QUIKTRIP STORE #0189

HIGHWAY 45 AND HIGHWAY 9

PARKVILLE, MISSOURI

TRAFFIC IMPACT STUDY

STATE OF MISSOURI
TODD A. FREDERICKSEN
NUMBER
PE-2005030484
REGISTERED PROFESSIONAL ENGINEER
02/26/15

REVISED FEBRUARY, 2015

OA Project No. 2012-2561

OLSSON ASSOCIATES

TABLE OF CONTENTS

1.0 INTRODUCTION & OBJECTIVE **1**

2.0 DESCRIPTION OF PROPOSED DEVELOPMENT **1**

3.0 EXISTING ROADWAY AND TRAFFIC CONDITIONS **4**

3.1 Roadway Classification and Characteristics 4
3.2 Data Collection 4
3.3 Signal Warrant Analysis 5
3.4 Capacity Analysis 6
3.5 Existing Recommendations 8

4.0 EXISTING PLUS DEVELOPMENT CONDITIONS **12**

4.1 Access 12
4.2 Trip Generation and Distribution 12
4.3 Turn Lane Analysis 14
4.4 Signal Warrant Analysis 15
4.5 Capacity Analysis 16
4.6 Site Circulation 18
4.7 Existing plus Development Recommendations 18

5.0 FUTURE YEAR 2035 CONDITIONS **27**

5.1 Capacity Analysis 27
5.2 Future Year 2035 Recommendations 28

6.0 RECOMMENDATIONS & CONCLUSIONS **32**

APPENDIX: **34**

LIST OF TABLES

Table 1: Intersection Level of Service Summary 6
Table 2: Existing Signalized Intersection Analysis 6
Table 3: Proposed Development Trip Generation 13
Table 4: Trip Generation – Pass-by 14
Table 5: Trip Distribution 14
Table 6: Existing plus Development Signalized Intersection Analysis 16
Table 7: Future Year 2035 Signalized Intersections Analysis 27

LIST OF FIGURES

Figure 1: Vicinity Map 2
Figure 2: Site Plan 3
Figure 3: Existing Peak hour Volumes 9
Figure 4: Existing Lane configurations and traffic control 10
Figure 5: Existing Level of Service 11
Figure 6: Existing Plus Development Peak Hour Trips with Drive 3 20
Figure 7: Existing Plus Development Peak Hour Trips without Drive 3 21
Figure 8: Existing Plus Development Peak Hour Volumes with Drive 3 22
Figure 9: Existing Plus Development Peak Hour Volumes without Drive 3 23
Figure 10: Existing Plus Development Lane Configurations & Traffic Control 24
Figure 11: Existing Plus Development Level of Service with Drive 3 25
Figure 12: Existing Plus Development Level of Service without Drive 3 26
Figure 13: Future Year 2035 Peak Hour Volumes 29
Figure 14: Future Year 2035 Lane Configurations and Traffic Control 30
Figure 15: Future Year 2035 Level of Service 31

1.0 INTRODUCTION & OBJECTIVE

This report is an update to the Parkville QuikTrip Store #0189 study submitted by Olsson Associates in December 2012 and subsequent MoDOT comments addressed July 2nd, 2013. Updates include the land use for the fast-food restaurant with drive-thru window shown in the original study is no longer included and the QuikTrip store decreases in size from 20 to 18 fuel positions. The development is located in the southeast quadrant of the intersection of Highway 45 and Highway 9 in Parkville, Missouri. The approximate location of the development is shown on the vicinity map, **Figure 1**.

The objective of this study is to evaluate the existing traffic and roadway conditions and the traffic impacts expected from the proposed development. The appropriate intersection geometrics and traffic control improvements necessary to accommodate the increased traffic on the study area roadways were identified. For the purpose of this study the Existing, Existing plus Proposed Development, and Future Year 2035 scenarios were evaluated for the AM and PM peak hour periods.

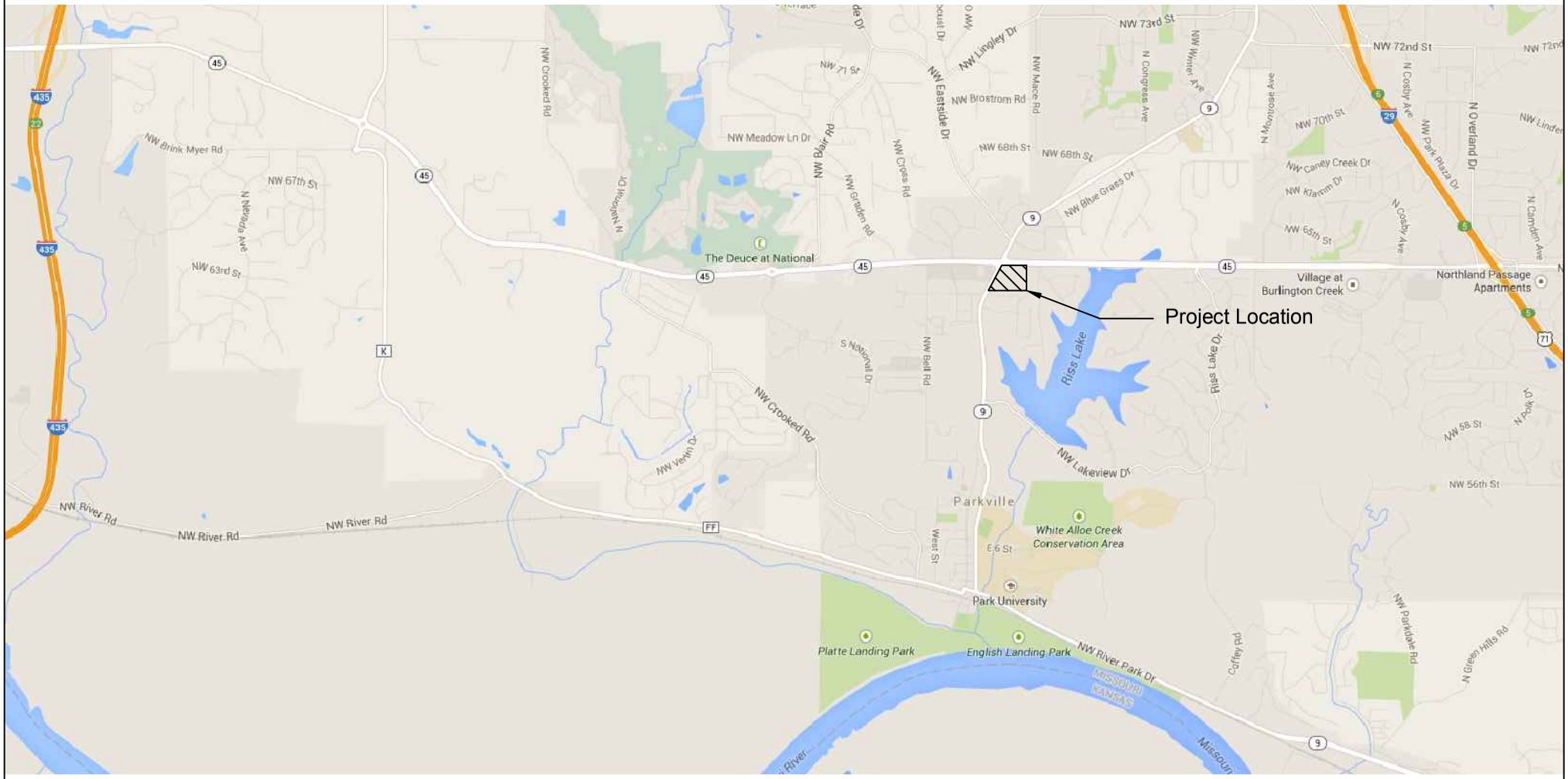
The study area intersections include:

- Highway 45 and Julian Drive
- Highway 45 and Highway 9
- Highway 9 and Lewis Street
- Highway 9 and NW 63rd Street
- Highway 9 and NW 62nd Street
- Site Drives as necessary

2.0 DESCRIPTION OF PROPOSED DEVELOPMENT

The proposed development is bound by Highway 45 to the north, a church and bank with parking lot to the east, Highway 9 to the west, and an existing bank and residential development border the proposed site to the south. The proposed development includes a 5,858 square foot convenience market with 18 fueling stations.

