

McBee Landing Traffic Impact Study

23rd Street at Haden Street
Independence, Missouri



Prepared for:
McBee's Coffee 'n Car Wash

Prepared by TranSystems
June 2020



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June 22, 2020

Mr. Steven McBee
McBee's Coffee 'n Carwash
126 N. Market Street
Gallatin, MO 64640

**Re: McBee Landing Traffic Impact Study
23rd Street and Haden Street
Independence, Missouri**

Dear Mr. McBee:

In response to your request and authorization, TranSystems has completed a traffic impact study for the proposed commercial development to be generally located in the south side of 23rd Street at Haden Street in Independence, Missouri. The purpose of this study was to assess the impact of the proposed development on the surrounding transportation system.

Included in this study is a discussion of the anticipated impact of the proposed development on the adjacent street network and identified improvements to mitigate deficiencies for the following scenarios:

- ▶ Existing Conditions
- ▶ Existing plus Development Conditions
- ▶ Future Year 2040 Conditions

We trust that the enclosed information proves beneficial to you, the Missouri Department of Transportation, and the City of Independence in this phase of the development process. We appreciate the opportunity to be of service to you and will be available to review this study at your convenience.

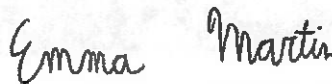
Sincerely,
TRANSYSTEMS

By:



Jeffrey J. Wilke, PE, PTOE

By:



Emma Martin, EIT

EHM:JJW/ehm/PI01200135
Enclosure

Introduction

TranSystems has completed a traffic impact study for the proposed McBee Landing residential and commercial development to be generally located along the south side of 23rd Street at Haden Street in Independence, Missouri. The purpose of this study was to assess the impact of the proposed development on the surrounding transportation system. The location of the development site relative to the major streets in the area is shown on **Figure A-1** in **Appendix A**.

This study also contains a description of the proposed development and the surrounding transportation infrastructure along with trip generation estimates, trip distribution estimates, capacity analyses, and a summary of the findings.

Proposed Development Plan

The proposed development consists of both residential and commercial land uses. The commercial portion of the development consists of an automated car wash and office space located along the south side of 23rd Street. Multifamily residential units for senior living will be located to south of the commercial businesses. The current development plan is included on **Figure A-2** in **Appendix A** for reference.

Access to the site will be provided from two new drives along 23rd Street. The first driveway will be aligned across 23rd Street from Haden Street. This drive will provide access to the offices and senior living land uses. The second driveway will be aligned across 23rd Street from Woodbury Street, and will primarily be an access for the car wash. A new drive is also proposed to be constructed onto Kings Highway, providing an alternate access point for the development in the future.

Study Area

To assess the impacts of the proposed development, the intersections listed below were identified for study during the A.M. and P.M. peak periods.

- ▶ 23rd Street and Kings Highway
- ▶ 23rd Street and Haden Street
- ▶ 23rd Street and Woodbury Street

Traffic Counts

Traffic counts were not collected at the time of this study due to the COVID-19 pandemic. The Governor of Missouri issued a Stay-At-Home order for the entire state from April 6, 2020 through May 3, 2020 to limit the spread of the virus. Schools and many businesses were closed. The closures have significantly altered traffic patterns, and will continue to do so as many businesses continue to operate on a limited basis and many professionals continue to work from home.

Turning-movement traffic volume counts were obtained from the Missouri Department of Transportation (MoDOT) 2019 Average Annual Daily Traffic Map for the segment of 23rd Street near the development site. The maps provided the A.M. and P.M. peak hour traffic volumes by direction of travel. Turning

movement counts at the study intersections were estimated based on street network characteristics, land uses in the surrounding area, and engineering judgement. The existing lane configurations, traffic control devices, and estimated peak hour volumes have been illustrated in **Figures A-3 through A-5**.

Surrounding Street Network and Land Uses

The development site is located on roughly 11 acres of undeveloped land. The site is bounded by 23rd Street on the north. The 23rd Street corridor is generally lined with commercial businesses, but there are also some single-family residences. To the east, south and west, the site is bounded by single-family residences, with some larger lot sizes. Along the northeast edge of the site there is a tire store and parking lot, which is part of a larger shopping center that includes a HyVee grocery store.

Adjacent to the development site, 23rd Street is a five-lane highway with a posted speed limit of 40 mph. Within the City of Independence, 23rd Street is part of the state highway system as MO-78 Highway, and is classified by MoDOT as a principal arterial roadway. The street is generally 68 feet wide, with five-lanes, including a center two-way left-turn lane. There are paved four-foot shoulders on each side of the street, along with curb and gutter. Sidewalks are provided along the north and south sides of the street. The alignment of the roadway is straight with some slight vertical curvature.

Kings Highway is classified by the City of Independence as a collector street. It is a 24-foot wide, two-lane street with a posted speed limit of 25 mph. South of 23rd Street there are curbs and gutters with sidewalk along only the west side of the street. The street provides access to the residential neighborhood to the south, including Hanthorn Early Education School, as well as some commercial businesses to the west of Kings Highway.

Haden Street is a two-lane local street that provides access to the residential neighborhood to the north of 23rd Street. It has no shoulders, curbs, or gutters. Woodbury Street is also a local street and has similar characteristics. Woodbury Street is not continuous to the north and provides local access only to the adjacent residences. There is no sidewalk and no posted speed limit on either local street.

Analysis

The scope of analysis for the assessment of the proposed development's impact on the surrounding transportation system is based in large part on the recommended practices of the Institute of Transportation Engineers (ITE), as outlined in their [Traffic Engineering Handbook](#). ITE is a nationally-recognized organization of transportation professionals with members from both private and public sectors. The analysis of the proposed development's impact included development of trip generation and trip distribution estimates as well as a traffic operations assessment for each study scenario. The study also addresses access management criteria provided in MODOT's Engineering Policy Guide (EPG). Each of the analysis methodologies and findings are described in the subsequent sections.

Driveway Spacing

The MoDOT EPG provides recommended spacings between driveways based on the type of highway. For major non-freeway routes in urban areas, the minimum driveway spacing is 440 feet. The proposed site

driveways are spaced closer together than the minimum spacing. The driveway at the Haden Street intersection is 210 feet east of Kings Highway and 330 feet west of Woodbury Street. The driveway at the Woodbury Street intersection is 210 feet west of Slayton Street.

While the proposed driveway spacings are less than the minimum spacing recommendations in the EPG, it should be noted that the driveways are all aligned with existing intersections. The EPG states that driveways should be lined up across the public roadway from each other whenever possible.

Sight Distance

Sight distances and methods for measurement are provided in A Policy on Geometric Design of Highways and Streets (7th Edition), also referred to as the AASHTO Green Book published by the American Association of State Highway and Transportation Officials (AASHTO). Intersection sight distance is provided at intersections to allow the drivers of stopped vehicles to depart from their approach and enter or cross the uncontrolled street. These distances are generous, allowing enough distance for the stopped driver to complete their turning or crossing maneuver without requiring through traffic on the uncontrolled street to reduce their speed. Stopping sight distance is the minimum distance required to allow for a vehicle to stop before reaching a stationary object in its path.

Sight distances were measured in the field at each proposed site driveway intersection. The measurements and AASHTO recommended sight distances for each direction of travel are shown in **Table 1**.

Table 1 Intersection Sight Distances				
Location	Direction Looking	Measured Sight Distance, feet	Recommended Intersection Sight Distance, feet	Recommended Stopping Sight Distance, feet
23rd Street at Haden Street	East	>600	500	305
	West	>600	385	305
23rd Street at Woodbury Street	East	>600	500	305
	West	500	385	305

The sight distance measurements indicate that sight distances are adequate at the both of the proposed site driveway intersections along 23rd Street. There is a slight crest vertical curve to the west of the intersection of Woodbury Street and 23rd Street that limits sight lines, however the measured sight distance exceeds the recommended sight distance for a right-turn movement from a stop controlled roadway.

Trip Generation

Trip generation estimates were prepared using the Institute of Transportation Engineer's Trip Generation, 10th Edition. The Automated Car Wash land use (ITE code 948) does not provide information regarding average weekday and A.M. peak hour data, however it was estimated using other similar auto-oriented

land uses and engineering judgement. **Table 2** shows the expected trips to be generated by the proposed development. Additional information related to trip generation is included in **Appendix B**.

Table 2 Proposed Development Trip Generation									
Land Use	Intensity	ITE Code	Average Weekday	A.M. Peak Hour			P.M. Peak Hour		
				Total	In	Out	Total	In	Out
Automated Car Wash	5,200 sf	948	400	8	4	4	74	37	37
General Office Building	10,400 sf	710	168	36	31	5	14	2	12
Senior Adult Housing - Detached	68 units	251	401	31	10	21	36	22	14
Total Development Trips			969	75	45	30	124	61	63
<i>Pass-by Trips (40% of car wash)</i>			-	-	-	-	30	15	15
<i>Non-Pass-by Trips</i>			969	75	45	30	94	46	48
Total New Development Trips			969	75	45	30	94	46	48

Pass-by traffic occurs when drivers stop at the proposed development while in route to their final destination. Pass-by traffic is common for car washes. A pass-by percentage of 40% was assumed for the car wash since it will be an auto-oriented business located along a heavily traveled corridor.

Trip Distribution

The estimated trips generated by the proposed development were distributed onto the surrounding street network based on the trip distributions summarized in **Table 3**. These distributions are based on traffic counts, the expected service area of the development and engineering judgment.

Table 3 Trip Distribution	
Direction To/From	Percentage
East on 23rd Street	50%
West on 23rd Street	50%
Total	100%

Traffic Operation Assessment

An assessment of traffic operations was made for the scenarios listed below.

- ▶ Existing Conditions
- ▶ Existing plus Development Conditions
- ▶ Future Year (2040)

The study intersections were evaluated using the Synchro traffic analysis software package. Calculations were performed based on the methodologies outlined in the Highway Capacity Manual (HCM), 6th Edition, which is published by the Transportation Research Board. The operating conditions at an intersection are graded by the “level of service” experienced by drivers. Level of service (LOS) describes the quality of traffic operating conditions and is rated from “A” to “F”. LOS A represents the least congested condition with free-flow movement of traffic and minimal delays. LOS F generally indicates severely congested conditions with excessive delays to motorists. Intermediate grades of B, C, D, and E reflect incremental increases in the average delay per stopped vehicle. Delay is measured in seconds per vehicle. **Table 4** shows the upper limit of delay associated with each level of service for signalized and unsignalized intersections.

Table 4 Intersection Level of Service Delay Thresholds		
Level of Service (LOS)	Signalized	Unsignalized
A	≤ 10 Seconds	≤ 10 Seconds
B	≤ 20 Seconds	≤ 15 Seconds
C	≤ 35 Seconds	≤ 25 Seconds
D	≤ 55 Seconds	≤ 35 Seconds
E	≤ 80 Seconds	≤ 50 Seconds
F	> 80 Seconds	> 50 Seconds

While LOS measurements apply to both signalized and unsignalized intersections, there are significant differences between how these intersections operate and how they are evaluated. LOS for signalized intersections reflects the operation of the intersection as a whole.

Unsignalized intersections, in contrast, are evaluated based on the movement groupings which are required to yield to other traffic. Typically, these are the left turns off of the major street and the side-street approaches for two-way stop-controlled intersections. At unsignalized intersections lower LOS ratings (D, E and F) do not, in themselves, indicate the need for additional improvements. Many times there are convenient alternative routes to avoid the longer delays. Other times the volumes on the unsignalized approaches are relatively minor when compared to the major street traffic, and improvements such as a traffic signal installation may increase the average delay to all users of the intersection.

The decision to install a traffic signal, which is often considered when lower LOS ratings are projected, should be based on engineering studies and the warrants for traffic signal installation as outlined in the Federal Highway Administration’s Manual on Uniform Traffic Control Devices (MUTCD). Signals are typically not recommended in locations where there are convenient alternative paths, or if the installation of a traffic signal would have negative impacts on the surrounding transportation system.

The LOS rating deemed acceptable varies by community, facility type and traffic control device. Most communities in the region have identified LOS D as the minimum desirable goal for signalized intersections.

However, at unsignalized intersections LOS D, E, or even F are often considered acceptable for low to moderate traffic volumes where the installation of a traffic signal is not warranted by the conditions at the intersection, or the location has been deemed undesirable for signalization.

Traffic queues were also evaluated as part of the analyses. Long traffic queues which extend beyond the amount of storage available, either between intersections or within turn lanes, can have significant impacts on operations. The projected vehicular queues were analyzed to ensure the analyses are reflective of the physical constraints of the study intersections and to identify if additional storage is needed for turn lanes.

Existing Conditions

The results of the existing conditions intersection analyses are summarized in **Table 5**. The study intersections were evaluated with the lane configurations, traffic volumes, and traffic control devices shown on **Figures A-3** through **A-5**. The Synchro output files are included in **Appendix C**.

Table 5 Intersection Operational Analysis Existing Conditions					
Intersection	Movement	A.M. Peak Hour		P.M. Peak Hour	
		LOS ¹	Delay ²	LOS ¹	Delay ²
23rd Street and Kings Highway	Northbound	E	42.4	F	>100
	Westbound Left-Turn	A	9.9	B	14.3
23rd Street and Haden Street	Southbound	D	28.1	C	21.8
	Eastbound Left-Turn	B	13.2	B	11.4
23rd Street and Woodbury Street	Southbound	D	25.0	C	11.3
	Eastbound Left-Turn	B	13.1	B	20.8

1 – Level of Service

2 – Delay in seconds per vehicle

The results in **Table 5** indicate that two of the three study intersections currently operate at acceptable levels of service during the peak hours. The northbound movements at the Kings Highway intersection operate at LOS E and LOS F during the A.M. and P.M. peak hours, respectively. The lengthy delays are due to the high volume of through traffic on 23rd Street. While the delays are long, the 95th percentile queue lengths are three vehicles or less.

