July 25, 2017
Updates September 12, 2017

Mrs. Lee Ann Difani
Cora Bopp Family Limited Partnership
12715 Irene Marie Way
Creve Coeur, Missouri 63141

RE: Traffic Planning Study
Bopp Property Area Plan – Mixed Use
Bryan Road and Feise Road
Dardenne Prairie, Missouri
CBB Job #25-17

Dear Mrs. Difani:

As requested, CBB has completed a Traffic Planning Study for the Bopp property located in the northwest quadrant of the intersection of Bryan Road and Feise Road in Dardenne Prairie, Missouri. The location of the site in relation to the surrounding road system is depicted in **Figure 1**. Although the site is in Dardenne Prairie, the City of O'Fallon owns and maintains Bryan Road. As such, any access or roadway improvements on Bryan Road will require the approval of the City of O'Fallon.

Based on the concept plan provided at the commencement of the study, the overall area plan encompasses approximately 180 acres and would include a mix of retail, office and residential uses. Based on discussions with the owner, the site would likely develop in phases over the next several years, though a specific timeframe is unknown at this point. Currently, there are no specific known users. A schematic of the conceptual site plan is shown in **Figure 2**.

CBB previously prepared a Traffic Impact Study in March 2016 for a portion of the overall Bopp property encompassing approximately 16 acres, also referred to as Zone 1 later in this report, for a proposed grocery store with fueling station and three outlots. Since that study was completed, the proposed grocery tenant no longer plans to build on the site.

The purpose of this Traffic Planning Study was to determine the number of additional trips that could be generated by the development of the overall Bopp property considering the current concept plan and evaluate the impact on the operating conditions for the adjacent roadways. This planning study is intended to assess the long-term impacts of the build-out of the Bopp property and assist in discussions with the City of O'Fallon regarding the access for the property off Bryan Road. As requested by the City, the focus of this study was the morning and evening peak period a typical weekday, and the midday peak period of a Saturday

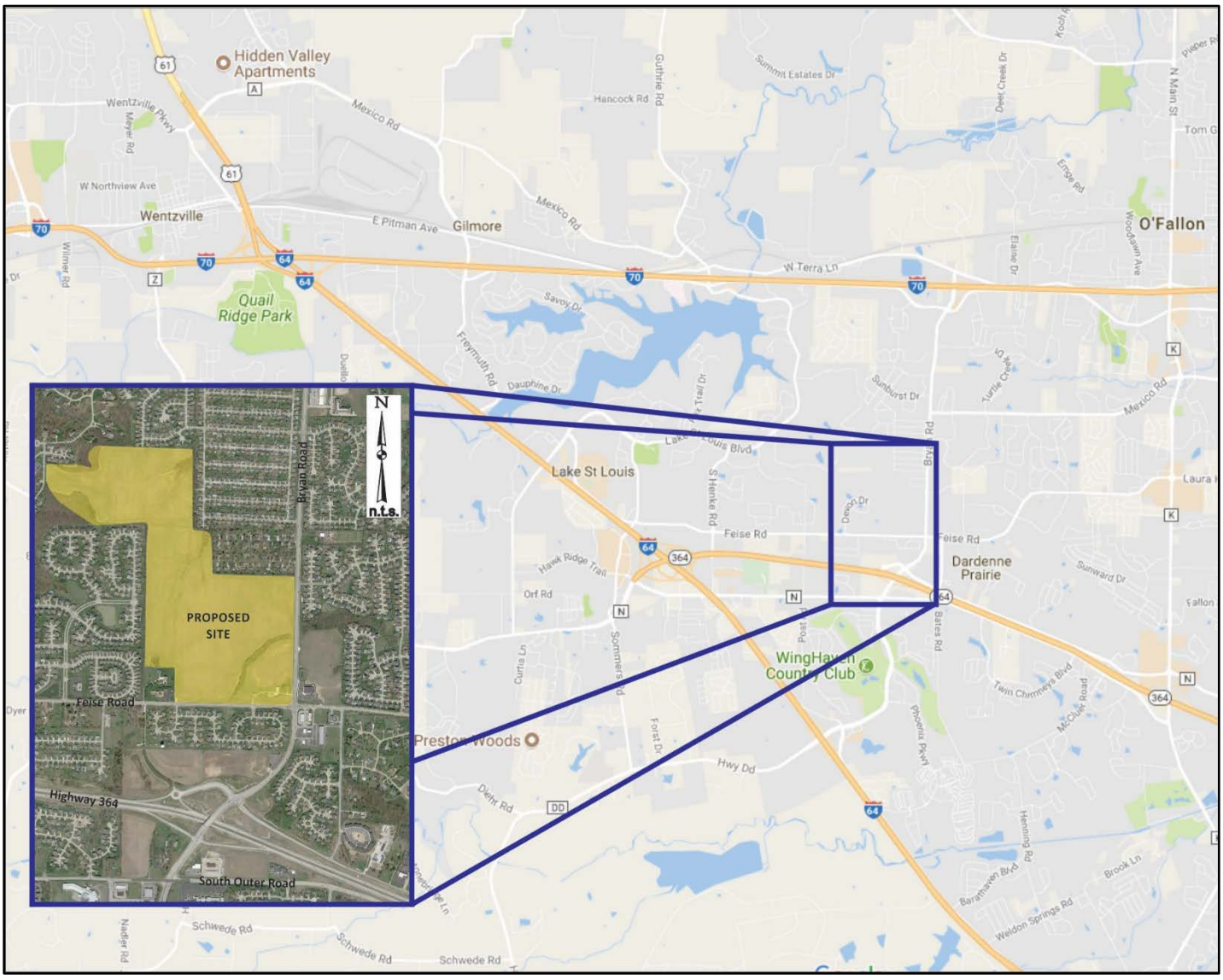


Figure 1: Project Location Map

CBB met with the City of O'Fallon at the commencement of the study process to develop the scope of work for this Traffic Planning Study. CBB also provided the City a Technical Memo summarizing the proposed site trip generation and directional distribution estimates for the proposed development area, as well as the 20-year background traffic growth assumptions and gained their consensus on the assumptions prior to completing the traffic analyses.

Figure 2: Bopp Overall Area Plan - Concept Plan (provided by Volz)

As requested, the following intersections noted below and depicted in **Figure 3** were included in the study:

1. Bryan Road and Great Warrior Drive;
2. Bryan Road and Crimson Meadow Drive/Proposed Site Drive;
3. Bryan Road and Feise Road;

4. Bryan Road and QT Drive;
5. Bryan Road and commercial drive (PNC Bank);
6. Bryan Road and 364 Westbound Ramp/North Outer Road;
7. Bryan Road and 364 Eastbound Ramp;
8. Bryan Road and Highway N;
9. Feise Road and Mt. Helena Lane/Proposed Site Drive;
10. Feise Road and Mt. McKinley Drive/Proposed North South Road;
11. Feise Road and Devon Drive;
12. Bryan Road and Proposed Cora Marie Drive;
13. Bryan Road and Proposed RIRO Drive;
14. Feise Road and Proposed ¾ Site Drive;
15. Cora Marie Drive and Zone 1 Drive;
16. Cora Marie Drive and Zone 2/3 East Drive;
17. Cora Marie Drive and Zone 2/3 West Drive; and
18. Cora Marie Drive North South Road.

As requested, the following analysis scenarios were considered:

- 2017 Existing Conditions;
- 2037 No-Build Conditions (Existing plus background growth);
- 2037 Build Conditions (2037 No-Build plus full build out of Bopp Property).
    - As requested by the City of O'Fallon, a sensitivity analysis was completed to assess the impact at the intersections of Bryan Road with Feise Road and with Cora Marie Drive if an internal connection was provided to Devon Drive to the west.
    - As requested, a sensitivity analysis was also completed to assess the impact at the intersections of Bryan Road with Feise Road and with Cora Marie Drive if the proposed access for Zone 3 (access opposite Crimson Meadow Drive) is restricted to a right-in/right-out.

The following report presents the methodology and findings relative to the Existing, 2037 No-Build, and 2037 Build conditions. The methodology employed to complete this study, along with the findings and recommendations are discussed in greater detail in the subsequent sections.

Figure 3: Study Intersections

EXISTING CONDITIONS

Area Roadway System: The existing roadways and intersections within the study area are described in the following paragraphs. The existing intersection lane configuration for the intersections within the study area are shown in **Exhibit 1.**

Bryan Road is a north-south major arterial maintained by the City of O'Fallon. Bryan Road serves central St. Charles County providing a connection to I-70 approximately two miles to the north and to Route 364 (Page Avenue) approximately one half mile south and I-64 approximately two miles south of the subject site. The road provides five lanes, two in each direction with a center two-way left-turn lane (TWLTL) and has a posted speed limit of 40 miles per hour (mph). A sidewalk has been constructed along the west side of the road and a multi-use trail is located along the east side of the roadway.

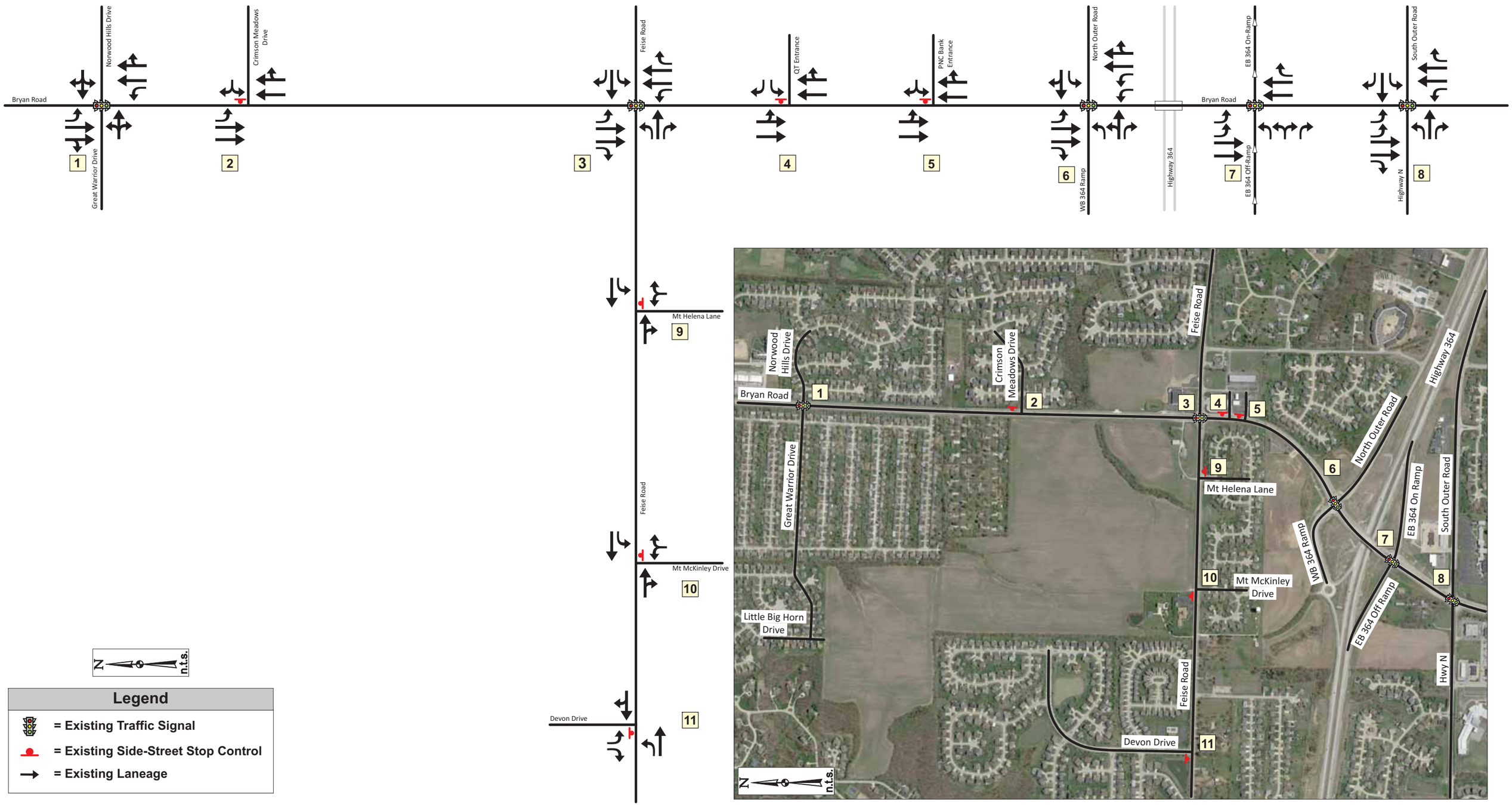
Feise Road is an east-west roadway maintained by the City of Dardenne Prairie adjacent to the site. Based on MoDOT's Functional Classification System Map, to the west Feise Road serves as an urban collector roadway, while to the east it serves as a minor arterial roadway. The road provides three lanes, one in each direction with a center TWLTL and has a posted speed limit of 35 mph. Sidewalks are provided along both sides of Feise Road.

The intersection of Bryan Road and Feise Road is controlled by a traffic signal. The signal is part of a coordinated traffic signal system along Bryan Road from just south of I-70 to just north of I-64. Separate right- and left-turn lanes are provided on all approaches to the intersection. All approaches operate under protected plus permissive phasing with a flashing yellow arrow to indicate permissive left turns. In addition, a right-turn overlap phase is provided for northbound and southbound Bryan Road. Push-button activated pedestrian signals and crosswalks are provided for all approaches at the intersection. **Figure 4** provides an aerial view of the Bryan Road and Feise Road intersection.

Route 364 (Page Avenue) is a freeway near the study area providing a connection between St. Charles and St. Louis Counties. The freeway provides four lanes, two in each direction, with a wide grassy median. Pedestrian and bicycle accommodations are not provided.

North 364 Outer Road/Highway N is a minor arterial that runs east-west. The road generally provides two lanes, one lane in each direction. Pedestrian and bicycle accommodations are not provided along North 364 Outer Road or Highway N.

The intersection of Bryan Road and North 364 Outer Road/Highway N is controlled by a traffic signal. The west leg of the intersection serves both the on- and off-ramps for westbound Route 364. The eastbound and westbound left-turns operate under split phasing. The northbound left-turns operate under protected-only phasing, and the southbound approach operates under protected plus permissive phasing with a flashing yellow arrow. Pedestrian crosswalks with push-button actuation are provided for northbound and southbound pedestrians along Bryan Road. An aerial view of the intersection is shown in **Figure 5.**



N n.t.s.

Legend

- = Existing Traffic Signal
- = Existing Side-Street Stop Control
- = Existing Laneage

Exhibit 1: Existing Lane Configuration and Traffic Control

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Figure 4: Aerial View of Bryan Road and Feise Road Intersection

Figure 5: Aerial View of Bryan Road and North 364 Outer Road/Highway N Intersection

South 364 Outer Road/Highway N is a collector road that runs east-west. The road generally provides three lanes, one in each direction with a center TWLTL. The posted speed limit is 35 mph. Sidewalks are provided along the south side of the roadway to the west of Bryan Road and along the commercial frontage on the north side of the road to the east of Bryan Road. Bike lanes are provided along both sides of the roadway to the east of Bryan Road.

The intersection of Bryan Road and the Eastbound 364 Off-Ramp is controlled by a traffic signal. The eastbound left-turns are protected in a single eastbound phase. The southbound left-turns operate under protected-only phasing. Pedestrian crosswalks with push-button actuation are provided for northbound and southbound pedestrians along Bryan Road. An aerial view of the intersection is shown in **Figure 6.**

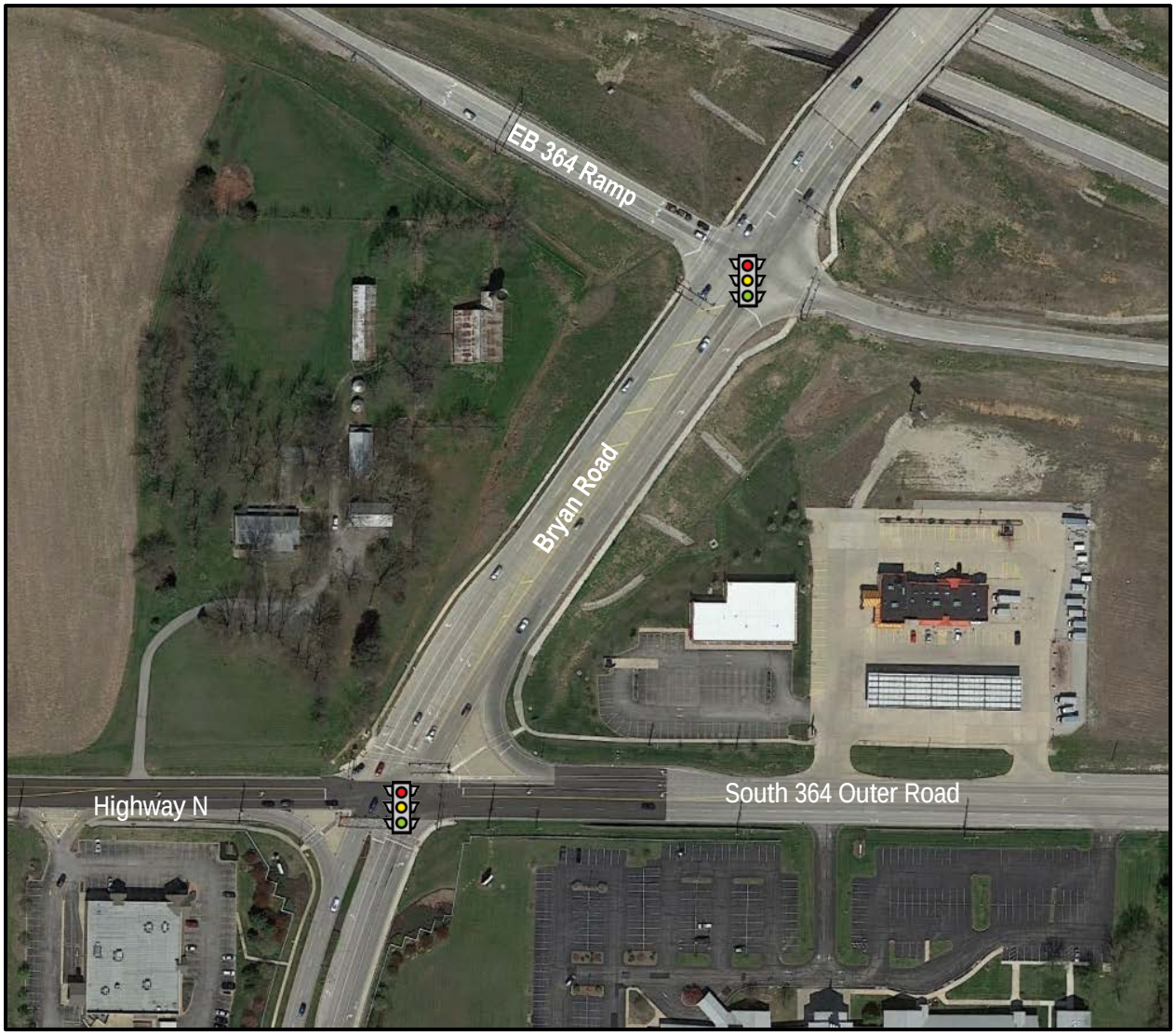


Figure 6: Aerial View of Bryan Road at Eastbound 364 Ramp and South 364 Outer Road/Highway N Intersections

The intersection of Bryan Road and South 364 Outer Road/Highway N is controlled by a traffic signal. The eastbound and westbound right-turn lanes are channelized. All left-turns operate under protected-only phasing. Push-button activated pedestrian signals and crosswalks are provided for all approaches at the intersection. An aerial view of the intersection is also shown in **Figure 6.**

Devon Drive is a local road maintained by the City of Dardenne Prairie which provides access to the Bainbridge subdivision from Feise Road. The road provides two lanes, one in each direction, with a grassy median. The posted speed limit is 25 mph. Sidewalks are provided along the east side of the road. The intersection of Feise Road and Devon Drive is controlled by a side-street stop with free-flow traffic along Feise Road. A pedestrian crosswalk is marked across the north leg (Devon Drive).

Mt. McKinley Drive and **Mt. Helena Lane** are local roads maintained by the City of Dardenne Prairie which provides access to the Pinnacle Pointe subdivision from Feise Road. The roads provide two lanes, one in each direction. The posted speed limit is 25 mph. Sidewalks are not provided along either roadway.

The intersection of Feise Road and Mt. McKinley Drive is controlled by a side-street stop with free-flow traffic along Feise Road. A pedestrian crosswalk is marked across the south leg (Mt. McKinley Drive). The intersection of Feise Road and Mt. Helena Lane is controlled by a side-street stop with free-flow traffic along Feise Road. A pedestrian crosswalk is marked across the south leg (Mt. Helena Lane).

Crimson Meadows Drive is a local road maintained by the City of O'Fallon which provides access to the Amber Meadows subdivision from Bryan Road. The road provides two lanes, one in each direction. The posted speed limit is 25 mph. Sidewalks are provided along the north side of the roadway. The intersection of Bryan Road and Crimson Meadows Drive is controlled by a side-street stop with free-flow traffic along Bryan Road. No pedestrian accommodations are provided across the intersection.

Great Warrior Drive is a local road maintained by the City of O'Fallon which provides access to residential subdivisions from Bryan Road. The road provides two lanes, one in each direction. The posted speed limit is 25 mph. Sidewalks are provided along the south side of the roadway.

Little Big Horn Drive is a local road maintained by the City of O'Fallon which provides access to residential uses. The road provides two lanes, one in each direction. There is no posted speed limit, but the speed limit for a local road in a residential area can be assumed at 25 mph. Sidewalks are marked along the east side of the roadway.

The intersection of Bryan Road and Great Warrior Drive/Norwood Hills Drive is controlled by a traffic signal. The northbound and southbound left-turns operate under protected plus permissive phasing, and the eastbound and westbound left-turns operate under permissive-only phasing. Push-button activated pedestrian signals and crosswalks are provided across all

approaches. **Figure 7** provides an aerial view of the Bryan Road and Great Warrior Drive/Norwood Hills Drive intersection.

Figure 7: Aerial View of Bryan Road and Great Warrior Drive/Norwood Hills Drive Intersection

The intersection of Bryan Road and the QuikTrip entrance, south of Feise Road, is controlled by a side-street stop with free-flow traffic along Bryan Road. No pedestrian accommodations are marked. The intersection of Bryan Road and the PNC Bank entrance is controlled by a side-street stop with free-flow traffic along Bryan Road. A pedestrian crosswalk is marked across the east leg (PNC Bank entrance).

Existing Traffic Volumes: To establish existing traffic conditions, manual, turning movement traffic counts were conducted at the following intersections during the weekday morning (6:30-8:30 a.m.), weekday afternoon (4:00-6:00 p.m.) and Saturday midday (11:30 a.m. to 1:30 p.m.) peak periods the first week of March 2017 with the additional study intersections requested counted in May 2017 (shown in bold below):

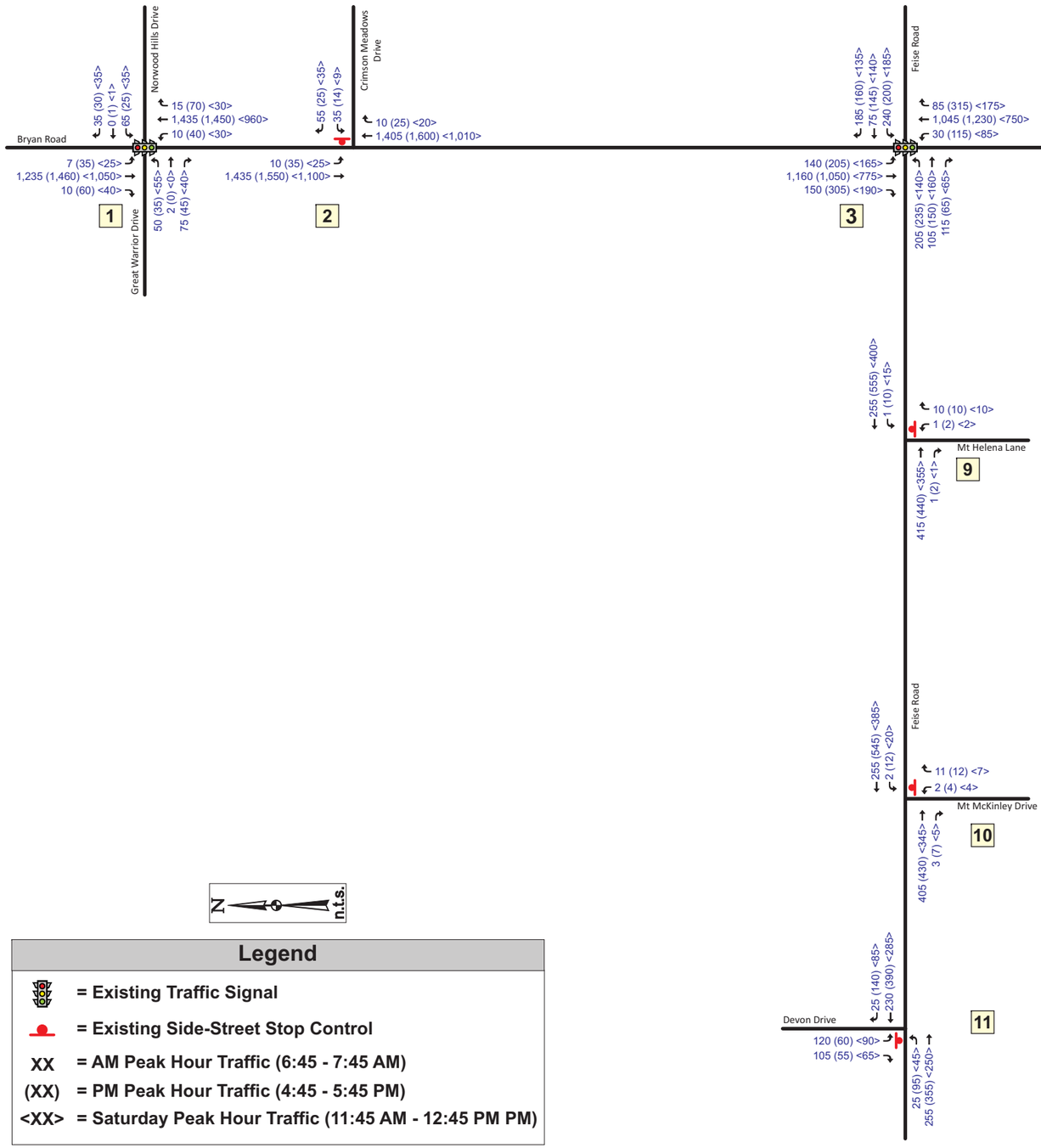
- Bryan Road and Great Warrior Drive (signalized);
- Bryan Road and Crimson Meadow Drive (unsignalized);
- Bryan Road and Feise Road (signalized);
- Bryan Road and QT Drive (unsignalized);
- Bryan Road and commercial drive (unsignalized);
- Bryan Road and 364 Westbound Ramp/North Outer Road (signalized);
- ***Bryan Road and 364 Eastbound Ramp (signalized);***
- ***Bryan Road and Highway N (signalized);***
- Feise Road and Mt. McKinley Drive (unsignalized); and
- Feise Road and Devon Drive (unsignalized).

