

RESOLUTION NO. 3503

A RESOLUTION OF THE CITY COUNCIL OF THE CITY OF LIBERTY, CLAY COUNTY, MISSOURI ADOPTING THE SOUTH LIBERTY PARKWAY ROUNDABOUT STUDY FOR THE CITY

WHEREAS, the City of Liberty, Missouri, (herein called "City") is a Special Charter City located in Clay County, Missouri, being duly created, organized, and existing under the laws of the State of Missouri; and

WHEREAS, the Planning and Zoning Commission (herein called "Commission") has the authority and responsibility under State Statute and the Municipal Code of the City to develop and adopt a comprehensive plan and any updates or additions for the City; and

WHEREAS, the City's comprehensive plan was adopted in 2023; and

WHEREAS, the City Council, in October of 2024, passed Ordinance No. 11983 approving an agreement with GBA, Inc. for the development of study to identify the overall feasibility of Roundabouts along SLP; and

WHEREAS, the South Liberty Parkway Roundabout Study, with accompanying maps, charts and descriptive and explanatory matter, contains strategies and recommendations and shows the Commission's recommendations for future transportation needs along South Liberty Parkway; and,

WHEREAS, the South Liberty Parkway Roundabout Study further seeks to guide and accomplish the coordinated development of the South Liberty Parkway corridor which, in accordance with existing and future needs, will best promote the general welfare, as well as efficiency and economy, in the community planning and development process; and

WHEREAS, as required under law, proper notice of a public hearing before the Commission on this matter was given; and

WHEREAS, on October 14, 2025, the Commission, under authority granted to it by the Missouri Revised Statutes, after a duly called public hearing, and after considering the views of all those who came before it, voted to approve the South Liberty Parkway Roundabout Study by a vote of 8 Ayes to 0 Nays; and

NOW, THEREFORE, BE IT RESOLVED BY THE CITY COUNCIL OF THE CITY OF LIBERTY, MISSOURI, AS FOLLOWS:

RESOLUTION NO. 3503 (CONT.)

SECTION I

The South Liberty Parkway Roundabout Study, including the accompanying maps, charts, and descriptive and explanatory matter, attached hereto as Attachment A, and incorporated herein, is adopted by the Council as part of the comprehensive plan for the City.

SECTION II

The Deputy City Clerk shall make copies of the adopted South Liberty Parkway Roundabout Study available for public inspection as required under State Statute and the Municipal Code of the City and shall record a copy of the South Liberty Parkway Roundabout Study in the office of the Clay County Recorder of Deeds.

SECTION III

The prior South Liberty Parkway Roundabout Study, portions thereof, updates thereto, or additions thereto, are hereby repealed to the extent they are inconsistent with the current South Liberty Parkway Roundabout Study.

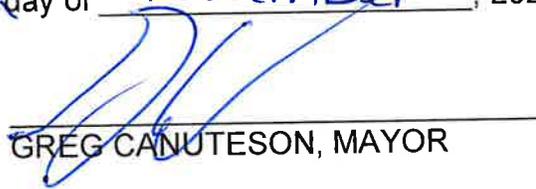
SECTION IV

The whereas clauses are hereby specifically incorporated herein by reference.

SECTION V

This Resolution shall take effect after passage as provided.

PASSED by the City Council this 10th day of November, 2025.



GREG CANUTESON, MAYOR

ATTEST:



DEPUTY CITY CLERK



GBA

**SOUTH
LIBERTY PARKWAY
ROUNDBABOUT STUDY**

LIBERTY, MISSOURI

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Lenexa, KS 66219-9745
913.492.0400 | www.gbateam.com

**2025
OCTOBER**

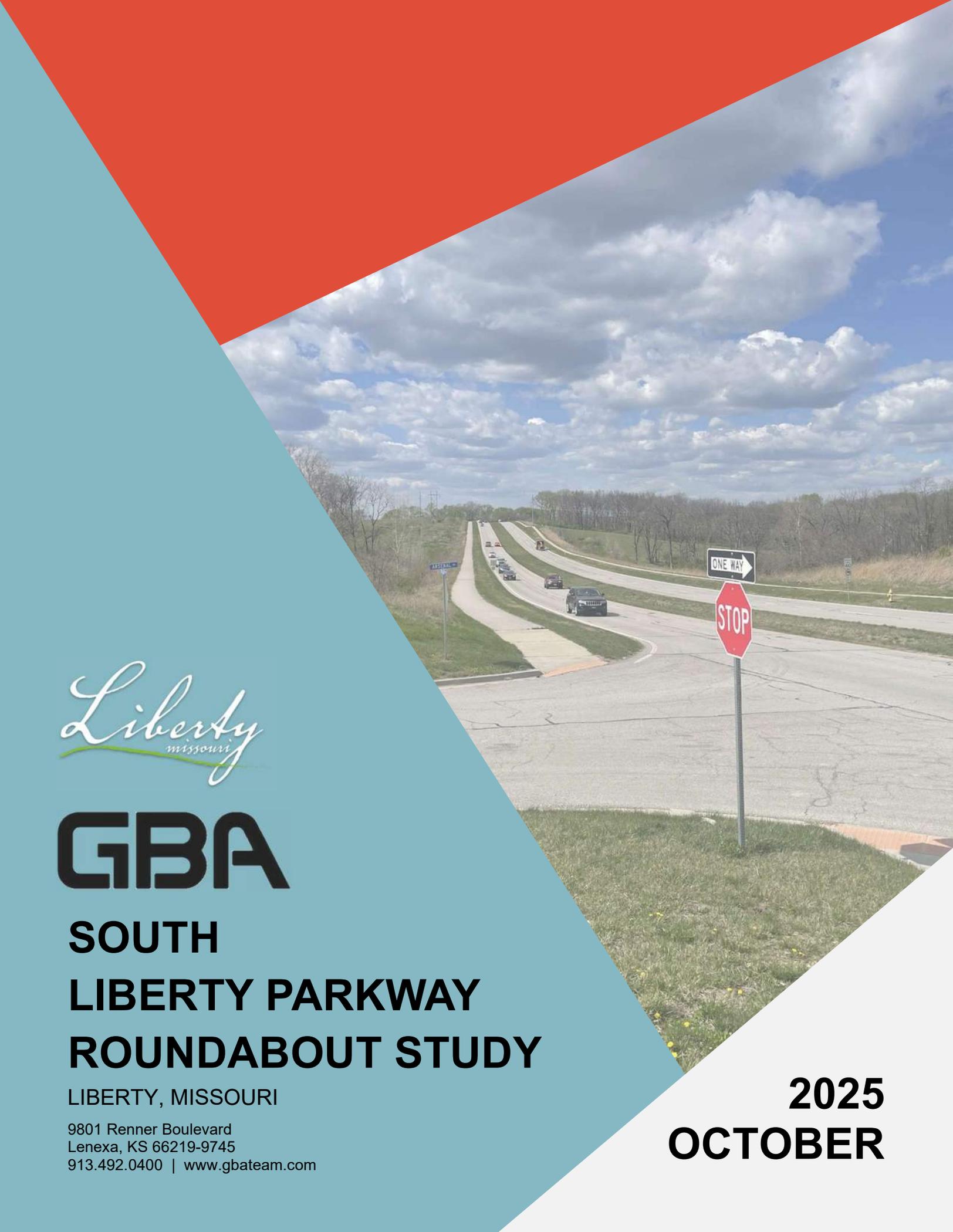


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1. Introduction

1.1. Study Location

Liberty, Missouri is located northeast of the Kansas City Metropolitan area along Interstate 35 (I-35) and is the county seat of Clay County. The study area for the *South Liberty Parkway Roundabout Study* (Study) stretches from Withers Road (west boundary) to Missouri State Highway 291 (MO-291) (east boundary). Properties along South Liberty Parkway are included in the study area. A map of the study area and location of Liberty is shown in **Figure 1**.

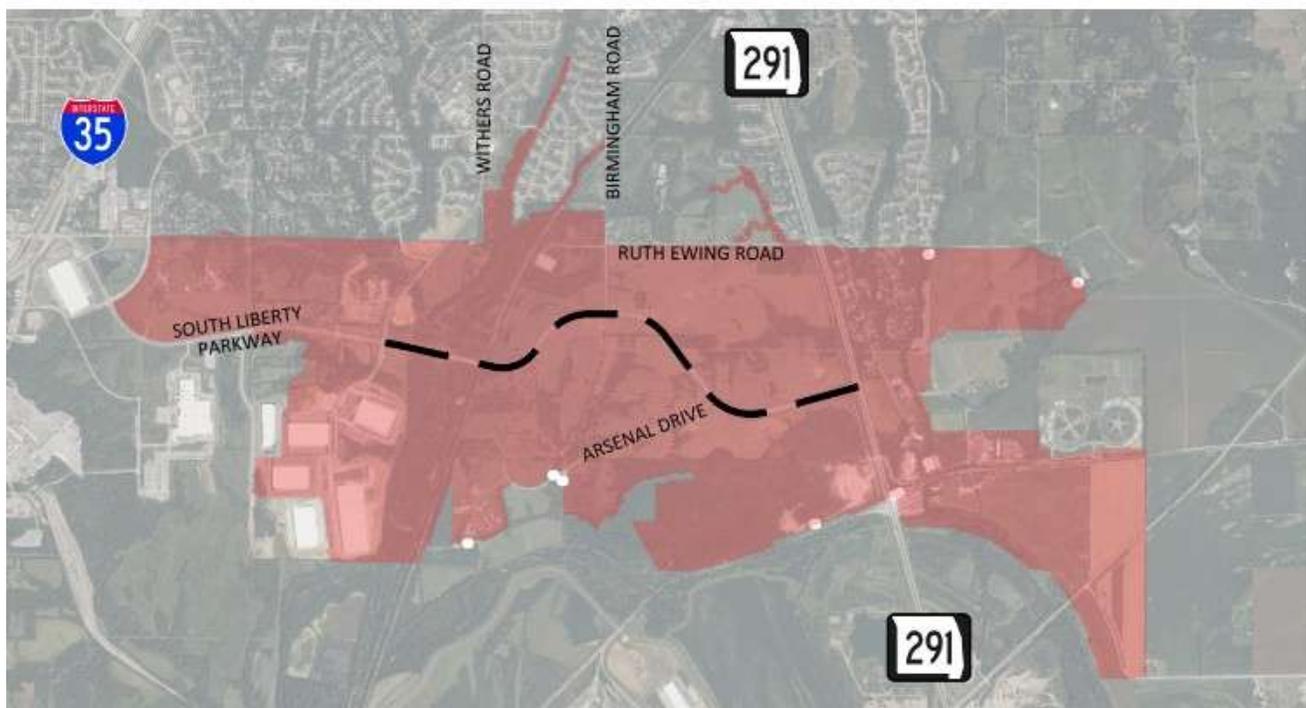


Figure 1. Project Study Area and Location

1.2. Project Background

Roundabouts were identified as being a desired intersection improvement type on the South Liberty Parkway corridor in the 2023 *Leading Liberty Forward Comprehensive Plan*, as shown in **Figure 2**.

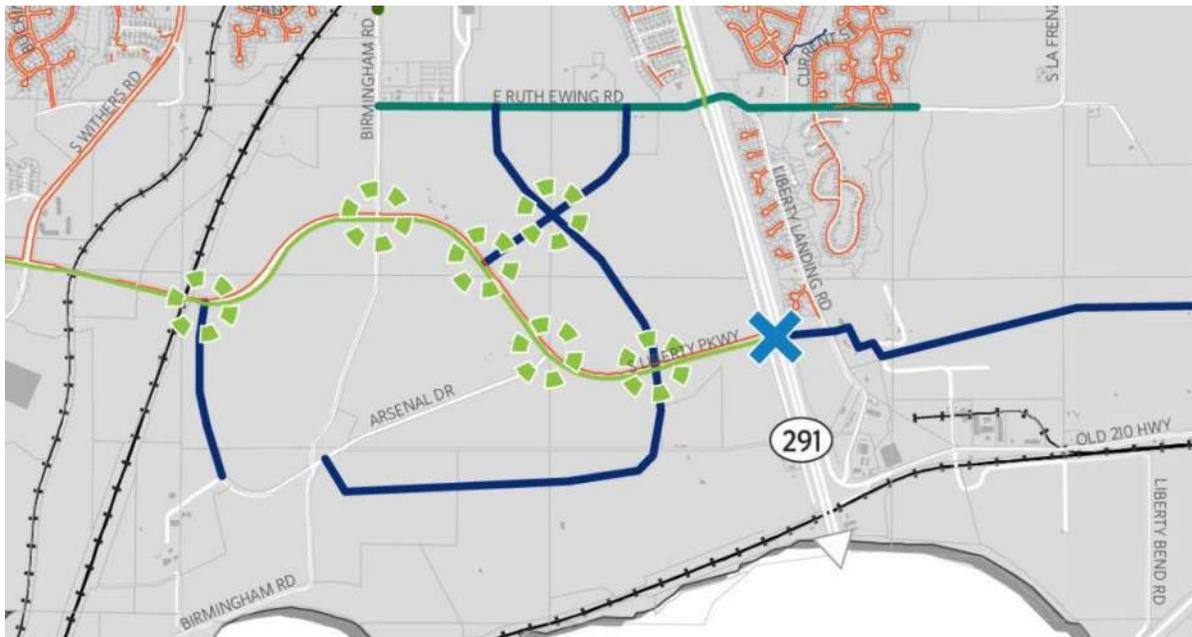


Figure 2. Conceptual Layout of South Liberty Parkway from 2023 *Leading Liberty Forward Comprehensive Plan*

This study is being conducted by the City of Liberty to identify the specific location and traffic volume triggers for potential roundabouts on South Liberty Parkway between Withers Road and MO-291. Locations and triggers for potential roundabouts were identified by reviewing existing conditions, planned land uses, and potential future traffic operations.

1.3. Review of Existing Planning Studies and Documents

Portions of the study corridor have been reviewed and analyzed, both directly and indirectly by previous studies and development plans, which will be discussed within this section.

1.3.1. 2006 South Liberty Study

The 2006 *South Liberty Parkway Section Study*, completed by HNTB, analyzed potential extensions to South Liberty Parkway. At the time, Phase 1 of South Liberty Parkway stretched from I-35 to Withers Road, but did not connect Withers Road to MO-291. This connection was considered to be Phase 2 of South Liberty Parkway. The study included land use summaries, transportation summaries, and a traffic demand model. Ultimately, the study recommended an alignment similar to what was constructed. Additional recommendations for adjacent roadways were provided, but fall outside of the scope of this study.

1.3.2. 2023 Leading Liberty Forward Comprehensive Plan

The primary purpose of reviewing the *2023 Leading Liberty Forward Comprehensive Plan* was to identify existing land uses, existing zoning, and future planned land uses along the study corridor, which were used to determine trip generation for undeveloped sites and potential access needs.

Currently, much of the existing study area is used for agricultural purposes. Properties not used for agricultural purposes do not abut South Liberty Parkway, and are located farther north or south from the corridor. Conversely, zoning for the study area is generally divided at Birmingham Road. Areas to the west are zoned for low-density residential uses, while areas to the east, between Birmingham Road and MO-291, are zoned for agricultural uses.

Future land uses in the study area are generally designated as single-family residential. Small areas of commercial development are proposed at the South Liberty Parkway and MO-291 intersection, and just east of the Withers Road intersection.

1.3.3. 2024 City of Liberty Transportation Master Plan

The interim *2024 City of Liberty Transportation Master Plan*, completed by HDR, outlined items to be completed as part of the full plan, and conducted high-level analyses of existing conditions, including daily traffic flows, corridor speeds and travel times, and existing intersection operations. While the plan reviewed conditions throughout Liberty, those pertaining to the study area for the *South Liberty Parkway Roundabout Study* were the most relevant.

Within the study area, the plan identified the Annual Average Daily Traffic (AADT) on South Liberty Parkway as being between 4,500 and 6,500 vehicles per day. No corridor speed or travel time concerns were identified based on AADT volumes. While the plan did analyze corridor operations throughout the City using travel time indices, South Liberty Parkway in the study area was omitted; only intersection analysis was performed. The conducted operational analysis used delay and Level of Service (LOS) as the primary judgement criteria. Level of Service is a qualitative term used to describe the operating conditions of a given roadway movement, which is correlated to the delay for the given movement. A full listing of LOS conditions for both signalized and unsignalized intersections may be seen in **Table 1**.

Table 1. Level of Service Definitions (From the 7th Edition of the Highway Capacity Manual (HCM))

Unsignalized Intersections		Signalized Intersections	
Level of Service	Average Control Delay (Sec/Veh)	Level of Service	Control Delay Per Vehicle (sec)
A	≤ 10	A	≤ 10
B	> 10 and ≤ 15	B	> 10 and ≤ 20
C	> 15 and ≤ 25	C	> 20 and ≤ 35
D	> 25 and ≤ 35	D	> 35 and ≤ 55
E	> 35 and ≤ 50	E	> 55 and ≤ 80
F	> 50	F	> 80

A summary of existing intersection operations for relevant intersections are summarized in **Table 2**. As shown, existing intersections on the study corridor operate acceptably, which is generally considered to be an LOS D or above during Peak Hours.

Table 2. Existing Peak Hour Operational Results (From 2024 Transportation Master Plan)

Intersection	Report Type	A.M. Peak Hour		P.M. Peak Hour	
		Delay	LOS	Delay	LOS
South Liberty Pkwy & Withers Rd	HCM 2000 Signal	28.1	C	33.6	C
South Liberty Pkwy & Birmingham Rd	HCM 6 th TWSC	13.5 (SBL)	B	27.2 (SBL)	D
South Liberty Pkwy & MO-291	HCM 2000 Signal	19.6	B	21.3	C

1.3.4. Mid-America Regional Council (MARC) Data

As part of the 2024 *City of Liberty Transportation Master Plan* review, data provided to HDR by the Mid-America Regional Council (MARC) was examined. The data included projected Peak Hour and daily volumes within the study area for 2050 and for a full build-out of all of Liberty. Projected volumes at various points on the study corridor are presented in **Table 3**.

Table 3. Existing and Projected South Liberty Parkway Volumes (MARC Data)

Location	Existing ADT	2050 Projected ADT	Full Build-Out Projected ADT
South Liberty Pkwy east of Withers Rd	6,144	10,261	13,975
South Liberty Pkwy east of Birmingham Rd	4,740	7,184	11,190
South Liberty Pkwy east of Arsenal Dr	4,912	11,293	20,599

2. Existing Conditions

2.1. Characteristics of the South Liberty Parkway

South Liberty Parkway traverses east-west for approximately 4.3 miles, from I-35 (west boundary) to MO-291 (east boundary). Throughout much of the corridor, South Liberty Parkway has a posted speed limit of 40 miles per hour (mph), and uses a four-lane divided cross section, with turn lanes provided at major intersections. Furthermore, South Liberty Parkway is classified as a minor arterial based on the Missouri Department of Transportation (MoDOT) Functional Classification Map, and a major arterial based on the City of Liberty Transportation Master Plan.

Through the 2.5 mile study corridor, South Liberty Parkway has a four-lane divided cross section without curb-and-gutter. A 9 foot shared-use trail is located on the south side of the roadway, and a 5 foot sidewalk is located on the north. Both pedestrian facilities terminate just west of the South Liberty Parkway and MO-291 intersection. The divided median serves as the stormwater conveyance system for the roadway, with various grate inlets and pipes located in the median throughout the study area. There are four existing intersections within the study area: South Liberty Parkway with Withers Road, Birmingham Road, Arsenal Drive, and MO-291. Additionally, there is existing access in the west area of the corridor, approximately 1,725 feet east of the Withers Road intersection. This access does not have any traffic control, and does not serve any development. A generic cross section of South Liberty Parkway may be seen in **Figure 3**.

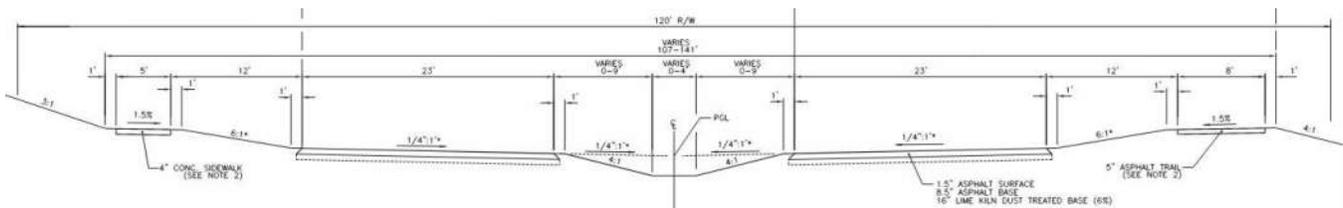


Figure 3. Typical South Liberty Parkway Cross Section (Oriented East)

The intersection of South Liberty Parkway and Withers Road is signalized and has four legs. The east and west legs of South Liberty Parkway provide a shared through/right-turn lane, a through lane, and an exclusive left-turn lane. For eastbound South Liberty Parkway, the left-turn lane has a storage length of approximately 250 feet. For westbound South Liberty Parkway, the left-turn lane has a storage length of approximately 165 feet. Northbound Withers Road provides one lane on approach to the intersection, which widens to three lanes at the intersection, with one lane each for left-turning, through, and right-turning movements. The left-turn and right-turn lanes have approximate storage lengths of 135 feet. Southbound Withers Road provides exclusive left-turn and right-turn lanes, as well as a shared through/right-turn lane. The left-turn lane has a storage length of approximately 265 feet.

The intersection of South Liberty Parkway and Birmingham Road operates under minor-road stop-control and has four legs. Eastbound South Liberty Parkway provides a shared through/right-turn lane, a through lane, and an exclusive left-turn lane with a storage length of approximately 180 feet. Westbound South Liberty Parkway provides a shared through/left-turn lane, and a shared through/right-turn lane. Conversely, the stop-controlled approaches of Birmingham Road provide one shared lane for all northbound and all southbound movements.

The intersection of South Liberty Parkway and Arsenal Drive operates under minor-road stop-control and has three legs. Eastbound South Liberty Parkway provides a shared through/right-turn lane, and a through lane. Westbound South Liberty Parkway provides two through lanes, and an exclusive left-turn lane with an approximate storage length of 185 feet. The stop-controlled approach of Arsenal Drive provides one shared lane for all northbound movements.

The intersection of South Liberty Parkway and MO-291 is signalized and has three legs. Eastbound South Liberty Parkway provides both an exclusive left-turn and right-turn lane, as South Liberty Parkway does not continue through the intersection. Northbound MO-291 provides two through-lanes, and an exclusive left-turn lane with a storage length of approximately 420 feet. Southbound MO-291 provides two through-lanes, and an exclusive right-turn lane with a storage length of approximately 250 feet.

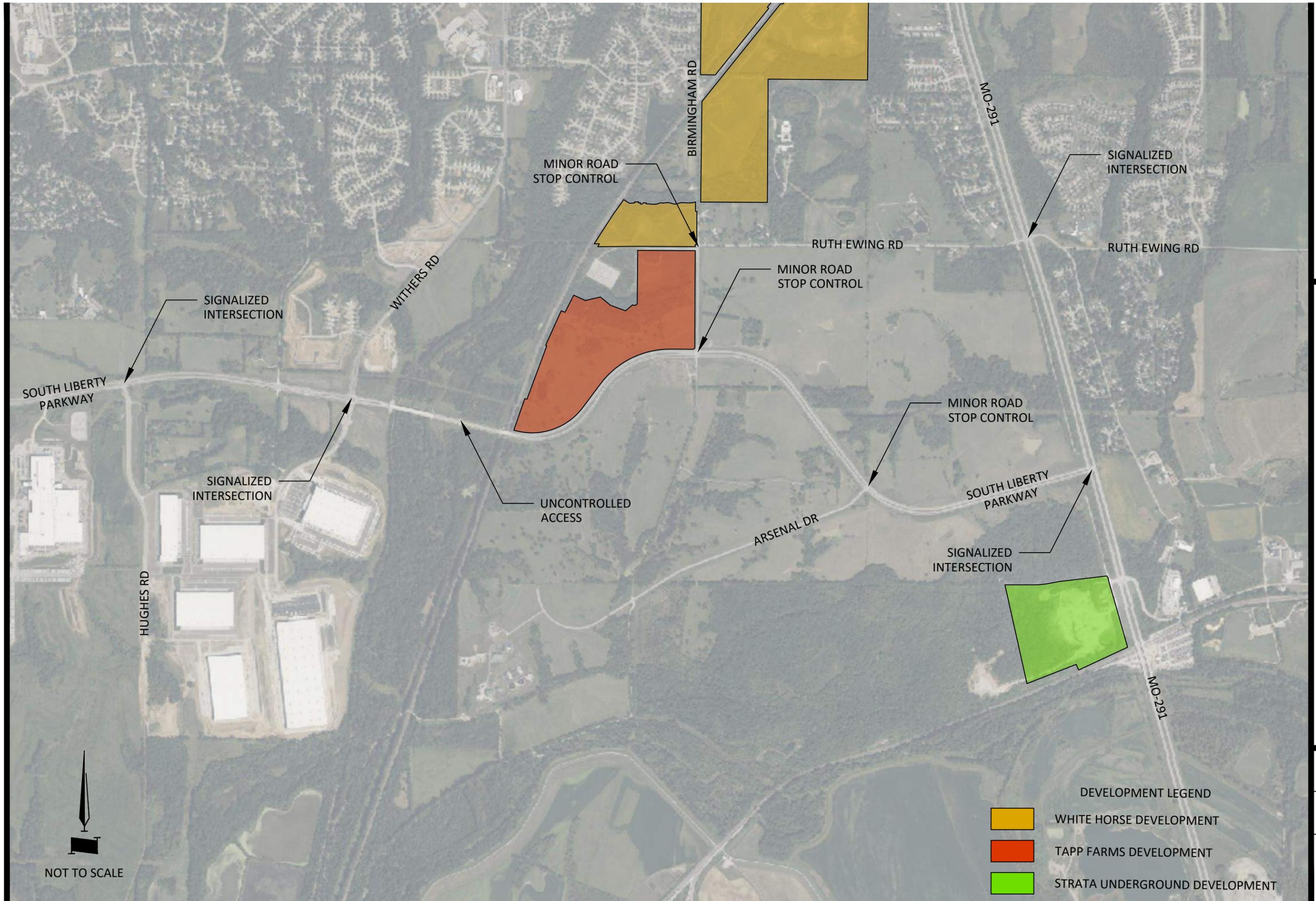
Through the study area, Arsenal Drive is classified as a local roadway, and has a posted speed of 35 mph. As stated, Arsenal Drive intersects South Liberty Parkway in the eastern portion of the study area to form a minor road stop-controlled intersection. Arsenal Drive provides a two-lane, two-way cross section without curb-and-gutter or sidewalks.

Similarly, Birmingham Road is classified as a local roadway through the study area, and has a posted speed of 35 mph. North of Ruth Ewing Road, Birmingham Road is classified as a Major Collector. Importantly, Birmingham Road has a railway crossing approximately 2,250 feet north of the Ruth Ewing Road intersection. Birmingham Road nearly bisects the study area, and generally traverses a north-south alignment. North of South Liberty Parkway, Birmingham Road provides a two-lane, two-way cross section without curb-and-gutter or sidewalks. South of the Parkway, Birmingham Road uses a gravel surface, and provides a two-lane, two-way cross section without curb-and-gutter or sidewalks.

Through the study area, Ruth Ewing Road is classified as a Major Collector, and has a posted speed of 35 mph. Ruth Ewing Road provides a two-lane, two-way cross section without curb-and-gutter or sidewalks. The intersection of Ruth Ewing Road with MO-291 is signalized, and has turn lanes provided for MO-291 and the east leg of Ruth Ewing Road.

The South Liberty Parkway Corridor connects to many key routes for trips within and surrounding Liberty. To the west, South Liberty Parkway intersects with I-35, which serves as a key route for interstate travel, and provides access to other interstate routes. As stated, Birmingham Road nearly bisects the study area, and functions as a key route between the South Liberty Parkway corridor and areas surrounding Downtown Liberty. To the east, MO-291 also serves as a connection to areas near downtown Liberty, as well as areas to the south of Liberty. Based on geographical constraints, there are no direct connections to the South Liberty Parkway corridor within the study area that provide routes to the south.

In addition to discussion of corridor elements and geometrics, **Figure 4** displays existing intersection controls along South Liberty Parkway within the study area.



SOUTH LIBERTY PARKWAY
ROUNDABOUT FEASIBILITY STUDY
EXISTING CORRIDOR CONDITIONS



NOT TO SCALE

DEVELOPMENT LEGEND

	WHITE HORSE DEVELOPMENT
	TAPP FARMS DEVELOPMENT
	STRATA UNDERGROUND DEVELOPMENT

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FIGURE
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2.2. Existing Traffic Volumes

Existing traffic volumes in this study used the data collected for the 2024 *City of Liberty Transportation Master Plan*, which was outlined previously in this study. As exact peak hours periods were not stated within the plan, generic A.M. and P.M. Peak periods will be used throughout this study.

Collected volumes within the study area based on the 2024 *City of Liberty Transportation Master Plan* may be seen in **Figure 5**.

While not used for calculations, volumes from the MoDOT Traffic Volume Maps were found to confirm existing data and truck traffic percentages on South Liberty Parkway. A summary of 2023 data is shown in **Table 4**.

Table 4. Summary of 2023 MoDOT Traffic Volume Data

Road	South Liberty Parkway at Withers Road	
Direction	Eastbound	Westbound
AADT	5,477	5,761
Truck Volume (%)	5.3%	4.9%
A.M. Peak Hour	8:00 - 9:00	8:00 - 9:00
P.M. Peak Hour	4:00 - 5:00	4:00 - 5:00

2.3. Traffic Signal Warrant Analysis

A signal warrant analysis was performed at the Birmingham Road intersection in accordance with the 2009 Edition of the Manual on Uniform Traffic Control Devices (MUTCD). Based on peak hour traffic volumes, it was determined that peak hour traffic signal warrants were satisfied at the South Liberty Parkway and Birmingham Road intersection. Full signal warrant calculations for these intersections are shown in **Appendix A**.

Signal warrant analyses were not performed at other intersections, because no turning movement count data was available at other intersections on the corridor. It is expected that turning movements to and from the minor roadways are very low, and would not satisfy any warrants.

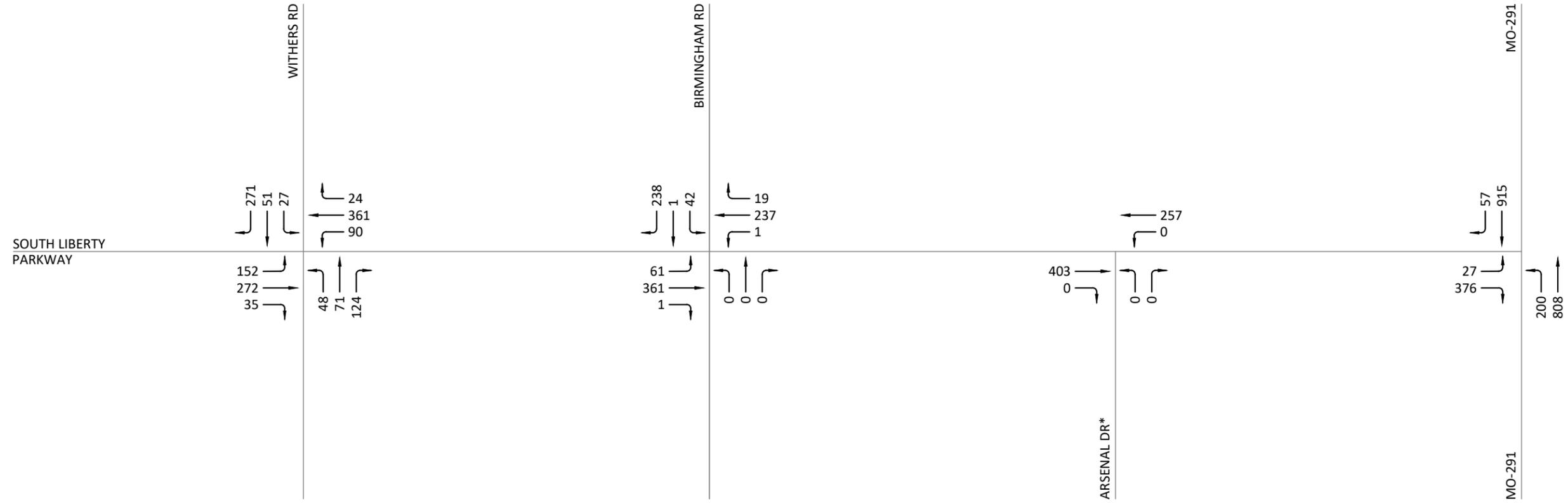
2.4. Turn Lane Warrant Analyses

Turn-lane warrant analyses were conducted for the South Liberty Parkway and Birmingham Road intersection in accordance with Section 940.9 *Auxiliary Acceleration and Turning Lanes* of the MoDOT Engineering Policy Guide (EPG).

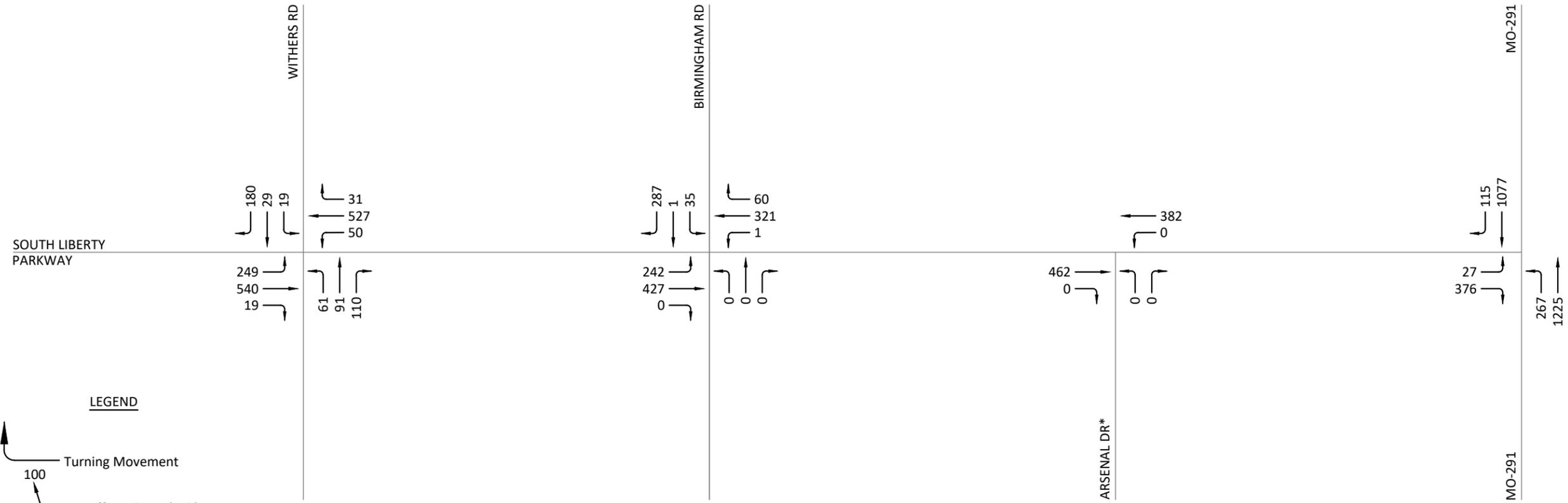
At Birmingham Road, it was determined that the existing eastbound left-turn lane was warranted. No additional turn lanes were determined to be warranted. Full auxiliary lane warrant calculations may be seen in **Appendix B**.

Turn lane warrant analyses were not performed at other intersections, because no turning movement count data was available at other intersections on the corridor. It is expected that turning movements to and from the minor roadways are very low, and would not satisfy any warrants.

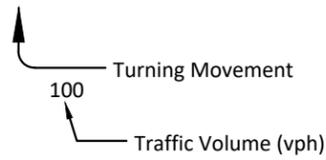
A.M. Peak Hour



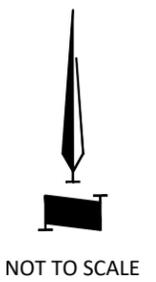
P.M. Peak Hour



LEGEND



* Traffic Counts Were Not Conducted at Arsenal Dr



SOUTH LIBERTY PARKWAY
 ROUNDABOUT FEASIBILITY STUDY
 EXISTING CORRIDOR VOLUMES

PROJECT NUMBER

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FIGURE

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3. Land Use Analysis

3.1. Existing Land Uses and Zoning

Existing zoning data and parcel maps were obtained through the City of Liberty and are shown in **Figure 6**. Existing zoning reflects specific designations as determined by the City of Liberty. Much of the study area is zoned for agricultural or low-density residential uses, which is reflected by the land uses of the parcels themselves. Some parcels within the study area are currently developed, and the existing zoning accurately represents the uses on site, as expected. Generally, developed parcels are located west of Shoal Creek or east of MO-291. Areas between Shoal Creek and MO-291 are generally undeveloped, with the exception of an electrical substation near the Birmingham Road and Ruth Ewing intersection, various City facilities near the Birmingham Road and Arsenal Drive intersection, and a mining operation and commercial business along MO-291.

3.2. Parcel Designations

To aid in analysis of the corridor, each parcel in the study area was given a code, as shown in **Figure 7**. Lots were designated starting with letters “A” through “E” to represent their potential access to the corridor. “A” and “B” lots were located to the west of the railroad line east of Withers Road, while “C” and “D” lots were located to the east. Finally, “E” lots were located east of MO-291.

3.3. Approved Development Plans

In addition to currently developed parcels, development plans have been submitted to the city for several areas. In total, three approved development plans were provided by the City for incorporation into the Study, and are included in **Appendix C**.

Tapp Farms is an approved residential development, located in the northwest corner of the South Liberty Parkway and Birmingham Road intersection, on much of parcel D5. In total, the development includes 149 units, spread across two sub-areas. Trip generation for the Tapp Farms development did not exceed the threshold to require a full traffic impact study, thus traffic impacts were included as part of the Whitehorse residential development’s traffic impact study.

Whitehorse residential development is located north of Ruth Ewing Parkway, and includes lots on both sides of Birmingham Road, with some properties located in parcel D5. Importantly, the Whitehorse development only has preliminary approval as of the writing of this report. In total, the development includes 327 units, spread across five sub-areas. The traffic impact study included trip generation, distribution, and traffic analyses for the combined Whitehorse and Tapp Farms developments. Based on the conducted analyses, minimal traffic impacts to adjacent roadways were expected, and no major improvements were recommended.

Anticipated trips generated by the Whitehorse and Tapp Farms developments were assigned to relevant parcels as part of the future land use analysis within this study.

Additionally, the Strata Underground development is proposed to include 3,262,000 Square Feet of leasable space in an underground facility on parcels C12 and C13. Full redevelopment of the existing mine is expected to occur over a 20 year period, with smaller amounts of development expected to occur during an initial five year period.

As part of the proposed development, the existing minor-road stop controlled intersection of MO-291 and Old State Highway 210 (Hwy 210) is being converted to a signalized intersection.

3.4. Future Land Uses

Compared to zoning, future land use utilizes broader, less prescriptive categories for a given parcel. Proposed land uses were outlined in the *Leading Liberty Forward Comprehensive Plan*, as was reviewed in the *Review of Existing Planning Studies and Documents* section of this study. While many properties within the study area are undeveloped, based on discussions with City staff, proposed developments in the area, as reviewed in the *Approved Development Plans* section, remain consistent with the proposed future land uses.

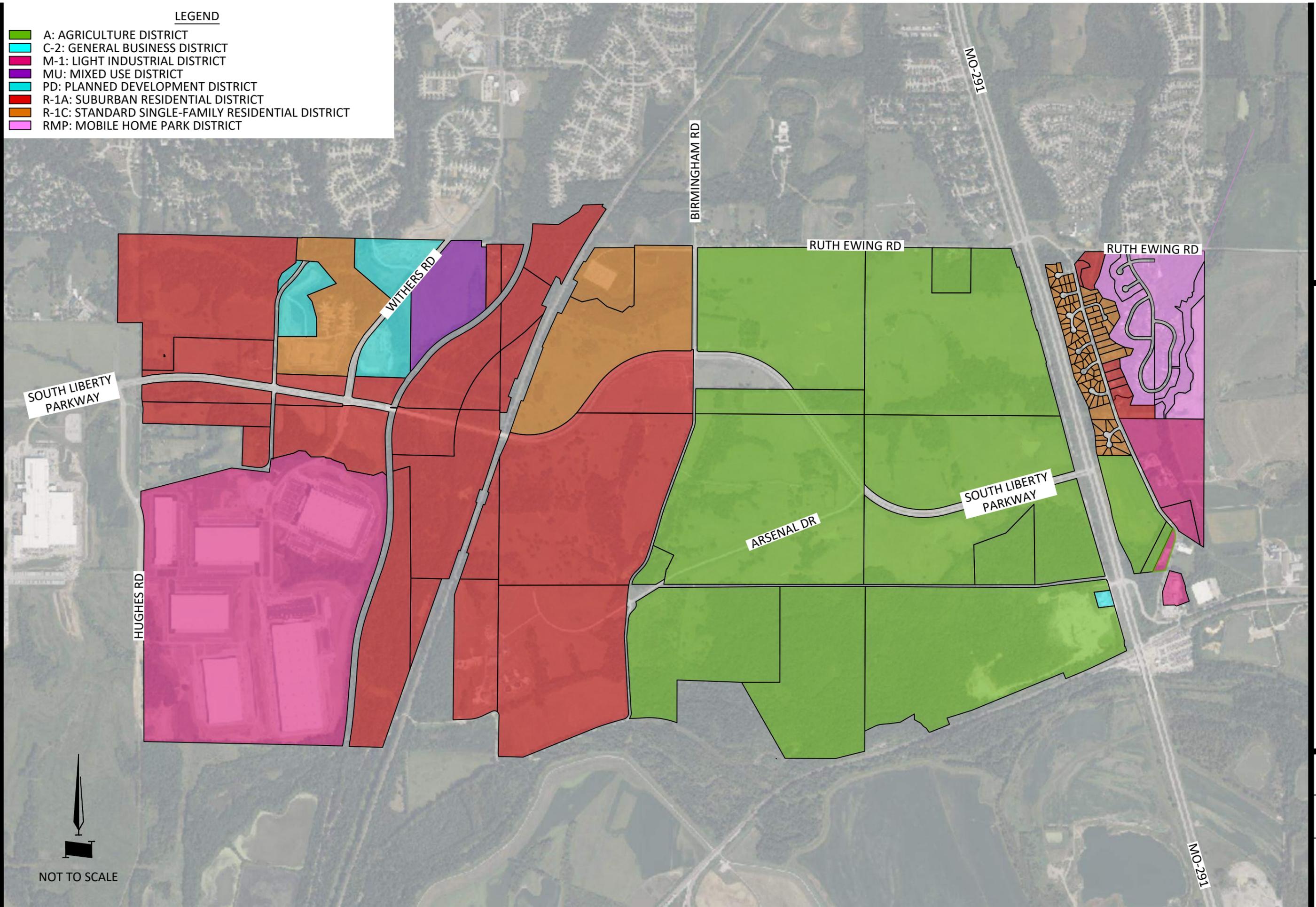
The future land use plan identified several areas that would be unlikely to develop, which were mostly based on geographic or existing features. Numerous streams, waterways, and ponds exist within the study area, and are unlikely to be developed without extensive site work to reroute the waterways. Most notably, Shoal Creek is located in the western portion of the study area, and has heavy vegetation on both sides. Additionally, railways are located on either side of Shoal Creek, making access to the area difficult. Between Shoal Creek and MO-291, the area is hilly, with little flat ground. For certain land uses, this may pose challenges when attempting to create large building pads.

While not specifically outlined as part of the future land use plan, the analyses in this study assumed a build out of additional collector and minor arterial roadways to serve area development. Although the future road network does have some impact on the conducted analyses, the primary influence on analyses is the relation of future land development relative to the roundabout locations.

Future land uses and parcels are shown in **Figure 8**.

LEGEND

- A: AGRICULTURE DISTRICT
- C-2: GENERAL BUSINESS DISTRICT
- M-1: LIGHT INDUSTRIAL DISTRICT
- MU: MIXED USE DISTRICT
- PD: PLANNED DEVELOPMENT DISTRICT
- R-1A: SUBURBAN RESIDENTIAL DISTRICT
- R-1C: STANDARD SINGLE-FAMILY RESIDENTIAL DISTRICT
- RMP: MOBILE HOME PARK DISTRICT



SOUTH LIBERTY PARKWAY
ROUNDBOUT FEASIBILITY STUDY
EXISTING ZONING MAP



NOT TO SCALE

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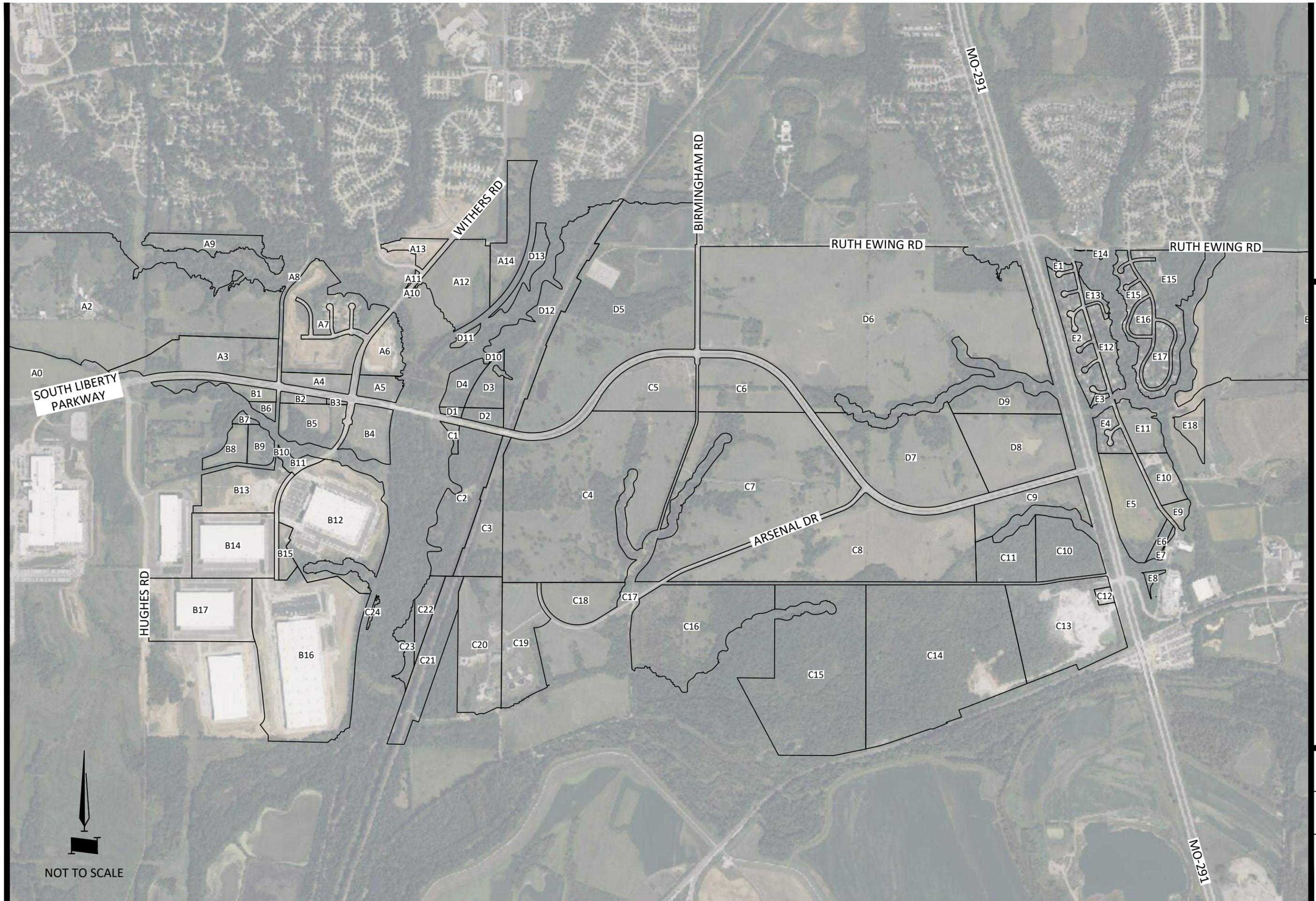
16652

DATE

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FIGURE

6



SOUTH LIBERTY PARKWAY

ARSENAL DR

RUTH EWING RD

RUTH EWING RD

BIRMINGHAM RD

WITHERS RD

HUGHES RD

MO-291

MO-291

SOUTH LIBERTY PARKWAY
ROUNDABOUT FEASIBILITY STUDY
NUMBERED PARCEL MAP



NOT TO SCALE

PROJECT NUMBER

16652

DATE

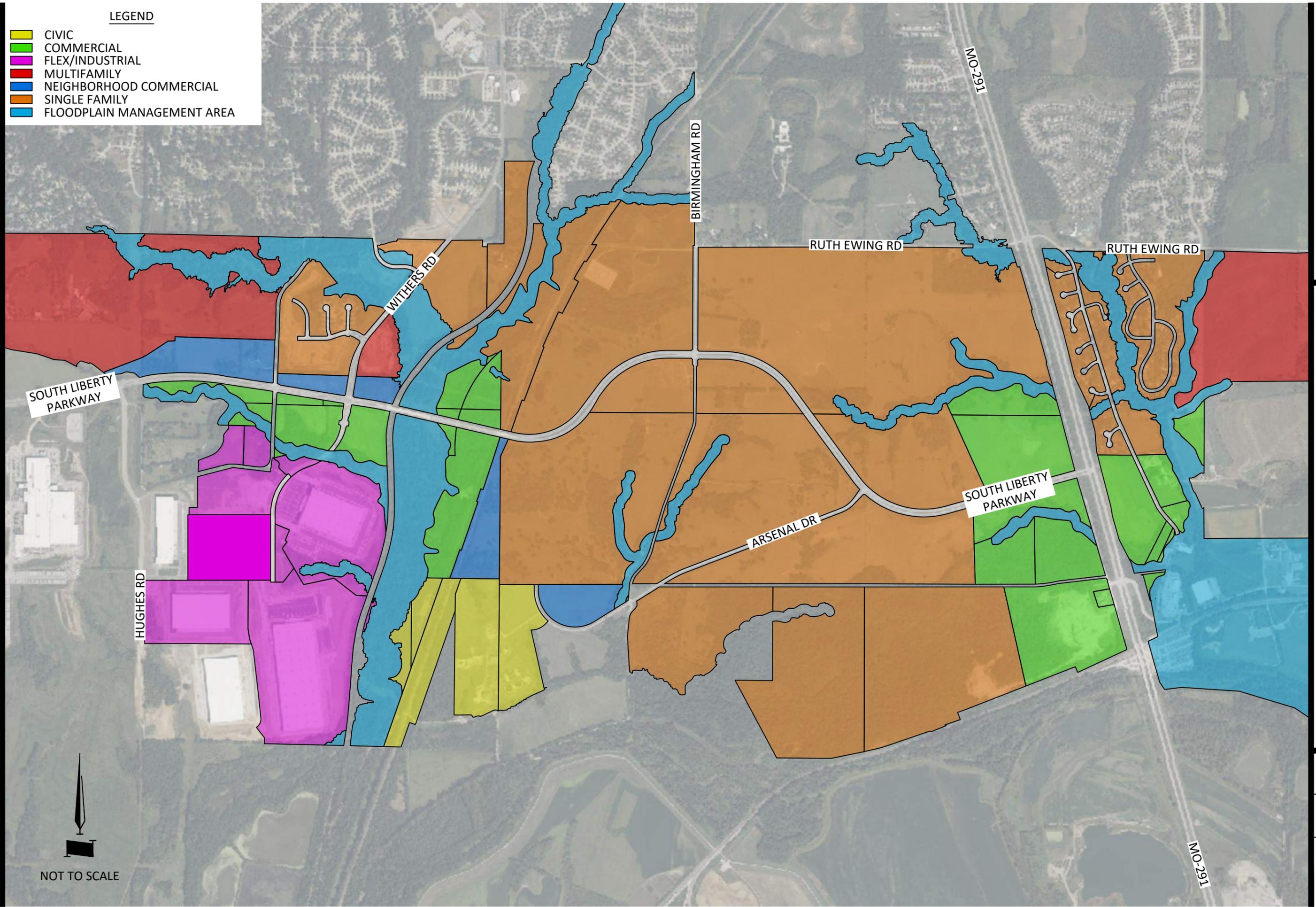
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FIGURE

7

LEGEND

- CIVIC
- COMMERCIAL
- FLEX/INDUSTRIAL
- MULTIFAMILY
- NEIGHBORHOOD COMMERCIAL
- SINGLE FAMILY
- FLOODPLAIN MANAGEMENT AREA



NOT TO SCALE

4. Transportation Analysis

4.1. Trip Distribution

The goal of a trip distribution projection is to estimate the origins and destinations of traffic generated by a given development. In creating a trip distribution for this plan, the projected turning movements for new trips were based on existing traffic patterns along the corridor, as well as city-wide traffic patterns outlined in the *City of Liberty Transportation Master Plan*. These trips were then added to existing traffic counts to create projected total traffic volumes for the Low, Medium, and High Development scenarios. Each parcel in the study area was assigned trip distribution values for entering and exiting vehicles, which were identical across A.M., P.M., and Daily traffic periods.

4.2. Trip Generation

After projecting trip distribution values for each parcel, anticipated trip generation for each parcel was calculated.

First, densities and development patterns for proposed land uses were identified by examining other areas with similar corridor and land use characteristics. This comparative inventory exercise was performed within the City of Liberty in an attempt to compensate for building setbacks, parking requirements, and other development policy guidelines not analyzed as part of this study. This local development pattern was then used to identify a “typical” floor area ratio (FAR) for each land use and parcel within the study area. A FAR is a ratio that compares the size of a building to its lot and is generally dependent upon the land use of the parcel. Determined FAR values were then used to calculate the approximate building sizes for future development on parcels in the study area.

Next, trip generation rates were calculated using the Institute of Transportation Engineers (ITE) *Trip Generation Manual*. Because the specifics of the future developments are unknown, multiple ITE Land Use Codes representing distinct but similar land uses were compiled to represent development of a given land use type. Then, a weighted average of the multiple trip generation rates for a land use group was calculated based on average building area, as provided by the ITE *Trip Generation Manual*.

Trip distribution and generation values, along with other relevant factors, were used to calculate trip generation for each parcel in the study area. An example calculation of trip generation for a given parcel is as follows:

Trip Generation

$$= \left(\text{Total Parcel} * \frac{\text{Area}}{1000} \right) * \text{Usable Area} * \text{Floor Area Ratio}$$

* *Development Percentage (Low, Medium, or High Development Scenario)*
* *Trip Generation Rate * Entering or Exiting Percentage*

Entering Trips (A. M. Peak Hour, High Development Scenario)

$$= (30,000 \text{ SF}/1000) * 100\% * 20\% * 100\% * 2.36 * 50\%$$

Entering Trips (A. M. Peak Hour, High Development Scenario) ≈ 7 Trips

4.3. Projected Corridor Traffic

Once land use and corresponding trip generation rates had been determined for each parcel, an iterative process was used to determine potential development patterns in the area. Three volume scenarios were developed: Low Development, Medium Development, and High Development. Volume scenarios were created based on trip generation from development along the corridor, as described previously. The High Development scenario anticipated full development of each parcel in the study area, while the Low and Medium Development scenarios anticipated partial development of certain parcels. Importantly, no background growth was included as part of projected future traffic. While properties along the corridor are currently undeveloped, areas that would use South Liberty Parkway as an east – west connection route are generally built up, meaning there is little room for background traffic growth. A summary of expected growth traffic volumes for Low, Medium, and High Development scenarios may be seen in **Table 5**.

Table 5. Summary of Proposed Corridor Volumes

Location	Existing ADT	Low Development Scenario ADT	Medium Development Scenario ADT	High Development Scenario ADT
South Liberty Pkwy east of Withers Rd	6,144	23,035	28,606	30,296
South Liberty Pkwy east of Birmingham Rd	4,740	19,210	22,177	23,613
South Liberty Pkwy east of Arsenal Dr	4,912	19,034	23,864	25,419

MARC has created traffic volume estimates for 2050 and Full Build-Out scenarios within the Kansas City Metropolitan area, including the study area, as shown in **Table 6**.

Table 6. MARC Traffic Volume Projections

Location	MARC 2050 Projections	MARC Full Build Projections
South Liberty Pkwy east of Withers Rd	10,261	13,975
South Liberty Pkwy east of Birmingham Rd	7,184	11,190
South Liberty Pkwy east of Arsenal Dr	11,293	20,599

As shown, the volumes calculated by the trip generation estimates in this study are considerably higher than those projected by MARC. The volumes calculated by the trip generation estimate will be used for the remainder of this study, as they were calculated using a more comprehensive analysis of this corridor. Importantly, the volumes represent a more conservative scenario, and it is likely that realized volumes at levels below those proposed in this study can be adequately handled by the recommended corridor layout presented.

5. Intersection Control Evaluation Matrix

In determining generic guidance for selection of potential intersection control, the first step was to identify contextually appropriate intersection control types for the South Liberty Parkway study corridor. Three potential alternatives were identified, and are outlined below:

Minor-road Stop-Controlled Intersections

Minor-road stop-controlled intersections allow major road movements to remain free-flowing but stop all minor-road movements onto and across the major road. Currently, the South Liberty Parkway intersections with Birmingham Road and Arsenal Drive operate under minor-road stop-control. Any future use of minor-road stop-controlled intersections along South Liberty Parkway would keep South Liberty Parkway movements as free-flowing and stop the intersecting minor-road.

Signalized Intersections

A signalized intersection places all legs of the intersection under signal control. Currently, the South Liberty Parkway intersections with Withers Road and MO-291 operate under signal control. Various geometric configurations may be used to provide turn lanes, storage, and access to specific locations at a signalized intersection. Furthermore, timing plans may be developed to accommodate specific movements during peak periods. Similarly, when used in series, signalized intersections can be coordinated to move large volumes of traffic through a corridor with minimal stops at intersections.

Roundabouts

A roundabout is characterized by counter-clockwise movements around a centralized island. Typically, all entering movements are yield-controlled, and remain free-flowing in the absence of circulating vehicles. Roundabouts may be used at specific locations, or in series along a corridor. Critically, roundabouts have fewer conflict points and have significant safety benefits when compared to traditional intersections. Published in 2012, *Safety Effectiveness of Converting Signalized Intersections to Roundabouts* provides crash modification factors (CMF) associated with conversion of intersections to roundabouts. For total crashes the CMF was calculated to be 0.792. Similarly, the CMF injury crashes was calculated to be 0.342.

A generic comparison of key considerations for the three intersection types may be seen in **Table 7**.

Table 7. Intersection Control Evaluation Matrix

Item	Minor-Road Stop-Control	Signalized Intersection	Roundabout
Approximate Entering Volumes (VPD)	14,000 (Maximum Major Road Volume)	10,000 – 80,000	7,500 – 80,000
Construction Cost	\$	\$\$	\$\$\$
Maintenance and Operations Cost	\$	\$\$\$	\$\$
Safety	-	+	++
Right-of-Way Impacts	Low	Low	Medium
Other Considerations	Simple and Low-Cost	-	May need lighting on entry/exit curves.

In making the ultimate selection of a preferred alternative, consideration should be given to each of the elements. No single factor, including the operational analysis to follow, is determinative between the three intersection controls. The *Recommendations* section of this study includes discussions of operational comparisons between roundabouts and traffic signals at locations where roundabouts have degraded operations, though the larger context of these other factors is also considered in providing recommended alternatives.

Analysis of Typical Roundabouts and Signalized Intersection Costs

An analysis of typical costs for roundabouts and signalized intersections demonstrates the monetary benefits of the increase in safety supporting the higher initial costs for the long-term implementation of roundabouts. Costs associated with construction, maintenance, and operations were estimated based on comparable intersections.

To calculate crash costs, statewide percentages of property damage only, injury, and fatal crash rates were found using MoDOT data. Then, crash rates per million entering vehicles were calculated based on available crash and volume information along the corridor. Finally, yearly crash costs were calculated by combining estimated future intersection volumes, calculated crash rates, expected crash costs, and crash percentages. For roundabouts, a CMF of 0.61 was applied to the overall crash rate prior to calculation.

Table 8 displays initial and annual costs associated with signalized intersections and roundabouts.

Table 8. Roundabouts vs Signalized Intersection Costs

Cost	Signalized Intersection	Roundabout
Construction	\$350,000	\$3,500,000
Annual Maintenance	\$7,500	\$2,500
Annual Electricity	\$4,000	-
Yearly Crash	\$2,150,000	\$610,000

Based on the provided information, it is estimated that the life-cycle costs of a roundabout will be lower than that of a signalized intersection sometime between 0 and 5 years post construction. Estimates were made based on expected full-build out volumes on the corridor, and thus lower volumes would lead to longer life-cycle cost

equivalency. Importantly, such estimates did not take into account property acquisition, major grading, or other elements associated with roundabout construction. However, the initial construction cost for the roundabout was conservative in an attempt to account for such details.



6. Roundabout Analyses

As stated, the *Leading Liberty Forward Comprehensive Plan* identified roundabouts as a solution for this corridor. As such, this study analyzes potential roundabout locations and configurations at various locations along the South Liberty Parkway corridor.

6.1. Potential Roundabout Locations

In total, six potential general roundabout locations on South Liberty Parkway were identified as part of this study. While some have a single feasible location, others may feasibly be sited within a several hundred foot segment along South Liberty Parkway. Determining the proposed locations of such roundabouts is the purpose of this section. Generally, the locations identified attempt to spread the roundabouts evenly throughout the study corridor, but considerations should be made for topography, drainage, utilities, and future development.

Roundabout 1 – Railroad

First, placement of a roundabout between the sets of bridges in the western portion of the corridor would maintain existing site access to potential development between Shoal Creek and the railway. Based on a sensitivity analysis, it was determined that the existing uncontrolled access configuration would be unable to handle volumes associated with anticipated development without worsening movements from the minor-road onto South Liberty Parkway to unacceptable delays and LOS. The location of the potential roundabout may be seen in **Figure 9**.



Figure 9. Potential Roundabout Locations Near Railway Bridges

Currently, there are two existing driveways located along South Liberty Parkway between the existing bridges over Shoal Creek and the railroads. It is assumed any potential development and associated roadway network would maintain access to South Liberty Parkway in generally the same location as the existing driveways.

Generally, spacing between successive intersections should be greater than a half mile and not less than a quarter mile. This location would provide approximately one third mile spacing to Withers Road and slightly less than a quarter mile spacing to the next intersection east of the railroad. It may be possible to adjust the intersection location slightly west to attain a full quarter mile spacing.

South Liberty Parkway is built significantly higher than the surrounding area at this location, likely to keep the roadway out of the Shoal Creek floodplain and provide adequate vertical clearance over the existing railroads. The adjacent terrain may make side road approaches to the proposed roundabout challenging to construct.

Roundabout 2 – Arsenal (West)

Another roundabout could be located in the western portion of the study corridor between Withers Road and Birmingham Road. Within this area, the logical location would be at the intersection of South Liberty Parkway and a potential Arsenal Drive extension as shown in the *Leading Liberty Forward Comprehensive Plan* mobility framework. Currently, the western portion of Arsenal Drive terminates approximately ½ mile south of South Liberty Parkway at an existing property line. It should be noted that the approved Tapp Farms residential development north of South Liberty Parkway does not propose a connection to the Parkway at this location, resulting in a 3-leg roundabout with Arsenal Drive to the south. The location of the potential roundabout at the intersection of Arsenal (West) Drive and South Liberty Parkway may be seen in **Figure 10**.

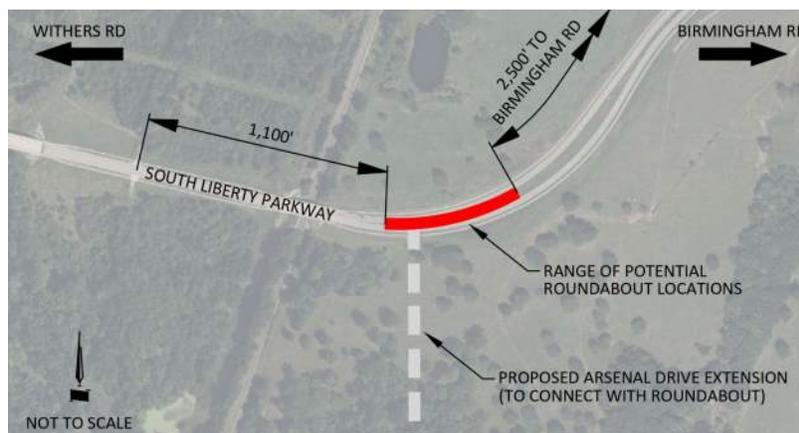


Figure 10. Potential Roundabout Locations In Western Portion of Corridor

Both the *Leading Liberty Forward Comprehensive Plan* mobility framework and a more recent major street map show Arsenal Drive being extended nearly due north from its current termini. Thus, the location of the roundabout is generally set just east of the existing railroad bridge and slightly into the horizontal curve that turns South Liberty Parkway north.

As noted previously, intersection spacing to the potential roundabout to the west is just under a quarter mile. The next intersection to the east is the existing Birmingham Road intersection which is over a half mile east of the proposed location of the Arsenal (west) roundabout.

Topography south of South Liberty Parkway at this location is rolling hills with the Parkway entering a significant cut section through the horizontal curve. A substantial amount of earthwork may be required at this location regardless of the location due to the existing terrain.

Roundabout 3 – Birmingham Road

A third potential roundabout could replace the existing minor-road stop-controlled intersection of South Liberty Parkway and Birmingham Road. Based on existing traffic patterns, Birmingham Road serves as a north-south connection between South Liberty Parkway and Downtown Liberty. The location of the potential roundabout at the intersection of Birmingham Road and South Liberty Parkway may be seen in **Figure 11**.



Figure 11. Potential Roundabout Locations Near Birmingham Road

The general location of this roundabout is fixed based on the existing street network. With the existing intersection being situated at almost exactly 90 degrees, a proposed roundabout at this location would likely be symmetrical along the east-west and north-south legs.

The surrounding topography is relatively flat with a slight drop in elevation along Birmingham Road to the north. South Liberty Parkway is on a modest grade of about 1%. It is not anticipated that the surrounding terrain will cause any adverse impacts to the implementation of a roundabout at this location.

Roundabout 4 – Central Area

Another potential roundabout could be located between Birmingham Road and Arsenal Drive. The location for the roundabout would likely be determined based on sight distances, as the horizontal curves and profile of South Liberty Parkway through the area limit sight distance at certain locations. Additionally, spacing from the roundabouts at Birmingham Road and Arsenal Drive should be considered in identifying an appropriate location. Potential locations for the roundabout may be seen in **Figure 12**.

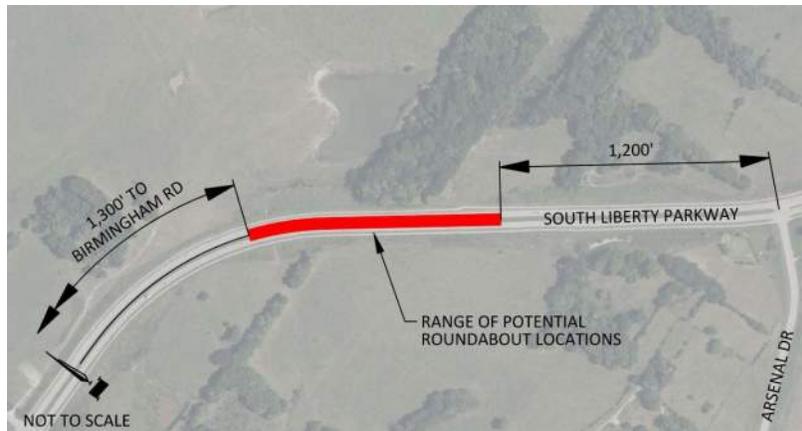


Figure 12. Potential Roundabout Locations In Central Portion of Corridor

Ideally, the roundabout would be located halfway between Birmingham Road and Arsenal Drive to maximize spacing between successive intersections. With approximately two-thirds of a mile between the two existing intersections, there is some flexibility to locate this proposed roundabout without violating the minimum quarter-mile intersection spacing.

It is anticipated that this will be a three-legged roundabout serving development on the north side of South Liberty Parkway. South Liberty Parkway is on slight grade of 1% at this location; however, there is a significant drop off from the parkway to the surrounding terrain to the north.

There is an existing cattle crossing (12' x 12' x 139' RCB) approximately a quarter-mile east of Birmingham Road that should be avoided to minimize roundabout cost. As development occurs on the adjacent properties, this structure could be repurposed as a pedestrian crossing between the north and south sides of South Liberty Parkway. Additionally, there is an existing farm pond and stream setback north of South Liberty Parkway that will need to be considered when locating the intersection.

The exact location of this roundabout will likely be dependent on adjacent development and the associated internal street network. The above-mentioned factors should be considered and vetted before finalizing the roundabout location.

Roundabout 5 – Arsenal Drive

Like a potential roundabout at Birmingham Road, the existing minor-road stop-controlled intersection at Arsenal Drive and South Liberty Parkway could be converted to a roundabout to serve minor-road movements from potential developments south and west of the existing intersection. A potential location may be seen in **Figure 13**.

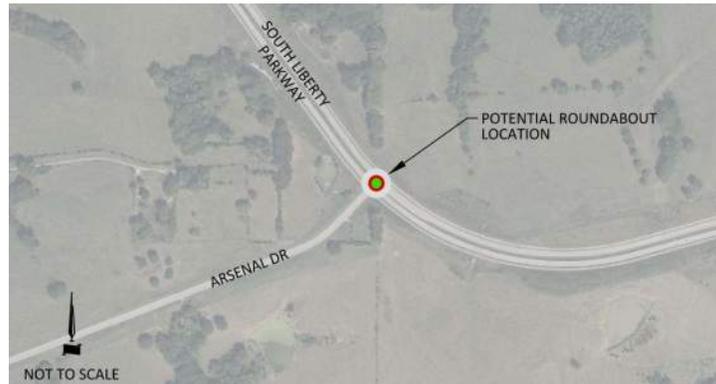


Figure 13. Potential Roundabout Locations Near Birmingham Road

The general location of this roundabout is fixed based on the existing street network. With the existing intersection being situated at almost exactly 90 degrees, a proposed roundabout at this location would likely be symmetrical along the east-west and south legs.

South Liberty Parkway is on a grade of just over 5%. Because of this grade, the circulatory roadway of the roundabout will likely need to be pitched in a similar manor to avoid major reconstruction along the parkway. The grade along Arsenal Drive is a more modest 2% and should more easily accommodate the roundabout approach leg.

Roundabout 6 – Eastern Area

A final potential roundabout could be considered between Arsenal Drive and MO-291. The location for the roundabout would likely be determined based on sight distances and proximity to adjacent intersections. The horizontal and vertical curvature of South Liberty Parkway through the area limit sight distance to and from the west. Additionally, spacing from the Arsenal Drive roundabout and the MO-291 signalized intersection limit the placement both to the east and to the west. Potential locations may be seen in **Figure 14**.

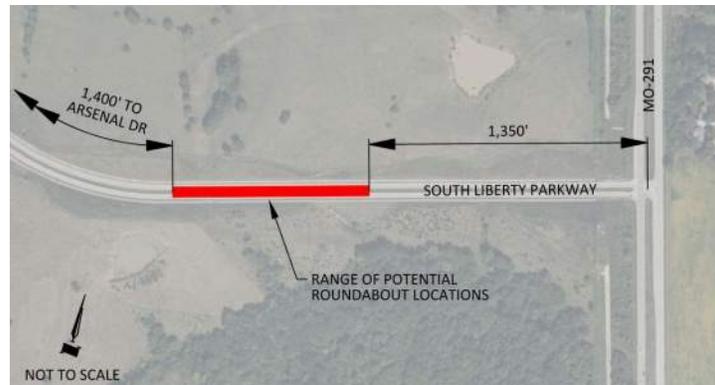


Figure 14. Potential Roundabout Locations In Eastern Portion of Corridor

Ideally, the roundabout would be located halfway between Arsenal Drive and MO-291 to maximize spacing between successive intersections. With over two-thirds of a mile between the two existing intersections, there is some flexibility to locate this proposed roundabout without violating the minimum quarter-mile intersection spacing.

It is anticipated that this will be a four-legged roundabout serving commercial and residential development on both the north and south side of South Liberty Parkway. Depending on the selected location, South Liberty Parkway is on a grade ranging from just under 0.4% to 3.5% at this location. This portion of South Liberty Parkway was constructed in a large cut and would likely require significant adjacent grading to accommodate the sideroad legs of the roundabout. Some of this mass grading will likely occur as the adjacent properties develop.

The exact location of this roundabout will likely be dependent on adjacent development and the associated internal street network. The above-mentioned factors should be considered and vetted before finalizing the roundabout location.

6.2. Future Corridor Operations

After identification of feasible roundabout locations, three potential access scenarios were developed and used for operational analyses. Each access scenario resulted in slightly different intersection geometries and hypothetical roadway network connections within the study area. Traffic volumes from the High Development Scenario, or a full build out of the corridor, were used for the analyses of the access scenarios to represent the “worst-case” development scenario based on planned future land use.

Operational analysis was conducted using Sidra (Version 9.1) analysis software. The main judgement criteria were Level of Service (LOS), delay, and queuing. For each scenario, individual roundabout sites were linked together using estimated spacing distances to provide analysis of the entire corridor. While the results of the conducted analyses are included throughout this study, **Appendix D** includes detailed reports for each analyzed intersection and scenario.

Scenario 1 – 5 Roundabouts

Scenario 1 proposed roundabouts between the railroads on the western portion of the study corridor, and between Arsenal Drive and MO-291 on the eastern portion of the study corridor. Additionally, roundabouts were proposed at the South Liberty Parkway intersection with Arsenal (West) Drive, Birmingham Road, and Arsenal Drive. A conceptual layout for Scenario 1 may be seen in **Figure 15**.

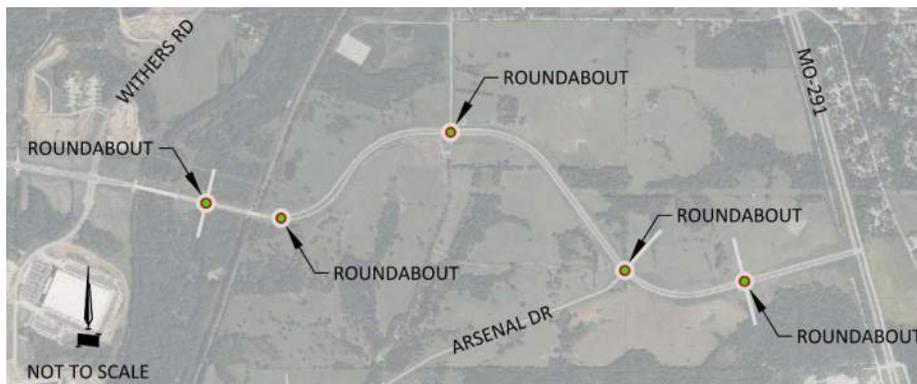


Figure 15. Scenario 1 Layout

Analysis of the corridor under the Scenario 1 layout revealed specific locations in which operational challenges may occur. Specifically northbound and westbound approaches at the Arsenal (West) roundabout, as well as southbound right movement at the Birmingham Road roundabout, were expected to function at LOS F. While these movements generally have lower volumes and are of lesser importance in the current corridor condition, they serve as critical movements for future developments and connection to other parts of Liberty and the surrounding areas.

Scenario 2 – 5 Roundabouts + 1 Minor-Road Stop-Controlled Intersection

Scenario 2 proposed roundabouts at the South Liberty Parkway intersection with Arsenal (West) Drive, Birmingham Road, and Arsenal Drive. Two additional roundabouts were proposed, with one between Birmingham Road and Arsenal Drive, and another between Arsenal Drive and MO-291. The existing access point on the western

portion of the corridor between the railroads was proposed to remain under minor-road stop-control. A conceptual layout for Scenario 2 may be seen in **Figure 16**.

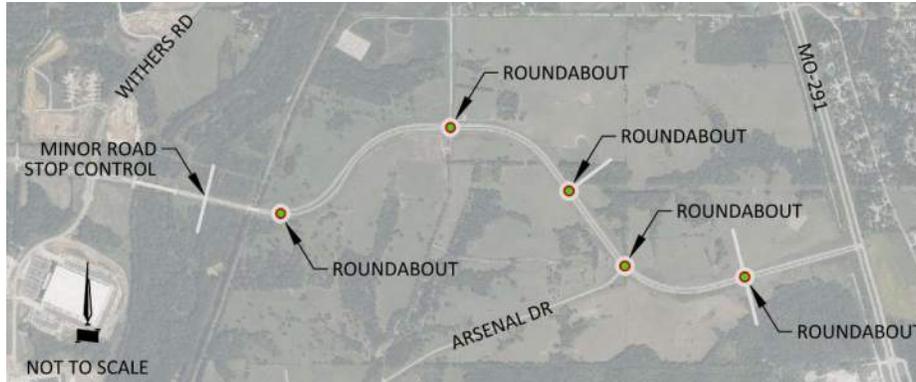


Figure 16. Scenario 2 Layout

Analysis of the corridor under the Scenario 2 layout revealed potential operational challenges at the same locations as was found for Scenario 1 analysis. However, it was determined that the railroad intersection would likely experience excessive delays and queues if some additional form of intersection control was not provided. The addition of a roundabout near the midpoint of Birmingham Road and Arsenal Drive did not appear to have major impacts on the operations of the adjacent roundabouts or the corridor as a whole, as the north leg of the Arsenal Drive roundabout was moved to the new roundabout location further west.

Scenario 3 – 5 Roundabouts + 2 Right-In-Right-Out Locations

Scenario 3 proposed a roundabout between the railroads on the western portion of the study corridor, and between Arsenal Drive and MO-291 on the eastern portion of the study corridor. Roundabouts were proposed at the South Liberty Parkway intersection with Arsenal (West), Birmingham Road, and Arsenal Drive. Additionally, right-in-right-out (RIRO) access was provided in multiple locations along South Liberty Parkway. A conceptual layout for Scenario 3 may be seen in **Figure 17**.

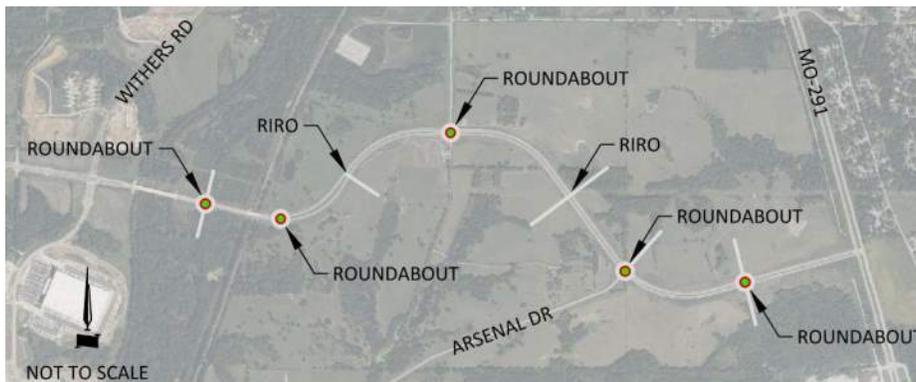


Figure 17. Scenario 3 Layout

Analysis of the corridor under the Scenario 3 layout revealed more extensive operational challenges than Scenarios 1 or 2. In short, the operational challenges at the Arsenal (West) and Birmingham Road roundabouts worsened, which spread throughout the corridor.

Summary of Operations Across All Scenarios

Operational analyses across the three scenarios revealed key locations in which maintaining functional operations will be critical for the corridor. Primarily, these locations were the Arsenal (West) and Birmingham Road roundabouts. It was found that if the two locations experience poor operations, effects would likely be felt throughout the corridor.

A summary of operations at major intersections in each scenario is shown in **Table 9**, with expanded results in **Appendix D**.

Table 9. Comparison of Corridor Operations

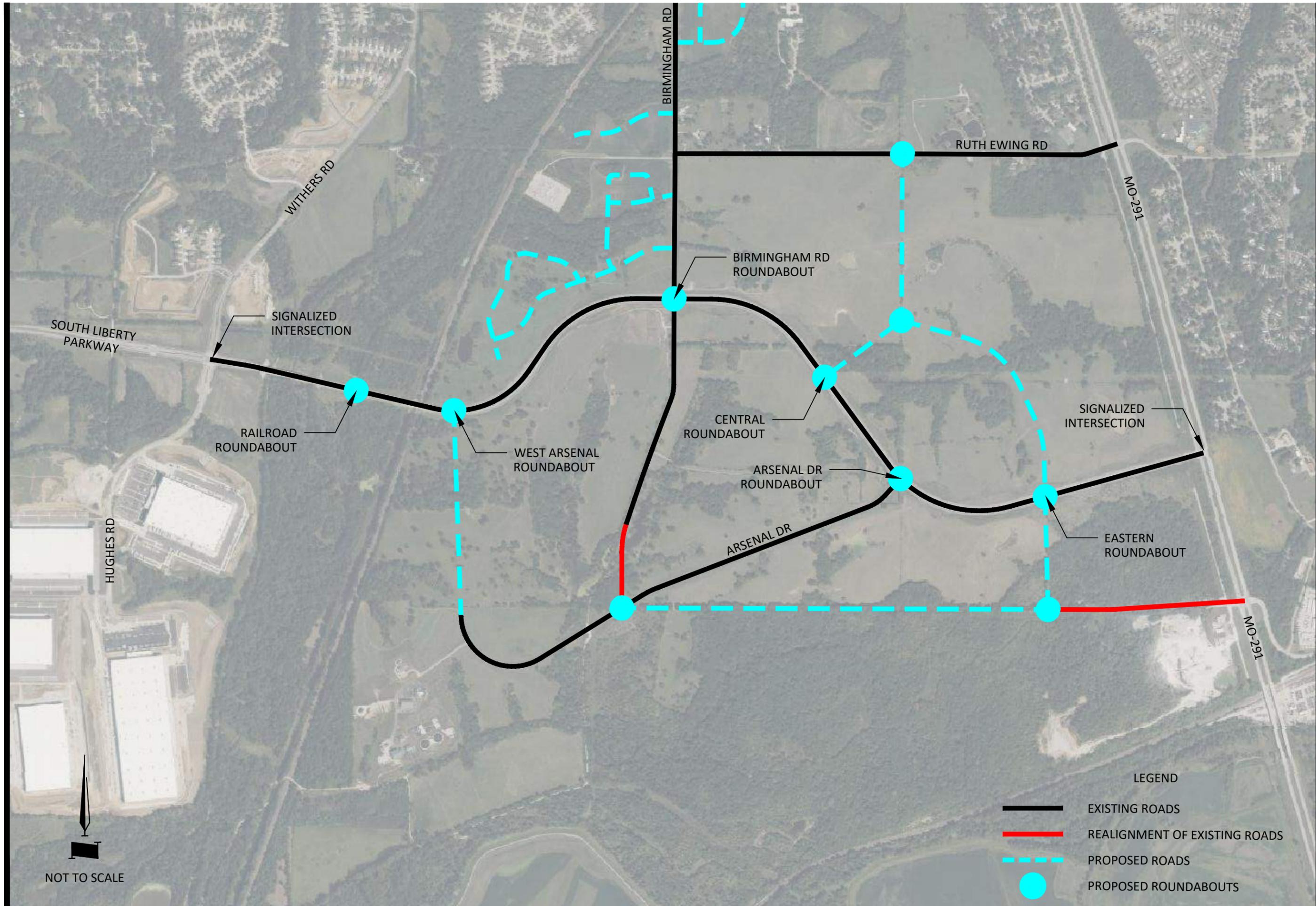
Intersection	Existing		Scenario 1		Scenario 2		Scenario 3	
	A.M. Peak	P.M. Peak	A.M. Peak	P.M. Peak	A.M. Peak	P.M. Peak	A.M. Peak	P.M. Peak
Railroad	-	-	A	C	A	C	A	C
Arsenal (West)	-	-	B	D	B	D	B	D
Birmingham Road	A	A	A	D	A	D	B	F
Central Roundabout	-	-	-	-	A	A	-	-
Arsenal Drive	A	A	A	B	A	B	A	B
Eastern Roundabout	-	-	A	C	A	C	B	E

7. Recommendations

A map of the proposed South Liberty Parkway corridor layout, showing the recommended alternative and the hypothetical study area roadway network, is shown in **Figure 18**. Generally, the layout identified in Scenario 1 was identified to be the most viable. As discussed previously, it is recommended that six roundabouts be constructed at the following intersections:

1. Railroad
2. Arsenal (West) Drive (Arsenal Drive Extension)
3. Birmingham Road
4. Central Roundabout
5. Arsenal Drive
6. Eastern Section

Specific locations of such roundabouts and associated volumetric triggers to warrant construction will be outlined in this section. Additionally, expected corridor turning movements are shown in **Figure 19**. Conceptual roundabout layouts and typical sections are provided in **Appendix E**.



SOUTH LIBERTY PARKWAY
ROUNDABOUT FEASIBILITY STUDY
PROPOSED CORRIDOR LAYOUT

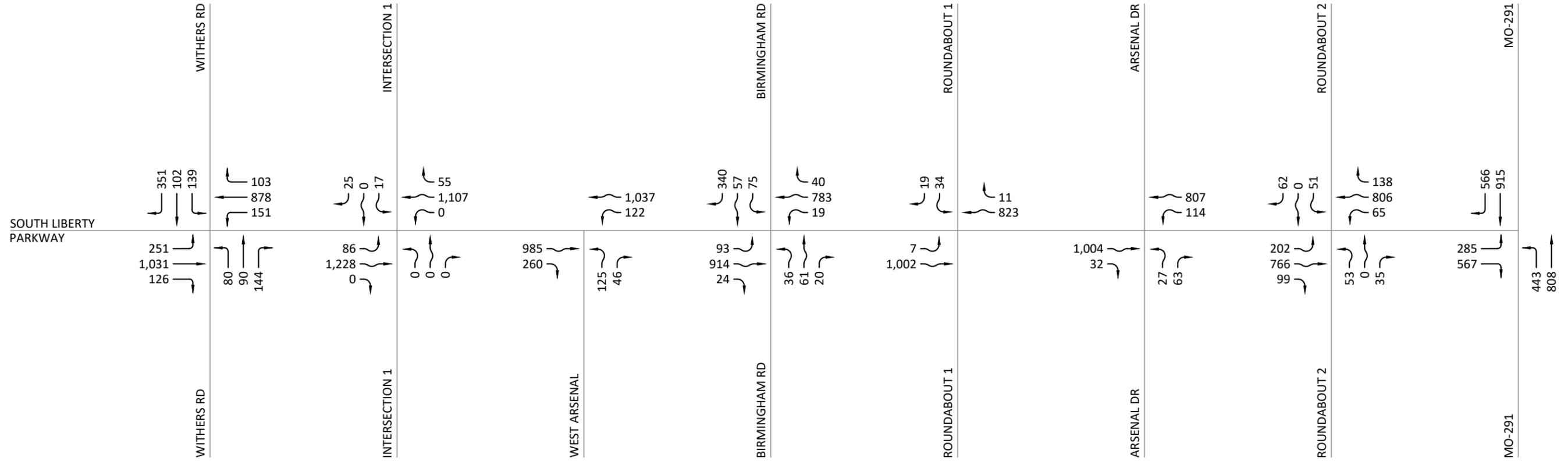
PROJECT NUMBER
16652

DATE
07/31/2025

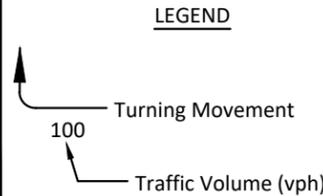
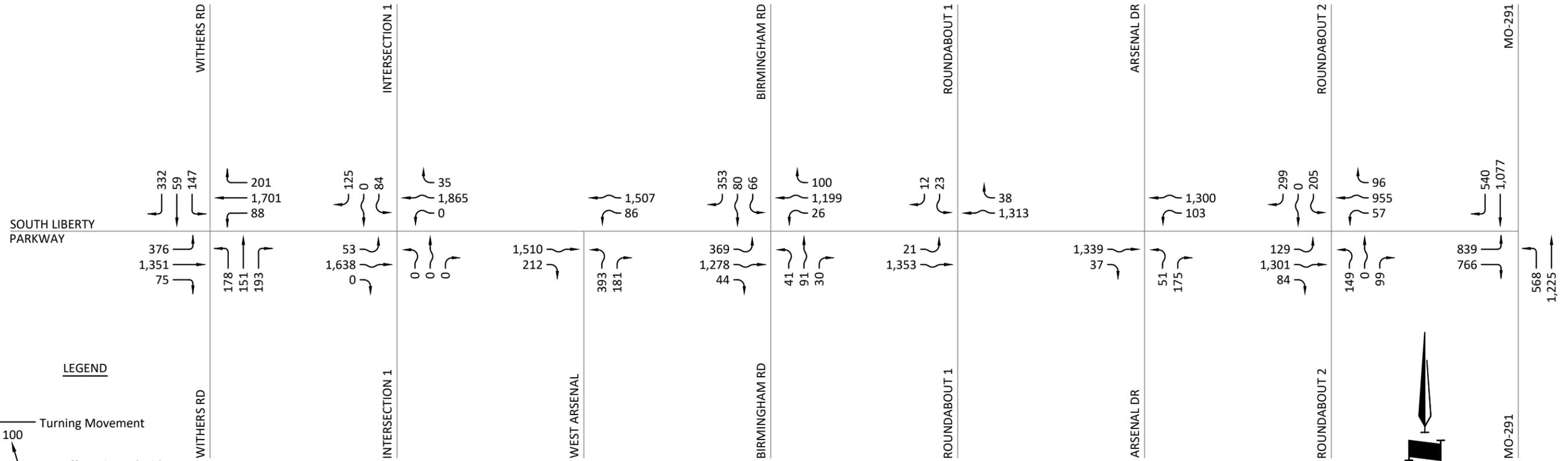
FIGURE
18

NOT TO SCALE

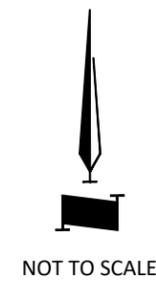
A.M. Peak Hour



P.M. Peak Hour



* Traffic Counts Were Not Conducted at Arsenal Dr



SOUTH LIBERTY PARKWAY
 ROUNDABOUT FEASIBILITY STUDY
 ESTIMATED CORRIDOR TURNING MOVEMENTS

PROJECT NUMBER	16652
DATE	07/31/2025
FIGURE	19

Railroad

A roundabout at the existing access point near Shoal Creek in the western portion of the corridor should be constructed in conjunction with development in the area. As there are no other access points between the two railways, the existing driveways serve as the only access point to or from South Liberty Parkway for any potential development. Given the topography and layout of parcels south of South Liberty Parkway, it was assumed that no development would occur in the area. While small portions of parcels C1 and C2 may be developable, these would likely lead to minimal trip generation that could be accommodated by a potential roundabout. In the event that no development occurs in the area, a roundabout would be an unnecessary corridor improvement.