Existing plus Development Conditions

The MoDOT Engineering Policy Guide also provides guidance on the need for turn lanes at intersections. According to the EPG, an eastbound right-turn lane is warranted on 23rd Street at Haden Street with the addition of development traffic. The turn lane warrant analysis is shown in **Appendix C**. Although the traffic volumes do satisfy the warranting criteria during the P.M. peak hour, it should be noted that there are no right-turn lanes at any of the commercial driveways along the 23rd Street corridor in the vicinity of the site. The addition of a right-turn lane would have a nominal impact on the capacity analysis and LOS

at the intersection. For these reasons, an eastbound right-turn lane was not included in the capacity analysis for the Existing plus Development Conditions scenario.

Due to the heavy volume of through traffic on 23rd Street, long delays can be expected for side street traffic exiting the site. Delays will be especially long for northbound left-turn traffic, which has to cross both directions of traffic on 23rd Street. Right-turn movements will experience less delay as they are only opposed by one direction of traffic on 23rd Street. The driveway that aligns with Haden Street is the main access to the development site. In order to separate these movements at the main access and minimize delays for right-turn traffic, a northbound right-turn lane is recommended at the site driveway that aligns with Haden Street.

The results of the Existing plus Development conditions intersection analyses are summarized on the following page in **Table 6**. The study intersections were evaluated with the lane configurations, traffic volumes, and traffic control devices shown on **Figures A-6** through **A-8**. The Synchro output files are included in **Appendix C**.

Table 6 Intersection Operational Analysis Existing plus Development Conditions					
Intersection	Movement	A.M. Peak Hour		P.M. Peak Hour	
		LOS ¹	Delay ²	LOS ¹	Delay ²
23rd Street and Kings Highway	Northbound	E	44.8	F	>100
	Westbound Left-Turn	B	10.0	B	14.6
23rd Street and Haden Street	Northbound Left-Turn/Through	F	93.8	F	>100
	Northbound Right-Turn	B	11.6	C	16.3
	Southbound	F	>100	F	>100
	Eastbound Left-Turn	B	13.2	B	11.4
	Westbound Left-Turn	B	10.0	B	14.0
23rd Street and Woodbury Street	Northbound	E	39.7	F	>100
	Southbound	F	86.0	F	84.2
	Eastbound Left-Turn	B	13.2	B	11.3
	Westbound Left-Turn	A	9.9	B	14.2

1 – Level of Service

2 – Delay in seconds per vehicle

The results in **Table 6** indicate that most of the side street movements are projected to operate at LOS E or LOS F with the addition of development traffic. The long delays are due to the high volume of through traffic on 23rd Street. The traffic signal on 23rd Street at the commercial driveway east of the site will interrupt the flow of through traffic and create gaps for drivers to enter 23rd Street. Although long delays are projected in this scenario, all 95th percentile queues are projected to be no more than four vehicles during each of the peak hours.

While delays are projected to be long in this scenario, the side-street volumes are relatively low and are well below the minimum thresholds for signalization. As such, no further improvements are identified at this time to address the low levels of service. In the long-term a connection should eventually be made to the east of the site to allow site traffic to access the existing signalized intersection at 23rd Street and the commercial driveway to the east of the site. This connection would require easements from private property owners and reconfiguration of existing parking lots, so it will take extensive cooperation between several property owners for this to occur.

Future Year (2040) Conditions

This scenario provides an estimate of future traffic conditions in year 2040 by considering the addition of background traffic growth to the existing plus development traffic volumes. To estimate future background traffic growth, the existing traffic volumes at the study intersections were assumed to increase at a rate of 0.5% per year. This modest growth rate is consistent with a mature developed area.

The results of the Future Year (2040) Conditions intersection analyses are summarized in **Table 7**. The study intersections were evaluated with the lane configurations, traffic volumes, and traffic control devices shown on **Figures A-9** through **A-11**. The Synchro output files are included in **Appendix C**.

Table 7 Intersection Operational Analysis Future Year 2040					
Intersection	Movement	A.M. Peak Hour		P.M. Peak Hour	
		LOS ¹	Delay ²	LOS ¹	Delay ²
23rd Street and Kings Highway	Northbound	F	66.1	F	>100
	Westbound Left-Turn	B	10.4	C	16.2
23rd Street and Haden Street	Northbound Left-Turn/Through	F	>100	F	>100
	Northbound Right-Turn	B	12.1	C	17.7
	Southbound	F	>100	F	>100
	Eastbound Left-Turn	B	14.4	B	12.2
	Westbound Left-Turn	B	10.5	C	15.4
23rd Street and Woodbury Street	Northbound	E	50.8	F	>100
	Southbound	F	>100	F	>100
	Eastbound Left-Turn	B	14.4	B	12.1
	Westbound Left-Turn	A	10.2	B	15.7

1 – Level of Service

2 – Delay in seconds per vehicle

The results in the table are similar to the previous scenario. Most side street movements are projected to operate at LOS F during the peak hours. All side street traffic volumes are anticipated to remain below the minimum thresholds for traffic signal installation.

Summary

TranSystems has completed a traffic impact study for the proposed residential and commercial development to be generally located along the south side of 23rd Street at Haden Street in Independence, Missouri. The purpose of this study was to assess the impact of the proposed development on the surrounding transportation system.

The proposed development plan includes two new site driveways on 23rd Street. Each driveway is aligned across 23rd Street from an existing intersection on the north side of the road. Sight distances are adequate from each proposed site driveway.

With the addition of development traffic, most side street movements at the study intersections are projected to operate at level of service E or F during the peak hours. This is due mostly to the high volume of through traffic on 23rd Street. To reduce delays for northbound traffic existing the site, the site driveway that aligns with Haden Street should be constructed with two outbound lanes to allow northbound right-turn traffic to bypass queued left-turning vehicles.

While delays are projected to be long with the addition of development traffic, the side-street volumes are relatively low and are well below the minimum thresholds for signalization. As such, no further improvements are identified at this time to address the low levels of service. In the long-term a connection should eventually be made to the east of the site to allow site traffic to access the existing signalized intersection at 23rd Street and the commercial driveway to the east of the site.

Appendix A - Figures

Figure A-1	Location Map
Figure A-2	Site Plan
Figure A-3	Existing Lane Configurations and Traffic Controls
Figure A-4	Existing A.M. Peak Hour Traffic Volumes
Figure A-5	Existing P.M. Peak Hour Traffic Volumes
Figure A-6	Existing plus Development Lane Configurations and Traffic Controls
Figure A-7	Existing plus Development A.M. Peak Hour Traffic Volumes
Figure A-8	Existing plus Development P.M. Peak Hour Traffic Volumes
Figure A-9	Future Year (2040) Lane Configurations and Traffic Controls
Figure A-10	Future Year (2040) A.M. Peak Hour Traffic Volumes
Figure A-11	Future Year (2040) P.M. Peak Hour Traffic Volumes

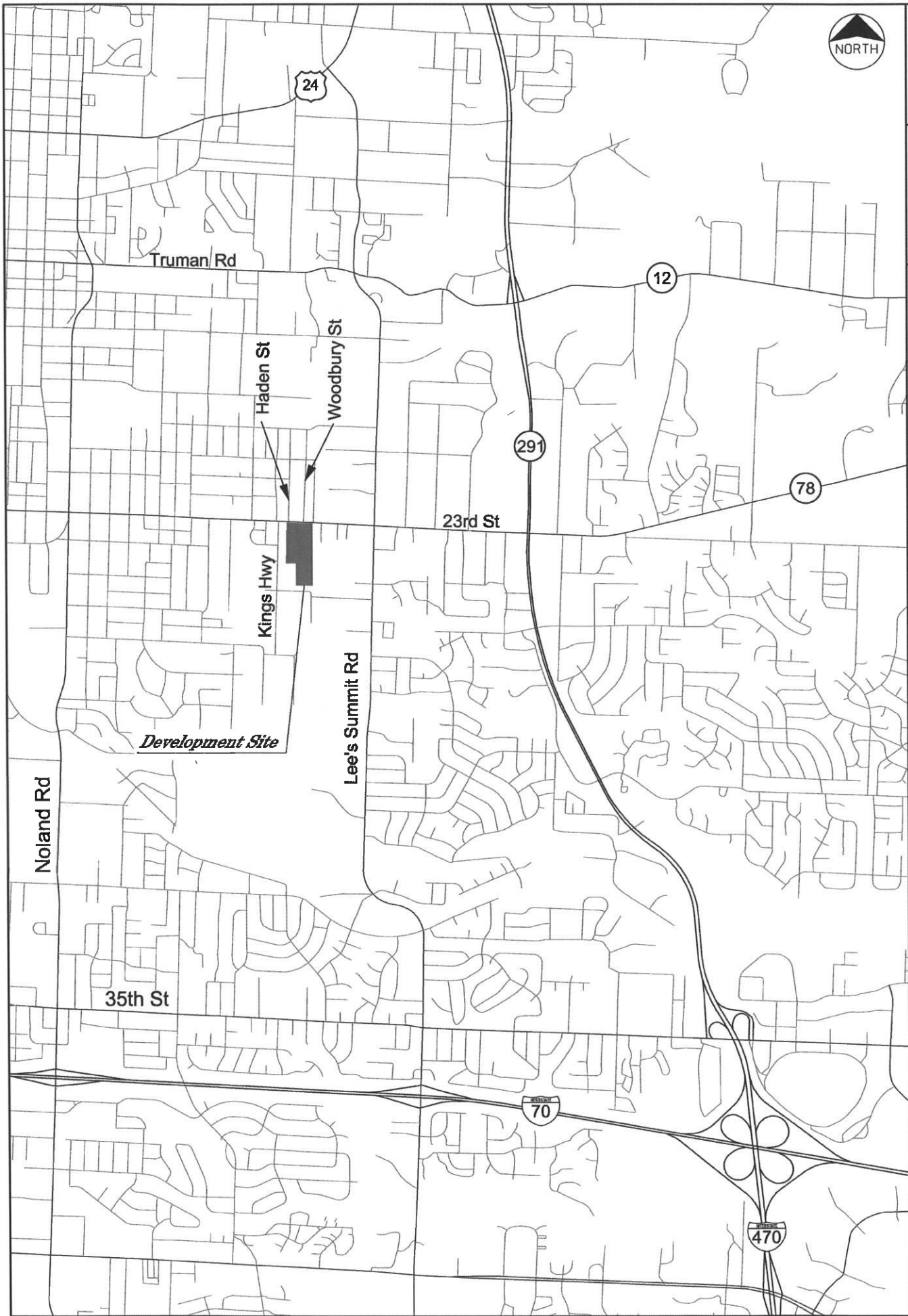


Figure A-1

June 2020

No Scale

McBee Landing
Traffic Impact Study
Independence, Missouri

LOCATION MAP



McBee Landing Traffic Impact Study

23rd Street at Haden Street
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Prepared for:
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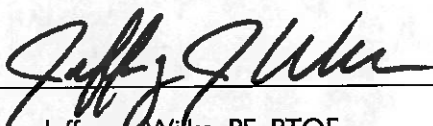
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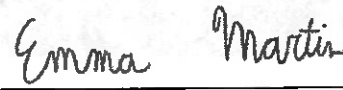
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23rd Street at Woodbury Street	East	>600	500	305
	West	500	385	305

The sight distance measurements indicate that sight distances are adequate at the both of the proposed site driveway intersections along 23rd Street. There is a slight crest vertical curve to the west of the intersection of Woodbury Street and 23rd Street that limits sight lines, however the measured sight distance exceeds the recommended sight distance for a right-turn movement from a stop controlled roadway.

Trip Generation

Trip generation estimates were prepared using the Institute of Transportation Engineer's Trip Generation, 10th Edition. The Automated Car Wash land use (ITE code 948) does not provide information regarding average weekday and A.M. peak hour data, however it was estimated using other similar auto-oriented

land uses and engineering judgement. **Table 2** shows the expected trips to be generated by the proposed development. Additional information related to trip generation is included in **Appendix B**.

Table 2 Proposed Development Trip Generation									
Land Use	Intensity	ITE Code	Average Weekday	A.M. Peak Hour			P.M. Peak Hour		
				Total	In	Out	Total	In	Out
Automated Car Wash	5,200 sf	948	400	8	4	4	74	37	37
General Office Building	10,400 sf	710	168	36	31	5	14	2	12
Senior Adult Housing - Detached	68 units	251	401	31	10	21	36	22	14
Total Development Trips			969	75	45	30	124	61	63
<i>Pass-by Trips (40% of car wash)</i>			-	-	-	-	30	15	15
<i>Non-Pass-by Trips</i>			969	75	45	30	94	46	48
Total New Development Trips			969	75	45	30	94	46	48

Pass-by traffic occurs when drivers stop at the proposed development while in route to their final destination. Pass-by traffic is common for car washes. A pass-by percentage of 40% was assumed for the car wash since it will be an auto-oriented business located along a heavily traveled corridor.

Trip Distribution

The estimated trips generated by the proposed development were distributed onto the surrounding street network based on the trip distributions summarized in **Table 3**. These distributions are based on traffic counts, the expected service area of the development and engineering judgment.

Table 3 Trip Distribution	
Direction To/From	Percentage
East on 23rd Street	50%
West on 23rd Street	50%
Total	100%

Traffic Operation Assessment

An assessment of traffic operations was made for the scenarios listed below.

