

Traffic Impact Study

for the

Proposed Commercial Development
Clayton Road and Henry Avenue/Schoettler Road

Ballwin, Missouri

May 5, 2009

Prepared for:

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CBB Job No. 62-09

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Introduction

Crawford, Bunte, Brammeier has completed a traffic impact study for a proposed commercial development in the southwest quadrant of Clayton Road with Henry Avenue/Schoettler Road. The site is located within the Ballwin municipal limits; with Clayton Road (Route HH) under MoDOT control, Schoettler Road controlled by St. Louis County and Henry Avenue under City of Ballwin jurisdiction. The site location, as well as existing lane configurations on the adjacent roadways, is depicted in **Exhibit 1**.

The proposed development is expected to consist of four commercial buildings near Clayton Road with a variety of uses including a CVS Pharmacy, general retail space, a sit-down restaurant, a coffee shop with drive-thru window, a bank with drive-thru lanes and general office space. A fifth building is proposed as a senior living facility on the south end of the site along the west side of Henry Avenue. Two access drives are proposed to each Clayton Road and Henry Avenue. **Exhibit 2** illustrates the proposed development plan (prepared by others).

A scoping meeting was held on April 20th, 2009 at Missouri Department of Transportation (MoDOT) office and was attended by representatives from MoDOT, St. Louis County Department of Highways & Traffic (SLCDHT), the City of Ballwin and the development team. A scope of work for a traffic impact study was agreed upon at this meeting, which includes the analysis of the following intersections:

- Clayton Road & Henry Avenue/Schoettler Road;
- Clayton Road & Town and Country Crossing/Village Green Parkway
- Clayton Road & Woods Mill Road; and
- All four proposed access points on the public roads.

The study analyzes traffic conditions during the morning (7:00 to 9:00 a.m.) and p.m. (4:00 to 6:00 p.m.) peak periods of a typical weekday. The purpose of this traffic impact study was to identify the number of trips that would be generated by the proposed development, determine the ability of motorists to safely enter and exit the site at each access point, and investigate the impact that the additional trips would have on operating conditions along both roadways. Where necessary, roadway improvements (lane additions and/or intersection modifications) have been recommended to mitigate the impact of the development and to accommodate the additional traffic.

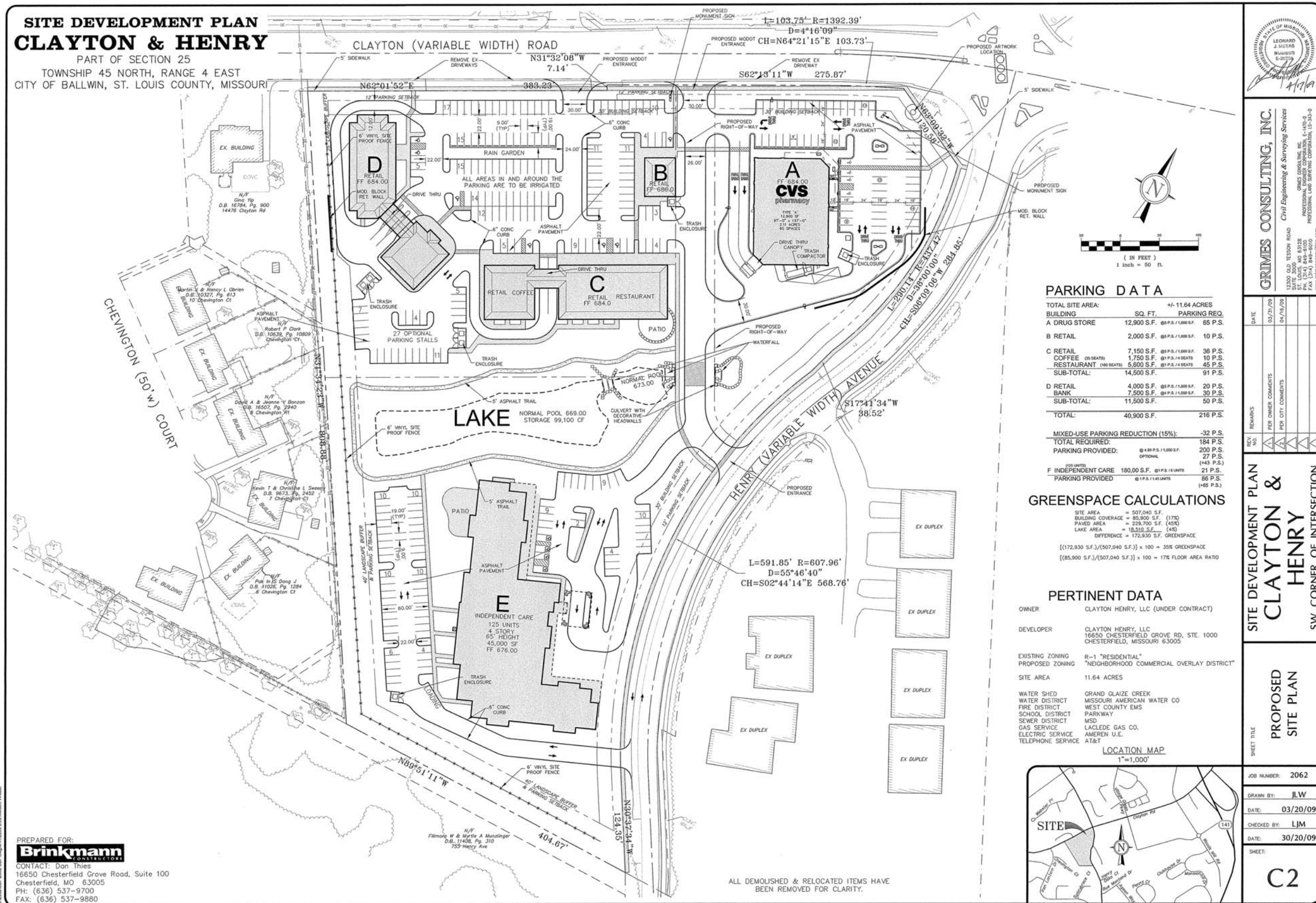
Based upon discussions during the scoping meeting, the following scenarios were established as critical analysis timeframes:

- **Base Conditions** – This scenario reflects conditions within the study area as they currently exist. Traffic data was collected previously at all study intersection in October 2008 and was adjusted based upon a current count made at the Henry Avenue Schoettler Road intersection in April 2009.



Exhibit 1: Site Location Map & Existing Lane Configurations

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PARKING DATA

BUILDING	SQ. FT.	PARKING REQ.
A DRUG STORE	12,900 S.F.	65 P.S.
B RETAIL	2,000 S.F.	10 P.S.
C RETAIL	7,150 S.F.	36 P.S.
COFFEE (25 SEATS)	1,750 S.F.	10 P.S.
RESTAURANT (180 SEATS)	5,600 S.F.	45 P.S.
SUB-TOTAL:	14,500 S.F.	91 P.S.
D RETAIL	4,000 S.F.	20 P.S.
BANK	7,500 S.F.	30 P.S.
SUB-TOTAL:	11,500 S.F.	50 P.S.
TOTAL:	40,900 S.F.	216 P.S.

MIXED-USE PARKING REDUCTION (15%): -32 P.S.
 TOTAL REQUIRED: 184 P.S.
 PARKING PROVIDED: 200 P.S.
 (+16 P.S.)

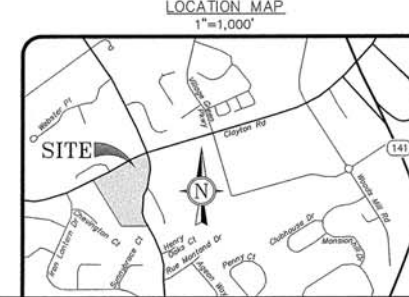
(125 UNITS)
 F INDEPENDENT CARE 180,00 S.F. @ 1 P.S./4 UNITS 21 P.S.
 PARKING PROVIDED @ 1 P.S./145 UNITS 86 P.S.
 (+65 P.S.)

GREENSPACE CALCULATIONS

SITE AREA = 507,040 S.F.
 BUILDING COVERAGE = 85,300 S.F. (17%)
 PAVED AREA = 229,700 S.F. (45%)
 LAKE AREA = 18,310 S.F. (4%)
 DIFFERENCE = 172,930 S.F. GREENSPACE
 [(172,930 S.F.)/(507,040 S.F.)] x 100 = 35% GREENSPACE
 [(85,900 S.F.)/(507,040 S.F.)] x 100 = 17% FLOOR AREA RATIO

PERTINENT DATA

OWNER: CLAYTON HENRY, LLC (UNDER CONTRACT)
 DEVELOPER: CLAYTON HENRY, LLC
 16650 CHESTERFIELD GROVE RD, STE. 1000
 CHESTERFIELD, MISSOURI 63005
 EXISTING ZONING: R-1 "RESIDENTIAL"
 PROPOSED ZONING: "NEIGHBORHOOD COMMERCIAL OVERLAY DISTRICT"
 SITE AREA: 11.64 ACRES
 WATER SHED: GRAND GLAIZE CREEK
 WATER DISTRICT: MISSOURI AMERICAN WATER CO
 FIRE DISTRICT: WEST COUNTY EMS
 SCHOOL DISTRICT: PARKWAY
 SEWER DISTRICT: MSD
 GAS SERVICE: LACLEDE GAS CO.
 ELECTRIC SERVICE: AMEREN U.E.
 TELEPHONE SERVICE: AT&T



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REV. NO.	DATE	REMARKS
1	03/20/09	ISSUED FOR PERMITS
2	04/19/09	PER CITY COMMENTS
3		PER CITY COMMENTS

SITE DEVELOPMENT PLAN
CLAYTON & HENRY
 SW CORNER OF INTERSECTION

PROPOSED
 SITE PLAN

JOB NUMBER:	2062
DRAWN BY:	JLW
DATE:	03/20/09
CHECKED BY:	LJM
DATE:	30/20/09
SHEET:	C2

Exhibit 2: Proposed Site Development Plan (by others)

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- **No-Build Conditions for Year 2011** - This scenario reflects traffic conditions representative of background growth (1% per year) as well as the full occupancy of the retail component of Town and Country Crossing in 2011 (constructed space, but currently vacant).
- **No-Build Conditions for Year 2031** - This Scenario reflects traffic conditions representative of background growth (0.5% per year from 2011 to 2031) as well as the build-out of the residential portion of Town and Country Crossing.
- **Build Conditions for Years 2011 and 2031** - These scenarios reflect the build-out of the subject development site in addition to the respective No-Build conditions.

The following report presents the methodologies, assumptions findings and conclusions from the analyses of the Base, No-Build and Build conditions in accordance with the scope of work agreed upon with the various review agencies.

Driveway Access Review

This section of the report discusses in detail the proposed driveway locations with respect to agency access management guidelines and desires. The proposed driveway spacings and corner clearances along Clayton Road were evaluated using MoDOT's "Access Management Guidelines" (AMG), last updated 2006.

Proposed Clayton Road Access

MoDOT Access Management Guidelines - Driveway Locations

MoDOT's AMG specifies a minimum corner clearance for driveways of 220 to 330 feet for minor roadways, measured from the edge of the public roadway to the centerline of the driveway. The minimum driveway spacing is 220 to 330 feet on minor roadways, measured centerline to centerline. MoDOT's AMG recommends that "Driveways should also be lined up across the public roadway from each other whenever possible. When driveways are not lined up, the spacing should be measured from the closest driveway on either side of the road, except where a non-traversable (e.g., raised) median exists." MoDOT's AMG indicates a minimum spacing/corner clearance for right-in/right-out driveways of 110 to 165 feet on minor roads where non-traversable medians exist.

Owner's Desires for Access

The owner of the property prefers to have full access as close as possible to the Henry Avenue/Schoettler Road signal and access within or directly adjacent to the CVS tract on the northeast corner of the site.

Physical Constraints - Location of Full Access Driveways

Based on left-turn conflicts between the eastbound left-turns on Clayton Road at Henry Avenue/Schoettler Road and the westbound left-turns into the proposed drive, a full access driveway location adjacent to the CVS tract could not be accommodated in the available distance. The 215 foot design length required includes: a minimum turning radius (25 feet), deceleration/storage length (90-feet) and a transition taper (100-feet) requirements (assuming that the existing raised median for the eastbound left-turn is not shortened). Since MoDOT indicated that they will not allow the median to be shortened, if left-turns are allowed at that location, they could slow westbound traffic and/or interfere with the westbound through lanes. As a result, full access should be located a minimum of 220 feet west of the end of the existing raised median.

Recommended Site Access Configuration

In order to obtain the owner's desired access and to meet MoDOT's AMG, the following access was considered. **Exhibit 3** illustrates the site access issues discussed below. One reasonable location for full access along the site's Clayton Road frontage would be opposite Rue de Gascony. This location would meet the AMG alignment suggestion as well as provide the maximum distance away from the signal (to avoid left-turn conflicts) as well as meet the

minimum corner clearance (\pm 560-foot corner clearance from Henry Avenue). This location is marked “A” on Exhibit 3.

As mentioned above, full access driveways should be 220 to 330 feet west of Henry Avenue to satisfy the AMG corner clearance requirement and 220 to 330 feet east apart from one another to meet the driveway spacing requirements. According to the AMG, a second full access drive could be located within the CVS frontage between Henry Avenue and the recommended full access driveway opposite Rue de Gascony. These locations are marked “B” and “C” on Exhibit 3. However, as discussed in the physical constraints section, a full access driveway at that location would not operate properly and has the potential to create congestion and possibly blockage of the westbound travel lanes.

Alternatively, if the second proposed access location was limited to right-in/right-out with a median added to Clayton Road between the signal and Rue de Gascony/proposed full access drive for the site, the AMG driveway spacing would be reduced to 110 to 165 feet. There appears to be adequate pavement width to add a 4-foot raised median without widening Clayton Road. The proposed eastern driveway could be restricted to right-in/right-out only by a raised median resulting in a \pm 170-foot driveway spacing to Rue de Gascony and the proposed full access driveway. This location is marked as “D” on Exhibit 3.

The operational analyses presented later in this report assume the recommended access plan with full access opposite Rue de Gascony and a right-in/right-out only access adjacent to the CVS tract.

Proposed Henry Avenue Access

Based on the site plan submitted to the City (See Exhibit 2), the north Henry Avenue driveway is located approximately 125 feet (centerline-to-centerline) south of the existing Clayton Corners Drive and the south driveway is located approximately 390 feet south of the proposed north driveway. It is our understanding that the City of Ballwin does not have specific access guidelines, but generally follows St. Louis County standards on traffic and transportation issues. However, SLCDHT does not have any specific access guidelines either. MoDOT’s 220-330 feet (centerline-to-centerline) requirements for a state highway could be considered excessive for applications on Henry Road.

An optimal location for the proposed north site driveway would be opposite Clayton Corners Drive. However, the current site plan is not unreasonable for several reasons. The grades on the site make the alignment difficult which would result in an extremely steep driveway (7% or more). Both side-streets (Clayton Corners and the proposed north driveway) are two-lanes and have a relatively low number of turns in and out. The inbound left-turns from Henry Avenue do not overlap and will not create any conflicts. The outbound left-turns could create conflicts, but the frequency is expected to be very low for concurrent existing left-turns and adequate sight distance is available. As a result, the 125-foot offset between Clayton Corners Drive and the proposed north site driveway is not unreasonable.

