FINAL STORM WATER MANAGEMENT STUDY

MCPL - COLBERN ROAD BRANCH REMODEL

1000 NORTHEAST COLBERN ROAD
LEE'S SUMMIT, MISSOURI

PREPARED FOR
MID-CONTINENT PUBLIC LIBRARY

PREPARED BY
OLSSON, INC.
OVERLAND PARK, KANSAS

FEBRUARY, 2020

OLSSON PROJECT NO. B18-0330.182

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GENERAL INFORMATION

This Stormwater Management Study is being submitted on behalf of the Mid-Continent Public Library (MCPL) for the proposed remodel and expansion of the existing Colbern Road Branch Library facility located at 1000 Northeast Colbern Road in Lee's Summit, Missouri. This study provides a more detailed analysis of the previously submitted and approved Colbern Road Branch Remodel Preliminary Stormwater Management Study (December 2019). This study maintains the methodology and conclusions of the previous study. The only major change is the basin elevation has been raised to accommodate the design elevations of the enclosed storm system.

Project Location and Description

The site is located on Lot 1 of the Rice Acres Plat in the Northeast ¼ of Section 29, Township 48 North, Range 31 West, in Jackson County, Lee's Summit, Missouri. Currently the site is 2.9 acres, however, the MCPL has acquired an additional 100' of the unplatted property to the east for a total of 4.0 acres (See Exhibit 1 – Appendix A).

Retail businesses surround the project to the south, while undeveloped properties are located to the west, north, and east. The proposed remodeled plans anticipate on demolishing the existing 18,000 sf. library facility and constructing a new library facility that will be approximately 34,000 sf. The improvements will consists of the expanding the existing parking lot, developing landscaping, updating grading, utilities.

The entirety of the existing and acquired sites are located outside of the 100-Year FEMA Floodplain (See Appendix B).

Study Purpose

The purpose of this study is to provide a Stormwater Management Plan for the proposed development in accordance with the American Public Works Association (APWA) *Standard Specifications and Design Criteria* Section 5600 "Storm Drainage Systems and Facilities", APWA Manual of Best Management Practices (BMP) for Stormwater Quality, and applicable City of Lee's Summit, Missouri guidelines.

Soils Descriptions

Soil classifications were obtained from the Natural Resource Conservation Service's website by utilizing the Web Soil Survey feature. The site soil composition and classification are listed below:

10128 – Sharpsburg-Urban Land Complex, 2 to 5 percent slopes – HSG Type D.

*HSG – Hydrologic Soils Group

See Soils Map in Appendix B.

METHODOLOGY

General Criteria and References

Analytical and design criteria conform to those of Division V - *Section 5600 – "Storm Drainage Systems and Facilities*" of the Kansas City Metropolitan Chapter of the American Public Works Association's *"Standard Specifications and Design Criteria"*. Based on these criteria's, Post-development discharge rates for the 2, 10, and 100-year storm events will be limited to provisions in section 5608.4-C1 *Performance Criteria – "Comprehensive Control"*. Post-development discharge rates are limited to 0.5 cfs per acre for 2-Year, 2.0 cfs per acre for 10-year, and 3.0 cfs per acre for 100-year storm events. Pre and post-development flows from the site are shown below and were calculated using HEC-HMS for the 2, 10 and 100-year storm events. Existing and proposed hydrographs were calculated using the 24-hour SCS Type II rainfall distribution. Existing times of concentration were determined using Inlet Time and Travel Time equations found in Section 5602.7 of APWA Section 5600. A minimum inlet time of five minutes was utilized when calculating the times that were under five minutes. This method was also applied during the calculation of the proposed times of concentration.

HYDROLOGIC/HYDRAULIC ANALYSES

Existing Conditions Analysis

The existing site is currently functioning as a branch for MCPL. The acquired property to the east is undeveloped, along with the properties to the west and north. The property is also bounded by retail businesses to the south.

Current runoff for the existing library is collected by roof drains and flumes in the parking lot that directs the water to an existing detention basin on the east side of the site. The roof drains are piped to the basin as well. The current drainage patterns consist of the paved parking area that drains to southeastern flumes, that then drain to a swale, that directs the flow to the basin. The basin is connected to an existing public storm line (existing Outfall "A") on the north side of Colbern Road that drains to the east to unnamed tributary (See Exhibit 2 – Appendix A).

The existing basin is not clearly defined, and the outflow structure is in disrepair. It seems to still function, but no clear indication of existing storage volume or outflow.

There is an existing swale on the western edge of the property as well. This swale diverts runoff from the undeveloped property west of the site to north along the existing curb. After this, the swale turns to the northeast. This is where the runoff flows to the neighboring undeveloped property.

With the comprehensive control method is being used for drainage design, an existing curve number analysis is not required for the site. For the purpose of these calculations, the analysis will treat the site as if the existing building and parking were not there.

Proposed Conditions Analysis

A new 34,000 SF library will be constructed on the site. The parking area will also be increased to accommodate the larger building. The Stormwater Management Plan noted as Exhibit 3 in Appendix A shows the proposed improvements. The location of the building

and the parking area will essentially remain in the same configuration. Along with this, the site drainage patterns will remain the same as existing. The additional site runoff will be captured by an enclosed storm sewer system. The increase in impervious area will increase runoff from the site and to mitigate the increase in runoff, the following strategy will be implemented.

Outfall A – All impervious areas for site will drain to the enclosed storm system and be directed into a new detention basin and water treatment facility. Due to the site design, the drainage area for this outfall will increase. However, the detention facility is designed to mitigate the increased runoff to this outfall. The site areas being directed to the basin includes the roof drains, the parking area, and the detention basin itself (approximately 3.2 acres). A control structure located within the basin will limit the 2, 10, and 100-year storm events to the comprehensive control levels.

Table 1: Post-Development Curve Number Analysis

Sub-Area	Area (AC)	Soil Group	Curve Number
Pavement, Buildings, Impervious	2.4	D	98
Turf (Good)	0.9	D	80

A peak flow analysis of the post-development site was conducted using HEC-HMS, the composite curve number, and rainfall and distribution information acquired from APWA section 5600. Post-development peak flows to the outfall are summarized in the Table 2. Detailed reports from HEC-HMS are available in Appendix D

Table 2: Proposed Peak Flows

Sub-Area / Outfall	Tributary Area (acres)	Q (2-Year Storm) (cfs)	Q (10-Year Storm) (cfs)	Q (100-Year Storm) (cfs)
Outfall A	3.4	9.2	20.0	29.4

In order to maintain the existing flow patterns on the west side of the property, the existing swale will be extended north to the edge of the proposed service area. The extended

swale will continue to divert the off-site runoff from the west to the undeveloped property to the north of the site. It is assumed that when the future public road is constructed on the west side of the site, runoff from the off-site area will be collected in a public storm system.

Stormwater Detention Requirements

As stated previously, a new detention pond will be constructed to mitigate the increase in flow due to the increase in impervious area. The detention basin will be located on the east side of the site and will collect runoff from 3.2 acres of the 4.0 acre property. This includes most of the impervious areas through a series of inlets, yard drains, roof drains, and underground pipes. A control structure will be located at the outlet of the basin. An orifice/weir plate in the control structure will limit outflow in the 2, 10, and 100 year storms.

The drainage from the southeast corner of the parking lot (0.2 ac) will collected in a curb inlet. This runoff will not be detained. The inlet is connected downstream of the control structure by the outlet pipe from the basin. It will combine with the outflow from the basin. The control structure was designed to over-detain the runoff collected in the basin. Therefore, the combined flow will not exceed the allowable release rate. HEC-HMS was used to route the storms as the enter the underground system. Hydrographs for the combined flows of the detained and undetained areas are shown in Appendix D.

To meet water treatment requirements, the water quality volume (WQv) will be controlled by a series of 1” orifices at the bottom of the orifice plate. The conduit will release the water quality volume over a 40-hour period to allow pollutants to settle out of this precipitation event.

Two areas from the 4.0-acre property will not be detained. The entrance drive and median on Colbern Road flow to the public storm system in the road. This drainage pattern is essentially unchanged in the pre and post construction phases. There is also an area on the north and eastern edge of the property that will not be detained. This is a pervious, vegetated area that will have no impact on the neighboring property.

An orifice will be located above the WQv surface elevation to control the 2 and 10-year storms. Both storms have been analyzed through the control structure and will release below the pre-existing storm events. The 100-year storm event will flow into a weir placed place at a higher elevation in the control structure. The dam will have an emergency spillway to control the 100-year overflow.

Table 3 provides the water surface elevations (WSE's) and peak flows for the proposed detention basin.

Table 3: Detention Basin, WSE's and Peak Flows

Description	Detention Basin
Bottom of Basin	960.5
Total Storage Volume	1.2 ac-ft
Top of Dam Elevation	967.5
WQv Orifice (IE Elevation, Pipe Size)	960.75, 4 – 1" (ft, # hole - diam)
Water Quality Volume WSE, Storage, Peak Outflow	962.4, 0.2, 0.08 (ft, ac-ft, cfs)
2-year & 10-Year Orifice (IE Elevation, Pipe Size)	962.5, 1-8" (ft, orifice size)
10–Year Storm WSE, Storage, Peak Outflow	964.7, 0.6, 4.4 (ft, ac-ft, cfs)
100–Year Storm Weir (Elevation, Length)	964.2, 0.9 (ft, lf)
100–Year Storm WSE, Storage, Peak Outflow	965.7, 0.8, 9.3 (ft, ac-ft, cfs)

Table 4 shows the allowable peak flow for the site based on the Comprehensive Control Method.

Table 4: Allowable Peak Flows Based on Comprehensive Control

Sub-Area / Outfall	Tributary Area (acres)	Q (2-Year Storm) (cfs)	Q (10-Year Storm) (cfs)	Q (100-Year Storm) (cfs)
Outfall A	3.4	1.7	6.8	10.1

Table 5 shows the peak flow for the site post-construction. Note that the peak flows for post-construction construction condition are at or below the allowable peak flows shown in Table 4.

Table 5: Post Construction Peak Flows

Sub-Area / Outfall	Tributary Area (acres)	Q (2-Year Storm) (cfs)	Q (10-Year Storm) (cfs)	Q (100-Year Storm) (cfs)
Detained	3.2	1.4	4.4	9.3
Undetained	0.2	0.6	1.4	2.0
Outfall A	3.4	1.6	4.9	10.1

STORMWATER TREATMENT REQUIREMENTS

As stated previously, the proposed detention is designed to act an extended dry bottom detention facility will be used to treat stormwater per MARC water quality standards. The orifice plate for the basin will be sized to release the water quality volume (1.37”) over a 40-hour period to allow pollutants to settle from runoff before entering the public stormwater system. The maximum storage for the water quality event in the basin will be 0.1 acre-ft reaching a peak water surface of elevation 962.4 feet.

CLEAN WATER ACT SECTION 404 PERMITTING REQUIREMENTS

No jurisdictional Waters of the United States have been identified on the study site. Therefore, a Section 404 permit is not required.

FEMA/DWR PERMIT REQUIREMENTS

No FEMA permitting or submittals will be required on this site because there are no FEMA delineated floodplains on the site. A copy of the FIRM map for this area has been included in Appendix B.

CONCLUSIONS AND RECOMMENDATIONS

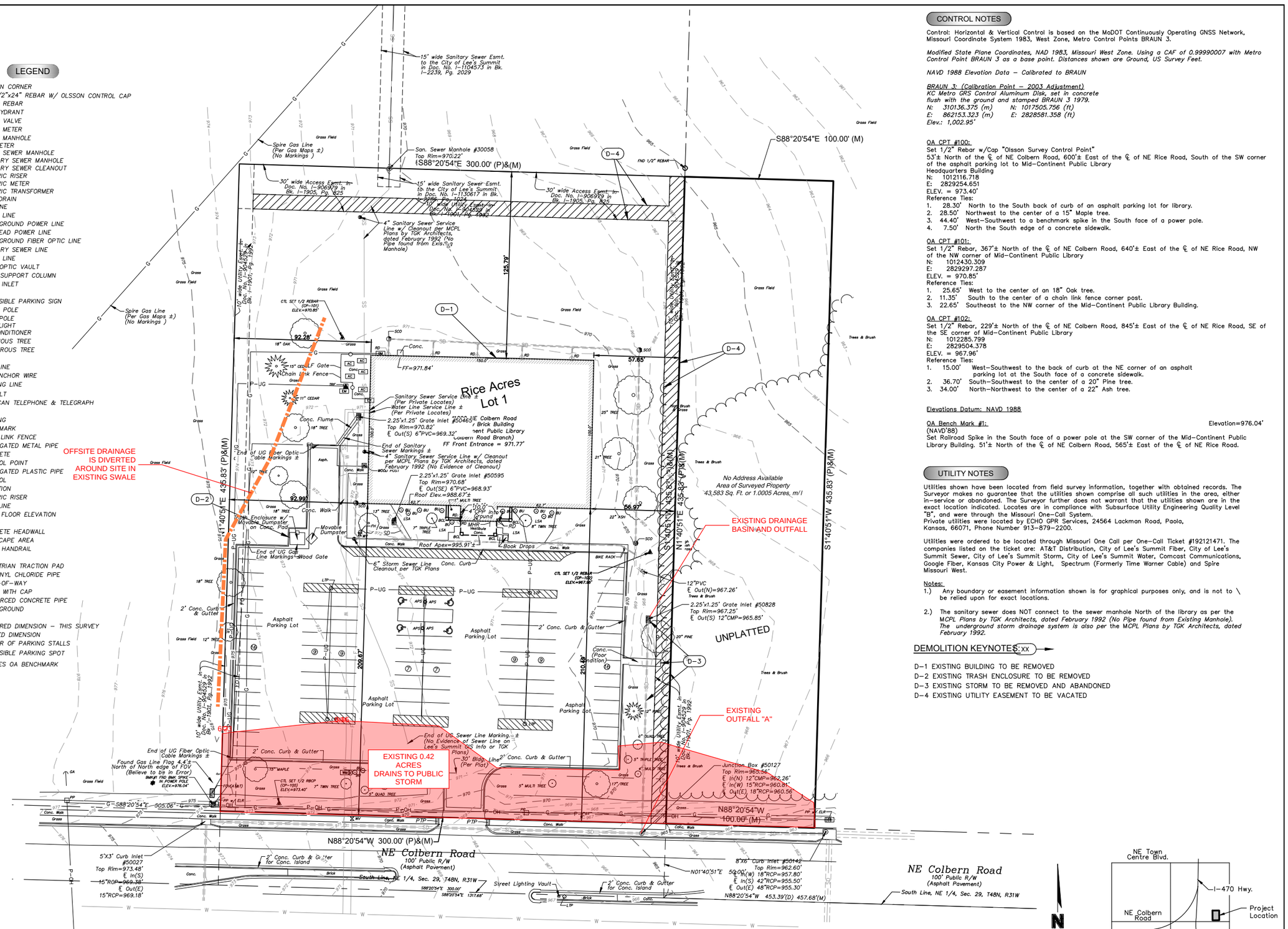
As outlined in the preceding report, increased runoff rates in the post-development conditions are mitigated by the detention basins. Drainage patterns on the site remain relatively unchanged. Lastly, an extended dry detention basin has been designed to maintain or improve the storm water quality. Based on these facts and other information provided herein, we request approval of this stormwater study.

Appendix A

Map Exhibits

LEGEND

- SECTION CORNER
- SET 1/2"x24" REBAR W/ OLSSON CONTROL CAP
- FOUND REBAR
- FH FIRE HYDRANT
- WV WATER VALVE
- WM WATER METER
- W WATER MANHOLE
- GM GAS METER
- D STORM SEWER MANHOLE
- S SANITARY SEWER MANHOLE
- SCO SANITARY SEWER CLEANOUT
- ER ELECTRIC RISER
- EM ELECTRIC METER
- TRF ELECTRIC TRANSFORMER
- ORD ROOF DRAIN
- —G— GAS LINE
- —W— WATER LINE
- —P-UG— UNDERGROUND POWER LINE
- —P-OH— OVERHEAD POWER LINE
- — FO — UNDERGROUND FIBER OPTIC LINE
- — SS — SANITARY SEWER LINE
- — SD — STORM LINE
- FOV FIBER OPTIC VAULT
- BCL BRICK SUPPORT COLUMN
- GRATE INLET
- SIGN
- APS ACCESSIBLE PARKING SIGN
- PP POWER POLE
- LTP LIGHT POLE
- YL YARD LIGHT
- AC AIR CONDITIONER
- DECIDUOUS TREE
- CONIFEROUS TREE
- BU BUSH
- TREE LINE
- GA GUY ANCHOR WIRE
- BUILDING LINE
- ASPH. ASPHALT
- AT&T AMERICAN TELEPHONE & TELEGRAPH
- BK. BOOK
- BLDG. BUILDING
- BMK BENCHMARK
- CLF CHAIN LINK FENCE
- CMP CORRUGATED METAL PIPE
- CONC. CONCRETE
- CP CONTROL POINT
- CPP CORRUGATED PLASTIC PIPE
- CTL CONTROL
- ELEV. ELEVATION
- ELR ELECTRIC RISER
- ℄ FLOW LINE
- FF FINISH FLOOR ELEVATION
- FND FOUND
- HDWL CONCRETE HEADWALL
- LSA LANDSCAPE AREA
- MHR METAL HANDRAIL
- PG. PAGE
- PTP PEDESTRIAN TRACTION PAD
- PVC POLYVINYL CHLORIDE PIPE
- R/W RIGHT-OF-WAY
- RBCP REBAR WITH CAP
- RCP REINFORCED CONCRETE PIPE
- UG UNDERGROUND
- W/ WITH
- (M) MEASURED DIMENSION - THIS SURVEY
- (P) PLATTED DIMENSION
- 9 NUMBER OF PARKING STALLS
- ACCESSIBLE PARKING SPOT
- ✱ DENOTES OA BENCHMARK



CONTROL NOTES

Control: Horizontal & Vertical Control is based on the MoDOT Continuously Operating GNSS Network, Missouri Coordinate System 1983, West Zone, Metro Control Points BRAUN 3.

Modified State Plane Coordinates, NAD 1983, Missouri West Zone. Using a CAF of 0.99990007 with Metro Control Point BRAUN 3 as a base point. Distances shown are Ground, US Survey Feet.

NAVD 1988 Elevation Data – Calibrated to BRAUN

BRAUN 3: (Calibration Point – 2003 Adjustment)
KC Metro GRS Control Aluminum Disk, set in concrete flush with the ground and stamped BRAUN 3 1979.
N: 310136.375 (m) N: 1017505.756 (ft)
E: 862153.323 (m) E: 2828581.358 (ft)
Elev.: 1,002.95'

QA CPT #100:
Set 1/2" Rebar w/Cap "Olsson Survey Control Point"
53'± North of the ℄ of NE Colbern Road, 600'± East of the ℄ of NE Rice Road, South of the SW corner of the asphalt parking lot to Mid-Continent Public Library Headquarters Building
N: 1012116.718
E: 2829254.651
ELEV. = 973.40'
Reference Ties:
1. 28.30' North to the South back of curb of an asphalt parking lot for library.
2. 28.50' Northwest to the center of a 15" Maple tree.
3. 44.40' West-Southwest to a benchmark spike in the South face of a power pole.
4. 7.50' North the South edge of a concrete sidewalk.

QA CPT #101:
Set 1/2" Rebar, 367'± North of the ℄ of NE Colbern Road, 640'± East of the ℄ of NE Rice Road, NW of the NW corner of Mid-Continent Public Library
N: 1012430.309
E: 2829297.287
ELEV. = 970.85'
Reference Ties:
1. 25.65' West to the center of an 18" Oak tree.
2. 11.35' South to the center of a chain link fence corner post.
3. 22.65' Southeast to the NW corner of the Mid-Continent Public Library Building.

QA CPT #102:
Set 1/2" Rebar, 229'± North of the ℄ of NE Colbern Road, 845'± East of the ℄ of NE Rice Road, SE of the SE corner of Mid-Continent Public Library
N: 1012285.799
E: 2829504.378
ELEV. = 967.96'
Reference Ties:
1. 15.00' West-Southwest to the back of curb at the NE corner of an asphalt parking lot at the South face of a concrete sidewalk.
2. 36.70' South-Southwest to the center of a 20" Pine tree.
3. 34.00' North-Northwest to the center of a 22" Ash tree.

Elevations Datum: NAVD 1988

QA Bench Mark #1: Elevation=976.04'
(NAVD'88)
Set Railroad Spike in the South face of a power pole at the SW corner of the Mid-Continent Public Library Building. 51'± North of the ℄ of NE Colbern Road, 565'± East of the ℄ of NE Rice Road.

UTILITY NOTES

Utilities shown have been located from field survey information, together with obtained records. The Surveyor makes no guarantee that the utilities shown comprise all such utilities in the area, either in-service or abandoned. The Surveyor further does not warrant that the utilities shown are in the exact location indicated. Locates are in compliance with Subsurface Utility Engineering Quality Level "B", and were through the Missouri One-Call System.
Private utilities were located by ECHO GPR Services, 24564 Lackman Road, Paola, Kansas, 66071, Phone Number 913-879-2200.

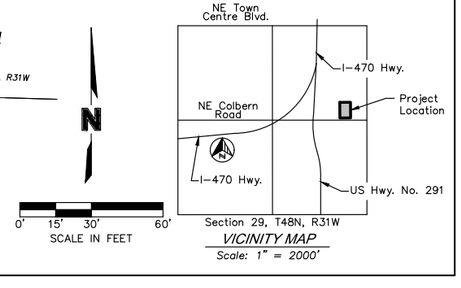
Utilities were ordered to be located through Missouri One Call per One-Call Ticket #192121471. The companies listed on the ticket are: AT&T Distribution, City of Lee's Summit Fiber, City of Lee's Summit Sewer, City of Lee's Summit Storm, City of Lee's Summit Water, Comcast Communications, Google Fiber, Kansas City Power & Light, Spectrum (Formerly Time Warner Cable) and Spire Missouri West.

Notes:
1.) Any boundary or easement information shown is for graphical purposes only, and is not to be relied upon for exact locations.

2.) The sanitary sewer does NOT connect to the sewer manhole North of the library as per the *MCPL Plans by TGK Architects, dated February 1992 (No Pipe found from Existing Manhole). The underground storm drainage system is also per the MCPL Plans by TGK Architects, dated February 1992.*

DEMOLITION KEYNOTES: XX

D-1 EXISTING BUILDING TO BE REMOVED
D-2 EXISTING TRASH ENCLOSURE TO BE REMOVED
D-3 EXISTING STORM TO BE REMOVED AND ABANDONED
D-4 EXISTING UTILITY EASEMENT TO BE VACATED



VICINITY MAP
Scale: 1" = 2000'

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SPECIAL NOTICES

Mid-Continent Public Library
PRELIMINARY DEVELOPMENT PLANS FOR
COLBERN ROAD BRANCH
1000 N.E. COLBERN ROAD
LEE'S SUMMIT, MO 64086
JACKSON COUNTY

PACKAGE 10

Engineer of Record

PRELIMINARY DEVELOPMENT PLAN

NOT FOR CONSTRUCTION

12.10.19

Terry M Parsons, Engineer MO PE-2018010505

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Revision No.	Description	Date

Project No.	Date	Drawn
B18-0330	09-18-18	KDP

Drawing No.

C1
EXISTING CONDITIONS

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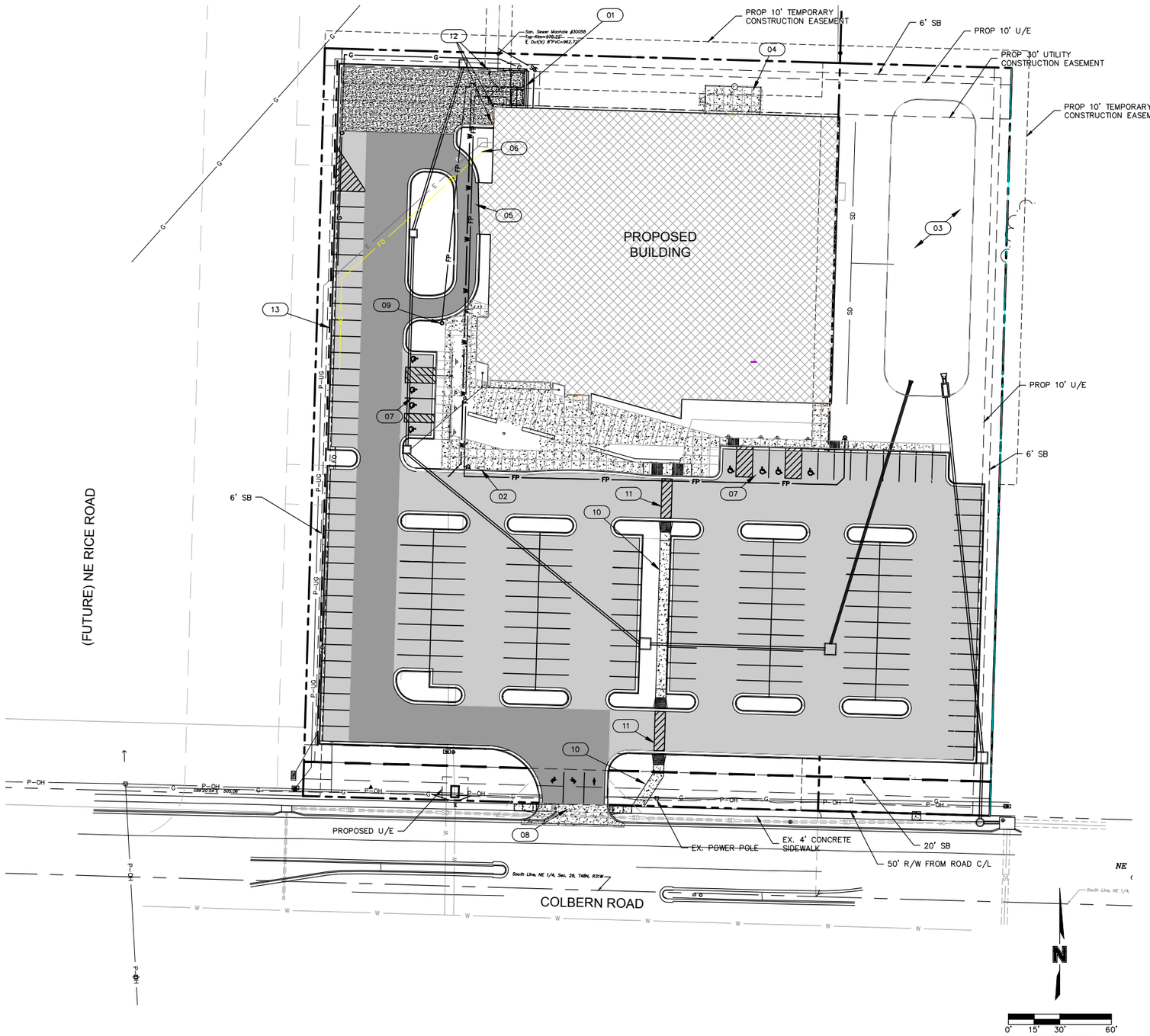

SITE DATA			
ZONING & SITE AREA			
PROPOSED USE:	PUBLIC LIBRARY		
	SITE AREA		ZONING
LOT 2 (AS DECRIBED):	4.00 ACRES (174,237 SF)		CP-2
IMPERVIOUS:	2.58 ACRES (112,384 SF) (64%)		
PERVIOUS:	1.42 ACRES (61,855 SF) (36%)		
FAR (0.55 MAX):	0.15		
BUILDING AREA			
BUILDING TYPE	# STORIES	SQUARE FOOTAGE	
BUILDING	1	34,030 SF	
PARKING			
USE	REQUIRED	PROVIDED	
LIBRARY	4 PER 1000 SF = 136	163	
ADA	4 (PER CITY TABLE)	8	
TOTAL	136	171 (INCLUDING ADA)	

NOTE:
ACCORDING TO MDNR STATE OIL & GAS COUNSEL THERE ARE NO OIL AND GAS WELLS LOCATED WITHIN OR ADJACENT TO THE PROPERTY.

THERE ARE NO FEMA DELINEATED FLOODPLAINS ON THE PROPERTY.

LEGEND

- PROPERTY LINES
- RIGHT-OF-WAY LINES
- LOT LINES
- ROAD CENTERLINE
- EASEMENT LINES
- SETBACK LINES
- EXISTING GRADE CONTOURS
- PROPOSED GRADE CONTOURS
- OVERHEAD ELECTRIC
- UNDERGROUND ELECTRIC
- UNDERGROUND TELEPHONE
- UNDERGROUND FIBER OPTIC
- GAS LINE
- WATER LINE
- FIRE PROTECTION LINE
- STORM SEWER LINE
- SANITARY SEWER LINE
- ACCESSIBLE SIDEWALK RAMP
- CONCRETE CURB & GUTTER TYPE "B" RE: DETAILS
- CONCRETE CURB & GUTTER TYPE "B-DRY" RE: DETAILS
- PROPOSED CONCRETE SIDEWALK
- PROPOSED HEAVY DUTY CONCRETE PAVEMENT
- PROPOSED LIGHT DUTY ASPHALT
- PROPOSED HEAVY DUTY ASPHALT
- PROPOSED DETENTION BASIN

KEYNOTES: (XX)

01 TRASH ENCLOSURE – CMU WALLS WITH BRICK FACING AND STEEL DOORS
02 BOOK DROP
03 EXTEND DRY DETENTION BASIN
04 CONCRETE PATIO
05 DRIVE-THRU WINDOW
06 POWER TRANSFORMER
07 ADA ACCESSIBLE SIGNAGE AND STRIPING
08 WIDENED COMMERCIAL ENTRANCE (40') WITH RECONSTRUCTED ADA RAMP
09 REMOTE FIRE DEPARTMENT CONNECTION
10 6' SIDEWALK
11 CROSSWALK STRIPING
12 BOLLARD
13 CONSTUCT 6" EARTHEN BERM TO DIVERT OFF DRAINAGE FROM THE EAST

LEGAL DESCRIPTION

All of Lot 1, Rice Acres, a subdivision in the City of Lee's Summit, JacksonCounty,Missouri, together with all that part of an unplatted trac t of land, all lying in the Northeast Quarter of Section 29, Township 48 North, Range 31 West, described by Timothy Blair Wiswell, MO-PLS 2009000067, as follows:

COMMENCING at the Southeast corner of the Northeast Quarter of Section 29, Township 48 North, Range 31 West; thence North 88 degrees 28 minutes 52 seconds West, on the South line of said Northeast Quarter, a distance of 755.18 feet to a point on the Southerly extension of the West line of Lot 1, Rice Acres, a subdivision in the City of Lee's Summit, Jackson County, Missouri; thence North 01 degree 23 minutes 04 seconds East, departing said South line, on said Southerly extension, a distance of 55.66 feet to the Southwest corner of said Lot 1, the POINT OF BEGINNING; thence North 01 degree 23 minutes 04 seconds East, on said West line, a distance of 436.21 feet to the Northwest corner of said Lot 1; thence South 88 degrees 38 minutes 41 seconds East, on the North line of said Lot 1 and its Easterly extension, a distance of 400.00 feet to a point; thence South 01 degree 23 minutes 04 seconds West, departing said Easterly extension, a distance of 436.21 feet to a point on the Easterly extension of the South line of said Lot 1; thence North 88 degrees 38 minutes 41 seconds West, on said Easterly extension and on said South line, a distance of 400.00 feet to the POINT OF BEGINNING, containing 174,485 Square Feet or 4.0056 Acres, more or less.

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PACKAGE 10

Engineer of Record

ISSUE FOR CONSTRUCTION
02.05.20

Terry M Parsons, Engineer MO PE-2018010505

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Revision No.	Description	Date

Project No.	Date	Drawn
B18-0330	02.05.20	RLK

Drawing No.
C3.0
FINAL DEVELOPMENT PLAN

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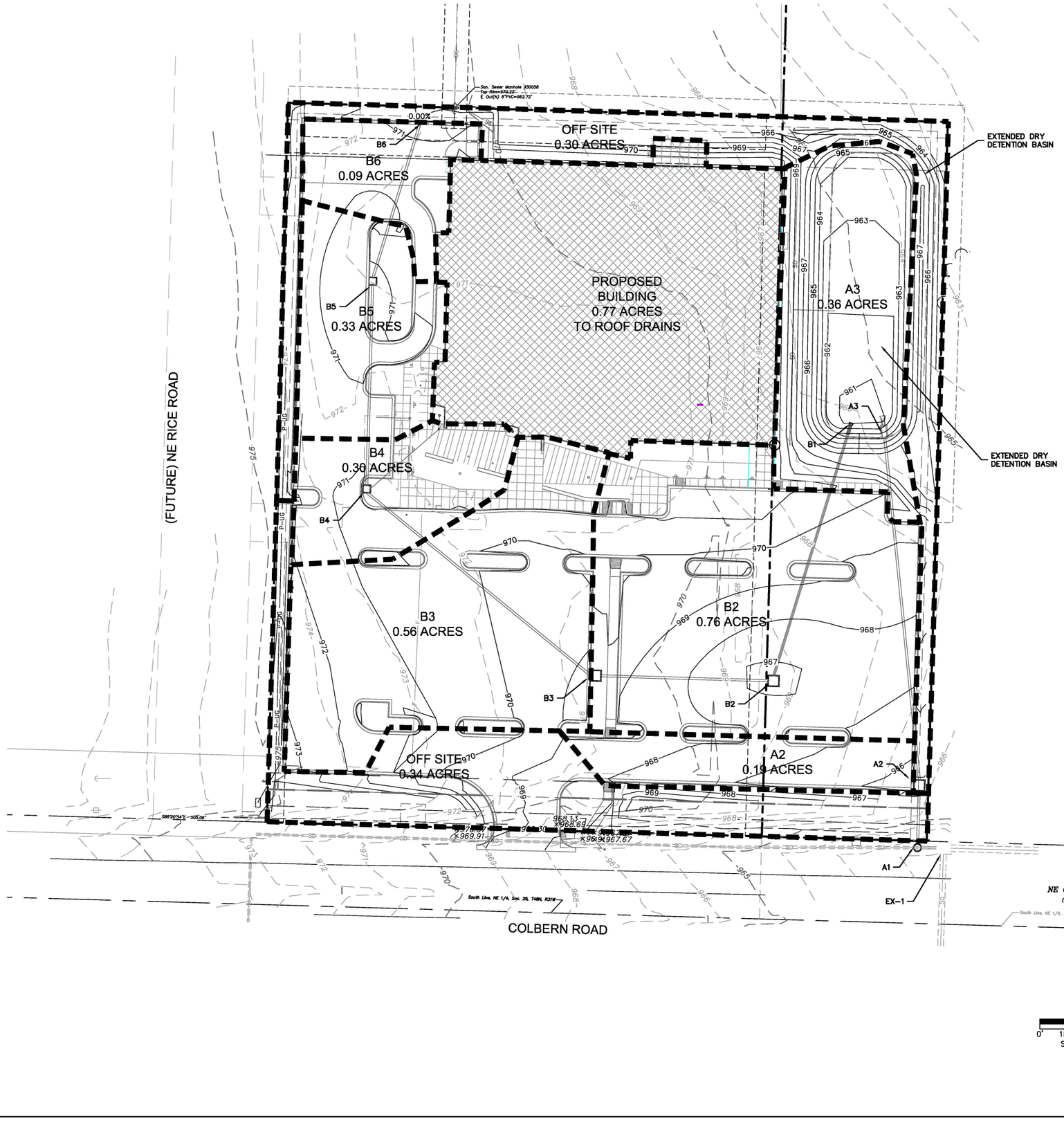

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Kansas City, MO 64108 816.300.0300

SPECIAL NOTICES

In the event the client consents to, allows, authorizes or approves of changes to any plans, specifications or other construction documents, and these changes are not approved in writing by the design professional, the client recognizes that such changes and the results thereof are not the responsibility of the design professional. Therefore, the client agrees to release the design professional from any liability arising from the construction, use or result of such changes. In addition, the client agrees to the fullest extent permitted by law, to indemnify and hold the design professional harmless from any damage, liability or cost (including reasonable attorney's fees and costs of defense) arising from such changes.

The personal seal of the registered Architect or Engineer shall be the legal equivalent of his signature whenever & wherever used, and the owner of the seal shall authenticate this sheet and the specification sections pertaining to this sheet. Responsibility shall be disclaimed for all other plans, specifications, estimates, reports or other documents or instruments relating to or intended to be used for any part or parts of the architectural project.

Mid-Continent Public Library

PRELIMINARY DEVELOPMENT PLANS FOR

COLBERN ROAD BRANCH

1000 N.E. COLBERN ROAD
LEE'S SUMMIT, MO 64086
JACKSON COUNTY

PACKAGE 10

Engineer of Record

ISSUE FOR CONSTRUCTION
02.05.20

Terry M Parsons, Engineer MO PE-2018010505

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Olsson
Missouri State Certificate of Authority #001592

Revision No.	Description	Date

Project No.	Date	Drawn
B18-0330	02.05.20	RLK

Drawing No.

C8.0
DRAINAGE PLAN

Appendix B

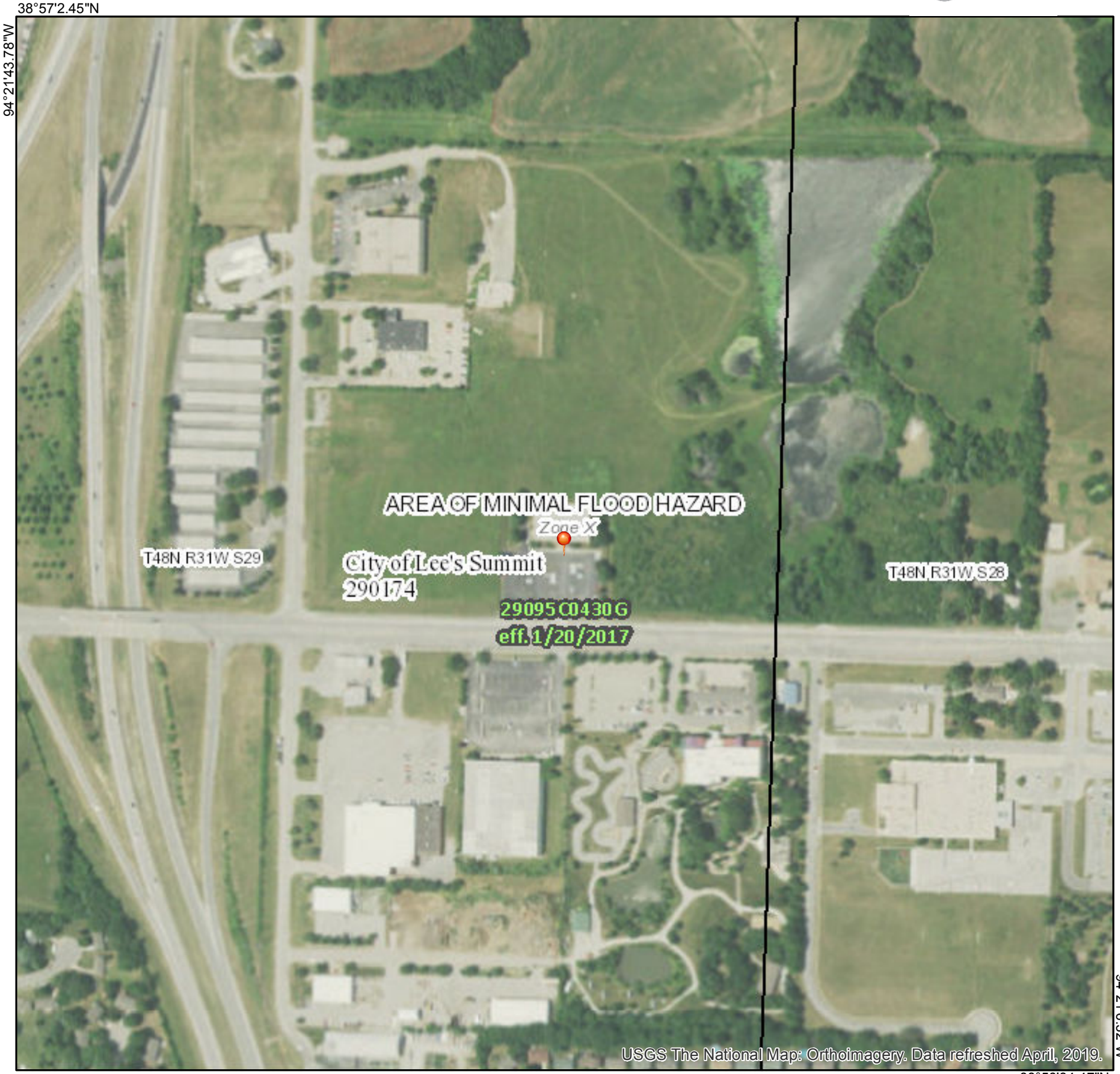
FEMA Flood Classification Firm

National Flood Hazard Layer FIRMette

FEMA

38°57'2.45"N

94°21'43.78"W



94°21'6.32"W

38°56'34.47"N

0 250 500 1,000 1,500 2,000 Feet

1:6,000

Legend

SEE FIS REPORT FOR DETAILED LEGEND AND INDEX MAP FOR FIRM PANEL LAYOUT

SPECIAL FLOOD HAZARD AREAS
- Without Base Flood Elevation (BFE) *Zone A, V, A99*
- With BFE or Depth *Zone AE, AO, AH, VE, AR*
- Regulatory Floodway

OTHER AREAS OF FLOOD HAZARD
- 0.2% Annual Chance Flood Hazard, Areas of 1% annual chance flood with average depth less than one foot or with drainage areas of less than one square mile *Zone X*
- Future Conditions 1% Annual Chance Flood Hazard *Zone X*
- Area with Reduced Flood Risk due to Levee. See Notes. *Zone X*
- Area with Flood Risk due to Levee *Zone D*

OTHER AREAS
- NO SCREEN — Area of Minimal Flood Hazard *Zone X*
- Effective LOMRs
- Area of Undetermined Flood Hazard *Zone D*

GENERAL STRUCTURES
- Channel, Culvert, or Storm Sewer
- Levee, Dike, or Floodwall

OTHER FEATURES
- 20.2 / 17.5 — Cross Sections with 1% Annual Chance Water Surface Elevation
- 8 — Coastal Transect
- 513 — Base Flood Elevation Line (BFE)
- Limit of Study
- Jurisdiction Boundary
- Coastal Transect Baseline
- Profile Baseline
- Hydrographic Feature

MAP PANELS
- Digital Data Available
- No Digital Data Available
- Unmapped

N

The pin displayed on the map is an approximate point selected by the user and does not represent an authoritative property location.

This map complies with FEMA's standards for the use of digital flood maps if it is not void as described below. The basemap shown complies with FEMA's basemap accuracy standards

The flood hazard information is derived directly from the authoritative NFHL web services provided by FEMA. This map was exported on 10/30/2019 at 10:40:35 AM and does not reflect changes or amendments subsequent to this date and time. The NFHL and effective information may change or become superseded by new data over time.

This map image is void if the one or more of the following map elements do not appear: basemap imagery, flood zone labels, legend, scale bar, map creation date, community identifiers, FIRM panel number, and FIRM effective date. Map images for unmapped and unmodernized areas cannot be used for regulatory purposes.

Appendix C

Soil Map

Soil Map—Jackson County, Missouri
(SOILS SURVEY)

Map Scale: 1:844 if printed on A landscape (11" x 8.5") sheet.