Based on the conducted operational analyses, it was determined that the roundabout should have two circulating lanes for eastbound and westbound Southbound Liberty Parkway movements, and one circulating lane for minor road movements. Additionally, an exclusive southbound right-turn lane should be provided for movements out of the potential future development north of South Liberty Parkway. Furthermore, it was estimated that the roundabout would operate at LOS A during the A.M. Peak Hour, and LOS C during the P.M. Peak Hour.

Arsenal (West)

As an extension of Arsenal Drive to the north to meet South Liberty Parkway in the western portion of the corridor has connectivity and access benefits, intersection control should be provided at the location to serve associated traffic.

The conducted operational analyses identified poor levels of service under full build volumes. To attempt to improve levels of service, two northbound left-turn lanes were provided, with an exclusive right-turn lane. While westbound movements were expected to reach LOS F during the P.M. Peak Hour, these are compared to unsignalized intersections. While roundabout levels of service typically use the delay values for unsignalized intersections because they are generally constructed at existing unsignalized locations, when appropriate, they may also use level of service delay values for signalized intersections, if that is the other considered alternative. Because drivers are typically willing to and expect to wait longer at signalized intersections, the delays associated with a given level of service, say LOS C, will be higher when compared to an unsignalized intersection. Therefore, when using the signalized LOS criteria for the West Arsenal roundabout, the levels of service will improve, even though the analysis itself, and the calculated delay, has not changed. Analysis of the intersection under signalized control was also performed to identify if signalized control was more feasible than a roundabout. A conceptual layout with a northbound left-turn and right-turn lane, and an exclusive westbound left-turn lane was used for the signalized alternative. Based on the analysis, it was expected that such an intersection would operate under LOS A during the A.M. Peak Hour, and LOS B during the P.M. Peak Hour. A comparison of expected operations at the intersection for a roundabout using unsignalized and signalized LOS criteria, as well as signalized control, is shown in **Table 10**.

Table 10. Comparison of Arsenal (West) Movement Operations

Lane	Roundabout Using Unsignalized Criteria Delay (LOS)		Roundabout Using Signalized Criteria Delay (LOS)		Signalized Delay (LOS)	
	A.M. Peak	P.M. Peak	A.M. Peak	P.M. Peak	A.M. Peak	P.M. Peak
NB Left	5.6 (A)	15.3 (C)	5.6 (A)	15.3 (B)	10.9 (B)	29.4 (C)
NB Right	6.2 (A)	18.9 (C)	6.2 (A)	18.9 (B)	10.1 (B)	15.3 (B)
WB Left	10.9 (B)	57.2 (F)	10.9 (B)	57.2 (E)	9.9 (A)	26.6 (C)
WB Through	10.9 (B)	56.0 (F)	10.9 (B)	56.0 (E)	5.3 (A)	12.1 (B)
EB Through	9.9 (A)	15.6 (C)	9.9 (A)	15.6 (B)	7.3 (A)	20.9 (C)
EB Right	9.9 (A)	15.5 (C)	9.9 (A)	15.5 (B)	7.4 (A)	21.1 (C)
Overall LOS	10.1 (B)	32.3 (D)	10.1 (B)	32.3 (C)	6.8 (A)	18.2 (B)

As shown in **Table 10**, it is expected that a signalized intersection will operate with lower delays and higher LOS at the intersection location when compared to a roundabout under full build volumes. While LOS provides a qualitative analysis measure, consideration should still be given to movements or intersections with lower LOS. In this case, benefits of choosing a roundabout over a signal are likely increased safety, lower maintenance costs, and improved corridor consistency. Furthermore, despite lower modeled LOS at the roundabout, the delays are likely not substantial enough to cause network-wide breakdowns. All in all, a wholistic evaluation of potential intersection controls should be completed prior to selection of any one control method. Furthermore, the traffic volumes used to estimate future LOS within this document are speculative, and based on generic development types. Further analysis will occur as a result of realized development in the area, and will likely differ from results presented within this study. Future traffic impact studies from these developments should be used to determine expected impacts of realized developments prior to approval.

It is most logical for construction of the intersection at Arsenal (West) and South Liberty Parkway to occur concurrently with an extension of Arsenal Drive, regardless of the chosen intersection control. Importantly, most trips at the intersection during the controlling P.M. Peak Hour are generated by the proposed neighborhood commercial development in parcel C3. If a lower trip generating development, such as single-family housing, occurs on the parcel, or no development occurs at all, the operational differences between the roundabout and traffic signal are likely to diminish significantly, as volumes would be significantly lowered.

Birmingham Road

At Birmingham Road, as discussed previously, signal warrants are satisfied at the intersection based on peak hour traffic volumes. Furthermore, based on the approved White Horse and Tapp Farms developments located north of the intersection, additional volumes can be expected at the intersection in the near future.

Based on the conducted operational analyses, it was determined that the proposed roundabout should have two circulating lanes for eastbound and westbound movements, and one circulating lane for northbound and southbound movements. The eastbound and westbound approaches should have a shared through/left-turn lane, and a shared through/right-turn lane. Conversely, the northbound approach should have a shared through/left-turn lane, and an exclusive right-turn lane. Finally, the southbound approach should have a shared left-turn/through/right-turn lane, and an exclusive right-turn lane. As the Birmingham Road intersection serves as a critical point along the corridor, a potential signal was also analyzed and is shown in **Table 11**.

Table 11. Comparison of Birmingham Movement Operations

Lane	Roundabout Using Unsignalized Criteria Delay (LOS)		Roundabout Using Signalized Criteria Delay (LOS)		Signalized Delay (LOS)	
	A.M. Peak	P.M. Peak	A.M. Peak	P.M. Peak	A.M. Peak	P.M. Peak
NB Left	8.1 (A)	25.0 (C)	8.1 (A)	25.0 (C)	11.6 (B)	13.6 (B)
NB Through	8.1 (A)	25.0 (C)	8.1 (A)	25.0 (C)	7.1 (A)	8.9 (A)
NB Right	14.4 (B)	39.3 (E)	14.4 (B)	39.3 (D)	7.1 (A)	8.9 (A)
WB Left	7.6 (A)	35.8 (E)	7.6 (A)	35.8 (D)	9.8 (A)	10.8 (B)
WB Through	7.6 (A)	34.9 (D)	7.6 (A)	34.9 (C)	8.3 (A)	12.6 (B)
WB Right	7.5 (A)	33.9 (D)	7.5 (A)	33.9 (C)	8.3 (A)	12.7 (B)
SB Left	12.7 (B)	34.5 (D)	12.7 (B)	34.5 (C)	7.8 (A)	9.3 (A)
SB Through	12.7 (B)	34.5 (D)	12.7 (B)	34.5 (C)	6.9 (A)	8.6 (A)
SB Right	13.7 (B)	66.7 (D)	13.7 (B)	66.7 (E)	12.3 (B)	31.4 (C)
EB Left	8.7 (A)	20.9 (C)	8.7 (A)	20.9 (C)	9.3 (A)	24.8 (C)
EB Through	8.6 (A)	20.7 (C)	8.6 (A)	20.7 (C)	9.7 (A)	13.0 (B)
EB Right	8.6 (A)	20.6 (C)	8.6 (A)	20.6 (C)	9.7 (A)	13.1 (B)
Overall LOS	9.2 (A)	31.1 (D)	9.2 (A)	31.1 (C)	9.4 (A)	15.5 (B)

As shown in **Table 11**, it is expected that the signalized intersection will operate similarly in the A.M. Peak Hour and better in the P.M. Peak Hour, though both intersection control alternatives are predicted to operate satisfactorily.

Central Roundabout

Between Birmingham Road and Arsenal Drive, a roundabout may be feasible to provide access to areas north of South Liberty Parkway. Additionally, based on the future land use plan, a roundabout in the area could provide shared access to parcels D6 and D7, with the roadway serving as key part of the future road network. Furthermore, a roundabout and connector roadway at the location were identified as part of the *Leading Liberty Forward Comprehensive Plan*.

A roundabout in this location is expected to operate well under full build conditions. As an intersection is not currently located in the area, it may be built as a roundabout or operate under minor-road stop-control until side street stop movements begin to fail, which can be expected at major roadway daily volumes of approximately 14,000 vpd.

Based on the conducted operational analyses, it was determined that roundabout should have two circulating lanes for eastbound and westbound Southbound Liberty Parkway movements, and one circulating lane for minor road movements from the north.

Arsenal Drive

At Arsenal Drive, the existence of an intersection generally justifies the placement of a future roundabout. Furthermore, Arsenal Drive will likely be used as a collector roadway for future development to the south, placing higher volumes of turning movements at the South Liberty Parkway and Arsenal Drive intersection.

The roundabout at Arsenal Drive is expected to operate well under full build conditions. The intersection may continue to remain under minor road stop control until side street stop movements onto South Liberty Parkway begin to fail, which can be expected at major roadway daily volumes of approximately 14,000 vpd.

Based on the conducted operational analyses, it was determined that roundabout should have two circulating lanes for eastbound and westbound Southbound Liberty Parkway movements, and one circulating lane for minor road movements from the south.

The Central Roundabout and roundabout at Arsenal Drive may be combined to create one four-legged roundabout, which would be expected to operate acceptably under full build volumes.

Eastern Portion of Corridor

While an intersection does not currently exist between Arsenal Drive and MO-291, the proposed commercial land use north and south of South Liberty Parkway will likely require some form of access. As full access should not be placed on MO-291 for access management reasons, turning movements to and from the development would likely need to be accommodated by some form of intersection on South Liberty Parkway.

Furthermore, the expected volumes to and from such development would likely necessitate some form of intersection control beyond minor-road stop-control. Therefore, it is recommended that a roundabout be constructed concurrently with development in the area, which also provides clear funding opportunities tied to the development, as will be discussed later in this study. Roundabout construction could be phased, with southern and northern legs being constructed independently should the south and north sides of South Liberty Parkway develop on different timelines.

Based on the conducted operational analyses, it was determined that the roundabout should have two circulating lanes for eastbound and westbound Southbound Liberty Parkway movements, and one circulating lane for minor road movements. An exclusive right-turn lane should also be provided on both minor road approaches.

Roundabout Implementation Matrix

For simplicity, a matrix displaying the locations and likely triggers for construction of the associated roundabout may be seen in **Table 12**.

Table 12. Roundabout Implementation Matrix

Roundabout Location	Construction Trigger
Railroad	Roundabout should serve as the primary access to South Liberty Parkway for any development occurring on Parcels D1-D4, C1, or C2.
Arsenal (West)	Concurrent with development that requires the extension of Arsenal Drive to South Liberty Parkway.
Birmingham Road	Currently warranted based on existing volumes and additional volumes from approved development.
Central Roundabout	Roundabout to serve as the primary access for Parcel D6 to South Liberty Parkway.
Arsenal Drive	Side road stop condition failure, which is likely to occur with any development using the intersection for primary access, even under current volumes.
Eastern Portion	Concurrent with commercial development. Roundabout should serve as primary access for any development occurring on Parcels D7, D8, and D9.

Importantly, construction of the roundabouts may be phased. For example, on roundabouts where a multi-lane minor-road approach was identified as necessary to provide adequate capacity, a single lane may be constructed initially, with additional lanes on the approach constructed in phases as development continues. Similarly, approaches at certain locations may not need to be constructed until a receiving roadway exists.



Roundabout Cost Estimates

Preliminary cost estimates for each roundabout were developed and are provided in **Table 13**. Cost estimates were developed by using the proposed Birmingham Road roundabout as a control case, and using estimated work at other proposed roundabout locations to develop low, median, and high estimates. Cost estimates were created in 2025 dollars, and a 2.5% inflation rate per year was assumed to create 2045 cost estimates.

Table 13. Preliminary Roundabout Cost Estimates

Roundabout Location	Low Estimate 2025 (2045)	Median Estimate 2025 (2045)	High Estimate 2025 (2045)
Railroad	\$2,400,000 (\$4,000,000)	\$2,700,000 (\$4,500,000)	\$3,000,000 (\$5,000,000)
Arsenal (West)	\$1,900,000 (\$3,000,000)	\$2,200,000 (\$3,500,000)	\$2,500,000 (\$4,000,000)
Birmingham Road	\$2,700,000 (\$4,500,000)	\$3,000,000 (\$5,000,000)	\$3,300,000 (\$5,500,000)
Central Roundabout	\$1,900,000 (\$3,000,000)	\$2,200,000 (\$3,500,000)	\$2,500,000 (\$4,000,000)
Arsenal Drive	\$1,900,000 (\$3,000,000)	\$2,200,000 (\$3,500,000)	\$2,500,000 (\$4,000,000)
Eastern Portion	\$2,700,000 (\$4,500,000)	\$3,000,000 (\$5,000,000)	\$3,300,000 (\$5,500,000)

Future Corridor Considerations

The analyses and discussions within this study did not account for a potential extension of South Liberty Parkway to the east of MO-291, which would have significant land use and transportation impacts.

Based on the conducted analyses, it may be beneficial to change the proposed land use of parcel D3 from neighborhood commercial to residential, or a similar lower trip generation use. Analyses across multiple scenarios revealed that the high trip generation rates from a neighborhood commercial development on parcel D3 led to poor LOS at the West Arsenal roundabout, regardless of corridor configuration.



8. Funding Mechanisms and Implementation

This section attempts to identify potential funding mechanisms for study area improvements. Combinations of funding mechanisms may be the most appropriate method to meet costs associated with area improvements. All funding mechanisms should be reviewed on a case-by-case basis in consultation with the City's legal counsel.

Development Impact Fees

Development impact fees are a one-time funding source assessed to new development to cover costs for public infrastructure improvements. Generally, the fee, assessed by a public entity, is a necessary condition of plan approval for a given development. According to the Federal Highway Administration (FHWA), development fees may be combined with other revenue sources to fund infrastructure improvements. In some cases, it may be possible for development fees to be held until specific conditions are met. In the case of the South Liberty Parkway corridor, the City may be able to collect a fee for a development within the study area and hold the funds until traffic or development levels warrant the construction of a specific roundabout.

Local Tax Increment Financing (TIF)

According to the Missouri Department of Revenue, Local TIF Financing "permits the use of a portion of local property and sales taxes to assist funding the redevelopment of certain designated areas within your community". While various property classifications may meet the eligibility criteria for Local TIF financing, the South Liberty Parkway study area could be defined as an "economic development" area. Generally, Local TIF financing is predicated on the assumption that taxes will increase on properties and sales within a defined area after redevelopment. Typically, funds are borrowed against the development, and increases in property taxes are used to pay back the loan.

Community Improvement District (CID)

According to MoDOT, a Community Improvement District (CID) "is a tool used by communities to form (within a specified area) either a not-for-profit corporation or a political subdivision." This subdivision, technically a separate legal entity from the municipality by which can be formed, can "raise revenue via special assessments and taxes to fund transportation infrastructure improvements."

Neighborhood Improvement District (NID)

According to MoDOT, a Neighborhood Improvement District (NID), "may be created in an area that seeks to build, maintain or improve transportation (as well as other public) infrastructure." Importantly, projects within a NID "must be public in nature and be beneficial to property in the NID", as would be the case for South Liberty Parkway improvements.

Transportation Development District (TDD)

Establishment of a Transportation Development District (TDD) is a similar mechanism to establishment of a CID or NID, but is specifically meant for transportation projects. A TDD is a separate legal entity from the municipality in which it lies, and has the power to levy special assessments, property taxes, and sales taxes. Importantly, items within the TDD are subject to district voter approval.

Economic Development Sales Tax

Another option is an imposition of a tax of up to 0.5% on all retail sales made in the community, which may be used to fund a variety of items, including transportation projects. Importantly, this mechanism must be approved by voters within the community.

Governor's Transportation Cost-Share Program

This state level program attempts to “build partnerships with local communities to pool efforts and resources to deliver road and bridge projects”, according to MoDOT. Furthermore, 20% of available funds are “set-aside for projects that demonstrate economic development.” Importantly, these funds are only eligible to cover construction costs, and are not eligible to cover other project costs such as preliminary engineering.

9. Appendices

Appendix A: Signal Warrant Analyses

Appendix B: Turn Lane Warrant Analyses

Appendix C: Known Development Studies

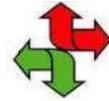
Appendix D: Roundabout Operational Analyses

Appendix E: Conceptual Roundabout Layouts and Typical Sections



APPENDIX A
SIGNAL WARRANT ANALYSES

**APPENDIX A.1
BIRMINGHAM ROAD SIGNAL
WARRANT ANALYSES**



TRAFFIC SIGNAL WARRANT PROGRAM

Location : South Liberty Parkway and Birmingham Road

Scenario : Existing Conditions

Count Date : 2024
 Day of Week : N/A
 By : City of Liberty

Street Information		# Lanes	85% Speed
Major Street	South Liberty Parkway	2	45
Minor Street	Birmingham Road	1	35
(N-S) Street	Birmingham Road		

Crash Experience (In Past 12 Months)	
Right Angle & Left Turn Crashes	0

Pop. > 10,000?	Yes
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End of Hour	Entering Traffic Volumes				Total Entering Traffic	Major Street Total	Minor Street Approach
	Birmingham Road		South Liberty Parkway				
	NB	SB	EB	WB			
0100	0	0	0	0	0	0	0
0200	0	0	0	0	0	0	0
0300	0	0	0	0	0	0	0
0400	0	0	0	0	0	0	0
0500	0	0	0	0	0	0	0
0600	0	0	0	0	0	0	0
0700	0	281	423	257	961	680	281
0800	0	0	0	0	0	0	0
0900	0	0	0	0	0	0	0
1000	0	0	0	0	0	0	0
1100	0	0	0	0	0	0	0
1200	0	0	0	0	0	0	0
1300	0	0	0	0	0	0	0
1400	0	0	0	0	0	0	0
1500	0	0	0	0	0	0	0
1600	0	323	669	382	1374	1051	323
1700	0	0	0	0	0	0	0
1800	0	0	0	0	0	0	0
1900	0	0	0	0	0	0	0
2000	0	0	0	0	0	0	0
2100	0	0	0	0	0	0	0
2200	0	0	0	0	0	0	0
2300	0	0	0	0	0	0	0
2400	0	0	0	0	0	0	0

24 HOUR SUM:	0	604	1092	639	2335	1731	604
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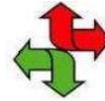
PEAK HOUR: 1600	0	323	669	382	1374	1051	323
-----------------	---	-----	-----	-----	------	------	-----

Volume Warrants						
Warrant Number	Required Hourly Volumes		Hours Req'd	Hours Met	Warrant Met	Warrant Not Met
	Major St	Minor St				
1A	420	105	8	2		X
1B	630	53	8	2		X
2	CURVE		4	2		X
3	CURVE		1	2	X	

Combination of Warrants 1A & 1B						
1A (80%)	480	120	8	2		X
1B (80%)	720	60	8	1		X
Combination of Warrants 1A & 1B Met?					No	

Crash Experience Warrant		
7	> 5 Crashes and either 1A(80%) or 1B(80%) met?	No

**APPENDIX A.2
ARSENAL DRIVE SIGNAL WARRANT
ANALYSES**



TRAFFIC SIGNAL WARRANT PROGRAM

Location : South Liberty Parkway and Arsenal Drive
Scenario : Existing Conditions

Street Information		# Lanes	85% Speed
Major Street	South Liberty Parkway	2	45
Minor Street	Arsenal Drive	1	35
(N-S) Street	Arsenal Drive		

Count Date : 2024
Day of Week : N/A
By : City of Liberty

Pop. > 10,000?	Yes
----------------	-----

Crash Experience (In Past 12 Months)	
Right Angle & Left Turn Crashes	0

End of Hour	Entering Traffic Volumes				Total Entering Traffic	Major Street Total	Minor Street Approach
	Arsenal Drive		South Liberty Parkway				
	NB	SB	EB	WB			
0100	0	0	0	0	0	0	0
0200	0	0	0	0	0	0	0
0300	0	0	0	0	0	0	0
0400	0	0	0	0	0	0	0
0500	0	0	0	0	0	0	0
0600	0	0	0	0	0	0	0
0700	0	0	403	257	660	660	0
0800	0	0	0	0	0	0	0
0900	0	0	0	0	0	0	0
1000	0	0	0	0	0	0	0
1100	0	0	0	0	0	0	0
1200	0	0	0	0	0	0	0
1300	0	0	0	0	0	0	0
1400	0	0	0	0	0	0	0
1500	0	0	0	0	0	0	0
1600	0	0	396	382	778	778	0
1700	0	0	0	0	0	0	0
1800	0	0	0	0	0	0	0
1900	0	0	0	0	0	0	0
2000	0	0	0	0	0	0	0
2100	0	0	0	0	0	0	0
2200	0	0	0	0	0	0	0
2300	0	0	0	0	0	0	0
2400	0	0	0	0	0	0	0

24 HOUR SUM:	0	0	799	639	1438	1438	0
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PEAK HOUR: 1600	0	0	396	382	778	778	0
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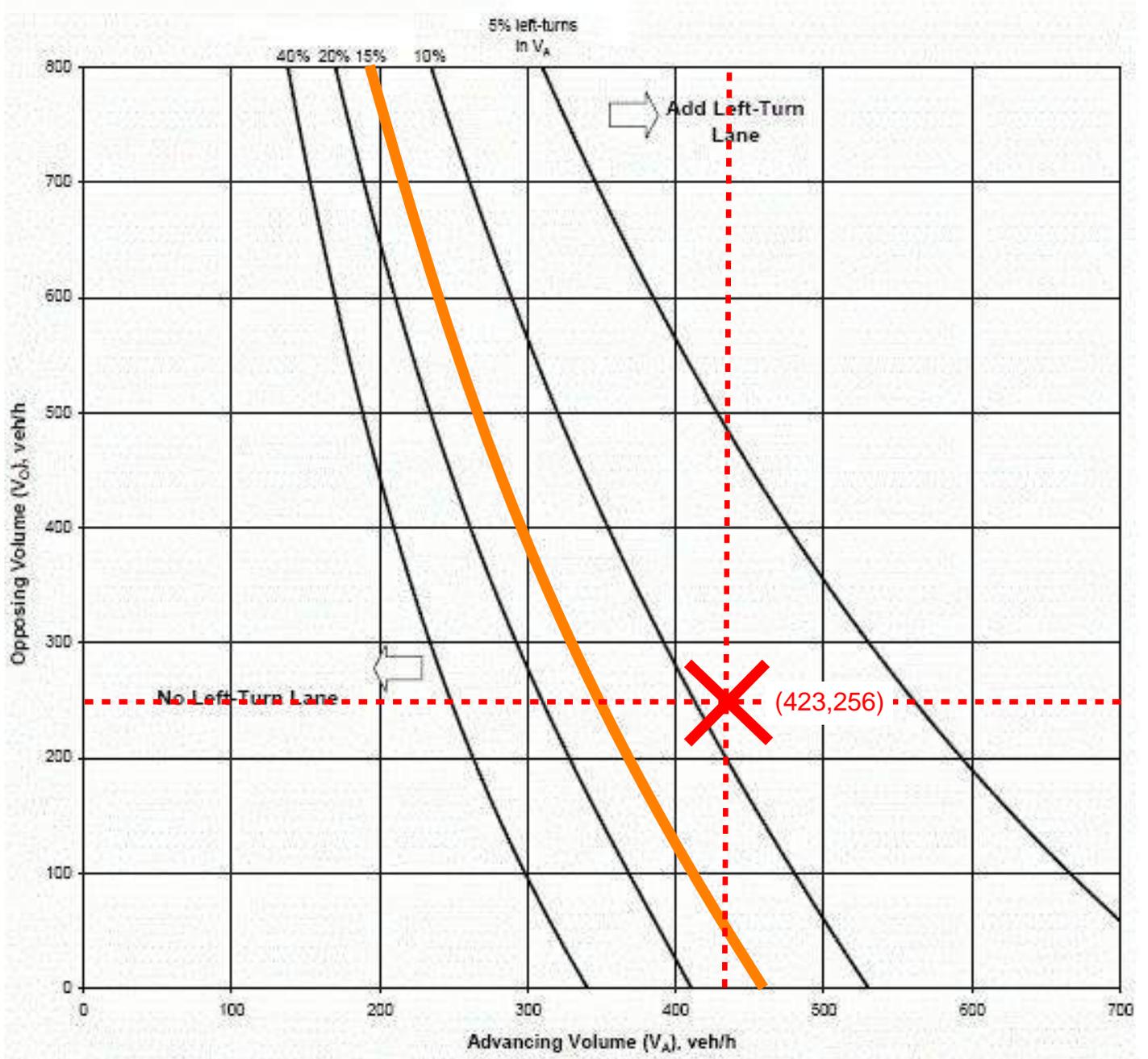
Volume Warrants						
Warrant Number	Required Hourly Volumes		Hours Req'd	Hours Met	Warrant Met	Warrant Not Met
	Major St	Minor St				
1A	420	105	8	0		X
1B	630	53	8	0		X
2	CURVE		4	0		X
3	CURVE		1	0		X

Combination of Warrants 1A & 1B						
1A (80%)	480	120	8	0		X
1B (80%)	720	60	8	0		X
Combination of Warrants 1A & 1B Met?					No	

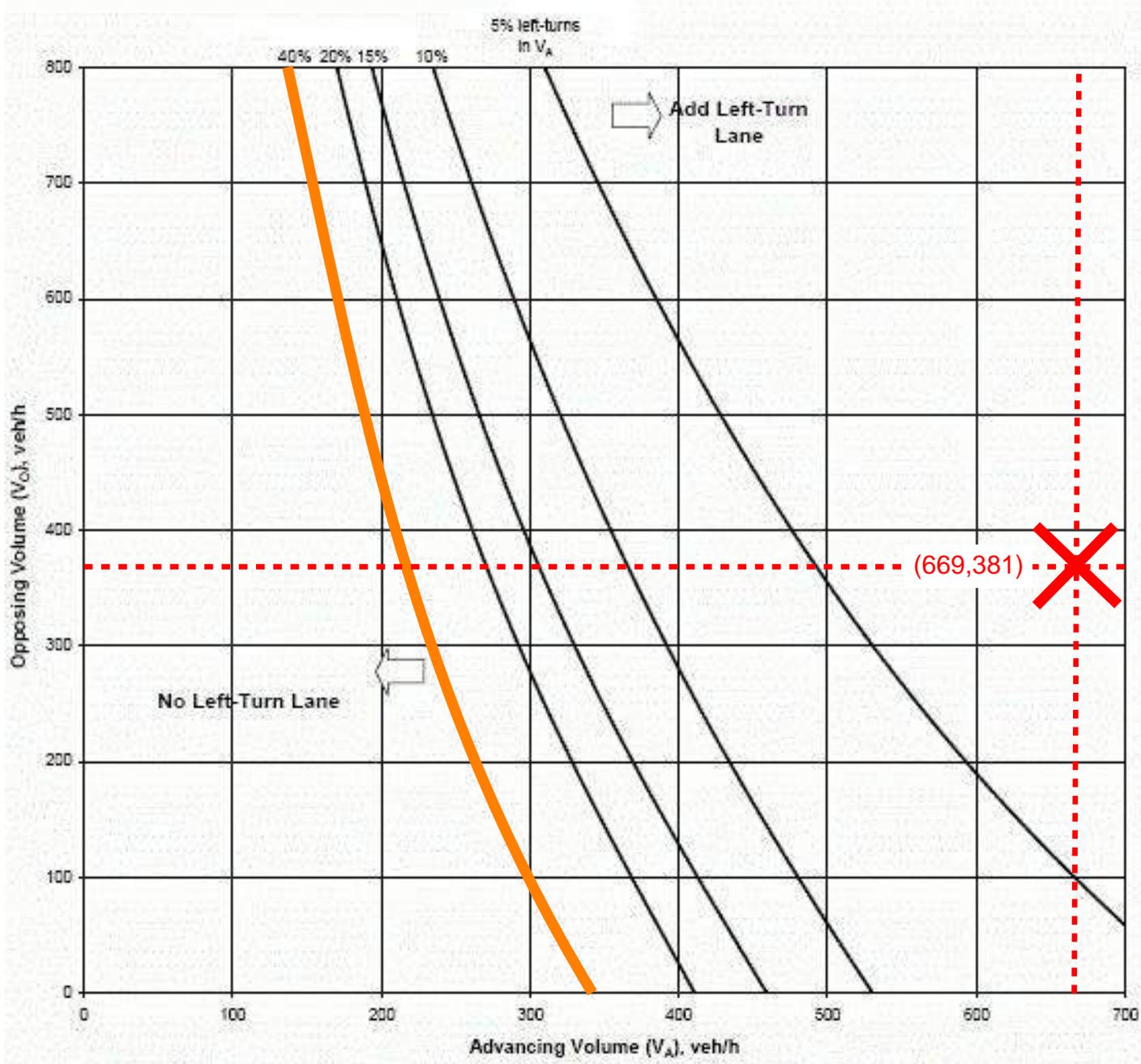
Crash Experience Warrant		
7	> 5 Crashes and either 1A(80%) or 1B(80%) met?	No

**APPENDIX B
TURN LANE WARRANT ANALYSES**

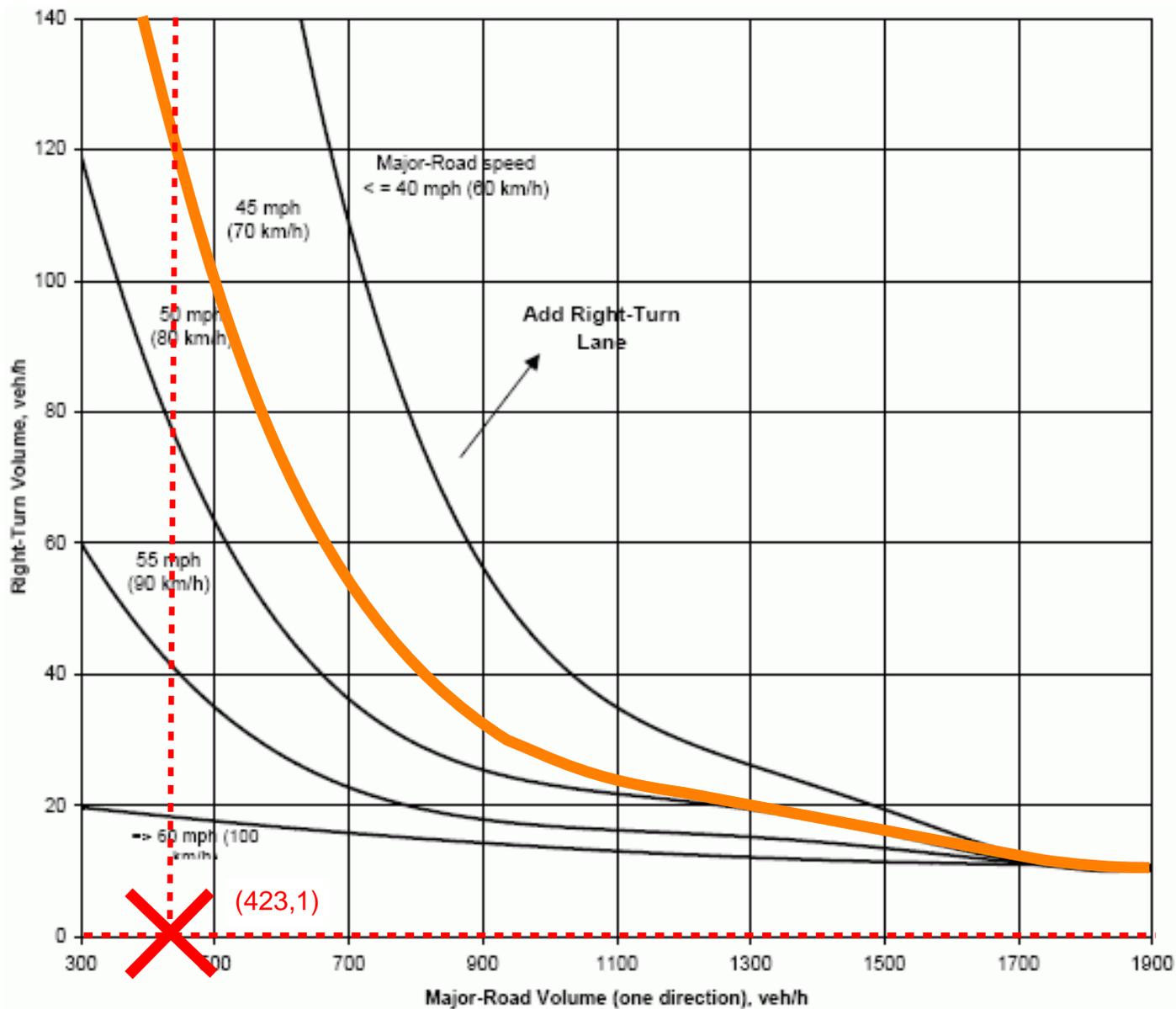
Left-Turn Lane Warrants
Eastbound South Liberty Parkway
At Birmingham
A.M. Peak Hour



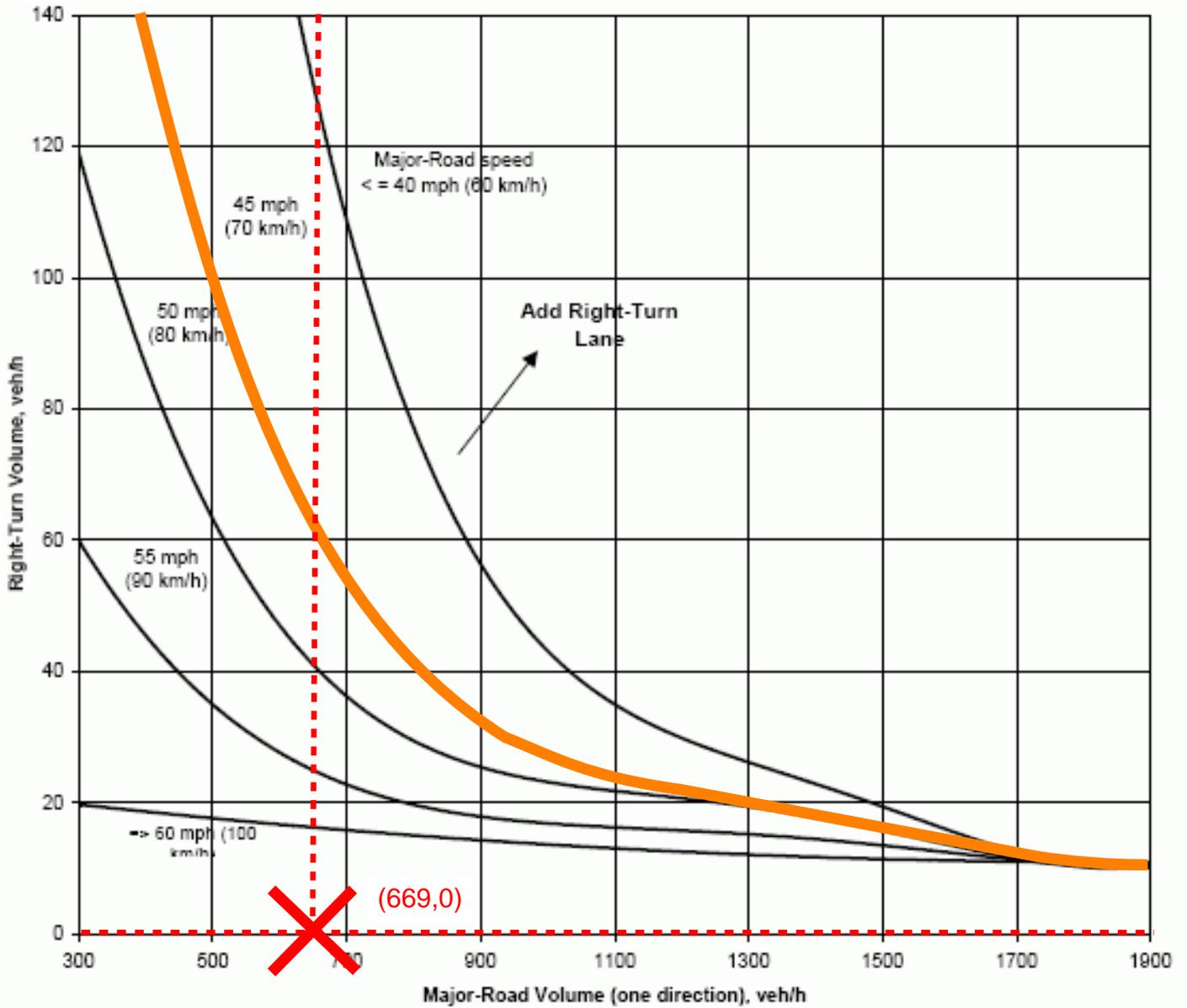
Left-Turn Lane Warrants
Eastbound South Liberty Parkway
At Birmingham
P.M. Peak Hour



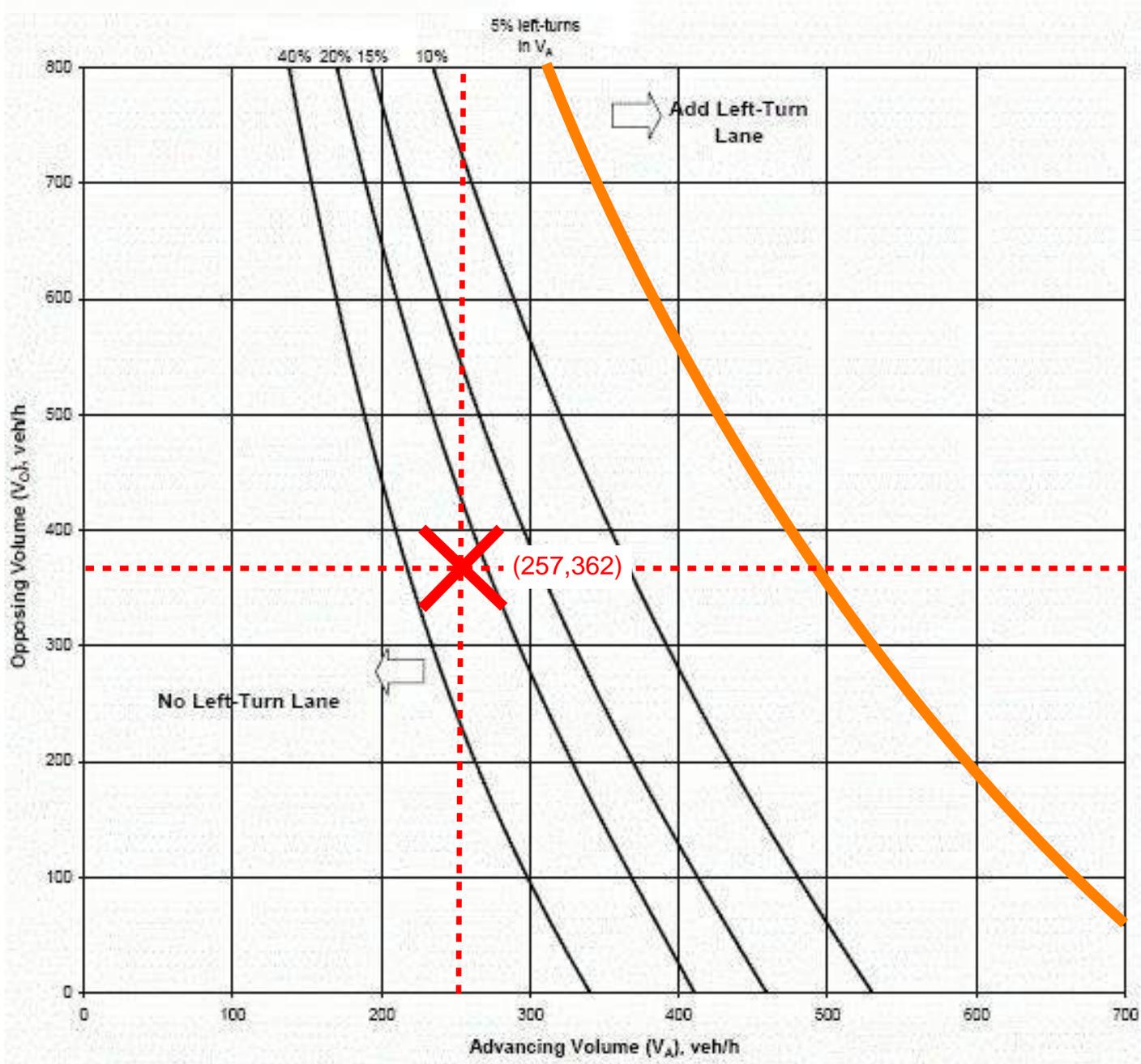
Right-Turn Lane Warrants
Eastbound South Liberty Parkway
At Birmingham
A.M. Peak Hour



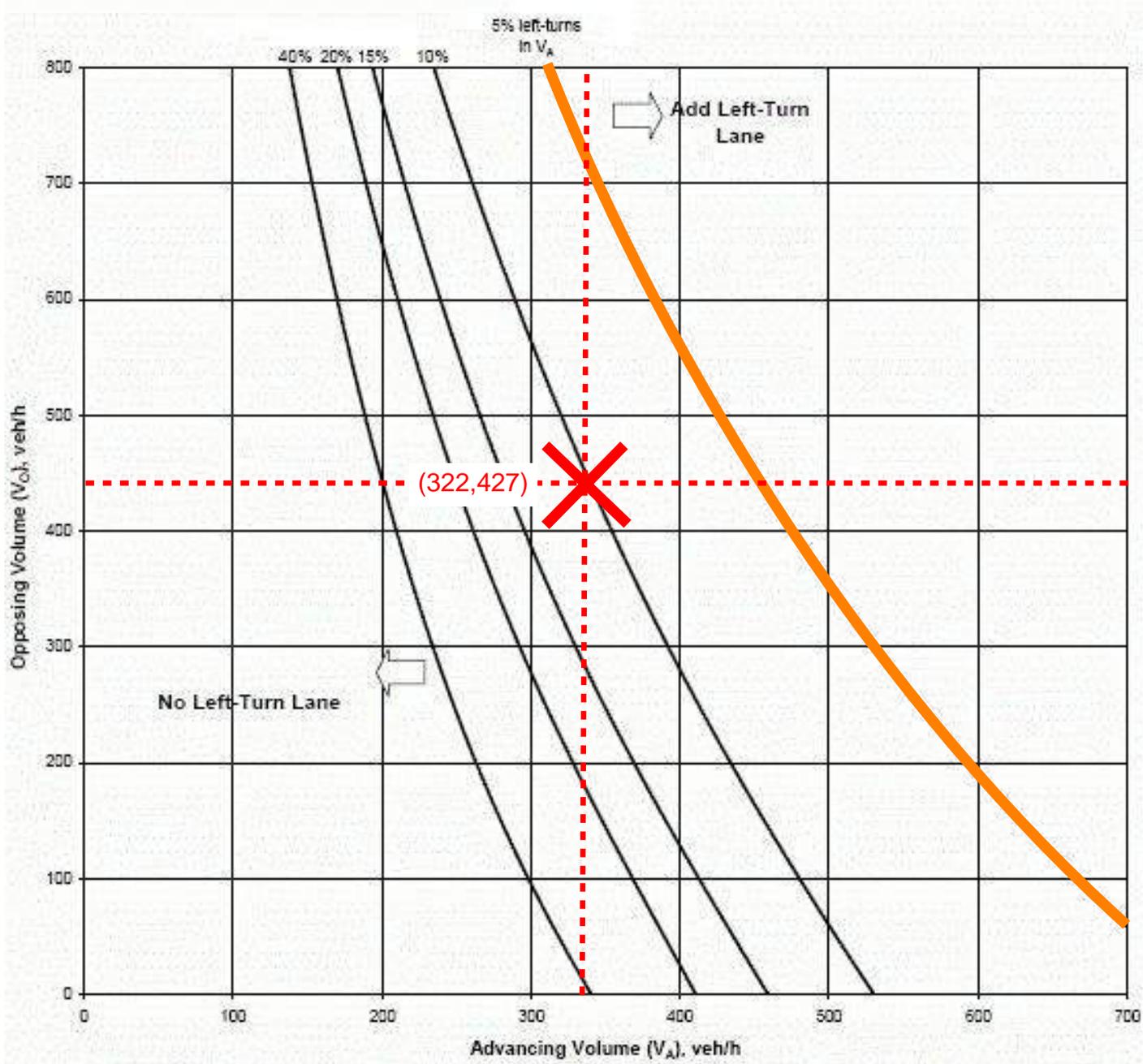
Right-Turn Lane Warrants
Eastbound South Liberty Parkway
At Birmingham
P.M. Peak Hour



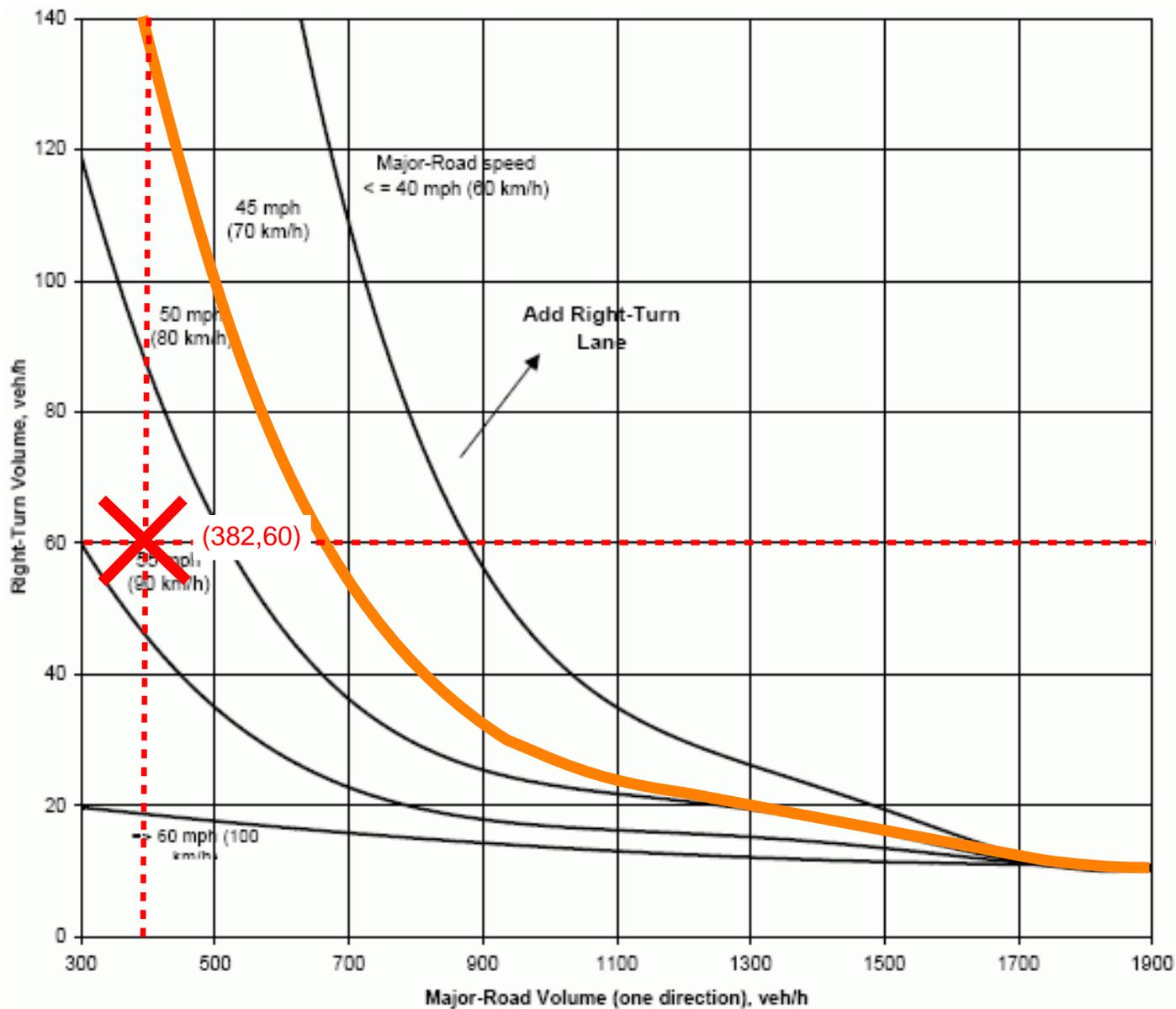
Left-Turn Lane Warrants
Westbound South Liberty Parkway
At Birmingham
A.M. Peak Hour



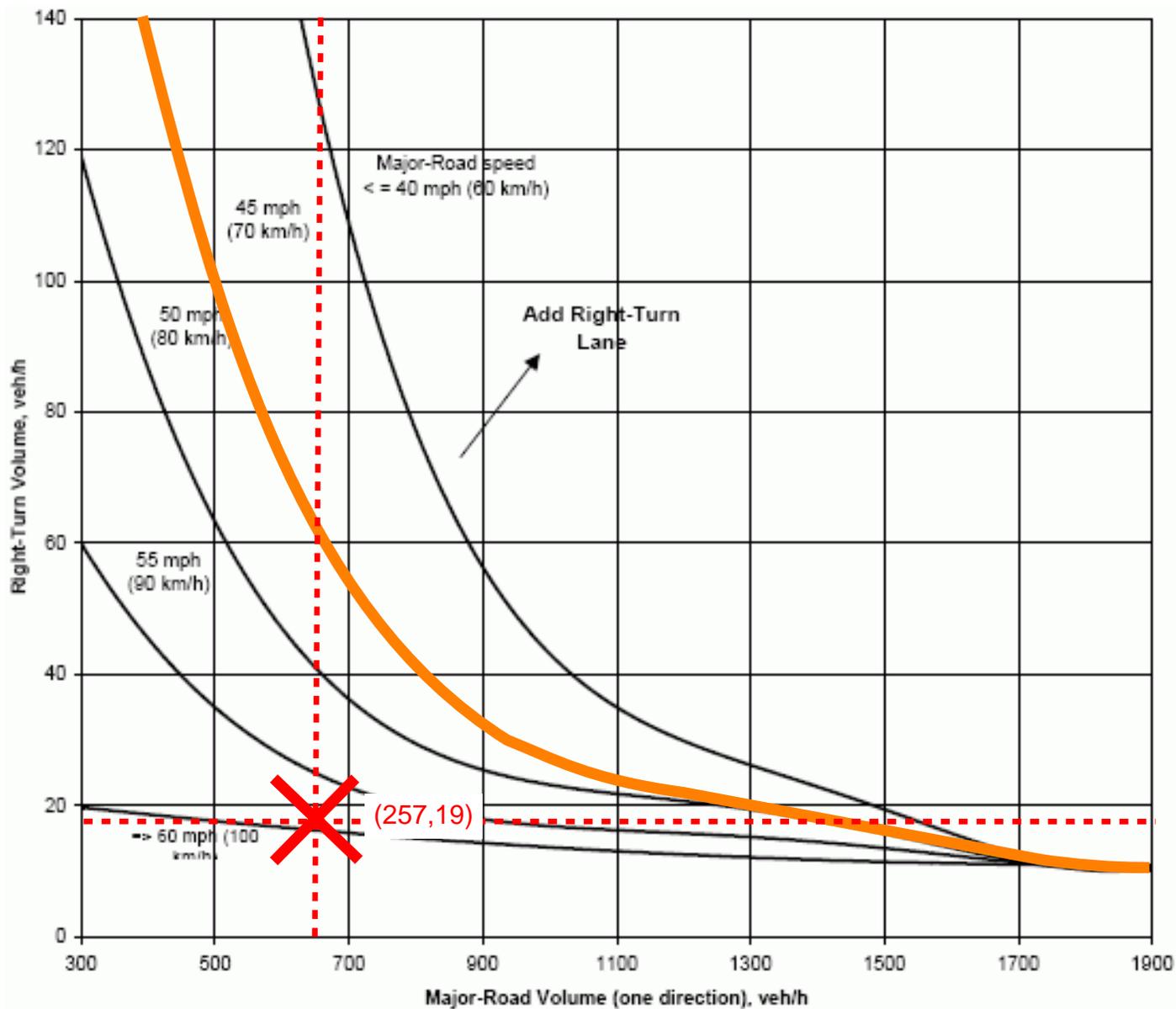
Left-Turn Lane Warrants
Westbound South Liberty Parkway
At Birmingham
P.M. Peak Hour



Right-Turn Lane Warrants
Westbound South Liberty Parkway
At Birmingham
A.M. Peak Hour



Right-Turn Lane Warrants
Westbound South Liberty Parkway
At Birmingham
A.M. Peak Hour



APPENDIX C
KNOWN DEVELOPMENT STUDIES

**APPENDIX C.1
WHITEHORSE AND TAPP FARMS
TRAFFIC IMPACT STUDY**

Whitehorse Residential Development

TRAFFIC IMPACT STUDY

September 27, 2022

Prepared For:
Star Development Corporation
244 West Mill St, Ste 101
Tower One, Suite 6000
Liberty, MO 64068

Prepared By:
Priority Engineers, Inc.
PO Box 563
Garden City, MO 64747





September 27, 2022

Mr. Tim Harris
Star Development Corporation
244 West Mill St, Ste 101
Liberty, MO 64068

Re: Whitehorse Residential Development – Liberty, MO

Dear Mr. Harris:

In response to your request, Priority Engineers, Inc. has completed a traffic impact analysis for the above referenced project. The purpose of the analysis is to determine the potential traffic impacts associated with this development on the intersections and streets surrounding this site, primarily during the AM and PM peak hours. The following report documents our analysis and recommendations.

We appreciate the opportunity to work with you on this project. Please contact us with any questions or if you require additional information.

Sincerely,

PRIORITY ENGINEERS, INC.

A blue ink handwritten signature, appearing to read 'Jesse Skinner', is written over a light blue horizontal line.

Jesse Skinner, P.E., PTOE
Senior Transportation Engineer

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1) INTRODUCTION

The purpose of this study is to examine the potential traffic impacts associated with the proposed Whitehorse Residential development located in Clay County, Missouri within the city limits of Liberty.

The study area is shown in Figure 1. The site layout is shown in Figure 2.

2) EXISTING CONDITIONS

The proposed Whitehorse residential development is located north of South Liberty Parkway and is located on both sides of Birmingham Road. Predominant land uses within the study area are agricultural and single family residential.

In the vicinity of the study, Birmingham Road is a two-lane facility with an open drainage system. Within the study area, Birmingham Road has a posted speed limit of 35 MPH. The Mid-America Regional Council (MARC) has not assigned a higher functional classification to the section of Birmingham Road between S Liberty Parkway and Ruth Ewing Road. It has been classified as a Local Road by default. The section of Birmingham Road, north of Ruth Ewing Road to Skyline Drive has been given a function classification of Major Collector by MARC.

Ruth Ewing Road is a two-lane road with an open drainage system and a posted speed limit of 35 MPH. MARC has assigned Ruth Ewing Road a functional classification of Major Collector.

S Liberty Parkway is a four-lane divided roadway with a grass median and an open drainage system. The posted speed limit of S Liberty Parkway is 40 MPH in the vicinity of Birmingham Road. MARC has assigned S Liberty Parkway a functional classification of Minor Arterial.

Holt Drive, Blythe Street and Lauren Street are all two-lane streets with curb and gutter and a posted speed limit of 25 MPH. All three roads have a MARC functional classification of Local Road by default and all three roads provide residential access to Birmingham Road.

The intersection of S Liberty Parkway with Birmingham Road is STOP controlled on the minor movements. The intersection of Birmingham Road with Ruth Ewing Road has an all way STOP condition. Remaining study intersections currently have a STOP condition on the minor movement.

Peak Hour turning movement counts were collected for the intersections of Birmingham Road with S Liberty Parkway, Birmingham Road with Ruth Ewing, Birmingham Road with Holt Drive, Birmingham Road with Blythe Street, and Birmingham Road with Lauren Street. These counts were collected on June 27th and 28th of this year. The Peak Hour turning movement counts were performed between 7:00 and 9:00 AM and 4:00 and 6:00 PM. The AM Peak Hour was found to be from 7:00 to 8:00 and the PM Peak Hour was found to be from 4:30 to 5:30 for the overall roadway network. The complete traffic counts are shown in Appendix II. The peak hour traffic volumes and existing lane configurations are shown in Figures 3-6.

3) PROPOSED DEVELOPMENT

The proposed development consists of 327 single family detached homes. There will be access from the proposed development on newly constructed portions of Lauren Street and Blythe Street. There will also be two new access points constructed on the east side of Birmingham Road to the south of the CP railroad and north of Ruth Ewing Road. There will be one new access point on the west side of Birmingham Road south of the CP railroad and to the north of Ruth Ewing Road.

As part of the proposed development, Birmingham Road will be upgraded to meet the City of Liberty's collector standards.

As part of the proposed development scenario, the Tapp Farms development to the south was evaluated since a TIS was not required for this approved development. This approved development consists of 149 single family detached homes. There will be a single access point onto Birmingham Road to the south of Ruth Ewing.

4) TRIP GENERATION

The vehicle trips generated by the proposed development were estimated using the Institute of Transportation Engineers' (ITE) Trip Generation, 11th Edition. The estimated AM and PM peak hour traffic volumes associated with this development are shown in Table 1. Land Use 210, Single-family detached housing was selected as the appropriate land use for the proposed development.

Table 1: Trip Generation								
Land Use	Intensity	Daily	AM Peak			PM Peak		
			Total	In	Out	Total	In	Out
(Whitehorse)								
Single-Family Detached Housing	327 Units	3001	219	57	162	303	191	112
(Approved Tapp Farms Development)								
Single-Family Detached Housing	149 Units	1459	107	28	79	145	91	54
Total		4460	326	85	241	448	282	166

5) TRIP DISTRIBUTION AND ASSIGNMENT

Trips generated by the Whitehorse residential development were distributed based on existing traffic flows and a general analysis of the surrounding area. The trips were distributed onto the existing street system approximately as follows:

- 40 percent to and from the north via Birmingham Road
- 35 percent to and from the west via S Liberty Parkway
- 15 percent to and from the east via S Liberty Parkway
- 10 percent to and from the east via Ruth Ewing

The same distribution was utilized for the approved development.

6) LEVEL OF SERVICE AND VOLUME/CAPACITY ANALYSES

Capacity analysis was used to quantify the impacts of the increased traffic on the intersections studied. The methodology outlined in the Highway Capacity Manual, 6th Edition, was used as a basis to perform the analysis for this study. Capacity analysis defines the quality of traffic operation for an intersection using a grading system called Level of Service (LOS). The LOS is defined in terms of average vehicle delay. Levels of service A through F have been established with A representing the best and F the worst.

Table 2: Level of Service Definitions		
Level of Service	Unsignalized Intersection	Signalized Intersection
A	< 10 Seconds	< 10 Seconds
B	< 15 Seconds	< 20 Seconds
C	< 25 Seconds	< 35 Seconds
D	< 35 Seconds	< 55 Seconds
E	< 50 Seconds	< 80 Seconds
F	≥ 50 Seconds	≥ 80 Seconds

The study intersections were evaluated using Synchro which is an analysis package based in part on Highway Capacity Manual methods. The analysis reports are included in Appendix II.

The levels of service, lane configuration, and queue lengths for existing conditions are shown in Figures 5 and 6 in Appendix I (Existing Conditions), Figures 9 and 10 (Proposed conditions) and Figures 13 and 14 (Future conditions). Future conditions were estimated with a two percent per year growth in background traffic volumes. MARC 2040 data indicates an approximate growth rate of 0.85% / year for the overall City of Liberty Missouri until 2040. A two percent per year growth rate was selected as a more conservative factor given the amount of undeveloped land in this portion of the City along South Liberty Parkway.

Table 3 below summarizes how study intersections and proposed new entrances will perform during each of the AM and PM Peak Hour scenarios. With the exception of the southbound movement group at the intersection of Birmingham Road and S Liberty Parkway which performs at a level of service F in the 2042, 20-year horizon PM Peak Hour all movement groups perform at a level of service C or better. In regards to this particular movement group, the delay is 90.9 seconds. It is not uncommon for STOP controlled minor movements to experience undesirable delays during peak hours.

Table 3: Level of Service Comparison						
	AM Peak Hour			PM Peak Hour		
	Existing	Proposed	Future (2042)	Existing	Proposed	Future (2042)
	LOS (veh queue)			LOS (veh queue)		
S Liberty Parkway & Birmingham Road						
EB Left	A (25')	A (25')	A (25')	A (25')	A (25')	B(30')
EB Through/ Right	A	A (25')	A (25')	A	A	A
WB Left	A (25')	A (25')	A (25')	A (25')	A (25')	A (25')
WB Through/ Right	A	A (25')	A (25')	A	A (25')	A
NB	A (25')	A (25')	A (25')	A (25')	A (25')	A (25')
SB	B (25')	B (48')	C (98')	B (25')	C (55')	F (205')
Birmingham Road & Ruth Ewing Road						
WB	A (25')	A (25')	A (25')	A (25')	A (25')	A (25')
NB	A (25')	A (25')	A (25')	A (25')	A (35')	A (53')
SB	A (25')	A (25')	A (30')	A (25')	A (25')	A (30')
Birmingham Road & Holt Drive						
EB Left	A (25')	A (25')	B (25')	A (25')	B (25')	B (25')
EB Right	A (25')	A (25')	A (25')	A (25')	A (25')	A (25')
SB	A	A	A	A	A (25')	A
NB	A (25')	A (25')	A (25')	A (25')	A	A (25')
Birmingham Road and Blythe Street						
EB	A (25')	B (25')	B (25')	A (25')	A (25')	A (25')
WB		A (25')	A (25')		B (25')	B (25')
NB	A (25')	A (25')	A (25')	A (25')	A (25')	A (25')
SB	A	A (25')	A (25')	A	A (25')	A (25')
Birmingham Road and Lauren Street						
EB	A (25')	A (25')	A (25')	A (25')	B (25')	B (25')
WB		A (25')	B (25')		B (25')	B (25')
NB	A (25')	A(25')	A (25')	A (25')	A (25')	A (25')
SB	A	A (25')	A (25')	A	A (25')	A (25')
North Drive						
WB		A (25')	A (25')		B (25')	B (25')
SB		A (25')	A (25')		A (25')	A (25')
NB		A	A		A (25')	A
Middle Drive						
WB		B (25')	B (25')		B (25')	A (25')
SB		A (25')	A (25')		A (25')	B (25')
NB		A	A		A	A
South Drive						
EB		B (25')	B (25')		A	B (25')
SB		A	A		A (25')	A
NB		A (25')	A (25')		A (25')	A (25')
Skyview Lane						
EB		B (25')	B (25')		B (25')	A (25')
SB		A	A		A (25')	A
NB		A (25')	A (25')		A (40')	B (58')

7) AUXILIARY LANES

While APWA design criteria is appropriate for the evaluation of this development, the more stringent MoDOT criteria for auxiliary lanes was used in evaluating the need for turn lanes on Birmingham Road at the proposed entrances. EPG section 940.9.1 (Left-Turn Lane Guidelines For Two Lane Roads less than or equal to 40 MPH) was used in evaluating the need for left turn lanes. Figure 15 of Appendix I illustrates that no proposed entrance comes close to approaching the warrant for a left turn lane. When EPG section 940.9.8 (Right Turn Lane Guidelines for Two-Lane Roadways) was reviewed at the proposed entrances into the development. The minimum X coordinate for the origin of the graph associated with this analysis is 200 advancing vehicles with the minimum advancing volume approximately 440 advancing vehicles with 140 right turning vehicles at the leftmost point of the less than or equal to 40 MPH curve. None of the study intersections had an advancing volume approaching the threshold, no right turn lanes are warranted.

8) RAILROAD CROSSING

The Canadian Pacific railroad and its subsidiaries have a railroad line that intersects Birmingham Road north of Ruth Ewing Road and south of Holt Drive. The US DOT- AAR Grade Crossing ID # for this location is 375414M. A review of the FRA's inventory for this location indicate that there were 3 daytime trains and 7 nighttime trains during the 2021 count. The maximum Timetable Speed for this location is 60 MPH and the typical speed range over the crossing is 25 to 60 MPH. The crossing already has automated barrier gates, signals and an active event recorder installed. A review of FRA safety data showed that on 07/05/1981 there was a crash that involved a single vehicle and a freight train that occurred when the driver of a vehicle drove behind a train and the vehicle struck another train. This crash resulted in an estimated \$800 damage and no injuries.

The FRA/FHWA Highway Rail Crossing Handbook Third edition was reviewed for this location. Since there are already automated gates and flashing signals at this crossing the criteria for grade separation was reviewed. The criteria for grade separation includes meeting at least one of the following criteria: posted speed greater than 55 MPH, AADT > 30,000 urban/ 20,000 rural, maximum authorized train speed greater than 79 MPH, average of 75 or more passenger trains/day, 150 or more transit trains per day, Freight Train Crossing Exposure > 900,000 (600,000 rural), Transit Train Crossing Exposure exceeding 4,500,000 urban (1,200,000 rural), a five year crash history exceeding 0.5 accidents per year with automated gates or a vehicle delay exceeding 30 vehicle hours per day. None of these conditions are met.

The inventory report and associated accident report are included in Appendix II.

9) SIGHT DISTANCE.

Intersection Sight Distance and Stopping Sight Distance were measured for each new proposed entrance onto Birmingham Road. Intersection sight distance represents the distance and time required for the driver to make the decision to turn, and to complete the turn without slowing oncoming traffic. Stopping sight distance represents the distance and time required for a driver to detect and safely come to a stop after observing a two-foot-tall object in the roadway. Sight distance is measured at a point approximately 14' from the edge of the pavement to give the same perspective as that of a stopped driver. The measurements and AASHTO recommended distances are illustrated in Table 4 below.

Table 3: Sight Distance Values				
	Measured Stopping Sight Distance	AASHTO Recommended Stopping Sight Distance	Measured Intersection Sight Distance	AASHTO Recommended Intersection Sight Distance
WB Blythe		35 mph		35 mph
To the south	>500'	250'	>500'	335'
To the north	>500'	250'	>500'	390'
WB Lauren Street		35 mph		35 mph
To the south	>500'	250'	>500'	335'
To the north	>500'	250'	>500'	390'
North Drive		35 mph		35 mph
To the south	305'	250'	325'	335'
To the north	>500'	250'	>500'	390'
Middle Drive		35 mph		35 mph
To the south	>500'	250'	>500'	335'
To the north	435'	250'	455'	390'
South Drive		35 mph		35 mph
To the south	to Ruth Ewing Road	250'	to Ruth Ewing Road	390'
To the north	>500'	250'	>500'	335'

If the proposed intersections are analyzed at the posted speed limits AASHTO minimums for sight distance everywhere except at the North Drive where intersection sight distance is approximately 10' short of meeting the minimum distance. If an assumed design speed of posted speed + 5 MPH is used in evaluating the sight distance the Middle Drive would require 445' of sight distance looking to the north (left turn from stop condition) where there is approximately 455' available currently available and the north drive would potentially have exactly the stopping sight distance needed for a 40 MPH design speed looking to the south and approximately 60' less than the required intersection sight distance.

10) SIGNAL WARRANT ANALYSIS

The intersection of South Liberty Parkway and Birmingham Road was evaluated for a signalization. EPG section 902.3.4 (Warrant 2, Four Hour Vehicular Volumes) was applied to this intersection. Since the posted speed limit is 40 MPH, the 70% factor is not appropriate to consider.

Current traffic count data at this intersection was collected between the hours of 7 and 9 AM and 4 and 6 PM with the Peak Hours found to be 7:00 to 8:00 and 4:30 to 5:30. While the current ITE trip generation manual has hourly trip data, there is variance between the peak hour of the adjacent street and the hourly data. The larger, more conservative peak hour of the adjacent street was applied to each of the four hours of the AM and PM Peak Periods. The resulting anticipated traffic volumes are shown in Table 5 below.

Table 5: 4 Hour Signal Warrant at South Liberty Parkway				
Intersection	Major Street Volume	Minor Street Volume	Minor Street threshold Table 4C-1	Met
7 to 8 AM	482	247	344	NO
8 to 9 AM	440	208	370	NO
4 to 5 PM	968	129	158	NO
5 to 6 PM	901	121	175	NO

11) RECOMMENDATIONS & CONCLUSIONS

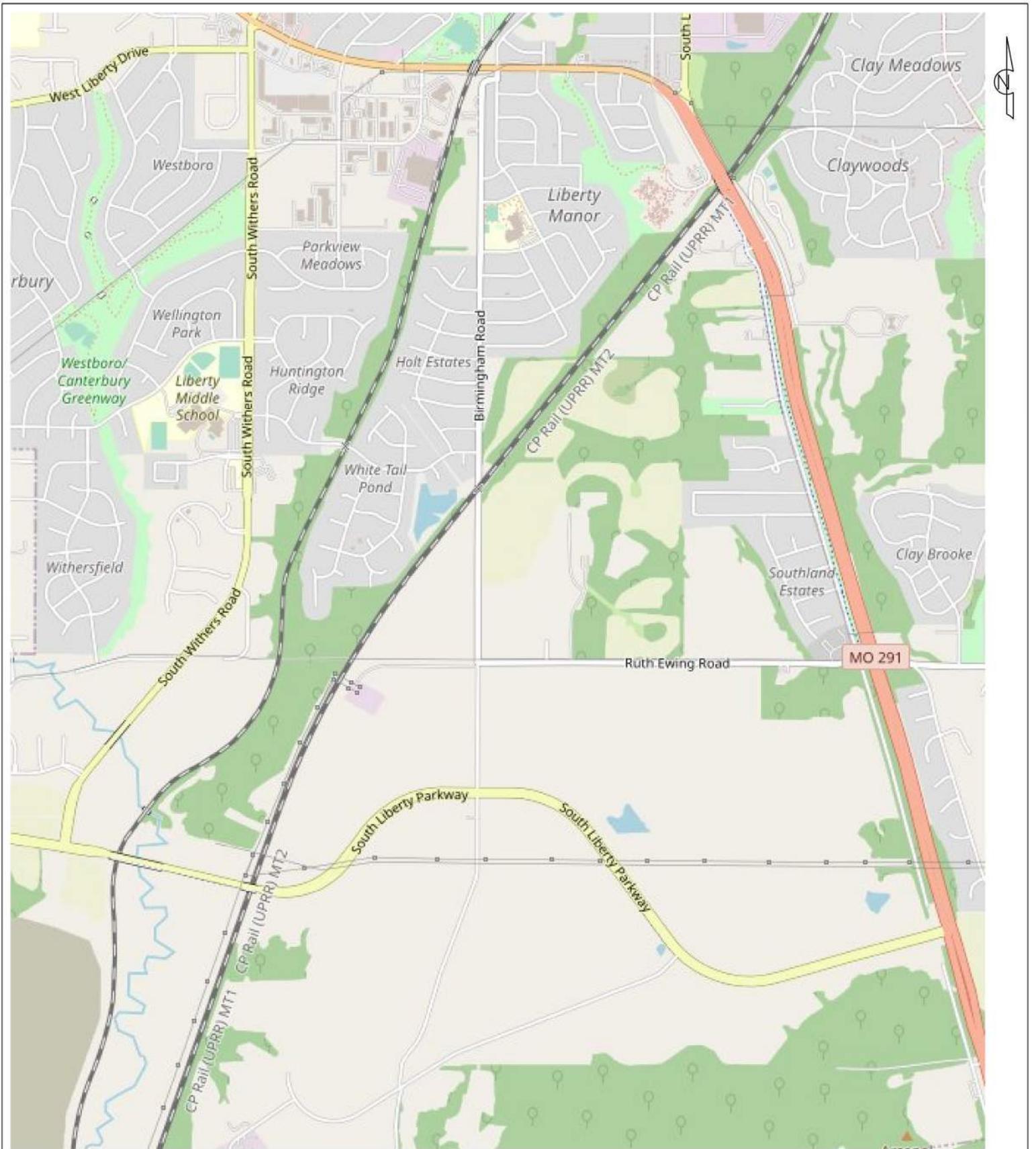
This study documents the impact of the proposed Whitehorse Residential development. The traffic impacts associated with this study are minimal.

Since Birmingham Road is being upgraded to a Collector standard and vertical adjustments to the profile of the road may occur, the final design location of the proposed north drive and middle drive need to be compared to the new vertical profile of Birmingham Road to ensure that sight distance minimums are met for the desired design speed.

No additional improvements are necessary as a result of this development.

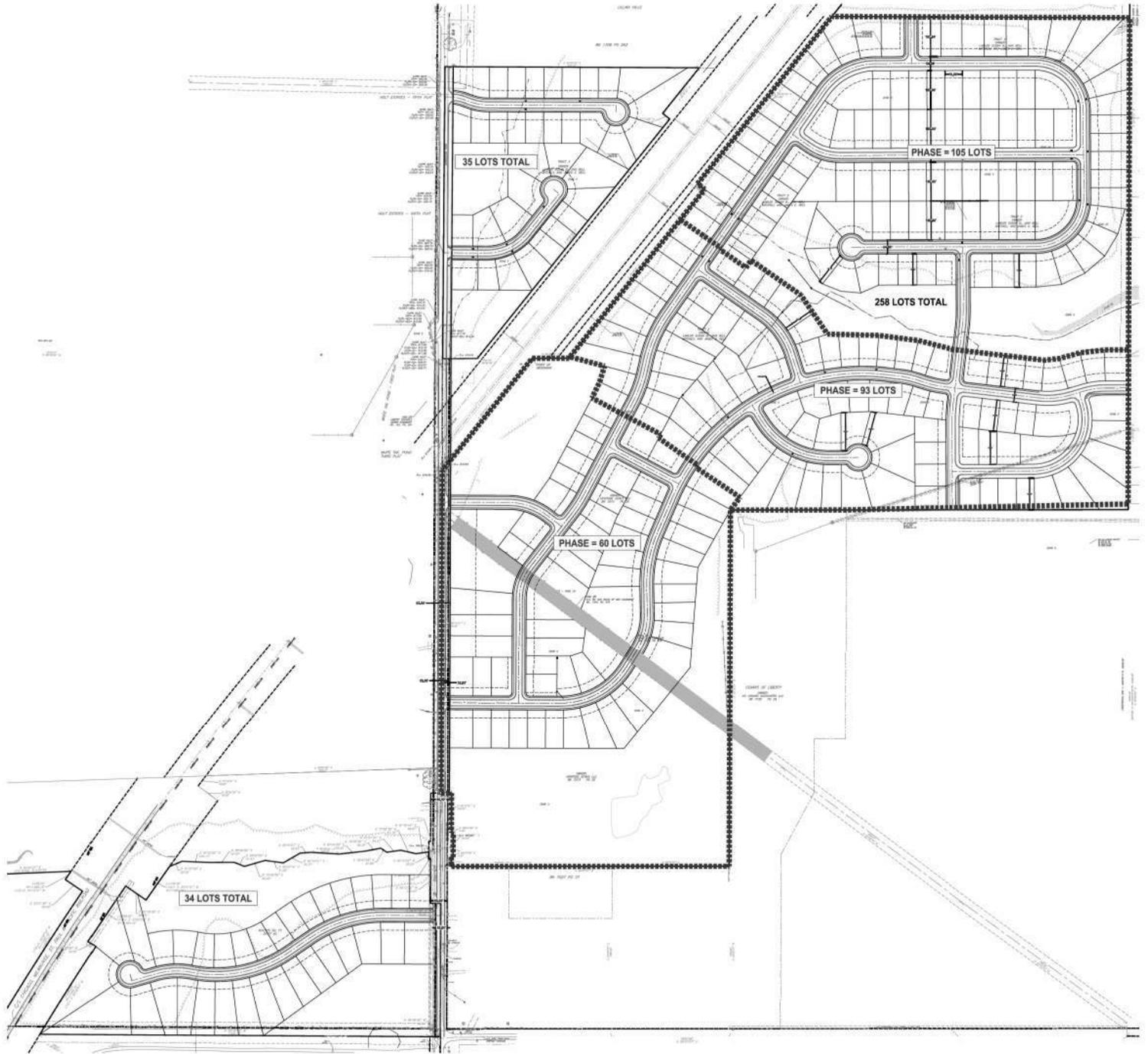
APPENDIX I

Project Location	Figure 1
Site Plan	Figure 2
Existing AM Peak Hour Traffic Volumes	Figure 3
Existing PM Peak Hour Traffic Volumes	Figure 4
Existing AM Peak Hour Lane Configurations & Levels of Service	Figure 5
Existing PM Peak Hour Lane Configurations & Levels of Service	Figure 6
Existing + Proposed Development AM Peak Hour Traffic Volumes	Figure 7
Existing + Proposed Development PM Peak Hour Traffic Volumes	Figure 8
Existing + Proposed Development AM Peak Hour Lane Configurations & Levels of Service	Figure 9
Existing + Proposed Development PM Peak Hour Lane Configurations & Levels of Service	Figure 10
Future (2042) AM Peak Hour Traffic Volumes	Figure 11
Future (2042) PM Peak Hour Traffic Volumes	Figure 12
Future (2042) AM Peak Hour Lane Configurations & Levels of Service	Figure 13
Future (2042) PM Peak Hour Lane Configurations & Levels of Service	Figure 14
Left Turn Lane Analysis	Figure 15



© OpenStreetMap Contributors

Project Location	Whitehorse	No Scale	
	Liberty, MO	Figure 1	



Site Plan

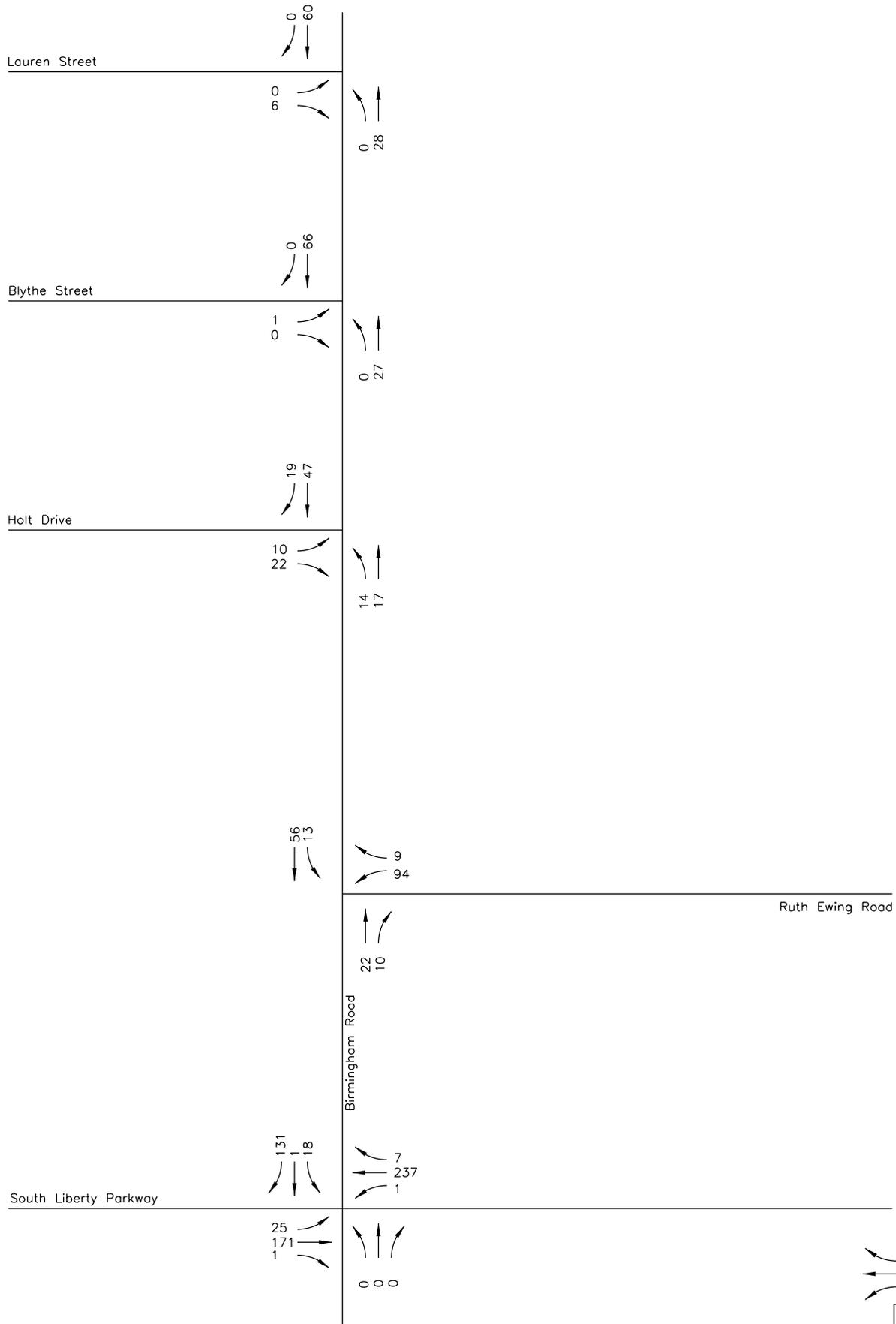
Whitehorse
Liberty, MO

No Scale

Figure 2



Priority
ENGINEERS



LEGEND

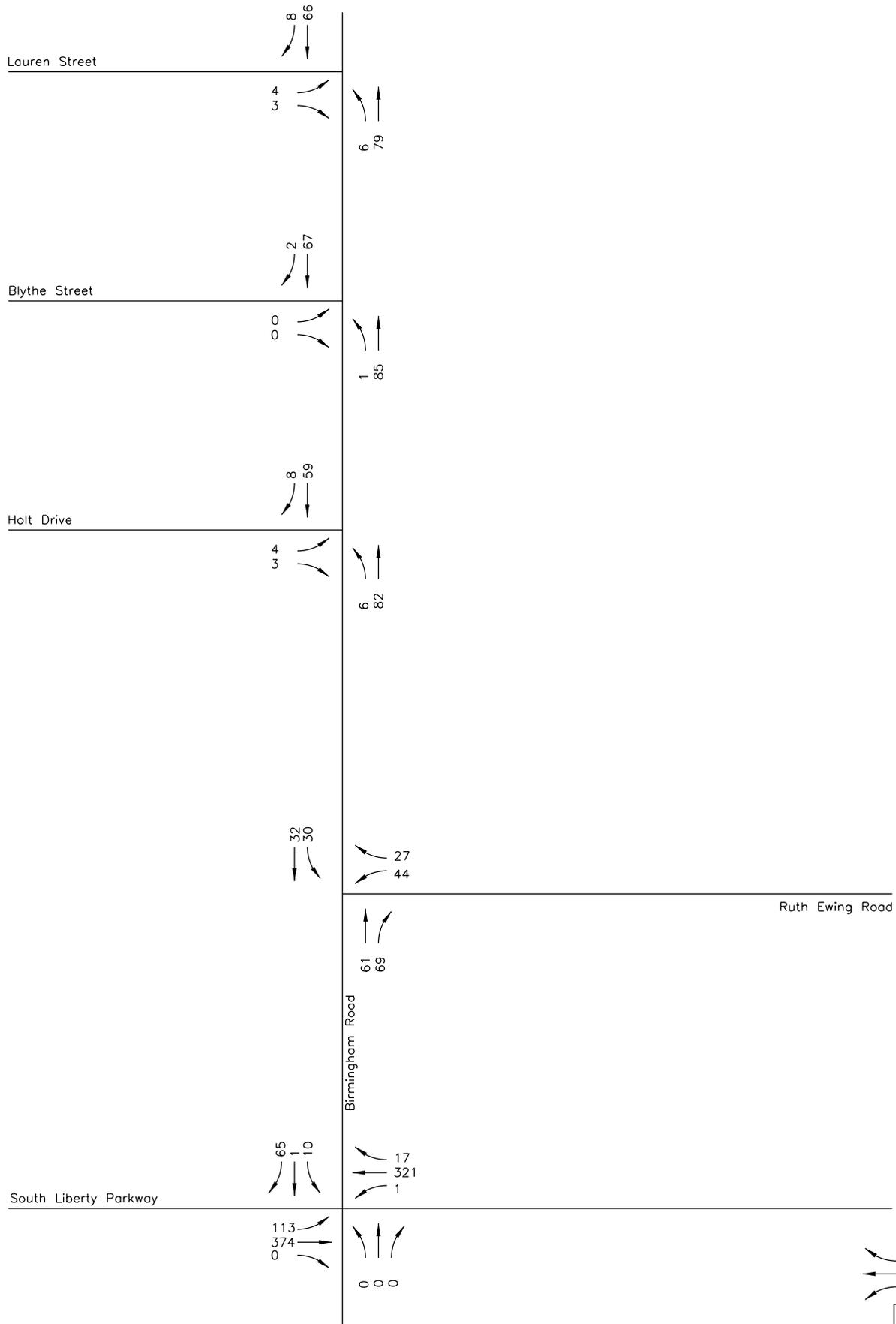
Total Volume

Existing AM Peak Hour
Traffic Volumes

Whitehorse
Liberity, MO

No Scale
Figure 3





LEGEND

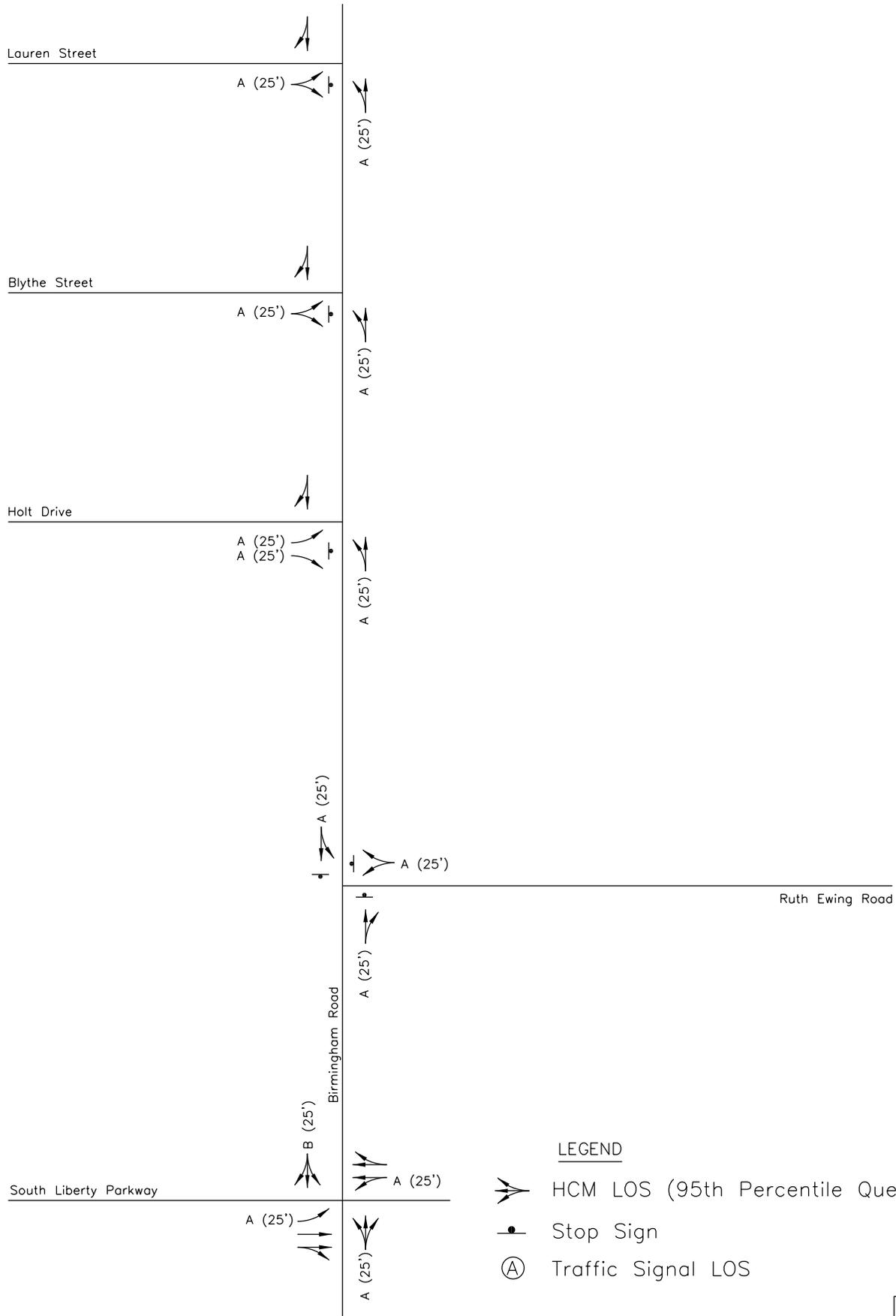
Total Volume

Existing PM Peak Hour
Traffic Volumes

Whitehorse
Liberty, MO

No Scale
Figure 4





LEGEND

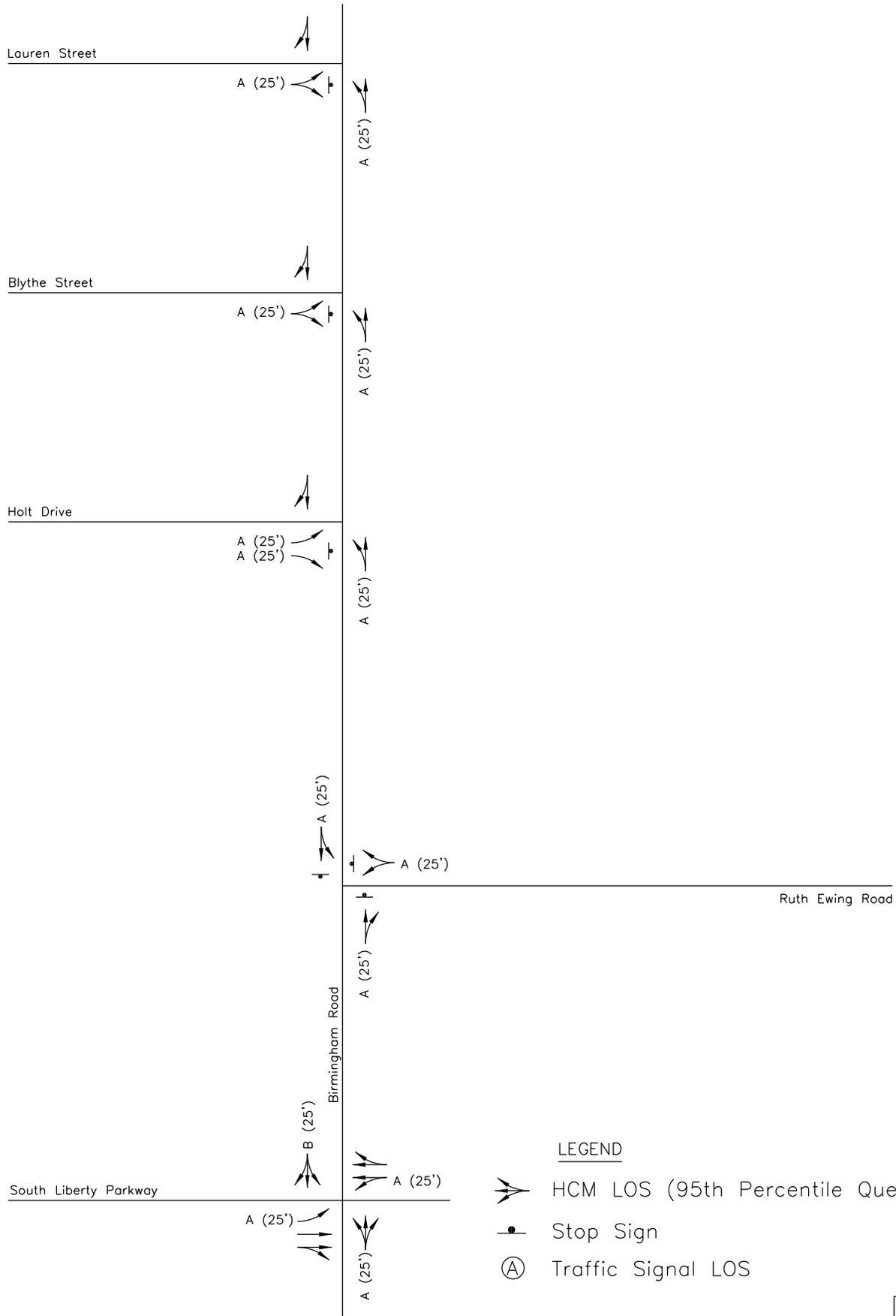
-  HCM LOS (95th Percentile Queue in Vehicles)
-  Stop Sign
-  Traffic Signal LOS