Existing Roadway Conditions

Area Roadway System

The study evaluated conditions along Clayton Road (Missouri Route HH) with the limits of Rue de Gascony to the west. Clayton Road is a minor arterial serving west St. Louis County that is owned and maintained by MoDOT adjacent to the site. Clayton Road is generally a five-lane roadway (two lanes in each direction with a center left-turn lane) west of Henry Avenue/Schoettler Road and generally a seven-lane roadway (three lanes in each direction with separate left-turn lanes) east to Woods Mill Road. An auxiliary eastbound right-turn lane is present at Town and Country Crossing. Clayton Road has a posted speed limit of 40 miles per hour (mph). The intersections of Clayton Road with Henry Avenue/Schoettler Road, Town and Country Crossing/Village Green Parkway, and Woods Mill Road are signalized and operate on coordinated timing plans.

Schoettler Road is generally a two-lane urban collector with several intersections providing separate left-turn lanes. Schoettler Road is owned and maintained by SLCDHT and has a posted speed limit of 40 mph. Schoettler Road serves primarily residential land uses to the north and ultimately has a connection to South Outer Forty near the Chesterfield Parkway East interchange. At the intersection of Clayton Road, two southbound left-turn lanes and a shared thru/right-turn lane are present.

South of Clayton Road, Schoettler Road changes name to Henry Avenue, and ownership and maintenance is by the City of Ballwin. Henry Avenue includes separate northbound left and right-turn lanes as well as a thru lane at the signalized intersection with Clayton Road. South of Clayton Road, Henry Avenue transitions back to a two-lane roadway. Henry Avenue has a posted speed limit of 35 mph.

Town and Country Crossing Drive provides access to the Town and Country Crossing development opposite Village Green Parkway. The retail buildings on the Town and Country Crossing are built, but not completely occupied, while the planned residential portion is expected to lag several years due to current economic conditions.

Village Green Parkway, Woods Mill North and Woods Mill Road serve commercial land uses close to Clayton Road and residential subdivisions further removed from Clayton Road.

Existing Traffic Volumes

CBB previously performed manual traffic counts during the morning (7:00-9:00 a.m.) and afternoon (2:45-6:00 p.m.) peak periods of a typical weekday at all of the study intersections as well as the Route 141 interchange in early October 2008 as part of a signal timing project for MoDOT. In order to validate those counts for current use and generate base traffic volumes, CBB performed manual traffic counts and queue observations in late April 2009 at the intersection of Clayton Road with Henry Avenue/Schoettler Road. Counts were also performed at the intersection of Rue de Gascony Lane with Clayton Road and Clayton Corners Drive with Henry Avenue.

Based on those counts, the peak hours identified for analysis were the a.m. (7:15-8:15 a.m.) and p.m. (4:45-5:45 p.m.) peak hours. As discussed in the Technical Memorandum submitted by CBB on April 24, 2009, the 2008 and 2009 traffic volumes at the intersection of Clayton Road at Henry Avenue/Schoettler Road are very similar. However, in order to be conservative in our analyses, the higher volume was assumed where variations were found to compile base traffic levels. **Exhibit 4** graphically summarizes the Base Traffic Volumes on the surrounding roadways.



Exhibit 4: Base Traffic Volumes (Combination of October 2008 and April 2009 Counts by CBB)

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No-Build Conditions

Background Traffic and Other Approved Developments

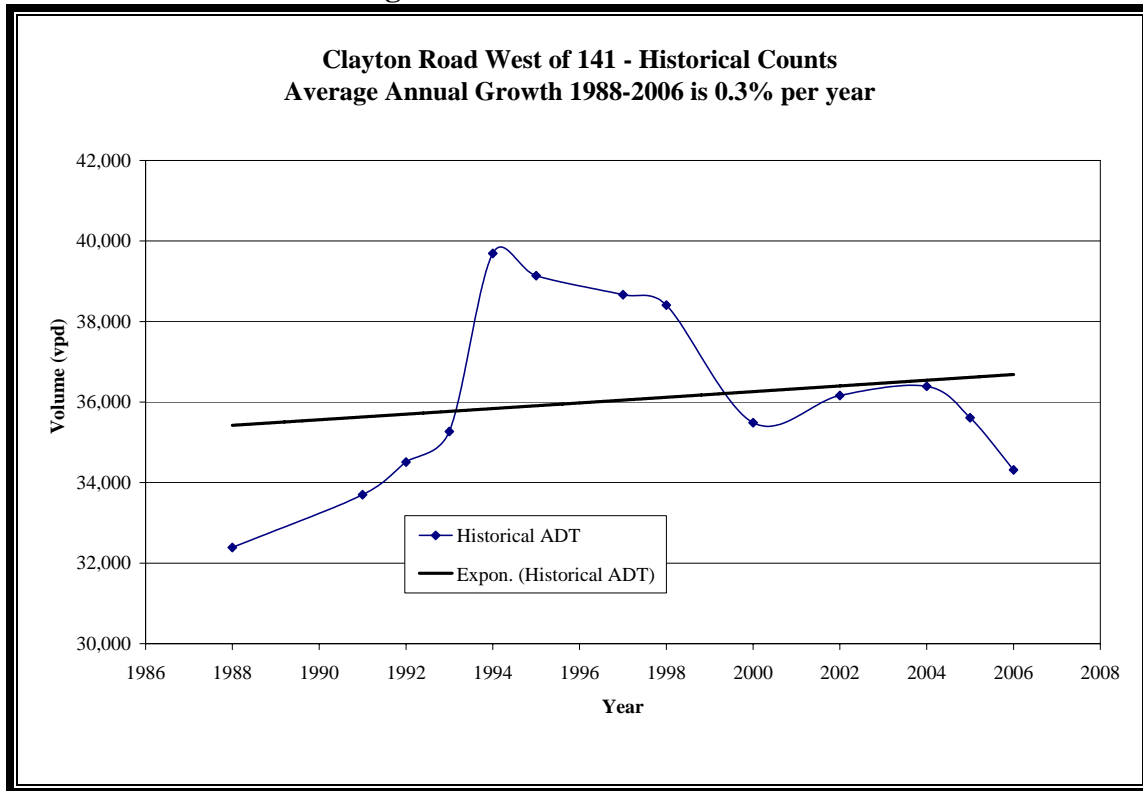
At the time of the 2008 traffic counts, it is our understanding that the retail buildings within the Town and Country Crossing development were completely built, but only partially occupied. Target, Whole Foods and select few businesses on the north end were in operation. Based on the forecasted trip generation from the original traffic study completed in January 2004 by CBB for the Town and Country Crossing development, the anchors alone were expected to generate approximately half of the development's retail trips. Therefore, it can be reasoned that half of the development traffic is already accounted for in the 2008 traffic counts. This appears reasonable also based on our comparison of the previously projected turning movements with the October 2008 traffic counts.

Since the Town and Country Crossing retail development is fully built but not occupied, traffic to that development was increased for the 2011 No-Build Scenario to account for the full occupancy of the remaining retail space. The 2008 counted volumes oriented to Town and Country Crossing Drive at Clayton Road (westbound left-turn, eastbound right-turn, northbound left-turn and northbound right-turn) was doubled and extended through the study area. Additionally, a nominal amount of traffic (5-20 vph) was also added to the thru movements on Woods Mill Road at Clayton Road to account for future trips using the Woods Mill Road to and from the north to access Town and Country Crossing.

The future residential portion of the Town and Country Crossing site would be located on the south side of Clayton Road between Town and Country Crossing Drive and Henry Avenue. In the scoping meeting, it was agreed that the residential development would most likely occur after 2011; therefore, its traffic would be accounted for in the design horizon (2031) traffic scenarios only. It was estimated that 65 condominium/townhome units could occupy that space to complete the build-out of the Town and Country Crossing site.

The projected background growth was based on historical Average Daily Traffic (ADT) data obtained from MoDOT's count maps from 1988 to 2006. **Figure 1** illustrates the historical traffic trends for Clayton Road. The traffic volumes have fluctuated greatly between approximately 32,000 vehicles per day (vpd) to 40,000 vpd over the past 18 years resulting in an annual increase of approximately 0.3% per year on average.

Figure 1: Historical Traffic Data



The ADT has constructed after peaking in 1994. As a result, we propose to use an annual growth rate of 1% for Clayton Road within the study area for the short term growth (2009 to 2011), which represents an overall growth of approximately 2%. This represents a very conservative approach based on the historical data. However, to address the 20-year design horizon, we propose to use a lower annual growth rate of 0.5% for Clayton Road (2011 to 2031), which represents an overall increase of 10.5% over 20 years.

2011 No-Build Traffic Volumes

Based upon the anticipated completion and full occupancy of the proposed development by 2011, the short-term background growth (2% overall) and the full occupancy of the Town and Country Crossing retail development was aggregated with the Base Traffic Volumes (Exhibit 3) to determine the 2011 No-Build traffic volumes. **Exhibit 5** illustrates the 2011 No-Build Traffic Volumes for the study intersections.

Year 2031 No-Build Traffic Volumes

In order to consider long-term planning, twenty-year traffic forecast were also developed. The 2031 No-Build Traffic Volumes, as presented in **Exhibit 6**, are reflective of an additional annual growth rate of 0.5 % per year (10.5% overall) for 20 years, as well as the build-out of the residential portion (65 condominium/townhome units) of the Town and Country Crossing development.



Exhibit 5: 2011 No-Build Traffic Volumes



Exhibit 6: 2031 No-Build Traffic Volumes

Site-Generated Traffic

The proposed development is located on the southwest quadrant of Clayton Road and Henry Avenue. Four commercial buildings are proposed near Clayton Road with a variety of uses which include: a CVS Pharmacy, general retail space, a sit-down restaurant, a coffee shop with drive-thru window, a bank with drive-thru lanes and general office space. A fifth building is anticipated to be senior living located south of the commercial area along the west side of Henry Avenue. Based on the previous access discussion above, one full access drive opposite Rue de Gascony and one right-in/right-out were assumed on Clayton Road. The site was also assumed to have two full access drives on Henry Avenue. The site plan with the recommended access plan is illustrated in Exhibit 3 herein.

Trip Generation

As a primary step in this analysis, traffic forecasts were prepared to estimate the level of traffic that the proposed development would generate during each peak hour. These forecasts were based upon information provided in the “Trip Generation Manual”, Eighth Edition, published by the Institute of Transportation Engineers (ITE). This manual, which is a standard resource for transportation engineers, is based on a compilation of nationwide studies documenting the characteristics of various land uses.

Based upon the recommended procedure for estimating trip generation outlined in the “Trip Generation Handbook, A Recommended Practice”, also published by ITE (March 2001), the regression equation was utilized for:

- Land Use: 820 – Shopping Center (pg 1497)

The average trip rates were used for:

- Land Use: 710 – General Office Building (pg 1194)
- Land Use: 881 – Pharmacy/Drugstore with Drive-Thru (pg 1714)
- Land Use: 912 – Drive-In Bank (pg 1746)
- Land Use: 932 – High-Turnover (Sit-Down) Restaurant (pg 1794)
- Land Use: 937 – Coffee/Donut Shop with Drive-Thru (pg 1850)
- Land Use: 255 – Continuing Care Retirement Community (pg 523)

It should be noted that ITE provides various categories of trip generation for senior living facilities. Several similar senior housing land uses were compared with regards to their trip generation. These facilities tend to have lower traffic demands than other multi-family residential facilities since some residents may not have a personal vehicle or license to drive. In fact, several facilities of this nature provide transportation for their tenants in the form of scheduled trips on a van or mini-bus, thereby minimizing the number of trips into and out of the facility by the residents. As a result, a large share of the peak hour traffic is generated by employees. Furthermore, most residents typically arrive and depart during off-peak periods. For the various senior housing land uses, the Continuing Care Retirement Community is expected to generate the most traffic during the peak hours; therefore, it was utilized in our trip estimation in order to be conservatively high.

The resulting traffic projections for the proposed development are shown in **Table 1**. It is important to note that the ITE estimates assume that each of the development's components would be freestanding. Instead, the commercial uses would share parking and access, and published studies show that patrons of multi-use developments often visit more than one store within a center on a single visit. As a result, a 10% and 20% reduction was applied to several of the land uses to account for motorists that visit more than one use on the site as part of a single trip during the a.m. and p.m. peak hour, respectively. No reductions were applied to the proposed pharmacy, senior living community or general office since those uses would be expected to generate a higher proportion of "destination" trips. **Table 2** summarizes the common trip assumptions.

Consequently, the proposed development would be expected to generate a total of approximately 370 external trips during the weekday a.m. peak hour and 490 external trips during the weekday p.m. peak hour. However, it should be noted that not all of these trips would represent *new* traffic on the adjacent roadways. Specifically, a significant portion of the traffic attracted to this site would already be traveling on Clayton Road or Henry Avenue as part of another trip; i.e., "pass-by" trips.

Based upon statistical information provided in the "Trip Generation Handbook, A Recommended Practice" the pass-by trip percentages summarized in **Table 2** were assumed for the proposed uses. These pass-by trips would create turning movements at the driveways serving the site, but they would not represent new traffic on the adjacent roadways. Therefore, the development would be expected to generate a total of 250 and 275 "new" trips during the a.m. and p.m. peak hours, respectively.

Directional Distribution

Access to the site is proposed via two access drives on Clayton Road and two access drives on Henry Avenue. The site-generated trips were assigned into and out of the proposed development based upon anticipated directional distributions. Based on the projected trip levels it should be noted that a 5% change in directional distribution would affect new trips by 8 vph or less during the p.m. peak hour. The pass-by trips will be assigned based on the existing traffic volumes along the adjacent roadways, while the new site-generated trips will be assigned as shown below:

- 58% to and from east on Clayton Road
 - 12% to and from the east on Clayton Road
 - 20% to and from northbound Route 141;
 - 20% to southbound Route 141
 - 20% from southbound Route 141 via Woods Mill Road
 - 2% to and from the north on Woods Mill Road;
 - 2% to and from the south on Woods Mill Road;
 - 2% to and from the north on Village Green;
- 25% to and from the west on Clayton Road;
- 10% to and from the north on Schoettler Road; and
- 7% to and from the south on Henry Avenue.