The existing peak hour volumes are summarized in **Exhibit 2**. Based on the traffic data collected, the morning peak hour occurred between 6:45 and 7:45 a.m., the afternoon peak hour occurred between 4:45 and 5:45 p.m., and the Saturday midday peak occurred between 11:45 a.m. and 12:45 p.m.

Based on the traffic count data at the Bryan Road and Feise Road intersection, the total entering volume during the weekday AM peak hour is 3,535 vehicles per hour (vph), the total entering volume during the weekday PM peak hour is 4,175 vph, and the total entering volume during the Saturday midday peak hour is 2,965 vph.

The weekday PM peak hour traffic volumes at the main intersection are approximately 40% higher than the Saturday midday peak hour traffic volumes, while the weekday AM peak hour traffic volumes are approximately 20% higher than the Saturday midday peak hour traffic volumes.

As such, given the traffic characteristics in the area and the anticipated trip generation for the proposed development, the weekday AM and PM peak periods would likely represent a "worst-case scenario" with regards to the traffic impact. If traffic operations are acceptable during these peak periods, it can be reasoned that conditions would be acceptable throughout the remainder of the day. Considering the trip generation for the proposed Bopp property, discussed later in this study, the PM peak hour traffic conditions will likely govern the improvement recommendations. However, a weekday AM and Saturday midday analysis will be completed as requested by the City.



Legend

- = Existing Traffic Signal
- = Existing Side-Street Stop Control
- XX = AM Peak Hour Traffic (6:45 - 7:45 AM)
- (XX) = PM Peak Hour Traffic (4:45 - 5:45 PM)
- <XX> = Saturday Peak Hour Traffic (11:45 AM - 12:45 PM PM)

Exhibit 2: Existing Traffic Volumes

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PROPOSED DEVELOPMENT AREA

Proposed Land Use: Based upon the concept plan provided by Volz, previously shown in Figure 2, the overall area plan encompasses approximately 180 acres and would include a mix of retail, office and residential uses located in the northwest quadrant of the intersection of Bryan Road and Feise Road.

For the purposes of this study, four sub areas were identified within the overall area plan to reflect common land use or site access opportunities as depicted in **Figure 8** and detailed in **Table 1**. ZONE 1 is located in the immediate area in the northwest quadrant of the intersection of Bryan Road and Feise Road, bound by the existing creek through the site. ZONE 1 is assumed to consist of a grocery store with fueling station and three outlots assumed to be a fast-food restaurant, a general office building and a small retail strip center.

ZONE 2 is assumed to consist of a mix of retail/commercial, general office and medical office buildings. It is also assumed a day-care facility would be provided within this zone.

ZONE 3 is assumed to consist of a large home improvement store with three outlots assumed to be various types of restaurants and eating establishments. ZONE 3 would have a direct access from Bryan Road.

ZONE 4 would be located in the northwestern part of the development, and would likely consist of single-family dwelling units.

Table 1: Land Use Assumptions by Sub Area

LAND USE	FLOOR AREA (sf) or Units
Zone 1	
Supermarket	44,000
Gasoline Station w/ Conv Store	8 vfp
General Office Building	26,000
Shopping Center	24,000
Fast-Food Rest. w/ Drive-Through	3,000
SUBTOTAL:	97,000
Zone 2	
Day Care Center	8,900
General Office Building	30,000
Medical / Dental Office	27,500
Shopping Center	119,000
SUBTOTAL:	185,400
Zone 3	
Home Improvement Superstore	200,000
High-Turnover (Sit-Down) Restuarant	3,300
Fast-Food Rest. W/ Drive-Through	3,300
Fast-Food Rest. W/ Drive-Through	3,300
SUBTOTAL:	209,900
Zone 4	
Single Family Dwelling Unit	268 homes
SUBTOTAL:	268 Homes

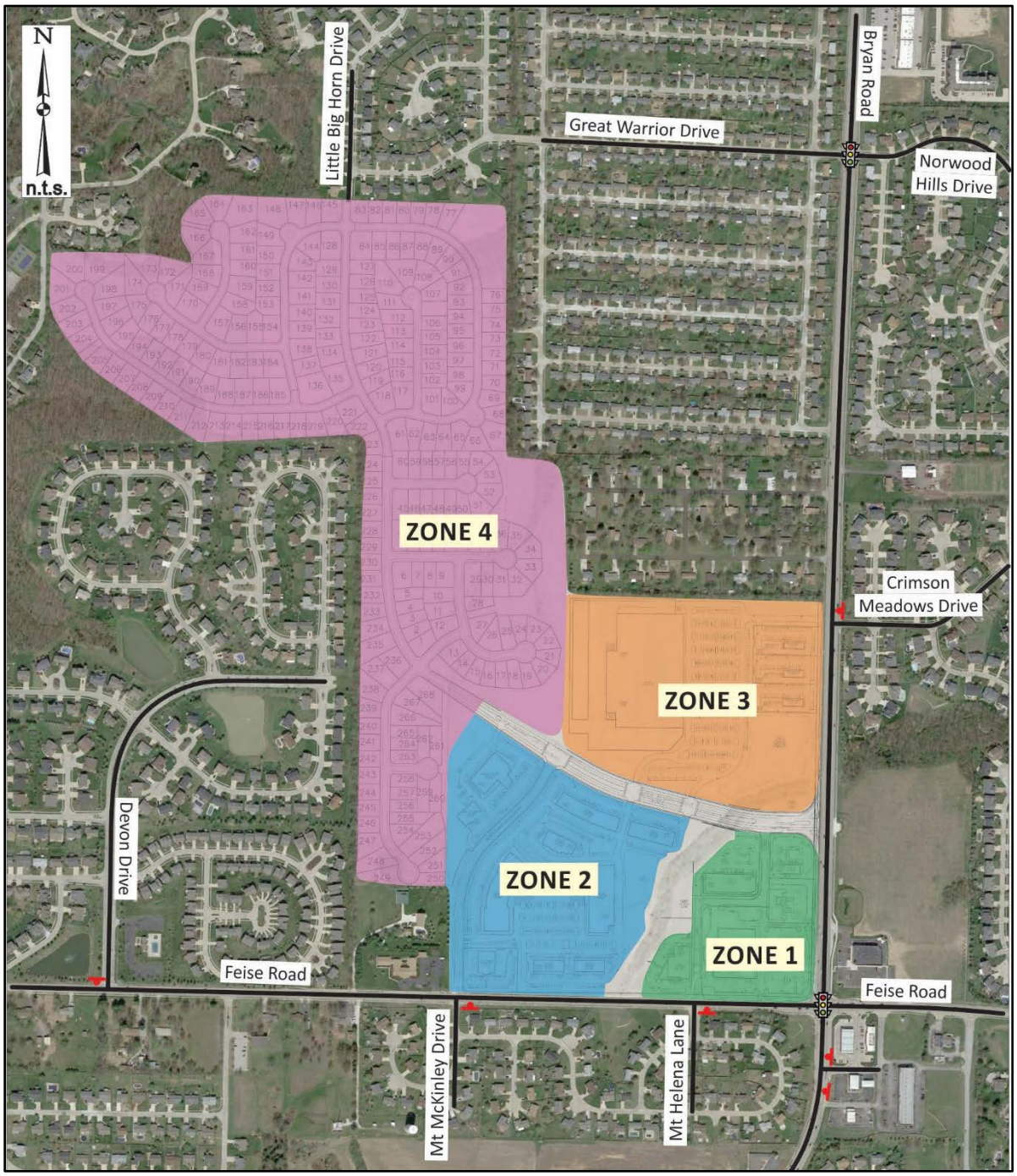


Figure 8: Overall Bopp Area Plan Sub Areas

These assumed uses are based on the vision of owner for the Bopp property. However, it is acknowledged that the actual uses could differ from those assumed in this study. In reality, this study should actually be considered more of a planning study. As specific developments come forward, it will likely be necessary to revisit this study to confirm if the recommendations in this study remain valid (i.e., if the actual development generates fewer trips than assumed in this study, the full recommendations may not be necessary, or conversely, if the actual

development generates more trips than assumed in this study, additional improvements above those recommended may be necessary).

Given the uncertainty of the full build-out of the proposed development area, it would not be practical to construct the recommended improvements identified by this study for the overall development up front, since it is likely that as the development evolves, the recommendations could change. Thus, there will likely be subsequent analyses to determine what improvements are warranted as actual developments are pursued. Rather than the recommendations contained herein being a definitive list of *required* roadway improvements, these evaluations can assist in the possible long-term needs within the corridor, though it would be advisable to dedicate any needed right-of-way along Bryan Road and Feise Road should the improvements discussed herein ultimately be needed in the future.

Site Access: As shown on the concept plan, previously shown in Figure 2, the development area includes an east-west interior roadway to serve as the primary route extending west from Bryan Road through the development and extending north through the residential portion of the development. For the purposes of this study, this roadway will be referred to as Cora Marie Drive. A north-south interior roadway is also planned on the west side of the development, with intersections at Cora Marie Drive to the north and Feise Road, opposite Mt. McKinley Drive, to the south. For the purposes of this study, this roadway will be referred to as North South Road. Driveways off these two main interior roadways will provide access to the commercial development areas.

A three-quarter access (right-in/right-out/left-in) drive is proposed off Bryan Road, opposite Crimson Meadows Drive, to provide direct access to ZONE 3 in the northeast quadrant of the development.

Limited access driveways are also proposed off Bryan Road and Feise Road to provide direct access to the commercial area in the southeast quadrant of the development (ZONE 1); specifically, a right-in/right-out (RIRO) drive on Bryan Road approximately 425 feet north of Feise Road and a three-quarter access (right-in/right-out/left-in) on Feise Road approximately 300 feet west of Bryan Road.

Two new signalized intersections are anticipated, per the concept plan, at the intersection of Cora Marie Drive and Bryan Road and at the intersection of the North South Road and Feise Road. The internal intersection between Cora Marie Drive and North South Road is anticipated as a stop-controlled intersection.

As discussed with the City of O'Fallon, it is anticipated that cross access would be provided via the stub street to the north at Little Big Horn Drive within the adjacent residential development.

Based on Section 14 of the City of O'Fallon's Traffic Management Policy, it is recommended that a minimum of 660 feet be provided between full access intersections on Major Arterials

such as Bryan Road. Thus, the full access for the proposed development, as well as the overall Bopp property, exceeds the recommended minimum of 660 feet with a spacing of 910 feet.

It is my understanding that access drives with a spacing less than 660 feet may be restricted in access. The proposed drive on Bryan Road to serve Zone 1 provides a spacing less than the recommended minimum of 660 feet (approximately 425 feet between Feise Road and the proposed drive), it is proposed as a RIRO only drive which would restrict all left-turn movements. Furthermore, the proposed RIRO is critical to the internal circulation on the Bopp property since the provision of the RIRO would significantly reduce the westbound left-turns at the first internal intersection on Cora Marie Drive at Zone 1.

The proposed drive on Bryan Road, opposite Crimson Meadows Drive, to serve Zone 3 exceeds the recommended minimum of 660 feet with approximately 970 feet between Crimson Meadows Drive and the proposed Cora Marie Drive.

As more detailed plans are developed, it is recommended that the proposed driveways along Cora Marie Drive and North South Road be evaluated by the site civil engineer to ensure that adequate sight distance is provided. The acceptable sight distance should be based on the guidelines published in *A Policy on Geometric Design of Highways and Streets* published by the American Association of State Highway and Transportation Officials (AASHTO) often referred to as the *Green Book*.

Careful consideration should be given to sight distance obstructions when planning any future aesthetics enhancements, such as berms, fencing and landscaping for the proposed Bopp property to ensure that these improvements do not obstruct the view of entering and exiting traffic at the proposed entrances onto Bryan Road, Feise Road, Cora Marie Drive and North South Road. 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.

Trip Generation: Traffic forecasts were prepared to estimate the amount of traffic that the potential build-out of the Bopp property would generate during the weekday AM, weekday PM and Saturday midday peak periods. These forecasts were based upon information provided in the *Trip Generation Manual*, Ninth 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.

The peak hour of adjacent street traffic (one hour between 7 and 9) was utilized for the AM peak hour and (one hour between 4 and 6) was utilized for the PM peak hour. The Saturday peak hour generator was utilized for the Saturday midday peak hour. It should be acknowledged that not all the land uses are anticipated to peak simultaneously on Saturday, but were assumed to do so which would represent a worst case scenario.

It is important to note that ITE estimates assume each of the development's uses would be freestanding. Instead, the uses within the development area would share access to the main

roadways surrounding the site and, in some cases, parking. Published studies show that patrons of multi-use developments, such as this, often visit more than one use within the development during a single visit. As a result, a portion of the trips generated by the development would be captured internally and not impact the external road system. As discussed with the City of O'Fallon, to account for internal capture trips within the Bopp Area Plan, a 15% "common trip" reduction was applied to the trip estimate to account for motorists that would visit other sites within the development (i.e., trips that would be captured internally and not impact the external road system). It should be noted that a common trip reduction was not applied to the residential zone. Based on this data, the trip generation forecast for the Overall Bopp Area Plan is shown in **Table 2**.

The trip generation estimates were further adjusted to account for the fact that not all of the trips generated by the development area would be new to the surrounding road system, but instead are trips already passing the site. These "pass-by trips" would be attracted to the development on their way to or from other destinations. The actual percentage of pass-by traffic depends on the nature of the use, the volume on the adjacent street, and time of day. Therefore, statistical information provided in the *Trip Generation Handbook, A Recommended Practice* was utilized to estimate pass-by percentages for the proposed uses. The pass-by percentages applied are summarized in **Table 3**. The values shown in blue were derived using the pass-by percentages for similar uses and time periods. 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.

Table 2: Trip Estimate – Overall Bopp Area Plan

ITE CODE	LAND USE	FLOOR AREA (sf) or Units	ADT (VPD)	AM PEAK HOUR (VPH) IN	AM PEAK HOUR (VPH) OUT	AM PEAK HOUR (VPH) TOTAL	PM PEAK HOUR (VPH) IN	PM PEAK HOUR (VPH) OUT	PM PEAK HOUR (VPH) TOTAL	SATURDAY PEAK HOUR (VPH) IN	SATURDAY PEAK HOUR (VPH) OUT	SATURDAY PEAK HOUR (VPH) TOTAL
Zone 1												
850	Supermarket	44,000	4,500	95	55	150	205	215	420	290	275	565
945	Gasoline Station w/ Conv Store	8 vpf	1,300	40	40	80	55	55	110	55	55	110
710	General Office Building	26,000	470	55	10	65	20	90	110			
820	Shopping Center	24,000	1,025	15	10	25	45	45	90	60	55	115
934	Fast-Food Rest. W/ Drive-Through	3,000	1,490	70	65	135	50	45	95	90	85	175
			Gross Trips	275	180	455	375	450	825	495	470	965
			Common Trip Reduction (15%)	-40	-25	-65	-55	-70	-125	-75	-70	-145
			Net Trips	235	155	390	320	380	700	420	400	820
			Zone 1 Pass-By Trips	60	60	120	125	125	250	135	135	270
			Zone 1 New Trips	175	95	270	195	255	450	285	265	550
Zone 2												
565	Day Care Center	8,900	660	55	50	105	50	60	110			
710	General Office Building	30,000	525	65	10	75	20	95	115			
720	Medical / Dental Office	27,500	910	50	15	65	25	65	90			
820	Shopping Center	119,000	5,080	70	45	115	210	230	440	300	275	575
			Gross Trips	240	120	360	305	450	755	300	275	575
			Common Trip Reduction (15%)	-35	-20	-55	-45	-70	-115	-45	-40	-85
			Net Trips	205	100	305	260	380	640	255	235	490
			Zone 2 Pass-By Trips	10	10	20	65	65	130	65	65	130
			Zone 2 New Trips	195	90	285	195	315	510	190	170	360
Zone 3												
862	Home Improvement Superstore	200,000	6,150	170	130	300	230	235	465	460	440	900
932	High-Turnover (Sit-Down) Restuarant	3,300	420	20	15	35	20	15	35	25	20	45
934	Fast-Food Rest. W/ Drive-Through	3,300	1,635	75	75	150	55	55	110	100	95	195
934	Fast-Food Rest. W/ Drive-Through	3,300	1,635	75	75	150	55	55	110	100	95	195
			Gross Trips	340	295	635	360	360	720	685	650	1,335
			Common Trip Reduction (15%)	-50	-45	-95	-55	-55	-110	-105	-100	-205
			Net Trips	290	250	540	305	305	610	580	550	1,130
			Zone 3 Pass-By Trips	80	80	160	150	150	300	185	185	370
			Zone 3 New Trips	210	170	380	155	155	310	395	365	760
Zone 4												
210	Single Family Dwelling Unit	268 homes	2,601	50	145	195	160	95	255	135	115	250
			Zone 4 New Trips	50	145	195	160	95	255	135	115	250
			Total Bopp Property Pass-By Trips	150	150	300	340	340	680	385	385	770
			Total Bopp Property New Trips	630	500	1,130	705	820	1,525	1,005	915	1,920

Table 3: Pass-by Trip Assumptions

Land Use	Pass-by Trip Assumptions		
	AM	PM	SATURDAY
Supermarket	10%	36%	25%
Home Improvement Store	10%	48%	25%
Gasoline/Service Station with Convenience Market	62%	56%	50%
Shopping Center/Retail Outlots	20%	34%	26%
High-Turnover Sit-Down Restaurant	30%	43%	40%
Fast Food Restaurant w/ Drive-Through	49%	50%	50%

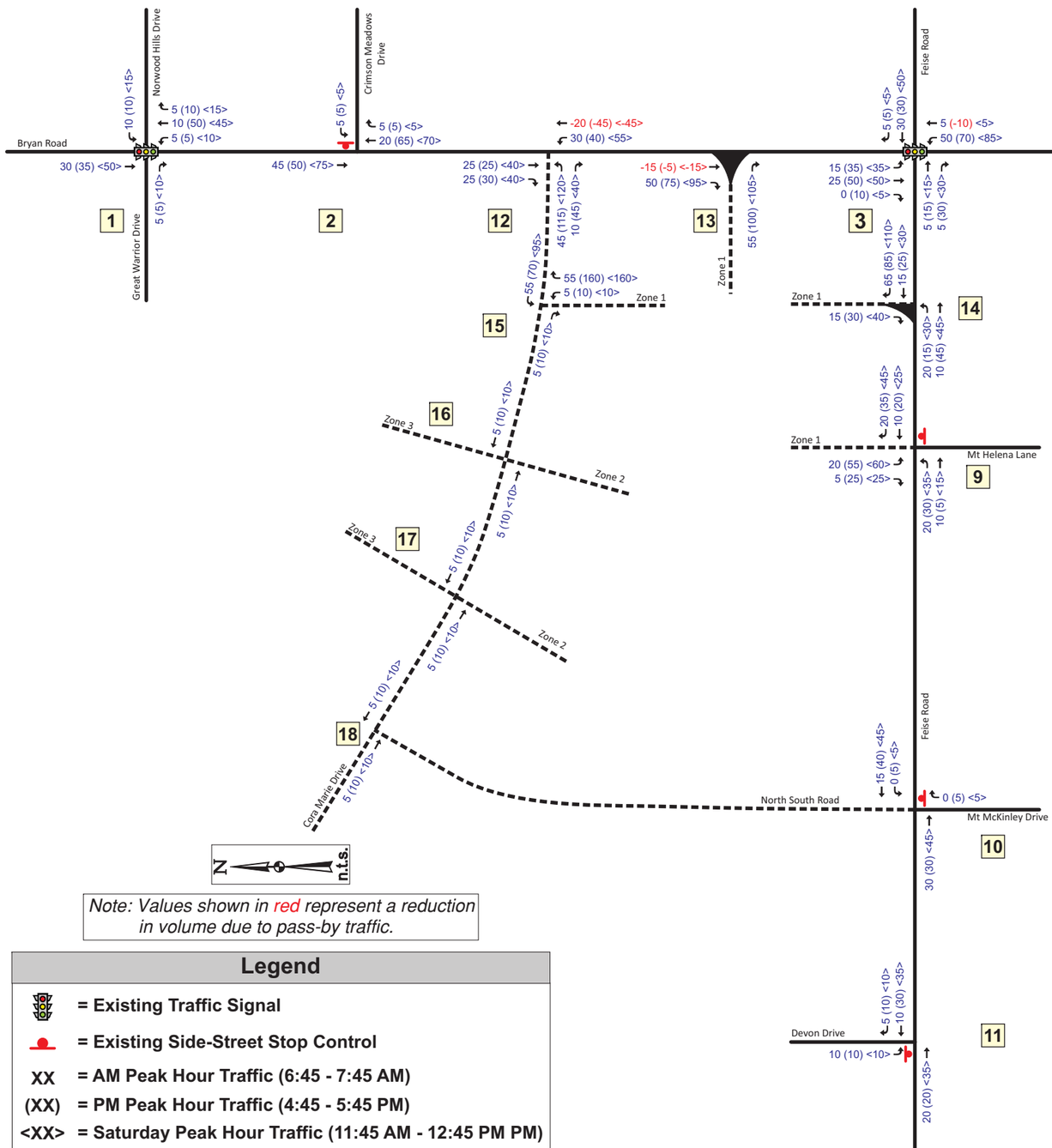
The full build out of the Bopp property would be expected to attract a total of approximately 300, 680 and 770 trips from traffic already utilizing the surrounding roadway system during the weekday AM, weekday PM and Saturday midday peak hours, respectively. In turn, the full build out of the Bopp property would generate a total of 1,130 new trips during the weekday AM peak hour, 1,525 new trips during the weekday PM peak hour and 1,920 new trips during the Saturday midday peak hour.

Trip Distribution*:* The site-generated trips for the overall Bopp area plan will then be assigned into and out of the site based upon an estimated directional distribution. Based upon the existing travel patterns in the area, and the proximity to nearby developments, it is anticipated that the distribution of *new* site-generated trips would be as summarized in **Table 4**. The pass-by trips were assigned in accordance with the existing traffic volumes on the adjacent roadways.

Table 4: Trip Distribution Assumptions

Land Use	Trip Distribution Assumptions	
	Retail/Office	Residential
To/from the north on Bryan Road	32%	37%
To/from the south on Bryan Road	31%	36%
To/from the east on Feise Road	19%	13%
To/from the west on Feise Road	18%	14%

The Zone 1, Zone 2, Zone 3 and Zone 4 site-generated trips for the peak hours are shown in **Exhibits 3, 4, 5** and **6,** respectively. The site-generated trips associated with the full build-out of the Bopp property (Zone 1 + Zone 2 + Zone 3 + Zone 4) are shown in **Exhibit 7.**

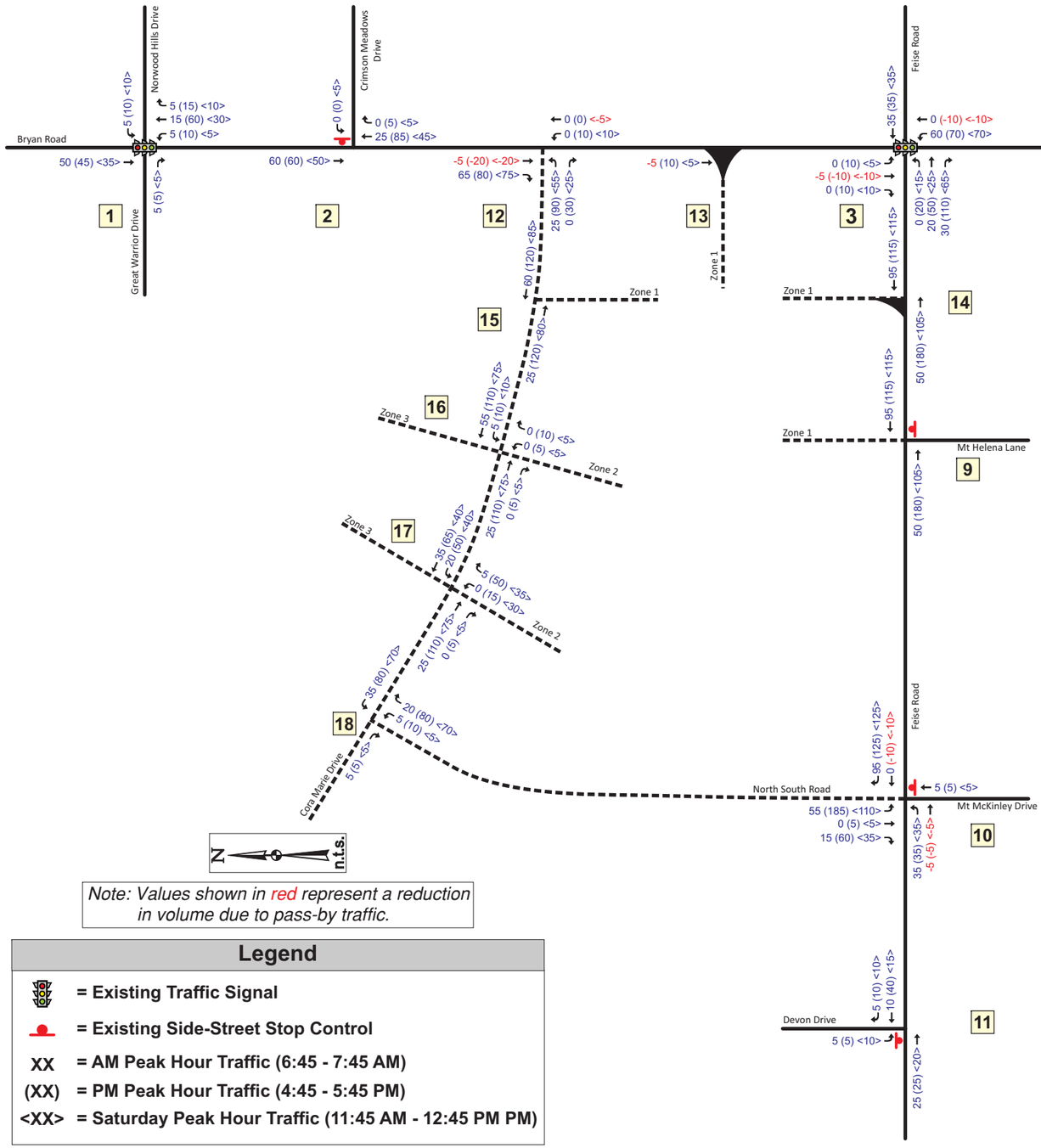


Note: Values shown in red represent a reduction in volume due to pass-by traffic.