Existing AM Peak Hour
Lane Configurations &
Levels of Service

Whitehorse
Liberty, MO

No Scale
Figure 5





LEGEND

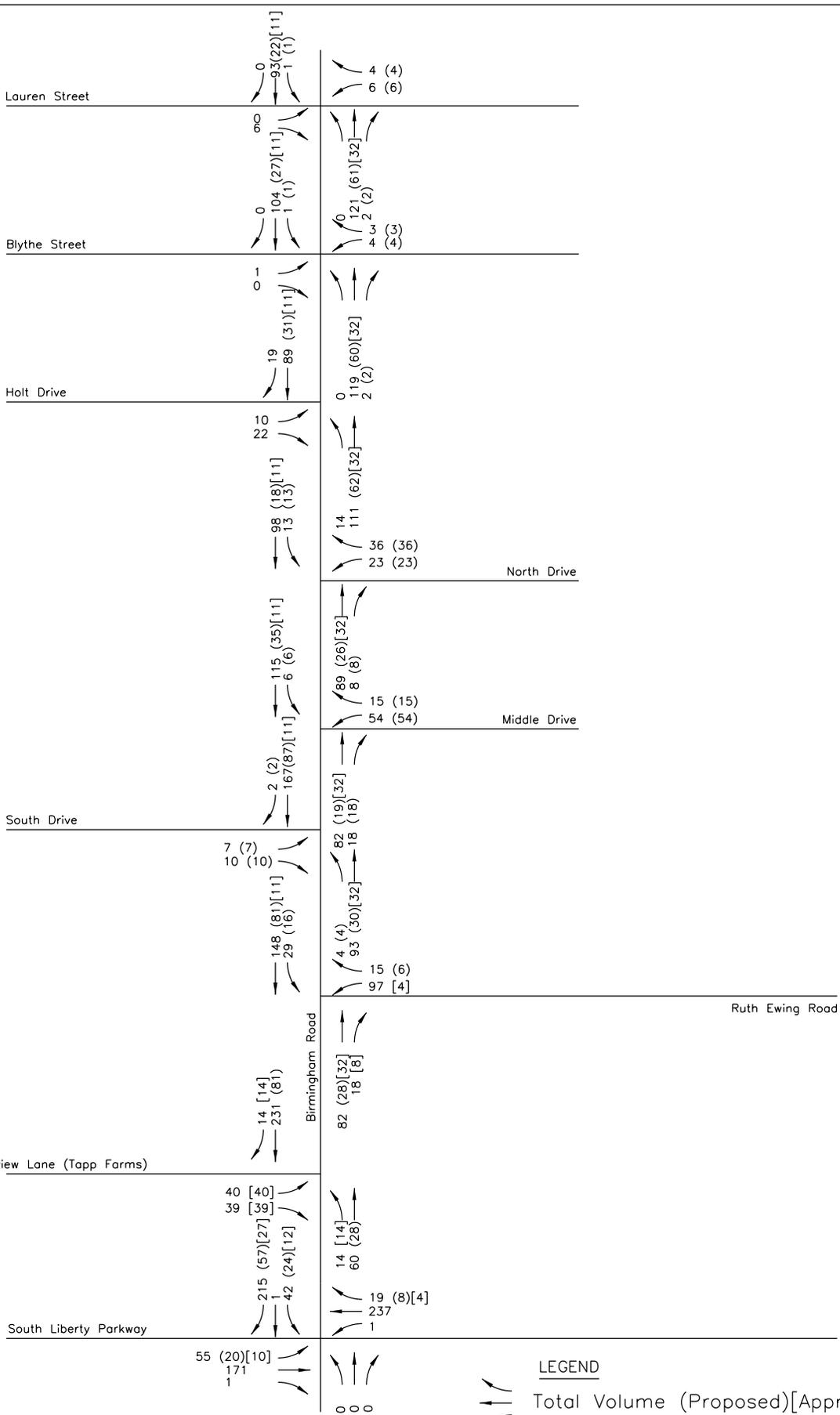
-  HCM LOS (95th Percentile Queue in Vehicles)
-  Stop Sign
-  Traffic Signal LOS

Existing PM Peak Hour
Lane Configurations &
Levels of Service

Whitehorse
Liberty, MO

No Scale
Figure 6





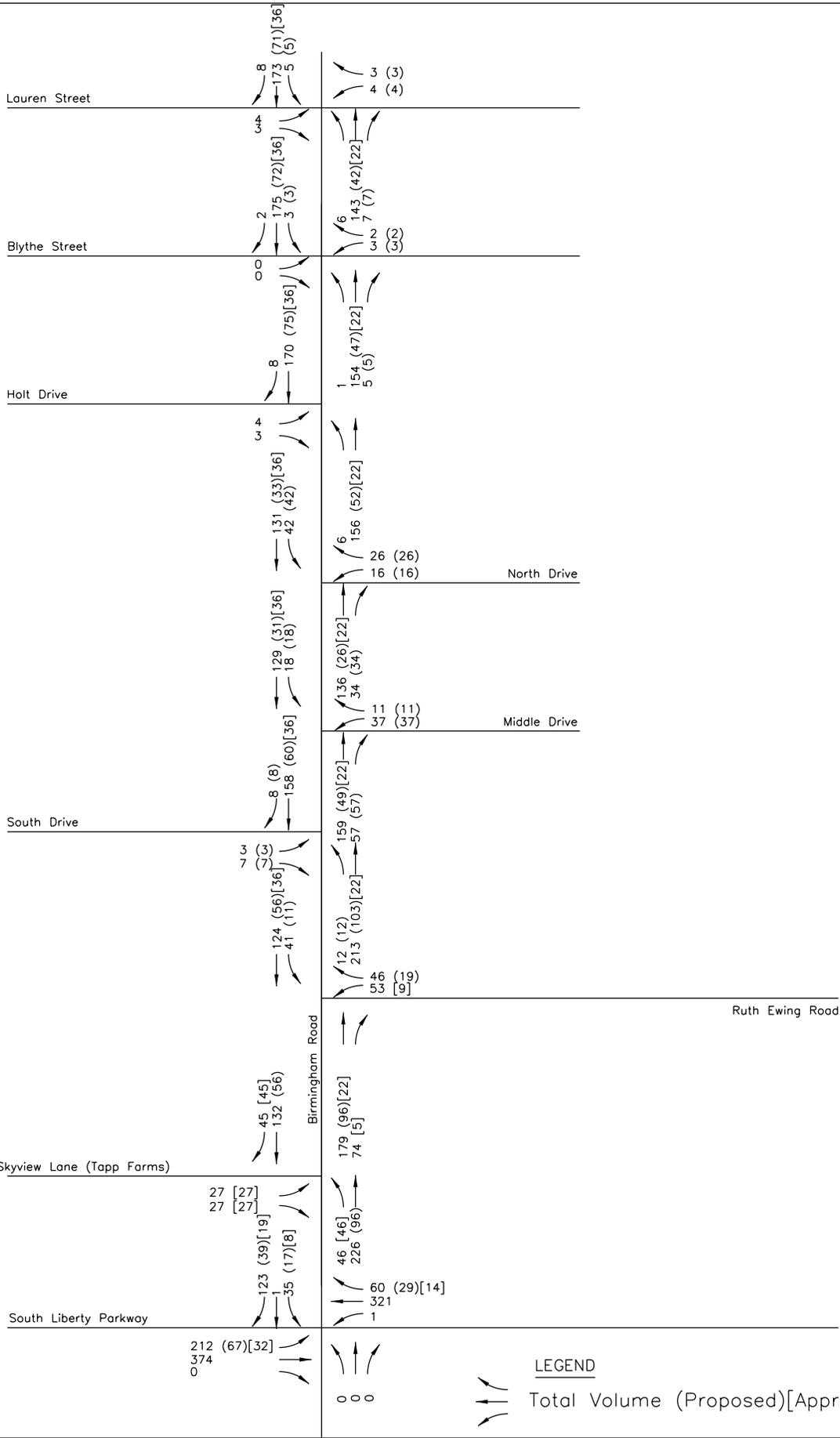
LEGEND
 [Approved]

Existing + Proposed Development
 AM Peak Hour
 Traffic Volumes

Whitehorse
 Liberty, MO

No Scale
 Figure 7



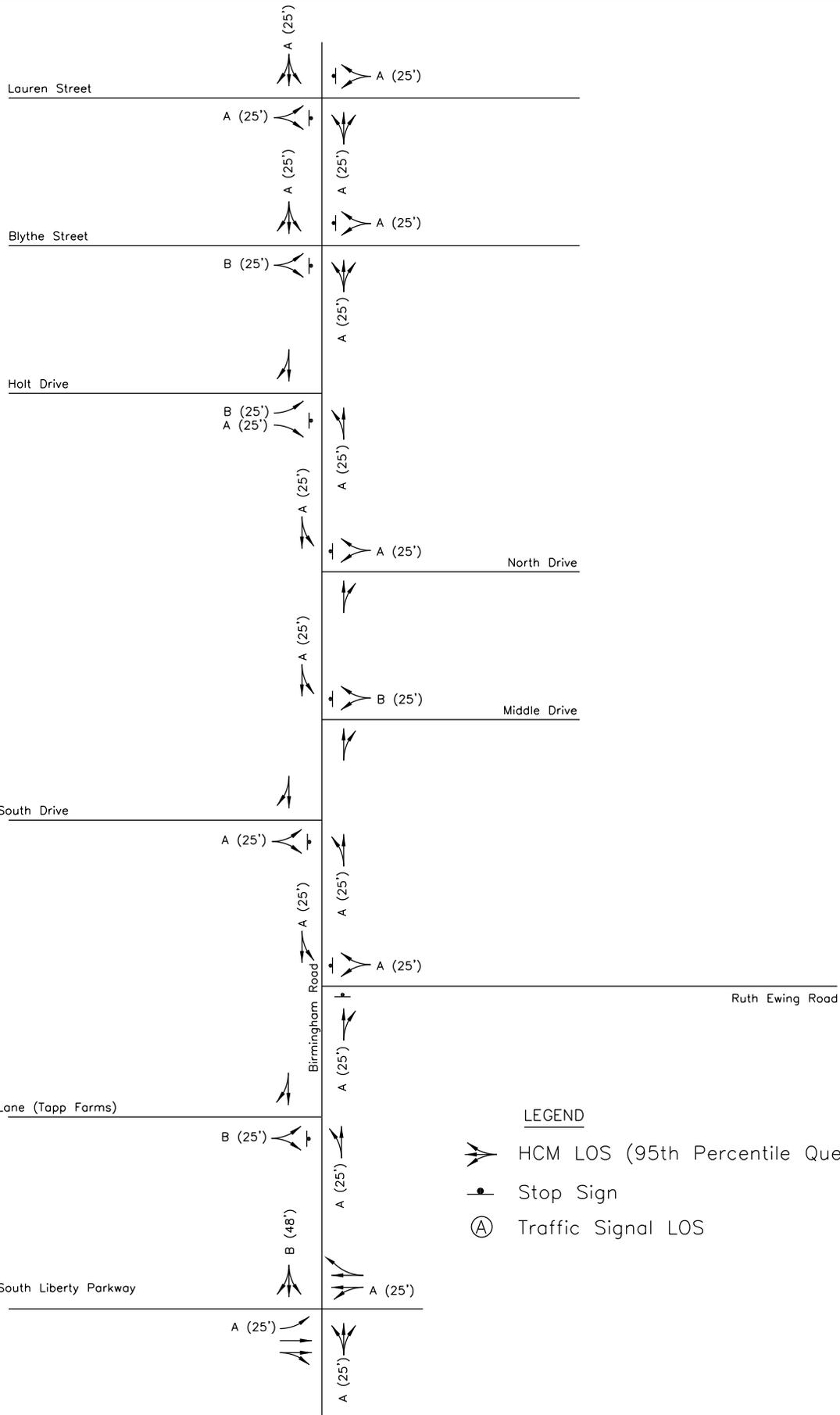


Existing + Proposed Development
 PM Peak Hour
 Traffic Volumes

Whitehorse
 Liberty, MO

No Scale
 Figure 8



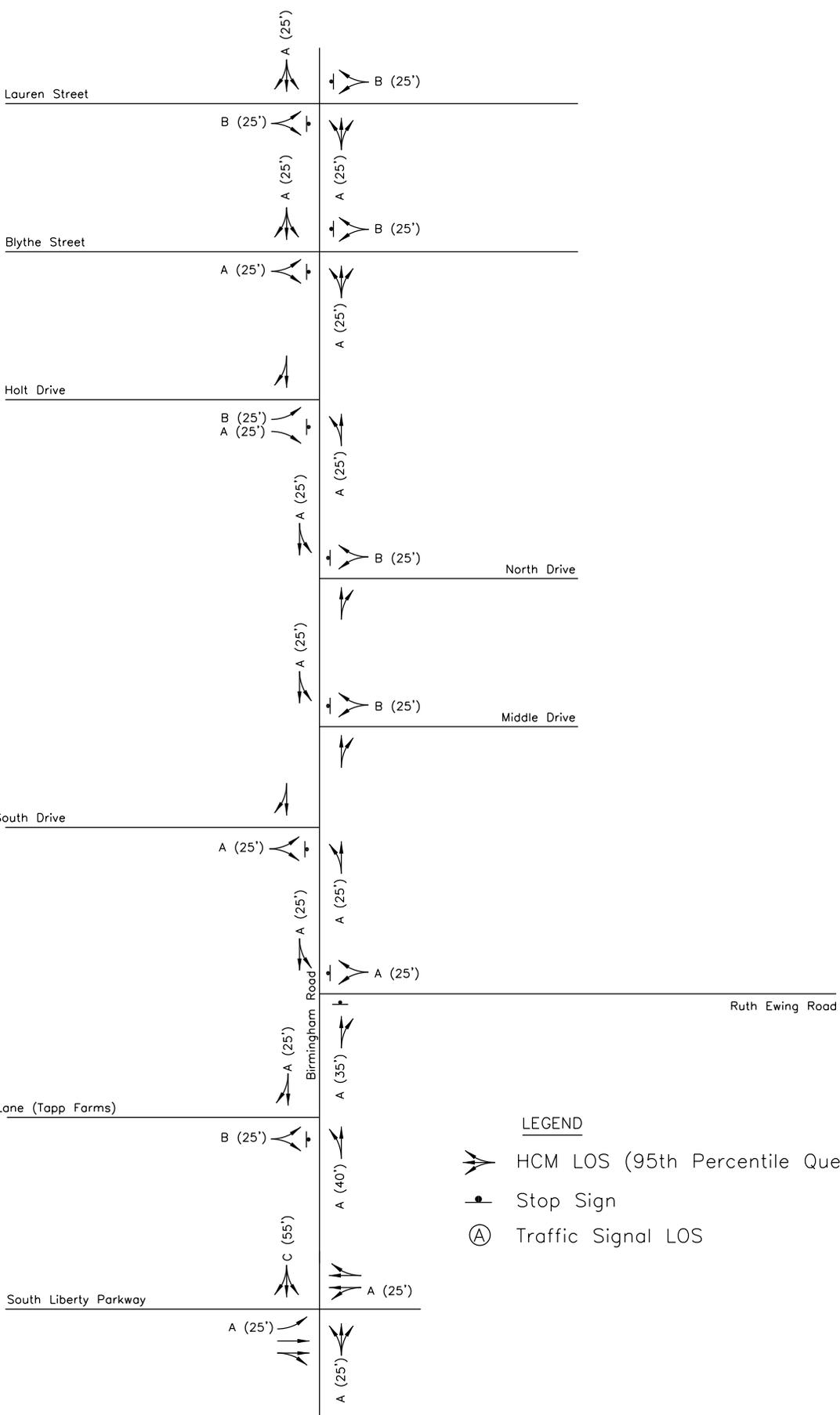


Existing + Proposed Development
 AM Peak Hour
 Lane Configurations &
 Levels of Service

Whitehorse
 Liberty, MO

No Scale
 Figure 9





Skyview Lane (Tapp Farms)

Existing + Proposed Development
PM Peak Hour
Lane Configurations &
Levels of Service

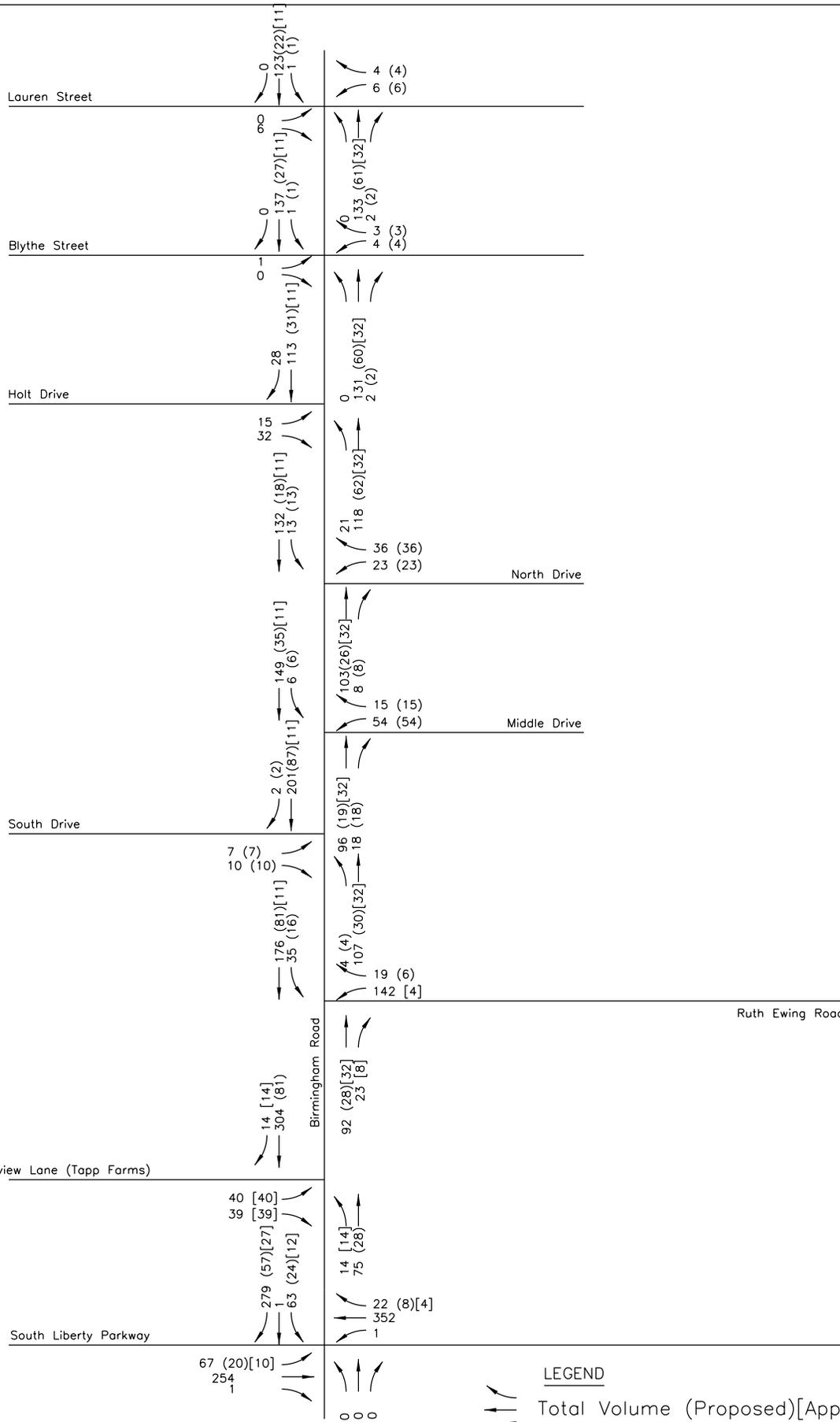
LEGEND

- HCM LOS (95th Percentile Queue in Vehicles)
- Stop Sign
- Traffic Signal LOS

Whitehorse
Liberty, MO

No Scale
Figure 10





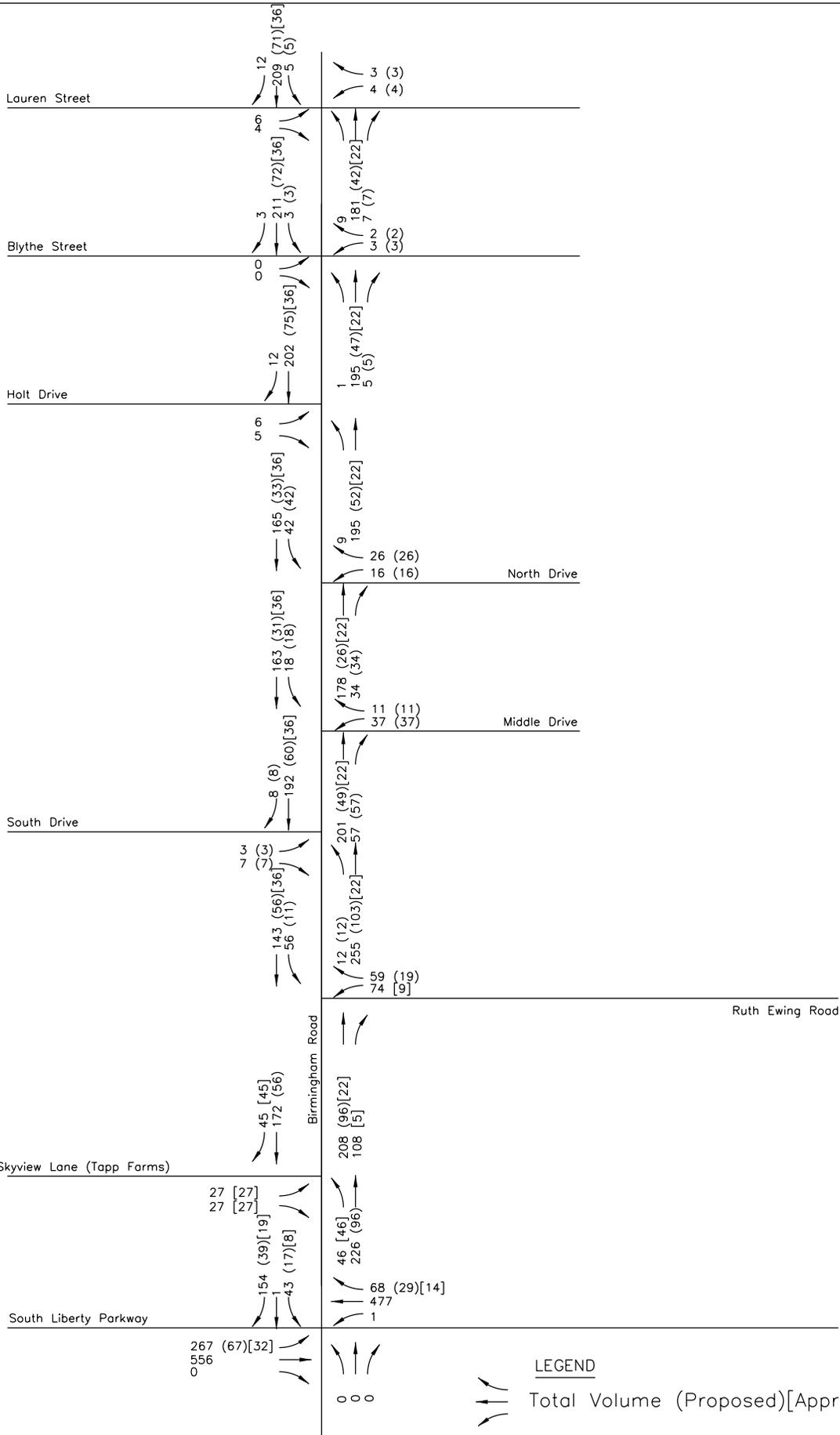
LEGEND
 Total Volume (Proposed) [Approved]

Future (2042)
 AM Peak Hour
 Traffic Volumes

Whitehorse
 Liberty, MO

No Scale
 Figure 11





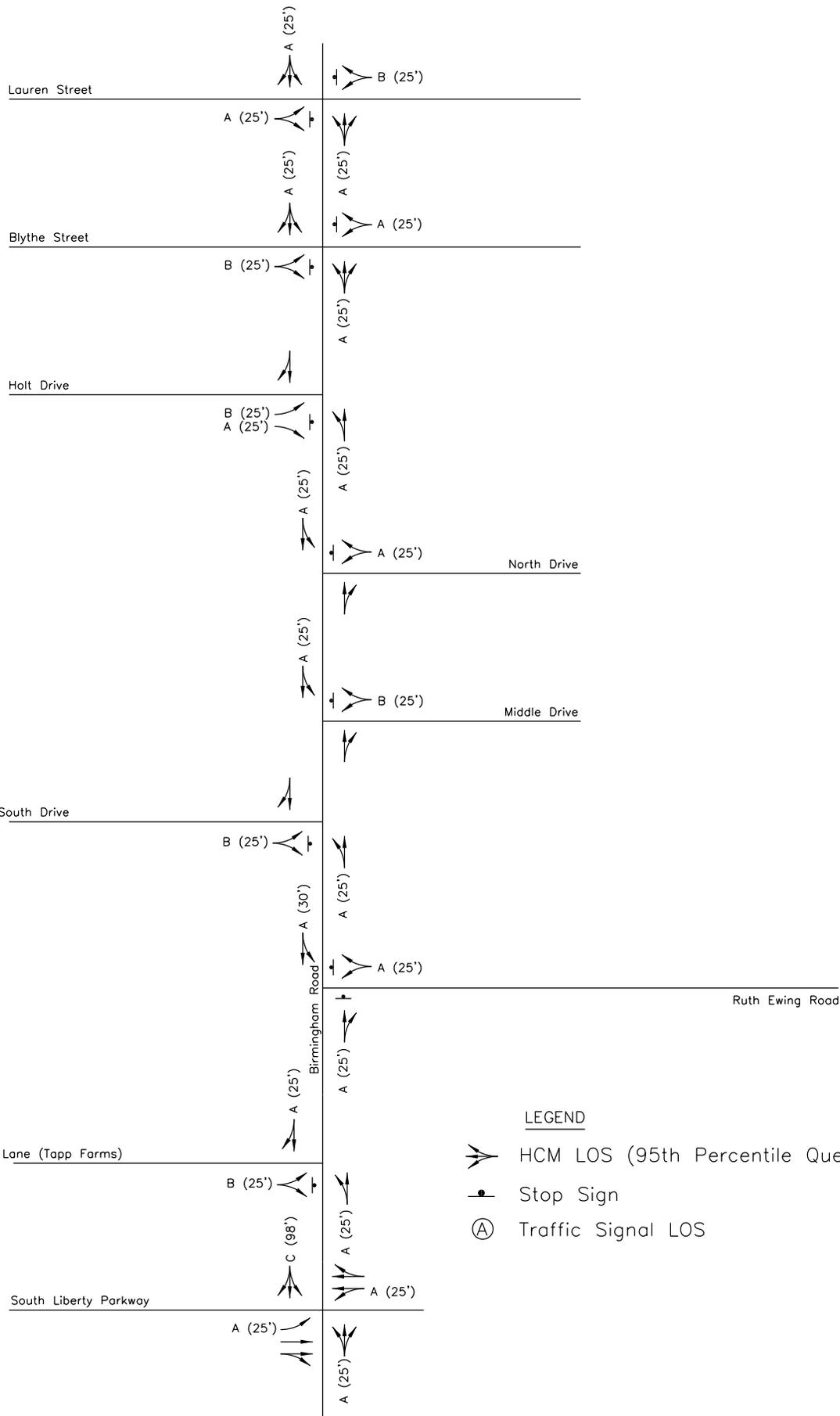
LEGEND
 Total Volume (Proposed)[Approved]

Future (2042)
 PM Peak Hour
 Traffic Volumes

Whitehorse
 Liberty, MO

No Scale
 Figure 12





LEGEND

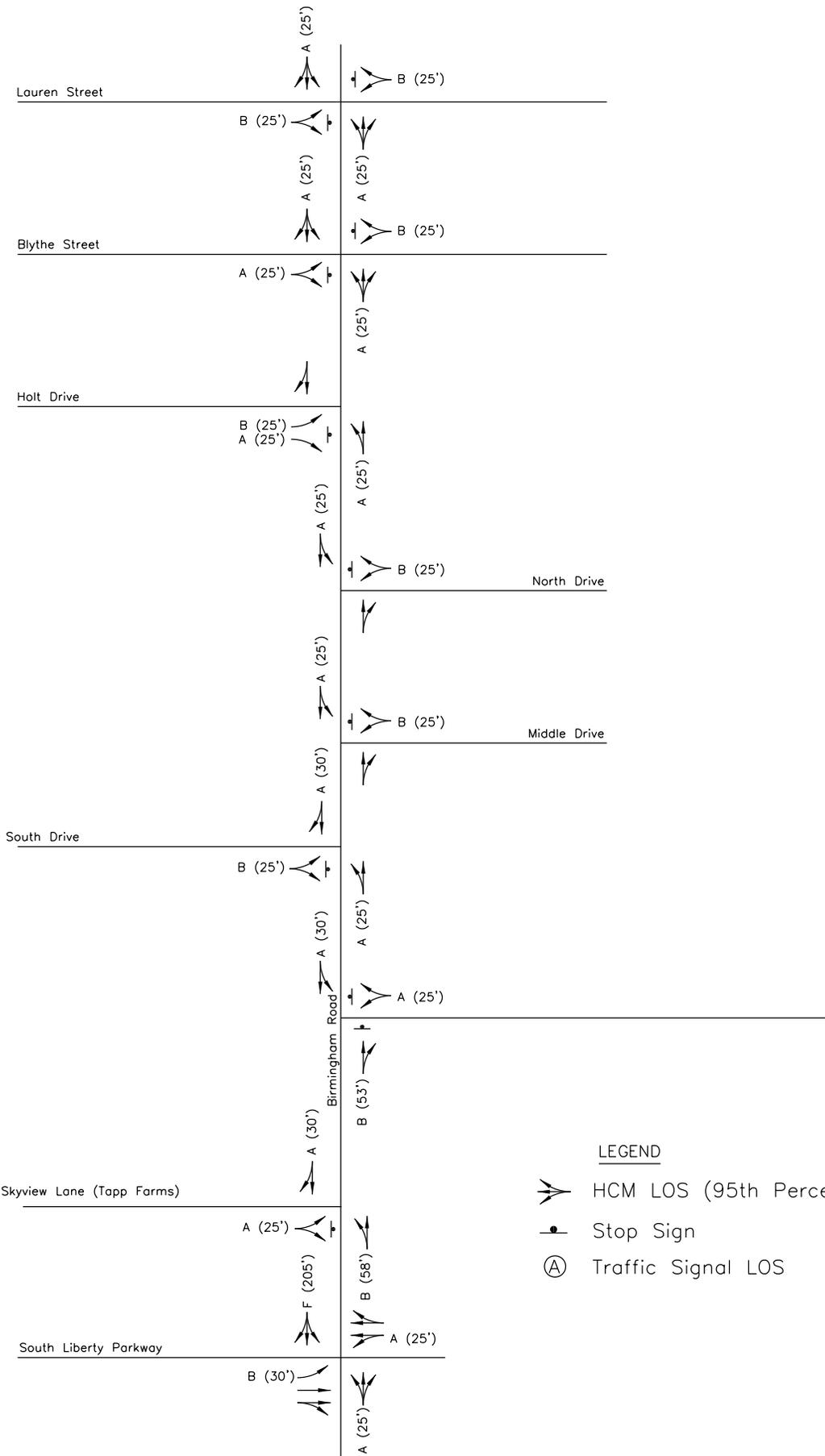
- HCM LOS (95th Percentile Queue in Vehicles)
- Stop Sign
- Traffic Signal LOS

Future (2042)
AM Peak Hour
Lane Configurations &
Levels of Service

Whitehorse
Liberty, MO

No Scale
Figure 13





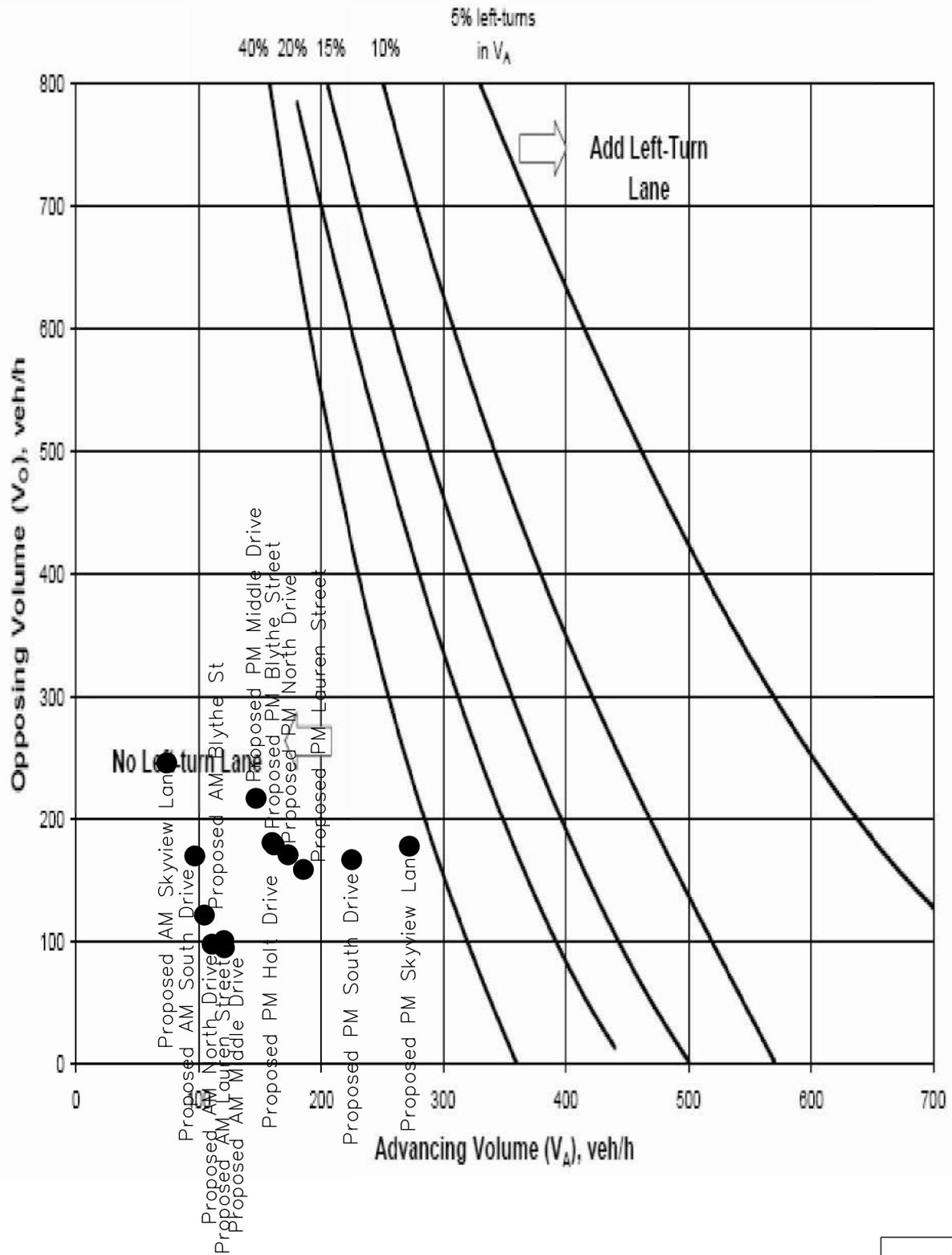
- LEGEND**
- Traffic Signal LOS
 - HCM LOS (95th Percentile Queue in Vehicles)
 - Stop Sign

Future (2042)
PM Peak Hour
Lane Configurations &
Levels of Service

Whitehorse
Liberty, MO

No Scale
Figure 14





Left Turn Lane Guidelines
for Two-Lane Roads
less than or equal to 40 mph
(MoDOT EPG 940.9.1)

Whitehorse
Liberty, MO

No Scale
Figure 15



APPENDIX II

Peak Hour Traffic Counts

FRA Crossing Inventory

FRA Accident History

Synchro Reports

Existing AM Peak Hour

Pages 1-5

Existing PM Peak Hour

Pages 6-10

Proposed AM Peak Hour

Pages 11-19

Proposed PM Peak Hour

Pages 20-28

Future AM Peak Hour

Pages 29-37

Future PM Peak Hour

Pages 38-46

Birmingham Road & Ruth Ewing Road

Start Time	Southbound				Westbound				Northbound				Eastbound				Totals
	Left	Thru	Right	Ped Bike	Left	Thru	Right	Ped Bike	Left	Thru	Right	Ped Bike	Left	Thru	Right	Ped Bike	
7:00	4	13			29		3		2	2							53
7:15	4	14			25		4		2	2							51
7:30	1	8			21		0		4	4							38
7:45	4	18			19		2		7	2							52
8:00	3	9			15		5		4	5							41
8:15	5	10			21		4		6	3							49
8:30	2	8			13		6		5	3							37
8:45	3	8			16		3		3	8							41
Totals	13	53	0	0	94	0	9	0	0	0	15	10	0	0	0	0	194
Trucks					1						2						
%					1%						13%						

South Liberty Parkway & Birmingham Road

Start Time	Southbound				Westbound				Northbound				Eastbound				Totals	
	Left	Thru	Right	Ped Bike	Left	Thru	Right	Ped Bike	Left	Thru	Right	Ped Bike	Left	Thru	Right	Ped Bike		
7:00	6	0	38		0	67	2		0	0			4	30	0		147	
7:15	3	0	37		0	51	1		0	0			6	62	0		160	
7:30	1	1	23		0	71	2		0	0			6	40	0		144	
7:45	7	0	28		1	48	2		0	0			7	39	1		133	
8:00	4	0	22		0	64	3		1	1			7	35	0		137	
8:15	2	0	27		0	61	3		0	0			6	41	0		140	
8:30	1	0	18		0	46	3		0	0			6	31	1		106	
8:45	5	0	21		0	39	1		0	0			11	40	0		117	
Totals	17	1	126	0	0	1	237	7	0	0	0	0	0	23	171	1	0	584
Trucks					2		31	1					1	23				
%					2%		13%	14%					4%	13%				

Birmingham Road & Holt Drive

Start Time	Southbound				Westbound				Northbound				Eastbound				Totals		
	Left	Thru	Right	Ped Bike	Left	Thru	Right	Ped Bike	Left	Thru	Right	Ped Bike	Left	Thru	Right	Ped Bike			
7:00	17	5							1	2			2	7	0		34		
7:15	8	3							4	4			2	6	0		27		
7:30	8	4							5	4			4	2	0		27		
7:45	14	7							4	7			2	7	1		42		
8:00	7	5							6	3			1	5	0		27		
8:15	10	2							6	2			3	6	4		33		
8:30	7	7							4	5			2	2	0		27		
8:45	6	6							3	3			7	7	0		32		
Totals	0	47	19	0	0	0	0	0	0	0	14	17	0	0	0	22	1	0	130
Trucks											1	1							
%											7%	6%							

Birmingham Road & Lauren Street

Start Time	Southbound				Westbound				Northbound				Eastbound				Totals		
	Left	Thru	Right	Ped Bike	Left	Thru	Right	Ped Bike	Left	Thru	Right	Ped Bike	Left	Thru	Right	Ped Bike			
7:00	18	0							0	5			0	3	1		27		
7:15	12	0						0	1	0	5		0	0	0		18		
7:30	10	0						0	0	8			0	1	0		19		
7:45	19	0						0	0	10			0	2	0		31		
8:00	12	1						0	0	3			0	1	1		18		
8:15	11	0						0	1	7			2	1	1		23		
8:30	13	0						0	0	8			0	0	1		22		
8:45	13	0						0	0	2	8		0	0	1		24		
Totals	0	59	0	0	0	0	0	0	0	1	0	28	0	0	0	6	1	0	95
Trucks												1							
%												4%							

Birmingham Road & Blythe Street

Start Time	Southbound				Westbound				Northbound				Eastbound				Totals		
	Left	Thru	Right	Ped Bike	Left	Thru	Right	Ped Bike	Left	Thru	Right	Ped Bike	Left	Thru	Right	Ped Bike			
7:00	22	0						0		4			0	0	0		26		
7:15	11	0						0	1	5			0	0	0		17		
7:30	12	0						0	0	8			0	0	0		20		
7:45	21	0						0	0	9			1	0	0		31		
8:00	12	1						0		4			0	1	1		18		
8:15	12	0						0	0	6			0	0	1		19		
8:30	14	0						0	0	8			0	0	1		23		
8:45	12	0						0	0	10			0	0	0		22		
Totals	0	66	0	0	0	0	0	0	0	1	0	26	0	0	0	1	0	0	94
Trucks												1							
%												4%							

HIGHWAY-RAIL GRADE CROSSING
ACCIDENT/INCIDENT REPORT

DEPARTMENT OF TRANSPORTATION
FEDERAL RAILROAD ADMINISTRATION (FRA)

OMB Approval No. 2130-0500

Name Of				Alphabetic Code	RR Accident/Incident No.
1. Reporting Railroad Chicago, Milwaukee, St. Paul & Pacific Railroad				1a. MILW	1b. 107971
2. Other Railroad Involved in Train Accident/Incident				2a.	2b.
3. Railroad Responsible for Track Maintenance Chicago, Milwaukee, St. Paul & Pacific Railroad				3a. MILW	3b. 107971
4. U.S. DOT-AAR Grade Crossing ID No. 375414M		5. Date of Accident/Incident 07/05/81		6. Time of Accident/Incident 07:04 PM	
7. Nearest Railroad Station LIBERTY		8. Division		9. County CLAY	
11. City (if in a city) LIBERTY		12. Highway Name or No. BIRMINGHAM RD		10. State Abbr. 29 Code MO	
Highway User Involved			Rail Equipment Involved		
13. Type C. Truck-trailer F. Bus J. Other Motor Vehicle A. Auto D. Pick-up truck G. School Bus K. Pedestrian B. Truck E. Van H. Motorcycle M. Other (specify) Code A			17. Equipment 1. Train (units pulling) 4. Car(s) (moving) 8. Other (specify) 2. Train (units pushing) 5. Car(s) (standing) A. Train pulling- RCL 3. Train (standing) 7. Light loco(s) (standing) B. Train pushing- RCL Code 1		
14. Vehicle Speed (est. mph at impact) 0		15. Direction (geographical) 1. North 2. South 3. East 4. West Code 2		18. Position of Car Unit in Train 1	
16. Position 1. Stalled on crossing 3. Moving over crossing 2. Stopped on Crossing 4. Trapped Code 1		19. Circumstance 1. Rail equipment struck highway user 2. Rail equipment struck by highway user Code 1			
20a. Was the highway user and/or rail equipment involved in the impact transporting hazardous materials? 1. Highway User 2. Rail Equipment 3. Both 4. Neither Code 4		20b. Was there a hazardous materials release by 1. Highway User 2. Rail Equipment 3. Both 4. Neither Code			
20c. State the name and quantity of the hazardous material released, if any					
21. Temperature (specify if minus) 90 °F		22. Visibility (single entry) 1. Dawn 2. Day 3. Dusk 4. Dark Code 2		23. Weather (single entry) 1. Clear 2. Cloudy 3. Rain 4. Fog 5. Sleet 6. Snow Code 1	
24. Type of Equipment Consist 1. Freight train 4. Work train 7. Yard/Switching (single entry) 2. Passenger train 5. Single car 8. Light loco(s) 3. Commuter train 6. Cut of cars 9. Main./inspect. car Code 1			25. Track Type Used by Rail Equipment Involved 1. Main 2. Yard 3. Siding 4. Industry Code 1		26. Track Number or Name MAIN
27. FRA Track Class 3	28. Number of Locomotive Units 2	29. Number of Cars 71	30. Consist Speed (Recorded if available) R. Recorded 30 mph E. Estimated Code R		31. Time Table Direction 1. North 2. South 3. East 4. West Code 3
32. Type of Crossing 1. Gates 4. Wig wags 7. Crossbucks 10. Flagged by crew 2. Cantilever FLS 5. Hwy. traffic signals 8. Stop signs 11. Other (specify) Warning 3. Standard FLS 6. Audible 9. Watchman 12. None Code(s) 03 06			33. Signaled Crossing Warning 20 sec warn min (1);		34. Whistle Ban 1. Yes 2. No 3. Unknown Code
35. Location of Warning 1. Both Sides 2. Side of Vehicle Approach 3. Opposite Side of Vehicle Approach Code 1			36. Crossing Warning Interconnected with Highway Signals 1. Yes 2. No 3. Unknown Code 2		37. Crossing Illuminated by Street Lights or Special Lights 1. Yes 2. No 3. Unknown Code 2
38. Driver's Age	39. Driver's Gender 1. Male 2. Female Code	40. Driver Drove Behind or in Front of Train and Struck or was Struck by Second Train 1. Yes 2. No 3. Unknown Code 2		41. Driver 1. Drove around or thru the gate 4. Stopped on crossing 2. Stopped and then proceeded 5. Other (specify) 3. Did not stop Code 5	
42. Driver Passed Standing Highway Vehicle 1. Yes 2. No 3. Unknown Code 2		43. View of Track Obscured by (primary obstruction) 1. Permanent Structure 3. Passing Train 5. Vegetation 7. Other (specify) 2. Standing railroad equipment 4. Topography 6. Highway Vehicles 8. Not Obstructed Code 8			
Casualties to:		Killed	Injured	44. Driver was 1. Killed 2. Injured 3. Uninjured Code 3	
46. Highway-Rail Crossing Users 0		0	47. Highway Vehicle Property Damage (est. dollar damage) \$800		48. Total Number of Highway-Rail Crossing Users (include driver) 1
49. Railroad Employees 0		0	50. Total Number of People on Train (include passengers and crew)		51. Is a Rail Equipment Accident / Incident Report Being Filed 1. Yes 2. No Code 2
52. Passengers on Train 0		0			
53a. Special Study Block			53b. Special Study Block		
54. Narrative Description					
55. Typed Name and Title			56. Signature		57. Date

U. S. DOT CROSSING INVENTORY FORM

DEPARTMENT OF TRANSPORTATION
FEDERAL RAILROAD ADMINISTRATION

OMB No. 2130-0017

Instructions for the initial reporting of the following types of new or previously unreported crossings: For public highway-rail grade crossings, complete the entire inventory Form. For private highway-rail grade crossings, complete the Header, Parts I and II, and the Submission Information section. For public pathway grade crossings (including pedestrian station grade crossings), complete the Header, Parts I and II, and the Submission Information section. For Private pathway grade crossings, complete the Header, Parts I and II, and the Submission Information section. For grade-separated highway-rail or pathway crossings (including pedestrian station crossings), complete the Header, Part I, and the Submission Information section. For changes to existing data, complete the Header, Part I Items 1-3, and the Submission Information section, in addition to the updated data fields. Note: For private crossings only, Part I Item 20 and Part III Item 2.K. are required unless otherwise noted. An asterisk * denotes an optional field.

A. Revision Date (MM/DD/YYYY) 12 / 13 / 2021	B. Reporting Agency <input checked="" type="checkbox"/> Railroad <input type="checkbox"/> Transit <input type="checkbox"/> State <input type="checkbox"/> Other	C. Reason for Update (Select only one) <input checked="" type="checkbox"/> Change in Data <input type="checkbox"/> Re-Open <input type="checkbox"/> New Crossing <input type="checkbox"/> Date Change Only <input type="checkbox"/> Closed <input type="checkbox"/> Change in Primary Operating RR <input type="checkbox"/> No Train Traffic <input type="checkbox"/> Quiet Zone Update <input type="checkbox"/> Admin. Correction	D. DOT Crossing Inventory Number 375414M
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Part I: Location and Classification Information

1. Primary Operating Railroad Dakota, Minnesota & Eastern Railroad [DME]		2. State MISSOURI		3. County CLAY	
4. City / Municipality <input type="checkbox"/> In <input checked="" type="checkbox"/> Near LIBERTY		5. Street/Road Name & Block Number OLD BIRMINGHAM RD (Street/Road Name) * (Block Number)		6. Highway Type & No. CORD	
7. Do Other Railroads Operate a Separate Track at Crossing? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No If Yes, Specify RR			8. Do Other Railroads Operate Over Your Track at Crossing? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No If Yes, Specify RR		
9. Railroad Division or Region <input type="checkbox"/> None EAST		10. Railroad Subdivision or District <input type="checkbox"/> None KANSAS CITY		11. Branch or Line Name <input type="checkbox"/> None LAREDO-KANSAS CITY	
12. RR Milepost 0490.610 (prefix) (nnnn.nnn) (suffix)		13. Line Segment *		14. Nearest RR Timetable Station LIBERTY	
15. Parent RR (if applicable) <input type="checkbox"/> N/A CP		16. Crossing Owner (if applicable) <input checked="" type="checkbox"/> N/A		17. Crossing Type <input checked="" type="checkbox"/> Public <input type="checkbox"/> Private	
18. Crossing Purpose <input checked="" type="checkbox"/> Highway <input type="checkbox"/> Pathway, Ped. <input type="checkbox"/> Station, Ped.		19. Crossing Position <input checked="" type="checkbox"/> At Grade <input type="checkbox"/> RR Under <input type="checkbox"/> RR Over		20. Public Access (if Private Crossing) <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	
21. Type of Train <input checked="" type="checkbox"/> Freight <input type="checkbox"/> Intercity Passenger <input type="checkbox"/> Commuter		<input type="checkbox"/> Transit <input type="checkbox"/> Shared Use Transit <input type="checkbox"/> Tourist/Other		22. Average Passenger Train Count Per Day <input type="checkbox"/> Less Than One Per Day <input type="checkbox"/> Number Per Day 0	
23. Type of Land Use <input checked="" type="checkbox"/> Open Space <input type="checkbox"/> Farm <input type="checkbox"/> Residential <input type="checkbox"/> Commercial <input type="checkbox"/> Industrial <input type="checkbox"/> Institutional <input type="checkbox"/> Recreational <input type="checkbox"/> RR Yard					
24. Is there an Adjacent Crossing with a Separate Number? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No If Yes, Provide Crossing Number			25. Quiet Zone (FRA provided) <input checked="" type="checkbox"/> No <input type="checkbox"/> 24 Hr <input type="checkbox"/> Partial <input type="checkbox"/> Chicago Excused Date Established		
26. HSR Corridor ID <input checked="" type="checkbox"/> N/A		27. Latitude in decimal degrees (WGS84 std: nn.nnnnnnn) 39.2219691		28. Longitude in decimal degrees (WGS84 std: -nnn.nnnnnnn) -94.4263271	
29. Lat/Long Source <input checked="" type="checkbox"/> Actual <input type="checkbox"/> Estimated					
30.A. Railroad Use *			31.A. State Use *		
30.B. Railroad Use *			31.B. State Use *		
30.C. Railroad Use *			31.C. State Use *		
30.D. Railroad Use *			31.D. State Use *		
32.A. Narrative (Railroad Use) *			32.B. Narrative (State Use) *		
33. Emergency Notification Telephone No. (posted) 800-716-9132		34. Railroad Contact (Telephone No.) 800-716-9132		35. State Contact (Telephone No.) 573-751-7125	

Part II: Railroad Information

1. Estimated Number of Daily Train Movements				
1.A. Total Day Thru Trains (6 AM to 6 PM) 3	1.B. Total Night Thru Trains (6 PM to 6 AM) 7	1.C. Total Switching Trains 0	1.D. Total Transit Trains 0	1.E. Check if Less Than One Movement Per Day <input type="checkbox"/> How many trains per week? _____
2. Year of Train Count Data (YYYY) 2021		3. Speed of Train at Crossing 3.A. Maximum Timetable Speed (mph) 60 3.B. Typical Speed Range Over Crossing (mph) From 25 to 60		
4. Type and Count of Tracks Main 2 Siding 0 Yard 0 Transit 0 Industry 0				
5. Train Detection (Main Track only) <input checked="" type="checkbox"/> Constant Warning Time <input type="checkbox"/> Motion Detection <input type="checkbox"/> AFO <input type="checkbox"/> PTC <input type="checkbox"/> DC <input type="checkbox"/> Other <input type="checkbox"/> None				
6. Is Track Signaled? <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No		7.A. Event Recorder <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No		7.B. Remote Health Monitoring <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No

U. S. DOT CROSSING INVENTORY FORM

A. Revision Date (MM/DD/YYYY) 12/13/2021		PAGE 2		D. Crossing Inventory Number (7 char.) 375414M	
Part III: Highway or Pathway Traffic Control Device Information					
1. Are there Signs or Signals? <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	2. Types of Passive Traffic Control Devices associated with the Crossing				
	2.A. Crossbuck Assemblies (count) 2	2.B. STOP Signs (R1-1) (count) 0	2.C. YIELD Signs (R1-2) (count) 0	2.D. Advance Warning Signs (Check all that apply; include count) <input checked="" type="checkbox"/> None <input type="checkbox"/> W10-1 _____ <input type="checkbox"/> W10-3 _____ <input type="checkbox"/> W10-11 _____ <input type="checkbox"/> W10-2 _____ <input type="checkbox"/> W10-4 _____ <input type="checkbox"/> W10-12 _____	
2.E. Low Ground Clearance Sign (W10-5) <input checked="" type="checkbox"/> Yes (count _____) <input type="checkbox"/> No	2.F. Pavement Markings <input type="checkbox"/> Stop Lines <input type="checkbox"/> Dynamic Envelope <input type="checkbox"/> RR Xing Symbols <input checked="" type="checkbox"/> None		2.G. Channelization Devices/Medians <input type="checkbox"/> All Approaches <input type="checkbox"/> Median <input type="checkbox"/> One Approach <input checked="" type="checkbox"/> None	2.H. EXEMPT Sign (R15-3) <input type="checkbox"/> Yes <input type="checkbox"/> No	2.I. ENS Sign (I-13) Displayed <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
2.J. Other MUTCD Signs <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No Specify Type _____ Count _____ Specify Type _____ Count _____ Specify Type _____ Count _____		2.K. Private Crossing Signs (if private) <input type="checkbox"/> Yes <input type="checkbox"/> No	2.L. LED Enhanced Signs (List types)		
3. Types of Train Activated Warning Devices at the Grade Crossing (specify count of each device for all that apply)					
3.A. Gate Arms (count) Roadway <u>2</u> Pedestrian <u>0</u>	3.B. Gate Configuration <input type="checkbox"/> 2 Quad <input type="checkbox"/> Full (Barrier) Resistance <input type="checkbox"/> 3 Quad <input type="checkbox"/> Median Gates	3.C. Cantilevered (or Bridged) Flashing Light Structures (count) Over Traffic Lane <u>4</u> <input type="checkbox"/> Incandescent Not Over Traffic Lane <u>0</u> <input type="checkbox"/> LED		3.D. Mast Mounted Flashing Lights (count of masts) <u>2</u> <input type="checkbox"/> Incandescent <input checked="" type="checkbox"/> LED <input checked="" type="checkbox"/> Back Lights Included <input type="checkbox"/> Side Lights Included	3.E. Total Count of Flashing Light Pairs 8
3.F. Installation Date of Current Active Warning Devices: (MM/YYYY) ____/____/____ <input checked="" type="checkbox"/> Not Required		3.G. Wayside Horn <input type="checkbox"/> Yes Installed on (MM/YYYY) ____/____/____ <input checked="" type="checkbox"/> No		3.H. Highway Traffic Signals Controlling Crossing <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	3.I. Bells (count) 2
3.J. Non-Train Active Warning <input type="checkbox"/> Flagging/Flagman <input type="checkbox"/> Manually Operated Signals <input type="checkbox"/> Watchman <input type="checkbox"/> Floodlighting <input checked="" type="checkbox"/> None				3.K. Other Flashing Lights or Warning Devices Count <u>0</u> Specify type _____	
4.A. Does nearby Hwy Intersection have Traffic Signals? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	4.B. Hwy Traffic Signal Interconnection <input checked="" type="checkbox"/> Not Interconnected <input type="checkbox"/> For Traffic Signals <input type="checkbox"/> For Warning Signs	4.C. Hwy Traffic Signal Preemption <input type="checkbox"/> Simultaneous <input type="checkbox"/> Advance	5. Highway Traffic Pre-Signals <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No Storage Distance * <u>0</u> Stop Line Distance * <u>0</u>	6. Highway Monitoring Devices (Check all that apply) <input type="checkbox"/> Yes - Photo/Video Recording <input type="checkbox"/> Yes - Vehicle Presence Detection <input checked="" type="checkbox"/> None	
Part IV: Physical Characteristics					
1. Traffic Lanes Crossing Railroad Number of Lanes <u>2</u> <input type="checkbox"/> One-way Traffic <input checked="" type="checkbox"/> Two-way Traffic <input type="checkbox"/> Divided Traffic		2. Is Roadway/Pathway Paved? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	3. Does Track Run Down a Street? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	4. Is Crossing Illuminated? (Street lights within approx. 50 feet from nearest rail) <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	
5. Crossing Surface (on Main Track, multiple types allowed) Installation Date * (MM/YYYY) ____/____/____ Width * _____ Length * _____ <input checked="" type="checkbox"/> 1 Timber <input type="checkbox"/> 2 Asphalt <input type="checkbox"/> 3 Asphalt and Timber <input type="checkbox"/> 4 Concrete <input type="checkbox"/> 5 Concrete and Rubber <input type="checkbox"/> 6 Rubber <input type="checkbox"/> 7 Metal <input type="checkbox"/> 8 Unconsolidated <input type="checkbox"/> 9 Composite <input type="checkbox"/> 10 Other (specify) _____					
6. Intersecting Roadway within 500 feet? <input type="checkbox"/> Yes <input type="checkbox"/> No If Yes, Approximate Distance (feet) <u>0</u>			7. Smallest Crossing Angle <input type="checkbox"/> 0° - 29° <input type="checkbox"/> 30° - 59° <input type="checkbox"/> 60° - 90°	8. Is Commercial Power Available? * <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	
Part V: Public Highway Information					
1. Highway System <input type="checkbox"/> (01) Interstate Highway System <input type="checkbox"/> (02) Other Nat Hwy System (NHS) <input type="checkbox"/> (03) Federal AID, Not NHS <input checked="" type="checkbox"/> (08) Non-Federal Aid		2. Functional Classification of Road at Crossing <input checked="" type="checkbox"/> (0) Rural <input type="checkbox"/> (1) Urban <input type="checkbox"/> (1) Interstate <input type="checkbox"/> (5) Major Collector <input type="checkbox"/> (2) Other Freeways and Expressways <input type="checkbox"/> (3) Other Principal Arterial <input type="checkbox"/> (6) Minor Collector <input type="checkbox"/> (4) Minor Arterial <input checked="" type="checkbox"/> (7) Local		3. Is Crossing on State Highway System? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	4. Highway Speed Limit System <u>1</u> _____ MPH <input type="checkbox"/> Posted <input type="checkbox"/> Statutory
5. Linear Referencing System (LRS Route ID) *					
6. LRS Milepost *					
7. Annual Average Daily Traffic (AADT) Year <u>1989</u> AADT <u>600</u>		8. Estimated Percent Trucks <u>20</u> %	9. Regularly Used by School Buses? <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No Average Number per Day <u>0</u>		10. Emergency Services Route <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No
Submission Information - This information is used for administrative purposes and is not available on the public website.					
Submitted by _____ Organization _____ Phone _____ Date _____					
Public reporting burden for this information collection is estimated to average 30 minutes per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed and completing and reviewing the collection of information. According to the Paperwork Reduction Act of 1995, a federal agency may not conduct or sponsor, and a person is not required to, nor shall a person be subject to a penalty for failure to comply with, a collection of information unless it displays a currently valid OMB control number. The valid OMB control number for information collection is 2130-0017. Send comments regarding this burden estimate or any other aspect of this collection, including for reducing this burden to: Information Collection Officer, Federal Railroad Administration, 1200 New Jersey Ave. SE, MS-25 Washington, DC 20590.					

3: Birmingham Road & Ruth Ewing Road

Existing AM Peak Hour

Intersection	
Intersection Delay, s/veh	7.8
Intersection LOS	A

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	94	9	22	10	13	56
Future Vol, veh/h	94	9	22	10	13	56
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles, %	2	2	13	2	2	2
Mvmt Flow	102	10	24	11	14	61
Number of Lanes	1	0	1	0	0	1

Approach	WB	NB	SB
Opposing Approach		SB	NB
Opposing Lanes	0	1	1
Conflicting Approach Left	NB		WB
Conflicting Lanes Left	1	0	1
Conflicting Approach Right	SB	WB	
Conflicting Lanes Right	1	1	0
HCM Control Delay	8	7.4	7.7
HCM LOS	A	A	A

Lane	NBLn1	WBLn1	SBLn1
Vol Left, %	0%	91%	19%
Vol Thru, %	69%	0%	81%
Vol Right, %	31%	9%	0%
Sign Control	Stop	Stop	Stop
Traffic Vol by Lane	32	103	69
LT Vol	0	94	13
Through Vol	22	0	56
RT Vol	10	9	0
Lane Flow Rate	35	112	75
Geometry Grp	1	1	1
Degree of Util (X)	0.04	0.132	0.087
Departure Headway (Hd)	4.189	4.254	4.196
Convergence, Y/N	Yes	Yes	Yes
Cap	843	837	845
Service Time	2.271	2.31	2.268
HCM Lane V/C Ratio	0.042	0.134	0.089
HCM Control Delay	7.4	8	7.7
HCM Lane LOS	A	A	A
HCM 95th-tile Q	0.1	0.5	0.3

4: Birmingham Road & South Liberty Parkway

Existing AM Peak Hour

Intersection												
Int Delay, s/veh	3											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	25	171	1	1	237	7	0	0	0	18	1	131
Future Vol, veh/h	25	171	1	1	237	7	0	0	0	18	1	131
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None									
Storage Length	180	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	4	13	2	2	13	14	2	2	2	2	2	2
Mvmt Flow	27	186	1	1	258	8	0	0	0	20	1	142

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	266	0	0	187	0	0	373	509	94	411	505	133
Stage 1	-	-	-	-	-	-	241	241	-	264	264	-
Stage 2	-	-	-	-	-	-	132	268	-	147	241	-
Critical Hdwy	4.18	-	-	4.14	-	-	7.54	6.54	6.94	7.54	6.54	6.94
Critical Hdwy Stg 1	-	-	-	-	-	-	6.54	5.54	-	6.54	5.54	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.54	5.54	-	6.54	5.54	-
Follow-up Hdwy	2.24	-	-	2.22	-	-	3.52	4.02	3.32	3.52	4.02	3.32
Pot Cap-1 Maneuver	1280	-	-	1385	-	-	559	466	944	525	468	892
Stage 1	-	-	-	-	-	-	741	705	-	718	689	-
Stage 2	-	-	-	-	-	-	858	686	-	841	705	-
Platoon blocked, %	-	-	-	-	-	-	-	-	-	-	-	-
Mov Cap-1 Maneuver	1280	-	-	1385	-	-	461	456	944	516	458	892
Mov Cap-2 Maneuver	-	-	-	-	-	-	461	456	-	516	458	-
Stage 1	-	-	-	-	-	-	725	690	-	703	688	-
Stage 2	-	-	-	-	-	-	719	685	-	823	690	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	1	0	0	10.5
HCM LOS			A	B

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	-	1280	-	-	1385	-	-	816
HCM Lane V/C Ratio	-	0.021	-	-	0.001	-	-	0.2
HCM Control Delay (s)	0	7.9	-	-	7.6	0	-	10.5
HCM Lane LOS	A	A	-	-	A	A	-	B
HCM 95th %tile Q(veh)	-	0.1	-	-	0	-	-	0.7

8: Birmingham Road & Holt Drive

Existing AM Peak Hour

Intersection						
Int Delay, s/veh	3					
Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	10	22	14	17	47	19
Future Vol, veh/h	10	22	14	17	47	19
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	0	-	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	7	6	2	2
Mvmt Flow	11	24	15	18	51	21

Major/Minor	Minor2	Major1	Major2			
Conflicting Flow All	110	62	72	0	-	0
Stage 1	62	-	-	-	-	-
Stage 2	48	-	-	-	-	-
Critical Hdwy	6.42	6.22	4.17	-	-	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	2.263	-	-	-
Pot Cap-1 Maneuver	887	1003	1497	-	-	-
Stage 1	961	-	-	-	-	-
Stage 2	974	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	878	1003	1497	-	-	-
Mov Cap-2 Maneuver	878	-	-	-	-	-
Stage 1	951	-	-	-	-	-
Stage 2	974	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	8.9	3.4	0
HCM LOS	A		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	EBLn2	SBT	SBR
Capacity (veh/h)	1497	-	878	1003	-	-
HCM Lane V/C Ratio	0.01	-	0.012	0.024	-	-
HCM Control Delay (s)	7.4	0	9.2	8.7	-	-
HCM Lane LOS	A	A	A	A	-	-
HCM 95th %tile Q(veh)	0	-	0	0.1	-	-

10: Birmingham Road & Lauren Street

Existing AM Peak Hour

Intersection						
Int Delay, s/veh	0.5					
Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	0	6	0	28	60	0
Future Vol, veh/h	0	6	0	28	60	0
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	4	2	2
Mvmt Flow	0	7	0	30	65	0

Major/Minor	Minor2	Major1		Major2	
Conflicting Flow All	95	65	65	0	0
Stage 1	65	-	-	-	-
Stage 2	30	-	-	-	-
Critical Hdwy	6.42	6.22	4.12	-	-
Critical Hdwy Stg 1	5.42	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-
Follow-up Hdwy	3.518	3.318	2.218	-	-
Pot Cap-1 Maneuver	905	999	1537	-	-
Stage 1	958	-	-	-	-
Stage 2	993	-	-	-	-
Platoon blocked, %				-	-
Mov Cap-1 Maneuver	905	999	1537	-	-
Mov Cap-2 Maneuver	905	-	-	-	-
Stage 1	958	-	-	-	-
Stage 2	993	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	8.6	0	0
HCM LOS	A		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	1537	-	999	-	-
HCM Lane V/C Ratio	-	-	0.007	-	-
HCM Control Delay (s)	0	-	8.6	-	-
HCM Lane LOS	A	-	A	-	-
HCM 95th %tile Q(veh)	0	-	0	-	-

12: Birmingham Road & Blythe Street

Existing AM Peak Hour

Intersection						
Int Delay, s/veh	0.1					
Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations	T			L		T
Traffic Vol, veh/h	1	0	0	27	66	0
Future Vol, veh/h	1	0	0	27	66	0
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	4	2	2
Mvmt Flow	1	0	0	29	72	0

Major/Minor	Minor2	Major1		Major2	
Conflicting Flow All	101	72	72	0	0
Stage 1	72	-	-	-	-
Stage 2	29	-	-	-	-
Critical Hdwy	6.42	6.22	4.12	-	-
Critical Hdwy Stg 1	5.42	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-
Follow-up Hdwy	3.518	3.318	2.218	-	-
Pot Cap-1 Maneuver	898	990	1528	-	-
Stage 1	951	-	-	-	-
Stage 2	994	-	-	-	-
Platoon blocked, %				-	-
Mov Cap-1 Maneuver	898	990	1528	-	-
Mov Cap-2 Maneuver	898	-	-	-	-
Stage 1	951	-	-	-	-
Stage 2	994	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	9	0	0
HCM LOS	A		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	1528	-	898	-	-
HCM Lane V/C Ratio	-	-	0.001	-	-
HCM Control Delay (s)	0	-	9	-	-
HCM Lane LOS	A	-	A	-	-
HCM 95th %tile Q(veh)	0	-	0	-	-

Intersection	
Intersection Delay, s/veh	7.6
Intersection LOS	A

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	44	27	61	69	30	32
Future Vol, veh/h	44	27	61	69	30	32
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles, %	2	4	2	2	2	2
Mvmt Flow	48	29	66	75	33	35
Number of Lanes	1	0	1	0	0	1

Approach	WB	NB	SB
Opposing Approach		SB	NB
Opposing Lanes	0	1	1
Conflicting Approach Left	NB		WB
Conflicting Lanes Left	1	0	1
Conflicting Approach Right	SB	WB	
Conflicting Lanes Right	1	1	0
HCM Control Delay	7.7	7.5	7.7
HCM LOS	A	A	A

Lane	NBLn1	WBLn1	SBLn1
Vol Left, %	0%	62%	48%
Vol Thru, %	47%	0%	52%
Vol Right, %	53%	38%	0%
Sign Control	Stop	Stop	Stop
Traffic Vol by Lane	130	71	62
LT Vol	0	44	30
Through Vol	61	0	32
RT Vol	69	27	0
Lane Flow Rate	141	77	67
Geometry Grp	1	1	1
Degree of Util (X)	0.149	0.09	0.08
Departure Headway (Hd)	3.803	4.188	4.276
Convergence, Y/N	Yes	Yes	Yes
Cap	934	844	831
Service Time	1.862	2.269	2.338
HCM Lane V/C Ratio	0.151	0.091	0.081
HCM Control Delay	7.5	7.7	7.7
HCM Lane LOS	A	A	A
HCM 95th-tile Q	0.5	0.3	0.3

4: Birmingham Road & South Liberty Parkway

Existing PM Peak Hour

Intersection												
Int Delay, s/veh	2											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	113	374	0	1	321	17	0	0	0	10	1	65
Future Vol, veh/h	113	374	0	1	321	17	0	0	0	10	1	65
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None									
Storage Length	180	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	9	2	2
Mvmt Flow	123	407	0	1	349	18	0	0	0	11	1	71

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	367	0	0	407	0	0	830	1022	204	810	1013	184
Stage 1	-	-	-	-	-	-	653	653	-	360	360	-
Stage 2	-	-	-	-	-	-	177	369	-	450	653	-
Critical Hdwy	4.14	-	-	4.14	-	-	7.54	6.54	6.94	7.68	6.54	6.94
Critical Hdwy Stg 1	-	-	-	-	-	-	6.54	5.54	-	6.68	5.54	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.54	5.54	-	6.68	5.54	-
Follow-up Hdwy	2.22	-	-	2.22	-	-	3.52	4.02	3.32	3.59	4.02	3.32
Pot Cap-1 Maneuver	1188	-	-	1148	-	-	263	235	803	260	237	827
Stage 1	-	-	-	-	-	-	423	462	-	612	625	-
Stage 2	-	-	-	-	-	-	808	619	-	540	462	-
Platoon blocked, %	-	-	-	-	-	-	-	-	-	-	-	-
Mov Cap-1 Maneuver	1188	-	-	1148	-	-	220	210	803	239	212	827
Mov Cap-2 Maneuver	-	-	-	-	-	-	220	210	-	239	212	-
Stage 1	-	-	-	-	-	-	379	414	-	548	624	-
Stage 2	-	-	-	-	-	-	737	618	-	484	414	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	1.9	0	0	11.9
HCM LOS			A	B

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	-	1188	-	-	1148	-	-	607
HCM Lane V/C Ratio	-	0.103	-	-	0.001	-	-	0.136
HCM Control Delay (s)	0	8.4	-	-	8.1	0	-	11.9
HCM Lane LOS	A	A	-	-	A	A	-	B
HCM 95th %tile Q(veh)	-	0.3	-	-	0	-	-	0.5

8: Birmingham Road & Holt Drive

Existing PM Peak Hour

Intersection						
Int Delay, s/veh	0.7					
Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	4	3	6	82	59	8
Future Vol, veh/h	4	3	6	82	59	8
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	0	-	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	4	3	7	89	64	9

Major/Minor	Minor2	Major1	Major2			
Conflicting Flow All	172	69	73	0	-	0
Stage 1	69	-	-	-	-	-
Stage 2	103	-	-	-	-	-
Critical Hdwy	6.42	6.22	4.12	-	-	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	2.218	-	-	-
Pot Cap-1 Maneuver	818	994	1527	-	-	-
Stage 1	954	-	-	-	-	-
Stage 2	921	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	814	994	1527	-	-	-
Mov Cap-2 Maneuver	814	-	-	-	-	-
Stage 1	949	-	-	-	-	-
Stage 2	921	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	9.1	0.5	0
HCM LOS	A		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	EBLn2	SBT	SBR
Capacity (veh/h)	1527	-	814	994	-	-
HCM Lane V/C Ratio	0.004	-	0.005	0.003	-	-
HCM Control Delay (s)	7.4	0	9.4	8.6	-	-
HCM Lane LOS	A	A	A	A	-	-
HCM 95th %tile Q(veh)	0	-	0	0	-	-

10: Birmingham Road & Lauren Street

Existing PM Peak Hour

Intersection						
Int Delay, s/veh	0.6					
Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	4	3	6	79	66	8
Future Vol, veh/h	4	3	6	79	66	8
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	4	3	7	86	72	9

Major/Minor	Minor2	Major1		Major2	
Conflicting Flow All	177	77	81	0	0
Stage 1	77	-	-	-	-
Stage 2	100	-	-	-	-
Critical Hdwy	6.42	6.22	4.12	-	-
Critical Hdwy Stg 1	5.42	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-
Follow-up Hdwy	3.518	3.318	2.218	-	-
Pot Cap-1 Maneuver	813	984	1517	-	-
Stage 1	946	-	-	-	-
Stage 2	924	-	-	-	-
Platoon blocked, %				-	-
Mov Cap-1 Maneuver	809	984	1517	-	-
Mov Cap-2 Maneuver	809	-	-	-	-
Stage 1	941	-	-	-	-
Stage 2	924	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	9.1	0.5	0
HCM LOS	A		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	1517	-	876	-	-
HCM Lane V/C Ratio	0.004	-	0.009	-	-
HCM Control Delay (s)	7.4	0	9.1	-	-
HCM Lane LOS	A	A	A	-	-
HCM 95th %tile Q(veh)	0	-	0	-	-

12: Birmingham Road & Blythe Street

Existing PM Peak Hour

Intersection						
Int Delay, s/veh	0.1					
Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	0	0	1	85	67	2
Future Vol, veh/h	0	0	1	85	67	2
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	0	0	1	92	73	2

Major/Minor	Minor2	Major1		Major2	
Conflicting Flow All	168	74	75	0	0
Stage 1	74	-	-	-	-
Stage 2	94	-	-	-	-
Critical Hdwy	6.42	6.22	4.12	-	-
Critical Hdwy Stg 1	5.42	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-
Follow-up Hdwy	3.518	3.318	2.218	-	-
Pot Cap-1 Maneuver	822	988	1524	-	-
Stage 1	949	-	-	-	-
Stage 2	930	-	-	-	-
Platoon blocked, %				-	-
Mov Cap-1 Maneuver	821	988	1524	-	-
Mov Cap-2 Maneuver	821	-	-	-	-
Stage 1	948	-	-	-	-
Stage 2	930	-	-	-	-

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

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	1524	-	-	-	-
HCM Lane V/C Ratio	0.001	-	-	-	-
HCM Control Delay (s)	7.4	0	0	-	-
HCM Lane LOS	A	A	A	-	-
HCM 95th %tile Q(veh)	0	-	-	-	-

Intersection	
Intersection Delay, s/veh	8.6
Intersection LOS	A

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	97	15	82	18	29	148
Future Vol, veh/h	97	15	82	18	29	148
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles, %	2	2	13	2	2	2
Mvmt Flow	105	16	89	20	32	161
Number of Lanes	1	0	1	0	0	1

Approach	WB	NB	SB
Opposing Approach		SB	NB
Opposing Lanes	0	1	1
Conflicting Approach Left	NB		WB
Conflicting Lanes Left	1	0	1
Conflicting Approach Right	SB	WB	
Conflicting Lanes Right	1	1	0
HCM Control Delay	8.6	8.3	8.7
HCM LOS	A	A	A

Lane	NBLn1	WBLn1	SBLn1
Vol Left, %	0%	87%	16%
Vol Thru, %	82%	0%	84%
Vol Right, %	18%	13%	0%
Sign Control	Stop	Stop	Stop
Traffic Vol by Lane	100	112	177
LT Vol	0	97	29
Through Vol	82	0	148
RT Vol	18	15	0
Lane Flow Rate	109	122	192
Geometry Grp	1	1	1
Degree of Util (X)	0.136	0.159	0.234
Departure Headway (Hd)	4.52	4.71	4.387
Convergence, Y/N	Yes	Yes	Yes
Cap	795	763	820
Service Time	2.538	2.728	2.403
HCM Lane V/C Ratio	0.137	0.16	0.234
HCM Control Delay	8.3	8.6	8.7
HCM Lane LOS	A	A	A
HCM 95th-tile Q	0.5	0.6	0.9

4: Birmingham Road & South Liberty Parkway

Proposed AM Peak Hour

Intersection												
Int Delay, s/veh	5.3											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	55	171	1	1	237	19	0	0	0	54	1	215
Future Vol, veh/h	55	171	1	1	237	19	0	0	0	54	1	215
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None									
Storage Length	180	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	4	13	2	2	13	14	2	2	2	2	2	2
Mvmt Flow	60	186	1	1	258	21	0	0	0	59	1	234

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	279	0	0	187	0	0	439	588	94	484	578	140
Stage 1	-	-	-	-	-	-	307	307	-	271	271	-
Stage 2	-	-	-	-	-	-	132	281	-	213	307	-
Critical Hdwy	4.18	-	-	4.14	-	-	7.54	6.54	6.94	7.54	6.54	6.94
Critical Hdwy Stg 1	-	-	-	-	-	-	6.54	5.54	-	6.54	5.54	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.54	5.54	-	6.54	5.54	-
Follow-up Hdwy	2.24	-	-	2.22	-	-	3.52	4.02	3.32	3.52	4.02	3.32
Pot Cap-1 Maneuver	1266	-	-	1385	-	-	502	420	944	466	425	882
Stage 1	-	-	-	-	-	-	678	660	-	712	684	-
Stage 2	-	-	-	-	-	-	858	677	-	769	660	-
Platoon blocked, %	-	-	-	-	-	-	-	-	-	-	-	-
Mov Cap-1 Maneuver	1266	-	-	1385	-	-	354	400	944	449	405	882
Mov Cap-2 Maneuver	-	-	-	-	-	-	354	400	-	449	405	-
Stage 1	-	-	-	-	-	-	646	629	-	679	683	-
Stage 2	-	-	-	-	-	-	629	676	-	733	629	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	1.9	0	0	13.1
HCM LOS			A	B

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	-	1266	-	-	1385	-	-	737
HCM Lane V/C Ratio	-	0.047	-	-	0.001	-	-	0.398
HCM Control Delay (s)		0	8	-	7.6	0	-	13.1
HCM Lane LOS		A	A	-	A	A	-	B
HCM 95th %tile Q(veh)	-	0.1	-	-	0	-	-	1.9

Intersection						
Int Delay, s/veh	1.5					
Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	10	22	14	111	89	19
Future Vol, veh/h	10	22	14	111	89	19
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	0	-	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	7	6	2	2
Mvmt Flow	11	24	15	121	97	21

Major/Minor	Minor2	Major1	Major2			
Conflicting Flow All	259	108	118	0	-	0
Stage 1	108	-	-	-	-	-
Stage 2	151	-	-	-	-	-
Critical Hdwy	6.42	6.22	4.17	-	-	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	2.263	-	-	-
Pot Cap-1 Maneuver	730	946	1440	-	-	-
Stage 1	916	-	-	-	-	-
Stage 2	877	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	722	946	1440	-	-	-
Mov Cap-2 Maneuver	722	-	-	-	-	-
Stage 1	906	-	-	-	-	-
Stage 2	877	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	9.3	0.8	0
HCM LOS	A		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	EBLn2	SBT	SBR
Capacity (veh/h)	1440	-	722	946	-	-
HCM Lane V/C Ratio	0.011	-	0.015	0.025	-	-
HCM Control Delay (s)	7.5	0	10.1	8.9	-	-
HCM Lane LOS	A	A	B	A	-	-
HCM 95th %tile Q(veh)	0	-	0	0.1	-	-

Intersection												
Int Delay, s/veh	0.7											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Traffic Vol, veh/h	0	0	6	6	0	4	0	121	2	1	93	0
Future Vol, veh/h	0	0	6	6	0	4	0	121	2	1	93	0
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None									
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	2	4	2	2	2	2
Mvmt Flow	0	0	7	7	0	4	0	132	2	1	101	0

Major/Minor	Minor2		Minor1		Major1			Major2				
Conflicting Flow All	238	237	101	240	236	133	101	0	0	134	0	0
Stage 1	103	103	-	133	133	-	-	-	-	-	-	-
Stage 2	135	134	-	107	103	-	-	-	-	-	-	-
Critical Hdwy	7.12	6.52	6.22	7.12	6.52	6.22	4.12	-	-	4.12	-	-
Critical Hdwy Stg 1	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Follow-up Hdwy	3.518	4.018	3.318	3.518	4.018	3.318	2.218	-	-	2.218	-	-
Pot Cap-1 Maneuver	716	664	954	714	665	916	1491	-	-	1451	-	-
Stage 1	903	810	-	870	786	-	-	-	-	-	-	-
Stage 2	868	785	-	898	810	-	-	-	-	-	-	-
Platoon blocked, %								-	-	-	-	-
Mov Cap-1 Maneuver	712	663	954	708	664	916	1491	-	-	1451	-	-
Mov Cap-2 Maneuver	712	663	-	708	664	-	-	-	-	-	-	-
Stage 1	903	809	-	870	786	-	-	-	-	-	-	-
Stage 2	864	785	-	891	809	-	-	-	-	-	-	-

Approach	EB		WB		NB		SB	
HCM Control Delay, s	8.8		9.7		0		0.1	
HCM LOS	A		A					

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	1491	-	-	954	779	1451	-	-
HCM Lane V/C Ratio	-	-	-	0.007	0.014	0.001	-	-
HCM Control Delay (s)	0	-	-	8.8	9.7	7.5	0	-
HCM Lane LOS	A	-	-	A	A	A	A	-
HCM 95th %tile Q(veh)	0	-	-	0	0	0	-	-

Intersection												
Int Delay, s/veh	0.4											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↔			↔			↔			↔	
Traffic Vol, veh/h	1	0	0	4	0	3	2	119	0	1	104	0
Future Vol, veh/h	1	0	0	4	0	3	2	119	0	1	104	0
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None									
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	2	4	2	2	2	2
Mvmt Flow	1	0	0	4	0	3	2	129	0	1	113	0

Major/Minor	Minor2		Minor1		Major1		Major2					
Conflicting Flow All	250	248	113	248	248	129	113	0	0	129	0	0
Stage 1	115	115	-	133	133	-	-	-	-	-	-	-
Stage 2	135	133	-	115	115	-	-	-	-	-	-	-
Critical Hdwy	7.12	6.52	6.22	7.12	6.52	6.22	4.12	-	-	4.12	-	-
Critical Hdwy Stg 1	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Follow-up Hdwy	3.518	4.018	3.318	3.518	4.018	3.318	2.218	-	-	2.218	-	-
Pot Cap-1 Maneuver	703	655	940	706	655	921	1476	-	-	1457	-	-
Stage 1	890	800	-	870	786	-	-	-	-	-	-	-
Stage 2	868	786	-	890	800	-	-	-	-	-	-	-
Platoon blocked, %								-	-	-	-	-
Mov Cap-1 Maneuver	699	654	940	705	654	921	1476	-	-	1457	-	-
Mov Cap-2 Maneuver	699	654	-	705	654	-	-	-	-	-	-	-
Stage 1	889	799	-	869	785	-	-	-	-	-	-	-
Stage 2	864	785	-	889	799	-	-	-	-	-	-	-

Approach	EB		WB		NB		SB	
HCM Control Delay, s	10.2		9.6		0.1		0.1	
HCM LOS	B		A					

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	1476	-	-	699	784	1457	-	-
HCM Lane V/C Ratio	0.001	-	-	0.002	0.01	0.001	-	-
HCM Control Delay (s)	7.4	0	-	10.2	9.6	7.5	0	-
HCM Lane LOS	A	A	-	B	A	A	A	-
HCM 95th %tile Q(veh)	0	-	-	0	0	0	-	-

Intersection						
Int Delay, s/veh	0.7					
Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	7	10	4	93	167	2
Future Vol, veh/h	7	10	4	93	167	2
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	8	11	4	101	182	2

Major/Minor	Minor2	Major1		Major2	
Conflicting Flow All	292	183	184	0	-
Stage 1	183	-	-	-	-
Stage 2	109	-	-	-	-
Critical Hdwy	6.42	6.22	4.12	-	-
Critical Hdwy Stg 1	5.42	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-
Follow-up Hdwy	3.518	3.318	2.218	-	-
Pot Cap-1 Maneuver	699	859	1391	-	-
Stage 1	848	-	-	-	-
Stage 2	916	-	-	-	-
Platoon blocked, %				-	-
Mov Cap-1 Maneuver	697	859	1391	-	-
Mov Cap-2 Maneuver	697	-	-	-	-
Stage 1	845	-	-	-	-
Stage 2	916	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	9.7	0.3	0
HCM LOS	A		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	1391	-	784	-	-
HCM Lane V/C Ratio	0.003	-	0.024	-	-
HCM Control Delay (s)	7.6	0	9.7	-	-
HCM Lane LOS	A	A	A	-	-
HCM 95th %tile Q(veh)	0	-	0.1	-	-

Intersection						
Int Delay, s/veh	2.6					
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	54	15	82	18	6	115
Future Vol, veh/h	54	15	82	18	6	115
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	59	16	89	20	7	125

Major/Minor	Minor1	Major1	Major2		
Conflicting Flow All	238	99	0	0	109
Stage 1	99	-	-	-	-
Stage 2	139	-	-	-	-
Critical Hdwy	6.42	6.22	-	-	4.12
Critical Hdwy Stg 1	5.42	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-
Follow-up Hdwy	3.518	3.318	-	-	2.218
Pot Cap-1 Maneuver	750	957	-	-	1481
Stage 1	925	-	-	-	-
Stage 2	888	-	-	-	-
Platoon blocked, %					
Mov Cap-1 Maneuver	746	957	-	-	1481
Mov Cap-2 Maneuver	746	-	-	-	-
Stage 1	925	-	-	-	-
Stage 2	884	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	10.1	0	0.4
HCM LOS	B		

Minor Lane/Major Mvmt	NBT	NBRWBLn1	SBL	SBT
Capacity (veh/h)	-	-	784	1481
HCM Lane V/C Ratio	-	-	0.096	0.004
HCM Control Delay (s)	-	-	10.1	7.4
HCM Lane LOS	-	-	B	A
HCM 95th %tile Q(veh)	-	-	0.3	0

Intersection						
Int Delay, s/veh	2.5					
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	23	36	89	8	13	98
Future Vol, veh/h	23	36	89	8	13	98
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	25	39	97	9	14	107

