the following factors:

- existing land use characteristics,
- the directions of approach of the existing traffic,
- the access proposed for the project, and
- the locations of population centers in the area.

The peak hour trip generations and directional distributions were used to add the site-generated trips to the roadway system. [Figures 5A and 5B](#) include the peak hour traffic volumes that are expected to be generated by the proposed project. The total entering and exiting traffic volumes shown in [Figures 5A and 5B](#) match the totals shown in [Tables 2A and 2B](#).



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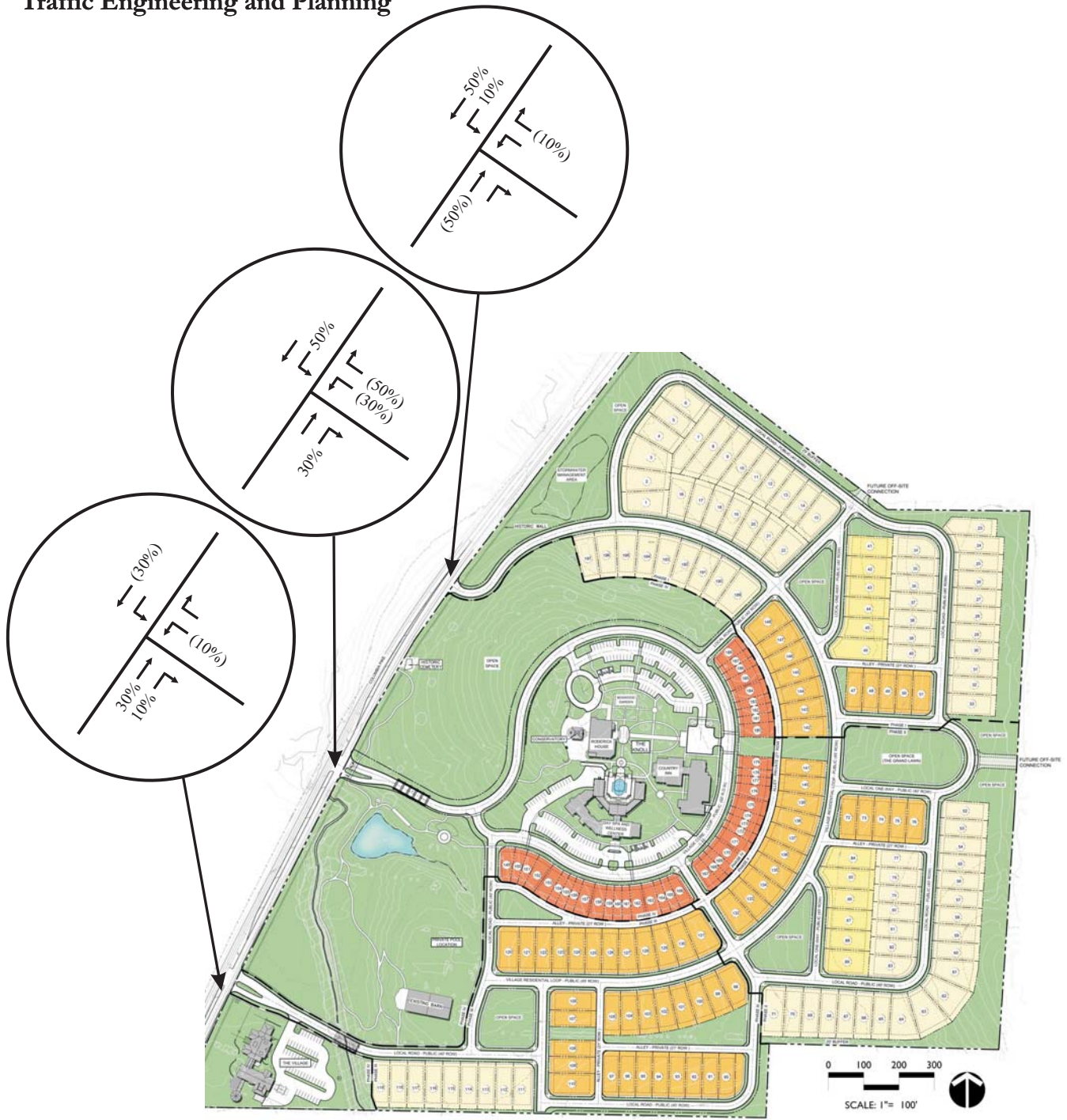


**No Scale**

XX - Entering Volumes  
 (XX) - Exiting Volumes

**Figure 4A.**  
**Directional Distribution of Traffic Generated by the Residential Portion of the Proposed Project**

F i s c h b a c h  
 Transportation Group, LLC  
 Traffic Engineering and Planning

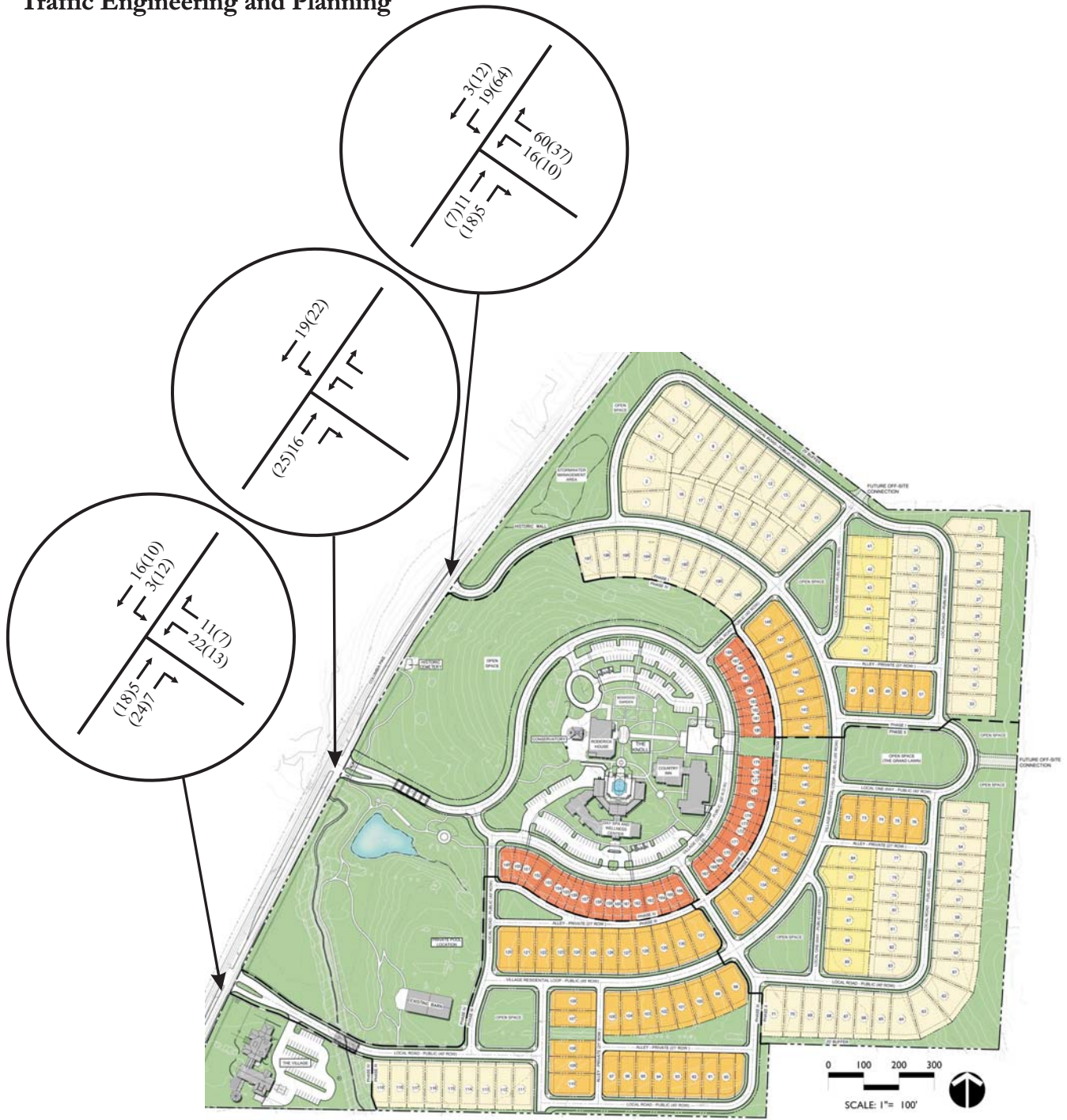


**No Scale**

XX - Entering Volumes  
 (XX) - Exiting Volumes

**Figure 4B.**  
**Directional Distribution of Traffic Generated by**  
**the Commercial Portion of the Proposed Project**

F i s c h b a c h  
 Transportation Group, LLC  
 Traffic Engineering and Planning

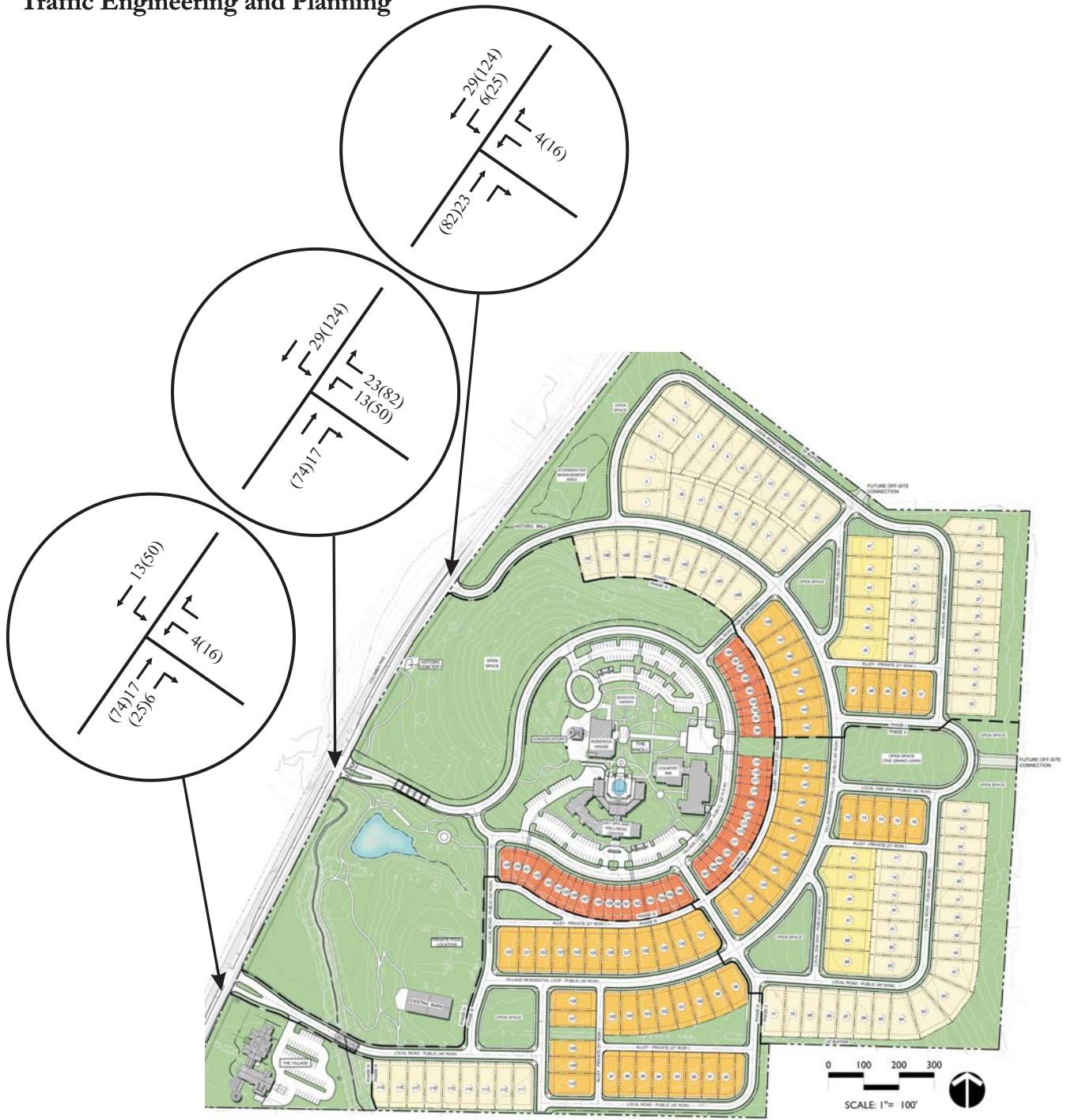


**No Scale**

XX - AM Peak Hour Volumes  
 (XX) - PM Peak Hour Volumes

**Figure 5A.**  
**Peak Hour Traffic Volumes Generated by  
 the Residential Portion of the Proposed Project**

F i s c h b a c h  
 Transportation Group, LLC  
 Traffic Engineering and Planning



**No Scale**

XX - AM Peak Hour Volumes  
 (XX) - PM Peak Hour Volumes

**Figure 5B.**  
**Peak Hour Traffic Volumes Generated by  
 the Commercial Portion of the Proposed Project**

### 5.3 CAPACITY ANALYSES

In order to identify the projected peak hour traffic volumes at the completion of the proposed project, the trips generated by the proposed development were added to the existing peak hour traffic volumes within the study area. The resulting peak hour volumes are shown in [Figure 6](#).