- ▶ Existing Conditions
- ▶ Existing plus Development Conditions
- ▶ Future Year (2040)

The study intersections were evaluated using the Synchro traffic analysis software package. Calculations were performed based on the methodologies outlined in the Highway Capacity Manual (HCM), 6th Edition, which is published by the Transportation Research Board. The operating conditions at an intersection are graded by the “level of service” experienced by drivers. Level of service (LOS) describes the quality of traffic operating conditions and is rated from “A” to “F”. LOS A represents the least congested condition with free-flow movement of traffic and minimal delays. LOS F generally indicates severely congested conditions with excessive delays to motorists. Intermediate grades of B, C, D, and E reflect incremental increases in the average delay per stopped vehicle. Delay is measured in seconds per vehicle. **Table 4** shows the upper limit of delay associated with each level of service for signalized and unsignalized intersections.

Table 4 Intersection Level of Service Delay Thresholds		
Level of Service (LOS)	Signalized	Unsignalized
A	≤ 10 Seconds	≤ 10 Seconds
B	≤ 20 Seconds	≤ 15 Seconds
C	≤ 35 Seconds	≤ 25 Seconds
D	≤ 55 Seconds	≤ 35 Seconds
E	≤ 80 Seconds	≤ 50 Seconds
F	> 80 Seconds	> 50 Seconds

While LOS measurements apply to both signalized and unsignalized intersections, there are significant differences between how these intersections operate and how they are evaluated. LOS for signalized intersections reflects the operation of the intersection as a whole.

Unsignalized intersections, in contrast, are evaluated based on the movement groupings which are required to yield to other traffic. Typically, these are the left turns off of the major street and the side-street approaches for two-way stop-controlled intersections. At unsignalized intersections lower LOS ratings (D, E and F) do not, in themselves, indicate the need for additional improvements. Many times there are convenient alternative routes to avoid the longer delays. Other times the volumes on the unsignalized approaches are relatively minor when compared to the major street traffic, and improvements such as a traffic signal installation may increase the average delay to all users of the intersection.

The decision to install a traffic signal, which is often considered when lower LOS ratings are projected, should be based on engineering studies and the warrants for traffic signal installation as outlined in the Federal Highway Administration’s Manual on Uniform Traffic Control Devices (MUTCD). Signals are typically not recommended in locations where there are convenient alternative paths, or if the installation of a traffic signal would have negative impacts on the surrounding transportation system.

The LOS rating deemed acceptable varies by community, facility type and traffic control device. Most communities in the region have identified LOS D as the minimum desirable goal for signalized intersections.

However, at unsignalized intersections LOS D, E, or even F are often considered acceptable for low to moderate traffic volumes where the installation of a traffic signal is not warranted by the conditions at the intersection, or the location has been deemed undesirable for signalization.

Traffic queues were also evaluated as part of the analyses. Long traffic queues which extend beyond the amount of storage available, either between intersections or within turn lanes, can have significant impacts on operations. The projected vehicular queues were analyzed to ensure the analyses are reflective of the physical constraints of the study intersections and to identify if additional storage is needed for turn lanes.

Existing Conditions

The results of the existing conditions intersection analyses are summarized in **Table 5**. The study intersections were evaluated with the lane configurations, traffic volumes, and traffic control devices shown on **Figures A-3** through **A-5**. The Synchro output files are included in **Appendix C**.

Table 5 Intersection Operational Analysis Existing Conditions					
Intersection	Movement	A.M. Peak Hour		P.M. Peak Hour	
		LOS ¹	Delay ²	LOS ¹	Delay ²
23rd Street and Kings Highway	Northbound	E	42.4	F	>100
	Westbound Left-Turn	A	9.9	B	14.3
23rd Street and Haden Street	Southbound	D	28.1	C	21.8
	Eastbound Left-Turn	B	13.2	B	11.4
23rd Street and Woodbury Street	Southbound	D	25.0	C	11.3
	Eastbound Left-Turn	B	13.1	B	20.8

1 – Level of Service

2 – Delay in seconds per vehicle

The results in **Table 5** indicate that two of the three study intersections currently operate at acceptable levels of service during the peak hours. The northbound movements at the Kings Highway intersection operate at LOS E and LOS F during the A.M. and P.M. peak hours, respectively. The lengthy delays are due to the high volume of through traffic on 23rd Street. While the delays are long, the 95th percentile queue lengths are three vehicles or less.

Existing plus Development Conditions

The MoDOT Engineering Policy Guide also provides guidance on the need for turn lanes at intersections. According to the EPG, an eastbound right-turn lane is warranted on 23rd Street at Haden Street with the addition of development traffic. The turn lane warrant analysis is shown in **Appendix C**. Although the traffic volumes do satisfy the warranting criteria during the P.M. peak hour, it should be noted that there are no right-turn lanes at any of the commercial driveways along the 23rd Street corridor in the vicinity of the site. The addition of a right-turn lane would have a nominal impact on the capacity analysis and LOS

at the intersection. For these reasons, an eastbound right-turn lane was not included in the capacity analysis for the Existing plus Development Conditions scenario.

Due to the heavy volume of through traffic on 23rd Street, long delays can be expected for side street traffic exiting the site. Delays will be especially long for northbound left-turn traffic, which has to cross both directions of traffic on 23rd Street. Right-turn movements will experience less delay as they are only opposed by one direction of traffic on 23rd Street. The driveway that aligns with Haden Street is the main access to the development site. In order to separate these movements at the main access and minimize delays for right-turn traffic, a northbound right-turn lane is recommended at the site driveway that aligns with Haden Street.

The results of the Existing plus Development conditions intersection analyses are summarized on the following page in **Table 6**. The study intersections were evaluated with the lane configurations, traffic volumes, and traffic control devices shown on **Figures A-6 through A-8**. The Synchro output files are included in **Appendix C**.

Table 6 Intersection Operational Analysis Existing plus Development Conditions					
Intersection	Movement	A.M. Peak Hour		P.M. Peak Hour	
		LOS ¹	Delay ²	LOS ¹	Delay ²
23rd Street and Kings Highway	Northbound	E	44.8	F	>100
	Westbound Left-Turn	B	10.0	B	14.6
23rd Street and Haden Street	Northbound Left-Turn/Through	F	93.8	F	>100
	Northbound Right-Turn	B	11.6	C	16.3
	Southbound	F	>100	F	>100
	Eastbound Left-Turn	B	13.2	B	11.4
	Westbound Left-Turn	B	10.0	B	14.0
23rd Street and Woodbury Street	Northbound	E	39.7	F	>100
	Southbound	F	86.0	F	84.2
	Eastbound Left-Turn	B	13.2	B	11.3
	Westbound Left-Turn	A	9.9	B	14.2

1 – Level of Service

2 – Delay in seconds per vehicle

The results in **Table 6** indicate that most of the side street movements are projected to operate at LOS E or LOS F with the addition of development traffic. The long delays are due to the high volume of through traffic on 23rd Street. The traffic signal on 23rd Street at the commercial driveway east of the site will interrupt the flow of through traffic and create gaps for drivers to enter 23rd Street. Although long delays are projected in this scenario, all 95th percentile queues are projected to be no more than four vehicles during each of the peak hours.

While delays are projected to be long in this scenario, the side-street volumes are relatively low and are well below the minimum thresholds for signalization. As such, no further improvements are identified at this time to address the low levels of service. In the long-term a connection should eventually be made to the east of the site to allow site traffic to access the existing signalized intersection at 23rd Street and the commercial driveway to the east of the site. This connection would require easements from private property owners and reconfiguration of existing parking lots, so it will take extensive cooperation between several property owners for this to occur.

Future Year (2040) Conditions

This scenario provides an estimate of future traffic conditions in year 2040 by considering the addition of background traffic growth to the existing plus development traffic volumes. To estimate future background traffic growth, the existing traffic volumes at the study intersections were assumed to increase at a rate of 0.5% per year. This modest growth rate is consistent with a mature developed area.

The results of the Future Year (2040) Conditions intersection analyses are summarized in **Table 7**. The study intersections were evaluated with the lane configurations, traffic volumes, and traffic control devices shown on **Figures A-9 through A-11**. The Synchro output files are included in **Appendix C**.

Table 7 Intersection Operational Analysis Future Year 2040					
Intersection	Movement	A.M. Peak Hour		P.M. Peak Hour	
		LOS ¹	Delay ²	LOS ¹	Delay ²
23rd Street and Kings Highway	Northbound	F	66.1	F	>100
	Westbound Left-Turn	B	10.4	C	16.2
23rd Street and Haden Street	Northbound Left-Turn/Through	F	>100	F	>100
	Northbound Right-Turn	B	12.1	C	17.7
	Southbound	F	>100	F	>100
	Eastbound Left-Turn	B	14.4	B	12.2
	Westbound Left-Turn	B	10.5	C	15.4
23rd Street and Woodbury Street	Northbound	E	50.8	F	>100
	Southbound	F	>100	F	>100
	Eastbound Left-Turn	B	14.4	B	12.1
	Westbound Left-Turn	A	10.2	B	15.7

1 – Level of Service

2 – Delay in seconds per vehicle

The results in the table are similar to the previous scenario. Most side street movements are projected to operate at LOS F during the peak hours. All side street traffic volumes are anticipated to remain below the minimum thresholds for traffic signal installation.

Summary

TranSystems has completed a traffic impact study for the proposed residential and commercial development to be generally located along the south side of 23rd Street at Haden Street in Independence, Missouri. The purpose of this study was to assess the impact of the proposed development on the surrounding transportation system.

The proposed development plan includes two new site driveways on 23rd Street. Each driveway is aligned across 23rd Street from an existing intersection on the north side of the road. Sight distances are adequate from each proposed site driveway.

With the addition of development traffic, most side street movements at the study intersections are projected to operate at level of service E or F during the peak hours. This is due mostly to the high volume of through traffic on 23rd Street. To reduce delays for northbound traffic existing the site, the site driveway that aligns with Haden Street should be constructed with two outbound lanes to allow northbound right-turn traffic to bypass queued left-turning vehicles.

While delays are projected to be long with the addition of development traffic, the side-street volumes are relatively low and are well below the minimum thresholds for signalization. As such, no further improvements are identified at this time to address the low levels of service. In the long-term a connection should eventually be made to the east of the site to allow site traffic to access the existing signalized intersection at 23rd Street and the commercial driveway to the east of the site.

Appendix A - Figures

Figure A-1	Location Map
Figure A-2	Site Plan
Figure A-3	Existing Lane Configurations and Traffic Controls
Figure A-4	Existing A.M. Peak Hour Traffic Volumes
Figure A-5	Existing P.M. Peak Hour Traffic Volumes
Figure A-6	Existing plus Development Lane Configurations and Traffic Controls
Figure A-7	Existing plus Development A.M. Peak Hour Traffic Volumes
Figure A-8	Existing plus Development P.M. Peak Hour Traffic Volumes
Figure A-9	Future Year (2040) Lane Configurations and Traffic Controls
Figure A-10	Future Year (2040) A.M. Peak Hour Traffic Volumes
Figure A-11	Future Year (2040) P.M. Peak Hour Traffic Volumes



Figure A-1

June 2020

No Scale

McBee Landing
Traffic Impact Study
Independence, Missouri

LOCATION MAP



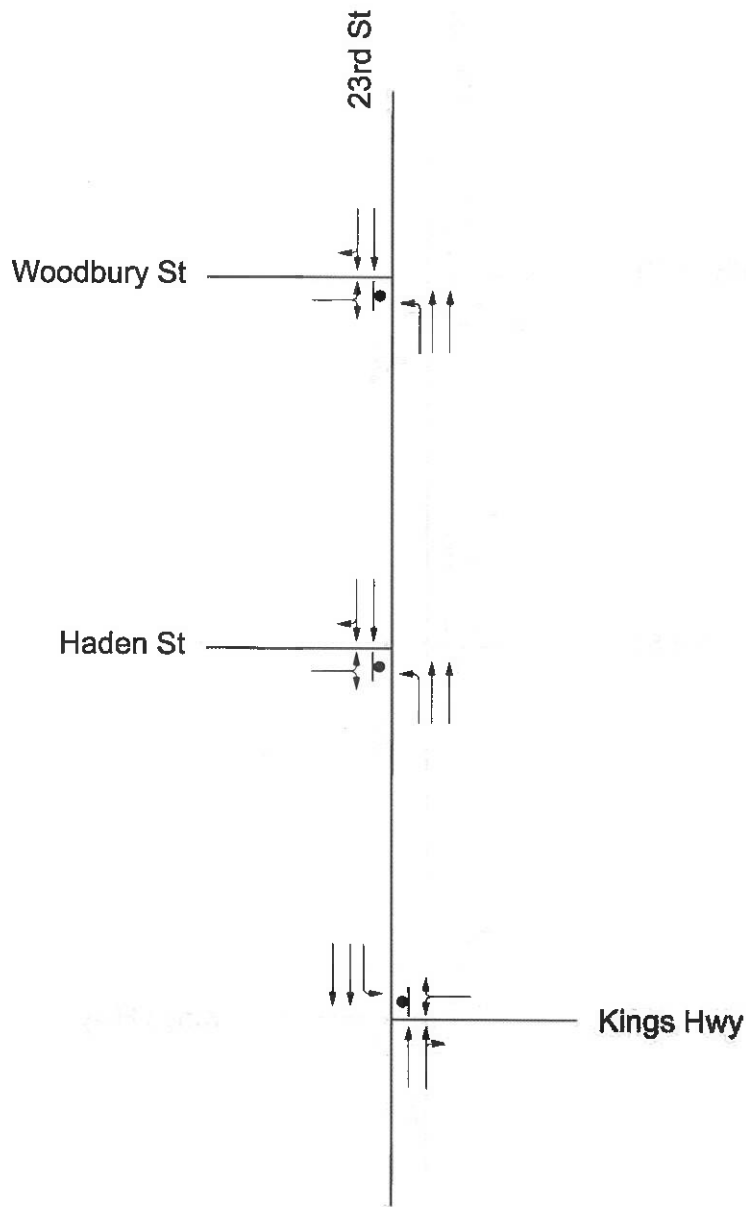


	<p align="center">SITE PLAN</p>	<p align="center">McBee Landing Traffic Impact Study Independence, Missouri</p>	June 2020	<p align="center">Figure A-2</p>
			No Scale	