Legend

- = Existing Traffic Signal
- = Existing Side-Street Stop Control
- XX = AM Peak Hour Traffic (6:45 - 7:45 AM)
- (XX) = PM Peak Hour Traffic (4:45 - 5:45 PM)
- <XX> = Saturday Peak Hour Traffic (11:45 AM - 12:45 PM PM)

Exhibit 3: Zone 1 Site-Generated Trips



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

Legend

- = Existing Traffic Signal
- = Existing Side-Street Stop Control
- XX = AM Peak Hour Traffic (6:45 - 7:45 AM)
- (XX) = PM Peak Hour Traffic (4:45 - 5:45 PM)
- <XX> = Saturday Peak Hour Traffic (11:45 AM - 12:45 PM PM)

Exhibit 4: Zone 2 Site-Generated Trips

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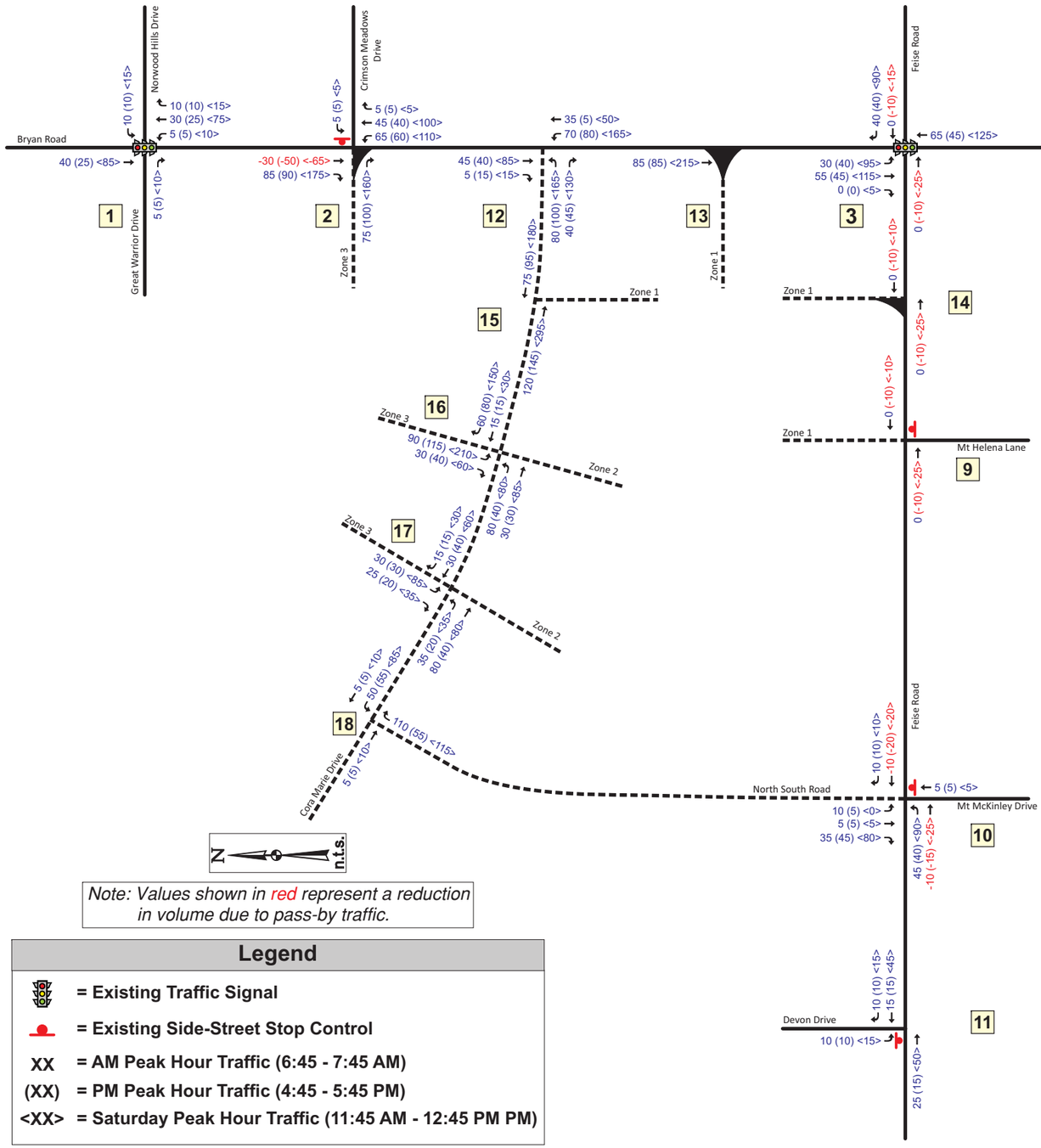

Note: Values shown in red represent a reduction in volume due to pass-by traffic.

Legend

- = Existing Traffic Signal
- = Existing Side-Street Stop Control
- XX = AM Peak Hour Traffic (6:45 - 7:45 AM)
- (XX) = PM Peak Hour Traffic (4:45 - 5:45 PM)
- <XX> = Saturday Peak Hour Traffic (11:45 AM - 12:45 PM PM)

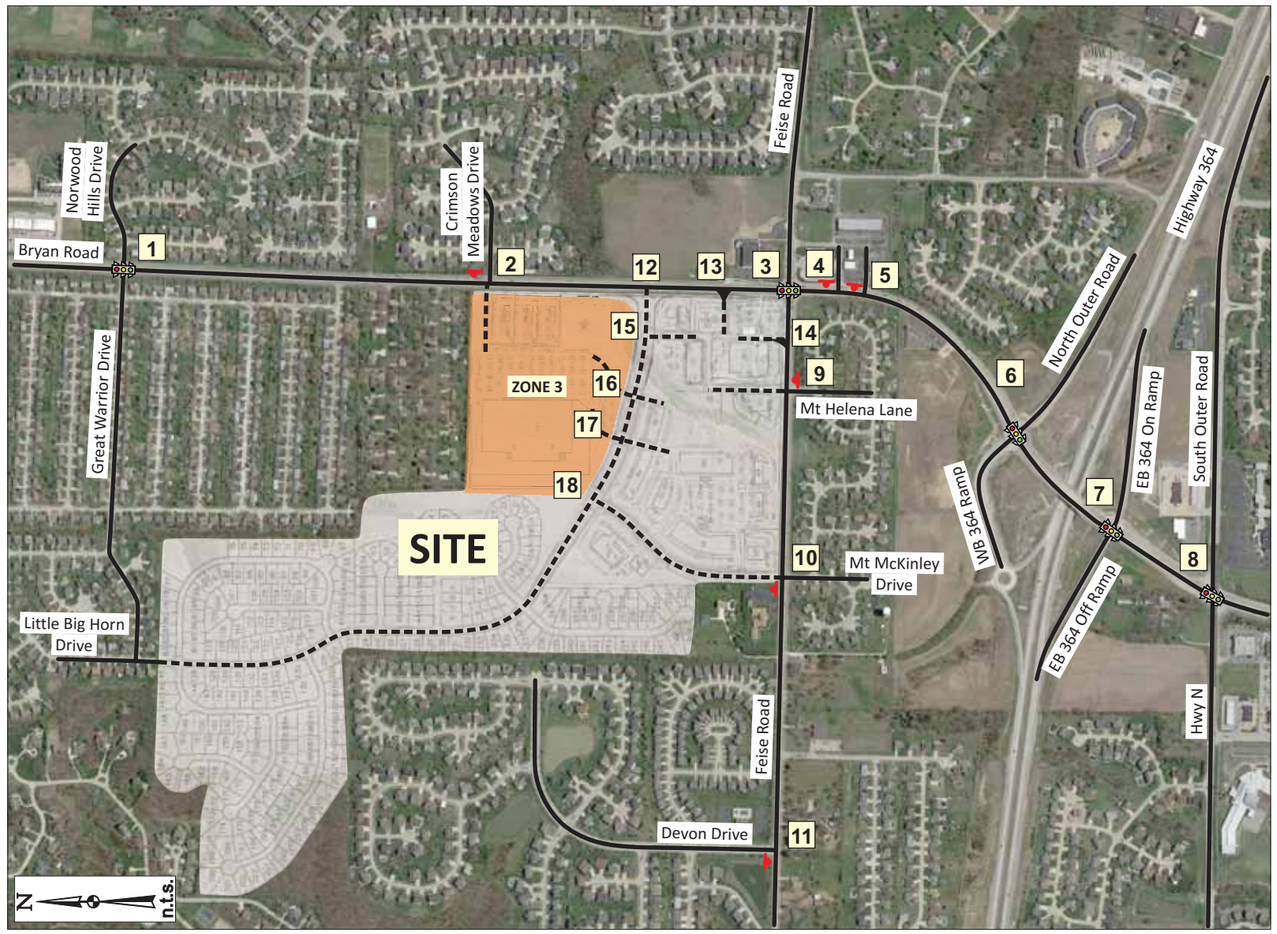

Exhibit 5: Zone 3 Site-Generated Trips

Job# 025-17
06/30/17

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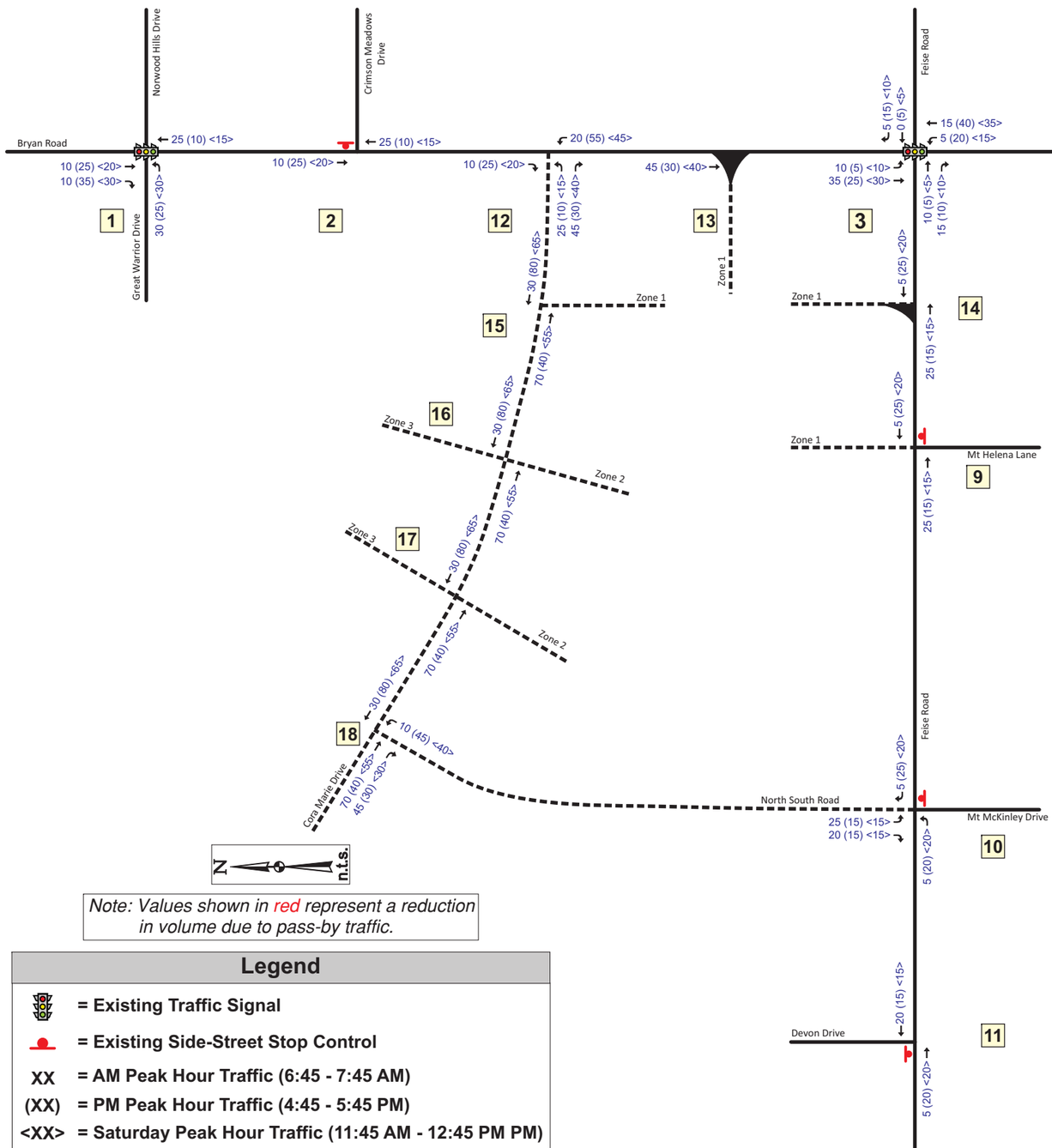

Note: Values shown in red represent a reduction in volume due to pass-by traffic.

Legend

- = Existing Traffic Signal
- = Existing Side-Street Stop Control
- XX = AM Peak Hour Traffic (6:45 - 7:45 AM)
- (XX) = PM Peak Hour Traffic (4:45 - 5:45 PM)
- <XX> = Saturday Peak Hour Traffic (11:45 AM - 12:45 PM PM)

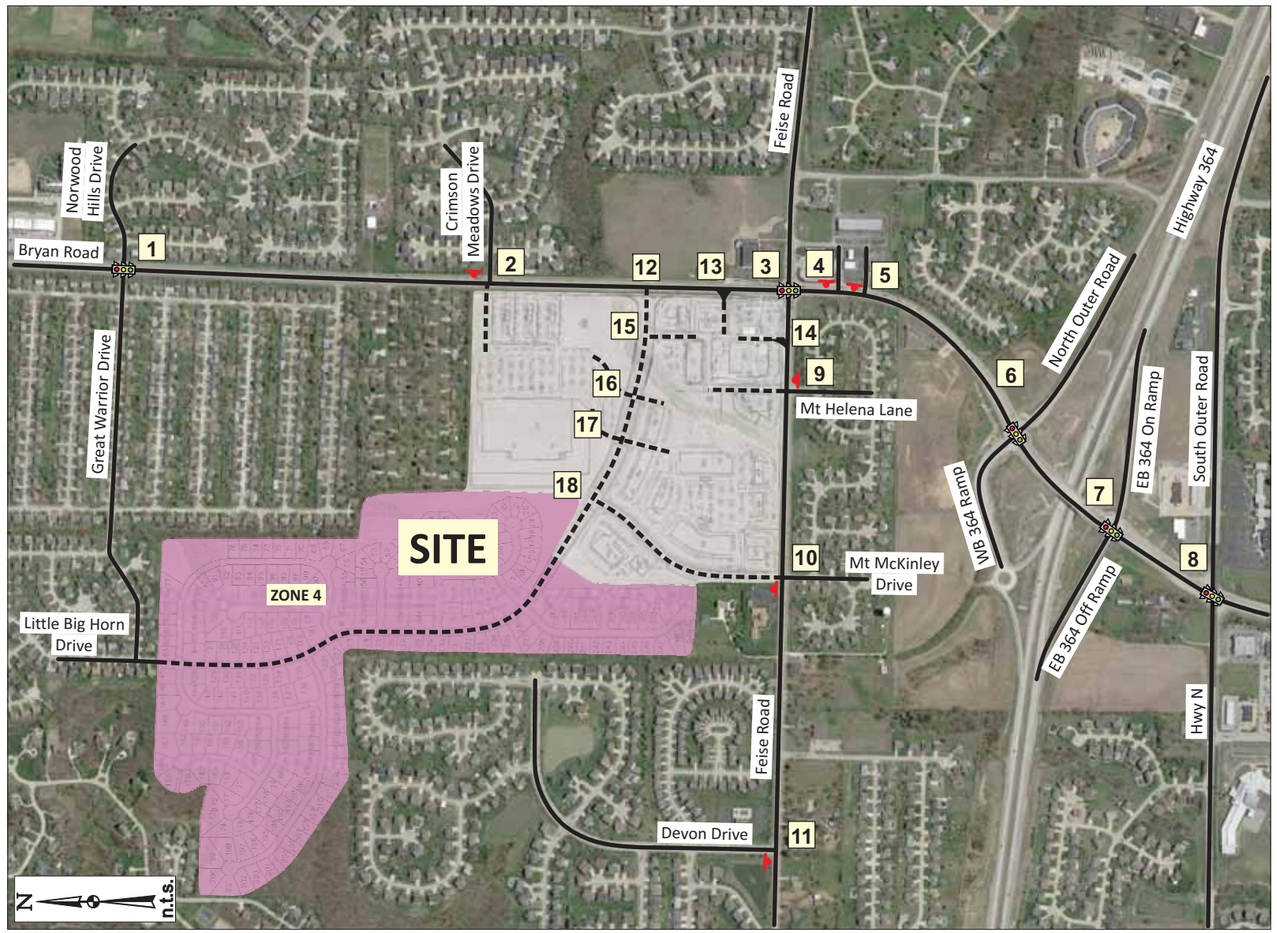

Exhibit 6: Zone 4 Site-Generated Trips

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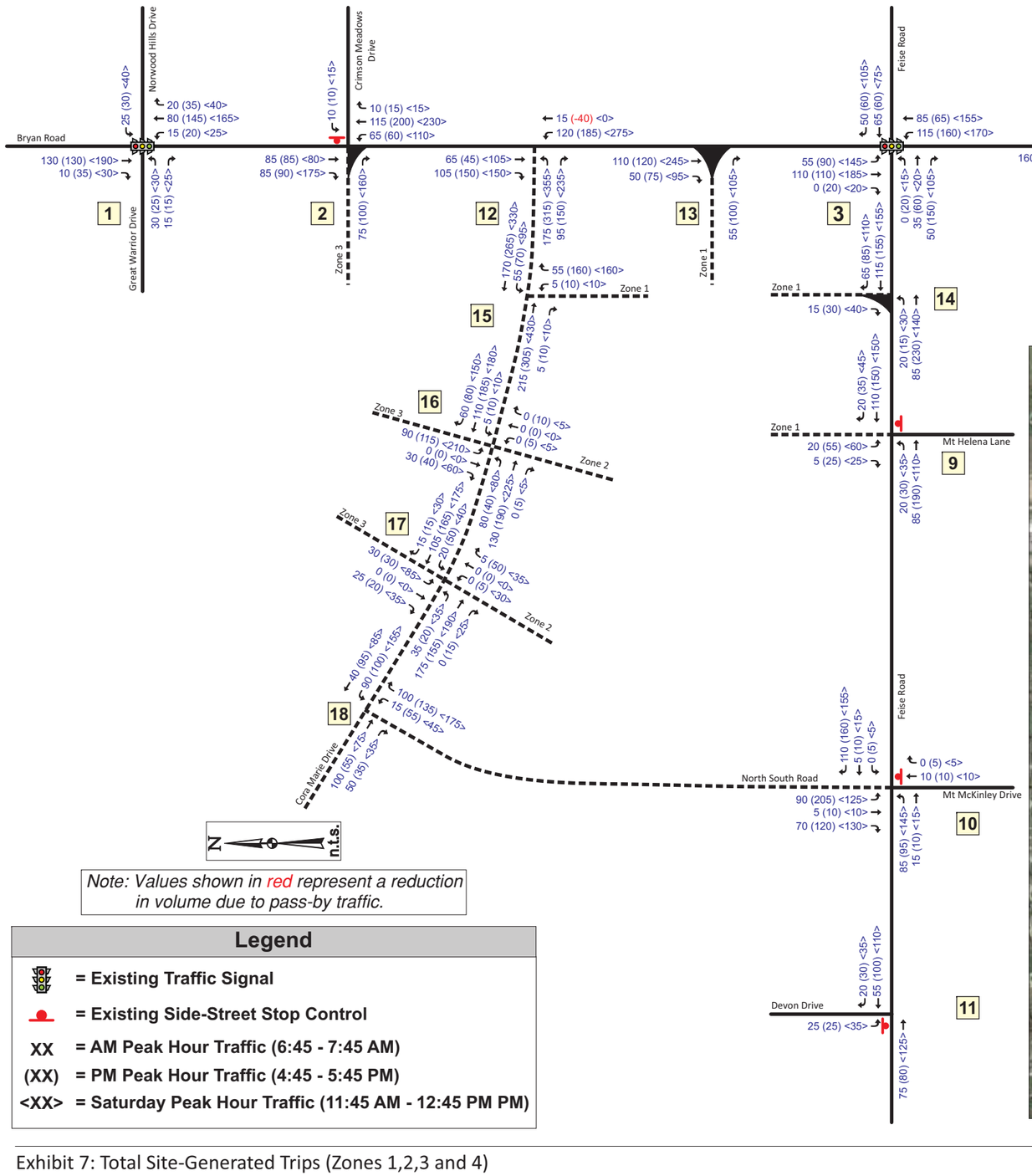

Note: Values shown in red represent a reduction in volume due to pass-by traffic.

Legend

- = Existing Traffic Signal
- = Existing Side-Street Stop Control
- XX = AM Peak Hour Traffic (6:45 - 7:45 AM)
- (XX) = PM Peak Hour Traffic (4:45 - 5:45 PM)
- <XX> = Saturday Peak Hour Traffic (11:45 AM - 12:45 PM PM)

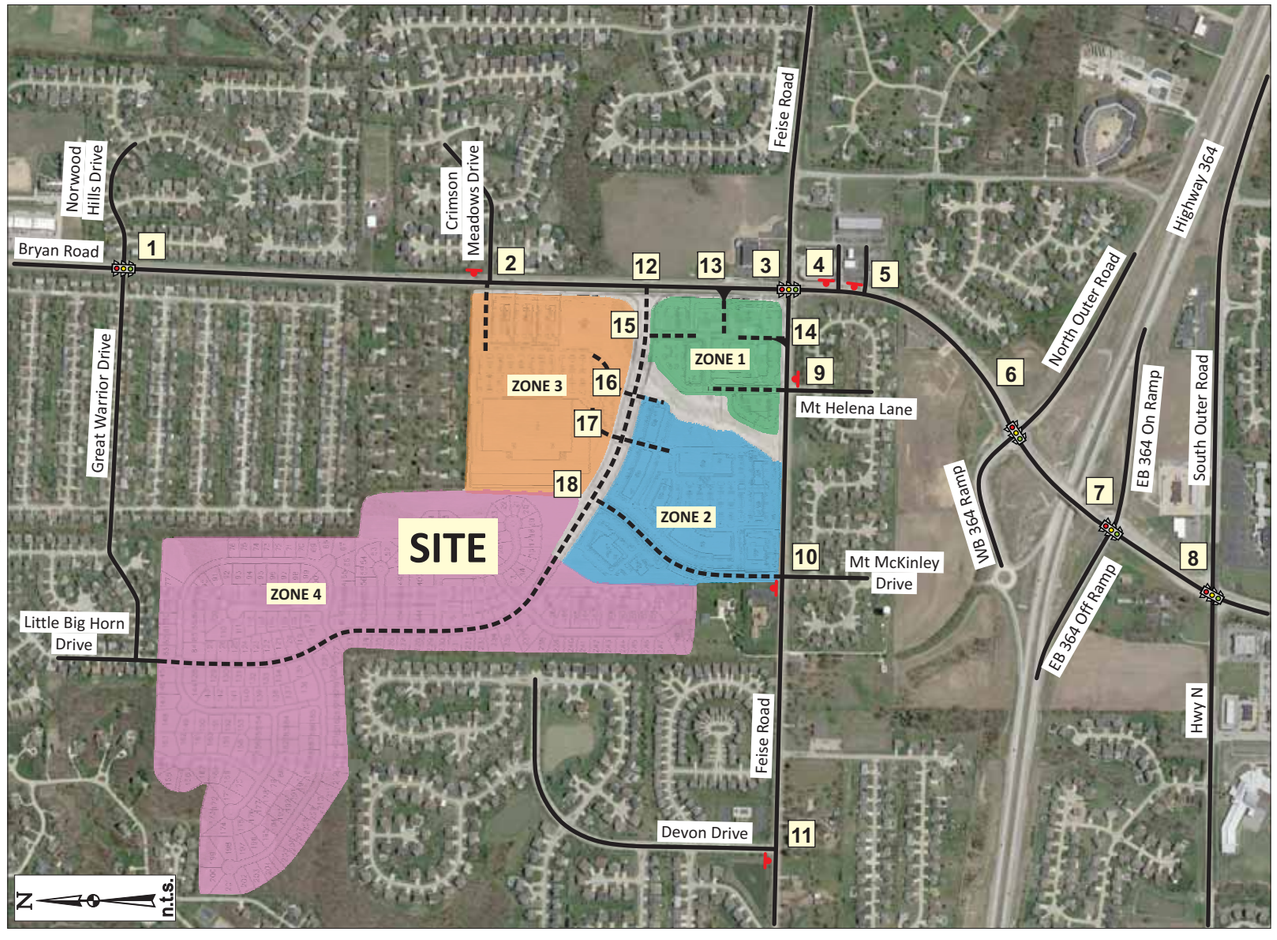

Exhibit 7: Total Site-Generated Trips (Zones 1,2,3 and 4)

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EXISTING AND 2037 NO-BUILD TRAFFIC ANALYSIS

Study Procedures: The operating conditions for the study intersections were analyzed using SYNCHRO 8, a macro-level analytical traffic flow model. SIDRA was used to analyze potential roundabout intersections. SYNCHRO and SIDRA are based on study procedures outlined in the *Highway Capacity Manual*, published 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. However, Level D is considered acceptable for peak period conditions in urban and suburban areas.