Major/Minor	Minor1	Major1	Major2		
Conflicting Flow All	237	102	0	0	106
Stage 1	102	-	-	-	-
Stage 2	135	-	-	-	-
Critical Hdwy	6.42	6.22	-	-	4.12
Critical Hdwy Stg 1	5.42	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-
Follow-up Hdwy	3.518	3.318	-	-	2.218
Pot Cap-1 Maneuver	751	953	-	-	1485
Stage 1	922	-	-	-	-
Stage 2	891	-	-	-	-
Platoon blocked, %					
Mov Cap-1 Maneuver	743	953	-	-	1485
Mov Cap-2 Maneuver	743	-	-	-	-
Stage 1	922	-	-	-	-
Stage 2	882	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	9.5	0	0.9
HCM LOS	A		

Minor Lane/Major Mvmt	NBT	NBRWBLn1	SBL	SBT
Capacity (veh/h)	-	-	858	1485
HCM Lane V/C Ratio	-	-	0.075	0.01
HCM Control Delay (s)	-	-	9.5	7.4
HCM Lane LOS	-	-	A	A
HCM 95th %tile Q(veh)	-	-	0.2	0

Intersection						
Int Delay, s/veh	2.4					
Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	40	39	14	60	231	14
Future Vol, veh/h	40	39	14	60	231	14
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	43	42	15	65	251	15
Major/Minor	Minor2	Major1		Major2		
Conflicting Flow All	354	259	266	0	-	0
Stage 1	259	-	-	-	-	-
Stage 2	95	-	-	-	-	-
Critical Hdwy	6.42	6.22	4.12	-	-	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	2.218	-	-	-
Pot Cap-1 Maneuver	644	780	1298	-	-	-
Stage 1	784	-	-	-	-	-
Stage 2	929	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	636	780	1298	-	-	-
Mov Cap-2 Maneuver	636	-	-	-	-	-
Stage 1	775	-	-	-	-	-
Stage 2	929	-	-	-	-	-
Approach	EB		NB		SB	
HCM Control Delay, s	10.9		1.5		0	
HCM LOS	B					
Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR	
Capacity (veh/h)	1298	-	700	-	-	
HCM Lane V/C Ratio	0.012	-	0.123	-	-	
HCM Control Delay (s)	7.8	0	10.9	-	-	
HCM Lane LOS	A	A	B	-	-	
HCM 95th %tile Q(veh)	0	-	0.4	-	-	

Intersection	
Intersection Delay, s/veh	9
Intersection LOS	A

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	53	46	179	74	41	124
Future Vol, veh/h	53	46	179	74	41	124
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles, %	2	4	2	2	2	2
Mvmt Flow	58	50	195	80	45	135
Number of Lanes	1	0	1	0	0	1

Approach	WB	NB	SB
Opposing Approach		SB	NB
Opposing Lanes	0	1	1
Conflicting Approach Left	NB		WB
Conflicting Lanes Left	1	0	1
Conflicting Approach Right	SB	WB	
Conflicting Lanes Right	1	1	0
HCM Control Delay	8.6	9.2	8.9
HCM LOS	A	A	A

Lane	NBLn1	WBLn1	SBLn1
Vol Left, %	0%	54%	25%
Vol Thru, %	71%	0%	75%
Vol Right, %	29%	46%	0%
Sign Control	Stop	Stop	Stop
Traffic Vol by Lane	253	99	165
LT Vol	0	53	41
Through Vol	179	0	124
RT Vol	74	46	0
Lane Flow Rate	275	108	179
Geometry Grp	1	1	1
Degree of Util (X)	0.322	0.142	0.226
Departure Headway (Hd)	4.219	4.752	4.528
Convergence, Y/N	Yes	Yes	Yes
Cap	853	754	793
Service Time	2.24	2.782	2.552
HCM Lane V/C Ratio	0.322	0.143	0.226
HCM Control Delay	9.2	8.6	8.9
HCM Lane LOS	A	A	A
HCM 95th-tile Q	1.4	0.5	0.9

4: Birmingham Road & South Liberty Parkway

Proposed PM Peak Hour

Intersection												
Int Delay, s/veh	4.6											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	212	374	0	1	321	60	0	0	0	35	1	123
Future Vol, veh/h	212	374	0	1	321	60	0	0	0	35	1	123
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None									
Storage Length	180	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	9	2	2
Mvmt Flow	230	407	0	1	349	65	0	0	0	38	1	134

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	414	0	0	407	0	0	1044	1283	204	1048	1251	207
Stage 1	-	-	-	-	-	-	867	867	-	384	384	-
Stage 2	-	-	-	-	-	-	177	416	-	664	867	-
Critical Hdwy	4.14	-	-	4.14	-	-	7.54	6.54	6.94	7.68	6.54	6.94
Critical Hdwy Stg 1	-	-	-	-	-	-	6.54	5.54	-	6.68	5.54	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.54	5.54	-	6.68	5.54	-
Follow-up Hdwy	2.22	-	-	2.22	-	-	3.52	4.02	3.32	3.59	4.02	3.32
Pot Cap-1 Maneuver	1141	-	-	1148	-	-	183	164	803	173	171	799
Stage 1	-	-	-	-	-	-	314	368	-	592	610	-
Stage 2	-	-	-	-	-	-	808	590	-	400	368	-
Platoon blocked, %	-	-	-	-	-	-	-	-	-	-	-	-
Mov Cap-1 Maneuver	1141	-	-	1148	-	-	128	131	803	146	136	799
Mov Cap-2 Maneuver	-	-	-	-	-	-	128	131	-	146	136	-
Stage 1	-	-	-	-	-	-	251	294	-	472	609	-
Stage 2	-	-	-	-	-	-	671	589	-	319	294	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	3.2	0	0	20.9
HCM LOS			A	C

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	-	1141	-	-	1148	-	-	396
HCM Lane V/C Ratio	-	0.202	-	-	0.001	-	-	0.436
HCM Control Delay (s)		0	9	-	8.1	0	-	20.9
HCM Lane LOS		A	A	-	A	A	-	C
HCM 95th %tile Q(veh)	-	0.8	-	-	0	-	-	2.2

Intersection						
Int Delay, s/veh	0.3					
Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	4	3	6	156	170	8
Future Vol, veh/h	4	3	6	156	170	8
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	0	-	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	4	3	7	170	185	9

Major/Minor	Minor2	Major1	Major2			
Conflicting Flow All	374	190	194	0	-	0
Stage 1	190	-	-	-	-	-
Stage 2	184	-	-	-	-	-
Critical Hdwy	6.42	6.22	4.12	-	-	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	2.218	-	-	-
Pot Cap-1 Maneuver	627	852	1379	-	-	-
Stage 1	842	-	-	-	-	-
Stage 2	848	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	623	852	1379	-	-	-
Mov Cap-2 Maneuver	623	-	-	-	-	-
Stage 1	837	-	-	-	-	-
Stage 2	848	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	10.1	0.3	0
HCM LOS	B		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	EBLn2	SBT	SBR
Capacity (veh/h)	1379	-	623	852	-	-
HCM Lane V/C Ratio	0.005	-	0.007	0.004	-	-
HCM Control Delay (s)	7.6	0	10.8	9.2	-	-
HCM Lane LOS	A	A	B	A	-	-
HCM 95th %tile Q(veh)	0	-	0	0	-	-

Intersection												
Int Delay, s/veh	0.6											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↔			↔			↔			↔	
Traffic Vol, veh/h	4	0	3	4	0	3	6	143	7	5	173	8
Future Vol, veh/h	4	0	3	4	0	3	6	143	7	5	173	8
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None									
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	4	0	3	4	0	3	7	155	8	5	188	9

Major/Minor	Minor2		Minor1		Major1			Major2				
Conflicting Flow All	378	380	193	377	380	159	197	0	0	163	0	0
Stage 1	203	203	-	173	173	-	-	-	-	-	-	-
Stage 2	175	177	-	204	207	-	-	-	-	-	-	-
Critical Hdwy	7.12	6.52	6.22	7.12	6.52	6.22	4.12	-	-	4.12	-	-
Critical Hdwy Stg 1	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Follow-up Hdwy	3.518	4.018	3.318	3.518	4.018	3.318	2.218	-	-	2.218	-	-
Pot Cap-1 Maneuver	580	552	849	580	552	886	1376	-	-	1416	-	-
Stage 1	799	733	-	829	756	-	-	-	-	-	-	-
Stage 2	827	753	-	798	731	-	-	-	-	-	-	-
Platoon blocked, %								-	-	-	-	-
Mov Cap-1 Maneuver	574	546	849	574	546	886	1376	-	-	1416	-	-
Mov Cap-2 Maneuver	574	546	-	574	546	-	-	-	-	-	-	-
Stage 1	794	730	-	824	751	-	-	-	-	-	-	-
Stage 2	819	748	-	792	728	-	-	-	-	-	-	-

Approach	EB		WB		NB		SB	
HCM Control Delay, s	10.5		10.4		0.3		0.2	
HCM LOS	B		B					

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	1376	-	-	667	676	1416	-	-
HCM Lane V/C Ratio	0.005	-	-	0.011	0.011	0.004	-	-
HCM Control Delay (s)	7.6	0	-	10.5	10.4	7.6	0	-
HCM Lane LOS	A	A	-	B	B	A	A	-
HCM 95th %tile Q(veh)	0	-	-	0	0	0	-	-

12: Birmingham Road & Blythe Street

Proposed PM Peak Hour

Intersection												
Int Delay, s/veh	0.2											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Traffic Vol, veh/h	0	0	0	3	0	2	1	154	5	3	175	2
Future Vol, veh/h	0	0	0	3	0	2	1	154	5	3	175	2
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None									
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	0	0	0	3	0	2	1	167	5	3	190	2

Major/Minor	Minor2		Minor1		Major1			Major2				
Conflicting Flow All	370	371	191	369	370	170	192	0	0	172	0	0
Stage 1	197	197	-	172	172	-	-	-	-	-	-	-
Stage 2	173	174	-	197	198	-	-	-	-	-	-	-
Critical Hdwy	7.12	6.52	6.22	7.12	6.52	6.22	4.12	-	-	4.12	-	-
Critical Hdwy Stg 1	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Follow-up Hdwy	3.518	4.018	3.318	3.518	4.018	3.318	2.218	-	-	2.218	-	-
Pot Cap-1 Maneuver	587	559	851	588	560	874	1381	-	-	1405	-	-
Stage 1	805	738	-	830	756	-	-	-	-	-	-	-
Stage 2	829	755	-	805	737	-	-	-	-	-	-	-
Platoon blocked, %								-	-	-	-	-
Mov Cap-1 Maneuver	584	557	851	587	558	874	1381	-	-	1405	-	-
Mov Cap-2 Maneuver	584	557	-	587	558	-	-	-	-	-	-	-
Stage 1	804	737	-	829	755	-	-	-	-	-	-	-
Stage 2	826	754	-	803	736	-	-	-	-	-	-	-

Approach	EB		WB		NB			SB		
HCM Control Delay, s	0		10.4		0			0.1		
HCM LOS	A		B							

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	1381	-	-	-	676	1405	-	-
HCM Lane V/C Ratio	0.001	-	-	-	0.008	0.002	-	-
HCM Control Delay (s)	7.6	0	-	0	10.4	7.6	0	-
HCM Lane LOS	A	A	-	A	B	A	A	-
HCM 95th %tile Q(veh)	0	-	-	-	0	0	-	-

Intersection						
Int Delay, s/veh	0.5					
Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	3	7	12	213	158	8
Future Vol, veh/h	3	7	12	213	158	8
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	3	8	13	232	172	9

Major/Minor	Minor2	Major1		Major2	
Conflicting Flow All	435	177	181	0	0
Stage 1	177	-	-	-	-
Stage 2	258	-	-	-	-
Critical Hdwy	6.42	6.22	4.12	-	-
Critical Hdwy Stg 1	5.42	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-
Follow-up Hdwy	3.518	3.318	2.218	-	-
Pot Cap-1 Maneuver	578	866	1394	-	-
Stage 1	854	-	-	-	-
Stage 2	785	-	-	-	-
Platoon blocked, %				-	-
Mov Cap-1 Maneuver	572	866	1394	-	-
Mov Cap-2 Maneuver	572	-	-	-	-
Stage 1	845	-	-	-	-
Stage 2	785	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	9.9	0.4	0
HCM LOS	A		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	1394	-	750	-	-
HCM Lane V/C Ratio	0.009	-	0.014	-	-
HCM Control Delay (s)	7.6	0	9.9	-	-
HCM Lane LOS	A	A	A	-	-
HCM 95th %tile Q(veh)	0	-	0	-	-

Intersection						
Int Delay, s/veh	1.6					
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	37	11	159	57	18	129
Future Vol, veh/h	37	11	159	57	18	129
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	40	12	173	62	20	140

Major/Minor	Minor1	Major1	Major2		
Conflicting Flow All	384	204	0	0	235
Stage 1	204	-	-	-	-
Stage 2	180	-	-	-	-
Critical Hdwy	6.42	6.22	-	-	4.12
Critical Hdwy Stg 1	5.42	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-
Follow-up Hdwy	3.518	3.318	-	-	2.218
Pot Cap-1 Maneuver	619	837	-	-	1332
Stage 1	830	-	-	-	-
Stage 2	851	-	-	-	-
Platoon blocked, %			-	-	-
Mov Cap-1 Maneuver	609	837	-	-	1332
Mov Cap-2 Maneuver	609	-	-	-	-
Stage 1	830	-	-	-	-
Stage 2	837	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	11	0	0.9
HCM LOS	B		

Minor Lane/Major Mvmt	NBT	NBRWBLn1	SBL	SBT
Capacity (veh/h)	-	-	650	1332
HCM Lane V/C Ratio	-	-	0.08	0.015
HCM Control Delay (s)	-	-	11	7.7
HCM Lane LOS	-	-	B	A
HCM 95th %tile Q(veh)	-	-	0.3	0

Intersection						
Int Delay, s/veh	2					
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	16	26	136	34	42	131
Future Vol, veh/h	16	26	136	34	42	131
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	17	28	148	37	46	142

Major/Minor	Minor1	Major1	Major2		
Conflicting Flow All	401	167	0	0	185
Stage 1	167	-	-	-	-
Stage 2	234	-	-	-	-
Critical Hdwy	6.42	6.22	-	-	4.12
Critical Hdwy Stg 1	5.42	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-
Follow-up Hdwy	3.518	3.318	-	-	2.218
Pot Cap-1 Maneuver	605	877	-	-	1390
Stage 1	863	-	-	-	-
Stage 2	805	-	-	-	-
Platoon blocked, %			-	-	-
Mov Cap-1 Maneuver	583	877	-	-	1390
Mov Cap-2 Maneuver	583	-	-	-	-
Stage 1	863	-	-	-	-
Stage 2	776	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	10.2	0	1.9
HCM LOS	B		

Minor Lane/Major Mvmt	NBT	NBRWBLn1	SBL	SBT
Capacity (veh/h)	-	-	736	1390
HCM Lane V/C Ratio	-	-	0.062	0.033
HCM Control Delay (s)	-	-	10.2	7.7
HCM Lane LOS	-	-	B	A
HCM 95th %tile Q(veh)	-	-	0.2	0.1

Intersection	
Intersection Delay, s/veh	9.1
Intersection LOS	A

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	27	27	46	226	132	45
Future Vol, veh/h	27	27	46	226	132	45
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	29	29	50	246	143	49
Number of Lanes	1	0	0	1	1	0

Approach	EB	NB	SB
Opposing Approach		SB	NB
Opposing Lanes	0	1	1
Conflicting Approach Left	SB	EB	
Conflicting Lanes Left	1	1	0
Conflicting Approach Right	NB		EB
Conflicting Lanes Right	1	0	1
HCM Control Delay	8.2	9.7	8.5
HCM LOS	A	A	A

Lane	NBLn1	EBLn1	SBLn1
Vol Left, %	17%	50%	0%
Vol Thru, %	83%	0%	75%
Vol Right, %	0%	50%	25%
Sign Control	Stop	Stop	Stop
Traffic Vol by Lane	272	54	177
LT Vol	46	27	0
Through Vol	226	0	132
RT Vol	0	27	45
Lane Flow Rate	296	59	192
Geometry Grp	1	1	1
Degree of Util (X)	0.355	0.078	0.226
Departure Headway (Hd)	4.318	4.786	4.226
Convergence, Y/N	Yes	Yes	Yes
Cap	837	749	852
Service Time	2.318	2.812	2.242
HCM Lane V/C Ratio	0.354	0.079	0.225
HCM Control Delay	9.7	8.2	8.5
HCM Lane LOS	A	A	A
HCM 95th-tile Q	1.6	0.3	0.9

Intersection	
Intersection Delay, s/veh	9.2
Intersection LOS	A

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	142	19	92	23	35	176
Future Vol, veh/h	142	19	92	23	35	176
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles, %	2	2	13	2	2	2
Mvmt Flow	154	21	100	25	38	191
Number of Lanes	1	0	1	0	0	1

Approach	WB	NB	SB
Opposing Approach		SB	NB
Opposing Lanes	0	1	1
Conflicting Approach Left	NB		WB
Conflicting Lanes Left	1	0	1
Conflicting Approach Right	SB	WB	
Conflicting Lanes Right	1	1	0
HCM Control Delay	9.4	8.7	9.4
HCM LOS	A	A	A

Lane	NBLn1	WBLn1	SBLn1
Vol Left, %	0%	88%	17%
Vol Thru, %	80%	0%	83%
Vol Right, %	20%	12%	0%
Sign Control	Stop	Stop	Stop
Traffic Vol by Lane	115	161	211
LT Vol	0	142	35
Through Vol	92	0	176
RT Vol	23	19	0
Lane Flow Rate	125	175	229
Geometry Grp	1	1	1
Degree of Util (X)	0.163	0.236	0.29
Departure Headway (Hd)	4.707	4.86	4.558
Convergence, Y/N	Yes	Yes	Yes
Cap	761	738	789
Service Time	2.738	2.893	2.585
HCM Lane V/C Ratio	0.164	0.237	0.29
HCM Control Delay	8.7	9.4	9.4
HCM Lane LOS	A	A	A
HCM 95th-tile Q	0.6	0.9	1.2

4: Birmingham Road & South Liberty Parkway

Future AM Peak Hour

Intersection												
Int Delay, s/veh	6.8											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	67	254	1	1	352	22	0	0	0	63	1	279
Future Vol, veh/h	67	254	1	1	352	22	0	0	0	63	1	279
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None									
Storage Length	180	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	4	13	2	2	13	14	2	2	2	2	2	2
Mvmt Flow	73	276	1	1	383	24	0	0	0	68	1	303

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	407	0	0	277	0	0	617	832	139	681	820	204
Stage 1	-	-	-	-	-	-	423	423	-	397	397	-
Stage 2	-	-	-	-	-	-	194	409	-	284	423	-
Critical Hdwy	4.18	-	-	4.14	-	-	7.54	6.54	6.94	7.54	6.54	6.94
Critical Hdwy Stg 1	-	-	-	-	-	-	6.54	5.54	-	6.54	5.54	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.54	5.54	-	6.54	5.54	-
Follow-up Hdwy	2.24	-	-	2.22	-	-	3.52	4.02	3.32	3.52	4.02	3.32
Pot Cap-1 Maneuver	1134	-	-	1283	-	-	374	303	884	336	308	803
Stage 1	-	-	-	-	-	-	579	586	-	600	602	-
Stage 2	-	-	-	-	-	-	789	594	-	699	586	-
Platoon blocked, %	-	-	-	-	-	-	-	-	-	-	-	-
Mov Cap-1 Maneuver	1134	-	-	1283	-	-	221	283	884	319	288	803
Mov Cap-2 Maneuver	-	-	-	-	-	-	221	283	-	319	288	-
Stage 1	-	-	-	-	-	-	542	548	-	562	601	-
Stage 2	-	-	-	-	-	-	490	593	-	654	548	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	1.7	0	0	18.9
HCM LOS			A	C

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	-	1134	-	-	1283	-	-	625
HCM Lane V/C Ratio	-	0.064	-	-	0.001	-	-	0.597
HCM Control Delay (s)	0	8.4	-	-	7.8	0	-	18.9
HCM Lane LOS	A	A	-	-	A	A	-	C
HCM 95th %tile Q(veh)	-	0.2	-	-	0	-	-	3.9

Intersection						
Int Delay, s/veh	1.9					
Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	15	32	21	118	113	28
Future Vol, veh/h	15	32	21	118	113	28
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	0	-	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	7	6	2	2
Mvmt Flow	16	35	23	128	123	30

Major/Minor	Minor2	Major1	Major2			
Conflicting Flow All	312	138	153	0	-	0
Stage 1	138	-	-	-	-	-
Stage 2	174	-	-	-	-	-
Critical Hdwy	6.42	6.22	4.17	-	-	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	2.263	-	-	-
Pot Cap-1 Maneuver	681	910	1398	-	-	-
Stage 1	889	-	-	-	-	-
Stage 2	856	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	669	910	1398	-	-	-
Mov Cap-2 Maneuver	669	-	-	-	-	-
Stage 1	873	-	-	-	-	-
Stage 2	856	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	9.5	1.2	0
HCM LOS	A		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	EBLn2	SBT	SBR
Capacity (veh/h)	1398	-	669	910	-	-
HCM Lane V/C Ratio	0.016	-	0.024	0.038	-	-
HCM Control Delay (s)	7.6	0	10.5	9.1	-	-
HCM Lane LOS	A	A	B	A	-	-
HCM 95th %tile Q(veh)	0.1	-	0.1	0.1	-	-

Intersection												
Int Delay, s/veh	0.7											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↔			↔			↔			↔	
Traffic Vol, veh/h	0	0	9	6	0	4	0	133	2	1	123	0
Future Vol, veh/h	0	0	9	6	0	4	0	133	2	1	123	0
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None									
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	2	4	2	2	2	2
Mvmt Flow	0	0	10	7	0	4	0	145	2	1	134	0

Major/Minor	Minor2		Minor1		Major1		Major2					
Conflicting Flow All	284	283	134	287	282	146	134	0	0	147	0	0
Stage 1	136	136	-	146	146	-	-	-	-	-	-	-
Stage 2	148	147	-	141	136	-	-	-	-	-	-	-
Critical Hdwy	7.12	6.52	6.22	7.12	6.52	6.22	4.12	-	-	4.12	-	-
Critical Hdwy Stg 1	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Follow-up Hdwy	3.518	4.018	3.318	3.518	4.018	3.318	2.218	-	-	2.218	-	-
Pot Cap-1 Maneuver	668	626	915	665	627	901	1451	-	-	1435	-	-
Stage 1	867	784	-	857	776	-	-	-	-	-	-	-
Stage 2	855	775	-	862	784	-	-	-	-	-	-	-
Platoon blocked, %								-	-	-	-	-
Mov Cap-1 Maneuver	664	625	915	658	626	901	1451	-	-	1435	-	-
Mov Cap-2 Maneuver	664	625	-	658	626	-	-	-	-	-	-	-
Stage 1	867	783	-	857	776	-	-	-	-	-	-	-
Stage 2	851	775	-	852	783	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	9	10	0	0.1
HCM LOS	A	B		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	1451	-	-	915	738	1435	-	-
HCM Lane V/C Ratio	-	-	-	0.011	0.015	0.001	-	-
HCM Control Delay (s)	0	-	-	9	10	7.5	0	-
HCM Lane LOS	A	-	-	A	B	A	A	-
HCM 95th %tile Q(veh)	0	-	-	0	0	0	-	-

12: Birmingham Road & Blythe Street

Future AM Peak Hour

Intersection												
Int Delay, s/veh	0.3											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Traffic Vol, veh/h	1	0	0	4	0	3	0	131	2	1	137	0
Future Vol, veh/h	1	0	0	4	0	3	0	131	2	1	137	0
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None									
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	2	4	2	2	2	2
Mvmt Flow	1	0	0	4	0	3	0	142	2	1	149	0

Major/Minor	Minor2		Minor1		Major1		Major2					
Conflicting Flow All	296	295	149	294	294	143	149	0	0	144	0	0
Stage 1	151	151	-	143	143	-	-	-	-	-	-	-
Stage 2	145	144	-	151	151	-	-	-	-	-	-	-
Critical Hdwy	7.12	6.52	6.22	7.12	6.52	6.22	4.12	-	-	4.12	-	-
Critical Hdwy Stg 1	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Follow-up Hdwy	3.518	4.018	3.318	3.518	4.018	3.318	2.218	-	-	2.218	-	-
Pot Cap-1 Maneuver	656	616	898	658	617	905	1432	-	-	1438	-	-
Stage 1	851	772	-	860	779	-	-	-	-	-	-	-
Stage 2	858	778	-	851	772	-	-	-	-	-	-	-
Platoon blocked, %								-	-	-	-	-
Mov Cap-1 Maneuver	653	615	898	657	616	905	1432	-	-	1438	-	-
Mov Cap-2 Maneuver	653	615	-	657	616	-	-	-	-	-	-	-
Stage 1	851	771	-	860	779	-	-	-	-	-	-	-
Stage 2	855	778	-	850	771	-	-	-	-	-	-	-

Approach	EB		WB		NB		SB	
HCM Control Delay, s	10.5		9.9		0		0.1	
HCM LOS	B		A					

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	1432	-	-	653	744	1438	-	-
HCM Lane V/C Ratio	-	-	-	0.002	0.01	0.001	-	-
HCM Control Delay (s)	0	-	-	10.5	9.9	7.5	0	-
HCM Lane LOS	A	-	-	B	A	A	A	-
HCM 95th %tile Q(veh)	0	-	-	0	0	0	-	-

Intersection						
Int Delay, s/veh	0.6					
Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	7	10	4	107	201	2
Future Vol, veh/h	7	10	4	107	201	2
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	8	11	4	116	218	2

Major/Minor	Minor2	Major1		Major2	
Conflicting Flow All	343	219	220	0	0
Stage 1	219	-	-	-	-
Stage 2	124	-	-	-	-
Critical Hdwy	6.42	6.22	4.12	-	-
Critical Hdwy Stg 1	5.42	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-
Follow-up Hdwy	3.518	3.318	2.218	-	-
Pot Cap-1 Maneuver	653	821	1349	-	-
Stage 1	817	-	-	-	-
Stage 2	902	-	-	-	-
Platoon blocked, %				-	-
Mov Cap-1 Maneuver	651	821	1349	-	-
Mov Cap-2 Maneuver	651	-	-	-	-
Stage 1	815	-	-	-	-
Stage 2	902	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	10	0.3	0
HCM LOS	B		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	1349	-	741	-	-
HCM Lane V/C Ratio	0.003	-	0.025	-	-
HCM Control Delay (s)	7.7	0	10	-	-
HCM Lane LOS	A	A	B	-	-
HCM 95th %tile Q(veh)	0	-	0.1	-	-

Intersection						
Int Delay, s/veh	2.3					
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	54	15	96	18	6	149
Future Vol, veh/h	54	15	96	18	6	149
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	59	16	104	20	7	162

Major/Minor	Minor1	Major1	Major2		
Conflicting Flow All	290	114	0	0	124
Stage 1	114	-	-	-	-
Stage 2	176	-	-	-	-
Critical Hdwy	6.42	6.22	-	-	4.12
Critical Hdwy Stg 1	5.42	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-
Follow-up Hdwy	3.518	3.318	-	-	2.218
Pot Cap-1 Maneuver	701	939	-	-	1463
Stage 1	911	-	-	-	-
Stage 2	855	-	-	-	-
Platoon blocked, %			-	-	-
Mov Cap-1 Maneuver	697	939	-	-	1463
Mov Cap-2 Maneuver	697	-	-	-	-
Stage 1	911	-	-	-	-
Stage 2	851	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	10.4	0	0.3
HCM LOS	B		

Minor Lane/Major Mvmt	NBT	NBRWBLn1	SBL	SBT
Capacity (veh/h)	-	-	738	1463
HCM Lane V/C Ratio	-	-	0.102	0.004
HCM Control Delay (s)	-	-	10.4	7.5
HCM Lane LOS	-	-	B	A
HCM 95th %tile Q(veh)	-	-	0.3	0

Intersection						
Int Delay, s/veh	2.1					
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	23	36	103	8	13	132
Future Vol, veh/h	23	36	103	8	13	132
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	25	39	112	9	14	143

Major/Minor	Minor1	Major1	Major2		
Conflicting Flow All	288	117	0	0	121
Stage 1	117	-	-	-	-
Stage 2	171	-	-	-	-
Critical Hdwy	6.42	6.22	-	-	4.12
Critical Hdwy Stg 1	5.42	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-
Follow-up Hdwy	3.518	3.318	-	-	2.218
Pot Cap-1 Maneuver	702	935	-	-	1467
Stage 1	908	-	-	-	-
Stage 2	859	-	-	-	-
Platoon blocked, %			-	-	-
Mov Cap-1 Maneuver	695	935	-	-	1467
Mov Cap-2 Maneuver	695	-	-	-	-
Stage 1	908	-	-	-	-
Stage 2	850	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	9.7	0	0.7
HCM LOS	A		

Minor Lane/Major Mvmt	NBT	NBRWBLn1	SBL	SBT
Capacity (veh/h)	-	-	824	1467
HCM Lane V/C Ratio	-	-	0.078	0.01
HCM Control Delay (s)	-	-	9.7	7.5
HCM Lane LOS	-	-	A	A
HCM 95th %tile Q(veh)	-	-	0.3	0

Intersection	
Intersection Delay, s/veh	9.5
Intersection LOS	A

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	40	39	14	75	304	14
Future Vol, veh/h	40	39	14	75	304	14
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	43	42	15	82	330	15
Number of Lanes	1	0	0	1	1	0

Approach	EB	NB	SB
Opposing Approach		SB	NB
Opposing Lanes	0	1	1
Conflicting Approach Left	SB	EB	
Conflicting Lanes Left	1	1	0
Conflicting Approach Right	NB		EB
Conflicting Lanes Right	1	0	1
HCM Control Delay	8.3	8.2	10.1
HCM LOS	A	A	B

Lane	NBLn1	EBLn1	SBLn1
Vol Left, %	16%	51%	0%
Vol Thru, %	84%	0%	96%
Vol Right, %	0%	49%	4%
Sign Control	Stop	Stop	Stop
Traffic Vol by Lane	89	79	318
LT Vol	14	40	0
Through Vol	75	0	304
RT Vol	0	39	14
Lane Flow Rate	97	86	346
Geometry Grp	1	1	1
Degree of Util (X)	0.122	0.112	0.407
Departure Headway (Hd)	4.525	4.712	4.236
Convergence, Y/N	Yes	Yes	Yes
Cap	793	762	854
Service Time	2.545	2.737	2.236
HCM Lane V/C Ratio	0.122	0.113	0.405
HCM Control Delay	8.2	8.3	10.1
HCM Lane LOS	A	A	B
HCM 95th-tile Q	0.4	0.4	2

Intersection	
Intersection Delay, s/veh	10
Intersection LOS	A

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	74	59	208	108	56	143
Future Vol, veh/h	74	59	208	108	56	143
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles, %	2	4	2	2	2	2
Mvmt Flow	80	64	226	117	61	155
Number of Lanes	1	0	1	0	0	1

Approach	WB	NB	SB
Opposing Approach		SB	NB
Opposing Lanes	0	1	1
Conflicting Approach Left	NB		WB
Conflicting Lanes Left	1	0	1
Conflicting Approach Right	SB	WB	
Conflicting Lanes Right	1	1	0
HCM Control Delay	9.3	10.5	9.6
HCM LOS	A	B	A

Lane	NBLn1	WBLn1	SBLn1
Vol Left, %	0%	56%	28%
Vol Thru, %	66%	0%	72%
Vol Right, %	34%	44%	0%
Sign Control	Stop	Stop	Stop
Traffic Vol by Lane	316	133	199
LT Vol	0	74	56
Through Vol	208	0	143
RT Vol	108	59	0
Lane Flow Rate	343	145	216
Geometry Grp	1	1	1
Degree of Util (X)	0.415	0.201	0.284
Departure Headway (Hd)	4.348	5.007	4.725
Convergence, Y/N	Yes	Yes	Yes
Cap	828	713	759
Service Time	2.385	3.062	2.768
HCM Lane V/C Ratio	0.414	0.203	0.285
HCM Control Delay	10.5	9.3	9.6
HCM Lane LOS	B	A	A
HCM 95th-tile Q	2.1	0.7	1.2

4: Birmingham Road & South Liberty Parkway

Future PM Peak Hour

Intersection												
Int Delay, s/veh	13.3											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	267	556	0	1	477	68	0	0	0	43	1	155
Future Vol, veh/h	267	556	0	1	477	68	0	0	0	43	1	155
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None									
Storage Length	180	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	9	2	2
Mvmt Flow	290	604	0	1	518	74	0	0	0	47	1	168

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	592	0	0	604	0	0	1446	1778	302	1439	1741	296
Stage 1	-	-	-	-	-	-	1184	1184	-	557	557	-
Stage 2	-	-	-	-	-	-	262	594	-	882	1184	-
Critical Hdwy	4.14	-	-	4.14	-	-	7.54	6.54	6.94	7.68	6.54	6.94
Critical Hdwy Stg 1	-	-	-	-	-	-	6.54	5.54	-	6.68	5.54	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.54	5.54	-	6.68	5.54	-
Follow-up Hdwy	2.22	-	-	2.22	-	-	3.52	4.02	3.32	3.59	4.02	3.32
Pot Cap-1 Maneuver	980	-	-	970	-	-	92	82	694	88	86	700
Stage 1	-	-	-	-	-	-	201	261	-	465	510	-
Stage 2	-	-	-	-	-	-	720	491	-	293	261	-
Platoon blocked, %	-	-	-	-	-	-	-	-	-	-	-	-
Mov Cap-1 Maneuver	980	-	-	970	-	-	53	58	694	68	60	700
Mov Cap-2 Maneuver	-	-	-	-	-	-	53	58	-	68	60	-
Stage 1	-	-	-	-	-	-	142	184	-	327	509	-
Stage 2	-	-	-	-	-	-	544	490	-	206	184	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	3.3	0	0	90.9
HCM LOS			A	F

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	-	980	-	-	970	-	-	229
HCM Lane V/C Ratio	-	0.296	-	-	0.001	-	-	0.945
HCM Control Delay (s)	0	10.2	-	-	8.7	0	-	90.9
HCM Lane LOS	A	B	-	-	A	A	-	F
HCM 95th %tile Q(veh)	-	1.2	-	-	0	-	-	8.2

Intersection						
Int Delay, s/veh	0.4					
Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	6	5	9	195	202	12
Future Vol, veh/h	6	5	9	195	202	12
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	0	-	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	7	5	10	212	220	13

Major/Minor	Minor2	Major1	Major2			
Conflicting Flow All	459	227	233	0	-	0
Stage 1	227	-	-	-	-	-
Stage 2	232	-	-	-	-	-
Critical Hdwy	6.42	6.22	4.12	-	-	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	2.218	-	-	-
Pot Cap-1 Maneuver	560	812	1335	-	-	-
Stage 1	811	-	-	-	-	-
Stage 2	807	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	556	812	1335	-	-	-
Mov Cap-2 Maneuver	556	-	-	-	-	-
Stage 1	805	-	-	-	-	-
Stage 2	807	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	10.6	0.3	0
HCM LOS	B		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	EBLn2	SBT	SBR
Capacity (veh/h)	1335	-	556	812	-	-
HCM Lane V/C Ratio	0.007	-	0.012	0.007	-	-
HCM Control Delay (s)	7.7	0	11.6	9.5	-	-
HCM Lane LOS	A	A	B	A	-	-
HCM 95th %tile Q(veh)	0	-	0	0	-	-

Intersection												
Int Delay, s/veh	0.7											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Traffic Vol, veh/h	6	0	4	4	0	3	9	181	7	5	209	12
Future Vol, veh/h	6	0	4	4	0	3	9	181	7	5	209	12
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None									
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	7	0	4	4	0	3	10	197	8	5	227	13

Major/Minor	Minor2		Minor1		Major1		Major2					
Conflicting Flow All	467	469	234	467	471	201	240	0	0	205	0	0
Stage 1	244	244	-	221	221	-	-	-	-	-	-	-
Stage 2	223	225	-	246	250	-	-	-	-	-	-	-
Critical Hdwy	7.12	6.52	6.22	7.12	6.52	6.22	4.12	-	-	4.12	-	-
Critical Hdwy Stg 1	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Follow-up Hdwy	3.518	4.018	3.318	3.518	4.018	3.318	2.218	-	-	2.218	-	-
Pot Cap-1 Maneuver	506	492	805	506	491	840	1327	-	-	1366	-	-
Stage 1	760	704	-	781	720	-	-	-	-	-	-	-
Stage 2	780	718	-	758	700	-	-	-	-	-	-	-
Platoon blocked, %								-	-	-	-	-
Mov Cap-1 Maneuver	499	486	805	498	485	840	1327	-	-	1366	-	-
Mov Cap-2 Maneuver	499	486	-	498	485	-	-	-	-	-	-	-
Stage 1	753	701	-	774	714	-	-	-	-	-	-	-
Stage 2	770	712	-	751	697	-	-	-	-	-	-	-

Approach	EB		WB		NB		SB	
HCM Control Delay, s	11.2		11		0.4		0.2	
HCM LOS	B		B					

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	1327	-	-	588	603	1366	-	-
HCM Lane V/C Ratio	0.007	-	-	0.018	0.013	0.004	-	-
HCM Control Delay (s)	7.7	0	-	11.2	11	7.6	0	-
HCM Lane LOS	A	A	-	B	B	A	A	-
HCM 95th %tile Q(veh)	0	-	-	0.1	0	0	-	-

12: Birmingham Road & Blythe Street

Future PM Peak Hour

Intersection												
Int Delay, s/veh	0.2											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Traffic Vol, veh/h	0	0	0	3	0	2	1	195	5	3	211	3
Future Vol, veh/h	0	0	0	3	0	2	1	195	5	3	211	3
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None									
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	0	0	0	3	0	2	1	212	5	3	229	3

Major/Minor	Minor2		Minor1		Major1		Major2					
Conflicting Flow All	455	456	231	454	455	215	232	0	0	217	0	0
Stage 1	237	237	-	217	217	-	-	-	-	-	-	-
Stage 2	218	219	-	237	238	-	-	-	-	-	-	-
Critical Hdwy	7.12	6.52	6.22	7.12	6.52	6.22	4.12	-	-	4.12	-	-
Critical Hdwy Stg 1	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Follow-up Hdwy	3.518	4.018	3.318	3.518	4.018	3.318	2.218	-	-	2.218	-	-
Pot Cap-1 Maneuver	515	501	808	516	501	825	1336	-	-	1353	-	-
Stage 1	766	709	-	785	723	-	-	-	-	-	-	-
Stage 2	784	722	-	766	708	-	-	-	-	-	-	-
Platoon blocked, %								-	-	-	-	-
Mov Cap-1 Maneuver	512	499	808	514	499	825	1336	-	-	1353	-	-
Mov Cap-2 Maneuver	512	499	-	514	499	-	-	-	-	-	-	-
Stage 1	765	707	-	784	722	-	-	-	-	-	-	-
Stage 2	781	721	-	764	706	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0	11	0	0.1
HCM LOS	A	B		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1WBLn1	SBL	SBT	SBR
Capacity (veh/h)	1336	-	-	-	605	1353	-
HCM Lane V/C Ratio	0.001	-	-	-	0.009	0.002	-
HCM Control Delay (s)	7.7	0	-	0	11	7.7	0
HCM Lane LOS	A	A	-	A	B	A	A
HCM 95th %tile Q(veh)	0	-	-	-	0	0	-

Intersection						
Int Delay, s/veh	0.4					
Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	3	7	12	255	192	8
Future Vol, veh/h	3	7	12	255	192	8
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	3	8	13	277	209	9

Major/Minor	Minor2	Major1		Major2	
Conflicting Flow All	517	214	218	0	0
Stage 1	214	-	-	-	-
Stage 2	303	-	-	-	-
Critical Hdwy	6.42	6.22	4.12	-	-
Critical Hdwy Stg 1	5.42	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-
Follow-up Hdwy	3.518	3.318	2.218	-	-
Pot Cap-1 Maneuver	518	826	1352	-	-
Stage 1	822	-	-	-	-
Stage 2	749	-	-	-	-
Platoon blocked, %				-	-
Mov Cap-1 Maneuver	512	826	1352	-	-
Mov Cap-2 Maneuver	512	-	-	-	-
Stage 1	813	-	-	-	-
Stage 2	749	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	10.2	0.3	0
HCM LOS	B		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	1352	-	698	-	-
HCM Lane V/C Ratio	0.01	-	0.016	-	-
HCM Control Delay (s)	7.7	0	10.2	-	-
HCM Lane LOS	A	A	B	-	-
HCM 95th %tile Q(veh)	0	-	0	-	-

Intersection						
Int Delay, s/veh	1.5					
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations	Y		B			A
Traffic Vol, veh/h	37	11	201	57	18	163
Future Vol, veh/h	37	11	201	57	18	163
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	40	12	218	62	20	177

Major/Minor	Minor1	Major1	Major2		
Conflicting Flow All	466	249	0	0	280
Stage 1	249	-	-	-	-
Stage 2	217	-	-	-	-
Critical Hdwy	6.42	6.22	-	-	4.12
Critical Hdwy Stg 1	5.42	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-
Follow-up Hdwy	3.518	3.318	-	-	2.218
Pot Cap-1 Maneuver	555	790	-	-	1283
Stage 1	792	-	-	-	-
Stage 2	819	-	-	-	-
Platoon blocked, %			-	-	-
Mov Cap-1 Maneuver	546	790	-	-	1283
Mov Cap-2 Maneuver	546	-	-	-	-
Stage 1	792	-	-	-	-
Stage 2	805	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	11.7	0	0.8
HCM LOS	B		

Minor Lane/Major Mvmt	NBT	NBRWBLn1	SBL	SBT
Capacity (veh/h)	-	-	588	1283
HCM Lane V/C Ratio	-	-	0.089	0.015
HCM Control Delay (s)	-	-	11.7	7.8
HCM Lane LOS	-	-	B	A
HCM 95th %tile Q(veh)	-	-	0.3	0

Intersection						
Int Delay, s/veh	1.7					
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	16	26	178	34	42	165
Future Vol, veh/h	16	26	178	34	42	165
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	17	28	193	37	46	179

Major/Minor	Minor1	Major1	Major2		
Conflicting Flow All	483	212	0	0	230
Stage 1	212	-	-	-	-
Stage 2	271	-	-	-	-
Critical Hdwy	6.42	6.22	-	-	4.12
Critical Hdwy Stg 1	5.42	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-
Follow-up Hdwy	3.518	3.318	-	-	2.218
Pot Cap-1 Maneuver	542	828	-	-	1338
Stage 1	823	-	-	-	-
Stage 2	775	-	-	-	-
Platoon blocked, %			-	-	-
Mov Cap-1 Maneuver	521	828	-	-	1338
Mov Cap-2 Maneuver	521	-	-	-	-
Stage 1	823	-	-	-	-
Stage 2	746	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	10.7	0	1.6
HCM LOS	B		

Minor Lane/Major Mvmt	NBT	NBRWBLn1	SBL	SBT
Capacity (veh/h)	-	-	676	1338
HCM Lane V/C Ratio	-	-	0.068	0.034
HCM Control Delay (s)	-	-	10.7	7.8
HCM Lane LOS	-	-	B	A
HCM 95th %tile Q(veh)	-	-	0.2	0.1

Intersection	
Intersection Delay, s/veh	10
Intersection LOS	A

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	27	27	46	289	172	45
Future Vol, veh/h	27	27	46	289	172	45
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	29	29	50	314	187	49
Number of Lanes	1	0	0	1	1	0

Approach	EB	NB	SB
Opposing Approach		SB	NB
Opposing Lanes	0	1	1
Conflicting Approach Left	SB	EB	
Conflicting Lanes Left	1	1	0
Conflicting Approach Right	NB		EB
Conflicting Lanes Right	1	0	1
HCM Control Delay	8.5	10.8	9.1
HCM LOS	A	B	A

Lane	NBLn1	EBLn1	SBLn1
Vol Left, %	14%	50%	0%
Vol Thru, %	86%	0%	79%
Vol Right, %	0%	50%	21%
Sign Control	Stop	Stop	Stop
Traffic Vol by Lane	335	54	217
LT Vol	46	27	0
Through Vol	289	0	172
RT Vol	0	27	45
Lane Flow Rate	364	59	236
Geometry Grp	1	1	1
Degree of Util (X)	0.44	0.082	0.284
Departure Headway (Hd)	4.351	5.025	4.332
Convergence, Y/N	Yes	Yes	Yes
Cap	830	712	830
Service Time	2.37	3.061	2.352
HCM Lane V/C Ratio	0.439	0.083	0.284
HCM Control Delay	10.8	8.5	9.1
HCM Lane LOS	B	A	A
HCM 95th-tile Q	2.3	0.3	1.2

**APPENDIX C.2
STRATA DEVELOPMENT TRAFFIC
IMPACT STUDY**

Strata Underground

TRAFFIC IMPACT STUDY

December 18, 2024

Prepared For:
Strata Underground, LLC

Prepared By:
Priority Engineers, Inc.
PO Box 563
Garden City, MO 64747



12-18-24



December 18, 2024

Mr. Bob Parks, PE
Weiskirch & Parks Engineers Inc

Re: Strata Underground Traffic Impact Study – Liberty, MO

Dear Mr. Parks:

In response to your request, Priority Engineers, Inc. has completed a traffic impact study for the above referenced project. The purpose of the analysis is to determine the existing traffic impacts associated with this development on the intersections and streets surrounding this site, primarily during the AM and PM peak hours. The following report documents our analysis and recommendations.

We appreciate the opportunity to work with you on this project. Please contact us with any questions or if you require additional information.

Sincerely,

PRIORITY ENGINEERS, INC.

A handwritten signature in blue ink that reads 'Kristin L. Skinner'.

Kristin L. Skinner, P.E., PTOE
President

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1) INTRODUCTION

The purpose of this study is to examine the potential traffic impacts associated with the proposed Strata Underground development to take place on the existing Liberty Aggregates site located at the southwest corner of Missouri 291 Highway and Old Highway 210/Southview Drive.

The study area is shown in Figure 1. The site layout is shown in Figure 2.

2) EXISTING CONDITIONS

The existing site is located on the southwest corner of Missouri 291 Highway and Old Highway 210/Seven Hills Road. Liberty Aggregates had a traffic impact study performed by Priority Engineers, Inc dated March 3, 2016. This study was performed prior to the commencement of operations by Liberty Aggregates. Subsequent to the previous study, the existing building that was previously used seasonally for fireworks has become a BesaMe Wellness Marijuana Dispensary.

Missouri 291 Highway is a four-lane divided highway with a posted speed limit of 55 miles per hour. The intersection of Missouri 291 Highway with Old Highway 210/Southview Road is an unsignalized crossover with north and southbound left turn lanes. Old Highway 210 is a two-lane road with a posted speed limit of 35 miles per hour. East and westbound traffic is stop controlled at the intersection with Missouri 291 Highway. The Mid-America Regional Council (MARC) has assigned the roadways included in this report the following functional classifications: MO 291 Freeway/Expressway, Old Highway 210 and Southview Road.

Surrounding this site is primarily vacant. To the south, the site is bordered by railroad tracks and property that is used for agricultural and agricultural uses and a sports complex. Immediately to the east, the intersection with Seven Hills Road, Southview Road terminates.

Does the count data being taken so late in November impact the volume? I expect need for aggregates slows down the closer to winter you get and therefore might not be typical.

If the site operates from 7-4 and is a primary user are you not missing employees coming in prior to 7:00 if you start your counts right at 7:00? i.e. your PM peak is 30 minutes after they close up which might imply the AM peak would shift earlier

Peak Hour turning movement traffic counts for the intersections of Missouri Highway 291 and Old Highway 210 / Southview Drive and at Southview Drive at the intersection of the crossover were conducted on Wednesday, November 29th, 2023. Counts were conducted between 7:00 and 9:00 AM and from 3:30 to 6:00 PM. The AM peak hour was determined to be from 7:00 to 8:00 AM. The Liberty Aggregates operates from 7:00 AM to 4:00 PM. The PM Peak Hour of the study area was found to be 4:30 to 5:30.

The peak hour traffic volumes and existing lane configurations are shown in Figures 3-7.

3) EXISTING DEVELOPMENT

The Liberty Aggregates site is a 250-acre underground mine. Access to the inventory is through Southview Drive, which allows entering trucks to drive straight when turning into the site from Missouri Highway 291. On-site employees have office space located off of Southview Drive south of the inventory access. BesaMe Wellness Marijuana Dispensary is located south of the inventory access for Liberty Aggregates and to the north of the Office Space for liberty aggregates. There are two drives to the south of the inventory access for Liberty Aggregates and the drives are configured such that internal circulation is possible between the two properties. BesaMe Wellness operates from 9:00 AM to 9:00 PM on typical weekdays.

4) EXISTING TRIP GENERATION & TRIP DISTRIBUTION

Both Liberty Aggregates and BesaMe Wellness Marijuana Dispensary are currently in operation and the traffic counts that were discussed in Section 2 of this report include traffic arriving at and exiting both businesses onto the adjacent roadway network. The BesaMe driveway does have interconnectivity with the Liberty Aggregates access, but traffic between the two is not likely. It appears that BesaMe is generating trips similar to what would be estimated using the ITE Trip Generation Manual for a 3,750 square foot marijuana dispensary (ITE Code 822) in the PM Peak Hour. The AM Peak Hour, from 7:00 to 8:00 AM, occurs before BesaMe Wellness opens at 9:00 AM.

Table 1: BesaMe Estimated Generation								
Land Use	Intensity	Daily	AM Peak			PM Peak		
			Total	In	Out	Total	In	Out
Marijuana Dispensary	3,750 SF	792	40	21	19	71	35	36
Total			40	21	19	71	35	36

Since the Capital Federal Sports Complex on Old Highway 210 was not in operation due to the seasonal nature of the sports played, the estimated traffic volumes generated by the sports complex in the previously approved study were added to the existing traffic volumes to analyze how the study intersections operate with the additional of sports complex traffic. These volumes included in Figure 3 of Appendix I.

5) PROPOSED DEVELOPMENT

Liberty Aggregates will cease current truck haulage operations by the end of April 2026. The proposed Strata Underground will redevelop existing, underground limestone mines into approximately 4,000,000 square foot of total area including service easements and travel ways, with approximately 3,262,000 SF of leasable space to be used as office and storage space. This redevelopment is expected to take up to 20 years, and approximately 10% of the available space is expected to be redeveloped within the next five years. The Kansas City region has a significant historical redevelopment of underground mines.

The proposed underground storage facility will utilize the existing site drives that connect it to the adjacent roadway network.

6) PROPOSED TRIP GENERATION

Underground Storage Facilities that are created from underground mining operations typically have a Gross Floor Area GFA much larger than related above ground land uses. The ITE trip generation database indicates the data range for Land Use 150 (Warehousing) has an average GFA of 292 KSF with an upper data limit of under 600 KSF.

Since the proposed development is significantly larger than comparable data within the ITE database, three local comparable sites were selected to observe to get an accurate trip generation estimate in accordance with the guidance within the ITE publication TRIP GENERATION HANDBOOK, 3rd Edition. These sites were:

Are they comparable in the fact that they are mines that were developed or in their end usage?

Strata Underg

- Carefree Industrial Park at 1600 North State Route 291, Independence, MO
- Space Center Executive Park at 1550 S Geospace Drive, Independence, MO
- Space Center Summit at 200 NW Space Center Drive, Lee's Summit, MO

The client provided information estimating the size of each facility as follows: Carefree Industrial Park (4.2 million SF), Space Center Executive Park (6.5 million SF), Space Center Summit (2.7 million SF).

Were these actual counts?

A twenty-four-hour observation on a normal weekday at each facility resulted in the following trip generation rates:

Table 2: Twenty-Four Hour Trip Generation								
Location	Total Trips	Entering	Exiting	Entering %	Exiting %	Truck %	Trips per 1,000 SF	Truck Trips per 1,000 SF
Carefree Industrial Park	1148	580	568	50.5	49.5	30	0.2733	0.0819
Space Center Executive Park	1957	985	972	50.3	49.7	20.9	0.3011	0.0631
Space Center Summit	1424	710	714	49.9	50.1	2.1	0.5274	0.01111
Average				50.2	49.8	17.7	0.33799	0.05851

Table 3: AM Peak Hour of Adjacent Street								
Location	Total Trips	Entering	Exiting	Entering %	Exiting %	Truck %	Trips per 1,000 SF	Truck Trips per 1,000 SF
Carefree Industrial Park	121	102	19	84.3	15.7	20.7	0.02881	0.005952
Space Center Executive Park	116	89	27	76.7	23.2	19	0.01785	0.003385
Space Center Summit	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Average				80.5	19.5	19.9	0.02215	0.004393

Table 4: AM Peak Hour of the Generator								
Location	Total Trips	Entering	Exiting	Entering %	Exiting %	Truck %	Trips per 1,000 SF	Truck Trips per 1,000 SF
Carefree Industrial Park	121	102	19	84.3	15.7	20.7	0.02881	0.005952
Space Center Executive Park	250	197	53	78.8	21.2	7.2	0.03846	0.002769
Space Center Summit	204	188	16	92.2	7.8	0	0.07556	0.000000
Average				85.1	14.9	9.3	0.04291	0.003507

Table 5: PM Peak Hour of Adjacent Street								
Location	Total Trips	Entering	Exiting	Entering %	Exiting %	Truck %	Trips per 1,000 SF	Truck Trips per 1,000 SF
Carefree Industrial Park	152	16	136	10.5	89.5	12.5	0.03619	0.004524
Space Center Executive Park	120	29	91	24.2	75.8	12.5	0.01846	0.002308
Space Center Summit	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Average				17.4	82.7	12.5	0.02542	0.003178

Table 6: PM Peak Hour of the Generator								
Location	Total Trips	Entering	Exiting	Entering %	Exiting %	Truck %	Trips per 1,000 SF	Truck Trips per 1,000 SF
Carefree Industrial Park	121	102	19	84.3	15.7	20.7	0.02881	0.004524
Space Center Executive Park	250	197	53	78.8	21.2	7.2	0.03846	0.002308
Space Center Summit	328	117	211	35.6	64.3	0.1	0.12148	0.000741
Average				66.2	33.7	9.3	0.05216	0.003433

*Note that due to ongoing construction with road closures on Lee's Summit Road an accurate determination of the peak hour of the adjacent street could not be made.

Which facility does this comment apply to?

Using the comparable sites to estimate the trip generation, the underground Storage facility is anticipated to generate the new trips estimated in Table 7 below:

Table 7: Full Build Trip Generation								
Land Use	Intensity	Daily	AM Peak			PM Peak		
			Total	In	Out	Total	In	Out
Underground Storage facility	3,260,000 SF	1102	72	60	12	83	14	69
Truck Trips		195	14	12	2	7	2	9
Total New Trips		1297	72	60	12	83	14	69

Approximately 10% of the potential development is expected to be constructed within five years. This volume is shown in Table 8 below.

You mentioned office space in the above paragraphs but here are only considering storage space. Those are two different uses with different volumes.

Table 8: Five year Trip Generation (2030 Design Year)								
<i>Land Use</i>	<i>Intensity</i>	<i>Daily</i>	<i>AM Peak</i>			<i>PM Peak</i>		
			<i>Total</i>	<i>In</i>	<i>Out</i>	<i>Total</i>	<i>In</i>	<i>Out</i>
Underground Storage facility	326,000 SF	110	7	6	1	8	1	7
<i>Truck Trips</i>		19	1	1	0	1	0	1
Total New Trips		110	7	6	1	8	1	7

7) TRIP DISTRIBUTION

The new trips anticipated by the underground storage facility were distributed onto the adjacent roadway network as follows:

Passenger Vehicles

- 55 percent to/from the north on Missouri Highway 291
- 45 percent to/from the south on Missouri Highway 291

Truck Traffic

- 10 percent to/from the north on Missouri Highway 291
- 90 percent to/from the south on Missouri Highway 291

In addition to adding the new trips onto the adjacent roadway network, the Liberty Aggregate trips were removed. This reduction applied only to the AM Peak Hour since Liberty Aggregates is not in operation during the PM Peak Hour. To generate the 2030 scenario in which 10% of Strata Underground has been developed, a 2% annual background growth was added to the MO-291 traffic volumes for seven years. The resulting volumes are illustrated in Figures 6 and 7 of Appendix I.

8) LEVEL OF SERVICE AND VOLUME/CAPACITY ANALYSES

Capacity analysis was used to quantify the impacts of the increased traffic on the intersections studied. The methodology outlined in the Highway Capacity Manual, 7th Edition, was used as a basis to perform the analysis for this study. Capacity analysis defines the quality of traffic operation for an intersection using a grading system called Level of Service (LOS). The LOS is defined in terms of average vehicle delay. Levels of service A through F have been established with A representing the best and F the worst.

Table 9: Level of Service Definitions		
Level of Service	Unsignalized Intersection	Signalized Intersection
A	< 10 Seconds	< 10 Seconds
B	< 15 Seconds	< 20 Seconds
C	< 25 Seconds	< 35 Seconds
D	< 35 Seconds	< 55 Seconds
E	< 50 Seconds	< 80 Seconds
F	≥ 50 Seconds	≥ 80 Seconds

The study intersections were evaluated using Synchro, an analysis package based in part on Highway Capacity Manual methods. In all scenarios, the intersection of the access to Southview Drive was modeled as a two way stop controlled intersection for the purposes of Synchro simulation. The analysis reports are included in Appendix II.

Existing Conditions

The levels of service, lane configuration, and queue lengths for existing conditions are shown in Figures 4 and 5 in Appendix I. Note that this scenario includes the existing development plus an estimated traffic volume for the Capital Federal Sports Complex.

North and southbound MO-291 experience free flow traffic with negligible delays caused by right turning vehicles in both Peak Hours. The left turning movements for both northbound and southbound MO-291 experience levels of service C or better in both peak hours. The stop controlled left turning movements for both eastbound and westbound OLD Highway 210 experience levels of delay associated with a level of service F in both peak hours but the PM Peak Hour exceeds 300 seconds. The westbound through and right turning movement group performs with a level of service E in the PM peak hour.

Proposed 2030 Conditions

The levels of service, lane configuration, and queue lengths for proposed 2030 conditions, with 10% of Strata Underground, 2% annual background growth applied to MO-291, and with the closure of Liberty Aggregates, are shown in Figures 8 and 9 in Appendix I.

If unsignalized, the intersection of MO-291 and Old State Highway 210 will continue to experience low levels for the east and west bound movements in the peak hours. In the PM Peak Hour, the eastbound left turning design queue will increase from 5.5 vehicles to 6.9 vehicles.

Two potential alternatives are shown in Figures 8 and 9. If signalized, the intersection of Old State Highway 210 and MO-291 has an overall level of service A in the AM Peak Hour and an overall level of service C in the PM Peak Hour. If reconfigured as a ¾ access intersection, which would restrict east and westbound left turning movements, individual movement groups have a level of service C or better with the exception of the westbound movement which will be a level of service E with a 3.6 vehicle design queue.

9) FUTURE (FULL-BUILD) CONDITIONS

A future scenario was created in order to estimate traffic volumes through study intersections in the year 2043 and with the full build out of Strata Underground. While MARC 2040 projections indicate a 1% growth rate for the City of Liberty in general, a review of MoDOT historical traffic

volume data indicates a growth rate of 2.07% per year for the time period between 2000 and 2022. A 2% growth factor was applied to background traffic volumes to generate this scenario which is illustrated in Figures 12 and 13 in Appendix I.

If background traffic volumes continue to increase at a two percent per year rate, additional capacity on MO-291 will be necessary for a signalized intersection at Old State Highway 210 and MO-291. This is a result of traffic growth and not the proposed development. With the additional lane in each direction on MO-291 the overall level of service at this intersection will be a B in the AM Peak Hour and a level of service C in the PM Peak Hour. If this intersection is configured as a ¾ access, without additional lanes, the westbound movement has a level of service F with a 170.8 second average delay and a design queue length exceeding 11 vehicles in the PM Peak Hour. Similarly, configured as a ¾ access intersection, the southbound left turning movement is a level of service F with a 190.4 second average delay and a 13.7 vehicle design queue length. Maintaining the existing configuration of this intersection in the future is not advisable due to the poor levels of service for the eastbound and westbound approaches.

In addition to the future scenario, a future “no-build” scenario has been provided. In this scenario, it is assumed that Strata Underground has not been constructed, that Liberty Aggregates is no longer in operation, but that BesaMe Wellness is still operating. This scenario is illustrated in Figure 16 and 17 of Appendix I. In the no-build scenario, with no improvements to the intersection, the southbound left turn will operate at a level of service F in the PM Peak Hour with a 13.7 vehicle design queue and an average delay of 190.4 seconds. With no improvements, the westbound left turn lane will operate at a level of service F in the PM Peak Hour with a 12.2 vehicle design queue and an average delay exceeding 300 seconds.

10) SIGNAL WARRANT ANALYSIS

EPG Section 902.3.4 was consulted to determine if the signal warrants would be met by either existing or proposed conditions. To determine the existing scenario, the AM Peak Hour generation was applied to both the time period of 7 to 8 AM and 8 to 9 AM and the PM Peak Hour generation was applied to both the time period of 4 to 5 PM and 5 to 6 PM. Table 10 below documents the traffic volumes:

Table 10: Four Hour Signal Warrant Traffic Volumes								
Time Period	Existing Traffic				Existing +Proposed			
	SB 291	NB 291	WB Old 210	EB Old 210	SB 291	NB 291	WB Old 210	EB Old 210
7-8 AM	874	972	26	15	1005	1111	30	1
8-9 AM	663	816	20	16	762	931	23	1
4-5 PM	1371	1376	132	40	1577	1583	152	53
5-6 PM	1329	1283	143	41	1528	1476	164	54

At the 70 percent factor (to account for the speed of traffic on MO-291) the warrant’s threshold is met at two out of four hours in both the existing and proposed development scenarios, both of which are based on the westbound traffic. At this location, the volumes on MO-291 are high, and the peak hour threshold is met when the side street volume reaches 80 vehicles in an hour. This volume is not met based upon eastbound traffic volumes. It is probable that other afternoon and evening hours may be met based on westbound traffic volumes.

11) AUXILIARY TURN LANES

Section 940.9.9 of the Missouri Department of Transportation Engineering Policy Guide was consulted to analyze the necessity of improvements associated with the existing traffic volumes on Southbound MO-291. Figure 18 of Appendix I documents the associated traffic volumes. The right turn lane guideline is exceeded in the Existing PM Peak Hour due to the traffic generated by the BesaMe Wellness Marijuana Dispensary. In the 2030 design year, the AM Peak Hour guideline would not be met.

12) RECOMMENDATIONS & CONCLUSIONS

This study documents both the impact of the Strata Underground redevelopment on the adjacent roadway during the AM and PM peak hours in both the 2030 and 2043 design years.

Existing Conditions

Data was collected in 2023 with both Liberty Aggregates and BesaMe Wellness operating during their normal business hours.

- The intersection of Old 210 and MO-291 currently experiences undesirable levels of service for eastbound and westbound left turning movements
- MoDOT southbound right turn lane guidelines are currently met in the PM Peak Hour due to BesaMe Wellness traffic (Liberty Aggregates is closed during this time period)
- At least two of the four hours are met for the MUTCD Signal Warrant 2 based on westbound traffic volumes

Proposed (2030) Conditions

This scenario assumes a 2% background growth rate for seven years, the closure of Liberty Aggregates, and 10% of Strata Underground developed.

- The intersection of Old 210 and MO-291 experiences undesirable levels of service for eastbound and westbound left turning movements
- If the intersection were reconfigured to a $\frac{3}{4}$ access, it would perform at acceptable levels of service except for the westbound movement in the PM Peak Hour, which would improve to a level of service E
- A signal could also improve levels of service, but may cause capacity concerns in the future

Future (2043) Conditions

This scenario assumes a 2% background growth rate for twenty years, the closure of Liberty Aggregates, and 100% of Strata Underground developed.

- Without improvements, east and westbound movements continue to experience low levels of service with increasing delays and queues
- Without improvements, the southbound left turn lane experiences a level of service F in the PM Peak Hour with design queues approaching 14 vehicles
- If restricted to $\frac{3}{4}$ access, eastbound will function at a level of service E with a 4.0 vehicle design queue in the PM Peak Hour, while the westbound and southbound left will function at a level of service F
- If signalized, this intersection will fail in the future without additional through lanes on MO-291

Future No-Build Conditions

This scenario assumes a 2% background growth rate for twenty years, the closure of Liberty Aggregates, and no redevelopment occurring on the former Liberty Aggregates site.

- Without improvements, east and westbound movements continue to experience low levels of service with increasing delays and queues
- Without improvements, the southbound left turn lane experiences a level of service F in the PM Peak Hour with design queues approaching 14 vehicles
- If restricted to $\frac{3}{4}$ access, eastbound will function at a level of service D with a 1.3 vehicle design queue in the PM Peak Hour, while the westbound and southbound left will function at a level of service F
- If signalized, this intersection will fail in the future without additional through lanes on MO-291

In summary, the intersection of Old 210 and MO-291 currently experiences undesirable levels of service for the east and westbound left turning movements. As volumes increase on MO-291 increase, delays and queues will also increase if improvements are not made. Signalization of this intersection may cause significant delays in the future if additional north and southbound lanes are not added to MO-291. Limiting the intersection to a $\frac{3}{4}$ access would provide some improvements to delays. For all scenarios, the east leg of the intersection has higher volumes and experiences greater delays than the west leg. While the Strata Underground redevelopment project will add additional traffic to the west leg of the intersection, all traffic concerns listed will remain in the absence of this development.

APPENDIX I

Project Location	Figure 1
Existing AM Peak Hour Traffic Volumes	Figure 2
Existing PM Peak Hour Traffic Volumes	Figure 3
Existing AM Peak Hour Lane Configurations & Levels of Service	Figure 4
Existing PM Peak Hour Lane Configurations & Levels of Service	Figure 5
Existing + 10% Proposed Underground (2030 Design Year) AM Peak Hour Traffic Volumes	Figure 6
Existing + 10% Proposed Underground (2030 Design Year) PM Peak Hour Traffic Volumes	Figure 7
Existing + 10% Proposed Underground (2030 Design Year) AM Peak Hour Lane Configurations & Levels of Service	Figure 8
Existing + 10% Proposed Underground (2030 Design Year) PM Peak Hour Lane Configurations & Levels of Service	Figure 9
Future (2043) AM Peak Hour Traffic Volumes	Figure 10
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Future (2043) AM Peak Hour Lane Configurations & Levels of Service	Figure 12
Future (2043) PM Peak Hour Lane Configurations & Levels of Service	Figure 13
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Future (2043) No-Build AM Peak Hour Lane Configurations & Levels of Service	Figure 16
Future (2043) No-Build PM Peak Hour Lane Configurations & Levels of Service	Figure 17
Right Turn Guideline for Four-Lane Roadways (MoDOT EPG 940.9.9)	Figure 18



Project Location

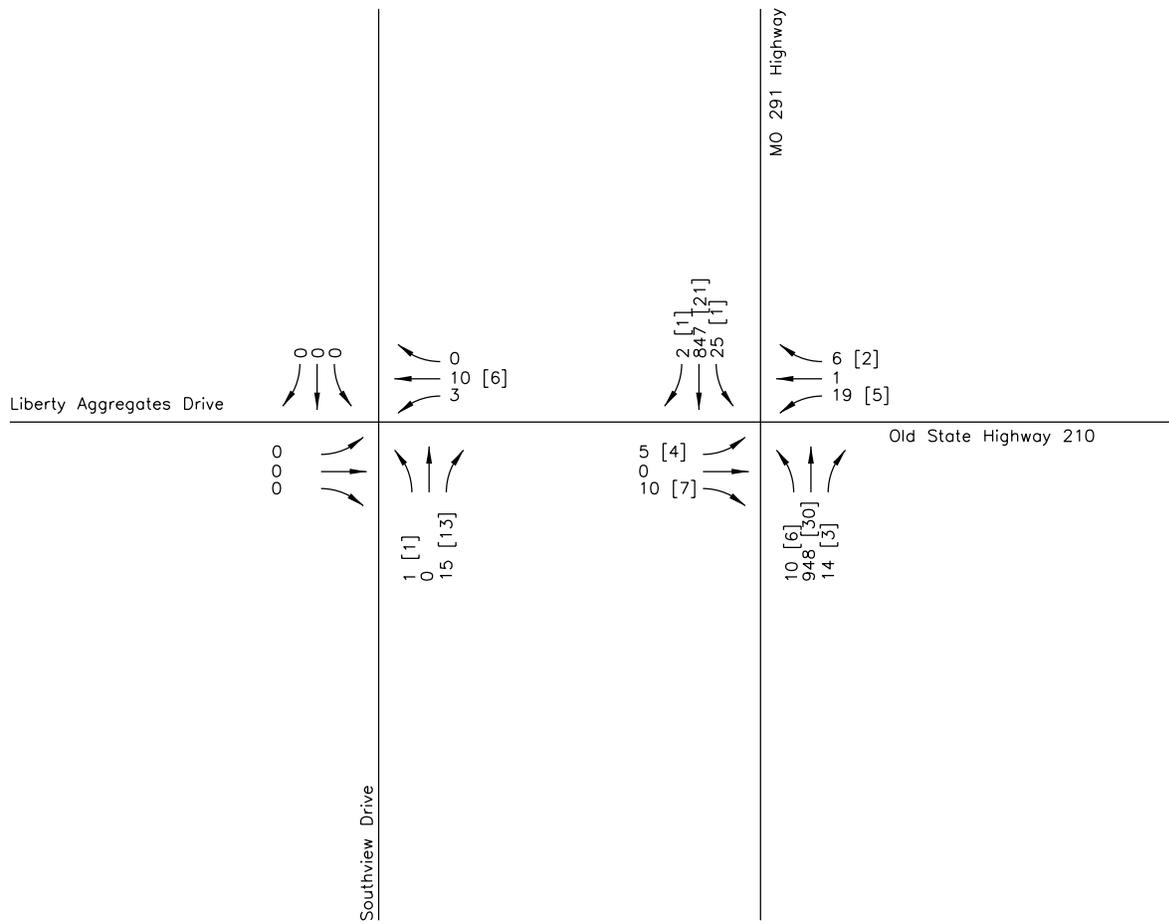
Project Location

Strata Underground
Liberty, MO

No Scale

Figure 1





LEGEND

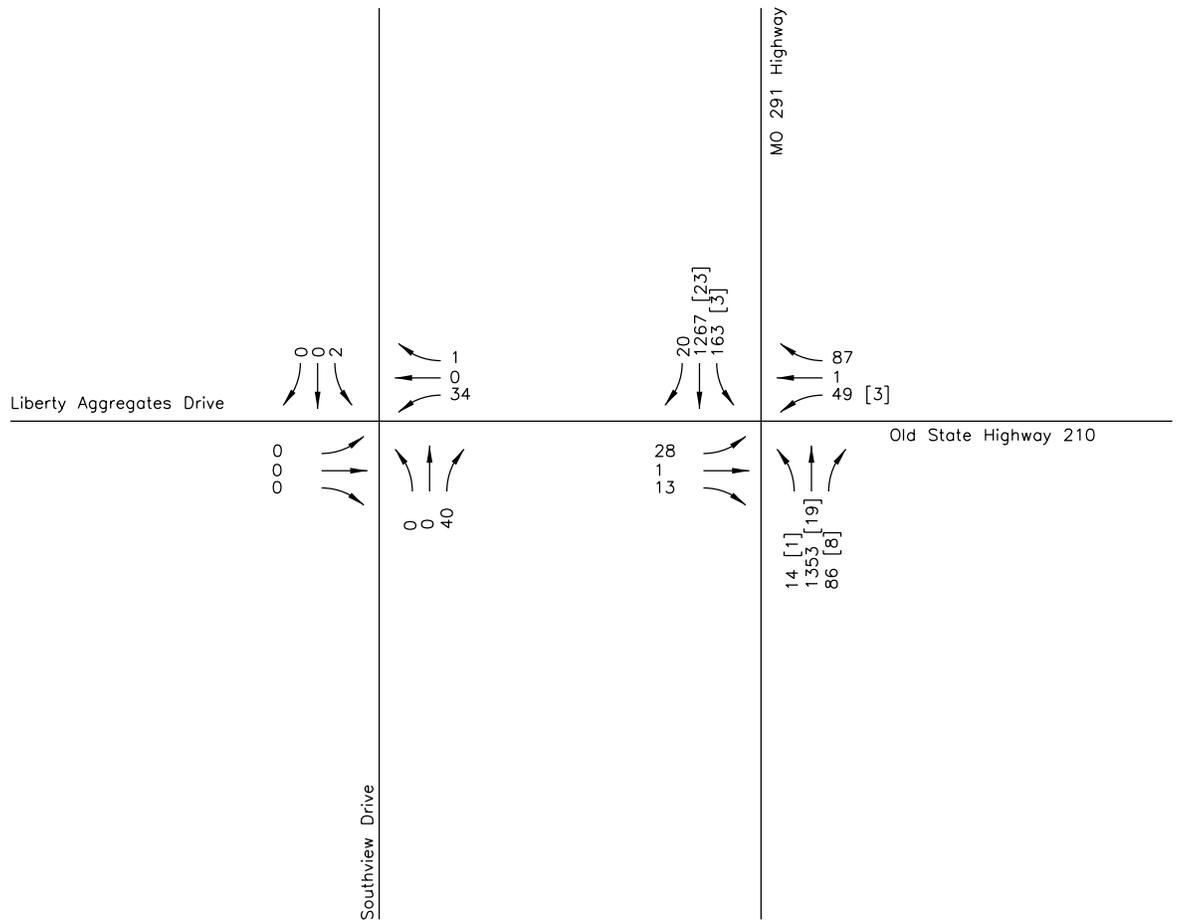
 Total Volume [Trucks]

Existing AM Peak Hour
Traffic Volumes

Strata
Underground
Liberty, MO

No Scale
Figure 2





LEGEND

 Total Volume (Site Generated)[Trucks]

Existing PM Peak Hour
Traffic Volumes

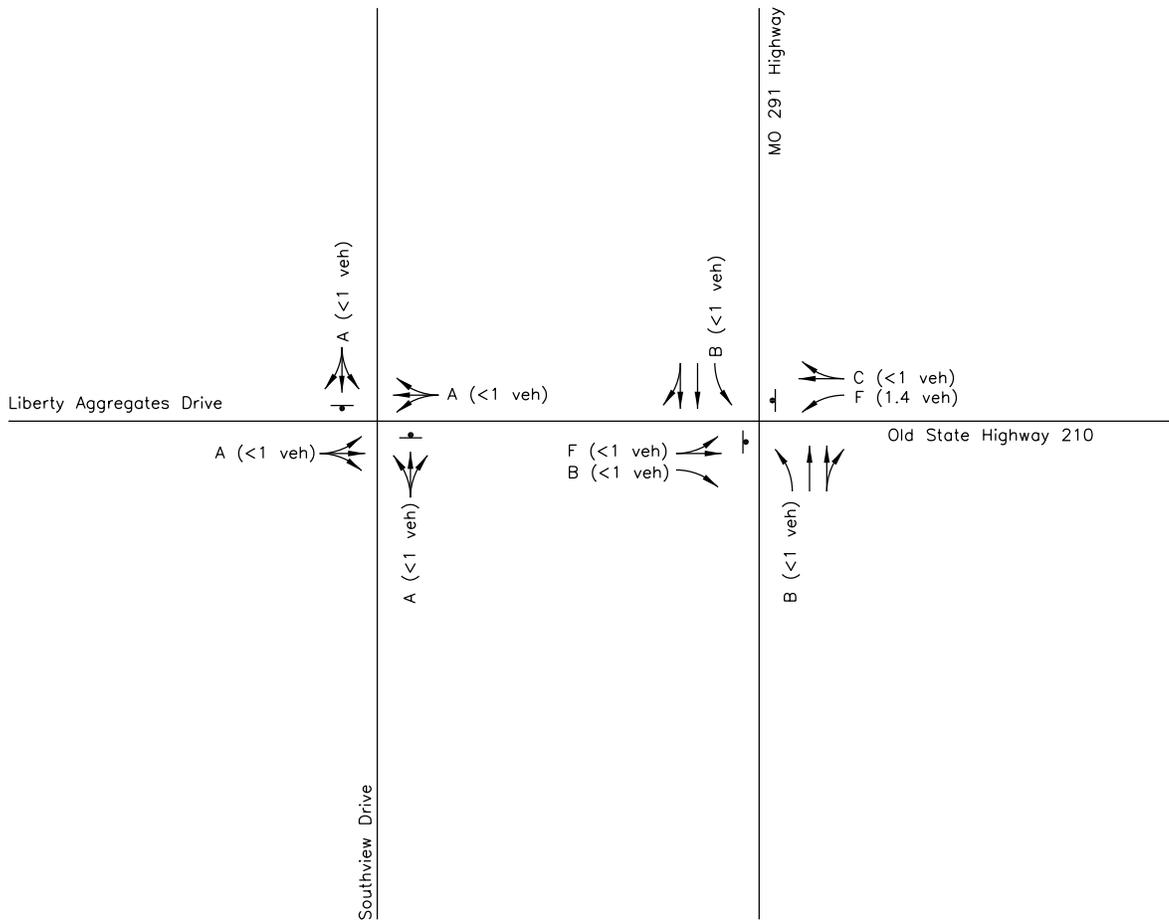
Strata
Underground
Liberty, MO

No Scale

Figure 3



Priority
ENGINEERS



LEGEND

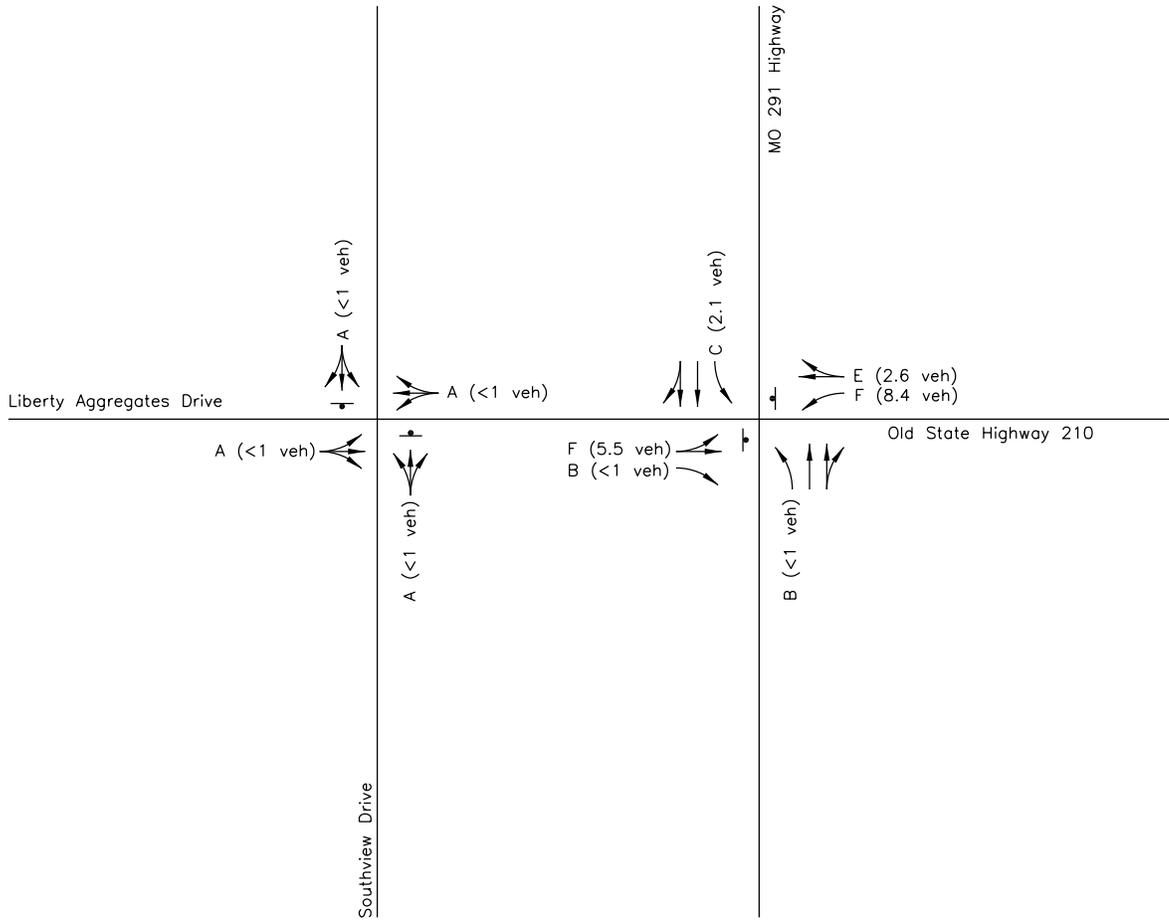
- HCM LOS (95th Percentile Queue in Vehicles)
- Stop Sign
- Traffic Signal LOS

Existing AM Peak Hour
Lane Configurations &
Levels of Service

Strata
Underground
Liberty, MO

No Scale
Figure 4





LEGEND

-  HCM LOS (95th Percentile Queue in Vehicles)
-  Stop Sign
-  Traffic Signal LOS

Existing PM Peak Hour
Lane Configurations &
Levels of Service

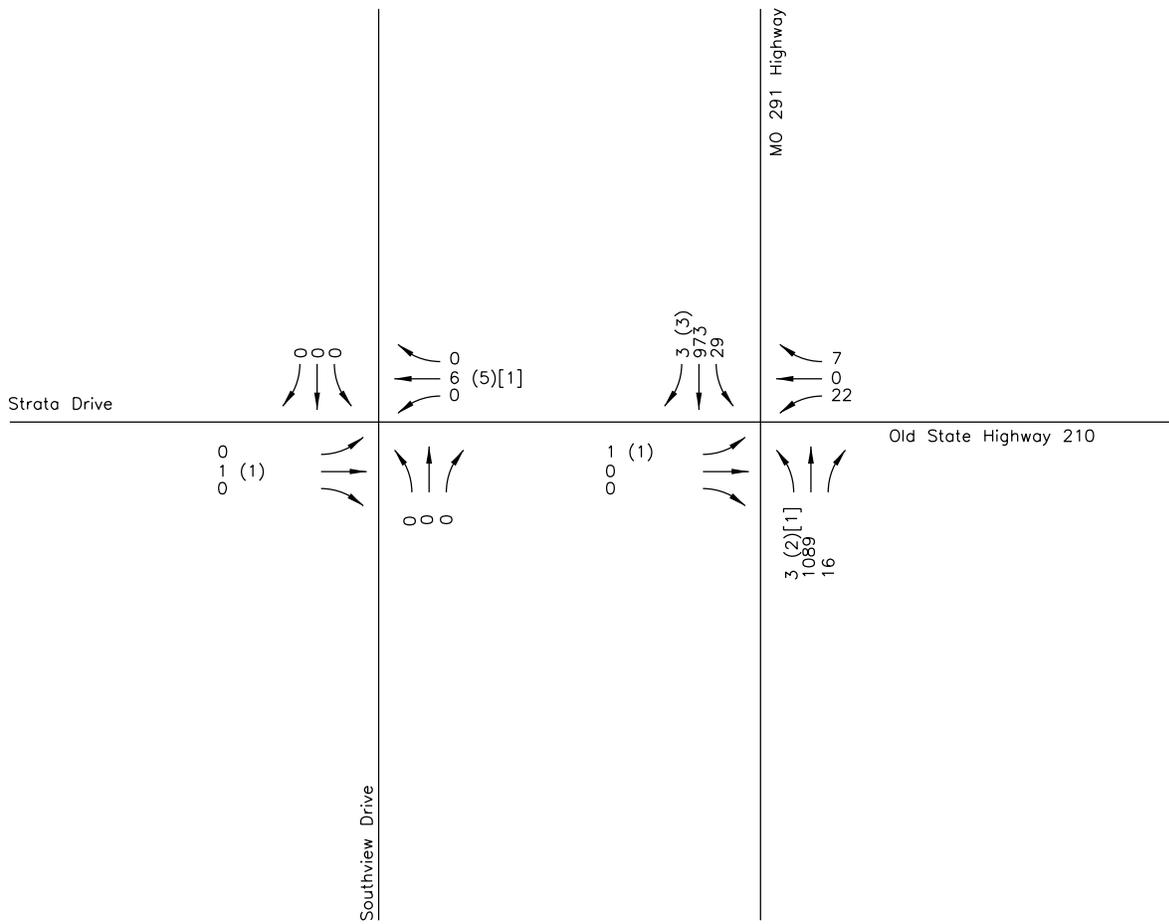
Strata
Underground
Liberty, MO

No Scale

Figure 5



Priority
ENGINEERS



LEGEND


 Total Volume (Development Passenger Cars)[Development Trucks]

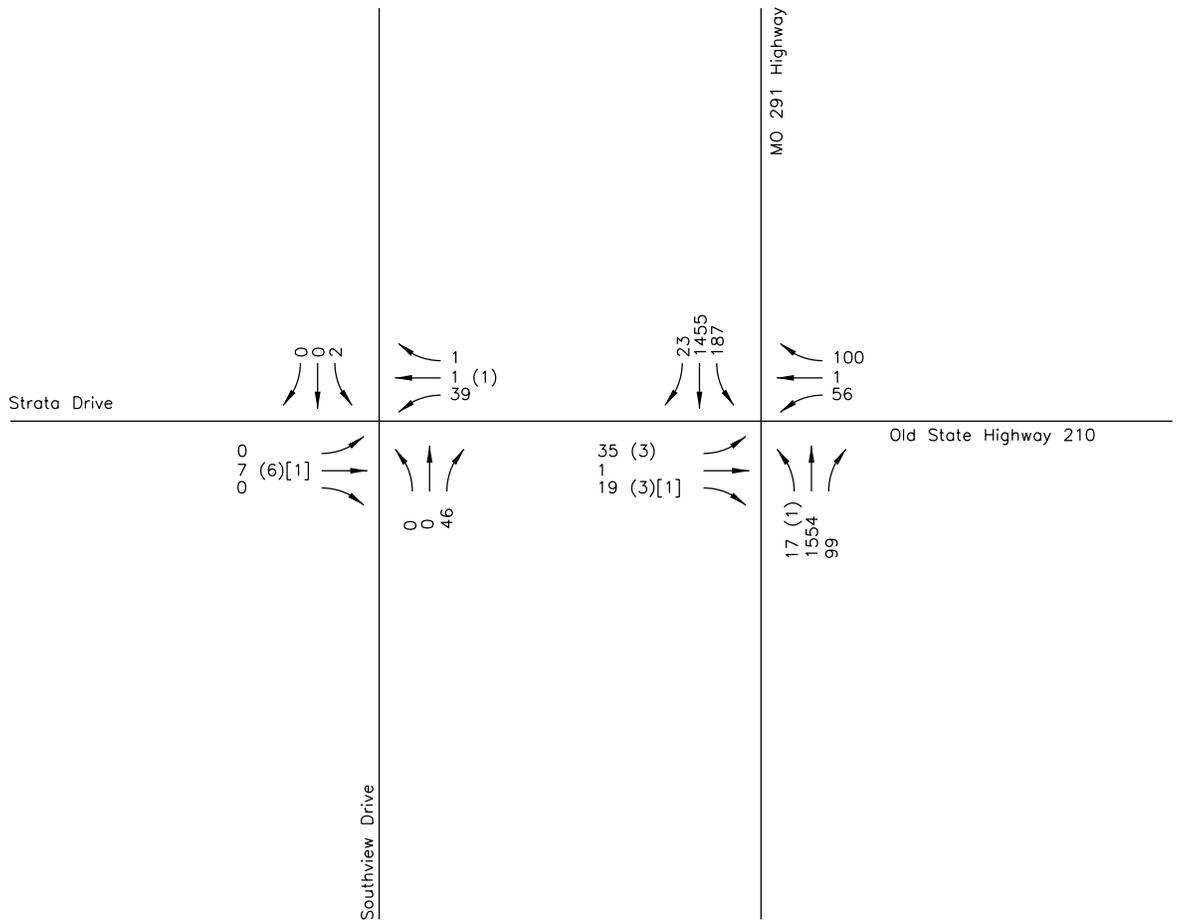
Existing + 10% Proposed Underground
(2030 Design Year)
AM Peak Hour
Traffic Volumes

Strata
Underground
Liberty, MO

No Scale

Figure 6





LEGEND



Total Volume (Development Passenger Cars)[Development Trucks]

Existing + 10% Proposed Underground
(2030 Design Year)
PM Peak Hour
Traffic Volumes