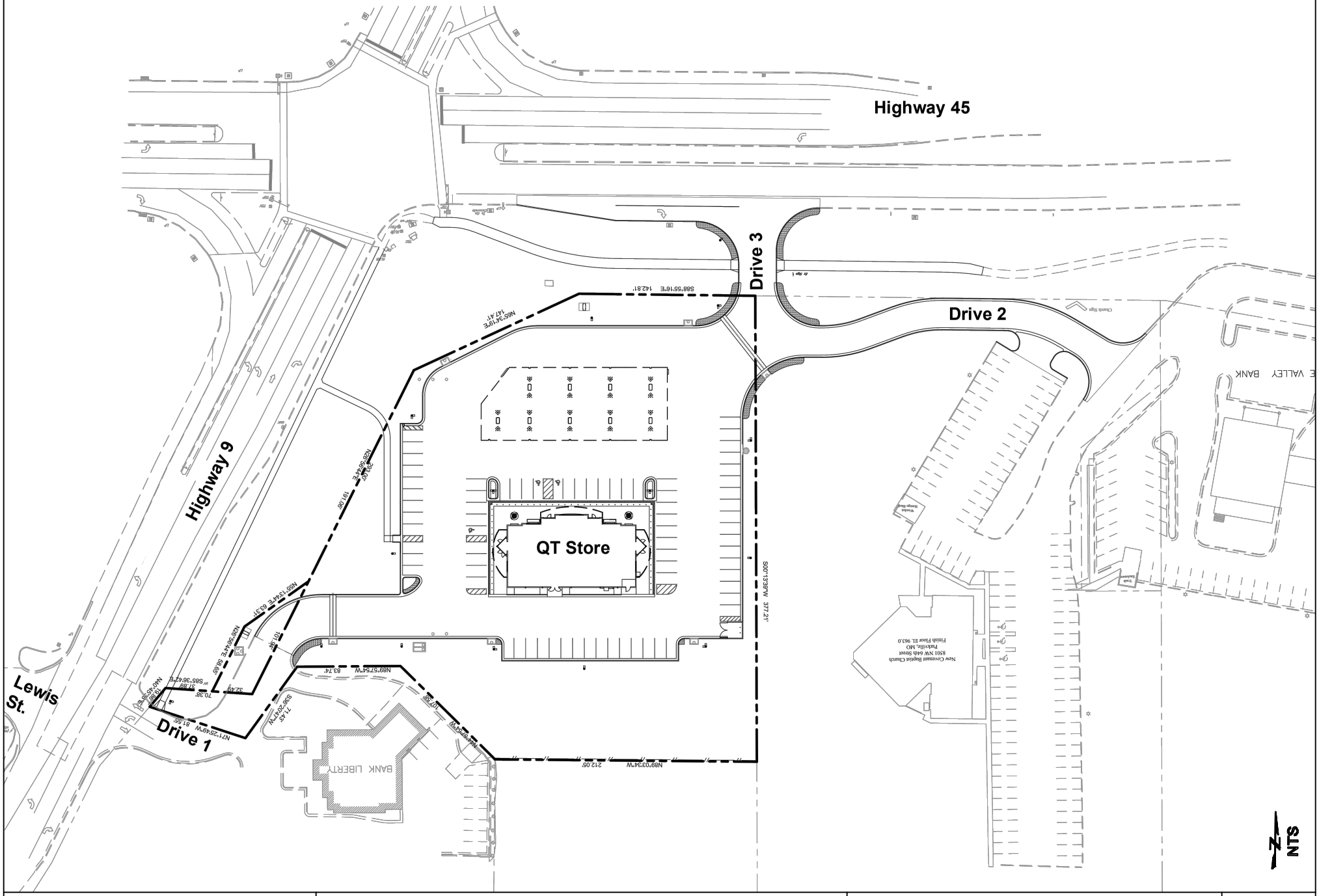
Access to the site is proposed via two existing full access drives and one new right-in/right-out drive. Drive 1 is an extension of an existing drive connecting with Highway 9 at Lewis Street, Drive 2 is an extension of an existing private road connected to Julian Drive, and Drive 3 is a proposed right-in/right-out drive along Highway 45. The impact of Drive 3 will be determined to define whether this proposed access drive is necessary for improved operations in the study area. The site plan for the proposed development is illustrated in **Figure 2**.



Source: Google Maps

NTS

PROJECT NO: 012-2561	Vicinity Map	OLSSON ASSOCIATES® 7301 West 133rd Street Suite 200 Overland Park, KS 66213-4750 TEL 913.381.1170 FAX 913.381.1174	FIGURE
DRAWN BY: JSS			1
DATE: 02/26/2015			



PROJECT NO: 012-2561	Site Plan	OLSSON ASSOCIATES	FIGURE
DRAWN BY: JSS		7301 West 133rd Street Suite 200 Overland Park, KS 66213-4750 TEL 913.381.1170 FAX 913.381.1174	2
DATE: 02/26/2015			

3.0 EXISTING ROADWAY AND TRAFFIC CONDITIONS

Completing an analysis of the existing traffic and roadway conditions in the vicinity of the development site allows for a comparison to aid in determining the impact of the proposed development to the surrounding roadway network.

3.1 Roadway Classification and Characteristics

Highway 45 is an east/west four-lane divided principal arterial near the proposed development site with a posted speed limit of 35 mph west of Highway 9 and 45 mph east of Highway 9. The intersection of Highway 45 and Highway 9 is a signalized intersection with auxiliary left and right-turn lanes on all approaches.

Highway 9 is a north/south four-lane undivided minor arterial roadway with a posted speed limit of 35 mph. In the vicinity of the project site, local streets which intersect with Highway 9 are stop controlled. Study intersections along Highway 9 include: Lewis Street, NW 63rd Street, and NW 62nd Street. At each intersection there are auxiliary left-turn lanes on Highway 9.

The intersection of Highway 45 and Highway 9 received improvements around the original 2012 study's completion date from a MoDOT project which improved capacity at the intersection of Highway 45 and Highway 9 by adding dual northbound and eastbound left-turn lanes as well as an additional through lane for northbound traffic north of Highway 45 to accept the dual eastbound left-turn lanes. The intersection also received upgraded pedestrian accommodations by improving sidewalk connectivity across all legs.

Lewis Street is an east/west two-lane undivided local street near the proposed development site. The intersection of Highway 9 and Lewis Street is an unsignalized intersection with a designated westbound left-turn lane on Lewis Street and stop signs on Lewis Street onto Highway 9.

Julian Drive is a north/south two-lane undivided local street near the proposed development site. The T-intersection of Highway 45 and Julian Drive is an unsignalized intersection with a designated left-turn lane on westbound Highway 45 and a stop sign on Julian Drive onto Highway 45.

Highway 9's intersection with NW 62nd Street and NW 63rd Street are T-intersections with the side-streets stop controlled. Dedicated left-turn lanes are provided on Highway 9 with single entering and exiting lanes at 62nd Street. 63rd Street has a small channelized right-turn lane and dedicated left-turn lane.

3.2 Data Collection

Olsson Associates collected AM and PM peak hour traffic counts at the intersections of Highway 9 and NW 63rd Street and Highway 9 and NW 62nd Street. This traffic count data was collected on January 4th, 2012. Based on the traffic count data, the AM peak hour period is from 7:45 to 8:45 AM, and the PM peak hour period is from 4:45 to 5:45 PM.

Previous AM and PM peak hour traffic counts from May 24th, 2012 were utilized at the intersection of Highway 45 and Highway 9, Highway 45 and Julian Drive, and Highway 9 and Lewis Street. Traffic count data was collected from 6:00 to 9:00 AM and 3:00 to 6:00 PM.

Due to collection dates of the traffic count data, volumes were balanced along the corridor to account for the variation in time-of-year of the counts. Volume balancing resulted in conservative values, with through volumes increasing slightly due to the balancing of trips between intersections with exception of the northbound traffic on Highway 9. Northbound traffic count data taken in May of 2012 was found to be higher than count data collected in January of 2012. Subsequent count data was collected in 2013 along Highway 9 just south of the study intersections corroborates the May 2012 data, thus volumes were decreased along Highway 9 during the AM peak hour period. The balanced existing volumes are illustrated in **Figure 3**. Count data sheets are included within the **Appendix**.

A field review was completed to determine the existing conditions of the corridor, including posted speed limits, intersection traffic control, and lane configurations. Sight distance was reviewed for existing drive locations and found to be adequate. Existing intersection geometrics and traffic control are illustrated in **Figure 4**.

The existing signal timings for intersection of Highway 45 and Highway 9 were acquired from MoDOT and utilized for existing capacity analysis.

3.3 Signal Warrant Analysis

The Manual on Uniform Traffic Control Devices (MUTCD – 2009 Edition) provides eight signal warrants for evaluation of signalization at intersections. Typically, traffic signal warrants are based on a complete review of traffic information including volumes, pedestrians, accidents experience, and traffic progression. The preliminary need for signalization at the study intersections were evaluated based on the Peak Hour Warrant (Warrant 3) contained in the MUTCD.

All signal warrant analysis was completed under the assumption that the City of Parkville does not meet reduction criteria due to the population being less than 10,000 because the City lies within the Greater Kansas City Metropolitan Area.

Signal warrant analysis was completed for the intersections on Highway 9 with NW 63rd Street, and Lewis Street as well as Highway 45 with Julian Drive. Existing traffic volumes at the intersections of Highway 9 with Lewis Street and NW 63rd Street are on the threshold of the peak hour warrant criteria for signalization. Signal warrant analysis sheets can be found in the **Appendix**.

In addition the MoDOT *Engineering Policy Guide* (*EPG*) was reviewed to determine the criteria for spacing between two signalized intersections. The center-to-center spacing on Highway 9 between the intersections of Highway 45 and Lewis Street is approximately 510'. The center-to-center spacing on Highway 9 between the intersections of Highway

45 and NW 63rd Street is approximately 890'. According to MoDOT's *EPG* the suggested minimum distance between two signalized intersections is 1,320'. Based on the signal warrants and spacing criteria result the intersections of Highway 9 with Lewis Street and NW 63rd Street will be analyzed in **Section 3.4** as unsignalized.

3.4 Capacity Analysis

Signalized intersection capacity analyses were performed using SYNCHRO, version 8.0, based on the Highway Capacity Manual (HCM) delay methodology. Unsignalized capacity analyses were performed in accordance with Chapter 17 of the HCM using the Highway Capacity Software (HCS+), version 6.5. For simplicity, the amount of delay is equated to a grade or Level of Service (LOS) based on thresholds of driver acceptance. A letter grade between A and F is assigned, where LOS A represents the best operation. **Table 1** represents the LOS associated with intersection control delay, in seconds per vehicle (sec/veh), for signalized and unsignalized intersections.

Table 1: Intersection Level of Service Summary

Level-of-Service Criteria		
Level of Service (LOS)	**Stop Control** Approach Delay sec/veh	**Signal Control** Control Delay sec/veh
A	≤ 10	≤ 10
B	>10 and ≤ 15	>10 and ≤ 20
C	>15 and ≤ 25	>20 and ≤ 35
D	>25 and ≤ 35	>35and ≤ 55
E	>35 and ≤ 50	>55 and ≤ 80
F	>50	>80

Capacity analysis was completed as discussed above for the signalized study intersection of Highway 45 and Highway 9. Signal timing data as provided by MoDOT were unaltered for analysis purposes. **Table 2** further details level of service for this intersection. Capacity analysis sheets are included in the **Appendix**.