The thresholds that define level of service at an intersection are based upon the type of control used (i.e., whether it is signalized or unsignalized) and the calculated delay. For signalized and all-way stop intersections, the average control delay per vehicle is estimated for each movement and aggregated for each approach and then the overall intersection. At intersections with partial (side-street) stop control, delay is calculated for the minor movements only since motorists on the main road are not required to stop.

Level of service is directly related to control delay. At signalized intersections, the level of service criteria differ from that at unsignalized intersections primarily because different transportation facilities create different driver expectations. The expectation is that a signalized intersection is designed to carry higher traffic volumes, and consequently may experience greater delay than an unsignalized intersection. **Table 5** summarizes the thresholds used in the analysis for signalized and unsignalized intersections.

Table 5: Level of Service Thresholds

Level of Service (LOS)	Control Delay per Vehicle (sec/veh)	
	Signalized Intersections	Unsignalized Intersections
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

In addition to LOS, volume to capacity (v/c) ratios provide an important measure of intersection operations. Intersection movements can operate an acceptable LOS (D or better) yet still have

movements unacceptably high v/c ratios. In general, a v/c ratio of approximately 0.9 corresponds to occasional queuing and cycle failure, and a v/c ratio between 0.9 and 1.0 corresponds to frequent queuing and cycle failure. A v/c ratio greater than 1.0 results in general failure of the movement. Therefore, v/c ratios were considered in addition to LOS and vehicular delay when evaluating critical intersection operations.

2037 No-Build Traffic Volumes: To assist the Cities of Dardenne Prairie and O'Fallon in their long-term traffic plan, background linear traffic growth was used to develop 20 year traffic volume projections for the "design year". As directed by the City of O'Fallon staff, an annual growth rate of 1.0% per year was used to account for the 20 years of background growth on the adjacent roadways (Bryan Road, Feise Road, North and South Outer Roads, and Highway N), which represents a global increase of approximately 22% for the study area over the existing conditions. The 2037 No-Build traffic volumes are shown in **Exhibit 8.**

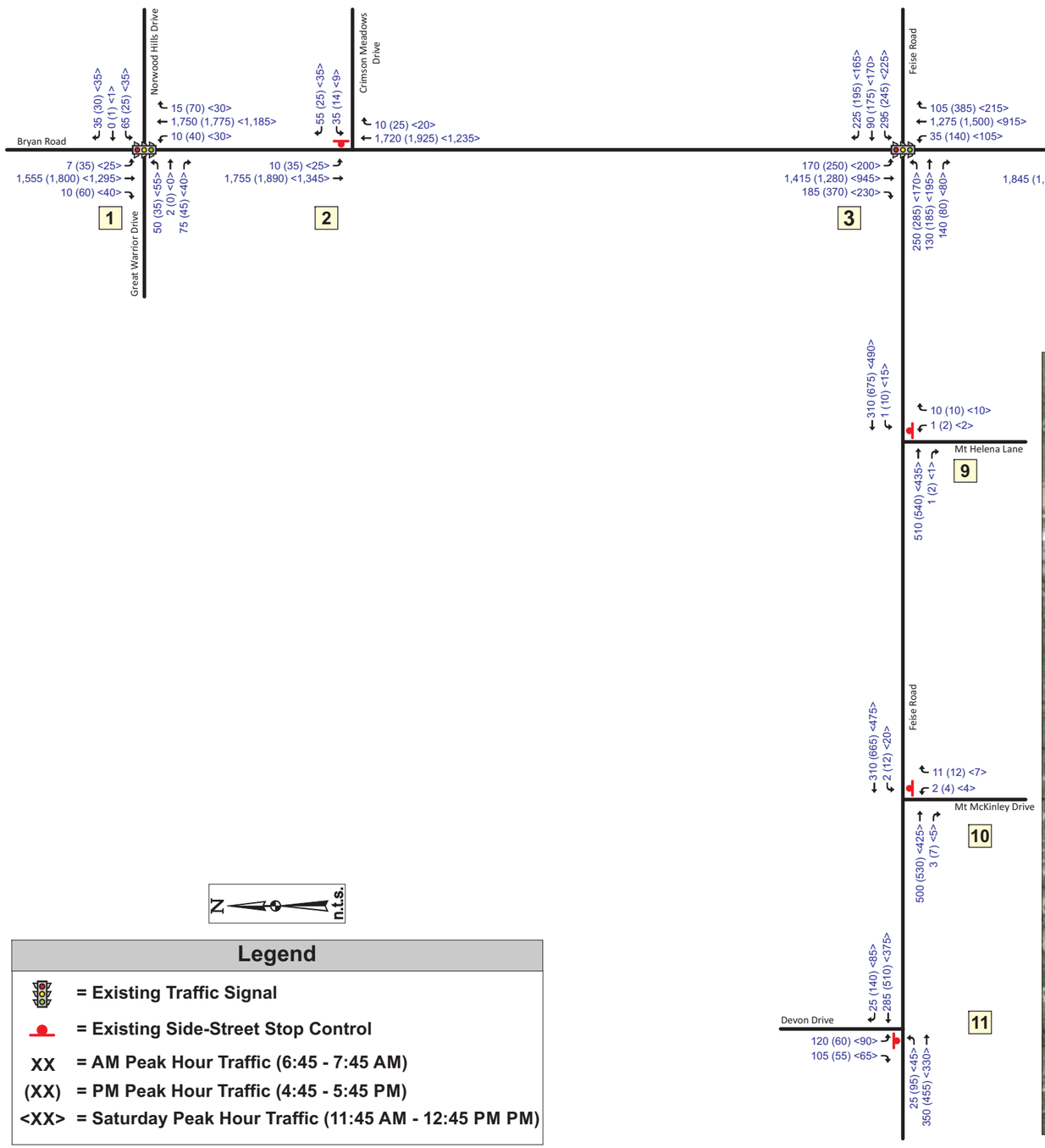
Based on discussions with the Cities of Dardenne Prairie and O'Fallon, it is our understanding that there are no planned roadway improvement projects or proposed developments planned within the study area that would alter the background traffic conditions in the near term.

Existing and 2037 No-Build Operating Conditions: The study intersections were evaluated using the methodologies described above. **Table 6** summarizes the results of this analysis, which reflects the existing and 2037 No-Build operating conditions and average delays during the weekday AM, weekday PM and Saturday midday peak hours. The Synchro estimated 95th percentile queue lengths for the primary intersection of Bryan Road and Feise Road are shown in the table.

The existing conditions analysis reflects the current traffic signals timings at the signals along the Bryan Road corridor. The 2037 No-Build conditions analysis increases the signal system cycle length to 120 seconds in the PM peak hour along with signal timing adjustments in the Am and Saturday midday to better accommodate the 2037 No-Build traffic volumes. The 2037 No-Build results summarized in **Table 6** do not reflect any roadway improvements, but rather represent the anticipated operations at the study intersections if the current traffic levels increase by 1.0% per year assuming no roadway improvements.

Based on the City of O'Fallon's Traffic Management Policy and subsequent conversations with City staff, it is recommended that all movements at an intersection operate at LOS D or better. **Table 6** provides the approach level of service and delay for each intersection. The approach is highlighted orange if there is a movement within the approach that operates at LOS E, while the approach is highlighted red if there is a movement within the approach that operates at LOS F.

As indicated in **Table 6**, there are several individual movements that operate at LOS E or F during the existing and 2037 No-Build conditions, specifically the signalized intersections of Bryan Road with Feise Road, the 364 westbound ramp/North Outer Road and Highway N/South Outer Road. Each study intersection is discussed in greater detail in the following paragraphs.



N n.t.s.

Legend

- = Existing Traffic Signal
- = Existing Side-Street Stop Control
- XX = AM Peak Hour Traffic (6:45 - 7:45 AM)
- (XX) = PM Peak Hour Traffic (4:45 - 5:45 PM)
- <XX> = Saturday Peak Hour Traffic (11:45 AM - 12:45 PM PM)

Exhibit 8: 2037 No-Build Traffic Volumes

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09/12/17

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Table 6: Existing and 2037 No Build Capacity Analysis Summary

Intersection/Movement	AM Peak Hour		PM Peak Hour		SAT Peak Hour	
	2017 Existing Conditions	2037 No- Build Conditions	2017 Existing Conditions	2037 No- Build Conditions	2017 Existing Conditions	2037 No- Build Conditions
1 – Bryan Road and Great Warrior Drive/Norwood Hills Drive (Signalized)						
Eastbound Great Warrior Drive Approach	C (32.3)	C (32.3)	A (9.2)	B (16.6)	B (18.7)	B (18.7)
Westbound Norwood Hills Drive Approach	C (27.8)	C (27.8)	C (22.1)	C (28.7)	C (34.0)	C (34.0)
Northbound Bryan Road Approach	A (3.9)	A (6.3)	B (12.8)	B (12.1)	A (1.8)	B (14.3)
Southbound Bryan Road Approach	A (4.6)	A (5.4)	B (14.3)	B (13.5)	A (8.9)	A (6.9)
Overall	A (6.4)	A (7.6)	B (13.6)	B (13.1)	A (7.0)	B (11.3)
2 – Bryan Road and Crimson Meadow Drive (Side-Street Stop Control)						
Westbound Crimson Meadow Approach	D (32.2)	F (58.1)	D (27.8)	E (41.4)	B (15.0)	C (17.8)
Northbound Bryan Road Approach	A (<1.0)	A (<1.0)	A (<1.0)	A (<1.0)	A (<1.0)	A (<1.0)
Southbound Bryan Road Left-Turn	B (13.6)	C (16.8)	C (15.6)	C (19.9)	B (10.8)	B (12.2)
3 – Bryan Road and Feise Road (Signalized)						
Eastbound Feise Road Approach	C (26.8) 95thQ: 170' L	C (32.2) 95thQ: 215' L	D (36.3) 95thQ: 190' L	D (53.8) 95thQ: 260' L	C (31.4) 95thQ: 160' T	C (34.0) 95thQ: 190' T
Westbound Feise Road Approach	C (30.2) 95thQ: 200' L	D (46.1) 95thQ: 335' L	C (30.9) 95thQ: 160' L	D (47.9) 95thQ: 270' L	C (29.6) 95thQ: 145' L	D (35.5) 95thQ: 170' L
Northbound Bryan Road Approach	C (33.0) 95thQ: 440' T	D (38.5) 95thQ: 620' T	C (21.0) 95thQ: 530' T	C (31.3) 95thQ: 690' T	C (25.3) 95thQ: 345' T	B (13.5) 95thQ: 410' T
Southbound Bryan Road Approach	C (27.4) 95thQ: 535' T	C (34.5) 95thQ: 720' T	C (34.3) 95thQ: 480' T	C (32.1) 95thQ: 670' T	C (30.7) 95thQ: 370' T	C (20.1) 95thQ: 420' T
Overall	C (29.5)	D (37.2)	C (28.9)	D (36.0)	C (28.8)	C (22.0)
4 – Bryan Road and QT Drive (Side-Street Stop Control)						
Westbound QT Drive Approach	E (48.3)	F (>200)	F (72.2)	F (>200)	D (30.5)	F (70.1)
Northbound Bryan Road Approach	A (<1.0)	A (<1.0)	A (<1.0)	A (<1.0)	A (<1.0)	A (<1.0)
Southbound Bryan Road Approach	A (<1.0)	A (<1.0)	A (<1.0)	A (<1.0)	A (<1.0)	A (<1.0)
5 – Bryan Road and Bank Drive (Side-Street Stop Control)						
Westbound Bank Drive Approach	F (74.1)	F (>200)	F (135.5)	F (>200)	C (20.3)	D (29.7)
Northbound Bryan Road Approach	A (<1.0)	A (<1.0)	A (<1.0)	A (<1.0)	A (<1.0)	A (<1.0)
Southbound Bryan Road Approach	A (<1.0)	A (<1.0)	A (<1.0)	A (<1.0)	A (<1.0)	A (<1.0)

X (XX.X) - Level of Service (Vehicular delay in seconds per vehicle)
Denotes a movement on the approach with LOS E; Denotes a movement on the approach with LOS F
95th percentile queue for the critical movement of the approach and lane (L-Left, TR-Shared Thru/Right, R-Right)

Table 6: Existing and 2037 No Build Capacity Analysis Summary (cont.)

Intersection/Movement	AM Peak Hour		PM Peak Hour		SAT Peak Hour	
	2017 Existing Conditions	2037 No- Build Conditions	2017 Existing Conditions	2037 No- Build Conditions	2017 Existing Conditions	2037 No- Build Conditions
6 – Bryan Road and 364 Westbound Ramp/North Outer Road (Signalized)						
Eastbound 364 WB Ramp Approach	C (21.2)	C (29.5)	E (60.7)	F (81.9)	C (32.2)	D (37.2)
Westbound North Outer Road Approach	D (44.9)	D (51.8)	D (46.8)	F (91.6)	D (42.7)	D (46.0)
Northbound Bryan Road Approach	B (10.9)	B (13.2)	C (25.7)	E (56.9)	B (14.8)	B (15.6)
Southbound Bryan Road Approach	C (34.0)	D (41.5)	B (12.7)	B (11.8)	B (10.2)	B (17.5)
Overall	C (24.7)	C (30.3)	C (29.2)	D (48.5)	B (17.2)	C (21.2)
7 – Bryan Road and 364 Eastbound Ramp (Signalized)						
Eastbound 364 EB Ramp Approach	C (26.3)	C (29.8)	C (25.8)	D (35.4)	C (29.9)	C (30.2)
Northbound Bryan Road Approach	A (8.9)	B (13.3)	B (10.0)	B (16.5)	A (7.5)	B (11.9)
Southbound Bryan Road Approach	B (13.7)	B (15.1)	B (11.2)	B (14.5)	A (8.0)	A (7.3)
Overall	B (12.8)	B (15.7)	B (12.5)	B (17.9)	B (10.7)	B (12.3)
8 – Bryan Road and Highway N/South Outer Road (Signalized)						
Eastbound Highway N Approach	D (42.6)	D (51.6)	D (50.5)	E (63.2)	D (42.6)	D (46.8)
Westbound South Outer Road Approach	D (39.5)	D (41.7)	D (35.2)	D (46.0)	C (28.9)	C (28.9)
Northbound Bryan Road Approach	C (32.3)	D (48.0)	D (35.5)	D (50.0)	C (30.0)	D (38.9)
Southbound Bryan Road Approach	C (24.6)	C (31.5)	C (20.1)	D (36.9)	C (20.2)	B (17.1)
Overall	C (31.8)	D (39.9)	C (32.2)	D (46.7)	C (28.4)	C (30.5)
9 – Feise Road and Mt. Helena Lane (Side-Street Stop Control)						
Eastbound Feise Road Approach	A (<1.0)	A (<1.0)	A (<1.0)	A (<1.0)	A (<1.0)	A (<1.0)
Westbound Feise Road Approach	A (<1.0)	A (<1.0)	A (<1.0)	A (<1.0)	A (<1.0)	A (<1.0)
Northbound Mt. Helena Lane Approach	B (11.1)	B (12.0)	B (11.6)	B (12.7)	B (10.8)	B (11.5)
10 – Feise Road and Mt. McKinley Drive (Side-Street Stop Control)						
Eastbound Feise Road Approach	A (<1.0)	A (<1.0)	A (<1.0)	A (<1.0)	A (<1.0)	A (<1.0)
Westbound Feise Road Approach	A (<1.0)	A (<1.0)	A (<1.0)	A (<1.0)	A (<1.0)	A (<1.0)
Northbound Mt. McKinley Drive Approach	B (11.0)	B (11.9)	B (11.8)	B (12.9)	B (11.0)	B (11.8)

X (XX.X) - Level of Service (Vehicular delay in seconds per vehicle)
Denotes a movement on the approach with LOS E; Denotes a movement on the approach with LOS F
95th percentile queue for the critical movement of the approach and lane (L-Left, TR-Shared Thru/Right, R-Right)

Table 6: Existing and 2037 No Build Capacity Analysis Summary (cont.)

Intersection/Movement	AM Peak Hour		PM Peak Hour		SAT Peak Hour	
	2017 Existing Conditions	2037 No- Build Conditions	2017 Existing Conditions	2037 No- Build Conditions	2017 Existing Conditions	2037 No- Build Conditions
11 - Feise Road and Devon Drive (Side-Street Stop Control)						
Eastbound Feise Road Approach	A (<1.0)	A (<1.0)	A (1.9)	A (1.6)	A (1.3)	A (1.0)
Westbound Feise Road Approach	A (<1.0)	A (<1.0)	A (<1.0)	A (<1.0)	A (<1.0)	A (<1.0)
Southbound Devon Drive Approach	B (11.4)	B (12.3)	B (13.6)	C (15.5)	B (11.8)	B (13.0)

X (XX.X) - Level of Service (Vehicular delay in seconds per vehicle)
Denotes a movement on the approach with LOS E; Denotes a movement on the approach with LOS F
95th percentile queue for the critical movement of the approach and lane (L-Left, TR-Shared Thru/Right, R-Right)

1 – Bryan Road and Great Warrior Drive/Norwood Hills Drive (Signalized)
The overall intersection, as well as each individual movement, currently operates at acceptable levels and is forecasted to continue to operate at acceptable levels of service with the 20 years of background traffic growth.

2 – Bryan Road and Crimson Meadow Drive (Side-Street Stop Control)
All individual movements currently operate at acceptable levels; however, with the 20 years of background traffic growth, the westbound approach exiting Crimson Meadows Drive is forecasted to operate at LOS F in the AM peak hour and LOS E in the PM peak hour for the 2037 No-Build conditions. It is important to note that residents desiring to travel south on Bryan Road can utilize Brook Hollow Drive to Feise Road to gain access to the traffic signal on Bryan Road during peak times when the delays are higher trying to make an unsignalized left onto Bryan Road from Crimson Meadows.

3 – Bryan Road and Feise Road (Signalized)
The overall intersection currently operates at acceptable levels (i.e., LOS D or better) and is forecasted to continue to operate at acceptable levels of service with the 20 years of background traffic growth. However, there are several individual movements that are forecasted to operate at LOS E or F during the peak hours for the 2037 No-Build condition.

Specifically, in the AM peak hour the westbound left-turn movement on Feise Road is forecasted to operate at LOS E with approximately 64 seconds of delay per vehicle and a v/c of 0.92.

In the PM peak hour, the eastbound left-turn movement on Feise Road is forecasted to operate at LOS E with approximately 73 seconds of delay per vehicle and a v/c of 0.93. The westbound left-turn movement on Feise Road is forecasted to operate at LOS E with approximately 71 seconds of delay per vehicle and a v/c of 0.89. The westbound through movement on Feise Road is forecasted to operate at LOS E with approximately 62 seconds of delay per vehicle and

a v/c of 0.69. The northbound through movement on Bryan Road is forecasted to operate at LOS D; however, the northbound through movement has a v/c of 1.01 which suggests that the movement is volatile and subject to frequent cycle failure. The southbound left-turn movement on Bryan Road is forecasted to operate at LOS F with approximately 98 seconds of delay per vehicle and a v/c of 1.06. Furthermore, the estimated 95th percentile southbound and northbound queues on Bryan Road block entry to the left- and right-turn bays.

As mentioned previously, with v/c ratios in excess of 1.0 you can expect general cycle failure of the movement and excessive queueing. To provide acceptable levels of service for all movements in the 2037 No-Build condition, a third northbound through lane would be needed on Bryan Road. This third lane should begin at the north side of the Route 364 bridge, just south of the Route 364 westbound ramp/North Outer Road intersection, and continue through Feise Road and then taper back to two lanes north of Feise Road. In considering 'best practices', with three northbound through lanes, permissive left-turns are not generally recommended. As a protected only left-turn movement, dual southbound left-turns are needed on Bryan Road at Feise Road. This would also require widening of eastbound Feise Road to two lanes, east of Bryan Road, to receive the dual left-turns. The two eastbound through lanes should provide a minimum of 500 feet (exclusive of taper) before merging back down to one lane.

Even with the recommended improvements, the westbound through movement would still operate at LOS E with approximately 60 seconds of delay per vehicle and a v/c of 0.67. However, a volume to capacity ratio in this range would not be expected to result in cycle failure or extensive queuing, rather the less than desirable level of service is a function of the green time allotted to the movement and signal timing favoring the through movements on Bryan Road.

<u>4/5 – Bryan Road and Commercial Drives (Side-Street Stop Control)</u>
The westbound approaches exiting the QuikTrip and PNC bank drives currently operate at LOS E/F during the peak hours and would degrade further considering the additional background growth in the 2037 No-Build conditions.

As mentioned previously, three northbound through lanes are needed on Bryan Road at these to driveways to accommodate the 2037 No-Build Condition. Considering 'best practices', with three northbound through lanes on Bryan Road, unsignalized lefts are generally not allowed from the side-street. As such, the unsignalized access drives serving the commercial uses (QuikTrip, PNC Bank, etc.) in the southeast quadrant of Bryan Road and Feise Road may be restricted to right-in/right-out (RIRO) in conjunction with any widening on Bryan Road.

As requested by the City of O'Fallon, crash data for the unsignalized drives serving the QuikTrip, PNC bank and other commercial uses was requested for a period for three years (2014, 2015 and 2016). Based on the crash data provided by the St. Charles County Police Department, there were a total of five crashes at the intersection of Bryan Road with the QuikTrip access drive. Of the five crashes, four were property damage only and one involved an injury. The primary type of crash was an angle crash with four of the five crashes classified as an angle crash. The primary cause of the angle crashes was stopped traffic on northbound Bryan Road in the outside lane

(closest to the edge of the roadway) leaving a gap in the northbound queue and then waving motorists trying to turn left out of the QuikTrip drive to proceed. When the motorists proceeding, they were hit by a moving car on northbound Bryan Road in the inside travel lane.

6 – Bryan Road and 364 Westbound Ramp/North Outer Road (Signalized)

The overall intersection currently operates at acceptable levels (i.e., LOS D or better) and is forecasted to continue to operate at overall acceptable levels of service with the 20 years of background traffic growth. However, there are several individual movements that are forecasted to operate at LOS E or F during the peak hours for the 2017 Existing and 2037 No-Build conditions. Specifically, in the AM peak hour the eastbound through/left-turn movement on the westbound Route 364 ramp is forecasted to operate at LOS E with approximately 57 seconds of delay per vehicle and a v/c of 0.49. The westbound left-turn movement on the North Outer Road is forecasted to operate at LOS E with approximately 67 seconds of delay per vehicle and a v/c of 0.75.

In the PM peak hour, the eastbound through/left-turn movement on the Route 364 westbound ramp is forecasted to operate at LOS F with approximately 82 seconds of delay per vehicle and a v/c of 1.02 in the 2037 No-Build Condition. The westbound left-turn movement on the North Outer Road is forecasted to operate at LOS F with approximately 118 seconds of delay per vehicle and a v/c of 0.99, while the westbound through movement is forecasted to operate at LOS E with approximately 63 seconds of delay per vehicle in the 2037 No-Build Condition. The northbound through movement on Bryan Road is forecasted to operate at LOS E with approximately 57 seconds of delay per vehicle and a v/c of 1.06. Furthermore, the estimated 95th percentile southbound and northbound queues on Bryan Road block entry to the left- and right-turn bays.

In the Saturday midday peak hour the eastbound through/left-turn movement on the westbound Route 364 ramp is forecasted to operate at LOS E with approximately 70 seconds of delay per vehicle and a v/c of 0.68 in the 2037 No-Build Condition.

With v/c ratios in excess of 1.0 (i.e., the northbound through movement at 1.06), you can expect general cycle failure of the movement and excessive queueing. To provide improved levels of service, a third northbound through lane is needed on Bryan Road at the 364 westbound ramp/North Outer Road intersection. As mentioned before, it was assumed that this third lane would begin at the north side of the Route 364 bridge, just south of the Route 364 westbound ramp/North Outer Road intersection, and continue through Feise Road and then taper back to two lanes north of Feise Road. In addition, it is recommended that the eastbound approach be widened from three lanes to four lanes to provide dual left-turn lanes, a through lane, and a right-turn lane.

Even with the recommended improvements, the westbound left-turn movement would still operate at LOS E with approximately 66 seconds of delay per vehicle and a v/c of 0.73. However, a volume to capacity ratio in this range would not be expected to result in cycle failure or

extensive queuing, rather the less than desirable level of service is a function of the green time allotted to the movement and signal timing favoring the through movements on Bryan Road.

7 – Bryan Road and 364 Eastbound Ramp (Signalized)

The overall intersection, as well as each individual movement, currently operates at acceptable levels and is forecasted to continue to operate at acceptable levels of service with the 20 years of background traffic growth.

8 – Bryan Road and Highway N/South Outer Road (Signalized)

The overall intersection currently operates at acceptable levels (i.e., LOS D or better) and is forecasted to continue to operate at overall acceptable levels of service with the 20 years of background traffic growth. However, there are several individual movements that are forecasted to operate at LOS E or F during the peak hours for the 2037 No-Build conditions.

Specifically, in the AM peak hour the eastbound left-turn movement on Highway N is forecasted to operate at LOS E with approximately 76 seconds of delay per vehicle and a v/c of 0.91 in the 2037 No-Build Condition. Furthermore, the estimated 95th percentile queue for southbound Bryan Road blocks entry to the left- and right-turn bays. The estimated 95th percentile queue for the westbound right-turn on the South Outer Road is 330 feet which would exceed the available storage of 225 feet.

In the PM peak hour, the eastbound left-turn movement on Highway N is forecasted to operate at LOS F with approximately 97 seconds of delay per vehicle and a v/c of 1.0 in the 2037 No-Build Condition. The westbound left-turn movement on the South Outer Road is forecasted to operate at LOS E with approximately 68 seconds of delay per vehicle and a v/c of 0.64, while the westbound through movement on the South Outer Road is forecasted to operate at LOS E with approximately 66 seconds of delay per vehicle and a v/c of 0.73. The northbound left-turn movement on Bryan Road is forecasted to operate at LOS E with approximately 79 seconds of delay per vehicle and a v/c of 0.76 in the 2037 No-Build Condition. The southbound left-turn movement on Bryan Road is forecasted to operate at LOS F with approximately 87 seconds of delay per vehicle and a v/c of 0.98. Furthermore, the estimated 95th percentile queue for northbound Bryan Road blocks entry to the left- and right-turn bays. The estimated 95th percentile queue for the eastbound left-turn on Highway N is 480 feet which would exceed the available storage of 230 feet.