Legend

-  - Traffic Signal
-  - Stop Sign
-  - Lane Configuration



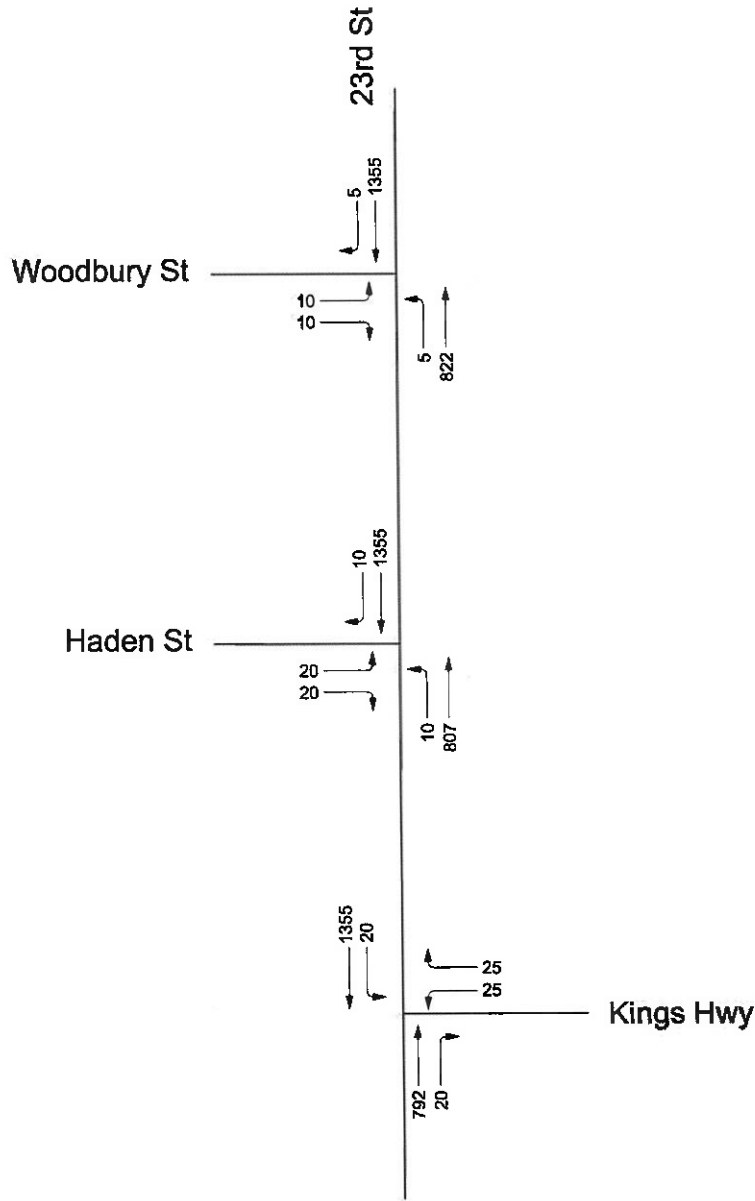
EXISTING CONDITIONS LANE CONFIGURATIONS

McBee Landing
Traffic Impact Study
Independence, Missouri

June 2020

No Scale

Figure A-3



**EXISTING CONDITIONS
A.M. PEAK HOUR TRAFFIC VOLUMES**

McBee Landing
Traffic Impact Study
Independence, Missouri

June 2020

No Scale

Figure A-4



Legend

123 - Total Hourly Volume

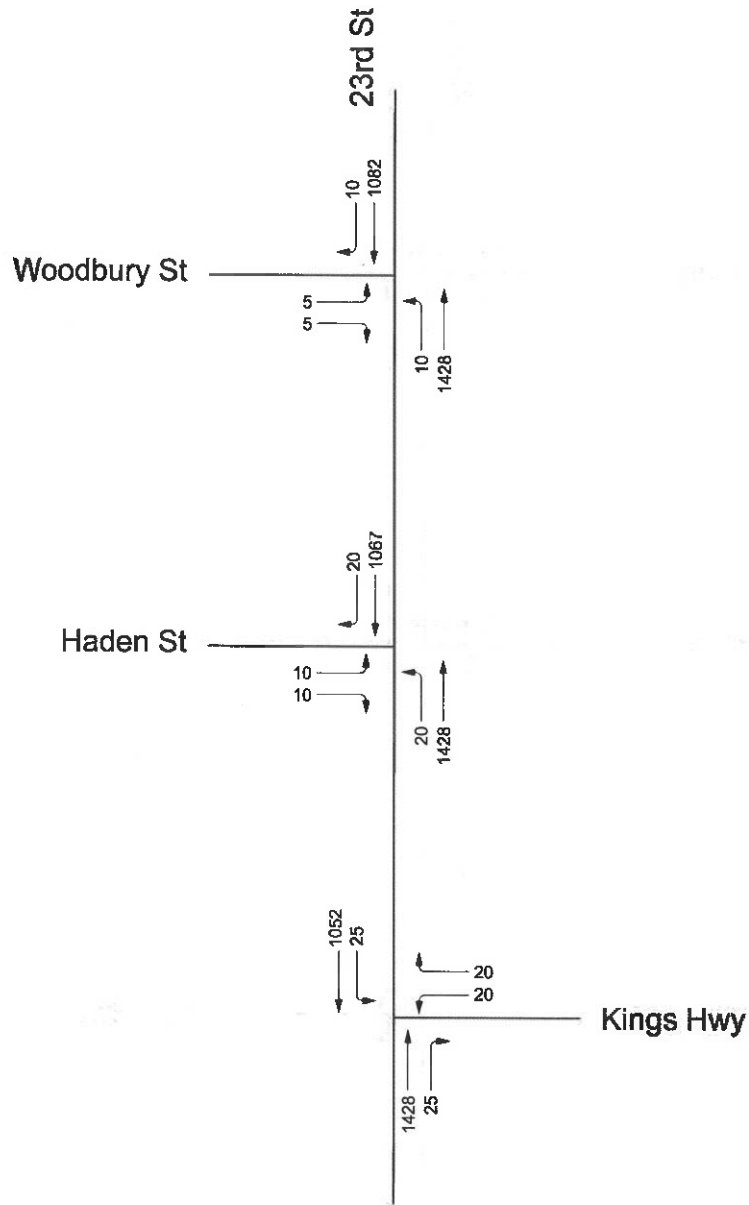


Figure A-5

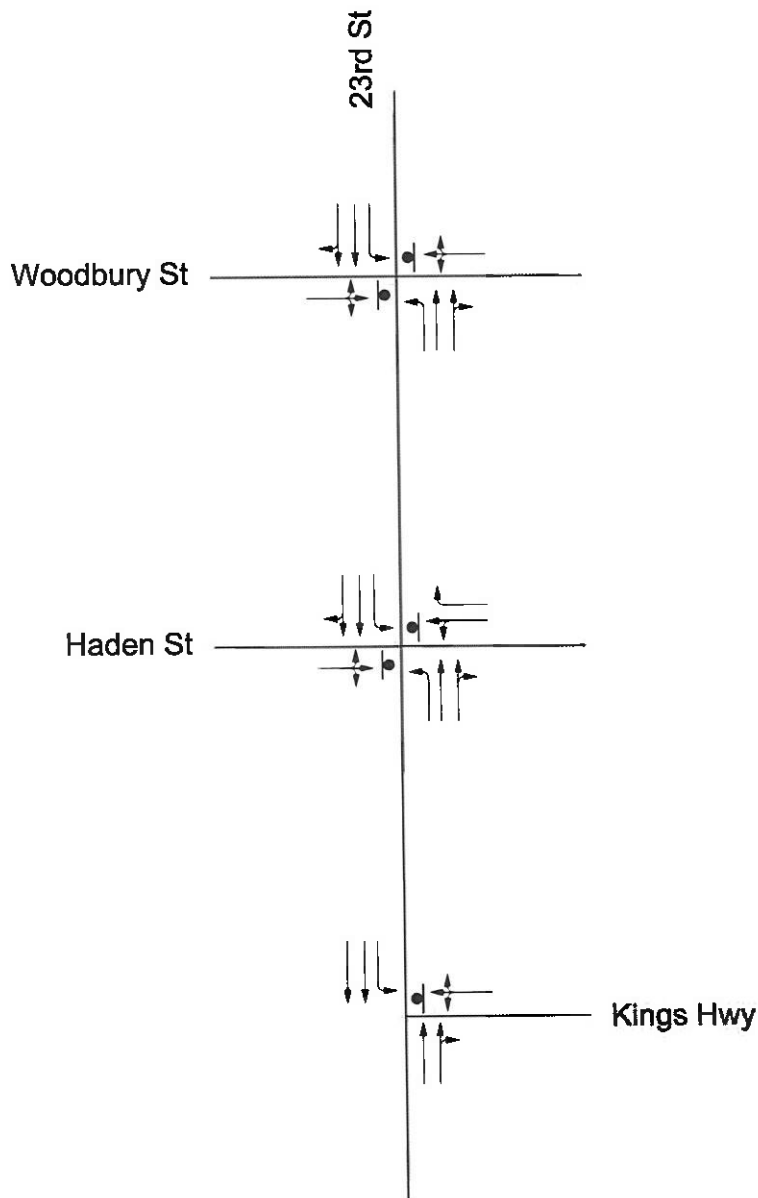
June 2020

No Scale

McBee Landing
Traffic Impact Study
Independence, Missouri

EXISTING CONDITIONS
P.M. PEAK HOUR TRAFFIC VOLUMES





Legend

-  - Traffic Signal
-  - Stop Sign
-  - Lane Configuration

June 2020

No Scale

McBee Landing
Traffic Impact Study
Independence, Missouri

EXISTING PLUS DEVELOPMENT CONDITIONS
LANE CONFIGURATIONS

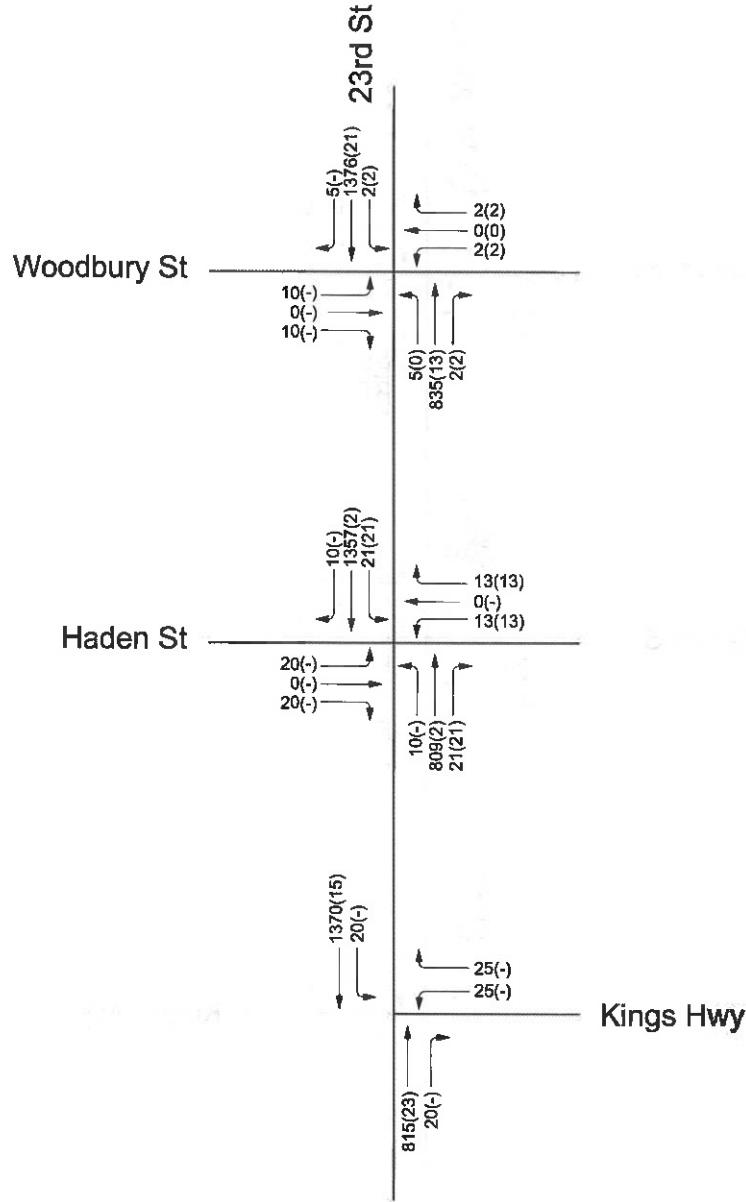


Figure A-6



Legend

- 123(45) — Total Hourly Volume
- Proposed Development Traffic



EXISTING PLUS DEVELOPMENT CONDITIONS A.M. PEAK HOUR TRAFFIC VOLUMES

McBee Landing
Traffic Impact Study
Independence, Missouri

June 2020



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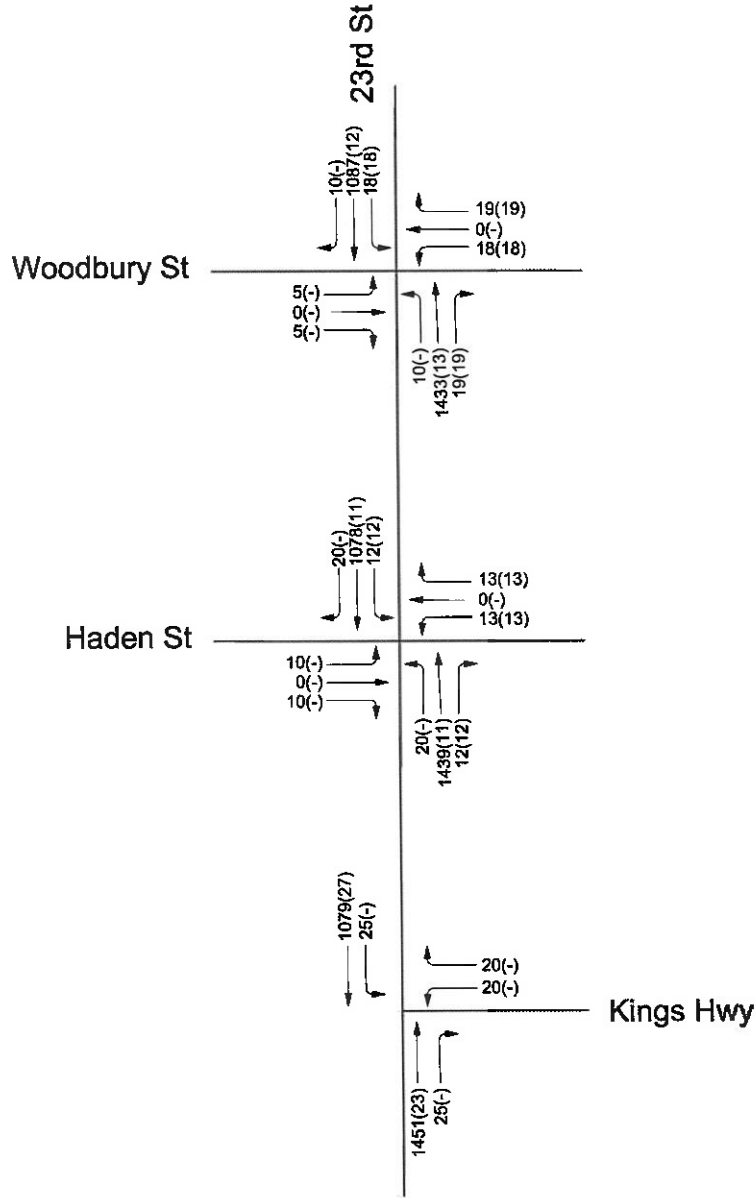
Figure A-7





Legend

-  Total Hourly Volume
-  Proposed Development Traffic