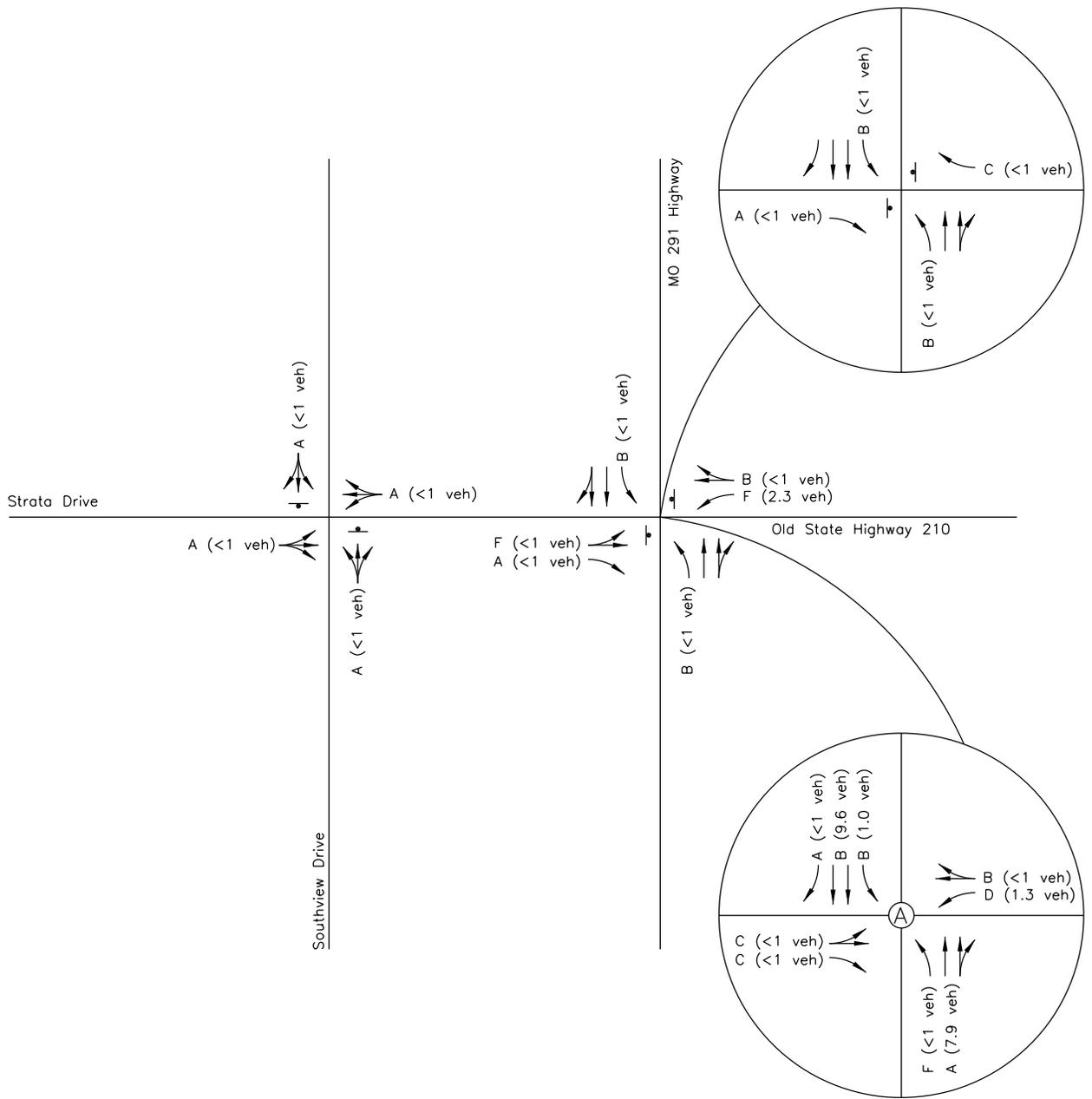
Strata
Underground
Liberty, MO

No Scale

Figure 7



Priority
ENGINEERS



LEGEND

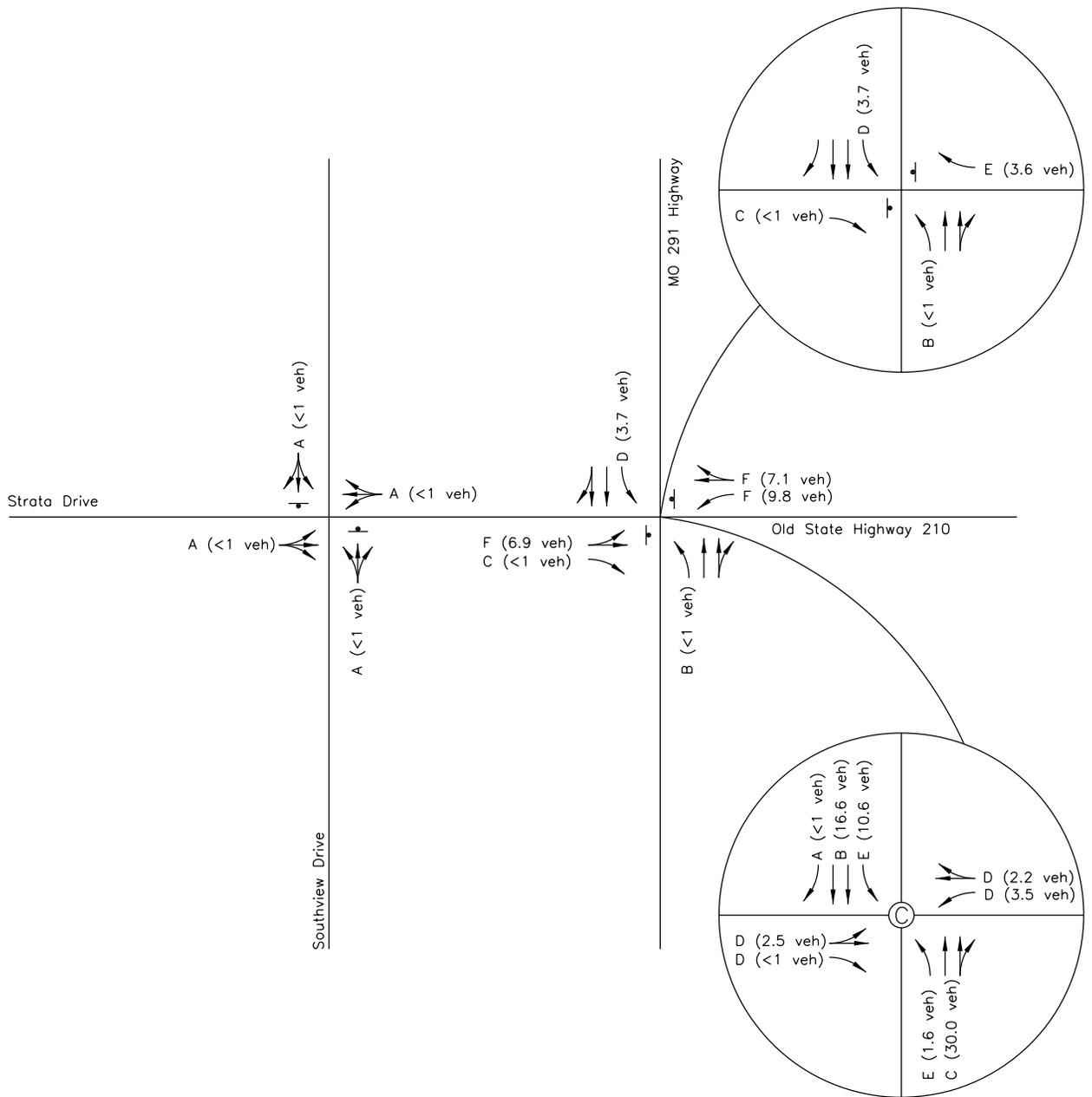
- HCM LOS (95th Percentile Queue in Vehicles)
- Stop Sign
- Traffic Signal LOS

Existing + Proposed Underground
AM Peak Hour
Lane Configurations &
Levels of Service

Strata
Underground
Liberty, MO

No Scale
Figure 8





LEGEND

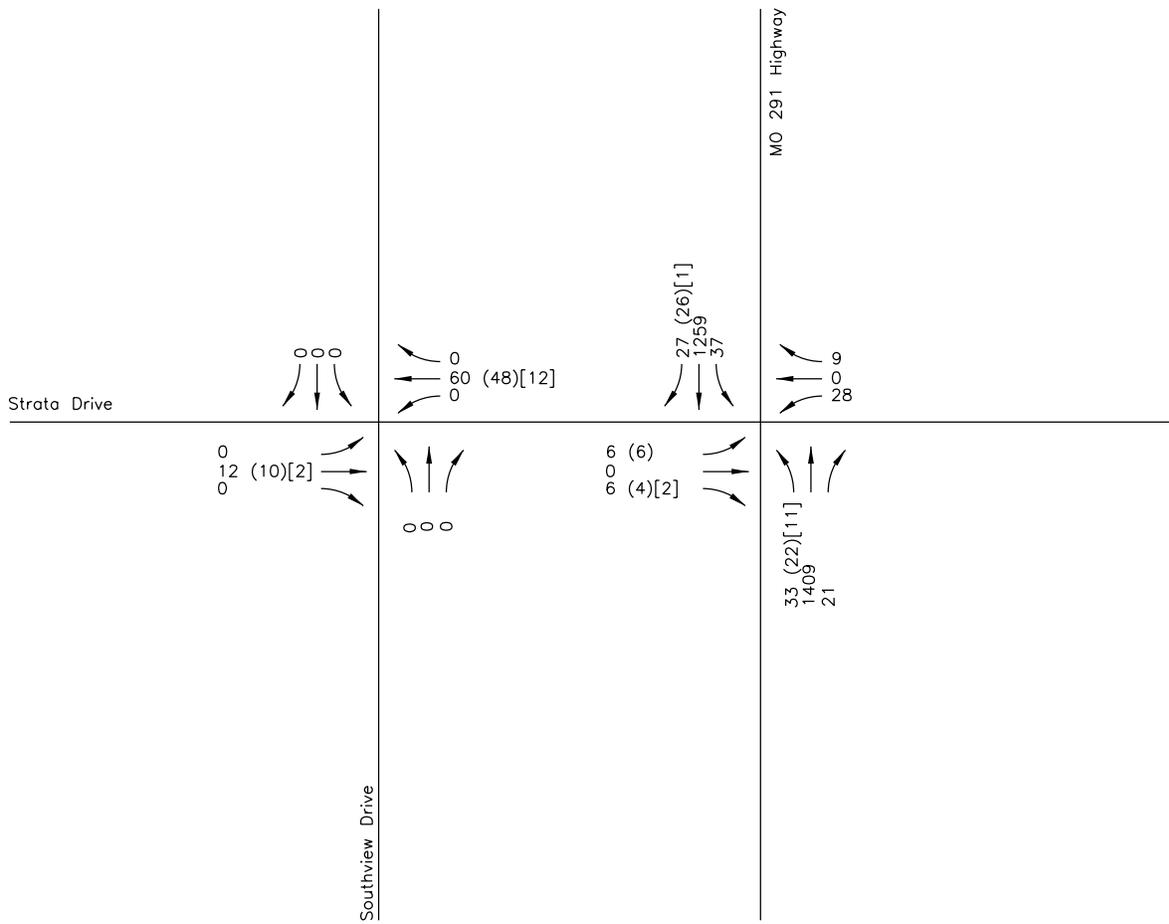
- HCM LOS (95th Percentile Queue in Vehicles)
- Stop Sign
- Traffic Signal LOS

Existing + Proposed Underground
PM Peak Hour
Lane Configurations &
Levels of Service

Strata
Underground
Liberty, MO

No Scale
Figure 9





LEGEND

 Total Volume (Future Development Cars)[Future Development Trucks]

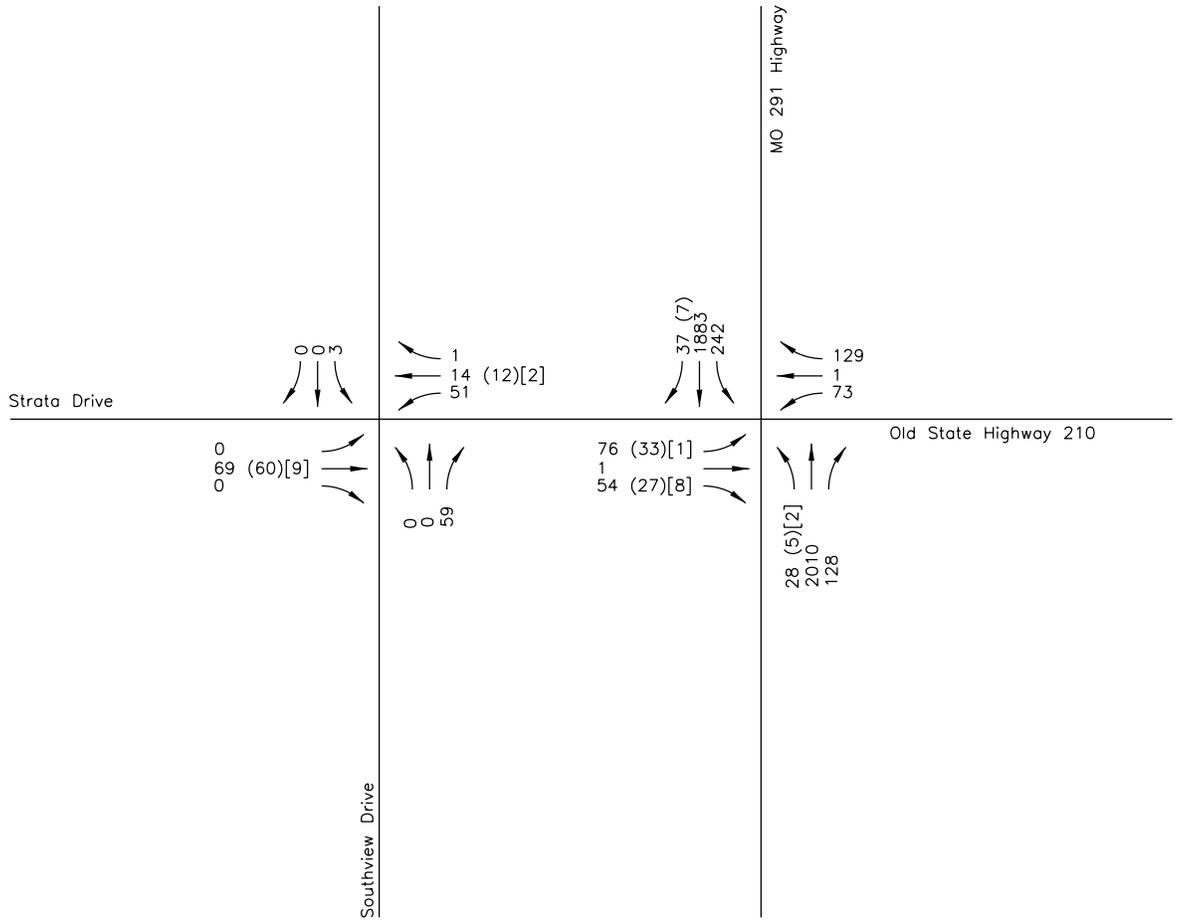
Future (2043) AM Peak Hour Traffic Volumes

Strata Underground Liberty, MO

No Scale

Figure 10





LEGEND



Total Volume (Future Development Cars)[Future Development Trucks]

Future (2043) PM Peak Hour
Traffic Volumes

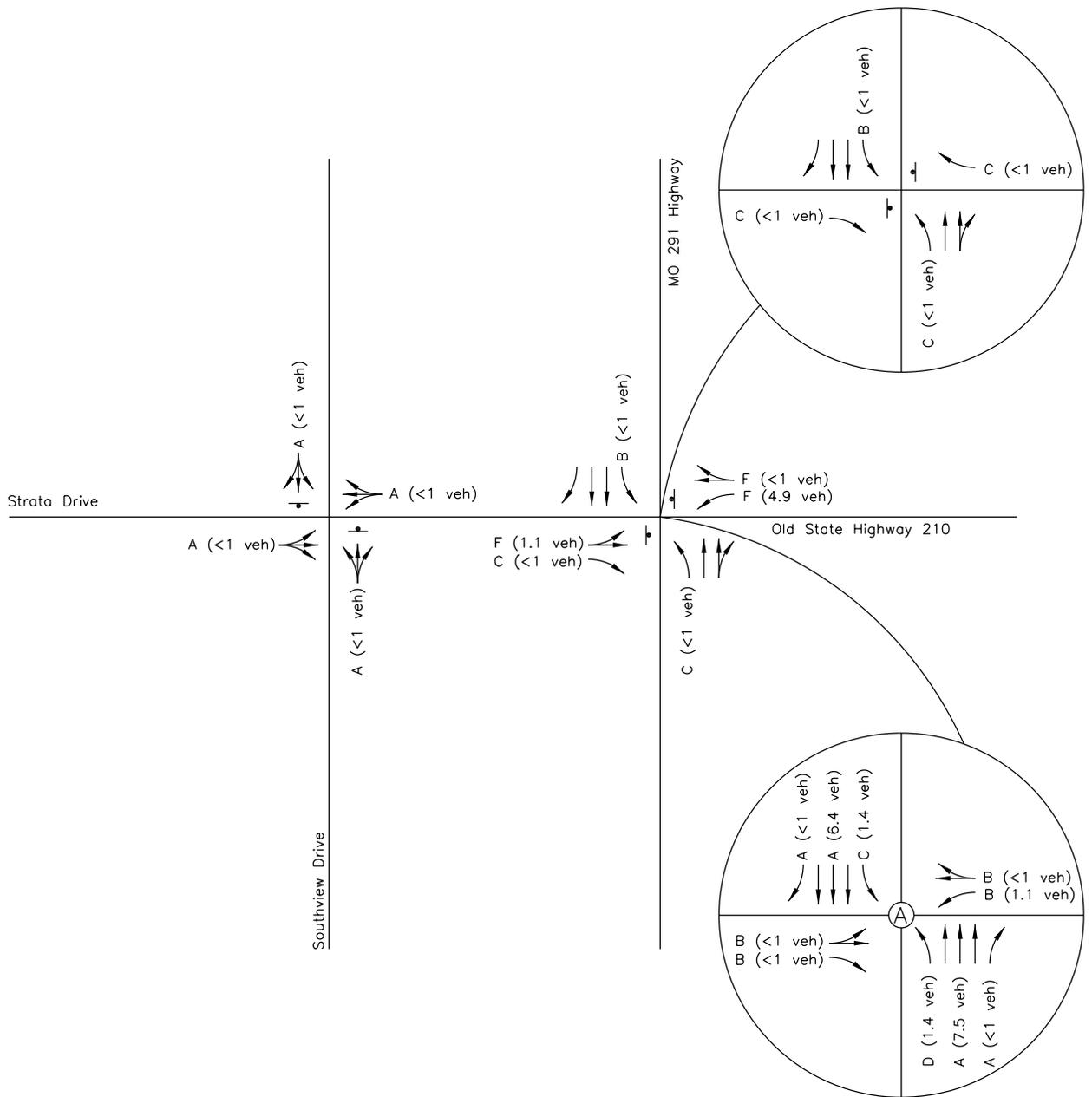
Strata
Underground
Liberty, MO

No Scale

Figure 11



Priority
ENGINEERS



LEGEND

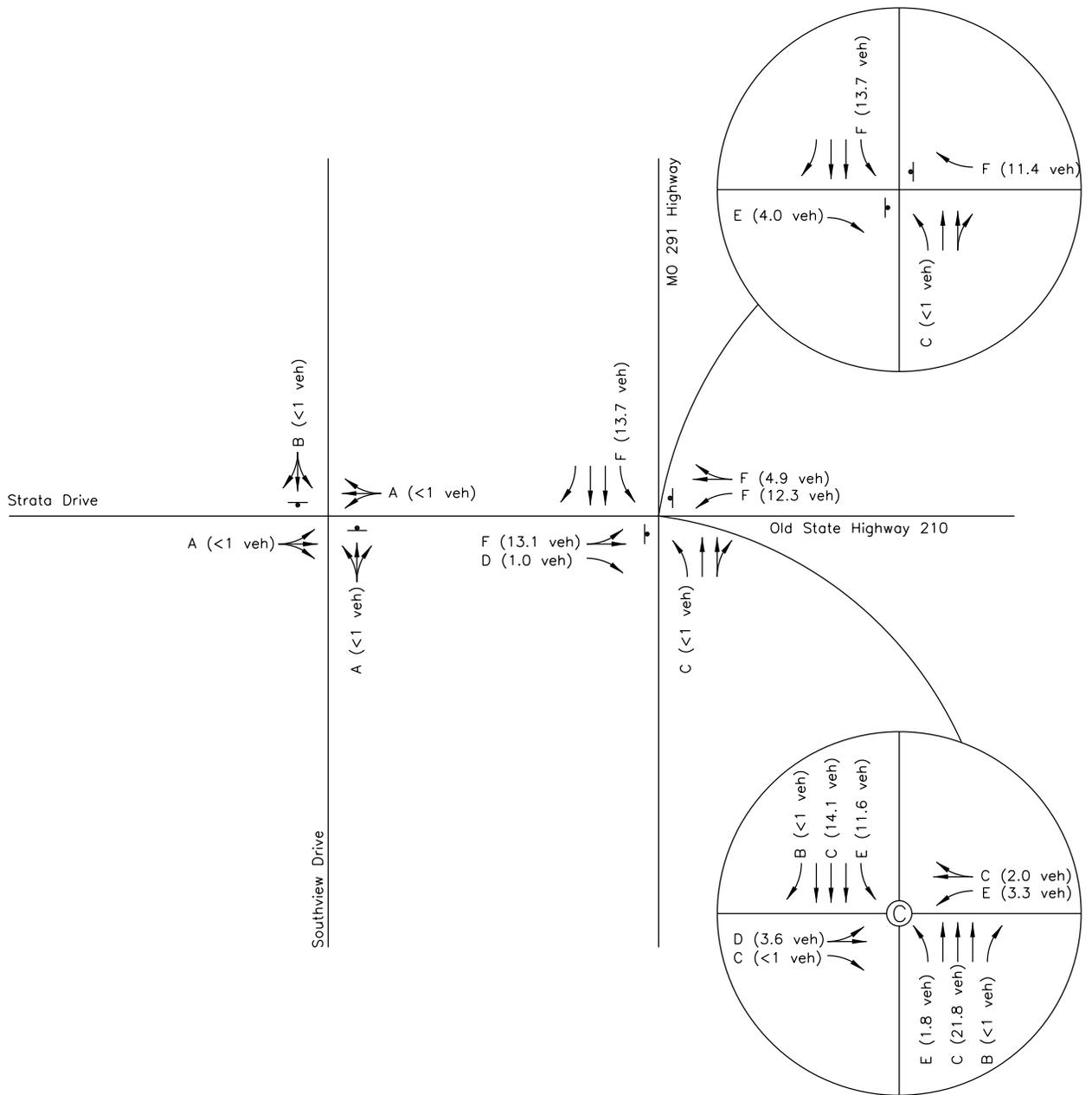
- HCM LOS (95th Percentile Queue in Vehicles)
- Stop Sign
- Traffic Signal LOS

Future (2043) AM Peak Hour
Lane Configurations &
Levels of Service

Strata
Underground
Liberty, MO

No Scale
Figure 12





LEGEND

- HCM LOS (95th Percentile Queue in Vehicles)
- Stop Sign
- Ⓐ Traffic Signal LOS

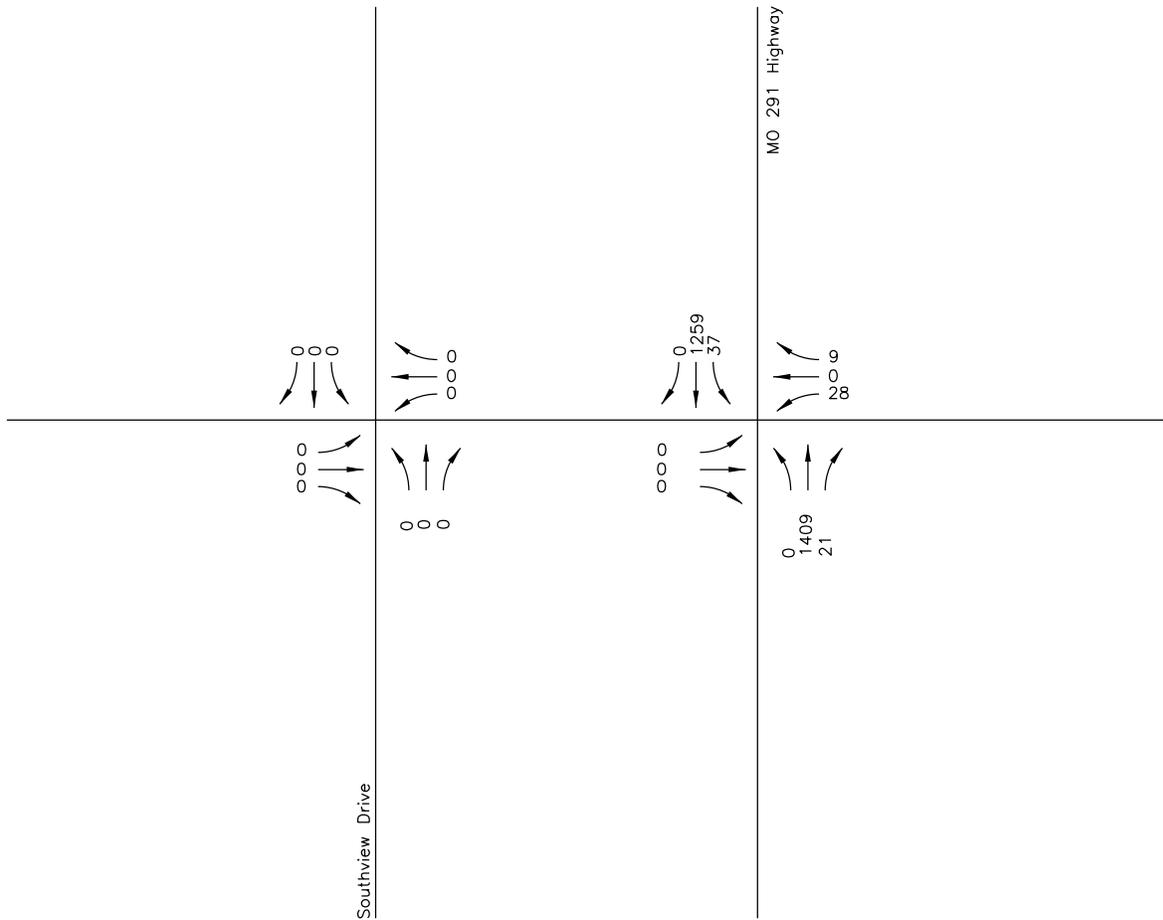
Future (2043) PM Peak Hour
Lane Configurations &
Levels of Service

Strata
Underground
Liberty, MO

No Scale

Figure 13





LEGEND



Total Volume (Future Development Cars)[Future Development Trucks]

Future (2043) No-Build
AM Peak Hour
Traffic Volumes

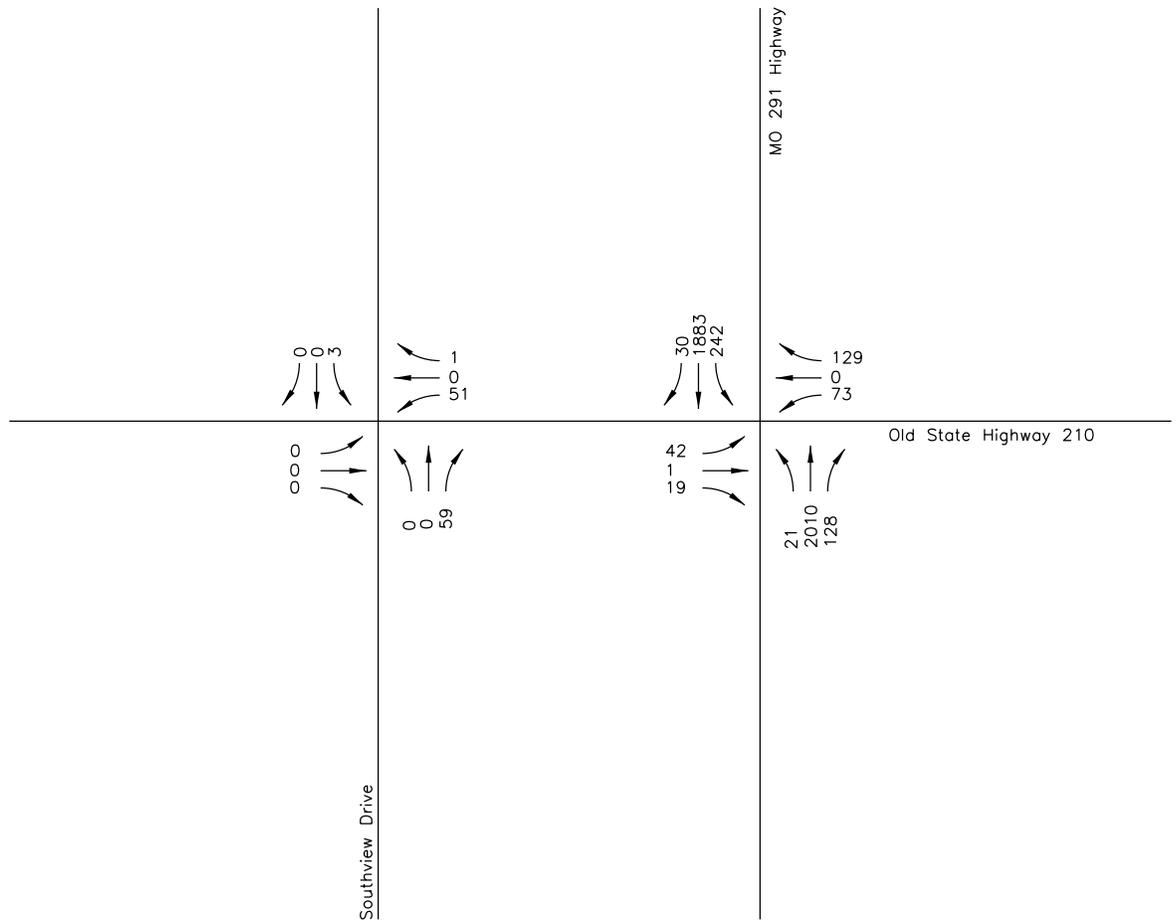
Strata
Underground
Liberty, MO

No Scale

Figure 14



Priority
ENGINEERS



LEGEND



Total Volume (Future Development Cars)[Future Development Trucks]

Future (2043) No-Build
PM Peak Hour
Traffic Volumes

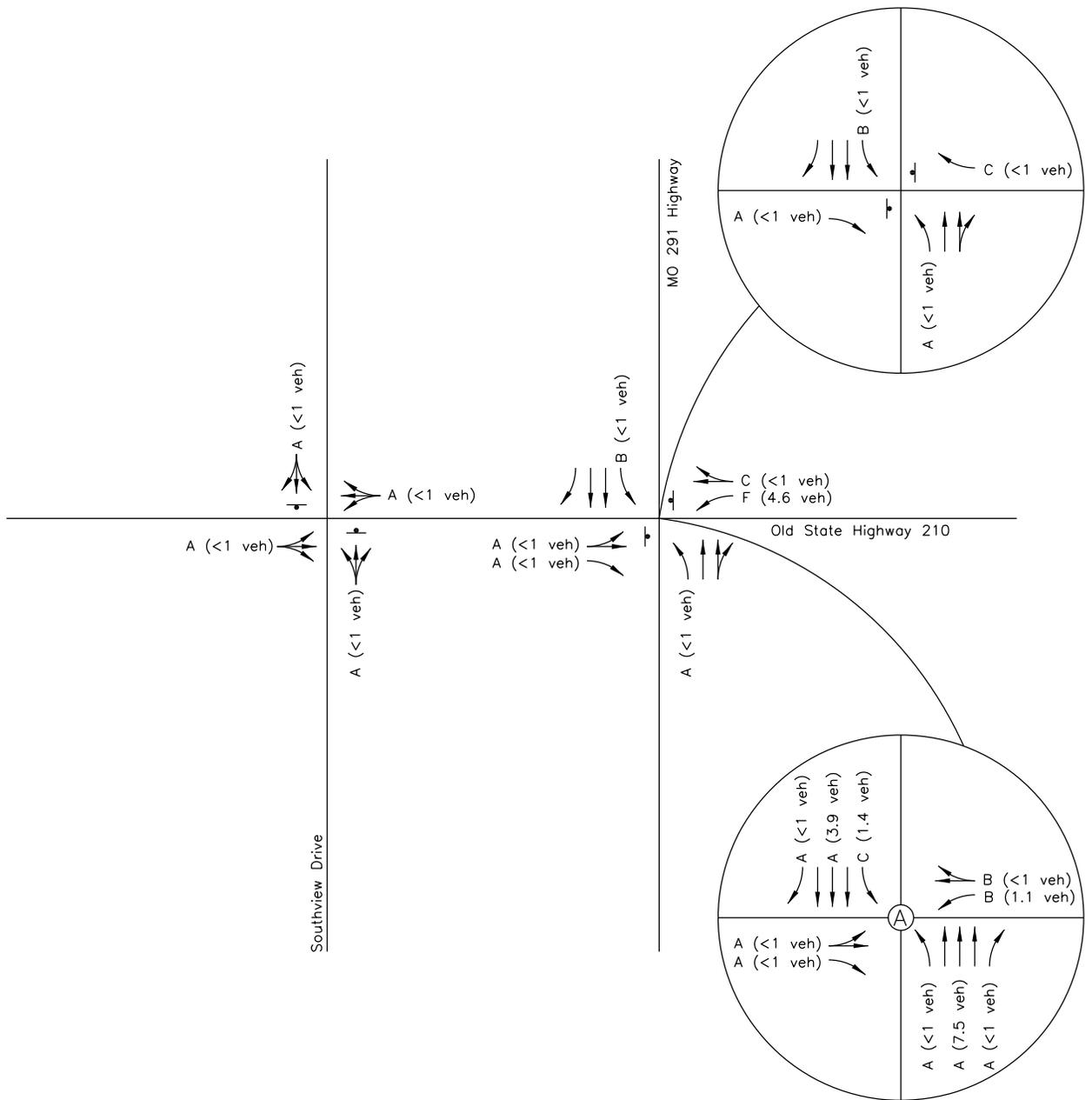
Strata
Underground
Liberty, MO

No Scale

Figure 15



Priority
ENGINEERS



LEGEND

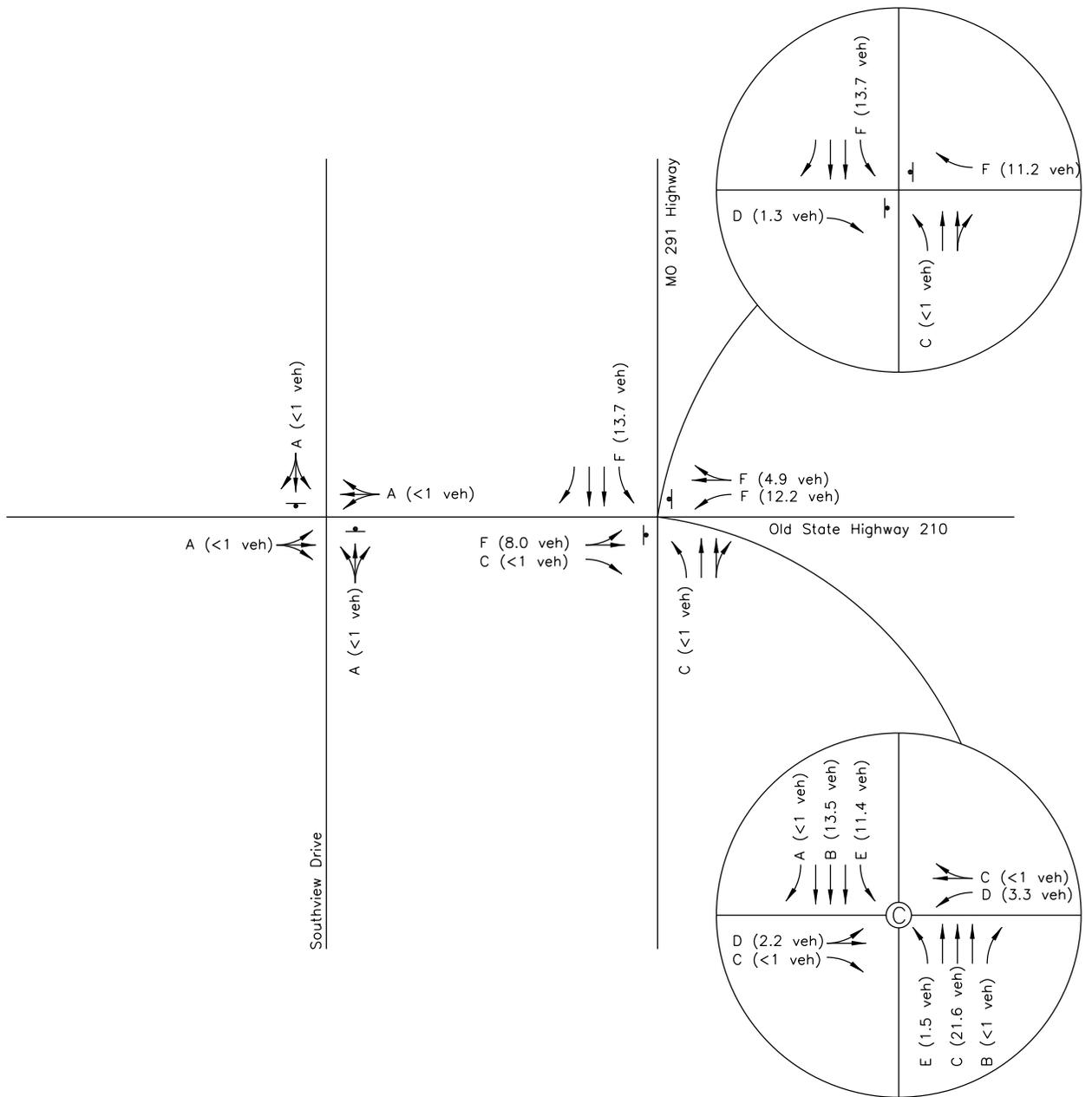
- HCM LOS (95th Percentile Queue in Vehicles)
- Stop Sign
- Traffic Signal LOS

Future (2043) No-Build
AM Peak Hour
Lane Configurations &
Levels of Service

Strata
Underground
Liberty, MO

No Scale
Figure 16





LEGEND

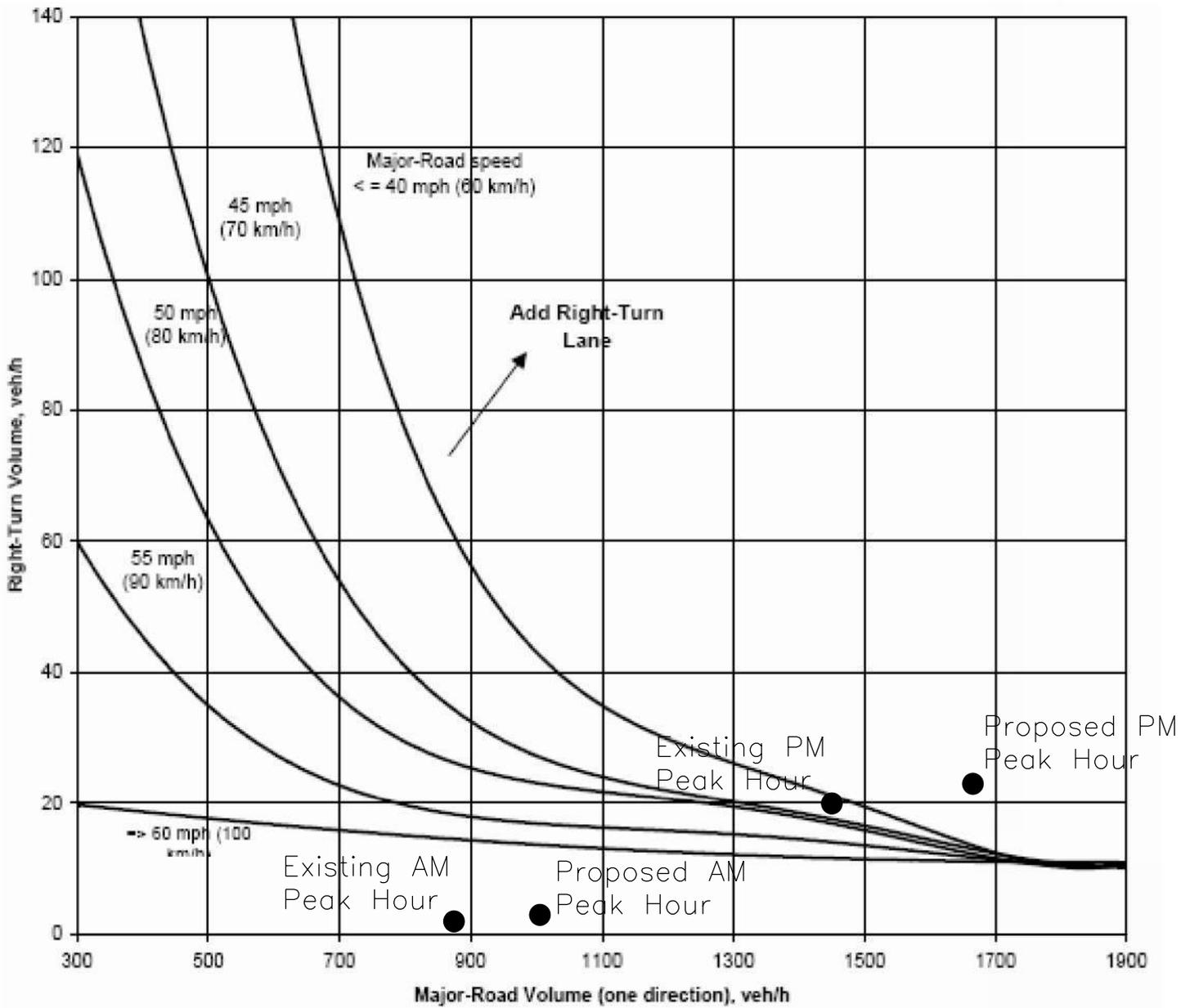
- HCM LOS (95th Percentile Queue in Vehicles)
- Stop Sign
- Traffic Signal LOS

Future (2043) No-Build
PM Peak Hour
Lane Configurations &
Levels of Service

Strata
Underground
Liberty, MO

No Scale
Figure 17





Right Turn Guideline for
Four-Lane Roadways
(MoDOT EPG 940.9.9)

Strata
Underground
Liberty, MO

No Scale

Figure 18



APPENDIX II

Peak Hour Traffic Counts

Synchro Reports

Existing AM Peak Hour	Pages 1-2
Existing PM Peak Hour	Pages 3-4
Existing + 10% Proposed Underground (2030) AM Peak Hour	Pages 5-6
Existing + 10% Proposed Underground (2030) PM Peak Hour	Pages 7-8
Existing + 10% Proposed Underground (2030) with Traffic Signal	Pages 9-12
Existing + 10% Proposed Underground (2030) with $\frac{3}{4}$ Access	Pages 13-14
Future (2043) AM Peak Hour	Pages 15-16
Future (2043) PM Peak Hour	Pages 17-18
Future (2043) with Traffic Signal	Pages 19-22
Future (2043) with $\frac{3}{4}$ Access	Pages 23-24
Future (2043) No-Build AM Peak Hour	Pages 25-26
Future (2043) No-Build PM Peak Hour	Pages 27-28
Future (2043) No-Build with Traffic Signal	Pages 29-32
Future (2043) No-Build with $\frac{3}{4}$ Access	Pages 33-34

Time	SB Right	SB Thru	SB Left	SB UTm		WB Right	WB Thru	WB Left	WB Utm		NB Right	NB Thru	NB Left	NB UTm		EB Right	EB Thru	EB Left	EB UTm	15 min total	hourly total	
07:00	0	0	0	0		0	0	2	0		6	0	0	0		0	0	0	0	8		
07:15	0	0	0	0		0	2	0	0		2	0	0	0		0	0	0	0	4		
07:30	0	0	0	0		0	1	0	0		2	0	0	0		0	0	0	0	3		
07:45	0	0	0	0		0	4	0	0		5	0	1	0		0	0	0	0	10	25	
08:00	0	0	0	0		0	3	1	0		3	0	2	0		0	0	0	0	9	26	
08:15	0	0	0	0		0	3	4	0		3	0	1	0		0	0	0	0	11	33	
08:30	0	0	0	0		0	4	3	0		3	0	0	0		0	0	0	0	10	40	
08:45	0	0	0	0		0	5	2	0		7	0	1	0		0	1	0	0	16	46	
Peak Hour	0	0	0	0	0	0	7	2	0	0	15	0	1	0	0	0	0	0	0			
% trucks																						
15:30	0	0	0	0	0	1	0	10	1	0	12	0	1	0	0	0	0	0	0			
15:45	0	0	1	0	0	1	0	7	0	0	12	0	0	0	0	0	1	0	0			
16:00	0	0	0	0		0	0	3	0		7	0	0	0		0	0	0	0	10		
16:15	0	0	0	0		0	0	2	0		6	0	0	0		0	1	0	0	9		
16:30	0	0	1	0		0	0	6	0		9	0	0	0		0	0	0	0	16		
16:45	0	0	1	0		1	0	7	0		12	0	0	0		0	0	0	0	21	56	
17:00	0	0	0	0		0	0	6	0		7	0	0	0		0	0	0	0	13	59	
17:15	0	0	0	0		0	0	12	0		6	0	0	0		0	0	0	0	18	68	
17:30	0	0	0	0		0	0	7	0		9	0	0	0		0	0	0	0	16	68	
17:45	0	0	0	0		0	0	5	0		9	0	0	0		0	0	0	0	14	61	
Peak Hour	0	0	2	0	0	1	0	31	0	0	34	0	0	0	0	0	0	0	0			
	0	0	1	0	0	2	0	22	1	0	37	0	1	0	0	0	2	0	0			

Time	SB				WB				NB				EB				15 min total hourly total	
	Right	Thru	Left	UTm	Right	Thru	Left	UTm	Right	Thru	Left	UTm	Right	Thru	Left	UTm		
07:00	0	179	3	0	1	1	7	0	5	191	3	0	3	0	3	0	396	
07:15	0	229	8	0	0	0	2	0	3	223	2	0	1	0	1	0	469	
07:30	1	221	6	0	4	0	5	0	2	252	1	0	2	0	0	0	494	
07:45	1	218	8	1	1	0	5	0	4	282	4	0	3	0	1	0	528	1887
08:00	1	148	6	0	1	0	3	0	2	215	3	1	2	0	1	0	383	1874
08:15	5	170	13	1	2	0	1	0	4	204	4	1	1	0	1	0	407	1812
08:30	4	172	10	0	6	0	3	0	3	190	4	0	4	0	0	0	396	1714
08:45	2	128	3	0	1	0	3	0	0	179	6	0	3	0	4	0	329	1515
Peak Hour Total	2	847	25	1	6	1	19	0	14	948	10	0	9	0	5	0	1887	
PHF		0.92				0.72				0.84				0.58				
% trucks		2.6%				26.9%				0.0%				78.6%				
15:30	7	285	10	1	0	4	0	11	0	0	3	237	4	0	0	0	674	2424
15:45	5	283	5	0	0	7	0	7	0	0	2	263	3	0	0	0	587	
16:00	2	294	13	0	5	0	7	0	4	252	2	0	4	0	4	0	674	2424
16:15	0	304	11	0	10	0	4	0	6	331	1	0	4	0	3	0	674	2424
16:30	3	286	10	1	6	0	4	0	8	355	1	0	5	1	7	0	687	2536
16:45	7	304	11	0	6	0	2	0	9	352	2	0	3	0	9	0	705	2653
17:00	2	352	8	0	4	0	10	1	9	330	7	0	2	0	8	0	733	2799
17:15	8	325	9	0	10	1	6	0	7	316	4	0	3	0	4	1	694	2819
17:30	43	224	12	0	3	0	6	0	9	303	6	0	3	2	5	0	616	2748
17:45	4	213	4	0	4	0	9	1	8	231	0	0	5	0	8	0	487	2530
Peak Hour Total	20	1267	38	1	26	1	22	1	33	1353	14	0	13	1	28	1	2819	
PHF		0.92				0.74				0.96				0.83				
% trucks		2.0%				6.0%				0.0%				0.0%				
	14	1166	39	1	0	26	0	29	0	0	15	1083	10	0	0	0	19	0

3: MO 291 & Seven Hills Road/Old Highway 210

Existing AM Peak Hour

Intersection												
Int Delay, s/veh	1.8											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↔	↗	↖	↗	↖	↖	↗		↖	↗	↖
Traffic Vol, veh/h	5	0	10	19	1	6	10	948	14	25	847	2
Future Vol, veh/h	5	0	10	19	1	6	10	948	14	25	847	2
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None									
Storage Length	-	-	-	100	-	-	100	-	-	380	-	200
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	80	2	70	26	2	33	60	3	21	4	2	50
Mvmt Flow	5	0	11	21	1	7	11	1030	15	27	921	2

Major/Minor	Minor2		Minor1		Major1		Major2					
Conflicting Flow All	1513	2042	460	1574	2037	523	923	0	0	1046	0	0
Stage 1	975	975	-	1060	1060	-	-	-	-	-	-	-
Stage 2	538	1067	-	515	977	-	-	-	-	-	-	-
Critical Hdwy	9.1	6.54	8.3	8.02	6.54	7.56	5.3	-	-	4.18	-	-
Critical Hdwy Stg 1	8.1	5.54	-	7.02	5.54	-	-	-	-	-	-	-
Critical Hdwy Stg 2	8.1	5.54	-	7.02	5.54	-	-	-	-	-	-	-
Follow-up Hdwy	4.3	4.02	4	3.76	4.02	3.63	2.8	-	-	2.24	-	-
Pot Cap-1 Maneuver	40	56	398	58	56	426	463	-	-	649	-	-
Stage 1	158	328	-	200	299	-	-	-	-	-	-	-
Stage 2	339	297	-	454	327	-	-	-	-	-	-	-
Platoon blocked, %								-	-	-	-	-
Mov Cap-1 Maneuver	36	52	398	53	52	426	463	-	-	649	-	-
Mov Cap-2 Maneuver	36	52	-	53	52	-	-	-	-	-	-	-
Stage 1	151	314	-	196	292	-	-	-	-	-	-	-
Stage 2	324	290	-	423	313	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s/v50.55		86.75	0.13	0.31
HCM LOS	F	F		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	EBLn2	WBLn1	WBLn2	SBL	SBT	SBR
Capacity (veh/h)	463	-	-	36	398	53	211	649	-	-
HCM Lane V/C Ratio	0.023	-	-	0.152	0.027	0.388	0.036	0.042	-	-
HCM Control Delay (s/veh)	13	-	-	123	14.3	110.4	22.7	10.8	-	-
HCM Lane LOS	B	-	-	F	B	F	C	B	-	-
HCM 95th %tile Q(veh)	0.1	-	-	0.5	0.1	1.4	0.1	0.1	-	-

6: Southview Drive & Liberty Aggregates/Seven Hills Road

Existing AM Peak Hour

Intersection												
Int Delay, s/veh	5.6											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Traffic Vol, veh/h	0	0	0	3	10	0	1	0	15	0	0	0
Future Vol, veh/h	0	0	0	3	10	0	1	0	15	0	0	0
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None									
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	60	2	100	2	87	2	2	2
Mvmt Flow	0	0	0	3	11	0	1	0	16	0	0	0

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	11	0	0	1	0	0	18	18	1	18	18	11
Stage 1	-	-	-	-	-	-	1	1	-	17	17	-
Stage 2	-	-	-	-	-	-	17	17	-	1	1	-
Critical Hdwy	4.12	-	-	4.12	-	-	8.1	6.52	7.07	7.12	6.52	6.22
Critical Hdwy Stg 1	-	-	-	-	-	-	7.1	5.52	-	6.12	5.52	-
Critical Hdwy Stg 2	-	-	-	-	-	-	7.1	5.52	-	6.12	5.52	-
Follow-up Hdwy	2.218	-	-	2.218	-	-	4.4	4.018	4.083	3.518	4.018	3.318
Pot Cap-1 Maneuver	1608	-	-	1622	-	-	794	875	880	996	875	1070
Stage 1	-	-	-	-	-	-	817	895	-	1002	881	-
Stage 2	-	-	-	-	-	-	799	881	-	1022	895	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	1608	-	-	1622	-	-	792	874	880	975	874	1070
Mov Cap-2 Maneuver	-	-	-	-	-	-	792	874	-	975	874	-
Stage 1	-	-	-	-	-	-	817	895	-	1000	879	-
Stage 2	-	-	-	-	-	-	797	879	-	1003	895	-

Approach	EB			WB			NB			SB		
HCM Control Delay, s/v	0			1.67			9.2			0		
HCM LOS							A			A		

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	874	1608	-	-	415	-	-	-
HCM Lane V/C Ratio	0.02	-	-	-	0.002	-	-	-
HCM Control Delay (s/veh)	9.2	0	-	-	7.2	0	-	0
HCM Lane LOS	A	A	-	-	A	A	-	A
HCM 95th %tile Q(veh)	0.1	0	-	-	0	-	-	-

3: MO 291 & Seven Hills Road/Old Highway 210

Existing PM Peak Hour

Intersection												
Int Delay, s/veh	123.6											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↔	↗	↖	↗	↖	↖	↗	↔	↖	↗	↗
Traffic Vol, veh/h	28	1	13	49	1	87	14	1353	86	163	1267	20
Future Vol, veh/h	28	1	13	49	1	87	14	1353	86	163	1267	20
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	100	-	-	100	-	-	380	-	200
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	6	2	2	7	2	9	2	2	2
Mvmt Flow	30	1	14	53	1	95	15	1471	93	177	1377	22

Major/Minor	Minor2		Minor1		Major1		Major2					
Conflicting Flow All	2498	3326	689	2591	3301	782	1399	0	0	1564	0	0
Stage 1	1732	1732	-	1548	1548	-	-	-	-	-	-	-
Stage 2	766	1595	-	1043	1753	-	-	-	-	-	-	-
Critical Hdwy	7.54	6.54	6.94	7.62	6.54	6.94	4.24	-	-	4.14	-	-
Critical Hdwy Stg 1	6.54	5.54	-	6.62	5.54	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.54	5.54	-	6.62	5.54	-	-	-	-	-	-	-
Follow-up Hdwy	3.52	4.02	3.32	3.56	4.02	3.32	2.27	-	-	2.22	-	-
Pot Cap-1 Maneuver	~ 15	8	388	~ 12	8	337	459	-	-	418	-	-
Stage 1	91	141	-	115	174	-	-	-	-	-	-	-
Stage 2	361	165	-	238	137	-	-	-	-	-	-	-
Platoon blocked, %								-	-	-	-	-
Mov Cap-1 Maneuver	~ 5	5	388	~ 5	5	337	459	-	-	418	-	-
Mov Cap-2 Maneuver	~ 5	5	-	~ 5	5	-	-	-	-	-	-	-
Stage 1	53	81	-	111	168	-	-	-	-	-	-	-
Stage 2	250	159	-	130	79	-	-	-	-	-	-	-

Approach	EB		WB		NB		SB	
HCM Control Delay \$/veh	26	14.55	19	154.82	0.13		2.22	
HCM LOS	F		F					

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	EBLn2	WBLn1	WBLn2	SBL	SBT	SBR
Capacity (veh/h)	459	-	-	5	388	5	187	418	-	-
HCM Lane V/C Ratio	0.033	-	-	6.304	0.036	10.017	0.512	0.424	-	-
HCM Control Delay (s/veh)	13.1	-	-	\$ 3780	14.5	\$ 5388.4	42.9	19.8	-	-
HCM Lane LOS	B	-	-	F	B	F	E	C	-	-
HCM 95th %tile Q(veh)	0.1	-	-	5.5	0.1	8.4	2.6	2.1	-	-

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

6: Southview Drive & Liberty Aggregates Drive/Seven Hills Road

Existing PM Peak Hour

Intersection												
Int Delay, s/veh	7.9											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Traffic Vol, veh/h	0	0	0	34	0	1	0	0	40	2	0	0
Future Vol, veh/h	0	0	0	34	0	1	0	0	40	2	0	0
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	34	2	2	2	2	14	2	2	2
Mvmt Flow	0	0	0	37	0	1	0	0	43	2	0	0
Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	1	0	0	1	0	0	75	76	1	76	76	1
Stage 1	-	-	-	-	-	-	1	1	-	74	74	-
Stage 2	-	-	-	-	-	-	74	75	-	1	1	-
Critical Hdwy	4.12	-	-	4.44	-	-	7.12	6.52	6.34	7.12	6.52	6.22
Critical Hdwy Stg 1	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Follow-up Hdwy	2.218	-	-	2.506	-	-	3.518	4.018	3.426	3.518	4.018	3.318
Pot Cap-1 Maneuver	1622	-	-	1435	-	-	915	814	1049	914	815	1084
Stage 1	-	-	-	-	-	-	1022	895	-	935	833	-
Stage 2	-	-	-	-	-	-	935	833	-	1022	895	-
Platoon blocked, %	-	-	-	-	-	-	-	-	-	-	-	-
Mov Cap-1 Maneuver	1622	-	-	1435	-	-	891	793	1049	854	794	1084
Mov Cap-2 Maneuver	-	-	-	-	-	-	891	793	-	854	794	-
Stage 1	-	-	-	-	-	-	1022	895	-	911	812	-
Stage 2	-	-	-	-	-	-	911	811	-	980	895	-
Approach	EB			WB			NB			SB		
HCM Control Delay, s/v	0			7.36			8.58			9.23		
HCM LOS							A			A		
Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1				
Capacity (veh/h)	1049	1622	-	-	1434	-	-	854				
HCM Lane V/C Ratio	0.041	-	-	-	0.026	-	-	0.003				
HCM Control Delay (s/veh)	8.6	0	-	-	7.6	0	-	9.2				
HCM Lane LOS	A	A	-	-	A	A	-	A				
HCM 95th %tile Q(veh)	0.1	0	-	-	0.1	-	-	0				

3: MO 291 & Seven Hills Road/Old Highway 210

Existing + 10% Proposed Underground (2030) AM Peak Hour

Intersection												
Int Delay, s/veh	2.4											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↔	↗	↖	↗	↖	↖	↗		↖	↗	↖
Traffic Vol, veh/h	1	0	0	22	0	7	3	1089	14	29	973	3
Future Vol, veh/h	1	0	0	22	0	7	3	1089	14	29	973	3
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None									
Storage Length	-	-	-	100	-	-	100	-	-	380	-	200
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	33	26	2	33	33	3	21	4	2	4
Mvmt Flow	1	0	0	24	0	8	3	1184	15	32	1058	3

Major/Minor	Minor2		Minor1		Major1		Major2					
Conflicting Flow All	1719	2326	529	1790	2322	599	1061	0	0	1199	0	0
Stage 1	1121	1121	-	1198	1198	-	-	-	-	-	-	-
Stage 2	598	1205	-	592	1124	-	-	-	-	-	-	-
Critical Hdwy	7.54	6.54	7.56	8.02	6.54	7.56	4.76	-	-	4.18	-	-
Critical Hdwy Stg 1	6.54	5.54	-	7.02	5.54	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.54	5.54	-	7.02	5.54	-	-	-	-	-	-	-
Follow-up Hdwy	3.52	4.02	3.63	3.76	4.02	3.63	2.53	-	-	2.24	-	-
Pot Cap-1 Maneuver	58	37	421	39	37	375	496	-	-	567	-	-
Stage 1	220	280	-	162	257	-	-	-	-	-	-	-
Stage 2	456	255	-	405	279	-	-	-	-	-	-	-
Platoon blocked, %								-	-	-	-	-
Mov Cap-1 Maneuver	53	34	421	37	35	375	496	-	-	567	-	-
Mov Cap-2 Maneuver	53	34	-	37	35	-	-	-	-	-	-	-
Stage 1	208	264	-	161	255	-	-	-	-	-	-	-
Stage 2	443	253	-	382	263	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s/v	74.3	163.09	0.03	0.34
HCM LOS	F	F		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	EBLn2	WBLn1	WBLn2	SBL	SBT	SBR
Capacity (veh/h)	496	-	-	53	-	37	375	567	-	-
HCM Lane V/C Ratio	0.007	-	-	0.02	-	0.649	0.02	0.056	-	-
HCM Control Delay (s/veh)	12.3	-	-	74.3	0	210.3	14.8	11.7	-	-
HCM Lane LOS	B	-	-	F	A	F	B	B	-	-
HCM 95th %tile Q(veh)	0	-	-	0.1	-	2.3	0.1	0.2	-	-

6: Southview Drive & Strata Drive/Seven Hills Road Existing + 10% Proposed Underground (2030) AM Peak Hour

Intersection												
Int Delay, s/veh	0											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Traffic Vol, veh/h	0	1	0	0	6	0	0	0	0	0	0	0
Future Vol, veh/h	0	1	0	0	6	0	0	0	0	0	0	0
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	20	2	100	2	87	2	2	2
Mvmt Flow	0	1	0	0	7	0	0	0	0	0	0	0
Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	7	0	0	1	0	0	8	8	1	8	8	7
Stage 1	-	-	-	-	-	-	1	1	-	7	7	-
Stage 2	-	-	-	-	-	-	7	7	-	1	1	-
Critical Hdwy	4.12	-	-	4.12	-	-	8.1	6.52	7.07	7.12	6.52	6.22
Critical Hdwy Stg 1	-	-	-	-	-	-	7.1	5.52	-	6.12	5.52	-
Critical Hdwy Stg 2	-	-	-	-	-	-	7.1	5.52	-	6.12	5.52	-
Follow-up Hdwy	2.218	-	-	2.218	-	-	4.4	4.018	4.083	3.518	4.018	3.318
Pot Cap-1 Maneuver	1614	-	-	1622	-	-	808	887	880	1012	887	1076
Stage 1	-	-	-	-	-	-	817	895	-	1015	890	-
Stage 2	-	-	-	-	-	-	811	890	-	1022	895	-
Platoon blocked, %	-	-	-	-	-	-	-	-	-	-	-	-
Mov Cap-1 Maneuver	1614	-	-	1622	-	-	808	887	880	1012	887	1076
Mov Cap-2 Maneuver	-	-	-	-	-	-	808	887	-	1012	887	-
Stage 1	-	-	-	-	-	-	817	895	-	1015	890	-
Stage 2	-	-	-	-	-	-	811	890	-	1022	895	-
Approach	EB			WB			NB			SB		
HCM Control Delay, s/v	0			0			0			0		
HCM LOS							A			A		
Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1				
Capacity (veh/h)	-	1614	-	-	1622	-	-	-				
HCM Lane V/C Ratio	-	-	-	-	-	-	-	-				
HCM Control Delay (s/veh)	0	0	-	-	0	-	-	0				
HCM Lane LOS		A	A	-	-	A	-	-	A			
HCM 95th %tile Q(veh)	-	0	-	-	0	-	-	-				

3: MO 291 & Seven Hills Road/Old Highway 210

Existing + 10% Proposed Underground (2030) PM Peak Hour

Intersection												
Int Delay, s/veh	848.9											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↔	↔	↔	↔		↔	↔		↔	↔	↔
Traffic Vol, veh/h	35	1	19	56	1	100	17	1554	99	187	1455	23
Future Vol, veh/h	35	1	19	56	1	100	17	1554	99	187	1455	23
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	100	-	-	100	-	-	380	-	200
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	5	6	2	2	2	2	9	2	2	2
Mvmt Flow	38	1	21	61	1	109	18	1689	108	203	1582	25

Major/Minor	Minor2		Minor1		Major1		Major2					
Conflicting Flow All	2870	3822	791	2978	3793	898	1607	0	0	1797	0	0
Stage 1	1988	1988	-	1780	1780	-	-	-	-	-	-	-
Stage 2	882	1834	-	1198	2013	-	-	-	-	-	-	-
Critical Hdwy	7.54	6.54	7	7.62	6.54	6.94	4.14	-	-	4.14	-	-
Critical Hdwy Stg 1	6.54	5.54	-	6.62	5.54	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.54	5.54	-	6.62	5.54	-	-	-	-	-	-	-
Follow-up Hdwy	3.52	4.02	3.35	3.56	4.02	3.32	2.22	-	-	2.22	-	-
Pot Cap-1 Maneuver	~ 7	4	326	~ 6	4	282	403	-	-	340	-	-
Stage 1	63	105	-	81	133	-	-	-	-	-	-	-
Stage 2	307	125	-	191	102	-	-	-	-	-	-	-
Platoon blocked, %								-	-	-	-	-
Mov Cap-1 Maneuver	~ 1	1	326	~ 1	2	282	403	-	-	340	-	-
Mov Cap-2 Maneuver	~ 1	1	-	~ 1	2	-	-	-	-	-	-	-
Stage 1	~ 25	42	-	78	127	-	-	-	-	-	-	-
Stage 2	179	120	-	70	41	-	-	-	-	-	-	-

Approach	EB		WB		NB		SB	
HCM Control Delay, s/veh	176	22.99	\$	12967.99	0.15			3.39
HCM LOS	F		F					

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	EBLn2	WBLn1	WBLn2	SBL	SBT	SBR
Capacity (veh/h)	403	-	-	1	326	1	99	340	-	-
HCM Lane V/C Ratio	0.046	-	-	44.009	0.063	64.748	1.109	0.598	-	-
HCM Control Delay (s/veh)	14.4	-	-	\$ 26915.1	16.8	5990.7	202.9	30.2	-	-
HCM Lane LOS	B	-	-	F	C	F	F	D	-	-
HCM 95th %tile Q(veh)	0.1	-	-	6.9	0.2	9.8	7.1	3.7	-	-

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

6: Southview Drive & Strata Drive/Seven Hills Road Existing + 10% Proposed Underground (2030) PM Peak Hour

Intersection												
Int Delay, s/veh	7.2											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Traffic Vol, veh/h	0	7	0	39	1	1	0	0	46	2	0	0
Future Vol, veh/h	0	7	0	39	1	1	0	0	46	2	0	0
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None									
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	14	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	0	8	0	42	1	1	0	0	50	2	0	0

Major/Minor	Major1		Major2		Minor1		Minor2					
Conflicting Flow All	2	0	0	8	0	0	93	95	8	94	94	2
Stage 1	-	-	-	-	-	-	8	8	-	86	86	-
Stage 2	-	-	-	-	-	-	86	87	-	8	8	-
Critical Hdwy	4.12	-	-	4.12	-	-	7.12	6.52	6.22	7.12	6.52	6.22
Critical Hdwy Stg 1	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Follow-up Hdwy	2.218	-	-	2.218	-	-	3.518	4.018	3.318	3.518	4.018	3.318
Pot Cap-1 Maneuver	1620	-	-	1613	-	-	890	795	1075	889	796	1083
Stage 1	-	-	-	-	-	-	1014	889	-	921	823	-
Stage 2	-	-	-	-	-	-	922	823	-	1014	889	-
Platoon blocked, %	-	-	-	-	-	-	-	-	-	-	-	-
Mov Cap-1 Maneuver	1620	-	-	1613	-	-	867	775	1075	826	775	1083
Mov Cap-2 Maneuver	-	-	-	-	-	-	867	775	-	826	775	-
Stage 1	-	-	-	-	-	-	1014	889	-	897	802	-
Stage 2	-	-	-	-	-	-	898	801	-	967	889	-

Approach	EB	WB	NB	SB
HCM Control Delay, s/v	0	6.94	8.51	9.37
HCM LOS			A	A

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	1075	1620	-	-	1557	-	-	826
HCM Lane V/C Ratio	0.047	-	-	-	0.026	-	-	0.003
HCM Control Delay (s/veh)	8.5	0	-	-	7.3	0	-	9.4
HCM Lane LOS	A	A	-	-	A	A	-	A
HCM 95th %tile Q(veh)	0.1	0	-	-	0.1	-	-	0

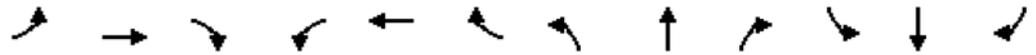
3: MO 291 & Seven Hills Road/Old Highway 240 + 10% Proposed Underground (2030) AM Peak Hour with Signal



Lane Group	EBT	WBL	WBT	NBL	NBT	SBL	SBT	SBR
Lane Group Flow (vph)	1	24	8	3	1201	32	1058	3
v/c Ratio	0.00	0.16	0.02	0.02	0.40	0.09	0.36	0.00
Control Delay (s/veh)	26.0	28.6	0.1	27.6	3.9	7.6	5.6	0.0
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay (s/veh)	26.0	28.6	0.1	27.6	3.9	7.6	5.6	0.0
Queue Length 50th (ft)	0	4	0	1	0	0	0	0
Queue Length 95th (ft)	5	32	0	9	197	25	239	0
Internal Link Dist (ft)	117		608		719		750	
Turn Bay Length (ft)		100		100		380		200
Base Capacity (vph)	726	147	814	132	3045	341	2826	1305
Starvation Cap Reductn	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.00	0.16	0.01	0.02	0.39	0.09	0.37	0.00

Intersection Summary

3: MO 291 & Seven Hills Road/Old Highway 240 + 10% Proposed Underground (2030) AM Peak Hour with Signal



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕	↗	↖	↖		↖	↕↖		↖	↕↕	↖
Traffic Volume (veh/h)	1	0	0	22	0	7	3	1089	16	29	973	3
Future Volume (veh/h)	1	0	0	22	0	7	3	1089	16	29	973	3
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Lane Width Adj.	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1411	1515	1870	1411	1411	1856	1589	1841	1870	1870
Adj Flow Rate, veh/h	1	0	0	24	0	8	3	1184	17	32	1058	3
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	2	2	33	26	2	33	33	3	21	4	2	2
Cap, veh/h	172	0	11	33	0	261	4	2031	29	322	1547	690
Arrive On Green	0.01	0.00	0.00	0.02	0.00	0.16	0.00	0.57	0.57	0.44	0.44	0.44
Sat Flow, veh/h	1407	0	1196	1443	0	1585	1344	3558	51	458	3554	1585
Grp Volume(v), veh/h	1	0	0	24	0	8	3	587	614	32	1058	3
Grp Sat Flow(s),veh/h/ln	1407	0	1196	1443	0	1585	1344	1763	1846	458	1777	1585
Q Serve(g_s), s	0.0	0.0	0.0	0.7	0.0	0.2	0.1	9.7	9.7	2.2	10.9	0.0
Cycle Q Clear(g_c), s	0.0	0.0	0.0	0.7	0.0	0.2	0.1	9.7	9.7	5.8	10.9	0.0
Prop In Lane	1.00		1.00	1.00		1.00	1.00		0.03	1.00		1.00
Lane Grp Cap(c), veh/h	172	0	11	33	0	261	4	1006	1054	322	1547	690
V/C Ratio(X)	0.01	0.00	0.00	0.72	0.00	0.03	0.68	0.58	0.58	0.10	0.68	0.00
Avail Cap(c_a), veh/h	655	0	422	127	0	908	118	1632	1709	446	2507	1118
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	0.00	1.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	22.3	0.0	0.0	22.0	0.0	15.9	22.6	6.3	6.3	10.1	10.3	7.2
Incr Delay (d2), s/veh	0.0	0.0	0.0	25.4	0.0	0.0	108.2	0.5	0.5	0.1	0.5	0.0
Initial Q Delay(d3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.0	0.0	0.0	0.5	0.0	0.1	0.2	1.4	1.4	0.2	2.5	0.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d), s/veh	22.3	0.0	0.0	47.4	0.0	16.0	130.8	6.8	6.8	10.2	10.8	7.3
LnGrp LOS	C			D		B	F	A	A	B	B	A
Approach Vol, veh/h		1			32			1204			1093	
Approach Delay, s/veh		22.3			39.6			7.1			10.8	
Approach LOS		C			D			A			B	
Timer - Assigned Phs		2	3	4	5	6		8				
Phs Duration (G+Y+Rc), s		31.9	7.0	6.4	6.1	25.7		13.5				
Change Period (Y+Rc), s		6.0	6.0	6.0	6.0	6.0		6.0				
Max Green Setting (Gmax), s		42.0	4.0	16.0	4.0	32.0		26.0				
Max Q Clear Time (g_c+I1), s		11.7	2.7	2.0	2.1	12.9		2.2				
Green Ext Time (p_c), s		7.9	0.0	0.0	0.0	6.9		0.0				
Intersection Summary												
HCM 7th Control Delay, s/veh			9.3									
HCM 7th LOS			A									

3: MO 291 & Seven Hills Road/Old Highway 240 + 10% Proposed Underground (2030) PM Peak Hour with Signal

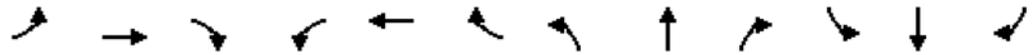


Lane Group	EBT	EBR	WBL	WBT	NBL	NBT	SBL	SBT	SBR
Lane Group Flow (vph)	39	21	61	110	18	1797	203	1582	25
v/c Ratio	0.34	0.07	0.47	0.43	0.21	0.89	0.75	0.59	0.02
Control Delay (s/veh)	56.0	0.5	60.5	14.9	60.2	27.0	63.7	8.3	0.0
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay (s/veh)	56.0	0.5	60.5	14.9	60.2	27.0	63.7	8.3	0.0
Queue Length 50th (ft)	28	0	44	1	13	546	144	173	0
Queue Length 95th (ft)	63	0	88	54	39	745	#266	414	0
Internal Link Dist (ft)	117			608		719		750	
Turn Bay Length (ft)			100		100		380		200
Base Capacity (vph)	180	352	203	337	85	2300	308	2821	1278
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.22	0.06	0.30	0.33	0.21	0.78	0.66	0.56	0.02

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
 Queue shown is maximum after two cycles.

3: MO 291 & Seven Hills Road/Old Highway 240 + 10% Proposed Underground (2030) PM Peak Hour with Signal



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↖	↗	↖	↗		↖	↖↗		↖	↖↗	↖
Traffic Volume (veh/h)	35	1	19	56	1	100	17	1554	99	187	1455	23
Future Volume (veh/h)	35	1	19	56	1	100	17	1554	99	187	1455	23
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Lane Width Adj.	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1826	1811	1870	1870	1870	1870	1767	1870	1870	1870
Adj Flow Rate, veh/h	38	1	21	61	1	109	18	1689	108	203	1582	25
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	2	2	5	6	2	2	2	2	9	2	2	2
Cap, veh/h	168	4	225	138	2	229	27	1899	121	234	2401	1071
Arrive On Green	0.15	0.15	0.15	0.15	0.15	0.15	0.02	0.56	0.56	0.13	0.68	0.68
Sat Flow, veh/h	709	25	1547	1346	14	1573	1781	3393	215	1781	3554	1585
Grp Volume(v), veh/h	39	0	21	61	0	110	18	878	919	203	1582	25
Grp Sat Flow(s),veh/h/ln	734	0	1547	1346	0	1587	1781	1777	1832	1781	1777	1585
Q Serve(g_s), s	3.1	0.0	1.3	4.9	0.0	7.0	1.1	47.3	48.8	12.3	28.6	0.6
Cycle Q Clear(g_c), s	10.1	0.0	1.3	15.0	0.0	7.0	1.1	47.3	48.8	12.3	28.6	0.6
Prop In Lane	0.97		1.00	1.00		0.99	1.00		0.12	1.00		1.00
Lane Grp Cap(c), veh/h	171	0	225	138	0	231	27	995	1025	234	2401	1071
V/C Ratio(X)	0.23	0.00	0.09	0.44	0.00	0.48	0.66	0.88	0.90	0.87	0.66	0.02
Avail Cap(c_a), veh/h	171	0	225	138	0	231	81	1098	1132	291	2616	1167
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	1.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	47.6	0.0	40.7	51.6	0.0	43.2	53.9	21.1	21.4	46.9	10.4	5.9
Incr Delay (d2), s/veh	0.7	0.0	0.2	2.2	0.0	1.5	23.6	8.1	9.0	19.9	0.5	0.0
Initial Q Delay(d3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	1.0	0.0	0.5	1.7	0.0	2.8	0.7	18.7	20.0	6.5	8.6	0.2
Unsig. Movement Delay, s/veh												
LnGrp Delay(d), s/veh	48.3	0.0	40.9	53.8	0.0	44.7	77.5	29.2	30.4	66.8	11.0	5.9
LnGrp LOS	D		D	D		D	E	C	C	E	B	A
Approach Vol, veh/h		60			171			1815			1810	
Approach Delay, s/veh		45.7			47.9			30.3			17.2	
Approach LOS		D			D			C			B	
Timer - Assigned Phs	1	2		4	5	6		8				
Phs Duration (G+Y+Rc), s	20.4	67.6		22.0	7.7	80.3		22.0				
Change Period (Y+Rc), s	6.0	6.0		6.0	6.0	6.0		6.0				
Max Green Setting (Gmax), s	18.0	68.0		16.0	5.0	81.0		16.0				
Max Q Clear Time (g_c+I1), s	14.3	50.8		12.1	3.1	30.6		17.0				
Green Ext Time (p_c), s	0.2	10.8		0.1	0.0	15.9		0.0				
Intersection Summary												
HCM 7th Control Delay, s/veh			25.1									
HCM 7th LOS			C									

3: MO 291 & Seven Hills Road/Old Highway 210 Existing 10% Proposed Underground (2030) AM Peak Hour with 3/4 Access

Intersection												
Int Delay, s/veh	0.4											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations			↗			↗	↗	↕		↗	↕	↗
Traffic Vol, veh/h	1	0	0	0	0	29	3	1089	16	29	973	3
Future Vol, veh/h	1	0	0	0	0	29	3	1089	16	29	973	3
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None									
Storage Length	-	-	-	-	-	-	100	-	-	380	-	200
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	17	26	2	33	33	3	21	4	2	2
Mvmt Flow	1	0	0	0	0	32	3	1184	17	32	1058	3

Major/Minor	Minor2		Minor1		Major1		Major2					
Conflicting Flow All	1719	-	529	-	-	601	1061	0	0	1201	0	0
Stage 1	1121	-	-	-	-	-	-	-	-	-	-	-
Stage 2	598	-	-	-	-	-	-	-	-	-	-	-
Critical Hdwy	7.54	-	7.24	-	-	7.56	4.76	-	-	4.18	-	-
Critical Hdwy Stg 1	6.54	-	-	-	-	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.54	-	-	-	-	-	-	-	-	-	-	-
Follow-up Hdwy	3.52	-	3.47	-	-	3.63	2.53	-	-	2.24	-	-
Pot Cap-1 Maneuver	58	0	457	0	0	375	496	-	-	566	-	-
Stage 1	220	0	-	0	0	-	-	-	-	-	-	-
Stage 2	456	0	-	0	0	-	-	-	-	-	-	-
Platoon blocked, %								-	-	-	-	-
Mov Cap-1 Maneuver	50	-	457	-	-	375	496	-	-	566	-	-
Mov Cap-2 Maneuver	50	-	-	-	-	-	-	-	-	-	-	-
Stage 1	208	-	-	-	-	-	-	-	-	-	-	-
Stage 2	414	-	-	-	-	-	-	-	-	-	-	-

Approach	EB		WB		NB		SB	
HCM Control Delay, s/v	0		15.49		0.03		0.34	
HCM LOS	A		C					

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	496	-	-	-	375	566	-	-
HCM Lane V/C Ratio	0.007	-	-	-	0.084	0.056	-	-
HCM Control Delay (s/veh)	12.3	-	-	0	15.5	11.7	-	-
HCM Lane LOS	B		A		C	B	-	
HCM 95th %tile Q(veh)	0	-	-	-	0.3	0.2	-	-

3: MO 291 & Seven Hills Road/Old Highway 210 Existing 10% Proposed Underground (2030) PM Peak Hour with 3/4 Access

Intersection												
Int Delay, s/veh	3.5											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations			↗			↗	↗	↕		↗	↕	↗
Traffic Vol, veh/h	0	0	55	0	0	157	17	1554	99	187	1455	23
Future Vol, veh/h	0	0	55	0	0	157	17	1554	99	187	1455	23
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None									
Storage Length	-	-	-	-	-	-	100	-	-	380	-	200
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	6	2	2	2	2	9	2	2	2
Mvmt Flow	0	0	60	0	0	171	18	1689	108	203	1582	25

Major/Minor	Minor2	Minor1	Major1	Major2
Conflicting Flow All	-	-	791	-
Stage 1	-	-	-	-
Stage 2	-	-	-	-
Critical Hdwy	-	-	6.94	4.14
Critical Hdwy Stg 1	-	-	-	-
Critical Hdwy Stg 2	-	-	-	-
Follow-up Hdwy	-	-	3.32	2.22
Pot Cap-1 Maneuver	0	0	333	403
Stage 1	0	0	-	-
Stage 2	0	0	-	-
Platoon blocked, %	-	-	-	-
Mov Cap-1 Maneuver	-	-	333	403
Mov Cap-2 Maneuver	-	-	-	-
Stage 1	-	-	-	-
Stage 2	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s/v	18.18	35.5	0.15	3.39
HCM LOS	C	E		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	403	-	-	333	282	340	-	-
HCM Lane V/C Ratio	0.046	-	-	0.18	0.605	0.598	-	-
HCM Control Delay (s/veh)	14.4	-	-	18.2	35.5	30.2	-	-
HCM Lane LOS	B	-	-	C	E	D	-	-
HCM 95th %tile Q(veh)	0.1	-	-	0.6	3.6	3.7	-	-

3: MO 291 & Seven Hills Road/Old Highway 210

Future (2043) AM Peak Hour

Intersection												
Int Delay, s/veh	17.4											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↔	↗	↖	↗	↖	↖	↗	↕	↖	↗	↖
Traffic Vol, veh/h	6	0	6	28	1	9	33	1409	21	37	1259	27
Future Vol, veh/h	6	0	6	28	1	9	33	1409	21	37	1259	27
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None									
Storage Length	-	-	-	100	-	-	100	-	-	380	-	200
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	56	26	2	33	33	3	21	4	2	4
Mvmt Flow	7	0	7	30	1	10	36	1532	23	40	1368	29

Major/Minor	Minor2		Minor1		Major1		Major2					
Conflicting Flow All	2287	3075	684	2379	3093	777	1398	0	0	1554	0	0
Stage 1	1449	1449	-	1615	1615	-	-	-	-	-	-	-
Stage 2	838	1626	-	765	1478	-	-	-	-	-	-	-
Critical Hdwy	7.54	6.54	8.02	8.02	6.54	7.56	4.76	-	-	4.18	-	-
Critical Hdwy Stg 1	6.54	5.54	-	7.02	5.54	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.54	5.54	-	7.02	5.54	-	-	-	-	-	-	-
Follow-up Hdwy	3.52	4.02	3.86	3.76	4.02	3.63	2.53	-	-	2.24	-	-
Pot Cap-1 Maneuver	21	12	287	~ 13	12	280	352	-	-	413	-	-
Stage 1	138	194	-	85	161	-	-	-	-	-	-	-
Stage 2	327	159	-	313	188	-	-	-	-	-	-	-
Platoon blocked, %								-	-	-	-	-
Mov Cap-1 Maneuver	15	10	287	~ 10	9	280	352	-	-	413	-	-
Mov Cap-2 Maneuver	15	10	-	~ 10	9	-	-	-	-	-	-	-
Stage 1	124	175	-	76	145	-	-	-	-	-	-	-
Stage 2	281	143	-	276	170	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s/veh	92.62	\$ 1206.02	0.37	0.41
HCM LOS	F	F		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	EBLn2	WBLn1	WBLn2	SBL	SBT	SBR
Capacity (veh/h)	352	-	-	15	287	10	72	413	-	-
HCM Lane V/C Ratio	0.102	-	-	0.433	0.023	2.968	0.151	0.097	-	-
HCM Control Delay (s/veh)	16.4	-	-	\$ 367.4	17.9	\$ 1614	63.6	14.7	-	-
HCM Lane LOS	C	-	-	F	C	F	F	B	-	-
HCM 95th %tile Q(veh)	0.3	-	-	1.1	0.1	4.9	0.5	0.3	-	-

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

6: Southview Drive & Strata Drive/Seven Hills Road

Future (2043) AM Peak Hour

Intersection												
Int Delay, s/veh	0											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Traffic Vol, veh/h	0	12	0	0	60	0	0	0	0	0	0	0
Future Vol, veh/h	0	12	0	0	60	0	0	0	0	0	0	0
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None									
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	17	2	2	20	2	100	2	87	2	2	2
Mvmt Flow	0	13	0	0	65	0	0	0	0	0	0	0

Major/Minor	Major1		Major2			Minor1			Minor2			
Conflicting Flow All	65	0	0	13	0	0	78	78	13	78	78	65
Stage 1	-	-	-	-	-	-	13	13	-	65	65	-
Stage 2	-	-	-	-	-	-	65	65	-	13	13	-
Critical Hdwy	4.12	-	-	4.12	-	-	8.1	6.52	7.07	7.12	6.52	6.22
Critical Hdwy Stg 1	-	-	-	-	-	-	7.1	5.52	-	6.12	5.52	-
Critical Hdwy Stg 2	-	-	-	-	-	-	7.1	5.52	-	6.12	5.52	-
Follow-up Hdwy	2.218	-	-	2.218	-	-	4.4	4.018	4.083	3.518	4.018	3.318
Pot Cap-1 Maneuver	1537	-	-	1605	-	-	719	812	866	911	812	999
Stage 1	-	-	-	-	-	-	804	885	-	945	841	-
Stage 2	-	-	-	-	-	-	748	841	-	1007	885	-
Platoon blocked, %	-	-	-	-	-	-	-	-	-	-	-	-
Mov Cap-1 Maneuver	1537	-	-	1605	-	-	719	812	866	911	812	999
Mov Cap-2 Maneuver	-	-	-	-	-	-	719	812	-	911	812	-
Stage 1	-	-	-	-	-	-	804	885	-	945	841	-
Stage 2	-	-	-	-	-	-	748	841	-	1007	885	-

Approach	EB	WB	NB	SB
HCM Control Delay, s/v	0	0	0	0
HCM LOS			A	A

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	-	1537	-	-	1605	-	-	-
HCM Lane V/C Ratio	-	-	-	-	-	-	-	-
HCM Control Delay (s/veh)	0	0	-	-	0	-	-	0
HCM Lane LOS	A	A	-	-	A	-	-	A
HCM 95th %tile Q(veh)	-	0	-	-	0	-	-	-

3: MO 291 & Seven Hills Road/Old Highway 210

Future (2043) PM Peak Hour

Intersection												
Int Delay, s/veh	3162.1											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↔	↗	↖	↗	↖	↖	↗	↗	↖	↗	↖
Traffic Vol, veh/h	78	1	52	73	1	129	28	2010	128	242	1883	37
Future Vol, veh/h	78	1	52	73	1	129	28	2010	128	242	1883	37
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	100	-	-	100	-	-	380	-	200
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	11	6	2	2	9	2	9	2	2	2
Mvmt Flow	85	1	57	79	1	140	30	2185	139	263	2047	40

Major/Minor	Minor2		Minor1		Major1		Major2					
Conflicting Flow All	3727	4958	1023	3865	4928	1162	2087	0	0	2324	0	0
Stage 1	2573	2573	-	2315	2315	-	-	-	-	-	-	-
Stage 2	1154	2385	-	1550	2613	-	-	-	-	-	-	-
Critical Hdwy	7.54	6.54	7.12	7.62	6.54	6.94	4.28	-	-	4.14	-	-
Critical Hdwy Stg 1	6.54	5.54	-	6.62	5.54	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.54	5.54	-	6.62	5.54	-	-	-	-	-	-	-
Follow-up Hdwy	3.52	4.02	3.41	3.56	4.02	3.32	2.29	-	-	2.22	-	-
Pot Cap-1 Maneuver	~ 2	~ 1	218	~ 1	~ 1	188	238	-	-	~ 211	-	-
Stage 1	~ 26	52	-	~ 36	71	-	-	-	-	-	-	-
Stage 2	210	65	-	114	50	-	-	-	-	-	-	-
Platoon blocked, %								-	-	-	-	-
Mov Cap-1 Maneuver	~ 0	0	218	~ 1	0	188	238	-	-	~ 211	-	-
Mov Cap-2 Maneuver	~ 0	0	-	~ 1	0	-	-	-	-	-	-	-
Stage 1	~ 26	0	-	~ 32	62	-	-	-	-	-	-	-
Stage 2	~ 46	57	-	85	0	-	-	-	-	-	-	-

Approach	EB		WB		NB		SB	
HCM Control Delay (s/veh)	7.90	87.32	\$	21353.39	0.29			21.32
HCM LOS	F		F					

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	EBLn2	WBLn1	WBLn2	SBL	SBT	SBR
Capacity (veh/h)	238	-	-	-	218	1	188	~ 211	-	-
HCM Lane V/C Ratio	0.128	-	-	247.936	0.259	111.14	0.751	1.248	-	-
HCM Control Delay (s/veh)	22.4	-	-	\$ 131126.9	27.5	262.2	66.1	190.4	-	-
HCM Lane LOS	C	-	-	F	D	F	F	F	-	-
HCM 95th %tile Q(veh)	0.4	-	-	13.1	1	12.3	4.9	13.7	-	-

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

6: Southview Drive & Strata Drive/Seven Hills Road

Future (2043) PM Peak Hour

Intersection												
Int Delay, s/veh	4.9											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Traffic Vol, veh/h	0	69	0	51	14	1	0	0	59	3	0	0
Future Vol, veh/h	0	69	0	51	14	1	0	0	59	3	0	0
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None									
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	9	2	34	7	2	2	2	14	2	2	2
Mvmt Flow	0	75	0	55	15	1	0	0	64	3	0	0

Major/Minor	Major1		Major2		Minor1		Minor2					
Conflicting Flow All	16	0	0	75	0	0	201	202	75	202	202	16
Stage 1	-	-	-	-	-	-	75	75	-	127	127	-
Stage 2	-	-	-	-	-	-	126	127	-	75	75	-
Critical Hdwy	4.12	-	-	4.44	-	-	7.12	6.52	6.34	7.12	6.52	6.22
Critical Hdwy Stg 1	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Follow-up Hdwy	2.218	-	-	2.506	-	-	3.518	4.018	3.426	3.518	4.018	3.318
Pot Cap-1 Maneuver	1601	-	-	1344	-	-	757	694	954	757	694	1064
Stage 1	-	-	-	-	-	-	934	833	-	877	791	-
Stage 2	-	-	-	-	-	-	878	791	-	934	833	-
Platoon blocked, %		-	-	-	-	-						
Mov Cap-1 Maneuver	1601	-	-	1344	-	-	726	665	954	676	666	1064
Mov Cap-2 Maneuver	-	-	-	-	-	-	726	665	-	676	666	-
Stage 1	-	-	-	-	-	-	934	833	-	841	758	-
Stage 2	-	-	-	-	-	-	841	758	-	871	833	-

Approach	EB		WB		NB		SB	
HCM Control Delay, s/v	0		6.02		9.05		10.35	
HCM LOS					A		B	

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	954	1601	-	-	1332	-	-	676
HCM Lane V/C Ratio	0.067	-	-	-	0.041	-	-	0.005
HCM Control Delay (s/veh)	9	0	-	-	7.8	0	-	10.3
HCM Lane LOS	A	A	-	-	A	A	-	B
HCM 95th %tile Q(veh)	0.2	0	-	-	0.1	-	-	0

3: MO 291 & Seven Hills Road/Old Highway 210

Future (2043) AM Peak Hour with Signal



Lane Group	EBT	EBR	WBL	WBT	NBL	NBT	NBR	SBL	SBT	SBR
Lane Group Flow (vph)	7	7	30	10	36	1532	23	40	1368	29
v/c Ratio	0.02	0.02	0.12	0.02	0.26	0.39	0.02	0.23	0.35	0.02
Control Delay (s/veh)	18.1	0.1	19.1	0.1	26.9	7.0	0.0	24.9	6.6	0.0
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay (s/veh)	18.1	0.1	19.1	0.1	26.9	7.0	0.0	24.9	6.6	0.0
Queue Length 50th (ft)	1	0	5	0	7	0	0	8	0	0
Queue Length 95th (ft)	11	0	27	0	#35	188	0	36	161	0
Internal Link Dist (ft)	117			608		719			750	
Turn Bay Length (ft)			100		100			380		200
Base Capacity (vph)	738	580	597	584	134	3866	1063	172	3904	1230
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.01	0.01	0.05	0.02	0.27	0.40	0.02	0.23	0.35	0.02

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
 Queue shown is maximum after two cycles.