In the Saturday midday peak hour, the eastbound left-turn movement on Highway N is forecasted to operate at LOS E with approximately 71 seconds of delay per vehicle and a v/c of 0.93 in the 2037 No-Build Condition. The northbound left-turn movement on Bryan Road is forecasted to operate at LOS E with approximately 75 seconds of delay per vehicle and a v/c of 0.78 in the 2037 No-Build Condition. The estimated 95th percentile queue for the eastbound left-turn on Highway N is 295 feet which would exceed the available storage of 230 feet.

To provide improved levels of service, it is recommended that dual eastbound left-turns be provided on Highway N and that dual westbound right-turn lanes be provided on the South

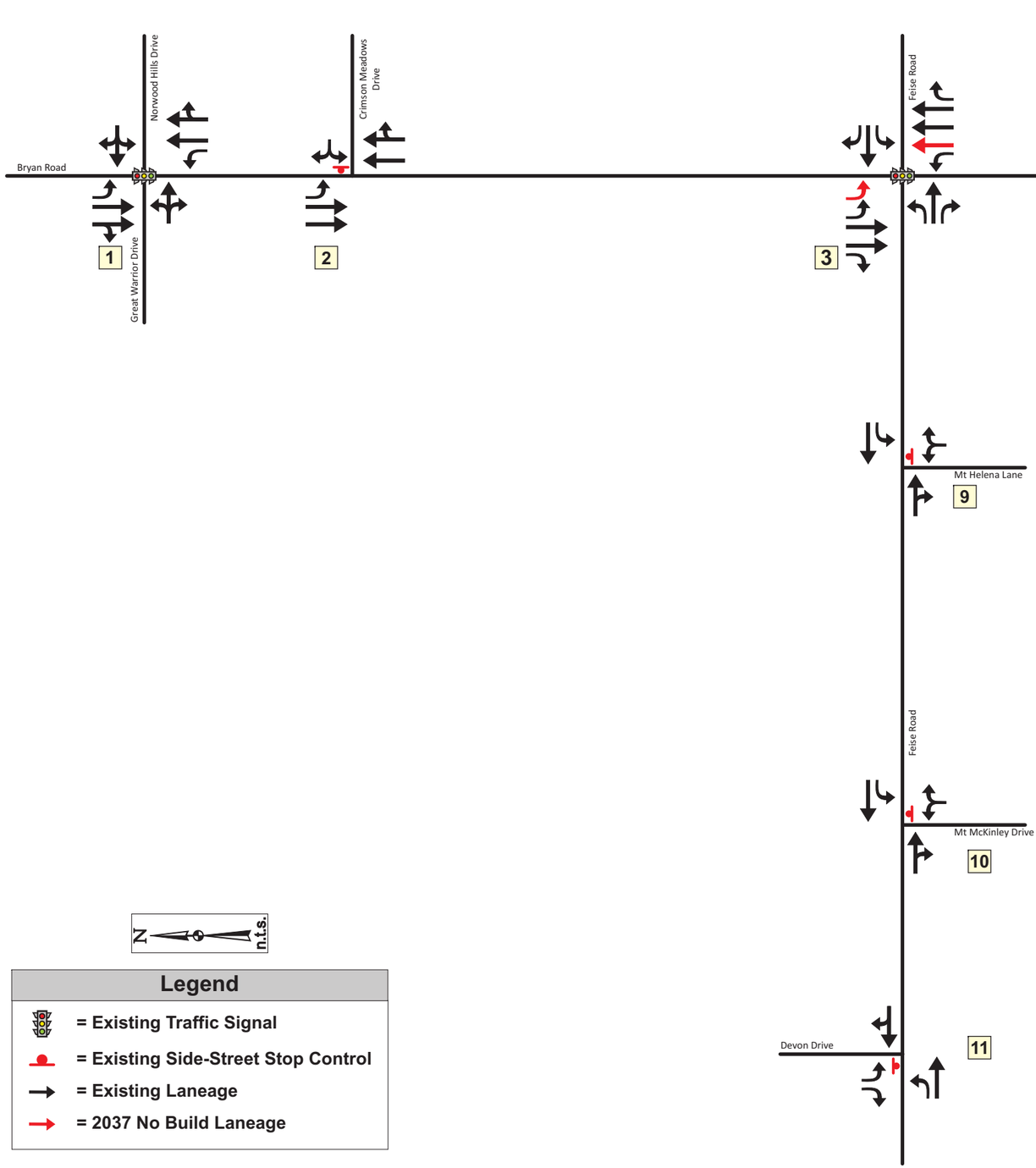
Outer Road. Even with the recommended improvements, the westbound left-turn and through movements, eastbound left-turn and through movements and the northbound left-turn movement would still operate at LOS E with approximately 56 to 68 seconds of delay per vehicle and v/c's ranging from 0.59 to 0.74. Volume to capacity ratios in this range would not be expected to result in cycle failure or extensive queuing, rather the less than desirable level of service is a function of the green time allotted to the movement and signal timing favoring the through movements on Bryan Road.

9 – Feise Road and Mt. Helena Lane (Side-Street Stop Control)
All individual movements currently operate at acceptable levels and are forecasted to continue to operate at acceptable levels of service with the 20 years of background traffic growth.

10 – Feise Road and Mt. McKinley Drive (Side-Street Stop Control)
All individual movements currently operate at acceptable levels and are forecasted to continue to operate at acceptable levels of service with the 20 years of background traffic growth.

11 - Feise Road and Devon Drive (Side-Street Stop Control)
All individual movements currently operate at acceptable levels and are forecasted to continue to operate at acceptable levels of service with the 20 years of background traffic growth.

The recommended lane configuration to better accommodate the 2037 No-Build traffic volumes for the study intersections is shown in **Exhibit 9.**



N n.t.s.

Legend

- = Existing Traffic Signal
- = Existing Side-Street Stop Control
- = Existing Laneage
- = 2037 No Build Laneage

Exhibit 9: 2037 No Build Recommended Lane Configuration and Traffic Control

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09/12/17

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2037 BUILD TRAFFIC ANALYSIS

Once the baseline roadway and traffic conditions have been established, the potential impacts of the traffic generated by the Bopp property and its associated access needs can be analyzed. The purpose of this scenario was to identify the potential impacts of the proposed build-out of the Bopp property and determine the probable roadway and traffic control improvements that may be necessary to support the projected traffic demands.

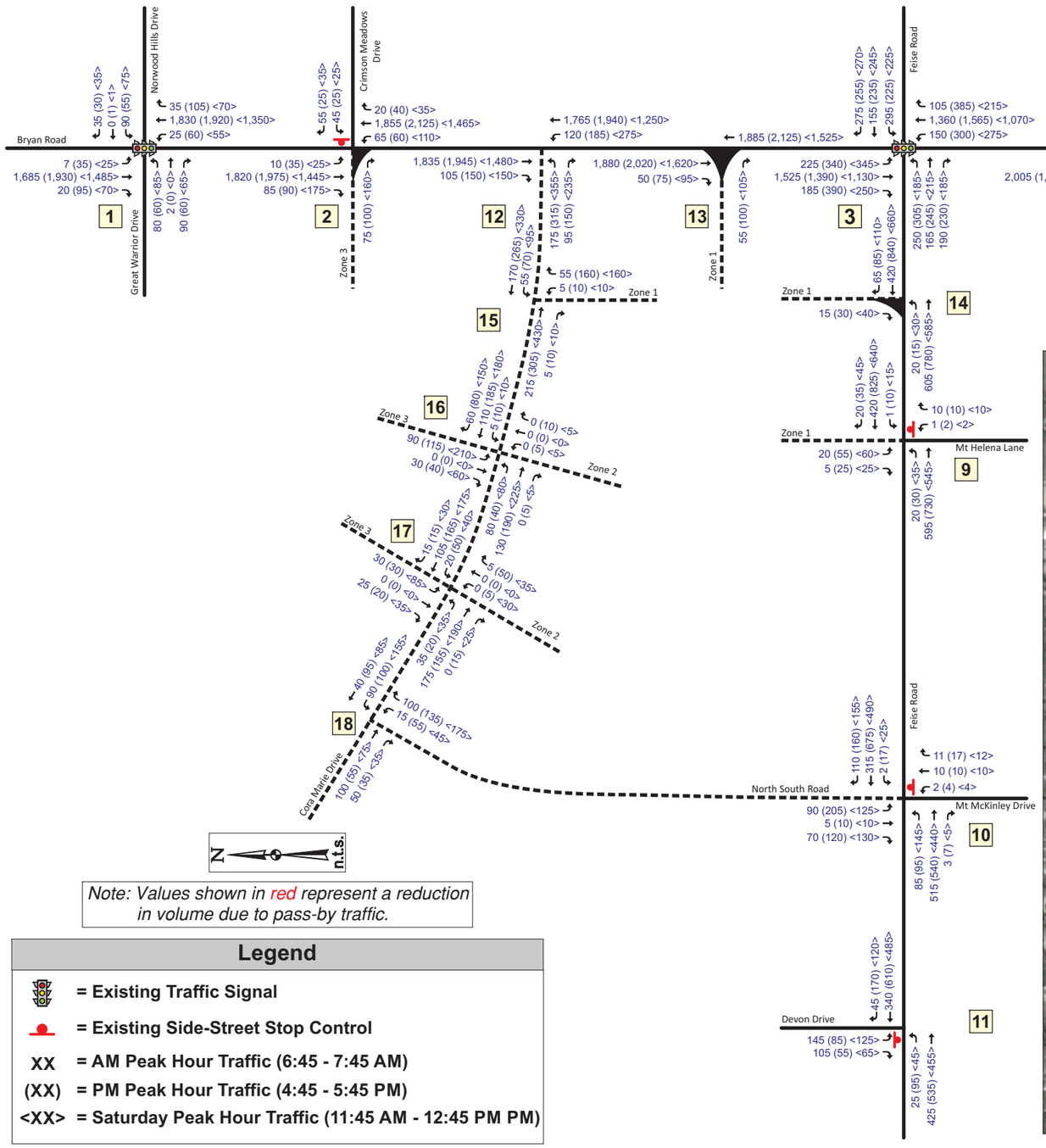
2037 Build Traffic Volumes (2037 No-Build plus Build-out of Bopp Property): The assigned traffic volumes resulting from the trip distribution for Zones 1, 2, 3 and 4 of the Bopp property were added to the 2037 No-Build traffic volumes to determine the total volumes in the 2037 Build scenario. The 2037 Build traffic volumes for the peak hours are shown in **Exhibit 10.**

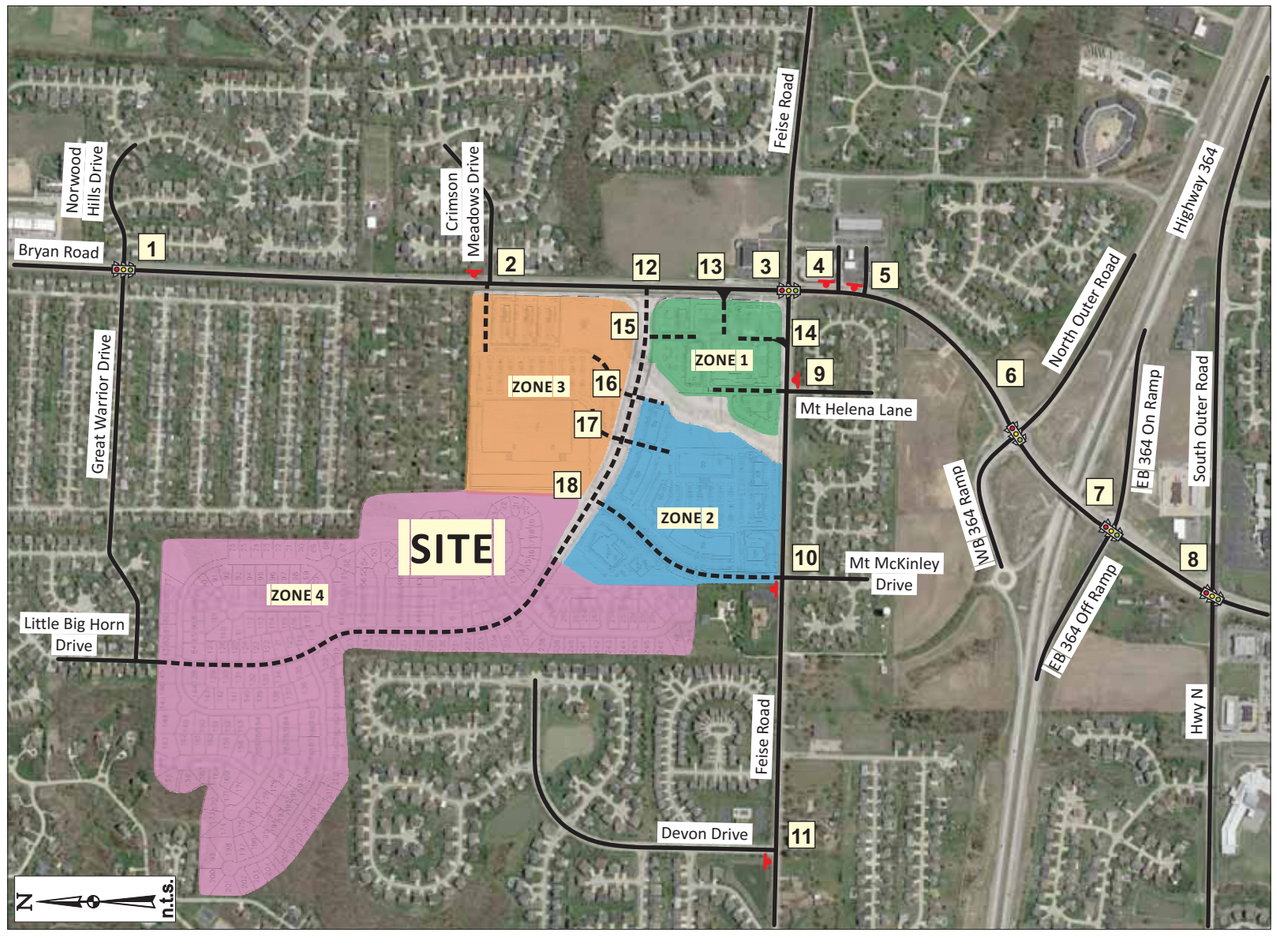
Auxiliary Turn Lane Needs*:* Based on Section 15 of the City of O'Fallon's Traffic Management Policy, right turns lanes are required on Major Arterials, such as Bryan Road, at all drives and streets. A minimum length of 250 feet plus taper should be provide at intersections with another arterial street and 100 feet plus taper at other locations. In accordance with the City of O'Fallon's guidelines, separate southbound right-turn lanes are required on Bryan Road at the proposed site drives. Per the City's code, the proposed right-turn lanes on Bryan Road should provide a minimum of 100 feet of storage plus taper.

The need for seperate westbound right-turn lanes on Feise Road at the site drives were also considered. However, we are not aware of specific right-turn lane warrant guidelines followed by the City of Dardenne Prairie. A Policy for the Geometric Design of Highways and Streets, published by the American Association of State Highway and Transportation Officials (AASHTO), commonly referred to as the *Green Book* is often used to evaluate the need for turn lanes, but the *Green Book* does not provide specific criteria to determine whether a right-turn lane is 'warranted'.

Outside other contributing factors that might necessitate the need for a separate right-turn lane, a general rule of thumb often used in the industry is to consider providing a separate right-turn lane when the right turn volume exceeds 100 vph during the peak hour. The forecasted right-turn volume on Feise Road at the proposed east site drive for Zone 1 is 85 vph during the PM peak hour and 110 vph during the Saturday midday peak hour which exceeds the general 100 vph guideline. In addition, considering the proximity to the traffic signal at Bryan Road, it is recommended that a separate right-turn lane with a minimum of 100 feet of storage plus taper be provided on Feise Road at the proposed east site drive for Zone 1.

The forecasted right-turn volume on Feise Road at the proposed west site drive for Zone 1, opposite Mt. Helena Lane, is less than 50 vph during the peak hours; as such, a separate right-turn lane is not necessary.





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

Legend

- = Existing Traffic Signal
- = Existing Side-Street Stop Control
- XX = AM Peak Hour Traffic (6:45 - 7:45 AM)
- (XX) = PM Peak Hour Traffic (4:45 - 5:45 PM)
- <XX> = Saturday Peak Hour Traffic (11:45 AM - 12:45 PM PM)

Exhibit 10: 2037 Build Traffic Volumes

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The forecasted right-turn volume on Feise Road at the proposed site drive for Zone 2, opposite Mt. McKinley Drive, exceeds 100 vph during the weekday AM, weekday PM and Saturday middday peak hours; as such, a separate right-turn lane is recommended.

The need for separate left-turn lanes on Bryan Road and Feise Road were not specifically analyzed since both Bryan Road and Feise Road have a center two-way left-turn lane to accommodate left-turn vehicles. Specifically, the TWLTL would allow for eastbound left-turn lanes at Mt. Helena Lane and Mt. McKinley Drive.

Signal Warrants – Bryan Road and Cora Marie Drive: The need for a traffic signal at Bryan Road and the proposed Cora Marie Drive was evaluated using criteria outlined in the *Manual on Uniform Traffic Control Devices* (MUTCD), published by the Federal Highway Administration, United States Department of Transportation. Part Four of the MUTCD provides nine different warrants for signalization that are based on hourly traffic volumes, traffic operations, pedestrian volumes and crash experience, though Warrant 1 is typically the primary warrant considered when evaluating the need for a traffic signal.

Warrant 1 has two conditions, "A" and "B". Condition "A" (Minimum Vehicular Volume) is intended for application where a large volume of intersecting traffic is the principal reason to consider a signal. Condition "B" (Interruption of Continuous Traffic) is intended for application where traffic volumes on a major street are so heavy that traffic on the minor intersecting street suffers excessive delay or conflict in entering or crossing the major street. The minimum volume requirements are shown in **Figure 9**.

Warrant 1A requires approach volumes of at least 600 vph on major streets with two lanes per direction and a minimum of 200 vph on the minor street assuming a two-lane approach. Warrant 1B requires approach volumes of at least 900 vph on major streets with two lanes per direction and a minimum of 100 vph on the minor street assuming a two-lane approach.

In the absence of eight-hour traffic counts, the 8th highest hourly volumes are commonly estimated as 55% of peak hour traffic. As indicated by the 2037 Build traffic volumes (Exhibit 10), the total approach volume on Bryan Road is forecasted at 4,220 vph during the weekday PM peak hour, while the approach volume on Cora Marie Drive (discounting the right-turn volume) is forecasted at 315 vph. At 55% of the peak hour, the 8th highest hourly volume is estimated to be approximately 2,320 vph on Bryan Road and 174 vph on Cora Marie Drive. Thus, the 2037 Build traffic volumes would more than satisfy the Warrant 1B criteria. As such, a traffic signal at Bryan Road and the proposed Cora Marie Drive is recommended.

Table 4C-1. Warrant 1, Eight-Hour Vehicular Volume

Condition A—Minimum Vehicular Volume

Number of lanes for moving traffic on each approach		Vehicles per hour on major street (total of both approaches)				Vehicles per hour on higher-volume minor-street approach (one direction only)			
Major Street	Minor Street	100%[a]	80%[b]	70%[c]	56%[d]	100%[a]	80%[b]	70%[c]	56%[d]
1	1	500	400	350	280	150	120	105	84
2 or more	1	600	480	420	336	150	120	105	84
2 or more	2 or more	600	480	420	336	200	160	140	112
1	2 or more	500	400	350	280	200	160	140	112

Condition B—Interruption of Continuous Traffic

Number of lanes for moving traffic on each approach		Vehicles per hour on major street (total of both approaches)				Vehicles per hour on higher-volume minor-street approach (one direction only)			
Major Street	Minor Street	100%[a]	80%[b]	70%[c]	56%[d]	100%[a]	80%[b]	70%[c]	56%[d]
1	1	750	600	525	420	75	60	53	42
2 or more	1	900	720	630	504	75	60	53	42
2 or more	2 or more	900	720	630	504	100	80	70	56
1	2 or more	750	600	525	420	100	80	70	56

[a] Basic minimum hourly volume
[b] Used for combination of Conditions A and B after adequate trial of other remedial measures
[c] May be used when the major-street speed exceeds 40 mph or in an isolated community with a population of less

Figure 9: MUTCD Warrant 1, Eight Hour Vehicular Volume

The need for a traffic signal at Feise Road and the proposed North South Road/Mt. McKinley Drive was also evaluated using criteria outlined in the MUTCD. Warrant 1A requires approach volumes of at least 500 vph on major streets with one lane per direction and a minimum of 150 vph on the minor street assuming a single-lane approach (assumes a left-turn lane with the right-turn movement removed from the evaluation). Warrant 1B requires approach volumes of at least 750 vph on major streets with one lane per direction and a minimum of 75 vph on the minor street assuming a single-lane approach.

As indicated by the 2037 Build traffic volumes (Exhibit 10), the total approach volume on Feise Road is forecasted at 1,630 vph during the weekday PM peak hour, while the approach volume on North South Road (discounting the right-turn volume) is forecasted at 215 vph. At 55% of the peak hour, the 8th highest hourly volume is estimated to be approximately 895 vph on Feise Road and 118 vph on North South Road.

If two lanes are ultimately provided on Feise Road, the minimum volume thresholds for Warrant 1B would be at least 900 vph on Feise Road with two lanes per direction and a minimum of 75 vph on the minor street assuming a single-lane approach. Again, at 55% of the peak hour, the 8th highest hourly volume is estimated to be approximately 895 vph on Feise Road and 118 vph on North South Road. Thus, the 2037 Build traffic volumes would be just shy of satisfying the Warrant 1B criteria assuming Feise Road has two lanes in each direction (i.e., requires 900 vph for 8 hours and the 8th highest hour is estimated at 895 vph). Nonetheless, given how close the estimated volumes are to meeting the minimum thresholds, a traffic signal at Feise Road and the proposed North South Road/Mt. McKinley Drive will likely be recommended at full build-out.

2037 Build Operating Conditions: The study intersections were reevaluated for the 2037 Build scenario using the same methodologies previously described. The 2037 Build scenario reflects the full build-out of the Bopp property on top of the 20-Year No Build conditions. **Table 7** summarizes the results of this analysis, which reflects the 2037 Build operating conditions and average delays during the weekday AM, weekday PM and Saturday midday peak hours. The Synchro estimated 95th percentile queue lengths for the primary intersection of Bryan Road and Feise Road, as well as Bryan Road and Cora Marie Drive are shown in the table.

As mentioned previously, a new east-west roadway, Cora Marie Drive, would be constructed to serve as the primary route extending west from Bryan Road through the development area and extending north through the residential portion of the development. Additionally, a north-south interior roadway, North South Road, would also be constructed on the west side of the development area, with intersections at Cora Marie Drive to the north and Feise Road, opposite Mt. McKinley Drive, to the south.

It is important to note that the 2037 Build analyses do reflect the proposed southbound right-turn lanes on Bryan Road at Cora Marie Drive and the two proposed site drives (for Zone 1 and Zone 3), as well as the recommended westbound right-turn lanes on Feise Road at North South Road and the proposed east site drive to Zone 1. The recommended traffic signals at Bryan Road with Cora Marie Drive and Feise Road with North South Road are also reflected in the analyses.

As the traffic volumes in the area grow, it will likely become necessary to increase the signal system cycle length along Bryan Road to better accommodate the higher traffic volumes. In the 2037 Build 'improved' analyses herein, the weekday AM and Saturday midday peak hour cycle length is 100 seconds, while the weekday PM peak hour cycle length was increased to 120 seconds to better accommodate the 20-year traffic volumes. Agencies typically retime their corridors every five to ten years, so these types of changes would be reasonable continuing operational modifications.

Table 7 provides the approach level of service and delay for each intersection. The approach is highlighted orange if there is a movement within the approach that operates at LOS E, while the approach is highlighted red if there is a movement within the approach that operates at LOS F. As indicated in **Table 7**, there are several individual movements that operate at LOS E or F for the 2037 Build conditions with only the base improvements, specifically the signalized intersections of Bryan Road with Feise Road, the 364 westbound ramp/North Outer Road, the 364 eastbound ramp and Highway N/South Outer Road. Each study intersection is discussed in greater detail in the following paragraphs.

Table 7 reflects the 2037 Build operations assuming the base improvements previously identified to accommodate the 2037 No-Build conditions, or background traffic growth, as well as the 2037 Build operations with the additional improvements necessary to accommodate the full build-out of the Bopp property.