Table 2: Existing Signalized Intersection Analysis

Intersection	AM Peak Hour	PM Peak Hour
Highway 45 and Highway 9	D (40.4)	D (47.6)

*LOS (Delay in Seconds)

During the AM and PM peak hour the overall operation of the intersection of Highway 45 and Highway 9 is acceptable. All individual movements operate at LOS D or better during the AM and PM peak hour with the following exceptions:

- During the AM peak hour period the eastbound and westbound left-turn movements operate at a LOS E; the southbound left-turn movement operates at a LOS F.
- During the PM peak hour period the eastbound and westbound left-turn and northbound left-turn and thru movements operate at a LOS E; the southbound left-turn movement operates at a LOS F.
    - The northbound thru movement has a 95th-percentile queue of 430' which extends to Lewis Street
- During both peak hour periods the westbound left-turn movement experiences' queuing that extends to or beyond the available storage.
    - During the PM peak hour, the westbound left-turn movement at the intersection of Highway 45 and Highway 9 has a 95th-percentile queue length of 387', which is beyond the current storage of 325'.

Existing conditions capacity analysis results detailed above indicate that during the peak hour periods the signalized intersection of Highway 45 and Highway 9 experiences operational deficiencies. Intersection deficiencies were present with the 2012 study and MoDOT improvements to the intersection did not address all operational issues, specifically issues pertaining to the northbound through, westbound left-turn, southbound left-turn, and southbound through movements. A concept study, the "Highway 9 Corridor Study", is in the beginning stages which will review Highway 9 in depth and make recommendations for improving capacity, walkability, and aesthetics.

Unsignalized capacity analysis was conducted for the remaining study intersections. Based on capacity analysis, all intersections were operating acceptably during study period with the following exceptions:

<u>Highway 9 & Lewis Street</u>

- During the AM peak hour period the westbound left-turn and eastbound movements are operating at LOS E and F, respectively.
- During the PM peak hour period the westbound left-turn movement and the eastbound movements operate at a LOS F and the westbound thru/right-turn movement operates at a LOS E.

<u>Highway 9 & 63rd Street</u>

- During the AM and PM peak hour periods the eastbound left-turn operates at LOS E and F, respectively.

Unsignalized side street movements can be expected to operate at a lower level of service during the peak hour periods as the higher major street movements are accommodated. The LOS, queuing, and delay is not a significant concern for the above intersections with the exception of Highway 9 and Lewis Street during the PM peak hour period. During the AM and PM peak hour at Highway 9 and Lewis Street the eastbound movement

experiences large delay causing queue lengths approaching 5 vehicles and 17 vehicles during the AM and PM peak hour periods, respectively.

These deficiencies are current conditions and are to be utilized as a baseline with which to evaluate conditions with the proposed development.

Figure 5 illustrates existing conditions level of service and 95th percentile queue lengths. Capacity analysis sheets are included in the **Appendix**.

3.5 Existing Recommendations

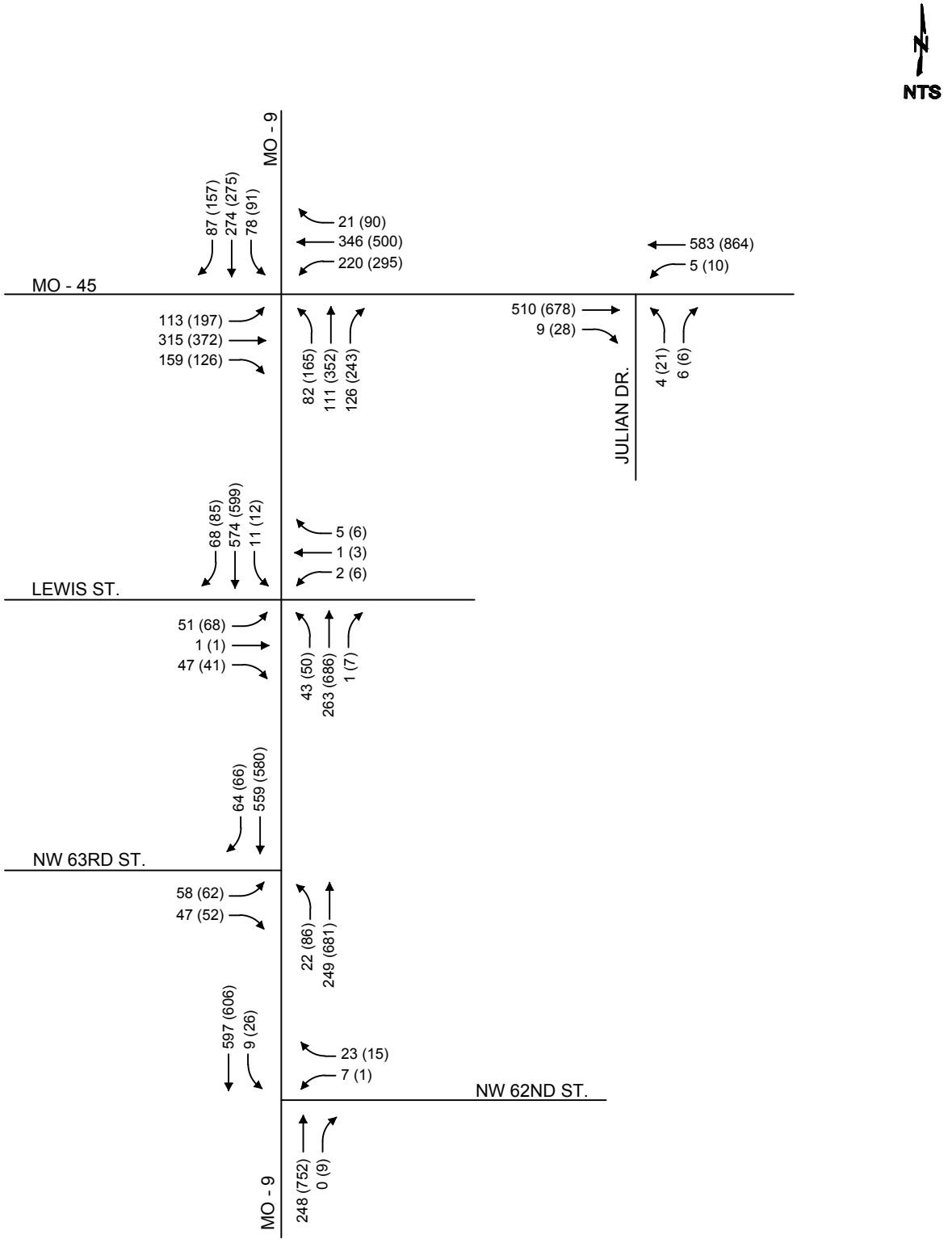
Study intersections are currently operating overall at acceptable levels of service during the AM and PM peak hour periods with the exception of the eastbound side street movements at the unsignalized intersections of Highway 9 with Lewis Street and NW 63rd Street, specifically during the PM peak hour period. Current volumes at the above intersections are on the threshold for satisfying the Peak Hour Warrant, Warrant 3, for signalization. Based on both signal warrant and intersection spacing criteria conditions at these unsignalized intersections will be monitored under the existing plus development scenario to determine whether intersection improvements are necessary. At remaining unsignalized study intersections, queuing is not expected to exceed one vehicle. The following roadway improvements are recommended regardless of whether the proposed development moves forward or not:

Highway 45 & Highway 9

- Complete the concept study, “Highway 9 Corridor Study”, to review Highway 9 in depth and make recommendations for improving capacity, walkability, and aesthetics.