3: MO 291 & Seven Hills Road/Old Highway 210

Future (2043) AM Peak Hour with Signal

													
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Lane Configurations								  			  		
Traffic Volume (veh/h)	6	0	6	28	0	9	33	1409	21	37	1259	27	
Future Volume (veh/h)	6	0	6	28	0	9	33	1409	21	37	1259	27	
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0	
Lane Width Adj.	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00	
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Work Zone On Approach		No			No			No			No		
Adj Sat Flow, veh/h/ln	1870	1870	1411	1515	1870	1411	1411	1856	1589	1841	1870	1841	
Adj Flow Rate, veh/h	7	0	7	30	0	10	36	1532	23	40	1368	29	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	
Percent Heavy Veh, %	2	2	33	26	2	33	33	3	21	4	2	4	
Cap, veh/h	239	0	54	224	0	72	44	2320	617	63	2354	719	
Arrive On Green	0.05	0.00	0.05	0.05	0.00	0.05	0.03	0.46	0.46	0.04	0.46	0.46	
Sat Flow, veh/h	1217	0	1196	1141	0	1585	1344	5066	1346	1753	5106	1560	
Grp Volume(v), veh/h	7	0	7	30	0	10	36	1532	23	40	1368	29	
Grp Sat Flow(s),veh/h/ln	1217	0	1196	1141	0	1585	1344	1689	1346	1753	1702	1560	
Q Serve(g_s), s	0.2	0.0	0.2	1.0	0.0	0.2	1.0	9.2	0.4	0.9	7.7	0.4	
Cycle Q Clear(g_c), s	0.4	0.0	0.2	1.4	0.0	0.2	1.0	9.2	0.4	0.9	7.7	0.4	
Prop In Lane	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00	
Lane Grp Cap(c), veh/h	239	0	54	224	0	72	44	2320	617	63	2354	719	
V/C Ratio(X)	0.03	0.00	0.13	0.13	0.00	0.14	0.81	0.66	0.04	0.63	0.58	0.04	
Avail Cap(c_a), veh/h	751	0	489	639	0	649	138	2851	758	179	2874	878	
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Upstream Filter(I)	1.00	0.00	1.00	1.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Uniform Delay (d), s/veh	18.1	0.0	17.9	18.7	0.0	17.9	18.8	8.2	5.8	18.6	7.8	5.8	
Incr Delay (d2), s/veh	0.0	0.0	1.1	0.3	0.0	0.9	28.0	0.4	0.0	10.0	0.2	0.0	
Initial Q Delay(d3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
%ile BackOfQ(50%),veh/ln	0.1	0.0	0.1	0.2	0.0	0.1	0.6	1.5	0.0	0.4	1.2	0.1	
Unsig. Movement Delay, s/veh													
LnGrp Delay(d), s/veh	18.2	0.0	19.0	19.0	0.0	18.8	46.7	8.6	5.9	28.6	8.0	5.8	
LnGrp LOS	B		B	B		B	D	A	A	C	A	A	
Approach Vol, veh/h	14		40				1591			1437			
Approach Delay, s/veh	18.6		18.9				9.5			8.5			
Approach LOS	B		B				A			A			
Timer - Assigned Phs	1	2	4		5	6	8						
Phs Duration (G+Y+Rc), s	7.4	23.9	7.8		7.3	24.0	7.8						
Change Period (Y+Rc), s	6.0	6.0	6.0		6.0	6.0	6.0						
Max Green Setting (Gmax), s	4.0	22.0	16.0		4.0	22.0	16.0						
Max Q Clear Time (g_c+I1), s	2.9	11.2	2.4		3.0	9.7	3.4						
Green Ext Time (p_c), s	0.0	6.7	0.0		0.0	6.6	0.1						
Intersection Summary													
HCM 7th Control Delay, s/veh			9.2										
HCM 7th LOS			A										

3: MO 291 & Seven Hills Road/Old Highway 210

Future (2043) PM Peak Hour with Signal



Lane Group	EBT	EBR	WBL	WBT	NBL	NBT	NBR	SBL	SBT	SBR
Lane Group Flow (vph)	86	57	79	141	30	2185	139	263	2047	40
v/c Ratio	0.58	0.16	0.47	0.42	0.26	0.89	0.17	0.86	0.59	0.03
Control Delay (s/veh)	50.9	1.0	43.6	10.4	45.0	26.6	1.5	62.8	10.3	0.0
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay (s/veh)	50.9	1.0	43.6	10.4	45.0	26.6	1.5	62.8	10.3	0.0
Queue Length 50th (ft)	44	0	40	1	16	376	0	139	153	0
Queue Length 95th (ft)	91	0	83	50	44	#545	17	#289	353	0
Internal Link Dist (ft)	117			608		719			750	
Turn Bay Length (ft)			100		100			380		200
Base Capacity (vph)	209	421	236	412	117	2454	809	312	3417	1099
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.41	0.14	0.33	0.34	0.26	0.89	0.17	0.84	0.60	0.04

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
 Queue shown is maximum after two cycles.

3: MO 291 & Seven Hills Road/Old Highway 210

Future (2043) PM Peak Hour with Signal



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↖	↗	↖	↗		↖	↑↑↑	↗	↖	↑↑↑	↗
Traffic Volume (veh/h)	78	1	52	73	1	129	28	2010	128	242	1883	37
Future Volume (veh/h)	78	1	52	73	1	129	28	2010	128	242	1883	37
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Lane Width Adj.	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1737	1811	1870	1870	1767	1870	1767	1870	1870	1870
Adj Flow Rate, veh/h	85	1	57	79	1	140	30	2185	139	263	2047	40
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	2	2	11	6	2	2	9	2	9	2	2	2
Cap, veh/h	200	2	262	121	2	280	39	2327	682	296	3057	949
Arrive On Green	0.18	0.18	0.18	0.18	0.18	0.18	0.02	0.46	0.46	0.17	0.60	0.60
Sat Flow, veh/h	680	11	1472	1302	11	1576	1682	5106	1497	1781	5106	1585
Grp Volume(v), veh/h	86	0	57	79	0	141	30	2185	139	263	2047	40
Grp Sat Flow(s),veh/h/ln	690	0	1472	1302	0	1587	1682	1702	1497	1781	1702	1585
Q Serve(g_s), s	5.9	0.0	3.0	2.8	0.0	7.2	1.6	36.6	5.0	13.0	24.2	0.9
Cycle Q Clear(g_c), s	13.2	0.0	3.0	16.0	0.0	7.2	1.6	36.6	5.0	13.0	24.2	0.9
Prop In Lane	0.99		1.00	1.00		0.99	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	202	0	262	121	0	282	39	2327	682	296	3057	949
V/C Ratio(X)	0.42	0.00	0.22	0.65	0.00	0.50	0.76	0.94	0.20	0.89	0.67	0.04
Avail Cap(c_a), veh/h	202	0	262	121	0	282	112	2327	682	297	3057	949
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	1.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	39.3	0.0	31.6	44.2	0.0	33.4	43.7	23.3	14.7	36.7	12.1	7.4
Incr Delay (d2), s/veh	1.4	0.0	0.4	11.8	0.0	1.4	25.3	9.0	0.7	26.0	0.6	0.0
Initial Q Delay(d3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	1.9	0.0	1.1	2.1	0.0	2.8	0.9	14.1	1.6	7.3	7.0	0.3
Unsig. Movement Delay, s/veh												
LnGrp Delay(d), s/veh	40.7	0.0	32.0	56.0	0.0	34.7	69.0	32.3	15.4	62.6	12.7	7.5
LnGrp LOS	D		C	E		C	E	C	B	E	B	A
Approach Vol, veh/h	143		220				2354		2350			
Approach Delay, s/veh	37.2		42.4				31.7		18.2			
Approach LOS	D		D				C		B			
Timer - Assigned Phs	1	2	4		5	6	8					
Phs Duration (G+Y+Rc), s	21.0	47.0	22.0		8.1	59.9	22.0					
Change Period (Y+Rc), s	6.0	6.0	6.0		6.0	6.0	6.0					
Max Green Setting (Gmax), s	15.0	41.0	16.0		6.0	50.0	16.0					
Max Q Clear Time (g_c+I1), s	15.0	38.6	15.2		3.6	26.2	18.0					
Green Ext Time (p_c), s	0.0	2.2	0.0		0.0	15.5	0.0					
Intersection Summary												
HCM 7th Control Delay, s/veh			26.1									
HCM 7th LOS			C									

3: MO 291 & Seven Hills Road/Old Highway 210

Future (2043) AM Peak Hour with 3/4 Access

Intersection												
Int Delay, s/veh	0.7											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations			↗			↗	↗	↗↘		↗	↗↗	↗
Traffic Vol, veh/h	0	0	12	0	0	37	33	1409	21	37	1259	27
Future Vol, veh/h	0	0	12	0	0	37	33	1409	21	37	1259	27
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None									
Storage Length	-	-	-	-	-	-	100	-	-	380	-	200
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	36	2	17	26	2	33	33	3	21	4	2	4
Mvmt Flow	0	0	13	0	0	40	36	1532	23	40	1368	29

Major/Minor	Minor2		Minor1		Major1		Major2					
Conflicting Flow All	-	-	684	-	-	777	1398	0	0	1554	0	0
Stage 1	-	-	-	-	-	-	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-	-	-	-	-	-	-
Critical Hdwy	-	-	7.24	-	-	7.56	4.76	-	-	4.18	-	-
Critical Hdwy Stg 1	-	-	-	-	-	-	-	-	-	-	-	-
Critical Hdwy Stg 2	-	-	-	-	-	-	-	-	-	-	-	-
Follow-up Hdwy	-	-	3.47	-	-	3.63	2.53	-	-	2.24	-	-
Pot Cap-1 Maneuver	0	0	358	0	0	280	352	-	-	413	-	-
Stage 1	0	0	-	0	0	-	-	-	-	-	-	-
Stage 2	0	0	-	0	0	-	-	-	-	-	-	-
Platoon blocked, %	-	-	-	-	-	-	-	-	-	-	-	-
Mov Cap-1 Maneuver	-	-	358	-	-	280	352	-	-	413	-	-
Mov Cap-2 Maneuver	-	-	-	-	-	-	-	-	-	-	-	-
Stage 1	-	-	-	-	-	-	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-	-	-	-	-	-	-

Approach	EB		WB		NB		SB	
HCM Control Delay, s/v15.44			20.02		0.37		0.41	
HCM LOS	C		C					

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	352	-	-	358	280	413	-	-
HCM Lane V/C Ratio	0.102	-	-	0.036	0.144	0.097	-	-
HCM Control Delay (s/veh)	16.4	-	-	15.4	20	14.7	-	-
HCM Lane LOS	C	-	-	C	C	B	-	-
HCM 95th %tile Q(veh)	0.3	-	-	0.1	0.5	0.3	-	-

3: MO 291 & Seven Hills Road/Old Highway 210

Future (2043) PM Peak Hour with 3/4 Access

Intersection												
Int Delay, s/veh	18.8											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations			↗			↗	↖	↕		↖	↕	↗
Traffic Vol, veh/h	0	0	131	0	0	203	28	2010	128	242	1883	37
Future Vol, veh/h	0	0	131	0	0	203	28	2010	128	242	1883	37
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None									
Storage Length	-	-	-	-	-	-	100	-	-	380	-	200
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	11	6	2	2	9	2	9	2	2	2
Mvmt Flow	0	0	142	0	0	221	30	2185	139	263	2047	40

Major/Minor	Minor2	Minor1	Major1	Major2								
Conflicting Flow All	-	-	1023	-	-	1162	2087	0	0	2324	0	0
Stage 1	-	-	-	-	-	-	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-	-	-	-	-	-	-
Critical Hdwy	-	-	7.12	-	-	6.94	4.28	-	-	4.14	-	-
Critical Hdwy Stg 1	-	-	-	-	-	-	-	-	-	-	-	-
Critical Hdwy Stg 2	-	-	-	-	-	-	-	-	-	-	-	-
Follow-up Hdwy	-	-	3.41	-	-	3.32	2.29	-	-	2.22	-	-
Pot Cap-1 Maneuver	0	0	218	0	0	~ 188	238	-	-	~ 211	-	-
Stage 1	0	0	-	0	0	-	-	-	-	-	-	-
Stage 2	0	0	-	0	0	-	-	-	-	-	-	-
Platoon blocked, %	-	-	-	-	-	-	-	-	-	-	-	-
Mov Cap-1 Maneuver	-	-	218	-	-	~ 188	238	-	-	~ 211	-	-
Mov Cap-2 Maneuver	-	-	-	-	-	-	-	-	-	-	-	-
Stage 1	-	-	-	-	-	-	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s/v	48.16	170.8	0.29	21.32
HCM LOS	E	F		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	238	-	-	218	188	~ 211	-	-
HCM Lane V/C Ratio	0.128	-	-	0.654	1.173	1.248	-	-
HCM Control Delay (s/veh)	22.4	-	-	48.2	170.8	190.4	-	-
HCM Lane LOS	C	-	-	E	F	F	-	-
HCM 95th %tile Q(veh)	0.4	-	-	4	11.4	13.7	-	-

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

3: MO 291 & Seven Hills Road/Old Highway 210

Future (2043) No-Build AM Peak Hour

Intersection												
Int Delay, s/veh	12											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕	↗	↖	↘		↖	↕		↖	↕	↗
Traffic Vol, veh/h	0	0	0	28	0	9	0	1409	21	37	1259	0
Future Vol, veh/h	0	0	0	28	0	9	0	1409	21	37	1259	0
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None									
Storage Length	-	-	-	100	-	-	100	-	-	380	-	200
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	56	26	2	33	33	3	21	4	2	4
Mvmt Flow	0	0	0	30	0	10	0	1532	23	40	1368	0

Major/Minor	Minor2		Minor1		Major1		Major2					
Conflicting Flow All	2215	3003	684	2308	2992	777	1368	0	0	1554	0	0
Stage 1	1449	1449	-	1543	1543	-	-	-	-	-	-	-
Stage 2	766	1554	-	765	1449	-	-	-	-	-	-	-
Critical Hdwy	7.54	6.54	8.02	8.02	6.54	7.56	4.76	-	-	4.18	-	-
Critical Hdwy Stg 1	6.54	5.54	-	7.02	5.54	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.54	5.54	-	7.02	5.54	-	-	-	-	-	-	-
Follow-up Hdwy	3.52	4.02	3.86	3.76	4.02	3.63	2.53	-	-	2.24	-	-
Pot Cap-1 Maneuver	24	13	287	~ 15	14	280	363	-	-	413	-	-
Stage 1	138	194	-	95	175	-	-	-	-	-	-	-
Stage 2	361	173	-	313	194	-	-	-	-	-	-	-
Platoon blocked, %								-	-	-	-	-
Mov Cap-1 Maneuver	21	12	287	~ 13	12	280	363	-	-	413	-	-
Mov Cap-2 Maneuver	21	12	-	~ 13	12	-	-	-	-	-	-	-
Stage 1	124	175	-	95	175	-	-	-	-	-	-	-
Stage 2	349	173	-	282	175	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s/v	0	\$ 880.47	0	0.42
HCM LOS	A	F		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	EBLn2	WBLn1	WBLn2	SBL	SBT	SBR
Capacity (veh/h)	363	-	-	-	-	13	280	413	-	-
HCM Lane V/C Ratio	-	-	-	-	-	2.273	0.035	0.097	-	-
HCM Control Delay (s/veh)	0	-	-	0	\$ 1157.6	18.3	14.7	-	-	-
HCM Lane LOS	A	-	-	A	A	F	C	B	-	-
HCM 95th %tile Q(veh)	0	-	-	-	-	4.6	0.1	0.3	-	-

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

6: Southview Drive & Seven Hills Road

Future (2043) No-Build AM Peak Hour

Intersection												
Int Delay, s/veh	0											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Traffic Vol, veh/h	0	0	0	0	0	0	0	0	0	0	0	0
Future Vol, veh/h	0	0	0	0	0	0	0	0	0	0	0	0
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None									
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	17	2	2	20	2	100	2	87	2	2	2
Mvmt Flow	0	0	0	0	0	0	0	0	0	0	0	0

Major/Minor	Major1		Major2		Minor1		Minor2					
Conflicting Flow All	1	0	0	1	0	0	2	2	1	2	2	1
Stage 1	-	-	-	-	-	-	1	1	-	1	1	-
Stage 2	-	-	-	-	-	-	1	1	-	1	1	-
Critical Hdwy	4.12	-	-	4.12	-	-	8.1	6.52	7.07	7.12	6.52	6.22
Critical Hdwy Stg 1	-	-	-	-	-	-	7.1	5.52	-	6.12	5.52	-
Critical Hdwy Stg 2	-	-	-	-	-	-	7.1	5.52	-	6.12	5.52	-
Follow-up Hdwy	2.218	-	-	2.218	-	-	4.4	4.018	4.083	3.518	4.018	3.318
Pot Cap-1 Maneuver	1622	-	-	1622	-	-	815	894	880	1020	894	1083
Stage 1	-	-	-	-	-	-	817	895	-	1022	895	-
Stage 2	-	-	-	-	-	-	817	895	-	1022	895	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	1622	-	-	1622	-	-	815	894	880	1020	894	1083
Mov Cap-2 Maneuver	-	-	-	-	-	-	815	894	-	1020	894	-
Stage 1	-	-	-	-	-	-	817	895	-	1022	895	-
Stage 2	-	-	-	-	-	-	817	895	-	1022	895	-

Approach	EB	WB	NB	SB
HCM Control Delay, s/v	0	0	0	0
HCM LOS			A	A

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	-	1622	-	-	1622	-	-	-
HCM Lane V/C Ratio	-	-	-	-	-	-	-	-
HCM Control Delay (s/veh)	0	0	-	-	0	-	-	0
HCM Lane LOS		A	A	-	-	A	-	A
HCM 95th %tile Q(veh)	-	0	-	-	0	-	-	-

3: MO 291 & Seven Hills Road/Old Highway 210

Future (2043) No-Build PM Peak Hour

Intersection												
Int Delay, s/veh	1436.3											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↔	↗	↖	↗	↖	↖	↗		↖	↗	↖
Traffic Vol, veh/h	42	1	19	73	1	129	21	2010	128	242	1883	30
Future Vol, veh/h	42	1	19	73	1	129	21	2010	128	242	1883	30
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	100	-	-	100	-	-	380	-	200
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	11	6	2	2	9	2	9	2	2	2
Mvmt Flow	46	1	21	79	1	140	23	2185	139	263	2047	33

Major/Minor	Minor2		Minor1		Major1		Major2					
Conflicting Flow All	3711	4942	1023	3850	4905	1162	2079	0	0	2324	0	0
Stage 1	2573	2573	-	2300	2300	-	-	-	-	-	-	-
Stage 2	1139	2370	-	1550	2605	-	-	-	-	-	-	-
Critical Hdwy	7.54	6.54	7.12	7.62	6.54	6.94	4.28	-	-	4.14	-	-
Critical Hdwy Stg 1	6.54	5.54	-	6.62	5.54	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.54	5.54	-	6.62	5.54	-	-	-	-	-	-	-
Follow-up Hdwy	3.52	4.02	3.41	3.56	4.02	3.32	2.29	-	-	2.22	-	-
Pot Cap-1 Maneuver	~ 2	~ 1	218	~ 1	~ 1	188	239	-	-	~ 211	-	-
Stage 1	~ 26	52	-	~ 37	72	-	-	-	-	-	-	-
Stage 2	214	67	-	114	50	-	-	-	-	-	-	-
Platoon blocked, %								-	-	-	-	-
Mov Cap-1 Maneuver	~ 0	0	218	~ 1	0	188	239	-	-	~ 211	-	-
Mov Cap-2 Maneuver	~ 0	0	-	~ 1	0	-	-	-	-	-	-	-
Stage 1	~ 26	0	-	~ 34	65	-	-	-	-	-	-	-
Stage 2	49	60	-	103	0	-	-	-	-	-	-	-

Approach	EB		WB		NB		SB	
HCM Control Delay (s/veh)	5.46	36.14	\$	16338.21	0.21			21.39
HCM LOS	F		F					

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	EBLn2	WBLn1	WBLn2	SBL	SBT	SBR
Capacity (veh/h)	239	-	-	-	218	1	188	~ 211	-	-
HCM Lane V/C Ratio	0.095	-	-	426.457	0.095	85.165	0.751	1.248	-	-
HCM Control Delay (s/veh)	21.6	-	-	\$ 74730.2	\$ 245315.9	66.1	190.4	-	-	-
HCM Lane LOS	C	-	-	F	C	F	F	F	-	-
HCM 95th %tile Q(veh)	0.3	-	-	8	0.3	12.2	4.9	13.7	-	-

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

3: MO 291 & Seven Hills Road/Old Highway 210

Future (2043) No-Build PM Peak Hour

Intersection												
Int Delay, s/veh	1436.3											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↔	↗	↖	↗	↖	↖	↗		↖	↗	↖
Traffic Vol, veh/h	42	1	19	73	1	129	21	2010	128	242	1883	30
Future Vol, veh/h	42	1	19	73	1	129	21	2010	128	242	1883	30
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	100	-	-	100	-	-	380	-	200
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	11	6	2	2	9	2	9	2	2	2
Mvmt Flow	46	1	21	79	1	140	23	2185	139	263	2047	33

Major/Minor	Minor2		Minor1		Major1		Major2					
Conflicting Flow All	3711	4942	1023	3850	4905	1162	2079	0	0	2324	0	0
Stage 1	2573	2573	-	2300	2300	-	-	-	-	-	-	-
Stage 2	1139	2370	-	1550	2605	-	-	-	-	-	-	-
Critical Hdwy	7.54	6.54	7.12	7.62	6.54	6.94	4.28	-	-	4.14	-	-
Critical Hdwy Stg 1	6.54	5.54	-	6.62	5.54	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.54	5.54	-	6.62	5.54	-	-	-	-	-	-	-
Follow-up Hdwy	3.52	4.02	3.41	3.56	4.02	3.32	2.29	-	-	2.22	-	-
Pot Cap-1 Maneuver	~ 2	~ 1	218	~ 1	~ 1	188	239	-	-	~ 211	-	-
Stage 1	~ 26	52	-	~ 37	72	-	-	-	-	-	-	-
Stage 2	214	67	-	114	50	-	-	-	-	-	-	-
Platoon blocked, %								-	-	-	-	-
Mov Cap-1 Maneuver	~ 0	0	218	~ 1	0	188	239	-	-	~ 211	-	-
Mov Cap-2 Maneuver	~ 0	0	-	~ 1	0	-	-	-	-	-	-	-
Stage 1	~ 26	0	-	~ 34	65	-	-	-	-	-	-	-
Stage 2	49	60	-	103	0	-	-	-	-	-	-	-

Approach	EB		WB		NB		SB	
HCM Control Delay, s/veh	336.14		\$ 16338.21		0.21		21.39	
HCM LOS	F		F					

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	EBLn2	WBLn1	WBLn2	SBL	SBT	SBR
Capacity (veh/h)	239	-	-	-	218	1	188	~ 211	-	-
HCM Lane V/C Ratio	0.095	-	-	426.457	0.095	85.165	0.751	1.248	-	-
HCM Control Delay (s/veh)	21.6	-	-	\$ 74730.2	\$ 245315.9	66.1	190.4	-	-	-
HCM Lane LOS	C	-	-	F	C	F	F	F	-	-
HCM 95th %tile Q(veh)	0.3	-	-	8	0.3	12.2	4.9	13.7	-	-

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

6: Southview Drive & Seven Hills Road

Future (2043) No-Build PM Peak Hour

Intersection												
Int Delay, s/veh	8.1											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Traffic Vol, veh/h	0	0	0	51	0	1	0	0	59	3	0	0
Future Vol, veh/h	0	0	0	51	0	1	0	0	59	3	0	0
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None									
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	9	2	34	7	2	2	2	14	2	2	2
Mvmt Flow	0	0	0	55	0	1	0	0	64	3	0	0

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	1	0	0	1	0	0	112	113	1	112	112	1
Stage 1	-	-	-	-	-	-	1	1	-	111	111	-
Stage 2	-	-	-	-	-	-	111	112	-	1	1	-
Critical Hdwy	4.12	-	-	4.44	-	-	7.12	6.52	6.34	7.12	6.52	6.22
Critical Hdwy Stg 1	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Follow-up Hdwy	2.218	-	-	2.506	-	-	3.518	4.018	3.426	3.518	4.018	3.318
Pot Cap-1 Maneuver	1622	-	-	1435	-	-	866	777	1049	865	778	1084
Stage 1	-	-	-	-	-	-	1022	895	-	894	803	-
Stage 2	-	-	-	-	-	-	894	803	-	1022	895	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	1622	-	-	1435	-	-	832	747	1049	781	748	1084
Mov Cap-2 Maneuver	-	-	-	-	-	-	832	747	-	781	748	-
Stage 1	-	-	-	-	-	-	1022	895	-	859	772	-
Stage 2	-	-	-	-	-	-	860	772	-	960	895	-

Approach	EB			WB			NB			SB		
HCM Control Delay, s/v	0			7.46			8.65			9.63		
HCM LOS							A			A		

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	1049	1622	-	-	1434	-	-	781
HCM Lane V/C Ratio	0.061	-	-	-	0.039	-	-	0.004
HCM Control Delay (s/veh)	8.7	0	-	-	7.6	0	-	9.6
HCM Lane LOS	A	A	-	-	A	A	-	A
HCM 95th %tile Q(veh)	0.2	0	-	-	0.1	-	-	0

3: MO 291 & Seven Hills Road/Old Highway 210

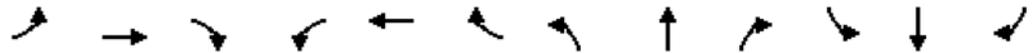
Future (2043) No-Build AM Peak Hour with Signal



Lane Group	WBL	WBT	NBT	NBR	SBL	SBT
Lane Group Flow (vph)	30	10	1532	23	40	1368
v/c Ratio	0.12	0.02	0.39	0.02	0.23	0.31
Control Delay (s/veh)	19.4	0.1	6.9	0.0	25.2	3.0
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay (s/veh)	19.4	0.1	6.9	0.0	25.2	3.0
Queue Length 50th (ft)	5	0	0	0	8	0
Queue Length 95th (ft)	27	0	188	0	36	97
Internal Link Dist (ft)		608	719			750
Turn Bay Length (ft)	100				380	
Base Capacity (vph)	593	581	3886	1067	170	4306
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.05	0.02	0.39	0.02	0.24	0.32
Intersection Summary						

3: MO 291 & Seven Hills Road/Old Highway 210

Future (2043) No-Build AM Peak Hour with Signal



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕	↗	↖	↗	↖	↖	↕↕↕	↗	↖	↕↕↕	↖
Traffic Volume (veh/h)	0	0	0	28	0	9	0	1409	21	37	1259	0
Future Volume (veh/h)	0	0	0	28	0	9	0	1409	21	37	1259	0
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Lane Width Adj.	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1411	1515	1870	1411	1411	1856	1589	1841	1870	1841
Adj Flow Rate, veh/h	0	0	0	30	0	10	0	1532	23	40	1368	0
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	2	2	33	26	2	33	33	3	21	4	2	4
Cap, veh/h	0	68	43	239	0	57	3	2337	621	63	3334	1019
Arrive On Green	0.00	0.00	0.00	0.04	0.00	0.04	0.00	0.46	0.46	0.04	0.65	0.00
Sat Flow, veh/h	0	1870	1196	1443	0	1585	1344	5066	1346	1753	5106	1560
Grp Volume(v), veh/h	0	0	0	30	0	10	0	1532	23	40	1368	0
Grp Sat Flow(s),veh/h/ln	0	1870	1196	1443	0	1585	1344	1689	1346	1753	1702	1560
Q Serve(g_s), s	0.0	0.0	0.0	0.8	0.0	0.2	0.0	9.0	0.4	0.9	4.9	0.0
Cycle Q Clear(g_c), s	0.0	0.0	0.0	0.8	0.0	0.2	0.0	9.0	0.4	0.9	4.9	0.0
Prop In Lane	0.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	0	68	43	239	0	57	3	2337	621	63	3334	1019
V/C Ratio(X)	0.00	0.00	0.00	0.13	0.00	0.17	0.00	0.66	0.04	0.63	0.41	0.00
Avail Cap(c_a), veh/h	0	775	496	784	0	657	139	2887	767	182	3334	1019
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	0.00	0.00	0.00	1.00	0.00	1.00	0.00	1.00	1.00	1.00	1.00	0.00
Uniform Delay (d), s/veh	0.0	0.0	0.0	18.3	0.0	18.0	0.0	8.0	5.7	18.3	3.2	0.0
Incr Delay (d2), s/veh	0.0	0.0	0.0	0.2	0.0	1.4	0.0	0.4	0.0	9.9	0.1	0.0
Initial Q Delay(d3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.0	0.0	0.0	0.2	0.0	0.1	0.0	1.4	0.0	0.4	0.0	0.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d), s/veh	0.0	0.0	0.0	18.5	0.0	19.5	0.0	8.4	5.7	28.3	3.3	0.0
LnGrp LOS				B		B		A	A	C	A	
Approach Vol, veh/h		0			40			1555			1408	
Approach Delay, s/veh		0.0			18.8			8.4			4.0	
Approach LOS					B			A			A	
Timer - Assigned Phs	1	2		4	5	6		8				
Phs Duration (G+Y+Rc), s	7.4	23.8		7.4	0.0	31.2		7.4				
Change Period (Y+Rc), s	6.0	6.0		6.0	6.0	6.0		6.0				
Max Green Setting (Gmax), s	4.0	22.0		16.0	4.0	22.0		16.0				
Max Q Clear Time (g_c+I1), s	2.9	11.0		0.0	0.0	6.9		2.8				
Green Ext Time (p_c), s	0.0	6.8		0.0	0.0	7.5		0.1				
Intersection Summary												
HCM 7th Control Delay, s/veh			6.4									
HCM 7th LOS			A									

3: MO 291 & Seven Hills Road/Old Highway 210

Future (2043) No-Build PM Peak Hour with Signal



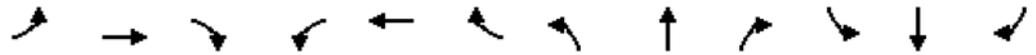
Lane Group	EBT	EBR	WBL	WBT	NBL	NBT	NBR	SBL	SBT	SBR
Lane Group Flow (vph)	47	21	79	140	23	2185	139	263	2047	33
v/c Ratio	0.34	0.06	0.49	0.38	0.23	0.88	0.17	0.85	0.58	0.02
Control Delay (s/veh)	40.4	0.3	45.0	4.7	45.4	25.4	1.5	61.0	9.4	0.0
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay (s/veh)	40.4	0.3	45.0	4.7	45.4	25.4	1.5	61.0	9.4	0.0
Queue Length 50th (ft)	23	0	40	0	12	364	0	136	142	0
Queue Length 95th (ft)	56	0	83	19	38	#540	17	#286	338	0
Internal Link Dist (ft)	117			608		719			750	
Turn Bay Length (ft)			100		100			380		200
Base Capacity (vph)	212	424	247	460	98	2482	816	316	3476	1116
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.22	0.05	0.32	0.30	0.23	0.88	0.17	0.83	0.59	0.03

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
 Queue shown is maximum after two cycles.

3: MO 291 & Seven Hills Road/Old Highway 210

Future (2043) No-Build PM Peak Hour with Signal



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↖	↗	↖	↗		↖	↑↑↑	↗	↖	↑↑↑	↗
Traffic Volume (veh/h)	42	1	19	73	0	129	21	2010	128	242	1883	30
Future Volume (veh/h)	42	1	19	73	0	129	21	2010	128	242	1883	30
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Lane Width Adj.	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1737	1811	1870	1870	1767	1870	1767	1870	1870	1870
Adj Flow Rate, veh/h	46	1	21	79	0	140	23	2185	139	263	2047	33
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	2	2	11	6	2	2	9	2	9	2	2	2
Cap, veh/h	200	4	262	166	0	282	33	2327	682	296	3077	955
Arrive On Green	0.18	0.18	0.18	0.18	0.00	0.18	0.02	0.46	0.46	0.17	0.60	0.60
Sat Flow, veh/h	680	20	1472	1346	0	1585	1682	5106	1497	1781	5106	1585
Grp Volume(v), veh/h	47	0	21	79	0	140	23	2185	139	263	2047	33
Grp Sat Flow(s),veh/h/ln	699	0	1472	1346	0	1585	1682	1702	1497	1781	1702	1585
Q Serve(g_s), s	3.1	0.0	1.1	5.3	0.0	7.2	1.2	36.6	5.0	13.0	23.9	0.8
Cycle Q Clear(g_c), s	10.2	0.0	1.1	15.5	0.0	7.2	1.2	36.6	5.0	13.0	23.9	0.8
Prop In Lane	0.98		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	204	0	262	166	0	282	33	2327	682	296	3077	955
V/C Ratio(X)	0.23	0.00	0.08	0.48	0.00	0.50	0.70	0.94	0.20	0.89	0.67	0.03
Avail Cap(c_a), veh/h	204	0	262	166	0	282	94	2327	682	297	3077	955
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	1.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	37.8	0.0	30.8	41.9	0.0	33.4	43.9	23.3	14.7	36.7	11.9	7.3
Incr Delay (d2), s/veh	0.6	0.0	0.1	2.1	0.0	1.4	23.9	9.0	0.7	26.0	0.6	0.0
Initial Q Delay(d3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	1.0	0.0	0.4	1.8	0.0	2.8	0.7	14.1	1.6	7.3	6.9	0.2
Unsig. Movement Delay, s/veh												
LnGrp Delay(d), s/veh	38.4	0.0	31.0	44.0	0.0	34.7	67.8	32.3	15.4	62.6	12.4	7.3
LnGrp LOS	D		C	D		C	E	C	B	E	B	A
Approach Vol, veh/h		68			219			2347			2343	
Approach Delay, s/veh		36.1			38.1			31.6			18.0	
Approach LOS		D			D			C			B	
Timer - Assigned Phs	1	2		4	5	6		8				
Phs Duration (G+Y+Rc), s	21.0	47.0		22.0	7.7	60.2		22.0				
Change Period (Y+Rc), s	6.0	6.0		6.0	6.0	6.0		6.0				
Max Green Setting (Gmax), s	15.0	41.0		16.0	5.0	51.0		16.0				
Max Q Clear Time (g_c+I1), s	15.0	38.6		12.2	3.2	25.9		17.5				
Green Ext Time (p_c), s	0.0	2.2		0.1	0.0	16.0		0.0				
Intersection Summary												
HCM 7th Control Delay, s/veh			25.5									
HCM 7th LOS			C									

3: MO 291 & Seven Hills Road/Old Highway 210

Future (2043) No-Build AM Peak Hour with 3/4 Access

Intersection												
Int Delay, s/veh	0.5											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations			↗			↗	↗	↕↗		↗	↕↗	↗
Traffic Vol, veh/h	0	0	0	0	0	37	0	1409	21	37	1259	0
Future Vol, veh/h	0	0	0	0	0	37	0	1409	21	37	1259	0
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None									
Storage Length	-	-	-	-	-	-	100	-	-	380	-	200
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	36	2	17	26	2	33	33	3	21	4	2	4
Mvmt Flow	0	0	0	0	0	40	0	1532	23	40	1368	0

Major/Minor	Minor2		Minor1		Major1		Major2					
Conflicting Flow All	-	-	684	-	-	777	1368	0	0	1554	0	0
Stage 1	-	-	-	-	-	-	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-	-	-	-	-	-	-
Critical Hdwy	-	-	7.24	-	-	7.56	4.76	-	-	4.18	-	-
Critical Hdwy Stg 1	-	-	-	-	-	-	-	-	-	-	-	-
Critical Hdwy Stg 2	-	-	-	-	-	-	-	-	-	-	-	-
Follow-up Hdwy	-	-	3.47	-	-	3.63	2.53	-	-	2.24	-	-
Pot Cap-1 Maneuver	0	0	358	0	0	280	363	-	-	413	-	-
Stage 1	0	0	-	0	0	-	-	-	-	-	-	-
Stage 2	0	0	-	0	0	-	-	-	-	-	-	-
Platoon blocked, %	-	-	-	-	-	-	-	-	-	-	-	-
Mov Cap-1 Maneuver	-	-	358	-	-	280	363	-	-	413	-	-
Mov Cap-2 Maneuver	-	-	-	-	-	-	-	-	-	-	-	-
Stage 1	-	-	-	-	-	-	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-	-	-	-	-	-	-

Approach	EB		WB		NB		SB	
HCM Control Delay, s/v	0		20.02		0		0.42	
HCM LOS	A		C					

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	363	-	-	-	280	413	-	-
HCM Lane V/C Ratio	-	-	-	-	0.144	0.097	-	-
HCM Control Delay (s/veh)	0	-	-	0	20	14.7	-	-
HCM Lane LOS	A	-	-	A	C	B	-	-
HCM 95th %tile Q(veh)	0	-	-	-	0.5	0.3	-	-

Intersection												
Int Delay, s/veh	18											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations			↗			↗	↗	↕		↗	↕	↗
Traffic Vol, veh/h	0	0	62	0	0	202	21	2010	128	242	1883	30
Future Vol, veh/h	0	0	62	0	0	202	21	2010	128	242	1883	30
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None									
Storage Length	-	-	-	-	-	-	100	-	-	380	-	200
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	11	6	2	2	9	2	9	2	2	2
Mvmt Flow	0	0	67	0	0	220	23	2185	139	263	2047	33

Major/Minor	Minor2		Minor1		Major1		Major2					
Conflicting Flow All	-	-	1023	-	-	1162	2079	0	0	2324	0	0
Stage 1	-	-	-	-	-	-	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-	-	-	-	-	-	-
Critical Hdwy	-	-	7.12	-	-	6.94	4.28	-	-	4.14	-	-
Critical Hdwy Stg 1	-	-	-	-	-	-	-	-	-	-	-	-
Critical Hdwy Stg 2	-	-	-	-	-	-	-	-	-	-	-	-
Follow-up Hdwy	-	-	3.41	-	-	3.32	2.29	-	-	2.22	-	-
Pot Cap-1 Maneuver	0	0	218	0	0	~ 188	239	-	-	~ 211	-	-
Stage 1	0	0	-	0	0	-	-	-	-	-	-	-
Stage 2	0	0	-	0	0	-	-	-	-	-	-	-
Platoon blocked, %	-	-	-	-	-	-	-	-	-	-	-	-
Mov Cap-1 Maneuver	-	-	218	-	-	~ 188	239	-	-	~ 211	-	-
Mov Cap-2 Maneuver	-	-	-	-	-	-	-	-	-	-	-	-
Stage 1	-	-	-	-	-	-	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s/v	28.76	168.8	0.21	21.39
HCM LOS	D	F		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	239	-	-	218	188	~ 211	-	-
HCM Lane V/C Ratio	0.095	-	-	0.309	1.167	1.248	-	-
HCM Control Delay (s/veh)	21.6	-	-	28.8	168.8	190.4	-	-
HCM Lane LOS	C	-	-	D	F	F	-	-
HCM 95th %tile Q(veh)	0.3	-	-	1.3	11.2	13.7	-	-

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



March 20, 2025

Mr. Bob Parks, PE
Weiskirch & Parks Engineers Inc

RE: Signal Warrant Analysis for the intersection of MO-291 & OLD 210- Liberty, MO

Dear Mr. Parks:

In response to your request, Priority Engineers, Inc. has reviewed the intersection of Missouri Route 291 and Old State Highway 210. In order to perform signal warrant analysis, a turning movement traffic count was performed on Wednesday, March 12th, 2025 between the hours of 6:00 AM and 7:00 PM. The raw traffic data is included as an attachment.

Warrant One, Eight Hour Warrant

MO-291, at the study intersection has a speed limit that is greater than 40 MPH so the Warrant should be evaluated at the 70% threshold. There are two separate conditions that Warrant One considers:

- Condition A (minimum vehicular volume)
- Condition B (interruption of continuous traffic)

If either Condition is met, the signal warrant is met.

Given the number of lanes for MO-291 and Old State Highway 210 at the approach to the intersection, the thresholds for Warrant One are shown in Table 1 below:

Table 1: Warrant One Thresholds		
	MO-291 combined Hourly Volume	Largest Old 210 Hwy Approaching Volume
Condition A	420	105
Condition B	630	53

The volumes on the major route (MO-291) met the 70% criteria (based upon speed of MO-291) and also the full warrant criteria for both Condition A and B for all hours

counted. No single hour exceeded the minor route volume criteria for Old State 210 Highway for Condition A. Condition A was not met.

When Condition B was evaluated, the following hours met the threshold: 12-1 PM (westbound), 2-3 PM (eastbound), 3-4 PM (both), 4-5 PM (westbound), 5-6 PM (westbound). To meet the Warrant using Condition B, 8 hours (nonconsecutive) need to exceed the criteria, since only 5 hours met the criteria, Condition B was not met.

Warrant One also allows consideration of a combination of Condition A and Condition B wherein it must meet 8 hours (nonconsecutive) for the criteria of both Condition A and Condition B as shown in Table 2 below:

Table 2: Warrant One Thresholds (Combination A and B, speed greater than 40 MPH)			
	MO-291 Volume	combined Hourly	Largest Old 210 Hwy Approaching Volume
Condition A	336		84
Condition B	504		42

Since the major route (MO-291) met the 100% and 70% criteria thresholds for all hours counted, it also exceeds the 56% Combination Condition A and Condition B criteria. No single hour exceeded the Condition A criteria of 84 vehicles approaching on the largest approach of the minor route. When Condition B was evaluated, the following hours meet the criteria: 9-10 AM (eastbound), 10-11 AM (eastbound), 11-12 AM (both), 12-1 PM (both), 1-2 PM (both), 2-3 PM (both), 3-4 PM (both), 4-5 PM (both), 5-6 PM (westbound), 6-7 PM (westbound). While 10 hours exceeded the 56% combination Criteria for Condition B, since 8 hours did not exceed the Condition A criteria, the combination of Condition A and B was not met.

Warrant Two, Four Hour Warrant

MO-291, at the study intersection has a speed limit that is greater than 40 MPH so the Warrant should be evaluated at the 70% threshold. For the geometrics of this intersection the warrant should be evaluated for the following conditions: Two or more lanes (major route) and one lane (minor approach). Since the volume of the major route exceeds 1000 vehicles for the combination of northbound and southbound traffic for all hours observed, any four hours that equal or exceed the threshold of 60 vehicles per hour on the largest minor route approach would satisfy the warrant. The following hours met the warrant: 2-3 PM (eastbound), 5-6 PM (westbound). The 3-4 PM hour (westbound) was one vehicle short of the criteria and the hour of 12-1 PM (westbound) and the hour of 4-5 PM (westbound) were 4 and 5 vehicles respectively short of the criteria.

Warrant Three, Peak Hour warrant, is not applicable to the specifics of this location as is intended for unique situations such as large office complexes and factories that experience a high volume of traffic for a short duration of time.

In summary, while Warrant One the Eight Hour Warrant was not met with existing conditions, it is approaching being met for Condition B. Five hours meet the warrant and an additional four hours have volumes of less than 6 vehicles from meeting the warrant. For six of the nine hours that either met or approach the criteria for Condition B the volume westbound traffic exceeded or equaled the eastbound volume of traffic. Warrant Two, the Four Hour was also not met with existing conditions but the existing conditions are approaching meeting the Warrant with two hours meeting the warrant an additional 3 hours being 5 or fewer vehicles from meeting the Warrant. Of the 5 hours that met or approached the criteria for the Warrant, four hours involved westbound traffic.

Sincerely,

PRIORITY ENGINEERS, INC.



Jesse Skinner, P.E., PTOE
Senior Transportation Engineer

Attachments

TOTAL

Date	Time	Southbound						Westbound						Northbound						Eastbound					
		U Turns	Left Turns	Straight Through	Right Turns	EB Crosswalk Crossings	WB Crosswalk Crossings	U Turns	Left Turns	Straight Through	Right Turns	NB Crosswalk Crossings	SB Crosswalk Crossings	U Turns	Left Turns	Straight Through	Right Turns	EB Crosswalk Crossings	WB Crosswalk Crossings	U Turns	Left Turns	Straight Through	Right Turns	NB Crosswalk Crossings	SB Crosswalk Crossings
0	0:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	0:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	0:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	0:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	1:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	1:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	1:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	1:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	2:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	2:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	2:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	2:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	3:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	3:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	3:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	224	0	0	0	0	0	0	0	0	0
	3:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	4:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	4:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	4:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	4:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	5:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	5:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	5:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	5:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	6:00	0	11	120	1	0	0	0	5	0	1	0	0	0	5	115	1	0	0	0	0	0	1	0	0
	6:15	0	4	167	4	0	0	0	1	0	1	0	0	1	8	179	1	0	0	0	0	0	0	0	0
	6:30	0	8	220	4	0	0	0	5	0	4	0	0	0	15	203	5	0	0	0	1	0	0	0	0
	6:45	0	10	203	1	0	0	0	2	0	1	0	0	0	6	255	5	0	0	0	3	0	4	0	0
	7:00	0	4	231	0	0	0	0	2	0	3	0	0	0	6	168	5	0	0	0	2	0	3	0	0
	7:15	0	4	241	4	0	0	0	3	0	1	0	0	0	6	214	5	0	0	0	5	0	1	0	0
	7:30	0	4	283	3	0	0	0	1	0	1	0	0	1	3	224	3	0	0	0	6	0	2	0	0
	7:45	0	6	244	3	0	0	0	3	0	4	0	0	0	2	233	5	0	0	0	3	0	7	0	0
	8:00	0	5	202	1	0	0	0	7	0	2	0	0	0	3	205	2	0	0	0	7	0	5	0	0
	8:15	1	8	191	8	0	0	0	3	0	0	0	0	0	2	219	4	0	0	0	2	0	4	0	0
	8:30	0	2	178	6	0	0	0	6	0	2	0	0	1	1	215	4	0	0	0	5	0	2	0	0
	8:45	0	4	128	5	0	0	0	6	0	1	0	0	0	4	188	4	0	0	0	3	0	5	0	0
	9:00	0	1	117	10	0	0	0	1	1	3	0	0	1	2	163	4	0	0	0	8	1	4	0	0
	9:15	0	4	150	7	0	0	0	1	0	1	0	0	1	7	148	1	0	0	0	9	0	3	0	0
	9:30	0	6	135	7	0	0	0	3	0	3	0	0	0	6	149	7	0	0	0	8	0	4	0	0
	9:45	0	8	135	7	0	0	0	0	0	5	0	0	0	3	122	3	0	0	0	7	0	5	0	0
	10:00	0	5	128	6	0	0	0	1	1	2	0	0	0	7	121	5	0	0	0	8	0	4	0	0
	10:15	0	10	117	4	0	0	0	4	0	1	0	0	0	8	128	8	0	0	0	4	0	5	0	0
	10:30	0	5	126	6	0	0	0	3	0	3	0	0	0	2	127	5	0	0	0	8	0	5	0	0
	10:45	0	6	119	9	0	0	0	5	0	7	0	0	0	7	129	8	0	0	0	9	0	5	0	0
	11:00	0	4	131	12	0	0	0	4	0	6	0	0	0	3	136	8	0	0	0	9	0	4	0	0
	11:15	0	11	126	6	0	0	0	7	0	7	0	0	0	5	151	11	0	0	0	10	0	3	0	0
	11:30	1	9	124	9	0	0	0	8	0	7	0	0	0	6	156	10	0	0	0	8	1	3	0	0
	11:45	0	12	131	7	0	0	0	4	0	8	0	0	0	4	127	11	0	0	0	7	0	6	0	0
	12:00	0	7	149	8	0	0	0	10	0	8	0	0	0	7	126	8	0	0	0	7	0	4	0	0
	12:15	0	10	142	4	0	0	0	6	0	7	0	0	1	8	171	10	0	0	0	7	1	7	0	0
	12:30	0	7	137	10	0	0	0	7	0	8	0	0	0	5	169	4	0	0	0	0	0	9	0	0
	12:45	0	8	144	6	0	0	0	5	0	5	0	0	1	3	154	4	0	0	0	9	0	7	0	0
	13:00	0	5	156	4	0	0	0	7	0	8	0	0	0	9	158	5	0	0	0	5	0	4	0	0
	13:15	0	6	162	5	0	0	0	5	0	4	0	0	1	9	157	8	0	0	0	7	0	7	0	0
	13:30	0	12	157	8	0	0	0	7	0	3	0	0	0	7	177	6	0	0	0	7	0	4	0	0
	13:45	0	9	171	5	0	0	0	4	0	10	0	0	0	5	150	12	0	0	0	7	0	7	0	0
	14:00	1	12	214	7	0	0	0	6	0	8	0	0	0	7	152	4	0	0	0	5	0	7	0	0
	14:15	0	11	183	10	0	0	0	5	0	2	0	0	0	8	178	5	0	0	0	12	0	8	0	0
	14:30	0	10	244	8	0	0	0	5	0	8	0	0	0	7	197	7	0	0	0	6	0	10	0	0
	14:45	0	10	191	11	0	0	0	5	0	10	0	0	0	3	189	6	0	0	0	5	0	7	0	0
	15:00	1	4	193	7	0	0	0	5	0	3	0	0	0	6	191	5	0	0	1	8	0	7	0	0
	15:15	0	8	209	6	0	0	0	7	0	9	0	0	0	5	215	8	0	0	0	6	0	11	0	0
	15:30	0	10	247	3	0	0	0	9	0	10	0	0	0	4	230	9	0	0	0	7	0	6	0	0
	15:45	1	8	285	7	0	0	0	9	0	7	0	0	1	2	313	8	0	0	0	5	0	3	0	0
	16:00	0	12	290	4	0	0	0	14	0	4	0	0	0	3	302	7	0	0	0	10	0	10	0	0

**APPENDIX D
ROUNDBOUT OPERATIONAL
ANALYSES**

APPENDIX D.1
SCENARIO 1 OPERATIONAL ANALYSES

LANE SUMMARY

Site: 101 [Railroad (Site Folder: High - AM Peak)]

Output produced by SIDRA INTERSECTION Version: 9.1.6.228

Network: N101 [AM High SLP (Network Folder: General)]

New Site
Site Category: (None)
Roundabout

Lane Use and Performance															
	Demand Flows		Arrival Flows		Cap.	Deg. Satn	Lane Util.	Aver. Delay	Level of Service	Aver. Back Of Queue		Lane Config	Lane Length	Cap. Adj.	Prob. Block.
	[Total veh/h]	[HV %]	[Total veh/h]	[HV %]						[Veh]	[Dist]				
	veh/h	%	veh/h	%	veh/h	v/c	%	sec			ft	ft	%	%	
East: South Liberty Parkway															
Lane 1	628	5.0	628	5.0	1216	0.516	100	8.4	LOS A	1.3	34.0	Full	1150	0.0	0.0
Lane 2 ^d	635	5.0	635	5.0	1231	0.516	100	8.3	LOS A	1.3	34.0	Full	1150	0.0	0.0
Approach	1263	5.0	1263	5.0		0.516		8.3	LOS A	1.3	34.0				
North: Railroad															
Lane 1	18	5.0	18	5.0	540	0.034	100	7.1	LOS A	0.0	0.8	Full	1600	0.0	0.0
Lane 2 ^d	27	5.0	27	5.0	625	0.044	100	6.3	LOS A	0.0	1.1	Full	1600	0.0	0.0
Approach	46	5.0	46	5.0		0.044		6.6	LOS A	0.0	1.1				
West: South Liberty Parkway															
Lane 1	712	5.0	712	5.0	1291	0.552	100	7.4	LOS A	2.0	53.2	Full	1725	0.0	0.0
Lane 2 ^d	716	5.0	716	5.0	1297	0.552	100	7.4	LOS A	2.0	53.2	Full	1725	0.0	0.0
Approach	1428	5.0	1428	5.0		0.552		7.4	LOS A	2.0	53.2				
All Vehicles	2737	5.0	2737	5.0		0.552		7.8	LOS A	2.0	53.2				

Site Level of Service (LOS) Method: Delay & v/c (HCM 6). Site LOS Method is specified in the Network Data dialog (Override Site Data tab).

Roundabout LOS Method: Same as Sign Control.

Lane LOS values are based on average delay and v/c ratio (degree of saturation) per lane.

LOS F will result if v/c > 1 irrespective of lane delay value (does not apply for approaches and intersection).

Intersection and Approach LOS values are based on average delay for all lanes (v/c not used as specified in HCM 6).

Roundabout Capacity Model: SIDRA HCM.

Delay Model: HCM Delay Formula (Stoptline Delay: Geometric Delay is not included).

Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Gap.

Gap-Acceptance Capacity Formula: Traditional M1.

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

^d Dominant lane on roundabout approach

Approach Lane Flows (veh/h)										
East: South Liberty Parkway										
Mov.	T1	R2	Total	%HV	Cap.	Deg. Satn	Lane Util.	Prob. SL Ov.	Ov. Lane No.	
From E To Exit:	W	N			veh/h	v/c	%	%		
Lane 1	628	-	628	5.0	1216	0.516	100	NA	NA	
Lane 2	575	60	635	5.0	1231	0.516	100	NA	NA	
Approach	1203	60	1263	5.0		0.516				
North: Railroad										
Mov.	L2	R2	Total	%HV	Cap.	Deg. Satn	Lane Util.	Prob. SL Ov.	Ov. Lane No.	
From N To Exit:	E	W			veh/h	v/c	%	%		
Lane 1	18	-	18	5.0	540	0.034	100	NA	NA	
Lane 2	-	27	27	5.0	625	0.044	100	NA	NA	

Approach	18	27	46	5.0	0.044				
West: South Liberty Parkway									
Mov. From W To Exit:	L2 N	T1 E	Total	%HV	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Prob. SL Ov. %	Ov. Lane No.
Lane 1	93	619	712	5.0	1291	0.552	100	NA	NA
Lane 2	-	716	716	5.0	1297	0.552	100	NA	NA
Approach	93	1335	1428	5.0	0.552				
Total %HV Deg. Satn (v/c)									
All Vehicles	2737	5.0	0.552						

Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

Merge Analysis												
Exit Lane Number	Short Lane Length ft	Percent Opng in Lane % veh/h	Opposing Flow Rate pcu/h	Critical Gap sec	Follow-up Headway sec	Lane Flow Rate veh/h	Capacity veh/h	Deg. Satn v/c	Min. Delay sec	Merge Delay sec		
There are no Exit Short Lanes for Merge Analysis at this Site.												

Variable Demand Analysis				
	Initial Queued Demand veh	Residual Queued Demand veh	Time for Residual Demand to Clear sec	Duration of Oversatn sec
East: South Liberty Parkway				
Lane 1	0.0	0.0	0.0	0.0
Lane 2	0.0	0.0	0.0	0.0
North: Railroad				
Lane 1	0.0	0.0	0.0	0.0
Lane 2	0.0	0.0	0.0	0.0
West: South Liberty Parkway				
Lane 1	0.0	0.0	0.0	0.0
Lane 2	0.0	0.0	0.0	0.0

LANE SUMMARY

Site: 101 [West Arsenal (Site Folder: High - AM Peak)]

Output produced by SIDRA INTERSECTION Version: 9.1.6.228

Network: N101 [AM High SLP (Network Folder: General)]

New Site
Site Category: (None)
Roundabout

Lane Use and Performance															
	Demand Flows		Arrival Flows		Cap.	Deg. Satn	Lane Util.	Aver. Delay	Level of Service	Aver. Back Of Queue		Lane Config	Lane Length	Cap. Adj.	Prob. Block.
	[Total veh/h	HV %	[Total veh/h	HV %						[Veh	Dist]				
South: West Arsenal															
Lane 1	62	5.0	62	5.0	699	0.088	100	6.1	LOS A	0.1	2.4	Full	1600	0.0	0.0
Lane 2 ^d	74	5.0	74	5.0	841	0.088	100	5.2	LOS A	0.1	2.5	Full	1600	0.0	0.0
Lane 3	50	5.0	50	5.0	670	0.075	100	6.2	LOS A	0.1	2.0	Full	1600	0.0	0.0
Approach	186	5.0	186	5.0		0.088		5.8	LOS A	0.1	2.5				
East: South Liberty Parkway															
Lane 1	625	5.0	625	5.0	1049	0.596	100	10.9	LOS B	1.6	40.3	Full	3050	0.0	0.0
Lane 2 ^d	635	5.0	635	5.0	1066	0.596	100	11.0	LOS B	1.6	41.0	Full	3050	0.0	0.0
Approach	1260	5.0	1260	5.0		0.596		10.9	LOS B	1.6	41.0				
West: South Liberty Parkway															
Lane 1	671	5.0	671	5.0	1155	0.581	100	9.9	LOS A	1.8	46.6	Full	1150	0.0	0.0
Lane 2 ^d	682	5.0	682	5.0	1173	0.581	100	9.8	LOS A	1.8	46.7	Full	1150	0.0	0.0
Approach	1353	5.0	1353	5.0		0.581		9.9	LOS A	1.8	46.7				
All Vehicles	2799	5.0	2799	5.0		0.596		10.1	LOS B	1.8	46.7				

Site Level of Service (LOS) Method: Delay & v/c (HCM 6). Site LOS Method is specified in the Network Data dialog (Override Site Data tab).

Roundabout LOS Method: Same as Sign Control.

Lane LOS values are based on average delay and v/c ratio (degree of saturation) per lane.

LOS F will result if v/c > 1 irrespective of lane delay value (does not apply for approaches and intersection).

Intersection and Approach LOS values are based on average delay for all lanes (v/c not used as specified in HCM 6).

Roundabout Capacity Model: SIDRA HCM.

Delay Model: HCM Delay Formula (Stopline Delay: Geometric Delay is not included).

Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Gap.

Gap-Acceptance Capacity Formula: Traditional M1.

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

^d Dominant lane on roundabout approach

Approach Lane Flows (veh/h)										
South: West Arsenal										
Mov.	L2	R2	Total	%HV	Cap.	Deg. Satn	Lane Util.	Prob. SL Ov.	Ov. Lane No.	
From S To Exit:	W	E			veh/h	v/c	%	%		
Lane 1	62	-	62	5.0	699	0.088	100	NA	NA	
Lane 2	74	-	74	5.0	841	0.088	100	NA	NA	
Lane 3	-	50	50	5.0	670	0.075	100	NA	NA	
Approach	136	50	186	5.0		0.088				
East: South Liberty Parkway										
Mov.	L2	T1	Total	%HV	Cap.	Deg. Satn	Lane Util.	Prob. SL Ov.	Ov. Lane No.	
From E To Exit:	S	W			veh/h	v/c	%	%		

Lane 1	133	492	625	5.0	1049	0.596	100	NA	NA
Lane 2	-	635	635	5.0	1066	0.596	100	NA	NA
Approach	133	1127	1260	5.0		0.596			
West: South Liberty Parkway									
Mov. From W To Exit:	T1	R2	Total	%HV	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Prob. SL %	Ov. Lane No.
	E	S							
Lane 1	671	-	671	5.0	1155	0.581	100	NA	NA
Lane 2	399	283	682	5.0	1173	0.581	100	NA	NA
Approach	1071	283	1353	5.0		0.581			
Total %HV Deg. Satn (v/c)									
All Vehicles	2799	5.0		0.596					

Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

Merge Analysis												
	Exit Lane Number	Short Lane Length	Percent Opng in Lane	Opposing Flow Rate	Critical Gap	Follow-up Headway	Lane Capacity Flow Rate	Deg. Satn	Min. Delay	Merge Delay		
		ft	%	veh/h	pcu/h	sec	veh/h	v/c	sec	sec		
There are no Exit Short Lanes for Merge Analysis at this Site.												

Variable Demand Analysis				
	Initial Queued Demand	Residual Queued Demand	Time for Residual Demand to Clear	Duration of Oversatn
	veh	veh	sec	sec
South: West Arsenal				
Lane 1	0.0	0.0	0.0	0.0
Lane 2	0.0	0.0	0.0	0.0
Lane 3	0.0	0.0	0.0	0.0
East: South Liberty Parkway				
Lane 1	0.0	0.0	0.0	0.0
Lane 2	0.0	0.0	0.0	0.0
West: South Liberty Parkway				
Lane 1	0.0	0.0	0.0	0.0
Lane 2	0.0	0.0	0.0	0.0

LANE SUMMARY

Site: 101 [Birmingham (Site Folder: High - AM Peak)]

Output produced by SIDRA INTERSECTION Version: 9.1.6.228

Network: N101 [AM High SLP (Network Folder: General)]

New Site
Site Category: (None)
Roundabout

Lane Use and Performance															
	Demand Flows		Arrival Flows		Cap.	Deg. Satn	Lane Util.	Aver. Delay	Level of Service	Aver. Back Of Queue		Lane Config	Lane Length	Cap. Adj.	Prob. Block.
	[Total veh/h]	[HV %]	[Total veh/h]	[HV %]						[Veh]	[Dist]				
	veh/h	%	veh/h	%	veh/h	v/c	%	sec			ft	ft	%	%	
South: Birmingham															
Lane 1 ^d	105	5.0	105	5.0	602	0.175	100	8.1	LOS A	0.2	4.9	Full	1600	0.0	0.0
Lane 2	22	5.0	22	5.0	279	0.078	100	14.4	LOS B	0.1	1.9	Full	1600	0.0	0.0
Approach	127	5.0	127	5.0		0.175		9.2	LOS A	0.2	4.9				
East: South Liberty Parkway															
Lane 1	452	5.0	452	5.0	1088	0.415	100	7.6	LOS A	0.9	23.0	Full	3580	0.0	0.0
Lane 2 ^d	463	5.0	463	5.0	1115	0.415	100	7.5	LOS A	0.9	23.0	Full	3580	0.0	0.0
Approach	915	5.0	915	5.0		0.415		7.6	LOS A	0.9	23.0				
North: Birmingham															
Lane 1	143	5.0	143	5.0	464	0.309	100	12.7	LOS B	0.4	9.7	Full	1600	0.0	0.0
Lane 2 ^d	370	5.0	370	5.0	690	0.536	100	13.7	LOS B	1.0	26.7	Full	1600	0.0	0.0
Approach	513	5.0	513	5.0		0.536		13.4	LOS B	1.0	26.7				
West: South Liberty Parkway															
Lane 1	555	5.0	555	5.0	1117	0.497	100	8.7	LOS A	1.3	33.9	Full	3050	0.0	0.0
Lane 2 ^d	566	5.0	566	5.0	1139	0.497	100	8.6	LOS A	1.3	34.0	Full	3050	0.0	0.0
Approach	1121	5.0	1121	5.0		0.497		8.6	LOS A	1.3	34.0				
All Vehicles	2676	5.0	2676	5.0		0.536		9.2	LOS A	1.3	34.0				

Site Level of Service (LOS) Method: Delay & v/c (HCM 6). Site LOS Method is specified in the Network Data dialog (Override Site Data tab).

Roundabout LOS Method: Same as Sign Control.

Lane LOS values are based on average delay and v/c ratio (degree of saturation) per lane.

LOS F will result if v/c > 1 irrespective of lane delay value (does not apply for approaches and intersection).

Intersection and Approach LOS values are based on average delay for all lanes (v/c not used as specified in HCM 6).

Roundabout Capacity Model: SIDRA HCM.

Delay Model: HCM Delay Formula (Stopline Delay: Geometric Delay is not included).

Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Gap.

Gap-Acceptance Capacity Formula: Traditional M1.

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

^d Dominant lane on roundabout approach

Approach Lane Flows (veh/h)											
South: Birmingham											
Mov. From S To Exit:	L2	T1	R2	Total	%HV	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Prob. SL %	Ov. Lane No.	
	W	N	E								
Lane 1	39	66	-	105	5.0	602	0.175	100	NA	NA	
Lane 2	-	-	22	22	5.0	279	0.078	100	NA	NA	
Approach	39	66	22	127	5.0		0.175				
East: South Liberty Parkway											

Mov. From E To Exit:	L2	T1	R2	Total	%HV	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Prob. SL Ov. %	Ov. Lane No.
Lane 1	21	432	-	452	5.0	1088	0.415	100	NA	NA
Lane 2	-	420	43	463	5.0	1115	0.415	100	NA	NA
Approach	21	851	43	915	5.0		0.415			
North: Birmingham										
Mov. From N To Exit:	L2	T1	R2	Total	%HV	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Prob. SL Ov. %	Ov. Lane No.
Lane 1	82	62	-	143	5.0	464	0.309	100	NA	NA
Lane 2	-	-	370	370	5.0	690	0.536	100	NA	NA
Approach	82	62	370	513	5.0		0.536			
West: South Liberty Parkway										
Mov. From W To Exit:	L2	T1	R2	Total	%HV	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Prob. SL Ov. %	Ov. Lane No.
Lane 1	101	454	-	555	5.0	1117	0.497	100	NA	NA
Lane 2	-	540	26	566	5.0	1139	0.497	100	NA	NA
Approach	101	993	26	1121	5.0		0.497			
Total %HV Deg.Satn (v/c)										
All Vehicles	2676	5.0		0.536						

Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

Merge Analysis												
Exit Lane Number	Short Lane Length ft	Percent Opng in Lane %	Opposing Flow Rate veh/h	Critical Gap sec	Follow-up Headway sec	Lane Capacity veh/h	Deg. Satn v/c	Min. Delay sec	Merge Delay sec			
There are no Exit Short Lanes for Merge Analysis at this Site.												

Variable Demand Analysis				
	Initial Queued Demand veh	Residual Queued Demand veh	Time for Residual Demand to Clear sec	Duration of Oversatn sec
South: Birmingham				
Lane 1	0.0	0.0	0.0	0.0
Lane 2	0.0	0.0	0.0	0.0
East: South Liberty Parkway				
Lane 1	0.0	0.0	0.0	0.0
Lane 2	0.0	0.0	0.0	0.0
North: Birmingham				
Lane 1	0.0	0.0	0.0	0.0
Lane 2	0.0	0.0	0.0	0.0
West: South Liberty Parkway				
Lane 1	0.0	0.0	0.0	0.0
Lane 2	0.0	0.0	0.0	0.0

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Project: G:\16652\Analysis\Traffic\Synchro-Sidra\Scenario1-2.sip9

LANE SUMMARY

Site: 101 [Arsenal (Site Folder: High - AM Peak)]

Output produced by SIDRA INTERSECTION Version: 9.1.6.228

Network: N101 [AM High SLP (Network Folder: General)]

New Site
Site Category: (None)
Roundabout

Lane Use and Performance															
	Demand Flows		Arrival Flows		Cap.	Deg. Satn	Lane Util.	Aver. Delay	Level of Service	Aver. Queue	Back Of Queue Dist	Lane Config	Lane Length	Cap. Adj.	Prob. Block.
	[Total veh/h	HV %	[Total veh/h	HV %											
South: Arsenal															
Lane 1	29	5.0	29	5.0	443	0.066	100	9.1	LOS A	0.1	1.7	Full	1600	0.0	0.0
Lane 2 ^d	68	5.0	68	5.0	638	0.107	100	6.9	LOS A	0.1	2.8	Full	1600	0.0	0.0
Approach	98	5.0	98	5.0		0.107		7.6	LOS A	0.1	2.8				
East: South Liberty Parkway															
Lane 1	499	5.0	499	5.0	1267	0.394	100	6.2	LOS A	1.0	26.8	Full	1800	0.0	0.0
Lane 2 ^d	502	5.0	502	5.0	1276	0.394	100	6.2	LOS A	1.0	26.8	Full	1800	0.0	0.0
Approach	1001	5.0	1001	5.0		0.394		6.2	LOS A	1.0	26.8				
North: Arsenal															
Lane 1 ^d	37	5.0	37	5.0	707	0.052	100	5.7	LOS A	0.0	1.2	Full	1600	0.0	0.0
Lane 2	21	5.0	21	5.0	572	0.036	100	6.7	LOS A	0.0	0.8	Full	1600	0.0	0.0
Approach	58	5.0	58	5.0		0.052		6.0	LOS A	0.0	1.2				
West: South Liberty Parkway															
Lane 1	543	5.0	543	5.0	1140	0.476	100	8.2	LOS A	1.1	28.9	Full	3580	0.0	0.0
Lane 2 ^d	553	5.0	553	5.0	1162	0.476	100	8.1	LOS A	1.1	29.0	Full	3580	0.0	0.0
Approach	1097	5.0	1097	5.0		0.476		8.2	LOS A	1.1	29.0				
All Vehicles	2253	5.0	2253	5.0		0.476		7.2	LOS A	1.1	29.0				

Site Level of Service (LOS) Method: Delay & v/c (HCM 6). Site LOS Method is specified in the Network Data dialog (Override Site Data tab).

Roundabout LOS Method: Same as Sign Control.

Lane LOS values are based on average delay and v/c ratio (degree of saturation) per lane.

LOS F will result if v/c > 1 irrespective of lane delay value (does not apply for approaches and intersection).

Intersection and Approach LOS values are based on average delay for all lanes (v/c not used as specified in HCM 6).

Roundabout Capacity Model: SIDRA HCM.

Delay Model: HCM Delay Formula (Stopline Delay: Geometric Delay is not included).

Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Gap.

Gap-Acceptance Capacity Formula: Traditional M1.

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

^d Dominant lane on roundabout approach

Approach Lane Flows (veh/h)										
South: Arsenal										
Mov. From S To Exit:	L2	R2	Total	%HV	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Prob. SL %	Ov. Lane No.	
	W	E								
Lane 1	29	-	29	5.0	443	0.066	100	NA	NA	
Lane 2	-	68	68	5.0	638	0.107	100	NA	NA	
Approach	29	68	98	5.0		0.107				
East: South Liberty Parkway										

Mov. From E To Exit:	L2	T1	R2	Total	%HV	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Prob. SL Ov. %	Ov. Lane No.
Lane 1	124	375	-	499	5.0	1267	0.394	100	NA	NA
Lane 2	-	490	12	502	5.0	1276	0.394	100	NA	NA
Approach	124	865	12	1001	5.0		0.394			
North: Arsenal										
Mov. From N To Exit:	L2	R2	Total	%HV	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Prob. SL Ov. %	Ov. Lane No.	
Lane 1	37	-	37	5.0	707	0.052	100	NA	NA	
Lane 2	-	21	21	5.0	572	0.036	100	NA	NA	
Approach	37	21	58	5.0		0.052				
West: South Liberty Parkway										
Mov. From W To Exit:	L2	T1	R2	Total	%HV	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Prob. SL Ov. %	Ov. Lane No.
Lane 1	8	536	-	543	5.0	1140	0.476	100	NA	NA
Lane 2	-	519	35	553	5.0	1162	0.476	100	NA	NA
Approach	8	1054	35	1097	5.0		0.476			
Total %HV Deg. Satn (v/c)										
All Vehicles	2253	5.0		0.476						

Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

Merge Analysis												
Exit Lane Number	Short Lane Length ft	Percent Opng in Lane %	Opposing Flow Rate veh/h	Critical Gap pcu/h	Follow-up Headway sec	Lane Capacity Flow Rate veh/h	Deg. Satn v/c	Min. Delay sec	Merge Delay sec			
There are no Exit Short Lanes for Merge Analysis at this Site.												

Variable Demand Analysis				
	Initial Queued Demand veh	Residual Queued Demand veh	Time for Residual Demand to Clear sec	Duration of Oversatn sec
South: Arsenal				
Lane 1	0.0	0.0	0.0	0.0
Lane 2	0.0	0.0	0.0	0.0
East: South Liberty Parkway				
Lane 1	0.0	0.0	0.0	0.0
Lane 2	0.0	0.0	0.0	0.0
North: Arsenal				
Lane 1	0.0	0.0	0.0	0.0
Lane 2	0.0	0.0	0.0	0.0
West: South Liberty Parkway				
Lane 1	0.0	0.0	0.0	0.0
Lane 2	0.0	0.0	0.0	0.0

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Project: G:\16652\Analysis\Traffic\Synchro-Sidra\Scenario1-2.sip9

LANE SUMMARY

Site: 101 [East Roundabout (Site Folder: High - AM Peak)]

Output produced by SIDRA INTERSECTION Version: 9.1.6.228

Network: N101 [AM High SLP (Network Folder: General)]

New Site
Site Category: (None)
Roundabout

Lane Use and Performance															
	Demand Flows		Arrival Flows		Cap.	Deg. Satn	Lane Util.	Aver. Delay	Level of Service	Aver. Back Of Queue		Lane Config	Lane Length	Cap. Adj.	Prob. Block.
	[Total veh/h]	[HV %]	[Total veh/h]	[HV %]						[Veh]	[Dist]				
	veh/h	%	veh/h	%	veh/h	v/c	%	sec			ft		ft	%	%
South: New Road															
Lane 1 ^d	58	5.0	58	5.0	639	0.090	100	6.7	LOS A	0.1	2.3	Full	1600	0.0	0.0
Lane 2	38	5.0	38	5.0	550	0.069	100	7.4	LOS A	0.1	1.7	Full	1600	0.0	0.0
Approach	96	5.0	96	5.0		0.090		7.0	LOS A	0.1	2.3				
East: South Liberty Parkway															
Lane 1	539	5.0	539	5.0	1022	0.527	100	9.9	LOS A	1.5	38.9	Full	1900	0.0	0.0
Lane 2 ^d	558	5.0	558	5.0	1058	0.527	100	9.6	LOS A	1.5	38.3	Full	1900	0.0	0.0
Approach	1097	5.0	1097	5.0		0.527		9.8	LOS A	1.5	38.9				
North: New Road															
Lane 1	55	5.0	55	5.0	621	0.089	100	6.8	LOS A	0.1	2.4	Full	1600	0.0	0.0
Lane 2 ^d	67	5.0	67	5.0	655	0.103	100	6.7	LOS A	0.1	2.8	Full	1600	0.0	0.0
Approach	123	5.0	123	5.0		0.103		6.8	LOS A	0.1	2.8				
West: South Liberty Parkway															
Lane 1	576	5.0	576	5.0	1171	0.492	100	8.3	LOS A	1.3	32.5	Full	1800	0.0	0.0
Lane 2 ^d	584	5.0	584	5.0	1189	0.492	100	8.2	LOS A	1.3	32.6	Full	1800	0.0	0.0
Approach	1160	5.0	1160	5.0		0.492		8.2	LOS A	1.3	32.6				
All Vehicles	2475	5.0	2475	5.0		0.527		8.8	LOS A	1.5	38.9				

Site Level of Service (LOS) Method: Delay & v/c (HCM 6). Site LOS Method is specified in the Network Data dialog (Override Site Data tab).

Roundabout LOS Method: Same as Sign Control.

Lane LOS values are based on average delay and v/c ratio (degree of saturation) per lane.

LOS F will result if v/c > 1 irrespective of lane delay value (does not apply for approaches and intersection).

Intersection and Approach LOS values are based on average delay for all lanes (v/c not used as specified in HCM 6).

Roundabout Capacity Model: SIDRA HCM.

Delay Model: HCM Delay Formula (Stopline Delay: Geometric Delay is not included).

Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Gap.

Gap-Acceptance Capacity Formula: Traditional M1.

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

^d Dominant lane on roundabout approach

Approach Lane Flows (veh/h)										
South: New Road										
Mov. From S To Exit:	L2	R2	Total	%HV	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Prob. SL %	Ov. Lane No.	
	W	E								
Lane 1	58	-	58	5.0	639	0.090	100	NA	NA	
Lane 2	-	38	38	5.0	550	0.069	100	NA	NA	
Approach	58	38	96	5.0		0.090				
East: South Liberty Parkway										

Mov. From E To Exit:	L2	T1	R2	Total	%HV	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Prob. SL Ov. %	Ov. Lane No.
Lane 1	71	468	-	539	5.0	1022	0.527	100	NA	NA
Lane 2	-	408	150	558	5.0	1058	0.527	100	NA	NA
Approach	71	876	150	1097	5.0		0.527			
North: New Road										
Mov. From N To Exit:	L2	R2	Total	%HV	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Prob. SL Ov. %	Ov. Lane No.	
Lane 1	55	-	55	5.0	621	0.089	100	NA	NA	
Lane 2	-	67	67	5.0	655	0.103	100	NA	NA	
Approach	55	67	123	5.0		0.103				
West: South Liberty Parkway										
Mov. From W To Exit:	L2	T1	R2	Total	%HV	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Prob. SL Ov. %	Ov. Lane No.
Lane 1	220	356	-	576	5.0	1171	0.492	100	NA	NA
Lane 2	-	477	108	584	5.0	1189	0.492	100	NA	NA
Approach	220	833	108	1160	5.0		0.492			
Total %HV Deg.Satn (v/c)										
All Vehicles	2475	5.0		0.527						

Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

Merge Analysis												
Exit Lane Number	Short Lane Length ft	Percent Opng in Lane %	Opposing Flow Rate veh/h	Critical Gap sec	Follow-up Headway sec	Lane Capacity veh/h	Deg. Satn v/c	Min. Delay sec	Merge Delay sec			
There are no Exit Short Lanes for Merge Analysis at this Site.												

Variable Demand Analysis				
	Initial Queued Demand veh	Residual Queued Demand veh	Time for Residual Demand to Clear sec	Duration of Oversatn sec
South: New Road				
Lane 1	0.0	0.0	0.0	0.0
Lane 2	0.0	0.0	0.0	0.0
East: South Liberty Parkway				
Lane 1	0.0	0.0	0.0	0.0
Lane 2	0.0	0.0	0.0	0.0
North: New Road				
Lane 1	0.0	0.0	0.0	0.0
Lane 2	0.0	0.0	0.0	0.0
West: South Liberty Parkway				
Lane 1	0.0	0.0	0.0	0.0
Lane 2	0.0	0.0	0.0	0.0

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Project: G:\16652\Analysis\Traffic\Synchro-Sidra\Scenario1-2.sip9

LANE SUMMARY

Site: 101 [Railroad (Site Folder: High - PM Peak)]

Output produced by SIDRA INTERSECTION Version: 9.1.6.228

Network: N101 [PM High SLP (Network Folder: General)]

New Site
Site Category: (None)
Roundabout

Lane Use and Performance															
	Demand Flows		Arrival Flows		Cap.	Deg. Satn	Lane Util.	Aver. Delay	Level of Service	Aver. Back Of Queue		Lane Config	Lane Length	Cap. Adj.	Prob. Block.
	[Total veh/h]	[HV %]	[Total veh/h]	[HV %]						[Veh]	[Dist]				
East: South Liberty Parkway															
Lane 1	1028	5.0	1009	5.0	1236	0.816	100	15.4	LOS C	5.9	153.5	Full	1150	0.0	0.0
Lane 2 ^d	1037	5.0	1017	5.0	1246	0.816	100	15.3	LOS C	5.9	153.9	Full	1150	0.0	0.0
Approach	2065	5.0	2026	5.0		0.816		15.4	LOS C	5.9	153.9				
North: Railroad															
Lane 1	91	5.0	91	5.0	267	0.342	100	22.0	LOS C	0.4	9.8	Full	1600	0.0	0.0
Lane 2 ^d	136	5.0	136	5.0	353	0.385	100	18.4	LOS C	0.5	12.1	Full	1600	0.0	0.0
Approach	227	5.0	227	5.0		0.385		19.8	LOS C	0.5	12.1				
West: South Liberty Parkway															
Lane 1	914	5.0	914	5.0	1187	0.770	100	14.8	LOS B	4.3	112.7	Full	1725	0.0	0.0
Lane 2 ^d	924	5.0	924	5.0	1201	0.770	100	14.6	LOS B	4.4	113.1	Full	1725	0.0	0.0
Approach	1838	5.0	1838	5.0		0.770		14.7	LOS B	4.4	113.1				
All Vehicles	4130	5.0	4091	5.0		0.816		15.3	LOS C	5.9	153.9				

Site Level of Service (LOS) Method: Delay & v/c (HCM 6). Site LOS Method is specified in the Network Data dialog (Override Site Data tab).

Roundabout LOS Method: Same as Sign Control.

Lane LOS values are based on average delay and v/c ratio (degree of saturation) per lane.

LOS F will result if v/c > 1 irrespective of lane delay value (does not apply for approaches and intersection).

Intersection and Approach LOS values are based on average delay for all lanes (v/c not used as specified in HCM 6).

Roundabout Capacity Model: SIDRA HCM.

Delay Model: HCM Delay Formula (Stopline Delay: Geometric Delay is not included).

Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Gap.

Gap-Acceptance Capacity Formula: Traditional M1.

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

^d Dominant lane on roundabout approach

Approach Lane Flows (veh/h)										
East: South Liberty Parkway										
Mov.	T1	R2	Total	%HV	Cap.	Deg. Satn	Lane Util.	Prob. SL	Ov.	Ov. Lane
From E					veh/h	v/c	%	%	No.	
To Exit:	W	N								
Lane 1	1009	-	1009	5.0	1236	0.816	100	NA	NA	
Lane 2	980	37	1017	5.0	1246	0.816	100	NA	NA	
Approach	1988	37	2026	5.0		0.816				
North: Railroad										
Mov.	L2	R2	Total	%HV	Cap.	Deg. Satn	Lane Util.	Prob. SL	Ov.	Ov. Lane
From N					veh/h	v/c	%	%	No.	
To Exit:	E	W								
Lane 1	91	-	91	5.0	267	0.342	100	NA	NA	
Lane 2	-	136	136	5.0	353	0.385	100	NA	NA	

Approach	91	136	227	5.0	0.385				
West: South Liberty Parkway									
Mov. From W To Exit:	L2 N	T1 E	Total	%HV	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Prob. SL Ov. %	Ov. Lane No.
Lane 1	58	856	914	5.0	1187	0.770	100	NA	NA
Lane 2	-	924	924	5.0	1201	0.770	100	NA	NA
Approach	58	1780	1838	5.0	0.770				
Total %HV Deg. Satn (v/c)									
All Vehicles	4091	5.0	0.816						

Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

Merge Analysis												
Exit Lane Number	Short Lane Length ft	Percent Opng in Lane % veh/h	Opposing Flow Rate pcu/h	Critical Gap sec	Follow-up Headway sec	Lane Flow Rate veh/h	Capacity veh/h	Deg. Satn v/c	Min. Delay sec	Merge Delay sec		
There are no Exit Short Lanes for Merge Analysis at this Site.												

Variable Demand Analysis				
	Initial Queued Demand veh	Residual Queued Demand veh	Time for Residual Demand to Clear sec	Duration of Oversatn sec
East: South Liberty Parkway				
Lane 1	0.0	0.0	0.0	0.0
Lane 2	0.0	0.0	0.0	0.0
North: Railroad				
Lane 1	0.0	0.0	0.0	0.0
Lane 2	0.0	0.0	0.0	0.0
West: South Liberty Parkway				
Lane 1	0.0	0.0	0.0	0.0
Lane 2	0.0	0.0	0.0	0.0

LANE SUMMARY

Site: 101 [West Arsenal (Site Folder: High - PM Peak)]

Output produced by SIDRA INTERSECTION Version: 9.1.6.228

Network: N101 [PM High SLP (Network Folder: General)]

New Site
 Site Category: (None)
 Roundabout

Lane Use and Performance															
	Demand Flows		Arrival Flows		Cap.	Deg. Satn	Lane Util.	Aver. Delay	Level of Service	Aver. Back Of Queue		Lane Config	Lane Length	Cap. Adj.	Prob. Block.
	[Total veh/h	HV %	[Total veh/h	HV %						[Veh	Dist]				
South: West Arsenal															
Lane 1	178	5.0	178	5.0	406	0.440	100	17.8	LOS C	0.6	15.8	Full	1600	0.0	0.0
Lane 2 ^d	249	5.0	249	5.0	565	0.440	100	13.5	LOS B	0.7	17.6	Full	1600	0.0	0.0
Lane 3	197	5.0	197	5.0	411	0.479	100	18.9	LOS C	0.7	17.8	Full	1600	0.0	0.0
Approach	624	5.0	624	5.0		0.479		16.4	LOS C	0.7	17.8				
East: South Liberty Parkway															
Lane 1	859	5.0	859	5.0	842	1.021	100	56.2	LOS F	14.7	381.1	Full	3050	0.0	0.0
Lane 2 ^d	872	5.0	872	5.0	855	1.021	100	55.9	LOS F	15.1	393.7	Full	3050	0.0	0.0
Approach	1732	5.0	1732	5.0		1.021		56.0	LOS F	15.1	393.7				
West: South Liberty Parkway															
Lane 1	930	5.0	930	5.0	1180	0.788	100	15.6	LOS C	4.8	125.4	Full	1150	0.0	0.0
Lane 2 ^d	941	5.0	941	5.0	1194	0.788	100	15.5	LOS C	4.8	125.9	Full	1150	0.0	0.0
Approach	1872	5.0	1872	5.0		0.788		15.6	LOS C	4.8	125.9				
All Vehicles	4227	5.0	4227	5.0		1.021		32.3	LOS D	15.1	393.7				

Site Level of Service (LOS) Method: Delay & v/c (HCM 6). Site LOS Method is specified in the Network Data dialog (Override Site Data tab).

Roundabout LOS Method: Same as Sign Control.

Lane LOS values are based on average delay and v/c ratio (degree of saturation) per lane.

LOS F will result if v/c > 1 irrespective of lane delay value (does not apply for approaches and intersection).

Intersection and Approach LOS values are based on average delay for all lanes (v/c not used as specified in HCM 6).

Roundabout Capacity Model: SIDRA HCM.

Delay Model: HCM Delay Formula (Stopline Delay: Geometric Delay is not included).

Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Gap.

Gap-Acceptance Capacity Formula: Traditional M1.

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

^d Dominant lane on roundabout approach

Approach Lane Flows (veh/h)										
South: West Arsenal										
Mov.	L2	R2	Total	%HV	Cap.	Deg. Satn	Lane Util.	Prob. SL Ov.	Ov. Lane No.	
From S To Exit:	W	E			veh/h	v/c	%	%		
Lane 1	178	-	178	5.0	406	0.440	100	NA	NA	
Lane 2	249	-	249	5.0	565	0.440	100	NA	NA	
Lane 3	-	197	197	5.0	411	0.479	100	NA	NA	
Approach	427	197	624	5.0		0.479				
East: South Liberty Parkway										
Mov.	L2	T1	Total	%HV	Cap.	Deg. Satn	Lane Util.	Prob. SL Ov.	Ov. Lane No.	
From E To Exit:	S	W			veh/h	v/c	%	%		

Lane 1	93	766	859	5.0	842	1.021	100	NA	NA
Lane 2	-	872	872	5.0	855	1.021	100	NA	NA
Approach	93	1638	1732	5.0		1.021			
West: South Liberty Parkway									
Mov. From W To Exit:	T1	R2	Total	%HV	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Prob. SL %	Ov. Lane No.
	E	S							
Lane 1	930	-	930	5.0	1180	0.788	100	NA	NA
Lane 2	711	230	941	5.0	1194	0.788	100	NA	NA
Approach	1641	230	1872	5.0		0.788			
Total %HV Deg. Satn (v/c)									
All Vehicles	4227	5.0		1.021					

Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

Merge Analysis												
	Exit Lane Number	Short Lane Length	Percent Opng in Lane	Opposing Flow Rate	Critical Gap	Follow-up Headway	Lane Capacity Flow Rate	Deg. Satn	Min. Delay	Merge Delay		
		ft	%	veh/h	pcu/h	sec	veh/h	v/c	sec	sec		
There are no Exit Short Lanes for Merge Analysis at this Site.												