N

Meters
0 10 20 40 60

Feet
0 40 80 160 240

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 15N WGS84

Jackson County, Missouri

10128—Sharpsburg-Urban land complex, 2 to 5 percent slopes

Map Unit Setting

National map unit symbol: 2ql09
Elevation: 1,000 to 1,300 feet
Mean annual precipitation: 33 to 41 inches
Mean annual air temperature: 50 to 55 degrees F
Frost-free period: 177 to 220 days
Farmland classification: All areas are prime farmland

Map Unit Composition

Sharpsburg and similar soils: 60 percent
Urban land: 35 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Sharpsburg

Setting

Landform: Interfluves
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Interfluve
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Loess

Typical profile

A - 0 to 17 inches: silt loam
Bt - 17 to 55 inches: silty clay loam
C - 55 to 60 inches: silty clay loam

Properties and qualities

Slope: 2 to 5 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Moderately well drained
Runoff class: High
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: About 24 to 35 inches
Frequency of flooding: None
Frequency of ponding: None
Salinity, maximum in profile: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water storage in profile: Very high (about 12.0 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2e
Hydrologic Soil Group: D

Ecological site: Loess Upland Prairie (R109XY002MO)
Other vegetative classification: Grass/Prairie (Herbaceous Vegetation)
Hydric soil rating: No

Description of Urban Land

Setting

Landform: Interfluves
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Interfluve

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 8
Hydric soil rating: No

Data Source Information

Soil Survey Area: Jackson County, Missouri
Survey Area Data: Version 20, Sep 16, 2019

Appendix D

Drainage and Detention Calculations

STORM SEWER PIPE AND STRUCTURE TABLE

STORM SEWER PIPE AND STRUCTURE TABLE
TITLE: COLBERN ROAD LIBRARY (LEES SUMMIT)
JOB #: B18-0330

DESIGN CONDITIONS: 10 YEAR STORM EVENT

STRUCTURES				RUNOFF CALCULATIONS							PIPE DESIGN																		
FROM	TO	DIRECT AREA (ACRES)	TOTAL AREA (ACRES)	C	KC (K=1.00)	Tc (MIN)	FLOW TIME (MIN)	INTENSITY (IN/HR)	DESIGN Q (CFS)	DESCRIPTION	PIPE LENGTH (L.F.)	PIPE SLOPE (%)	PIPE DIA (IN)	Q FULL (CFS)	PIPE AREA (SQ.FT.)	V FULL (F/S)	DESIGN V (F/S)	Hw/D	MH TOP ELEVATION	UPSTREAM FLOWLINE	DOWNSTREAM FLOWLINE	DOWNSTREAM WATER ELEVATION	FRICTION HEAD (h f)	ENTRY LOSS COEFFICIENT (k)	ACTUAL ENTRY LOSS (k)	ENTRY LOSS (h m)	h f + h m (FT)	HW, INLET CONTROL	HW, OUTLET CONTROL	HYDRAULIC GRADE ELEV.	HYDRAULIC GRADE (MAX)	Comments
RD		0.77		0.90	0.90	5.0	-	7.35	5.09	ROOF DRAINS									N/A											N/A	N/A	
	A3		0.77	0.90	0.90	5.0	-	7.35	5.09	18 in. HDPE	30.00	1.20	18	11.54	1.77	6.53	6.32	0.89		969.00	968.64	N/A	N/A	N/A	N/A	N/A	N/A	N/A			END SECTION TO BASIN
B6		0.09		0.80	0.80	5.0	-	7.35	0.53	CURB INLET									970.59											968.18	969.59	
	B5		0.09	0.80	0.80	5.0	-	7.35	0.53	15 in. HDPE	103.07	0.51	15	4.63	1.23	3.77	2.51	0.68		967.34	966.81	967.26	0.01	1.00	1.00	0.10	0.11	968.18	967.37			
B5		0.33		0.80	0.80	5.0	-	7.35	1.94	CURB INLET									971.36											967.26	970.36	
	B4		0.42	0.65	0.65	5.0	-	7.35	2.01	15 in. HDPE	125.95	0.86	15	6.01	1.23	4.89	4.40	0.76		966.32	965.24	965.92	0.12	0.30	1.00	0.30	0.42	967.26	966.34			
B4		0.30		0.80	0.80	5.0	-	7.35	1.76	CURB INLET									970.86											965.92	969.86	
	B3		0.72	0.71	0.71	5.0	-	7.35	3.76	18 in. HDPE	179.00	0.70	18	8.81	1.77	4.99	4.78	0.79		964.73	963.48	964.49	0.23	0.40	0.40	0.14	0.37	965.92	964.86			
B3		0.56		0.65	0.65	5.0	-	7.35	2.68	CURB INLET									969.82											964.49	968.82	
	B2		1.28	0.68	0.68	5.0	-	7.35	6.40	24 in. HDPE	108.00	0.70	24	18.98	3.14	6.04	5.44	0.75		962.98	962.22	963.47	0.09	0.40	0.40	0.18	0.27	964.49	963.74			
B2		0.76		0.65	0.65	5.0	-	7.35	3.63	CURB INLET									967.00											963.47	966.00	
	B1		2.04	0.67	0.67	5.0	-	7.35	10.05	24 in. HDPE	179.00	0.70	24	18.98	3.14	6.04	6.11	0.87		961.72	960.45	962.20	0.36	0.50	0.50	0.29	0.65	963.47	962.85			END SECTION TO BASIN
A3		0.36		0.30	0.30	5.0	-	7.35	0.79	Control Structure									965.00											961.77	964.00	
	A2		3.17	0.68	0.68	5.0	-	7.35	4.40	18 in. HDPE	220.00	0.50	18	7.45	1.77	4.21	4.47	0.87		960.47	959.34	960.66	0.46	1.00	1.00	0.31	0.78	961.77	961.43			Design Q based on Detained Flows (includes all areas to basin)
A2		0.19		0.80	0.80	5.0	-	7.35	0.88	CURB INLET									966.02											960.66	965.02	
	A1		3.36	0.69	0.69	5.0	-	7.35	4.90	18 in. HDPE	38.00	0.50	18	7.45	1.77	4.21	4.71	1.00		958.84	958.65	960.18	0.13	0.50	1.00	0.34	0.48	960.34	960.66			Design Q based on Detained Flows

STORM SEWER PIPE AND STRUCTURE TABLE

STORM SEWER PIPE AND STRUCTURE TABLE
TITLE: COLBERN ROAD LIBRARY (LEES SUMMIT)
JOB #: B18-0330

DESIGN CONDITIONS: 100 YEAR STORM EVENT

STRUCTURES				RUNOFF CALCULATIONS							PIPE DESIGN																		
FROM	TO	DIRECT AREA (ACRES)	TOTAL AREA (ACRES)	C	KC (K=1.00)	Tc (MIN)	FLOW TIME (MIN)	INTENSITY (IN/HR)	DESIGN Q (CFS)	DESCRIPTION	PIPE LENGTH (L.F.)	PIPE SLOPE (%)	PIPE DIA (IN)	Q FULL (CFS)	PIPE AREA (SQ.FT.)	V FULL (F/S)	DESIGN V (F/S)	Hw/D	MH TOP ELEVATION	UPSTREAM FLOWLINE	DOWNSTREAM FLOWLINE	DOWNSTREAM WATER ELEVATION	FRICTION HEAD (h f)	ENTRY LOSS COEFFICIENT (k)	ACTUAL ENTRY LOSS (k)	ENTRY LOSS (h m)	h f + h m (FT)	HW, INLET CONTROL	HW, OUTLET CONTROL	HYDRAULIC GRADE ELEV.	HYDRAULIC GRADE (MAX)	Comments
RD		0.77		0.90	1.13	5.0	-	10.32	8.94	ROOF DRAINS									N/A											N/A	N/A	
	A3		0.77	0.90	1.13	5.0	-	10.32	8.94	18 in. HDPE	30.00	1.20	18	11.54	1.77	6.53	7.20	1.35		969.00	968.64	N/A	N/A	N/A	N/A	N/A	N/A	N/A			END SECTION TO BASIN
B6		0.09		0.80	1.00	5.0	-	10.32	0.93	CURB INLET									970.59											968.20	969.59	
	B5		0.09	0.80	1.00	5.0	-	10.32	0.93	15 in. HDPE	75.00	0.51	15	4.63	1.23	3.77	2.95	0.69		967.34	966.96	967.49	0.02	1.00	1.00	0.13	0.15	968.20	967.64			
B5		0.33		0.80	1.00	5.0	-	10.32	3.41	CURB INLET									971.36											967.49	970.36	
	B4		0.42	0.65	0.81	5.0	-	10.32	3.52	15 in. HDPE	156.00	0.86	15	6.01	1.23	4.89	5.09	0.93		966.32	1012.02	966.29	0.47	0.30	1.00	0.40	0.87	967.49	967.16			
B4		0.30		0.80	1.00	5.0	-	10.32	3.10	CURB INLET									970.86											966.29	969.86	
	B3	MA	0.72	0.71	0.89	5.0	-	10.32	6.59	18 in. HDPE	179.00	0.70	18	8.81	1.77	4.99	5.46	1.04		964.73	1009.98	965.27	0.71	0.40	0.40	0.19	0.90	966.29	966.17			
B3		0.56		0.65	0.81	5.0	-	10.32	4.70	CURB INLET									969.82											965.27	968.82	
	B2		1.28	0.68	0.85	5.0	-	10.32	11.23	18 in. HDPE	108.00	0.70	24	18.98	3.14	6.04	6.28	0.92		962.98	1009.98	964.76	0.27	0.40	0.40	0.25	0.51	964.83	965.27			
B2		0.76		0.65	0.81	5.0	-	10.32	6.37	CURB INLET									967.00											964.76	966.00	
	B1		2.04	0.67	0.84	5.0	-	10.32	17.63	18 in. HDPE	179.00	0.70	24	18.98	3.14	6.04	6.85	1.30		961.72	1009.98	963.30	1.10	0.50	0.50	0.36	1.46	964.31	964.76			END SECTION TO BASIN
A3		0.36		0.30	0.38	5.0	-	10.32	1.39	Control Structure									965.00											963.44	964.00	
	A2		3.17	0.68	0.85	5.0	-	10.32	9.20	18 in. HDPE	220.00	0.70	18	8.81	1.77	4.99	5.67	1.31		960.47	1016.01	961.41	1.53	1.00	1.00	0.50	2.03	962.44	963.44			Design Q based on Detained Flows (includes all areas to basin)
A2		0.15		0.80	1.00	5.0	-	10.32	1.55	CURB INLET									966.02											961.41	965.02	
	A1		3.36	0.69	0.86	5.0	-	10.32	10.10	18 in. HDPE	38.00	0.76	18	9.18	1.77	5.20	5.21	1.39		958.84	958.61	960.70	0.29	0.50	1.00	0.42	0.72	960.92	961.41			Design Q based on Detained Flows

SAPP DESIGN ARCHITECTS
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Sapp Design Associates Architects, P.C.
Missouri State Certificate of Authority #000607

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1629 Walnut
Kansas City, MO 64108 816.300.0300

SPECIAL NOTICES

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Revision No.	Description	Date

Project No.	Date	Drawn
B18-0330	02.05.20	RLK

Drawing No.
C8.1
DRAINAGE CALCULATIONS

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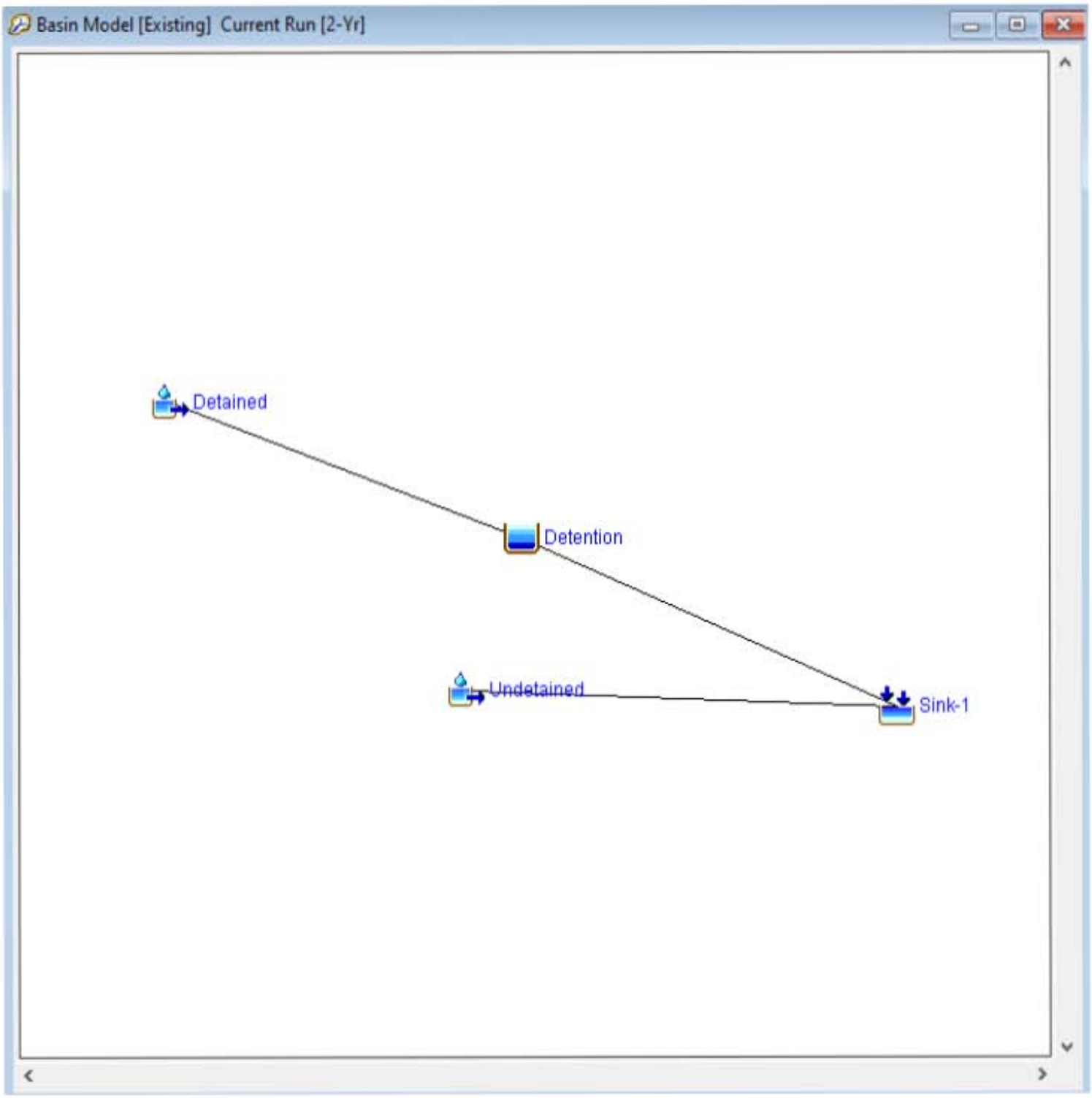
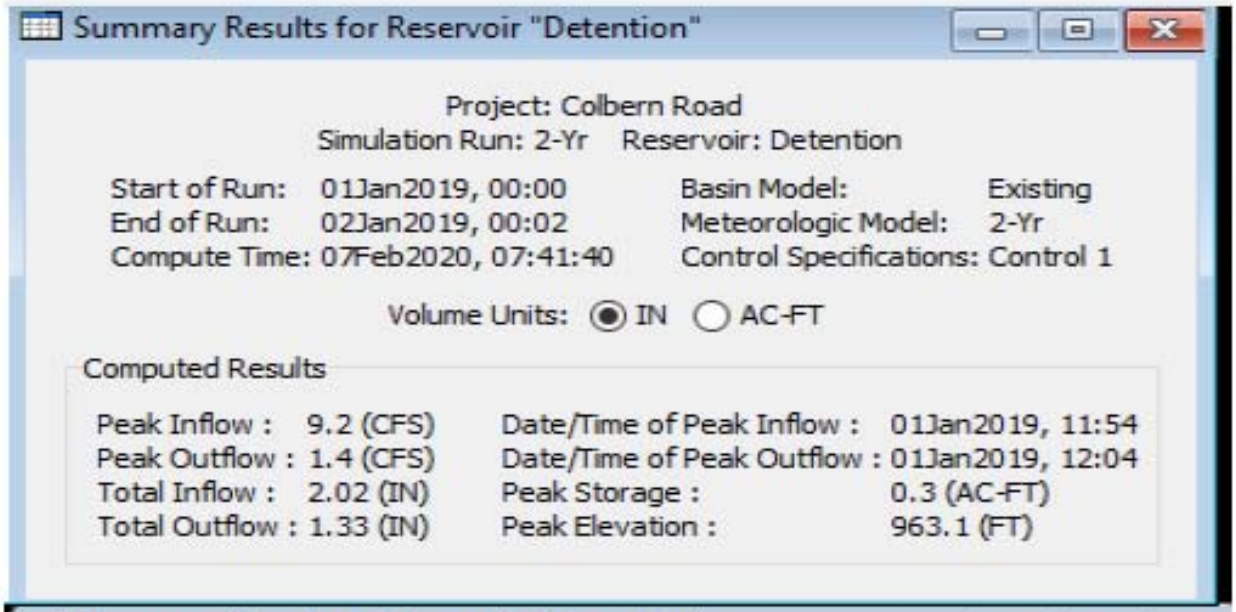
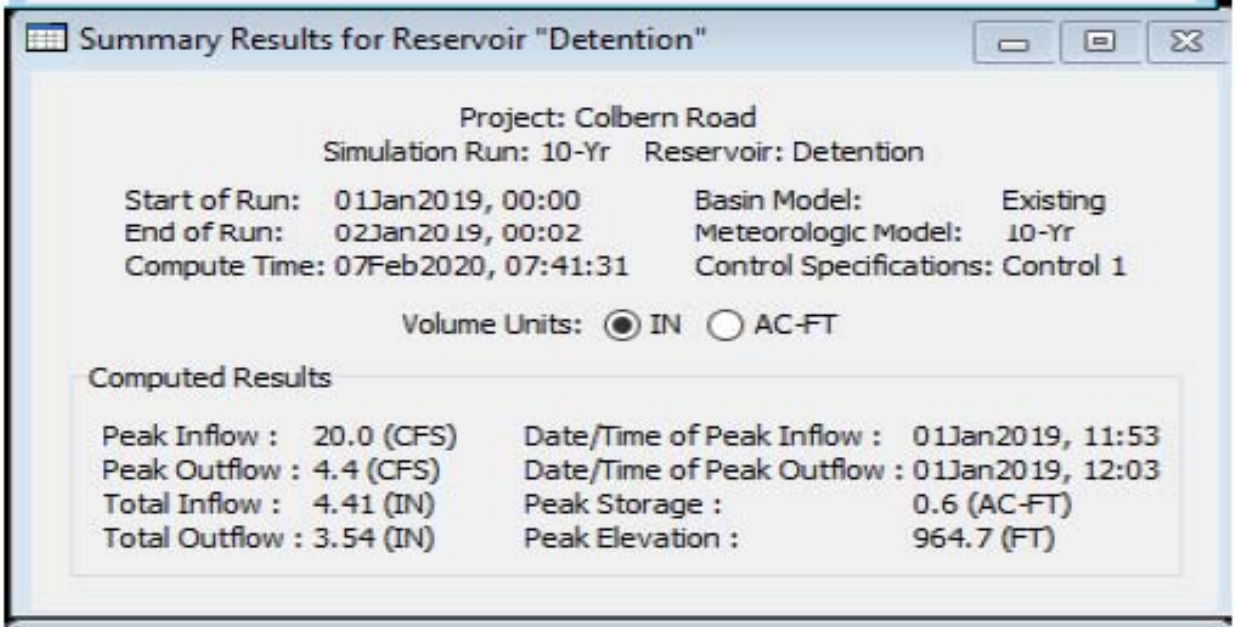
MCPL COLBERN ROAD BRANCH
HEC-HMS
BASIN MODEL

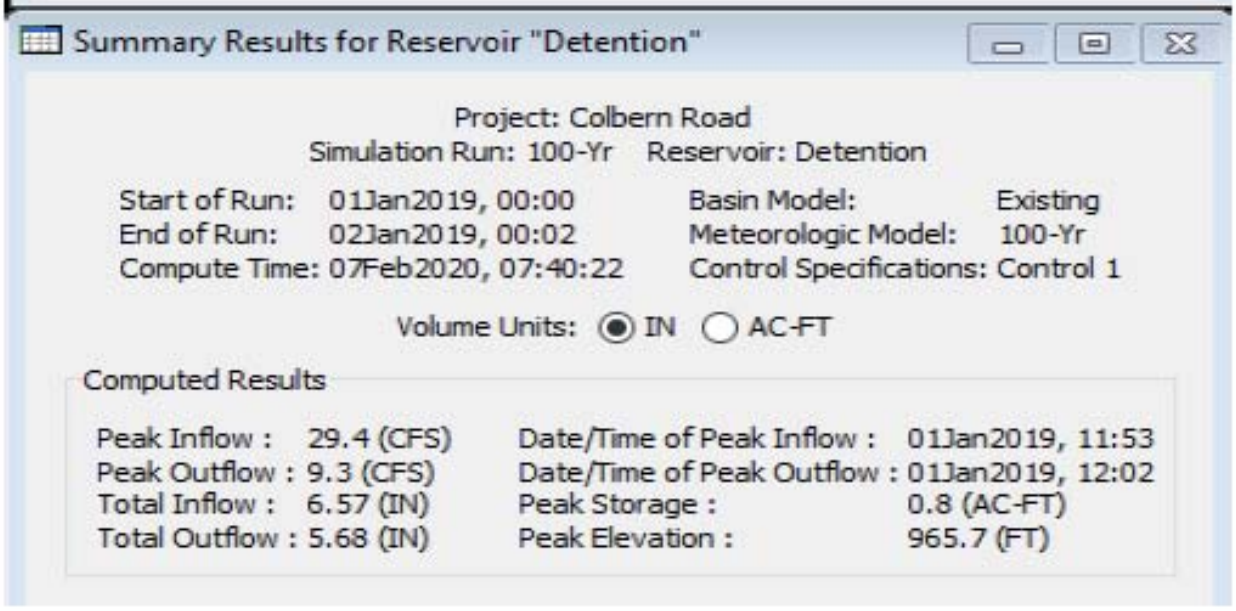


MCPL COLBERN ROAD BRANCH
HEC-HMS

PEAK FLOWS FOR DETENTION BASIN

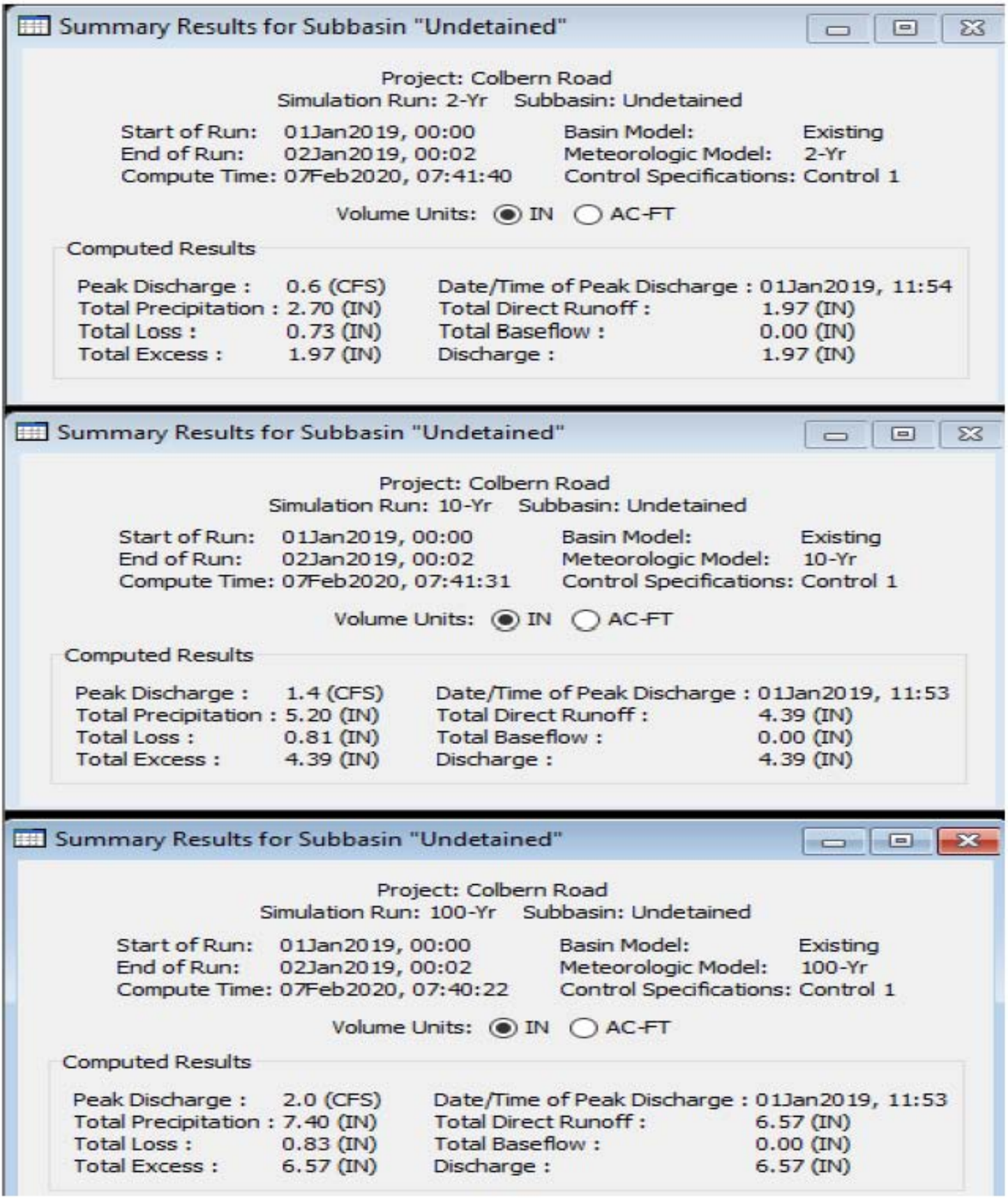






MCPL COLBERN ROAD BRANCH
HEC-HMS

PEAK FLOWS FOR UNDETAINED AREA



Summary Results for Subbasin "Undetained"

Project: Colbern Road
Simulation Run: 2-Yr Subbasin: Undetained

Start of Run:	01Jan2019, 00:00	Basin Model:	Existing
End of Run:	02Jan2019, 00:02	Meteorologic Model:	2-Yr
Compute Time:	07Feb2020, 07:41:40	Control Specifications:	Control 1

Volume Units: (•) IN ( ) AC-FT

Computed Results

Peak Discharge :	0.6 (CFS)	Date/Time of Peak Discharge :	01Jan2019, 11:54
Total Precipitation :	2.70 (IN)	Total Direct Runoff :	1.97 (IN)
Total Loss :	0.73 (IN)	Total Baseflow :	0.00 (IN)
Total Excess :	1.97 (IN)	Discharge :	1.97 (IN)

Summary Results for Subbasin "Undetained"

Project: Colbern Road
Simulation Run: 10-Yr Subbasin: Undetained

Start of Run:	01Jan2019, 00:00	Basin Model:	Existing
End of Run:	02Jan2019, 00:02	Meteorologic Model:	10-Yr
Compute Time:	07Feb2020, 07:41:31	Control Specifications:	Control 1

Volume Units: (•) IN ( ) AC-FT

Computed Results

Peak Discharge :	1.4 (CFS)	Date/Time of Peak Discharge :	01Jan2019, 11:53
Total Precipitation :	5.20 (IN)	Total Direct Runoff :	4.39 (IN)
Total Loss :	0.81 (IN)	Total Baseflow :	0.00 (IN)
Total Excess :	4.39 (IN)	Discharge :	4.39 (IN)

Summary Results for Subbasin "Undetained"

Project: Colbern Road
Simulation Run: 100-Yr Subbasin: Undetained

Start of Run:	01Jan2019, 00:00	Basin Model:	Existing
End of Run:	02Jan2019, 00:02	Meteorologic Model:	100-Yr
Compute Time:	07Feb2020, 07:40:22	Control Specifications:	Control 1

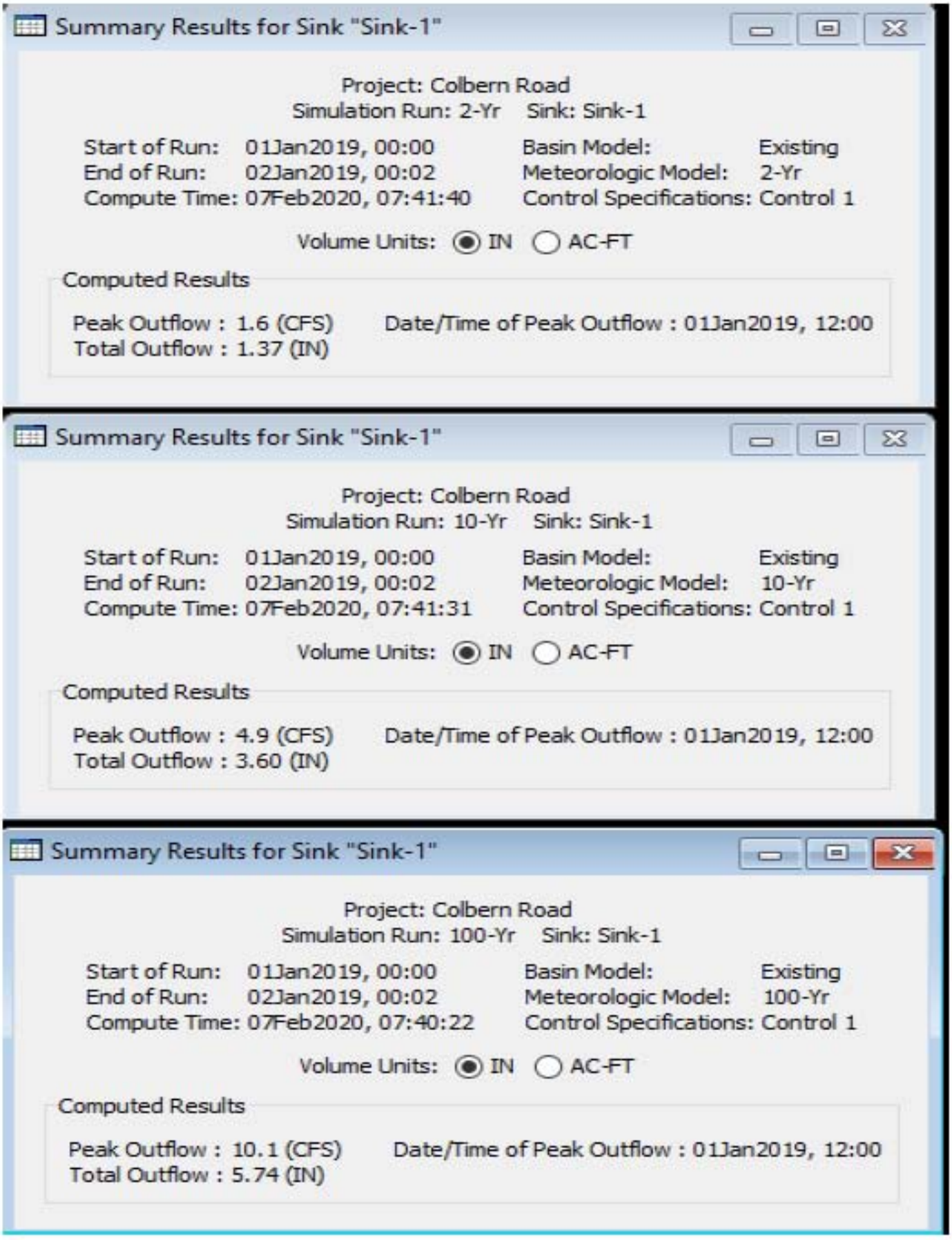
Volume Units: (•) IN ( ) AC-FT

Computed Results

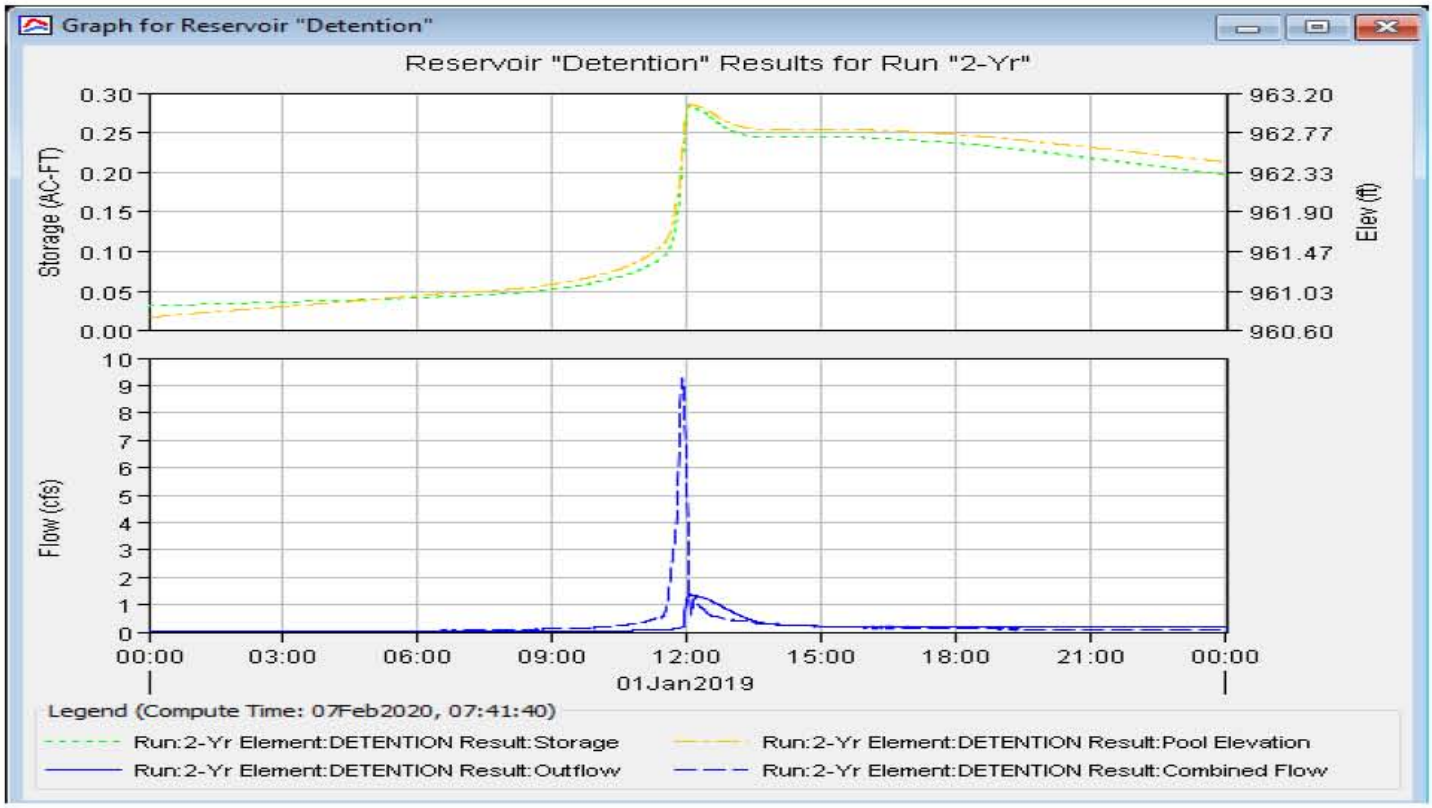
Peak Discharge :	2.0 (CFS)	Date/Time of Peak Discharge :	01Jan2019, 11:53
Total Precipitation :	7.40 (IN)	Total Direct Runoff :	6.57 (IN)
Total Loss :	0.83 (IN)	Total Baseflow :	0.00 (IN)
Total Excess :	6.57 (IN)	Discharge :	6.57 (IN)

MCPL COLBERN ROAD BRANCH
HEC-HMS

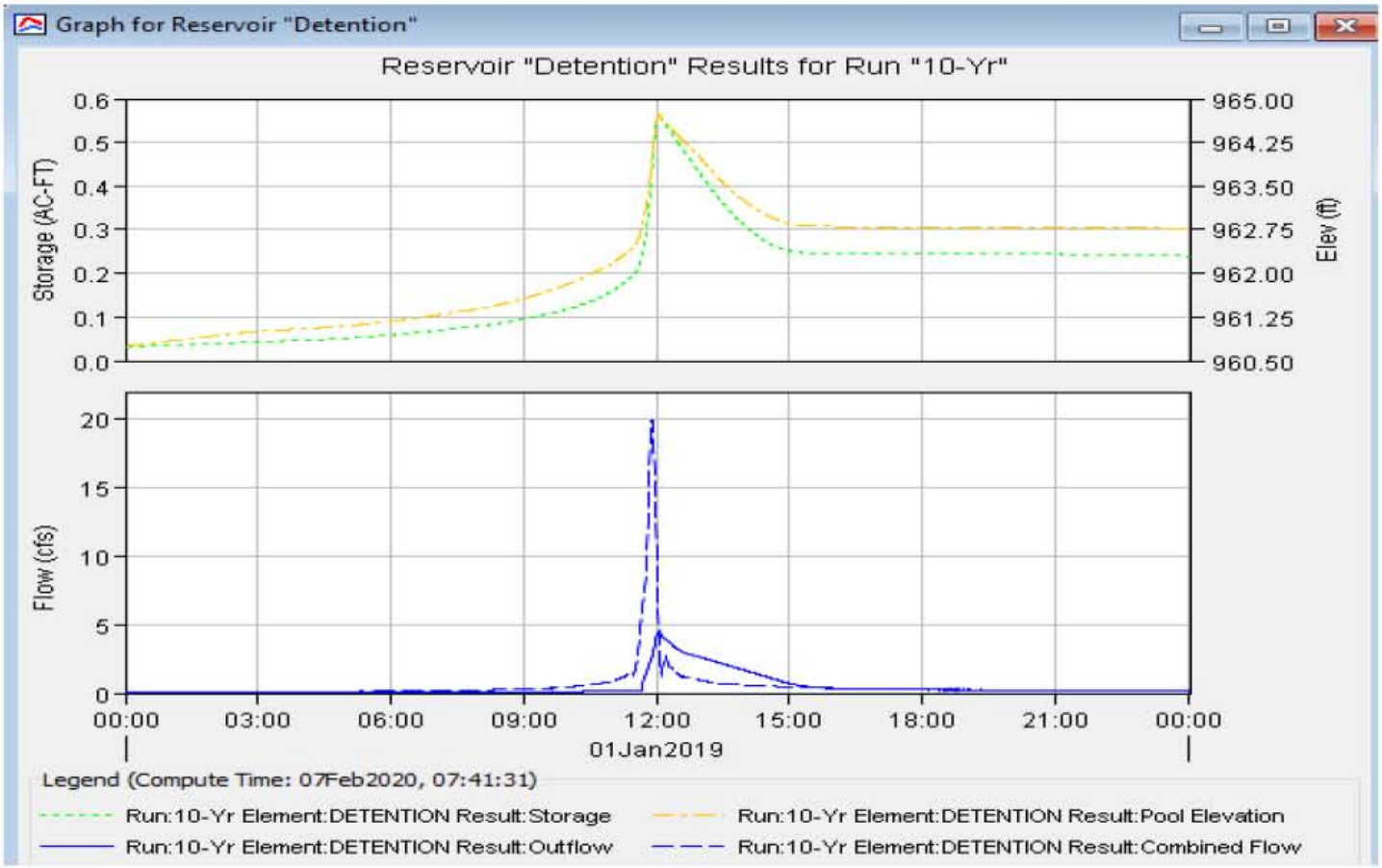
PEAK FLOWS TO PROPOSED OUTFALL "A"