Using the total projected peak hour traffic volumes, capacity analyses were conducted in order to determine the impact of the proposed project on the roadway system. Specifically, in order to evaluate the need for roadway and traffic control improvements within the study area, capacity calculations were performed for the project accesses, based on the methods outlined in the [Highway Capacity Manual 2010 \(HCM2010\)](#). These analyses result in the determination of a Level of Service (LOS), which is a measure of evaluation is used to describe how well an intersection or roadway operates. LOS A represents free flow traffic operations, and LOS F suggests that average vehicle delays are relatively high. [Table 3](#) presents the descriptions of LOS for unsignalized intersections.

For the purposes of these analyses, three laneage scenarios were considered:

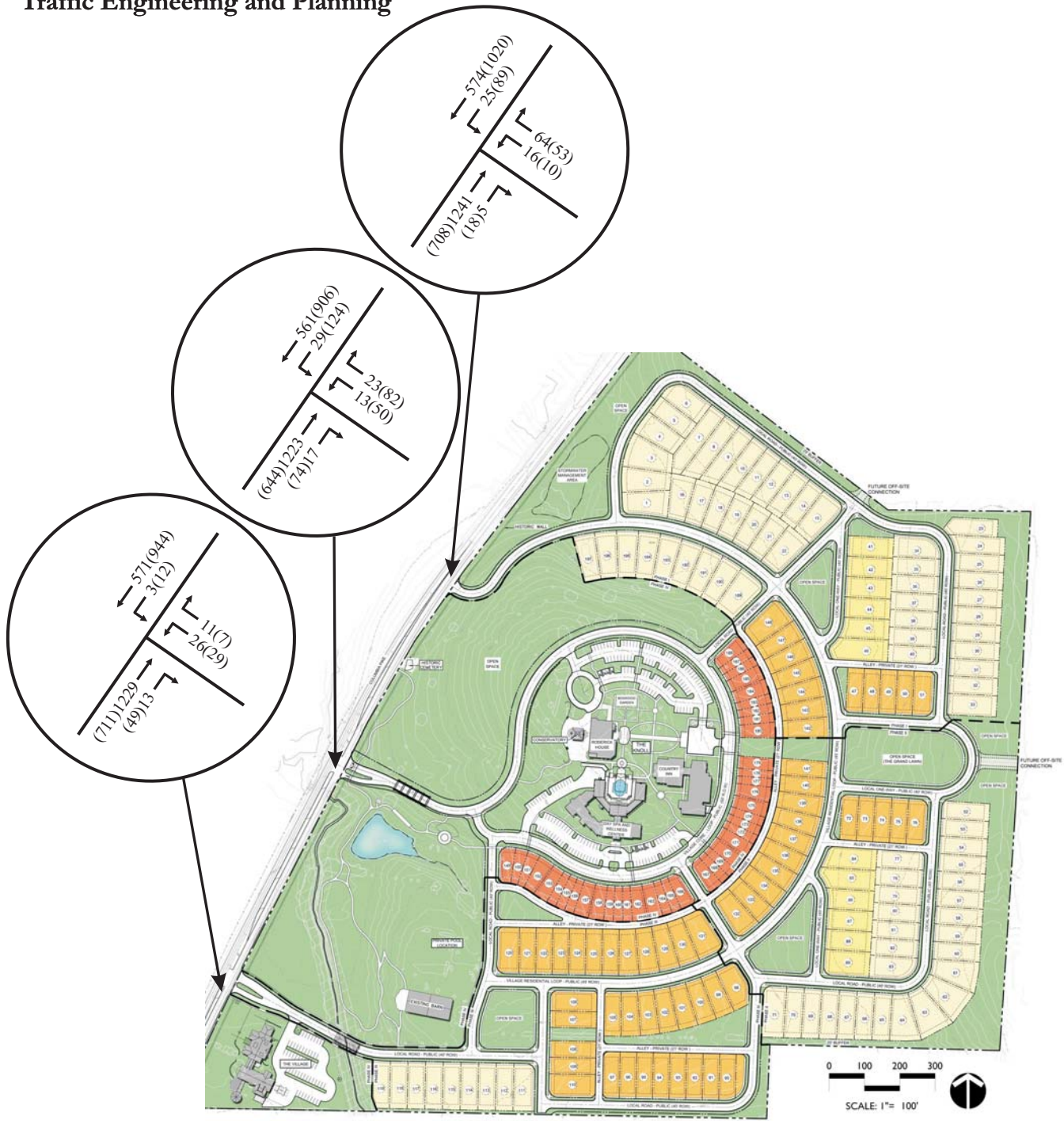
1. Initially, it was assumed that all existing laneage on Columbia Pike will be maintained. Specifically, it was assumed that Columbia Pike will continue to include one travel lane in each direction, and no dedicated left and/or right turn lanes will be provided at the project accesses. Also, it was initially assumed that each of the project accesses will be constructed to include one eastbound entering lane and one westbound exiting lane.
2. Additional consideration was given to a laneage scenario that includes dedicated turn lanes at the project accesses. Specifically, it was assumed that Columbia Pike will continue to include one travel lane in each direction but a dedicated southbound left turn lane and a dedicated northbound right turn lane will be provided at each project access. Also, for this scenario, it was assumed that each of the project accesses will be constructed to include one eastbound entering lane and two westbound exiting lanes, striped as separate left and right turn lanes.
3. Final consideration was given to a laneage scenario that includes the future widening of Columbia Pike as well as dedicated turn lanes at the project accesses. Specifically, it was assumed that Columbia Pike will include two travel lanes in each direction. Also, it was assumed that a dedicated southbound left turn lane and a dedicated northbound right turn lane will be provided at each project access. Finally, it was assumed that each of the project accesses will be constructed to include one eastbound entering lane and two westbound exiting lanes, striped as separate left and right turn lanes.

The results of the capacity analyses for the existing peak hour traffic volumes are shown in [Table 4](#), and [Appendix C](#) includes the capacity analyses worksheets. These analyses indicate the following:

1. With a two-lane cross-section on Columbia Pike and without dedicated turn lanes at the project accesses, the westbound turning movements from the project accesses will operate poorly during the AM and PM peak hours, and significant vehicle queues are likely to occur at the middle project access.
2. With a two-lane cross-section on Columbia Pike, as well as a southbound left turn lane, a northbound right turn lane, and separate westbound left and right turn lanes at each project access, the vehicle delays and queues will be reduced significantly. This is particularly true for the middle project access.
3. With a five-lane cross-section on Columbia Pike, as well as a southbound left turn lane, a northbound right turn lane, and separate westbound left and right turn lanes at each project access, the vehicle delays and queues will be reduced even further. This is particularly true for right turns from the project accesses on to northbound Columbia Pike.

Additional analyses were conducted to determine whether or not dedicated left and/or right turn lanes are warranted for construction on Columbia Pike at one or more of the project accesses. These analyses were based on the method outlined in *NCHRP Report 457: Engineering Study Guide for Evaluating Intersection Improvements*. The relevant charts and the results are included in [Appendix D](#). As shown, a southbound left turn lane and a northbound right turn lane are warranted at each of the project accesses on Columbia Pike.

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**No Scale**

XX - AM Peak Hour Volumes  
 (XX) - PM Peak Hour Volumes

**Figure 6.**  
**Total Projected Peak Hour Traffic Volumes**  
**with the Completion of the Proposed Project**

**TABLE 3. DESCRIPTIONS OF LOS FOR UNSIGNALIZED INTERSECTIONS**

<b>Level of Service</b>	<b>Description</b>	<b>Average Control Delay (sec/veh)</b>
A	Minimal delay	$\leq 10$
B	Brief delay	$> 10$ and $\leq 15$
C	Average delay	$> 15$ and $\leq 25$
D	Significant delay	$> 25$ and $\leq 35$
E	Long delay	$> 35$ and $\leq 50$
F	Extreme delay	$> 50$

Source: Highway Capacity Manual 2010 (HCM 2010)



**TABLE 4. TOTAL PROJECTED PEAK HOUR LEVELS OF SERVICE**

INTERSECTION	TURNING MOVEMENT	AM PEAK HOUR		PM PEAK HOUR	
		LEVEL OF SERVICE	95 <sup>th</sup> %-ILE QUEUE	LEVEL OF SERVICE	95 <sup>th</sup> %-ILE QUEUE
<b>Columbia Pike and the Northern Project Access</b> (with existing laneage and without turn lanes)	Southbound Left Turns / Thrus	LOS B	1 veh	LOS B	1 veh
	Westbound Left and Right Turns	LOS F	5 veh	LOS E	2 veh
<b>Columbia Pike and the Northern Project Access</b> (with existing laneage and without dedicated turn lanes)	Southbound Left Turns	LOS B	1 veh	LOS B	1 veh
	Westbound Left Turns	LOS F	1 veh	LOS F	1 veh
	Westbound Right Turns	LOS E	2 veh	LOS C	1 veh
<b>Columbia Pike and the Northern Project Access</b> (with five-lane cross-section and dedicated turn lanes)	Southbound Left Turns	LOS B	1 veh	LOS B	1 veh
	Westbound Left Turns	LOS F	1 veh	LOS F	1 veh
	Westbound Right Turns	LOS B	1 veh	LOS B	1 veh
<b>Columbia Pike and the Middle Project Access</b> (with existing laneage and without turn lanes)	Southbound Left Turns / Thrus	LOS B	1 veh	LOS B	1 veh
	Westbound Left and Right Turns	LOS F	2 veh	LOS F	12 veh
<b>Columbia Pike and the Middle Project Access</b> (with existing laneage and without dedicated turn lanes)	Southbound Left Turns	LOS B	1 veh	LOS B	1 veh
	Westbound Left Turns	LOS F	1 veh	LOS F	5 veh
	Westbound Right Turns	LOS D	1 veh	LOS C	1 veh
<b>Columbia Pike and the Middle Project Access</b> (with five-lane cross-section and dedicated turn lanes)	Southbound Left Turns	LOS B	1 veh	LOS B	1 veh
	Westbound Left Turns	LOS F	1 veh	LOS F	3 veh
	Westbound Right Turns	LOS B	1 veh	LOS B	1 veh
<b>Columbia Pike and the Southern Project Access</b> (with existing laneage and without turn lanes)	Southbound Left Turns / Thrus	LOS B	1 veh	LOS A	1 veh
	Westbound Left and Right Turns	LOS F	2 veh	LOS F	2 veh

<b>Columbia Pike and the Southern Project Access</b> (with existing laneage and without dedicated turn lanes)	Southbound Left Turns	LOS B	1 veh	LOS A	1 veh
	Westbound Left Turns	LOS F	2 veh	LOS F	2 veh
	Westbound Right Turns	LOS D	1 veh	LOS B	1 veh
<b>Columbia Pike and the Southern Project Access</b> (with five-lane cross-section and dedicated turn lanes)	Southbound Left Turns	LOS B	1 veh	LOS A	1 veh
	Westbound Left Turns	LOS F	1 veh	LOS E	1 veh
	Westbound Right Turns	LOS B	1 veh	LOS B	1 veh

## 6. CONCLUSIONS AND RECOMMENDATIONS

The analyses presented in this study indicate that the following infrastructure improvements should be provided in order to accommodate the total projected traffic volumes with the completion of the proposed mixed-use project:

1. Each project access should be constructed to include one eastbound entering lane and two westbound exiting lanes. At the northern and southern project accesses, each of the westbound exiting lanes should include at least 100 feet of storage and should be designed and constructed according to AASHTO standards. At the middle project access, the westbound left turn lane should include at least 250 feet of storage, and the westbound right lane should include at least 100 feet of storage. These turn lanes should be designed and constructed according to AASHTO standards.
2. A southbound left turn lane should be constructed on Columbia Pike at each project access. Each of these turn lanes should be 12 feet wide and include at least 100 feet of storage, designed and constructed according to AASHTO standards. It is important to note that these turn lanes are warranted because of the significantly high northbound and southbound peak hour traffic volumes on Columbia Pike. Therefore, these turn lanes should be provided when each project access is constructed in order to facilitate safe and efficient turning movements at these locations.

Depending on the timing of the planned widening of Columbia Pike to a five-lane cross-section, the southbound left turn lanes at the project accesses could be provided in conjunction with widening project. However, if the improvement of Columbia Pike is uncertain or is scheduled to occur well after the development of the Roderick Place project, the dedicated southbound left turn lane at each project access should be added to the existing two-lane cross-section of Columbia Pike.