Table 7: 2037 Build Capacity Analysis Summary

Intersection/Movement	AM Peak Hour		PM Peak Hour		SAT Peak Hour	
	2037 Build (Base Imp)	2037 Build (Improved)	2037 Build (Base Imp)	2037 Build (Improved)	2037 Build (Base Imp)	2037 Build (Improved)
1 – Bryan Road and Great Warrior Drive/Norwood Hills Drive (Signalized)						
Eastbound Great Warrior Drive Approach	D (54.1)	D (41.8)	C (33.7)	C (28.1)	C (29.3)	C (29.3)
Westbound Norwood Hills Drive Approach	C (31.9)	C (22.8)	D (53.7)	D (46.4)	D (49.4)	D (49.4)
Northbound Bryan Road Approach	B (18.5)	B (17.5)	C (21.8)	C (25.6)	A (9.8)	B (12.2)
Southbound Bryan Road Approach	B (16.4)	B (17.5)	B (19.4)	C (20.7)	B (15.2)	B (15.2)
Overall	B (19.7)	B (18.8)	C (21.7)	C (23.8)	B (14.6)	B (15.6)
2 – Bryan Road and Crimson Meadow Drive/Proposed Zone 3 Drive (Side-Street Stop Control)						
Eastbound Zone 3 Right-Turn	D (25.8)	D (25.8)	E (35.5)	E (35.5)	D (25.7)	D (25.7)
Westbound Crimson Meadow Approach	F (>200)	F (>200)	F (>200)	F (>200)	F (>200)	F (>200)
Northbound Bryan Road Left-Turn	C (22.5)	C (22.5)	D (25.9)	D (25.9)	C (19.8)	C (19.8)
Southbound Bryan Road Left-Turn	C (18.3)	C (18.4)	C (23.1)	C (20.5)	B (13.8)	B (14.2)
3 – Bryan Road and Feise Road (Signalized)						
Eastbound Feise Road Approach	E (62.2) 95thQ: 295' L	D (36.5) 95thQ: 130' L	F (145.0) 95thQ: 475' L	D (46.9) 95thQ: 205' L	C (31.5) 95thQ: 200' T	D (36.4) 95thQ: 110' T
Westbound Feise Road Approach	F (104.7) 95thQ: 415' L	D (43.4) 95thQ: 190' R	F (86.7) 95thQ: 380' L	D (43.4) 95thQ: 140' L	D (50.4) 95thQ: 285' L	D (35.3) 95thQ: 150' L
Northbound Bryan Road Approach	D (37.8) 95thQ: 410' T	C (27.9) 95thQ: 415' T	D (41.4) 95thQ: 570' T	C (23.5) 95thQ: 400' T	D (42.0) 95thQ: 355' L	C (21.5) 95thQ: 260' L
Southbound Bryan Road Approach	C (29.7) 95thQ: 845' T	B (19.0) 95thQ: 140' T	C (24.4) 95thQ: 505' T	C (27.3) 95thQ: 230' T	D (48.9) 95thQ: 475' T	B (18.1) 95thQ: 235' L
Overall	D (47.6)	C (27.7)	D (54.5)	C (30.4)	D (44.7)	C (24.4)
4 – Bryan Road and QT Drive (Side-Street Stop Control - RIRO)						
Westbound QT Drive Approach	B (14.2)	B (14.2)	C (19.0)	C (19.0)	B (14.3)	B (14.3)
Northbound Bryan Road Approach	A (<1.0)	A (<1.0)	A (<1.0)	A (<1.0)	A (<1.0)	A (<1.0)
Southbound Bryan Road Approach	A (<1.0)	A (<1.0)	A (<1.0)	A (<1.0)	A (<1.0)	A (<1.0)
5 – Bryan Road and Bank Drive (Side-Street Stop Control - RIRO)						
Westbound Bank Drive Approach	B (13.2)	B (13.2)	C (16.8)	C (16.8)	B (12.9)	B (12.9)
Northbound Bryan Road Approach	A (<1.0)	A (<1.0)	A (<1.0)	A (<1.0)	A (<1.0)	A (<1.0)
Southbound Bryan Road Approach	A (<1.0)	A (<1.0)	A (<1.0)	A (<1.0)	A (<1.0)	A (<1.0)

X (XX.X) - Level of Service (Vehicular delay in seconds per vehicle)
Denotes a movement on the approach with LOS E; Denotes a movement on the approach with LOS F
95th percentile queue for the critical movement of the approach and lane (L-Left, TR-Shared Thru/Right, R-Right)

Table 7: 2037 Build Capacity Analysis Summary (cont.)

Intersection/Movement	AM Peak Hour		PM Peak Hour		SAT Peak Hour	
	2037 Build (Base Imp)	2037 Build (Improved)	2037 Build (Base Imp)	2037 Build (Improved)	2037 Build (Base Imp)	2037 Build (Improved)
6 – Bryan Road and 364 Westbound Ramp/North Outer Road (Signalized)						
Eastbound 364 WB Ramp Approach	D (50.1)	C (25.4)	E (69.7)	D (49.6)	C (39.2)	C (31.0)
Westbound North Outer Road Approach	E (67.8)	D (41.7)	F (85.9)	E (65.7)	D (50.1)	D (45.1)
Northbound Bryan Road Approach	B (16.4)	C (24.1)	B (16.1)	C (20.0)	B (13.8)	B (12.9)
Southbound Bryan Road Approach	C (20.8)	D (39.9)	C (20.9)	C (29.0)	B (18.0)	C (21.0)
Overall	C (24.3)	C (32.7)	C (31.7)	C (31.4)	C (20.6)	C (20.3)
7 – Bryan Road and 364 Eastbound Ramp (Signalized)						
Eastbound 364 EB Ramp Approach	D (41.1)	D (37.7)	D (52.2)	D (48.5)	C (30.7)	D (36.4)
Northbound Bryan Road Approach	C (24.7)	C (26.4)	C (21.9)	C (30.0)	B (11.1)	B (12.0)
Southbound Bryan Road Approach	B (17.6)	B (14.7)	B (13.5)	B (12.9)	A (10.0)	A (8.9)
Overall	C (22.8)	C (21.8)	C (21.9)	C (25.0)	B (13.0)	B (13.7)
8 – Bryan Road and Highway N/South Outer Road (Signalized)						
Eastbound Highway N Approach	D (47.6)	D (39.3)	E (71.8)	E (60.4)	D (49.1)	D (39.5)
Westbound South Outer Road Approach	C (33.0)	C (22.4)	C (34.7)	D (38.2)	C (25.2)	C (26.1)
Northbound Bryan Road Approach	C (28.3)	C (29.3)	D (48.5)	E (79.6)	C (33.3)	D (35.1)
Southbound Bryan Road Approach	C (31.5)	C (20.9)	C (29.9)	D (35.9)	C (21.8)	C (20.9)
Overall	C (32.9)	C (25.4)	D (42.8)	D (53.9)	C (30.3)	C (28.9)
9 – Feise Road and Mt. Helena Lane/Proposed Zone 1 Drive (Side-Street Stop Control)						
Eastbound Feise Road Approach	A (<1.0)	A (<1.0)	A (<1.0)	A (<1.0)	A (<1.0)	A (<1.0)
Westbound Feise Road Approach	A (<1.0)	A (<1.0)	A (<1.0)	A (<1.0)	A (<1.0)	A (<1.0)
Northbound Mt. Helena Lane Approach	B (13.1)	B (14.1)	C (16.3)	C (16.2)	B (13.4)	B (13.7)
Southbound Zone 1 Drive Approach	B (14.8)	C (15.3)	D (25.2)	C (23.6)	C (19.0)	C (18.5)
10 – Feise Road and Mt. McKinley Drive/Proposed Zone 2 Drive (Side-Street Stop Control)						
Eastbound Feise Road Approach	A (1.2)	A (1.2)	A (1.6)	A (1.6)	A (2.5)	A (2.4)
Westbound Feise Road Approach	A (<1.0)	A (<1.0)	A (<1.0)	A (<1.0)	A (<1.0)	A (<1.0)
Northbound Mt. McKinley Drive Approach	B (14.7)	B (14.7)	C (21.8)	C (21.2)	C (21.0)	C (20.5)
Southbound Zone 2 Drive Approach	C (17.1)	C (16.6)	F (76.4)	F (66.1)	D (28.2)	D (26.1)

X (XX.X) - Level of Service (Vehicular delay in seconds per vehicle)
Denotes a movement on the approach with LOS E; Denotes a movement on the approach with LOS F
95th percentile queue for the critical movement of the approach and lane (L-Left, TR-Shared Thru/Right, R-Right)

Table 7: 2037 Build Capacity Analysis Summary (cont.)

Intersection/Movement	AM Peak Hour		PM Peak Hour		SAT Peak Hour	
	2037 Build (Base Imp)	2037 Build (Improved)	2037 Build (Base Imp)	2037 Build (Improved)	2037 Build (Base Imp)	2037 Build (Improved)
11 - Feise Road and Devon Drive (Side-Street Stop Control)						
Eastbound Feise Road Approach	A (<1.0)	A (<1.0)	A (1.5)	A (1.5)	A (<1.0)	A (<1.0)
Westbound Feise Road Approach	A (<1.0)	A (<1.0)	A (<1.0)	A (<1.0)	A (<1.0)	A (<1.0)
Southbound Devon Drive Approach	B (13.8)	B (13.8)	C (19.1)	C (19.1)	C (16.3)	C (16.3)
12 – Bryan Road and Proposed Cora Marie Drive (Signalized)						
Eastbound Cora Marie Drive Approach	D (44.9)	C (34.7) 95th Q: 90' L	E (72.3)	D (41.2) 95th Q: 175' L	D (36.8)	C (31.9) 95th Q: 160' L
Northbound Bryan Road Approach	B (11.7)	B (14.0) 95th Q: 365' T	B (15.5)	C (24.8) 95th Q: 350' T	C (22.4)	B (12.6) 95th Q: 165' L
Southbound Bryan Road Approach	B (17.0)	B (14.1) 95th Q: 500' T	D (39.5)	B (18.7) 95th Q: 500' T	D (35.1)	C (22.9) 95th Q: 440' T
Overall	B (16.4)	B (15.4)	C (31.9)	C (23.7)	C (30.2)	C (20.1)
13 – Bryan Road and Proposed Zone 1 RIRO Drive (Side-Street Stop Control)						
Eastbound Zone 1 Right-Turn	B (12.8)	A (9.6)	C (15.3)	B (10.3)	B (12.4)	A (9.7)
Southbound Bryan Road Approach	A (<1.0)	A (<1.0)	A (<1.0)	A (<1.0)	A (<1.0)	A (<1.0)
14 – Feise Road and Proposed Zone 1 Three-Quarter Access Drive (Side-Street Stop Control)						
Eastbound Feise Road Left-Turn	A (8.6)	A (8.4)	B (11.2)	B (10.1)	B (10.2)	A (9.5)
Westbound Feise Road Approach	A (<1.0)	A (<1.0)	A (<1.0)	A (<1.0)	A (<1.0)	A (<1.0)
Southbound Zone 1 Right-Turn	B (10.8)	A (9.3)	C (17.4)	B (10.7)	B (13.8)	B (10.0)

X (XX.X) - Level of Service (Vehicular delay in seconds per vehicle)
Denotes a movement on the approach with LOS E; Denotes a movement on the approach with LOS F
95th percentile queue for the critical movement of the approach and lane (L-Left, TR-Shared Thru/Right, R-Right)

To recap, the following improvements are necessary to provide favorable operations for the 2037 No-Build conditions (existing plus 20 years of background at 1% per year). These improvements are reflected in the 2037 Build base analyses.

- Provide a third northbound through lane on Bryan Road from just south of the Route 364 westbound/North Outer Road intersection to north of Feise Road.
  - Thus, it is likely that the existing commercial drives serving the QuikTrip, PNC bank and other uses would be restricted to RIRO since unsignalized left-turns are generally not allowed across three lanes.

- *#3 Bryan Road and Feise Road*
  - Provide an additional southbound left-turn lane to provide dual left-turn lanes (with three northbound through lanes, permissive left-turns are not generally allowed; as a protected only left-turn dual lefts are needed).
- *#6 Bryan Road and WB 364/North Outer Road*
  - Widen the eastbound Route 364 approach from three lanes to four lanes (dual left-turn lanes; a through lane; and a right-turn lane)
- *#8 Bryan Road and Highway N/South Outer Road*
  - Provide an additional eastbound left-turn lane on Highway N to provide dual left-turn lanes.
  - Provide an additional westbound right-turn lane on South Outer Road to provide dual right-turn lanes

1 – Bryan Road and Great Warrior Drive/Norwood Hills Drive (Signalized)
The overall intersection, as well as each individual movement, is forecasted to continue to operate at acceptable levels of service in the 2037 Build scenario.

2 – Bryan Road and Crimson Meadow Drive/Zone 3 (Side-Street Stop Control)
The westbound approach exiting Crimson Meadows Drive is forecasted to operate at LOS F during the peak hours for the 2037 Build conditions. As mentioned previously, residents desiring to travel south on Bryan Road can utilize Brook Hollow Drive to Feise Road to gain access to the traffic signal on Bryan Road during peak times when the delays are higher trying to make an unsignalized left onto Bryan Road from Crimson Meadows. Given the heavy through volumes on Bryan Road, it is recommended that consideration be given to restricting the left-turn movement exiting Crimson Meadows, similar to what is proposed for the access opposite Crimson Meadows to serve Zone 3 of the Bopp property.

As discussed previously, a separate southbound right-turn lane is recommended on Bryan Road at the proposed drive serving Zone 3. Per the City of O'Fallon code, the right-turn lane should provide a minimum of 100 feet of storage.

3 – Bryan Road and Feise Road (Signalized)
As shown in Table 7, the overall intersection would operate acceptably (i.e., LOS D or better) with only the prior improvements needed to accommodate the background traffic growth. With the full build-out of the Bopp property, the overall intersection would still operate at acceptable levels, but several of the individual movements are forecasted to operate at LOS E or F during the peak hours. Specifically, in the AM peak hour the eastbound, westbound and northbound left-turn movements are forecasted to operate at LOS F with delays ranging from approximately 106 to 199 seconds of delay per vehicle and v/c ratios ranging from 1.04 to 1.30. The southbound left-turn movement is forecasted to operate at LOS E with an approximate delay of 60 seconds of delay per vehicle.

In the PM peak hour, the eastbound, westbound and northbound left-turn movements are also forecasted to operate at LOS F with delays ranging from approximately 157 to 304 seconds of delay per vehicle and v/c ratios ranging from 1.24 to 1.56.

In the Saturday midday peak hour, the westbound, northbound and southbound left-turn movements are forecasted to operate at LOS F with delays ranging from approximately 89 to 183 seconds of delay per vehicle and v/c ratios ranging from 1.02 to 1.28.

As mentioned previously, with v/c ratios in excess of 1.0 you can expect general cycle failure of the movement and excessive queueing. To provide acceptable levels of service for all approaches, a third southbound through lane is needed on Bryan Road. It was assumed that this third lane would begin just north of Cora Marie Drive south to the Route 364 westbound ramp/North Outer Road intersection where it would drop as a dedicated right-turn lane. The following additional improvements are needed at the Bryan Road and Feise Road intersection to accommodate the full build-out of the Bopp property:

- Provide an additional eastbound left-turn lane to provide dual left turns on Feise Road.
    a. Based on the estimated queues, the existing turn bay length of 200 feet is acceptable.
- Provide an additional westbound left-turn lane to provide dual left turns on Feise Road.
    a. Based on the estimated queues, the existing turn bay length of 200 feet is acceptable.
- Provide an additional northbound left-turn lane to provide dual left turns on Bryan Road.
    a. Based on the estimated queues, the existing turn bay length of 190 feet should be lengthened to 250 feet.
- Lengthen the existing southbound right-turn lane on Bryan Road from 200 feet to 250 feet.
- Provide two eastbound through lanes on Feise Road at Bryan Road. It is recommended that this second eastbound through lane begin at Mt. Helena Lane/Zone 1 Drive and continue across Bryan Road for approximately 500 feet.
- Provide two westbound through lanes on Feise Road at Bryan Road. It is recommended that this second westbound through lane begin just east of Bryan Road and continue to North South Road/Mt. McKinley Drive where it would drop as a right-turn lane.

<u>4/5 – Bryan Road and Commercial Drives (Side-Street Stop Control)</u>
As mentioned previously, in considering 'best practices', with three northbound through lanes on Bryan Road, unsignalized lefts are generally not allowed. As such, the unsignalized access drives serving the commercial uses (QuikTrip, PNC Bank, etc.) in the southeast quadrant of Bryan Road and Feise Road may be restricted to RIRO in conjunction with any widening on Bryan Road. As a RIRO, the drives are forecasted to operate acceptably.

6 – Bryan Road and 364 Westbound Ramp/North Outer Road (Signalized)

As shown in Table 7, the overall intersection would operate acceptably (i.e., LOS C or better) with only the prior improvements needed to accommodate the background traffic growth. However, the eastbound and westbound approaches have individual movements forecasted to operate at LOS E or F during the peak hours. Specifically, in the AM peak hour the eastbound left-turn movement is forecasted to operate at LOS E with approximately 79 seconds of delay per vehicle and a v/c of 0.76. The westbound left-turn movement is forecasted to operate at LOS F with approximately 95 seconds of delay per vehicle and a v/c of 0.86.

In the PM peak hour, the eastbound left-turn movement is forecasted to operate at LOS F with approximately 97 seconds of delay per vehicle and a v/c of 1.01. The westbound left-turn movement is forecasted to operate at LOS F with approximately 105 seconds of delay per vehicle and a v/c of 0.93. The eastbound through movement on the Route 364 westbound ramp is forecasted to operate at LOS E with approximately 67 seconds of delay per vehicle and a v/c of 0.81.

In the Saturday midday peak hour the eastbound left-turn movement is forecasted to operate at LOS E with approximately 67 seconds of delay per vehicle and a v/c of 0.79. The westbound left-turn movement is forecasted to operate at LOS E with approximately 64 seconds of delay per vehicle and a v/c of 0.76.

To provide improved levels of service for the eastbound and westbound approaches, the previously recommended four-lane eastbound approach on the Route 364 ramp should be restriped to provide dual left-turn lanes; a shared through/right-turn lane; and a right-turn lane. In addition, although the forecasted westbound left-turn volume is fairly light (130 to 165 vph), consider providing dual westbound left-turn lanes on the North Outer Road.

7 – Bryan Road and 364 Eastbound Ramp (Signalized)

As shown in Table 7, the overall intersection would operate acceptably (i.e., LOS C or better) under the existing configuration, though some of individual movements are forecasted to operate at LOS E or F during the peak hours. Specifically, in the AM peak hour the eastbound left-turn movement is forecasted to operate at LOS E with approximately 69 seconds of delay per vehicle and a v/c of 0.73. The southbound left-turn movement is forecasted to operate at LOS E with approximately 65 seconds of delay per vehicle and a v/c of 0.82.

In the PM peak hour, the eastbound left-turn movement is forecasted to operate at LOS F with approximately 80 seconds of delay per vehicle and a v/c of 0.83. The southbound left-turn movement is forecasted to operate at LOS E with approximately 67 seconds of delay per vehicle and a v/c of 0.79.

In the Saturday midday peak hour, the southbound left-turn movement is forecasted to operate at LOS E with approximately 56 seconds of delay per vehicle and a v/c of 0.64.

To provide improved levels of service, the existing three lane eastbound approach on the Route 364 ramp should be restriped to provide dual left-turn lanes and a separate right-turn lane.

8 – Bryan Road and Highway N/South Outer Road (Signalized)

As shown in Table 7, the overall intersection would operate acceptably (i.e., LOS D or better) considering the full build-out of the Bopp property with only the prior improvements needed to accommodate the background traffic growth. All of the individual movements at the intersection are forecasted to operate at LOS D or better during the AM and Saturday midday peak hour; however, there are still some individual movements forecasted to operate at LOS E or F during the PM peak hour.

Specifically, in the PM peak hour the eastbound, westbound and northbound left-turn movements are forecasted to operate at LOS E with delays ranging from approximately 75 to 80 seconds of delay per vehicle and v/c ratios ranging from 0.67 to 0.91. The southbound left-turn movement on Bryan Road is forecasted to operate at LOS F with approximately 87 seconds of delay per vehicle and a v/c of 0.99. The eastbound and westbound through movements are forecasted to operate at LOS E with delays ranging from approximately 60 to 67 seconds of delay per vehicle and v/c ratios ranging from 0.73 to 0.74. The northbound through movement is forecasted to operate at LOS F with approximately 87 seconds of delay per vehicle and a v/c of 0.89.

Ultimately it may be necessary to provide additional through capacity by widening northbound Bryan Road to three lanes. However, to continue this third lane to the north, it would require the widening of the newly constructed bridge over Route 364. Considering the fact that the overall intersection is forecasted to operate at LOS C during the AM peak hour, LOS D during the PM peak hour and LOS C during the Saturday midday peak hour, widening of Bryan Road is not recommended in conjunction with the development of the Bopp property.

9 – Feise Road and Mt. Helena Lane (Side-Street Stop Control)

All individual movements are forecasted to continue to operate at acceptable levels of service in the 2037 Build scenario. It is recommended that two exiting lanes (a left-turn lane and a shared through/right-turn lane) be provided on the proposed drive for Zone 1.

10 – Feise Road and North South Road/Mt. McKinley Drive (Side-Street Stop Control/Signalized)

Under side street STOP control, all individual movements are forecasted to continue to operate at acceptable levels of service in the 2037 Build scenario with the exception of the southbound left-turn movement exiting North South Road which is forecasted to operate at LOS F in the PM peak hour and LOS E in the Saturday midday peak hour.

As discussed previously, the 2037 Build traffic volumes at the intersection of Feise Road and North South Road are just shy of satisfying the Warrant 1B criteria assuming Feise Road has two lanes in each direction (i.e., requires 900 vph for 8 hours and the 8th highest hour is estimated at 895 vph). Nonetheless, given how close the estimated volumes are to meeting the minimum thresholds, a traffic signal at Feise Road and the proposed North South Road/Mt.

McKinley Drive will likely be recommended at full build-out. As a signalized intersection, the intersection of Feise Road and North South Road would operate at overall LOS B during all peak hours with all movement also forecasted to operate acceptably. It is recommended that the east/west left-turn movements operate under protected plus permissive control and that the north/south approaches operate under permissive control. Given the generous separation between the existing traffic signal at Bryan Road and the potential traffic signal at North South Road (approximately 1,900 feet), it is not necessary to coordinate the traffic signals. In fact, the recommended traffic signal at Feise Road and the proposed North South Road/Mt. McKinley Drive would operate much better under free operation as opposed to operating under the longer cycle lengths required on Bryan Road.

It is recommended that two exiting lanes (a left-turn lane and a shared through/right-turn lane) be provided on the proposed North South Road.

11 - Feise Road and Devon Drive (Side-Street Stop Control)
All individual movements are forecasted to continue to operate at acceptable levels of service in the 2037 Build scenario.

12 – Bryan Road and Cora Marie Drive (Signalized)
As shown in Table 7, the overall intersection is forecasted to operate at LOS C or better in the 2037 Build conditions. The following improvements are recommended at the Bryan Road and Cora Marie Drive intersection to accommodate the full build-out of the Bopp property:

- Install a traffic signal and interconnect to the adjacent traffic signals on Bryan Road.
- Provide dual eastbound left-turn lanes and a separate right-turn lane on Cora Marie Drive.
    a. Based on the estimated queues, it is recommended that the eastbound left-turn bay provide a storage of 175 feet.
- Provide dual northbound left-turn lanes on Bryan Road.
    a. Based on the estimated queues, it is recommended that the northbound left-turn bay provide a storage of 250 feet.
    b. The provision of northbound dual lefts would require two lanes westbound on Cora Marie Drive to receive the dual left-turns. It was assumed that the second through lane would drop as a dedicated right turn lane into Zone 3.
- Provide a separate southbound right-turn lane on Bryan Road.
    a. The estimated queues for the southbound right-turn lane are less than 100 feet; however, a longer turn bay would be desirable to allow southbound right-turns to get around the southbound through queues. Thus, it is recommended that the southbound right-turn bay provide a storage of 400 feet.

To assess the potential for the northbound and southbound queues on Bryan Road between Feise Road and the proposed Cora Marie Drive to back through the adjacent signals, the northbound queues at Cora Marie Drive and the southbound queues at Feise Road were reviewed. As shown in Table 7, the estimated 95th percentile queue for the northbound approach of Bryan Road at Cora Marie Drive is approximately 365 feet. The estimated 95th percentile queue for the southbound approach of Bryan Road at Feise Road is approximately 235 feet.

There is approximately 900 feet between the existing traffic signal at Feise Road and the proposed traffic signal at Cora Marie Drive; thus, the northbound and southbound queues on Bryan Road between Feise Road and the proposed Cora Marie Drive are not expected to impact the adjacent intersections.

13 – Bryan Road and Zone 1 RIRO Drive (Side-Street Stop Control)

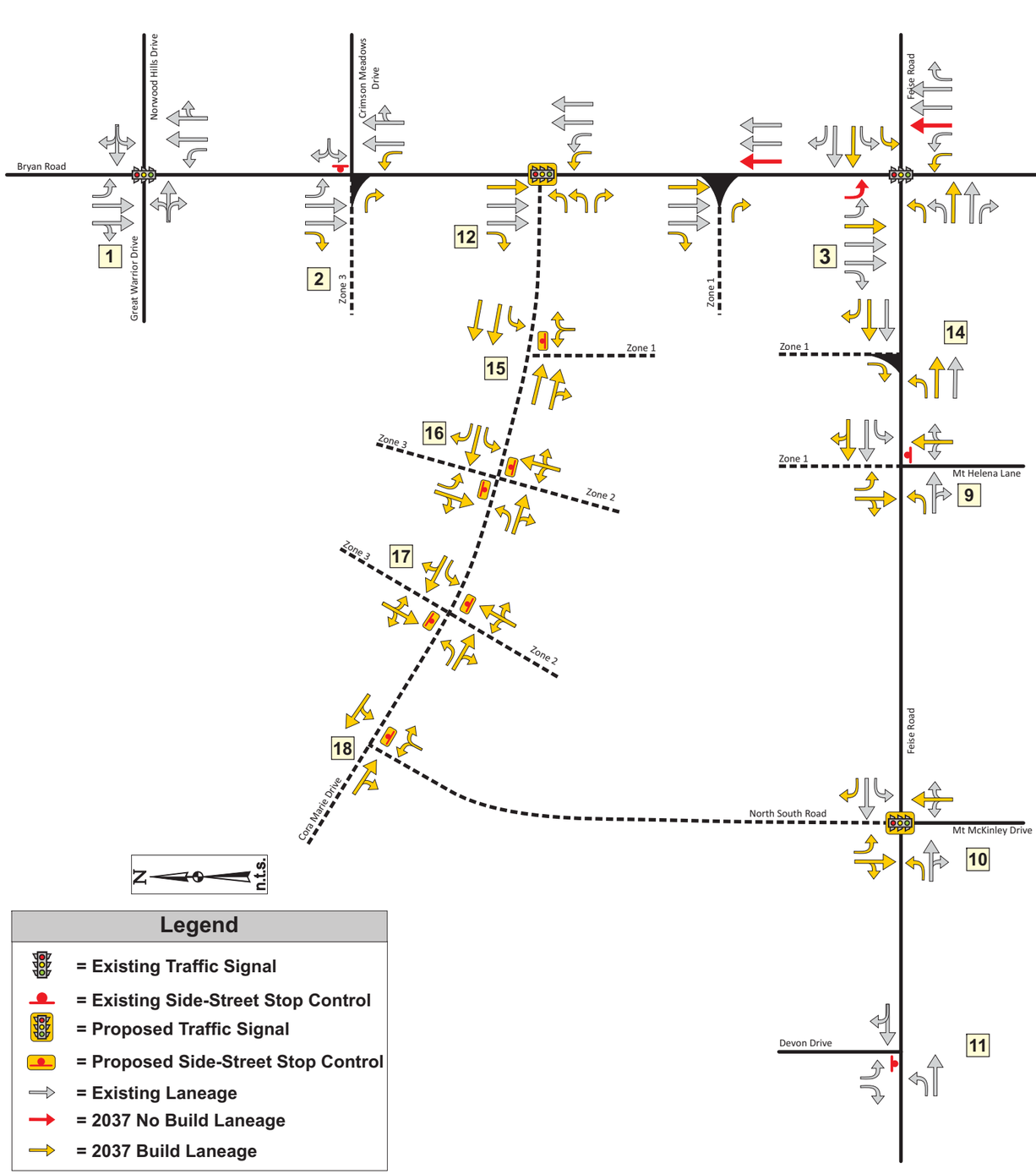
The eastbound right-turn exiting Zone 1 is forecasted to operate at LOS C or better in the 2037 Build conditions. As discussed previously, a separate southbound right-turn lane is recommended on Bryan Road. Per the City of O'Fallon code, the right-turn lane should provide a minimum of 100 feet of storage.