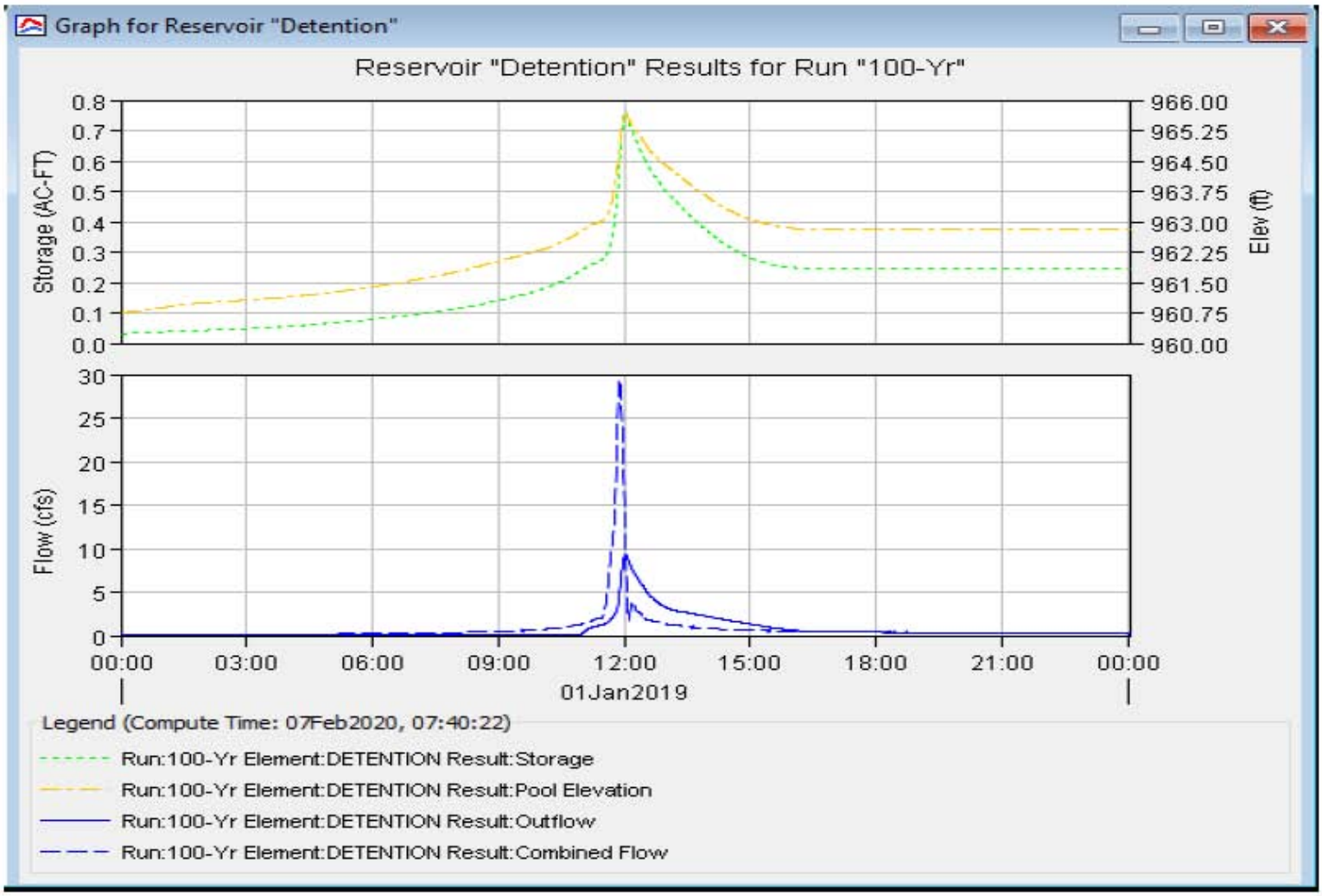
MCPL COLBERN ROAD BRANCH
HEC-HMS
DETENTION HYDROGRAPH 2-YEAR



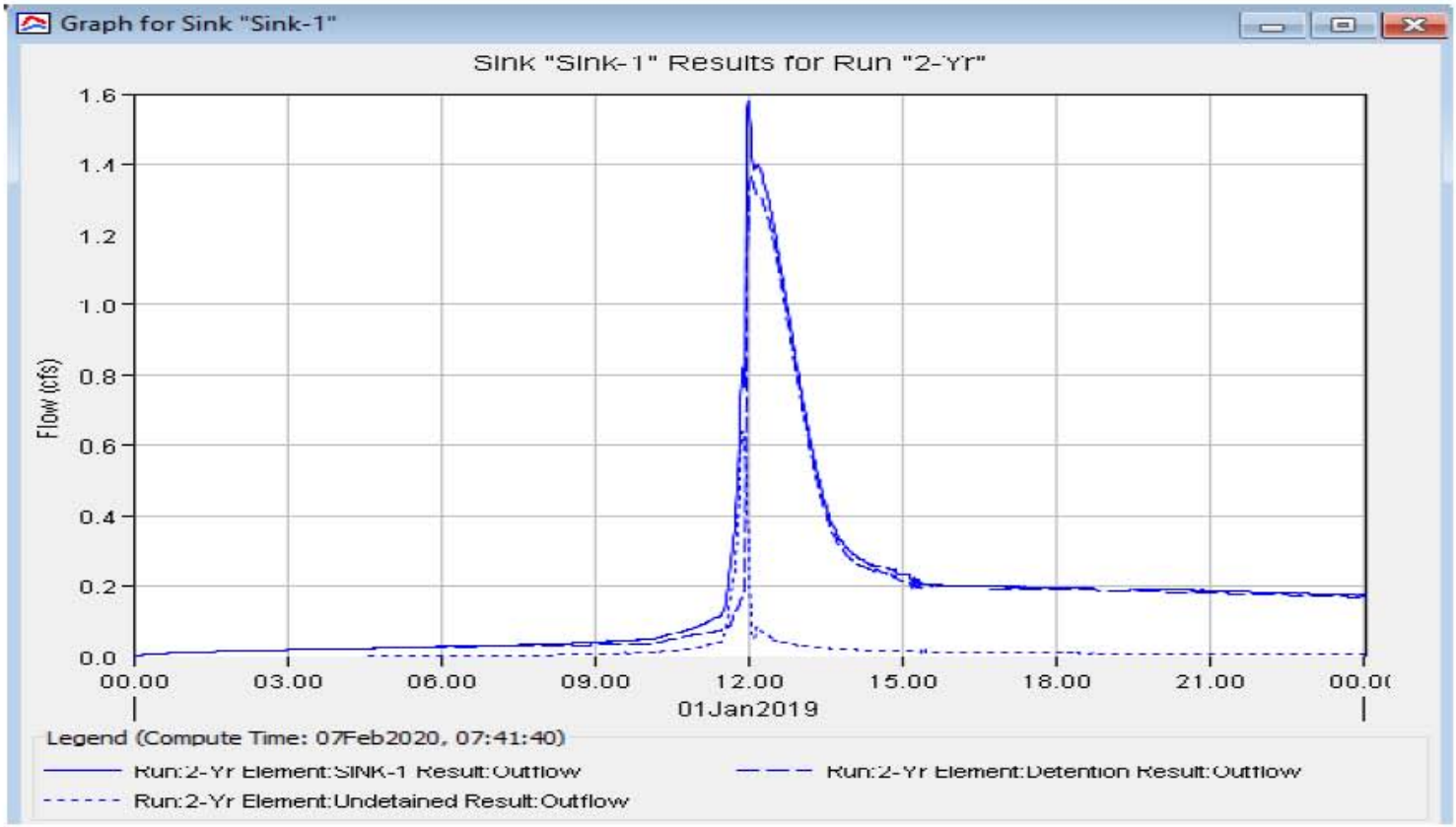
DETENTION HYDROGRAPH 10-YEAR



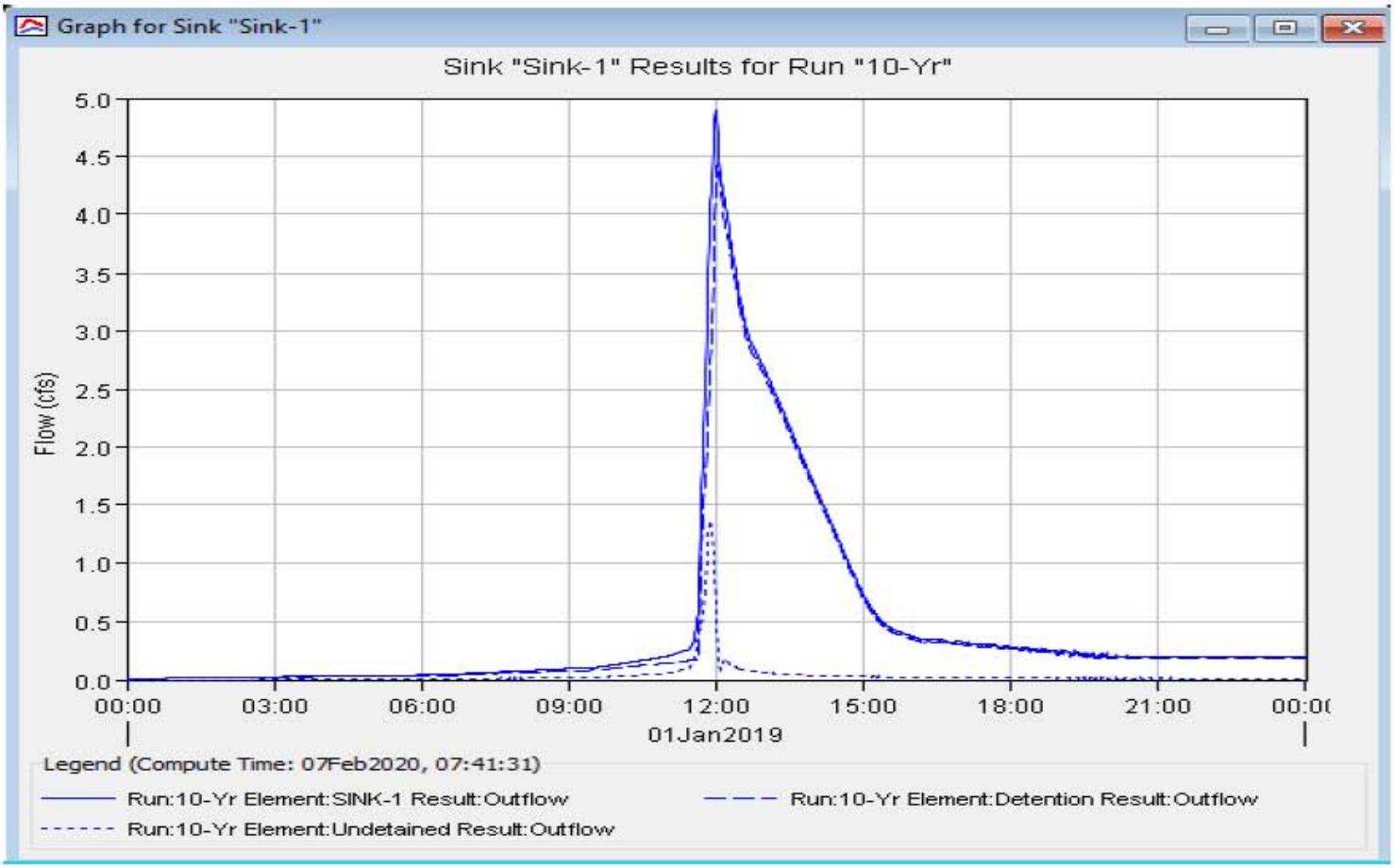
MCPL COLBERN ROAD BRANCH
HEC-HMS
DETENTION HYDROGRAPH 100-YEAR



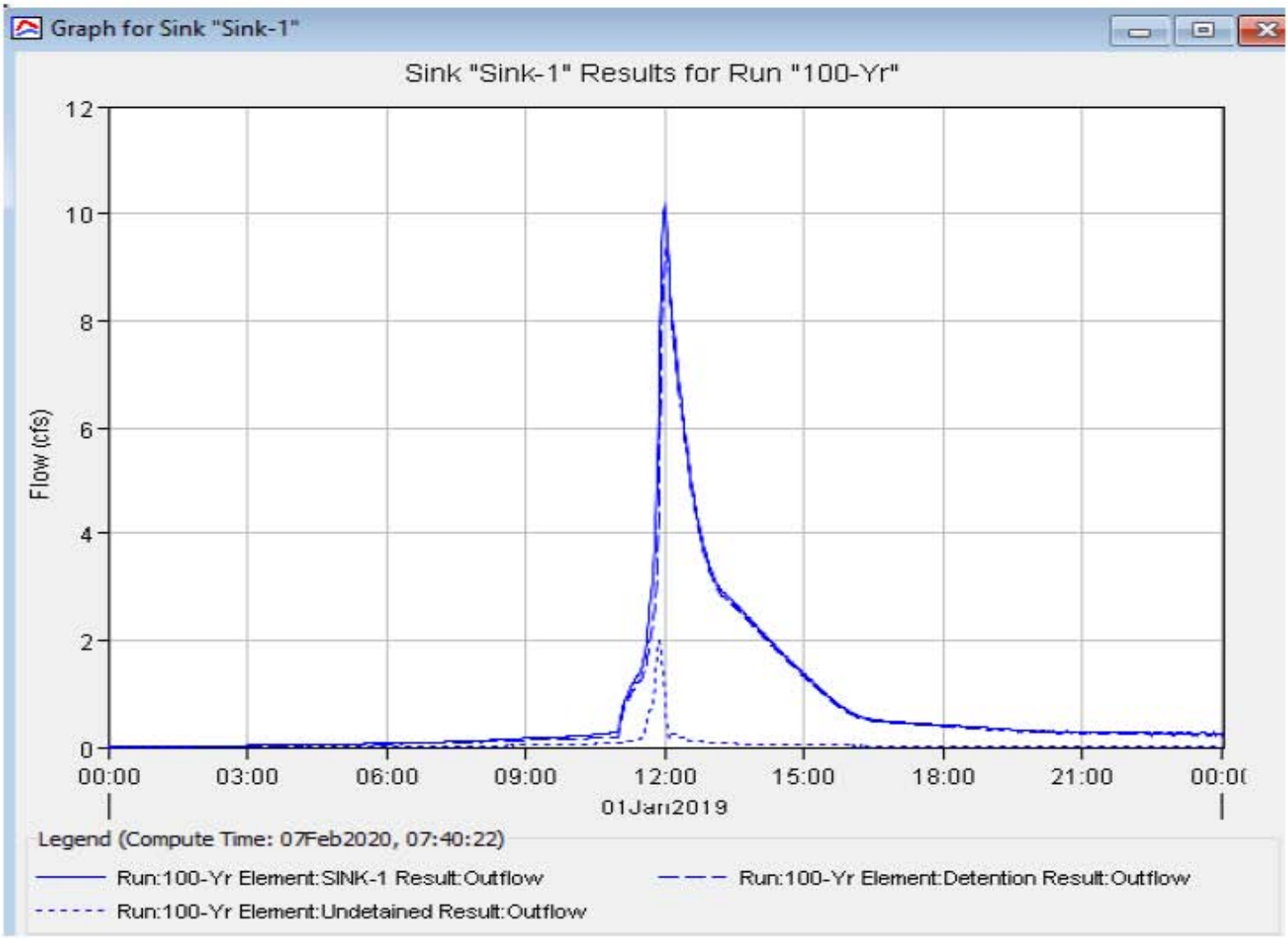
MCPL COLBERN ROAD BRANCH
HEC-HMS
OUTFALL "A" - OUTFLOW HYDROGRAPH - 2-YEAR



OUTFALL "A" - OUTFLOW HYDROGRAPH - 10-YEAR



MCPL COLBERN ROAD BRANCH
HEC-HMS
OUTFALL "A" - OUTFLOW HYDROGRAPH - 100-YEAR



GEOTECHNICAL ENGINEERING REPORT

MID-CONTINENT PUBLIC LIBRARY
COLBERN ROAD BRANCH
1000 NE COLBERN ROAD
LEE'S SUMMIT, MISSOURI

PREPARED FOR
MID-CONTINENT PUBLIC LIBRARY
INDEPENDENCE, MISSOURI

PREPARED BY
OLSSON, INC.
OLATHE, KANSAS

DECEMBER 30, 2019

OLSSON PROJECT NO. A18-0330

1700 East 123rd Street • Olathe, KS 66061 • (913) 829-0078 • FAX (913) 829-0258

olsson

December 30, 2019

Mid-Continent Public Library
Attn: Jake Wimmer
15616 E 24 Highway
Independence, Missouri 64050

Re: Geotechnical Engineering Report
MCPL Colbern Road
Lee's Summit, Missouri
Olsson Project No. A18-0330

Dear Mr. Wimmer,

Olsson, Inc. has completed the authorized Geotechnical Engineering Report for the above referenced project. This report describes our understanding of the project, presents the results of the borings and laboratory tests, discusses the observed subsurface conditions, and, based on these conditions, provides our opinions and geotechnical engineering recommendations for the Colbern Road project.

We appreciate the opportunity to provide our geotechnical engineering services for this project. If you have any questions or need further assistance, please contact us.

Respectfully submitted,
Olsson, Inc.

JD Putnam

STATE OF MISSOURI
IAN ANDREW DILLON
12/31/19
NUMBER PE-2013000554
PROFESSIONAL ENGINEER

Ian A. Dillon, PE

1700 E. 123rd Street / Olathe, KS 66061
O 913.829.0078 / **olsson.com**

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A. PROJECT UNDERSTANDING

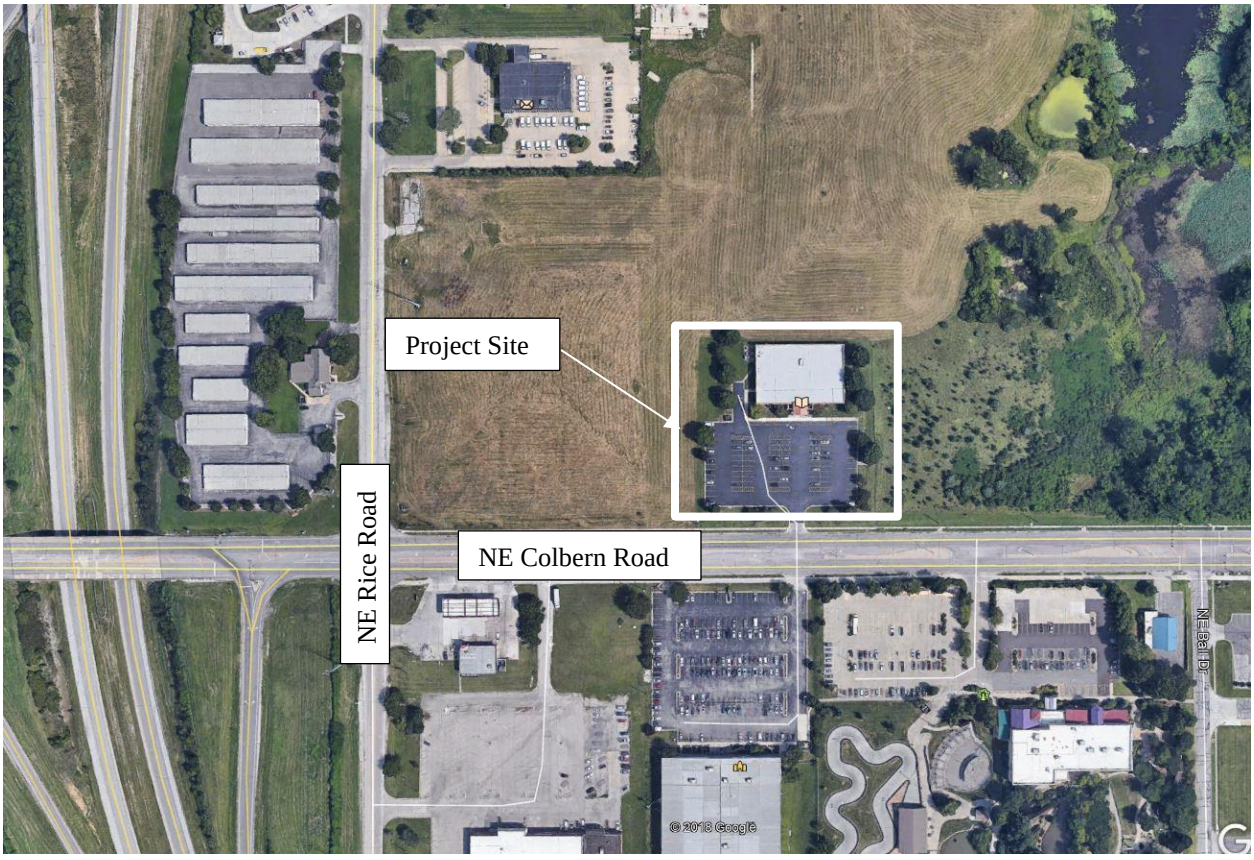
A.1. GEOTECHNICAL SCOPE

This Geotechnical Engineering Report presents the results of the subsurface exploration completed for the new library in Lee's Summit, Missouri. We drilled eight borings at the site for the proposed structure and the associated parking and drive areas. The locations of the borings are shown on the Boring Location Plan in Appendix A and the associated Borehole Reports are presented in Appendix B. The purpose of this exploration was to evaluate the existing subsurface conditions encountered at the borings and provide geotechnical design recommendations for the support of foundations, floor slabs, and pavements for the proposed structure.

A.2. PROJECT DESCRIPTION

The project site is located NE Rice Road and NE Colbern Road in Lee's Summit, Missouri as shown in Figure 1. The site is currently occupied by the existing library and associated pavements. We have not been informed of any foundation related distress within the existing structure. The existing site is relatively flat but gently slopes from the southwest to the northeast.

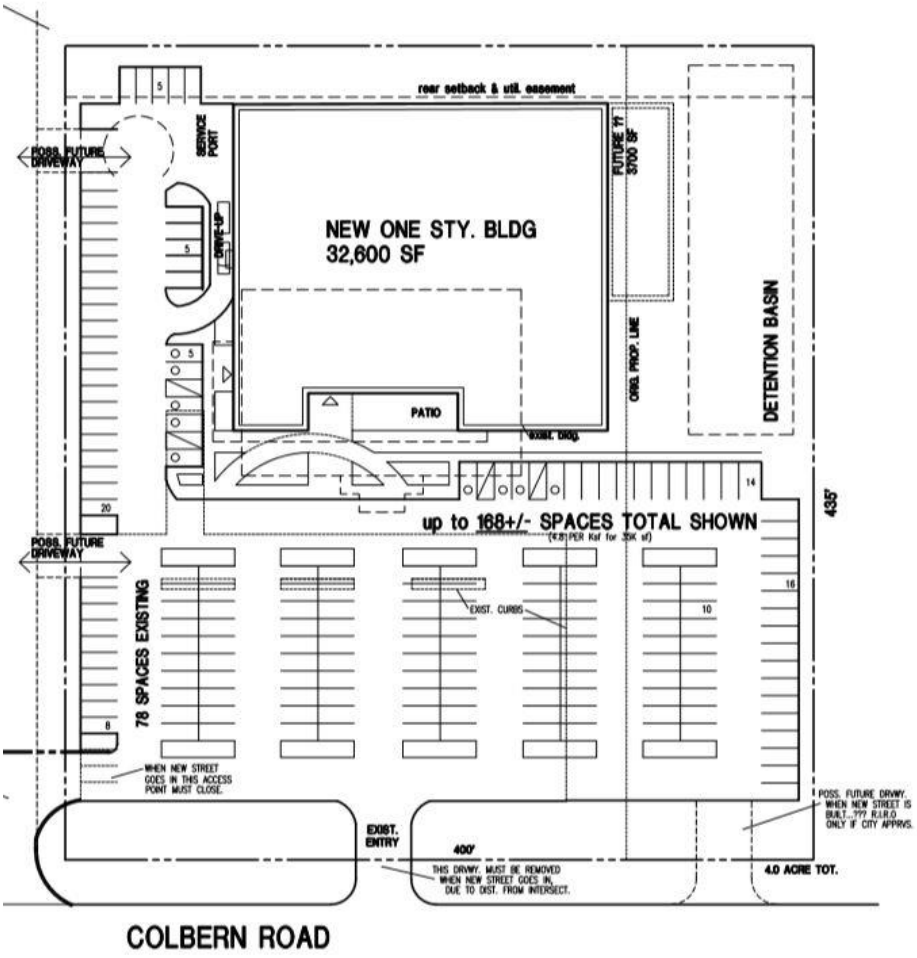
Figure 1: Site Location



A.3. PROJECT DESCRIPTION

We understand that the project will include the demolition of the existing structure and the reconstruction of a new library. The new library will be a single story, slab-on-grade structure. We also understand that the current parking lot will likely remain on site for the future library. At the time of this report, the finished floor elevation (FFE) and grading plans were not yet finalized, yet we anticipate cuts and fill to be minimal and the new FFE will likely maintain the existing FFE. A detention basis is planned for the northeast corner of the project site. The proposed site layout is presented in Figure 2.

Figure 2: Site Layout



B. Exploratory and Test Procedures

B.1. Field Exploration

The drill crew used a truck mounted drill rig to complete the eight borings at the site. The drill crew located the borings in the field by using GPS coordinates. The approximate locations of the borings are presented on the Boring Location Plan in Appendix A.

The borings were drilled to a depth ranging from 10 feet to 15 feet. Soil samples were obtained by using thin-walled sampling tubes and split-barreled procedures. The drill crew prepared field logs for each boring. These field logs contained visual classifications of the materials encountered during the drilling process as well as the drillers' interpretation of the subsurface conditions between the samples. Water level observations were made during and immediately after the drilling process. The Borehole Reports are presented in Appendix B.

B.2. Laboratory Testing

At our laboratory, we visually classified the soil samples in accordance with the Unified Soil Classification System (USCS). We measured the moisture content of each sample. Dry density and unconfined compression tests on selected tube samples. Two Atterberg limits test was performed on selected samples to aid in the classification of the soils under the USCS. Based on the laboratory test results and our observations of the samples, we modified the field logs that were prepared by the drill crew. Results of the laboratory tests are shown on the appended Borehole Reports.

C. SUBSURFACE CONDITIONS

C.1. SOIL STRATIGRAPHY

The subsurface conditions shown on the boring logs represent conditions at the specific boring locations at the times they were drilled. Variations may occur between or beyond the borings. The stratifications lines shown on the boring logs represent the approximate locations of changes in soil and bedrock types. The actual transitions between materials is usually gradual. Based on the borings, the subsurface conditions at this project site can be generalized as follows.

Borings B-1 through B-6 were drilled for the new structure and encountered a relatively thin rootzone layer. Borings B-7 and B-8 were drilled in the existing parking lot. Beneath the rootzone and/or Asphalt/gravel layers, native lean-to-fat clay soils were encountered to depths ranging from 10.5 feet to 14 feet. Borings B-5, B-7 and B-8 terminated in the clay soils at depths of 14 feet, 10 feet and 10 feet respectively. The clay soils were generally stiff to very stiff in consistency. Variably weathered limestone and shale bedrock were encountered in borings B-1 through B-6. Limestone was encountered at borings B-2, B-3 and B-4 at depths of 10 feet, 10.5 feet and 11.5 feet respectively. The limestone resulted in practical auger refusal at 11.6 feet in boring B-4. A possible clay filled joint in the limestone was encountered at boring B-3B at approximately 11.7 feet. Shale bedrock was encountered at borings B-1 and B-6 at approximate depths of 14 feet.

C.2. GROUNDWATER SUMMARY

Water level observations were made at the boring locations during drilling and immediately upon completion. Water was observed in borings B-2 and B-3 during the drilling process at 13.5 feet and 11.7 feet respectively. Water was also observed immediately following the drilling process in B-3 at 10 feet. Variations and uncertainties exist with relatively short-term water level observations in boreholes. Water levels can and should be anticipated to vary between boring locations, as well as with time within specific borings. Water typically collects near the interface between different materials such as soil and bedrock. Groundwater levels may be expected to fluctuate with precipitation, site grading, drainage and adjacent land use. Long term monitoring with piezometers generally provides a more representative indication of the potential range of groundwater conditions.

D. GEOTECHNICAL CONSIDERATIONS

Demolition of the existing build is planned. We recommend the removal of the existing floor slab, any remaining below ground features, such as foundation elements, basement walls, or abandoned utility lines, be completely removed from the site prior to construction.

We further understand that the current parking lot will be revisited. However, if demolition of the existing parking lot is required, an ***Olsson*** representative should observe the exposed ground surface in the current parking lot areas.

Any loose, low density fills associated with prior construction should also be removed at this time. ***Olsson*** should observe the exposed grades in these areas following overexcavation and prior to placement of new fill. Excavations created by demolition and removal of existing structures or parking areas should be backfilled with structural fill, placed and compacted as recommended in this report.

E. SITE PREPARATION

E.1. BUILDING AND PAVEMENT AREAS

Demolition of the existing structure should include removal of floor slabs, foundations, utilities and any other below grade features that will conflict with the planned construction. Areas disturbed during demolition operations should be thoroughly evaluated by ***Olsson*** prior to placement of fill. All disturbed soils should be undercut prior to placement of fill. Where existing or abandoned underground utilities are encountered within the proposed building areas, the trench backfill should be evaluated by ***Olsson*** to determine if the backfill should be undercut and replaced. Outside the existing building any existing topsoil, vegetation and related root systems, frozen soil, and/or any other deleterious or unsuitable materials should be stripped from the construction area. Stripping depths will likely vary and should be adjusted as necessary. These unsuitable materials should be removed and carefully separated to avoid incorporation of organic materials into new fill sections or building areas.

Prior to placement of fill in areas below design grade and after completion of rough grading in cut areas of the site, the subgrade should be visually observed, and proof rolled to help delineate soft or disturbed areas. An ***Olsson*** representative should observe the proofrolling. Unsuitable areas identified by proofrolling should be undercut to expose stable material and backfilled with controlled engineered fill. Proofrolling should be accomplished using a fully loaded, tandem-axle dump truck or other equipment providing an equivalent subgrade loading.

Prior to placement of fill, the moisture content of the exposed grade should be evaluated in all construction areas. Where moisture contents are outside the range recommended for controlled fill, the exposed grade should be scarified, moisture conditioned and recompacted according to the recommendations presented in the "Fill Placement" section of this report. The required depth of scarification, moisture conditioning and recompaction will depend on soil conditions at the time of construction

E.2. STRUCTURAL FILL

All structural fill and backfill should consist of approved materials, free of organic matter (organic content less than 5 percent), and debris. Structural fill soils should not contain particle sizes larger than three inches. With the exception of the low volume change (LVC) layer beneath grade supported slabs, in our opinion, the existing soils are suitable for reuse at this site in new fill areas. Samples of all proposed fill materials should be submitted to the geotechnical engineer of record prior to use on the site. Laboratory Proctor compaction tests and classification tests should be performed on any fill material placed during mass grading operations.

We recommend that structural fill and backfill be compacted in accordance with the criteria provided in Table 1. An ***Olsson*** representative should observe fill placement operations and perform field density tests, as required.

Suitable fill materials should be placed in thin loose lifts of 8 inches or less. Within small excavations, such as in utility trenches, around manholes, or behind retaining walls, the use of vibrating plate compactors, jumping jack compactors or walk behind sheepsfoot compactors may be used to facilitate compaction in these areas. Loose lift thicknesses of 4 inches or less are recommended where small compaction equipment is used.

The moisture content for suitable borrow soils at the time of compaction should generally be maintained between the ranges specified above. More stringent moisture limits may be necessary with certain soils and some adjustments to moisture contents may be necessary to achieve compaction in accordance with project specifications.

Table 1: Fill Placement Guidelines

Area of Fill Placement	Material	Compaction Recommendation*	Moisture Content (Percent of Optimum)
Granular Layer – 4" beneath floor slabs	ASTM C-33, # 57 Stone	65% of Relative Density	As necessary to obtain density
Low Volume Change (LVC) – 18" below base of building granular layer	MoDOT Type 5 Baserock	95%	As necessary to obtain density
Structural Fill – on-site	On-site Cohesive Soil	95%	0 to 4 percent
Structural Fill – imported	LL < 60 PI < 30	95%	0 to +4 percent
Pavement Subgrade – 9" Recompacted Subgrade	LL < 60 PI < 30	95%	0 to +4 percent

*According to ASTM D-698 – Standard Proctor

E.3. DRAINAGE AND GROUNDWATER CONSIDERATIONS

Water should not be allowed to collect at the ground surfaces near foundations, floor slabs, or areas of new pavement, either during or after construction. Provisions should be made to quickly remove accumulating seepage water or storm water runoff from excavations. Undercut or excavated areas should be sloped toward one corner to allow rainwater or surface runoff to be quickly collected and gravity drained or pumped from construction areas. Subgrade soils that are exposed to precipitation or runoff should be evaluated by ***Olsson*** prior to the placement of new fill, reinforcing steel, or concrete, to determine if corrective action is required.

To minimize concerns related to improper or inadequate drainage away from foundation bearing subgrades or from cohesive backfill materials used in utility or foundation trenches, we recommend the following:

- Site grading should provide for efficient drainage of rainfall or surface runoff away from new structures and pavement.
- Roof run-off should be collected and transferred directly to the storm sewer system or directed to a location with positive and rapid drainage away from new structures and pavements.
- External hose connections in unpaved areas should incorporate splash blocks to prevent accidental flooding of foundation bearing or backfill soils. External hose connections should have cut-off valves inside the building to prevent accidental or unauthorized use.
- Maintenance personnel should be informed of the potential problems associated with watering near the building.

F. STRUCTURES

F.1. FOUNDATIONS

In our opinion, the new buildings can be supported on shallow foundations bearing on stiff to very stiff native clay and/or structural fill placed and compacted as recommended in this report. For shallow foundations supported on stiff to very stiff native clay soils and/or structural fill, a maximum net allowable soil bearing pressure of 2,000 pounds per square foot (psf) can be used for design. The net allowable soil bearing pressure refers to the bearing pressure at foundation level in excess of surrounding overburden pressure.

Exterior footings should bear at a minimum depth of 3 feet below the lowest adjacent final ground surface. Footings should have a minimum foundation width of 18 inches for continuous footings and 30 inches for isolated column footings. Earth formed trench footings should have a minimum width of 12 inches.

Lightly loaded interior partition walls (applying less than 0.75 kips per lineal foot (klf)) may be supported directly on the slab-on-grade floor. Depending on the floor slab design and the specific wall loads, it may be necessary to increase the floor slab reinforcement or provide a thickened slab cross-section below interior wall. For interior walls with loads greater than 0.75 klf, we recommend a footing be installed, independent of the floor slab, to properly distribute the wall loads to the underlying soils and reduce the potential for floor slab damage.

The base of all foundation excavations should be free of water and loose material (or soil) prior to placing concrete. Prior to placement of concrete, Olsson should observe the soil conditions. If the base of the footing excavations becomes disturbed during construction or if unsuitable bearing conditions are encountered, we recommend carefully extending the excavations to suitable bearing soils. Concrete should be placed soon after excavating to minimize disturbance of the bearing materials. Should the materials at bearing level become excessively dry, disturbed or saturated, the affected material should be removed prior to placing concrete.

In our opinion, foundations supported on clay soils (fill or native) could experience total settlements on the order of 1 inch and differential settlements on the order of ½ inch.

F.2. FLOOR SLAB SUBGRADE PREPARATION

A low volume change (LVC) material should be used to construct at least the top 18 inches of the building floor slab subgrades. We recommend the use of MoDOT Type 5 base rock for the LVC Zone.

The low volume change material should be placed and compacted in accordance with the *Structural Fill* section of this report. Upon completion of grading operations in the building areas, care should be taken to maintain the recommended subgrade moisture content and density until the floor slabs are constructed. Areas of the completed subgrade that become desiccated, saturated, frozen or disturbed by construction activity should be reconditioned to meet the recommendations of this report prior to placement of the granular leveling course and construction of the slabs.

A free draining compacted granular leveling course (e.g. ASTM C 33 Size No. 57 aggregate) having a minimum thickness of 6 inches should be placed below the floor slabs to provide uniform slab support. The layer of free-draining granular material should be in addition to the minimum 18-inch thick low volume change zone recommended below the building floor slab. If moisture vapor transmission through the concrete slab is a concern (e.g. if moisture sensitive floor coverings will be used), a vapor barrier should be used.

The procedures recommended above may not eliminate all future subgrade volume change and resultant floor slab movement. However, the procedures outlined should significantly reduce the potential for subgrade volume change. Common construction practice is to tie the slab-on-grade into the foundation elements to limit the impact of differential movement at doorways. Depending on the location of construction joints in the slab, the rigidity of the slab and foundation connection, and the magnitude of actual movement that occurs, some minor cracking within the floor slab could occur and should be anticipated.

F.3. SEISMIC SITE CLASSIFICATION

The subsurface profile for the project site consists of clay soils over limestone and shale bedrock. These conditions are consistent with the definition of Site Class "D" according to ASCE 7.

G. PAVEMENTS

G.1. PAVEMENT SUBGRADE PREPARATION

All pavements should be supported on a minimum of 9 inches of subgrade prepared in accordance with the recommendations presented in the Site Preparation section of this report. Construction scheduling often involves grading and paving by separate contractors and can involve a time lapse between the end of grading operations and the commencement of paving. Disturbance, desiccation or wetting of the subgrade soils between grading and paving can result in deterioration of the previously completed subgrade. If soft areas are identified during the subgrade preparation or if the subgrade soils have been exposed to adverse weather conditions, frost, excessive construction traffic, standing water, or similar conditions, the Olsson should be consulted to determine if corrective action is necessary.

It is important that the pavement subgrade support be relatively uniform, with no abrupt changes in the degree of support. Non-uniform pavement support can occur at the transition from cut to fill areas, or as a result of varying soil moisture contents or soil types, or where improperly placed utility backfill has been placed across or through areas to be paved. Improper subgrade preparation such as inadequate vegetation removal, failure to identify soft or unstable areas by proofrolling, and inadequate or improper compaction can also produce non-uniform subgrade support.

We recommend that the prepared subgrade extend a minimum of 2-feet outside the pavements, where feasible. Olsson should be present during subgrade preparation to observe, document, and test compaction of the materials at the time of placement. As recommended for all prepared soil subgrades, heavy, repetitive construction traffic should be controlled, especially during periods of wet weather, to minimize disturbance. The final prepared subgrade should be proof rolled with a loaded dump truck or similar rubber-tired equipment with a total weight of at least 20-tons, immediately prior to placement of new pavements. Proofrolling operations should be observed and documented by Olsson. Unstable or unsuitable soils revealed by proofrolling should be reworked to provide a stable subgrade or removed and replaced with structural fill.

Although not required, in our opinion, full depth flexible pavements supported on a stabilized subgrade tend to perform better and have longer design lives than pavements supported directly on a clay soil subgrade. Stabilization may also be required if subgrades become unstable. As a preferred pavement subgrade, the upper 9 inches of pavement subgrade should be stabilized with approximately 15 percent class C fly ash, 5 percent soil cement, or 5 percent hydrated lime (based on dry unit weights).

G.2. PAVEMENT DESIGN

Table 2 summarizes typical pavement sections for Asphaltic Cement (AC) with a granular base and Portland Cement Concrete (PCC). The sections represent typical minimum thicknesses. Routine maintenance of the pavement will be required, consisting of periodic seal coats and possibly one intermediate mill, in addition to regular crack maintenance.

PCC pavements are recommended for, loading/unloading areas, trash receptacle pads and approaches and other areas where heavy wheel loads will be concentrated. Concrete pavements in these areas should have a minimum thickness of 6 inches with a 4-inch leveling and drainage course of clean, crushed rock placed below the pavements. The leveling and drainage course for the PCC pavements should have an appropriate sub-drainage or other connection to a suitable gravity outfall to remove water from the drainage layer. The pavement subgrade should be graded to provide positive drainage below the granular base section. We further recommend that the length of concrete sections be such that no heavy truck wheels are allowed to rest on AC sections during loading/unloading operations.

The performance of pavements will be dependent upon a number of factors, including subgrade conditions at the time of paving, rainwater runoff, and traffic. Rainwater runoff should not be allowed to seep below pavements from adjacent areas. Pavements should be sloped approximately 1/4 inch per foot to provide rapid surface drainage.

Table 2: Minimum Recommended Pavement Sections

Parking Areas & Drive Areas	Heavy Vehicle Areas*
AC w/ Granular Base: 5" Asphalt Concrete 9" Compacted MoDOT Type 5 Baserock	Full Depth PCC: 8" PCC 4" Clean Rock Base *Applies to trash receptacle pads

*-Preferred subgrade stabilized w/ 15% Class C fly ash, 5% soil cement, or 5% lime

The pavement subgrade should be graded to adjacent storm sewer inlets and provisions should be made to provide drainage from the granular section into the storm sewer. Drainage of the granular base is particularly important where two different sections of pavements (AC and PCC) abut, so that water does not pond beneath the pavements and saturate the subgrade soils.

H. CONCLUSIONS AND LIMITATIONS

H.1. CONSTRUCTION OBSERVATION AND TESTING

We recommend that all earthwork during construction be monitored by a representative of ***Olsson***, including site preparation, placement of all structural fill and trench backfill, and pavement subgrades. The purpose of these services would be to provide ***Olsson*** the opportunity to observe the soil conditions encountered during construction, evaluate the applicability of the recommendations presented in this report to the soil conditions encountered, and recommend appropriate changes in design or construction procedures if conditions differ from those described herein.

H.2. LIMITATIONS

The conclusions and recommendations presented in this report are based on the information available regarding the proposed construction, the results obtained from our borings, laboratory testing program, and our experience with similar projects. The borings represent a very small statistical sampling of subsurface soils and it is possible that conditions may be encountered during construction that are substantially different from those indicated by the borings. In these instances, adjustments to design and construction may be necessary.

This geotechnical report is based on the site plan and information provided to ***Olsson*** and our understanding of the project as noted in this report. Changes in the location or design of new structures and could significantly affect the conclusions and recommendations presented in this geotechnical report. ***Olsson*** should be contacted in the event of such changes to determine if the recommendations of this report remain appropriate for the revised site design.

This report was prepared under the direction and supervision of a Professional Engineer registered in the State of Missouri with the firm of **Olsson, Inc.** The conclusions and recommendations contained herein are based on generally accepted, professional, geotechnical engineering practices at the time of this report, within this geographic area. No warranty, express or implied, is intended or made. This report has been prepared for the exclusive use of **Mid-Continent Public Library** and their authorized representatives for specific application to the proposed project described herein.

APPENDIX A
Boring Location Plan

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Boring Location Plan

Scale: n.t.s.
Project No. A18-0330
Approved by: JDP
Date: 12/20/2019

Mid-Continent Public Library: Colbern Road
Lee's Summit, Missouri

APPENDIX B
Symbols and Nomenclature
Boring Logs

SYMBOLS AND NOMENCLATURE

DRILLING NOTES

DRILLING AND SAMPLING SYMBOLS

SS:	Split-Spoon Sample (1.375" ID, 2.0" OD)	HSA:	Hollow Stem Auger	NE:	Not Encountered
U:	Thin-Walled Tube Sample (3.0" OD)	CFA:	Continuous Flight Auger	NP:	Not Performed
CS:	Continuous Sample	HA:	Hand Auger	NA:	Not Applicable
BS:	Bulk Sample	CPT:	Cone Penetration Test	% Rec:	Percent of Recovery
MC:	Modified California Sampler	WB:	Wash Bore	WD:	While Drilling
GB:	Grab Sample	FT:	Fish Tail Bit	IAD:	Immediately After Drilling
SPT:	Standard Penetration Test Blows per 6.0"	RB:	Rock Bit	AD:	After Drilling
				CI:	Cave-In

DRILLING PROCEDURES

Soil samples designated as "U" samples on the boring logs were obtained in using Thin-Walled Tube Sampling techniques. Soil samples designated as "SS" samples were obtained during Penetration Test using a Split-Spoon Barrel sampler. The standard penetration resistance 'N' value is the number of blows of a 140 pound hammer falling 30 inches to drive the Split-Spoon sampler one foot. Soil samples designated as "MC" were obtained in using Thick-Walled, Ring-Lined, Split-Barrel Drive sampling techniques. Recovered samples were sealed in containers, labeled, and protected for transportation to the laboratory for testing.

WATER LEVEL MEASUREMENTS

Water levels indicated on the boring logs are levels measured in the borings at the times indicated. In relatively high permeable materials, the indicated levels may reflect the location of groundwater. In low permeability soils, the accurate determination of groundwater levels is not possible with only short-term observations.

SOIL PROPERTIES & DESCRIPTIONS

Descriptions of the soils encountered in the soil test borings were prepared using Visual-Manual Procedures for Descriptions and Identification of Soils.