3. A northbound right turn lane should be constructed on Columbia Pike at each project access. Each of these turn lanes should be 12 feet wide and include at least 100 feet of storage, designed and constructed according to AASHTO standards. It is important to note that these turn lanes are warranted because of the significantly high northbound and southbound peak hour traffic volumes on Columbia Pike. Therefore, these turn lanes should be provided when each project access is constructed in order to facilitate safe and efficient turning movements at these locations.

Depending on the timing of the planned widening of Columbia Pike to a five-lane cross-section, the northbound right turn lanes at the project accesses could be provided in conjunction with widening project. However, if the improvement of Columbia Pike is uncertain or is scheduled to occur well after the development of the Roderick Place project, the dedicated northbound right turn lane at each project access should be added to the existing two-lane cross-section of Columbia Pike.

It is important to note that, even with the future laneage on Columbia Pike and the construction of dedicated turn lanes at the project accesses, the westbound left turns from the project accesses onto southbound Columbia Pike are expected to operate at poor LOS during both peak hours. However, these results are typical for unsignalized accesses on major arterial roadways. Also, the low vehicle queues expected for each of these turning movements indicate that the turning movements at these locations will operate acceptably and appropriately. Furthermore, the projected traffic volumes do not approach the thresholds that would indicate that traffic signalization is warranted at one or more of the project accesses. Therefore, the recommended laneage and stop control on the project accesses are the appropriate treatments for these intersections.

**APPENDIX A  
EXISTING TRAFFIC COUNTS**

County: Williamson

Station Number: 000067

Route: SR006

Station Type: Other Rural

Station Out: NO

Location: NEAR THOMPSON STATION

Month	Year	Average Weekday Traffic	Average Daily Traffic	Annual Average Daily	Axle Adjustment Factor	Remarks
03	1985	9,366	9,834	9,342	0.95	
02	1986	9,238	10,993	10,443	0.95	
02	1987	10,049	11,456	10,883	0.95	
03	1988	10,845		11,127	0.95	
03	1989	11,699	0	7,490	0.95	ACTUAL = 12226
01	1990	7,392		8,427	0.95	
03	1991	6,937	7,492	7,117	0.95	
03	1992	7,747	8,057	7,654	0.95	
04	1993	8,722	8,548	8,121	0.95	
05	1994	11,218	10,881	10,337	0.95	
04	1995	9,852	9,556	9,079	0.95	
04	1996	10,220	9,913	9,418	0.95	
04	1997	10,416	9,999	9,499	0.95	
04	1998	12,078	11,595	11,015	0.95	
03	1999	11,154	11,489	10,915	0.95	
05	2000	14,735	13,998	13,289	0.95	CT LOOKS GOOD
05	2001	16,740	15,903	15,108	0.95	
01	2002	14,346	14,776	14,037	0.95	
03	2003	14,920	15,367	14,599	0.95	
08	2004	0	0	15,037	0.95	EST
05	2005	21,270	20,845	15,488	0.95	ACTUAL - 19802
05	2006	24,766	22,785	21,645	0.95	HIGH LAST 2 YEARS
03	2007	22,465	21,566	20,488	0.95	
03	2008	18,289	17,923	19,891	0.95	ACTUAL= 17027
04	2009	20,761	19,308	18,342	0.95	
11	2010	19,834	18,842	17,900	0.95	
04	2011	21,149	19,669	18,685	0.98	
04	2012	19,240	18,470	18,101	0.98	
03	2013	20,688	20,067	19,666	0.98	
03	2014	21,658	21,441	21,013	0.98	

# NORTHBOUND

## COVERAGE COUNT DATA WITH 24 HOUR TOTALS

<b>Station Number:</b> 000067	<b>County:</b> 94 Williamson
<b>Start Date:</b> 03 / 31 / 2014	<b>End Date:</b> 04 / 01 / 2014
<b>Start Time:</b> 12 : 00	<b>End Time:</b> 12 : 00
<b>Direction:</b> 1 (Coverage)	

Time

12:00 - 13:00	597
13:00 - 14:00	608
14:00 - 15:00	666
15:00 - 16:00	654
16:00 - 17:00	616
17:00 - 18:00	619
18:00 - 19:00	581
19:00 - 20:00	446
20:00 - 21:00	247
21:00 - 22:00	167
22:00 - 23:00	104
23:00 - 24:00	56
24:00 - 01:00	29
01:00 - 02:00	18
02:00 - 03:00	17
03:00 - 04:00	25
04:00 - 05:00	89
05:00 - 06:00	333
06:00 - 07:00	1,065
07:00 - 08:00	1,207
08:00 - 09:00	1,110
09:00 - 10:00	879
10:00 - 11:00	674
11:00 - 12:00	644

**Total:** 11,451

<b>Peak AM</b>	<b>Peak Total</b>	<b>Peak Hour Factor</b>	<b>Peak PM</b>	<b>Peak Total</b>	<b>Peak Hour Factor</b>
07:15 - 08:15	1789	0.92	17:00 - 18:00	1503	0.94

---

<b>Peak AM %</b>	<b>Dir Dist AM %</b>	<b>Peak PM %</b>	<b>Dir Dist PM %</b>	<b>Daily Peak %</b>	<b>Daily Dir Dist %</b>
8	67	7	59	8	67

# SOUTH BOUND

## COVERAGE COUNT DATA WITH 24 HOUR TOTALS

<b>Station Number:</b> 000067	<b>County:</b> 94 Williamson
<b>Start Date:</b> 03 / 31 / 2014	<b>End Date:</b> 04 / 01 / 2014
<b>Start Time:</b> 12 : 00	<b>End Time:</b> 12 : 00
<b>Direction:</b> 2 (Coverage)	

Time

12:00 - 13:00	589
13:00 - 14:00	589
14:00 - 15:00	636
15:00 - 16:00	807
16:00 - 17:00	875
17:00 - 18:00	884
18:00 - 19:00	885
19:00 - 20:00	673
20:00 - 21:00	552
21:00 - 22:00	379
22:00 - 23:00	229
23:00 - 24:00	132
24:00 - 01:00	136
01:00 - 02:00	29
02:00 - 03:00	27
03:00 - 04:00	21
04:00 - 05:00	26
05:00 - 06:00	101
06:00 - 07:00	184
07:00 - 08:00	542
08:00 - 09:00	477
09:00 - 10:00	491
10:00 - 11:00	460
11:00 - 12:00	483

**Total:** 10,207

<b>Peak AM</b>	<b>Peak Total</b>	<b>Peak Hour Factor</b>	<b>Peak PM</b>	<b>Peak Total</b>	<b>Peak Hour Factor</b>
07:15 - 08:15	1789	0.92	17:00 - 18:00	1503	0.94

---

<b>Peak AM %</b>	<b>Dir Dist AM %</b>	<b>Peak PM %</b>	<b>Dir Dist PM %</b>	<b>Daily Peak %</b>	<b>Daily Dir Dist %</b>
8	67	7	59	8	67



TOTAL

**COVERAGE COUNT DATA WITH 24 HOUR TOTALS**

**Station Number:** 000067      **County:** 94 Williamson  
**Start Date:** 03 / 31 / 2014      **End Date:** 04 / 01 / 2014  
**Start Time:** 12 : 00      **End Time:** 12 : 00  
**Direction:** 6      (Coverage)

Time

12:00 - 13:00	1,186
13:00 - 14:00	1,197
14:00 - 15:00	1,302
15:00 - 16:00	1,461
16:00 - 17:00	1,491
17:00 - 18:00	1,503
18:00 - 19:00	1,466
19:00 - 20:00	1,119
20:00 - 21:00	799
21:00 - 22:00	546
22:00 - 23:00	333
23:00 - 24:00	188
24:00 - 01:00	165
01:00 - 02:00	47
02:00 - 03:00	44
03:00 - 04:00	46
04:00 - 05:00	115
05:00 - 06:00	434
06:00 - 07:00	1,249
07:00 - 08:00	1,749
08:00 - 09:00	1,587
09:00 - 10:00	1,370
10:00 - 11:00	1,134
11:00 - 12:00	1,127

**Total:** 21,658 x Variation Factor: 0.99 = 21,441 x Truck Factor: 0.98 = AADT: 21,012.5

<b>Peak AM</b>	<b>Peak Total</b>	<b>Peak Hour Factor</b>	<b>Peak PM</b>	<b>Peak Total</b>	<b>Peak Hour Factor</b>
07:15 - 08:15	1789	0.92	17:00 - 18:00	1503	0.94

---

<b>Peak AM %</b>	<b>Dir Dist AM %</b>	<b>Peak PM %</b>	<b>Dir Dist PM %</b>	<b>Daily Peak %</b>	<b>Daily Dir Dist %</b>
8	67	7	59	8	67

**APPENDIX B  
TRIP GENERATION**

**TRIP GENERATION CALCULATIONS - Single-family Homes**

The following calculations are based on the data compiled for ITE Land Use Code 210.

**Average Daily Traffic**

$$T = 9.52 \text{ (X)}$$

$$T = 9.52 \text{ (157)}$$

$$T = 1,494 \text{ vehicles}$$

$$\text{Enter} = 0.50 (1,494) = 747 \text{ vehicles}$$

$$\text{Exit} = 0.50 (1,494) = 747 \text{ vehicles}$$

**AM traffic during peak hour of adjacent street**

$$T = 0.75 \text{ (X)}$$

$$T = 0.75 \text{ (157)}$$

$$T = 118 \text{ vehicles}$$

$$\text{Enter} = 0.25 (118) = 30 \text{ vehicles}$$

$$\text{Exit} = 0.75 (118) = 88 \text{ vehicles}$$

**PM traffic during peak hour of adjacent street**

$$T = 1.00 \text{ (X)}$$

$$T = 1.00 \text{ (157)}$$

$$T = 157 \text{ vehicles}$$

$$\text{Enter} = 0.63 (157) = 99 \text{ vehicles}$$

$$\text{Exit} = 0.37 (157) = 58 \text{ vehicles}$$

**TRIP GENERATION CALCULATIONS – Townhomes**

The following calculations are based on the data compiled for ITE Land Use Code 230.

**Average Daily Traffic**

$$\ln(T) = 0.87 \ln(X) + 2.46$$

$$\ln(T) = 0.87 \ln(40) + 2.46$$

$$T = 290 \text{ vehicle-trips}$$

$$\text{Enter} = 0.50 (290) = 145 \text{ vehicles}$$

$$\text{Exit} = 0.50 (290) = 145 \text{ vehicles}$$

**AM traffic during peak hour of adjacent street**

$$\ln(T) = 0.80 \ln(X) + 0.26$$

$$\ln(T) = 0.80 \ln(40) + 0.26$$

$$T = 25 \text{ vehicle-trips}$$

$$\text{Enter} = 0.17 (25) = 4 \text{ vehicles}$$

$$\text{Exit} = 0.83 (25) = 21 \text{ vehicles}$$

**PM traffic during peak hour of adjacent street**

$$\ln(T) = 0.82 \ln(X) + 0.32$$

$$\ln(T) = 0.82 \ln(40) + 0.32$$

$$T = 28 \text{ vehicle-trips}$$

$$\text{Enter} = 0.67 (28) = 19 \text{ vehicles}$$

$$\text{Exit} = 0.33 (28) = 9 \text{ vehicles}$$

**TRIP GENERATION CALCULATIONS – Quality Restaurant**

The following calculations are based on the data compiled for ITE Land Use Code 931.

**Average Daily Traffic**

$$T = 89.95 (X)$$

$$T = 89.95 (25.400)$$

$$T = 2,284 \text{ vehicles}$$

$$\text{Enter} = 0.50 (2,284) = 1,142 \text{ vehicles}$$

$$\text{Exit} = 0.50 (2,284) = 1,142 \text{ vehicles}$$

**AM traffic during peak hour of adjacent street**

$$T = 0.81 (X)$$

$$T = 0.81 (25.400)$$

$$T = 21 \text{ vehicles}$$

$$\text{Enter} = 0.67 (21) = 14 \text{ vehicles}$$

$$\text{Exit} = 0.33 (21) = 7 \text{ vehicles}$$

**PM traffic during peak hour of adjacent street**

$$T = 7.49 (X)$$

$$T = 7.49 (25.400)$$

$$T = 190 \text{ vehicles}$$

$$\text{Enter} = 0.67 (190) = 127 \text{ vehicles}$$

$$\text{Exit} = 0.33 (190) = 63 \text{ vehicles}$$

**TRIP GENERATION CALCULATIONS – Hotel**

The following calculations are based on the data compiled for ITE Land Use Code 310.