EXISTING PLUS DEVELOPMENT CONDITIONS P.M. PEAK HOUR TRAFFIC VOLUMES

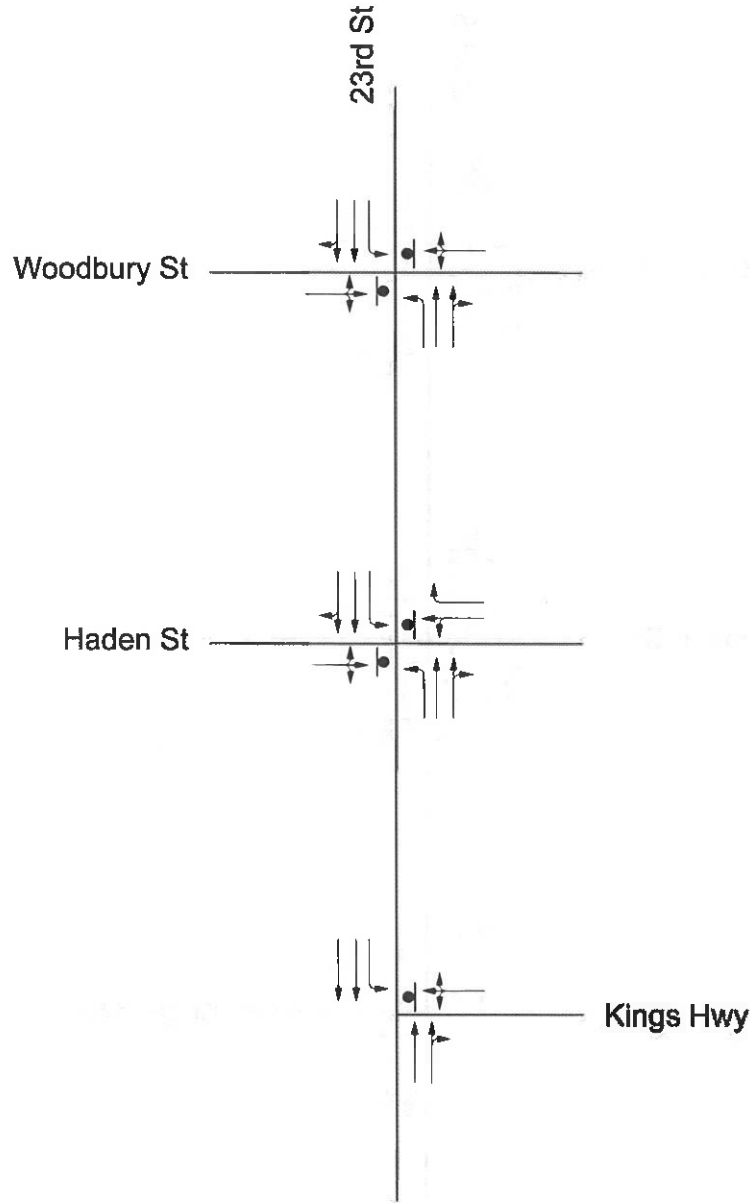


McBee Landing
Traffic Impact Study
Independence, Missouri

June 2020

No Scale

Figure A-8



Legend

-  - Traffic Signal
-  - Stop Sign
-  - Lane Configuration



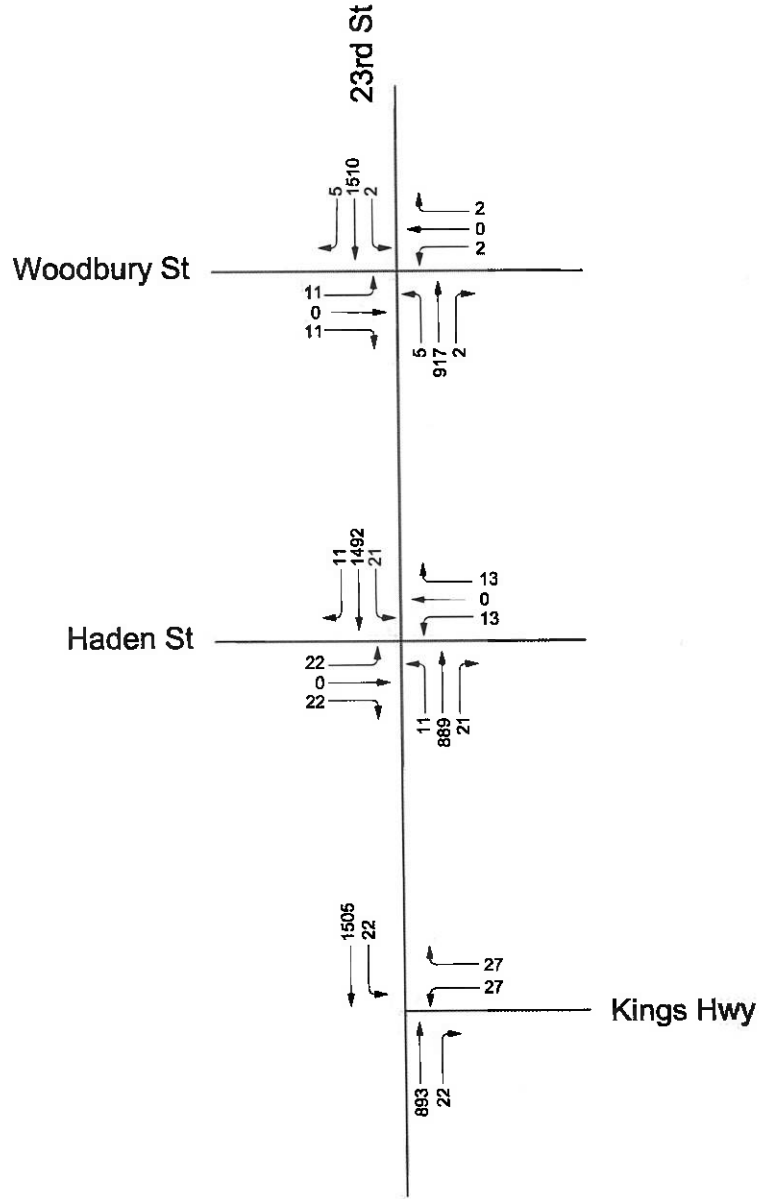
FUTURE YEAR 2040 LANE CONFIGURATIONS

McBee Landing
Traffic Impact Study
Independence, Missouri

June 2020

No Scale

Figure A-9



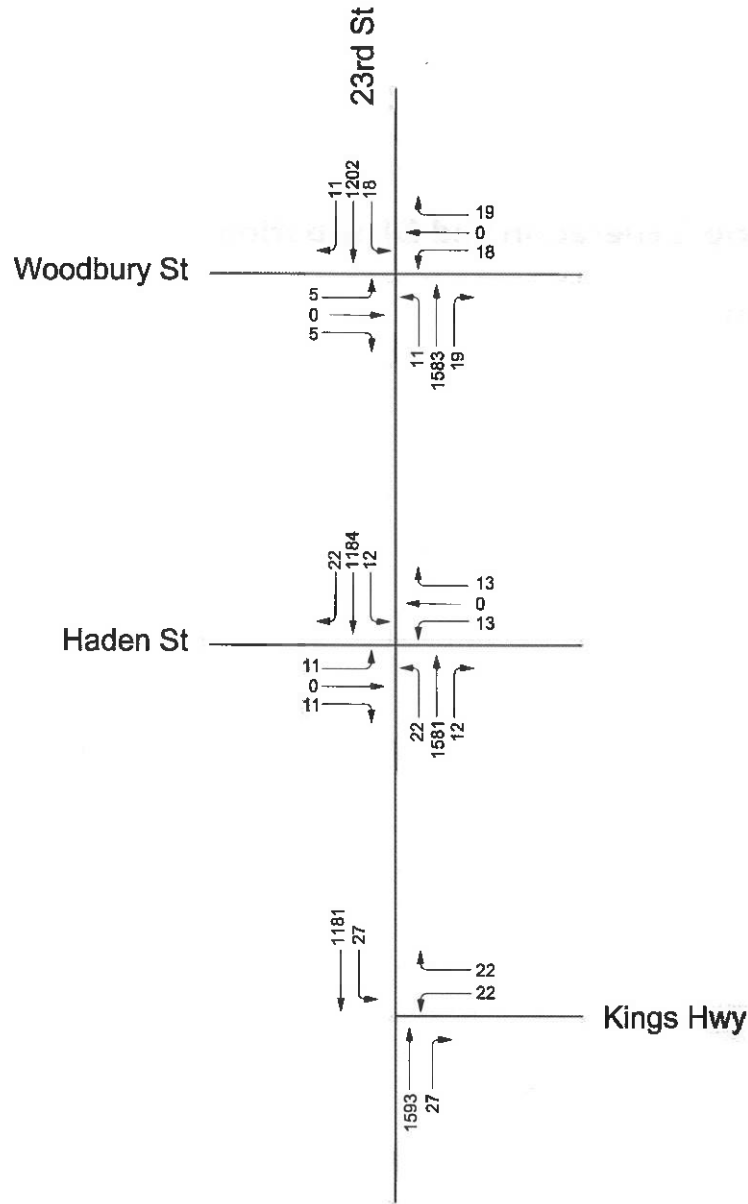
**FUTURE YEAR 2040
A.M. PEAK HOUR TRAFFIC VOLUMES**

McBee Landing
Traffic Impact Study
Independence, Missouri

June 2020

No Scale

Figure A-10



Appendix B – Trip Generation and Distribution

See attached worksheets.

McBee Landing TIS

Independence, Missouri

Trip Generation

Land Use	Intensity	ITE Code	Daily	A.M. Peak Hour				P.M. Peak Hour			
				Total	% In	% Out	In	Total	% In	% Out	In
Automated Car Wash	5,200 sf	948	400	8	50%	50%	4	74	50%	50%	37
Office Building	10,400 sf	710	168	36	86%	14%	31	14	16%	84%	2
Senior Adult Housing - Detached	68 units	251	401	31	33%	67%	10	36	61%	39%	22
Total Proposed Development Trips			969	75			45	124			61
Pass-by Trips			-	-			-	30			15
Non-Pass by Trips			969	75			45	94			46
Total New Proposed Development Trips			969	75			45	94			46

Notes -

- Trip generation estimates were developed using ITE's Trip Generation, 10th Edition.