Highway 9 & Lewis Street

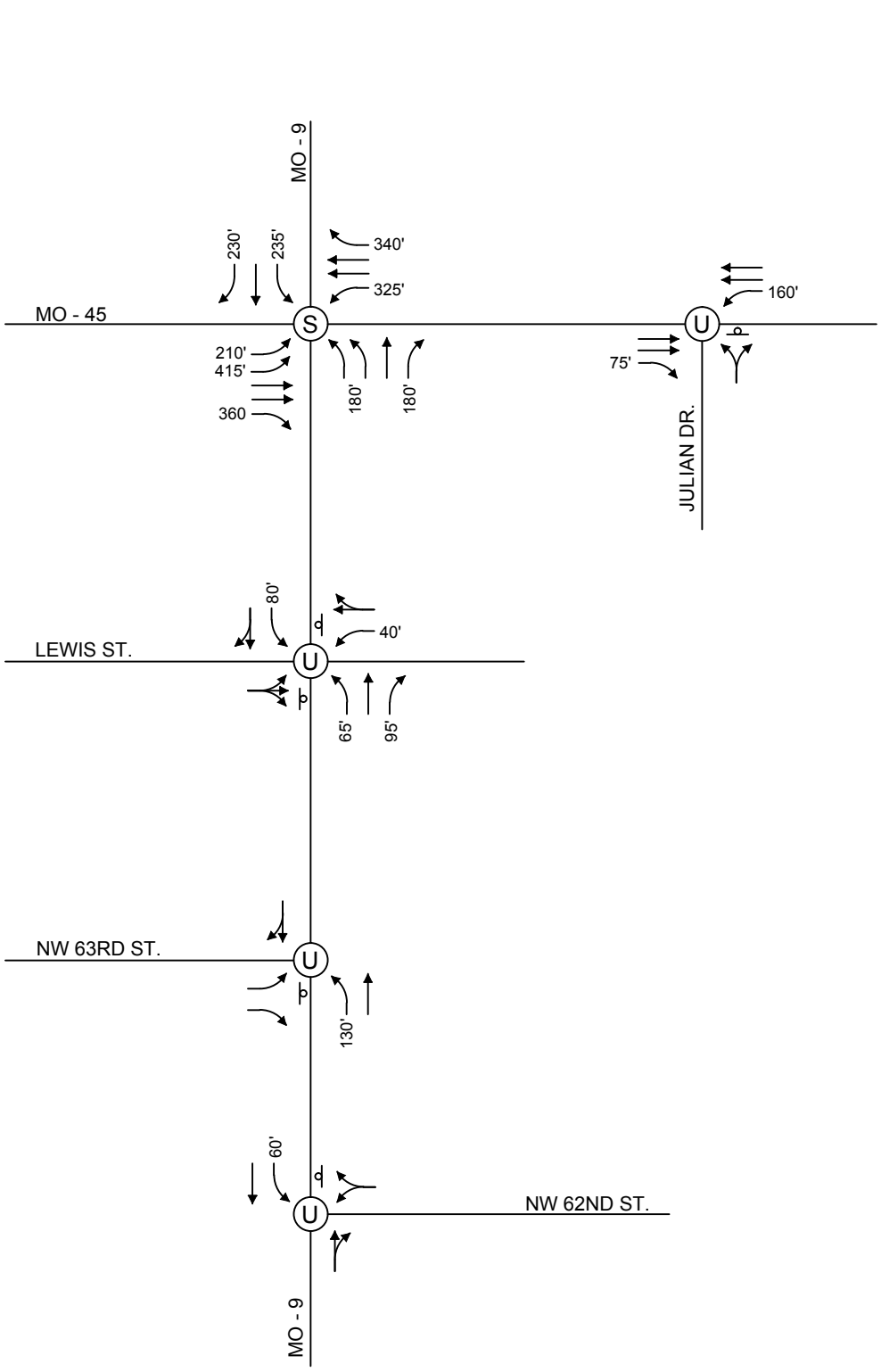
- Add an eastbound left-turn lane at the intersection with storage of approximately 75’.



LEGEND

XX (XX) - AM (PM) Peak Hour Volumes

PROJECT NO: 012-2561	Existing Peak Hour Volumes	OLSSON ASSOCIATES	FIGURE
DRAWN BY: JMS		7301 West 133rd Street Suite 200 Overland Park, KS 66213-4750 TEL 913.381.1170 FAX 913.381.1174	3
DATE: 2/26/2015			



LEGEND

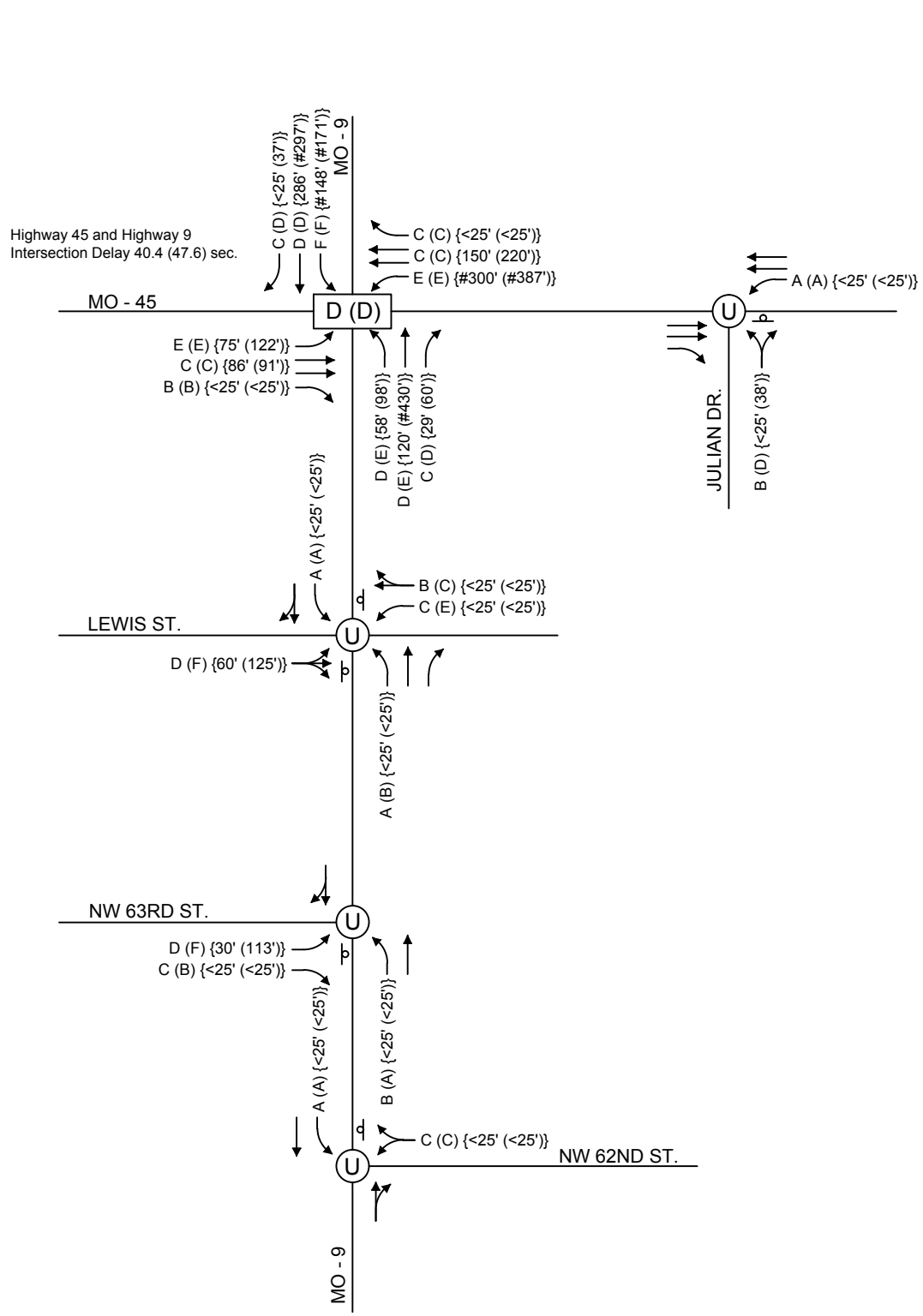
(U) Unsignalized Intersection

(S) Signalized Intersection

Stop Sign

XX' Turn Bay Storage Length

PROJECT NO: 012-2561	Existing Lane Configurations and Traffic Control	OLSSON ASSOCIATES	FIGURE
DRAWN BY: JMS		7301 West 133rd Street Suite 200 Overland Park, KS 66213-4750 TEL 913.381.1170 FAX 913.381.1174	4
DATE: 2/26/2015			



LEGEND

(U) Unsignalized Intersection

X (X) AM (PM) Level of Service

Stop Sign

XX (XX) {XX (XX)}

95th percentile volume exceeds capacity, queue may be longer

PROJECT NO: 012-2561	Existing Level of Service	OLSSON ASSOCIATES	7301 West 133rd Street Suite 200 Overland Park, KS 66213-4750 TEL 913.381.1170 FAX 913.381.1174	FIGURE
DRAWN BY: JMS				5
DATE: 2/26/2015				

4.0 EXISTING PLUS DEVELOPMENT CONDITIONS

The proposed development site consists of a 5,858 square foot convenience market with 18 fueling positions. The existing plus development scenario reviews expected operations of the roadway network based on the addition of proposed development traffic to existing traffic volumes.

4.1 Access

MoDOT *Access Management Guidelines,* located in the MoDOT *Engineering Policy Guide* (EPG) section 940, Access Management, was used to determine whether the proposed driveway meets MoDOT requirements for upstream functional area and corner clearance.

Access to the site is proposed via two full access drives and one right-in/right-out access drive. Drive 1 is an extension of an existing full access drive for a bank connecting to Lewis Street on the east side of Highway 9. Lewis Street is a two-way stop controlled full access drive connecting with Highway 9 with stop signs on Lewis Street. Drive 2 is an extension of an existing private street that will be turned into a full access drive located along Julian Drive approximately 120' south of Highway 45. Drive 3 is a proposed right-in/right-out access drive located on Highway 45 approximately 330' east of the intersection of Highway 9. This distance is 110' shorter than MoDOT's *EPG* Section 940 suggested minimum spacing for driveways. Drive 3 is recommended to be installed as far from Highway 9 to come as close as possible to suggested drive spacing. Capacity analysis results will be included for scenarios with and without the proposed Drive 3. Recommendations for the installation of the proposed Drive 3 are included in **Section 4.6** and are based on capacity analysis and site circulation operations. All distances were measured using a center-to-center criterion.

4.2 Trip Generation and Distribution

Trip generation characteristics expected for the site are shown in **Table 3**. These characteristics are based on trip generation data included in the Institute of Transportation Engineers (ITE) *Trip Generation Manual* (9th Edition). For trip generation determination the site had classifications of Convenience Market with Gasoline Pumps as described in the trip generation manual. To be more conservative with the QuikTrip land use, trip generation was based on fueling positions instead of square footage, which results in a higher trip generation for the proposed site. The proposed development is expected to generate 9,767 daily trips on an average weekday, and 299 trips and 344 trips during the AM and PM peak hours respectively.