**Average Daily Traffic**

$$T = 8.92 \text{ (X)}$$

$$T = 8.92 \text{ (75)}$$

$$T = 670 \text{ vehicles}$$

$$\text{Enter} = 0.50 (670) = 335 \text{ vehicles}$$

$$\text{Exit} = 0.50 (670) = 335 \text{ vehicles}$$

**AM traffic during peak hour of adjacent street**

$$T = 0.67 \text{ (X)}$$

$$T = 0.67 \text{ (75)}$$

$$T = 50 \text{ vehicles}$$

$$\text{Enter} = 0.58 (50) = 29 \text{ vehicles}$$

$$\text{Exit} = 0.42 (50) = 21 \text{ vehicles}$$

**PM traffic during peak hour of adjacent street**

$$T = 0.70 \text{ (X)}$$

$$T = 0.70 \text{ (75)}$$

$$T = 53 \text{ vehicles}$$

$$\text{Enter} = 0.49 (53) = 26 \text{ vehicles}$$

$$\text{Exit} = 0.51 (53) = 27 \text{ vehicles}$$

**TRIP GENERATION CALCULATIONS – Spa**

There is no data available for spas, so for the purposes of this study, it was assumed that the spa will generate a negligible amount of traffic during the AM peak hour. The following calculations are based on the PM peak hour data compiled for ITE Land Use Code 826. Also, it was assumed that the total daily trips will be ten times the total PM peak hour trips and split 50% entering and 50% exiting.

**Average Daily Traffic**

$$T = 10 (X)$$

$$T = 10 (146)$$

$$T = 1,460 \text{ vehicles}$$

$$\text{Enter} = 0.50 (1,460) = 1,730 \text{ vehicles}$$

$$\text{Exit} = 0.50 (1,460) = 1,730 \text{ vehicles}$$

**PM traffic during peak hour of adjacent street**

$$T = 5.02 (X)$$

$$T = 5.02 (29.000)$$

$$T = 146 \text{ vehicles}$$

$$\text{Enter} = 0.56 (146) = 82 \text{ vehicles}$$

$$\text{Exit} = 0.44 (146) = 64 \text{ vehicles}$$

**TRIP GENERATION CALCULATIONS - Retail**

The following calculations are based on the data compiled for ITE Land Use Code 826.

**Average Daily Traffic**

$$T = 44.32 \text{ (X)}$$

$$T = 44.32 \text{ (4.587)}$$

$$T = 204 \text{ vehicles}$$

$$\text{Enter} = 0.50 (204) = 102 \text{ vehicles}$$

$$\text{Exit} = 0.50 (204) = 102 \text{ vehicles}$$

**AM traffic during peak hour of adjacent street**

$$T = 6.84 \text{ (X)}$$

$$T = 6.84 \text{ (4.587)}$$

$$T = 31 \text{ vehicles}$$

$$\text{Enter} = 0.48 (31) = 15 \text{ vehicles}$$

$$\text{Exit} = 0.52 (31) = 16 \text{ vehicles}$$

**PM traffic during peak hour of adjacent street**

$$T = 5.02 \text{ (X)}$$

$$T = 5.02 \text{ (4.587)}$$

$$T = 23 \text{ vehicles}$$

$$\text{Enter} = 0.56 (23) = 13 \text{ vehicles}$$

$$\text{Exit} = 0.44 (23) = 10 \text{ vehicles}$$



**APPENDIX C  
CAPACITY ANALYSES**

**WITH EXISTING CROSS-SECTION AND  
WITHOUT DEDICATED TURN LANES**

HCS+: Unsignalized Intersections Release 5.6

TWO-WAY STOP CONTROL SUMMARY

Analyst: FTG  
 Date Performed: May 2015  
 Analysis Time Period: AM Peak Hour  
 Intersection: Columbia and N. Project Access  
 Jurisdiction: Thompson's Station, TN  
 Analysis Year: Total with Roderick Place  
 East/West Street: N. Project Access  
 North/South Street: Columbia Pike  
 Intersection Orientation: NS Study period (hrs): 0.25

Vehicle Volumes and Adjustments

Major Street:	Approach Movement	Northbound			Southbound		
		1 L	2 T	3 R	4 L	5 T	6 R
Volume		1241	5	25	574		
Peak-Hour Factor, PHF		0.90	0.80	0.80	0.90		
Hourly Flow Rate, HFR		1378	6	31	637		
Percent Heavy Vehicles		--	--	0	--	--	
Median Type/Storage		Undivided			/		
RT Channelized?							
Lanes		1	0		0	1	
Configuration			TR		LT		
Upstream Signal?		No			No		

Minor Street:	Approach Movement	Westbound			Eastbound		
		7 L	8 T	9 R	10 L	11 T	12 R
Volume		16		64			
Peak Hour Factor, PHF		0.80		0.80			
Hourly Flow Rate, HFR		19		79			
Percent Heavy Vehicles		0		0			
Percent Grade (%)			0			0	
Flared Approach: Exists?/Storage				No	/		/
Lanes		0		0			
Configuration			LR				

Delay, Queue Length, and Level of Service

Approach Movement	NB	SB	Westbound			Eastbound		
			7	8	9	10	11	12
Lane Config	1	4 LT		LR				
v (vph)		31		98				
C(m) (vph)		501		124				
v/c		0.06		0.79				
95% queue length		0.20		4.65				
Control Delay		12.7		98.9				
LOS		B		F				
Approach Delay				98.9				
Approach LOS				F				

HCS+: Unsignalized Intersections Release 5.6

TWO-WAY STOP CONTROL SUMMARY

Analyst: FTG  
 Date Performed: May 2015  
 Analysis Time Period: PM Peak Hour  
 Intersection: Columbia and N. Project Access  
 Jurisdiction: Thompson's Station, TN  
 Analysis Year: Total with Roderick Place  
 East/West Street: N. Project Access  
 North/South Street: Columbia Pike  
 Intersection Orientation: NS Study period (hrs): 0.25

Vehicle Volumes and Adjustments

Major Street:	Approach Movement	Northbound			Southbound		
		1	2	3	4	5	6
		L	T	R	L	T	R
Volume			708	18	89	1020	
Peak-Hour Factor, PHF			0.90	0.80	0.80	0.90	
Hourly Flow Rate, HFR			786	22	111	1133	
Percent Heavy Vehicles			--	--	0	--	--
Median Type/Storage		Undivided			/		
RT Channelized?							
Lanes			1	0		0	1
Configuration				TR		LT	
Upstream Signal?			No			No	

Minor Street:	Approach Movement	Westbound			Eastbound		
		7	8	9	10	11	12
		L	T	R	L	T	R
Volume		10		53			
Peak Hour Factor, PHF		0.80		0.80			
Hourly Flow Rate, HFR		12		66			
Percent Heavy Vehicles		0		0			
Percent Grade (%)			0			0	
Flared Approach: Exists?/Storage				No	/		/
Lanes		0		0			
Configuration			LR				

Delay, Queue Length, and Level of Service

Approach	NB	SB	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Config		LT		LR				
v (vph)		111		78				
C(m) (vph)		826		184				
v/c		0.13		0.42				
95% queue length		0.46		1.93				
Control Delay		10.0+		38.2				
LOS		B		E				
Approach Delay				38.2				
Approach LOS				E				

HCS+: Unsignalized Intersections Release 5.6

TWO-WAY STOP CONTROL SUMMARY

Analyst: FTG  
 Date Performed: May 2015  
 Analysis Time Period: AM Peak Hour  
 Intersection: Columbia and Mid Project Acc  
 Jurisdiction: Thompson's Station, TN  
 Analysis Year: Total with Roderick Place  
 East/West Street: Middle Project Access  
 North/South Street: Columbia Pike  
 Intersection Orientation: NS Study period (hrs): 0.25

Vehicle Volumes and Adjustments

Major Street:	Approach Movement	Northbound			Southbound		
		1	2	3	4	5	6
		L	T	R	L	T	R
Volume			1223	17	29	561	
Peak-Hour Factor, PHF			0.90	0.80	0.80	0.90	
Hourly Flow Rate, HFR			1358	21	36	623	
Percent Heavy Vehicles			--	--	0	--	--
Median Type/Storage RT Channelized?		Undivided			/		
Lanes Configuration			1	0		0	1
Upstream Signal?			No			No	

Minor Street:	Approach Movement	Westbound			Eastbound		
		7	8	9	10	11	12
		L	T	R	L	T	R
Volume		13		23			
Peak Hour Factor, PHF		0.80		0.80			
Hourly Flow Rate, HFR		16		28			
Percent Heavy Vehicles		0		0			
Percent Grade (%)			0			0	
Flared Approach: Exists?/Storage				No	/		/
Lanes Configuration		0		0			
			LR				

Delay, Queue Length, and Level of Service

Approach Movement	NB	SB	Westbound			Eastbound		
	1	4	7	8	9	10	11	12
Lane Config		LT		LR				
v (vph)		36		44				
C(m) (vph)		504		101				
v/c		0.07		0.44				
95% queue length		0.23		1.84				
Control Delay		12.7		65.7				
LOS		B		F				
Approach Delay				65.7				
Approach LOS				F				

HCS+: Unsignalized Intersections Release 5.6

TWO-WAY STOP CONTROL SUMMARY

Analyst: FTG  
 Date Performed: May 2015  
 Analysis Time Period: PM Peak Hour  
 Intersection: Columbia and Mid Project Acc  
 Jurisdiction: Thompson's Station, TN  
 Analysis Year: Total with Roderick Place  
 East/West Street: Middle Project Access  
 North/South Street: Columbia Pike  
 Intersection Orientation: NS Study period (hrs): 0.25

Vehicle Volumes and Adjustments

Major Street:	Approach Movement	Northbound			Southbound		
		1	2	3	4	5	6
		L	T	R	L	T	R
Volume			644	74	124	906	
Peak-Hour Factor, PHF			0.90	0.80	0.80	0.90	
Hourly Flow Rate, HFR			715	92	154	1006	
Percent Heavy Vehicles			--	--	0	--	--
Median Type/Storage RT Channelized?		Undivided			/		
Lanes Configuration			1	0		0	1
Upstream Signal?			No			No	

Minor Street:	Approach Movement	Westbound			Eastbound		
		7	8	9	10	11	12
		L	T	R	L	T	R
Volume		50		82			
Peak Hour Factor, PHF		0.80		0.80			
Hourly Flow Rate, HFR		62		102			
Percent Heavy Vehicles		0		0			
Percent Grade (%)			0			0	
Flared Approach: Exists?/Storage				No	/		/
Lanes Configuration		0		0			
			LR				

Delay, Queue Length, and Level of Service

Approach	NB	SB	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Config		LT		LR				
v (vph)		154		164				
C(m) (vph)		827		108				
v/c		0.19		1.52				
95% queue length		0.68		12.09				
Control Delay		10.3		345.8				
LOS		B		F				
Approach Delay				345.8				
Approach LOS				F				

HCS+: Unsignalized Intersections Release 5.6

TWO-WAY STOP CONTROL SUMMARY

Analyst: FTG  
 Date Performed: May 2015  
 Analysis Time Period: AM Peak Hour  
 Intersection: Columbia and S. Project Access  
 Jurisdiction: Thompson's Station, TN  
 Analysis Year: Total with Roderick Place  
 East/West Street: S. Project Access  
 North/South Street: Columbia Pike  
 Intersection Orientation: NS Study period (hrs): 0.25

Vehicle Volumes and Adjustments

Major Street:	Approach Movement	Northbound			Southbound		
		1	2	3	4	5	6
		L	T	R	L	T	R
Volume			1229	13	3	571	
Peak-Hour Factor, PHF			0.90	0.80	0.80	0.90	
Hourly Flow Rate, HFR			1365	16	3	634	
Percent Heavy Vehicles			--	--	0	--	--
Median Type/Storage		Undivided			/		
RT Channelized?							
Lanes			1	0		0	1
Configuration				TR		LT	
Upstream Signal?			No			No	

Minor Street:	Approach Movement	Westbound			Eastbound		
		7	8	9	10	11	12
		L	T	R	L	T	R
Volume		26		11			
Peak Hour Factor, PHF		0.80		0.80			
Hourly Flow Rate, HFR		32		13			
Percent Heavy Vehicles		0		0			
Percent Grade (%)			0			0	
Flared Approach: Exists?/Storage				No	/		/
Lanes		0		0			
Configuration			LR				

Delay, Queue Length, and Level of Service

Approach	NB	SB	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Config		LT		LR				
v (vph)		3		45				
C(m) (vph)		503		80				
v/c		0.01		0.56				
95% queue length		0.02		2.47				
Control Delay		12.2		96.8				
LOS		B		F				
Approach Delay				96.8				
Approach LOS				F				

HCS+: Unsignalized Intersections Release 5.6

TWO-WAY STOP CONTROL SUMMARY

Analyst: FTG  
 Date Performed: May 2015  
 Analysis Time Period: PM Peak Hour  
 Intersection: Columbia and S. Project Access  
 Jurisdiction: Thompson's Station, TN  
 Analysis Year: Total with Roderick Place  
 East/West Street: S. Project Access  
 North/South Street: Columbia Pike  
 Intersection Orientation: NS Study period (hrs): 0.25

Vehicle Volumes and Adjustments

Major Street:	Approach Movement	Northbound			Southbound		
		1	2	3	4	5	6
		L	T	R	L	T	R
Volume			711	49	12	944	
Peak-Hour Factor, PHF			0.90	0.80	0.80	0.90	
Hourly Flow Rate, HFR			790	61	14	1048	
Percent Heavy Vehicles			--	--	0	--	--
Median Type/Storage RT Channelized?		Undivided			/		
Lanes Configuration			1	0		0	1
Upstream Signal?			No			No	