**Existing Conditions
A.M. Peak Hour**

P101200135

**Existing Conditions
P.M. Peak Hour**

P101200135

McBee Landing TIS
Independence, Missouri

23rd St (Mo-78) and Kings Hwy

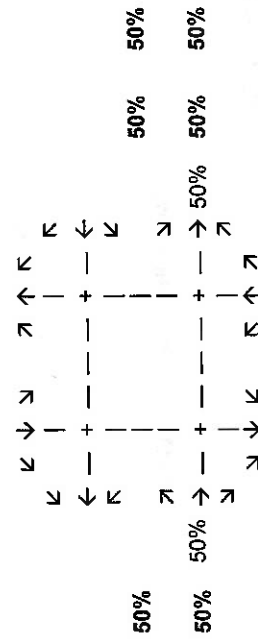
McBee Landing TIS
Independence, Missouri

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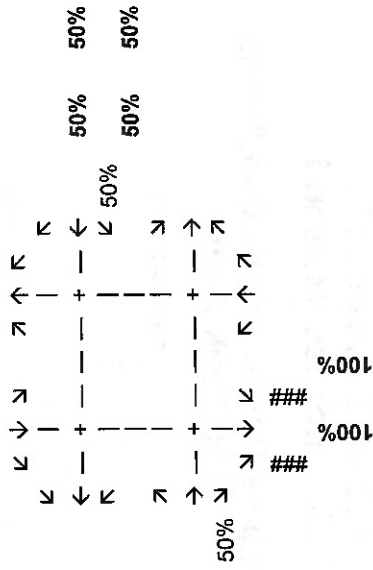
McBee Landing TIS Independence, Missouri

Trip Distribution Inbound

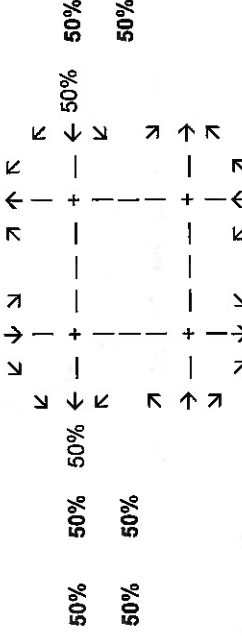
23rd St (Mo-78) and Kings Hwy



23rd St (Mo-78) and Haden St



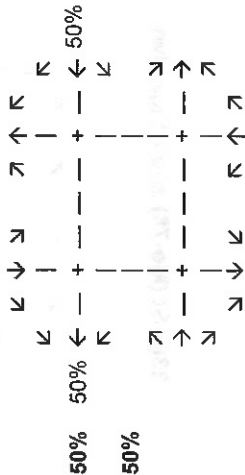
23rd St (Mo-78) and Woodbury St



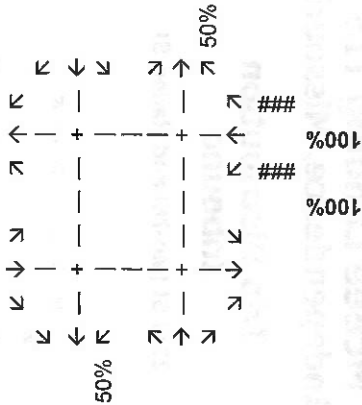
McBee Landing TIS Independence, Missouri

Trip Distribution Outbound

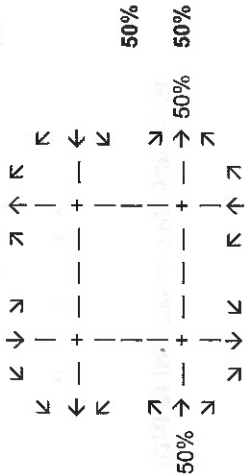
23rd St (Mo-78) and Kings Hwy



23rd St (Mo-78) and Haden St



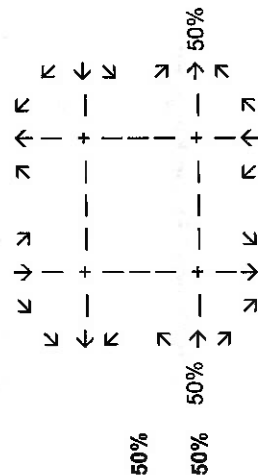
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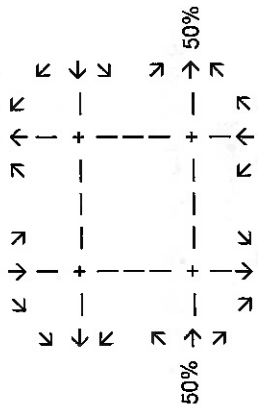
McBee Landing TIS Independence, Missouri

Trip Distribution Inbound

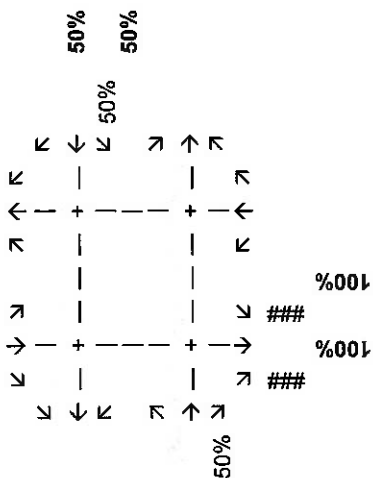
23rd St (Mo-78) and Kings Hwy



23rd St (Mo-78) and Haden St



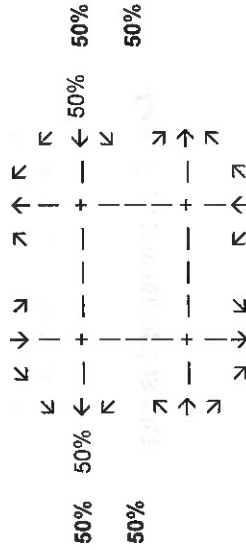
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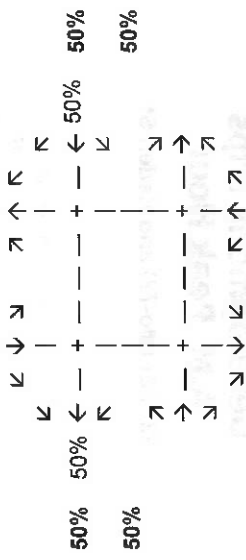
McBee Landing TIS Independence, Missouri

Trip Distribution Outbound

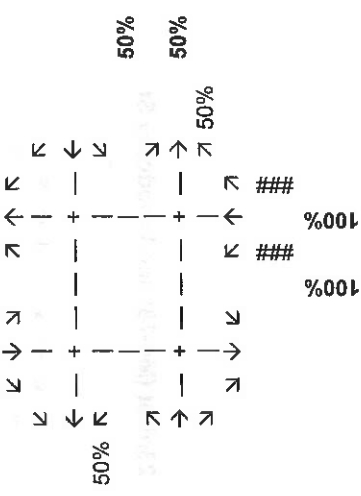
23rd St (Mo-78) and Kings Hwy



23rd St (Mo-78) and Haden St



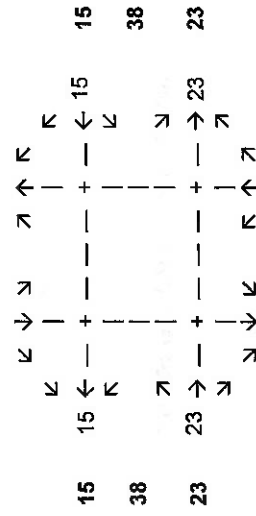
23rd St (Mo-78) and Woodbury St



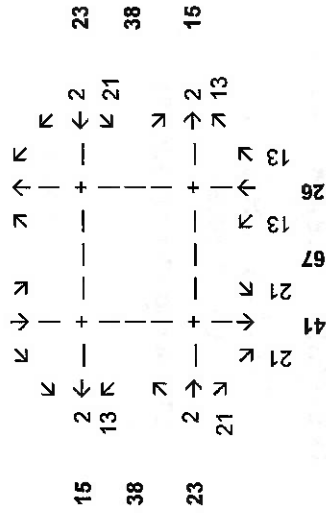
McBee Landing TIS Independence, Missouri

Development Trips A.M. Peak Hour

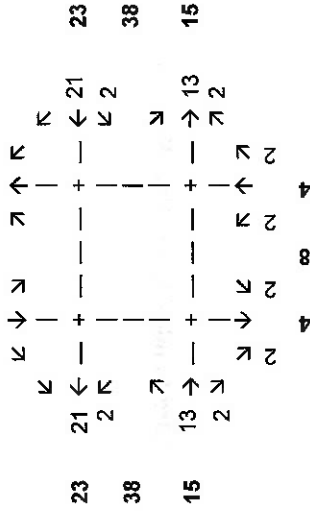
23rd St (Mo-78) and Kings Hwy



23rd St (Mo-78) and Haden St



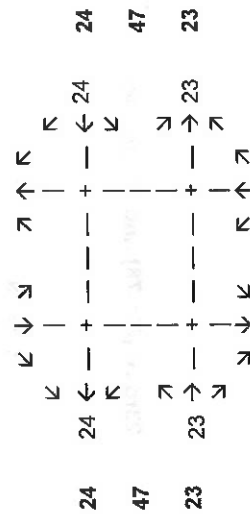
23rd St (Mo-78) and Woodbury St



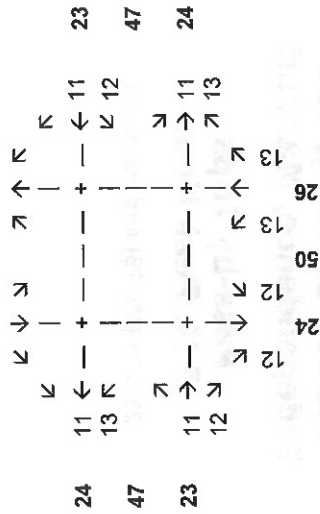
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Development Trips P.M. Peak Hour

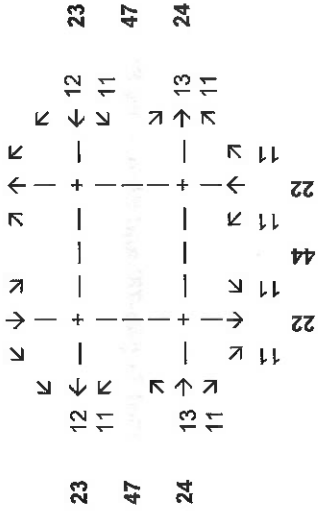
23rd St (Mo-78) and Kings Hwy



23rd St (Mo-78) and Haden St



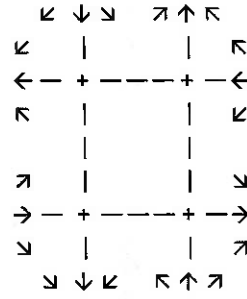
23rd St (Mo-78) and Woodbury St



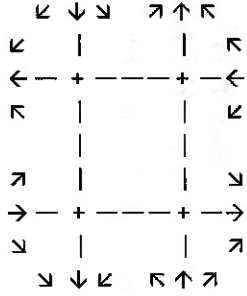
McBee Landing TIS **Independence, Missouri**

Pass-by Trips **P.M. Peak Hour**

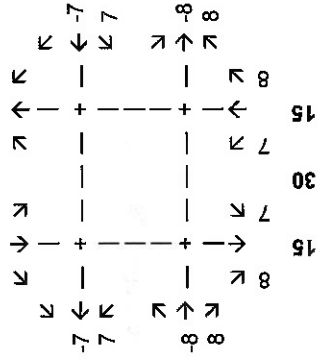
23rd St (Mo-78) and Kings Hwy



23rd St (Mo-78) and Haden St



23rd St (Mo-78) and Woodbury St



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**Future Year 2040
P.M. Peak Hour**

P101200135

**Future Year + Dev
A.M. Peak Hour**

P101200135

**Future Year + Dev
P.M. Peak Hour**

6/18/2020

Appendix C – Capacity Analysis Reports

See attached worksheets.

HCM 2010 TWSC
1: Kings Hwy & 23rd St

AM Peak Hour
Existing Conditions

Intersection

Int Delay, s/veh 1

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑↑		↓	↑↑	↓	
Traffic Vol, veh/h	792	20	20	1355	25	25
Future Vol, veh/h	792	20	20	1355	25	25
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	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	861	22	22	1473	27	27

Major/Minor	Major1	Major2	Minor1
Conflicting Flow All	0	0	883
Stage 1	-	-	-
Stage 2	-	-	-
Critical Hdwy	-	-	4.14
Critical Hdwy Stg 1	-	-	-
Critical Hdwy Stg 2	-	-	-
Follow-up Hdwy	-	-	2.22
Pot Cap-1 Maneuver	-	-	762
Stage 1	-	-	-
Stage 2	-	-	-
Platoon blocked, %	-	-	-
Mov Cap-1 Maneuver	-	-	762
Mov Cap-2 Maneuver	-	-	-
Stage 1	-	-	-
Stage 2	-	-	-

Approach	EB	WB	NB
HCM Control Delay, s	0	0.1	42.4
HCM LOS			E

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	149	-	-	762	-
HCM Lane V/C Ratio	0.365	-	-	0.029	-
HCM Control Delay (s)	42.4	-	-	9.9	-
HCM Lane LOS	E	-	-	A	-
HCM 95th %tile Q(veh)	1.5	-	-	0.1	-

Intersection						
Int Delay, s/veh	0.6					
Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations	T	↑↑	↑↑		T	
Traffic Vol, veh/h	10	807	1355	10	20	20
Future Vol, veh/h	10	807	1355	10	20	20
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	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	11	877	1473	11	22	22





Major/Minor	Major1	Major2	Minor2
Conflicting Flow All	1484	0	0 1940 742
Stage 1	-	-	- 1479 -
Stage 2	-	-	- 461 -
Critical Hdwy	4.14	-	- 6.84 6.94
Critical Hdwy Stg 1	-	-	- 5.84 -
Critical Hdwy Stg 2	-	-	- 5.84 -
Follow-up Hdwy	2.22	-	- 3.52 3.32
Pot Cap-1 Maneuver	449	-	- 57 358
Stage 1	-	-	- 176 -
Stage 2	-	-	- 601 -
Platoon blocked, %		-	-
Mov Cap-1 Maneuver	449	-	- 56 358
Mov Cap-2 Maneuver	-	-	- 138 -
Stage 1	-	-	- 172 -
Stage 2	-	-	- 601 -