PARTICLE SIZE

Boulders	12 in. +	Coarse Sand	4.75mm-2.0mm	Silt	0.075mm-0.005mm
Cobbles	12 in.-3 in.	Medium Sand	2.0mm-0.425mm	Clay	<0.005mm
Gravel	3 in.-4.75mm	Fine Sand	0.425mm-0.075mm		

COHESIVE SOILS

Consistency	Unconfined Compressive Strength (Qu) (tsf)
Very Soft	<0.25
Soft	0.25 – 0.5
Firm	0.5 – 1.0
Stiff	1.0 – 2.0
Very Stiff	2.0 – 4.0
Hard	> 4.0

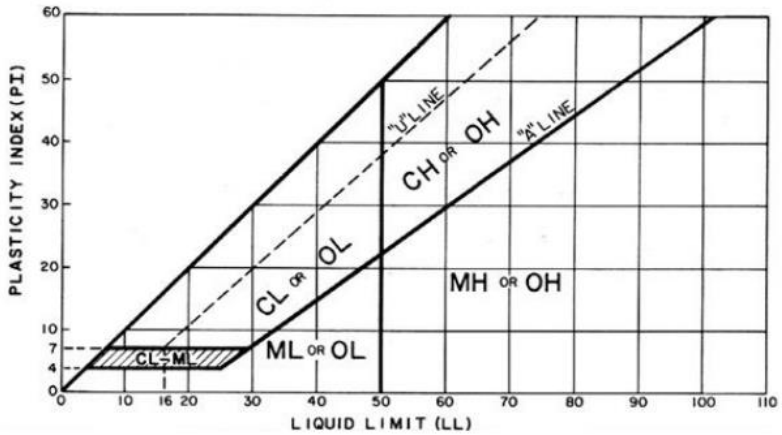
COHESIONLESS SOILS

Relative Density	'N' Value
Very Loose	0 – 3
Loose	4 – 9
Medium Dense	10 – 29
Dense	30 – 49
Very Dense	≥ 50

COMPONENT %

Description	Percent (%)
Trace	<5
Few	5 - 10
Little	15 - 25
Some	30 - 45
Mostly	50 - 100

PLASTICITY CHART



ROCK QUALITY DESIGNATION (RQD)

Description	RQD (%)
Very Poor	0 – 25
Poor	25 – 50
Fair	50 – 75
Good	75 – 90
Excellent	90 – 100

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BOREHOLE REPORT NO. B-1

Sheet 1 of 1

PROJECT NAME: **Mid-Continent Public Structural & Civil Evaluations**

CLIENT: **Mid-Continent Public Library**

PROJECT NUMBER: **A18-0330**

LOCATION: **Lee's Summit, Missouri**

Split Spoon | Shelby Tube

ELEVATION (ft)	MATERIAL DESCRIPTION	GRAPHIC LOG	DEPTH (ft)	SAMPLE TYPE NUMBER	CLASSIFICATION (USCS)	BLOWS/6" N-VALUE	UNC. STR. (tsf)	MOISTURE (%)	DRY DENSITY (pcf)	LL/PI (%)	ADDITIONAL DATA/ REMARKS
	ROOT ZONE 0.3'		0								
	LEAN CLAY *Stiff, dark brown*			SS 1		3-6-11 N=17	3.1	22.3		42/17	
	3.0' ***FAT CLAY*** *Stiff, red brown*			U 2				28.0	94.4		P.P.=4.25
	6.0' *Firm, light red brown*		5								
			10	SS 3		2-3-4 N=7		26.4			
	13.7' ***WEATHERED SHALE*** *Red brown* 14.2'			SS 4		3-50/3"		36.6			

BASE OF BORING AT 14.2 FEET

WATER LEVEL OBSERVATIONS	
WD	▽ Not Encountered
IAD	▼ Not Encountered
AD	▼ Not Encountered

OLSSON, INC.
1700 E. 123RD STREET
OLATHE, KANSAS 66061

STARTED:	11/19/19	FINISHED:	11/19/19
DRILL CO.:	OLSSON	DRILL RIG:	CME 45B
DRILLER:	K. PATTERSON	LOGGED BY:	D. Martin
METHOD: CONTINUOUS FLIGHT AUGER			

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BOREHOLE REPORT NO. B-2

Sheet 1 of 1

PROJECT NAME	CLIENT
Mid-Continent Public Structural & Civil Evaluations	Mid-Continent Public Library
PROJECT NUMBER	**LOCATION**
A18-0330	Lee's Summit, Missouri

Split Spoon ☒ Shelby Tube ■

ELEVATION (ft)	MATERIAL DESCRIPTION	GRAPHIC LOG	DEPTH (ft)	SAMPLE TYPE NUMBER	CLASSIFICATION (USCS)	BLOWS/6" N-VALUE	UNC. STR. (tsf)	MOISTURE (%)	DRY DENSITY (pcf)	LL/PI (%)	ADDITIONAL DATA/ REMARKS
	ROOT ZONE 0.2'		0								
	FAT CLAY										
	Firm, dark brown			SS 1		2-3-3 N=6		27.6			
	4.0'			U 2			3.3	24.6	99.2		
	Very stiff, olive brown		5								
	6.0'										
	Firm, light brown			SS 3		2-3-3 N=6		24.5			
	10.0'		10								
	WEATHERED LIMESTONE										
	Light brown, clay seams										
	▽			SS 4		2-50		35.9			
	14.5'										

BASE OF BORING AT 14.5 FEET

WATER LEVEL OBSERVATIONS	
WD	▽ 13.5 ft
IAD	▼ Not Encountered
AD	▼ Not Encountered

OLSSON, INC.
1700 E. 123RD STREET
OLATHE, KANSAS 66061

STARTED:	11/19/19	FINISHED:	11/19/19
DRILL CO.:	OLSSON	DRILL RIG:	CME 45B
DRILLER:	K. PATTERSON	LOGGED BY:	D. Martin
METHOD: CONTINUOUS FLIGHT AUGER			

BOREHOLE REPORT NO. B-3

Sheet 1 of 1

PROJECT NAME	CLIENT
Mid-Continent Public Structural & Civil Evaluations	Mid-Continent Public Library
PROJECT NUMBER	**LOCATION**
A18-0330	Lee's Summit, Missouri

Split Spoon ☒ Shelby Tube ■

ELEVATION (ft)	MATERIAL DESCRIPTION	GRAPHIC LOG	DEPTH (ft)	SAMPLE TYPE NUMBER	CLASSIFICATION (USCS)	BLOWS/6" N-VALUE	UNC. STR. (tsf)	MOISTURE (%)	DRY DENSITY (pcf)	LL/PI (%)	ADDITIONAL DATA/ REMARKS
	ROOT ZONE 0.5'		0								
	FAT CLAY										
	Firm, dark brown			SS 1		3-3-4 N=7		26.8			
	2.3'										
	Very stiff, olive red brown			U 2			2.4	25.2	99.5		
			5								
	6.0'										
	Firm, light brown										
				SS 3		3-4-5 N=9		26.7			
	▼		10								
	11.0'										
	11.5'										
	Yellow brown, shaley 11.7'										
	WEATHERED LIMESTONE										
	FAT CLAY										
	Dark brown, clay joint										
	13.6'										
	LIMESTONE 13.9'			SS 4		50/5"		28.5			

BASE OF BORING AT 13.9 FEET

WATER LEVEL OBSERVATIONS	
WD	▽ 11.7 ft
IAD	▼ 10.0 ft after 0 Hrs
AD	▼ Not Encountered

OLSSON, INC.
1700 E. 123RD STREET
OLATHE, KANSAS 66061

STARTED:	11/19/19	FINISHED:	11/19/19
DRILL CO.:	OLSSON	DRILL RIG:	CME 45B
DRILLER:	K. PATTERSON	LOGGED BY:	D. Martin
METHOD: CONTINUOUS FLIGHT AUGER			

olsson

BOREHOLE REPORT NO. B-4

Sheet 1 of 1

PROJECT NAME	CLIENT
Mid-Continent Public Structural & Civil Evaluations	Mid-Continent Public Library
PROJECT NUMBER	**LOCATION**
A18-0330	Lee's Summit, Missouri

Split Spoon ☒ Shelby Tube ■

ELEVATION (ft)	MATERIAL DESCRIPTION	GRAPHIC LOG	DEPTH (ft)	SAMPLE TYPE NUMBER	CLASSIFICATION (USCS)	BLOWS/6" N-VALUE	UNC. STR. (tsf)	MOISTURE (%)	DRY DENSITY (pcf)	LL/PI (%)	ADDITIONAL DATA/ REMARKS
	ROOT ZONE 0.3'		0								
	FAT CLAY										
	Stiff, dark brown			SS 1		3-4-5 N=9		15.5			
	4.0'			U 2			1.1	23.8	95.7		
	Stiff, olive brown with red		5								
	6.0'										
	Stiff, light brown										
			10	SS 3		3-3-4 N=7		34.2			
	10.5'										
	WEATHERED LIMESTONE 11.3'										
	LIMESTONE 11.6'										

REFUSAL AT 11.6 FEET

WATER LEVEL OBSERVATIONS	
WD	▽ Not Encountered
IAD	▼ Not Encountered
AD	▼ Not Encountered

OLSSON, INC.
1700 E. 123RD STREET
OLATHE, KANSAS 66061

STARTED:	11/18/19	FINISHED:	11/18/19
DRILL CO.:	OLSSON	DRILL RIG:	CME 45B
DRILLER:	K. PATTERSON	LOGGED BY:	D. Martin
METHOD: CONTINUOUS FLIGHT AUGER			

BOREHOLE REPORT NO. B-5

Sheet 1 of 1

PROJECT NAME: Mid-Continent Public Structural & Civil Evaluations	CLIENT: Mid-Continent Public Library
PROJECT NUMBER: A18-0330	LOCATION: Lee's Summit, Missouri

Split Spoon ☒ Shelby Tube ■

ELEVATION (ft)	MATERIAL DESCRIPTION	GRAPHIC LOG	DEPTH (ft)	SAMPLE TYPE NUMBER	CLASSIFICATION (USCS)	BLOWS/6" N-VALUE	UNC. STR. (tsf)	MOISTURE (%)	DRY DENSITY (pcf)	LL/PI (%)	ADDITIONAL DATA/ REMARKS
	ROOT ZONE 0.4'		0								
	LEAN CLAY										
	Stiff, dark brown			SS 1		4-4-5 N=9		25.7		49/26	
	4.0'										
	FAT CLAY			U 2				26.9	93.0		P.P.=3.75
	Stiff, olive brown		5								
	6.0'										
	Firm, light brown										
				SS 3		2-3-3 N=6		24.0			
			10								
				U 4			0.5	47.1	75.2		
	14.0'										

BASE OF BORING AT 14.0 FEET

WATER LEVEL OBSERVATIONS	
WD	▽ Not Encountered
IAD	▼ Not Encountered
AD	▼ Not Encountered

OLSSON, INC.
1700 E. 123RD STREET
OLATHE, KANSAS 66061

STARTED:	11/19/19	FINISHED:	11/19/19
DRILL CO.:	OLSSON	DRILL RIG:	CME 45B
DRILLER:	K. PATTERSON	LOGGED BY:	D. Martin
METHOD: CONTINUOUS FLIGHT AUGER			

BOREHOLE REPORT NO. B-6

Sheet 1 of 1

PROJECT NAME: Mid-Continent Public Structural & Civil Evaluations	CLIENT: Mid-Continent Public Library
PROJECT NUMBER: A18-0330	LOCATION: Lee's Summit, Missouri

Split Spoon ☒ Shelby Tube ■

ELEVATION (ft)	MATERIAL DESCRIPTION	GRAPHIC LOG	DEPTH (ft)	SAMPLE TYPE NUMBER	CLASSIFICATION (USCS)	BLOWS/6" N-VALUE	UNC. STR. (tsf)	MOISTURE (%)	DRY DENSITY (pcf)	LL/PI (%)	ADDITIONAL DATA/ REMARKS
	ROOT ZONE 0.3'		0								
	FAT CLAY										
	Stiff, dark brown			SS 1		4-5-4 N=9		20.0			
	4.0'			U 2			2.9	25.2	95.9		
	Stiff, olive brown with red		5								
	6.0'										
	Stiff, light brown										
			10	SS 3		2-3-4 N=7		28.8			
	14.0'			SS 4		3-17-17 N=34		39.3			
	WEATHERED SHALE		15								
	Brown with gray, clayey 15.0'										

BASE OF BORING AT 15.0 FEET

WATER LEVEL OBSERVATIONS	
WD	▽ Not Performed
IAD	▼ Not Performed
AD	▼ Not Performed

OLSSON, INC.
1700 E. 123RD STREET
OLATHE, KANSAS 66061

STARTED:	11/19/19	FINISHED:	11/19/19
DRILL CO.:	OLSSON	DRILL RIG:	CME 45B
DRILLER:	K. PATTERSON	LOGGED BY:	D. Martin
METHOD: CONTINUOUS FLIGHT AUGER			

BOREHOLE REPORT NO. B-7

PROJECT NAME	CLIENT
Mid-Continent Public Structural & Civil Evaluations	Mid-Continent Public Library
PROJECT NUMBER	**LOCATION**
A18-0330	Lee's Summit, Missouri

Split Spoon ☒ Shelby Tube ■

ELEVATION (ft)	MATERIAL DESCRIPTION	GRAPHIC LOG	DEPTH (ft)	SAMPLE TYPE NUMBER	CLASSIFICATION (USCS)	BLOWS/6" N-VALUE	UNC. STR. (tsf)	MOISTURE (%)	DRY DENSITY (pcf)	LL/PI (%)	ADDITIONAL DATA/ REMARKS
	ASPHALT 0.4'		0								
	AGGREGATE BASE 0.9'										
	FAT CLAY										
	Stiff, dark brown			SS 1		4-4-4 N=8		27.6			
	4.0'			U 2			0.7	27.9	94.3		
	Firm, olive brown		5								
	6.0'										
	Firm, light brown										
	10.0'		10	SS 3		2-2-3 N=5		23.2			

BASE OF BORING AT 10.0 FEET

WATER LEVEL OBSERVATIONS	
WD	▽ Not Performed
IAD	▼ Not Performed
AD	▼ Not Performed

OLSSON, INC.
1700 E. 123RD STREET
OLATHE, KANSAS 66061

STARTED:	11/19/19	FINISHED:	11/19/19
DRILL CO.:	OLSSON	DRILL RIG:	CME 45B
DRILLER:	K. PATTERSON	LOGGED BY:	D. Martin
METHOD: CONTINUOUS FLIGHT AUGER			

BOREHOLE REPORT NO. B-8

PROJECT NAME: **Mid-Continent Public Structural & Civil Evaluations**	CLIENT: **Mid-Continent Public Library**
PROJECT NUMBER: **A18-0330**	LOCATION: **Lee's Summit, Missouri**

Split Spoon ☒ Shelby Tube ■

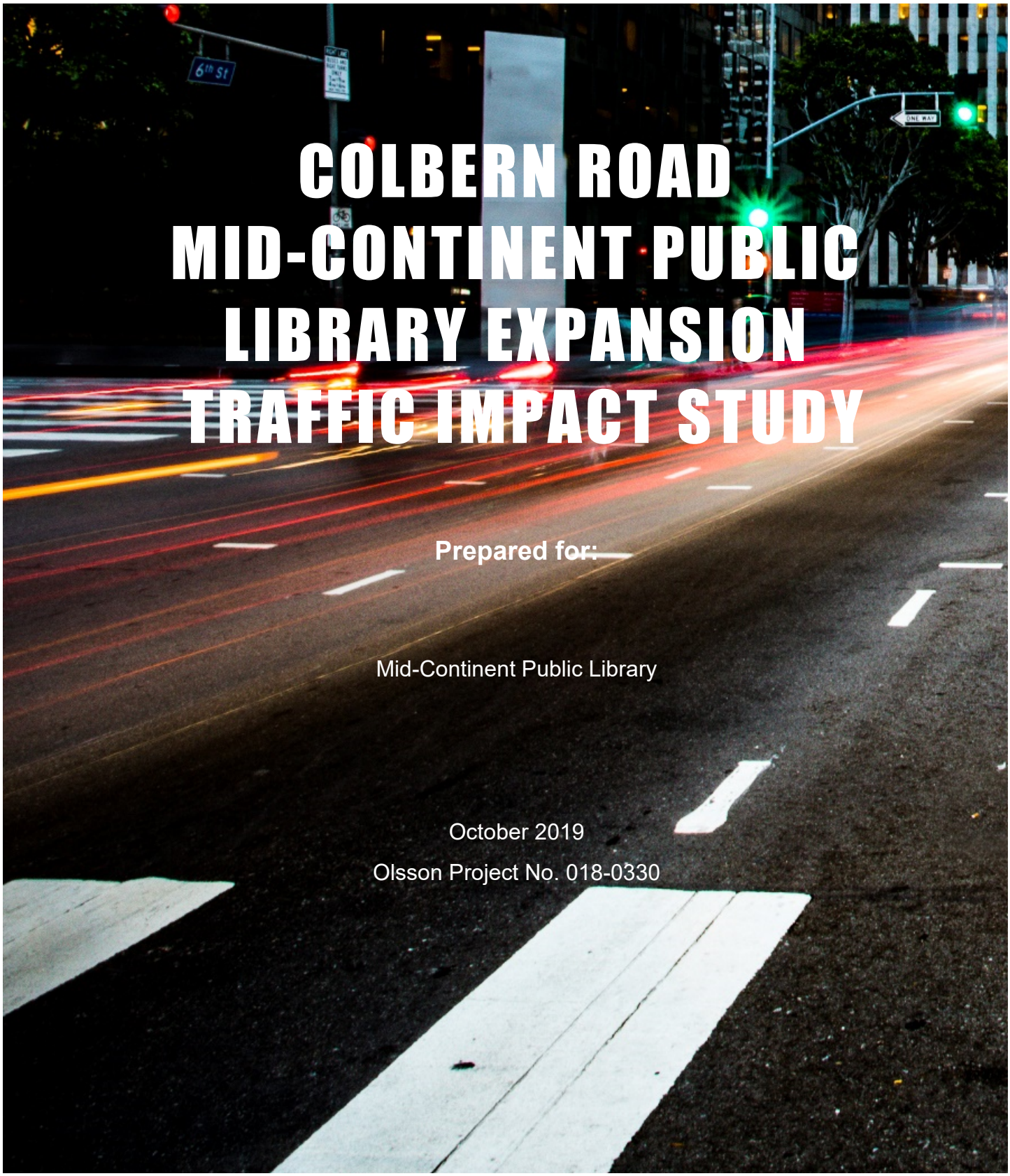
ELEVATION (ft)	MATERIAL DESCRIPTION	GRAPHIC LOG	DEPTH (ft)	SAMPLE TYPE NUMBER	CLASSIFICATION (USCS)	BLOWS/6" N-VALUE	UNC. STR. (tsf)	MOISTURE (%)	DRY DENSITY (pcf)	LL/PI (%)	ADDITIONAL DATA/ REMARKS
	ASPHALT 0.4'		0								
	AGGREGATE BASE 0.9'										
	FAT CLAY *Stiff, dark brown*			SS 1		3-4-7 N=11		28.1			
	4.0'										
	Stiff, olive brown		5	U 2			1.0	28.0	95.2		
	6.0'										
	Firm, brown										
	10.0'		10	SS 3		2-3-2 N=5		27.0			

BASE OF BORING AT 10.0 FEET

WATER LEVEL OBSERVATIONS	
WD	▽ Not Encountered
IAD	▼ Not Encountered
AD	▼ Not Encountered

OLSSON, INC.
1700 E. 123RD STREET
OLATHE, KANSAS 66061

STARTED:	11/19/19	FINISHED:	11/19/19
DRILL CO.:	OLSSON	DRILL RIG:	CME 45B
DRILLER:	K. PATTERSON	LOGGED BY:	D. Martin
METHOD: CONTINUOUS FLIGHT AUGER			



COLBERN ROAD MID-CONTINENT PUBLIC LIBRARY EXPANSION TRAFFIC IMPACT STUDY

Prepared for:

Mid-Continent Public Library

October 2019

Olsson Project No. 018-0330

olsson

STATE OF MISSOURI
SHANNON JEFFRIES
NUMBER PE-2008000069
PROFESSIONAL ENGINEER
10.03.2019

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APPENDICES

1. INTRODUCTION

This report studies traffic impacts associated with the Colbern Road Mid-Continent Public Library (MCPL) proposed expansion to the existing facility located north of Colbern Road between Rice Road and Ball Drive in Lee's Summit, Missouri.

This report will review the impacts of the proposed expansion development on the existing roadway network and will recommend additional turn lanes, storage bays, and intersection control methods per the City of Lee's Summit *Access Management Code* and Missouri Department of Transportation's (MoDOT's) Engineering Policy Guide (EPG), as appropriate, for the following study intersections:

- Colbern Road and Northbound 291 Off-Ramp
- Colbern Road and Rice Road
- Colbern Road and Existing West Church Access (aligns with proposed MCPL access)
- Colbern Road and Existing Library/East Church Access
- Colbern Road and Ball Drive

For this study, the following scenarios were analyzed:

- Existing Conditions
- Existing Plus Proposed Development Conditions

In addition to the scenarios analyzed, a discussion of future access for the development will be provided considering public roadway plans adjacent to the site.

The approximate location of the proposed development is shown on **Figure 1**.

FIGURE 1

Vicinity Map

Colbern Road MCPL
Lee's Summit, MO

LEGEND

Proposed Site Expansion

Source: Google Maps

2. DATA COLLECTION

The data collection effort included acquiring AM and PM peak hour turning movement counts and documentation of current roadway geometrics. Traffic counts were collected on Tuesday, July 23rd, 2019 at the study intersections listed in **Section 1.0**.

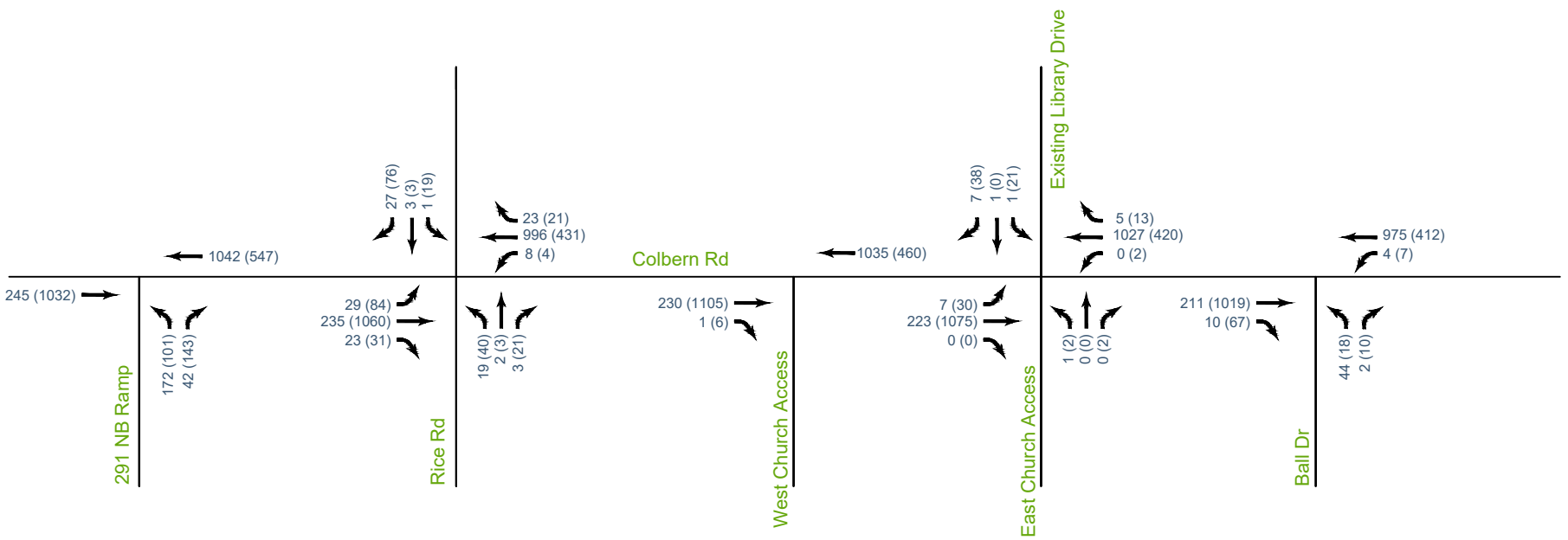
The counts were conducted during the typical weekday AM and PM peak periods from 7:00-9:00 AM and 4:00-6:00 PM. The AM peak hour period for the study intersections was determined to be from 7:00-8:00 AM. The PM peak hour period for the study intersections was determined to be from 4:45-5:45 PM. The existing peak hour volumes are illustrated in **Figure 1**. Count data for this study can be found in **Appendix A**.

The existing library is approximately 15,000 square feet. A comparison of actual trips to the site based on AM and PM peak hour data collection was compared to trip generation results for a 15,000 square foot library. Trip generation was conducted as discussed in **Section 4.1**. For reference, documentation of this comparison is provided in **Appendix A**. Reviewing actual traffic to expected traffic, the existing library site generates more actual trips during the AM peak hour period than expected through trip generation. The site generates fewer actual trips during the PM peak hour period than expected through trip generation.

FIGURE 2

Existing
Peak Hour Volumes

Colbern Road MCPL
Lee's Summit, MO



LEGEND

AM (PM) Peak Hour Volume

Proposed Site Location

3. EXISTING CONDITIONS

Existing traffic conditions were evaluated to identify any existing deficiencies and to provide a baseline for comparative purposes.

3.1. Network Characteristics

Four roadways within the study area were considered during analysis: Colbern Road, Northbound 291 Off-Ramp, Rice Road, and Ball Drive. Referencing the City's *2019 Comprehensive Plan Land Use Map,* current network characteristics are summarized in **Table 1**.

Table 1. Existing Network Summary.

Roadway	Functional Classification	Typical Section	Median Type	Posted Speed
Colbern Road	Major Arterial	4-Lane	Raised	40 mph
Northbound 291 Off-Ramp	Freeway	1-Lane Approach	Not Applicable	35 mph
Rice Road	Commercial Collector	2-Lane	None	45 mph north of Colbern Road/25 mph south of Colbern Road
Ball Drive	Residential Collector	2-Lane	None	25 mph

The intersection of Colbern Road and the Northbound 291 Off-Ramp is a signalized intersection. Pedestrian accommodations including marked crosswalks and pedestrian pushbuttons and signal heads are provided at the intersection.

The intersection of Colbern Road and Rice Road is unsignalized with stop-control provided for the minor street approaches (Rice Road). Marked crosswalks are provided along the north and south legs of the intersection for east/west pedestrian travel.

The intersection of Colbern Road and Ball Drive is a signalized intersection. Pedestrian accommodations including marked crosswalks and pedestrian pushbuttons and signal heads are provided at the intersection.

Sidewalk is provided along Colbern Road along both the north and south sides of the roadway. The existing sidewalk network along the north side of Colbern Road ends at the Northbound 291 Off-Ramp. The south sidewalk network is continuous throughout the project area.

3.2. Existing Warrant Analysis

Signal Warrants

A traffic signal may be justified if traffic conditions meet any of the applicable nine signal warrants described in the 2009 Manual on Uniform Traffic Control Devices (MUTCD). The MUTCD provides criteria for conducting an engineering study to determine whether a traffic signal is appropriate at any intersection.

For this study, based on the data available, the Four-Hour Vehicular Volume Warrant (Warrant 2) and the Peak Hour Signal Warrant (Warrant 3) were reviewed under existing conditions to determine if alternative control measures are warranted for the currently unsignalized intersections of Colbern Road with Rice Road and the Existing Library/Church Access. Based on available data, the intersections do not meet the necessary criteria to warrant a traffic signal.

Signal warrant analysis sheets can be found in **Appendix B**.

Turn Lane Warrants

City of Lee's Summit Access Management Code (AMC) guidelines were reviewed for turn lanes along study area roadways.

Left-turn Lanes: Based on the Lee's Summit AMC, left-turn lanes shall be provided on all approaches to intersections controlled by a signal. Turn lanes are provided as recommended at signalized intersections with the exception of the northbound approach of Ball Drive at Colbern Road. This is a T-intersection, serving northbound traffic approaching Colbern Road (left and right-turn movements). A dedicated left-turn lane is not provided; however, the approach does not service a through movement thus a turn lane may not be required for this situation. Capacity analysis and queuing will be reviewed to determine if a dedicated turn lane is recommended.

Based on the Lee's Summit AMC, left-turn lanes shall be provided on all arterial streets at the intersection with another arterial or collector street. On major arterial streets, left-turn lanes shall be provided at the intersection with all connectors (an exception may be granted for a singular, existing, residential lot). Turn lanes are provided as recommended along Colbern Road at the study intersections.

Per the AMC, left-turn lanes shall be provided on non-residential connectors intersecting with major arterial streets (where left-turn egress is permitted). Left-turn lanes should be provided on any connector at any location as recommended by a traffic study or where the left-turn lane provides design efficiencies desired by the owner/developer with exception of access associated with residential property. Dedicated left-turn lanes are not provided for northbound and southbound approaches at the intersection of Colbern Road and Rice Road. Capacity analysis and queuing will be reviewed to determine if a dedicated turn lane is recommended.

The existing library access has a single exit approach. Capacity analysis and queuing will be reviewed to determine if a dedicated turn lane is recommended.

Per the AMC, the minimum length of a left-turn lane should be 200 feet plus taper on an arterial street at non-arterial intersecting locations. The minimum length of a left-turn lane on collectors should be 150 feet plus taper. The minimum length of a left-turn lane on connectors should meet the driveway throat length requirements.

The eastbound left-turn lane at Colbern Road and Rice Road (60-feet), does not meet the recommended turn bay length for an arterial intersecting a collector. The ability to increase the eastbound left-turn lane is limited by the presence of the adjacent intersection of Colbern Road and the Northbound 291 Off-Ramp. Capacity analysis and queuing for the movement will be reviewed.

The existing eastbound left-turn lane at the library access (90-feet) does not meet the recommended minimum turn bay length. The ability to increase the turn bay length is limited by the presence of turn bays for adjacent access drives. Capacity analysis and queuing for the movement will be reviewed.

Right-turn Lanes: Based on the Lee's Summit AMC, right-turn lanes shall be provided on arterial streets for any movement with a volume of 30 vehicles in any hour at each intersecting street or driveway. Based on this criteria, the eastbound right-turn movement at the intersection of Colbern Road and Rice Road exceeds the criteria for a right-turn lane by one vehicle during the PM peak hour period (31 right-turning vehicles) based on existing volumes. Due to the proximity of the intersection to the signalized intersection of Colbern Road and the Northbound 291 Off-Ramp, the opportunity to construct an eastbound right-turn lane is limited. Capacity analysis and queuing for this movement will be reviewed.

The eastbound right-turn movement at the intersection of Colbern Road and Ball Drive exceeds the criteria for a right-turn lane (67 right-turning vehicles) during the PM peak hour period based on existing volumes. Capacity analysis and queuing for this movement will be reviewed to determine if a dedicated right turn lane is recommended at this location.

Existing locations that do not meet left or right-turn lane standards include:

- Dedicated left-turn lanes in northbound and southbound directions at Colbern Road and Rice Road are not provided
- Eastbound left-turn lane with reduced storage at Colbern Road and Rice Road
- Eastbound left-turn lane with reduced storage at Colbern Road and Existing Library/East Church Drive
- Dedicated eastbound right-turn lane at Colbern Road and Rice Road is not provided
- Dedicated eastbound right-turn lane at Colbern Road and Ball Drive is not provided

Capacity analysis is provided in **Section 3.3** to determine if additional turn lanes and/or storage length is recommended based on existing operations. Existing conditions lane configurations and traffic control for the study intersections are illustrated in **Figure 2**.

3.3. Existing Capacity Analysis

Capacity analysis was performed for the study intersections utilizing the existing lane configurations and traffic control. Analysis was conducted using Synchro, Version 10, based on the Highway Capacity Manual (HCM) delay methodologies. For simplicity, the amount of control delay is equated to a grade or Level of Service (LOS) based on thresholds of driver acceptance. The amount of delay is assigned a letter grade A through F, LOS A representing little or no delay and LOS F representing very high delay. **Table 2** shows the delays associated with each LOS grade for signalized and unsignalized intersections, respectively.

Table 2. Intersection LOS Criteria.

Level of Service	Average Control Delay (seconds)	
	Signalized	Unsignalized
A	< 10	< 10
B	> 10-20	> 10-15
C	> 20-35	> 15-25
D	> 35-55	> 25-35
E	> 55-80	> 35-50
F	> 80	> 50
Highway Capacity Manual (HCM 6th Edition)		

Queuing analysis was conducted using the 95th-percentile queue length. This represents the queue length that has a 5 percent probability of being exceeded during the peak hour period.

Results of the analysis indicate that the existing signalized study intersections are operating at an overall LOS B or better with individual movements operating at a LOS C or better during the AM and PM peak hour periods. The following operations were noted for existing analysis:

AM Peak Hour

- Colbern Road and Northbound 291 Off-Ramp
    - The westbound through movement 95th percentile queue may extend past the intersection of Colbern Road and Rice Road during portions of the AM peak hour period.

All movements at the unsignalized study intersections are operating at LOS D or better with acceptable queues during both the AM and PM peak hour periods with the following exceptions:

- Colbern Road and Rice Road
    - The southbound through movement is operating at a LOS E with a 95th percentile queue length of 78 feet during the PM peak hour period.
    - The northbound through movement is operating at a LOS F with a 95th percentile queue of 215 feet during the PM peak hour period.
    - Operations of this movement were observed via data collection video. Actual queuing of the northbound and southbound movements were not observed to exceed 3 to 4 vehicles.
- Colbern Road and Existing Library/East Church Access
    - The northbound movement is operating at a LOS E with a 95th percentile queue length of less than one vehicle.

Referencing Section 20.7 of the HCM for Two-Way Stop-Controlled Intersections, minor street approaches with movements operating at a lower level of service during peak hour periods are not uncommon at an unsignalized intersection. This is more prevalent for stop-controlled left-turn movements in urban areas, as higher volumes on the main road are accommodated. The HCM suggests that performance measures in addition to delay, such as volume-to-capacity (v/c) ratios for individual movements and queue lengths, should also be considered when evaluating the overall performance at two-way stop-controlled intersections. At the unsignalized minor street approaches listed above, the v/c ratios and 95th-percentile queues are acceptable during the peak hour periods with the exception of the northbound movement at the intersection of Colbern Road and Rice Road during the PM peak hour period. As stated above, the queue and delay represented in the capacity analysis was not noted during field observations. Capacity analysis will be reviewed for existing plus development conditions to determine if the proposed development has a substantial impact on existing operations.

Several existing turn lane deficiencies were noted. Capacity and queuing analysis were reviewed for each movement.

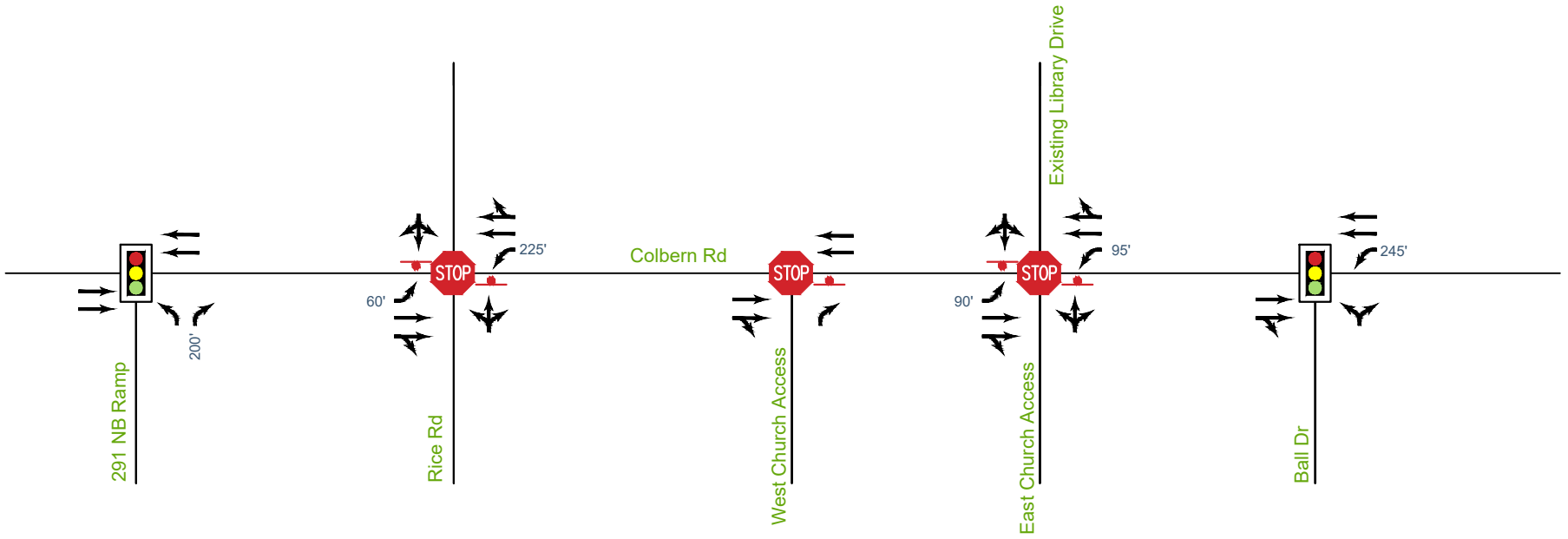
- *Dedicated left-turn lanes in northbound and southbound directions at Colbern Road and Rice Road are not provided.*
    - As mentioned under review of operations, data collection video was reviewed for the northbound and southbound approaches. Based on this review of operations, queuing of approximately 3 to 4 vehicles southbound and northbound was observed. This is consistent with reported southbound queuing but a decrease of expected northbound queuing.

  - Utilities in the area and existing access/development located in the southeast quadrant of the intersection may limit the opportunity for improvement. Additionally, the City has future plans for limitation of movements of this intersection and relocation of the full access intersection.
  - Capacity analysis will be reviewed for existing plus development conditions to determine if the proposed development has a substantial impact on existing operations.
- *Eastbound left-turn lane with reduced storage at Colbern Road and Rice Road*
  - Reviewing capacity analysis, the eastbound left-turn movement is operating at an acceptable level of service during both peak hour periods and 95th percentile queue lengths are not expected to exceed provided storage.
- *Eastbound left-turn lane with reduced storage at Colbern Road and Existing Library/East Church Drive*
  - Reviewing capacity analysis, the eastbound left-turn movement is operating at an acceptable level of service during both peak hour periods and 95th percentile queue lengths are not expected to exceed provided storage.
- *Dedicated eastbound right-turn lane at Colbern Road and Rice Road is not provided*
  - The limited intersection spacing between the Northbound 291 Off-Ramp and Rice Road limits the opportunity for an eastbound right-turn lane at this location. Volumes for the movement are low, and impact to the eastbound through movement is expected to be minimal.
- *Dedicated eastbound right-turn lane at Colbern Road and Ball Drive is not provided*
  - A longer through movement 95th percentile queue length (216') is noted during the PM peak hour period for the eastbound movement, although the queue is not indicated to extend to access for the business located west of the intersection. Capacity analysis will be reviewed for existing plus development conditions to determine if the proposed development has a substantial impact on existing operations.

FIGURE 3

Existing
Lane Configuration and Traffic Control

Colbern Road MCPL
Lee's Summit, MO



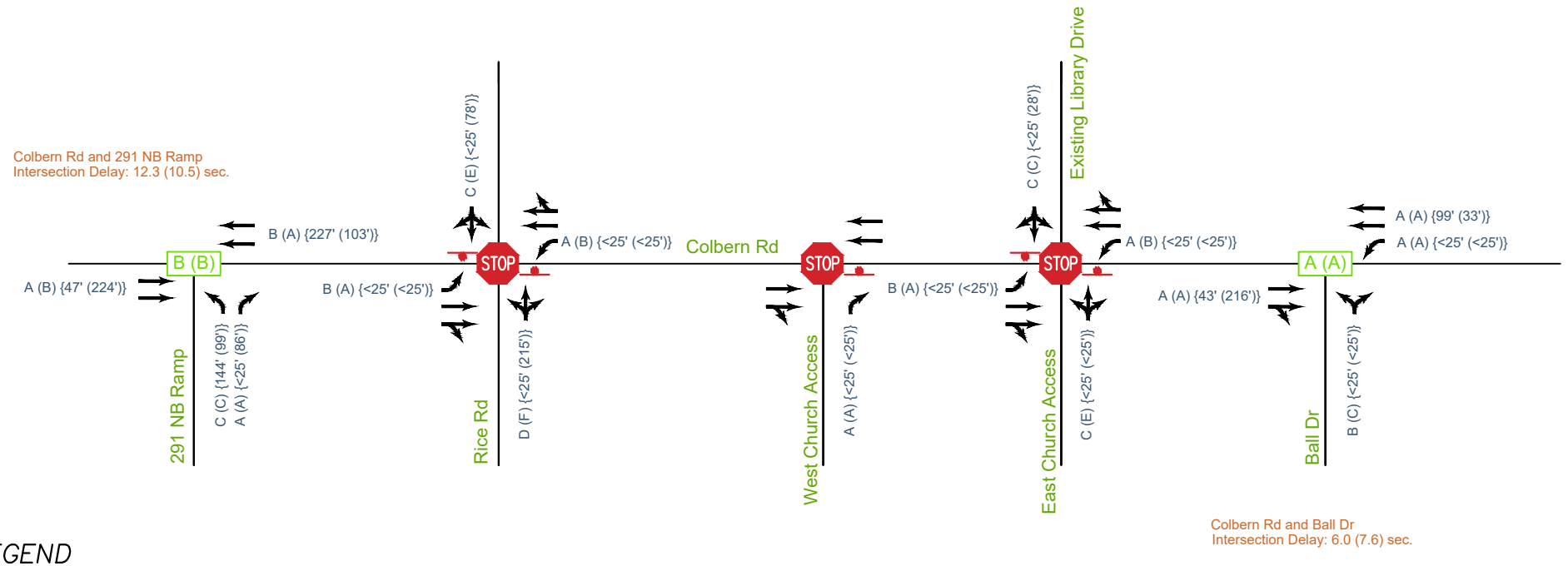
LEGEND

- XX' — Lane Configuration & Storage Length
- Signalized Intersection
- STOP — Stop Controlled Intersection
- Stop Sign

FIGURE 4

Existing
Level of Service

Colbern Road MCPL
Lee's Summit, MO



LEGEND

AM (PM) {AM (PM)} — Movement LOS & {95th Percentile Queue}

AM (PM) — Signalized Intersection LOS

STOP — Stop Controlled Intersection

Stop Sign

Lane Geometry

4. EXISTING PLUS PROPOSED DEVELOPMENT CONDITIONS

This scenario considers an expansion of the existing Mid-Continent Public Library located north of Colbern Road between Rice Road and Ball Drive. The proposed expansion consists of the addition of 20,000 square feet to the existing library (the current library square footage is approximately 15,000 square feet) for a total building square footage of 35,000 square feet. The site plan associated with the proposed development is illustrated in **Figure 5**.

The site plan illustrates proposed near-term access (considered during existing plus proposed development analysis) and a future access scenario. Proposed access dependent upon the existing and proposed roadway network will be discussed in detail in this section.

4.1. Proposed Development Trip Generation and Distribution

To determine the impact of potential site traffic on the roadway network, expected trips associated with the proposed expansion were generated and applied to the study network. The Institute of Transportation Engineers (ITE) provides methods for estimating traffic volumes of common land uses in the Trip Generation Manual (10th Edition). The land use that most resembles that which is planned for this site is Land Use Code 590 (Library).

Based on the *ITE Trip Generation Manual*, trip generation characteristics were developed for the proposed site. Trip generation characteristics expected for the site are shown in **Table 3**. Detailed ITE trip generation information can be found in **Appendix C.**

Table 3. Proposed Development Trip Generation.

Land Use	Size	Average Weekday	AM Peak Hour			PM Peak Hour		
			Total	Enter	Exit	Total	Enter	Exit
Library	20,000 SF	1,403	21	15	6	170	82	88

Trips were distributed through the network based on the anticipated land use, the surrounding area, and the existing distribution of trips associated with the existing library. Directional trip distribution percentages expected for the site are illustrated in **Table 4.**

Table 4. Proposed Development Trip Distribution.

Direction	Trip Distribution	
	TO	FROM
Colbern Road (West)	60%	45%
Colbern Road (East)	30%	30%
Ball Drive (South)	10%	10%
Northbound 291 Off-Ramp	0%	15%
TOTAL	**100%**	**100%**

The City of Lee's Summit has indicated that a future roadway is planned west of the library site. At the writing of this report, conclusive plans regarding alignment, design, or funding for the future roadway were not available. However, access considerations for the library site considered this future roadway. For current development conditions, the existing full access library drive is proposed to remain. An additional right-in/right-out drive (Drive 1) is proposed approximately 200 feet west of the existing full access drive. The location of Drive 1 aligns with the anticipated location of the future roadway. A discussion of potential future access with construction of the roadway and how this may impact access to the library site is provided later in this report.

The expected trip distribution for the proposed development is shown in **Figure 5**. The resulting existing plus proposed development volumes are illustrated in **Figure 6**.

4.2. Access Characteristics

As discussed in **Section 4.1**, access is proposed to the site via the existing full access drive located along Colbern Road and via a proposed right-in/right-out (Drive 1) located west of the existing drive. The proposed right-in/right-out access aligns at the location of a proposed roadway extension. The use of the existing full access drive and Drive 1 are expected to be near-term solutions for access to the library. As the future roadway to the west of the site is constructed, alternative access considerations are proposed for the site and will be discussed later in the report.

Access Spacing

Drive 1 aligns with the location of a future roadway proposed to extend north from Colbern Road. As a right-in/right-out, Drive 1 does not meet spacing standards provided in the AMC as the drive is within the influence area of nearby drives serving adjacent development. However,

reviewing future plans for this roadway section and the drive location corresponding with a future roadway extension to the north, the location of Drive 1 incorporates future considerations. Discussion regarding access when the roadway is constructed north of Colbern Road is provided later in the report.

Drive 1 is located approximately 200 feet west of the existing library/east church drive (measured center to center). Drive 1 is located approximately 230 feet east of an existing full access drive located south of Colbern Road.

Table 5. Access Characteristics

Proposed Access	Public Roadway Intersected	Access Type	Proposed Throat Length	Proposed Width	Median Divided
Existing Library Access	Colbern Road	Full Access	Existing (48 feet)	Existing (26 feet)	No
Drive 1	Colbern Road	Right-In/ Right-Out	81 feet	28 feet	No

Drive 1 access is expected to be constructed as an access to the library; the drive will not be constructed to standards associated with the planned roadway expansion. Driveway standards were reviewed for drive width and throat length.

Trip generation completed in **Section 4.1** of this report projects that Drive 1 will service 30 vehicles during the highest peak hour period. Drive 1 has a proposed driveway width of 28 feet. Referencing *Table 18-1* of the AMC, driveways servicing less than 150 vehicles per hour (vph) during the peak hour period should have a driveway width between 28 feet and 42 feet for two-way access. The proposed width of Drive 1 meets City standards.

Throat length standards for Drive 1 is based on projected peak hour volumes, per the City of Lee's Summit AMC. Drive 1 has a proposed driveway throat length of 81 feet. Referencing *Table 18-2* of the AMC, driveways servicing between 10 to 50 vph during the peak hour period should have a minimum throat length of 50 feet adjacent to an arterial roadway. The proposed throat length of Drive 1 meets City standards.