Minor Street:	Approach Movement	Westbound			Eastbound		
		7	8	9	10	11	12
		L	T	R	L	T	R
Volume		29		7			
Peak Hour Factor, PHF		0.80		0.80			
Hourly Flow Rate, HFR		36		8			
Percent Heavy Vehicles		0		0			
Percent Grade (%)			0			0	
Flared Approach: Exists?/Storage				No	/		/
Lanes Configuration		0		0			
			LR				

Delay, Queue Length, and Level of Service

Approach	NB	SB	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Config		LT		LR				
v (vph)		14		44				
C(m) (vph)		796		89				
v/c		0.02		0.49				
95% queue length		0.05		2.13				
Control Delay		9.6		79.8				
LOS		A		F				
Approach Delay				79.8				
Approach LOS				F				



**WITH EXISTING CROSS-SECTION AND  
WITH DEDICATED TURN LANES**

HCS+: Unsignalized Intersections Release 5.6

TWO-WAY STOP CONTROL SUMMARY

Analyst: FTG  
 Date Performed: May 2015  
 Analysis Time Period: AM Peak Hour  
 Intersection: Columbia and N. Project Access  
 Jurisdiction: Thompson's Station, TN  
 Analysis Year: Total with Roderick Place  
 East/West Street: N. Project Access  
 North/South Street: Columbia Pike  
 Intersection Orientation: NS Study period (hrs): 0.25

Vehicle Volumes and Adjustments

Major Street:	Approach Movement	Northbound			Southbound		
		1 L	2 T	3 R	4 L	5 T	6 R

Volume		1241	5	25	574		
Peak-Hour Factor, PHF		0.90	0.80	0.80	0.90		
Hourly Flow Rate, HFR		1378	6	31	637		
Percent Heavy Vehicles		--	--	0	--	--	
Median Type/Storage		Undivided		/			
RT Channelized?			No				
Lanes		1	1		1	1	
Configuration		T	R		L	T	
Upstream Signal?		No			No		

Minor Street:	Approach Movement	Westbound			Eastbound		
		7 L	8 T	9 R	10 L	11 T	12 R

Volume		16	64				
Peak Hour Factor, PHF		0.80	0.80				
Hourly Flow Rate, HFR		19	79				
Percent Heavy Vehicles		0	0				
Percent Grade (%)		0			0		
Flared Approach: Exists?/Storage				/			/
Lanes		1	1				
Configuration		L	R				

Delay, Queue Length, and Level of Service

Approach Movement	NB	SB	Westbound			Eastbound		
			7 L	8 R	9 R	10 L	11 T	12 R

v (vph)		31	19	79			
C(m) (vph)		501	56	179			
v/c		0.06	0.34	0.44			
95% queue length		0.20	1.22	2.04			
Control Delay		12.7	99.3	40.1			
LOS		B	F	E			
Approach Delay				51.6			
Approach LOS				F			

HCS+: Unsignalized Intersections Release 5.6

TWO-WAY STOP CONTROL SUMMARY

Analyst: FTG  
 Date Performed: May 2015  
 Analysis Time Period: PM Peak Hour  
 Intersection: Columbia and N. Project Access  
 Jurisdiction: Thompson's Station, TN  
 Analysis Year: Total with Roderick Place  
 East/West Street: N. Project Access  
 North/South Street: Columbia Pike  
 Intersection Orientation: NS Study period (hrs): 0.25

Vehicle Volumes and Adjustments

Major Street:	Approach Movement	Northbound			Southbound		
		1	2	3	4	5	6
		L	T	R	L	T	R
Volume			708	18	89	1020	
Peak-Hour Factor, PHF			0.90	0.80	0.80	0.90	
Hourly Flow Rate, HFR			786	22	111	1133	
Percent Heavy Vehicles			--	--	0	--	--
Median Type/Storage		Undivided			/		
RT Channelized?		No					
Lanes			1	1		1	1
Configuration			T	R		L	T
Upstream Signal?			No			No	

Minor Street:	Approach Movement	Westbound			Eastbound		
		7	8	9	10	11	12
		L	T	R	L	T	R
Volume		10		53			
Peak Hour Factor, PHF		0.80		0.80			
Hourly Flow Rate, HFR		12		66			
Percent Heavy Vehicles		0		0			
Percent Grade (%)			0			0	
Flared Approach: Exists?/Storage					/		
Lanes		1		1			
Configuration		L		R			

Delay, Queue Length, and Level of Service

Approach	NB	SB	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Config		L	L		R			
v (vph)		111	12		66			
C(m) (vph)		826	47		395			
v/c		0.13	0.26		0.17			
95% queue length		0.46	0.86		0.59			
Control Delay		10.0+	106.1		15.9			
LOS		B	F		C			
Approach Delay				29.8				
Approach LOS				D				

HCS+: Unsignalized Intersections Release 5.6

TWO-WAY STOP CONTROL SUMMARY

Analyst: FTG  
 Date Performed: May 2015  
 Analysis Time Period: AM Peak Hour  
 Intersection: Columbia and Mid Project Acc  
 Jurisdiction: Thompson's Station, TN  
 Analysis Year: Total with Roderick Place  
 East/West Street: Middle Project Access  
 North/South Street: Columbia Pike  
 Intersection Orientation: NS Study period (hrs): 0.25

Vehicle Volumes and Adjustments

Major Street:	Approach Movement	Northbound			Southbound		
		1 L	2 T	3 R	4 L	5 T	6 R
Volume			1223	17	29	561	
Peak-Hour Factor, PHF			0.90	0.80	0.80	0.90	
Hourly Flow Rate, HFR			1358	21	36	623	
Percent Heavy Vehicles			--	--	0	--	--
Median Type/Storage		Undivided			/		
RT Channelized?			No				
Lanes			1	1		1	1
Configuration			T	R		L	T
Upstream Signal?			No			No	

Minor Street:	Approach Movement	Westbound			Eastbound		
		7 L	8 T	9 R	10 L	11 T	12 R
Volume		13		23			
Peak Hour Factor, PHF		0.80		0.80			
Hourly Flow Rate, HFR		16		28			
Percent Heavy Vehicles		0		0			
Percent Grade (%)			0			0	
Flared Approach: Exists?/Storage					/		
Lanes		1		1			
Configuration		L		R			

Delay, Queue Length, and Level of Service

Approach	NB	SB	Westbound			Eastbound		
			7 L	8 R	9 R	10 L	11 T	12 R
Movement	1	4						
Lane Config		L	L		R			
v (vph)		36	16		28			
C(m) (vph)		504	58		184			
v/c		0.07	0.28		0.15			
95% queue length		0.23	0.97		0.52			
Control Delay		12.7	89.2		28.0			
LOS		B	F		D			
Approach Delay				50.3				
Approach LOS				F				

HCS+: Unsignalized Intersections Release 5.6

TWO-WAY STOP CONTROL SUMMARY

Analyst: FTG  
 Date Performed: May 2015  
 Analysis Time Period: PM Peak Hour  
 Intersection: Columbia and Mid Project Acc  
 Jurisdiction: Thompson's Station, TN  
 Analysis Year: Total with Roderick Place  
 East/West Street: Middle Project Access  
 North/South Street: Columbia Pike  
 Intersection Orientation: NS Study period (hrs): 0.25

Vehicle Volumes and Adjustments

Major Street:	Approach Movement	Northbound			Southbound		
		1 L	2 T	3 R	4 L	5 T	6 R
Volume		644	74	124	906		
Peak-Hour Factor, PHF		0.90	0.80	0.80	0.90		
Hourly Flow Rate, HFR		715	92	154	1006		
Percent Heavy Vehicles		--	--	0	--	--	
Median Type/Storage		Undivided		/			
RT Channelized?		No					
Lanes		1	1		1	1	
Configuration		T	R		L	T	
Upstream Signal?		No			No		

Minor Street:	Approach Movement	Westbound			Eastbound		
		7 L	8 T	9 R	10 L	11 T	12 R
Volume		50	82				
Peak Hour Factor, PHF		0.80	0.80				
Hourly Flow Rate, HFR		62	102				
Percent Heavy Vehicles		0	0				
Percent Grade (%)		0			0		
Flared Approach: Exists?/Storage				/			/
Lanes		1	1				
Configuration		L	R				

Delay, Queue Length, and Level of Service

Approach Movement	NB	SB	Westbound			Eastbound		
			7 L	8 R	9 R	10 L	11 T	12 R
Lane Config		L	L		R			
v (vph)		154	62		102			
C(m) (vph)		827	52		434			
v/c		0.19	1.19		0.24			
95% queue length		0.68	5.49		0.90			
Control Delay		10.3	315.0		15.8			
LOS		B	F		C			
Approach Delay				128.9				
Approach LOS				F				

HCS+: Unsignalized Intersections Release 5.6

TWO-WAY STOP CONTROL SUMMARY

Analyst: FTG  
 Date Performed: May 2015  
 Analysis Time Period: AM Peak Hour  
 Intersection: Columbia and S. Project Access  
 Jurisdiction: Thompson's Station, TN  
 Analysis Year: Total with Roderick Place  
 East/West Street: S. Project Access  
 North/South Street: Columbia Pike  
 Intersection Orientation: NS Study period (hrs): 0.25

Vehicle Volumes and Adjustments

Major Street:	Approach Movement	Northbound			Southbound		
		1 L	2 T	3 R	4 L	5 T	6 R
Volume		1229	13	3	571		
Peak-Hour Factor, PHF		0.90	0.80	0.80	0.90		
Hourly Flow Rate, HFR		1365	16	3	634		
Percent Heavy Vehicles		--	--	0	--	--	
Median Type/Storage		Undivided			/		
RT Channelized?		No					
Lanes		1	1		1	1	
Configuration		T	R		L	T	
Upstream Signal?		No				No	

Minor Street:	Approach Movement	Westbound			Eastbound		
		7 L	8 T	9 R	10 L	11 T	12 R
Volume		26		11			
Peak Hour Factor, PHF		0.80		0.80			
Hourly Flow Rate, HFR		32		13			
Percent Heavy Vehicles		0		0			
Percent Grade (%)			0			0	
Flared Approach: Exists?/Storage					/		/
Lanes		1		1			
Configuration		L		R			

Delay, Queue Length, and Level of Service

Approach Movement	NB	SB	Westbound			Eastbound		
			7 L	8 R	9 R	10 L	11 T	12 R
Lane Config	1	4 L	7 L	8 R	9 R	10 L	11 T	12 R
v (vph)		3	32		13			
C(m) (vph)		503	66		182			
v/c		0.01	0.48		0.07			
95% queue length		0.02	1.94		0.23			
Control Delay		12.2	102.8		26.3			
LOS		B	F		D			
Approach Delay				80.7				
Approach LOS				F				

HCS+: Unsignalized Intersections Release 5.6

TWO-WAY STOP CONTROL SUMMARY

Analyst: FTG  
 Date Performed: May 2015  
 Analysis Time Period: PM Peak Hour  
 Intersection: Columbia and S. Project Access  
 Jurisdiction: Thompson's Station, TN  
 Analysis Year: Total with Roderick Place  
 East/West Street: S. Project Access  
 North/South Street: Columbia Pike  
 Intersection Orientation: NS Study period (hrs): 0.25

Vehicle Volumes and Adjustments

Major Street:	Approach Movement	Northbound			Southbound		
		1	2	3	4	5	6
		L	T	R	L	T	R
Volume			711	49	12	944	
Peak-Hour Factor, PHF			0.90	0.80	0.80	0.90	
Hourly Flow Rate, HFR			790	61	14	1048	
Percent Heavy Vehicles			--	--	0	--	--
Median Type/Storage		Undivided			/		
RT Channelized?		No					
Lanes			1	1		1	1
Configuration			T	R		L	T
Upstream Signal?			No			No	

Minor Street:	Approach Movement	Westbound			Eastbound		
		7	8	9	10	11	12
		L	T	R	L	T	R
Volume		29		7			
Peak Hour Factor, PHF		0.80		0.80			
Hourly Flow Rate, HFR		36		8			
Percent Heavy Vehicles		0		0			
Percent Grade (%)			0			0	
Flared Approach: Exists?/Storage					/		
Lanes		1		1			
Configuration		L		R			

Delay, Queue Length, and Level of Service

Approach	NB	SB	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Config		L	L		R			
v (vph)		14	36		8			
C(m) (vph)		796	80		393			
v/c		0.02	0.45		0.02			
95% queue length		0.05	1.84		0.06			
Control Delay		9.6	82.5		14.4			
LOS		A	F		B			
Approach Delay				70.1				
Approach LOS				F				

**WITH FUTURE CROSS-SECTION AND  
WITH DEDICATED TURN LANES**



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TWO-WAY STOP CONTROL SUMMARY