Approach	EB	WB	SB
HCM Control Delay, s	0.2	0	28.1
HCM LOS			D

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	449	-	-	-	199
HCM Lane V/C Ratio	0.024	-	-	-	0.218
HCM Control Delay (s)	13.2	-	-	-	28.1
HCM Lane LOS	B	-	-	-	D
HCM 95th %tile Q(veh)	0.1	-	-	-	0.8

HCM 2010 TWSC
3: 23rd St & Woodbury St

AM Peak Hour
Existing Conditions

Intersection						
Int Delay, s/veh	0.3					
Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	5	822	1355	5	10	10
Future Vol, veh/h	5	822	1355	5	10	10
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	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	5	893	1473	5	11	11

Major/Minor	Major1	Major2	Minor2		
Conflicting Flow All	1478	0	0	1933	739
Stage 1	-	-	-	1476	-
Stage 2	-	-	-	457	-
Critical Hdwy	4.14	-	-	6.84	6.94
Critical Hdwy Stg 1	-	-	-	5.84	-
Critical Hdwy Stg 2	-	-	-	5.84	-
Follow-up Hdwy	2.22	-	-	3.52	3.32
Pot Cap-1 Maneuver	452	-	-	58	360
Stage 1	-	-	-	176	-
Stage 2	-	-	-	604	-
Platoon blocked, %	-	-	-	-	-
Mov Cap-1 Maneuver	452	-	-	57	360
Mov Cap-2 Maneuver	-	-	-	140	-
Stage 1	-	-	-	174	-
Stage 2	-	-	-	604	-

Approach	EB	WB	SB
HCM Control Delay, s	0.1	0	25
HCM LOS			D

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	452	-	-	-	202
HCM Lane V/C Ratio	0.012	-	-	-	0.108
HCM Control Delay (s)	13.1	-	-	-	25
HCM Lane LOS	B	-	-	-	D
HCM 95th %tile Q(veh)	0	-	-	-	0.4

HCM 6th TWSC
1: Kings Hwy & 23rd St

PM Peak Hour
Existing Conditions

Intersection						
Int Delay, s/veh	2.2					
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑↑		↑	↑↑	↑	
Traffic Vol, veh/h	1428	25	25	1052	20	20
Future Vol, veh/h	1428	25	25	1052	20	20
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	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	1552	27	27	1143	22	22





Major/Minor	Major1	Major2	Minor1
Conflicting Flow All	0	0 1579	0 2192 790
Stage 1	-	-	- 1566 -
Stage 2	-	-	- 626 -
Critical Hdwy	-	- 4.14	- 6.84 6.94
Critical Hdwy Stg 1	-	-	- 5.84 -
Critical Hdwy Stg 2	-	-	- 5.84 -
Follow-up Hdwy	-	- 2.22	- 3.52 3.32
Pot Cap-1 Maneuver	-	- 413	- 39 333
Stage 1	-	-	- 158 -
Stage 2	-	-	- 495 -
Platoon blocked, %	-	-	-
Mov Cap-1 Maneuver	-	- 413	- 36 333
Mov Cap-2 Maneuver	-	-	- 36 -
Stage 1	-	-	- 158 -
Stage 2	-	-	- 463 -

Approach	EB	WB	NB
HCM Control Delay, s	0	0.3	135
HCM LOS			F

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	65	-	-	413	-
HCM Lane V/C Ratio	0.669	-	-	0.066	-
HCM Control Delay (s)	135	-	-	14.3	-
HCM Lane LOS	F	-	-	B	-
HCM 95th %tile Q(veh)	2.9	-	-	0.2	-

HCM 6th TWSC
2: 23rd St & Haden St

PM Peak Hour
Existing Conditions

Intersection						
Int Delay, s/veh	0.3					
Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	20	1428	1067	20	10	10
Future Vol, veh/h	20	1428	1067	20	10	10
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	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	22	1552	1160	22	11	11





Major/Minor	Major1	Major2	Minor2		
Conflicting Flow All	1182	0	-	0	1991
Stage 1	-	-	-	-	1171
Stage 2	-	-	-	-	820
Critical Hdwy	4.14	-	-	-	6.84
Critical Hdwy Stg 1	-	-	-	-	5.84
Critical Hdwy Stg 2	-	-	-	-	5.84
Follow-up Hdwy	2.22	-	-	-	3.52
Pot Cap-1 Maneuver	587	-	-	-	53
Stage 1	-	-	-	-	257
Stage 2	-	-	-	-	393
Platoon blocked, %	-	-	-	-	-
Mov Cap-1 Maneuver	587	-	-	-	51
Mov Cap-2 Maneuver	-	-	-	-	160
Stage 1	-	-	-	-	247
Stage 2	-	-	-	-	393

Approach	EB	WB	SB
HCM Control Delay, s	0.2	0	21.8
HCM LOS			C

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	587	-	-	-	236
HCM Lane V/C Ratio	0.037	-	-	-	0.092
HCM Control Delay (s)	11.4	-	-	-	21.8
HCM Lane LOS	B	-	-	-	C
HCM 95th %tile Q(veh)	0.1	-	-	-	0.3

HCM 6th TWSC
3: 23rd St & Woodbury St

PM Peak Hour
Existing Conditions

Intersection						
Int Delay, s/veh	0.1					
Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	10	1428	1082	10	5	5
Future Vol, veh/h	10	1428	1082	10	5	5
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	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	11	1552	1176	11	5	5

Major/Minor	Major1	Major2	Minor2		
Conflicting Flow All	1187	0	0	1980	594
Stage 1	-	-	-	1182	-
Stage 2	-	-	-	798	-
Critical Hdwy	4.14	-	-	6.84	6.94
Critical Hdwy Stg 1	-	-	-	5.84	-
Critical Hdwy Stg 2	-	-	-	5.84	-
Follow-up Hdwy	2.22	-	-	3.52	3.32
Pot Cap-1 Maneuver	584	-	-	54	448
Stage 1	-	-	-	254	-
Stage 2	-	-	-	404	-
Platoon blocked, %	-	-	-	-	-
Mov Cap-1 Maneuver	584	-	-	53	448
Mov Cap-2 Maneuver	-	-	-	163	-
Stage 1	-	-	-	249	-
Stage 2	-	-	-	404	-

Approach	EB	WB	SB
HCM Control Delay, s	0.1	0	20.8
HCM LOS			C

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	584	-	-	-	239
HCM Lane V/C Ratio	0.019	-	-	-	0.045
HCM Control Delay (s)	11.3	-	-	-	20.8
HCM Lane LOS	B	-	-	-	C
HCM 95th %tile Q(veh)	0.1	-	-	-	0.1

HCM 6th TWSC
1: Kings Hwy & 23rd St

AM Peak Hour
Existing + Dev Conditions

Intersection

Int Delay, s/veh 1

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑↑		↑	↑↑	↑	
Traffic Vol, veh/h	815	20	20	1370	25	25
Future Vol, veh/h	815	20	20	1370	25	25
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	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	886	22	22	1489	27	27

Major/Minor	Major1	Major2	Minor1
Conflicting Flow All	0	0	908
Stage 1	-	-	-
Stage 2	-	-	-
Critical Hdwy	-	-	4.14
Critical Hdwy Stg 1	-	-	-
Critical Hdwy Stg 2	-	-	-
Follow-up Hdwy	-	-	2.22
Pot Cap-1 Maneuver	-	-	745
Stage 1	-	-	-
Stage 2	-	-	-
Platoon blocked, %	-	-	-
Mov Cap-1 Maneuver	-	-	745
Mov Cap-2 Maneuver	-	-	-
Stage 1	-	-	-
Stage 2	-	-	-

Approach	EB	WB	NB
HCM Control Delay, s	0	0.1	44.8
HCM LOS			E

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	143	-	-	745	-
HCM Lane V/C Ratio	0.38	-	-	0.029	-
HCM Control Delay (s)	44.8	-	-	10	-
HCM Lane LOS	E	-	-	A	-
HCM 95th %tile Q(veh)	1.6	-	-	0.1	-

HCM 6th TWSC
2: Haden St & 23rd St

AM Peak Hour
Existing + Dev Conditions

Intersection												
Int Delay, s/veh	3.4											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↰↱		↰	↰↱			↱	↱		↱↰	
Traffic Vol, veh/h	10	809	21	21	1357	10	13	0	13	20	0	20
Future Vol, veh/h	10	809	21	21	1357	10	13	0	13	20	0	20
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	-	-	-	-	0	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	11	879	23	23	1475	11	14	0	14	22	0	22

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	1486	0	0	902	0	0	1697	2445	451	1989	2451	743
Stage 1	-	-	-	-	-	-	913	913	-	1527	1527	-
Stage 2	-	-	-	-	-	-	784	1532	-	462	924	-
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	448	-	-	749	-	-	60	31	556	36	31	358
Stage 1	-	-	-	-	-	-	294	350	-	123	178	-
Stage 2	-	-	-	-	-	-	352	177	-	549	346	-
Platoon blocked, %	-	-	-	-	-	-	-	-	-	-	-	-
Mov Cap-1 Maneuver	448	-	-	749	-	-	54	29	556	34	29	358
Mov Cap-2 Maneuver	-	-	-	-	-	-	54	29	-	34	29	-
Stage 1	-	-	-	-	-	-	287	341	-	120	172	-
Stage 2	-	-	-	-	-	-	320	172	-	522	337	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0.4	0.2	52.7	147
HCM LOS			F	F

Minor Lane/Major Mvmt	NBLn1	NBLn2	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	54	556	448	-	-	749	-	-	62
HCM Lane V/C Ratio	0.262	0.025	0.024	-	-	0.03	-	-	0.701
HCM Control Delay (s)	93.8	11.6	13.2	0.2	-	10	-	-	147
HCM Lane LOS	F	B	B	A	-	A	-	-	F
HCM 95th %tile Q(veh)	0.9	0.1	0.1	-	-	0.1	-	-	3

HCM 6th TWSC
3: Woodbury St & 23rd St

AM Peak Hour
Existing + Dev Conditions

Intersection												
Int Delay, s/veh	0.9											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↙	↑↑		↙	↑↑			↔			↔	
Traffic Vol, veh/h	5	835	2	2	1376	5	2	0	2	10	0	10
Future Vol, veh/h	5	835	2	2	1376	5	2	0	2	10	0	10
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	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	5	908	2	2	1496	5	2	0	2	11	0	11

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	1501	0	0	910	0	0	1671	2424	455	1967	2423	751
Stage 1	-	-	-	-	-	-	919	919	-	1503	1503	-
Stage 2	-	-	-	-	-	-	752	1505	-	464	920	-
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	442	-	-	744	-	-	63	32	552	37	32	353
Stage 1	-	-	-	-	-	-	292	348	-	127	183	-
Stage 2	-	-	-	-	-	-	368	182	-	548	348	-
Platoon blocked, %	-	-	-	-	-	-	-	-	-	-	-	-
Mov Cap-1 Maneuver	442	-	-	744	-	-	60	32	552	36	32	353
Mov Cap-2 Maneuver	-	-	-	-	-	-	60	32	-	36	32	-
Stage 1	-	-	-	-	-	-	289	344	-	126	182	-
Stage 2	-	-	-	-	-	-	356	181	-	540	344	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0.1	0	39.7	86
HCM LOS			E	F

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	108	442	-	-	744	-	-	65
HCM Lane V/C Ratio	0.04	0.012	-	-	0.003	-	-	0.334
HCM Control Delay (s)	39.7	13.2	-	-	9.9	-	-	86
HCM Lane LOS	E	B	-	-	A	-	-	F
HCM 95th %tile Q(veh)	0.1	0	-	-	0	-	-	1.2

HCM 2010 TWSC
1: Kings Hwy & 23rd St

PM Peak Hour
Existing + Dev Conditions

Intersection						
Int Delay, s/veh	2.4					
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑↑		↑	↑↑	↑	
Traffic Vol, veh/h	1451	25	25	1079	20	20
Future Vol, veh/h	1451	25	25	1079	20	20
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	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	1577	27	27	1173	22	22








Major/Minor	Major1	Major2	Minor1
Conflicting Flow All	0	0	1604
Stage 1	-	-	-
Stage 2	-	-	-
Critical Hdwy	-	-	4.14
Critical Hdwy Stg 1	-	-	-
Critical Hdwy Stg 2	-	-	-
Follow-up Hdwy	-	-	2.22
Pot Cap-1 Maneuver	-	-	404
Stage 1	-	-	-
Stage 2	-	-	-
Platoon blocked, %	-	-	-
Mov Cap-1 Maneuver	-	-	404
Mov Cap-2 Maneuver	-	-	-
Stage 1	-	-	-
Stage 2	-	-	-

Approach	EB	WB	NB
HCM Control Delay, s	0	0.3	147
HCM LOS			F

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	62	-	-	404	-
HCM Lane V/C Ratio	0.701	-	-	0.067	-
HCM Control Delay (s)	147	-	-	14.6	-
HCM Lane LOS	F	-	-	B	-
HCM 95th %tile Q(veh)	3	-	-	0.2	-

HCM 2010 TWSC
2: Haden St & 23rd St

PM Peak Hour
Existing + Dev Conditions

Intersection												
Int Delay, s/veh	2.7											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	20	1439	12	12	1078	20	13	0	13	10	0	10
Future Vol, veh/h	20	1439	12	12	1078	20	13	0	13	10	0	10
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	-	-	-	-	0	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	22	1564	13	13	1172	22	14	0	14	11	0	11