Table 1 - Site Generated Traffic

<i>Land Use</i>	<i>Size</i>	<i>AM Peak Hour</i>			<i>PM Peak Hour</i>		
		<i>In</i>	<i>Out</i>	<i>Total</i>	<i>In</i>	<i>Out</i>	<i>Total</i>
Pharmacy/Drugstore with Drive-Thru	12,900 ft ²	20	15	35	65	65	130
Shopping Center (General Retail)	13,150 ft ²	30	15	45	80	85	165
High-Turnover (Sit-Down) Restaurant	5,600 ft ²	35	30	65	35	25	60
Coffee Shop with Drive-Thru	1,750 ft ²	100	95	195	40	40	80
Drive-In Bank	3 Lanes	15	15	30	40	40	80
General Office Building	3,750 ft ²	5	0	5	0	5	5
Retirement Community	125 Units	15	10	25	20	20	40
Subtotal		220	180	400	280	280	560
<i>Common Trip Reduction (see Table 2)</i>		(15)	(15)	(30)	(40)	(35)	(75)
Total Trips		205	165	370	240	245	485
<i>Pass-by Trips (See Table 2)</i>		60	60	120	105	105	210
<i>New Trips</i>		145	105	250	135	140	275

Table 2 - Common and Pass-by Trip Assumptions

<i>Land Use</i>	<i>Common Trip Assumptions</i>		<i>Pass-by Trip Assumptions</i>	
	<i>AM Peak Hour</i>	<i>PM Peak Hour</i>	<i>AM Peak Hour</i>	<i>PM Peak Hour</i>
Pharmacy/Drugstore with Drive-Thru	0%	0%	49%	49%
Shopping Center (General Retail)	10%	20%	25%	34%
High Turnover Sit-Down Restaurant	10%	20%	40%	43%
Coffee Shop with Drive-Thru	10%	20%	50%	50%
Drive-In Bank	10%	20%	30%	47%
General Office Building	0%	0%	0%	0%
Retirement Community	0%	0%	0%	0%

The site-generated trips were assigned to the roadways as shown in **Exhibit 7**. Please note that the values shown in red on the exhibit are deductions resulting for the diversion of pass-by trips. Generally, the new trips were assigned with approximately two-thirds of the site traffic to the Clayton Road Entrances and the remaining one-third to the Henry Road access drives.

2011 Build Traffic Volumes

The site-generated traffic volumes (Exhibit 7) were aggregated with the 2011 No-Build Traffic Volumes (Exhibit 5) in order to determine the total volumes forecast in the 2011 Build Scenario. The 2011 Build Traffic Volumes for both peak hours are shown in **Exhibit 8**.

2031 Build Traffic Volumes

The site-generated traffic volumes (Exhibit 7) were also aggregated with the 2031 No-Build Traffic Volumes (Exhibit 6). The resulting 2031 Build Traffic Volumes are depicted in **Exhibit 9**.



Exhibit 7: Total Site-Generated Trips

Note: Values shown in red represent a reduction in volume due to pass-by traffic.

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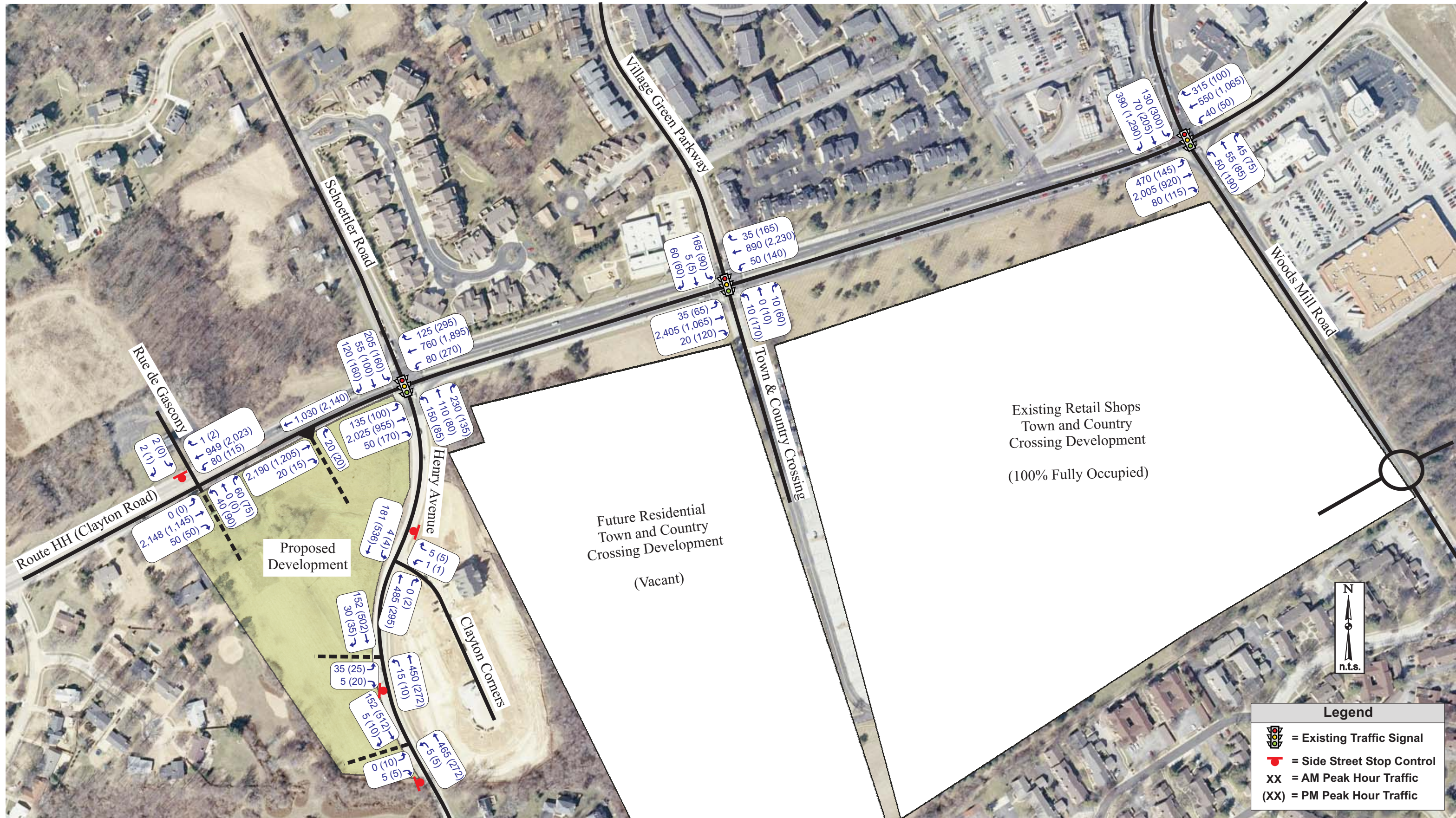


Exhibit 8: 2011 Build Traffic Volumes

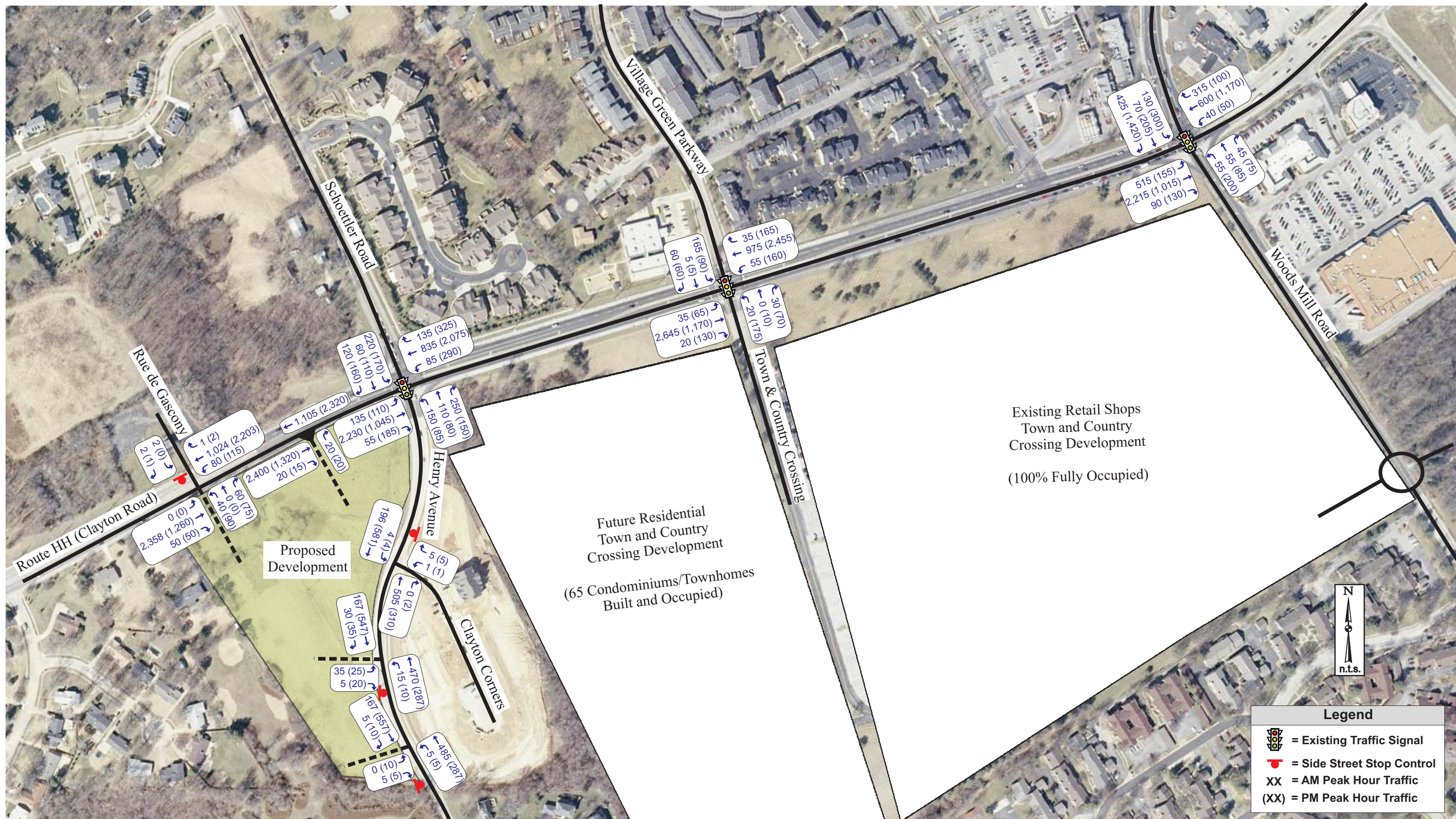


Exhibit 9: 2031 Build Traffic Volumes

Operational Analysis

The following sections of the report discuss the operational aspects of the current and future traffic conditions at the study intersections. This analysis reviewed the need for auxiliary turn lanes per volume criteria, recommended lane configurations of the proposed driveways, and available sight distance at the proposed driveways.

Auxiliary Turn Lane Analysis

The need for dedicated right-turn lanes on Clayton Road at the proposed entrances was evaluated using MoDOT's AMG. Clayton Road has a center left-turn lane, which can accommodate left-turn movements entering the site. Based on the recommended access plan the center median should be extended to restrict left-turns at the proposed eastern driveway. Therefore, it is not necessary to evaluate the need for dedicated left turn lanes on Clayton Road. The MoDOT guidelines consider auxiliary lanes an asset in promoting safety and improved traffic flow. Separate turn lanes are intended to remove turning vehicles from the through lanes to reduce the potential number of rear-end collisions at intersections.

Since the City of Ballwin does not have any specific turn lane requirements, the MoDOT AMG left and right-turn lane methodology was also applied to the forecasted volumes for both proposed driveways on Henry Avenue.

Right-Turn Lane Warrants

The MoDOT figure, *Right Turn Lane Warrant for a Four-Lane Roadway*, was utilized to compare traffic volumes at the intersection of Clayton Road with the proposed western driveway and the proposed right-in/right-out eastern driveway. **Figures 1 and 2** in the Appendix illustrate the 2011 Build Traffic Volumes plotted on the MoDOT figure for the evaluation of right-turn lanes. Based on the minimal number of right-turns needed to satisfy the criteria in conjunction with the existing high traffic volumes along Clayton Road, separate eastbound right-turn lanes are warranted on Clayton Road at both proposed driveways.

The MoDOT figure, *Right Turn Lane Warrant for a Two-Lane Roadway*, was utilized to compare traffic volumes at the intersection of Henry Avenue with the proposed northern driveway and southern driveway. **Figures 3 and 4** in the Appendix illustrate the 2031 Build Traffic Volumes plotted on the MoDOT figure evaluation of right-turn lanes. Based on the minimal number of right-turns and the relatively moderate level of through traffic on Henry Avenue, separate southbound right-turn lanes are NOT warranted on Henry Avenue at either of the proposed driveways.

Left -Turn Lane Warrants

The MoDOT figure, *Left Turn Lane Warrant for Two-Lane Roadway <= 40 mph*, was utilized to compare traffic volumes at the intersections of Henry Avenue at both proposed drives. It should be noted that if left-turn volumes are less than 10 vph, then a left-turn lane is not justified, unless warranted by crash experience. Since the proposed southern driveway is expected to generate

less than 10 vph, that location would not require a separate left-turn lane. **Figure 5** in the Appendix illustrates the 2031 Build Traffic Volumes plotted on the MoDOT figure for evaluations of left-turn lanes. Based on the low number of left-turns and the moderate levels of through traffic along Henry Avenue, a separate northbound left-turn lane is NOT warranted on Henry Avenue at either of the proposed driveways.

Driveway Geometrics

According to MoDOT's AMG, Low Volume Commercial driveways are categorized as driveways that serve less than 150 vph during the peak hour. Based on the projected traffic volumes during the peak hours, the proposed right-in/right-out adjacent to the CVS as well as both access driveways on Henry Road would be considered Low Volume Commercial Driveways. Low Volume Commercial Driveways are recommended to have a width of 28-feet (two-lanes) to 42-feet (three-lanes) with a minimum throat depth of 20-feet. The proposed 30-foot wide driveways are consistent with those guidelines.

Medium Volume Commercial driveways are categorized as driveways that serve between 150 and 400 vph during the peak hour. Based on the projected traffic volumes the proposed western full access drive opposite Rue de Gascony would be considered a Medium Volume Commercial Driveway. Medium Volume Commercial Driveways are recommended to have a width of 42-feet (three-lanes) to 54-feet (four-lanes) and a minimum throat depth of 60-feet.

Driveway Sight Distance

Adequate sight distance is necessary at intersections to allow drivers to perceive potentially conflicting vehicles and allow those motorists sufficient time to adjust their speed to avoid a collision or make a choice of when to cross or enter the mainline traffic flow. All drivers approaching or stopped at the intersection should have an unobstructed view of the entire intersection so that potential collisions can be avoided.

It should be noted that MoDOT utilizes a tiered approach in their requirements based upon Table III-1 and Figure IX-41 of the AASHTO Green Book 1994 Edition. The three "levels" of sight distance compliance are: minimum entrance stopping sight distance, minimum entering sight distance and design entering sight distance. The design entering sight distance is the largest, most conservative requirement and is preferred for optimal sight distance. The design entering sight distance for the proposed entrances on Clayton Road would be 575 feet.

As verified in the field, the driveway has more than adequate sight distance (in excess of 800 foot) available. Thus, the sight distance for the proposed commercial driveway exceeds the design entering sight distance recommended by MoDOT. However, it should be acknowledged that the eastbound queue from the Henry Avenue Schoettler Road traffic signal can obstruct the through lanes and ultimately limit the available sight distance during those occurrences.