Analyst: FTG  
 Date Performed: May 2015  
 Analysis Time Period: AM Peak Hour  
 Intersection: Columbia and N. Project Access  
 Jurisdiction: Thompson's Station, TN  
 Analysis Year: Total with Roderick Place  
 East/West Street: N. Project Access  
 North/South Street: Columbia Pike  
 Intersection Orientation: NS Study period (hrs): 0.25

Vehicle Volumes and Adjustments

Major Street:	Approach Movement	Northbound			Southbound		
		1 L	2 T	3 R	4 L	5 T	6 R
Volume			1241	5	25	574	
Peak-Hour Factor, PHF			0.90	0.80	0.80	0.90	
Hourly Flow Rate, HFR			1378	6	31	637	
Percent Heavy Vehicles			--	--	0	--	--
Median Type/Storage		Undivided			/		
RT Channelized?		No					
Lanes		2	1		1	2	
Configuration		T	R		L	T	
Upstream Signal?		No			No		

Minor Street:	Approach Movement	Westbound			Eastbound		
		7 L	8 T	9 R	10 L	11 T	12 R
Volume		16		64			
Peak Hour Factor, PHF		0.80		0.80			
Hourly Flow Rate, HFR		19		79			
Percent Heavy Vehicles		0		0			
Percent Grade (%)			0			0	
Flared Approach: Exists?/Storage					/		
Lanes		1		1			
Configuration		L		R			

Delay, Queue Length, and Level of Service

Approach Movement	NB	SB	Westbound			Eastbound		
			7 L	8 R	9 R	10 L	11 T	12 R
Lane Config	1	4 L	7 L	8 R	9 R	10 L	11 T	12 R
v (vph)		31	19		79			
C(m) (vph)		501	73		449			
v/c		0.06	0.26		0.18			
95% queue length		0.20	0.93		0.63			
Control Delay		12.7	70.8		14.7			
LOS		B	F		B			
Approach Delay				25.6				
Approach LOS				D				

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TWO-WAY STOP CONTROL SUMMARY

Analyst: FTG  
 Date Performed: May 2015  
 Analysis Time Period: PM Peak Hour  
 Intersection: Columbia and N. Project Access  
 Jurisdiction: Thompson's Station, TN  
 Analysis Year: Total with Roderick Place  
 East/West Street: N. Project Access  
 North/South Street: Columbia Pike  
 Intersection Orientation: NS Study period (hrs): 0.25

Vehicle Volumes and Adjustments

Major Street:	Approach Movement	Northbound			Southbound		
		1	2	3	4	5	6
		L	T	R	L	T	R
Volume			708	18	89	1020	
Peak-Hour Factor, PHF			0.90	0.80	0.80	0.90	
Hourly Flow Rate, HFR			786	22	111	1133	
Percent Heavy Vehicles			--	--	0	--	--
Median Type/Storage		Undivided			/		
RT Channelized?		No					
Lanes			2	1		1	2
Configuration			T	R		L	T
Upstream Signal?			No			No	

Minor Street:	Approach Movement	Westbound			Eastbound		
		7	8	9	10	11	12
		L	T	R	L	T	R
Volume		10		53			
Peak Hour Factor, PHF		0.80		0.80			
Hourly Flow Rate, HFR		12		66			
Percent Heavy Vehicles		0		0			
Percent Grade (%)			0			0	
Flared Approach: Exists?/Storage					/		
Lanes		1		1			
Configuration		L		R			

Delay, Queue Length, and Level of Service

Approach	NB	SB	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Config		L	L		R			
v (vph)		111	12		66			
C(m) (vph)		826	89		660			
v/c		0.13	0.13		0.10			
95% queue length		0.46	0.45		0.33			
Control Delay		10.0+	51.7		11.1			
LOS		B	F		B			
Approach Delay				17.3				
Approach LOS				C				

HCS+: Unsignalized Intersections Release 5.6

TWO-WAY STOP CONTROL SUMMARY

Analyst: FTG  
 Date Performed: May 2015  
 Analysis Time Period: AM Peak Hour  
 Intersection: Columbia and Mid Project Acc  
 Jurisdiction: Thompson's Station, TN  
 Analysis Year: Total with Roderick Place  
 East/West Street: Middle Project Access  
 North/South Street: Columbia Pike  
 Intersection Orientation: NS Study period (hrs): 0.25

Vehicle Volumes and Adjustments

Major Street:	Approach Movement	Northbound			Southbound		
		1 L	2 T	3 R	4 L	5 T	6 R
Volume			1223	17	29	561	
Peak-Hour Factor, PHF			0.90	0.80	0.80	0.90	
Hourly Flow Rate, HFR			1358	21	36	623	
Percent Heavy Vehicles			--	--	0	--	--
Median Type/Storage		Undivided			/		
RT Channelized?		No					
Lanes		2	1		1	2	
Configuration		T	R		L	T	
Upstream Signal?		No			No		

Minor Street:	Approach Movement	Westbound			Eastbound		
		7 L	8 T	9 R	10 L	11 T	12 R
Volume		13		23			
Peak Hour Factor, PHF		0.80		0.80			
Hourly Flow Rate, HFR		16		28			
Percent Heavy Vehicles		0		0			
Percent Grade (%)			0			0	
Flared Approach: Exists?/Storage					/		
Lanes		1		1			
Configuration		L		R			

Delay, Queue Length, and Level of Service

Approach Movement	NB	SB	Westbound			Eastbound		
			4 L	7 L	8 R	9 R	10 L	11 T
Lane Config	1	4	L	L	R			
v (vph)		36	16		28			
C(m) (vph)		504	74		455			
v/c		0.07	0.22		0.06			
95% queue length		0.23	0.75		0.20			
Control Delay		12.7	66.6		13.4			
LOS		B	F		B			
Approach Delay					32.8			
Approach LOS					D			

HCS+: Unsignalized Intersections Release 5.6

TWO-WAY STOP CONTROL SUMMARY

Analyst: FTG  
 Date Performed: May 2015  
 Analysis Time Period: PM Peak Hour  
 Intersection: Columbia and Mid Project Acc  
 Jurisdiction: Thompson's Station, TN  
 Analysis Year: Total with Roderick Place  
 East/West Street: Middle Project Access  
 North/South Street: Columbia Pike  
 Intersection Orientation: NS Study period (hrs): 0.25

Vehicle Volumes and Adjustments

Major Street:	Approach Movement	Northbound			Southbound		
		1 L	2 T	3 R	4 L	5 T	6 R
Volume		644	74	124	906		
Peak-Hour Factor, PHF		0.90	0.80	0.80	0.90		
Hourly Flow Rate, HFR		715	92	154	1006		
Percent Heavy Vehicles		--	--	0	--	--	
Median Type/Storage		Undivided			/		
RT Channelized?		No					
Lanes		2	1		1	2	
Configuration		T	R		L	T	
Upstream Signal?		No			No		

Minor Street:	Approach Movement	Westbound			Eastbound		
		7 L	8 T	9 R	10 L	11 T	12 R
Volume		50		82			
Peak Hour Factor, PHF		0.80		0.80			
Hourly Flow Rate, HFR		62		102			
Percent Heavy Vehicles		0		0			
Percent Grade (%)			0			0	
Flared Approach: Exists?/Storage					/		
Lanes		1		1			
Configuration		L		R			

Delay, Queue Length, and Level of Service

Approach Movement	NB	SB	Westbound			Eastbound		
			7 L	8 R	9 R	10 L	11 T	12 R
Lane Config		L	L		R			
v (vph)		154	62		102			
C(m) (vph)		827	90		691			
v/c		0.19	0.69		0.15			
95% queue length		0.68	3.38		0.52			
Control Delay		10.3	106.5		11.1			
LOS		B	F		B			
Approach Delay				47.2				
Approach LOS				E				

HCS+: Unsignalized Intersections Release 5.6

TWO-WAY STOP CONTROL SUMMARY

Analyst: FTG  
 Date Performed: May 2015  
 Analysis Time Period: AM Peak Hour  
 Intersection: Columbia and S. Project Access  
 Jurisdiction: Thompson's Station, TN  
 Analysis Year: Total with Roderick Place  
 East/West Street: S. Project Access  
 North/South Street: Columbia Pike  
 Intersection Orientation: NS Study period (hrs): 0.25

Vehicle Volumes and Adjustments

Major Street:	Approach Movement	Northbound			Southbound		
		1 L	2 T	3 R	4 L	5 T	6 R
Volume			1229	13	3	571	
Peak-Hour Factor, PHF			0.90	0.80	0.80	0.90	
Hourly Flow Rate, HFR			1365	16	3	634	
Percent Heavy Vehicles			--	--	0	--	--
Median Type/Storage		Undivided			/		
RT Channelized?			No				
Lanes			2	1		1	2
Configuration			T	R		L	T
Upstream Signal?			No				No

Minor Street:	Approach Movement	Westbound			Eastbound		
		7 L	8 T	9 R	10 L	11 T	12 R
Volume		26		11			
Peak Hour Factor, PHF		0.80		0.80			
Hourly Flow Rate, HFR		32		13			
Percent Heavy Vehicles		0		0			
Percent Grade (%)			0			0	
Flared Approach: Exists?/Storage					/		/
Lanes		1		1			
Configuration		L		R			

Delay, Queue Length, and Level of Service

Approach Movement	NB	SB	Westbound			Eastbound		
			7 L	8 R	9 R	10 L	11 T	12 R
Lane Config		L	L		R			
v (vph)		3	32		13			
C(m) (vph)		503	85		453			
v/c		0.01	0.38		0.03			
95% queue length		0.02	1.48		0.09			
Control Delay		12.2	70.9		13.2			
LOS		B	F		B			
Approach Delay				54.3				
Approach LOS				F				

HCS+: Unsignalized Intersections Release 5.6

TWO-WAY STOP CONTROL SUMMARY

Analyst: FTG  
 Date Performed: May 2015  
 Analysis Time Period: PM Peak Hour  
 Intersection: Columbia and S. Project Access  
 Jurisdiction: Thompson's Station, TN  
 Analysis Year: Total with Roderick Place  
 East/West Street: S. Project Access  
 North/South Street: Columbia Pike  
 Intersection Orientation: NS Study period (hrs): 0.25

Vehicle Volumes and Adjustments

Major Street:	Approach Movement	Northbound			Southbound		
		1 L	2 T	3 R	4 L	5 T	6 R
Volume		711	49	12	944		
Peak-Hour Factor, PHF		0.90	0.80	0.80	0.90		
Hourly Flow Rate, HFR		790	61	14	1048		
Percent Heavy Vehicles		--	--	0	--	--	
Median Type/Storage		Undivided		/			
RT Channelized?			No				
Lanes		2	1		1	2	
Configuration		T	R		L	T	
Upstream Signal?		No			No		

Minor Street:	Approach Movement	Westbound			Eastbound		
		7 L	8 T	9 R	10 L	11 T	12 R
Volume		29		7			
Peak Hour Factor, PHF		0.80		0.80			
Hourly Flow Rate, HFR		36		8			
Percent Heavy Vehicles		0		0			
Percent Grade (%)			0			0	
Flared Approach: Exists?/Storage				/			/
Lanes		1		1			
Configuration		L		R			

Delay, Queue Length, and Level of Service

Approach Movement	NB	SB	Westbound			Eastbound		
			7 L	8 R	9 R	10 L	11 T	12 R
Lane Config	1	4 L	7 L	8 R	9 R	10 L	11 T	12 R
v (vph)		14	36		8			
C(m) (vph)		796	143		659			
v/c		0.02	0.25		0.01			
95% queue length		0.05	0.94		0.04			
Control Delay		9.6	38.4		10.5			
LOS		A	E		B			
Approach Delay				33.4				
Approach LOS				D				

**APPENDIX D**  
**RELEVANT PAGES FROM NCHRP REPORT 457:**  
***ENGINEERING STUDY GUIDE FOR EVALUATING INTERSECTION IMPROVEMENTS***

# **NCHRP**

## **REPORT 457**

**NATIONAL  
COOPERATIVE  
HIGHWAY  
RESEARCH  
PROGRAM**

### **Evaluating Intersection Improvements: An Engineering Study Guide**

**TRANSPORTATION RESEARCH BOARD**

**NATIONAL RESEARCH COUNCIL**



can also indirectly reduce the delay to the left-turn or through movements by lessening their need to compete for service with the right-turn movement.

One disadvantage of adding a lane to the minor-road approach is that it may require reallocating the existing pavement or widening of the approach cross section. Sometimes the pavement width needed for the additional lane is available within the existing roadway cross section. In this instance, the only impact is a reallocation of the paved surface through modification of the pavement markings. However, in downtown settings this reallocation may require the removal of some curb parking stalls and can affect adjacent business significantly. Occasionally, the cross section must be widened to provide for the additional lane. If the needed lane width can be provided within the available right-of-way, the cost may be limited to that of construction. However, if additional right-of-way is needed, the costs of acquiring this property in urban settings can be high.