Major/Minor	Major1		Major2		Minor1		Minor2					
Conflicting Flow All	1194	0	0	1577	0	0	2227	2835	789	2035	2830	597
Stage 1	-	-	-	-	-	-	1615	1615	-	1209	1209	-
Stage 2	-	-	-	-	-	-	612	1220	-	826	1621	-
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	580	-	-	414	-	-	24	17	333	33	17	446
Stage 1	-	-	-	-	-	-	108	161	-	194	254	-
Stage 2	-	-	-	-	-	-	447	251	-	332	160	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	580	-	-	414	-	-	22	16	333	30	16	446
Mov Cap-2 Maneuver	-	-	-	-	-	-	22	16	-	30	16	-
Stage 1	-	-	-	-	-	-	104	155	-	187	246	-
Stage 2	-	-	-	-	-	-	422	243	-	306	154	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0.2	0.2	168.2	105.4
HCM LOS			F	F

Minor Lane/Major Mvmt	NBLn1	NBLn2	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	22	333	580	-	-	414	-	-	56
HCM Lane V/C Ratio	0.642	0.042	0.037	-	-	0.032	-	-	0.388
HCM Control Delay (s)	\$ 320	16.3	11.4	-	-	14	-	-	105.4
HCM Lane LOS	F	C	B	-	-	B	-	-	F
HCM 95th %tile Q(veh)	1.9	0.1	0.1	-	-	0.1	-	-	1.4

HCM 2010 TWSC
3: Woodbury St & 23rd St

PM Peak Hour
Existing + Dev Conditions

Intersection												
Int Delay, s/veh	4											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↑↑		↰	↑↑			↰		↰		
Traffic Vol, veh/h	10	1433	19	18	1087	10	18	0	19	5	0	5
Future Vol, veh/h	10	1433	19	18	1087	10	18	0	19	5	0	5
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	-	-	-	-	-	0	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	11	1558	21	20	1182	11	20	0	21	5	0	5
Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	1193	0	0	1579	0	0	2222	2824	790	2029	-	597
Stage 1	-	-	-	-	-	-	1591	1591	-	1228	-	-
Stage 2	-	-	-	-	-	-	631	1233	-	801	-	-
Critical Hdwy	4.14	-	-	4.14	-	-	7.54	6.54	6.94	7.54	-	6.94
Critical Hdwy Stg 1	-	-	-	-	-	-	6.54	5.54	-	6.54	-	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.54	5.54	-	6.54	-	-
Follow-up Hdwy	2.22	-	-	2.22	-	-	3.52	4.02	3.32	3.52	-	3.32
Pot Cap-1 Maneuver	581	-	-	413	-	-	24	17	333	34	0	446
Stage 1	-	-	-	-	-	-	112	166	-	189	0	-
Stage 2	-	-	-	-	-	-	436	247	-	344	0	-
Platoon blocked, %	-	-	-	-	-	-	-	-	-	-	-	-
Mov Cap-1 Maneuver	581	-	-	413	-	-	23	16	333	30	-	446
Mov Cap-2 Maneuver	-	-	-	-	-	-	23	16	-	30	-	-
Stage 1	-	-	-	-	-	-	110	163	-	185	-	-
Stage 2	-	-	-	-	-	-	410	235	-	317	-	-
Approach	EB			WB			NB			SB		
HCM Control Delay, s	0.1			0.2			251.9			84.2		
HCM LOS							F			F		
Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1				
Capacity (veh/h)	44	581	-	-	413	-	-	56				
HCM Lane V/C Ratio	0.914	0.019	-	-	0.047	-	-	0.194				
HCM Control Delay (s)	251.9	11.3	-	-	14.2	-	-	84.2				
HCM Lane LOS	F	B	-	-	B	-	-	F				
HCM 95th %tile Q(veh)	3.7	0.1	-	-	0.1	-	-	0.6				

HCM 6th TWSC
1: Kings Hwy & 23rd St

A.M. Peak Hour
Future 2040

Intersection						
Int Delay, s/veh	1.5					
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑↑		↑	↑↑	↑	
Traffic Vol, veh/h	893	22	22	1505	27	27
Future Vol, veh/h	893	22	22	1505	27	27
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	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	971	24	24	1636	29	29

Major/Minor	Major1	Major2	Minor1
Conflicting Flow All	0	0	995
Stage 1	-	-	-
Stage 2	-	-	-
Critical Hdwy	-	-	4.14
Critical Hdwy Stg 1	-	-	-
Critical Hdwy Stg 2	-	-	-
Follow-up Hdwy	-	-	2.22
Pot Cap-1 Maneuver	-	-	691
Stage 1	-	-	-
Stage 2	-	-	-
Platoon blocked, %	-	-	-
Mov Cap-1 Maneuver	-	-	691
Mov Cap-2 Maneuver	-	-	-
Stage 1	-	-	-
Stage 2	-	-	-

Approach	EB	WB	NB
HCM Control Delay, s	0	0.1	66.1
HCM LOS			F

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	114	-	-	691	-
HCM Lane V/C Ratio	0.515	-	-	0.035	-
HCM Control Delay (s)	66.1	-	-	10.4	-
HCM Lane LOS	F	-	-	B	-
HCM 95th %tile Q(veh)	2.4	-	-	0.1	-

Intersection												
Int Delay, s/veh	6.7											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↰↱		↰	↰↱			↱	↱		↰↱	
Traffic Vol, veh/h	11	889	21	33	1492	11	13	0	13	22	0	22
Future Vol, veh/h	11	889	21	33	1492	11	13	0	13	22	0	22
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	-	-	-	-	0	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	12	966	23	36	1622	12	14	0	14	24	0	24

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	1634	0	0	989	0	0	1885	2708	495	2207	2713	817
Stage 1	-	-	-	-	-	-	1002	1002	-	1700	1700	-
Stage 2	-	-	-	-	-	-	883	1706	-	507	1013	-
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	393	-	-	695	-	-	43	21	520	25	21	320
Stage 1	-	-	-	-	-	-	260	318	-	96	146	-
Stage 2	-	-	-	-	-	-	307	145	-	516	315	-
Platoon blocked, %	-	-	-	-	-	-	-	-	-	-	-	-
Mov Cap-1 Maneuver	393	-	-	695	-	-	37	19	520	~ 23	19	320
Mov Cap-2 Maneuver	-	-	-	-	-	-	37	19	-	~ 23	19	-
Stage 1	-	-	-	-	-	-	252	308	-	93	138	-
Stage 2	-	-	-	-	-	-	269	137	-	487	305	-







Approach	EB	WB	NB	SB
HCM Control Delay, s	0.4	0.2	82.6	\$ 320.2
HCM LOS			F	F

Minor Lane/Major Mvmt	NBLn1	NBLn2	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	37	520	393	-	-	695	-	-	43
HCM Lane V/C Ratio	0.382	0.027	0.03	-	-	0.052	-	-	1.112
HCM Control Delay (s)	153.1	12.1	14.4	0.2	-	10.5	-	-	\$ 320.2
HCM Lane LOS	F	B	B	A	-	B	-	-	F
HCM 95th %tile Q(veh)	1.3	0.1	0.1	-	-	0.2	-	-	4.5

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

HCM 6th TWSC
3: Woodbury St & 23rd St

A.M. Peak Hour
Future 2040

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	5	917	2	2	1510	5	2	0	2	11	0	11
Future Vol, veh/h	5	917	2	2	1510	5	2	0	2	11	0	11
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	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	5	997	2	2	1641	5	2	0	2	12	0	12

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	1646	0	0	999	0	0	1833	2658	500	2157	2657	823
Stage 1	-	-	-	-	-	-	1008	1008	-	1648	1648	-
Stage 2	-	-	-	-	-	-	825	1650	-	509	1009	-
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	389	-	-	689	-	-	47	22	516	27	22	317
Stage 1	-	-	-	-	-	-	258	316	-	103	155	-
Stage 2	-	-	-	-	-	-	333	155	-	515	316	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	389	-	-	689	-	-	45	22	516	27	22	317
Mov Cap-2 Maneuver	-	-	-	-	-	-	45	22	-	27	22	-
Stage 1	-	-	-	-	-	-	255	312	-	102	155	-
Stage 2	-	-	-	-	-	-	320	155	-	506	312	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0.1	0	50.8	130.7
HCM LOS			F	F

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	83	389	-	-	689	-	-	50
HCM Lane V/C Ratio	0.052	0.014	-	-	0.003	-	-	0.478
HCM Control Delay (s)	50.8	14.4	-	-	10.2	-	-	130.7
HCM Lane LOS	F	B	-	-	B	-	-	F
HCM 95th %tile Q(veh)	0.2	0	-	-	0	-	-	1.8

HCM 6th TWSC
1: Kings Hwy & 23rd St

PM Peak Hour

Future 2040

Intersection						
Int Delay, s/veh	4.9					
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑↑		↑	↑↑	↑	
Traffic Vol, veh/h	1593	27	27	1181	22	22
Future Vol, veh/h	1593	27	27	1181	22	22
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	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	1732	29	29	1284	24	24

Major/Minor	Major1	Major2	Minor1
Conflicting Flow All	0	0	1761
Stage 1	-	-	-
Stage 2	-	-	-
Critical Hdwy	-	-	4.14
Critical Hdwy Stg 1	-	-	-
Critical Hdwy Stg 2	-	-	-
Follow-up Hdwy	-	-	2.22
Pot Cap-1 Maneuver	-	-	351
Stage 1	-	-	-
Stage 2	-	-	-
Platoon blocked, %	-	-	-
Mov Cap-1 Maneuver	-	-	351
Mov Cap-2 Maneuver	-	-	-
Stage 1	-	-	-
Stage 2	-	-	-








Approach	EB	WB	NB
HCM Control Delay, s	0	0.4	\$ 307.4
HCM LOS			F

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	44	-	-	351	-
HCM Lane V/C Ratio	1.087	-	-	0.084	-
HCM Control Delay (s)	\$ 307.4	-	-	16.2	-
HCM Lane LOS	F	-	-	C	-
HCM 95th %tile Q(veh)	4.5	-	-	0.3	-

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

HCM 6th TWSC
2: Haden St & 23rd St

PM Peak Hour
Future 2040

Intersection												
Int Delay, s/veh	4.2											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	22	1581	12	12	1184	22	13	0	13	11	0	11
Future Vol, veh/h	22	1581	12	12	1184	22	13	0	13	11	0	11
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	-	-	-	-	0	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	24	1718	13	13	1287	24	14	0	14	12	0	12







Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	1311	0	0	1731	0	0	2443	3110	866	2232	3104	656
Stage 1	-	-	-	-	-	-	1773	1773	-	1325	1325	-
Stage 2	-	-	-	-	-	-	670	1337	-	907	1779	-
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	524	-	-	360	-	-	16	11	297	23	11	408
Stage 1	-	-	-	-	-	-	86	134	-	164	223	-
Stage 2	-	-	-	-	-	-	413	220	-	297	133	-
Platoon blocked, %	-	-	-	-	-	-	-	-	-	-	-	-
Mov Cap-1 Maneuver	524	-	-	360	-	-	15	10	297	21	10	408
Mov Cap-2 Maneuver	-	-	-	-	-	-	15	10	-	21	10	-
Stage 1	-	-	-	-	-	-	82	128	-	156	215	-
Stage 2	-	-	-	-	-	-	386	212	-	270	127	-

Approach	EB			WB			NB			SB		
HCM Control Delay, s	0.2			0.2			284.5			184.5		
HCM LOS							F			F		

Minor Lane/Major Mvmt	NBLn1	NBLn2	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	15	297	524	-	-	360	-	-	40
HCM Lane V/C Ratio	0.942	0.048	0.046	-	-	0.036	-	-	0.598
HCM Control Delay (s)	\$ 551.2	17.7	12.2	-	-	15.4	-	-	184.5
HCM Lane LOS	F	C	B	-	-	C	-	-	F
HCM 95th %tile Q(veh)	2.2	0.1	0.1	-	-	0.1	-	-	2.2

HCM 6th TWSC
3: Woodbury St & 23rd St

PM Peak Hour
Future 2040

Intersection												
Int Delay, s/veh	7.1											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	11	1583	19	18	1202	11	18	0	19	5	0	5
Future Vol, veh/h	11	1583	19	18	1202	11	18	0	19	5	0	5
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	-	-	-	-	-	0	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	12	1721	21	20	1307	12	20	0	21	5	0	5

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	1319	0	0	1742	0	0	2450	3115	871	2238	-	660
Stage 1	-	-	-	-	-	-	1756	1756	-	1353	-	-
Stage 2	-	-	-	-	-	-	694	1359	-	885	-	-
Critical Hdwy	4.14	-	-	4.14	-	-	7.54	6.54	6.94	7.54	-	6.94
Critical Hdwy Stg 1	-	-	-	-	-	-	6.54	5.54	-	6.54	-	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.54	5.54	-	6.54	-	-
Follow-up Hdwy	2.22	-	-	2.22	-	-	3.52	4.02	3.32	3.52	-	3.32
Pot Cap-1 Maneuver	520	-	-	357	-	-	~ 16	11	294	23	0	406
Stage 1	-	-	-	-	-	-	88	137	-	158	0	-
Stage 2	-	-	-	-	-	-	399	215	-	306	0	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	520	-	-	357	-	-	~ 15	10	294	20	-	406
Mov Cap-2 Maneuver	-	-	-	-	-	-	~ 15	10	-	20	-	-
Stage 1	-	-	-	-	-	-	86	134	-	154	-	-
Stage 2	-	-	-	-	-	-	372	203	-	278	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0.1	0.2	\$ 507.8	134
HCM LOS			F	F

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	29	520	-	-	357	-	-	38
HCM Lane V/C Ratio	1.387	0.023	-	-	0.055	-	-	0.286
HCM Control Delay (s)	\$ 507.8	12.1	-	-	15.7	-	-	134
HCM Lane LOS	F	B	-	-	C	-	-	F
HCM 95th %tile Q(veh)	4.6	0.1	-	-	0.2	-	-	0.9

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