Table 3: Proposed Development Trip Generation

Daily Trip Generation									
ITE				Trip Gen.	Daily	Trip Distribution		Daily Trips	
Code/Page	Land Use	Size		Avg. Rate/Eq.	Trips	Enter	Exit	Enter	Exit
853/1670	Convenience Market w/ Gasoline Pumps	18	Positions	Average	9,767	50%	50%	4,884	4,883
Total					**9,767**			**4,884**	**4,883**
AM Peak Hour Trip Generation									
ITE				Trip Gen.	AM Peak	Trip Distribution		AM Peak Hour Trips	
Code/Page	Land Use	Size		Avg. Rate/Eq.	Hour Trips	Enter	Exit	Enter	Exit
853/1671	Convenience Market w/ Gasoline Pumps	18	Positions	Average	299	50%	50%	150	149
Total					**299**			**150**	**149**
PM Peak Hour Trip Generation									
ITE				Trip Gen.	PM Peak	Trip Distribution		PM Peak Hour Trips	
Code/Page	Land Use	Size		Avg. Rate/Eq.	Hour Trips	Enter	Exit	Enter	Exit
853/1672	Convenience Market w/ Gasoline Pumps	18	Positions	Average	344	50%	50%	172	172
Total					**344**			**172**	**172**

After determination of trip generation for the site, pass-by trips (re-assignment) were determined for both the AM and PM peak hour. Trips to a site can be classified as primary or pass-by. The trip generation manual provides information regarding pass-by trips for different classifications of development. Pass-by trips are made by traffic that is already on the roadway and passing the site, versus making a specific trip to the development. According to the ITE Trip Generation Handbook, the pass-by trips during the AM and PM peak hour periods for a convenience market with gasoline pumps varies from 48% to 87%. To be conservative 40% pass-by trips during the AM and PM peak hour was used for this study. Considering pass-by, the site is expected to generate 179 primary and 120 pass-by trips during the AM peak hour and 206 primary and 138 pass-by trips during the PM peak hour. Complete trip generation data considering pass-by trips is illustrated in **Table 4**. The totals seen in **Table 4** were added to existing traffic count data for analysis of the existing plus development scenario.

Table 4: Trip Generation – Pass-by

Land Use	AM Peak Hour Trips		Pass-by Calculations				
			Pass-by	Pass-by Trips		Primary Trips	
	Enter	Exit	Percentage	Enter	Exit	Enter	Exit
Convenience Market w/Gas Pumps	150	149	40%	60	60	90	89
Total	**150**	**149**		**60**	**60**	**90**	**89**

Land Use	PM Peak Hour Trips		Pass-by Calculations				
			Pass-by	Pass-by Trips		Primary Trips	
	Enter	Exit	Percentage	Enter	Exit	Enter	Exit
Convenience Market w/Gas Pumps	172	172	40%	69	69	103	103
Total	**172**	**172**		**69**	**69**	**103**	**103**

Trip distribution was developed for the proposed site based on review of the area and the existing traffic volumes. The distribution of the trips generated from the site during the AM and PM peak hours are illustrated in **Table 5**.

Table 5: Trip Distribution

Trip Distribution			
	Primary	Pass-by	
	AM & PM	AM	PM
	Enter / Exit	Enter / Exit	Enter / Exit
North via MO-9	20%	25% / 15%	15% / 25%
South via MO-9	20%	15% / 25%	25% / 15%
East via MO-45	30%	30%	30%
West via MO-45	25%	30%	30%
West via Lewis St.	2%	0%	0%
West via NW 63rd St.	1%	0%	0%
East via NW 62nd St.	1%	0%	0%
South via Julian Dr.	1%	0%	0%
Total	100%	100%	100%

The AM and PM peak hour trips for the proposed development, following distribution and assignment to the roadway network, are illustrated in **Figure 6**. A separate trip assignment was completed, based on the above distribution, to further evaluate Drive 3. AM and PM peak hour trips for the proposed development without Drive 3 are illustrated in **Figure 7**. The resulting existing plus development peak hour traffic volumes from each of the trip assignments are illustrated in **Figure 8** and **Figure 9**.

4.3 Turn Lane Analysis

MoDOT *Access Management Guidelines,* located in the MoDOT *Engineering Policy Guide* (EPG) section 940.9.8, were used to determine whether auxiliary turn lanes are warranted at the proposed development drives and drives along Highway 9 and Highway

45. In addition to the turn lane warrant, vehicular queuing, movement and intersection level of service, as well as volume of turning vehicles was used when considering the need for a turn lane. The guidelines state that dedicated left and right-turn lanes should be provided in situations where traffic volumes and speeds are relatively high and conflicts are likely to develop at public road intersections and driveways between through and turning traffic.

Right-Turn

Using existing plus development volumes at the study intersections, EPG sections 940.9.8 and 940.9.9 were utilized to determine if existing plus development conditions warrant the need for right-turn lanes.

Following the procedure outline in the EPG, it was determined that existing plus development volumes warrant an additional right-turn lane on Highway 45 and Drive 3 in the eastbound direction for the scenario with Drive 3 as well as Highway 9 with Lewis Street and 63rd Street in the southbound direction for all scenarios. Warrants for right-turn lanes at Lewis Street and 63rd Street are related to background traffic volumes and are likely not in place due to right-of-way constraints. Right-turn lane warrant analysis sheets can be found in the **Appendix**.

Left-Turn

EPG section 940.9.1 was used to determine if auxiliary left-turn lanes are currently in place for all study intersections.

Recommendations for lengths of suggested auxiliary lanes are discussed in **Section 4.7**. Operations of the proposed drive location and queuing along the roadway will be reviewed and discussed later in the report.

4.4 Signal Warrant Analysis

Signal warrant analysis for the existing plus development scenario was performed using the methodologies described in **Section 3.3** as well as additional criteria commonly used by municipalities to help determine the need for a signal based on projected volumes. Two different warrants were reviewed, Eight-Hour Warrant (Warrant 1) and the Peak Hour Warrant (Warrant 3).

To account for Warrant 1, Eight-Hour Warrant, two conditions were evaluated, Condition A – Minimum Vehicular Volume and Condition B – Interruption of Continuous Traffic. This warrant is based on accepted criteria used by agencies such as MoDOT for the construction year at an intersection using projected volumes. Signal warrant analysis for the Eight-Hour Warrant was completed for the intersection of Highway 9 with Lewis Street. Based on existing plus development volumes with or without the proposed Drive 3, the intersection does not satisfy the Eighth-Hour Warrant criteria for the existing plus development conditions.

Signal warrant analysis for Warrant 3, Peak Hour Warrant, was completed for the intersections of Highway 9 with Lewis Street and NW 63rd Street and Highway 45 with Julian Drive under the existing plus development scenarios with and without Drive 3. With or without the proposed Drive 3 in place the intersections of Highway 9 with Lewis Street and 63rd Street are on the threshold for satisfying the peak hour warrant criteria based on Warrant 3 during the PM peak hour period only.

No other warrants for signalization are satisfied considering the City of Parkville to be a part of the Greater Kansas City Metropolitan Area and no reduction factor applied as described in **Section 3.3**. The spacing between the intersections of Highway 9 with Highway 45 and Lewis Street does not meet MoDOT EPG guidelines for signalized intersections. Based on signal warrants and spacing criteria operations as an unsignalized intersection will be analyzed to determine if the intersection may be an appropriate location for signal control.

4.5 Capacity Analysis

Capacity analysis was performed using the methodologies described in **Section 3.4**. For the existing plus development scenario signal timings remain unchanged from the existing scenario to provide a direct impact of the anticipated development volumes at the Highway 45 and Highway 9 intersection with and without the proposed Drive 3.

Table 6 represents the LOS and delay associated with the signalized study intersection. Capacity analysis sheets are included in the **Appendix**.

Table 6: Existing plus Development Signalized Intersection Analysis

Intersection	AM Peak Hour *	PM Peak Hour *
Highway 45 and Highway 9 with Drive 3	D (43.1)	D (53.0)
Highway 45 and Highway 9 without Drive 3	D (42.1)	D (51.5)

*LOS (Delay in Seconds)

With the proposed Drive 3 in place the intersection of Highway 45 and Highway 9 is expected to operate at a LOS D during the AM and PM peak hour periods. Some individual movements are expected to operate at lower LOS during the peak hour periods as discussed below:

- During the AM peak hour period the southbound left-turn movement is expected to continue to operate at LOS F and the eastbound and westbound left-turn movements are expected to continue to operate at LOS E.
- During the PM peak hour period the northbound and southbound left-turn movements are expected to operate at LOS F while the eastbound, westbound left-turn and northbound thru movements are expected to continue to operate at LOS E. During the PM peak hour period the westbound left-turn 95th-percentile queue length has the possibility of exceeding the available storage length and the

northbound thru movements are expected to queue back near the intersection of Highway 9 and Lewis Street as was present in the existing conditions

Existing plus development capacity analysis results detailed above indicate that during the peak hour periods the signalized intersection of Highway 45 and Highway 9 are expected to continue to experience deficiencies present in the existing conditions with minor increases in delay and queuing. Intersection deficiencies were present with the 2012 study and MoDOT improvements to the intersection did not address all deficiencies, specifically issues pertaining to the northbound through, westbound left-turn, southbound left-turn, and southbound through movements. Geometric improvements to the intersection of Highway 9 and Highway 45 should be addressed within the Highway 9 study and should accommodate future traffic volumes.

Capacity analyses were also completed for unsignalized intersections. Based on existing plus development analysis with Drive 3, all individual movements are expected to operate at similar LOS of the existing conditions with the following exceptions:
<u>Highway 45 & Julian Drive</u>

- The northbound movement is expected to operate at LOS F during the PM peak hour.
    - Striping the intersection for northbound traffic could be used to better define lane assignments at the intersection to ensure proper usage and minimize capacity impacts.

Unsignalized side street movements can be expected to operate at a lower level of service during the peak hour periods as higher major street movements are accommodated.