SLCDHT sight distance guidelines were utilized for the driveways on Henry Avenue. These guidelines assume that vehicles are entering roadway from a stopped position and incorporates the cross-section and the design speed (35 mph posted + 5 mph = 40 mph design) of Henry Avenue. The minimum sight distance for left-turns exiting from the minor road is 445 feet.

Based on our cursory field observations of the available sight distance, the visibility to and from the south at the northern driveway on Henry Avenue is marginal. Therefore, the site designer should verify that adequate sight distance is provided on the site plan.

However, careful consideration should be given to sight distance obstructions when planning any future aesthetics enhancements, such as berms, fencing and landscaping, to ensure that these improvements do not obstruct the view of entering and exiting traffic at the site intersections with the public roads. It is generally recommended that all improvements higher than 3.5 feet above the elevation of the nearest pavement edge be held back at least 20 feet from the traveled roadway.

Capacity Analysis

Methodology

It is also necessary to evaluate the traffic operations at the study intersections. The operating conditions at the study intersections were evaluated using SYNCHRO 7, which is based on study procedures outlined in the *Highway Capacity Manual*, last updated in 2000 by the Transportation Research Board. This manual, which is used universally by traffic engineers to measure roadway capacity, establishes six levels of traffic service: Level A ("Free Flow"), to Level F ("Fully Saturated"). Levels of service (LOS) are measures of traffic flow which consider such factors as speed, delay, traffic interruptions, safety, driver comfort, and convenience. Level C, which is normally used for highway design, represents a roadway with volumes ranging from 70% to 80% of its capacity. Level D is considered acceptable for peak period conditions in urban areas, while LOS C is preferred in rural areas.

LOS thresholds and criteria vary depending upon the type of traffic control used at an intersection (i.e. whether it is signalized or unsignalized). At signalized intersections, average control delay per vehicle is estimated for each movement and aggregated for each approach and the intersection as a whole. At intersections with partial (side-street) stop control, delay is only calculated for the minor movements - but not for the intersection as a whole - since motorists on the main road are not required to stop. In addition, signalized intersections are designed to carry higher traffic volumes, so longer delays are tolerated than at unsignalized intersections. **Table 3** summarizes the thresholds for each LOS.

Table 3 – Level of Service Thresholds

<u>Level of Service (LOS)</u>	<u>Control Delay per Vehicle (sec/veh)</u>	
	<i>Signalized Intersections</i>	<i>Unsignalized Intersections</i>
A	≤ 10	0-10
B	> 10-20	> 10-15
C	> 20-35	> 15-25
D	> 35-55	> 25-35
E	> 55-80	> 35-50
F	> 80	> 50

Capacity Analysis Results

The traffic signals along Clayton Road within the study area are part of a coordinated traffic system (Henry/Schoettler to Route 141 northbound ramps) which runs on a 120-second cycle during the weekday a.m. peak hour and a 130-second cycle during the p.m. peak hour. The traffic signal at Clayton Road and Henry Avenue/Schoettler Road operates with protected-only southbound (dual left-turn lanes) and eastbound left-turns, while the northbound and westbound left-turns operate under protected plus permitted phasing. The traffic signal at Clayton Road and Village Green/Town and Country Crossing Road signal operates with protected-only east-west left-turns, while the north-south approaches operate split phased. The traffic signal at Clayton Road and Woods Mill Road operates with protected-only southbound and westbound left-turns, while the northbound and eastbound left-turns operate under protected plus permitted phasing. A right-turn overlap phase is also included for the southbound approach.

The study intersections were evaluated using the traffic volumes for each scenario and design horizon presented earlier in the report. The Base Traffic, 2011 No-Build, 2031 No-Build, 2011 Build and 2031 Build operational evaluations are summarized in **Table 4** for the weekday a.m. and p.m. peak hours. These tables identify the levels of service and average delays for comparison during each peak hour.

Base Traffic Conditions

Based upon field observations, as well as operational analyses of the base traffic volumes, the following constraints were identified at the study intersections:

- The eastbound approach of Clayton Road at Henry Avenue/Schoettler Road operates at less than desirable conditions during the a.m. peak hour. The existing eastbound through traffic is very high with nearly 2,000 vph. The existing volume to capacity ratio is estimated at 1.19, which indicates volume currently exceeds the existing theoretical capacity during the a.m. peak hour. While some traffic signal timing changes may decrease the delays, additional eastbound capacity would likely be needed to make significant improvements to operating conditions in the a.m. peak hour.

Lengthy eastbound queues were observed in the through lanes that extended well beyond the Rue de Gascony intersection regularly during the a.m. peak hour. However, the eastbound left-turn queue only reached a maximum of 7 vehicles and never extended past the existing raised median, even during the a.m. peak hour.

- The northbound approach of Henry Avenue at Clayton Road also operates at less than desirable conditions during the a.m. peak hour. The conditions are a result of the coordinated signal timing along Clayton Road and the extremely heavy traffic oriented to Route 141, which limit the ability to provide sufficient green time to Henry Avenue in the a.m. peak hour.

Although the northbound approach operates at less than desirable levels during the a.m. peak hour, the maximum queue was 13 vehicles, which resulted in a maximum queue length approximately half the distance from Clayton Road to Clayton Corners Drive. These queues created no interference with Clayton Corners Drive.

- Conversely, the southbound approach of Shoettler Road operates at less than desirable conditions during the p.m. peak hour. Again, the conditions are a result of the coordinated signal timing along Clayton Road and the heavy westbound traffic, which limits the green time for Schoettler Road in the p.m. peak hour.

It should be noted that all of the other study intersections (Clayton Road with Woods Mill Road, Clayton Road with Village Green/Town and Country Crossing, Clayton Road with Rue de Gascony Court and Henry Avenue with Clayton Corners) operate at acceptable levels of service during both peak hours.

No-Build Traffic Conditions

2011 No-Build Conditions were also analyzed. As previously stated, the traffic forecasts for the 2011 No-Build Condition accounts for the full occupancy of the retail portion of Town and Country Crossing as well as 2% overall background growth along Clayton Road.

In general, the additional traffic will increase delays at all locations slightly. The existing approaches with poor operating conditions will be further exacerbated. It is a foregone conclusion that conditions along an already congested Clayton Road would worsen somewhat. For example, the eastbound delays and queues will get slightly worse in the morning peak hour. However, the northbound queue on Henry Avenue is not expected to increase by more than 1 vehicle, therefore the queues will still not impact Clayton Corners Drive.

2031 No-Build Conditions were also evaluated in an effort to address long term planning matters. The 2031 No-Build Conditions include the full occupancy of the retail and residential portions of Town and Country Crossing as well as background growth over the next twenty years. As expected, conditions along an already congested Clayton Road would worsen.

Specifically, westbound Clayton Road and southbound Woods Mill Road will degrade to poor levels during the p.m. peak hour. Timing adjustments could slightly improve conditions between Woods Mill Road to west of Town and Country Crossing, but the westbound approach (mainly through movements) will be constrained at Henry Avenue/Schoettler Road since the roadway changes from three to two westbound lanes west of the signal.

Table 4 - Operating Conditions

Intersection/Movement	Existing Conditions		2011 No-Build		2031 No-Build		2011 Build Condition ¹		2031 Build Condition ¹	
	AM Peak	PM Peak	AM Peak	PM Peak	AM Peak	PM Peak	AM Peak	PM Peak	AM Peak	PM Peak
Clayton Road at Henry Avenue/Schoettler Road (signalized)										
Eastbound Clayton Road	E (73.1) v/c =1.08	C (27.1)	F (83.9) v/c =1.11	C (28.1)	F (138.4) v/c =1.25	C (30.3)	F (115.4) v/c =1.19	C (29.9)	F (175.4) v/c =1.25	C (33.6)
Westbound Clayton Road	A (9.1)	C (21.8)	A (8.4)	D (36.7)	A (9.1)	E (73.5)	B (10.9)	D (51.4)	B (11.6)	E (71.6)
Northbound Henry Avenue	E (57.0)	D (44.1)	E (59.5)	D (43.6)	E (64.1)	D (42.0)	E (62.4)	D (41.3)	E (67.7)	D (42.2)
Southbound Schoettler Road	D (50.4)	E (73.6)	D (50.4)	E (75.3)	D (52.5)	F (83.1)	D (52.3)	E (76.4)	D (54.3)	F (90.7)
Overall Intersection	D (54.5)	C (30.0)	E (60.6)	D (38.7)	F (92.0)	E (60.6)	E (78.0)	D (47.3)	F (112.1)	E (60.9)
Clayton Road at Town and Country Crossing/Village Green Parkway (signalized)										
Eastbound Clayton Road	A (7.3)	A (9.8)	A (9.2)	B (10.7)	B (12.0)	B (10.4)	A (9.2)	B (10.7)	B (12.8)	A (9.8)
Westbound Clayton Road	B (16.3)	C (21.5)	B (18.9)	D (38.5)	B (18.0)	F (108.5)	B (18.9)	D (50.6)	B (17.8)	D (54.4)
Northbound Town and Country Crossing	D (41.4)	D (50.4)	D (39.2)	D (52.6)	D (33.4)	D (51.6)	D (39.2)	D (53.9)	D (33.4)	E (57.6)
Southbound Village Green Parkway	D (53.1)	D (46.6)	D (53.0)	D (51.6)	D (53.0)	D (52.0)	D (53.0)	D (52.3)	D (52.1)	E (56.6)
Overall Intersection	B (12.6)	B (19.9)	B (14.6)	C (32.3)	B (16.1)	E (77.7)	B (14.6)	D (39.9)	B (16.5)	D (42.4)
Clayton Road at Old Woods Mill Road (Signalized)										
Eastbound Clayton Road	A (9.0)	C (23.1)	A (9.0)	C (23.9)	B (11.0)	C (27.3)	A (9.0)	C (21.2)	B (12.1)	C (30.8)
Westbound Clayton Road	B (17.7)	D (35.2)	B (18.4)	D (37.4)	C (21.2)	D (41.6)	B (18.4)	D (35.6)	C (22.4)	D (53.8)
Northbound Old Woods Mill Road	D (38.8)	D (37.5)	D (38.8)	D (38.2)	D (38.8)	D (38.5)	D (38.8)	D (45.2)	D (41.9)	D (47.2)
Southbound Old Woods Mill Road	C (22.6)	D (48.4)	C (23.5)	D (54.7)	C (22.3)	F (82.7)	C (23.5)	D (53.1)	C (21.3)	D (53.2)
Overall Intersection	B (13.7)	D (37.1)	B (13.9)	D (41.0)	B (15.5)	D (54.0)	B (13.9)	D (39.5)	B (16.6)	D (47.0)
Clayton Road at Rue de Gascony Lane/Site Driveway (Side-Street Stop Controlled)										
Eastbound Left-Turn from Clayton Road	A (9.6)	C (16.9)	A (9.7)	C (19.6)	A (10.0)	D (26.3)	A (9.6)	C (18.1)	A (9.8)	C (23.8)
Westbound Left-Turn from Clayton Road							D (33.8)	B (13.6)	E (45.9)	B (14.9)
Northbound Site Driveway Exit – Left-Turn							F (>200)	F (56.6)	F (>200)	F (79.2)
Northbound Site Driveway Exit – Right-Turn							D (32.4)	C (15.0)	E (40.6)	C (16.3)
Southbound Rue de Gascony Lane	C (15.5)	B (12.2)	C (15.8)	B (12.3)	C (16.9)	B (12.3)	F (52.2)	E (37.5)	F (146.7)	E (55.3)
Henry Avenue at Clayton Corners Drive (Side-Street Stop Controlled)										
Westbound Clayton Corners Drive	B (11.6)	B (10.7)	B (11.7)	B (10.8)	B (11.9)	B (11.1)	B (11.7)	B (11.2)	B (12.2)	B (11.4)
Southbound Henry Avenue	A (0.3)	A (0.1)	A (0.3)	A (0.1)	A (0.3)	A (0.1)	A (0.3)	A (0.1)	A (0.3)	A (0.1)
Henry Avenue at Site Driveway - North (Side-Street Stop Controlled)										
Eastbound Site Driveway							C (18.5)	C (20.9)	C (19.3)	C (22.7)
Northbound Henry Avenue							A (0.4)	A (0.5)	A (0.4)	A (0.5)
Henry Avenue at Site Driveway - South (Side-Street Stop Controlled)										
Eastbound Site Driveway							A (9.1)	B (15.0)	A (9.2)	C (15.9)
Northbound Henry Avenue							A (0.1)	A (0.2)	A (0.1)	A (0.2)
Clayton Road at Proposed right-in/right-out Driveway (Side-Street Stop Controlled)										
Northbound Right-Turn Out of Site							D (26.7)	B (14.1)	D (31.4)	C (15.0)

X (XX.X) - Level of Service (Vehicular delay in seconds per vehicle) ¹ Traffic signal timings optimized

Build Traffic Conditions

2011 Build Conditions aggregated the anticipated traffic from the proposed commercial development with the 2011 No-Build Traffic Volumes, which accounts for the full occupancy of the retail portion of Town and Country Crossing and 2% overall background growth. The forecasted volumes were analyzed using the same methodology applied to the No-Build scenarios in an attempt to quantify the net impacts associated with the proposed development.

Minor signal timing modifications and/or offset modifications were made as a means to accommodate the increased westbound through traffic volumes at Town and Country Crossing and southbound approach of Woods Mill Road during the p.m. peak hour. As with the No-Build analysis, traffic progression along Clayton Road was maintained and the “greenband” for the predominant direction of traffic (time of day dependent) remained relatively constant (no more than a few seconds deviation) despite the signal timing modifications.

During the a.m. peak hour, the operating conditions increased approximately 18 seconds overall at the intersection of Clayton Road and Henry Avenue/Schoettler Road with the largest increase occurring for the eastbound approach, which is already over capacity. During the p.m. peak hour, the operating conditions increased approximately 9 seconds overall at the intersection of Clayton Road and Henry Avenue/Schoettler Road with the largest increase occurring for the westbound approach in an attempt to better serve the north-south approaches.

The overall impact to the other signalized intersections to the east is expected to be nominal during either time period. The unsignalized intersections along Henry Avenue are expected to operate at acceptable levels, primarily due to their relatively low turning volumes.

The proposed full access entrance to Clayton Road opposite Rue de Gascony is expected to have less than desirable levels of service for the left-turns exiting the site to the west. Furthermore, both access driveways would be blocked frequently during the a.m. peak hour by the eastbound through lane queues from the Henry Avenue/Schoettler Road traffic signal.

The ability of motorists to turn left onto Clayton Road from the proposed full access or Rue de Gascony would be expected to operate poorly during both peak hours. Extremely long delays are anticipated for someone turning left out of the development via the western drive during the a.m. peak hour, while the p.m. delays are expected to be approximately one minute. The 95th percentile queue for the westbound left-turn movement into the proposed western driveway is forecasted to be less than 50-feet during the peak hours. As a result, the minimum deceleration distance (90 feet) will accommodate the entering westbound left-turns without queuing into the westbound thru lane.