**Guidance.** The literature does not offer guidance regarding conditions where a second approach lane would benefit from the operation of a minor-road approach. However, the procedures in Chapter 17 of the *Highway Capacity Manual 2000* (15) can be used to identify major- and minor- road volume combinations that would benefit operationally from the provision of a second approach lane or bay. Bonneson and Fontaine (20) developed Figure 2-4 using these procedures and an assumed upper limit of 0.7 for the shared-lane, minor-road volume-to-capacity ratio.

**Application.** Figure 2-4 indicates the conditions that may justify the use of two approach lanes. Use of the information in this figure requires two types of data:

1. Major-road approach volume for the peak hour of the average day and
2. Minor-road turn movement volume for the peak hour of the average day (used to compute right-turn percentage).

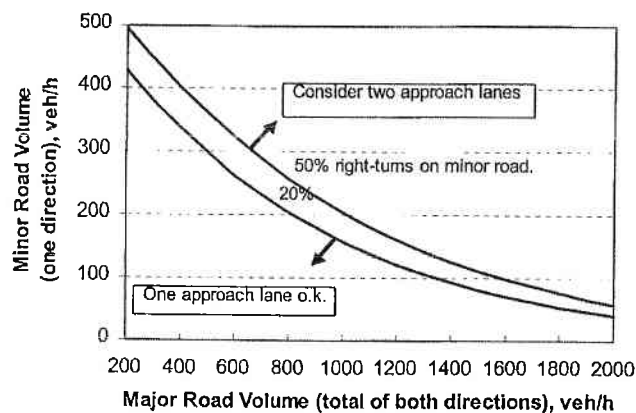


Figure 2-4. Guideline for determining minor-road approach geometry at two-way stop-controlled intersections.

Figure 2-4 would be used once for each minor-road approach to the intersection. The appropriate trend line would be identified on the basis of the percentage of right-turns on the subject minor-road approach. If the volume combination for the major and minor roads intersects above or to the right of this trend line, a second traffic lane should be considered for the subject minor-road approach. If a bay is selected for addition to the intersection, it should be long enough to store vehicles 95 percent of the time (i.e., the bay should not overflow more than 5 percent of the time). Techniques for estimating the 95<sup>th</sup> percentile storage length are provided in the section, [Increase the Length of the Turn Bay](#).

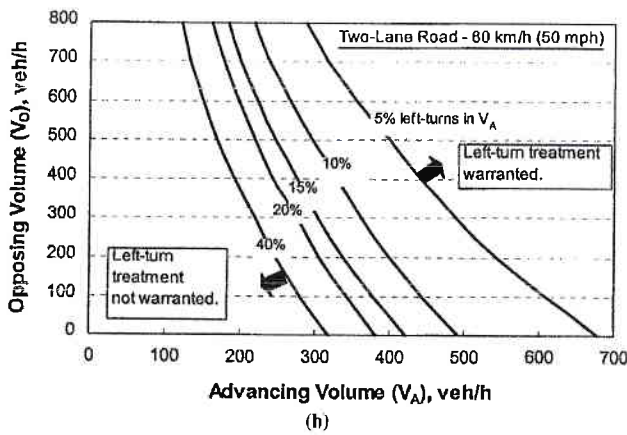
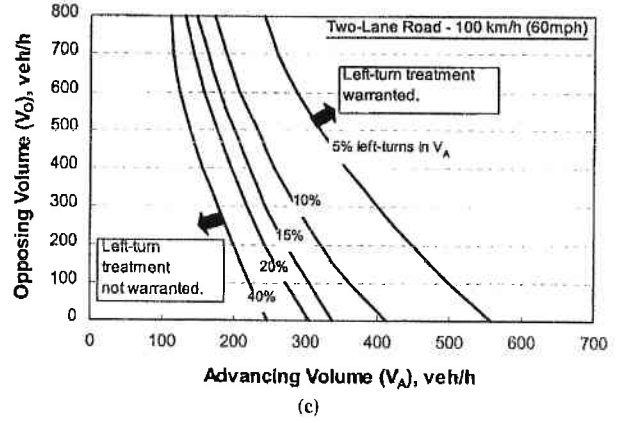
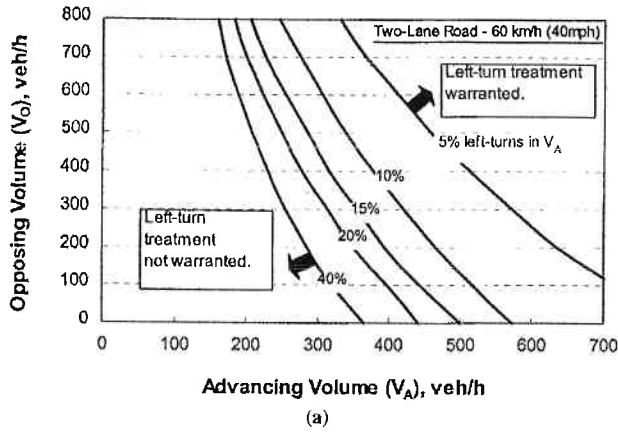
#### Add a Left-Turn Bay on the Major Road

**Introduction.** Provision of a left-turn bay on the major road to a two-way stop-controlled intersection can significantly improve operations and safety at the intersection. A left-turn bay effectively separates those vehicles that are slowing or stopped to turn from those vehicles in through traffic lanes. This separation minimizes turn-related crashes and eliminates unnecessary delay to through vehicles. Data reported by Neuman (21) indicate that the crash rate for unsignalized intersections can be reduced by 35 to 75 percent through the provision of a left-turn bay.

One disadvantage of adding a bay to the major-road approach is that it may require reallocating the existing pavement or widening of the approach cross section. Sometimes the pavement width needed for the additional lane is available within the existing roadway cross section. However, in downtown settings this reallocation may require the removal of some curb parking stalls and can affect adjacent business significantly. Occasionally, the cross section must be widened to provide for the turn bay. If the needed width can be provided within the available right-of-way, the cost may be limited to that of construction. However, if additional right-of-way is needed, the costs of acquiring this property in urban settings can be high.

**Guidance.** Neuman (21) suggests that the following guidelines should be used to determine when to provide a left-turn bay on the major road of a two-way stop-controlled intersection:

1. A left-turn lane should be considered at any median crossover on a divided, high-speed road.
2. A left-turn lane should be provided on the unstopped approach of a high-speed rural highway when it intersects with other arterials or collectors.
3. A left-turn lane is recommended on the unstopped approach of any intersection when the combination of intersection volumes intersect above or to the right of the appropriate trend line shown in Figure 2-5.



Note: When  $V_o < 400$  veh/h (dashed line), a left-turn lane is not normally warranted unless the advancing volume ( $V_A$ ) in the same direction as the left-turning traffic exceeds 400 veh/h ( $V_A > 400$  veh/h).

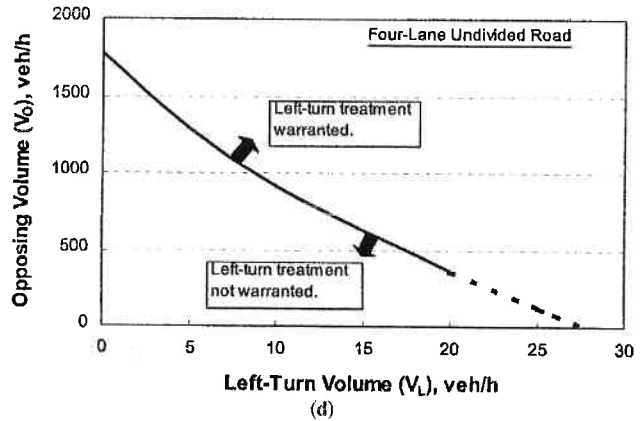


Figure 2-5. Guideline for determining the need for a major-road left-turn bay at a two-way stop-controlled intersection.

**Application.** The guidance stated in the preceding section defines the conditions that may justify the provision of a left-turn bay. Application of this guidance requires two types of data:

1. Major-road turn movement volume for the peak hour of the average day and
2. Major-road 85<sup>th</sup> percentile speed (posted speed can be substituted if data are unavailable).

Use of Figure 2-5 requires determination of the opposing volume, the advancing volume, and the operating speed. The opposing volume should include only the right-turn and through movements on the approach across from (and heading in the opposite direction of) the subject major-road approach. The advancing volume should include the left-turn, right-turn, and through movements on the subject approach. The operating speed can be estimated as the 85<sup>th</sup> percentile speed. If the operating speed does not coincide with 60, 80, or 100 km/h (i.e., 40, 50, or 60 mph), then interpolation can

be used or, as a more conservative approach, the operating speed can be rounded up to the nearest speed for which a figure is provided.

In application, Figure 2-5 is used once for each major-road approach to the intersection. The appropriate trend line is identified on the basis of the percentage of left-turns on the subject major-road approach. If the advancing and opposing volume combination intersects above or to the right of this trend line, a left-turn bay should be considered for the subject approach. If a bay is included at the intersection, it should be long enough to store left-turn vehicles 99.5 percent of the time (i.e., the bay should not overflow more than 0.5 percent of the time). Techniques for estimating this storage length are provided in the section, [Increase the Length of the Turn Bay](#).

#### Add a Right-Turn Bay on the Major Road

**Introduction.** Provision of a right-turn bay on the major road to a two-way stop-controlled intersection can signifi-

cantly improve operations and safety at the intersection. A right-turn bay effectively separates those vehicles that are slowing or stopped to turn from those vehicles in the through traffic lanes. This separation minimizes turn-related collisions (e.g., angle, rear-end, and same-direction-sideswipe) and eliminates unnecessary delay to through vehicles.

One disadvantage of adding a bay to the major-road approach is that it may require reallocating the existing pavement or widening of the approach cross section. Sometimes the pavement width needed for the additional lane is available within the existing roadway cross section. However, in downtown settings this reallocation may require the removal of some curb parking stalls and can affect adjacent business significantly. Occasionally, the cross section must be widened to provide for the turn bay. If the needed width can be provided within the available right-of-way, the cost may be limited to that of construction. However, if additional right-of-way is needed, the costs of acquiring this property in urban settings can be high.

**Guidance.** Hasan and Stokes (22) developed guidelines for determining when to provide a right-turn bay on the major road of a two-way stop-controlled intersection. These guidelines were based on an evaluation of the operating and collision costs associated with the right-turn maneuver relative to the cost of constructing a right-turn bay. The operating costs included those of road-user fuel and delay. Separate guidelines were developed for two-lane and four-lane roadways. These guidelines are shown in Figure 2-6.

**Application.** The guidance described in the preceding section defines conditions that may justify the provision of a right-turn bay. Application of this guidance requires two types of data:

1. Major-road turn movement volume for the peak hour of the average day and
2. Major-road 85<sup>th</sup> percentile speed (posted speed can be substituted if data are unavailable).

Figure 2-6 should be consulted once for each major-road approach. If the combination of major-road approach volume and right-turn volume intersects above or to the right of the trend line corresponding to the major-road operating speed, then a right-turn bay is a viable alternative.

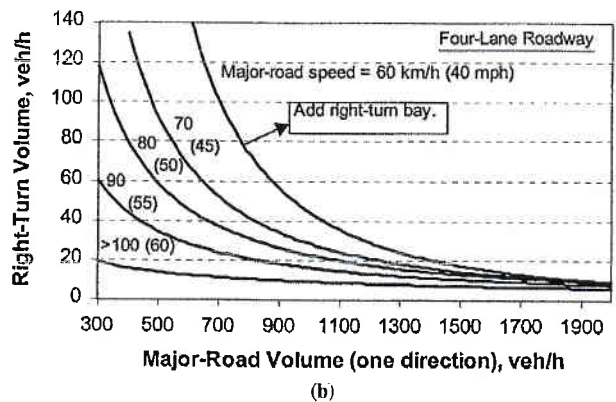
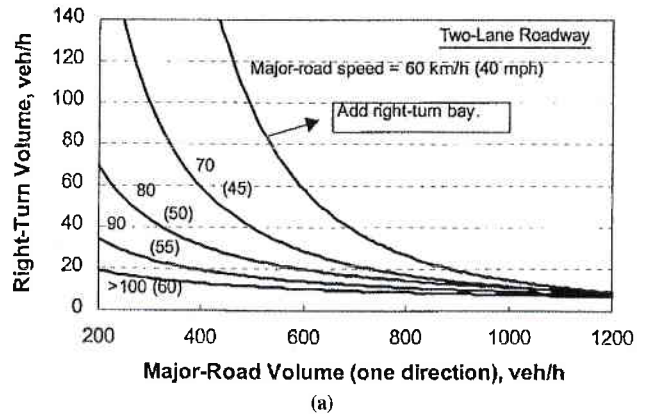


Figure 2-6. Guideline for determining the need for a major-road right-turn bay at a two-way stop-controlled intersection.