Variable Demand Analysis				
	Initial Queued Demand	Residual Queued Demand	Time for Residual Demand to Clear	Duration of Oversatn
	veh	veh	sec	sec
South: West Arsenal				
Lane 1	0.0	0.0	0.0	0.0
Lane 2	0.0	0.0	0.0	0.0
Lane 3	0.0	0.0	0.0	0.0
East: South Liberty Parkway				
Lane 1	0.0	4.3	18.5	NA
Lane 2	0.0	4.4	18.5	NA
West: South Liberty Parkway				
Lane 1	0.0	0.0	0.0	0.0
Lane 2	0.0	0.0	0.0	0.0

LANE SUMMARY

Site: 101 [Birmingham (Site Folder: High - PM Peak)]

Output produced by SIDRA INTERSECTION Version: 9.1.6.228

Network: N101 [PM High SLP (Network Folder: General)]

New Site
Site Category: (None)
Roundabout

Lane Use and Performance															
	Demand Flows		Arrival Flows		Cap.	Deg. Satn	Lane Util.	Aver. Delay	Level of Service	Aver. Back Of Queue		Lane Config	Lane Length	Cap. Adj.	Prob. Block.
	[Total veh/h]	[HV %]	[Total veh/h]	[HV %]						[Veh]	[Dist]				
	veh/h	%	veh/h	%	veh/h	v/c	%	sec			ft	ft	%	%	
South: Birmingham															
Lane 1 ^d	143	5.0	143	5.0	299	0.480	100	25.0	LOS C	0.6	16.5	Full	1600	0.0	0.0
Lane 2	33	5.0	33	5.0	126	0.258	100	39.3	LOS E	0.3	6.7	Full	1600	0.0	0.0
Approach	176	5.0	176	5.0		0.480		27.6	LOS D	0.6	16.5				
East: South Liberty Parkway															
Lane 1	690	5.0	690	5.0	761	0.907	100	35.8	LOS E	7.0	183.1	Full	3580	0.0	0.0
Lane 2 ^d	750	5.0	750	5.0	827	0.907	100	33.9	LOS D	7.5	193.9	Full	3580	0.0	0.0
Approach	1440	5.0	1440	5.0		0.907		34.8	LOS D	7.5	193.9				
North: Birmingham															
Lane 1	159	5.0	159	5.0	266	0.597	100	34.5	LOS D	0.9	23.2	Full	1600	0.0	0.0
Lane 2 ^d	384	5.0	384	5.0	400	0.960	100	66.7	LOS F	3.6	92.8	Full	1600	0.0	0.0
Approach	542	5.0	542	5.0		0.960		57.2	LOS F	3.6	92.8				
West: South Liberty Parkway															
Lane 1	909	5.0	909	5.0	1081	0.841	100	20.9	LOS C	9.8	255.4	Full	3050	0.0	0.0
Lane 2 ^d	929	5.0	929	5.0	1104	0.841	100	20.6	LOS C	9.9	256.9	Full	3050	0.0	0.0
Approach	1838	5.0	1838	5.0		0.841		20.7	LOS C	9.9	256.9				
All Vehicles	3997	5.0	3997	5.0		0.960		31.1	LOS D	9.9	256.9				

Site Level of Service (LOS) Method: Delay & v/c (HCM 6). Site LOS Method is specified in the Network Data dialog (Override Site Data tab).

Roundabout LOS Method: Same as Sign Control.

Lane LOS values are based on average delay and v/c ratio (degree of saturation) per lane.

LOS F will result if v/c > 1 irrespective of lane delay value (does not apply for approaches and intersection).

Intersection and Approach LOS values are based on average delay for all lanes (v/c not used as specified in HCM 6).

Roundabout Capacity Model: SIDRA HCM.

Delay Model: HCM Delay Formula (Stopline Delay: Geometric Delay is not included).

Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Gap.

Gap-Acceptance Capacity Formula: Traditional M1.

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

^d Dominant lane on roundabout approach

Approach Lane Flows (veh/h)										
South: Birmingham										
Mov. From S To Exit:	L2	T1	R2	Total	%HV	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Prob. SL %	Ov. Lane No.
	W	N	E							
Lane 1	45	99	-	143	5.0	299	0.480	100	NA	NA
Lane 2	-	-	33	33	5.0	126	0.258	100	NA	NA
Approach	45	99	33	176	5.0		0.480			
East: South Liberty Parkway										

Mov. From E To Exit:	L2	T1	R2	Total	%HV	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Prob. SL Ov. %	Ov. Lane No.
Lane 1	28	662	-	690	5.0	761	0.907	100	NA	NA
Lane 2	-	641	109	750	5.0	827	0.907	100	NA	NA
Approach	28	1303	109	1440	5.0		0.907			
North: Birmingham										
Mov. From N To Exit:	L2	T1	R2	Total	%HV	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Prob. SL Ov. %	Ov. Lane No.
Lane 1	72	87	-	159	5.0	266	0.597	100	NA	NA
Lane 2	-	-	384	384	5.0	400	0.960	100	NA	NA
Approach	72	87	384	542	5.0		0.960			
West: South Liberty Parkway										
Mov. From W To Exit:	L2	T1	R2	Total	%HV	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Prob. SL Ov. %	Ov. Lane No.
Lane 1	401	508	-	909	5.0	1081	0.841	100	NA	NA
Lane 2	-	881	48	929	5.0	1104	0.841	100	NA	NA
Approach	401	1389	48	1838	5.0		0.841			
Total %HV Deg. Satn (v/c)										
All Vehicles	3997	5.0		0.960						

Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

Merge Analysis												
Exit Lane Number	Short Lane Length ft	Percent Opng in Lane %	Opposing Flow Rate veh/h	Critical Gap sec	Follow-up Headway sec	Lane Capacity veh/h	Deg. Satn v/c	Min. Delay sec	Merge Delay sec			
There are no Exit Short Lanes for Merge Analysis at this Site.												

Variable Demand Analysis				
	Initial Queued Demand veh	Residual Queued Demand veh	Time for Residual Demand to Clear sec	Duration of Oversatn sec
South: Birmingham				
Lane 1	0.0	0.0	0.0	0.0
Lane 2	0.0	0.0	0.0	0.0
East: South Liberty Parkway				
Lane 1	0.0	0.0	0.0	0.0
Lane 2	0.0	0.0	0.0	0.0
North: Birmingham				
Lane 1	0.0	0.0	0.0	0.0
Lane 2	0.0	0.0	0.0	0.0
West: South Liberty Parkway				
Lane 1	0.0	0.0	0.0	0.0
Lane 2	0.0	0.0	0.0	0.0

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Project: G:\16652\Analysis\Traffic\Synchro-Sidra\Scenario1-2.sip9

LANE SUMMARY

Site: 101 [Arsenal (Site Folder: High - PM Peak)]

Output produced by SIDRA INTERSECTION Version: 9.1.6.228

Network: N101 [PM High SLP (Network Folder: General)]

New Site
Site Category: (None)
Roundabout

Lane Use and Performance															
	Demand Flows		Arrival Flows		Cap.	Deg. Satn	Lane Util.	Aver. Delay	Level of Service	Aver. Back Of Queue		Lane Config	Lane Length	Cap. Adj.	Prob. Block.
	[Total veh/h	HV %	[Total veh/h	HV %						[Veh	Dist]				
South: Arsenal															
Lane 1	55	5.0	55	5.0	247	0.224	100	19.9	LOS C	0.2	5.9	Full	1600	0.0	0.0
Lane 2 ^d	190	5.0	190	5.0	488	0.390	100	13.9	LOS B	0.5	13.3	Full	1600	0.0	0.0
Approach	246	5.0	246	5.0		0.390		15.3	LOS C	0.5	13.3				
East: South Liberty Parkway															
Lane 1	759	5.0	759	5.0	1213	0.625	100	10.3	LOS B	2.4	61.8	Full	1800	0.0	0.0
Lane 2 ^d	766	5.0	766	5.0	1226	0.625	100	10.2	LOS B	2.4	61.9	Full	1800	0.0	0.0
Approach	1525	5.0	1525	5.0		0.625		10.2	LOS B	2.4	61.9				
North: Arsenal															
Lane 1 ^d	25	5.0	25	5.0	504	0.050	100	7.8	LOS A	0.0	1.3	Full	1600	0.0	0.0
Lane 2	13	5.0	13	5.0	376	0.035	100	10.1	LOS B	0.0	0.9	Full	1600	0.0	0.0
Approach	38	5.0	38	5.0		0.050		8.6	LOS A	0.0	1.3				
West: South Liberty Parkway															
Lane 1	741	5.0	741	5.0	1153	0.642	100	11.3	LOS B	2.2	56.3	Full	3580	0.0	0.0
Lane 2 ^d	753	5.0	753	5.0	1172	0.642	100	11.2	LOS B	2.2	56.4	Full	3580	0.0	0.0
Approach	1493	5.0	1493	5.0		0.642		11.3	LOS B	2.2	56.4				
All Vehicles	3302	5.0	3302	5.0		0.642		11.0	LOS B	2.4	61.9				

Site Level of Service (LOS) Method: Delay & v/c (HCM 6). Site LOS Method is specified in the Network Data dialog (Override Site Data tab).

Roundabout LOS Method: Same as Sign Control.

Lane LOS values are based on average delay and v/c ratio (degree of saturation) per lane.

LOS F will result if v/c > 1 irrespective of lane delay value (does not apply for approaches and intersection).

Intersection and Approach LOS values are based on average delay for all lanes (v/c not used as specified in HCM 6).

Roundabout Capacity Model: SIDRA HCM.

Delay Model: HCM Delay Formula (Stopline Delay: Geometric Delay is not included).

Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Gap.

Gap-Acceptance Capacity Formula: Traditional M1.

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

^d Dominant lane on roundabout approach

Approach Lane Flows (veh/h)										
South: Arsenal										
Mov. From S To Exit:	L2	R2	Total	%HV	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Prob. SL %	Ov. Lane No.	
	W	E								
Lane 1	55	-	55	5.0	247	0.224	100	NA	NA	
Lane 2	-	190	190	5.0	488	0.390	100	NA	NA	
Approach	55	190	246	5.0		0.390				
East: South Liberty Parkway										

Mov. From E To Exit:	L2	T1	R2	Total	%HV	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Prob. SL Ov. %	Ov. Lane No.
Lane 1	112	647	-	759	5.0	1213	0.625	100	NA	NA
Lane 2	-	725	41	766	5.0	1226	0.625	100	NA	NA
Approach	112	1372	41	1525	5.0		0.625			
North: Arsenal										
Mov. From N To Exit:	L2	R2	Total	%HV	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Prob. SL Ov. %	Ov. Lane No.	
Lane 1	25	-	25	5.0	504	0.050	100	NA	NA	
Lane 2	-	13	13	5.0	376	0.035	100	NA	NA	
Approach	25	13	38	5.0		0.050				
West: South Liberty Parkway										
Mov. From W To Exit:	L2	T1	R2	Total	%HV	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Prob. SL Ov. %	Ov. Lane No.
Lane 1	23	718	-	741	5.0	1153	0.642	100	NA	NA
Lane 2	-	713	40	753	5.0	1172	0.642	100	NA	NA
Approach	23	1430	40	1493	5.0		0.642			
Total %HV Deg. Satn (v/c)										
All Vehicles	3302	5.0		0.642						

Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

Merge Analysis												
Exit Lane Number	Short Lane Length ft	Percent Opng in Lane %	Opposing Flow Rate veh/h	Critical Gap sec	Follow-up Headway sec	Lane Capacity veh/h	Deg. Satn v/c	Min. Delay sec	Merge Delay sec			
There are no Exit Short Lanes for Merge Analysis at this Site.												

Variable Demand Analysis				
	Initial Queued Demand veh	Residual Queued Demand veh	Time for Residual Demand to Clear sec	Duration of Oversatn sec
South: Arsenal				
Lane 1	0.0	0.0	0.0	0.0
Lane 2	0.0	0.0	0.0	0.0
East: South Liberty Parkway				
Lane 1	0.0	0.0	0.0	0.0
Lane 2	0.0	0.0	0.0	0.0
North: Arsenal				
Lane 1	0.0	0.0	0.0	0.0
Lane 2	0.0	0.0	0.0	0.0
West: South Liberty Parkway				
Lane 1	0.0	0.0	0.0	0.0
Lane 2	0.0	0.0	0.0	0.0

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Project: G:\16652\Analysis\Traffic\Synchro-Sidra\Scenario1-2.sip9

LANE SUMMARY

Site: 101 [East Roundabout (Site Folder: High - PM Peak)]

Output produced by SIDRA INTERSECTION Version: 9.1.6.228

Network: N101 [PM High SLP (Network Folder: General)]

New Site
Site Category: (None)
Roundabout

Lane Use and Performance															
	Demand Flows		Arrival Flows		Cap.	Deg. Satn	Lane Util.	Aver. Delay	Level of Service	Aver. Back Of Queue		Lane Config	Lane Length	Cap. Adj.	Prob. Block.
	[Total veh/h	HV %	[Total veh/h	HV %						[Veh	Dist]				
South: New Road															
Lane 1 ^d	162	5.0	162	5.0	352	0.460	100	20.9	LOS C	0.6	16.0	Full	1600	0.0	0.0
Lane 2	108	5.0	108	5.0	281	0.383	100	22.4	LOS C	0.5	12.1	Full	1600	0.0	0.0
Approach	270	5.0	270	5.0		0.460		21.5	LOS C	0.6	16.0				
East: South Liberty Parkway															
Lane 1	591	5.0	591	5.0	990	0.597	100	11.7	LOS B	2.3	60.3	Full	1900	0.0	0.0
Lane 2 ^d	614	5.0	614	5.0	1029	0.597	100	11.3	LOS B	2.3	60.4	Full	1900	0.0	0.0
Approach	1204	5.0	1204	5.0		0.597		11.5	LOS B	2.3	60.4				
North: New Road															
Lane 1	223	5.0	223	5.0	476	0.468	100	16.3	LOS C	0.7	17.9	Full	1600	0.0	0.0
Lane 2 ^d	325	5.0	325	5.0	550	0.591	100	18.4	LOS C	1.1	27.5	Full	1600	0.0	0.0
Approach	548	5.0	548	5.0		0.591		17.6	LOS C	1.1	27.5				
West: South Liberty Parkway															
Lane 1	808	5.0	808	5.0	997	0.811	100	20.3	LOS C	7.1	184.5	Full	1800	0.0	0.0
Lane 2 ^d	838	5.0	838	5.0	1033	0.811	100	19.7	LOS C	7.2	187.6	Full	1800	0.0	0.0
Approach	1646	5.0	1646	5.0		0.811		20.0	LOS C	7.2	187.6				
All Vehicles	3667	5.0	3667	5.0		0.811		17.0	LOS C	7.2	187.6				

Site Level of Service (LOS) Method: Delay & v/c (HCM 6). Site LOS Method is specified in the Network Data dialog (Override Site Data tab).

Roundabout LOS Method: Same as Sign Control.

Lane LOS values are based on average delay and v/c ratio (degree of saturation) per lane.

LOS F will result if v/c > 1 irrespective of lane delay value (does not apply for approaches and intersection).

Intersection and Approach LOS values are based on average delay for all lanes (v/c not used as specified in HCM 6).

Roundabout Capacity Model: SIDRA HCM.

Delay Model: HCM Delay Formula (Stopline Delay: Geometric Delay is not included).

Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Gap.

Gap-Acceptance Capacity Formula: Traditional M1.

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

^d Dominant lane on roundabout approach

Approach Lane Flows (veh/h)										
South: New Road										
Mov. From S To Exit:	L2	R2	Total	%HV	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Prob. SL %	Ov. Lane No.	
	W	E								
Lane 1	162	-	162	5.0	352	0.460	100	NA	NA	
Lane 2	-	108	108	5.0	281	0.383	100	NA	NA	
Approach	162	108	270	5.0		0.460				
East: South Liberty Parkway										

Mov. From E To Exit:	L2	T1	R2	Total	%HV	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Prob. SL Ov. %	Ov. Lane No.
Lane 1	62	529	-	591	5.0	990	0.597	100	NA	NA
Lane 2	-	509	104	614	5.0	1029	0.597	100	NA	NA
Approach	62	1038	104	1204	5.0		0.597			
North: New Road										
Mov. From N To Exit:	L2	R2	Total	%HV	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Prob. SL Ov. %	Ov. Lane No.	
Lane 1	223	-	223	5.0	476	0.468	100	NA	NA	
Lane 2	-	325	325	5.0	550	0.591	100	NA	NA	
Approach	223	325	548	5.0		0.591				
West: South Liberty Parkway										
Mov. From W To Exit:	L2	T1	R2	Total	%HV	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Prob. SL Ov. %	Ov. Lane No.
Lane 1	140	668	-	808	5.0	997	0.811	100	NA	NA
Lane 2	-	746	91	838	5.0	1033	0.811	100	NA	NA
Approach	140	1414	91	1646	5.0		0.811			
Total %HV Deg.Satn (v/c)										
All Vehicles	3667	5.0		0.811						

Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

Merge Analysis												
Exit Lane Number	Short Lane Length ft	Percent Opng in Lane %	Opposing Flow Rate veh/h	Critical Gap sec	Follow-up Headway sec	Lane Capacity Flow Rate veh/h	Deg. Satn v/c	Min. Delay sec	Merge Delay sec			
There are no Exit Short Lanes for Merge Analysis at this Site.												

Variable Demand Analysis				
	Initial Queued Demand veh	Residual Queued Demand veh	Time for Residual Demand to Clear sec	Duration of Oversatn sec
South: New Road				
Lane 1	0.0	0.0	0.0	0.0
Lane 2	0.0	0.0	0.0	0.0
East: South Liberty Parkway				
Lane 1	0.0	0.0	0.0	0.0
Lane 2	0.0	0.0	0.0	0.0
North: New Road				
Lane 1	0.0	0.0	0.0	0.0
Lane 2	0.0	0.0	0.0	0.0
West: South Liberty Parkway				
Lane 1	0.0	0.0	0.0	0.0
Lane 2	0.0	0.0	0.0	0.0

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APPENDIX D.2
SCENARIO 2 OPERATIONAL ANALYSES

LANE SUMMARY

Site: 101vv [Railroad (Site Folder: High - AM Peak)]

Output produced by SIDRA INTERSECTION Version: 9.1.6.228

Network: N101 [AM High SLP (Network Folder: General)]

New Site
Site Category: (None)
Roundabout

Lane Use and Performance															
	Demand Flows		Arrival Flows		Cap.	Deg. Satn	Lane Util.	Aver. Delay	Level of Service	Aver. Back Of Queue		Lane Config	Lane Length	Cap. Adj.	Prob. Block.
	[Total veh/h]	[HV %]	[Total veh/h]	[HV %]						[Veh]	[Dist]				
	veh/h	%	veh/h	%	veh/h	v/c	%	sec			ft		ft	%	%
East: South Liberty Parkway															
Lane 1	628	5.0	628	5.0	1216	0.516	100	8.4	LOS A	1.3	34.0	Full	1150	0.0	0.0
Lane 2 ^d	635	5.0	635	5.0	1231	0.516	100	8.3	LOS A	1.3	34.0	Full	1150	0.0	0.0
Approach	1263	5.0	1263	5.0		0.516		8.3	LOS A	1.3	34.0				
North: Railroad															
Lane 1	18	5.0	18	5.0	540	0.034	100	7.1	LOS A	0.0	0.8	Full	1600	0.0	0.0
Lane 2 ^d	27	5.0	27	5.0	625	0.044	100	6.3	LOS A	0.0	1.1	Full	1600	0.0	0.0
Approach	46	5.0	46	5.0		0.044		6.6	LOS A	0.0	1.1				
West: South Liberty Parkway															
Lane 1	712	5.0	712	5.0	1291	0.552	100	7.4	LOS A	2.0	53.2	Full	1725	0.0	0.0
Lane 2 ^d	716	5.0	716	5.0	1297	0.552	100	7.4	LOS A	2.0	53.2	Full	1725	0.0	0.0
Approach	1428	5.0	1428	5.0		0.552		7.4	LOS A	2.0	53.2				
All Vehicles	2737	5.0	2737	5.0		0.552		7.8	LOS A	2.0	53.2				

Site Level of Service (LOS) Method: Delay & v/c (HCM 6). Site LOS Method is specified in the Network Data dialog (Override Site Data tab).

Roundabout LOS Method: Same as Sign Control.

Lane LOS values are based on average delay and v/c ratio (degree of saturation) per lane.

LOS F will result if v/c > 1 irrespective of lane delay value (does not apply for approaches and intersection).

Intersection and Approach LOS values are based on average delay for all lanes (v/c not used as specified in HCM 6).

Roundabout Capacity Model: SIDRA HCM.

Delay Model: HCM Delay Formula (Stoptline Delay: Geometric Delay is not included).

Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Gap.

Gap-Acceptance Capacity Formula: Traditional M1.

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

^d Dominant lane on roundabout approach

Approach Lane Flows (veh/h)										
East: South Liberty Parkway										
Mov.	T1	R2	Total	%HV	Cap.	Deg. Satn	Lane Util.	Prob. SL	Ov. Lane	
From E					veh/h	v/c	%	%	No.	
To Exit:	W	N								
Lane 1	628	-	628	5.0	1216	0.516	100	NA	NA	
Lane 2	575	60	635	5.0	1231	0.516	100	NA	NA	
Approach	1203	60	1263	5.0		0.516				
North: Railroad										
Mov.	L2	R2	Total	%HV	Cap.	Deg. Satn	Lane Util.	Prob. SL	Ov. Lane	
From N					veh/h	v/c	%	%	No.	
To Exit:	E	W								
Lane 1	18	-	18	5.0	540	0.034	100	NA	NA	
Lane 2	-	27	27	5.0	625	0.044	100	NA	NA	

Approach	18	27	46	5.0	0.044				
West: South Liberty Parkway									
Mov. From W To Exit:	L2 N	T1 E	Total	%HV	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Prob. SL Ov. %	Ov. Lane No.
Lane 1	93	619	712	5.0	1291	0.552	100	NA	NA
Lane 2	-	716	716	5.0	1297	0.552	100	NA	NA
Approach	93	1335	1428	5.0	0.552				
Total %HV Deg. Satn (v/c)									
All Vehicles	2737	5.0	0.552						

Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

Merge Analysis												
Exit Lane Number	Short Lane Length ft	Percent Opng in Lane % veh/h	Opposing Flow Rate pcu/h	Critical Gap sec	Follow-up Headway sec	Lane Flow Rate veh/h	Capacity veh/h	Deg. Satn v/c	Min. Delay sec	Merge Delay sec		
There are no Exit Short Lanes for Merge Analysis at this Site.												

Variable Demand Analysis				
	Initial Queued Demand veh	Residual Queued Demand veh	Time for Residual Demand to Clear sec	Duration of Oversatn sec
East: South Liberty Parkway				
Lane 1	0.0	0.0	0.0	0.0
Lane 2	0.0	0.0	0.0	0.0
North: Railroad				
Lane 1	0.0	0.0	0.0	0.0
Lane 2	0.0	0.0	0.0	0.0
West: South Liberty Parkway				
Lane 1	0.0	0.0	0.0	0.0
Lane 2	0.0	0.0	0.0	0.0

LANE SUMMARY

Site: 101 [West Arsenal (Site Folder: High - AM Peak)]

Output produced by SIDRA INTERSECTION Version: 9.1.6.228

Network: N101 [AM High SLP (Network Folder: General)]

New Site
Site Category: (None)
Roundabout

Lane Use and Performance															
	Demand Flows		Arrival Flows		Cap.	Deg. Satn	Lane Util.	Aver. Delay	Level of Service	Aver. Back Of Queue		Lane Config	Lane Length	Cap. Adj.	Prob. Block.
	[Total veh/h	HV %	[Total veh/h	HV %						[Veh	Dist]				
South: West Arsenal															
Lane 1	62	5.0	62	5.0	699	0.088	100	6.1	LOS A	0.1	2.4	Full	1600	0.0	0.0
Lane 2 ^d	74	5.0	74	5.0	841	0.088	100	5.2	LOS A	0.1	2.5	Full	1600	0.0	0.0
Lane 3	50	5.0	50	5.0	670	0.075	100	6.2	LOS A	0.1	2.0	Full	1600	0.0	0.0
Approach	186	5.0	186	5.0		0.088		5.8	LOS A	0.1	2.5				
East: South Liberty Parkway															
Lane 1	625	5.0	625	5.0	1049	0.596	100	10.9	LOS B	1.6	40.3	Full	3050	0.0	0.0
Lane 2 ^d	635	5.0	635	5.0	1066	0.596	100	11.0	LOS B	1.6	41.0	Full	3050	0.0	0.0
Approach	1260	5.0	1260	5.0		0.596		10.9	LOS B	1.6	41.0				
West: South Liberty Parkway															
Lane 1	671	5.0	671	5.0	1155	0.581	100	9.9	LOS A	1.8	46.6	Full	1150	0.0	0.0
Lane 2 ^d	682	5.0	682	5.0	1173	0.581	100	9.8	LOS A	1.8	46.7	Full	1150	0.0	0.0
Approach	1353	5.0	1353	5.0		0.581		9.9	LOS A	1.8	46.7				
All Vehicles	2799	5.0	2799	5.0		0.596		10.1	LOS B	1.8	46.7				

Site Level of Service (LOS) Method: Delay & v/c (HCM 6). Site LOS Method is specified in the Network Data dialog (Override Site Data tab).

Roundabout LOS Method: Same as Sign Control.

Lane LOS values are based on average delay and v/c ratio (degree of saturation) per lane.

LOS F will result if v/c > 1 irrespective of lane delay value (does not apply for approaches and intersection).

Intersection and Approach LOS values are based on average delay for all lanes (v/c not used as specified in HCM 6).

Roundabout Capacity Model: SIDRA HCM.

Delay Model: HCM Delay Formula (Stopline Delay: Geometric Delay is not included).

Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Gap.

Gap-Acceptance Capacity Formula: Traditional M1.

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

^d Dominant lane on roundabout approach

Approach Lane Flows (veh/h)										
South: West Arsenal										
Mov.	L2	R2	Total	%HV	Cap.	Deg. Satn	Lane Util.	Prob. SL Ov.	Ov. Lane No.	
From S To Exit:	W	E			veh/h	v/c	%	%		
Lane 1	62	-	62	5.0	699	0.088	100	NA	NA	
Lane 2	74	-	74	5.0	841	0.088	100	NA	NA	
Lane 3	-	50	50	5.0	670	0.075	100	NA	NA	
Approach	136	50	186	5.0		0.088				
East: South Liberty Parkway										
Mov.	L2	T1	Total	%HV	Cap.	Deg. Satn	Lane Util.	Prob. SL Ov.	Ov. Lane No.	
From E To Exit:	S	W			veh/h	v/c	%	%		

Lane 1	133	492	625	5.0	1049	0.596	100	NA	NA
Lane 2	-	635	635	5.0	1066	0.596	100	NA	NA
Approach	133	1127	1260	5.0		0.596			
West: South Liberty Parkway									
Mov. From W To Exit:	T1	R2	Total	%HV	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Prob. SL %	Ov. Lane No.
	E	S							
Lane 1	671	-	671	5.0	1155	0.581	100	NA	NA
Lane 2	399	283	682	5.0	1173	0.581	100	NA	NA
Approach	1071	283	1353	5.0		0.581			
Total %HV Deg. Satn (v/c)									
All Vehicles	2799	5.0		0.596					

Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

Merge Analysis												
	Exit Lane Number	Short Lane Length	Percent Opng in Lane	Opposing Flow Rate	Critical Gap	Follow-up Headway	Lane Capacity Flow Rate	Deg. Satn	Min. Delay	Merge Delay		
		ft	%	veh/h	pcu/h	sec	veh/h	v/c	sec	sec		
There are no Exit Short Lanes for Merge Analysis at this Site.												

Variable Demand Analysis				
	Initial Queued Demand	Residual Queued Demand	Time for Residual Demand to Clear	Duration of Oversatn
	veh	veh	sec	sec
South: West Arsenal				
Lane 1	0.0	0.0	0.0	0.0
Lane 2	0.0	0.0	0.0	0.0
Lane 3	0.0	0.0	0.0	0.0
East: South Liberty Parkway				
Lane 1	0.0	0.0	0.0	0.0
Lane 2	0.0	0.0	0.0	0.0
West: South Liberty Parkway				
Lane 1	0.0	0.0	0.0	0.0
Lane 2	0.0	0.0	0.0	0.0

LANE SUMMARY

Site: 101 [Birmingham (Site Folder: High - AM Peak)]

Output produced by SIDRA INTERSECTION Version: 9.1.6.228

Network: N101 [AM High SLP (Network Folder: General)]

New Site
Site Category: (None)
Roundabout

Lane Use and Performance															
	Demand Flows		Arrival Flows		Cap.	Deg. Satn	Lane Util.	Aver. Delay	Level of Service	Aver. Back Of Queue		Lane Config	Lane Length	Cap. Adj.	Prob. Block.
	[Total veh/h]	[HV %]	[Total veh/h]	[HV %]						[Veh]	[Dist]				
	veh/h	%	veh/h	%	veh/h	v/c	%	sec			ft	ft	%	%	
South: Birmingham															
Lane 1 ^d	105	5.0	105	5.0	602	0.175	100	8.1	LOS A	0.2	4.9	Full	1600	0.0	0.0
Lane 2	22	5.0	22	5.0	279	0.078	100	14.4	LOS B	0.1	1.9	Full	1600	0.0	0.0
Approach	127	5.0	127	5.0		0.175		9.2	LOS A	0.2	4.9				
East: South Liberty Parkway															
Lane 1	452	5.0	452	5.0	1088	0.415	100	7.6	LOS A	0.9	23.0	Full	2180	0.0	0.0
Lane 2 ^d	463	5.0	463	5.0	1115	0.415	100	7.5	LOS A	0.9	23.0	Full	2180	0.0	0.0
Approach	915	5.0	915	5.0		0.415		7.6	LOS A	0.9	23.0				
North: Birmingham															
Lane 1	143	5.0	143	5.0	464	0.309	100	12.7	LOS B	0.4	9.7	Full	1600	0.0	0.0
Lane 2 ^d	370	5.0	370	5.0	690	0.536	100	13.7	LOS B	1.0	26.7	Full	1600	0.0	0.0
Approach	513	5.0	513	5.0		0.536		13.4	LOS B	1.0	26.7				
West: South Liberty Parkway															
Lane 1	555	5.0	555	5.0	1117	0.497	100	8.7	LOS A	1.3	33.9	Full	3050	0.0	0.0
Lane 2 ^d	566	5.0	566	5.0	1139	0.497	100	8.6	LOS A	1.3	34.0	Full	3050	0.0	0.0
Approach	1121	5.0	1121	5.0		0.497		8.6	LOS A	1.3	34.0				
All Vehicles	2676	5.0	2676	5.0		0.536		9.2	LOS A	1.3	34.0				

Site Level of Service (LOS) Method: Delay & v/c (HCM 6). Site LOS Method is specified in the Network Data dialog (Override Site Data tab).

Roundabout LOS Method: Same as Sign Control.

Lane LOS values are based on average delay and v/c ratio (degree of saturation) per lane.

LOS F will result if v/c > 1 irrespective of lane delay value (does not apply for approaches and intersection).

Intersection and Approach LOS values are based on average delay for all lanes (v/c not used as specified in HCM 6).

Roundabout Capacity Model: SIDRA HCM.

Delay Model: HCM Delay Formula (Stopline Delay: Geometric Delay is not included).

Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Gap.

Gap-Acceptance Capacity Formula: Traditional M1.

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

^d Dominant lane on roundabout approach

Approach Lane Flows (veh/h)											
South: Birmingham											
Mov. From S To Exit:	L2	T1	R2	Total	%HV	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Prob. SL %	Ov. Lane No.	
	W	N	E								
Lane 1	39	66	-	105	5.0	602	0.175	100	NA	NA	
Lane 2	-	-	22	22	5.0	279	0.078	100	NA	NA	
Approach	39	66	22	127	5.0		0.175				
East: South Liberty Parkway											

Mov. From E To Exit:	L2	T1	R2	Total	%HV	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Prob. SL Ov. %	Ov. Lane No.
Lane 1	21	432	-	452	5.0	1088	0.415	100	NA	NA
Lane 2	-	420	43	463	5.0	1115	0.415	100	NA	NA
Approach	21	851	43	915	5.0		0.415			
North: Birmingham										
Mov. From N To Exit:	L2	T1	R2	Total	%HV	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Prob. SL Ov. %	Ov. Lane No.
Lane 1	82	62	-	143	5.0	464	0.309	100	NA	NA
Lane 2	-	-	370	370	5.0	690	0.536	100	NA	NA
Approach	82	62	370	513	5.0		0.536			
West: South Liberty Parkway										
Mov. From W To Exit:	L2	T1	R2	Total	%HV	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Prob. SL Ov. %	Ov. Lane No.
Lane 1	101	454	-	555	5.0	1117	0.497	100	NA	NA
Lane 2	-	540	26	566	5.0	1139	0.497	100	NA	NA
Approach	101	993	26	1121	5.0		0.497			
Total %HV Deg.Satn (v/c)										
All Vehicles	2676	5.0		0.536						

Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

Merge Analysis												
Exit Lane Number	Short Lane Length ft	Percent Opng in Lane % veh/h	Opposing Flow Rate pcu/h	Critical Gap sec	Follow-up Headway sec	Lane Capacity Flow Rate veh/h	Deg. Satn v/c	Min. Delay sec	Merge Delay sec			
There are no Exit Short Lanes for Merge Analysis at this Site.												

Variable Demand Analysis				
	Initial Queued Demand veh	Residual Queued Demand veh	Time for Residual Demand to Clear sec	Duration of Oversatn sec
South: Birmingham				
Lane 1	0.0	0.0	0.0	0.0
Lane 2	0.0	0.0	0.0	0.0
East: South Liberty Parkway				
Lane 1	0.0	0.0	0.0	0.0
Lane 2	0.0	0.0	0.0	0.0
North: Birmingham				
Lane 1	0.0	0.0	0.0	0.0
Lane 2	0.0	0.0	0.0	0.0
West: South Liberty Parkway				
Lane 1	0.0	0.0	0.0	0.0
Lane 2	0.0	0.0	0.0	0.0

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Project: G:\16652\Analysis\Traffic\Synchro-Sidra\Scenario2-2.sip9

LANE SUMMARY

Site: 101 [Middle Roundabout (Site Folder: High - AM Peak)]

Output produced by SIDRA INTERSECTION Version: 9.1.6.228

Network: N101 [AM High SLP (Network Folder: General)]

New Site
Site Category: (None)
Roundabout

Lane Use and Performance															
	Demand Flows		Arrival Flows		Cap.	Deg. Satn	Lane Util.	Aver. Delay	Level of Service	Aver. Back Of Queue		Lane Config	Lane Length	Cap. Adj.	Prob. Block.
	[Total veh/h]	[HV %]	[Total veh/h]	[HV %]						[Veh]	[Dist]				
	veh/h	%	veh/h	%	veh/h	v/c	%	sec			ft	ft	%	%	
East: South Liberty Parkway															
Lane 1	452	5.0	452	5.0	1308	0.346	100	4.9	LOS A	0.8	20.6	Full	1400	0.0	0.0
Lane 2 ^d	454	5.0	454	5.0	1313	0.346	100	4.9	LOS A	0.8	20.6	Full	1400	0.0	0.0
Approach	907	5.0	907	5.0		0.346		4.9	LOS A	0.8	20.6				
North: New Road															
Lane 1 ^d	58	5.0	58	5.0	601	0.096	100	7.0	LOS A	0.1	2.2	Full	1600	0.0	0.0
Approach	58	5.0	58	5.0		0.096		7.0	LOS A	0.1	2.2				
West: South Liberty Parkway															
Lane 1	547	5.0	547	5.0	1271	0.430	100	6.6	LOS A	1.2	31.0	Full	2180	0.0	0.0
Lane 2 ^d	550	5.0	550	5.0	1279	0.430	100	6.6	LOS A	1.2	31.0	Full	2180	0.0	0.0
Approach	1097	5.0	1097	5.0		0.430		6.6	LOS A	1.2	31.0				
All Vehicles	2061	5.0	2061	5.0		0.430		5.9	LOS A	1.2	31.0				

Site Level of Service (LOS) Method: Delay & v/c (HCM 6). Site LOS Method is specified in the Network Data dialog (Override Site Data tab).

Roundabout LOS Method: Same as Sign Control.

Lane LOS values are based on average delay and v/c ratio (degree of saturation) per lane.

LOS F will result if v/c > 1 irrespective of lane delay value (does not apply for approaches and intersection).

Intersection and Approach LOS values are based on average delay for all lanes (v/c not used as specified in HCM 6).

Roundabout Capacity Model: SIDRA HCM.

Delay Model: HCM Delay Formula (Stopline Delay: Geometric Delay is not included).

Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Gap.

Gap-Acceptance Capacity Formula: Traditional M1.

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

^d Dominant lane on roundabout approach

Approach Lane Flows (veh/h)										
East: South Liberty Parkway										
Mov.	T1	R2	Total	%HV	Cap.	Deg. Satn	Lane Util.	Prob. SL	Ov. Lane	
From E To Exit:	W	N			veh/h	v/c	%	%	No.	
Lane 1	452	-	452	5.0	1308	0.346	100	NA	NA	
Lane 2	442	12	454	5.0	1313	0.346	100	NA	NA	
Approach	895	12	907	5.0		0.346				
North: New Road										
Mov.	L2	R2	Total	%HV	Cap.	Deg. Satn	Lane Util.	Prob. SL	Ov. Lane	
From N To Exit:	E	W			veh/h	v/c	%	%	No.	
Lane 1	37	21	58	5.0	601	0.096	100	NA	NA	
Approach	37	21	58	5.0		0.096				

West: South Liberty Parkway										
Mov.	L2	T1	Total	%HV	Cap.	Deg.	Lane	Prob.	Ov.	Ov.
From W					veh/h	Satn	Util.	SL	%	Lane
To Exit:	N	E				v/c	%	%		No.
Lane 1	8	539	547	5.0	1271	0.430	100	NA	NA	NA
Lane 2	-	550	550	5.0	1279	0.430	100	NA	NA	NA
Approach	8	1089	1097	5.0		0.430				
Total		%HV		Deg.Satn		(v/c)				
All Vehicles	2061	5.0				0.430				

Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

Merge Analysis												
	Exit Lane Number	Short Lane Length ft	Percent Opng in Lane %	Opposing Flow Rate veh/h	Critical Gap sec	Follow-up Headway sec	Lane Capacity Rate veh/h	Deg. Satn v/c	Min. Delay sec	Merge Delay sec		
There are no Exit Short Lanes for Merge Analysis at this Site.												

Variable Demand Analysis				
	Initial Queued Demand veh	Residual Queued Demand veh	Time for Residual Demand to Clear sec	Duration of Oversatn sec
East: South Liberty Parkway				
Lane 1	0.0	0.0	0.0	0.0
Lane 2	0.0	0.0	0.0	0.0
North: New Road				
Lane 1	0.0	0.0	0.0	0.0
West: South Liberty Parkway				
Lane 1	0.0	0.0	0.0	0.0
Lane 2	0.0	0.0	0.0	0.0

LANE SUMMARY

Site: 101 [Arsenal (Site Folder: High - AM Peak)]

Output produced by SIDRA INTERSECTION Version: 9.1.6.228

Network: N101 [AM High SLP (Network Folder: General)]

New Site
Site Category: (None)
Roundabout

Lane Use and Performance															
	Demand Flows		Arrival Flows		Cap.	Deg. Satn	Lane Util.	Aver. Delay	Level of Service	Aver. Back Of Queue		Lane Config	Lane Length	Cap. Adj.	Prob. Block.
	[Total veh/h]	[HV %]	[Total veh/h]	[HV %]						[Veh]	[Dist]				
	veh/h	%	veh/h	%	veh/h	v/c	%	sec			ft		ft	%	%
South: Arsenal															
Lane 1 ^d	98	5.0	98	5.0	496	0.197	100	10.1	LOS B	0.2	5.3	Full	1600	0.0	0.0
Approach	98	5.0	98	5.0		0.197		10.1	LOS B	0.2	5.3				
East: South Liberty Parkway															
Lane 1	499	5.0	499	5.0	1275	0.391	100	6.1	LOS A	1.1	28.0	Full	1800	0.0	0.0
Lane 2 ^d	502	5.0	502	5.0	1283	0.391	100	6.0	LOS A	1.1	28.0	Full	1800	0.0	0.0
Approach	1001	5.0	1001	5.0		0.391		6.1	LOS A	1.1	28.0				
West: South Liberty Parkway															
Lane 1	559	5.0	559	5.0	1176	0.475	100	8.0	LOS A	1.2	30.2	Full	1400	0.0	0.0
Lane 2 ^d	567	5.0	567	5.0	1193	0.475	100	7.9	LOS A	1.2	30.2	Full	1400	0.0	0.0
Approach	1126	5.0	1126	5.0		0.475		7.9	LOS A	1.2	30.2				
All Vehicles	2225	5.0	2225	5.0		0.475		7.2	LOS A	1.2	30.2				

Site Level of Service (LOS) Method: Delay & v/c (HCM 6). Site LOS Method is specified in the Network Data dialog (Override Site Data tab).

Roundabout LOS Method: Same as Sign Control.

Lane LOS values are based on average delay and v/c ratio (degree of saturation) per lane.

LOS F will result if v/c > 1 irrespective of lane delay value (does not apply for approaches and intersection).

Intersection and Approach LOS values are based on average delay for all lanes (v/c not used as specified in HCM 6).

Roundabout Capacity Model: SIDRA HCM.

Delay Model: HCM Delay Formula (Stopline Delay: Geometric Delay is not included).

Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Gap.

Gap-Acceptance Capacity Formula: Traditional M1.

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

^d Dominant lane on roundabout approach

Approach Lane Flows (veh/h)										
South: Arsenal										
Mov.	L2	R2	Total	%HV	Cap.	Deg. Satn	Lane Util.	Prob. SL	Ov.	Ov. Lane No.
From S To Exit:	W	E			veh/h	v/c	%	%		
Lane 1	29	68	98	5.0	496	0.197	100	NA	NA	
Approach	29	68	98	5.0		0.197				
East: South Liberty Parkway										
Mov.	L2	T1	Total	%HV	Cap.	Deg. Satn	Lane Util.	Prob. SL	Ov.	Ov. Lane No.
From E To Exit:	S	W			veh/h	v/c	%	%		
Lane 1	124	375	499	5.0	1275	0.391	100	NA	NA	
Lane 2	-	502	502	5.0	1283	0.391	100	NA	NA	
Approach	124	877	1001	5.0		0.391				

West: South Liberty Parkway										
Mov.	T1	R2	Total	%HV	Cap.	Deg.	Lane	Prob.	Ov.	Ov.
From W To Exit:	E	S			veh/h	Satn v/c	Util. %	SL %	Lane No.	Lane No.
Lane 1	559	-	559	5.0	1176	0.475	100	NA	NA	NA
Lane 2	532	35	567	5.0	1193	0.475	100	NA	NA	NA
Approach	1091	35	1126	5.0		0.475				
Total %HV Deg.Satn (v/c)										
All Vehicles	2225	5.0		0.475						

Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

Merge Analysis												
	Exit Lane Number	Short Lane Length ft	Percent Opng in Lane %	Opposing Flow Rate veh/h	Critical Gap pcu/h	Follow-up Headway sec	Lane Capacity Rate veh/h	Deg. Satn v/c	Min. Delay sec	Merge Delay sec		
There are no Exit Short Lanes for Merge Analysis at this Site.												

Variable Demand Analysis				
	Initial Queued Demand veh	Residual Queued Demand veh	Time for Residual Demand to Clear sec	Duration of Oversatn sec
South: Arsenal				
Lane 1	0.0	0.0	0.0	0.0
East: South Liberty Parkway				
Lane 1	0.0	0.0	0.0	0.0
Lane 2	0.0	0.0	0.0	0.0
West: South Liberty Parkway				
Lane 1	0.0	0.0	0.0	0.0
Lane 2	0.0	0.0	0.0	0.0

LANE SUMMARY

Site: 101 [East Roundabout (Site Folder: High - AM Peak)]

Output produced by SIDRA INTERSECTION Version: 9.1.6.228

Network: N101 [AM High SLP (Network Folder: General)]

New Site
Site Category: (None)
Roundabout

Lane Use and Performance															
	Demand Flows		Arrival Flows		Cap.	Deg. Satn	Lane Util.	Aver. Delay	Level of Service	Aver. Back Of Queue		Lane Config	Lane Length	Cap. Adj.	Prob. Block.
	[Total veh/h	HV %	[Total veh/h	HV %						[Veh	Dist]				
					veh/h	v/c	%	sec			ft		ft	%	%
South: New Road															
Lane 1 ^d	58	5.0	58	5.0	639	0.090	100	6.7	LOS A	0.1	2.3	Full	1600	0.0	0.0
Lane 2	38	5.0	38	5.0	550	0.069	100	7.4	LOS A	0.1	1.7	Full	1600	0.0	0.0
Approach	96	5.0	96	5.0		0.090		7.0	LOS A	0.1	2.3				
East: South Liberty Parkway															
Lane 1	539	5.0	539	5.0	1022	0.527	100	9.9	LOS A	1.5	38.9	Full	1900	0.0	0.0
Lane 2 ^d	558	5.0	558	5.0	1058	0.527	100	9.6	LOS A	1.5	38.3	Full	1900	0.0	0.0
Approach	1097	5.0	1097	5.0		0.527		9.8	LOS A	1.5	38.9				
North: New Road															
Lane 1	55	5.0	55	5.0	621	0.089	100	6.8	LOS A	0.1	2.4	Full	1600	0.0	0.0
Lane 2 ^d	67	5.0	67	5.0	655	0.103	100	6.7	LOS A	0.1	2.8	Full	1600	0.0	0.0
Approach	123	5.0	123	5.0		0.103		6.8	LOS A	0.1	2.8				
West: South Liberty Parkway															
Lane 1	576	5.0	576	5.0	1171	0.492	100	8.3	LOS A	1.3	32.5	Full	1800	0.0	0.0
Lane 2 ^d	584	5.0	584	5.0	1189	0.492	100	8.2	LOS A	1.3	32.6	Full	1800	0.0	0.0
Approach	1160	5.0	1160	5.0		0.492		8.2	LOS A	1.3	32.6				
All Vehicles	2475	5.0	2475	5.0		0.527		8.8	LOS A	1.5	38.9				

Site Level of Service (LOS) Method: Delay & v/c (HCM 6). Site LOS Method is specified in the Network Data dialog (Override Site Data tab).

Roundabout LOS Method: Same as Sign Control.

Lane LOS values are based on average delay and v/c ratio (degree of saturation) per lane.

LOS F will result if v/c > 1 irrespective of lane delay value (does not apply for approaches and intersection).

Intersection and Approach LOS values are based on average delay for all lanes (v/c not used as specified in HCM 6).

Roundabout Capacity Model: SIDRA HCM.

Delay Model: HCM Delay Formula (Stopline Delay: Geometric Delay is not included).

Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Gap.

Gap-Acceptance Capacity Formula: Traditional M1.

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

^d Dominant lane on roundabout approach

Approach Lane Flows (veh/h)										
South: New Road										
Mov. From S To Exit:	L2	R2	Total	%HV	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Prob. SL %	Ov. Lane No.	
	W	E								
Lane 1	58	-	58	5.0	639	0.090	100	NA	NA	
Lane 2	-	38	38	5.0	550	0.069	100	NA	NA	
Approach	58	38	96	5.0		0.090				
East: South Liberty Parkway										

Mov. From E To Exit:	L2	T1	R2	Total	%HV	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Prob. SL Ov. %	Ov. Lane No.
Lane 1	71	468	-	539	5.0	1022	0.527	100	NA	NA
Lane 2	-	408	150	558	5.0	1058	0.527	100	NA	NA
Approach	71	876	150	1097	5.0		0.527			
North: New Road										
Mov. From N To Exit:	L2	R2	Total	%HV	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Prob. SL Ov. %	Ov. Lane No.	
Lane 1	55	-	55	5.0	621	0.089	100	NA	NA	
Lane 2	-	67	67	5.0	655	0.103	100	NA	NA	
Approach	55	67	123	5.0		0.103				
West: South Liberty Parkway										
Mov. From W To Exit:	L2	T1	R2	Total	%HV	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Prob. SL Ov. %	Ov. Lane No.
Lane 1	220	356	-	576	5.0	1171	0.492	100	NA	NA
Lane 2	-	477	108	584	5.0	1189	0.492	100	NA	NA
Approach	220	833	108	1160	5.0		0.492			
Total %HV Deg.Satn (v/c)										
All Vehicles	2475	5.0		0.527						

Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

Merge Analysis												
Exit Lane Number	Short Lane Length ft	Percent Opng in Lane %	Opposing Flow Rate veh/h	Critical Gap sec	Follow-up Headway sec	Lane Capacity veh/h	Deg. Satn v/c	Min. Delay sec	Merge Delay sec			
There are no Exit Short Lanes for Merge Analysis at this Site.												

Variable Demand Analysis				
	Initial Queued Demand veh	Residual Queued Demand veh	Time for Residual Demand to Clear sec	Duration of Oversatn sec
South: New Road				
Lane 1	0.0	0.0	0.0	0.0
Lane 2	0.0	0.0	0.0	0.0
East: South Liberty Parkway				
Lane 1	0.0	0.0	0.0	0.0
Lane 2	0.0	0.0	0.0	0.0
North: New Road				
Lane 1	0.0	0.0	0.0	0.0
Lane 2	0.0	0.0	0.0	0.0
West: South Liberty Parkway				
Lane 1	0.0	0.0	0.0	0.0
Lane 2	0.0	0.0	0.0	0.0

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Project: G:\16652\Analysis\Traffic\Synchro-Sidra\Scenario2-2.sip9

LANE SUMMARY

Site: 101vv [Railroad (Site Folder: High - PM Peak)]

Output produced by SIDRA INTERSECTION Version: 9.1.6.228

Network: N101 [PM High SLP (Network Folder: General)]

New Site
Site Category: (None)
Roundabout

Lane Use and Performance															
	Demand Flows		Arrival Flows		Cap.	Deg. Satn	Lane Util.	Aver. Delay	Level of Service	Aver. Back Of Queue		Lane Config	Lane Length	Cap. Adj.	Prob. Block.
	[Total veh/h]	[HV %]	[Total veh/h]	[HV %]						[Veh]	[Dist]				
	veh/h	%	veh/h	%	veh/h	v/c	%	sec			ft		ft	%	%
East: South Liberty Parkway															
Lane 1	1028	5.0	1009	5.0	1236	0.816	100	15.4	LOS C	5.9	153.5	Full	1150	0.0	0.0
Lane 2 ^d	1037	5.0	1017	5.0	1246	0.816	100	15.3	LOS C	5.9	153.9	Full	1150	0.0	0.0
Approach	2065	5.0	2026	5.0		0.816		15.4	LOS C	5.9	153.9				
North: Railroad															
Lane 1	91	5.0	91	5.0	267	0.342	100	22.0	LOS C	0.4	9.8	Full	1600	0.0	0.0
Lane 2 ^d	136	5.0	136	5.0	353	0.385	100	18.4	LOS C	0.5	12.1	Full	1600	0.0	0.0
Approach	227	5.0	227	5.0		0.385		19.8	LOS C	0.5	12.1				
West: South Liberty Parkway															
Lane 1	914	5.0	914	5.0	1187	0.770	100	14.8	LOS B	4.3	112.7	Full	1725	0.0	0.0
Lane 2 ^d	924	5.0	924	5.0	1201	0.770	100	14.6	LOS B	4.4	113.1	Full	1725	0.0	0.0
Approach	1838	5.0	1838	5.0		0.770		14.7	LOS B	4.4	113.1				
All Vehicles	4130	5.0	4091	5.0		0.816		15.3	LOS C	5.9	153.9				

Site Level of Service (LOS) Method: Delay & v/c (HCM 6). Site LOS Method is specified in the Network Data dialog (Override Site Data tab).

Roundabout LOS Method: Same as Sign Control.

Lane LOS values are based on average delay and v/c ratio (degree of saturation) per lane.

LOS F will result if v/c > 1 irrespective of lane delay value (does not apply for approaches and intersection).

Intersection and Approach LOS values are based on average delay for all lanes (v/c not used as specified in HCM 6).

Roundabout Capacity Model: SIDRA HCM.

Delay Model: HCM Delay Formula (Stoptline Delay: Geometric Delay is not included).

Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Gap.

Gap-Acceptance Capacity Formula: Traditional M1.

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

^d Dominant lane on roundabout approach

Approach Lane Flows (veh/h)										
East: South Liberty Parkway										
Mov.	T1	R2	Total	%HV	Cap.	Deg. Satn	Lane Util.	Prob. SL	Ov.	Ov. Lane
From E					veh/h	v/c	%	%	No.	
To Exit:	W	N								
Lane 1	1009	-	1009	5.0	1236	0.816	100	NA	NA	
Lane 2	980	37	1017	5.0	1246	0.816	100	NA	NA	
Approach	1988	37	2026	5.0		0.816				
North: Railroad										
Mov.	L2	R2	Total	%HV	Cap.	Deg. Satn	Lane Util.	Prob. SL	Ov.	Ov. Lane
From N					veh/h	v/c	%	%	No.	
To Exit:	E	W								
Lane 1	91	-	91	5.0	267	0.342	100	NA	NA	
Lane 2	-	136	136	5.0	353	0.385	100	NA	NA	

Approach	91	136	227	5.0	0.385				
West: South Liberty Parkway									
Mov. From W To Exit:	L2	T1	Total	%HV	Deg. Cap. veh/h	Deg. Satn v/c	Lane Util. %	Prob. SL Ov. %	Ov. Lane No.
	N	E							
Lane 1	58	856	914	5.0	1187	0.770	100	NA	NA
Lane 2	-	924	924	5.0	1201	0.770	100	NA	NA
Approach	58	1780	1838	5.0	0.770				
Total %HV Deg. Satn (v/c)									
All Vehicles	4091	5.0	0.816						

Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

Merge Analysis												
Exit Lane Number	Short Lane Length ft	Percent Opng in Lane % veh/h	Opposing Flow Rate pcu/h	Critical Gap sec	Follow-up Headway sec	Lane Flow Rate veh/h	Capacity veh/h	Deg. Satn v/c	Min. Delay sec	Merge Delay sec		
There are no Exit Short Lanes for Merge Analysis at this Site.												

Variable Demand Analysis				
	Initial Queued Demand veh	Residual Queued Demand veh	Time for Residual Demand to Clear sec	Duration of Oversatn sec
East: South Liberty Parkway				
Lane 1	0.0	0.0	0.0	0.0
Lane 2	0.0	0.0	0.0	0.0
North: Railroad				
Lane 1	0.0	0.0	0.0	0.0
Lane 2	0.0	0.0	0.0	0.0
West: South Liberty Parkway				
Lane 1	0.0	0.0	0.0	0.0
Lane 2	0.0	0.0	0.0	0.0

LANE SUMMARY

Site: 101 [West Arsenal (Site Folder: High - PM Peak)]

Output produced by SIDRA INTERSECTION Version: 9.1.6.228

Network: N101 [PM High SLP (Network Folder: General)]

New Site
 Site Category: (None)
 Roundabout

Lane Use and Performance															
	Demand Flows		Arrival Flows		Cap.	Deg. Satn	Lane Util.	Aver. Delay	Level of Service	Aver. Back Of Queue		Lane Config	Lane Length	Cap. Adj.	Prob. Block.
	[Total veh/h	HV %	[Total veh/h	HV %						[Veh	Dist]				
South: West Arsenal															
Lane 1	178	5.0	178	5.0	406	0.440	100	17.8	LOS C	0.6	15.8	Full	1600	0.0	0.0
Lane 2 ^d	249	5.0	249	5.0	565	0.440	100	13.5	LOS B	0.7	17.6	Full	1600	0.0	0.0
Lane 3	197	5.0	197	5.0	411	0.479	100	18.9	LOS C	0.7	17.8	Full	1600	0.0	0.0
Approach	624	5.0	624	5.0		0.479		16.4	LOS C	0.7	17.8				
East: South Liberty Parkway															
Lane 1	859	5.0	859	5.0	842	1.021	100	56.2	LOS F	14.7	381.1	Full	3050	0.0	0.0
Lane 2 ^d	872	5.0	872	5.0	855	1.021	100	55.9	LOS F	15.1	393.7	Full	3050	0.0	0.0
Approach	1732	5.0	1732	5.0		1.021		56.0	LOS F	15.1	393.7				
West: South Liberty Parkway															
Lane 1	930	5.0	930	5.0	1180	0.788	100	15.6	LOS C	4.8	125.4	Full	1150	0.0	0.0
Lane 2 ^d	941	5.0	941	5.0	1194	0.788	100	15.5	LOS C	4.8	125.9	Full	1150	0.0	0.0
Approach	1872	5.0	1872	5.0		0.788		15.6	LOS C	4.8	125.9				
All Vehicles	4227	5.0	4227	5.0		1.021		32.3	LOS D	15.1	393.7				

Site Level of Service (LOS) Method: Delay & v/c (HCM 6). Site LOS Method is specified in the Network Data dialog (Override Site Data tab).

Roundabout LOS Method: Same as Sign Control.

Lane LOS values are based on average delay and v/c ratio (degree of saturation) per lane.

LOS F will result if v/c > 1 irrespective of lane delay value (does not apply for approaches and intersection).

Intersection and Approach LOS values are based on average delay for all lanes (v/c not used as specified in HCM 6).

Roundabout Capacity Model: SIDRA HCM.

Delay Model: HCM Delay Formula (Stopline Delay: Geometric Delay is not included).

Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Gap.

Gap-Acceptance Capacity Formula: Traditional M1.

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

^d Dominant lane on roundabout approach

Approach Lane Flows (veh/h)										
South: West Arsenal										
Mov.	L2	R2	Total	%HV	Cap.	Deg. Satn	Lane Util.	Prob. SL Ov.	Ov. Lane No.	
From S To Exit:	W	E			veh/h	v/c	%	%		
Lane 1	178	-	178	5.0	406	0.440	100	NA	NA	
Lane 2	249	-	249	5.0	565	0.440	100	NA	NA	
Lane 3	-	197	197	5.0	411	0.479	100	NA	NA	
Approach	427	197	624	5.0		0.479				
East: South Liberty Parkway										
Mov.	L2	T1	Total	%HV	Cap.	Deg. Satn	Lane Util.	Prob. SL Ov.	Ov. Lane No.	
From E To Exit:	S	W			veh/h	v/c	%	%		

Lane 1	93	766	859	5.0	842	1.021	100	NA	NA
Lane 2	-	872	872	5.0	855	1.021	100	NA	NA
Approach	93	1638	1732	5.0		1.021			
West: South Liberty Parkway									
Mov. From W To Exit:	T1	R2	Total	%HV	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Prob. SL Ov. %	Ov. Lane No.
	E	S							
Lane 1	930	-	930	5.0	1180	0.788	100	NA	NA
Lane 2	711	230	941	5.0	1194	0.788	100	NA	NA
Approach	1641	230	1872	5.0		0.788			
Total %HV Deg. Satn (v/c)									
All Vehicles	4227	5.0		1.021					

Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

Merge Analysis												
	Exit Lane Number	Short Lane Length	Percent Opng in Lane	Opposing Flow Rate	Critical Gap	Follow-up Headway	Lane Capacity Flow Rate	Deg. Satn	Min. Delay	Merge Delay		
		ft	%	veh/h	pcu/h	sec	veh/h	v/c	sec	sec		
There are no Exit Short Lanes for Merge Analysis at this Site.												

Variable Demand Analysis				
	Initial Queued Demand	Residual Queued Demand	Time for Residual Demand to Clear	Duration of Oversatn
	veh	veh	sec	sec
South: West Arsenal				
Lane 1	0.0	0.0	0.0	0.0
Lane 2	0.0	0.0	0.0	0.0
Lane 3	0.0	0.0	0.0	0.0
East: South Liberty Parkway				
Lane 1	0.0	4.3	18.5	NA
Lane 2	0.0	4.4	18.5	NA
West: South Liberty Parkway				
Lane 1	0.0	0.0	0.0	0.0
Lane 2	0.0	0.0	0.0	0.0

LANE SUMMARY

Site: 101 [West Arsenal (Site Folder: High - AM Peak)]

Output produced by SIDRA INTERSECTION Version: 9.1.6.228

Network: N101 [AM High SLP (Network Folder: General)]

New Site
Site Category: (None)
Roundabout

Lane Use and Performance															
	Demand Flows		Arrival Flows		Cap.	Deg. Satn	Lane Util.	Aver. Delay	Level of Service	Aver. Back Of Queue		Lane Config	Lane Length	Cap. Adj.	Prob. Block.
	[Total veh/h	HV %	[Total veh/h	HV %						[Veh	Dist]				
South: West Arsenal															
Lane 1	62	5.0	62	5.0	699	0.088	100	6.1	LOS A	0.1	2.4	Full	1600	0.0	0.0
Lane 2 ^d	74	5.0	74	5.0	841	0.088	100	5.2	LOS A	0.1	2.5	Full	1600	0.0	0.0
Lane 3	50	5.0	50	5.0	670	0.075	100	6.2	LOS A	0.1	2.0	Full	1600	0.0	0.0
Approach	186	5.0	186	5.0		0.088		5.8	LOS A	0.1	2.5				
East: South Liberty Parkway															
Lane 1	625	5.0	625	5.0	1049	0.596	100	10.9	LOS B	1.6	40.3	Full	3050	0.0	0.0
Lane 2 ^d	635	5.0	635	5.0	1066	0.596	100	11.0	LOS B	1.6	41.0	Full	3050	0.0	0.0
Approach	1260	5.0	1260	5.0		0.596		10.9	LOS B	1.6	41.0				
West: South Liberty Parkway															
Lane 1	671	5.0	671	5.0	1155	0.581	100	9.9	LOS A	1.8	46.6	Full	1150	0.0	0.0
Lane 2 ^d	682	5.0	682	5.0	1173	0.581	100	9.8	LOS A	1.8	46.7	Full	1150	0.0	0.0
Approach	1353	5.0	1353	5.0		0.581		9.9	LOS A	1.8	46.7				
All Vehicles	2799	5.0	2799	5.0		0.596		10.1	LOS B	1.8	46.7				

Site Level of Service (LOS) Method: Delay & v/c (HCM 6). Site LOS Method is specified in the Network Data dialog (Override Site Data tab).

Roundabout LOS Method: Same as Sign Control.

Lane LOS values are based on average delay and v/c ratio (degree of saturation) per lane.

LOS F will result if v/c > 1 irrespective of lane delay value (does not apply for approaches and intersection).

Intersection and Approach LOS values are based on average delay for all lanes (v/c not used as specified in HCM 6).

Roundabout Capacity Model: SIDRA HCM.

Delay Model: HCM Delay Formula (Stoptline Delay: Geometric Delay is not included).

Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Gap.

Gap-Acceptance Capacity Formula: Traditional M1.

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

^d Dominant lane on roundabout approach

Approach Lane Flows (veh/h)										
South: West Arsenal										
Mov.	L2	R2	Total	%HV	Cap.	Deg. Satn	Lane Util.	Prob. SL Ov.	Ov. Lane No.	
From S To Exit:	W	E			veh/h	v/c	%	%		
Lane 1	62	-	62	5.0	699	0.088	100	NA	NA	
Lane 2	74	-	74	5.0	841	0.088	100	NA	NA	
Lane 3	-	50	50	5.0	670	0.075	100	NA	NA	
Approach	136	50	186	5.0		0.088				
East: South Liberty Parkway										
Mov.	L2	T1	Total	%HV	Cap.	Deg. Satn	Lane Util.	Prob. SL Ov.	Ov. Lane No.	
From E To Exit:	S	W			veh/h	v/c	%	%		

Lane 1	133	492	625	5.0	1049	0.596	100	NA	NA
Lane 2	-	635	635	5.0	1066	0.596	100	NA	NA
Approach	133	1127	1260	5.0	0.596				
West: South Liberty Parkway									
Mov. From W To Exit:	T1	R2	Total	%HV	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Prob. SL Ov. %	Ov. Lane No.
	E	S							
Lane 1	671	-	671	5.0	1155	0.581	100	NA	NA
Lane 2	399	283	682	5.0	1173	0.581	100	NA	NA
Approach	1071	283	1353	5.0	0.581				
Total %HV Deg. Satn (v/c)									
All Vehicles	2799	5.0	0.596						

Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

Merge Analysis												
	Exit Lane Number	Short Lane Length	Percent Opng in Lane	Opposing Flow Rate	Critical Gap	Follow-up Headway	Lane Capacity Flow Rate	Deg. Satn	Min. Delay	Merge Delay		
		ft	%	veh/h	pcu/h	sec	veh/h	v/c	sec	sec		
There are no Exit Short Lanes for Merge Analysis at this Site.												

Variable Demand Analysis				
	Initial Queued Demand	Residual Queued Demand	Time for Residual Demand to Clear	Duration of Oversatn
	veh	veh	sec	sec
South: West Arsenal				
Lane 1	0.0	0.0	0.0	0.0
Lane 2	0.0	0.0	0.0	0.0
Lane 3	0.0	0.0	0.0	0.0
East: South Liberty Parkway				
Lane 1	0.0	0.0	0.0	0.0
Lane 2	0.0	0.0	0.0	0.0
West: South Liberty Parkway				
Lane 1	0.0	0.0	0.0	0.0
Lane 2	0.0	0.0	0.0	0.0

LANE SUMMARY

Site: 101 [Birmingham (Site Folder: High - PM Peak)]

Output produced by SIDRA INTERSECTION Version: 9.1.6.228

Network: N101 [PM High SLP (Network Folder: General)]

New Site
Site Category: (None)
Roundabout

Lane Use and Performance															
	Demand Flows		Arrival Flows		Cap.	Deg. Satn	Lane Util.	Aver. Delay	Level of Service	Aver. Back Of Queue		Lane Config	Lane Length	Cap. Adj.	Prob. Block.
	[Total veh/h]	[HV %]	[Total veh/h]	[HV %]						[Veh]	[Dist]				
	veh/h	%	veh/h	%	veh/h	v/c	%	sec			ft	ft	%	%	
South: Birmingham															
Lane 1 ^d	143	5.0	143	5.0	299	0.480	100	25.0	LOS C	0.6	16.5	Full	1600	0.0	0.0
Lane 2	33	5.0	33	5.0	126	0.258	100	39.3	LOS E	0.3	6.7	Full	1600	0.0	0.0
Approach	176	5.0	176	5.0		0.480		27.6	LOS D	0.6	16.5				
East: South Liberty Parkway															
Lane 1	690	5.0	690	5.0	761	0.907	100	35.8	LOS E	7.0	183.1	Full	2180	0.0	0.0
Lane 2 ^d	750	5.0	750	5.0	827	0.907	100	33.9	LOS D	7.5	193.9	Full	2180	0.0	0.0
Approach	1440	5.0	1440	5.0		0.907		34.8	LOS D	7.5	193.9				
North: Birmingham															
Lane 1	159	5.0	159	5.0	266	0.597	100	34.5	LOS D	0.9	23.2	Full	1600	0.0	0.0
Lane 2 ^d	384	5.0	384	5.0	400	0.960	100	66.7	LOS F	3.6	92.8	Full	1600	0.0	0.0
Approach	542	5.0	542	5.0		0.960		57.2	LOS F	3.6	92.8				
West: South Liberty Parkway															
Lane 1	909	5.0	909	5.0	1081	0.841	100	20.9	LOS C	9.8	255.4	Full	3050	0.0	0.0
Lane 2 ^d	929	5.0	929	5.0	1104	0.841	100	20.6	LOS C	9.9	256.9	Full	3050	0.0	0.0
Approach	1838	5.0	1838	5.0		0.841		20.7	LOS C	9.9	256.9				
All Vehicles	3997	5.0	3997	5.0		0.960		31.1	LOS D	9.9	256.9				

Site Level of Service (LOS) Method: Delay & v/c (HCM 6). Site LOS Method is specified in the Network Data dialog (Override Site Data tab).

Roundabout LOS Method: Same as Sign Control.

Lane LOS values are based on average delay and v/c ratio (degree of saturation) per lane.

LOS F will result if v/c > 1 irrespective of lane delay value (does not apply for approaches and intersection).

Intersection and Approach LOS values are based on average delay for all lanes (v/c not used as specified in HCM 6).

Roundabout Capacity Model: SIDRA HCM.

Delay Model: HCM Delay Formula (Stopline Delay: Geometric Delay is not included).

Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Gap.

Gap-Acceptance Capacity Formula: Traditional M1.

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

^d Dominant lane on roundabout approach

Approach Lane Flows (veh/h)											
South: Birmingham											
Mov. From S To Exit:	L2	T1	R2	Total	%HV	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Prob. SL %	Ov. Lane No.	
	W	N	E								
Lane 1	45	99	-	143	5.0	299	0.480	100	NA	NA	
Lane 2	-	-	33	33	5.0	126	0.258	100	NA	NA	
Approach	45	99	33	176	5.0		0.480				
East: South Liberty Parkway											

Mov. From E To Exit:	L2	T1	R2	Total	%HV	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Prob. SL Ov. %	Ov. Lane No.
Lane 1	28	662	-	690	5.0	761	0.907	100	NA	NA
Lane 2	-	641	109	750	5.0	827	0.907	100	NA	NA
Approach	28	1303	109	1440	5.0		0.907			
North: Birmingham										
Mov. From N To Exit:	L2	T1	R2	Total	%HV	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Prob. SL Ov. %	Ov. Lane No.
Lane 1	72	87	-	159	5.0	266	0.597	100	NA	NA
Lane 2	-	-	384	384	5.0	400	0.960	100	NA	NA
Approach	72	87	384	542	5.0		0.960			
West: South Liberty Parkway										
Mov. From W To Exit:	L2	T1	R2	Total	%HV	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Prob. SL Ov. %	Ov. Lane No.
Lane 1	401	508	-	909	5.0	1081	0.841	100	NA	NA
Lane 2	-	881	48	929	5.0	1104	0.841	100	NA	NA
Approach	401	1389	48	1838	5.0		0.841			
Total %HV Deg. Satn (v/c)										
All Vehicles	3997	5.0		0.960						

Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

Merge Analysis												
Exit Lane Number	Short Lane Length ft	Percent Opng in Lane %	Opposing Flow Rate veh/h	Critical Gap sec	Follow-up Headway sec	Lane Capacity veh/h	Deg. Satn v/c	Min. Delay sec	Merge Delay sec			
There are no Exit Short Lanes for Merge Analysis at this Site.												

Variable Demand Analysis				
	Initial Queued Demand veh	Residual Queued Demand veh	Time for Residual Demand to Clear sec	Duration of Oversatn sec
South: Birmingham				
Lane 1	0.0	0.0	0.0	0.0
Lane 2	0.0	0.0	0.0	0.0
East: South Liberty Parkway				
Lane 1	0.0	0.0	0.0	0.0
Lane 2	0.0	0.0	0.0	0.0
North: Birmingham				
Lane 1	0.0	0.0	0.0	0.0
Lane 2	0.0	0.0	0.0	0.0
West: South Liberty Parkway				
Lane 1	0.0	0.0	0.0	0.0
Lane 2	0.0	0.0	0.0	0.0

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Project: G:\16652\Analysis\Traffic\Synchro-Sidra\Scenario2-2.sip9

LANE SUMMARY

Site: 101 [Middle Roundabout (Site Folder: High - PM Peak)]

Output produced by SIDRA INTERSECTION Version: 9.1.6.228

Network: N101 [PM High SLP (Network Folder: General)]

New Site
 Site Category: (None)
 Roundabout

Lane Use and Performance															
	Demand Flows		Arrival Flows		Cap.	Deg. Satn	Lane Util.	Aver. Delay	Level of Service	Aver. Back Of Queue		Lane Config	Lane Length	Cap. Adj.	Prob. Block.
	[Total veh/h]	[HV %]	[Total veh/h]	[HV %]						[Veh]	[Dist]				
	veh/h	%	veh/h	%	veh/h	v/c	%	sec			ft	ft	%	%	
East: South Liberty Parkway															
Lane 1	732	5.0	732	5.0	1288	0.569	100	7.8	LOS A	1.9	50.7	Full	1400	0.0	0.0
Lane 2 ^d	736	5.0	736	5.0	1295	0.569	100	7.8	LOS A	1.9	50.7	Full	1400	0.0	0.0
Approach	1468	5.0	1468	5.0		0.569		7.8	LOS A	1.9	50.7				
North: New Road															
Lane 1 ^d	38	5.0	38	5.0	444	0.086	100	9.3	LOS A	0.1	2.0	Full	1600	0.0	0.0
Approach	38	5.0	38	5.0		0.086		9.3	LOS A	0.1	2.0				
West: South Liberty Parkway															
Lane 1	745	5.0	745	5.0	1281	0.581	100	8.1	LOS A	2.3	60.1	Full	2180	0.0	0.0
Lane 2 ^d	749	5.0	749	5.0	1288	0.581	100	8.1	LOS A	2.3	60.2	Full	2180	0.0	0.0
Approach	1493	5.0	1493	5.0		0.581		8.1	LOS A	2.3	60.2				
All Vehicles	3000	5.0	3000	5.0		0.581		8.0	LOS A	2.3	60.2				

Site Level of Service (LOS) Method: Delay & v/c (HCM 6). Site LOS Method is specified in the Network Data dialog (Override Site Data tab).

Roundabout LOS Method: Same as Sign Control.

Lane LOS values are based on average delay and v/c ratio (degree of saturation) per lane.

LOS F will result if v/c > 1 irrespective of lane delay value (does not apply for approaches and intersection).

Intersection and Approach LOS values are based on average delay for all lanes (v/c not used as specified in HCM 6).

Roundabout Capacity Model: SIDRA HCM.

Delay Model: HCM Delay Formula (Stopline Delay: Geometric Delay is not included).

Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Gap.

Gap-Acceptance Capacity Formula: Traditional M1.

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

^d Dominant lane on roundabout approach

Approach Lane Flows (veh/h)										
East: South Liberty Parkway										
Mov.	T1	R2	Total	%HV	Cap.	Deg. Satn	Lane Util.	Prob. SL	Ov. Lane	
From E To Exit:	W	N			veh/h	v/c	%	%	No.	
Lane 1	732	-	732	5.0	1288	0.569	100	NA	NA	
Lane 2	695	41	736	5.0	1295	0.569	100	NA	NA	
Approach	1427	41	1468	5.0		0.569				
North: New Road										
Mov.	L2	R2	Total	%HV	Cap.	Deg. Satn	Lane Util.	Prob. SL	Ov. Lane	
From N To Exit:	E	W			veh/h	v/c	%	%	No.	
Lane 1	25	13	38	5.0	444	0.086	100	NA	NA	
Approach	25	13	38	5.0		0.086				

West: South Liberty Parkway										
Mov.	L2	T1	Total	%HV	Cap.	Deg.	Lane	Prob.	Ov.	Ov.
From W					veh/h	Satn	Util.	SL	%	Lane
To Exit:	N	E				v/c	%	%		No.
Lane 1	23	722	745	5.0	1281	0.581	100	NA	NA	NA
Lane 2	-	749	749	5.0	1288	0.581	100	NA	NA	NA
Approach	23	1471	1493	5.0		0.581				
Total %HV Deg.Satn (v/c)										
All Vehicles	3000	5.0		0.581						

Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

Merge Analysis												
	Exit Lane Number	Short Lane Length ft	Percent Opng in Lane %	Opposing Flow Rate veh/h	Critical Gap sec	Follow-up Headway sec	Lane Capacity veh/h	Deg. Satn v/c	Min. Delay sec	Merge Delay sec		
There are no Exit Short Lanes for Merge Analysis at this Site.												

Variable Demand Analysis				
	Initial Queued Demand veh	Residual Queued Demand veh	Time for Residual Demand to Clear sec	Duration of Oversatn sec
East: South Liberty Parkway				
Lane 1	0.0	0.0	0.0	0.0
Lane 2	0.0	0.0	0.0	0.0
North: New Road				
Lane 1	0.0	0.0	0.0	0.0
West: South Liberty Parkway				
Lane 1	0.0	0.0	0.0	0.0
Lane 2	0.0	0.0	0.0	0.0

LANE SUMMARY

Site: 101 [Arsenal (Site Folder: High - PM Peak)]

Output produced by SIDRA INTERSECTION Version: 9.1.6.228

Network: N101 [PM High SLP (Network Folder: General)]

New Site
Site Category: (None)
Roundabout

Lane Use and Performance															
	Demand Flows		Arrival Flows		Cap.	Deg. Satn	Lane Util.	Aver. Delay	Level of Service	Aver. Back Of Queue		Lane Config	Lane Length	Cap. Adj.	Prob. Block.
	[Total veh/h]	[HV %]	[Total veh/h]	[HV %]						[Veh]	[Dist]				
	veh/h	%	veh/h	%	veh/h	v/c	%	sec			ft		ft	%	%
South: Arsenal															
Lane 1 ^d	246	5.0	246	5.0	374	0.657	100	29.3	LOS D	1.1	28.6	Full	1600	0.0	0.0
Approach	246	5.0	246	5.0		0.657		29.3	LOS D	1.1	28.6				
East: South Liberty Parkway															
Lane 1	759	5.0	759	5.0	1234	0.615	100	9.7	LOS A	2.6	67.7	Full	1800	0.0	0.0
Lane 2 ^d	766	5.0	766	5.0	1245	0.615	100	9.6	LOS A	2.6	67.9	Full	1800	0.0	0.0
Approach	1525	5.0	1525	5.0		0.615		9.6	LOS A	2.6	67.9				
West: South Liberty Parkway															
Lane 1	743	5.0	743	5.0	1179	0.630	100	10.8	LOS B	2.2	56.9	Full	1400	0.0	0.0
Lane 2 ^d	753	5.0	753	5.0	1195	0.630	100	10.7	LOS B	2.2	57.0	Full	1400	0.0	0.0
Approach	1496	5.0	1496	5.0		0.630		10.7	LOS B	2.2	57.0				
All Vehicles	3266	5.0	3266	5.0		0.657		11.6	LOS B	2.6	67.9				

Site Level of Service (LOS) Method: Delay & v/c (HCM 6). Site LOS Method is specified in the Network Data dialog (Override Site Data tab).

Roundabout LOS Method: Same as Sign Control.

Lane LOS values are based on average delay and v/c ratio (degree of saturation) per lane.

LOS F will result if v/c > 1 irrespective of lane delay value (does not apply for approaches and intersection).

Intersection and Approach LOS values are based on average delay for all lanes (v/c not used as specified in HCM 6).

Roundabout Capacity Model: SIDRA HCM.

Delay Model: HCM Delay Formula (Stopline Delay: Geometric Delay is not included).

Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Gap.

Gap-Acceptance Capacity Formula: Traditional M1.

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

^d Dominant lane on roundabout approach

Approach Lane Flows (veh/h)										
South: Arsenal										
Mov.	L2	R2	Total	%HV	Cap.	Deg. Satn	Lane Util.	Prob. SL	Ov.	Ov. Lane No.
From S To Exit:	W	E			veh/h	v/c	%	%		
Lane 1	55	190	246	5.0	374	0.657	100	NA	NA	
Approach	55	190	246	5.0		0.657				
East: South Liberty Parkway										
Mov.	L2	T1	Total	%HV	Cap.	Deg. Satn	Lane Util.	Prob. SL	Ov.	Ov. Lane No.
From E To Exit:	S	W			veh/h	v/c	%	%		
Lane 1	112	647	759	5.0	1234	0.615	100	NA	NA	
Lane 2	-	766	766	5.0	1245	0.615	100	NA	NA	
Approach	112	1413	1525	5.0		0.615				

West: South Liberty Parkway										
Mov.	T1	R2	Total	%HV	Cap.	Deg.	Lane	Prob.	Ov.	Ov.
From W To Exit:	E	S			veh/h	Satn v/c	Util. %	SL %	%	Lane No.
Lane 1	743	-	743	5.0	1179	0.630	100	NA	NA	NA
Lane 2	713	40	753	5.0	1195	0.630	100	NA	NA	NA
Approach	1455	40	1496	5.0		0.630				
Total %HV Deg.Satn (v/c)										
All Vehicles	3266	5.0		0.657						

Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

Merge Analysis												
	Exit Lane Number	Short Lane Length ft	Percent Opng in Lane % veh/h	Opposing Flow Rate pcu/h	Critical Gap sec	Follow-up Headway sec	Lane Flow Rate veh/h	Capacity veh/h	Deg. Satn v/c	Min. Delay sec	Merge Delay sec	
There are no Exit Short Lanes for Merge Analysis at this Site.												

Variable Demand Analysis				
	Initial Queued Demand veh	Residual Queued Demand veh	Time for Residual Demand to Clear sec	Duration of Oversatn sec
South: Arsenal				
Lane 1	0.0	0.0	0.0	0.0
East: South Liberty Parkway				
Lane 1	0.0	0.0	0.0	0.0
Lane 2	0.0	0.0	0.0	0.0
West: South Liberty Parkway				
Lane 1	0.0	0.0	0.0	0.0
Lane 2	0.0	0.0	0.0	0.0

LANE SUMMARY

Site: 101 [East Roundabout (Site Folder: High - PM Peak)]

Output produced by SIDRA INTERSECTION Version: 9.1.6.228

Network: N101 [PM High SLP (Network Folder: General)]

New Site
Site Category: (None)
Roundabout

Lane Use and Performance															
	Demand Flows		Arrival Flows		Cap.	Deg. Satn	Lane Util.	Aver. Delay	Level of Service	Aver. Back Of Queue		Lane Config	Lane Length	Cap. Adj.	Prob. Block.
	[Total veh/h	HV %	[Total veh/h	HV %						[Veh	Dist]				
South: New Road															
Lane 1 ^d	162	5.0	162	5.0	352	0.460	100	20.9	LOS C	0.6	16.0	Full	1600	0.0	0.0
Lane 2	108	5.0	108	5.0	281	0.383	100	22.4	LOS C	0.5	12.1	Full	1600	0.0	0.0
Approach	270	5.0	270	5.0		0.460		21.5	LOS C	0.6	16.0				
East: South Liberty Parkway															
Lane 1	591	5.0	591	5.0	990	0.597	100	11.7	LOS B	2.3	60.3	Full	1900	0.0	0.0
Lane 2 ^d	614	5.0	614	5.0	1029	0.597	100	11.3	LOS B	2.3	60.4	Full	1900	0.0	0.0
Approach	1204	5.0	1204	5.0		0.597		11.5	LOS B	2.3	60.4				
North: New Road															
Lane 1	223	5.0	223	5.0	476	0.468	100	16.3	LOS C	0.7	17.9	Full	1600	0.0	0.0
Lane 2 ^d	325	5.0	325	5.0	550	0.591	100	18.4	LOS C	1.1	27.5	Full	1600	0.0	0.0
Approach	548	5.0	548	5.0		0.591		17.6	LOS C	1.1	27.5				
West: South Liberty Parkway															
Lane 1	808	5.0	808	5.0	997	0.811	100	20.3	LOS C	7.1	184.5	Full	1800	0.0	0.0
Lane 2 ^d	838	5.0	838	5.0	1033	0.811	100	19.7	LOS C	7.2	187.6	Full	1800	0.0	0.0
Approach	1646	5.0	1646	5.0		0.811		20.0	LOS C	7.2	187.6				
All Vehicles	3667	5.0	3667	5.0		0.811		17.0	LOS C	7.2	187.6				

Site Level of Service (LOS) Method: Delay & v/c (HCM 6). Site LOS Method is specified in the Network Data dialog (Override Site Data tab).

Roundabout LOS Method: Same as Sign Control.

Lane LOS values are based on average delay and v/c ratio (degree of saturation) per lane.

LOS F will result if v/c > 1 irrespective of lane delay value (does not apply for approaches and intersection).

Intersection and Approach LOS values are based on average delay for all lanes (v/c not used as specified in HCM 6).

Roundabout Capacity Model: SIDRA HCM.

Delay Model: HCM Delay Formula (Stopline Delay: Geometric Delay is not included).

Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Gap.

Gap-Acceptance Capacity Formula: Traditional M1.

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

^d Dominant lane on roundabout approach

Approach Lane Flows (veh/h)										
South: New Road										
Mov. From S To Exit:	L2	R2	Total	%HV	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Prob. SL %	Ov. Lane No.	
	W	E								
Lane 1	162	-	162	5.0	352	0.460	100	NA	NA	
Lane 2	-	108	108	5.0	281	0.383	100	NA	NA	
Approach	162	108	270	5.0		0.460				
East: South Liberty Parkway										

Mov. From E To Exit:	L2	T1	R2	Total	%HV	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Prob. SL Ov. %	Ov. Lane No.
Lane 1	62	529	-	591	5.0	990	0.597	100	NA	NA
Lane 2	-	509	104	614	5.0	1029	0.597	100	NA	NA
Approach	62	1038	104	1204	5.0		0.597			
North: New Road										
Mov. From N To Exit:	L2	R2	Total	%HV	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Prob. SL Ov. %	Ov. Lane No.	
Lane 1	223	-	223	5.0	476	0.468	100	NA	NA	
Lane 2	-	325	325	5.0	550	0.591	100	NA	NA	
Approach	223	325	548	5.0		0.591				
West: South Liberty Parkway										
Mov. From W To Exit:	L2	T1	R2	Total	%HV	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Prob. SL Ov. %	Ov. Lane No.
Lane 1	140	668	-	808	5.0	997	0.811	100	NA	NA
Lane 2	-	746	91	838	5.0	1033	0.811	100	NA	NA
Approach	140	1414	91	1646	5.0		0.811			
Total %HV Deg.Satn (v/c)										
All Vehicles	3667	5.0		0.811						

Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

Merge Analysis												
Exit Lane Number	Short Lane Length ft	Percent Opng in Lane % veh/h	Opposing Flow Rate pcu/h	Critical Gap sec	Follow-up Headway sec	Lane Capacity Flow Rate veh/h	Deg. Satn v/c	Min. Delay sec	Merge Delay sec			
There are no Exit Short Lanes for Merge Analysis at this Site.												

Variable Demand Analysis				
	Initial Queued Demand veh	Residual Queued Demand veh	Time for Residual Demand to Clear sec	Duration of Oversatn sec
South: New Road				
Lane 1	0.0	0.0	0.0	0.0
Lane 2	0.0	0.0	0.0	0.0
East: South Liberty Parkway				
Lane 1	0.0	0.0	0.0	0.0
Lane 2	0.0	0.0	0.0	0.0
North: New Road				
Lane 1	0.0	0.0	0.0	0.0
Lane 2	0.0	0.0	0.0	0.0
West: South Liberty Parkway				
Lane 1	0.0	0.0	0.0	0.0
Lane 2	0.0	0.0	0.0	0.0

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APPENDIX D.3
SCENARIO 3 OPERATIONAL ANALYSES

LANE SUMMARY

Site: 101vv [Railroad (Site Folder: High - AM Peak)]

Output produced by SIDRA INTERSECTION Version: 9.1.6.228

Network: N101 [AM High SLP (Network Folder: General)]

New Site
 Site Category: (None)
 Roundabout

Lane Use and Performance															
	Demand Flows		Arrival Flows		Cap.	Deg. Satn	Lane Util.	Aver. Delay	Level of Service	Aver. Back Of Queue		Lane Config	Lane Length	Cap. Adj.	Prob. Block.
	[Total veh/h]	[HV %]	[Total veh/h]	[HV %]						[Veh]	[Dist]				
East: South Liberty Parkway															
Lane 1	686	5.0	686	5.0	1215	0.565	100	9.2	LOS A	1.6	41.1	Full	1150	0.0	0.0
Lane 2 ^d	694	5.0	694	5.0	1229	0.565	100	9.1	LOS A	1.6	41.1	Full	1150	0.0	0.0
Approach	1379	5.0	1379	5.0		0.565		9.1	LOS A	1.6	41.1				
North: Railroad															
Lane 1 ^d	46	5.0	46	5.0	434	0.105	100	9.8	LOS A	0.1	2.7	Full	1600	0.0	0.0
Approach	46	5.0	46	5.0		0.105		9.8	LOS A	0.1	2.7				
West: South Liberty Parkway															
Lane 1	780	5.0	780	5.0	1290	0.604	100	8.0	LOS A	2.6	67.2	Full	1725	0.0	0.0
Lane 2 ^d	784	5.0	784	5.0	1296	0.604	100	8.0	LOS A	2.6	67.3	Full	1725	0.0	0.0
Approach	1563	5.0	1563	5.0		0.604		8.0	LOS A	2.6	67.3				
All Vehicles	2988	5.0	2988	5.0		0.604		8.5	LOS A	2.6	67.3				

Site Level of Service (LOS) Method: Delay & v/c (HCM 6). Site LOS Method is specified in the Network Data dialog (Override Site Data tab).

Roundabout LOS Method: Same as Sign Control.

Lane LOS values are based on average delay and v/c ratio (degree of saturation) per lane.

LOS F will result if v/c > 1 irrespective of lane delay value (does not apply for approaches and intersection).

Intersection and Approach LOS values are based on average delay for all lanes (v/c not used as specified in HCM 6).

Roundabout Capacity Model: SIDRA HCM.

Delay Model: HCM Delay Formula (Stopline Delay: Geometric Delay is not included).

Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Gap.

Gap-Acceptance Capacity Formula: Traditional M1.

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

^d Dominant lane on roundabout approach

Approach Lane Flows (veh/h)										
East: South Liberty Parkway										
Mov.	T1	R2	Total	%HV	Cap.	Deg. Satn	Lane Util.	Prob. SL	Ov.	Ov. Lane
From E					veh/h	v/c	%	%	No.	
To Exit:	W	N								
Lane 1	686	-	686	5.0	1215	0.565	100	NA	NA	
Lane 2	634	60	694	5.0	1229	0.565	100	NA	NA	
Approach	1320	60	1379	5.0		0.565				
North: Railroad										
Mov.	L2	R2	Total	%HV	Cap.	Deg. Satn	Lane Util.	Prob. SL	Ov.	Ov. Lane
From N					veh/h	v/c	%	%	No.	
To Exit:	E	W								
Lane 1	18	27	46	5.0	434	0.105	100	NA	NA	
Approach	18	27	46	5.0		0.105				

West: South Liberty Parkway										
Mov.	L2	T1	Total	%HV	Cap.	Deg.	Lane	Prob.	Ov.	Ov.
From W					veh/h	Satn	Util.	SL	%	Lane
To Exit:	N	E				v/c	%	%		No.
Lane 1	93	686	780	5.0	1290	0.604	100	NA	NA	NA
Lane 2	-	784	784	5.0	1296	0.604	100	NA	NA	NA
Approach	93	1470	1563	5.0		0.604				
Total		%HV	Deg.	Satn	(v/c)					
All Vehicles	2988	5.0		0.604						

Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

Merge Analysis												
	Exit Lane Number	Short Lane Length ft	Percent Opng in Lane %	Opposing Flow Rate veh/h	Critical Gap sec	Follow-up Headway sec	Lane Capacity Rate veh/h	Deg. Satn v/c	Min. Delay sec	Merge Delay sec		
There are no Exit Short Lanes for Merge Analysis at this Site.												