The installation of a traffic signal along this stretch of Clayton Road to serve this development is not practical as a means of improving the exiting left-turn delays. It must be acknowledged that it is not uncommon along heavily traveled highways, such as Clayton Road, for motorists on many of the cross streets and private drives to incur lengthy delays. The presence of a center-

left-turn lane does allow for a motorist to complete their turn in two stages as opposed to waiting for a simultaneous gap in both directions of traffic flow. For example, a motorist exiting the proposed development destined to the west on Clayton Road could wait for eastbound Clayton Road to clear, turn into the center-left-turn lane and then wait for a gap in the westbound flows to merge into traffic. This practice is common throughout the greater St. Louis Metropolitan area.

It should be noted that MoDOT previously expressed concerns about providing a three-lane driveway (one inbound lane and separate left and right exit lanes) onto Clayton Road at the scoping meeting. As a result, the western driveway was also analyzed under a single northbound lane. The results of the single northbound lane access to Clayton Road are summarized in **Table 5** with only one lane. The northbound and southbound approaches degrade further.

2031 Build Conditions were also evaluated in an effort to assist with long term planning. Assuming the physical improvements and signal operation modifications recommended in the 2011 Build Conditions, it is feasible to maintain operating conditions along Clayton Road comparable to the No-Build scenario for the Year 2031. The service levels of most approaches at all signalized intersections would with not change or degrade more than one letter grade (example: LOS C to LOS D). Therefore, it can be concluded the impact of the development's traffic could be mitigated with above recommendations. Although, more significant improvements maybe required to address systematic congestion due to current conditions and traffic growth by 2031.

Table 5 – Operating Conditions – Single Northbound Exit Lane at Propsoed Full Access

<i>Intersection/Movement</i>	<i>2011 Build Condition</i>		<i>2031 Build Condition</i>	
	<i>AM Peak</i>	<i>PM Peak</i>	<i>AM Peak</i>	<i>PM Peak</i>
<i>Clayton Road at Rue de Gascony Lane/Site Driveway (Side-Street Stop Controlled)</i>				
Eastbound Left-Turn from Clayton Road	A (9.8)	C (18.2)	A (9.8)	C (23.8)
Westbound Left-Turn from Clayton Road	D (33.8)	B (13.6)	E (45.9)	B (14.9)
Northbound Site Driveway Exit – Approach	F (>200)	F (61.6)	F (>200)	F (92.7)
Southbound Rue de Gascony Lane	F (52.2)	E (37.5)	F (146.7)	F (55.3)

X (XX.X) - Level of Service (Vehicular delay in seconds per vehicle)

Conclusion

Crawford, Bunte, Brammeier has completed a study to evaluate the traffic impacts associated with a proposed commercial development in Ballwin, Missouri. The development site is located in the southwest quadrant of Clayton Road and Henry Avenue/Schoettler Road. A variety of uses are proposed including a CVS Pharmacy, general retail space, a sit-down restaurant, a coffee shop with drive-thru window, a bank with drive-thru lanes, general office space and a senior living facility. Two access drives are proposed to each Clayton Road and Henry Avenue.

The purpose of the study was to determine an acceptable access plan for the site and identify the need for roadway improvements to mitigate the impact of the site's traffic. The focus of our analysis was the a.m., and p.m. peak hours of a typical weekday.

After a detailed access review, it is recommend that one full access driveway be provided to Clayton Road opposite Rue de Gascony and one right-in/right-out only drive be located near the CVS property limit. A center median along Clayton Road is recommended to restrict left-turns by extending the existing median as shown in Exhibit 3.

Base traffic conditions were observed and evaluated to reveal constraints that currently exist at the signalized intersection of Clayton Road with Henry Avenue/Schoettler Road (northbound and eastbound approaches during the a.m. peak hour as well as the southbound approach during the p.m. peak hour).

Year 2010 No-Build Conditions, which considered additional traffic related to the full occupancy of the retail part of Town and Country Crossing as well as 2% background growth along Clayton Road, were evaluated for comparison to initial occupancy of conditions of the site. Similar constraints are expected at the intersection of Clayton Road with Henry Avenue/Schoettler Road (northbound and eastbound approaches during the a.m. peak hour as well as the southbound approach during the p.m. peak hour), slightly exacerbated by the increased traffic.

The analysis of the 2011 Build Conditions determined that the following improvements would be beneficial in conjunction with the development of the proposed commercial development:

- A dedicated eastbound right-turn deceleration lane will be warranted on Clayton Road in advance of the proposed Full Access Drive opposite Rue de Gascony;
- A dedicated eastbound right-turn deceleration lane will be warranted on Clayton Road in advance of the proposed right-in/right-out only drive;
- Extension of the raised median on Clayton Road is recommended to restrict the east driveway to right-turns only and still allow left-turns into and out of the proposed west driveway and Rue de Gascony;

- The signal timing at the intersection of Clayton Road with Henry Avenue/Schoettler Road should be modified to provide a few additional seconds of green time to the southbound thru movement during the p.m. peak hour; and
- It is acknowledged that the proposed full access driveway opposite Rue de Gascony, will be frequently blocked by the eastbound queues from the adjacent signal at Henry Avenue/Schoettler Road in the a.m. peak hour. Providing separate left and right-turn lanes at Clayton Road will help to reduce the delays for the right-turn vehicles. In fact, some left-turn movements will choose to use the signalized access to westbound Clayton Road via Henry Avenue to reduce wait times and frustration, especially during the peak hours. Consequently, those turning movements and associated delays may be lower at the unsignalized driveway.

Assuming the above physical improvements and signal timing modifications are implemented, it is feasible to maintain operating conditions along Clayton Road comparable to the No-Build Conditions for the Year 2011. The service levels of most approaches at the signalized intersections either do not change, or degrade only by one letter grade (example: LOS C to LOS D). The impact of the proposed development's traffic could be lessened with the above recommendations.

Appendix

Trip Generation Memo

Auxiliary Turn Lane Needs Analysis

Figure 1 – Right-Turn Lane Needs - Clayton Road at Propsoed West Driveway

Figure 2 – Right-Turn Lane Needs - Clayton Road at Propsoed Right-In/Right-Out Driveway

Figure 3 – Right-Turn Lane Needs - Henry Avenue at Propsoed North Driveway

Figure 4 – Right-Turn Lane Needs - Henry Avenue at Propsoed South Driveway

Figure 5 – Left-Turn Lane Needs - Henry Avenue at Propsoed North Driveway

Synchro 7 Outputs

Base Conditions

Year 2011 No-Build Conditions

Year 2011 Build Conditions

Year 2031 No-Build Conditions

Year 2031 Build Conditions

Technical Memorandum for Traffic Impact Study

Date: April 24, 2009

To: Mr. Jeff Baird, MoDOT
Mr. Richard Beckman, SLCDHT
Mr. Tom Aiken, City of Ballwin
Mr. Mr. Dan Theis, Brinkman
Mr. Bill Biermann, WB Properties,
Mr. Rob Taylor, PR&S

From: Lee Cannon, P.E., PTOE
Brian Rensing, P.E., PTOE

Subject: Technical Memorandum for Traffic Impact Study

Project: Development of the SW Quadrant of Clayton Road with Henry Avenue/Schoettler Road
Ballwin, Missouri
CBB Job No. 62-09

As you are aware, Crawford Bunte Brammeier (CBB) is working on a traffic impact study for a proposed development in the southwest quadrant of Clayton Road and Henry Avenue/Schoettler Road in Ballwin, Missouri. As an initial step in the traffic study, we have established base traffic volumes for the roadways within the study area; forecasted the amount of trips that would be generated by the development; estimated the directional distribution of these trips; and identified growth rates for future traffic volumes.

We have prepared the following memorandum to summarize these initial traffic study components. We ask that you review this memorandum and offer any thoughts or concerns that you may have. Crawford, Bunte, Brammeier will move forward with completing the remainder of the traffic study while the technical memorandum under review. For that reason, we ask that your agency offer comments and concerns as quickly as your schedule permits.

Baseline Traffic Volumes

The traffic study will evaluate conditions during the morning and afternoon peak periods of a typical weekday at the following intersections:

- Clayton Road at Henry Avenue/Schoettler Road;
- Clayton Road at Village Green/Town and Country Crossing;
- Clayton Road at Old Woods Mill Road; and
- All Proposed Site Entrances.

CBB performed a manual traffic count and queue observations in late April 2009 at the intersection of Clayton Road at Henry Avenue/Schoettler Road. It should be noted that CBB previously performed manual traffic counts at all of the study intersections as well as the

Route 141 interchange in early October 2008 as part of a signal timing project for MoDOT. Since the 2008 counts are within the MoDOT traffic impact criteria (2 or less years old), those counts were used as the base traffic conditions.

In general, the 2008 and 2009 traffic volumes at the intersection of Clayton Road at Henry Avenue/Schoettler Road are very similar. Where variations were found, the higher volume for any given movement was applied to be conservative, and the surplus was extended through the system. The most appreciable difference was the eastbound through volume during the a.m. peak hour, which was approximately 170 vehicles per hour (vph) heavier in 2009, representing an 8% increase. It should also be acknowledged that traffic volumes fluctuate day to day with changes up to 10% generally considered normal variation. **Exhibit 1** illustrates the traffic volumes which are intended to be used for the analysis of the existing conditions. The traffic volumes for the 2009 and 2008 counts are attached to the rear of this memo as Exhibit A and Exhibit B, respectively.

Background Traffic and Other Approved Developments

At the time of the 2008 traffic counts, it is our understanding that the retail components of the Town and Country Crossing development were completely built, but only partially occupied (Target, Whole Foods and select few businesses on the north end). Based on the forecasted trip generation of the original traffic study completed in January 2004 by CBB for the Town and Country Crossing development, the anchors alone are expected to generate approximately half of the development's traffic. Therefore, it can be reasoned that half of the development traffic is already accounted for in the 2008 traffic counts.

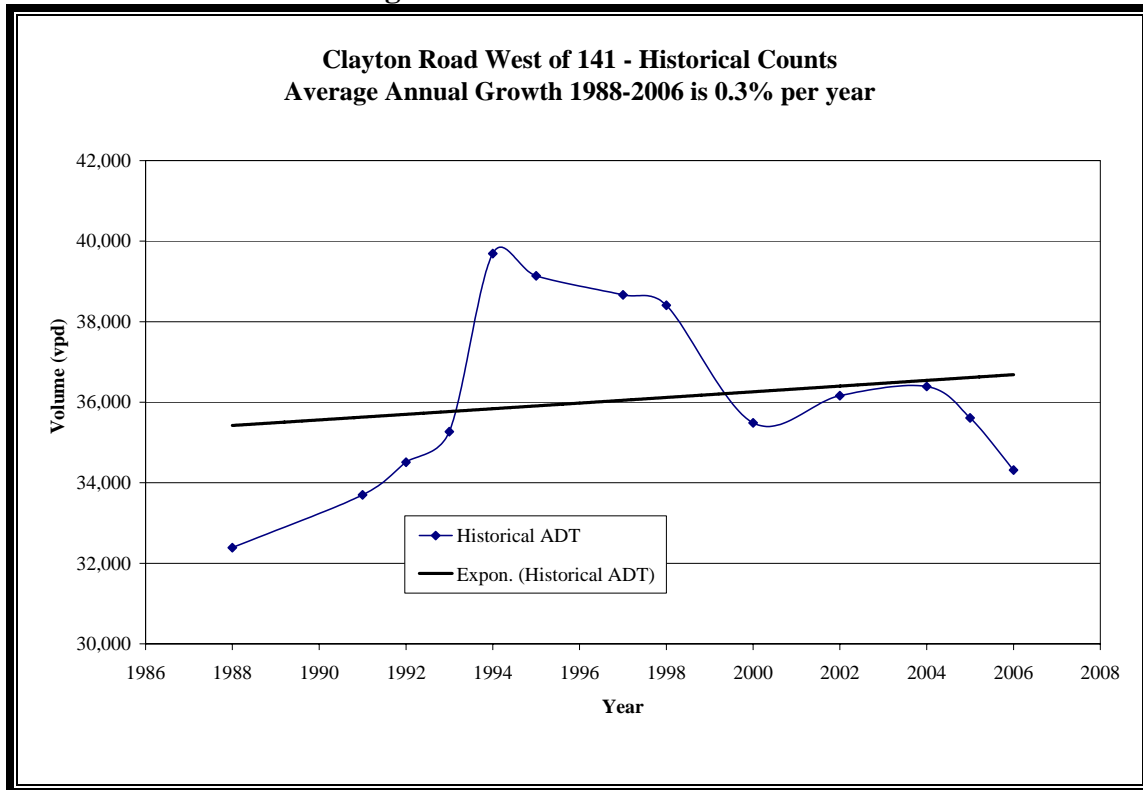
Since the Town and Country Crossing retail development is fully built but not occupied, we propose to increase traffic to the Town and Country Crossing development for the 2011 No-Build Scenario to account for the full occupancy of the remaining retail space. In order to keep the future traffic projections for the full occupancy of the Town and Country Crossing development relatively simple, we intend to double the 2008 traffic volumes oriented to Town and Country Crossing Drive (westbound left-turn, eastbound right-turn, northbound left-turn and northbound right-turn) and extend those trips through the study area. Additionally, a nominal amount of traffic (5-20 vph) will also be added to the thru movements on Old Woods Mill Road at Clayton Road to account for future trips using the Old Woods Mill Road access to Town and Country Crossing.

The future build-out of the Town and Country Crossing site also includes a residential portion on the south side of Clayton Road between Town and Country Crossing drive and Henry Avenue. In the scoping meeting, it was agreed that the residential development would likely occur after 2011; therefore, its traffic would be accounted for in the design horizon, 2031 traffic scenarios only. It was estimated that 65 condominium/townhome units could occupy the vacant area to complete the build-out of the Town and Country Crossing site.

The projected background growth was based on historical Average Daily Traffic (ADT) data obtained from MoDOT's count maps from 1988 to 2006. **Figure 1** illustrates the

historical traffic trend for Clayton Road. The traffic volumes have fluctuated between approximately 32,000 vehicles per day (vpd) to 40,000 vpd over the past 18 years resulting in an annual increase of approximately 0.3% per year on average.

Figure 1: Historical Traffic Data



The ADT has stabilized after peaking in 1994. As a result, we propose to use an annual growth rate of 1% for Clayton Road within the study area for the short term growth (2009 to 2011), which represents an overall growth of approximately 2%. This represents a very conservative approach based on the data. However, to address the 20-year design horizon, we propose to use an annual growth rate of 0.5% for Clayton Road (2011 to 2031), which represents an overall increase of 10.5%.

Proposed Development

The proposed development is located in the southwest quadrant of Clayton Road and Henry Avenue. Four commercial buildings are proposed near Clayton Road with a variety of uses which include: a CVS Pharmacy, general retail space, a sit-down restaurant, a coffee shop with drive-thru window, a bank with a drive-thru lanes and general office space. A fifth building is anticipated to be independent living located south of the commercial area along the west side of Henry Avenue. Two access drives are proposed to each Clayton Road and Henry Avenue. A site plan is attached to this memo.

Trip Generation

As a primary step in this analysis, traffic forecasts were prepared to estimate the amount of traffic that the proposed development would generate during each peak period. These forecasts were based upon information provided in the “Trip Generation Manual”, Eighth Edition, published by the Institute of Transportation Engineers (ITE). This manual, which is a standard resource for transportation engineers, is based on a compilation of nationwide studies documenting the characteristics of various land uses.