*Increase Length of Turn Bay*

**Introduction.** Turn bay length can affect the safety and operation of the intersection approach significantly. This effect becomes more negative as the frequency with which vehicles exceed the available storage increases. Also, for unstopped approaches, this effect becomes more negative as more of the turning vehicle's deceleration occurs in the through lane, prior to the bay. The need to provide adequate storage length, deceleration length, or both is dependent on the type of approach control used and whether the vehicle is turning left or right. Table 2-13 identifies the appropriate bay

TABLE 2-13 Turn-bay length components at unsignalized intersections

Approach Control	Length Components	
	Left-Turn Bay	Right-Turn Bay
Unstopped	Storage Length + Deceleration Length	Deceleration Length
Stopped	Storage Length	Storage Length

**Southbound Left Turn Lane on Columbia Pike at the Northern Project Access:**

Guidance. The following guidelines should be used to determine when to provide a left-turn bay on the major road of a two-way stop-controlled intersection:

- 1. A left-turn lane should be considered at any median crossover on a divided, high-speed road.**

Since Columbia Pike is not median-divided, this guideline does not apply.

- 2. A left-turn lane should be provided on the unstopped approach of a high-speed rural highway when it intersects with other arterials or collectors.**

The project access is not an arterial or collector roadway, and so this guideline does not apply.

- 3. A left-turn lane is recommended on the unstopped approach of any intersection when the combination of intersection volumes intersect above or to the right of the appropriate trend line shown in Figure 2-5 of *NCHRP Report 457: Engineering Study Guide for Evaluating Intersection Improvements*.**

	<b>AM Peak Hour</b>	<b>PM Peak Hour</b>
L =	4.2%	8.0%
v =	45 mph (use 50 mph)	45 mph (use 50 mph)
v <sub>a</sub> =	599	1,109
v <sub>o</sub> =	1,246	726
Result:	turn lane <u>IS</u> warranted	turn lane <u>IS</u> warranted

**Northbound Right Turn Lane on Columbia Pike at the Northern Project Access**

Guidance. The following guidelines should be used to determine when to provide a right-turn bay on the major road of a two-way stop-controlled intersection:

**A right-turn lane is recommended on the unstopped approach of any intersection when the combination of intersection volumes intersect above or to the right of the appropriate trend line shown in Figure 2-6 of *NCHRP Report 457: Engineering Study Guide for Evaluating Intersection Improvements*.**

	<b>AM Peak Hour</b>	<b>PM Peak Hour</b>
v =	45 mph (use 50 mph)	45 mph (use 50 mph)
Northbound Volume:	1,246	726
Right-Turn Volume:	5	18
Result:	turn lane <u>NOT</u> warranted	turn lane <u>IS</u> warranted

**Southbound Left Turn Lane on Columbia Pike at the Middle Project Access:**

Guidance. The following guidelines should be used to determine when to provide a left-turn bay on the major road of a two-way stop-controlled intersection:

- 1. A left-turn lane should be considered at any median crossover on a divided, high-speed road.**

Since Columbia Pike is not median-divided, this guideline does not apply.

- 2. A left-turn lane should be provided on the unstopped approach of a high-speed rural highway when it intersects with other arterials or collectors.**

The project access is not an arterial or collector roadway, and so this guideline does not apply.

- 3. A left-turn lane is recommended on the unstopped approach of any intersection when the combination of intersection volumes intersect above or to the right of the appropriate trend line shown in Figure 2-5 of *NCHRP Report 457: Engineering Study Guide for Evaluating Intersection Improvements*.**

	<b>AM Peak Hour</b>	<b>PM Peak Hour</b>
L =	4.9%	12.0%
v =	45 mph (use 50 mph)	45 mph (use 50 mph)
v <sub>a</sub> =	590	1,030
v <sub>o</sub> =	1,240	718
Result:	turn lane <u>IS</u> warranted	turn lane <u>IS</u> warranted

**Northbound Right Turn Lane on Columbia Pike at the Middle Project Access**

Guidance. The following guidelines should be used to determine when to provide a right-turn bay on the major road of a two-way stop-controlled intersection:

**A right-turn lane is recommended on the unstopped approach of any intersection when the combination of intersection volumes intersect above or to the right of the appropriate trend line shown in Figure 2-6 of *NCHRP Report 457: Engineering Study Guide for Evaluating Intersection Improvements*.**

	<b>AM Peak Hour</b>	<b>PM Peak Hour</b>
v =	45 mph (use 50 mph)	45 mph (use 50 mph)
Northbound Volume:	1,240	718
Right-Turn Volume:	17	74
Result:	turn lane <u>IS</u> warranted	turn lane <u>IS</u> warranted

**Southbound Left Turn Lane on Columbia Pike at the Southern Project Access:**

Guidance. The following guidelines should be used to determine when to provide a left-turn bay on the major road of a two-way stop-controlled intersection:

- 1. A left-turn lane should be considered at any median crossover on a divided, high-speed road.**

Since Columbia Pike is not median-divided, this guideline does not apply.

- 2. A left-turn lane should be provided on the unstopped approach of a high-speed rural highway when it intersects with other arterials or collectors.**

The project access is not an arterial or collector roadway, and so this guideline does not apply.

- 3. A left-turn lane is recommended on the unstopped approach of any intersection when the combination of intersection volumes intersect above or to the right of the appropriate trend line shown in Figure 2-5 of *NCHRP Report 457: Engineering Study Guide for Evaluating Intersection Improvements*.**

	<b>AM Peak Hour</b>	<b>PM Peak Hour</b>
L =	0.5%	1.3%
v =	45 mph (use 50 mph)	45 mph (use 50 mph)
v <sub>a</sub> =	574	956
v <sub>o</sub> =	1,242	760
Result:	turn lane <u>IS</u> warranted	turn lane <u>IS</u> warranted

**Northbound Right Turn Lane on Columbia Pike at the Southern Project Access**

Guidance. The following guidelines should be used to determine when to provide a right-turn bay on the major road of a two-way stop-controlled intersection:

**A right-turn lane is recommended on the unstopped approach of any intersection when the combination of intersection volumes intersect above or to the right of the appropriate trend line shown in Figure 2-6 of *NCHRP Report 457: Engineering Study Guide for Evaluating Intersection Improvements*.**

	<b>AM Peak Hour</b>	<b>PM Peak Hour</b>
v =	45 mph (use 50 mph)	45 mph (use 50 mph)
Northbound Volume:	1,242	760
Right-Turn Volume:	13	49
Result:	turn lane <u>IS</u> warranted	turn lane <u>IS</u> warranted

**Thompson's Station Planning Commission**  
**Staff Report – Item 2 (File: SP 2015-008 & DR 2015-007)**  
**November 17, 2015**

**Site Plan for the development of (Roderick Market) a restaurant and convenience store with a gas station within Roderick Place.**

**PROJECT DESCRIPTION**

The applicant, Kiser/Vogrin Design has submitted a site plan application for the development of a restaurant and convenience store with a gas station on a 2.77 acre site located along the east side of Columbia Pike, north of Thompson's Station Road, south of Critz Lane within Roderick Place.

**BACKGROUND**

The project site was rezoned in November 2006 to Specific Plan and a concept plan with envisioning book was approved as part of the rezone process. A revision to the concept plan was approved in October 2007, which included 174 residential units and 127,606 square feet of commercial uses.

In October 2014, the Commission reviewed another revision to include 198 residential units and 127,606 square feet of commercial uses. However, at this meeting, no action was taken by the Planning Commission to formally approve the project as modified.

On October 27, 2015, the Planning Commission deferred the preliminary plat in order to meet with TDOT regarding the potential of a traffic signal along Columbia Pike for Roderick Place.

On November 4, 2015, the DRC reviewed and approved the architecture contingent on approval by the Planning Commission.

**ANALYSIS**

**Site Plan**

The applicant is proposing the development of a 5,761 square foot one story building containing a restaurant with patio dining and a convenience store with gas facilities on 2.77 acres.

***Zoning/Land Use***

**Commercial land uses are set forth within the approved concept plan and envisioning (pattern) book for the Specific Plan zone.** The project is consistent with the approved plan for the development of a restaurant and convenience store/gas station in this location.

***Non-residential Development Standards***

**Additional standards are applicable to non-residential land uses that are not addressed in the envisioning (pattern) book.**

*Lot coverage for automotive facilities shall include all buildings and canopies on site and shall not exceed 25%. Total amount of impervious surface shall be limited to 40%. The total lot coverage proposed is 23% and the total impervious surface is 35%.*

*Parking shall be predominantly located in the rear of the site behind the main structure, where feasible. In cases where a portion of the parking fronts a public right of way, a landscaped hedge shall be provided to screen all parking spaces. The overnight parking or storage of any*

*vehicles shall be fully screened from all public rights-of-way. All parking is located in the rear of the site.*

*A maximum height of 25 feet is permitted for all structures. The building will be a maximum of 25 feet in height.*

*Internal pedestrian access shall be provided and shall consist of paved walkways, decorative treatments, etc. to clearly identify the pedestrian path. A pedestrian path of travel is shown on the plans from the canopy to the building. Material has not been identified for this walkway; therefore, Staff recommends a contingency for the pathway to match the decorative entrance treatment.*

*All non-residential buildings shall be reviewed by the Design Review Committee. The project was approved by the Design Review Commission contingent on Planning Commission approval.*

*Canopy fascia shall match the color and materials of the other buildings on site. No more than two points of ingress/egress shall be permitted and no more than 35% of the street frontage shall be dedicated to curb cuts. Driveways shall be located a minimum of 200 feet from any intersection. The gas pump canopy is attached to the main building with the use of similar materials. The driveway is 26 feet in width, however the location of the driveway is 180, therefore, prior to construction plan approval, the driveway will be required to be relocated to meet the 200 feet minimum distance.*

*Entry drives shall be designated to incorporate enhanced paving, landscaping and other features which complement the building architecture. The plan does not address this requirement; therefore, Staff recommends the driveway entrance incorporate enhanced paving to complement the site entrance.*

### ***Parking***

**Parking is not addressed in the envisioning (pattern) book and therefore subject to the LDO.** All parking will be provided on site and located in the rear of the site. The project proposed 52 spaces and includes bicycle parking. Four bicycle spaces are required and are located on site adjacent to the north porch. The parking will be landscaped with the inclusion of a landscaped island every eight to 11 spaces (as required by the standards approved in the envisioning book). The parking is subject to low impact design (LID) requirements.

### ***Lighting***

**Lighting is not addressed in the envisioning (pattern) book and therefore subject to the LDO.** The project site will have lighting on site for the parking areas and building. A photometric plan was submitted and demonstrates that lighting shall not exceed the maximum illumination permitted at property lines. Therefore, no spillover is anticipated as demonstrated by the photometric survey completed for the lighting.

### ***Open Space***

**Open space requirements are set forth within the approved envisioning (pattern) book for the Specific Plan zone.** The open space requirement is 40% for residential land uses and 50% for non-residential land uses. The site is 2.77 acres thereby requiring approximately 1.4 acres of open space. The project as proposed has 1.74 acres of open space. Therefore, the proposal meets the requirements set forth for approval of the plans.



### ***Landscaping***

**The landscaping requirements are set forth within the envisioning (pattern) book for the Specific Plan zone.** The project includes a street buffer of 15 feet in width to be planted along Columbia Pike and shall be planted with one tree for every 50 feet along Columbia Pike. Landscape buffers are required along the remaining property lines to provide a street buffers and a buffer between residential and nonresidential land uses. In addition, parking lot landscape islands are required every 12 spaces. The landscaping consists of Black Gum, Scarlet Oaks, Nuttall Oaks, Cypress, and Japanese Cedar trees. In addition, a variety of shrubs and grasses will be provided throughout the site. The landscaping is consistent with the approved plans, however, Staff does recommend that a landscaping bond be posted, a pre installation meeting for landscaping occur. These are standard recommendations for all nonresidential projects.

### **RECOMMENDATION**

Based on the project's consistency with the approved plans, Staff recommends that the project be approved with the following contingencies:

1. Prior to the issuance of any grading or building permits, the applicant shall submit a preliminary plat to establish a single lot for the purposes of development. The plat shall incorporate the roadway connection to Columbia Pike as approved by the Board of Mayor and Aldermen and TDOT.
2. Prior to issuance of grading permits, construction plans shall be submitted and approved. The location of the driveway entrance shall be located a minimum of 200 feet from any intersection. Any upgrades to the utility infrastructure necessary for the project shall be incorporated into the construction plans and shall be completed by the applicant.
3. Prior to the issuance of building permits, the site plan shall be modified to incorporate enhanced paving at the project entrance which shall match the pedestrian pathway on site. All mechanical equipment locations shall be identified and screening provided.
4. Prior to the issuance of building permits, the applicant shall post a letter of credit for the landscaping in the amount of \$24,000.
5. Prior to installation of the landscaping, the applicant shall meet with staff to confirm location of all landscaping.
6. Any change of use or expansion of the project site shall conform to the requirements set forth within the Land Development Ordinance and shall be approved prior to the implementation of any changes to the project.

### **ATTACHMENTS**

Site Plan Packet (previously sent)