Variable Demand Analysis				
	Initial Queued Demand veh	Residual Queued Demand veh	Time for Residual Demand to Clear sec	Duration of Oversatn sec
East: South Liberty Parkway				
Lane 1	0.0	0.0	0.0	0.0
Lane 2	0.0	0.0	0.0	0.0
North: Railroad				
Lane 1	0.0	0.0	0.0	0.0
West: South Liberty Parkway				
Lane 1	0.0	0.0	0.0	0.0
Lane 2	0.0	0.0	0.0	0.0

LANE SUMMARY

Site: 101 [West Arsenal (Site Folder: High - AM Peak)]

Output produced by SIDRA INTERSECTION Version: 9.1.6.228

Network: N101 [AM High SLP (Network Folder: General)]

New Site
 Site Category: (None)
 Roundabout

Lane Use and Performance															
	Demand Flows		Arrival Flows		Cap.	Deg. Satn	Lane Util.	Aver. Delay	Level of Service	Aver. Back Of Queue		Lane Config	Lane Length	Cap. Adj.	Prob. Block.
	[Total veh/h	HV %	[Total veh/h	HV %						[Veh	Dist]				
South: West Arsenal															
Lane 1	52	5.0	52	5.0	623	0.083	100	6.8	LOS A	0.1	2.3	Full	1600	0.0	0.0
Lane 2 ^d	64	5.0	64	5.0	775	0.083	100	5.5	LOS A	0.1	2.4	Full	1600	0.0	0.0
Lane 3	53	5.0	53	5.0	626	0.085	100	6.8	LOS A	0.1	2.4	Full	1600	0.0	0.0
Approach	170	5.0	170	5.0		0.085		6.3	LOS A	0.1	2.4				
East: South Liberty Parkway															
Lane 1 ^d	704	5.0	704	5.0	1080	0.652	100	12.2	LOS B	2.0	52.6	Full	1300	0.0	0.0
Lane 2	693	5.0	693	5.0	1062	0.652	100	12.1	LOS B	2.0	51.7	Full	1300	0.0	0.0
Approach	1397	5.0	1397	5.0		0.652		12.1	LOS B	2.0	52.6				
West: South Liberty Parkway															
Lane 1	738	5.0	738	5.0	1152	0.641	100	11.3	LOS B	2.2	57.7	Full	1150	0.0	0.0
Lane 2 ^d	750	5.0	750	5.0	1171	0.641	100	11.2	LOS B	2.2	57.9	Full	1150	0.0	0.0
Approach	1488	5.0	1488	5.0		0.641		11.2	LOS B	2.2	57.9				
All Vehicles	3054	5.0	3054	5.0		0.652		11.4	LOS B	2.2	57.9				

Site Level of Service (LOS) Method: Delay & v/c (HCM 6). Site LOS Method is specified in the Network Data dialog (Override Site Data tab).

Roundabout LOS Method: Same as Sign Control.

Lane LOS values are based on average delay and v/c ratio (degree of saturation) per lane.

LOS F will result if v/c > 1 irrespective of lane delay value (does not apply for approaches and intersection).

Intersection and Approach LOS values are based on average delay for all lanes (v/c not used as specified in HCM 6).

Roundabout Capacity Model: SIDRA HCM.

Delay Model: HCM Delay Formula (Stopline Delay: Geometric Delay is not included).

Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Gap.

Gap-Acceptance Capacity Formula: Traditional M1.

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

^d Dominant lane on roundabout approach

Approach Lane Flows (veh/h)										
South: West Arsenal										
Mov.	L2	R2	Total	%HV	Cap.	Deg. Satn	Lane Util.	Prob. SL Ov.	Ov. Lane No.	
From S To Exit:	W	E			veh/h	v/c	%	%		
Lane 1	52	-	52	5.0	623	0.083	100	NA	NA	
Lane 2	64	-	64	5.0	775	0.083	100	NA	NA	
Lane 3	-	53	53	5.0	626	0.085	100	NA	NA	
Approach	116	53	170	5.0		0.085				
East: South Liberty Parkway										
Mov.	L2	T1	Total	%HV	Cap.	Deg. Satn	Lane Util.	Prob. SL Ov.	Ov. Lane No.	
From E To Exit:	S	W			veh/h	v/c	%	%		

Lane 1	134	570	704	5.0	1080	0.652	100	NA	NA
Lane 2	-	693	693	5.0	1062	0.652	100	NA	NA
Approach	134	1263	1397	5.0		0.652			
West: South Liberty Parkway									
Mov. From W To Exit:	T1	R2	Total	%HV	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Prob. SL %	Ov. Lane No.
	E	S							
Lane 1	738	-	738	5.0	1152	0.641	100	NA	NA
Lane 2	474	276	750	5.0	1171	0.641	100	NA	NA
Approach	1212	276	1488	5.0		0.641			
Total %HV Deg. Satn (v/c)									
All Vehicles	3054	5.0		0.652					

Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

Merge Analysis												
	Exit Lane Number	Short Lane Length	Percent Opng in Lane	Flow Rate	Opposing Flow Rate	Critical Gap	Follow-up Headway	Lane Capacity	Deg. Satn	Min. Delay	Merge Delay	
		ft	%	veh/h	pcu/h	sec	sec	veh/h	v/c	sec	sec	
There are no Exit Short Lanes for Merge Analysis at this Site.												

Variable Demand Analysis				
	Initial Queued Demand	Residual Queued Demand	Time for Residual Demand to Clear	Duration of Oversatn
	veh	veh	sec	sec
South: West Arsenal				
Lane 1	0.0	0.0	0.0	0.0
Lane 2	0.0	0.0	0.0	0.0
Lane 3	0.0	0.0	0.0	0.0
East: South Liberty Parkway				
Lane 1	0.0	0.0	0.0	0.0
Lane 2	0.0	0.0	0.0	0.0
West: South Liberty Parkway				
Lane 1	0.0	0.0	0.0	0.0
Lane 2	0.0	0.0	0.0	0.0

LANE SUMMARY

 Site: 101 [RIRO 1 (Site Folder: High - AM Peak)]

Output produced by SIDRA INTERSECTION Version: 9.1.6.228

 Network: N101 [AM High SLP (Network Folder: General)]

New Site
 Site Category: (None)
 Stop (Two-Way)

Lane Use and Performance															
	Demand Flows		Arrival Flows		Cap.	Deg. Satn	Lane Util.	Aver. Delay	Level of Service	Aver. Back Of Queue		Lane Config	Lane Length	Cap. Adj.	Prob. Block.
	[Total veh/h]	HV %	[Total veh/h]	HV %						[Veh]	[Dist]				
	veh/h	%	veh/h	%	veh/h	v/c	%	sec			ft	ft	%	%	
South: New Road															
Lane 1	16	5.0	16	5.0	411	0.040	100	14.1	LOS B	0.1	1.7	Full	1600	0.0	0.0
Approach	16	5.0	16	5.0		0.040		14.1	LOS B	0.1	1.7				
East: South Liberty Parkway															
Lane 1	698	5.0	698	5.0	1810	0.386	100	0.1	LOS A	0.0	0.0	Full	1750	0.0	0.0
Lane 2	698	5.0	698	5.0	1810	0.386	100	0.1	LOS A	0.0	0.0	Full	1750	0.0	0.0
Approach	1397	5.0	1397	5.0		0.386		0.1	NA	0.0	0.0				
West: South Liberty Parkway															
Lane 1	633	5.0	633	5.0	1810	0.350	100	0.1	LOS A	0.0	0.0	Full	1300	0.0	0.0
Lane 2	632	5.0	632	5.0	1806	0.350	100	0.1	LOS A	0.0	0.0	Full	1300	0.0	0.0
Approach	1265	5.0	1265	5.0		0.350		0.1	NA	0.0	0.0				
All Vehicles	2678	5.0	2678	5.0		0.386		0.2	NA	0.1	1.7				

Site Level of Service (LOS) Method: Delay & v/c (HCM 6). Site LOS Method is specified in the Network Data dialog (Override Site Data tab).

Lane LOS values are based on average delay and v/c ratio (degree of saturation) per lane.

LOS F will result if v/c > 1 irrespective of lane delay value (does not apply for approaches and intersection).

Minor Road Approach LOS values are based on average delay for all lanes (v/c not used as specified in HCM 6).

NA (TWSC): Level of Service is not defined for major road approaches or the intersection as a whole for Two-Way Sign Control (HCM LOS rule).

Two-Way Sign Control Capacity Model: SIDRA Standard (HCM).

Delay Model: HCM Delay Formula (Stopline Delay: Geometric Delay is not included).

Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Gap.

Gap-Acceptance Capacity Formula: Traditional M1.

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

Approach Lane Flows (veh/h)									
South: New Road									
Mov. From S To Exit:	R2	Total	%HV		Deg. Satn	Lane Util.	Prob. SL Ov.	Ov. Lane No.	
	E			Cap. veh/h	v/c	%	%		
Lane 1	16	16	5.0	411	0.040	100	NA	NA	
Approach	16	16	5.0		0.040				
East: South Liberty Parkway									
Mov. From E To Exit:	T1	Total	%HV		Deg. Satn	Lane Util.	Prob. SL Ov.	Ov. Lane No.	
	W			Cap. veh/h	v/c	%	%		
Lane 1	698	698	5.0	1810	0.386	100	NA	NA	
Lane 2	698	698	5.0	1810	0.386	100	NA	NA	
Approach	1397	1397	5.0		0.386				

West: South Liberty Parkway										
Mov.	T1	R2	Total	%HV	Cap.	Deg.	Lane	Prob.	Ov.	Ov.
From W To Exit:	E	S			veh/h	Satn v/c	Util. %	SL %	%	Lane No.
Lane 1	633	-	633	5.0	1810	0.350	100	NA	NA	NA
Lane 2	625	7	632	5.0	1806	0.350	100	NA	NA	NA
Approach	1259	7	1265	5.0		0.350				
Total %HV Deg.Satn (v/c)										
All Vehicles	2678	5.0		0.386						

Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

Merge Analysis												
	Exit Lane Number	Short Lane Length ft	Percent Opng in Lane % veh/h	Opposing Flow Rate pcu/h	Critical Gap sec	Follow-up Headway sec	Lane Flow Rate veh/h	Capacity veh/h	Deg. Satn v/c	Min. Delay sec	Merge Delay sec	
There are no Exit Short Lanes for Merge Analysis at this Site.												

Variable Demand Analysis				
	Initial Queued Demand veh	Residual Queued Demand veh	Time for Residual Demand to Clear sec	Duration of Oversatn sec
South: New Road				
Lane 1	0.0	0.0	0.0	0.0
East: South Liberty Parkway				
Lane 1	0.0	0.0	0.0	0.0
Lane 2	0.0	0.0	0.0	0.0
West: South Liberty Parkway				
Lane 1	0.0	0.0	0.0	0.0
Lane 2	0.0	0.0	0.0	0.0

LANE SUMMARY

Site: 101 [Birmingham (Site Folder: High - AM Peak)]

Output produced by SIDRA INTERSECTION Version: 9.1.6.228

Network: N101 [AM High SLP (Network Folder: General)]

New Site
Site Category: (None)
Roundabout

Lane Use and Performance															
	Demand Flows		Arrival Flows		Cap.	Deg. Satn	Lane Util.	Aver. Delay	Level of Service	Aver. Back Of Queue		Lane Config	Lane Length	Cap. Adj.	Prob. Block.
	[Total veh/h]	[HV %]	[Total veh/h]	[HV %]						[Veh]	[Dist]				
	veh/h	%	veh/h	%	veh/h	v/c	%	sec			ft	ft	%	%	
South: Birmingham															
Lane 1 ^d	93	5.0	93	5.0	497	0.188	100	9.9	LOS A	0.2	5.3	Full	1600	0.0	0.0
Lane 2	17	5.0	17	5.0	219	0.079	42 ⁵	18.3	LOS C	0.1	1.9	Full	1600	0.0	0.0
Approach	111	5.0	111	5.0		0.188		11.2	LOS B	0.2	5.3				
East: South Liberty Parkway															
Lane 1 ^d	533	5.0	533	5.0	1025	0.520	100	9.8	LOS A	1.1	27.8	Full	2180	0.0	0.0
Lane 2	522	5.0	522	5.0	1004	0.520	100	9.7	LOS A	1.0	27.3	Full	2180	0.0	0.0
Approach	1054	5.0	1054	5.0		0.520		9.8	LOS A	1.1	27.8				
North: Birmingham															
Lane 1	242	5.0	242	5.0	555	0.437	72 ⁵	13.6	LOS B	0.6	16.9	Full	1600	0.0	0.0
Lane 2 ^d	398	5.0	398	5.0	658	0.604	100	16.4	LOS C	1.2	32.4	Full	1600	0.0	0.0
Approach	640	5.0	640	5.0		0.604		15.3	LOS C	1.2	32.4				
West: South Liberty Parkway															
Lane 1 ^d	644	5.0	644	5.0	973	0.662	100	13.8	LOS B	3.1	81.7	Full	1750	0.0	0.0
Lane 2	631	5.0	631	5.0	953	0.662	100	13.7	LOS B	3.1	80.0	Full	1750	0.0	0.0
Approach	1275	5.0	1275	5.0		0.662		13.8	LOS B	3.1	81.7				
All Vehicles	3080	5.0	3080	5.0		0.662		12.6	LOS B	3.1	81.7				

Site Level of Service (LOS) Method: Delay & v/c (HCM 6). Site LOS Method is specified in the Network Data dialog (Override Site Data tab).

Roundabout LOS Method: Same as Sign Control.

Lane LOS values are based on average delay and v/c ratio (degree of saturation) per lane.

LOS F will result if v/c > 1 irrespective of lane delay value (does not apply for approaches and intersection).

Intersection and Approach LOS values are based on average delay for all lanes (v/c not used as specified in HCM 6).

Roundabout Capacity Model: SIDRA HCM.

Delay Model: HCM Delay Formula (Stopline Delay: Geometric Delay is not included).

Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Gap.

Gap-Acceptance Capacity Formula: Traditional M1.

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

⁵ Lane under-utilisation found by the program

^d Dominant lane on roundabout approach

Approach Lane Flows (veh/h)											
South: Birmingham											
Mov. From S To Exit:	L2	T1	R2	Total	%HV	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Prob. SL %	Ov. Lane No.	
	W	N	E								
Lane 1	41	52	-	93	5.0	497	0.188	100	NA	NA	
Lane 2	-	-	17	17	5.0	219	0.079	42 ⁵	NA	NA	
Approach	41	52	17	111	5.0		0.188				

East: South Liberty Parkway											
Mov. From E To Exit:	L2	T1	R2	Total	%HV	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Prob. SL Ov. %	Ov. Lane No.	
Lane 1	13	520	-	533	5.0	1025	0.520	100	NA	NA	
Lane 2	-	438	84	522	5.0	1004	0.520	100	NA	NA	
Approach	13	958	84	1054	5.0		0.520				
North: Birmingham											
Mov. From N To Exit:	L2	T1	R2	Total	%HV	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Prob. SL Ov. %	Ov. Lane No.	
Lane 1	179	63	-	242	5.0	555	0.437	72 ⁵	NA	NA	
Lane 2	-	-	398	398	5.0	658	0.604	100	NA	NA	
Approach	179	63	398	640	5.0		0.604				
West: South Liberty Parkway											
Mov. From W To Exit:	L2	T1	R2	Total	%HV	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Prob. SL Ov. %	Ov. Lane No.	
Lane 1	111	533	-	644	5.0	973	0.662	100	NA	NA	
Lane 2	-	604	27	631	5.0	953	0.662	100	NA	NA	
Approach	111	1137	27	1275	5.0		0.662				
Total %HV Deg. Satn (v/c)											
All Vehicles	3080	5.0					0.662				

Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

5 Lane under-utilisation found by the program

Merge Analysis												
Exit Lane Number	Short Lane Length ft	Percent Opng in Lane	Opposing Flow Rate % veh/h	Critical Gap pcu/h	Follow-up Headway sec	Lane Capacity Flow Rate veh/h	Deg. Satn v/c	Min. Delay sec	Merge Delay sec			
There are no Exit Short Lanes for Merge Analysis at this Site.												

Variable Demand Analysis				
	Initial Queued Demand veh	Residual Queued Demand veh	Time for Residual Demand to Clear sec	Duration of Oversatn sec
South: Birmingham				
Lane 1	0.0	0.0	0.0	0.0
Lane 2	0.0	0.0	0.0	0.0
East: South Liberty Parkway				
Lane 1	0.0	0.0	0.0	0.0
Lane 2	0.0	0.0	0.0	0.0
North: Birmingham				
Lane 1	0.0	0.0	0.0	0.0
Lane 2	0.0	0.0	0.0	0.0
West: South Liberty Parkway				
Lane 1	0.0	0.0	0.0	0.0
Lane 2	0.0	0.0	0.0	0.0

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Project: G:\16652\Analysis\Traffic\Synchro-Sidra\Scenario3-2.sip9

LANE SUMMARY

 Site: 101 [RIRO 2 (Site Folder: High - AM Peak)]

Output produced by SIDRA INTERSECTION Version: 9.1.6.228

 Network: N101 [AM High SLP (Network Folder: General)]

New Site
 Site Category: (None)
 Stop (Two-Way)

Lane Use and Performance															
	Demand Flows		Arrival Flows		Cap.	Deg. Satn	Lane Util.	Aver. Delay	Level of Service	Aver. Back Of Queue		Lane Config	Lane Length	Cap. Adj.	Prob. Block.
	[Total veh/h]	[HV %]	[Total veh/h]	[HV %]						[Veh]	[Dist]				
	veh/h	%	veh/h	%	veh/h	v/c	%	sec			ft	ft	%	%	
South: New Road															
Lane 1	16	5.0	16	5.0	393	0.042	100	14.5	LOS B	0.1	1.7	Full	1600	0.0	0.0
Approach	16	5.0	16	5.0		0.042		14.5	LOS B	0.1	1.7				
East: South Liberty Parkway															
Lane 1	507	5.0	507	5.0	1810	0.280	100	0.1	LOS A	0.0	0.0	Full	1400	0.0	0.0
Lane 2	503	5.0	503	5.0	1795	0.280	100	0.1	LOS A	0.0	0.0	Full	1400	0.0	0.0
Approach	1010	5.0	1010	5.0		0.280		0.1	NA	0.0	0.0				
North: New Road															
Lane 1	67	5.0	67	5.0	516	0.131	100	13.0	LOS B	0.2	6.1	Full	1600	0.0	0.0
Approach	67	5.0	67	5.0		0.131		13.0	LOS B	0.2	6.1				
West: South Liberty Parkway															
Lane 1	668	5.0	668	5.0	1810	0.369	100	0.2	LOS A	0.0	0.0	Full	2180	0.0	0.0
Lane 2	666	5.0	666	5.0	1804	0.369	100	0.2	LOS A	0.0	0.0	Full	2180	0.0	0.0
Approach	1334	5.0	1334	5.0		0.369		0.2	NA	0.0	0.0				
All Vehicles	2427	5.0	2427	5.0		0.369		0.6	NA	0.2	6.1				

Site Level of Service (LOS) Method: Delay & v/c (HCM 6). Site LOS Method is specified in the Network Data dialog (Override Site Data tab).

Lane LOS values are based on average delay and v/c ratio (degree of saturation) per lane.

LOS F will result if v/c > 1 irrespective of lane delay value (does not apply for approaches and intersection).

Minor Road Approach LOS values are based on average delay for all lanes (v/c not used as specified in HCM 6).

NA (TWSC): Level of Service is not defined for major road approaches or the intersection as a whole for Two-Way Sign Control (HCM LOS rule).

Two-Way Sign Control Capacity Model: SIDRA Standard (HCM).

Delay Model: HCM Delay Formula (Stopline Delay: Geometric Delay is not included).

Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Gap.

Gap-Acceptance Capacity Formula: Traditional M1.

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

Approach Lane Flows (veh/h)									
South: New Road									
Mov. From S To Exit:	R2	Total	%HV			Deg. Satn	Lane Util.	Prob. SL Ov.	Ov. Lane No.
	E			Cap. veh/h	v/c	%	%		
Lane 1	16	16	5.0	393	0.042	100	NA	NA	
Approach	16	16	5.0		0.042				
East: South Liberty Parkway									
Mov. From E To Exit:	T1	R2	Total	%HV		Deg. Satn	Lane Util.	Prob. SL Ov.	Ov. Lane No.
	W	N			Cap. veh/h	v/c	%	%	

Lane 1	507	-	507	5.0	1810	0.280	100	NA	NA
Lane 2	480	23	503	5.0	1795	0.280	100	NA	NA
Approach	987	23	1010	5.0		0.280			
North: New Road									
Mov. From N To Exit:	R2	Total	%HV		Cap. veh/h	Deg. Satn v/c	Lane Util. %	Prob. SL %	Ov. Lane No.
	W								
Lane 1	67	67	5.0		516	0.131	100	NA	NA
Approach	67	67	5.0			0.131			
West: South Liberty Parkway									
Mov. From W To Exit:	T1	R2	Total	%HV	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Prob. SL %	Ov. Lane No.
	E	S							
Lane 1	668	-	668	5.0	1810	0.369	100	NA	NA
Lane 2	655	11	666	5.0	1804	0.369	100	NA	NA
Approach	1323	11	1334	5.0		0.369			
Total %HV Deg.Satn (v/c)									
All Vehicles	2427	5.0		0.369					

Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

Merge Analysis												
	Exit Lane Number	Short Lane Length ft	Percent Opng in Lane % veh/h	Opposing Flow Rate pcu/h	Critical Gap sec	Follow-up Headway sec	Lane Flow Rate veh/h	Capacity veh/h	Deg. Satn v/c	Min. Delay sec	Merge Delay sec	
There are no Exit Short Lanes for Merge Analysis at this Site.												

Variable Demand Analysis				
	Initial Queued Demand veh	Residual Queued Demand veh	Time for Residual Demand to Clear sec	Duration of Oversatn sec
South: New Road				
Lane 1	0.0	0.0	0.0	0.0
East: South Liberty Parkway				
Lane 1	0.0	0.0	0.0	0.0
Lane 2	0.0	0.0	0.0	0.0
North: New Road				
Lane 1	0.0	0.0	0.0	0.0
West: South Liberty Parkway				
Lane 1	0.0	0.0	0.0	0.0
Lane 2	0.0	0.0	0.0	0.0

LANE SUMMARY

Site: 101 [Arsenal (Site Folder: High - AM Peak)]

Output produced by SIDRA INTERSECTION Version: 9.1.6.228

Network: N101 [AM High SLP (Network Folder: General)]

New Site
Site Category: (None)
Roundabout

Lane Use and Performance															
	Demand Flows		Arrival Flows		Cap.	Deg. Satn	Lane Util.	Aver. Delay	Level of Service	Aver. Back Of Queue		Lane Config	Lane Length	Cap. Adj.	Prob. Block.
	[Total veh/h]	[HV %]	[Total veh/h]	[HV %]						[Veh]	[Dist]				
	veh/h	%	veh/h	%	veh/h	v/c	%	sec			ft		ft	%	%
South: Arsenal															
Lane 1 ^d	104	5.0	104	5.0	423	0.247	100	12.5	LOS B	0.3	7.0	Full	1600	0.0	0.0
Approach	104	5.0	104	5.0		0.247		12.5	LOS B	0.3	7.0				
East: South Liberty Parkway															
Lane 1	546	5.0	546	5.0	1262	0.433	100	6.7	LOS A	1.3	33.4	Full	1800	0.0	0.0
Lane 2 ^d	550	5.0	550	5.0	1271	0.433	100	6.6	LOS A	1.3	33.4	Full	1800	0.0	0.0
Approach	1096	5.0	1096	5.0		0.433		6.7	LOS A	1.3	33.4				
West: South Liberty Parkway															
Lane 1	665	5.0	665	5.0	1173	0.566	100	9.5	LOS A	1.6	42.4	Full	1400	0.0	0.0
Lane 2 ^d	675	5.0	675	5.0	1191	0.566	100	9.4	LOS A	1.6	42.5	Full	1400	0.0	0.0
Approach	1339	5.0	1339	5.0		0.566		9.5	LOS A	1.6	42.5				
All Vehicles	2539	5.0	2539	5.0		0.566		8.4	LOS A	1.6	42.5				

Site Level of Service (LOS) Method: Delay & v/c (HCM 6). Site LOS Method is specified in the Network Data dialog (Override Site Data tab).

Roundabout LOS Method: Same as Sign Control.

Lane LOS values are based on average delay and v/c ratio (degree of saturation) per lane.

LOS F will result if v/c > 1 irrespective of lane delay value (does not apply for approaches and intersection).

Intersection and Approach LOS values are based on average delay for all lanes (v/c not used as specified in HCM 6).

Roundabout Capacity Model: SIDRA HCM.

Delay Model: HCM Delay Formula (Stopline Delay: Geometric Delay is not included).

Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Gap.

Gap-Acceptance Capacity Formula: Traditional M1.

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

^d Dominant lane on roundabout approach

Approach Lane Flows (veh/h)										
South: Arsenal										
Mov.	L2	R2	Total	%HV	Cap.	Deg. Satn	Lane Util.	Prob. SL	Ov. Lane	
From S To Exit:	W	E			veh/h	v/c	%	%	No.	
Lane 1	38	66	104	5.0	423	0.247	100	NA	NA	
Approach	38	66	104	5.0		0.247				
East: South Liberty Parkway										
Mov.	L2	T1	Total	%HV	Cap.	Deg. Satn	Lane Util.	Prob. SL	Ov. Lane	
From E To Exit:	S	W			veh/h	v/c	%	%	No.	
Lane 1	124	422	546	5.0	1262	0.433	100	NA	NA	
Lane 2	-	550	550	5.0	1271	0.433	100	NA	NA	
Approach	124	972	1096	5.0		0.433				

West: South Liberty Parkway										
Mov.	T1	R2	Total	%HV	Cap.	Deg.	Lane	Prob.	Ov.	Ov.
From W To Exit:	E	S			veh/h	Satn v/c	Util. %	SL %	Lane No.	Lane No.
Lane 1	665	-	665	5.0	1173	0.566	100	NA	NA	NA
Lane 2	638	37	675	5.0	1191	0.566	100	NA	NA	NA
Approach	1302	37	1339	5.0		0.566				
Total %HV Deg.Satn (v/c)										
All Vehicles	2539	5.0		0.566						

Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

Merge Analysis												
	Exit Lane Number	Short Lane Length ft	Percent Opng in Lane %	Opposing Flow Rate veh/h	Critical Gap pcu/h	Follow-up Headway sec	Lane Capacity Rate veh/h	Deg. Satn v/c	Min. Delay sec	Merge Delay sec		
There are no Exit Short Lanes for Merge Analysis at this Site.												

Variable Demand Analysis				
	Initial Queued Demand veh	Residual Queued Demand veh	Time for Residual Demand to Clear sec	Duration of Oversatn sec
South: Arsenal				
Lane 1	0.0	0.0	0.0	0.0
East: South Liberty Parkway				
Lane 1	0.0	0.0	0.0	0.0
Lane 2	0.0	0.0	0.0	0.0
West: South Liberty Parkway				
Lane 1	0.0	0.0	0.0	0.0
Lane 2	0.0	0.0	0.0	0.0

LANE SUMMARY

Site: 101 [East Roundabout (Site Folder: High - AM Peak)]

Output produced by SIDRA INTERSECTION Version: 9.1.6.228

Network: N101 [AM High SLP (Network Folder: General)]

New Site
Site Category: (None)
Roundabout

Lane Use and Performance															
	Demand Flows		Arrival Flows		Cap.	Deg. Satn	Lane Util.	Aver. Delay	Level of Service	Aver. Back Of Queue		Lane Config	Lane Length	Cap. Adj.	Prob. Block.
	[Total veh/h]	[HV %]	[Total veh/h]	[HV %]						[Veh]	[Dist]				
	veh/h	%	veh/h	%	veh/h	v/c	%	sec			ft		ft	%	%
South: New Road															
Lane 1	83	5.0	83	5.0	554	0.150	100	8.4	LOS A	0.2	4.2	Full	1600	0.0	0.0
Lane 2 ^d	85	5.0	85	5.0	566	0.150	100	8.2	LOS A	0.2	4.2	Full	1600	0.0	0.0
Approach	167	5.0	167	5.0		0.150		8.3	LOS A	0.2	4.2				
East: South Liberty Parkway															
Lane 1 ^d	607	5.0	607	5.0	946	0.641	100	13.5	LOS B	2.7	69.2	Full	1900	0.0	0.0
Lane 2	595	5.0	595	5.0	928	0.641	100	13.4	LOS B	2.6	67.0	Full	1900	0.0	0.0
Approach	1202	5.0	1202	5.0		0.641		13.4	LOS B	2.7	69.2				
North: New Road															
Lane 1	55	5.0	55	5.0	519	0.107	78 ⁵	8.3	LOS A	0.1	2.8	Full	1600	0.0	0.0
Lane 2 ^d	83	5.0	83	5.0	601	0.138	100	7.7	LOS A	0.1	3.8	Full	1600	0.0	0.0
Approach	138	5.0	138	5.0		0.138		7.9	LOS A	0.1	3.8				
West: South Liberty Parkway															
Lane 1 ^d	691	5.0	691	5.0	1031	0.670	100	13.4	LOS B	3.2	82.6	Full	1800	0.0	0.0
Lane 2	677	5.0	677	5.0	1010	0.670	100	13.3	LOS B	3.2	81.9	Full	1800	0.0	0.0
Approach	1368	5.0	1368	5.0		0.670		13.4	LOS B	3.2	82.6				
All Vehicles	2876	5.0	2876	5.0		0.670		12.8	LOS B	3.2	82.6				

Site Level of Service (LOS) Method: Delay & v/c (HCM 6). Site LOS Method is specified in the Network Data dialog (Override Site Data tab).

Roundabout LOS Method: Same as Sign Control.

Lane LOS values are based on average delay and v/c ratio (degree of saturation) per lane.

LOS F will result if v/c > 1 irrespective of lane delay value (does not apply for approaches and intersection).

Intersection and Approach LOS values are based on average delay for all lanes (v/c not used as specified in HCM 6).

Roundabout Capacity Model: SIDRA HCM.

Delay Model: HCM Delay Formula (Stopline Delay: Geometric Delay is not included).

Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Gap.

Gap-Acceptance Capacity Formula: Traditional M1.

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

⁵ Lane under-utilisation found by the program

^d Dominant lane on roundabout approach

Approach Lane Flows (veh/h)										
South: New Road										
Mov. From S To Exit:	L2	R2	Total	%HV	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Prob. SL %	Ov. Lane No.	
	W	E								
Lane 1	83	-	83	5.0	554	0.150	100	NA	NA	
Lane 2	17	67	85	5.0	566	0.150	100	NA	NA	
Approach	100	67	167	5.0		0.150				

East: South Liberty Parkway										
Mov. From E To Exit:	L2	T1	R2	Total	%HV	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Prob. SL Ov. %	Ov. Lane No.
Lane 1	139	468	-	607	5.0	946	0.641	100	NA	NA
Lane 2	-	445	150	595	5.0	928	0.641	100	NA	NA
Approach	139	913	150	1202	5.0		0.641			
North: New Road										
Mov. From N To Exit:	L2	R2	Total	%HV	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Prob. SL Ov. %	Ov. Lane No.	
Lane 1	55	-	55	5.0	519	0.107	78 ⁵	NA	NA	
Lane 2	-	83	83	5.0	601	0.138	100	NA	NA	
Approach	55	83	138	5.0		0.138				
West: South Liberty Parkway										
Mov. From W To Exit:	L2	T1	R2	Total	%HV	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Prob. SL Ov. %	Ov. Lane No.
Lane 1	224	467	-	691	5.0	1031	0.670	100	NA	NA
Lane 2	-	470	208	677	5.0	1010	0.670	100	NA	NA
Approach	224	937	208	1368	5.0		0.670			
Total %HV Deg. Satn (v/c)										
All Vehicles	2876	5.0		0.670						

Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

5 Lane under-utilisation found by the program

Merge Analysis												
Exit Lane Number	Short Lane Length ft	Percent Opng in Lane %	Opposing Flow Rate % veh/h	Critical Gap pcu/h	Follow-up Headway sec	Lane Capacity Flow Rate veh/h	Deg. Satn v/c	Min. Delay sec	Merge Delay sec			
There are no Exit Short Lanes for Merge Analysis at this Site.												

Variable Demand Analysis				
	Initial Queued Demand veh	Residual Queued Demand veh	Time for Residual Demand to Clear sec	Duration of Oversatn sec
South: New Road				
Lane 1	0.0	0.0	0.0	0.0
Lane 2	0.0	0.0	0.0	0.0
East: South Liberty Parkway				
Lane 1	0.0	0.0	0.0	0.0
Lane 2	0.0	0.0	0.0	0.0
North: New Road				
Lane 1	0.0	0.0	0.0	0.0
Lane 2	0.0	0.0	0.0	0.0
West: South Liberty Parkway				
Lane 1	0.0	0.0	0.0	0.0
Lane 2	0.0	0.0	0.0	0.0

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Project: G:\16652\Analysis\Traffic\Synchro-Sidra\Scenario3-2.sip9

LANE SUMMARY

Site: 101vv [Railroad (Site Folder: High - PM Peak)]

Output produced by SIDRA INTERSECTION Version: 9.1.6.228

Network: N101 [PM High SLP (Network Folder: General)]

New Site
 Site Category: (None)
 Roundabout

Lane Use and Performance															
	Demand Flows		Arrival Flows		Cap.	Deg. Satn	Lane Util.	Aver. Delay	Level of Service	Aver. Back Of Queue		Lane Config	Lane Length	Cap. Adj.	Prob. Block.
	[Total veh/h]	[HV %]	[Total veh/h]	[HV %]						[Veh]	[Dist]				
East: South Liberty Parkway															
Lane 1	1139	5.0	1009	5.0	1230	0.821	100	15.7	LOS C	6.4	165.7	Full	1150	0.0	0.0
Lane 2 ^d	1149	5.0	1018	5.0	1240	0.821	100	15.6	LOS C	6.4	166.2	Full	1150	0.0	0.0
Approach	2288	5.0	2028	5.0		0.821		15.6	LOS C	6.4	166.2				
North: Railroad															
Lane 1 ^d	227	5.0	227	5.0	242	0.937	100	84.3	LOS F	2.2	56.8	Full	1600	0.0	0.0
Approach	227	5.0	227	5.0		0.937		84.3	LOS F	2.2	56.8				
West: South Liberty Parkway															
Lane 1	985	5.0	985	5.0	1182	0.833	100	17.9	LOS C	5.9	153.4	Full	1725	0.0	0.0
Lane 2 ^d	997	5.0	997	5.0	1196	0.833	100	17.8	LOS C	5.9	154.1	Full	1725	0.0	0.0
Approach	1982	5.0	1982	5.0		0.833		17.8	LOS C	5.9	154.1				
All Vehicles	4497	5.0	4236	5.3		0.937		20.3	LOS C	6.4	166.2				

Site Level of Service (LOS) Method: Delay & v/c (HCM 6). Site LOS Method is specified in the Network Data dialog (Override Site Data tab).

Roundabout LOS Method: Same as Sign Control.

Lane LOS values are based on average delay and v/c ratio (degree of saturation) per lane.

LOS F will result if v/c > 1 irrespective of lane delay value (does not apply for approaches and intersection).

Intersection and Approach LOS values are based on average delay for all lanes (v/c not used as specified in HCM 6).

Roundabout Capacity Model: SIDRA HCM.

Delay Model: HCM Delay Formula (Stopline Delay: Geometric Delay is not included).

Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Gap.

Gap-Acceptance Capacity Formula: Traditional M1.

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

^d Dominant lane on roundabout approach

Approach Lane Flows (veh/h)										
East: South Liberty Parkway										
Mov.	T1	R2	Total	%HV	Cap.	Deg. Satn	Lane Util.	Prob. SL	Ov. Ov.	Ov. Lane No.
From E To Exit:	W	N			veh/h	v/c	%	%		
Lane 1	1009	-	1009	5.0	1230	0.821	100	NA	NA	
Lane 2	984	34	1018	5.0	1240	0.821	100	NA	NA	
Approach	1994	34	2028	5.0		0.821				
North: Railroad										
Mov.	L2	R2	Total	%HV	Cap.	Deg. Satn	Lane Util.	Prob. SL	Ov. Ov.	Ov. Lane No.
From N To Exit:	E	W			veh/h	v/c	%	%		
Lane 1	91	136	227	5.0	242	0.937	100	NA	NA	
Approach	91	136	227	5.0		0.937				

West: South Liberty Parkway										
Mov.	L2	T1	Total	%HV	Cap.	Deg.	Lane	Prob.	Ov.	Ov.
From W					veh/h	Satn	Util.	SL	%	Lane
To Exit:	N	E				v/c	%	%		No.
Lane 1	58	927	985	5.0	1182	0.833	100	NA	NA	NA
Lane 2	-	997	997	5.0	1196	0.833	100	NA	NA	NA
Approach	58	1924	1982	5.0		0.833				
Total	%HV	Deg.	Satn	(v/c)						
All Vehicles	4236	5.3		0.937						

Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

Merge Analysis												
	Exit Lane Number	Short Lane Length ft	Percent Opng in Lane %	Opposing Flow Rate veh/h	Critical Gap sec	Follow-up Headway sec	Lane Capacity veh/h	Deg. Satn v/c	Min. Delay sec	Merge Delay sec		
There are no Exit Short Lanes for Merge Analysis at this Site.												

Variable Demand Analysis				
	Initial Queued Demand veh	Residual Queued Demand veh	Time for Residual Demand to Clear sec	Duration of Oversatn sec
East: South Liberty Parkway				
Lane 1	0.0	0.0	0.0	0.0
Lane 2	0.0	0.0	0.0	0.0
North: Railroad				
Lane 1	0.0	0.0	0.0	0.0
West: South Liberty Parkway				
Lane 1	0.0	0.0	0.0	0.0
Lane 2	0.0	0.0	0.0	0.0

LANE SUMMARY

Site: 101 [West Arsenal (Site Folder: High - PM Peak)]

Output produced by SIDRA INTERSECTION Version: 9.1.6.228

Network: N101 [PM High SLP (Network Folder: General)]

New Site
Site Category: (None)
Roundabout

Lane Use and Performance															
	Demand Flows		Arrival Flows		Cap.	Deg. Satn	Lane Util.	Aver. Delay	Level of Service	Aver. Back Of Queue		Lane Config	Lane Length	Cap. Adj.	Prob. Block.
	[Total veh/h	HV %	[Total veh/h	HV %						[Veh	Dist]				
					veh/h	v/c	%	sec			ft		ft	%	%
South: West Arsenal															
Lane 1	168	5.0	168	5.0	326	0.516	100	24.7	LOS C	0.7	18.8	Full	1600	0.0	0.0
Lane 2 ^d	246	5.0	246	5.0	476	0.516	100	17.9	LOS C	0.8	21.4	Full	1600	0.0	0.0
Lane 3	199	5.0	199	5.0	332	0.599	100	28.7	LOS D	0.9	23.3	Full	1600	0.0	0.0
Approach	613	5.0	613	5.0		0.599		23.3	LOS C	0.9	23.3				
East: South Liberty Parkway															
Lane 1	978	5.0	859	5.0	844	1.019	100	55.5	LOS F	14.7	383.5	Full	1300	0.0	0.0
Lane 2 ^d	993	5.0	872	5.0	857	1.019	100	55.3	LOS F	15.2	396.4	Full	1300	0.0	0.0
Approach	1972	5.0	1732	5.0		1.019		55.4	LOS F	15.2	396.4				
West: South Liberty Parkway															
Lane 1	1002	5.0	1002	5.0	1190	0.842	100	18.2	LOS C	6.4	165.3	Full	1150	0.0	0.0
Lane 2 ^d	1013	5.0	1013	5.0	1203	0.842	100	18.0	LOS C	6.4	166.1	Full	1150	0.0	0.0
Approach	2015	5.0	2015	5.0		0.842		18.1	LOS C	6.4	166.1				
All Vehicles	4600	5.0	4360	5.3		1.019		33.6	LOS D	15.2	396.4				

Site Level of Service (LOS) Method: Delay & v/c (HCM 6). Site LOS Method is specified in the Network Data dialog (Override Site Data tab).

Roundabout LOS Method: Same as Sign Control.

Lane LOS values are based on average delay and v/c ratio (degree of saturation) per lane.

LOS F will result if v/c > 1 irrespective of lane delay value (does not apply for approaches and intersection).

Intersection and Approach LOS values are based on average delay for all lanes (v/c not used as specified in HCM 6).

Roundabout Capacity Model: SIDRA HCM.

Delay Model: HCM Delay Formula (Stopline Delay: Geometric Delay is not included).

Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Gap.

Gap-Acceptance Capacity Formula: Traditional M1.

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

^d Dominant lane on roundabout approach

Approach Lane Flows (veh/h)										
South: West Arsenal										
Mov.	L2	R2	Total	%HV	Cap.	Deg. Satn	Lane Util.	Prob. SL Ov.	Ov. Lane No.	
From S To Exit:	W	E			veh/h	v/c	%	%		
Lane 1	168	-	168	5.0	326	0.516	100	NA	NA	
Lane 2	246	-	246	5.0	476	0.516	100	NA	NA	
Lane 3	-	199	199	5.0	332	0.599	100	NA	NA	
Approach	414	199	613	5.0		0.599				
East: South Liberty Parkway										
Mov.	L2	T1	Total	%HV	Cap.	Deg. Satn	Lane Util.	Prob. SL Ov.	Ov. Lane No.	
From E To Exit:	S	W			veh/h	v/c	%	%		

Lane 1	86	774	859	5.0	844	1.019	100	NA	NA
Lane 2	-	872	872	5.0	857	1.019	100	NA	NA
Approach	86	1646	1732	5.0		1.019			
West: South Liberty Parkway									
Mov. From W To Exit:	T1	R2	Total	%HV	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Prob. SL %	Ov. Lane No.
	E	S							
Lane 1	1002	-	1002	5.0	1190	0.842	100	NA	NA
Lane 2	806	208	1013	5.0	1203	0.842	100	NA	NA
Approach	1808	208	2015	5.0		0.842			
Total %HV Deg. Satn (v/c)									
All Vehicles	4360	5.3		1.019					

Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

Merge Analysis												
	Exit Lane Number	Short Lane Length	Percent Opng in Lane	Opposing Flow Rate	Critical Gap	Follow-up Headway	Lane Capacity Flow Rate	Deg. Satn	Min. Delay	Merge Delay		
		ft	%	veh/h	pcu/h	sec	veh/h	v/c	sec	sec		
There are no Exit Short Lanes for Merge Analysis at this Site.												

Variable Demand Analysis				
	Initial Queued Demand	Residual Queued Demand	Time for Residual Demand to Clear	Duration of Oversatn
	veh	veh	sec	sec
South: West Arsenal				
Lane 1	0.0	0.0	0.0	0.0
Lane 2	0.0	0.0	0.0	0.0
Lane 3	0.0	0.0	0.0	0.0
East: South Liberty Parkway				
Lane 1	0.0	3.9	16.7	NA
Lane 2	0.0	4.0	16.7	NA
West: South Liberty Parkway				
Lane 1	0.0	0.0	0.0	0.0
Lane 2	0.0	0.0	0.0	0.0

LANE SUMMARY

 Site: 101 [RIRO 1 (Site Folder: High - PM Peak)]

Output produced by SIDRA INTERSECTION Version: 9.1.6.228

 Network: N101 [PM High SLP (Network Folder: General)]

New Site
Site Category: (None)
Stop (Two-Way)

Lane Use and Performance															
	Demand Flows		Arrival Flows		Cap.	Deg. Satn	Lane Util.	Aver. Delay	Level of Service	Aver. Queue	Back Of Queue Dist	Lane Config	Lane Length	Cap. Adj.	Prob. Block.
	[Total veh/h]	HV %	[Total veh/h]	HV %											
South: New Road															
Lane 1	11	5.0	11	5.0	235	0.046	100	21.0	LOS C	0.1	1.8	Full	1600	0.0	0.0
Approach	11	5.0	11	5.0		0.046		21.0	LOS C	0.1	1.8				
East: South Liberty Parkway															
Lane 1	986	5.0	866	5.0	1810	0.479	100	0.2	LOS A	0.0	0.0	Full	1750	0.0	0.0
Lane 2	986	5.0	866	5.0	1810	0.479	100	0.2	LOS A	0.0	0.0	Full	1750	0.0	0.0
Approach	1972	5.0	1732	5.0		0.479		0.2	NA	0.0	0.0				
West: South Liberty Parkway															
Lane 1	1005	5.0	1005	5.0	1810	0.556	100	0.2	LOS A	0.0	0.0	Full	1300	0.0	0.0
Lane 2	1001	5.0	1001	5.0	1802	0.556	100	0.2	LOS A	0.0	0.0	Full	1300	0.0	0.0
Approach	2007	5.0	2007	5.0		0.556		0.2	NA	0.0	0.0				
All Vehicles	3989	5.0	3749	5.3		0.556		0.3	NA	0.1	1.8				

Site Level of Service (LOS) Method: Delay & v/c (HCM 6). Site LOS Method is specified in the Network Data dialog (Override Site Data tab).

Lane LOS values are based on average delay and v/c ratio (degree of saturation) per lane.

LOS F will result if v/c > 1 irrespective of lane delay value (does not apply for approaches and intersection).

Minor Road Approach LOS values are based on average delay for all lanes (v/c not used as specified in HCM 6).

NA (TWSC): Level of Service is not defined for major road approaches or the intersection as a whole for Two-Way Sign Control (HCM LOS rule).

Two-Way Sign Control Capacity Model: SIDRA Standard (HCM).

Delay Model: HCM Delay Formula (Stopline Delay: Geometric Delay is not included).

Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Gap.

Gap-Acceptance Capacity Formula: Traditional M1.

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

Approach Lane Flows (veh/h)									
South: New Road									
Mov. From S To Exit:	R2	Total	%HV		Deg. Satn	Lane Util.	Prob. SL Ov.	Ov. Lane No.	
	E			Cap. veh/h	v/c	%	%		
Lane 1	11	11	5.0	235	0.046	100	NA	NA	
Approach	11	11	5.0		0.046				
East: South Liberty Parkway									
Mov. From E To Exit:	T1	Total	%HV		Deg. Satn	Lane Util.	Prob. SL Ov.	Ov. Lane No.	
	W			Cap. veh/h	v/c	%	%		
Lane 1	866	866	5.0	1810	0.479	100	NA	NA	
Lane 2	866	866	5.0	1810	0.479	100	NA	NA	
Approach	1732	1732	5.0		0.479				

West: South Liberty Parkway										
Mov.	T1	R2	Total	%HV	Cap.	Deg.	Lane	Prob.	Ov.	Ov.
From W To Exit:	E	S			veh/h	Satn v/c	Util. %	SL %	Lane	Lane No.
Lane 1	1005	-	1005	5.0	1810	0.556	100	NA	NA	NA
Lane 2	980	22	1001	5.0	1802	0.556	100	NA	NA	NA
Approach	1985	22	2007	5.0		0.556				
Total %HV Deg.Satn (v/c)										
All Vehicles	3749	5.3		0.556						

Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

Merge Analysis												
	Exit Lane Number	Short Lane Length ft	Percent Opng in Lane %	Opposing Flow Rate veh/h	Critical Gap pcu/h	Follow-up Headway sec	Lane Capacity Rate veh/h	Deg. Satn v/c	Min. Delay sec	Merge Delay sec		
There are no Exit Short Lanes for Merge Analysis at this Site.												

Variable Demand Analysis				
	Initial Queued Demand veh	Residual Queued Demand veh	Time for Residual Demand to Clear sec	Duration of Oversatn sec
South: New Road				
Lane 1	0.0	0.0	0.0	0.0
East: South Liberty Parkway				
Lane 1	0.0	0.0	0.0	0.0
Lane 2	0.0	0.0	0.0	0.0
West: South Liberty Parkway				
Lane 1	0.0	0.0	0.0	0.0
Lane 2	0.0	0.0	0.0	0.0

LANE SUMMARY

Site: 101 [Birmingham (Site Folder: High - PM Peak)]

Output produced by SIDRA INTERSECTION Version: 9.1.6.228

Network: N101 [PM High SLP (Network Folder: General)]

New Site
Site Category: (None)
Roundabout

Lane Use and Performance															
	Demand Flows		Arrival Flows		Cap.	Deg. Satn	Lane Util.	Aver. Delay	Level of Service	Aver. Back Of Queue		Lane Config	Lane Length	Cap. Adj.	Prob. Block.
	[Total veh/h]	[HV %]	[Total veh/h]	[HV %]						[Veh]	[Dist]				
	veh/h	%	veh/h	%	veh/h	v/c	%	sec			ft	ft	%	%	
South: Birmingham															
Lane 1 ^d	143	5.0	143	5.0	286	0.501	100	26.9	LOS D	0.6	16.6	Full	1600	0.0	0.0
Lane 2	22	5.0	22	5.0	119	0.182	36 ⁵	37.4	LOS E	0.2	4.4	Full	1600	0.0	0.0
Approach	165	5.0	165	5.0		0.501		28.3	LOS D	0.6	16.6				
East: South Liberty Parkway															
Lane 1	889	5.0	889	5.0	750	1.186	100	114.8	LOS F	23.8	619.2	Full	2180	0.0	0.0
Lane 2 ^d	904	5.0	904	5.0	762	1.186	100	114.6	LOS F	24.3	632.9	Full	2180	0.0	0.0
Approach	1793	5.0	1793	5.0		1.186		114.7	LOS F	24.3	632.9				
North: Birmingham															
Lane 1	222	5.0	222	5.0	318	0.697	71 ⁵	36.7	LOS E	1.2	31.9	Full	1600	0.0	0.0
Lane 2 ^d	401	5.0	401	5.0	406	0.988	100	72.6	LOS F	4.3	111.4	Full	1600	0.0	0.0
Approach	623	5.0	623	5.0		0.988		59.8	LOS F	4.3	111.4				
West: South Liberty Parkway															
Lane 1 ^d	1009	5.0	1009	5.0	972	1.039	100	56.1	LOS F	22.6	587.1	Full	1750	0.0	0.0
Lane 2	986	5.0	986	5.0	950	1.039	100	56.6	LOS F	21.9	568.7	Full	1750	0.0	0.0
Approach	1996	5.0	1996	5.0		1.039		56.4	LOS F	22.6	587.1				
All Vehicles	4577	5.0	4577	5.0		1.186		78.7	LOS F	24.3	632.9				

Site Level of Service (LOS) Method: Delay & v/c (HCM 6). Site LOS Method is specified in the Network Data dialog (Override Site Data tab).

Roundabout LOS Method: Same as Sign Control.

Lane LOS values are based on average delay and v/c ratio (degree of saturation) per lane.

LOS F will result if v/c > 1 irrespective of lane delay value (does not apply for approaches and intersection).

Intersection and Approach LOS values are based on average delay for all lanes (v/c not used as specified in HCM 6).

Roundabout Capacity Model: SIDRA HCM.

Delay Model: HCM Delay Formula (Stopline Delay: Geometric Delay is not included).

Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Gap.

Gap-Acceptance Capacity Formula: Traditional M1.

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

⁵ Lane under-utilisation found by the program

^d Dominant lane on roundabout approach

Approach Lane Flows (veh/h)											
South: Birmingham											
Mov. From S To Exit:	L2	T1	R2	Total	%HV	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Prob. SL %	Ov. Lane No.	
	W	N	E								
Lane 1	45	99	-	143	5.0	286	0.501	100	NA	NA	
Lane 2	-	-	22	22	5.0	119	0.182	36 ⁵	NA	NA	
Approach	45	99	22	165	5.0		0.501				

East: South Liberty Parkway										
Mov. From E To Exit:	L2	T1	R2	Total	%HV	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Prob. SL Ov. %	Ov. Lane No.
Lane 1	24	865	-	889	5.0	750	1.186	100	NA	NA
Lane 2	-	661	243	904	5.0	762	1.186	100	NA	NA
Approach	24	1526	243	1793	5.0		1.186			
North: Birmingham										
Mov. From N To Exit:	L2	T1	R2	Total	%HV	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Prob. SL Ov. %	Ov. Lane No.
Lane 1	148	74	-	222	5.0	318	0.697	71 ⁵	NA	NA
Lane 2	-	-	401	401	5.0	406	0.988	100	NA	NA
Approach	148	74	401	623	5.0		0.988			
West: South Liberty Parkway										
Mov. From W To Exit:	L2	T1	R2	Total	%HV	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Prob. SL Ov. %	Ov. Lane No.
Lane 1	433	577	-	1009	5.0	972	1.039	100	NA	NA
Lane 2	-	936	50	986	5.0	950	1.039	100	NA	NA
Approach	433	1513	50	1996	5.0		1.039			
Total %HV Deg. Satn (v/c)										
All Vehicles	4577	5.0		1.186						

Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

5 Lane under-utilisation found by the program

Merge Analysis											
Exit Lane Number	Short Lane Length ft	Percent Opng in Lane %	Opposing Flow Rate % veh/h	Critical Gap pcu/h	Follow-up Headway sec	Lane Capacity Flow Rate veh/h	Deg. Satn v/c	Min. Delay sec	Merge Delay sec		
There are no Exit Short Lanes for Merge Analysis at this Site.											

Variable Demand Analysis				
	Initial Queued Demand veh	Residual Queued Demand veh	Time for Residual Demand to Clear sec	Duration of Oversatn sec
South: Birmingham				
Lane 1	0.0	0.0	0.0	0.0
Lane 2	0.0	0.0	0.0	0.0
East: South Liberty Parkway				
Lane 1	0.0	34.9	167.8	NA
Lane 2	0.0	35.5	167.8	NA
North: Birmingham				
Lane 1	0.0	0.0	0.0	0.0
Lane 2	0.0	0.0	0.0	0.0
West: South Liberty Parkway				
Lane 1	0.0	9.4	34.8	NA
Lane 2	0.0	9.2	34.8	NA

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Project: G:\16652\Analysis\Traffic\Synchro-Sidra\Scenario3-2.sip9

LANE SUMMARY

 Site: 101 [RIRO 2 (Site Folder: High - PM Peak)]

Output produced by SIDRA INTERSECTION Version: 9.1.6.228

 Network: N101 [PM High SLP (Network Folder: General)]

New Site
 Site Category: (None)
 Stop (Two-Way)

Lane Use and Performance															
	Demand Flows		Arrival Flows		Cap.	Deg. Satn	Lane Util.	Aver. Delay	Level of Service	Aver. Back Of Queue		Lane Config	Lane Length	Cap. Adj.	Prob. Block.
	[Total veh/h]	[HV %]	[Total veh/h]	[HV %]						[Veh]	[Dist]				
	veh/h	%	veh/h	%	veh/h	v/c	%	sec			ft	ft	%	%	
South: New Road															
Lane 1	10	5.0	10	5.0	322	0.030	100	16.5	LOS C	0.0	1.2	Full	1600	0.0	0.0
Approach	10	5.0	10	5.0		0.030		16.5	LOS C	0.0	1.2				
East: South Liberty Parkway															
Lane 1	919	5.0	919	5.0	1810	0.508	100	0.2	LOS A	0.0	0.0	Full	1400	0.0	0.0
Lane 2	906	5.0	906	5.0	1782	0.508	100	0.2	LOS A	0.0	0.0	Full	1400	0.0	0.0
Approach	1825	5.0	1825	5.0		0.508		0.2	NA	0.0	0.0				
North: New Road															
Lane 1	46	5.0	46	5.0	299	0.153	100	19.1	LOS C	0.2	6.3	Full	1600	0.0	0.0
Approach	46	5.0	46	5.0		0.153		19.1	LOS C	0.2	6.3				
West: South Liberty Parkway															
Lane 1	844	5.0	816	5.0	1810	0.451	100	0.2	LOS A	0.0	0.0	Full	2180	0.0	0.0
Lane 2	838	5.0	810	5.0	1797	0.451	100	0.2	LOS A	0.0	0.0	Full	2180	0.0	0.0
Approach	1683	5.0	1626	5.0		0.451		0.2	NA	0.0	0.0				
All Vehicles	3563	5.0	3507	5.1		0.508		0.5	NA	0.2	6.3				

Site Level of Service (LOS) Method: Delay & v/c (HCM 6). Site LOS Method is specified in the Network Data dialog (Override Site Data tab).

Lane LOS values are based on average delay and v/c ratio (degree of saturation) per lane.

LOS F will result if v/c > 1 irrespective of lane delay value (does not apply for approaches and intersection).

Minor Road Approach LOS values are based on average delay for all lanes (v/c not used as specified in HCM 6).

NA (TWSC): Level of Service is not defined for major road approaches or the intersection as a whole for Two-Way Sign Control (HCM LOS rule).

Two-Way Sign Control Capacity Model: SIDRA Standard (HCM).

Delay Model: HCM Delay Formula (Stopline Delay: Geometric Delay is not included).

Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Gap.

Gap-Acceptance Capacity Formula: Traditional M1.

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

Approach Lane Flows (veh/h)									
South: New Road									
Mov. From S To Exit:	R2	Total	%HV		Deg. Satn	Lane Util.	Prob. SL	Ov. %	Ov. Lane No.
	E			Cap. veh/h	v/c	%	%		
Lane 1	10	10	5.0	322	0.030	100	NA	NA	
Approach	10	10	5.0		0.030				
East: South Liberty Parkway									
Mov. From E To Exit:	T1	R2	Total	%HV	Deg. Satn	Lane Util.	Prob. SL	Ov. %	Ov. Lane No.
	W	N			Cap. veh/h	v/c	%	%	

Lane 1	919	-	919	5.0	1810	0.508	100	NA	NA
Lane 2	828	77	906	5.0	1782	0.508	100	NA	NA
Approach	1748	77	1825	5.0		0.508			
North: New Road									
Mov. From N To Exit:	R2	Total	%HV		Cap. veh/h	Deg. Satn v/c	Lane Util. %	Prob. SL Ov. %	Ov. Lane No.
	W								
Lane 1	46	46	5.0		299	0.153	100	NA	NA
Approach	46	46	5.0			0.153			
West: South Liberty Parkway									
Mov. From W To Exit:	T1	R2	Total	%HV	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Prob. SL Ov. %	Ov. Lane No.
	E	S							
Lane 1	816	-	816	5.0	1810	0.451	100	NA	NA
Lane 2	780	30	810	5.0	1797	0.451	100	NA	NA
Approach	1596	30	1626	5.0		0.451			
Total %HV Deg.Satn (v/c)									
All Vehicles	3507	5.1		0.508					

Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

Merge Analysis												
	Exit Lane Number	Short Lane Length ft	Percent Opng in Lane % veh/h	Opposing Flow Rate pcu/h	Critical Gap sec	Follow-up Headway sec	Lane Flow Rate veh/h	Capacity veh/h	Deg. Satn v/c	Min. Delay sec	Merge Delay sec	
There are no Exit Short Lanes for Merge Analysis at this Site.												

Variable Demand Analysis				
	Initial Queued Demand veh	Residual Queued Demand veh	Time for Residual Demand to Clear sec	Duration of Oversatn sec
South: New Road				
Lane 1	0.0	0.0	0.0	0.0
East: South Liberty Parkway				
Lane 1	0.0	0.0	0.0	0.0
Lane 2	0.0	0.0	0.0	0.0
North: New Road				
Lane 1	0.0	0.0	0.0	0.0
West: South Liberty Parkway				
Lane 1	0.0	0.0	0.0	0.0
Lane 2	0.0	0.0	0.0	0.0

LANE SUMMARY

Site: 101 [Arsenal (Site Folder: High - PM Peak)]

Output produced by SIDRA INTERSECTION Version: 9.1.6.228

Network: N101 [PM High SLP (Network Folder: General)]

New Site
Site Category: (None)
Roundabout

Lane Use and Performance															
	Demand Flows		Arrival Flows		Cap.	Deg. Satn	Lane Util.	Aver. Delay	Level of Service	Aver. Queue	Back Of Queue Dist	Lane Config	Lane Length	Cap. Adj.	Prob. Block.
	[Total veh/h]	[HV %]	[Total veh/h]	[HV %]											
South: Arsenal															
Lane 1 ^d	249	5.0	249	5.0	337	0.738	100	38.8	LOS E	1.3	34.5	Full	1600	0.0	0.0
Approach	249	5.0	249	5.0		0.738		38.8	LOS E	1.3	34.5				
East: South Liberty Parkway															
Lane 1	933	5.0	933	5.0	1227	0.760	100	13.4	LOS B	4.7	122.3	Full	1800	0.0	0.0
Lane 2 ^d	941	5.0	941	5.0	1238	0.760	100	13.3	LOS B	4.7	122.6	Full	1800	0.0	0.0
Approach	1874	5.0	1874	5.0		0.760		13.4	LOS B	4.7	122.6				
West: South Liberty Parkway															
Lane 1	825	5.0	797	5.0	1174	0.679	100	12.0	LOS B	2.8	72.2	Full	1400	0.0	0.0
Lane 2 ^d	836	5.0	808	5.0	1189	0.679	100	11.9	LOS B	2.8	72.4	Full	1400	0.0	0.0
Approach	1661	5.0	1606	5.0		0.679		12.0	LOS B	2.8	72.4				
All Vehicles	3784	5.0	3728	5.1		0.760		14.5	LOS B	4.7	122.6				

Site Level of Service (LOS) Method: Delay & v/c (HCM 6). Site LOS Method is specified in the Network Data dialog (Override Site Data tab).

Roundabout LOS Method: Same as Sign Control.

Lane LOS values are based on average delay and v/c ratio (degree of saturation) per lane.

LOS F will result if v/c > 1 irrespective of lane delay value (does not apply for approaches and intersection).

Intersection and Approach LOS values are based on average delay for all lanes (v/c not used as specified in HCM 6).

Roundabout Capacity Model: SIDRA HCM.

Delay Model: HCM Delay Formula (Stopline Delay: Geometric Delay is not included).

Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Gap.

Gap-Acceptance Capacity Formula: Traditional M1.

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

^d Dominant lane on roundabout approach

Approach Lane Flows (veh/h)										
South: Arsenal										
Mov.	L2	R2	Total	%HV	Cap.	Deg. Satn	Lane Util.	Prob. SL	Ov. Lane	
From S To Exit:	W	E			veh/h	v/c	%	%	No.	
Lane 1	60	189	249	5.0	337	0.738	100	NA	NA	
Approach	60	189	249	5.0		0.738				
East: South Liberty Parkway										
Mov.	L2	T1	Total	%HV	Cap.	Deg. Satn	Lane Util.	Prob. SL	Ov. Lane	
From E To Exit:	S	W			veh/h	v/c	%	%	No.	
Lane 1	109	824	933	5.0	1227	0.760	100	NA	NA	
Lane 2	-	941	941	5.0	1238	0.760	100	NA	NA	
Approach	109	1765	1874	5.0		0.760				

West: South Liberty Parkway										
Mov. From W To Exit:	T1	R2	Total	%HV	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Prob. SL Ov. %	Ov. Lane No.	
Lane 1	797	-	797	5.0	1174	0.679	100	NA	NA	
Lane 2	761	47	808	5.0	1189	0.679	100	NA	NA	
Approach	1558	47	1606	5.0		0.679				
Total %HV Deg. Satn (v/c)										
All Vehicles	3728	5.1		0.760						

Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

Merge Analysis												
	Exit Lane Number	Short Lane Length ft	Percent Opng in Lane %	Opposing Flow Rate veh/h	Critical Gap sec	Follow-up Headway sec	Lane Capacity Flow Rate veh/h	Deg. Satn v/c	Min. Delay sec	Merge Delay sec		
There are no Exit Short Lanes for Merge Analysis at this Site.												

Variable Demand Analysis				
	Initial Queued Demand veh	Residual Queued Demand veh	Time for Residual Demand to Clear sec	Duration of Oversatn sec
South: Arsenal				
Lane 1	0.0	0.0	0.0	0.0
East: South Liberty Parkway				
Lane 1	0.0	0.0	0.0	0.0
Lane 2	0.0	0.0	0.0	0.0
West: South Liberty Parkway				
Lane 1	0.0	0.0	0.0	0.0
Lane 2	0.0	0.0	0.0	0.0

LANE SUMMARY

Site: 101 [East Roundabout (Site Folder: High - PM Peak)]

Output produced by SIDRA INTERSECTION Version: 9.1.6.228

Network: N101 [PM High SLP (Network Folder: General)]

New Site
Site Category: (None)
Roundabout

Lane Use and Performance															
	Demand Flows		Arrival Flows		Cap.	Deg. Satn	Lane Util.	Aver. Delay	Level of Service	Aver. Back Of Queue		Lane Config	Lane Length	Cap. Adj.	Prob. Block.
	[Total veh/h	HV %	[Total veh/h	HV %						[Veh	Dist]				
South: New Road															
Lane 1	247	5.0	247	5.0	294	0.841	100	56.8	LOS F	1.6	42.6	Full	1600	0.0	0.0
Lane 2 ^d	277	5.0	277	5.0	330	0.841	100	52.2	LOS F	1.7	43.6	Full	1600	0.0	0.0
Approach	524	5.0	524	5.0		0.841		54.4	LOS F	1.7	43.6				
East: South Liberty Parkway															
Lane 1	716	5.0	716	5.0	831	0.861	100	28.1	LOS D	6.1	158.2	Full	1900	0.0	0.0
Lane 2 ^d	726	5.0	726	5.0	843	0.861	100	28.0	LOS D	6.3	164.0	Full	1900	0.0	0.0
Approach	1442	5.0	1442	5.0		0.861		28.0	LOS D	6.3	164.0				
North: New Road															
Lane 1	223	5.0	223	5.0	329	0.678	81 ⁵	34.3	LOS D	1.1	28.6	Full	1600	0.0	0.0
Lane 2 ^d	335	5.0	335	5.0	400	0.837	100	44.8	LOS E	1.9	48.7	Full	1600	0.0	0.0
Approach	558	5.0	558	5.0		0.837		40.6	LOS E	1.9	48.7				
West: South Liberty Parkway															
Lane 1	893	5.0	867	5.0	905	0.957	100	39.6	LOS E	12.8	333.6	Full	1800	0.0	0.0
Lane 2 ^d	908	5.0	881	5.0	920	0.957	100	39.4	LOS E	13.1	340.7	Full	1800	0.0	0.0
Approach	1801	5.0	1747	5.0		0.957		39.5	LOS E	13.1	340.7				
All Vehicles	4325	5.0	4271	5.1		0.957		37.6	LOS E	13.1	340.7				

Site Level of Service (LOS) Method: Delay & v/c (HCM 6). Site LOS Method is specified in the Network Data dialog (Override Site Data tab).

Roundabout LOS Method: Same as Sign Control.

Lane LOS values are based on average delay and v/c ratio (degree of saturation) per lane.

LOS F will result if v/c > 1 irrespective of lane delay value (does not apply for approaches and intersection).

Intersection and Approach LOS values are based on average delay for all lanes (v/c not used as specified in HCM 6).

Roundabout Capacity Model: SIDRA HCM.

Delay Model: HCM Delay Formula (Stopline Delay: Geometric Delay is not included).

Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Gap.

Gap-Acceptance Capacity Formula: Traditional M1.

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

⁵ Lane under-utilisation found by the program

^d Dominant lane on roundabout approach

Approach Lane Flows (veh/h)										
South: New Road										
Mov. From S To Exit:	L2	R2	Total	%HV	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Prob. SL %	Ov. Lane No.	
	W	E								
Lane 1	247	-	247	5.0	294	0.841	100	NA	NA	
Lane 2	67	210	277	5.0	330	0.841	100	NA	NA	
Approach	314	210	524	5.0		0.841				

East: South Liberty Parkway										
Mov. From E To Exit:	L2	T1	R2	Total	%HV	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Prob. SL Ov. %	Ov. Lane No.
Lane 1	113	603	-	716	5.0	831	0.861	100	NA	NA
Lane 2	-	622	104	726	5.0	843	0.861	100	NA	NA
Approach	113	1225	104	1442	5.0		0.861			
North: New Road										
Mov. From N To Exit:	L2	R2	Total	%HV	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Prob. SL Ov. %	Ov. Lane No.	
Lane 1	223	-	223	5.0	329	0.678	81 ⁵	NA	NA	
Lane 2	-	335	335	5.0	400	0.837	100	NA	NA	
Approach	223	335	558	5.0		0.837				
West: South Liberty Parkway										
Mov. From W To Exit:	L2	T1	R2	Total	%HV	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Prob. SL Ov. %	Ov. Lane No.
Lane 1	153	714	-	867	5.0	905	0.957	100	NA	NA
Lane 2	-	715	166	881	5.0	920	0.957	100	NA	NA
Approach	153	1429	166	1747	5.0		0.957			
Total %HV Deg. Satn (v/c)										
All Vehicles	4271	5.1		0.957						

Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

5 Lane under-utilisation found by the program

Merge Analysis												
Exit Lane Number	Short Lane Length ft	Percent Opng in Lane %	Opposing Flow Rate % veh/h	Critical Gap pcu/h	Follow-up Headway sec	Lane Capacity Flow Rate veh/h	Deg. Satn v/c	Min. Delay sec	Merge Delay sec			
There are no Exit Short Lanes for Merge Analysis at this Site.												

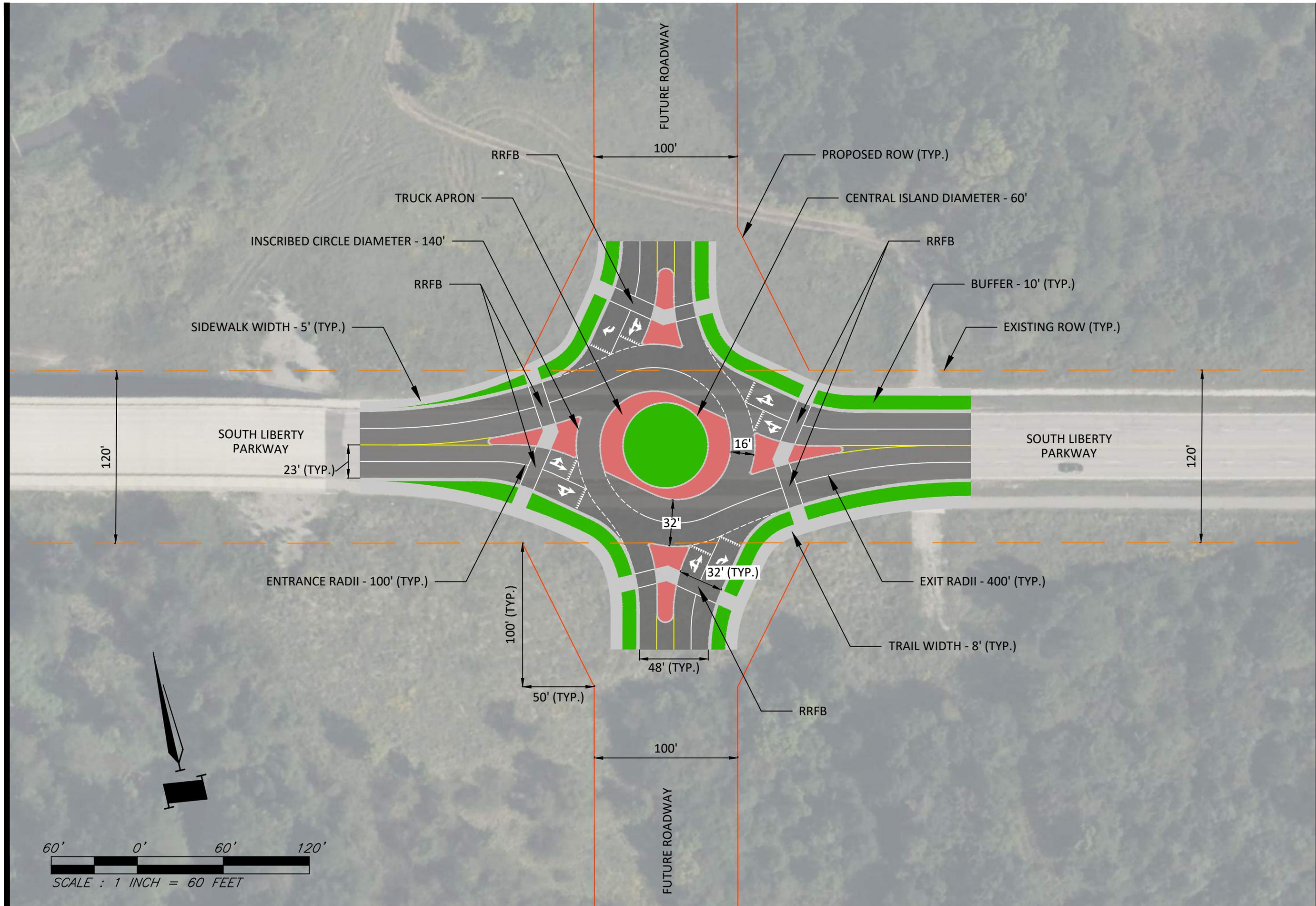
Variable Demand Analysis				
	Initial Queued Demand veh	Residual Queued Demand veh	Time for Residual Demand to Clear sec	Duration of Oversatn sec
South: New Road				
Lane 1	0.0	0.0	0.0	0.0
Lane 2	0.0	0.0	0.0	0.0
East: South Liberty Parkway				
Lane 1	0.0	0.0	0.0	0.0
Lane 2	0.0	0.0	0.0	0.0
North: New Road				
Lane 1	0.0	0.0	0.0	0.0
Lane 2	0.0	0.0	0.0	0.0
West: South Liberty Parkway				
Lane 1	0.0	0.0	0.0	0.0
Lane 2	0.0	0.0	0.0	0.0

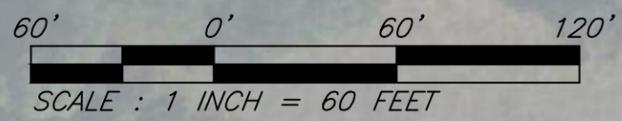
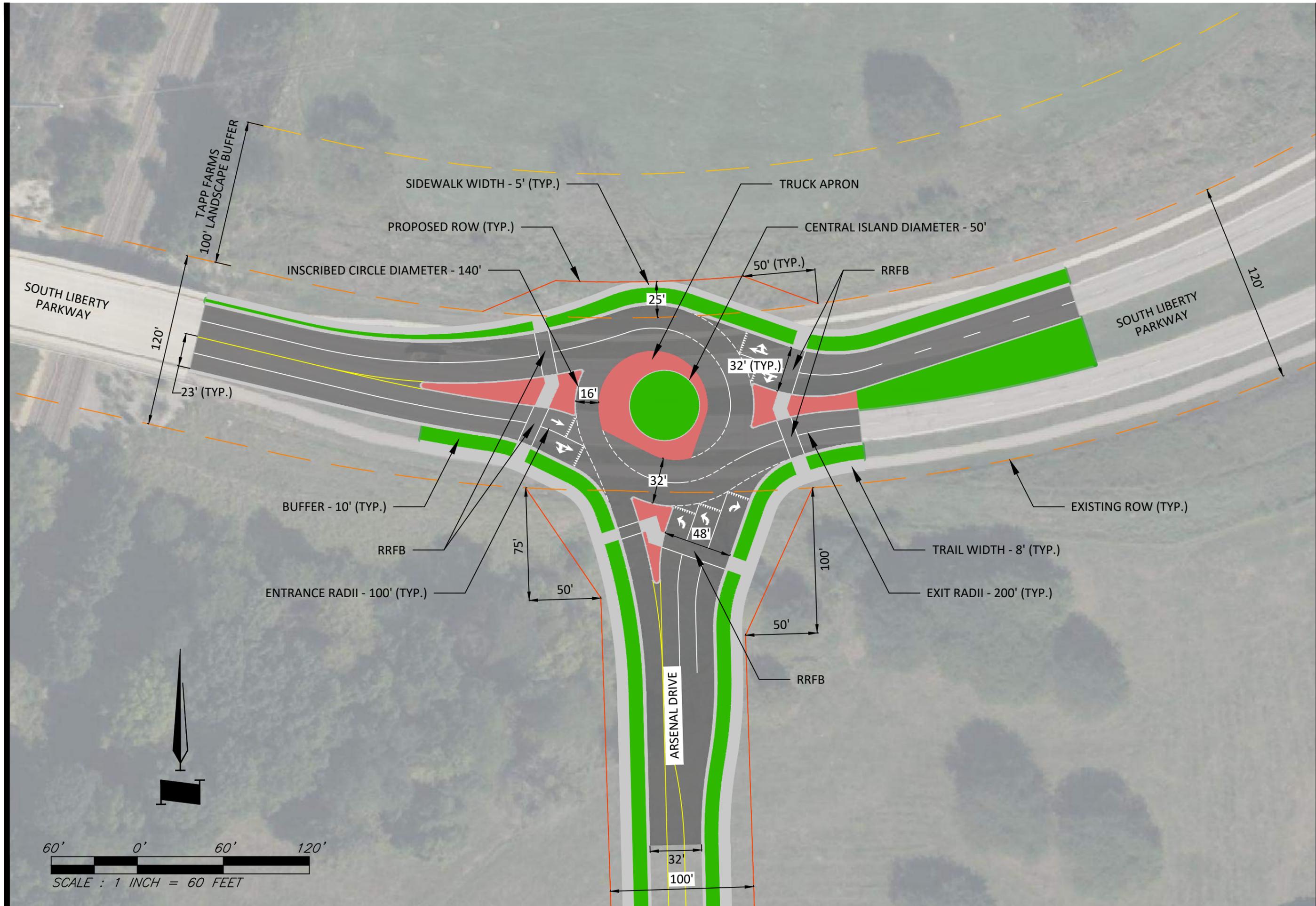
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Project: G:\16652\Analysis\Traffic\Synchro-Sidra\Scenario3-2.sip9

APPENDIX E
CONCEPTUAL ROUNDABOUT
LAYOUTS AND TYPICAL SECTIONS



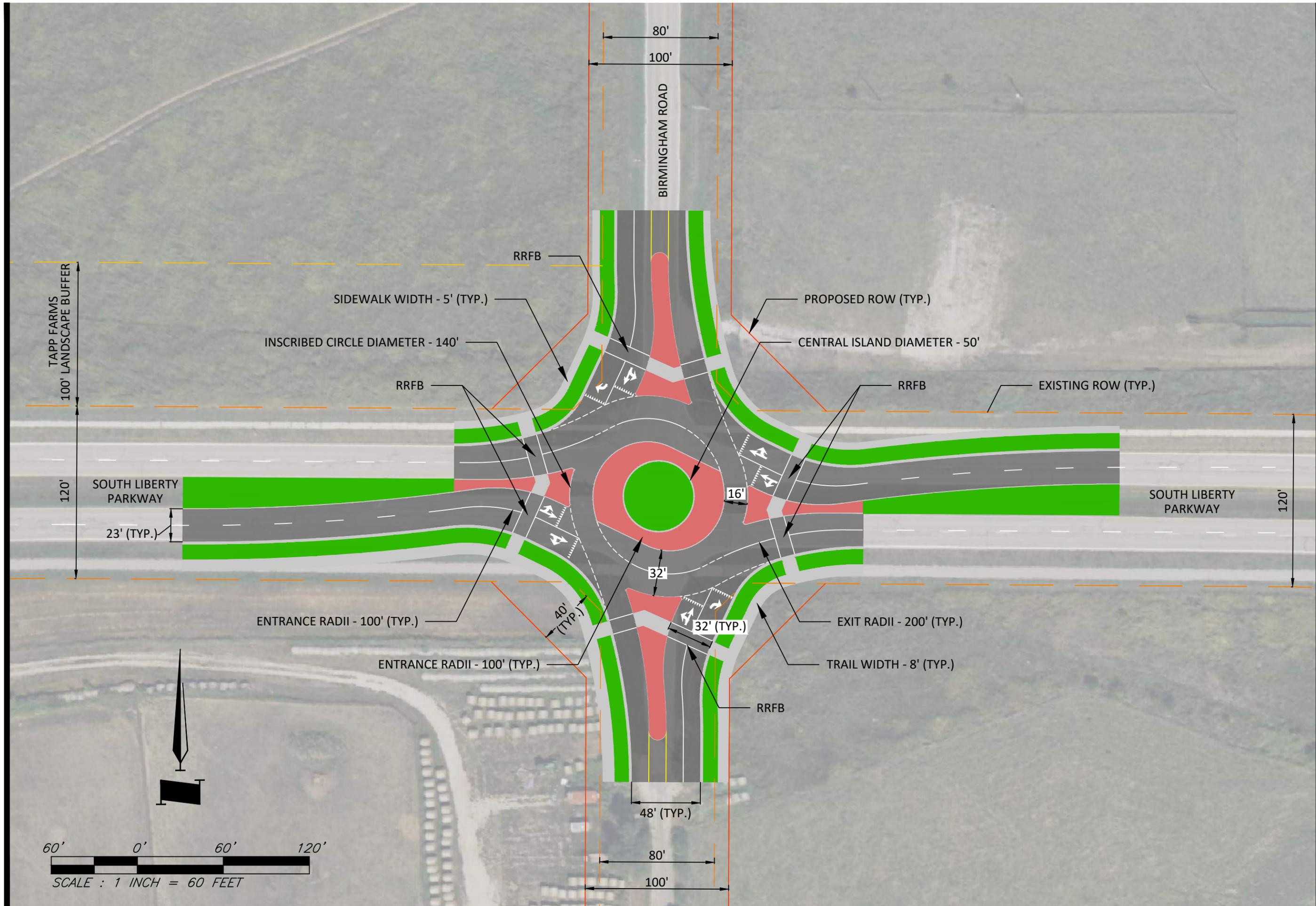


SOUTH LIBERTY PARKWAY
CONCEPTUAL ROUNDABOUT LAYOUT
WEST ARSENAL

PROJECT NUMBER
16652

DATE
07/31/2025

FIGURE
B

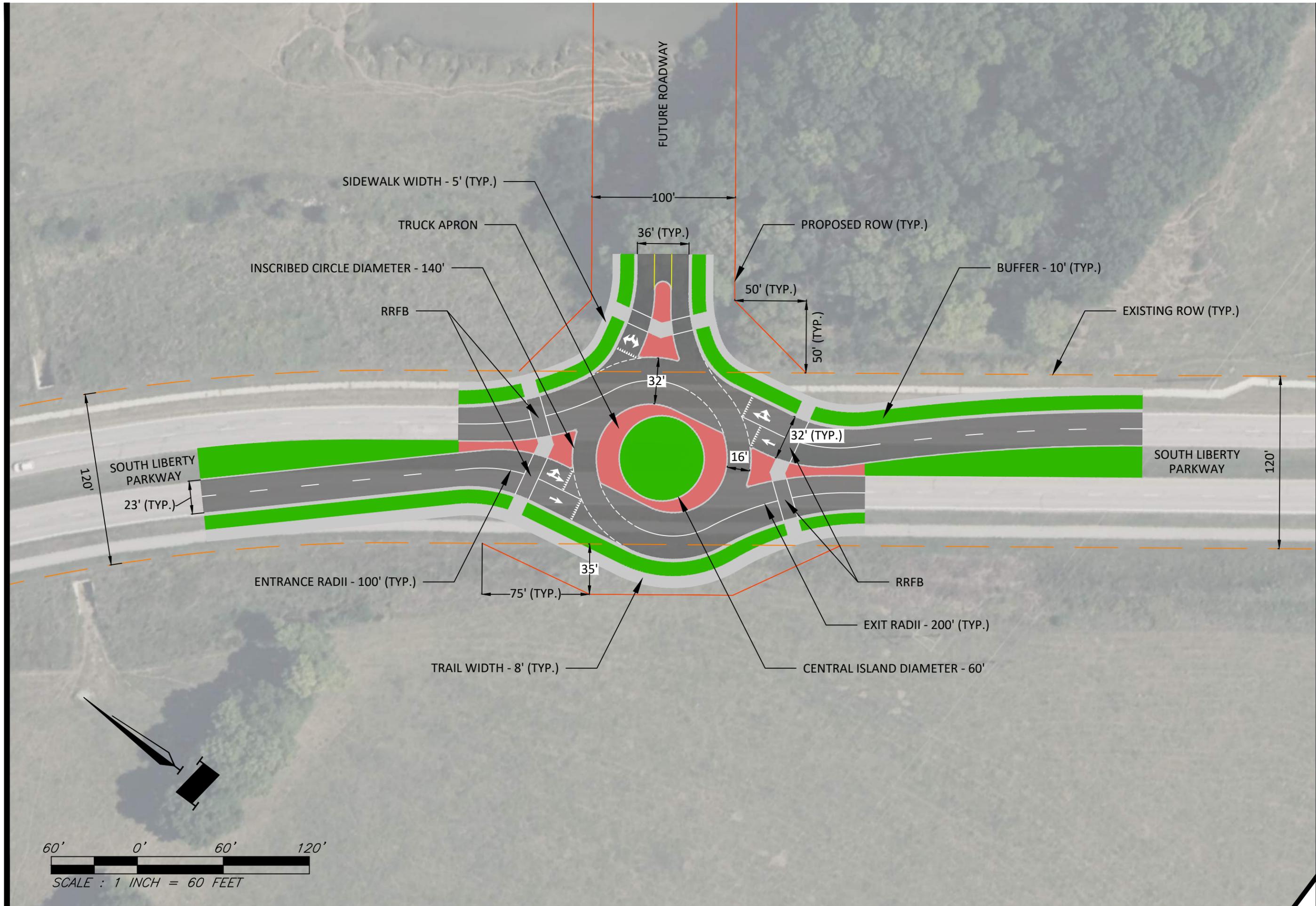


SOUTH LIBERTY PARKWAY
CONCEPTUAL ROUNDABOUT LAYOUT
BIRMINGHAM ROAD

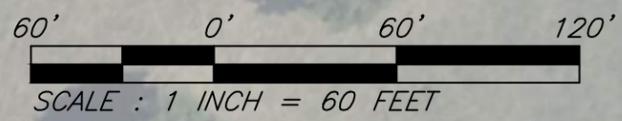
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16652

DATE
07/31/2025

FIGURE
C



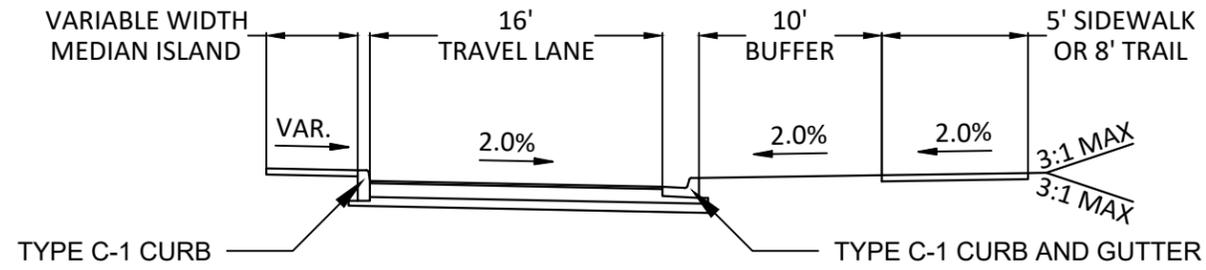
SOUTH LIBERTY PARKWAY
CONCEPTUAL ROUNDABOUT LAYOUT
CENTRAL



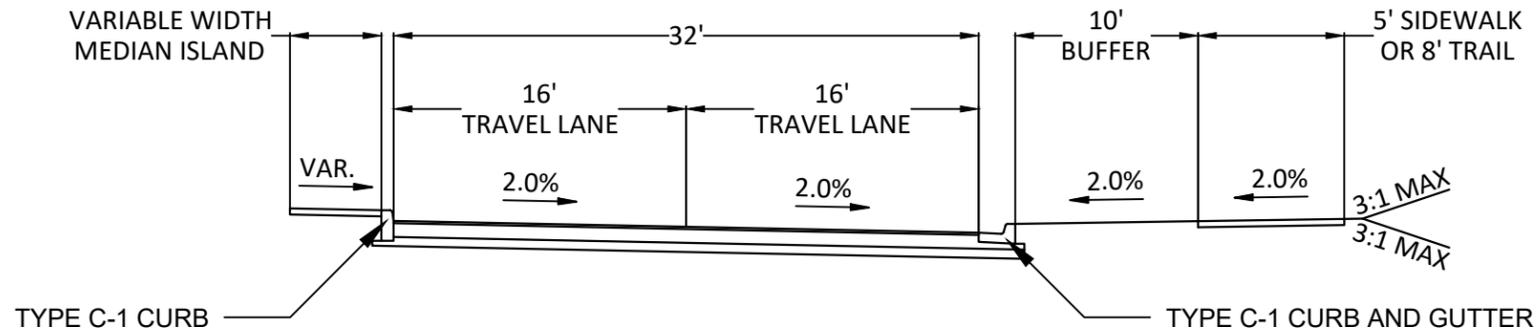
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DATE
07/31/2025

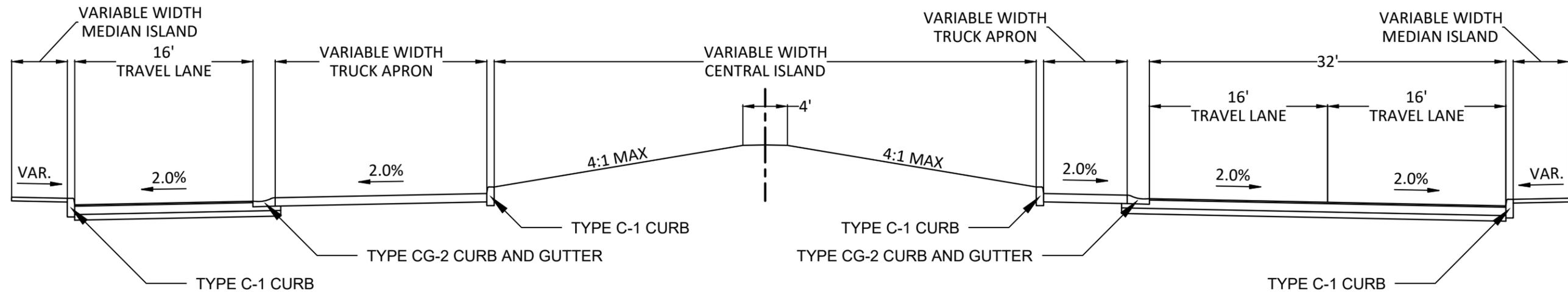
FIGURE
D



TYPICAL SECTION
SINGLE-LANE APPROACH



TYPICAL SECTION
MULTI-LANE APPROACH



TYPICAL SECTION
ROUNDBOUT