Based upon the recommended procedure for estimating trip generation outlined in the “Trip Generation Handbook, A Recommended Practice”, also published by the ITE (March 2001), the regression equation was utilized for:

- Land Use: 820 – Shopping Center (pg 1497)

The average trip rates were used for:

- Land Use: 710 – General Office Building (pg 1194)
- Land Use: 881 – Pharmacy/Drugstore with Drive-Thru (pg 1714)
- Land Use: 912 – Drive-In Bank (pg 1746)
- Land Use: 932 – High-Turnover (Sit-Down) Restaurant (pg 1794)
- Land Use: 937 – Coffee/Donut Shop with Drive-Thru (pg 1850)
- Land Use: 255 – Continuing Care Retirement Community (pg 523)

It should be noted that ITE does not provide trip generation specifically for independent care facilities. As a result, several similar senior housing land uses were compared with regards to their trip generation. These facilities tend to have lower traffic demands than other multi-family residential facilities since some residents may not have a personal vehicle or license to drive. Instead, most facilities of this nature provide transportation for their tenants in the form of scheduled trips on a van or mini-bus, thereby minimizing the number of trips into and out of the facility by the residents. As a result, traffic is primarily generated by employees. Furthermore, most employees and residents typically arrive and depart during off-peak periods, so the facilities’ peak hours typically occur in the late morning or early afternoon. For the various senior housing land uses, the Continuing Care Retirement Community is expected to generate the most traffic during the peak hours; therefore, it was utilized in our trip estimation.

The resulting traffic projection for the proposed development is shown in **Table 1**. It is important to note that the ITE estimates assume that each of the development’s components would be freestanding. Instead, the commercial uses would share parking and access, and published studies show that patrons of multi-use developments often visit more than one store within a center on a single visit. As a result, a 10% and 20% reduction was applied to several of the land uses to account for motorists that visit more than one use on the site as part of a single trip during the a.m. and p.m. peak hour, respectively. No reductions were applied to the proposed pharmacy, independent care community or general office since those uses would be expected to generate a higher proportion of “destination” trips. **Table 2** summarizes the common trip assumptions.



Table 1 – Site Generated Traffic

Land Use	Size	AM Peak Hour			PM Peak Hour		
		In	Out	Total	In	Out	Total
Pharmacy/Drugstore with Drive-Thru	12,900 ft ²	20	15	35	65	65	130
Shopping Center (General Retail)	13,150 ft ²	30	15	45	80	85	165
High-Turnover (Sit-Down) Restaurant	5,600 ft ²	35	30	65	35	25	60
Coffee Shop with Drive-Thru	1,750 ft ²	100	95	195	40	40	80
Drive-In Bank	3 Lanes	15	15	30	40	40	80
General Office Building	3,750 ft ²	5	0	5	0	5	5
Continuing Care Retirement Community	125 Units	15	10	25	20	20	45
Subtotal		220	180	400	280	280	560
<i>Common Trip Reduction (see Table 2)</i>		(15)	(15)	(30)	(40)	(35)	(75)
Total Trips		205	165	370	240	245	485
<i>Pass-by Trips (See Table 2)</i>		60	60	120	105	105	210
<i>New Trips</i>		145	105	250	135	140	275

Table 2: Common and Pass-by Trip Assumptions

Land Use	Common Trip Assumptions		Pass-by Trip Assumptions	
	AM Peak Hour	PM Peak Hour	AM Peak Hour	PM Peak Hour
Pharmacy/Drugstore with Drive-Thru	0%	0%	49%	49%
Shopping Center (General Retail)	10%	20%	25%	34%
High Turnover Sit-Down Restaurant	10%	20%	40%	43%
Coffee Shop with Drive-Thru	10%	20%	50%	50%
Drive-In Bank	10%	20%	30%	47%
General Office Building	0%	0%	0%	0%
Continuing Care Retirement Community	0%	0%	0%	0%

Consequently, the proposed development would be expected to generate a total of approximately 370 external trips during the weekday a.m. peak hour and 490 external trips during the weekday p.m. peak hour. However, it should be noted that not all of these trips would represent *new* traffic on the adjacent roadways. Specifically, a significant portion of the traffic attracted to this site would already be traveling on Clayton Road or Henry Avenue as part of another trip; i.e., “pass-by” trips.

Based upon statistical information provided in the “Trip Generation Handbook, A Recommended Practice” the pass-by trip percentages summarized in **Table 2** were assumed for the proposed uses. These pass-by trips would create turning movements at the driveways serving the site, but they would not represent new traffic on the adjacent roadways. Therefore, the development would be expected to generate a total of 250 and 280 “new” trips during the a.m. and p.m. peak hours, respectively.

Directional Distribution

Access to the site is proposed via two access drives on Clayton Road and two access drives on Henry Avenue. In subsequent steps of the traffic study, the site-generated trips will be assigned into and out of the proposed development based upon anticipated directional distributions. The pass-by trips will be assigned based on the existing traffic volumes along the adjacent roadways, while the new site-generated trips will be assigned as shown below:

- 58% to and from east on Clayton Road
 - 52% to and from the east on Clayton Road/Route 141;
 - 2% to and from the north on Old Woods Mill Road;
 - 2% to and from the south on Old Woods Mill Road;
 - 2% to and from the north on Village Green;
- 25% to and from the west on Clayton Road;
- 10% to and from the north on Schoettler Road; and
- 7% to and from the south on Henry Avenue.

We appreciate your review of this memorandum and look forward to receiving your comments and/or consensus on this information. Each participant is asked to review the above and offer any comments or changes prior to April 30. Please contact our office should there be any questions or need for additional information.

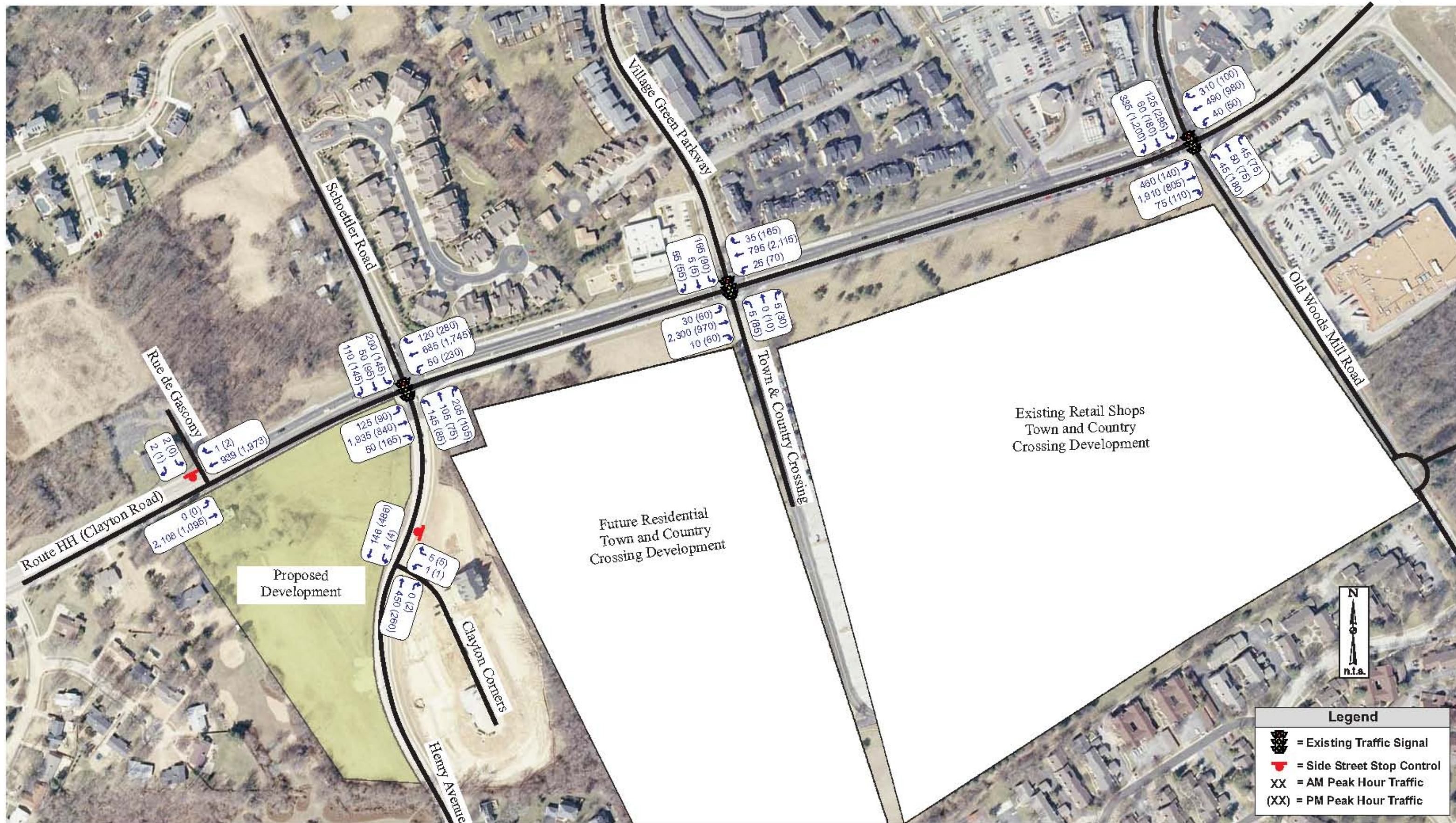


Exhibit I: Base Traffic Volumes (2009)

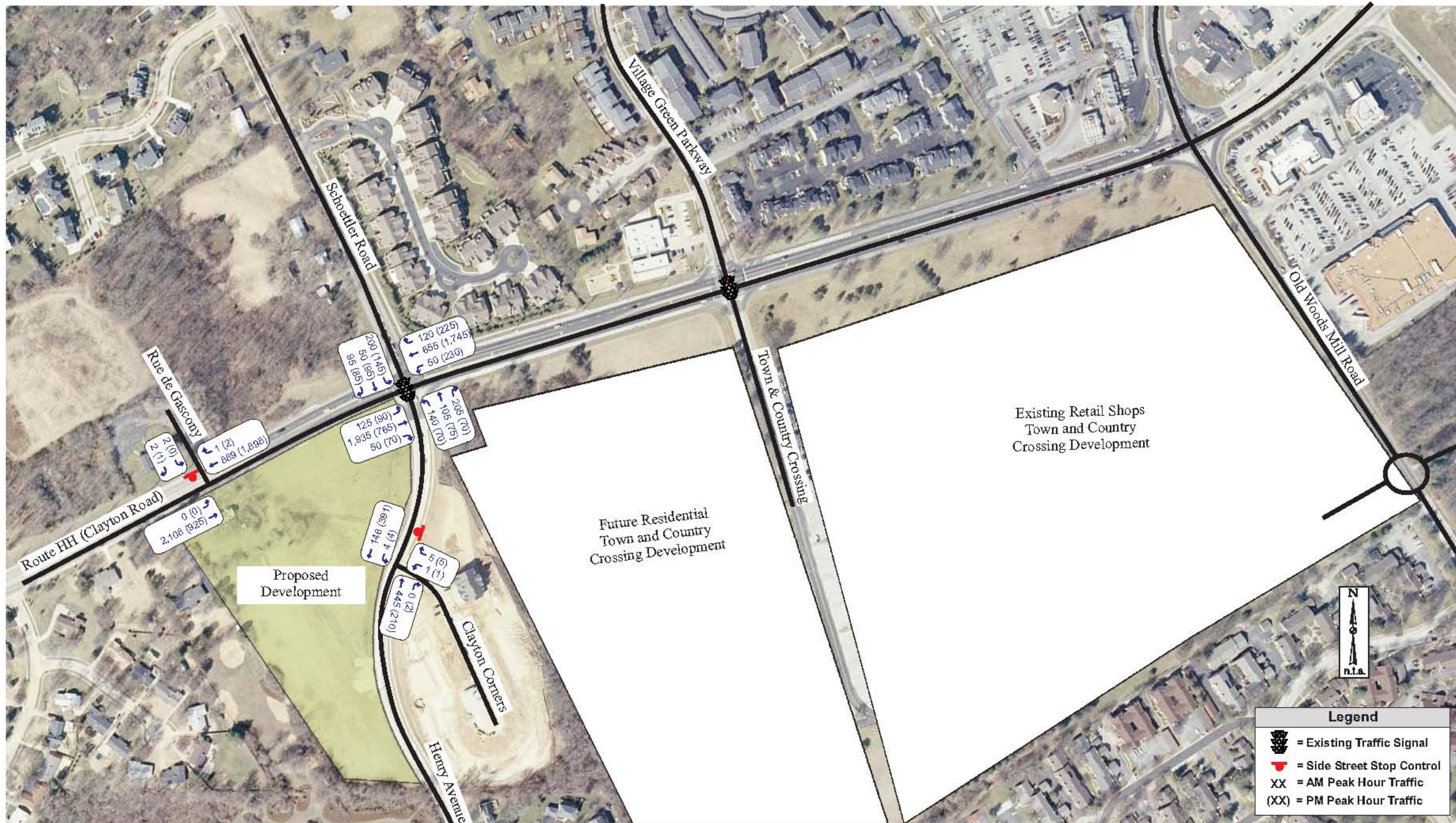


Exhibit A: Existing Traffic Volumes (2009)