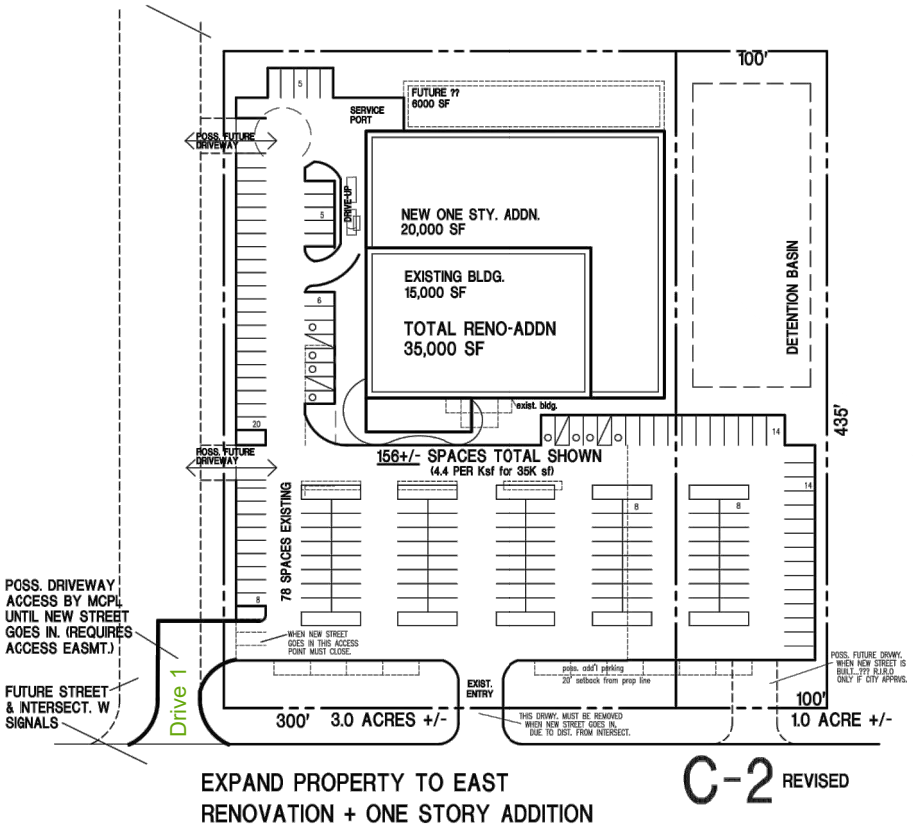
The driveway geometrics of the existing drive were reviewed considering additional traffic associated with the proposed expansion. The existing drive has an existing width of 26 feet. Based on the expected volume of 242 vehicles during the highest peak hour period, the AMC states a driveway width between 28 feet and 42 feet for two-way access. Based on acceptable current operations and acknowledgement that this access is expected to be modified in the future, the existing driveway width is expected to be acceptable.

The throat length of the existing drive is 45 feet. Based on the expected volume of 242 vehicles during the highest peak hour period, the AMC states the driveway throat should be a minimum of 125 feet. Acknowledging that this access is expected to be modified in the future, and that exiting vehicles can queue onto the site, the existing throat length is expected to be acceptable.

FIGURE 5

Site Plan

Colbern Road MCPL
Lee's Summit, MO



PRELIMINARY

This dwg. is a prelim. sketch; actual conditions may vary.

0' 20' 40' 60'
1"=80' at 11x17;

MCPL
COLBERN ROAD BRANCH LEE'S SUMMIT MO

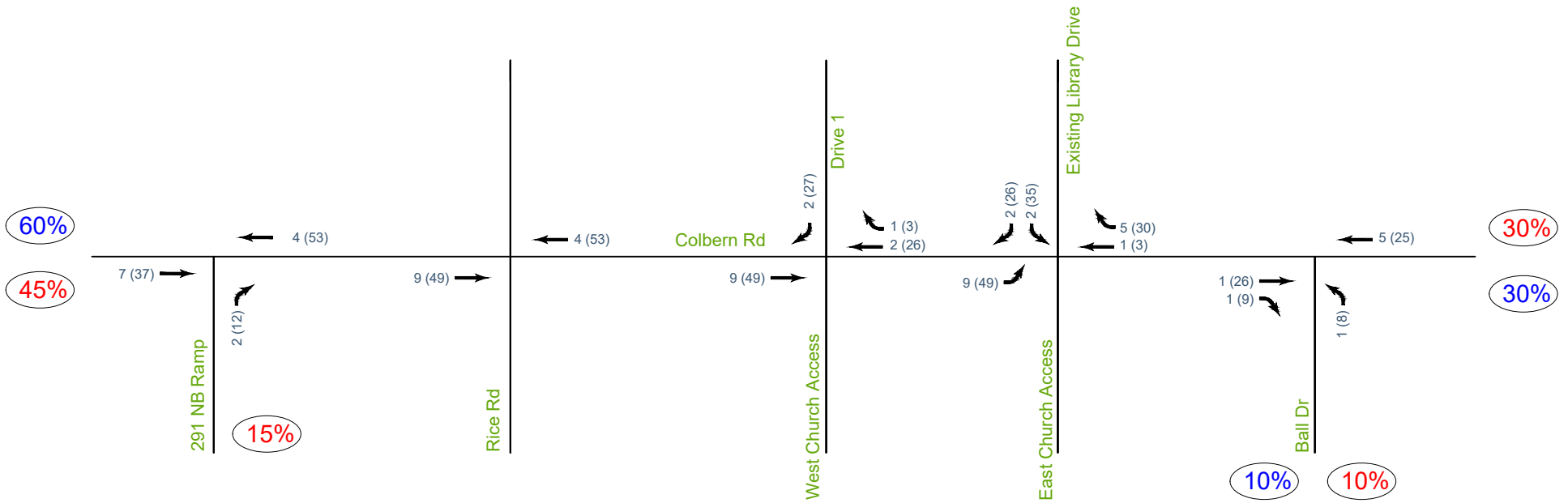
5-13-19
SITE STUDIES

SAPP DESIGN + helix ARCHITECTS

FIGURE 6

Trip Distribution

Colbern Road MCPL
Lee's Summit, MO



LEGEND

AM (PM) *Primary Peak Hour Trips*

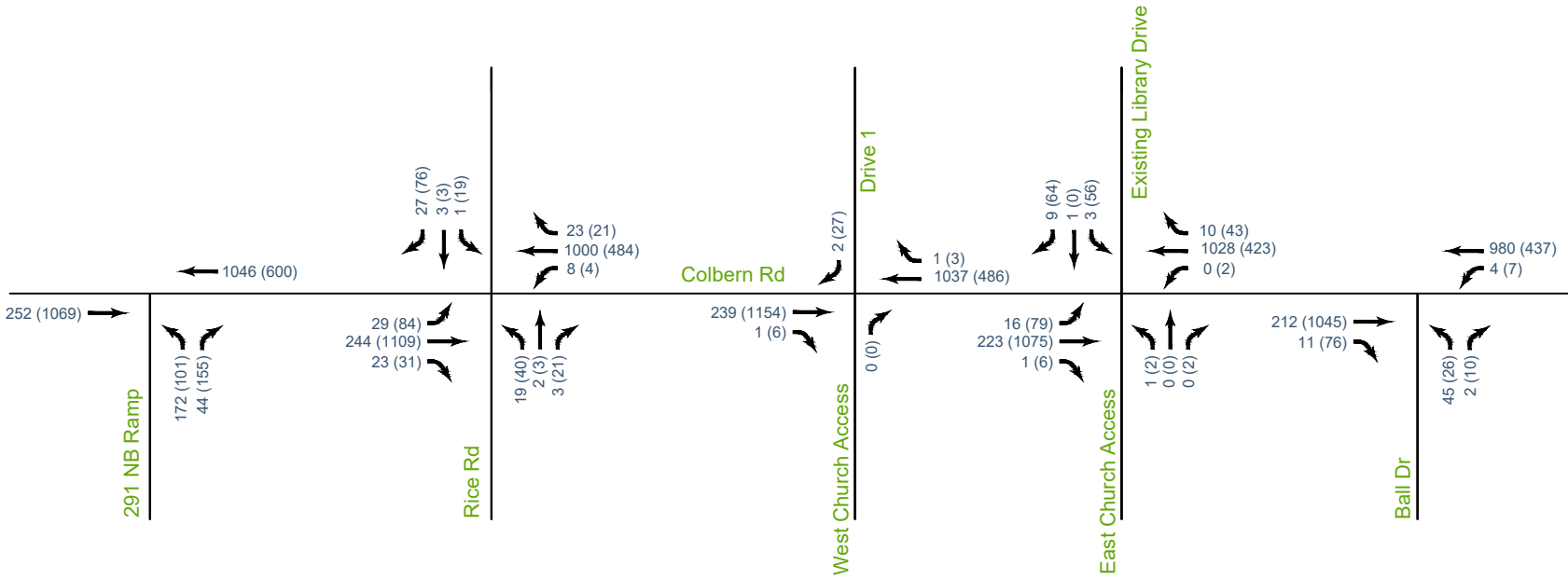
X% *Primary Entering Trip Distribution Percentage*

X% *Primary Exiting Trip Distribution Percentage*

FIGURE 7

Existing plus Development
Peak Hour Volumes

Colbern Road MCPL
Lee's Summit, MO



LEGEND

AM (PM) *Peak Hour Volume*

4.3. Existing Plus Proposed Development Conditions

Signal Warrants

Considering existing plus proposed development volumes, the intersection of Colbern Road with Rice Road is not expected to meet the criteria for signalization during either peak hour period based on Warrant 3 (Peak Hour Warrant). The intersection of Colbern Road and the Existing Library/Church Drive is on the threshold for warranting a signal based on PM peak hour volumes. Due to only being warranted during the PM peak hour period, and future removal of this as a full access location, signalization is not recommended.

Signal warrant analysis sheets can be found in **Appendix C**.

Turn Lane Warrants

As discussed in **Section 3.2**, the following turn lane deficiencies were noted in existing conditions.

- Dedicated left-turn lanes in northbound and southbound directions at Colbern Road and Rice Road are not provided
- Eastbound left-turn lane with reduced storage at Colbern Road and Rice Road
- Eastbound left-turn lane with reduced storage at Colbern Road and Existing Library/East Church Drive
- Dedicated eastbound right-turn lane at Colbern Road and Rice Road is not provided
- Dedicated eastbound right-turn lane at Colbern Road and Ball Drive is not provided

Capacity analysis is provided in **Section 4.4** to determine if additional turn lanes and/or storage length is recommended based on existing operations.

Based on the Lee's Summit AMC, right-turn lanes shall be provided on arterial streets for any movement with a volume of 30 vehicles in any hour at each intersecting street or driveway. Based on this criteria, the westbound right-turn movement at the intersection of Colbern Road and Existing Library/East Church Drive exceeds the criteria for a right-turn lane during the PM peak hour period (43 right-turning vehicles) based on expected existing plus development volumes. Due to the planned relocation of this drive and exceeding the threshold for one peak hour period, it is not recommended to construct a right-turn lane. Capacity analysis and queuing for this movement will be reviewed.

Existing plus proposed development conditions lane configurations and traffic control for the study network are illustrated in **Figure 8**.

4.4. Existing Plus Proposed Development Capacity Analysis

Capacity analysis was performed under existing plus proposed development conditions using the methodologies described in **Section 3.3**. The peak hour factors observed under existing conditions were utilized for this scenario except for movements which are expected to experience an increase in traffic with the proposed development. At these locations, the peak hour factors were conservatively adjusted considering the Synchro suggested values and expected traffic conditions after development.

Results of the capacity analysis indicate similar operations to existing conditions. Results of the analysis indicate that the existing signalized study intersections are expected to operate at an overall LOS B or better with individual movements operating at a LOS C or better during the AM and PM peak hour periods.

All movements at the unsignalized study intersections are operating at LOS D or better with acceptable queues during both the AM and PM peak hour periods with the following exceptions:

- Colbern Road and Rice Road
    - Similar to the existing conditions, the northbound and southbound movements are expected to operate at a lower level of service. Significant increases to delay or 95th percentile queue lengths are not expected due to the proposed library expansion.
- Colbern Road and Existing Library/East Church Access
    - Similar to existing conditions, the northbound movement is expected to operate at a lower level of service. Significant increases to delay or 95th percentile queue lengths are not expected due to the proposed library expansion.
    - The southbound movement is expected to operate at a level of service F during the PM peak hour period with a 95th percentile queue length of 133 feet.
        - Existing throat length of this approach is not expected to accommodate the PM peak hour southbound 95th percentile queue. However, adequate storage for this queue length is provided on site. The main entrance for the library is expected to be located along the west side of the building, northwest of this proposed access. Thus, queuing associated with the movement would not be expected to significantly impact ingress to the main entrance.
        - Considering the future relocation and limitation of this access, the existing throat and acknowledgement of potential southbound queuing onto the site is expected to be acceptable.

As discussed in **Section 3.3**, v/c ratios were reviewed following guidance provided in the HCM. At the unsignalized minor street approaches listed above, the v/c ratios and 95th-percentile queues are expected to be acceptable during the peak hour periods with the exception of the

northbound movement at the intersection of Colbern Road and Rice Road during the PM peak hour period. Comparing operations expected with development to existing conditions for this movement, the proposed development is expected to have a minimal impact on operations of this movement.

Several existing turn lane deficiencies were noted in **Section 3.2**. Capacity and queuing analysis were reviewed for each movement considering development conditions. After review of the analysis, it was determined that the proposed development is not expected to have a significant impact to existing operations. Operations specifically related to the existing library are further detailed below:

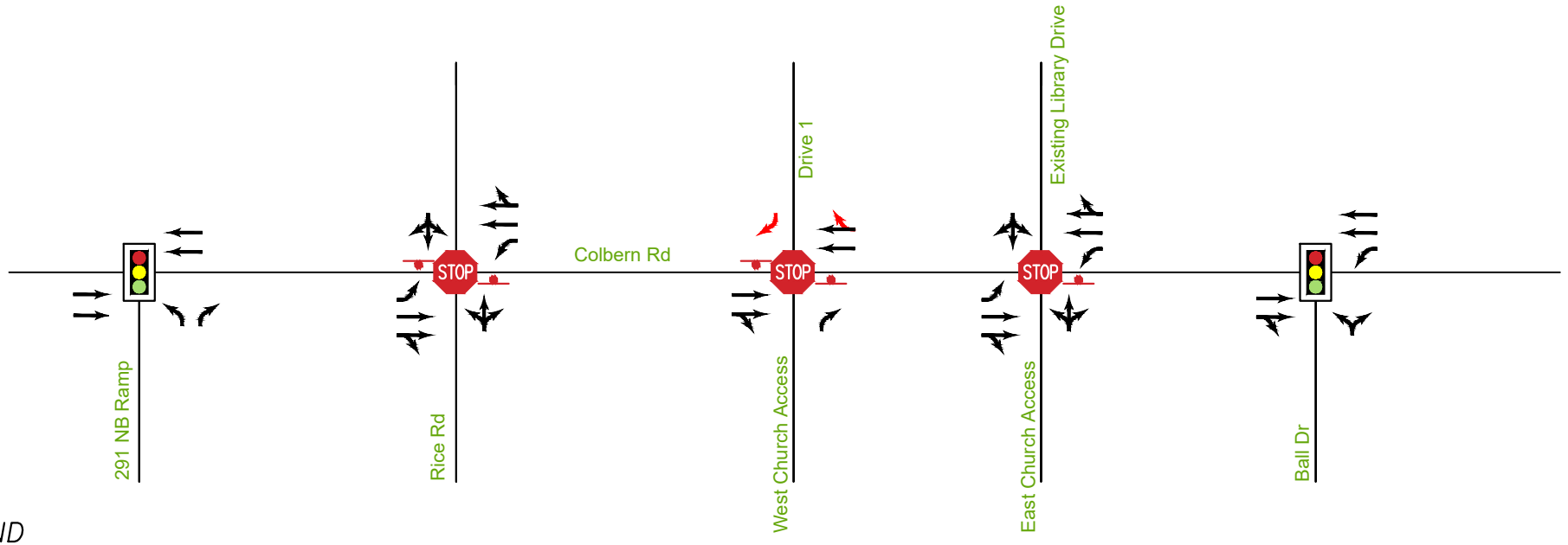
- *Eastbound left-turn lane with reduced storage at Colbern Road and Existing Library/East Church Drive*
    - Reviewing capacity analysis, the eastbound left-turn movement is operating at an acceptable level of service during both peak hour periods and 95th percentile queue lengths are not expected to exceed provided storage considering additional traffic associated with the proposed expansion.
- *Dedicated westbound right-turn lane at Colbern Road and Existing Library/Church*
    - Operations of the westbound movement are expected to be acceptable. Due to the full access location serving a near-term access need and the planned relocation of this drive in the future, construction of a westbound right-turn lane is not recommended.

The existing plus proposed development conditions capacity analysis summary is illustrated in **Figure 9**. Detailed results may be found in **Appendix C**.

FIGURE 8

Existing plus Development
Lane Configuration and Traffic Control

Colbern Road MCPL
Lee's Summit, MO



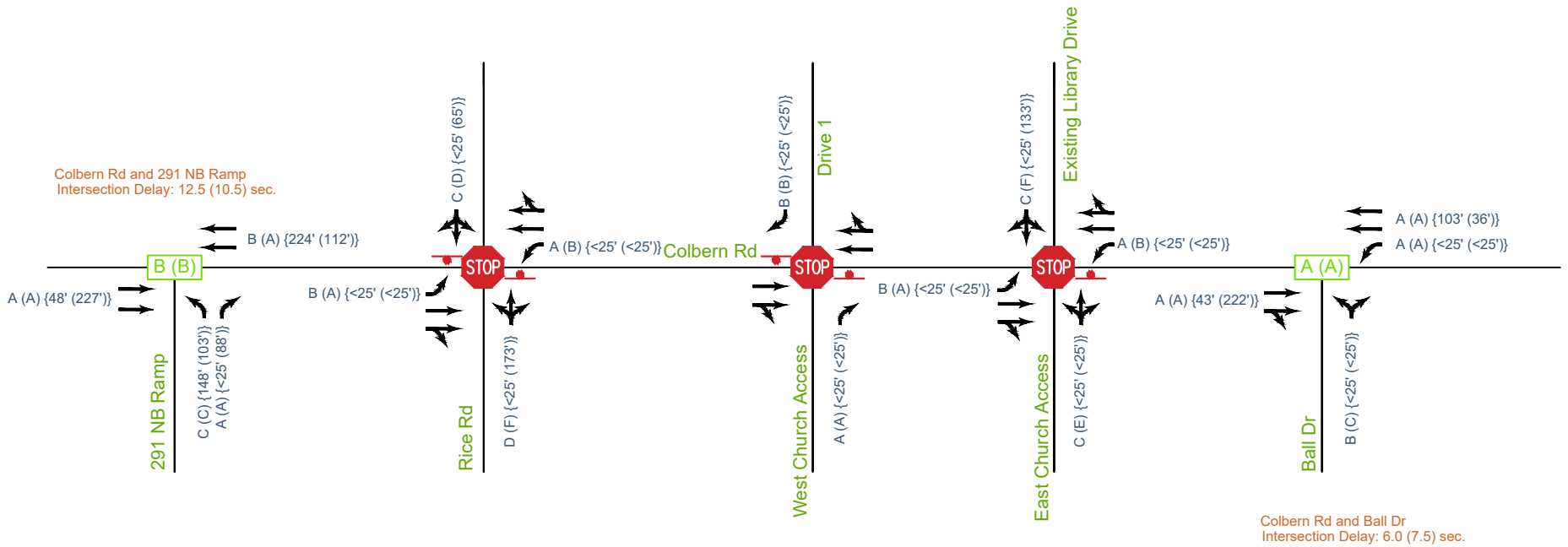
LEGEND

- Lane Configuration & Storage Length
- xx' Proposed Lane Configuration & Storage Length
- Signalized Intersection
- STOP Stop Controlled Intersection
- Stop Sign

FIGURE 9

Existing plus Development
Level of Service

Colbern Road MCPL
Lee's Summit, MO



LEGEND

AM (PM) {AM (PM)} — Movement LOS & {95th Percentile Queue}

AM (PM) — Signalized Intersection LOS

STOP — Stop Controlled Intersection

Stop Sign

Lane Geometry

4.5. Future Access Considerations

As discussed at the beginning of this section, this study presents a review of a near-term solution for access for the proposed MCPL library expansion. Utilization of an existing full access location is recommended, as well as the addition of a right-in/right-out that aligns with a future proposed roadway extension.

When the roadway extension occurs at the west side of the project property, current access should be modified. The right-in/right-out will be removed and replaced with a full access intersection. It is assumed that this full access intersection will align with the existing west church access (currently limited to a right-in/right-out) located south of Colbern Road.

It should be noted that future analysis was not conducted. Consideration of future development that may occur along the proposed roadway or re-distribution of trips to the proposed roadway was outside the scope of this project review. However, a high-level review of future access considerations is provided. Prior to making access modification or design decisions, it is recommended to conduct analysis reviewing proposed use of the future roadway.

When the future roadway is constructed, a review of access along the south side of Colbern Road in the vicinity of the roadway extension should be reviewed. In order to provide turn lanes as recommended in the AMC, modifications to existing full access locations along the south side of Colbern Road may be required.

Specifically reviewing the library site, with the construction of the proposed roadway the right-in/right-out access will be eliminated.

To provide for adequate spacing from the new intersection of Colbern Road and the proposed roadway, the existing full access library drive located east of the proposed roadway should be located to the east edge of the property and limited to a right-in/right-out. Review of existing operations and changes to trip distribution due to revisions to the roadway network should be considered, but a westbound right-turn lane at this location may not be needed. Specific location of the proposed roadway is unknown at the writing of this report, however it is anticipated that the right-in/right-out for the library, located along Colbern Road, could be approximately 350 feet east of the proposed intersection (measured center to center).

It is anticipated that full access to the library site will be provided via the proposed roadway due to the limitation of access along Colbern Road. This supports improved access management along the Colbern Road corridor by limiting access along the major arterial roadway and providing access along a lower classification route (assuming the proposed roadway will operate as a collector or minor arterial roadway consistent with the current designation of Rice Road).

Access to the library from the proposed roadway should be located outside of any turn lanes associated with the southbound approach. It is anticipated that this will result in location of full access for the library towards the north edge of the library property line. As future development along the proposed roadway is considered, opportunities for shared full access with adjacent property to the north may be considered.

A right-in/right-out access is illustrated on the site plan along the new roadway between Colbern Road and the library full access. Potential for a right-in/right-out access should be considered when more definitive roadway plans are available.

5. SUMMARY

The purpose of this study was to summarize traffic impacts regarding a proposed library expansion to the existing Mid-Continent Public Library Colbern Road branch located north of Colbern Road between Rice Road and Ball Drive in Lee's Summit, Missouri.

5.1. Conclusions

The general findings of note for the traffic impact study include the following:

1. In general, traffic operations are not expected to be significantly impacted by the proposed development.
2. Several existing deficiencies of turn lanes at study intersections were noted, either turn lanes not provided or have reduced existing storage length. The operations of these existing movements are not expected to be significantly impacted by the proposed development.
3. An increase in southbound queuing at the existing library drive is expected with the library expansion. This queuing is expected to exceed available throat but can be contained internal to the site. Considering the future relocation and restriction of access at this drive location, the operations are expected to be acceptable.
4. As modifications are made to the roadway network in the vicinity of this project, evaluation of existing access and modifications to accommodate future roadway projects should be made.

5.2. Recommendations

There are no recommended improvements associated with the proposed development conditions analysis conducted for this study. As modifications to the roadway network in the vicinity of the library are made, a review of access should be conducted.

APPENDIX A

Data Collection

Count Data

Olsson Associates : Overland Park
7301 West 133rd St

Overland Park, Kansas, United States 66213
913.381.1170 tmchenry@olssonassociates.com

Count Name: Colbern Rd & Route 291 NB Off-Ramp
Site Code:
Start Date: 07/23/2019

Turning Movement Data

Start Time	Colbern Westbound				291 Off Ramp Northbound				Colbern Eastbound				
	Thru	Left	U-Turn	App. Total	Right	Left	U-Turn	App. Total	Right	Thru	U-Turn	App. Total	Int. Total
7:00 AM	243	0	0	243	10	39	0	49	0	51	0	51	343
7:15 AM	272	0	0	272	7	46	0	53	0	60	0	60	385
7:30 AM	233	0	0	233	14	43	0	57	0	64	0	64	354
7:45 AM	281	0	0	281	11	44	0	55	0	70	0	70	406
Hourly Total	1029	0	0	1029	42	172	0	214	0	245	0	245	1488
8:00 AM	224	0	0	224	12	30	0	42	0	68	0	68	334
8:15 AM	179	0	0	179	12	45	0	57	0	62	0	62	298
8:30 AM	165	0	0	165	13	24	0	37	0	57	0	57	259
8:45 AM	166	0	0	166	12	25	0	37	0	81	0	81	284
Hourly Total	734	0	0	734	49	124	0	173	0	268	0	268	1175
*** BREAK ***	-	-	-	-	-	-	-	-	-	-	-	-	-
4:00 PM	115	0	0	115	32	32	0	64	0	191	0	191	370
4:15 PM	128	0	0	128	26	17	0	43	0	176	0	176	347
4:30 PM	117	0	0	117	37	28	0	65	0	211	0	211	393
4:45 PM	151	0	0	151	38	25	0	63	0	232	0	232	446
Hourly Total	511	0	0	511	133	102	0	235	0	810	0	810	1556
5:00 PM	146	0	0	146	41	24	0	65	0	297	0	297	508
5:15 PM	121	0	0	121	35	26	0	61	0	274	0	274	456
5:30 PM	117	0	0	117	29	26	0	55	0	224	0	224	396
5:45 PM	104	0	0	104	32	24	0	56	0	207	0	207	367
Hourly Total	488	0	0	488	137	100	0	237	0	1002	0	1002	1727
Grand Total	2762	0	0	2762	361	498	0	859	0	2325	0	2325	5946
Approach %	100.0	0.0	0.0	-	42.0	58.0	0.0	-	0.0	100.0	0.0	-	-
Total %	46.5	0.0	0.0	46.5	6.1	8.4	0.0	14.4	0.0	39.1	0.0	39.1	-
Lights	2736	0	0	2736	357	491	0	848	0	2303	0	2303	5887
% Lights	99.1	-	-	99.1	98.9	98.6	-	98.7	-	99.1	-	99.1	99.0
Mediums	23	0	0	23	2	3	0	5	0	14	0	14	42
% Mediums	0.8	-	-	0.8	0.6	0.6	-	0.6	-	0.6	-	0.6	0.7
Articulated Trucks	3	0	0	3	2	4	0	6	0	8	0	8	17
% Articulated Trucks	0.1	-	-	0.1	0.6	0.8	-	0.7	-	0.3	-	0.3	0.3

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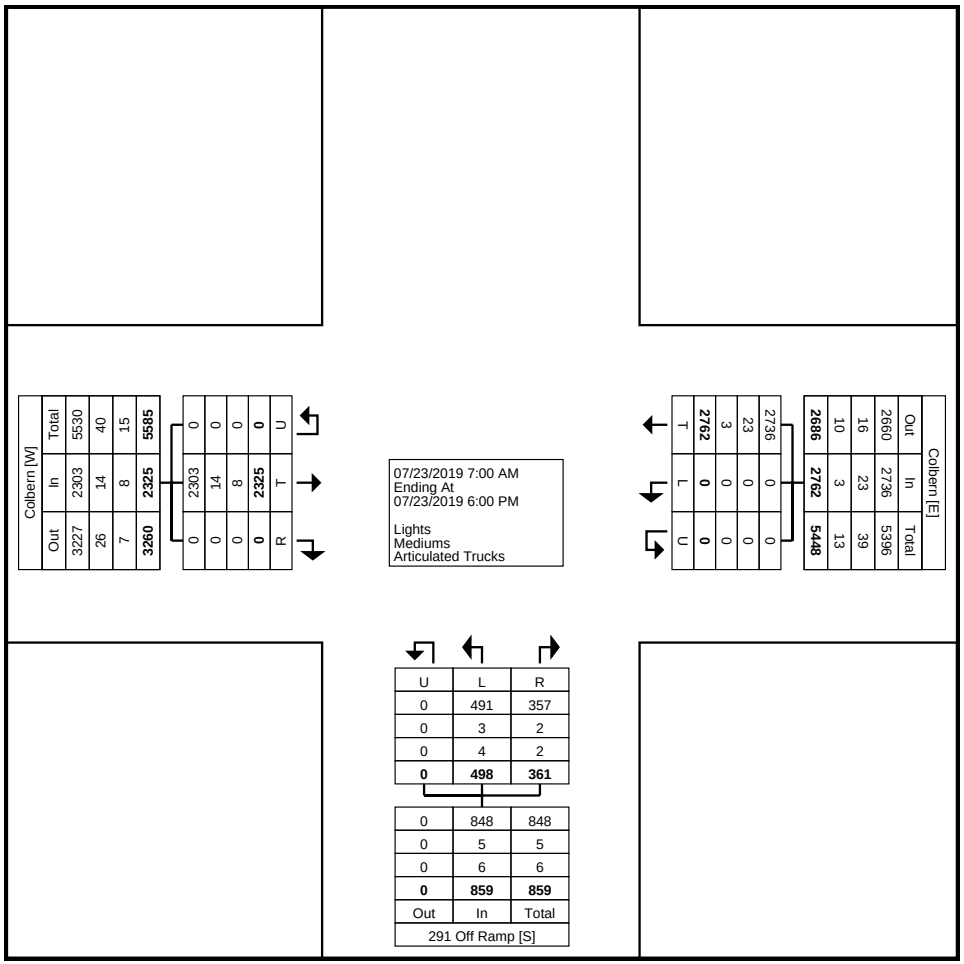
Site Code:
Start Date: 07/23/2019



Turning Movement Data Plot

Olsson Associates : Overland Park
7301 West 133rd St

Overland Park, Kansas, United States 66213
913.381.1170 tmchenry@olssonassociates.com

Count Name: Colbern Rd & Route 291 NB Off-Ramp
Site Code:
Start Date: 07/23/2019

Turning Movement Peak Hour Data (7:00 AM)

Start Time	Colbern Westbound				291 Off Ramp Northbound				Colbern Eastbound				Int. Total
	Thru	Left	U-Turn	App. Total	Right	Left	U-Turn	App. Total	Right	Thru	U-Turn	App. Total	
7:00 AM	243	0	0	243	10	39	0	49	0	51	0	51	343
7:15 AM	272	0	0	272	7	46	0	53	0	60	0	60	385
7:30 AM	233	0	0	233	14	43	0	57	0	64	0	64	354
7:45 AM	281	0	0	281	11	44	0	55	0	70	0	70	406
Total	1029	0	0	1029	42	172	0	214	0	245	0	245	1488
Approach %	100.0	0.0	0.0	-	19.6	80.4	0.0	-	0.0	100.0	0.0	-	-
Total %	69.2	0.0	0.0	69.2	2.8	11.6	0.0	14.4	0.0	16.5	0.0	16.5	-
PHF	0.915	0.000	0.000	0.915	0.750	0.935	0.000	0.939	0.000	0.875	0.000	0.875	0.916
Lights	1022	0	0	1022	40	171	0	211	0	237	0	237	1470
% Lights	99.3	-	-	99.3	95.2	99.4	-	98.6	-	96.7	-	96.7	98.8
Mediums	4	0	0	4	1	1	0	2	0	5	0	5	11
% Mediums	0.4	-	-	0.4	2.4	0.6	-	0.9	-	2.0	-	2.0	0.7
Articulated Trucks	3	0	0	3	1	0	0	1	0	3	0	3	7
% Articulated Trucks	0.3	-	-	0.3	2.4	0.0	-	0.5	-	1.2	-	1.2	0.5

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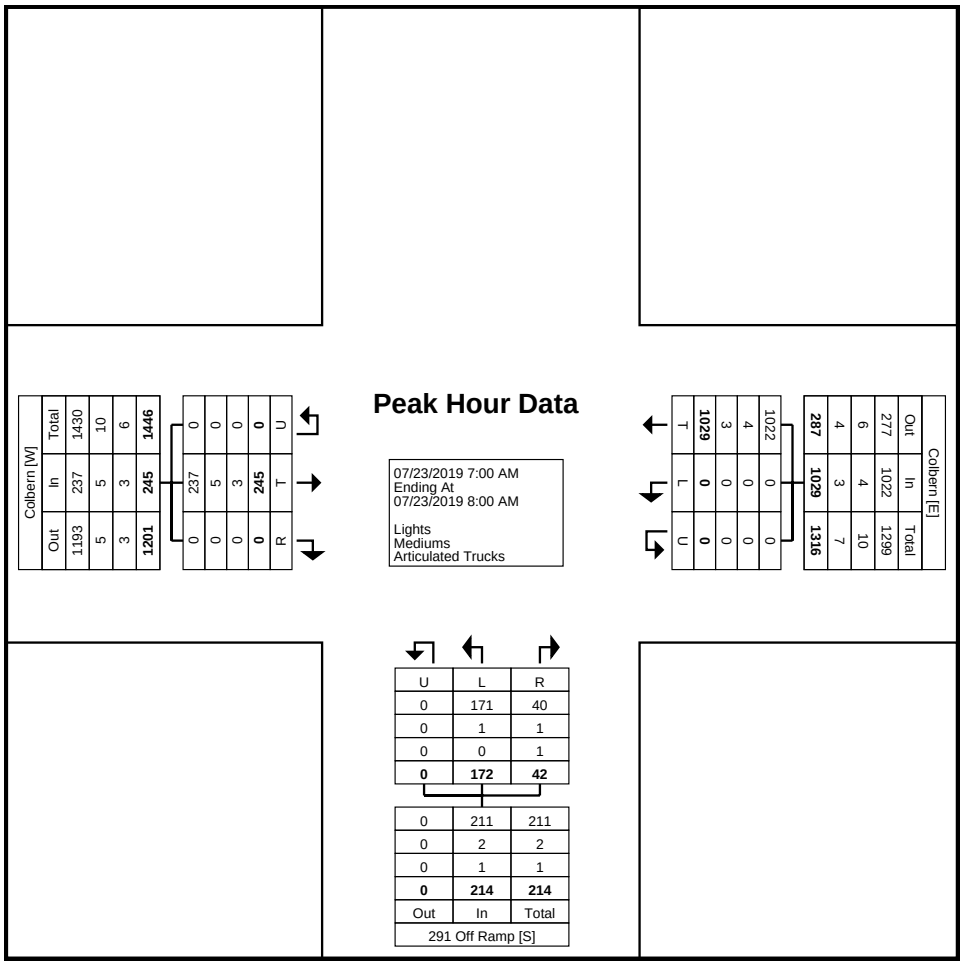
Count Name: Colbern Rd & Route 291 NB Off-Ramp
Site Code:
Start Date: 07/23/2019



Turning Movement Peak Hour Data Plot (7:00 AM)

Olsson Associates : Overland Park
7301 West 133rd St

Overland Park, Kansas, United States 66213
913.381.1170 tmchenry@olssonassociates.com

Count Name: Colbern Rd & Route 291 NB Off-Ramp
Site Code:
Start Date: 07/23/2019

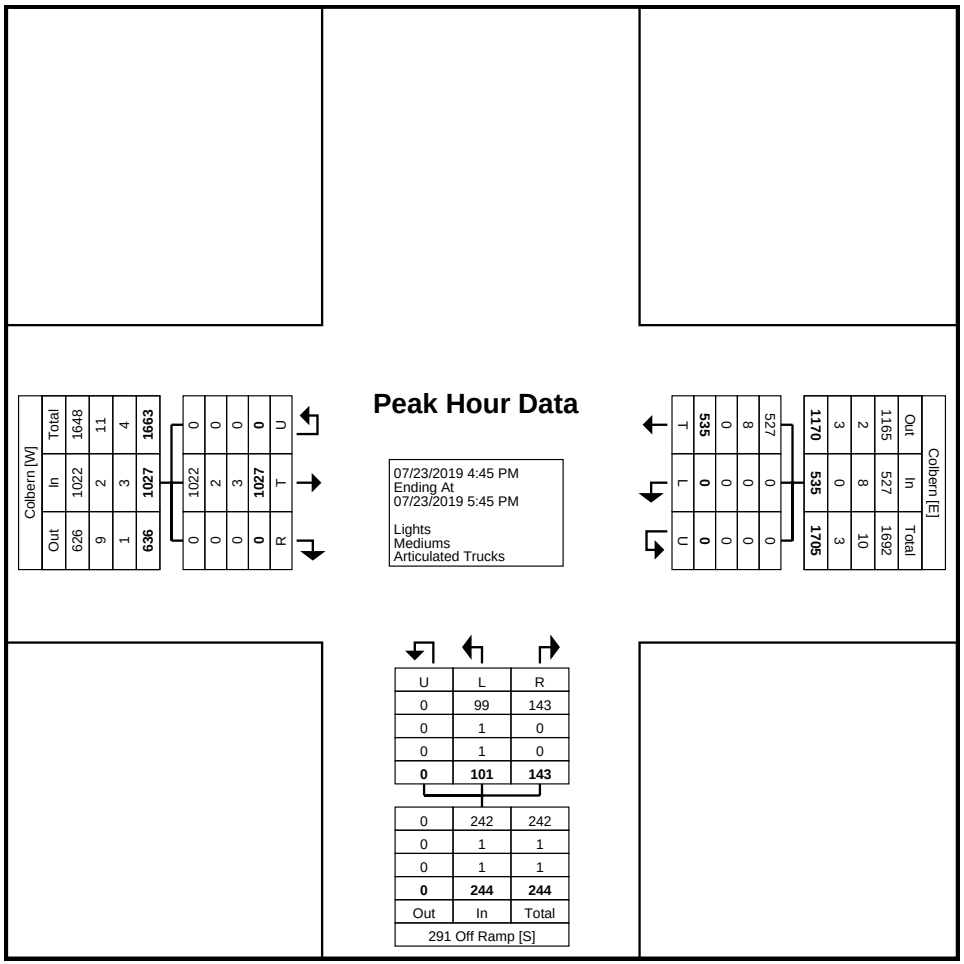
Turning Movement Peak Hour Data (4:45 PM)

Start Time	Colbern Westbound				291 Off Ramp Northbound				Colbern Eastbound				
	Thru	Left	U-Turn	App. Total	Right	Left	U-Turn	App. Total	Right	Thru	U-Turn	App. Total	Int. Total
4:45 PM	151	0	0	151	38	25	0	63	0	232	0	232	446
5:00 PM	146	0	0	146	41	24	0	65	0	297	0	297	508
5:15 PM	121	0	0	121	35	26	0	61	0	274	0	274	456
5:30 PM	117	0	0	117	29	26	0	55	0	224	0	224	396
Total	535	0	0	535	143	101	0	244	0	1027	0	1027	1806
Approach %	100.0	0.0	0.0	-	58.6	41.4	0.0	-	0.0	100.0	0.0	-	-
Total %	29.6	0.0	0.0	29.6	7.9	5.6	0.0	13.5	0.0	56.9	0.0	56.9	-
PHF	0.886	0.000	0.000	0.886	0.872	0.971	0.000	0.938	0.000	0.864	0.000	0.864	0.889
Lights	527	0	0	527	143	99	0	242	0	1022	0	1022	1791
% Lights	98.5	-	-	98.5	100.0	98.0	-	99.2	-	99.5	-	99.5	99.2
Mediums	8	0	0	8	0	1	0	1	0	2	0	2	11
% Mediums	1.5	-	-	1.5	0.0	1.0	-	0.4	-	0.2	-	0.2	0.6
Articulated Trucks	0	0	0	0	0	1	0	1	0	3	0	3	4
% Articulated Trucks	0.0	-	-	0.0	0.0	1.0	-	0.4	-	0.3	-	0.3	0.2

Olsson Associates : Overland Park
7301 West 133rd St

Overland Park, Kansas, United States 66213
913.381.1170 tmchenry@olssonassociates.com

Count Name: Colbern Rd & Route 291 NB Off-Ramp
Site Code:
Start Date: 07/23/2019



Turning Movement Peak Hour Data Plot (4:45 PM)

Olsson Associates : Overland Park
7301 West 133rd St

Overland Park, Kansas, United States 66213
913.381.1170 tmchenry@olssonassociates.com

Count Name: Colbern Rd & Ball Dr
Site Code:
Start Date: 07/23/2019

Turning Movement Data

Start Time	Colbern Westbound				Ball Northbound				Colbern Eastbound				Int. Total
	Thru	Left	U-Turn	App. Total	Right	Left	U-Turn	App. Total	Right	Thru	U-Turn	App. Total	
7:00 AM	241	1	0	242	0	14	0	14	3	42	0	45	301
7:15 AM	243	0	0	243	0	12	0	12	1	52	0	53	308
7:30 AM	235	0	0	235	1	7	0	8	3	56	0	59	302
7:45 AM	256	3	0	259	1	11	0	12	3	54	0	57	328
Hourly Total	975	4	0	979	2	44	0	46	10	204	0	214	1239
8:00 AM	200	2	0	202	1	13	0	14	1	55	0	56	272
8:15 AM	164	0	0	164	2	6	0	8	4	51	0	55	227
8:30 AM	160	1	0	161	3	5	0	8	1	45	0	46	215
8:45 AM	152	1	0	153	0	7	0	7	6	58	0	64	224
Hourly Total	676	4	0	680	6	31	0	37	12	209	0	221	938
*** BREAK ***	-	-	-	-	-	-	-	-	-	-	-	-	-
4:00 PM	93	0	0	93	0	9	0	9	7	167	0	174	276
4:15 PM	84	0	0	84	1	6	0	7	6	190	0	196	287
4:30 PM	85	0	0	85	0	2	0	2	7	232	0	239	326
4:45 PM	122	1	0	123	2	4	0	6	15	238	0	253	382
Hourly Total	384	1	0	385	3	21	0	24	35	827	0	862	1271
5:00 PM	94	1	0	95	3	2	0	5	14	292	0	306	406
5:15 PM	92	2	0	94	2	3	0	5	20	274	0	294	393
5:30 PM	94	3	0	97	3	9	0	12	18	215	0	233	342
5:45 PM	93	4	0	97	2	7	0	9	15	204	0	219	325
Hourly Total	373	10	0	383	10	21	0	31	67	985	0	1052	1466
Grand Total	2408	19	0	2427	21	117	0	138	124	2225	0	2349	4914
Approach %	99.2	0.8	0.0	-	15.2	84.8	0.0	-	5.3	94.7	0.0	-	-
Total %	49.0	0.4	0.0	49.4	0.4	2.4	0.0	2.8	2.5	45.3	0.0	47.8	-
Lights	2390	19	0	2409	21	116	0	137	122	2201	0	2323	4869
% Lights	99.3	100.0	-	99.3	100.0	99.1	-	99.3	98.4	98.9	-	98.9	99.1
Mediums	15	0	0	15	0	1	0	1	2	17	0	19	35
% Mediums	0.6	0.0	-	0.6	0.0	0.9	-	0.7	1.6	0.8	-	0.8	0.7
Articulated Trucks	3	0	0	3	0	0	0	0	0	7	0	7	10
% Articulated Trucks	0.1	0.0	-	0.1	0.0	0.0	-	0.0	0.0	0.3	-	0.3	0.2