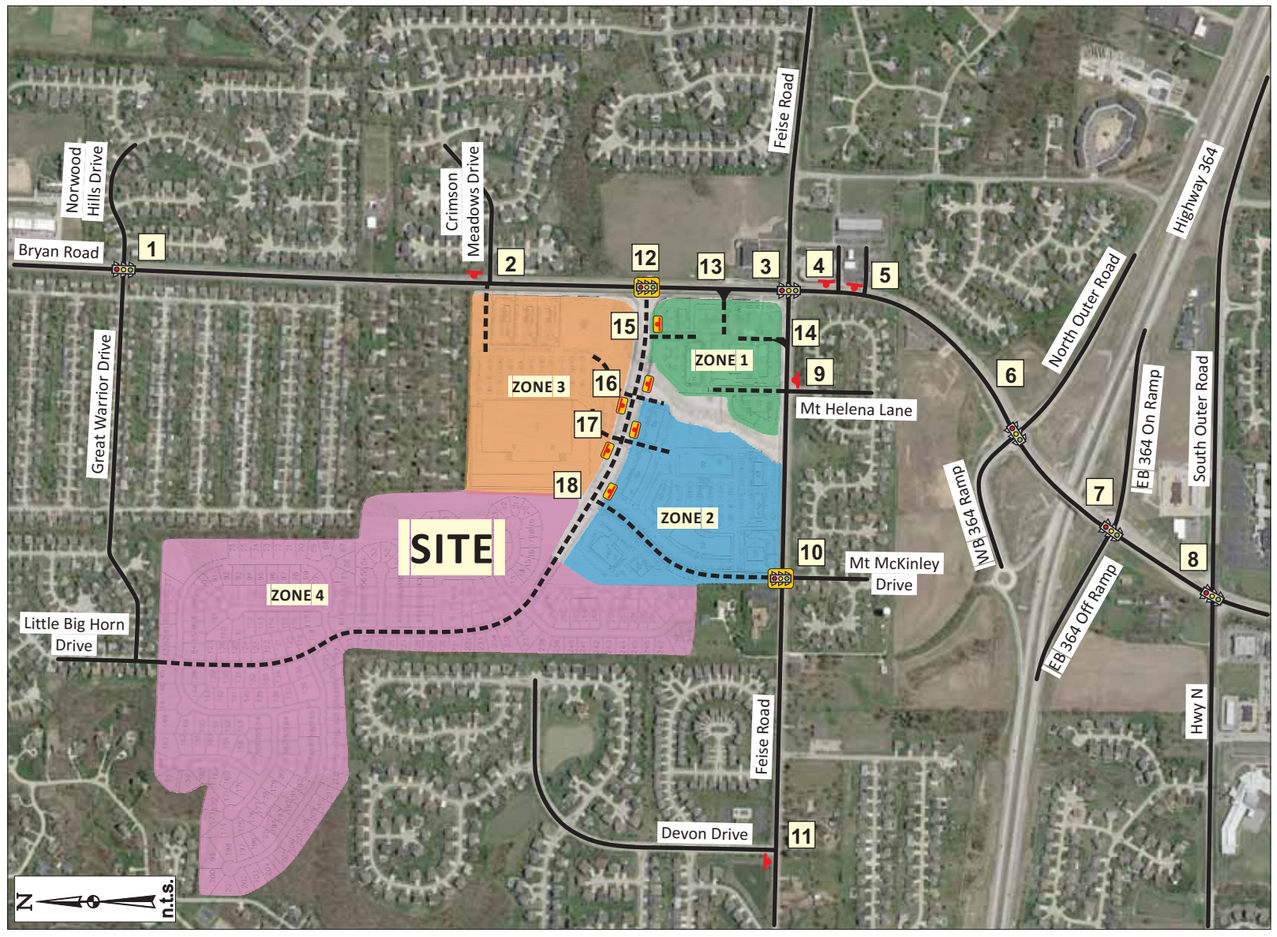
14 – Feise Road and Zone 1 East Drive (Side-Street Stop Control)

All individual movements are forecasted to continue to operate at acceptable levels of service in the 2037 Build scenario. As discussed previously, a separate westbound right-turn lane is recommended on Feise Road.

To assess the potential for the proposed east drive to Zone 1 to be blocked, the eastbound queues on Feise Road at Bryan Road were reviewed. As shown in Table 7, considering the previously recommended improvements at the intersection of Feise Road and Bryan Road, the estimated 95th percentile queue for the eastbound approach of Feise Road at Bryan Road is between 110 and 205 feet. The proposed east site drive is approximately 235 feet from the eastbound Feise Road stop bar, as such, the drive is not expected to be blocked by eastbound queues on Feise Road. Additionally, since exiting left-turns are not allowed at the site drive and a separate left-turn is provided on Feise Road for eastbound lefts into Zone 1, the eastbound queues would not be a significant cause for concern.

The recommended lane configuration to better accommodate the 2037 Build traffic volumes for the study intersections is shown in **Exhibit 11.** The red laneage depicts the previously recommended improvements to accommodate the 2037 No-Build conditions while the yellow laneage depicts the additional improvements recommended to accommodate the build out of the Bopp property.





Legend

- = Existing Traffic Signal
- = Existing Side-Street Stop Control
- = Proposed Traffic Signal
- = Proposed Side-Street Stop Control
- = Existing Laneage
- = 2037 No Build Laneage
- = 2037 Build Laneage

Exhibit 11: 2037 Build Recommended Lane Configuration and Traffic Control

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2037 Build Operating Conditions – Internal Intersections: The study intersections were reevaluated for the 2037 Build scenario using the same methodologies previously described. The 2037 Build scenario reflects the full build-out of the Bopp property. **Table 8** summarizes the results of this analysis, which reflects the 2037 Build operating conditions and average delays during the weekday AM, weekday PM and Saturday midday peak hours. The recommended lane configuration for the internal intersections along Cora Marie Drive are shown in **Exhibit 11.**

Table 8: 2037 Build Capacity Analysis Summary – Internal Intersections

INTERSECTION/MOVEMENT	AM PEAK HOUR	PM PEAK HOUR	SAT PEAK HOUR
15 – Proposed Cora Marie Drive and Zone 1 Drive (Side-Street Stop Control)			
Eastbound Cora Marie Drive Approach	Free Flow	Free Flow	Free Flow
Westbound Cora Marie Drive Left-Turn	A (7.8)	A (8.2)	A (8.7)
Northbound Zone 1 Drive Approach	A (9.6)	B (11.0)	B (12.2)
16 – Proposed Cora Marie Drive and Zone 2/3 East Drive (Side-Street Stop Control)			
Eastbound Cora Marie Drive Left-Turn	A (7.8)	A (7.9)	A (8.2)
Westbound Cora Marie Drive Left-Turn	A (7.5)	A (7.7)	A (7.7)
Northbound Zone 2 Drive Approach	B (13.4)	B (12.0)	C (15.0)
Southbound Zone 3 Drive Approach	B (12.9)	B (14.7)	D (26.5)
17 – Proposed Cora Marie Drive and Zone 2/3 West Drive (Side-Street Stop Control)			
Eastbound Cora Marie Drive Left-Turn	A (7.5)	A (7.7)	A (7.8)
Westbound Cora Marie Drive Left-Turn	A (7.6)	A (7.7)	A (7.8)
Northbound Zone 2 Drive Approach	A (9.3)	B (10.3)	B (13.3)
Southbound Zone 3 Drive Approach	B (11.2)	B (13.4)	C (17.1)
18 – Proposed Cora Marie Drive and Proposed North South Road (Side-Street Stop Control)			
Eastbound Cora Marie Drive Approach	Free Flow	Free Flow	Free Flow
Westbound Cora Marie Drive Approach	A (<1.0)	A (<1.0)	A (<1.0)
Northbound North South Road Approach	B (10.0)	B (11.0)	B (11.7)

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

As mentioned previously, a new east-west roadway, Cora Marie Drive, would be constructed to serve as the primary route extending west from Bryan Road through the development area and extending north through the residential portion of the development. Based on the prior analyses and the need to accommodate dual left-turn movements, it is recommended that two through lanes in each direction be provided on Cora Marie Drive from Bryan Road to the first Zone 2/3 drive (approximately 650 feet) with left-turn lanes provided at the site drives.

Additionally, a north-south interior roadway, North South Road, would also be constructed on the west side of the development area, with intersections at Cora Marie Drive to the north and

Feise Road, opposite Mt. McKinley Drive, to the south. Based on the prior analyses, it is recommended that one through lane in each direction be provided on North South Road. Given the low traffic volumes forecasted on North South Road, separate northbound and/or southbound left-turn lanes on North South Road at the site drives are not necessary though they could be provided if desired.

15 – Proposed Cora Marie Drive and Zone 1 Drive (Side-Street Stop Control)

All individual movements are forecasted to operate at highly desirable levels of service (i.e., LOS B or better) in the 2037 Build scenario. It is recommended that a separate westbound left-turn lane be provided at the Zone 1 drive. A single northbound exit lane is sufficient for the Zone 1 drive, though two lanes (a left-turn lane and a shared through/right-turn lane) could be provided if desired.

To assess the potential for the proposed drive to Zone 1 to be blocked, the eastbound queues on Cora Marie Drive at Bryan Road were reviewed. As shown in Table 7, considering the previously recommended improvements at the intersection of Cora Marie Drive and Bryan Road, the estimated 95th percentile queue for the eastbound approach of Cora Marie Drive at Bryan Road is between 90 and 175 feet. The proposed Zone 1 drive is approximately 250 feet from the eastbound Cora Marie Drive stop bar, as such, the drive is not expected to be blocked by eastbound queues. Nonetheless, it is recommended that the drive for Zone 1 off Cora Marie Drive be located as far to the west as possible, acknowledging that the creek is a natural barrier.

16 – Proposed Cora Marie Drive and Zone 2/3 East Drive (Side-Street Stop Control)

All individual movements are forecasted to operate at acceptable levels of service (i.e., LOS D or better) in the 2037 Build scenario. It is recommended that separate eastbound and westbound left-turn lanes be provided at the drives for Zone 2 and 3. It is recommended that two southbound lanes (a left-turn lane and a shared through/right-turn lane) exiting Zone 3 be provided. A single northbound lane exiting Zone 2 is appropriate.

17 – Proposed Cora Marie Drive and Zone 2/3 West Drive (Side-Street Stop Control)

All individual movements are forecasted to operate at favorable levels of service (i.e., LOS C or better) in the 2037 Build scenario. It is recommended that separate eastbound and westbound left-turn lanes be provided at the drives for Zone 2 and 3. A single southbound lane exiting Zone 3 and a single northbound lane exiting Zone 2 is appropriate.

18 – Proposed Cora Marie Drive and Proposed North South Road (Side-Street Stop Control)

All individual movements are forecasted to operate at highly desirable levels of service (i.e., LOS B or better) in the 2037 Build scenario. A single lane is appropriate for all approaches. The site plan provided at the commencement of the study process depicts Cora Marie Drive as the through street with North South Drive intersecting Cora Marie Drive, thus, it was assumed that Cora Marie Drive would operate free with North South Drive under STOP control. Based on input from the City of O'Fallon, they prefer for Cora Marie Drive to curve to the south creating a loop road with the residential street then intersection Cora Marie Drive under STOP control. Either configuration yields favorable operations.

2037 BUILD TRAFFIC ANALYSIS – SENSITIVITY ANALYSIS

Devon Drive Connection: As requested by the City of O'Fallon, a sensitivity analysis was completed for the 2037 Build conditions to assess the impact at the intersections of Bryan Road with Feise Road and with Cora Marie Drive if an internal connection was provided to Devon Drive to the west. It is important to note that a connection to Devon Drive could not be made without condemning property; and is therefore, unlikely.

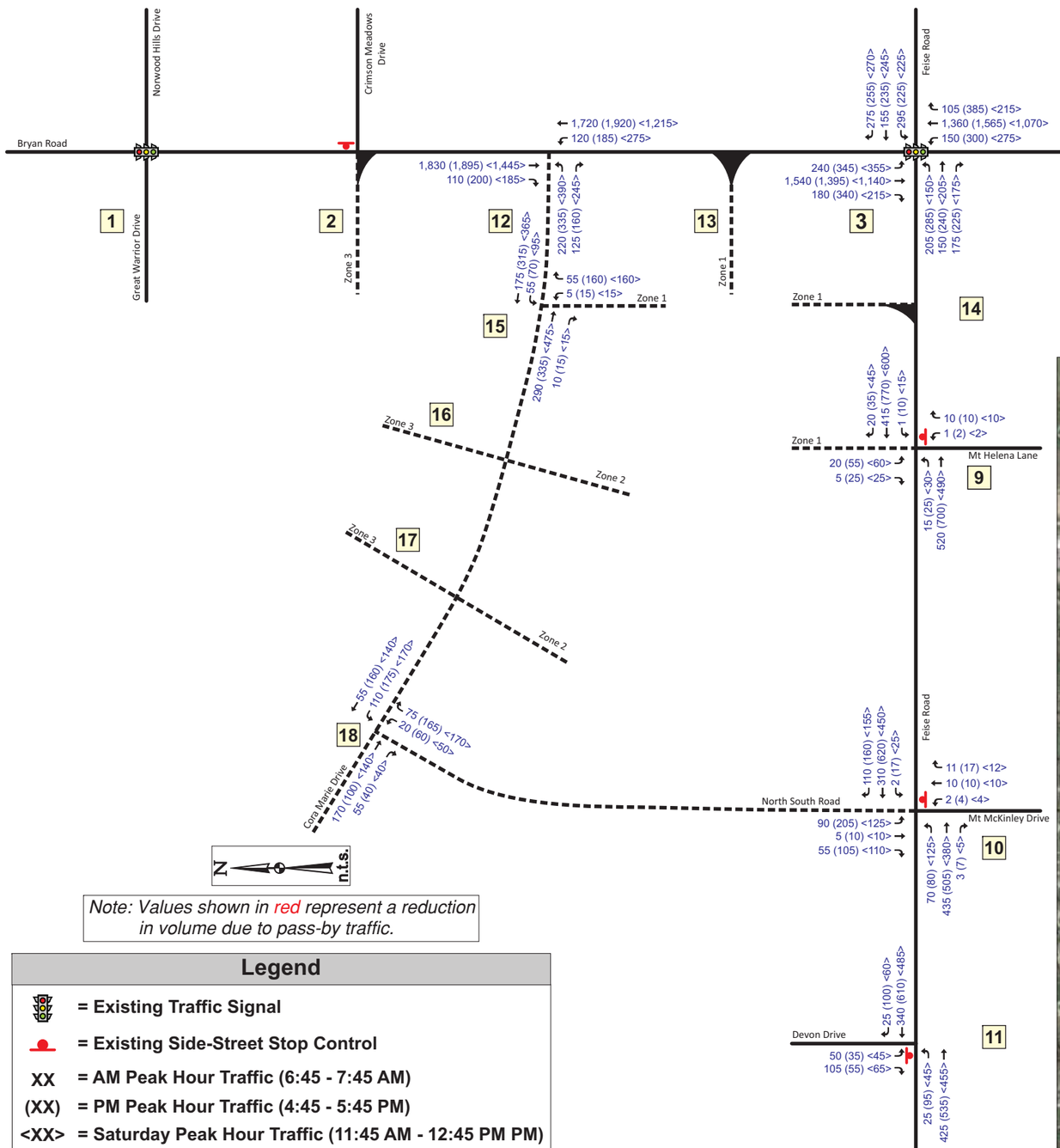
The existing traffic to and from Devon Drive was reassigned through the Bopp property to Bryan Road assuming a connection was provided. The assigned trips to and from Zones 1, 2, 3 and 4 were also reassigned assuming a connection was provided between the Bopp property and the existing Bainbridge subdivision off Devon Drive. The reassigned 2037 Build traffic volumes for the peak hours assuming a Devon Drive connection are shown in **Exhibit 12.**

By providing a connection, a majority of the southbound right-turns on Bryan Road at Feise Road traveling to Devon Drive would turn right at Cora Marie Drive instead. Similarly, a majority of the eastbound left-turns on Feise Road at Bryan Road traveling from Devon Drive would turn left at Cora Marie Drive instead. Additionally, some the northbound left-turns on Bryan Road at Feise Road traveling to Devon Drive would continue north to Cora Marie Drive and some of the eastbound right-turns on Feise Road at Bryan Road traveling from Devon Drive would turn right from Cora Marie Drive instead.

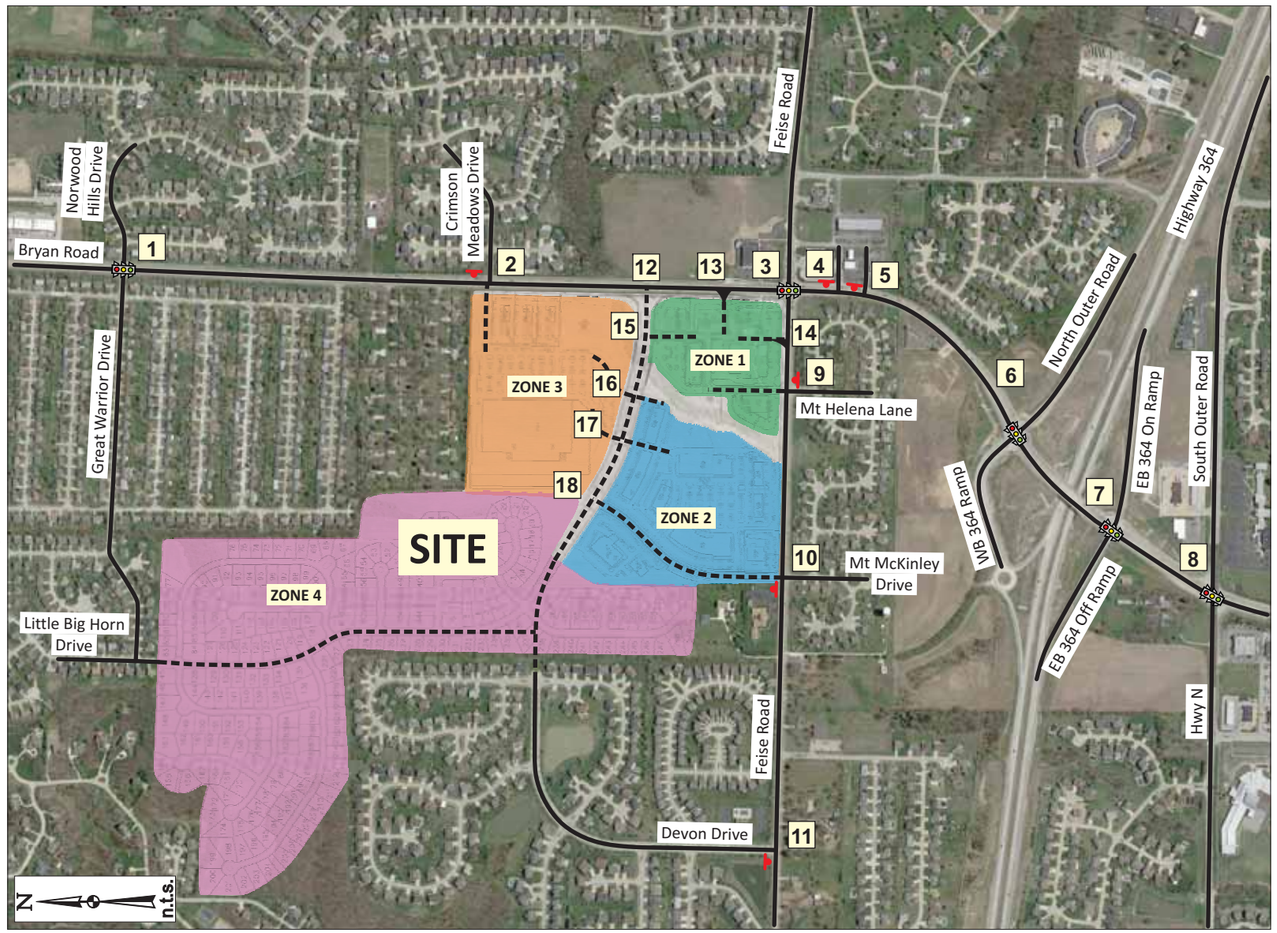
The study intersections impacted by the reassigned traffic volumes were reevaluated for the 2037 Build scenario using the same methodologies previously described. **Table 9** summarizes the results of this analysis, which reflects the 2037 Build operating conditions and average delays during the weekday AM, weekday PM and Saturday midday peak hours assuming the connection of Devon Drive through the Bopp property.

As shown in **Table 9**, the reassignment of trips through the adjacent study intersections does not have much of an impact on the intersection operations. In fact, most of the movements operate at basically the same delay and level of service whether Devon Drive is connected or not.

As a STOP controlled intersection, the connection of Devon Drive would improve the southbound North South Road approach from LOS F with approximately 66 seconds of delay per vehicle to LOS E with approximately 48 seconds of delay per vehicle. However, as discussed previously, a traffic signal will likely be recommended at full build-out at the Feise Road and the North South Road/Mt. McKinley Drive intersection. As a signalized intersection, the intersection of Feise Road and North South Road would operate at overall LOS B during all peak hours regardless of whether Devon Drive is connected or not.



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



Legend

- = Existing Traffic Signal
- = Existing Side-Street Stop Control
- XX = AM Peak Hour Traffic (6:45 - 7:45 AM)
- (XX) = PM Peak Hour Traffic (4:45 - 5:45 PM)
- <XX> = Saturday Peak Hour Traffic (11:45 AM - 12:45 PM PM)

Exhibit 12: 2037 Build Traffic Volumes - Devon Drive Connected

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Table 9: 2037 Build Capacity Analysis Summary – Devon Drive Connected

Intersection/Movement	AM Peak Hour		PM Peak Hour		SAT Peak Hour	
	2037 Build	2037 Build [1]	2037 Build	2037 Build [1]	2037 Build	2037 Build [1]
3 – Bryan Road and Feise Road (Signalized)						
Eastbound Feise Road Approach	D (36.5) 95thQ: 130' L	C (33.9) 95thQ: 105' L	D (46.9) 95thQ: 205' L	D (45.1) 95thQ: 185' L	D (36.4) 95thQ: 110' T	C (34.1) 95thQ: 105' T
Westbound Feise Road Approach	D (43.4) 95thQ: 190' R	D (41.4) 95thQ: 170' R	D (43.4) 95thQ: 140' L	D (43.4) 95thQ: 140' L	D (35.3) 95thQ: 150' L	D (35.5) 95thQ: 150' L
Northbound Bryan Road Approach	C (27.9) 95thQ: 415' T	C (28.8) 95thQ: 420' T	C (23.5) 95thQ: 400' T	C (23.4) 95thQ: 400' T	C (21.5) 95thQ: 260' L	C (21.3) 95thQ: 245' T
Southbound Bryan Road Approach	B (19.0) 95thQ: 140' T	B (19.7) 95thQ: 160' T	C (27.3) 95thQ: 230' T	C (29.2) 95thQ: 255' T	B (18.1) 95thQ: 235' L	B (18.1) 95thQ: 210' T
Overall	C (27.7)	C (27.5)	C (30.4)	C (30.8)	C (24.4)	C (24.0)
9 – Feise Road and Mt. Helena Lane/Proposed Zone 1 Drive (Side-Street Stop Control)						
Eastbound Feise Road Approach	A (<1.0)	A (<1.0)	A (<1.0)	A (<1.0)	A (<1.0)	A (1.1)
Westbound Feise Road Approach	A (<1.0)	A (<1.0)	A (<1.0)	A (<1.0)	A (<1.0)	A (<1.0)
Northbound Mt. Helena Lane Approach	B (14.1)	B (13.0)	C (16.2)	C (16.1)	B (13.7)	B (12.9)
Southbound Zone 1 Drive Approach	C (15.3)	B (14.3)	C (23.6)	C (21.6)	C (18.5)	C (17.0)
10 – Feise Road and Mt. McKinley Drive/Proposed Zone 2 Drive (Side-Street Stop Control)						
Eastbound Feise Road Approach	A (1.2)	A (1.2)	A (1.6)	A (1.4)	A (2.4)	A (2.3)
Westbound Feise Road Approach	A (<1.0)	A (<1.0)	A (<1.0)	A (<1.0)	A (<1.0)	A (<1.0)
Northbound Mt. McKinley Drive Approach	B (14.7)	B (13.5)	C (21.2)	C (18.1)	C (20.5)	C (17.2)
Southbound Zone 2 Drive Approach	C (16.6)	C (15.1)	F (66.1)	E (47.8)	D (26.1)	C (21.3)
11 - Feise Road and Devon Drive (Side-Street Stop Control)						
Eastbound Feise Road Approach	A (<1.0)	A (<1.0)	A (1.5)	A (1.5)	A (<1.0)	A (<1.0)
Westbound Feise Road Approach	A (<1.0)	A (<1.0)	A (<1.0)	A (<1.0)	A (<1.0)	A (<1.0)
Southbound Devon Drive Approach	B (13.8)	B (12.0)	C (19.1)	C (16.0)	C (16.3)	B (13.6)
12 – Bryan Road and Proposed Cora Marie Drive (Signalized)						
Eastbound Cora Marie Drive Approach	C (34.7)	C (33.7)	D (41.2)	D (40.9)	C (31.9)	C (32.2)
Northbound Bryan Road Approach	B (14.0)	B (15.0)	C (24.8)	C (24.5)	B (12.6)	B (12.6)
Southbound Bryan Road Approach	B (14.1)	B (15.2)	B (18.7)	B (18.6)	C (22.9)	C (23.2)
Overall	B (15.4)	B (16.7)	C (23.7)	C (23.6)	C (20.1)	C (20.5)

X (XX.X) - Level of Service (Vehicular delay in seconds per vehicle)
[1] Analysis results assuming Devon Drive is connected to Cora Marie Drive

Restricted Access at Zone 3 Drive Opposite Crimson Meadows Drive: As requested by the City of O'Fallon, a sensitivity analysis was completed for the 2037 Build conditions to assess the impact on the operations for Crimson Meadows at Bryan Road assuming the proposed drive for Zone 3 is restricted from three-quarter access to RIRO.