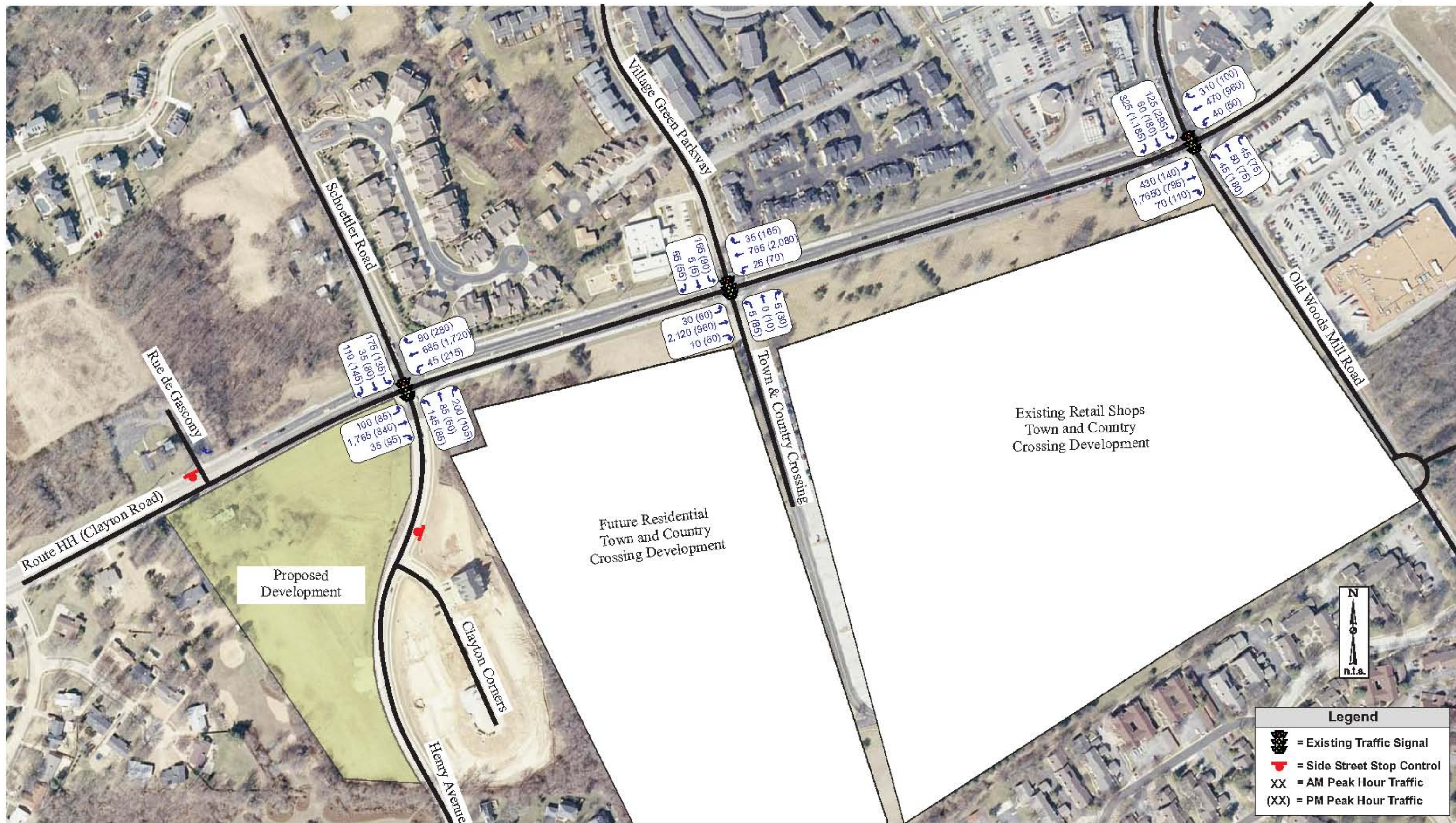
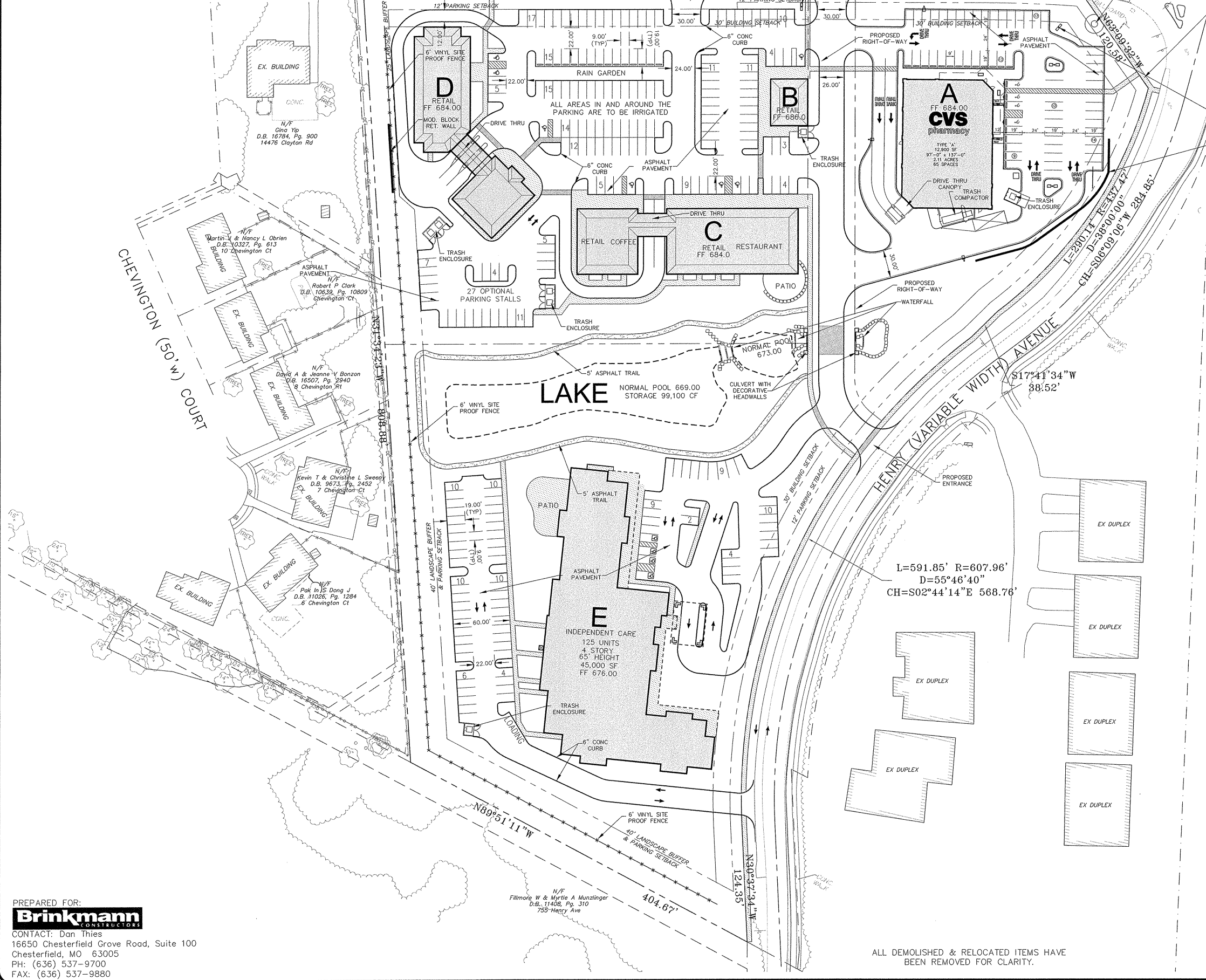


Exhibit B: Existing Traffic Volumes (2008)

SITE DEVELOPMENT PLAN CLAYTON & HENRY

PART OF SECTION 25
TOWNSHIP 45 NORTH, RANGE 4 EAST
CITY OF BALLWIN, ST. LOUIS COUNTY, MISSOURI



PARKING DATA

BUILDING	SQ. FT.	PARKING REQ.
A DRUG STORE	12,900 S.F. @5 P.S./1,000 S.F.	65 P.S.
B RETAIL	2,000 S.F. @5 P.S./1,000 S.F.	10 P.S.
C RETAIL COFFEE (65 SEATS)	1,750 S.F. @1 P.S./4 SEATS	10 P.S.
RESTAURANT (180 SEATS)	5,600 S.F. @1 P.S./4 SEATS	45 P.S.
SUB-TOTAL:	14,500 S.F.	91 P.S.
D RETAIL BANK	4,000 S.F. @5 P.S./1,000 S.F.	20 P.S.
7,500 S.F. @4 P.S./1,000 S.F.		30 P.S.
SUB-TOTAL:	11,500 S.F.	50 P.S.
TOTAL:	40,900 S.F.	216 P.S.
MIXED-USE PARKING REDUCTION (15%):		-32 P.S.
TOTAL REQUIRED:		184 P.S.
PARKING PROVIDED:	@ 4.89 P.S./1,000 S.F.	200 P.S.
OPTIONAL		27 P.S.
		(+43 P.S.)
F (125 UNITS) INDEPENDENT CARE	180,00 S.F. @1 P.S./6 UNITS	21 P.S.
PARKING PROVIDED	@ 1 P.S./1.45 UNITS	88 P.S.
		(+65 P.S.)

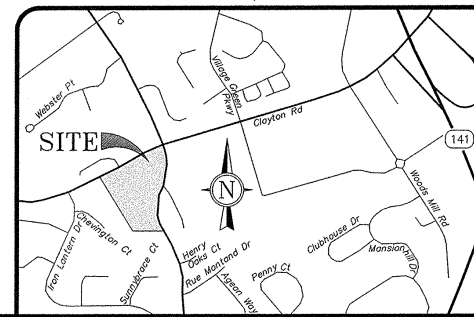
GREENSPACE CALCULATIONS

SITE AREA = 507,040 S.F.
 BUILDING COVERAGE = 85,900 S.F. (17%)
 PAVED AREA = 229,700 S.F. (45%)
 LAKE AREA = 18,510 S.F. (4%)
 DIFFERENCE = 172,930 S.F. GREENSPACE
 [(172,930 S.F.)/(507,040 S.F.)] x 100 = 35% GREENSPACE
 [(85,900 S.F.)/(507,040 S.F.)] x 100 = 17% FLOOR AREA RATIO

PERTINENT DATA

OWNER: CLAYTON HENRY, LLC (UNDER CONTRACT)
 DEVELOPER: CLAYTON HENRY, LLC
 16650 CHESTERFIELD GROVE RD, STE. 1000
 CHESTERFIELD, MISSOURI 63005
 EXISTING ZONING: R-1 "RESIDENTIAL"
 PROPOSED ZONING: "NEIGHBORHOOD COMMERCIAL OVERLAY DISTRICT"
 SITE AREA: 11.64 ACRES
 WATER SHED: GRAND GLAIZE CREEK
 WATER DISTRICT: MISSOURI AMERICAN WATER CO
 FIRE DISTRICT: WEST COUNTY EMS
 SCHOOL DISTRICT: PARKWAY
 SEWER DISTRICT: MSD
 GAS SERVICE: LACLEDE GAS CO.
 ELECTRIC SERVICE: AMEREN U.E.
 TELEPHONE SERVICE: AT&T

LOCATION MAP



ALL DEMOLISHED & RELOCATED ITEMS HAVE BEEN REMOVED FOR CLARITY.

PREPARED FOR:
Brinkmann
 CONSTRUCTORS
 CONTACT: Dan Thies
 16650 Chesterfield Grove Road, Suite 100
 Chesterfield, MO 63005
 PH: (636) 537-9700
 FAX: (636) 537-9880

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 www.grimesconsulting.com

REV. NO.	DATE	REMARKS
1	03/21/09	PER OWNER COMMENTS
2	04/16/09	PER CITY COMMENTS

SITE DEVELOPMENT PLAN
CLAYTON & HENRY
 SW CORNER OF INTERSECTION

PROPOSED
 SITE PLAN

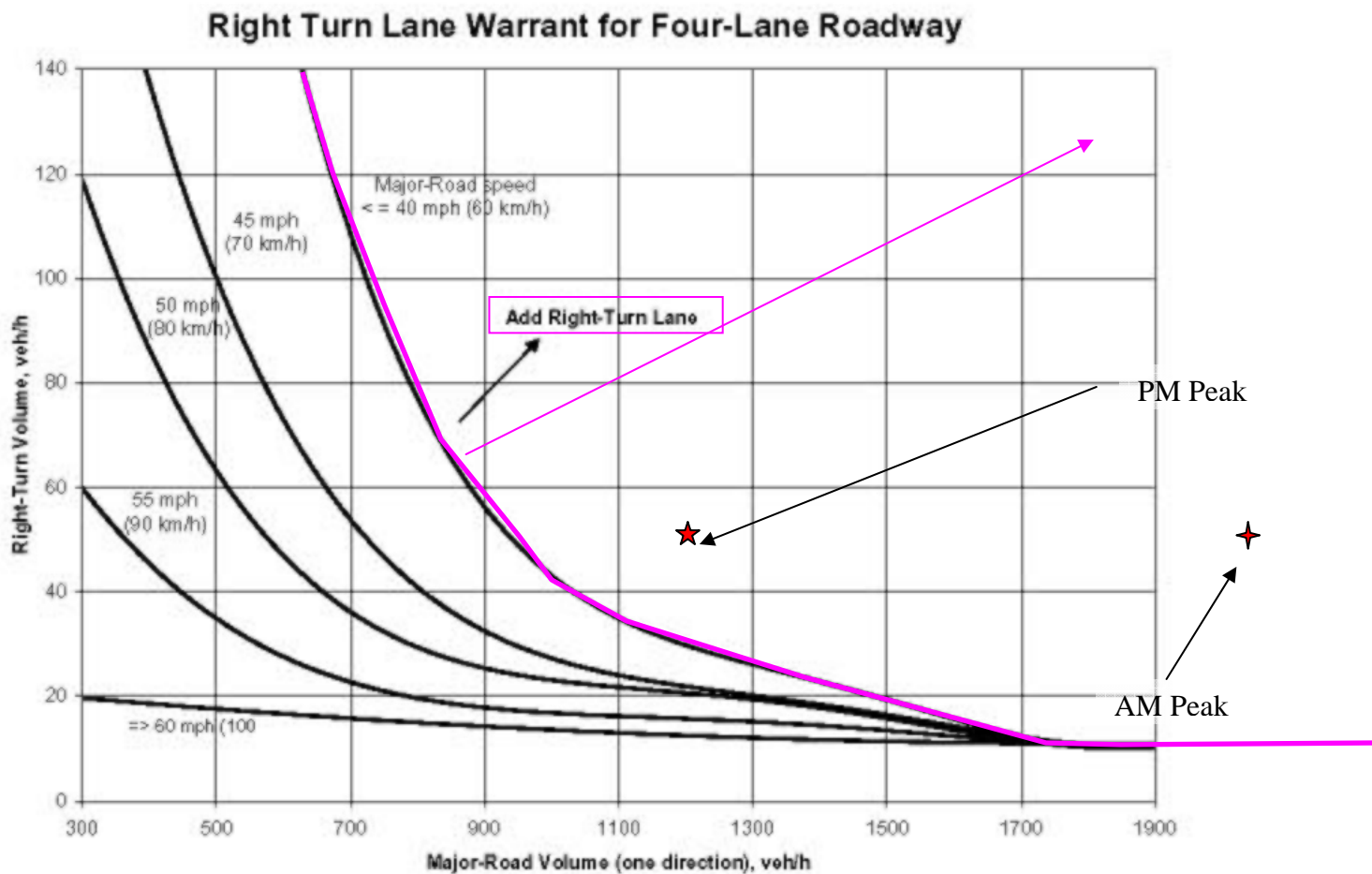
JOB NUMBER: 2062
 DRAWN BY: JLW
 DATE: 03/20/09
 CHECKED BY: LJM
 DATE: 30/20/09
 SHEET:

C2

Auxiliary Turn Lane Needs Analysis

Warranted

Figure 1
Clayton Road at Proposed West Driveway
Right-Turn Lane Needs Evaluation
2011 Build Conditions



The following data are required:

1. Advancing Volume (veh/hr) - The advancing volume should include the right-turn, left-turn and through movements in the same direction as the right turning vehicle.
2. Right Turning Volume (veh/hr) - The right turning volume is the number of advancing vehicles turning right.
3. Operating Speed (mph) - The greater of design or posted speed.

Note: Right turn lane not warranted for right turn volume less than 10 vph

If the combination of major-road approach volume and right-turn volume intersects above or to the right of the speed trend line corresponding the major road operating speed, then a right-turn lane is warranted.