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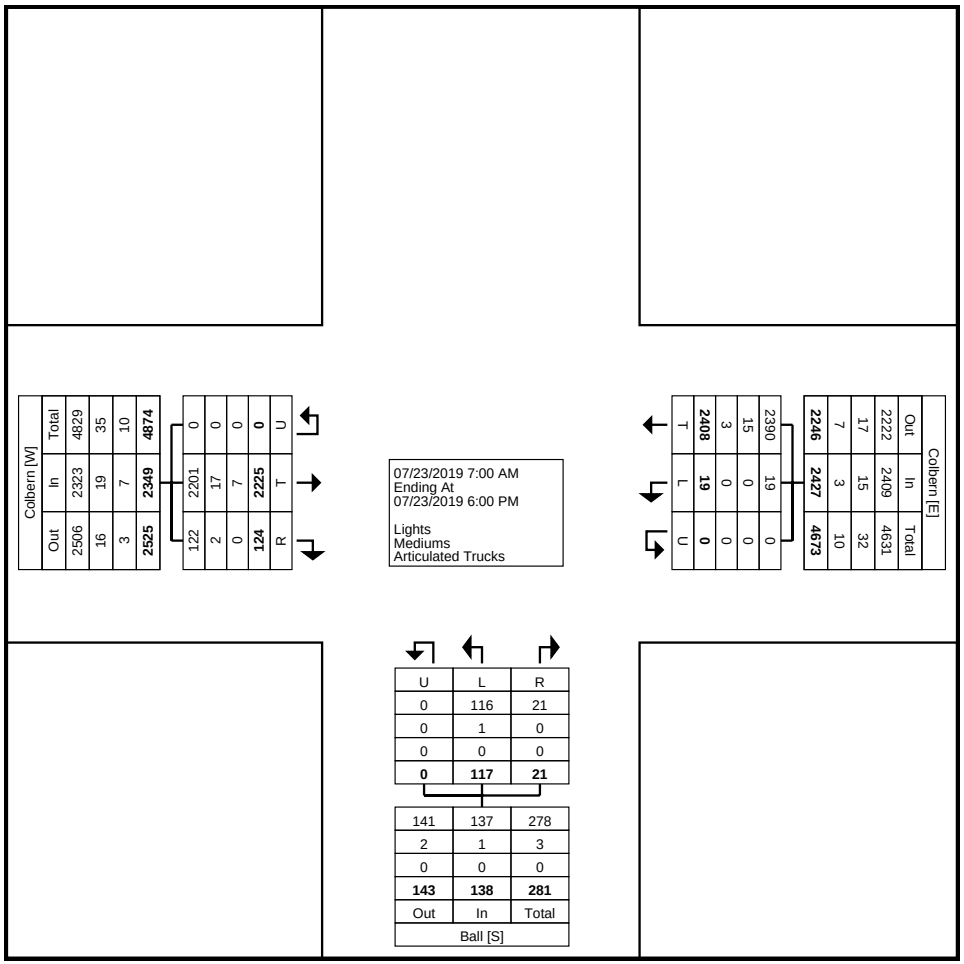
Count Name: Colbern Rd & Ball Dr
Site Code:
Start Date: 07/23/2019



Turning Movement Data Plot

Olsson Associates : Overland Park
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913.381.1170 tmchenry@olssonassociates.com

Count Name: Colbern Rd & Ball Dr
Site Code:
Start Date: 07/23/2019

Turning Movement Peak Hour Data (7:00 AM)

Start Time	Colbern Westbound				Ball Northbound				Colbern Eastbound				
	Thru	Left	U-Turn	App. Total	Right	Left	U-Turn	App. Total	Right	Thru	U-Turn	App. Total	Int. Total
7:00 AM	241	1	0	242	0	14	0	14	3	42	0	45	301
7:15 AM	243	0	0	243	0	12	0	12	1	52	0	53	308
7:30 AM	235	0	0	235	1	7	0	8	3	56	0	59	302
7:45 AM	256	3	0	259	1	11	0	12	3	54	0	57	328
Total	975	4	0	979	2	44	0	46	10	204	0	214	1239
Approach %	99.6	0.4	0.0	-	4.3	95.7	0.0	-	4.7	95.3	0.0	-	-
Total %	78.7	0.3	0.0	79.0	0.2	3.6	0.0	3.7	0.8	16.5	0.0	17.3	-
PHF	0.952	0.333	0.000	0.945	0.500	0.786	0.000	0.821	0.833	0.911	0.000	0.907	0.944
Lights	971	4	0	975	2	44	0	46	9	196	0	205	1226
% Lights	99.6	100.0	-	99.6	100.0	100.0	-	100.0	90.0	96.1	-	95.8	99.0
Mediums	2	0	0	2	0	0	0	0	1	5	0	6	8
% Mediums	0.2	0.0	-	0.2	0.0	0.0	-	0.0	10.0	2.5	-	2.8	0.6
Articulated Trucks	2	0	0	2	0	0	0	0	0	3	0	3	5
% Articulated Trucks	0.2	0.0	-	0.2	0.0	0.0	-	0.0	0.0	1.5	-	1.4	0.4

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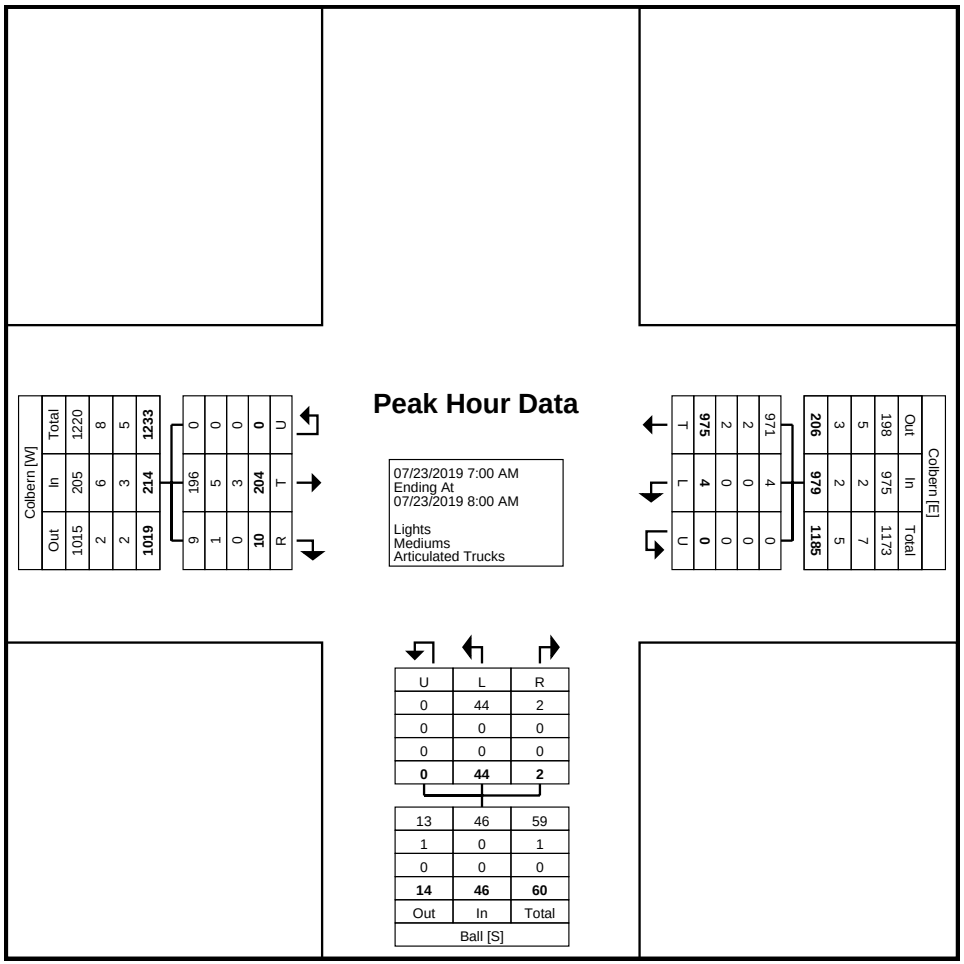
Count Name: Colbern Rd & Ball Dr
Site Code:
Start Date: 07/23/2019
Page No: 4



Turning Movement Peak Hour Data Plot (7:00 AM)

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Count Name: Colbern Rd & Ball Dr
Site Code:
Start Date: 07/23/2019

Turning Movement Peak Hour Data (4:45 PM)

Start Time	Colbern Westbound				Ball Northbound				Colbern Eastbound				
	Thru	Left	U-Turn	App. Total	Right	Left	U-Turn	App. Total	Right	Thru	U-Turn	App. Total	Int. Total
4:45 PM	122	1	0	123	2	4	0	6	15	238	0	253	382
5:00 PM	94	1	0	95	3	2	0	5	14	292	0	306	406
5:15 PM	92	2	0	94	2	3	0	5	20	274	0	294	393
5:30 PM	94	3	0	97	3	9	0	12	18	215	0	233	342
Total	402	7	0	409	10	18	0	28	67	1019	0	1086	1523
Approach %	98.3	1.7	0.0	-	35.7	64.3	0.0	-	6.2	93.8	0.0	-	-
Total %	26.4	0.5	0.0	26.9	0.7	1.2	0.0	1.8	4.4	66.9	0.0	71.3	-
PHF	0.824	0.583	0.000	0.831	0.833	0.500	0.000	0.583	0.838	0.872	0.000	0.887	0.938
Lights	395	7	0	402	10	18	0	28	67	1013	0	1080	1510
% Lights	98.3	100.0	-	98.3	100.0	100.0	-	100.0	100.0	99.4	-	99.4	99.1
Mediums	7	0	0	7	0	0	0	0	0	4	0	4	11
% Mediums	1.7	0.0	-	1.7	0.0	0.0	-	0.0	0.0	0.4	-	0.4	0.7
Articulated Trucks	0	0	0	0	0	0	0	0	0	2	0	2	2
% Articulated Trucks	0.0	0.0	-	0.0	0.0	0.0	-	0.0	0.0	0.2	-	0.2	0.1

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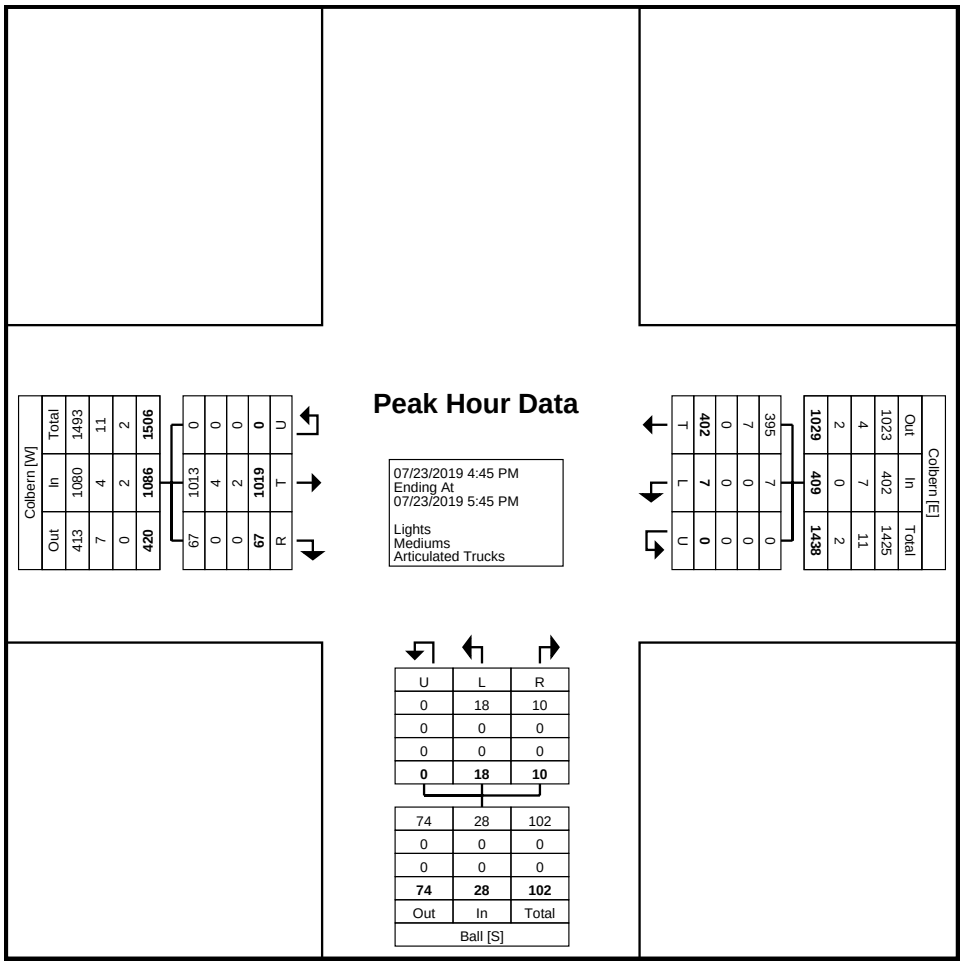
Count Name: Colbern Rd & Ball Dr
Site Code:
Start Date: 07/23/2019



Turning Movement Peak Hour Data Plot (4:45 PM)

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Count Name: Colbern Rd & Existing Church Access
Site Code:
Start Date: 07/23/2019

Turning Movement Data

Start Time	Colbern Westbound				Church Access Northbound				Colbern Eastbound				Int. Total
	Thru	Left	U-Turn	App. Total	Right	Left	U-Turn	App. Total	Right	Thru	U-Turn	App. Total	
7:00 AM	248	0	0	248	0	0	0	0	0	47	0	47	295
7:15 AM	266	0	0	266	0	0	0	0	0	52	0	52	318
7:30 AM	238	0	0	238	0	0	0	0	1	61	0	62	300
7:45 AM	275	0	0	275	0	0	0	0	0	66	0	66	341
Hourly Total	1027	0	0	1027	0	0	0	0	1	226	0	227	1254
8:00 AM	210	0	0	210	0	0	0	0	0	58	0	58	268
8:15 AM	169	0	0	169	0	0	0	0	0	56	0	56	225
8:30 AM	160	0	0	160	0	0	0	0	0	51	0	51	211
8:45 AM	151	0	0	151	0	0	0	0	0	73	0	73	224
Hourly Total	690	0	0	690	0	0	0	0	0	238	0	238	928
*** BREAK ***	-	-	-	-	-	-	-	-	-	-	-	-	-
4:00 PM	106	0	0	106	1	0	0	1	0	187	0	187	294
4:15 PM	107	0	0	107	0	0	0	0	0	202	0	202	309
4:30 PM	98	0	0	98	0	0	0	0	0	237	0	237	335
4:45 PM	131	0	0	131	0	0	0	0	1	254	0	255	386
Hourly Total	442	0	0	442	1	0	0	1	1	880	0	881	1324
5:00 PM	108	0	0	108	0	0	0	0	1	312	0	313	421
5:15 PM	116	0	0	116	0	0	0	0	2	288	0	290	406
5:30 PM	103	0	0	103	0	0	0	0	2	244	0	246	349
5:45 PM	95	0	0	95	0	0	0	0	5	230	0	235	330
Hourly Total	422	0	0	422	0	0	0	0	10	1074	0	1084	1506
Grand Total	2581	0	0	2581	1	0	0	1	12	2418	0	2430	5012
Approach %	100.0	0.0	0.0	-	100.0	0.0	0.0	-	0.5	99.5	0.0	-	-
Total %	51.5	0.0	0.0	51.5	0.0	0.0	0.0	0.0	0.2	48.2	0.0	48.5	-
Lights	2565	0	0	2565	1	0	0	1	12	2393	0	2405	4971
% Lights	99.4	-	-	99.4	100.0	-	-	100.0	100.0	99.0	-	99.0	99.2
Mediums	14	0	0	14	0	0	0	0	0	19	0	19	33
% Mediums	0.5	-	-	0.5	0.0	-	-	0.0	0.0	0.8	-	0.8	0.7
Articulated Trucks	2	0	0	2	0	0	0	0	0	6	0	6	8
% Articulated Trucks	0.1	-	-	0.1	0.0	-	-	0.0	0.0	0.2	-	0.2	0.2

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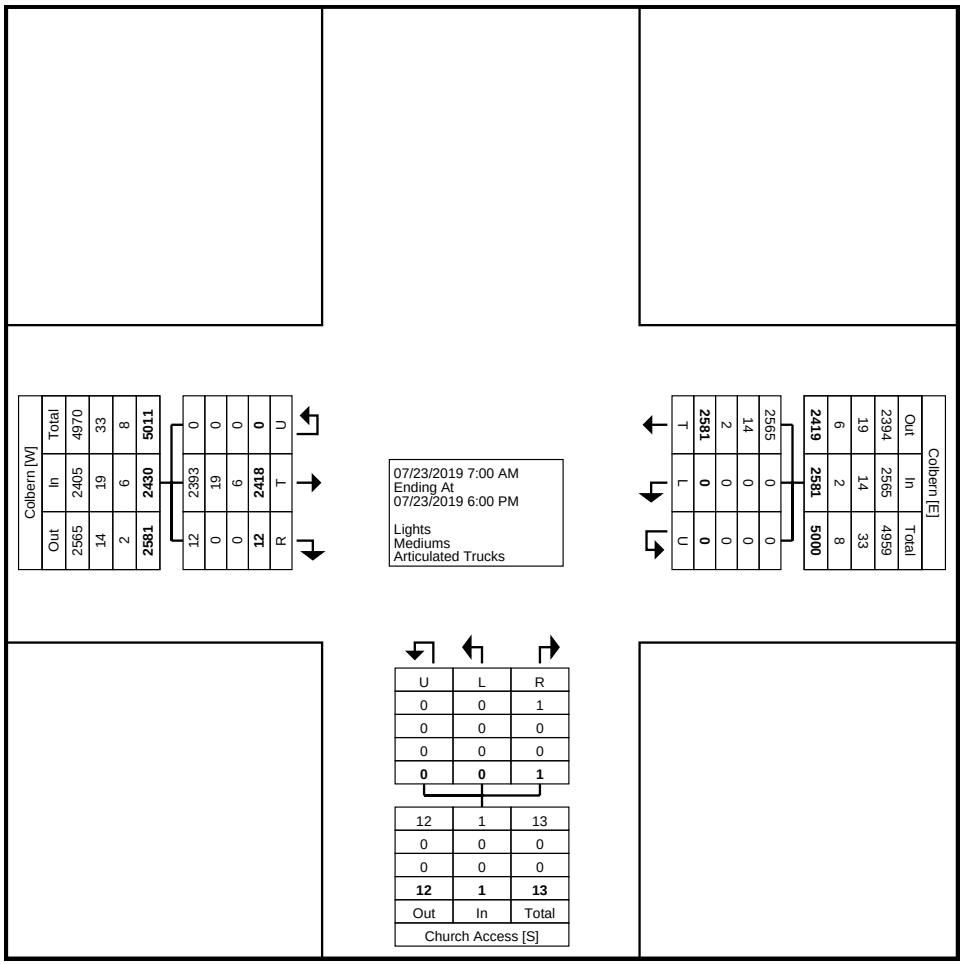
Count Name: Colbern Rd & Existing Church Access
Site Code:
Start Date: 07/23/2019



Turning Movement Data Plot

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913.381.1170 tmchenry@olssonassociates.com

Count Name: Colbern Rd & Existing Church Access
Site Code:
Start Date: 07/23/2019

Turning Movement Peak Hour Data (7:00 AM)

Start Time	Colbern Westbound				Church Access Northbound				Colbern Eastbound				
	Thru	Left	U-Turn	App. Total	Right	Left	U-Turn	App. Total	Right	Thru	U-Turn	App. Total	Int. Total
7:00 AM	248	0	0	248	0	0	0	0	0	47	0	47	295
7:15 AM	266	0	0	266	0	0	0	0	0	52	0	52	318
7:30 AM	238	0	0	238	0	0	0	0	1	61	0	62	300
7:45 AM	275	0	0	275	0	0	0	0	0	66	0	66	341
Total	1027	0	0	1027	0	0	0	0	1	226	0	227	1254
Approach %	100.0	0.0	0.0	-	0.0	0.0	0.0	-	0.4	99.6	0.0	-	-
Total %	81.9	0.0	0.0	81.9	0.0	0.0	0.0	0.0	0.1	18.0	0.0	18.1	-
PHF	0.934	0.000	0.000	0.934	0.000	0.000	0.000	0.000	0.250	0.856	0.000	0.860	0.919
Lights	1024	0	0	1024	0	0	0	0	1	216	0	217	1241
% Lights	99.7	-	-	99.7	-	-	-	-	100.0	95.6	-	95.6	99.0
Mediums	1	0	0	1	0	0	0	0	0	8	0	8	9
% Mediums	0.1	-	-	0.1	-	-	-	-	0.0	3.5	-	3.5	0.7
Articulated Trucks	2	0	0	2	0	0	0	0	0	2	0	2	4
% Articulated Trucks	0.2	-	-	0.2	-	-	-	-	0.0	0.9	-	0.9	0.3

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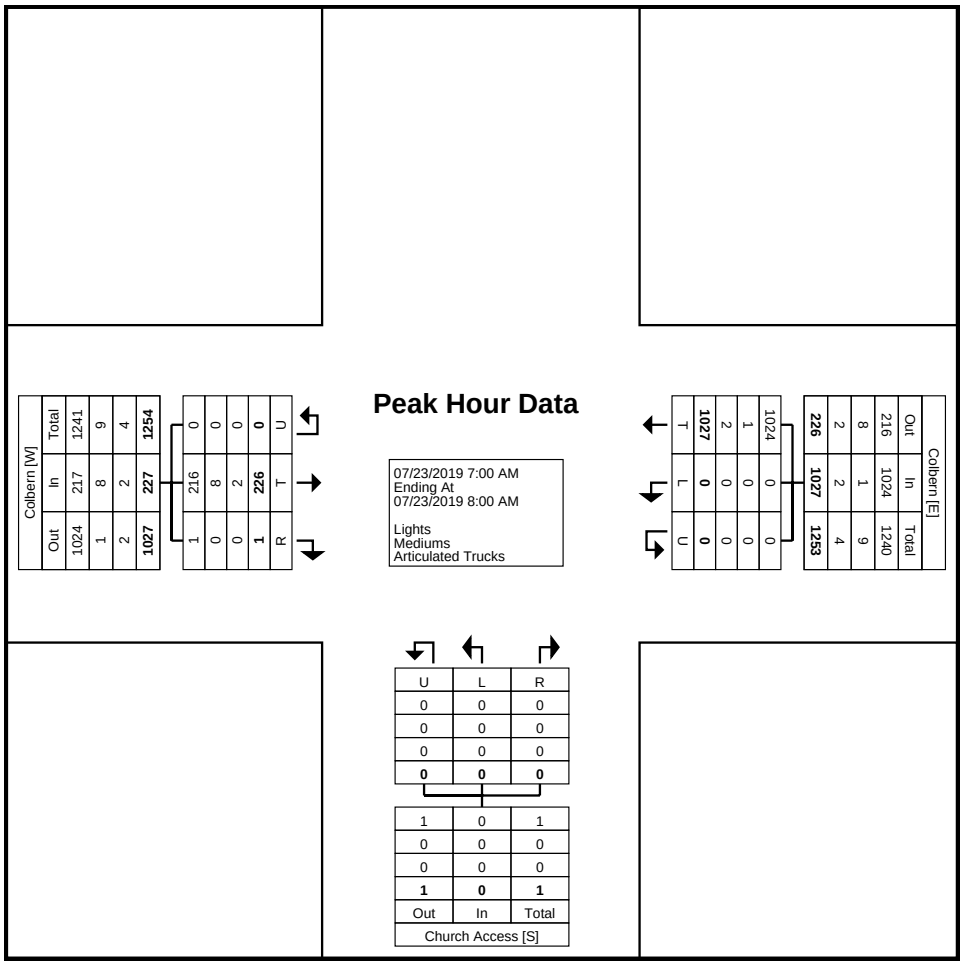
Count Name: Colbern Rd & Existing Church Access
Site Code:
Start Date: 07/23/2019



Turning Movement Peak Hour Data Plot (7:00 AM)

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Count Name: Colbern Rd & Existing Church Access
Site Code:
Start Date: 07/23/2019

Turning Movement Peak Hour Data (4:45 PM)

Start Time	Colbern Westbound				Church Access Northbound				Colbern Eastbound				
	Thru	Left	U-Turn	App. Total	Right	Left	U-Turn	App. Total	Right	Thru	U-Turn	App. Total	Int. Total
4:45 PM	131	0	0	131	0	0	0	0	1	254	0	255	386
5:00 PM	108	0	0	108	0	0	0	0	1	312	0	313	421
5:15 PM	116	0	0	116	0	0	0	0	2	288	0	290	406
5:30 PM	103	0	0	103	0	0	0	0	2	244	0	246	349
Total	458	0	0	458	0	0	0	0	6	1098	0	1104	1562
Approach %	100.0	0.0	0.0	-	0.0	0.0	0.0	-	0.5	99.5	0.0	-	-
Total %	29.3	0.0	0.0	29.3	0.0	0.0	0.0	0.0	0.4	70.3	0.0	70.7	-
PHF	0.874	0.000	0.000	0.874	0.000	0.000	0.000	0.000	0.750	0.880	0.000	0.882	0.928
Lights	450	0	0	450	0	0	0	0	6	1092	0	1098	1548
% Lights	98.3	-	-	98.3	-	-	-	-	100.0	99.5	-	99.5	99.1
Mediums	8	0	0	8	0	0	0	0	0	4	0	4	12
% Mediums	1.7	-	-	1.7	-	-	-	-	0.0	0.4	-	0.4	0.8
Articulated Trucks	0	0	0	0	0	0	0	0	0	2	0	2	2
% Articulated Trucks	0.0	-	-	0.0	-	-	-	-	0.0	0.2	-	0.2	0.1

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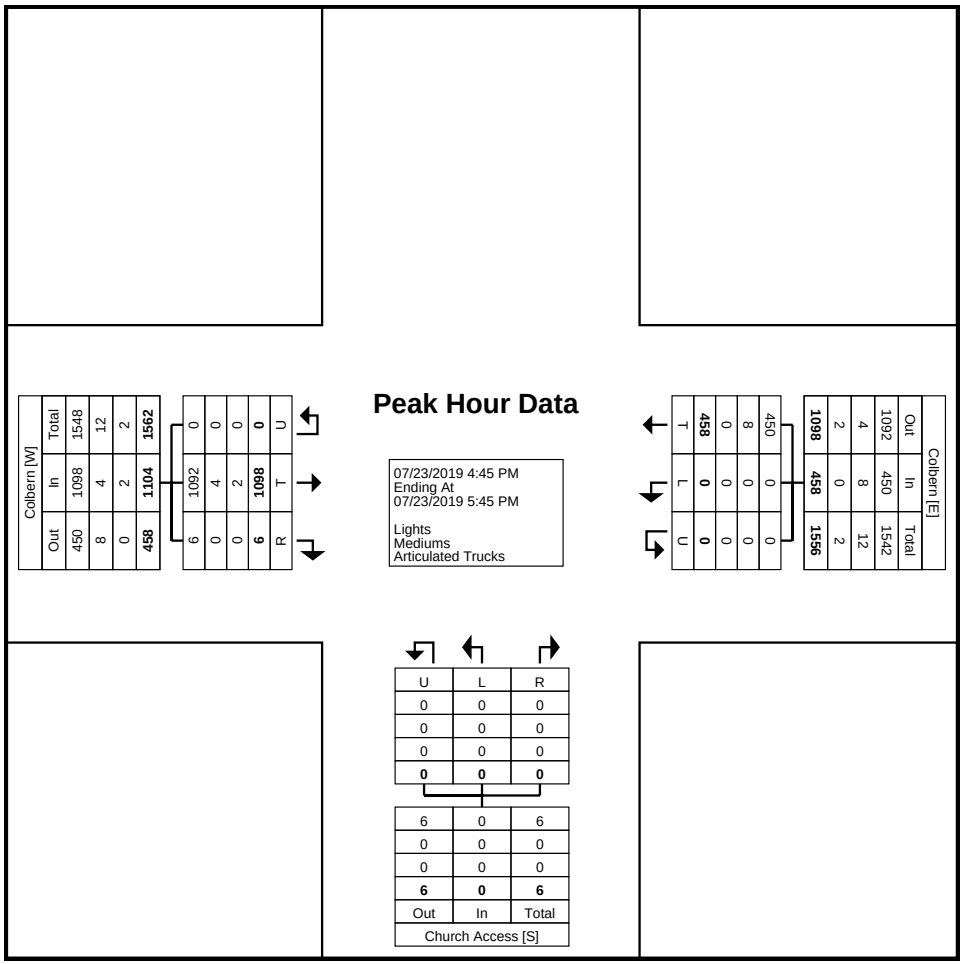
Count Name: Colbern Rd & Existing Church Access
Site Code:
Start Date: 07/23/2019



Turning Movement Peak Hour Data Plot (4:45 PM)

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Count Name: Colbern Rd & Existing Library Drive
Site Code:
Start Date: 07/23/2019

Turning Movement Data

Start Time	Library Southbound					Colbern Westbound					Eastern Church Northbound					Colbern Eastbound					Int. Total
	Right	Thru	Left	U-Turn	App. Total	Right	Thru	Left	U-Turn	App. Total	Right	Thru	Left	U-Turn	App. Total	Right	Thru	Left	U-Turn	App. Total	
7:00 AM	1	1	0	0	2	1	257	0	0	258	0	0	1	0	1	0	45	0	1	46	307
7:15 AM	1	0	0	0	1	1	262	0	0	263	0	0	0	0	0	0	53	0	0	53	317
7:30 AM	3	0	0	0	3	3	236	0	0	239	0	0	0	0	0	0	59	1	0	60	302
7:45 AM	2	0	1	0	3	0	272	0	0	272	0	0	0	0	0	0	59	6	1	66	341
Hourly Total	7	1	1	0	9	5	1027	0	0	1032	0	0	1	0	1	0	216	7	2	225	1267
8:00 AM	1	0	0	0	1	3	210	0	0	213	0	0	0	0	0	1	56	1	0	58	272
8:15 AM	1	0	0	0	1	0	167	0	0	167	0	0	0	0	0	0	54	1	0	55	223
8:30 AM	0	0	0	0	0	3	160	1	0	164	0	0	0	0	0	1	46	3	0	50	214
8:45 AM	5	0	2	0	7	4	147	1	0	152	0	0	0	0	0	0	66	7	0	73	232
Hourly Total	7	0	2	0	9	10	684	2	0	696	0	0	0	0	0	2	222	12	0	236	941
*** BREAK ***	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4:00 PM	6	0	2	0	8	7	100	0	0	107	0	0	0	0	0	0	180	9	1	190	305
4:15 PM	17	0	5	0	22	7	88	1	0	96	0	1	1	0	2	0	192	10	0	202	322
4:30 PM	13	0	6	0	19	4	86	0	0	90	0	0	0	0	0	0	241	7	0	248	357
4:45 PM	5	0	2	0	7	5	122	2	0	129	1	0	1	0	2	0	254	5	0	259	397
Hourly Total	41	0	15	0	56	23	396	3	0	422	1	1	2	0	4	0	867	31	1	899	1381
5:00 PM	9	0	6	0	15	2	98	0	0	100	0	0	1	0	1	0	301	10	1	312	428
5:15 PM	11	0	7	0	18	2	104	0	0	106	1	0	0	0	1	0	279	7	0	286	411
5:30 PM	6	0	4	0	10	3	95	4	0	102	1	0	3	0	4	0	229	10	0	239	355
5:45 PM	9	1	1	0	11	2	86	8	0	96	0	1	2	0	3	1	214	9	0	224	334
Hourly Total	35	1	18	0	54	9	383	12	0	404	2	1	6	0	9	1	1023	36	1	1061	1528
Grand Total	90	2	36	0	128	47	2490	17	0	2554	3	2	9	0	14	3	2328	86	4	2421	5117
Approach %	70.3	1.6	28.1	0.0	-	1.8	97.5	0.7	0.0	-	21.4	14.3	64.3	0.0	-	0.1	96.2	3.6	0.2	-	-
Total %	1.8	0.0	0.7	0.0	2.5	0.9	48.7	0.3	0.0	49.9	0.1	0.0	0.2	0.0	0.3	0.1	45.5	1.7	0.1	47.3	-
Lights	90	2	36	0	128	47	2469	17	0	2533	3	2	9	0	14	3	2300	86	4	2393	5068
% Lights	100.0	100.0	100.0	-	100.0	100.0	99.2	100.0	-	99.2	100.0	100.0	100.0	-	100.0	100.0	98.8	100.0	100.0	98.8	99.0
Mediums	0	0	0	0	0	0	19	0	0	19	0	0	0	0	0	0	21	0	0	21	40
% Mediums	0.0	0.0	0.0	-	0.0	0.0	0.8	0.0	-	0.7	0.0	0.0	0.0	-	0.0	0.0	0.9	0.0	0.0	0.9	0.8
Articulated Trucks	0	0	0	0	0	0	2	0	0	2	0	0	0	0	0	0	7	0	0	7	9
% Articulated Trucks	0.0	0.0	0.0	-	0.0	0.0	0.1	0.0	-	0.1	0.0	0.0	0.0	-	0.0	0.0	0.3	0.0	0.0	0.3	0.2

Olsson Associates : Overland Park
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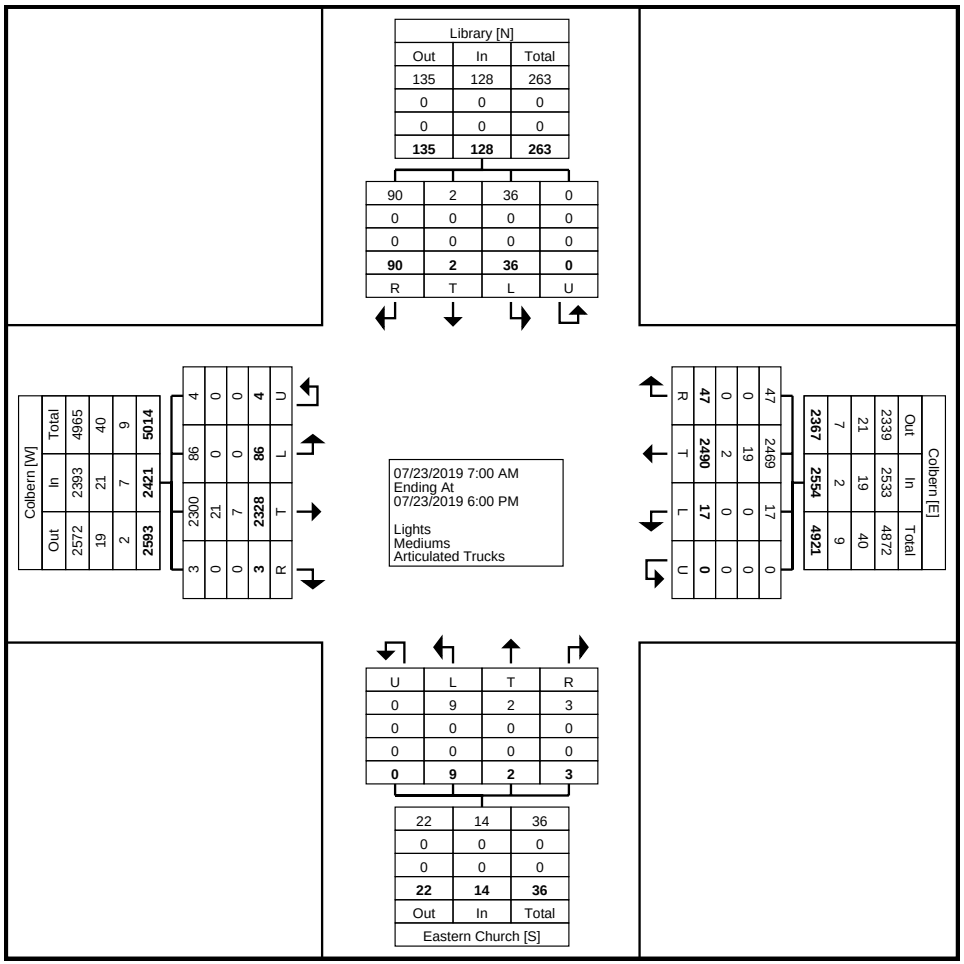
Count Name: Colbern Rd & Existing Library Drive
Site Code:
Start Date: 07/23/2019



Turning Movement Data Plot

Olsson Associates : Overland Park
7301 West 133rd St

Overland Park, Kansas, United States 66213
913.381.1170 tmchenry@olssonassociates.com

Count Name: Colbern Rd & Existing Library Drive
Site Code:
Start Date: 07/23/2019

Turning Movement Peak Hour Data (7:00 AM)

Start Time	Library Southbound					Colbern Westbound					Eastern Church Northbound					Colbern Eastbound					
	Right	Thru	Left	U-Turn	App. Total	Right	Thru	Left	U-Turn	App. Total	Right	Thru	Left	U-Turn	App. Total	Right	Thru	Left	U-Turn	App. Total	Int. Total
7:00 AM	1	1	0	0	2	1	257	0	0	258	0	0	1	0	1	0	45	0	1	46	307
7:15 AM	1	0	0	0	1	1	262	0	0	263	0	0	0	0	0	0	53	0	0	53	317
7:30 AM	3	0	0	0	3	3	236	0	0	239	0	0	0	0	0	0	59	1	0	60	302
7:45 AM	2	0	1	0	3	0	272	0	0	272	0	0	0	0	0	0	59	6	1	66	341
Total	7	1	1	0	9	5	1027	0	0	1032	0	0	1	0	1	0	216	7	2	225	1267
Approach %	77.8	11.1	11.1	0.0	-	0.5	99.5	0.0	0.0	-	0.0	0.0	100.0	0.0	-	0.0	96.0	3.1	0.9	-	-
Total %	0.6	0.1	0.1	0.0	0.7	0.4	81.1	0.0	0.0	81.5	0.0	0.0	0.1	0.0	0.1	0.0	17.0	0.6	0.2	17.8	-
PHF	0.583	0.250	0.250	0.000	0.750	0.417	0.944	0.000	0.000	0.949	0.000	0.000	0.250	0.000	0.250	0.000	0.915	0.292	0.500	0.852	0.929
Lights	7	1	1	0	9	5	1022	0	0	1027	0	0	1	0	1	0	207	7	2	216	1253
% Lights	100.0	100.0	100.0	-	100.0	100.0	99.5	-	-	99.5	-	-	100.0	-	100.0	-	95.8	100.0	100.0	96.0	98.9
Mediums	0	0	0	0	0	0	3	0	0	3	0	0	0	0	0	0	6	0	0	6	9
% Mediums	0.0	0.0	0.0	-	0.0	0.0	0.3	-	-	0.3	-	-	0.0	-	0.0	-	2.8	0.0	0.0	2.7	0.7
Articulated Trucks	0	0	0	0	0	0	2	0	0	2	0	0	0	0	0	0	3	0	0	3	5
% Articulated Trucks	0.0	0.0	0.0	-	0.0	0.0	0.2	-	-	0.2	-	-	0.0	-	0.0	-	1.4	0.0	0.0	1.3	0.4

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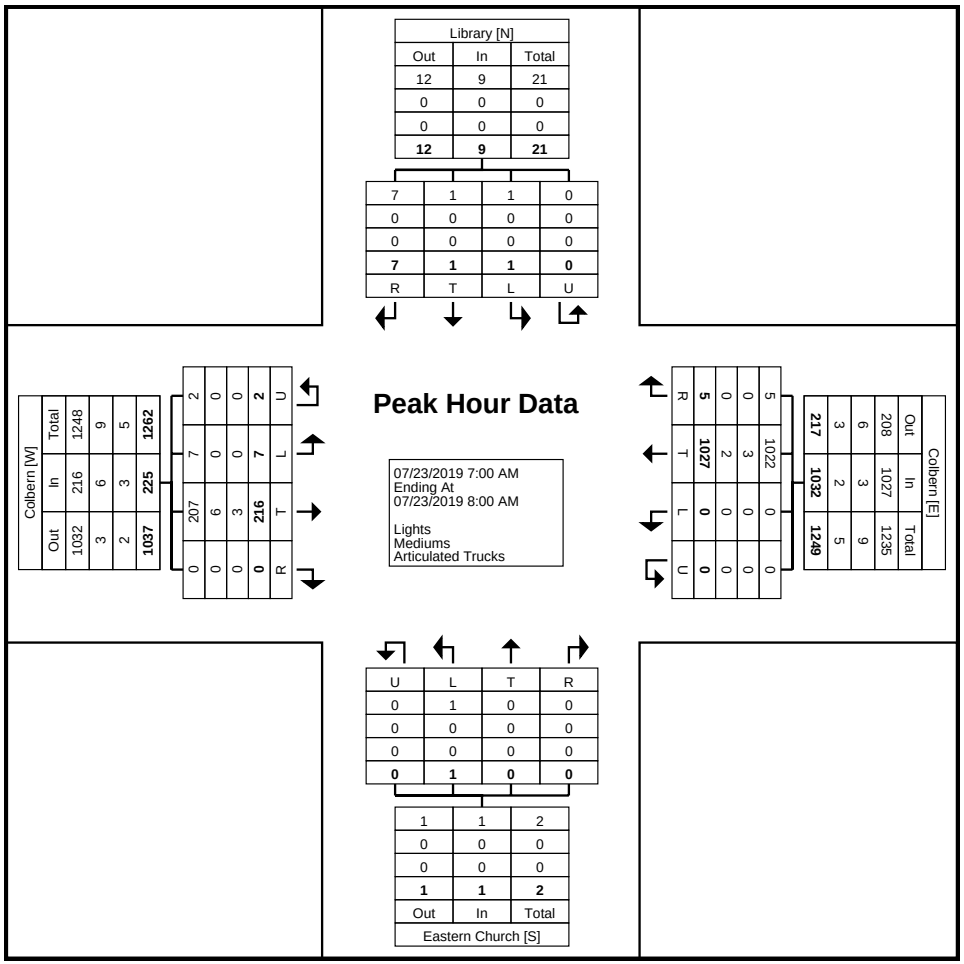

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Count Name: Colbern Rd & Existing Library Drive
Site Code:
Start Date: 07/23/2019

Turning Movement Peak Hour Data (4:30 PM)

Start Time	Library Southbound					Colbern Westbound					Eastern Church Northbound					Colbern Eastbound					
	Right	Thru	Left	U-Turn	App. Total	Right	Thru	Left	U-Turn	App. Total	Right	Thru	Left	U-Turn	App. Total	Right	Thru	Left	U-Turn	App. Total	Int. Total
4:30 PM	13	0	6	0	19	4	86	0	0	90	0	0	0	0	0	0	241	7	0	248	357
4:45 PM	5	0	2	0	7	5	122	2	0	129	1	0	1	0	2	0	254	5	0	259	397
5:00 PM	9	0	6	0	15	2	98	0	0	100	0	0	1	0	1	0	301	10	1	312	428
5:15 PM	11	0	7	0	18	2	104	0	0	106	1	0	0	0	1	0	279	7	0	286	411
Total	38	0	21	0	59	13	410	2	0	425	2	0	2	0	4	0	1075	29	1	1105	1593
Approach %	64.4	0.0	35.6	0.0	-	3.1	96.5	0.5	0.0	-	50.0	0.0	50.0	0.0	-	0.0	97.3	2.6	0.1	-	-
Total %	2.4	0.0	1.3	0.0	3.7	0.8	25.7	0.1	0.0	26.7	0.1	0.0	0.1	0.0	0.3	0.0	67.5	1.8	0.1	69.4	-
PHF	0.731	0.000	0.750	0.000	0.776	0.650	0.840	0.250	0.000	0.824	0.500	0.000	0.500	0.000	0.500	0.000	0.893	0.725	0.250	0.885	0.930
Lights	38	0	21	0	59	13	403	2	0	418	2	0	2	0	4	0	1068	29	1	1098	1579
% Lights	100.0	-	100.0	-	100.0	100.0	98.3	100.0	-	98.4	100.0	-	100.0	-	100.0	-	99.3	100.0	100.0	99.4	99.1
Mediums	0	0	0	0	0	0	7	0	0	7	0	0	0	0	0	0	6	0	0	6	13
% Mediums	0.0	-	0.0	-	0.0	0.0	1.7	0.0	-	1.6	0.0	-	0.0	-	0.0	-	0.6	0.0	0.0	0.5	0.8
Articulated Trucks	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	1
% Articulated Trucks	0.0	-	0.0	-	0.0	0.0	0.0	0.0	-	0.0	0.0	-	0.0	-	0.0	-	0.1	0.0	0.0	0.1	0.1