The existing plus development signalized analysis without Drive 3 have similar LOS to the existing plus development with Drive 3 scenario. Without the proposed right-in/right-out Drive 3 the intersection of Highway 45 and Highway 9 is expected to operate similarly to operations with Drive 3 with the following exceptions. The northbound and southbound thru 95th-percentile queue lengths are expected to extend further than queue lengths anticipated with Drive 3. Additionally, operations at Lewis Street are expected to be worse without Drive 3 due to increased traffic expected to utilize this entrance to enter the surrounding roadway network. Without the proposed Drive 3 the intersection of Highway 45 and Julian Drive is expected to operate slightly better during the PM peak hour period.

In the existing plus development analysis for both with and without Drive 3 scenarios the westbound side street movements operate at a lower level of service at Highway 9 and Lewis Street compared with existing conditions. This intersection is not expected to have excessive queuing along Highway 9 during the critical peak hour periods. The eastbound movement from Lewis Street is expected to continue to operate with deficiencies. Existing capacity analysis indicates that vehicles utilizing this movement are currently experiencing large delay at the intersection and this is expected to continue to be the case with the proposed development in place. If these conditions continue, vehicles could be expected to utilize other public roadways to avoid this intersection as there have

recently been improvements made at Lewis Street's connection with Highway 45 just northwest of the study area. Additionally, these conditions are expected to be limited to the peak hour periods, primarily the PM peak hour.

The existing plus development intersection geometrics and traffic control for the study intersections are illustrated in **Figure 10**, and each intersection's level of service and 95th percentile queue lengths with Drive 3 is shown in **Figure 11** and without Drive 3 in **Figure 12**. Capacity and 95th-percentile queuing analysis sheets are included in the **Appendix**.

4.6 Site Circulation

Layouts of the site with and without the proposed right-in/right-out, Drive 3 along Highway 45 were reviewed. Based on capacity analysis results, Drive 3 offers an overall improvement on the adjacent intersections. Operations at the signalized intersection of Highway 45 and Highway 9 have slight differences in movement delay and overall intersection delay.

Operational analysis at study area intersections depicts that conditions with and without Drive 3 study intersections are expected to operate at acceptable levels of service. Although operations with and without Drive 3 are similar, the internal site circulation benefits from the addition of Drive 3. With Drive 3 the site is more centrally loaded and provides easier access to and from the development. Access to the proposed QuikTrip is improved for vehicles entering off of Highway 45. With the proposed Drive 3 in place vehicles are able to directly enter the QuikTrip development rather than travel on frontage roads between other developments. Consideration should be given to control vehicles east and westbound on the internal site drive to allow vehicles entering the site free-flow.

According to the MoDOT *EPG* a right-in/right-out access drive should be located a minimum of 440' away from a major intersection. The proposed site plan shows the access drive approximately 330' east of the intersection of Highway 9 and Highway 45. Although this does not meet MoDOT guidelines, due to analysis of its operations, similarities in operations at the study area intersections and considering the improvements of site circulation, Drive 3 is recommended to be installed as far from Highway 9 to come as close as possible to suggested drive spacing. .

4.7 Existing plus Development Recommendations

Signal warrants at Highway 9 and Lewis Street are just over the threshold for warranting a signal in the PM peak hour period only. This is primarily due to existing background volumes. Meeting one of the eight warrants for signalization does not indicate that a signal be installed considering none of the other warrants for signalization are met at the intersection as well as MoDOT recommended spacing criteria. Considering this, operations at the unsignalized intersection of Highway 9 and Lewis Street can be expected to decrease slightly for side street traffic, specifically the eastbound movement. However, vehicles utilizing the eastbound leg at Highway 9 and Lewis Street may be inclined to utilize other public streets to enter Highway 9 via the Lewis Street access to Highway 45 just northwest of the site due to operations at the intersection. With the

addition of the proposed development volumes, the following roadway improvements are recommended:

Highway 9 & Lewis Street

- Restripe the existing westbound left-turn lane to allow for a 75' storage lane.

Highway 45 & Drive 3

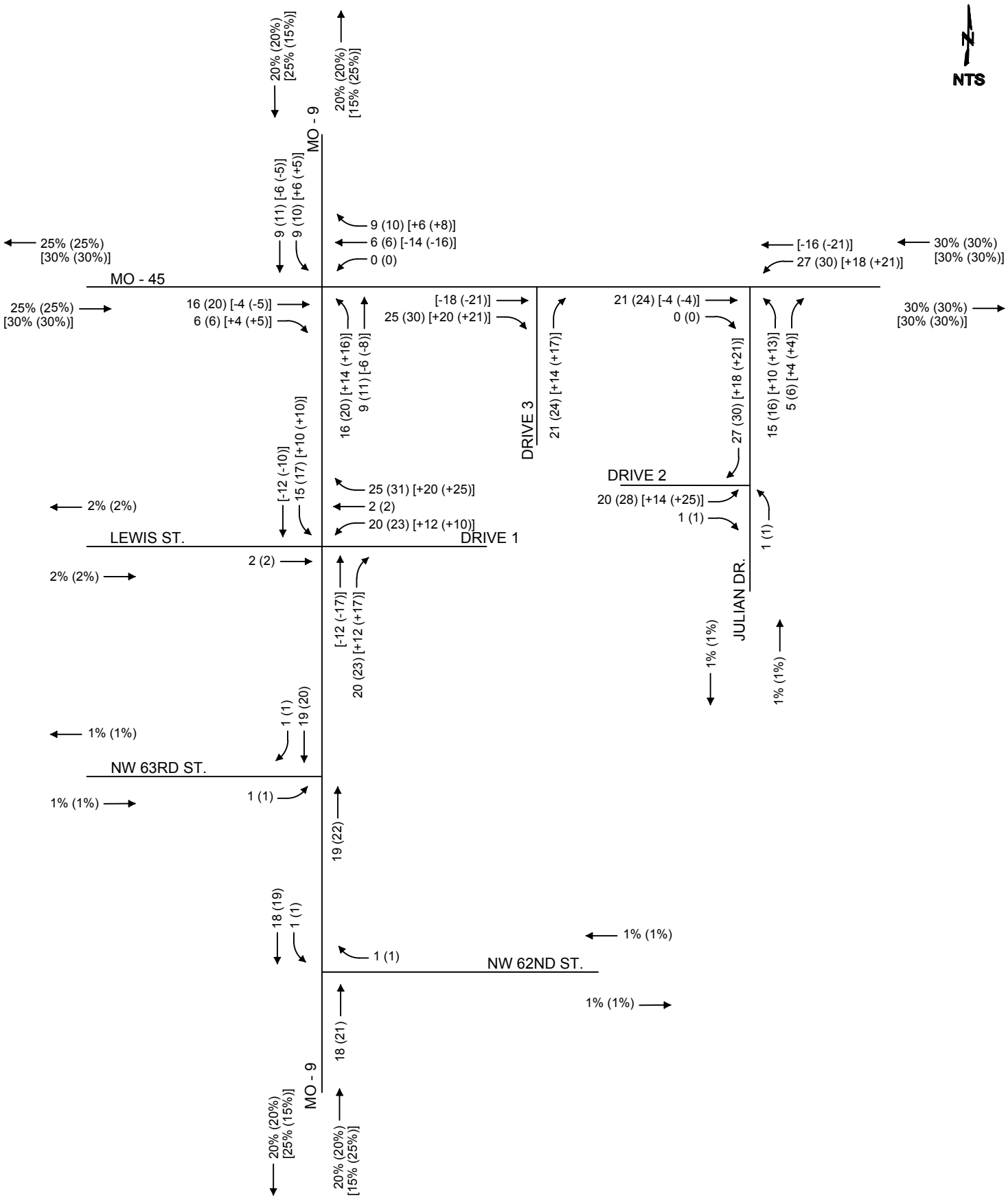
- Capacity analysis with and without the proposed Drive 3 is similar, however, internal site circulation is improved with the right-in/right-out centrally located drive. Drive 3 is recommended to be installed as far from Highway 9 to come as close as possible to suggested drive spacing.
- Install a 150' minimum eastbound right-turn lane (plus taper length) at the Drive 3 entrance.
- Consideration should be given to control vehicles east and westbound on the internal site drive to allow vehicles entering the site free-flow.