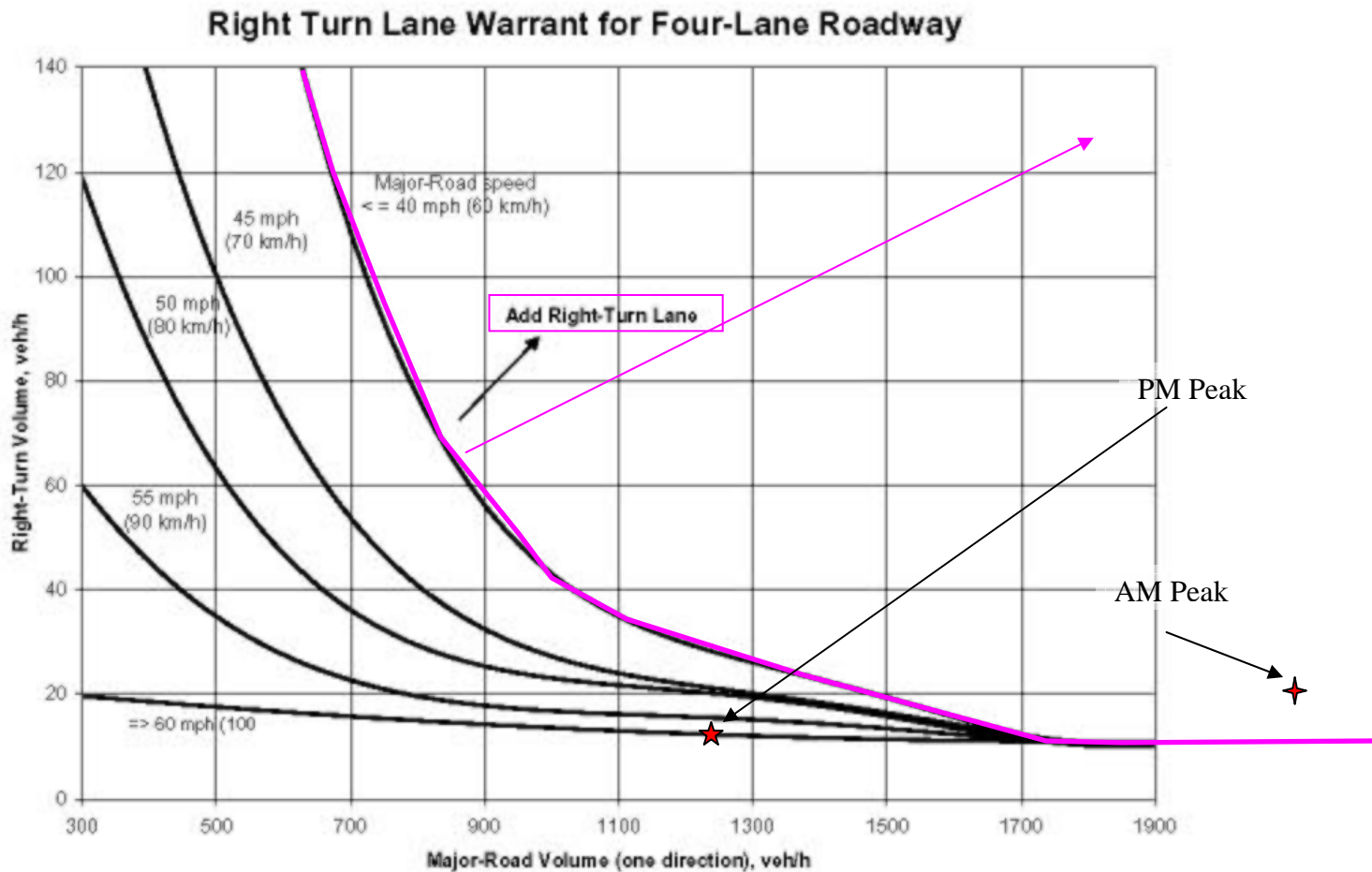
Roadway Speed
40 mph

AM Peak Hour
 $V_A = 2,198$ vph
Right-Turns = 50

PM Peak Hour
 $V_A = 1,195$ vph
Right-Turns = 50

Warranted

Figure 2
Clayton Road at Proposed East Driveway
Right-Turn Lane Needs Evaluation
2011 Build Conditions



The following data are required:

1. Advancing Volume (veh/hr) - The advancing volume should include the right-turn, left-turn and through movements in the same direction as the right turning vehicle.
2. Right Turning Volume (veh/hr) - The right turning volume is the number of advancing vehicles turning right.
3. Operating Speed (mph) - The greater of design or posted speed.

Note: Right turn lane not warranted for right turn volume less than 10 vph

If the combination of major-road approach volume and right-turn volume intersects above or to the right of the speed trend line corresponding the major road operating speed, then a right-turn lane is warranted.

Roadway Speed
40 mph

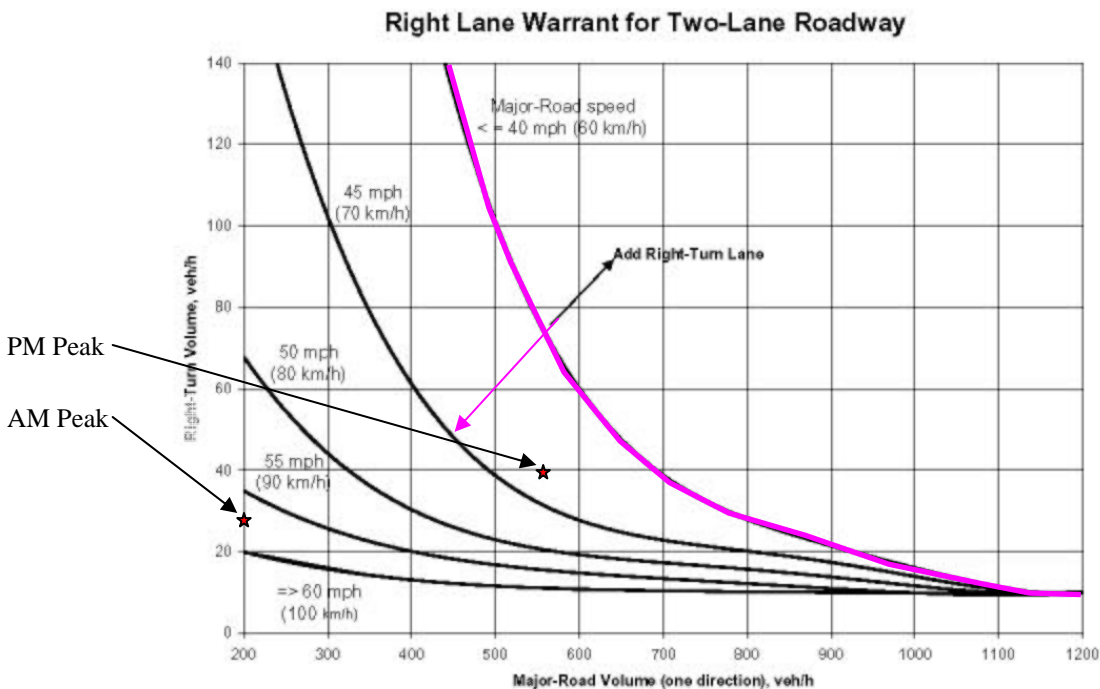
AM Peak Hour
 $V_A = 2,210$ vph
Right-Turns = 20

PM Peak Hour
 $V_A = 1,220$ vph
Right-Turns = 15

Figure 3 Henry Avenue at Proposed North Site Drive Right-Turn Lane Needs Evaluation 2031 Build Conditions

**Not
Warranted**

Posted Speed = 35 mph	
<u>AM Peak Hour</u>	<u>PM Peak Hour</u>
V _a = 197 vph	V _a = 582 vph
Right-Turns = 30 vph	Right-Turns = 35 vph



The following data are required:

1. Advancing Volume (veh/hr) - The advancing volume should include the right-turn, left-turn and through movements in the same direction as the right turning vehicle.
2. Right Turning Volume (veh/hr) - The right turning volume is the number of advancing vehicles turning right.
3. Operating Speed (mph) - The greater of design or posted speed.

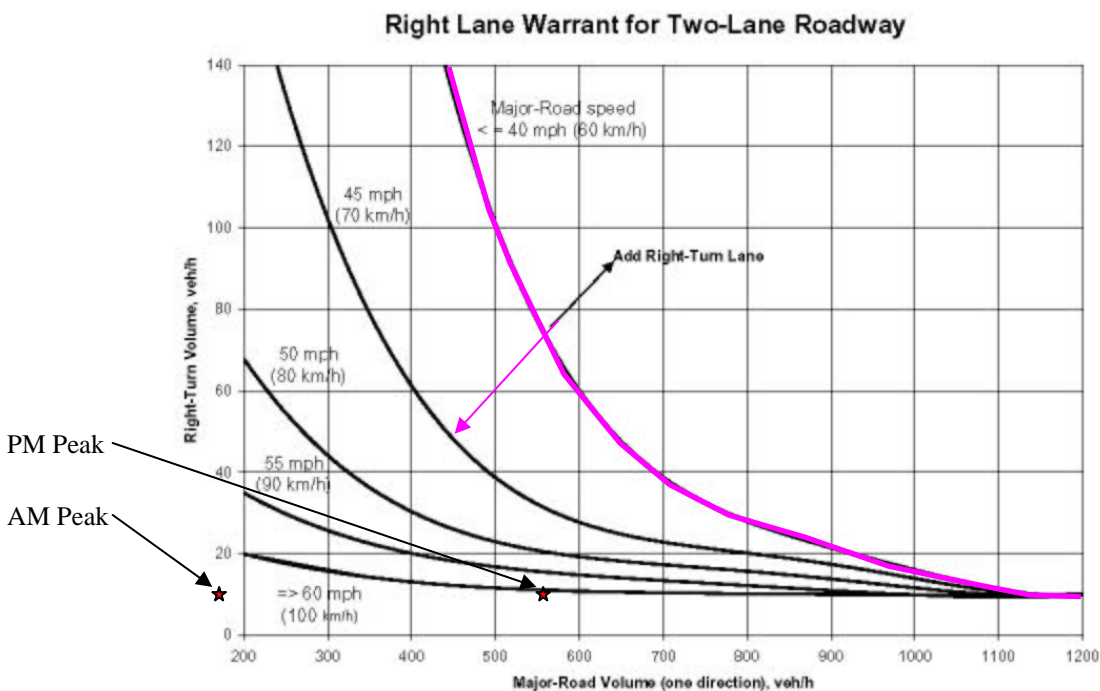
Note: Right turn lane is not warranted for right turn volume less than 10 vph

If the combination of major-road approach volume and right-turn volume intersects above or to the right of the speed trend line corresponding the major road operating speed, then a right-turn lane is warranted.

Figure 4 Henry Avenue at Proposed South Site Drive Right-Turn Lane Needs Evaluation 2031 Build Conditions

**Not
Warranted**

Posted Speed = 35 mph	
<u>AM Peak Hour</u>	<u>PM Peak Hour</u>
Va = 172vph	Va = 567 vph
Right-Turns = 5 vph	Right-Turns = 10 vph



The following data are required:

1. Advancing Volume (veh/hr) - The advancing volume should include the right-turn, left-turn and through movements in the same direction as the right turning vehicle.
2. Right Turning Volume (veh/hr) - The right turning volume is the number of advancing vehicles turning right.
3. Operating Speed (mph) - The greater of design or posted speed.

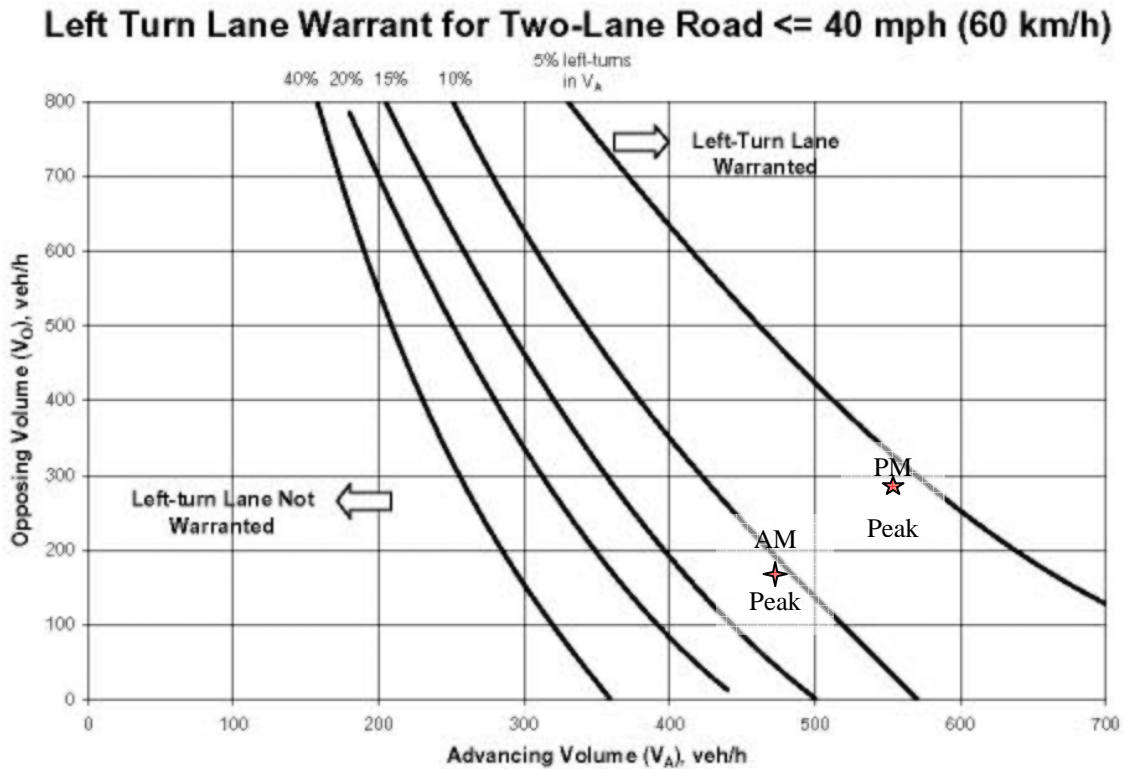
Note: Right turn lane is not warranted for right turn volume less than 10 vph

If the combination of major-road approach volume and right-turn volume intersects above or to the right of the speed trend line corresponding the major road operating speed, then a right-turn lane is warranted.

Figure 5
Henry Avenue at Proposed Northern Site Driveway
Right-Turn Lane Needs Evaluation
2031 Build Conditions

Not Warranted

<u>AM Peak Hour</u>	<u>PM Peak Hour</u>
NB LT = 15	SB LT = 10
$V_A = 485$ vph	$V_A = 297$ vph
$V_O = 197$ vph	$V_O = 582$ vph
% LT = 3 %	% LT = 3 %



The following data are required:

1. Opposing Volume (veh/hr) - V_O - The opposing volume should include only the right-turn and through movements in the opposite direction of the left turning vehicle.
2. Advancing Volume (veh/hr) - V_A - The advancing volume should include the right-turn, left-turn and through movements in the same direction as the left turning vehicle.
3. Operating Speed (mph) - The greater of design or posted speed.
4. Percentage of left turns in V_A

Synchro 7 Outputs
Available Upon Request