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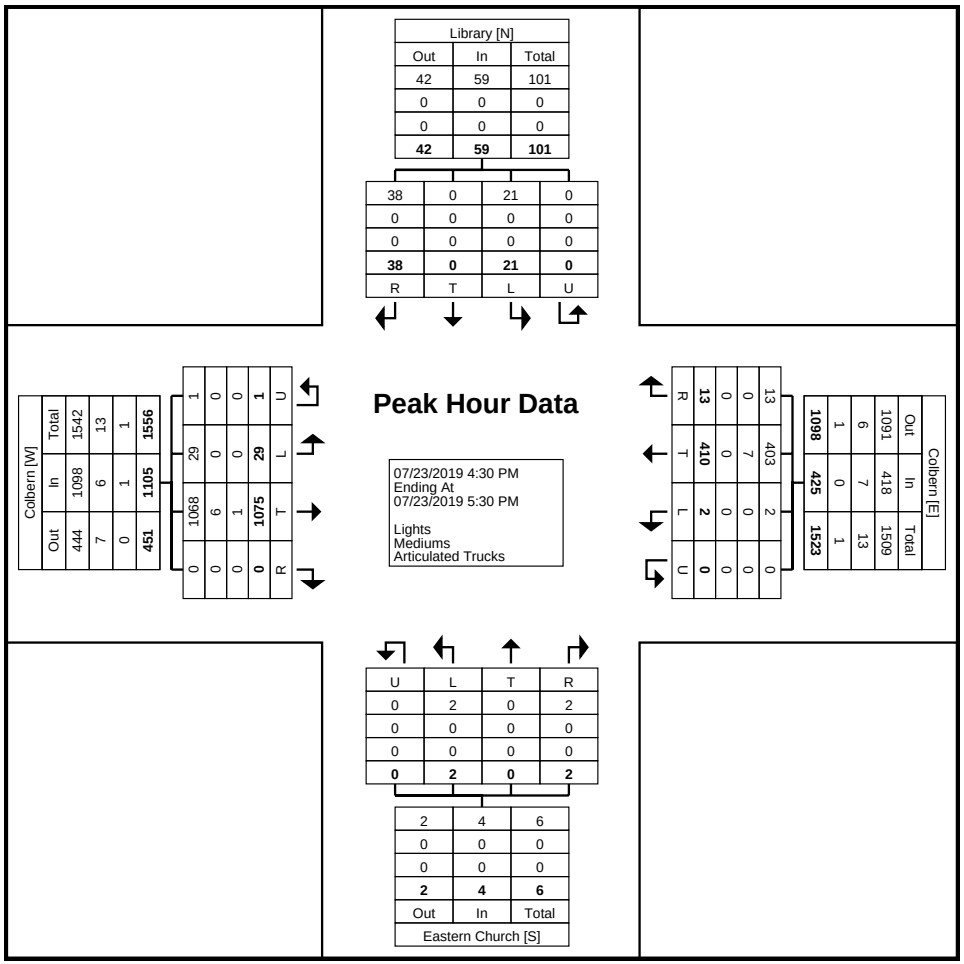

Turning Movement Peak Hour Data Plot (4:30 PM)

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Count Name: Colbern Rd & Rice Rd
Site Code:
Start Date: 07/23/2019

Turning Movement Data

Start Time	Rice Southbound					Colbern Westbound					Rice Northbound					Colbern Eastbound					
	Right	Thru	Left	U-Turn	App. Total	Right	Thru	Left	U-Turn	App. Total	Right	Thru	Left	U-Turn	App. Total	Right	Thru	Left	U-Turn	App. Total	Int. Total
7:00 AM	8	0	0	0	8	4	238	2	0	244	2	1	4	0	7	2	49	10	0	61	320
7:15 AM	6	0	1	0	7	8	257	2	0	267	0	1	6	0	7	6	53	8	0	67	348
7:30 AM	5	2	0	0	7	5	224	0	0	229	0	0	3	0	3	5	65	6	1	77	316
7:45 AM	8	1	0	0	9	6	269	4	0	279	1	0	6	0	7	10	64	5	0	79	374
Hourly Total	27	3	1	0	31	23	988	8	0	1019	3	2	19	0	24	23	231	29	1	284	1358
8:00 AM	14	1	1	0	16	2	205	4	0	211	1	0	5	0	6	11	59	9	0	79	312
8:15 AM	6	1	0	0	7	3	166	2	0	171	2	1	5	0	8	10	58	6	1	75	261
8:30 AM	14	0	3	0	17	1	149	6	0	156	0	1	4	0	5	9	52	9	0	70	248
8:45 AM	16	1	2	0	19	7	142	3	0	152	1	0	8	0	9	11	73	11	0	95	275
Hourly Total	50	3	6	0	59	13	662	15	0	690	4	2	22	0	28	41	242	35	1	319	1096
*** BREAK ***	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4:00 PM	20	1	6	0	27	14	89	1	0	104	4	1	8	0	13	9	189	20	0	218	362
4:15 PM	20	1	9	0	30	4	103	0	0	107	5	3	8	0	16	4	187	21	0	212	365
4:30 PM	16	0	5	0	21	5	94	0	0	99	6	0	8	0	14	7	221	15	1	244	378
4:45 PM	22	1	7	0	30	7	120	1	0	128	4	0	14	0	18	6	248	28	0	282	458
Hourly Total	78	3	27	0	108	30	406	2	0	438	19	4	38	0	61	26	845	84	1	956	1563
5:00 PM	25	1	4	0	30	2	109	2	0	113	9	2	12	0	23	9	296	29	0	334	500
5:15 PM	13	1	3	0	17	7	106	1	0	114	2	1	6	0	9	9	288	12	0	309	449
5:30 PM	10	0	4	0	14	1	101	0	0	102	2	1	8	0	11	6	233	11	0	250	377
5:45 PM	5	0	3	0	8	2	91	0	0	93	3	1	8	0	12	4	229	8	0	241	354
Hourly Total	53	2	14	0	69	12	407	3	0	422	16	5	34	0	55	28	1046	60	0	1134	1680
Grand Total	208	11	48	0	267	78	2463	28	0	2569	42	13	113	0	168	118	2364	208	3	2693	5697
Approach %	77.9	4.1	18.0	0.0	-	3.0	95.9	1.1	0.0	-	25.0	7.7	67.3	0.0	-	4.4	87.8	7.7	0.1	-	-
Total %	3.7	0.2	0.8	0.0	4.7	1.4	43.2	0.5	0.0	45.1	0.7	0.2	2.0	0.0	2.9	2.1	41.5	3.7	0.1	47.3	-
Lights	203	10	48	0	261	76	2444	27	0	2547	39	12	111	0	162	113	2345	206	3	2667	5637
% Lights	97.6	90.9	100.0	-	97.8	97.4	99.2	96.4	-	99.1	92.9	92.3	98.2	-	96.4	95.8	99.2	99.0	100.0	99.0	98.9
Mediums	5	1	0	0	6	2	16	1	0	19	3	1	2	0	6	3	12	2	0	17	48
% Mediums	2.4	9.1	0.0	-	2.2	2.6	0.6	3.6	-	0.7	7.1	7.7	1.8	-	3.6	2.5	0.5	1.0	0.0	0.6	0.8
Articulated Trucks	0	0	0	0	0	0	3	0	0	3	0	0	0	0	0	2	7	0	0	9	12
% Articulated Trucks	0.0	0.0	0.0	-	0.0	0.0	0.1	0.0	-	0.1	0.0	0.0	0.0	-	0.0	1.7	0.3	0.0	0.0	0.3	0.2

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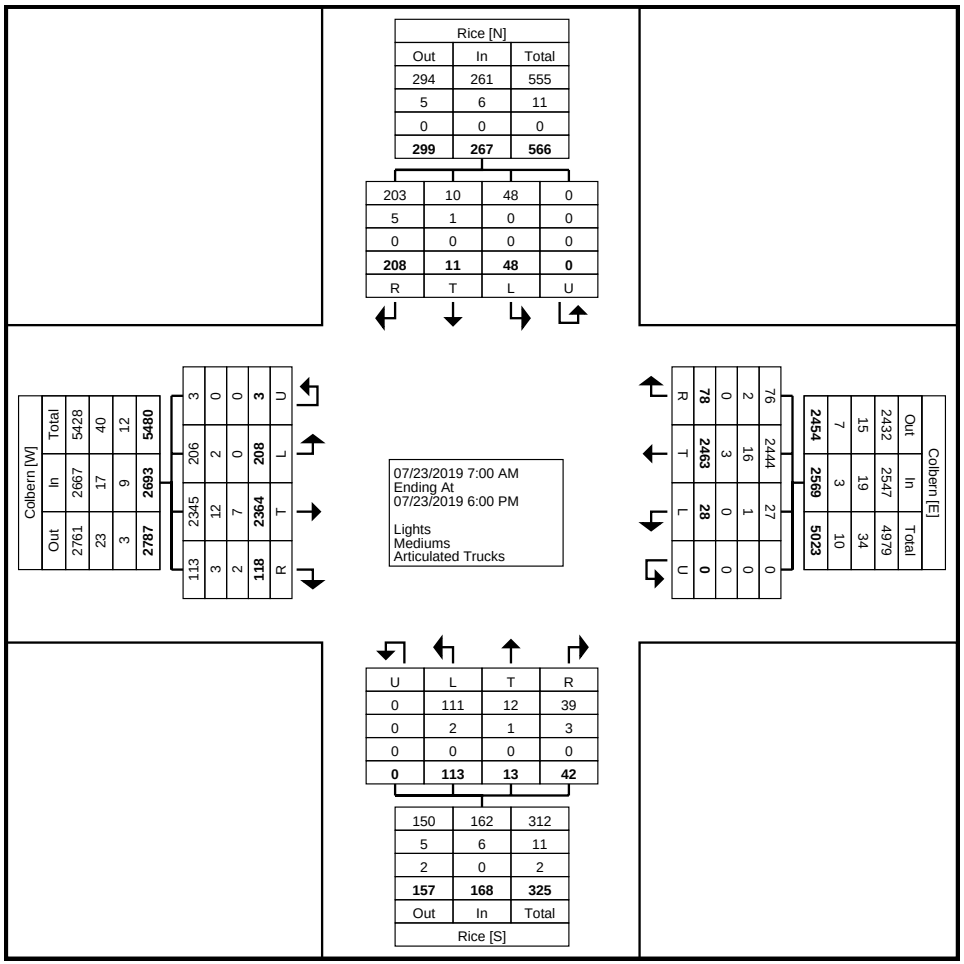

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Start Time	Rice Southbound					Colbern Westbound					Rice Northbound					Colbern Eastbound					
	Right	Thru	Left	U-Turn	App. Total	Right	Thru	Left	U-Turn	App. Total	Right	Thru	Left	U-Turn	App. Total	Right	Thru	Left	U-Turn	App. Total	Int. Total
7:00 AM	8	0	0	0	8	4	238	2	0	244	2	1	4	0	7	2	49	10	0	61	320
7:15 AM	6	0	1	0	7	8	257	2	0	267	0	1	6	0	7	6	53	8	0	67	348
7:30 AM	5	2	0	0	7	5	224	0	0	229	0	0	3	0	3	5	65	6	1	77	316
7:45 AM	8	1	0	0	9	6	269	4	0	279	1	0	6	0	7	10	64	5	0	79	374
Total	27	3	1	0	31	23	988	8	0	1019	3	2	19	0	24	23	231	29	1	284	1358
Approach %	87.1	9.7	3.2	0.0	-	2.3	97.0	0.8	0.0	-	12.5	8.3	79.2	0.0	-	8.1	81.3	10.2	0.4	-	-
Total %	2.0	0.2	0.1	0.0	2.3	1.7	72.8	0.6	0.0	75.0	0.2	0.1	1.4	0.0	1.8	1.7	17.0	2.1	0.1	20.9	-
PHF	0.844	0.375	0.250	0.000	0.861	0.719	0.918	0.500	0.000	0.913	0.375	0.500	0.792	0.000	0.857	0.575	0.888	0.725	0.250	0.899	0.908
Lights	27	3	1	0	31	22	982	8	0	1012	2	1	17	0	20	22	224	28	1	275	1338
% Lights	100.0	100.0	100.0	-	100.0	95.7	99.4	100.0	-	99.3	66.7	50.0	89.5	-	83.3	95.7	97.0	96.6	100.0	96.8	98.5
Mediums	0	0	0	0	0	1	3	0	0	4	1	1	2	0	4	1	4	1	0	6	14
% Mediums	0.0	0.0	0.0	-	0.0	4.3	0.3	0.0	-	0.4	33.3	50.0	10.5	-	16.7	4.3	1.7	3.4	0.0	2.1	1.0
Articulated Trucks	0	0	0	0	0	0	3	0	0	3	0	0	0	0	0	0	3	0	0	3	6
% Articulated Trucks	0.0	0.0	0.0	-	0.0	0.0	0.3	0.0	-	0.3	0.0	0.0	0.0	-	0.0	0.0	1.3	0.0	0.0	1.1	0.4

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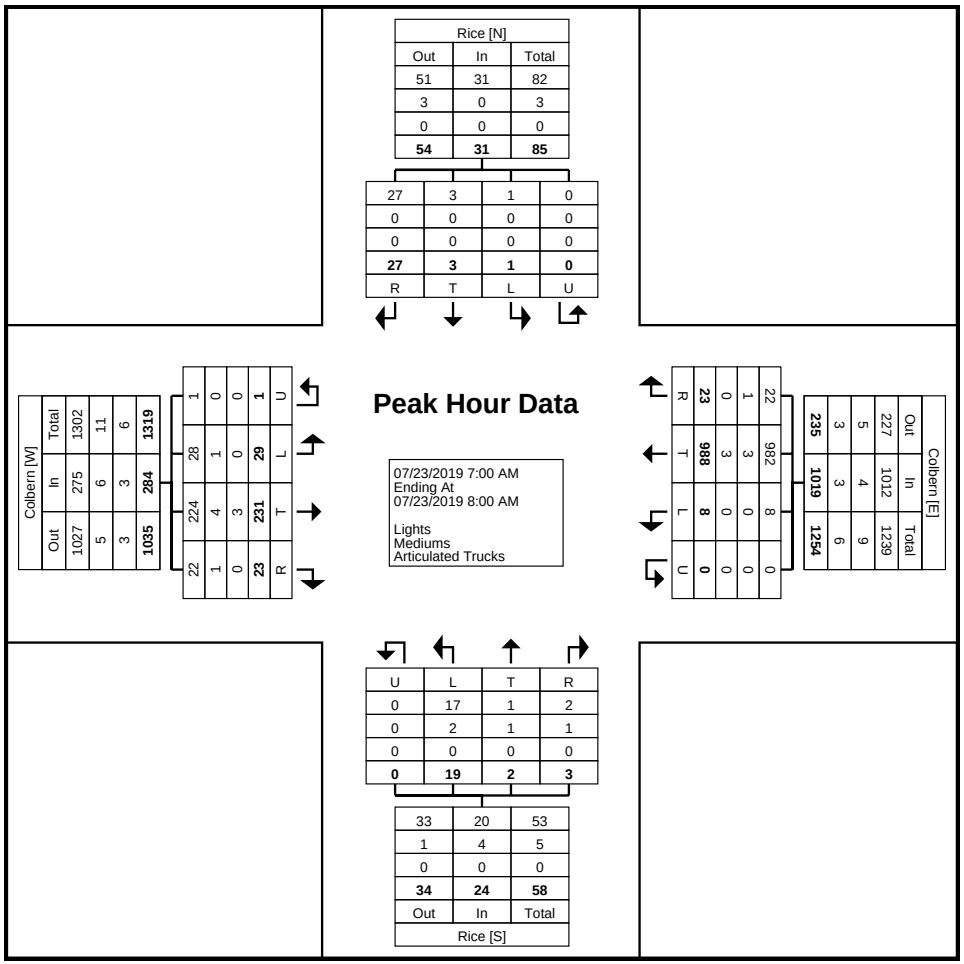

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Turning Movement Peak Hour Data (4:30 PM)

Start Time	Rice Southbound					Colbern Westbound					Rice Northbound					Colbern Eastbound					
	Right	Thru	Left	U-Turn	App. Total	Right	Thru	Left	U-Turn	App. Total	Right	Thru	Left	U-Turn	App. Total	Right	Thru	Left	U-Turn	App. Total	Int. Total
4:30 PM	16	0	5	0	21	5	94	0	0	99	6	0	8	0	14	7	221	15	1	244	378
4:45 PM	22	1	7	0	30	7	120	1	0	128	4	0	14	0	18	6	248	28	0	282	458
5:00 PM	25	1	4	0	30	2	109	2	0	113	9	2	12	0	23	9	296	29	0	334	500
5:15 PM	13	1	3	0	17	7	106	1	0	114	2	1	6	0	9	9	288	12	0	309	449
Total	76	3	19	0	98	21	429	4	0	454	21	3	40	0	64	31	1053	84	1	1169	1785
Approach %	77.6	3.1	19.4	0.0	-	4.6	94.5	0.9	0.0	-	32.8	4.7	62.5	0.0	-	2.7	90.1	7.2	0.1	-	-
Total %	4.3	0.2	1.1	0.0	5.5	1.2	24.0	0.2	0.0	25.4	1.2	0.2	2.2	0.0	3.6	1.7	59.0	4.7	0.1	65.5	-
PHF	0.760	0.750	0.679	0.000	0.817	0.750	0.894	0.500	0.000	0.887	0.583	0.375	0.714	0.000	0.696	0.861	0.889	0.724	0.250	0.875	0.893
Lights	75	3	19	0	97	21	423	3	0	447	20	3	40	0	63	29	1048	84	1	1162	1769
% Lights	98.7	100.0	100.0	-	99.0	100.0	98.6	75.0	-	98.5	95.2	100.0	100.0	-	98.4	93.5	99.5	100.0	100.0	99.4	99.1
Mediums	1	0	0	0	1	0	6	1	0	7	1	0	0	0	1	1	4	0	0	5	14
% Mediums	1.3	0.0	0.0	-	1.0	0.0	1.4	25.0	-	1.5	4.8	0.0	0.0	-	1.6	3.2	0.4	0.0	0.0	0.4	0.8
Articulated Trucks	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	2	2
% Articulated Trucks	0.0	0.0	0.0	-	0.0	0.0	0.0	0.0	-	0.0	0.0	0.0	0.0	-	0.0	3.2	0.1	0.0	0.0	0.2	0.1

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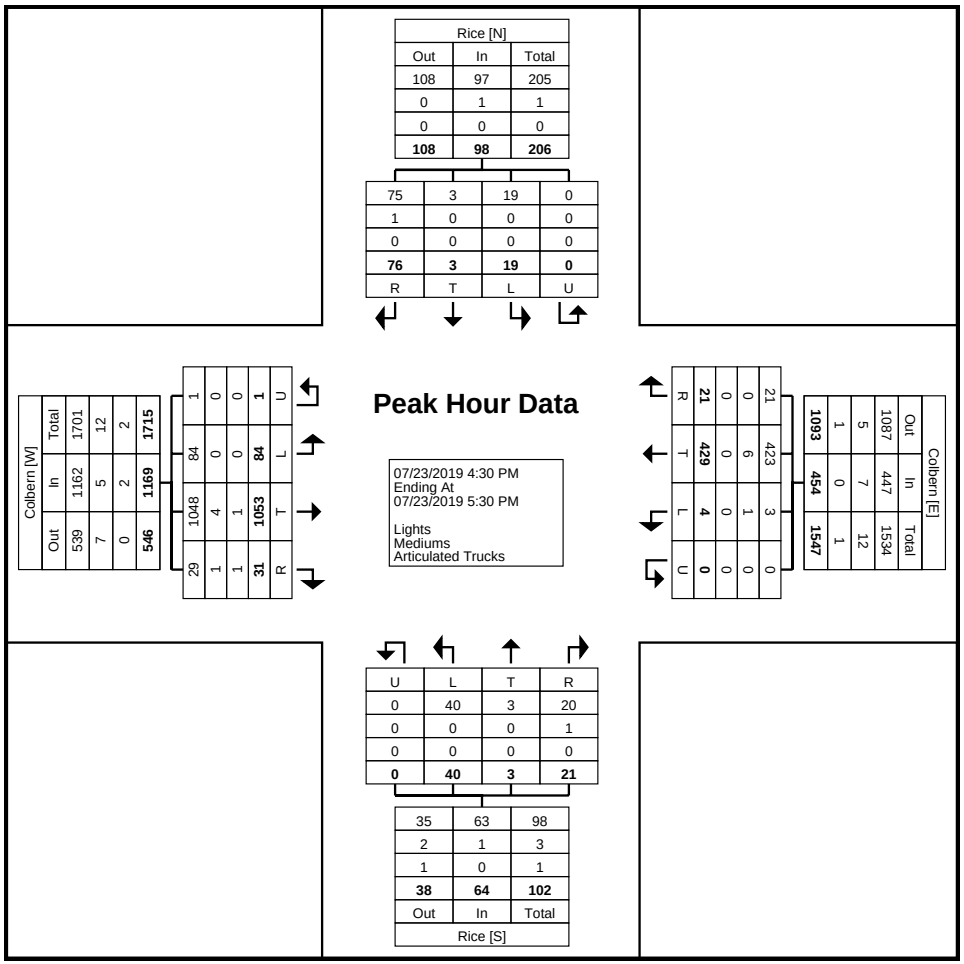


Turning Movement Peak Hour Data Plot (4:30 PM)

Trip Generation Comparison

Daily Trip Generation

ITE Code/Page	Land Use	Size		Trip Gen. Avg. Rate/Eq.	Daily Trips	Trip Distribution Enter	Trip Distribution Exit	Daily Trips Enter	Daily Trips Exit
590	Library	15,000	SF	Equation	1055	50%	50%	528	527
Total					**1,055**			**528**	**527**

AM Peak Hour Trip Generation (Adjacent Street)

ITE Code/Page	Land Use	Size		Trip Gen. Avg. Rate/Eq.	AM Peak Hour Trips	Trip Distribution Enter	Trip Distribution Exit	AM Peak Hour Trips Enter	AM Peak Hour Trips Exit
590	Library	15,000	SF	Equation	12	71%	29%	9	3
Total					**12**			**9**	**3**

PM Peak Hour Trip Generation (Adjacent Street)

ITE Code/Page	Land Use	Size		Trip Gen. Avg. Rate/Eq.	PM Peak Hour Trips	Trip Distribution Enter	Trip Distribution Exit	PM Peak Hour Trips Enter	PM Peak Hour Trips Exit
590	Library	15,000	SF	Equation	123	48%	52%	60	63
Total					**123**			**60**	**63**

Comparison of Existing Actual Trips to Expected Trips

	AM			PM		
	Total	Enter	Exit	Total	Enter	Exit
Existing Actual Trips	21	12	9	102	43	59
Existing Expected Trips	12	9	3	123	60	63
Difference	**9**	**3**	**6**	**-21**	**-17**	**-4**

APPENDIX B

Existing Development Conditions

Signal Warrants

Major Street : Colbern Rd
Minor Street : Rice Rd
City : Lee's Summit, MO
County :

Time Count Began : 6:00am
Date : July 23rd, 2019
Day of Week of Count: Tuesday

Is the intersection in a community with a population less than 10,000 or are speeds greater than 40 mph? No

	Major Street	Minor Street
Adjustment factor for day of week and month of year of count	1	1
Number of Lanes	4	2

Time Beginning	Major Street Approach Volumes EAST	WEST	Total	≅	Minor Street Approach Volumes NORTH	SOUTH	*
12:00 m	0	0	0		0	0	0
1:00	0	0	0		0	0	0
2:00	0	0	0		0	0	0
3:00 am	0	0	0		0	0	0
4:00	0	0	0		0	0	0
5:00	0	0	0		0	0	0
6:00 am	0	0	0		0	0	0
7:00	284	1019	1303		24	31	31
8:00	319	690	1009		28	59	59
9:00 am	0	0	0		0	0	0
10:00	0	0	0		0	0	0
11:00	0	0	0		0	0	0
12:00 n	0	0	0		0	0	0
1:00	0	0	0		0	0	0
2:00	0	0	0		0	0	0
3:00 pm	0	0	0		0	0	0
4:00	956	438	1394		61	108	108
5:00	1134	422	1556		55	69	69
6:00 pm	0	0	0		0	0	0
7:00	0	0	0		0	0	0
8:00	0	0	0		0	0	0
9:00 pm	0	0	0		0	0	0
10:00	0	0	0		0	0	0
11:00	0	0	0		0	0	0
24HR Total	2693	2569			168	267	

Note: ≅ Total of both approaches.
* The HIGHEST approach only.

NOTE:
Basic minimum hourly volumes (unreduced)

NOTE: No adjust ment made

Warrant #2 - Four-Hour Vehicular Volume		Warrant #3 - Peak Hour	
Warrant Volume	Percent of Warrant	Warrant Volume	Percent of Warrant
0	*****	0	*****
0	*****	0	*****
0	*****	0	*****
0	*****	0	*****
0	*****	0	*****
0	*****	0	*****
0	*****	0	*****
120	26	250	12
190	31	360	16
0	*****	0	*****
0	*****	0	*****
0	*****	0	*****
0	*****	0	*****
0	*****	0	*****
0	*****	0	*****
0	*****	0	*****
120	90	230	47
120	58	180	38
0	*****	0	*****
0	*****	0	*****
0	*****	0	*****
0	*****	0	*****
0	*****	0	*****
0	*****	0	*****
Warranting Volumes From MUTCD Fig. 4C-1		Warranting Volumes From MUTCD Fig. 4C-3	
Hours Met	0	Hours Met	0
Warrant Met	No	Warrant Met	No

***** Major Street volume is so low that no Minor Street warrant exists

Major Street : Colbern Rd
Minor Street : Ex. Library Access
City : Lee's Summit, MO
County :

Time Count Began : 6:00am
Date : July 23rd, 2019
Day of Week of Count: Tuesday

Is the intersection in a community with a population less than 10,000 or are speeds greater than 40 mph? No

	Major Street	Minor Street
Adjustment factor for day of week and month of year of count	1	1
Number of Lanes	4	2

Time Beginning	Major Street Approach Volumes EAST	WEST	Total	≅	Minor Street Approach Volumes NORTH	SOUTH	*
12:00 m	0	0	0		0	0	0
1:00	0	0	0		0	0	0
2:00	0	0	0		0	0	0
3:00 am	0	0	0		0	0	0
4:00	0	0	0		0	0	0
5:00	0	0	0		0	0	0
6:00 am	0	0	0		0	0	0
7:00	225	1032	1257		1	9	9
8:00	236	696	932		0	9	9
9:00 am	0	0	0		0	0	0
10:00	0	0	0		0	0	0
11:00	0	0	0		0	0	0
12:00 n	0	0	0		0	0	0
1:00	0	0	0		0	0	0
2:00	0	0	0		0	0	0
3:00 pm	0	0	0		0	0	0
4:00	899	422	1321		4	56	56
5:00	1061	404	1465		9	54	54
6:00 pm	0	0	0		0	0	0
7:00	0	0	0		0	0	0
8:00	0	0	0		0	0	0
9:00 pm	0	0	0		0	0	0
10:00	0	0	0		0	0	0
11:00	0	0	0		0	0	0
24HR Total	2421	2554			14	128	

Note: ≅ Total of both approaches.
* The HIGHEST approach only.

NOTE:
Basic minimum hourly volumes (unreduced)

NOTE: No adjust ment made

Warrant #2 - Four-Hour Vehicular Volume		Warrant #3 - Peak Hour	
Warrant Volume	Percent of Warrant	Warrant Volume	Percent of Warrant
0	*****	0	*****
0	*****	0	*****
0	*****	0	*****
0	*****	0	*****
0	*****	0	*****
0	*****	0	*****
0	*****	0	*****
120	8	270	3
220	4	400	2
0	*****	0	*****
0	*****	0	*****
0	*****	0	*****
0	*****	0	*****
0	*****	0	*****
0	*****	0	*****
0	*****	0	*****
120	47	250	22
120	45	210	26
0	*****	0	*****
0	*****	0	*****
0	*****	0	*****
0	*****	0	*****
0	*****	0	*****
0	*****	0	*****
Warranting Volumes From MUTCD Fig. 4C-1		Warranting Volumes From MUTCD Fig. 4C-3	
Hours Met	0	Hours Met	0
Warrant Met	No	Warrant Met	No

***** Major Street volume is so low that no Minor Street warrant exists

Capacity Analysis

Intersection	
Int Delay, s/veh	1.6

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	29	235	23	8	996	23	19	2	3	1	3	27
Future Vol, veh/h	29	235	23	8	996	23	19	2	3	1	3	27
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	60	-	-	225	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	73	89	58	50	92	72	79	50	38	25	38	84
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	40	264	40	16	1083	32	24	4	8	4	8	32

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	1115	0	0	304	0	0	942	1511	152	1345	1515	558
Stage 1	-	-	-	-	-	-	364	364	-	1131	1131	-
Stage 2	-	-	-	-	-	-	578	1147	-	214	384	-
Critical Hdwy	4.14	-	-	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	2.22	-	-	2.22	-	-	3.52	4.02	3.32	3.52	4.02	3.32
Pot Cap-1 Maneuver	622	-	-	1254	-	-	218	119	867	110	118	473
Stage 1	-	-	-	-	-	-	627	622	-	217	277	-
Stage 2	-	-	-	-	-	-	468	272	-	768	610	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	622	-	-	1254	-	-	181	110	867	100	109	473
Mov Cap-2 Maneuver	-	-	-	-	-	-	181	110	-	100	109	-
Stage 1	-	-	-	-	-	-	587	582	-	203	273	-
Stage 2	-	-	-	-	-	-	418	268	-	707	571	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	1.3	0.1	26.6	23
HCM LOS			D	C

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	202	622	-	-	1254	-	-	244
HCM Lane V/C Ratio	0.178	0.064	-	-	0.013	-	-	0.18
HCM Control Delay (s)	26.6	11.2	-	-	7.9	-	-	23
HCM Lane LOS	D	B	-	-	A	-	-	C
HCM 95th %tile Q(veh)	0.6	0.2	-	-	0	-	-	0.6

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	7	223	0	0	1027	5	1	0	0	1	1	7
Future Vol, veh/h	7	223	0	0	1027	5	1	0	0	1	1	7
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	90	-	-	95	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	29	92	100	100	94	42	25	100	100	25	25	58
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	24	242	0	0	1093	12	4	0	0	4	4	12

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	1105	0	0	242	0	0	839	1395	121	1268	1389	553
Stage 1	-	-	-	-	-	-	290	290	-	1099	1099	-
Stage 2	-	-	-	-	-	-	549	1105	-	169	290	-
Critical Hdwy	4.14	-	-	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	2.22	-	-	2.22	-	-	3.52	4.02	3.32	3.52	4.02	3.32
Pot Cap-1 Maneuver	628	-	-	1322	-	-	259	140	908	125	141	477
Stage 1	-	-	-	-	-	-	694	671	-	227	287	-
Stage 2	-	-	-	-	-	-	488	285	-	816	671	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	628	-	-	1322	-	-	240	135	908	121	136	477
Mov Cap-2 Maneuver	-	-	-	-	-	-	240	135	-	121	136	-
Stage 1	-	-	-	-	-	-	668	646	-	218	287	-
Stage 2	-	-	-	-	-	-	469	285	-	785	646	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	1	0	20.3	22.2
HCM LOS			C	C

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	240	628	-	-	1322	-	-	229
HCM Lane V/C Ratio	0.017	0.038	-	-	-	-	-	0.088
HCM Control Delay (s)	20.3	11	-	-	0	-	-	22.2
HCM Lane LOS	C	B	-	-	A	-	-	C
HCM 95th %tile Q(veh)	0.1	0.1	-	-	0	-	-	0.3

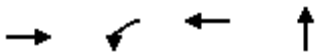
Intersection	
Int Delay, s/veh	0

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	230	1	0	1035	0	0
Future Vol, veh/h	230	1	0	1035	0	0
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	-	0
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	86	25	100	93	100	100
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	267	4	0	1113	0	0

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	-	-	-	136
Stage 1	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-
Critical Hdwy	-	-	-	-	-	6.94
Critical Hdwy Stg 1	-	-	-	-	-	-
Critical Hdwy Stg 2	-	-	-	-	-	-
Follow-up Hdwy	-	-	-	-	-	3.32
Pot Cap-1 Maneuver	-	-	0	-	0	888
Stage 1	-	-	0	-	0	-
Stage 2	-	-	0	-	0	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	-	-	-	888
Mov Cap-2 Maneuver	-	-	-	-	-	-
Stage 1	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-

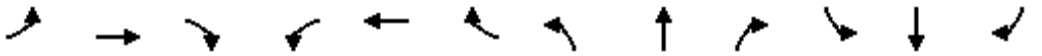
Approach	EB	WB	NB
HCM Control Delay, s	0	0	0
HCM LOS			A

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

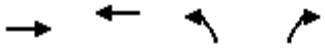


Lane Group	EBT	WBL	WBT	NBT
Lane Group Flow (vph)	244	12	1026	60
v/c Ratio	0.11	0.02	0.41	0.13
Control Delay	6.6	4.2	5.1	3.2
Queue Delay	0.0	0.0	0.0	0.0
Total Delay	6.6	4.2	5.1	3.2
Queue Length 50th (ft)	11	1	63	0
Queue Length 95th (ft)	43	2	99	13
Internal Link Dist (ft)	295		547	737
Turn Bay Length (ft)		245		
Base Capacity (vph)	3473	1212	3539	1396
Starvation Cap Reductn	0	0	0	0
Spillback Cap Reductn	0	0	0	0
Storage Cap Reductn	0	0	0	0
Reduced v/c Ratio	0.07	0.01	0.29	0.04

Intersection Summary



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	211	10	4	975	0	44	0	2	0	0	0
Future Volume (veh/h)	0	211	10	4	975	0	44	0	2	0	0	0
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0			
Ped-Bike Adj(A_pbT)	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			
Work Zone On Approach		No			No			No				
Adj Sat Flow, veh/h/ln	0	1870	1870	1870	1870	0	1900	1870	1900			
Adj Flow Rate, veh/h	0	232	12	12	1026	0	56	0	4			
Peak Hour Factor	0.92	0.91	0.83	0.33	0.95	0.92	0.79	0.92	0.50			
Percent Heavy Veh, %	0	2	2	2	2	0	0	2	0			
Cap, veh/h	0	1073	55	563	1868	0	129	0	9			
Arrive On Green	0.00	0.31	0.31	0.02	0.53	0.00	0.08	0.00	0.08			
Sat Flow, veh/h	0	3532	177	1781	3647	0	1649	0	118			
Grp Volume(v), veh/h	0	119	125	12	1026	0	60	0	0			
Grp Sat Flow(s),veh/h/ln	0	1777	1839	1781	1777	0	1767	0	0			
Q Serve(g_s), s	0.0	1.5	1.5	0.1	5.8	0.0	1.0	0.0	0.0			
Cycle Q Clear(g_c), s	0.0	1.5	1.5	0.1	5.8	0.0	1.0	0.0	0.0			
Prop In Lane	0.00		0.10	1.00		0.00	0.93		0.07			
Lane Grp Cap(c), veh/h	0	554	574	563	1868	0	139	0	0			
V/C Ratio(X)	0.00	0.22	0.22	0.02	0.55	0.00	0.43	0.00	0.00			
Avail Cap(c_a), veh/h	0	2285	2364	1651	4570	0	1398	0	0			
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00			
Upstream Filter(I)	0.00	1.00	1.00	1.00	1.00	0.00	1.00	0.00	0.00			
Uniform Delay (d), s/veh	0.0	7.7	7.7	5.8	4.8	0.0	13.3	0.0	0.0			
Incr Delay (d2), s/veh	0.0	0.2	0.2	0.0	0.3	0.0	2.1	0.0	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			
%ile BackOfQ(50%),veh/ln	0.0	0.3	0.4	0.0	0.5	0.0	0.4	0.0	0.0			
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	0.0	7.9	7.9	5.8	5.0	0.0	15.4	0.0	0.0			
LnGrp LOS	A	A	A	A	A	A	B	A	A			
Approach Vol, veh/h		244			1038			60				
Approach Delay, s/veh		7.9			5.1			15.4				
Approach LOS		A			A			B				
Timer - Assigned Phs		2	3	4				8				
Phs Duration (G+Y+Rc), s		8.4	6.5	15.5				21.9				
Change Period (Y+Rc), s		6.0	6.0	6.0				6.0				
Max Green Setting (Gmax), s		24.0	19.0	39.0				39.0				
Max Q Clear Time (g_c+I1), s		3.0	2.1	3.5				7.8				
Green Ext Time (p_c), s		0.2	0.0	1.3				8.1				
Intersection Summary												
HCM 6th Ctrl Delay			6.0									
HCM 6th LOS			A									



Lane Group	EBT	WBT	NBL	NBR
Lane Group Flow (vph)	278	1133	185	56
v/c Ratio	0.13	0.52	0.38	0.12
Control Delay	7.6	11.1	29.0	7.8
Queue Delay	0.0	0.0	0.0	0.0
Total Delay	7.6	11.1	29.0	7.8
Queue Length 50th (ft)	32	176	85	0
Queue Length 95th (ft)	47	227	144	19
Internal Link Dist (ft)	516	112	754	
Turn Bay Length (ft)				250
Base Capacity (vph)	2162	2162	491	480
Starvation Cap Reductn	0	0	0	0
Spillback Cap Reductn	0	0	0	0
Storage Cap Reductn	0	0	0	0
Reduced v/c Ratio	0.13	0.52	0.38	0.12

Intersection Summary

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (veh/h)	245	0	0	1042	172	42
Future Volume (veh/h)	245	0	0	1042	172	42
Initial Q (Qb), veh	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)		1.00	1.00		1.00	1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach	No			No	No	
Adj Sat Flow, veh/h/ln	1870	0	0	1870	1870	1870
Adj Flow Rate, veh/h	278	0	0	1133	185	0
Peak Hour Factor	0.88	1.00	1.00	0.92	0.93	0.75
Percent Heavy Veh, %	2	0	0	2	2	2
Cap, veh/h	2172	0	0	2172	495	
Arrive On Green	0.61	0.00	0.00	0.61	0.28	0.00
Sat Flow, veh/h	3741	0	0	3741	1781	1585
Grp Volume(v), veh/h	278	0	0	1133	185	0
Grp Sat Flow(s),veh/h/ln	1777	0	0	1777	1781	1585
Q Serve(g_s), s	3.0	0.0	0.0	16.4	7.5	0.0
Cycle Q Clear(g_c), s	3.0	0.0	0.0	16.4	7.5	0.0
Prop In Lane		0.00	0.00		1.00	1.00
Lane Grp Cap(c), veh/h	2172	0	0	2172	495	
V/C Ratio(X)	0.13	0.00	0.00	0.52	0.37	
Avail Cap(c_a), veh/h	2172	0	0	2172	495	
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	0.00	1.00	1.00	0.00
Uniform Delay (d), s/veh	7.4	0.0	0.0	10.0	26.2	0.0
Incr Delay (d2), s/veh	0.1	0.0	0.0	0.9	2.2	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	1.0	0.0	0.0	5.6	3.4	0.0
Unsig. Movement Delay, s/veh						
LnGrp Delay(d),s/veh	7.5	0.0	0.0	10.9	28.3	0.0
LnGrp LOS	A	A	A	B	C	
Approach Vol, veh/h	278			1133	185	A
Approach Delay, s/veh	7.5			10.9	28.3	
Approach LOS	A			B	C	

Timer - Assigned Phs	2				6	8
Phs Duration (G+Y+Rc), s	60.0				60.0	30.0
Change Period (Y+Rc), s	5.0				5.0	5.0
Max Green Setting (Gmax), s	55.0				55.0	25.0
Max Q Clear Time (g_c+I1), s	18.4				5.0	9.5
Green Ext Time (p_c), s	9.7				1.8	0.4

Intersection Summary	
HCM 6th Ctrl Delay	12.3
HCM 6th LOS	B

Notes

Unsignalized Delay for [NBR] is excluded from calculations of the approach delay and intersection delay.