Highway 45 & Site Drives

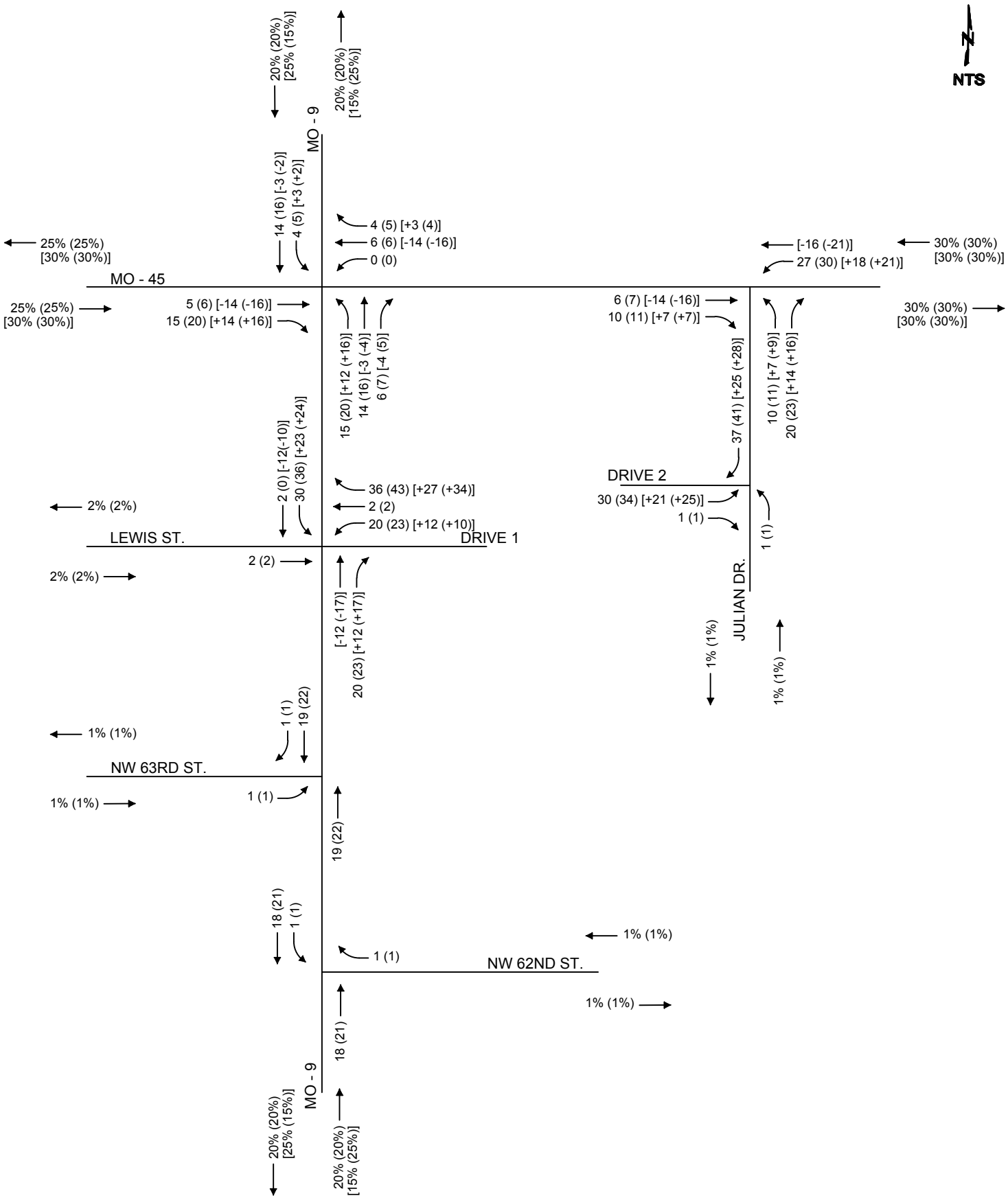
- All proposed site drives shall have a minimum of 75' throat distance and are recommended to be installed with the development.

Highway 45 & Julian Drive

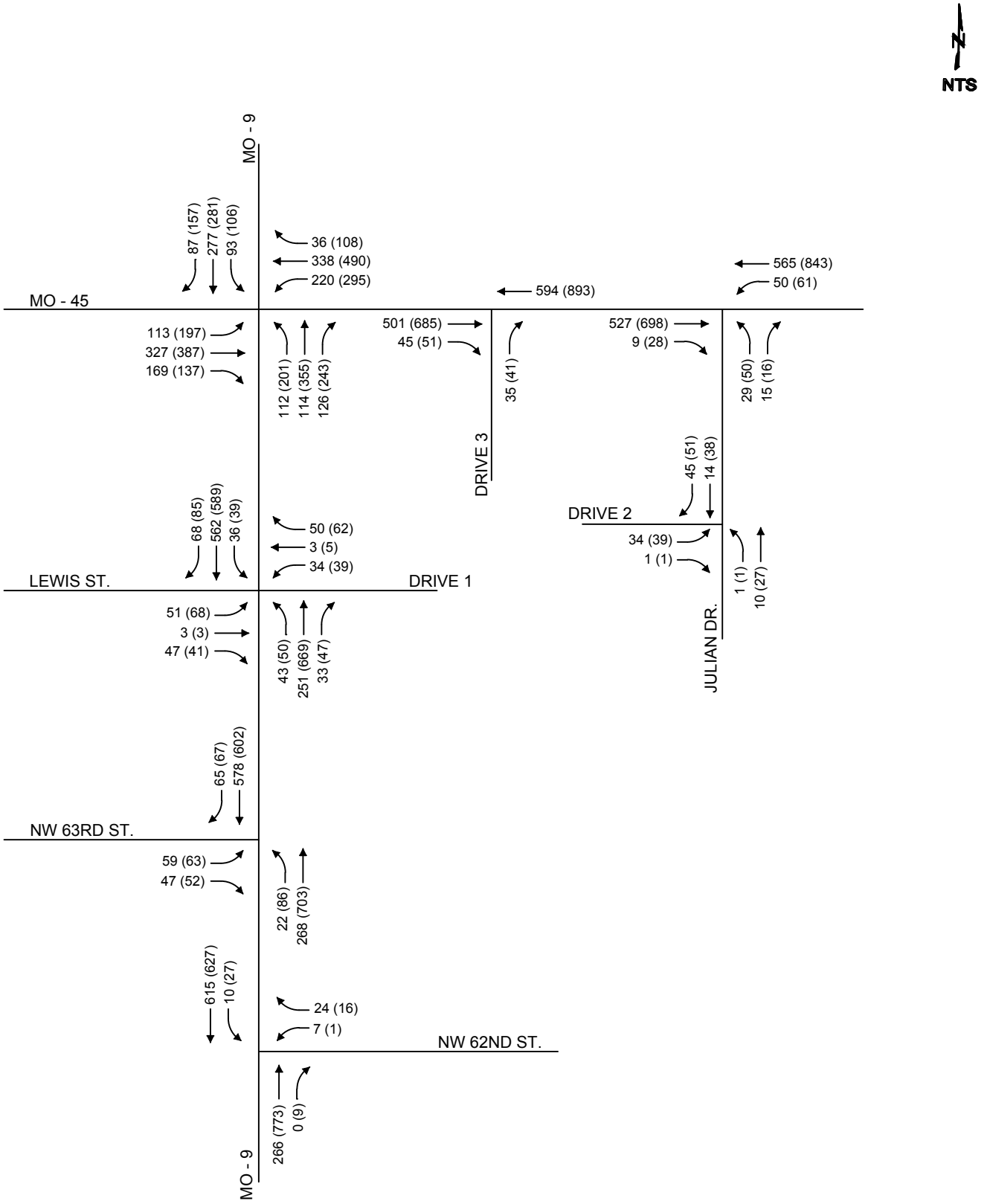
- Provide striping for two northbound exiting lanes and a single entering lane along the length of available 3-lane roadway to define lane assignment, approximately 90'.



PROJECT NO: 012-2561	Existing + Development Peak Hour Trips with Drive 3	OLSSON ASSOCIATES 7301 West 133rd Street Suite 200 Overland Park, KS 66213-4750 TEL 913.381.1170 FAX 913.381.1174	FIGURE
DRAWN BY: JMS			6
DATE: 2/26/2015			



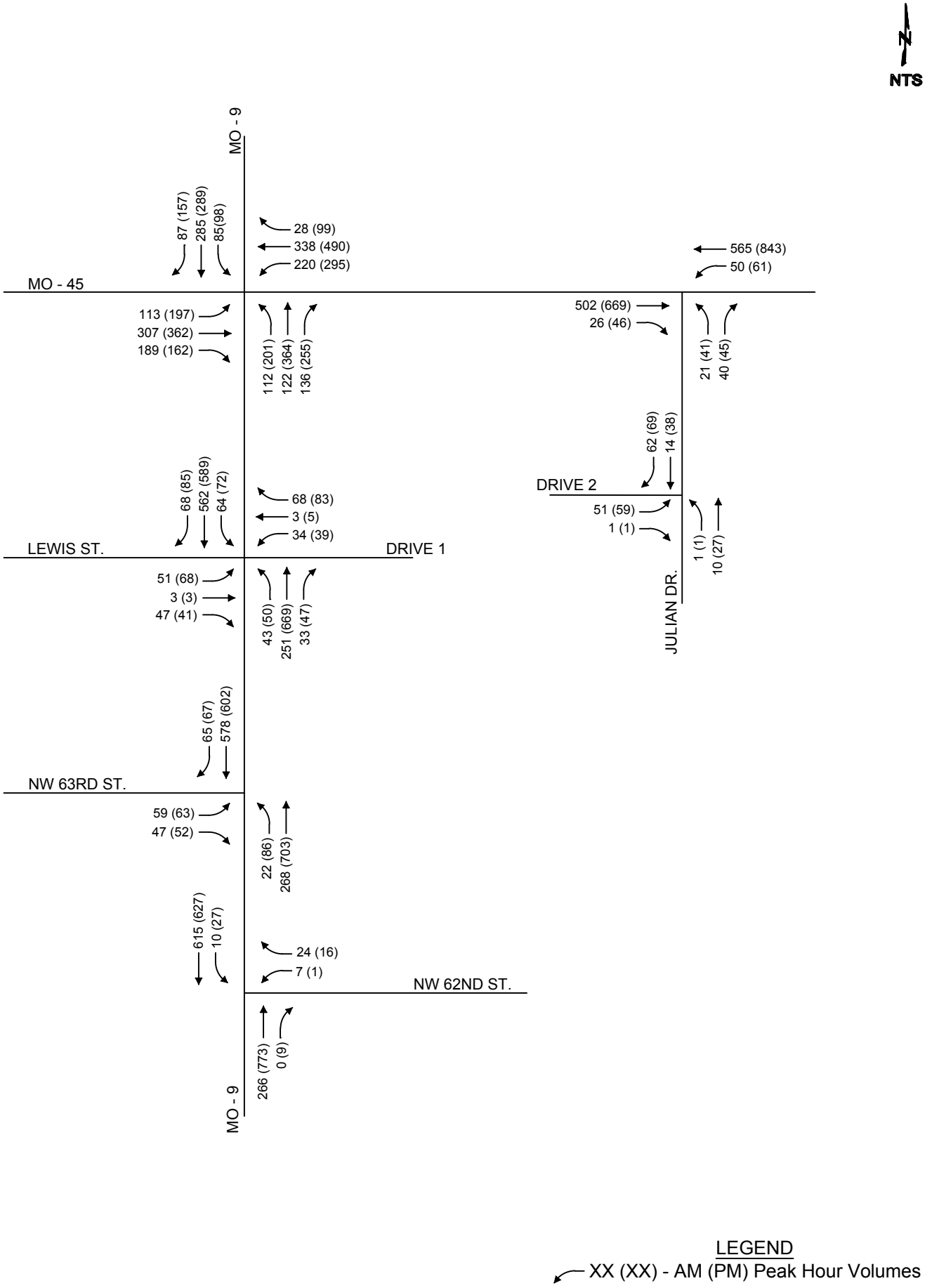
PROJECT NO: 012-2561	Existing + Development Peak Hour Trips without Drive 3	OLSSON ASSOCIATES	FIGURE
DRAWN BY: JMS		7301 West 133rd Street Suite 200 Overland Park, KS 66213-4750 TEL 913.381.1170 FAX 913.381.1174	7
DATE: 2/26/2015			