The previously assigned northbound left-turns on Bryan Road into the Zone 3 drive opposite Crimson Meadows Drive were reassigned to Cora Marie Drive. The intersections of Cora Marie Drive and Crimson Meadows Drive with Bryan Road were reevaluated for the 2037 Build scenario using the same methodologies previously described. **Table 10** summarizes the results of this analysis, which reflects the 2037 Build operating conditions and average delays during the weekday AM, weekday PM and Saturday midday peak hours assuming the alternative control for the Zone 3 drive opposite Crimson Meadows.

Table 10: 2037 Build Capacity Analysis Summary – Crimson Meadow Access Comparison

Intersection/Movement	AM Peak Hour		PM Peak Hour		SAT Peak Hour	
	2037 Build (Improved)	2037 Build (RIRO)	2037 Build (Improved)	2037 Build (RIRO)	2037 Build (Improved)	2037 Build (RIRO)
2 – Bryan Road and Crimson Meadow Drive/Proposed Zone 3 Drive (Side-Street Stop Control)						
Eastbound Zone 3 Right-Turn	D (25.8)	D (25.8)	E (35.5)	E (35.5)	D (25.7)	D (25.7)
Westbound Crimson Meadow Approach	F (>200)	F (110.7)	F (>200)	F (67.4)	F (>200)	E (41.0)
Northbound Bryan Road Left-Turn	C (22.5)	N/A	D (25.9)	N/A	C (19.8)	N/A
Southbound Bryan Road Left-Turn	C (18.4)	C (18.5)	C (23.1)	C (20.4)	B (13.8)	B (14.2)
12 – Bryan Road and Proposed Cora Marie Drive (Signalized)						
Eastbound Cora Marie Drive Approach	C (34.7) 95thQ: 90' L	C (34.7) 95thQ: 90' L	D (41.2) 95thQ: 175' L	D (41.2) 95thQ: 175' L	C (31.9) 95thQ: 160' L	C (30.2) 95thQ: 160' L
Northbound Bryan Road Approach	B (14.0) 95thQ: 365' T	B (13.9) 95thQ: 330' T	C (24.8) 95thQ: 350' T	C (21.6) 95thQ: 295' T	B (12.6) 95thQ: 165' L	B (12.3) 95thQ: 195' L
Southbound Bryan Road Approach	B (14.1) 95thQ: 500' T	B (16.0) 95thQ: 505' T	B (18.7) 95thQ: 500' T	C (20.0) 95thQ: 505' T	C (22.9) 95thQ: 440' T	C (28.2) 95thQ: 445' T
Overall	B (15.4)	B (16.2)	C (23.7)	C (22.9)	C (20.1)	C (22.0)

X (XX.X) - Level of Service (Vehicular delay in seconds per vehicle)
Denotes a movement on the approach with LOS E; Denotes a movement on the approach with LOS F
95th percentile queue for the critical movement of the approach and lane (L-Left, TR-Shared Thru/Right, R-Right)

As shown in **Table 10**, the reassignment of the northbound lefts at the Zone 3 drive to the traffic signal at Cora Marie Drive does not have much of an impact on the operations at the signalized intersection at Bryan Road and Cora Marie Drive. In fact, most of the movements operate at basically the same delay and level of service whether northbound left-turns are allowed at Crimson Meadow Drive or not.

However, removing the northbound left-turn movement into Zone 3 opposite Crimson Meadow Drive does has a notable impact on the operations for motorists exiting Crimson

Meadow Drive. As shown in **Table 10**, the westbound approach of Crimson Meadow Drive is still forecasted to operate at LOS F in the AM and PM peak hours even when removing the northbound left-turns at Zone 3, but it is a much-improved LOS F (delays ranging from 67 to 111 seconds of delay per vehicle as compared to delays in excess of 200 seconds allowing the northbound left-turn).

As mentioned previously, residents desiring to travel south on Bryan Road can utilize Brook Hollow Drive to Feise Road to gain access to the traffic signal on Bryan Road during peak times when the delays are higher trying to make an unsignalized left onto Bryan Road from Crimson Meadows. Given the heavy through volumes on Bryan Road, it is recommended that consideration be given to restricting the left-turn movement exiting Crimson Meadow Drive. The northbound left-turn movement from Bryan Road to Zone 3 could then be allowed without any impact to the operations on Crimson Meadow Drive.

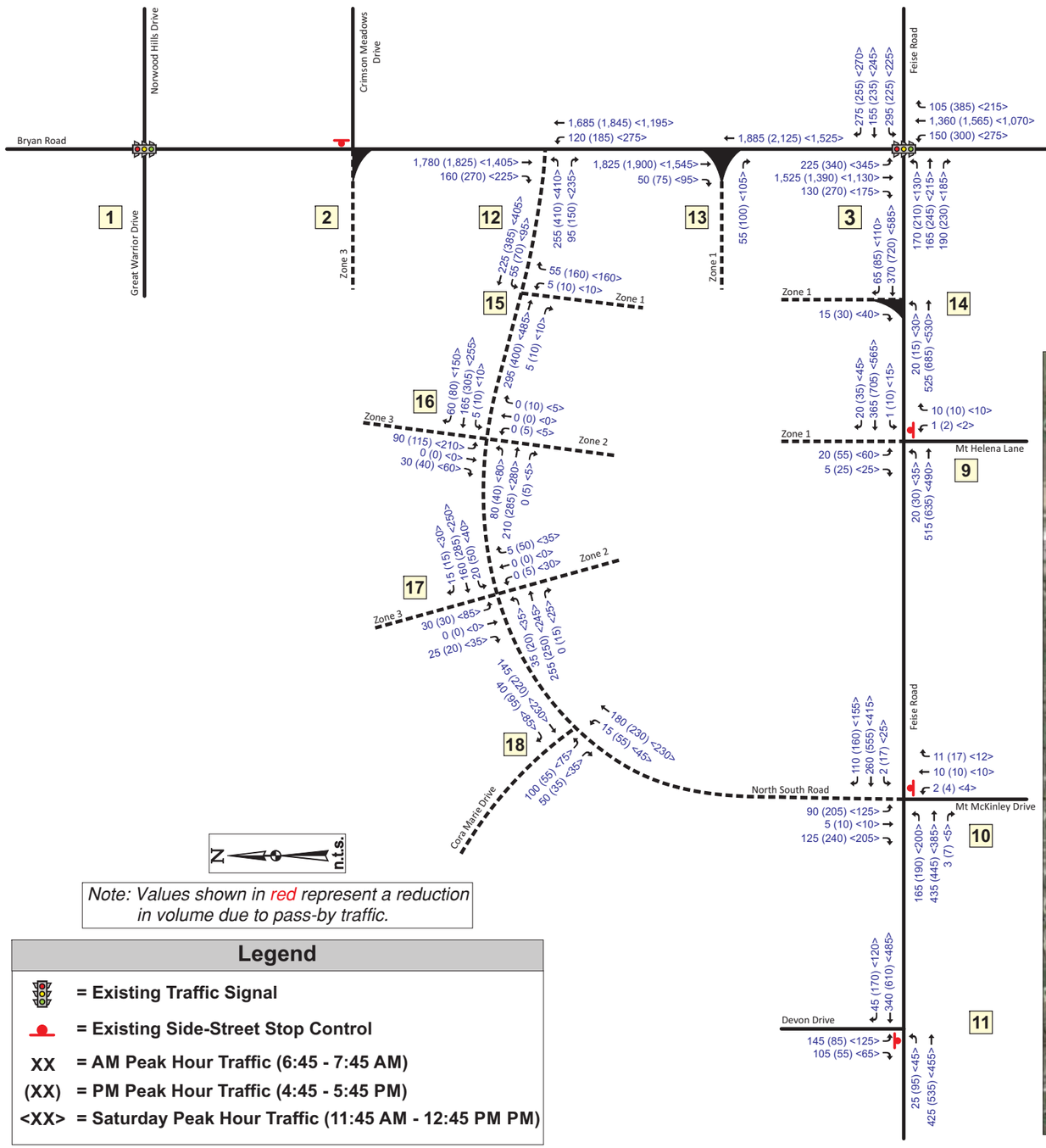
Loop Road Configuration: As requested by the City of O'Fallon, a sensitivity analysis was completed for the 2037 Build conditions to assess the impact at the intersections of Bryan Road with Feise Road and with Cora Marie Drive if Cora Marie Drive is constructed as more of a loop road between Bryan Road and Feise Road.

It was conservatively assumed that one third of the existing eastbound left-turn volume on Feise Road at Bryan Road would utilize Cora Marie Drive as a "cut-thru". Conversely, it was conservatively assumed that one third of the existing southbound right-turn volume on Bryan Road at Feise Road would utilize Cora Marie Drive as a "cut-thru". The reassigned 2037 Build traffic volumes for the peak hours assuming a loop road configuration is shown in **Exhibit 13.**

The study intersections impacted by the reassigned traffic volumes were reevaluated for the 2037 Build scenario using the same methodologies previously described. **Table 11** summarizes the results of this analysis, which reflects the 2037 Build operating conditions and average delays during the weekday AM, weekday PM and Saturday midday peak hours assuming a loop road configuration of Cora Marie Drive through the Bopp property.

As shown in **Table 11**, if Cora Marie Drive is configured as a loop road to promote eastbound left-turns on Feise Road at Bryan Road and southbound right-turns on Bryan Road at Feise Road to use Cora Marie Drive as a "cut-thru", there is not a notable impact on the intersection operations. In general, the intersection of Bryan Road and Feise Road operates slightly better with a reduction in the overall delay of approximately five percent, or one second.

To better accommodate the eastbound queues on Cora Marie Drive at Bryan Road should a fair number of motorists choose to use it as a "cut-thru", it is recommended that the dual eastbound left-turn bay provide a storage of 215 feet compared to the previously recommended 175 feet if no "cut-thru" traffic.



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

Legend

- = Existing Traffic Signal
- = Existing Side-Street Stop Control
- XX = AM Peak Hour Traffic (6:45 - 7:45 AM)
- (XX) = PM Peak Hour Traffic (4:45 - 5:45 PM)
- <XX> = Saturday Peak Hour Traffic (11:45 AM - 12:45 PM PM)

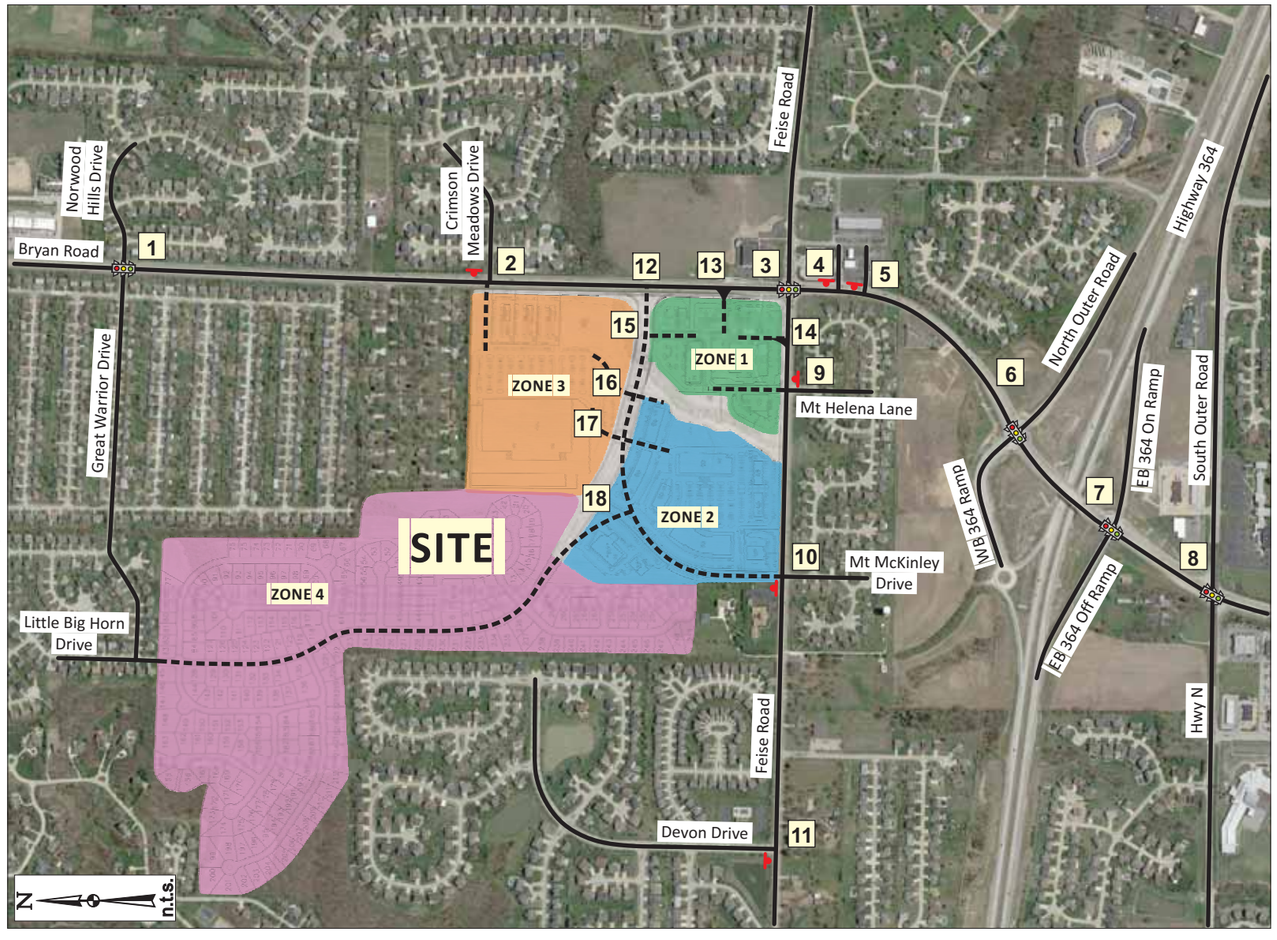


Exhibit 13: 2037 Build Traffic Volumes - Loop Road Configuration

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09/12/17

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Table 11: 2037 Build Capacity Analysis Summary –Loop Road Configuration

Intersection/Movement	AM Peak Hour		PM Peak Hour		SAT Peak Hour	
	2037 Build	2037 Build [1]	2037 Build	2037 Build [1]	2037 Build	2037 Build [1]
3 – Bryan Road and Feise Road (Signalized)						
Eastbound Feise Road Approach	D (36.5) 95thQ: 130' L	C (34.6) 95thQ: 95' L	D (46.9) 95thQ: 205' L	D (40.6) 95thQ: 140' L	D (36.4) 95thQ: 110' T	C (33.6) 95thQ: 110' T
Westbound Feise Road Approach	D (43.4) 95thQ: 190' R	D (40.1) 95thQ: 150' R	D (43.4) 95thQ: 140' L	D (43.3) 95thQ: 140' L	D (35.3) 95thQ: 150' L	D (35.6) 95thQ: 150' L
Northbound Bryan Road Approach	C (27.9) 95thQ: 415' T	C (27.3) 95thQ: 415' T	C (23.5) 95thQ: 400' T	C (22.8) 95thQ: 400' T	C (21.5) 95thQ: 260' L	C (20.6) 95thQ: 235' T
Southbound Bryan Road Approach	B (19.0) 95thQ: 140' T	B (18.2) 95thQ: 145' T	C (27.3) 95thQ: 230' T	C (27.3) 95thQ: 230' T	B (18.1) 95thQ: 235' L	B (16.1) 95thQ: 185' L
Overall	C (27.7)	C (26.5)	C (30.4)	C (29.2)	C (24.4)	C (23.1)
9 – Feise Road and Mt. Helena Lane/Proposed Zone 1 Drive (Side-Street Stop Control)						
Eastbound Feise Road Approach	A (<1.0)	A (<1.0)	A (<1.0)	A (<1.0)	A (<1.0)	A (<1.0)
Westbound Feise Road Approach	A (<1.0)	A (<1.0)	A (<1.0)	A (<1.0)	A (<1.0)	A (<1.0)
Northbound Mt. Helena Lane Approach	B (14.1)	B (12.9)	C (16.2)	B (14.6)	B (13.7)	B (12.9)
Southbound Zone 1 Drive Approach	C (15.3)	B (14.1)	C (23.6)	C (19.2)	C (18.5)	C (16.8)
10 – Feise Road and Mt. McKinley Drive/Proposed Zone 2 Drive (Side-Street Stop Control)						
Eastbound Feise Road Approach	A (1.2)	A (2.4)	A (1.6)	A (3.2)	A (2.4)	A (3.3)
Westbound Feise Road Approach	A (<1.0)	A (<1.0)	A (<1.0)	A (<1.0)	A (<1.0)	A (<1.0)
Northbound Mt. McKinley Drive Approach	B (14.7)	C (15.5)	C (21.2)	E (49.1)	C (20.5)	D (32.5)
Southbound Zone 2 Drive Approach	C (16.6)	C (17.2)	F (66.1)	F (87.2)	D (26.1)	D (27.7)
12 – Bryan Road and Proposed Cora Marie Drive (Signalized)						
Eastbound Cora Marie Drive Approach	C (34.7) 95thQ: 90' L	D (36.6) 95thQ: 125' L	D (41.2) 95thQ: 175' L	D (42.5) 95thQ: 215' L	C (31.9) 95thQ: 160' L	C (30.5) 95thQ: 175' L
Northbound Bryan Road Approach	B (14.0) 95thQ: 365' T	B (15.0) 95thQ: 345' T	C (24.8) 95thQ: 350' T	C (20.3) 95thQ: 165' T	B (12.6) 95thQ: 165' L	B (10.5) 95thQ: 150' L
Southbound Bryan Road Approach	B (14.1) 95thQ: 500' T	B (15.1) 95thQ: 490' T	B (18.7) 95thQ: 500' T	C (20.3) 95thQ: 495' T	C (22.9) 95thQ: 440' T	C (24.9) 95thQ: 420' T
Overall	B (15.4)	B (16.9)	C (23.7)	C (22.9)	C (20.1)	C (20.2)
18 – Cora Marie Drive and Zone 4 Drive (Side-Street Stop Control)						
Eastbound Cora Marie Drive Approach		A (<1.0)		A (1.9)		A (1.6)
Westbound Cora Marie Drive Approach		A (<1.0)		A (<1.0)		A (<1.0)
Southbound Zone 4 Drive Approach		B (12.2)		C (14.0)		B (14.8)

X (XX.X) - Level of Service (Vehicular delay in seconds per vehicle)
[1] Analysis results assuming Cora Marie Drive configured as a Loop Road

With the additional turning traffic at the intersection the North South Road/Mt. McKinley Drive, the southbound approach exiting North South Road would decline to LOS F in the PM peak hour. However, as discussed previously, a traffic signal will likely be needed at full build-out at the Feise Road and North South Road/Mt. McKinley Drive intersection. As a signalized intersection, the intersection of Feise Road and North South Road would operate at overall LOS B during all peak hours regardless of the configuration of Cora Marie Drive.

SUMMARY

CBB completed the preceding study to address the potential traffic impacts associated with the proposed development of the Bopp property located in the northwest quadrant of the intersection of Bryan Road and Feise Road in Dardenne Prairie, Missouri.

Based on the most recent concept plan, the overall area plan encompasses approximately 180 acres and would include a mix of retail, office and residential uses. The assumed uses considered in this study are based on the vision of the owner for the Bopp property. However, it is acknowledged that the actual uses could differ from those assumed in this study. In reality, this study should be considered more of a planning study. As specific developments are proposed, it will likely be necessary to revisit this study to confirm if the recommendations in this study remain valid (i.e., if the actual development generates fewer trips than assumed in this study, the full recommendations may not be necessary, or conversely, if the actual development generates more trips than assumed in this study, additional improvements above those recommended may be necessary).

Based on discussions with the owner, the site would likely develop in phases over the next several years, though a specific timeframe is unknown at this point. Given the uncertainty of the full build-out of the proposed development area, it would not be practical to construct the recommended improvements identified by this study for the overall development up front, since it is likely that as the development evolves, the recommendations could change. Rather than the recommendations contained herein being a definitive list of *required* roadway improvements, these evaluations can assist in the possible long-term needs within the corridor, though it would be advisable to dedicate any needed right-of-way along Bryan Road and Feise Road should the improvements discussed herein ultimately be needed in the future.

In summary, the following improvements are necessary to provide favorable operations for the 2037 No-Build conditions (existing plus 20 years of background at 1% per year):

- Provide a third northbound through lane on Bryan Road from just south of the Route 364 westbound/North Outer Road intersection to north of Feise Road.
  - Consequently, the existing commercial drives serving the QuikTrip, PNC bank and other uses may be restricted to RIRO since unsignalized left-turns are generally not allowed across three lanes.
- *#3 Bryan Road and Feise Road*
  - Provide an additional southbound left-turn lane to provide dual left-turn lanes on Bryan Road.
- *#6 Bryan Road and WB 364/North Outer Road*
  - Widen the eastbound Route 364 approach from three lanes to four lanes (dual left-turn lanes; a through lane; and a right-turn lane)
- *#8 Bryan Road and Highway N/South Outer Road*

- Provide an additional eastbound left-turn lane on Highway N to provide dual left-turn lanes.
- Provide an additional westbound right-turn lane on South Outer Road to provide dual right-turn lanes.

Based on the current concept plan, the following additional improvements are likely necessary to provide favorable operations for the 2037 Build conditions (build-out of the Bopp property):

- Provide a third southbound through lane on Bryan Road from just north of Cora Marie Drive to the Route 364 westbound/North Outer Road intersection where it would drop as a right-turn lane.
- *#2 Bryan Road and Crimson Meadow Drive/Zone 3*
  - Given the heavy through volumes on Bryan Road, it is recommended that consideration be given to restricting the left-turn movement exiting Crimson Meadows, similar to what is proposed for the access opposite Crimson Meadows to serve Zone 3 of the Bopp property.
  - Provide a separate southbound right-turn lane (100 feet minimum).
- *#3 Bryan Road and Feise Road*
  - Provide an additional eastbound left-turn lane to provide dual left turns on Feise Road. (200 feet minimum)
  - Provide an additional westbound left-turn lane to provide dual left turns on Feise Road. (200 feet minimum)
  - Provide an additional northbound left-turn lane to provide dual left turns on Bryan Road. (250 feet minimum)
  - Lengthen the existing southbound right-turn lane on Bryan Road from 200 feet to 250 feet.
  - Provide two eastbound through lanes on Feise Road at Bryan Road. It is recommended that this second eastbound through lane begin at North South Road/Mt. McKinley Drive and continue through Bryan Road.
  - Provide two westbound through lanes on Feise Road at Bryan Road. It is recommended that this second westbound through lane begin just east of Bryan Road and continue to North South Road/Mt. McKinley Drive where it would drop as a right-turn lane.
- *#6 Bryan Road and 364 Westbound Ramp/North Outer Road*
  - The previously recommended four-lane eastbound approach on the Route 364 ramp should be restriped to provide dual left-turn lanes; a shared through/right-turn lane; and a right-turn lane.

- Provide an additional westbound left-turn lane to provide dual left turns on North Outer Road.

- *#7 Bryan Road and 364 Eastbound Ramp*
  - Restripe the Route 364 eastbound approach to provide dual left-turn lanes and a separate right-turn lane.
- *#8 Bryan Road and Highway N/North Outer Road*
  - Ultimately, it may be necessary to provide additional through capacity by widening northbound Bryan Road to three lanes. However, to continue this third lane to the north, it would require the widening of the newly constructed bridge over Route 364. Considering the fact that the overall intersection is forecasted to operate at LOS C during the AM peak hour, LOS D during the PM peak hour and LOS C during the Saturday midday peak hour, widening of Bryan Road south of Route 364 is not recommended in conjunction with the development of the Bopp property.
- *#9 Feise Road and Mt. Helena Lane/Zone 1 Drive*
  - Provide two southbound exiting lanes (a left-turn lane and a shared through/right-turn lane) on the proposed drive for Zone 1.
  - Provide a second westbound through/right-turn lane (from the Bryan Road signal).
- *#10 Feise Road and Mt. McKinley Drive/ North South Road*
  - Provide two southbound exiting lanes (a left-turn lane and a shared through/right-turn lane) on the proposed North South Road.
  - Terminate the second westbound through lane as a right-turn at the North South Road.
  - Signalize the intersection if volumes meet warrants or delays become excessive.
- *#12 Bryan Road and Cora Marie Drive*
  - Install a traffic signal and interconnect to the adjacent traffic signals on Bryan Road.
  - Provide dual eastbound left-turn lanes and a separate right-turn lane on Cora Marie Drive. (215 feet minimum based on Loop Road analysis)
  - Provide dual northbound left-turn lanes on Bryan Road. (250 feet minimum)
    - The provision of northbound dual lefts would require two lanes westbound on Cora Marie Drive to receive the dual left-turns. It was assumed that the second through lane would drop as a dedicated right turn lane at the first drive to Zone 3.

- Provide a separate southbound right-turn lane on Bryan Road. (400 feet minimum)

- *#13 Bryan Road and Zone 1 RIRO Drive*
  - Provide a separate southbound right-turn lane on Bryan Road. (100 feet minimum)
- *#14 Feise Road and Zone 1 East Drive*
  - Provide a second westbound through lane (from the Bryan Road signal).
  - Provide a separate westbound right-turn lane on Feise Road. (100 feet minimum)

As more detailed plans are developed, it is recommended that the proposed driveways be evaluated to ensure that adequate sight distance is provided. Careful consideration should be given to sight distance obstructions when planning any future aesthetics enhancements, such as berms, fencing and landscaping for the proposed Bopp development area to ensure that these improvements do not obstruct the view of entering and exiting traffic at the proposed entrances onto Bryan Road, Feise Road, Cora Marie Drive and North South Road. 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.

We trust that this study adequately describes the forecasted traffic conditions that could be expected as a result of the build-out of the Bopp property. If additional information is desired, please feel free to contact me at 314-449-9572 or swhite@cbbtraffic.com.

Sincerely,

Shawn Lerai White, P.E., PTOE
Associate - Senior Traffic Engineer