Intersection	
Int Delay, s/veh	21.7

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	84	1060	31	4	431	21	40	3	21	19	3	76
Future Vol, veh/h	84	1060	31	4	431	21	40	3	21	19	3	76
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	60	-	-	225	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	72	89	86	50	89	75	71	38	58	68	75	76
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	117	1191	36	8	484	28	56	8	36	28	4	100

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	512	0	0	1227	0	0	1703	1971	614	1348	1975	256
Stage 1	-	-	-	-	-	-	1443	1443	-	514	514	-
Stage 2	-	-	-	-	-	-	260	528	-	834	1461	-
Critical Hdwy	4.14	-	-	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	2.22	-	-	2.22	-	-	3.52	4.02	3.32	3.52	4.02	3.32
Pot Cap-1 Maneuver	1050	-	-	564	-	-	59	62	435	109	61	743
Stage 1	-	-	-	-	-	-	139	196	-	511	534	-
Stage 2	-	-	-	-	-	-	722	526	-	329	192	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	1050	-	-	564	-	-	~ 44	54	435	80	53	743
Mov Cap-2 Maneuver	-	-	-	-	-	-	~ 44	54	-	80	53	-
Stage 1	-	-	-	-	-	-	124	174	-	454	527	-
Stage 2	-	-	-	-	-	-	611	519	-	256	171	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0.8	0.2	$ 392.1	38
HCM LOS			F	E

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	67	1050	-	-	564	-	-	236
HCM Lane V/C Ratio	1.499	0.111	-	-	0.014	-	-	0.559
HCM Control Delay (s)	$ 392.1	8.9	-	-	11.5	-	-	38
HCM Lane LOS	F	A	-	-	B	-	-	E
HCM 95th %tile Q(veh)	8.6	0.4	-	-	0	-	-	3.1

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

Intersection	
Int Delay, s/veh	1.4

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	30	1075	0	2	420	13	2	0	2	21	0	38
Future Vol, veh/h	30	1075	0	2	420	13	2	0	2	21	0	38
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	90	-	-	95	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	73	89	100	25	84	65	50	100	50	75	100	73
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	41	1208	0	8	500	20	4	0	4	28	0	52

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	520	0	0	1208	0	0	1556	1826	604	1212	1816	260
Stage 1	-	-	-	-	-	-	1290	1290	-	526	526	-
Stage 2	-	-	-	-	-	-	266	536	-	686	1290	-
Critical Hdwy	4.14	-	-	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	2.22	-	-	2.22	-	-	3.52	4.02	3.32	3.52	4.02	3.32
Pot Cap-1 Maneuver	1042	-	-	573	-	-	77	76	441	138	77	739
Stage 1	-	-	-	-	-	-	173	232	-	503	527	-
Stage 2	-	-	-	-	-	-	716	522	-	404	232	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	1042	-	-	573	-	-	69	72	441	131	73	739
Mov Cap-2 Maneuver	-	-	-	-	-	-	69	72	-	131	73	-
Stage 1	-	-	-	-	-	-	166	223	-	483	520	-
Stage 2	-	-	-	-	-	-	656	515	-	385	223	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0.3	0.2	37.4	22.8
HCM LOS			E	C

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	119	1042	-	-	573	-	-	282
HCM Lane V/C Ratio	0.067	0.039	-	-	0.014	-	-	0.284
HCM Control Delay (s)	37.4	8.6	-	-	11.4	-	-	22.8
HCM Lane LOS	E	A	-	-	B	-	-	C
HCM 95th %tile Q(veh)	0.2	0.1	-	-	0	-	-	1.1

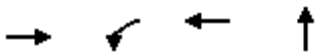
Intersection	
Int Delay, s/veh	0

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	1105	6	0	460	0	0
Future Vol, veh/h	1105	6	0	460	0	0
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	-	0
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	88	75	100	87	100	100
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	1256	8	0	529	0	0

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	-	-	-	632
Stage 1	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-
Critical Hdwy	-	-	-	-	-	6.94
Critical Hdwy Stg 1	-	-	-	-	-	-
Critical Hdwy Stg 2	-	-	-	-	-	-
Follow-up Hdwy	-	-	-	-	-	3.32
Pot Cap-1 Maneuver	-	-	0	-	0	423
Stage 1	-	-	0	-	0	-
Stage 2	-	-	0	-	0	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	-	-	-	423
Mov Cap-2 Maneuver	-	-	-	-	-	-
Stage 1	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-

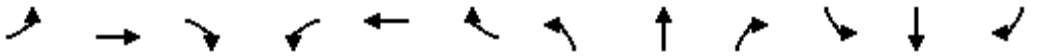
Approach	EB	WB	NB
HCM Control Delay, s	0	0	0
HCM LOS			A

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

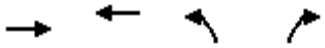


Lane Group	EBT	WBL	WBT	NBT
Lane Group Flow (vph)	1251	12	502	48
v/c Ratio	0.48	0.03	0.18	0.12
Control Delay	6.2	3.1	3.0	2.2
Queue Delay	0.0	0.0	0.0	0.0
Total Delay	6.2	3.1	3.0	2.2
Queue Length 50th (ft)	84	1	25	0
Queue Length 95th (ft)	216	3	33	8
Internal Link Dist (ft)	295		547	737
Turn Bay Length (ft)		245		
Base Capacity (vph)	3040	1071	3488	1223
Starvation Cap Reductn	0	0	0	0
Spillback Cap Reductn	0	0	0	0
Storage Cap Reductn	0	0	0	0
Reduced v/c Ratio	0.41	0.01	0.14	0.04

Intersection Summary



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	1019	67	7	412	0	18	0	10	0	0	0
Future Volume (veh/h)	0	1019	67	7	412	0	18	0	10	0	0	0
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0			
Ped-Bike Adj(A_pbT)	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			
Work Zone On Approach		No			No			No				
Adj Sat Flow, veh/h/ln	0	1870	1870	1870	1870	0	1900	1870	1900			
Adj Flow Rate, veh/h	0	1171	80	12	502	0	36	0	12			
Peak Hour Factor	0.92	0.87	0.84	0.58	0.82	0.92	0.50	0.92	0.83			
Percent Heavy Veh, %	0	2	2	2	2	0	0	2	0			
Cap, veh/h	0	1726	118	309	2368	0	78	0	26			
Arrive On Green	0.00	0.51	0.51	0.02	0.67	0.00	0.06	0.00	0.06			
Sat Flow, veh/h	0	3469	230	1781	3647	0	1296	0	432			
Grp Volume(v), veh/h	0	616	635	12	502	0	48	0	0			
Grp Sat Flow(s),veh/h/ln	0	1777	1829	1781	1777	0	1728	0	0			
Q Serve(g_s), s	0.0	11.4	11.4	0.1	2.4	0.0	1.2	0.0	0.0			
Cycle Q Clear(g_c), s	0.0	11.4	11.4	0.1	2.4	0.0	1.2	0.0	0.0			
Prop In Lane	0.00		0.13	1.00		0.00	0.75		0.25			
Lane Grp Cap(c), veh/h	0	908	935	309	2368	0	105	0	0			
V/C Ratio(X)	0.00	0.68	0.68	0.04	0.21	0.00	0.46	0.00	0.00			
Avail Cap(c_a), veh/h	0	1577	1623	1046	3153	0	944	0	0			
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00			
Upstream Filter(I)	0.00	1.00	1.00	1.00	1.00	0.00	1.00	0.00	0.00			
Uniform Delay (d), s/veh	0.0	8.0	8.0	6.1	2.8	0.0	19.9	0.0	0.0			
Incr Delay (d2), s/veh	0.0	0.9	0.9	0.1	0.0	0.0	3.1	0.0	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			
%ile BackOfQ(50%),veh/ln	0.0	2.7	2.8	0.0	0.2	0.0	0.5	0.0	0.0			
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	0.0	8.9	8.9	6.1	2.9	0.0	23.1	0.0	0.0			
LnGrp LOS	A	A	A	A	A	A	C	A	A			
Approach Vol, veh/h		1251			514			48				
Approach Delay, s/veh		8.9			3.0			23.1				
Approach LOS		A			A			C				
Timer - Assigned Phs		2	3	4				8				
Phs Duration (G+Y+Rc), s		8.7	6.8	28.5				35.3				
Change Period (Y+Rc), s		6.0	6.0	6.0				6.0				
Max Green Setting (Gmax), s		24.0	19.0	39.0				39.0				
Max Q Clear Time (g_c+I1), s		3.2	2.1	13.4				4.4				
Green Ext Time (p_c), s		0.2	0.0	9.0				3.4				
Intersection Summary												
HCM 6th Ctrl Delay			7.6									
HCM 6th LOS			A									



Lane Group	EBT	WBT	NBL	NBR
Lane Group Flow (vph)	1200	615	104	164
v/c Ratio	0.52	0.27	0.24	0.35
Control Delay	10.3	7.8	31.6	16.3
Queue Delay	0.0	0.0	0.0	0.0
Total Delay	10.3	7.8	31.6	16.3
Queue Length 50th (ft)	192	78	53	35
Queue Length 95th (ft)	224	103	99	86
Internal Link Dist (ft)	516	112	754	
Turn Bay Length (ft)				250
Base Capacity (vph)	2300	2300	442	466
Starvation Cap Reductn	0	0	0	0
Spillback Cap Reductn	0	0	0	0
Storage Cap Reductn	0	0	0	0
Reduced v/c Ratio	0.52	0.27	0.24	0.35

Intersection Summary

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (veh/h)	1032	0	0	547	101	143
Future Volume (veh/h)	1032	0	0	547	101	143
Initial Q (Qb), veh	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)		1.00	1.00		1.00	1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach	No			No	No	
Adj Sat Flow, veh/h/ln	1870	0	0	1870	1870	1870
Adj Flow Rate, veh/h	1200	0	0	615	104	0
Peak Hour Factor	0.86	1.00	1.00	0.89	0.97	0.87
Percent Heavy Veh, %	2	0	0	2	2	2
Cap, veh/h	2310	0	0	2310	445	
Arrive On Green	0.65	0.00	0.00	0.65	0.25	0.00
Sat Flow, veh/h	3741	0	0	3741	1781	1585
Grp Volume(v), veh/h	1200	0	0	615	104	0
Grp Sat Flow(s),veh/h/ln	1777	0	0	1777	1781	1585
Q Serve(g_s), s	17.8	0.0	0.0	7.3	4.7	0.0
Cycle Q Clear(g_c), s	17.8	0.0	0.0	7.3	4.7	0.0
Prop In Lane		0.00	0.00		1.00	1.00
Lane Grp Cap(c), veh/h	2310	0	0	2310	445	
V/C Ratio(X)	0.52	0.00	0.00	0.27	0.23	
Avail Cap(c_a), veh/h	2310	0	0	2310	445	
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	0.00	1.00	1.00	0.00
Uniform Delay (d), s/veh	9.2	0.0	0.0	7.4	29.9	0.0
Incr Delay (d2), s/veh	0.8	0.0	0.0	0.3	1.2	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	6.0	0.0	0.0	2.5	2.1	0.0
Unsig. Movement Delay, s/veh						
LnGrp Delay(d),s/veh	10.1	0.0	0.0	7.7	31.1	0.0
LnGrp LOS	B	A	A	A	C	
Approach Vol, veh/h	1200			615	104	A
Approach Delay, s/veh	10.1			7.7	31.1	
Approach LOS	B			A	C	

Timer - Assigned Phs	2				6	8
Phs Duration (G+Y+Rc), s	70.0				70.0	30.0
Change Period (Y+Rc), s	5.0				5.0	5.0
Max Green Setting (Gmax), s	65.0				65.0	25.0
Max Q Clear Time (g_c+I1), s	9.3				19.8	6.7
Green Ext Time (p_c), s	4.5				11.0	0.2

Intersection Summary	
HCM 6th Ctrl Delay	10.5
HCM 6th LOS	B

Notes

Unsignalized Delay for [NBR] is excluded from calculations of the approach delay and intersection delay.

APPENDIX C

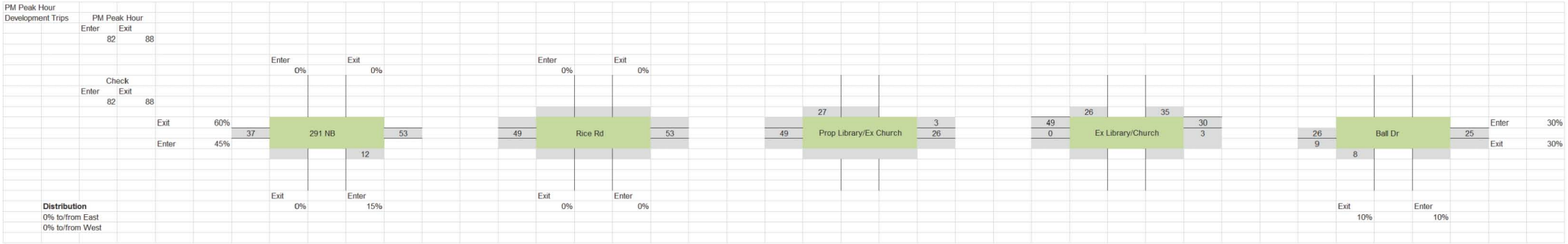
Existing plus Proposed Development Conditions

Trip Distribution

AM

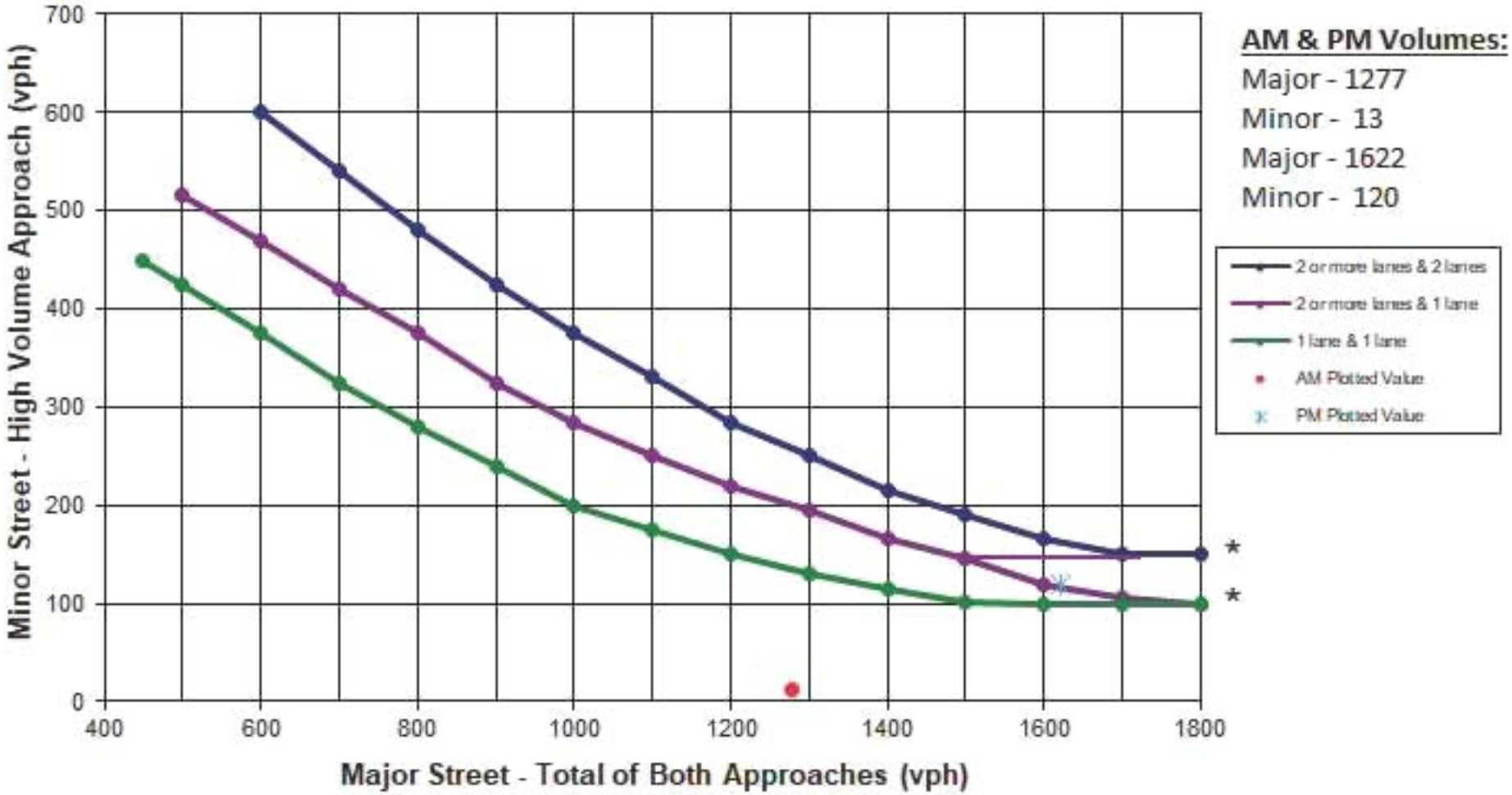

AM Peak Hour
Development Trips
AM Peak Hour
Enter 15
Exit 6
Check
Enter 15
Exit 6
Exit 60%
Enter 45%
291 NB
7
4
2
Enter 0%
Exit 0%
Exit 0%
Enter 15%
Rice Rd
9
4
Enter 0%
Exit 0%
Exit 0%
Enter 0%
Prop Library/Ex Church
9
2
1
2
Exi Library/ Church
9
2
5
1
2
Ball Dr
1
1
5
1
Enter 30%
Exit 30%
Exit 10%
Enter 10%
Distribution
0% to/from East
0% to/from West

PM


PM Peak Hour
Development Trips
PM Peak Hour
Enter 82
Exit 88
Check
Enter 82
Exit 88
Exit 60%
Enter 45%
291 NB
37
53
12
Enter 0%
Exit 0%
Exit 0%
Enter 15%
Rice Rd
49
53
Enter 0%
Exit 0%
Exit 0%
Enter 0%
Prop Library/Ex Church
49
27
3
26
Ex Library/Church
49
0
26
35
30
3
Ball Dr
26
9
8
25
Enter 30%
Exit 30%
Exit 10%
Enter 10%
Distribution
0% to/from East
0% to/from West

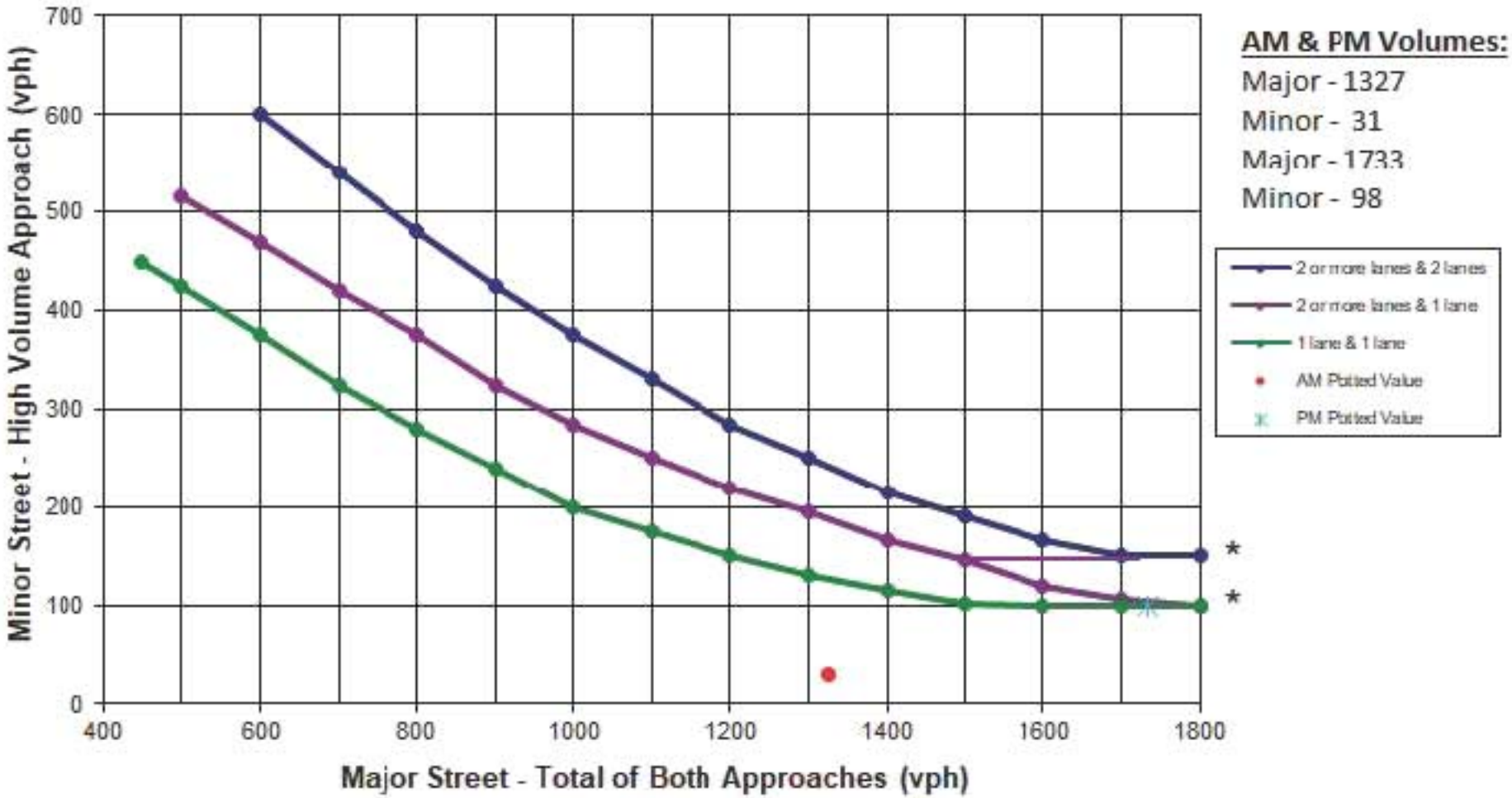
Signal Warrants

Peak Hour Volume Warrant (Existing + Development)
Colbern Rd & Proposed Library Access



*Note: 150 vph applies as the lower threshold volume for a minor street approach with two or more lanes and 100 vph applies as the lower threshold volume for a minor street approach with one lane.

Peak Hour Volume Warrant (Existing+Dev)
Colbern Rd & Rice Rd



*Note: 150 vph applies as the lower threshold volume for a minor street approach with two or more lanes and 100 vph applies as the lower threshold volume for a minor street approach with one lane.

Capacity Analysis

Intersection	
Int Delay, s/veh	1.3

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	29	244	23	8	1000	23	19	2	3	1	3	27
Future Vol, veh/h	29	244	23	8	1000	23	19	2	3	1	3	27
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	60	-	-	225	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	78	87	78	78	93	78	78	78	78	78	78	78
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	37	280	29	10	1075	29	24	3	4	1	4	35

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	1104	0	0	309	0	0	929	1493	155	1326	1493	552
Stage 1	-	-	-	-	-	-	369	369	-	1110	1110	-
Stage 2	-	-	-	-	-	-	560	1124	-	216	383	-
Critical Hdwy	4.14	-	-	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	2.22	-	-	2.22	-	-	3.52	4.02	3.32	3.52	4.02	3.32
Pot Cap-1 Maneuver	628	-	-	1248	-	-	222	122	863	114	122	477
Stage 1	-	-	-	-	-	-	623	619	-	223	283	-
Stage 2	-	-	-	-	-	-	480	279	-	766	610	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	628	-	-	1248	-	-	190	114	863	106	114	477
Mov Cap-2 Maneuver	-	-	-	-	-	-	190	114	-	106	114	-
Stage 1	-	-	-	-	-	-	586	582	-	210	281	-
Stage 2	-	-	-	-	-	-	436	277	-	714	574	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	1.2	0.1	26.5	17.1
HCM LOS			D	C

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	198	628	-	-	1248	-	-	336
HCM Lane V/C Ratio	0.155	0.059	-	-	0.008	-	-	0.118
HCM Control Delay (s)	26.5	11.1	-	-	7.9	-	-	17.1
HCM Lane LOS	D	B	-	-	A	-	-	C
HCM 95th %tile Q(veh)	0.5	0.2	-	-	0	-	-	0.4

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	16	223	0	0	1028	10	1	0	0	3	1	9
Future Vol, veh/h	16	223	0	0	1028	10	1	0	0	3	1	9
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	90	-	-	95	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	78	87	78	100	93	78	78	100	100	78	78	78
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	21	256	0	0	1105	13	1	0	0	4	1	12

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	1118	0	0	256	0	0	851	1416	128	1282	1410	559
Stage 1	-	-	-	-	-	-	298	298	-	1112	1112	-
Stage 2	-	-	-	-	-	-	553	1118	-	170	298	-
Critical Hdwy	4.14	-	-	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	2.22	-	-	2.22	-	-	3.52	4.02	3.32	3.52	4.02	3.32
Pot Cap-1 Maneuver	620	-	-	1306	-	-	253	136	898	122	137	472
Stage 1	-	-	-	-	-	-	686	666	-	223	282	-
Stage 2	-	-	-	-	-	-	485	281	-	815	666	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	620	-	-	1306	-	-	239	131	898	119	132	472
Mov Cap-2 Maneuver	-	-	-	-	-	-	239	131	-	119	132	-
Stage 1	-	-	-	-	-	-	663	643	-	215	282	-
Stage 2	-	-	-	-	-	-	471	281	-	787	643	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0.8	0	20.1	20.4
HCM LOS			C	C

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	239	620	-	-	1306	-	-	251
HCM Lane V/C Ratio	0.005	0.033	-	-	-	-	-	0.066
HCM Control Delay (s)	20.1	11	-	-	0	-	-	20.4
HCM Lane LOS	C	B	-	-	A	-	-	C
HCM 95th %tile Q(veh)	0	0.1	-	-	0	-	-	0.2

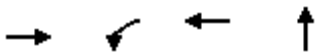
Intersection	
Int Delay, s/veh	0

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↑↑↳			↑↑↳				↱			↱
Traffic Vol, veh/h	0	239	1	0	1037	1	0	0	0	0	0	2
Future Vol, veh/h	0	239	1	0	1037	1	0	0	0	0	0	2
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	0	-	-	0
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	78	87	78	78	93	92	100	92	100	92	92	78
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	0	275	1	0	1115	1	0	0	0	0	0	3

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	-	0	0	-	-	0	-	-	138	-	-	558
Stage 1	-	-	-	-	-	-	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-	-	-	-	-	-	-
Critical Hdwy	-	-	-	-	-	-	-	-	6.94	-	-	6.94
Critical Hdwy Stg 1	-	-	-	-	-	-	-	-	-	-	-	-
Critical Hdwy Stg 2	-	-	-	-	-	-	-	-	-	-	-	-
Follow-up Hdwy	-	-	-	-	-	-	-	-	3.32	-	-	3.32
Pot Cap-1 Maneuver	0	-	-	0	-	-	0	0	885	0	0	473
Stage 1	0	-	-	0	-	-	0	0	-	0	0	-
Stage 2	0	-	-	0	-	-	0	0	-	0	0	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	-	-	-	-	-	-	-	-	885	-	-	473
Mov Cap-2 Maneuver	-	-	-	-	-	-	-	-	-	-	-	-
Stage 1	-	-	-	-	-	-	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-	-	-	-	-	-	-

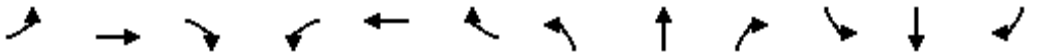
Approach	EB	WB	NB	SB
HCM Control Delay, s	0	0	0	12.7
HCM LOS			A	B

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBT	WBR	SBLn1
Capacity (veh/h)	-	-	-	-	-	473
HCM Lane V/C Ratio	-	-	-	-	-	0.005
HCM Control Delay (s)	0	-	-	-	-	12.7
HCM Lane LOS	A	-	-	-	-	B
HCM 95th %tile Q(veh)	-	-	-	-	-	0



Lane Group	EBT	WBL	WBT	NBT
Lane Group Flow (vph)	258	5	1054	61
v/c Ratio	0.11	0.01	0.41	0.13
Control Delay	6.4	4.2	5.1	3.3
Queue Delay	0.0	0.0	0.0	0.0
Total Delay	6.4	4.2	5.1	3.3
Queue Length 50th (ft)	12	1	66	0
Queue Length 95th (ft)	43	3	103	14
Internal Link Dist (ft)	295		547	737
Turn Bay Length (ft)		245		
Base Capacity (vph)	3462	1205	3539	1386
Starvation Cap Reductn	0	0	0	0
Spillback Cap Reductn	0	0	0	0
Storage Cap Reductn	0	0	0	0
Reduced v/c Ratio	0.07	0.00	0.30	0.04

Intersection Summary



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	212	11	4	980	0	45	0	2	0	0	0
Future Volume (veh/h)	0	212	11	4	980	0	45	0	2	0	0	0
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0			
Ped-Bike Adj(A_pbT)	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			
Work Zone On Approach		No			No			No				
Adj Sat Flow, veh/h/ln	0	1870	1870	1870	1870	0	1900	1870	1900			
Adj Flow Rate, veh/h	0	244	14	5	1054	0	58	0	3			
Peak Hour Factor	0.92	0.87	0.78	0.78	0.93	0.78	0.78	1.00	0.78			
Percent Heavy Veh, %	0	2	2	2	2	0	0	2	0			
Cap, veh/h	0	1135	65	559	1894	0	133	0	7			
Arrive On Green	0.00	0.33	0.33	0.01	0.53	0.00	0.08	0.00	0.08			
Sat Flow, veh/h	0	3511	195	1781	3647	0	1683	0	87			
Grp Volume(v), veh/h	0	126	132	5	1054	0	61	0	0			
Grp Sat Flow(s),veh/h/ln	0	1777	1835	1781	1777	0	1771	0	0			
Q Serve(g_s), s	0.0	1.6	1.6	0.1	6.1	0.0	1.0	0.0	0.0			
Cycle Q Clear(g_c), s	0.0	1.6	1.6	0.1	6.1	0.0	1.0	0.0	0.0			
Prop In Lane	0.00		0.11	1.00		0.00	0.95		0.05			
Lane Grp Cap(c), veh/h	0	590	610	559	1894	0	140	0	0			
V/C Ratio(X)	0.00	0.21	0.22	0.01	0.56	0.00	0.44	0.00	0.00			
Avail Cap(c_a), veh/h	0	2240	2314	1642	4481	0	1374	0	0			
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00			
Upstream Filter(I)	0.00	1.00	1.00	1.00	1.00	0.00	1.00	0.00	0.00			
Uniform Delay (d), s/veh	0.0	7.4	7.4	5.7	4.8	0.0	13.6	0.0	0.0			
Incr Delay (d2), s/veh	0.0	0.2	0.2	0.0	0.3	0.0	2.1	0.0	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			
%ile BackOfQ(50%),veh/ln	0.0	0.4	0.4	0.0	0.6	0.0	0.4	0.0	0.0			
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	0.0	7.6	7.6	5.7	5.1	0.0	15.7	0.0	0.0			
LnGrp LOS	A	A	A	A	A	A	B	A	A			
Approach Vol, veh/h		258			1059			61				
Approach Delay, s/veh		7.6			5.1			15.7				
Approach LOS		A			A			B				
Timer - Assigned Phs		2	3	4				8				
Phs Duration (G+Y+Rc), s		8.4	6.2	16.3				22.5				
Change Period (Y+Rc), s		6.0	6.0	6.0				6.0				
Max Green Setting (Gmax), s		24.0	19.0	39.0				39.0				
Max Q Clear Time (g_c+I1), s		3.0	2.1	3.6				8.1				
Green Ext Time (p_c), s		0.2	0.0	1.4				8.4				
Intersection Summary												
HCM 6th Ctrl Delay			6.0									
HCM 6th LOS			A									

Lane Group	EBT	WBT	NBL	NBR
Lane Group Flow (vph)	290	1125	198	56
v/c Ratio	0.13	0.52	0.40	0.12
Control Delay	7.6	11.1	29.5	7.8
Queue Delay	0.0	0.0	0.0	0.0
Total Delay	7.6	11.1	29.5	7.8
Queue Length 50th (ft)	33	174	91	0
Queue Length 95th (ft)	48	224	148	21
Internal Link Dist (ft)	516	112	754	
Turn Bay Length (ft)				250
Base Capacity (vph)	2162	2162	491	480
Starvation Cap Reductn	0	0	0	0
Spillback Cap Reductn	0	0	0	0
Storage Cap Reductn	0	0	0	0
Reduced v/c Ratio	0.13	0.52	0.40	0.12

Intersection Summary

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (veh/h)	252	0	0	1046	172	44
Future Volume (veh/h)	252	0	0	1046	172	44
Initial Q (Qb), veh	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)		1.00	1.00		1.00	1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach	No			No	No	
Adj Sat Flow, veh/h/ln	1870	0	0	1870	1870	1870
Adj Flow Rate, veh/h	290	0	0	1125	198	0
Peak Hour Factor	0.87	1.00	1.00	0.93	0.87	0.78
Percent Heavy Veh, %	2	0	0	2	2	2
Cap, veh/h	2172	0	0	2172	495	
Arrive On Green	0.61	0.00	0.00	0.61	0.28	0.00
Sat Flow, veh/h	3741	0	0	3741	1781	1585
Grp Volume(v), veh/h	290	0	0	1125	198	0
Grp Sat Flow(s),veh/h/ln	1777	0	0	1777	1781	1585
Q Serve(g_s), s	3.1	0.0	0.0	16.2	8.1	0.0
Cycle Q Clear(g_c), s	3.1	0.0	0.0	16.2	8.1	0.0
Prop In Lane		0.00	0.00		1.00	1.00
Lane Grp Cap(c), veh/h	2172	0	0	2172	495	
V/C Ratio(X)	0.13	0.00	0.00	0.52	0.40	
Avail Cap(c_a), veh/h	2172	0	0	2172	495	
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	0.00	1.00	1.00	0.00
Uniform Delay (d), s/veh	7.4	0.0	0.0	10.0	26.4	0.0
Incr Delay (d2), s/veh	0.1	0.0	0.0	0.9	2.4	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	1.0	0.0	0.0	5.5	3.7	0.0
Unsig. Movement Delay, s/veh						
LnGrp Delay(d),s/veh	7.5	0.0	0.0	10.8	28.8	0.0
LnGrp LOS	A	A	A	B	C	
Approach Vol, veh/h	290			1125	198	A
Approach Delay, s/veh	7.5			10.8	28.8	
Approach LOS	A			B	C	

Timer - Assigned Phs	2				6	8
Phs Duration (G+Y+Rc), s	60.0				60.0	30.0
Change Period (Y+Rc), s	5.0				5.0	5.0
Max Green Setting (Gmax), s	55.0				55.0	25.0
Max Q Clear Time (g_c+I1), s	18.2				5.1	10.1
Green Ext Time (p_c), s	9.6				1.9	0.5

Intersection Summary	
HCM 6th Ctrl Delay	12.5
HCM 6th LOS	B

Notes

Unsignalized Delay for [NBR] is excluded from calculations of the approach delay and intersection delay.

Intersection	
Int Delay, s/veh	15.1

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	84	1109	31	4	484	21	40	3	21	19	3	76
Future Vol, veh/h	84	1109	31	4	484	21	40	3	21	19	3	76
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	60	-	-	225	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	78	93	78	78	92	78	78	78	78	78	78	78
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	108	1192	40	5	526	27	51	4	27	24	4	97

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	553	0	0	1232	0	0	1703	1991	616	1364	1998	277
Stage 1	-	-	-	-	-	-	1428	1428	-	550	550	-
Stage 2	-	-	-	-	-	-	275	563	-	814	1448	-
Critical Hdwy	4.14	-	-	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	2.22	-	-	2.22	-	-	3.52	4.02	3.32	3.52	4.02	3.32
Pot Cap-1 Maneuver	1013	-	-	561	-	-	59	60	433	106	59	720
Stage 1	-	-	-	-	-	-	142	199	-	487	514	-
Stage 2	-	-	-	-	-	-	708	507	-	338	195	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	1013	-	-	561	-	-	~ 44	53	433	86	52	720
Mov Cap-2 Maneuver	-	-	-	-	-	-	~ 44	53	-	86	52	-
Stage 1	-	-	-	-	-	-	127	178	-	435	509	-
Stage 2	-	-	-	-	-	-	602	502	-	277	174	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0.7	0.1	$ 325.4	32.1
HCM LOS			F	D

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	63	1013	-	-	561	-	-	255
HCM Lane V/C Ratio	1.302	0.106	-	-	0.009	-	-	0.493
HCM Control Delay (s)	$ 325.4	9	-	-	11.5	-	-	32.1
HCM Lane LOS	F	A	-	-	B	-	-	D
HCM 95th %tile Q(veh)	6.9	0.4	-	-	0	-	-	2.5

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

Intersection	
Int Delay, s/veh	5.8

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	79	1075	0	2	423	43	2	0	2	56	0	64
Future Vol, veh/h	79	1075	0	2	423	43	2	0	2	56	0	64
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	90	-	-	95	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	78	93	100	78	87	78	78	100	78	78	100	78
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	101	1156	0	3	486	55	3	0	3	72	0	82

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	541	0	0	1156	0	0	1607	1905	578	1300	1878	271
Stage 1	-	-	-	-	-	-	1358	1358	-	520	520	-
Stage 2	-	-	-	-	-	-	249	547	-	780	1358	-
Critical Hdwy	4.14	-	-	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	2.22	-	-	2.22	-	-	3.52	4.02	3.32	3.52	4.02	3.32
Pot Cap-1 Maneuver	1024	-	-	600	-	-	70	68	459	119	71	727
Stage 1	-	-	-	-	-	-	157	215	-	507	530	-
Stage 2	-	-	-	-	-	-	733	516	-	354	215	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	1024	-	-	600	-	-	57	61	459	109	64	727
Mov Cap-2 Maneuver	-	-	-	-	-	-	57	61	-	109	64	-
Stage 1	-	-	-	-	-	-	141	194	-	457	527	-
Stage 2	-	-	-	-	-	-	647	513	-	317	194	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0.7	0.1	42.5	66.4
HCM LOS			E	F

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	101	1024	-	-	600	-	-	199
HCM Lane V/C Ratio	0.051	0.099	-	-	0.004	-	-	0.773
HCM Control Delay (s)	42.5	8.9	-	-	11	-	-	66.4
HCM Lane LOS	E	A	-	-	B	-	-	F
HCM 95th %tile Q(veh)	0.2	0.3	-	-	0	-	-	5.3

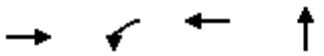
Intersection	
Int Delay, s/veh	0.2

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↑↑↱			↑↑↱				↱			↱
Traffic Vol, veh/h	0	1154	6	0	486	3	0	0	0	0	0	27
Future Vol, veh/h	0	1154	6	0	486	3	0	0	0	0	0	27
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	-	-	-	-	-	-	-	-	0	-	-	0
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	93	78	100	92	78	100	92	100	92	92	78
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	0	1241	8	0	528	4	0	0	0	0	0	35

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	-	0	0	-	-	0	-	-	625	-	-	266
Stage 1	-	-	-	-	-	-	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-	-	-	-	-	-	-
Critical Hdwy	-	-	-	-	-	-	-	-	6.94	-	-	6.94
Critical Hdwy Stg 1	-	-	-	-	-	-	-	-	-	-	-	-
Critical Hdwy Stg 2	-	-	-	-	-	-	-	-	-	-	-	-
Follow-up Hdwy	-	-	-	-	-	-	-	-	3.32	-	-	3.32
Pot Cap-1 Maneuver	0	-	-	0	-	-	0	0	428	0	0	732
Stage 1	0	-	-	0	-	-	0	0	-	0	0	-
Stage 2	0	-	-	0	-	-	0	0	-	0	0	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	-	-	-	-	-	-	-	-	428	-	-	732
Mov Cap-2 Maneuver	-	-	-	-	-	-	-	-	-	-	-	-
Stage 1	-	-	-	-	-	-	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-	-	-	-	-	-	-

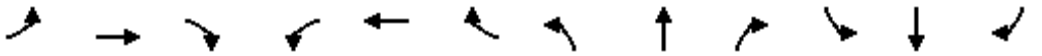
Approach	EB	WB	NB	SB
HCM Control Delay, s	0	0	0	10.2
HCM LOS			A	B

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBT	WBR	SBLn1
Capacity (veh/h)	-	-	-	-	-	732
HCM Lane V/C Ratio	-	-	-	-	-	0.047
HCM Control Delay (s)	0	-	-	-	-	10.2
HCM Lane LOS	A	-	-	-	-	B
HCM 95th %tile Q(veh)	-	-	-	-	-	0.1



Lane Group	EBT	WBL	WBT	NBT
Lane Group Flow (vph)	1221	9	502	46
v/c Ratio	0.42	0.02	0.16	0.11
Control Delay	4.9	2.7	2.1	1.8
Queue Delay	0.0	0.0	0.0	0.0
Total Delay	4.9	2.7	2.1	1.8
Queue Length 50th (ft)	0	0	0	0
Queue Length 95th (ft)	222	3	36	0
Internal Link Dist (ft)	295		547	737
Turn Bay Length (ft)		245		
Base Capacity (vph)	3128	1196	3493	1318
Starvation Cap Reductn	0	0	0	0
Spillback Cap Reductn	0	0	0	0
Storage Cap Reductn	0	0	0	0
Reduced v/c Ratio	0.39	0.01	0.14	0.03

Intersection Summary



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	1045	76	7	437	0	26	0	10	0	0	0
Future Volume (veh/h)	0	1045	76	7	437	0	26	0	10	0	0	0
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0			
Ped-Bike Adj(A_pbT)	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			
Work Zone On Approach		No			No			No				
Adj Sat Flow, veh/h/ln	0	1870	1870	1870	1870	0	1900	1870	1900			
Adj Flow Rate, veh/h	0	1124	97	9	502	0	33	0	13			
Peak Hour Factor	0.92	0.93	0.78	0.78	0.87	0.78	0.78	0.78	0.78			
Percent Heavy Veh, %	0	2	2	2	2	0	0	2	0			
Cap, veh/h	0	1677	145	309	2349	0	73	0	29			
Arrive On Green	0.00	0.51	0.51	0.01	0.66	0.00	0.06	0.00	0.06			
Sat Flow, veh/h	0	3404	285	1781	3647	0	1235	0	486			
Grp Volume(v), veh/h	0	603	618	9	502	0	46	0	0			
Grp Sat Flow(s),veh/h/ln	0	1777	1819	1781	1777	0	1721	0	0			
Q Serve(g_s), s	0.0	10.9	10.9	0.1	2.4	0.0	1.1	0.0	0.0			
Cycle Q Clear(g_c), s	0.0	10.9	10.9	0.1	2.4	0.0	1.1	0.0	0.0			
Prop In Lane	0.00		0.16	1.00		0.00	0.72		0.28			
Lane Grp Cap(c), veh/h	0	900	922	309	2349	0	102	0	0			
V/C Ratio(X)	0.00	0.67	0.67	0.03	0.21	0.00	0.45	0.00	0.00			
Avail Cap(c_a), veh/h	0	1617	1656	1073	3235	0	964	0	0			
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00			
Upstream Filter(I)	0.00	1.00	1.00	1.00	1.00	0.00	1.00	0.00	0.00			
Uniform Delay (d), s/veh	0.0	7.9	7.9	6.0	2.9	0.0	19.5	0.0	0.0			
Incr Delay (d2), s/veh	0.0	0.9	0.9	0.0	0.0	0.0	3.1	0.0	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			
%ile BackOfQ(50%),veh/ln	0.0	2.5	2.6	0.0	0.2	0.0	0.5	0.0	0.0			
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	0.0	8.8	8.8	6.0	2.9	0.0	22.6	0.0	0.0			
LnGrp LOS	A	A	A	A	A	A	C	A	A			
Approach Vol, veh/h		1221			511			46				
Approach Delay, s/veh		8.8			3.0			22.6				
Approach LOS		A			A			C				
Timer - Assigned Phs		2	3	4				8				
Phs Duration (G+Y+Rc), s		8.5	6.6	27.7				34.3				
Change Period (Y+Rc), s		6.0	6.0	6.0				6.0				
Max Green Setting (Gmax), s		24.0	19.0	39.0				39.0				
Max Q Clear Time (g_c+I1), s		3.1	2.1	12.9				4.4				
Green Ext Time (p_c), s		0.2	0.0	8.8				3.4				
Intersection Summary												
HCM 6th Ctrl Delay			7.5									
HCM 6th LOS			A									

Lane Group	EBT	WBT	NBL	NBR
Lane Group Flow (vph)	1149	652	122	187
v/c Ratio	0.50	0.28	0.28	0.39
Control Delay	10.0	7.9	32.3	16.8
Queue Delay	0.0	0.0	0.0	0.0
Total Delay	10.0	7.9	32.3	16.8
Queue Length 50th (ft)	180	84	63	42
Queue Length 95th (ft)	227	112	103	88
Internal Link Dist (ft)	516	112	754	
Turn Bay Length (ft)				250
Base Capacity (vph)	2300	2300	442	474
Starvation Cap Reductn	0	0	0	0
Spillback Cap Reductn	0	0	0	0
Storage Cap Reductn	0	0	0	0
Reduced v/c Ratio	0.50	0.28	0.28	0.39

Intersection Summary

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (veh/h)	1069	0	0	600	101	155
Future Volume (veh/h)	1069	0	0	600	101	155
Initial Q (Qb), veh	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)		1.00	1.00		1.00	1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach	No			No	No	
Adj Sat Flow, veh/h/ln	1870	0	0	1870	1870	1870
Adj Flow Rate, veh/h	1149	0	0	652	122	0
Peak Hour Factor	0.93	1.00	1.00	0.92	0.83	0.83
Percent Heavy Veh, %	2	0	0	2	2	2
Cap, veh/h	2310	0	0	2310	445	
Arrive On Green	0.65	0.00	0.00	0.65	0.25	0.00
Sat Flow, veh/h	3741	0	0	3741	1781	1585
Grp Volume(v), veh/h	1149	0	0	652	122	0
Grp Sat Flow(s),veh/h/ln	1777	0	0	1777	1781	1585
Q Serve(g_s), s	16.7	0.0	0.0	7.9	5.5	0.0
Cycle Q Clear(g_c), s	16.7	0.0	0.0	7.9	5.5	0.0
Prop In Lane		0.00	0.00		1.00	1.00
Lane Grp Cap(c), veh/h	2310	0	0	2310	445	
V/C Ratio(X)	0.50	0.00	0.00	0.28	0.27	
Avail Cap(c_a), veh/h	2310	0	0	2310	445	
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	0.00	1.00	1.00	0.00
Uniform Delay (d), s/veh	9.1	0.0	0.0	7.5	30.2	0.0
Incr Delay (d2), s/veh	0.8	0.0	0.0	0.3	1.5	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	5.7	0.0	0.0	2.6	2.5	0.0
Unsig. Movement Delay, s/veh						
LnGrp Delay(d),s/veh	9.8	0.0	0.0	7.8	31.7	0.0
LnGrp LOS	A	A	A	A	C	
Approach Vol, veh/h	1149			652	122	A
Approach Delay, s/veh	9.8			7.8	31.7	
Approach LOS	A			A	C	

Timer - Assigned Phs	2				6	8
Phs Duration (G+Y+Rc), s	70.0				70.0	30.0
Change Period (Y+Rc), s	5.0				5.0	5.0
Max Green Setting (Gmax), s	65.0				65.0	25.0
Max Q Clear Time (g_c+I1), s	9.9				18.7	7.5
Green Ext Time (p_c), s	4.8				10.3	0.3

Intersection Summary	
HCM 6th Ctrl Delay	10.5
HCM 6th LOS	B

Notes

Unsignalized Delay for [NBR] is excluded from calculations of the approach delay and intersection delay.