LEGEND

XX (XX) - AM (PM) Peak Hour Volumes

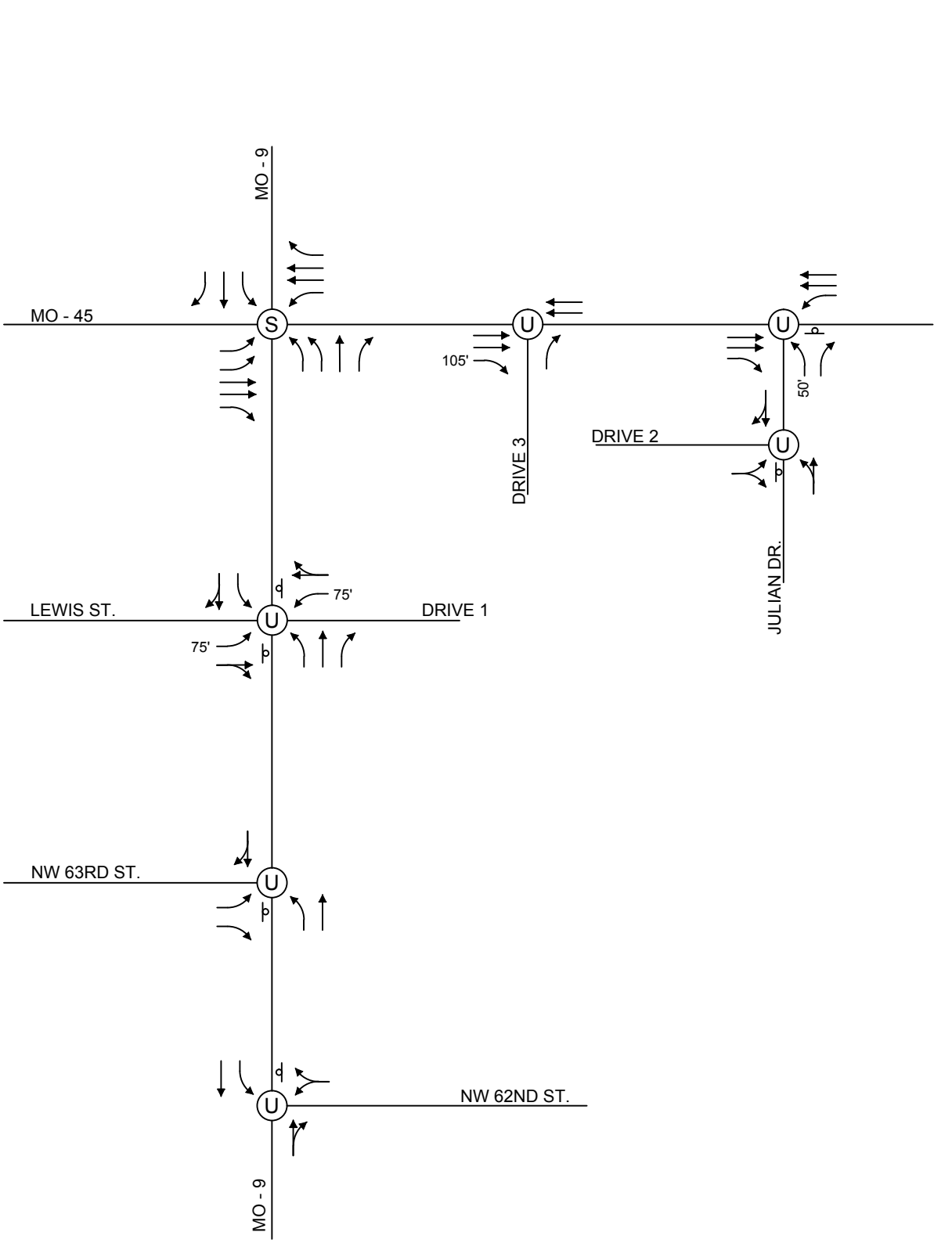
PROJECT NO: 012-2561	Existing + Development Peak Hour Volumes with Drive 3	OLSSON ASSOCIATES	FIGURE
DRAWN BY: JMS		7301 West 133rd Street Suite 200 Overland Park, KS 66213-4750 TEL 913.381.1170 FAX 913.381.1174	8
DATE: 2/26/2015			



LEGEND

XX (XX) - AM (PM) Peak Hour Volumes

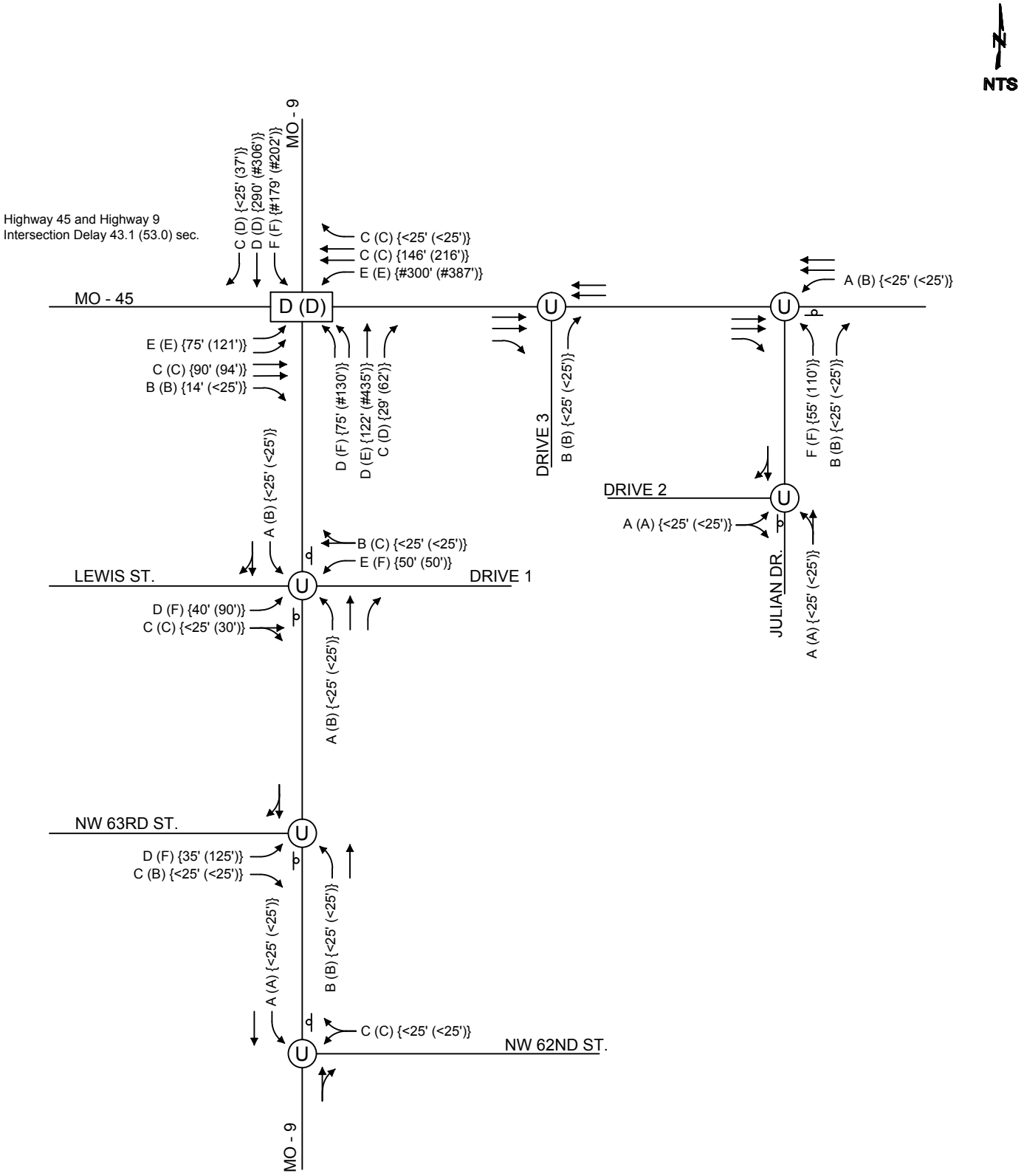
PROJECT NO: 012-2561	Existing + Development Peak Hour Volumes without Drive 3	OLSSON ASSOCIATES	7301 West 133rd Street Suite 200 Overland Park, KS 66213-4750 TEL 913.381.1170 FAX 913.381.1174	FIGURE
DRAWN BY: JMS				9
DATE: 2/26/2015				



LEGEND

- (U) Unsignalized Intersection
- (S) Signalized Intersection
- Stop Sign
- XX' Turn Bay Storage Length
- — — Proposed Drive 3

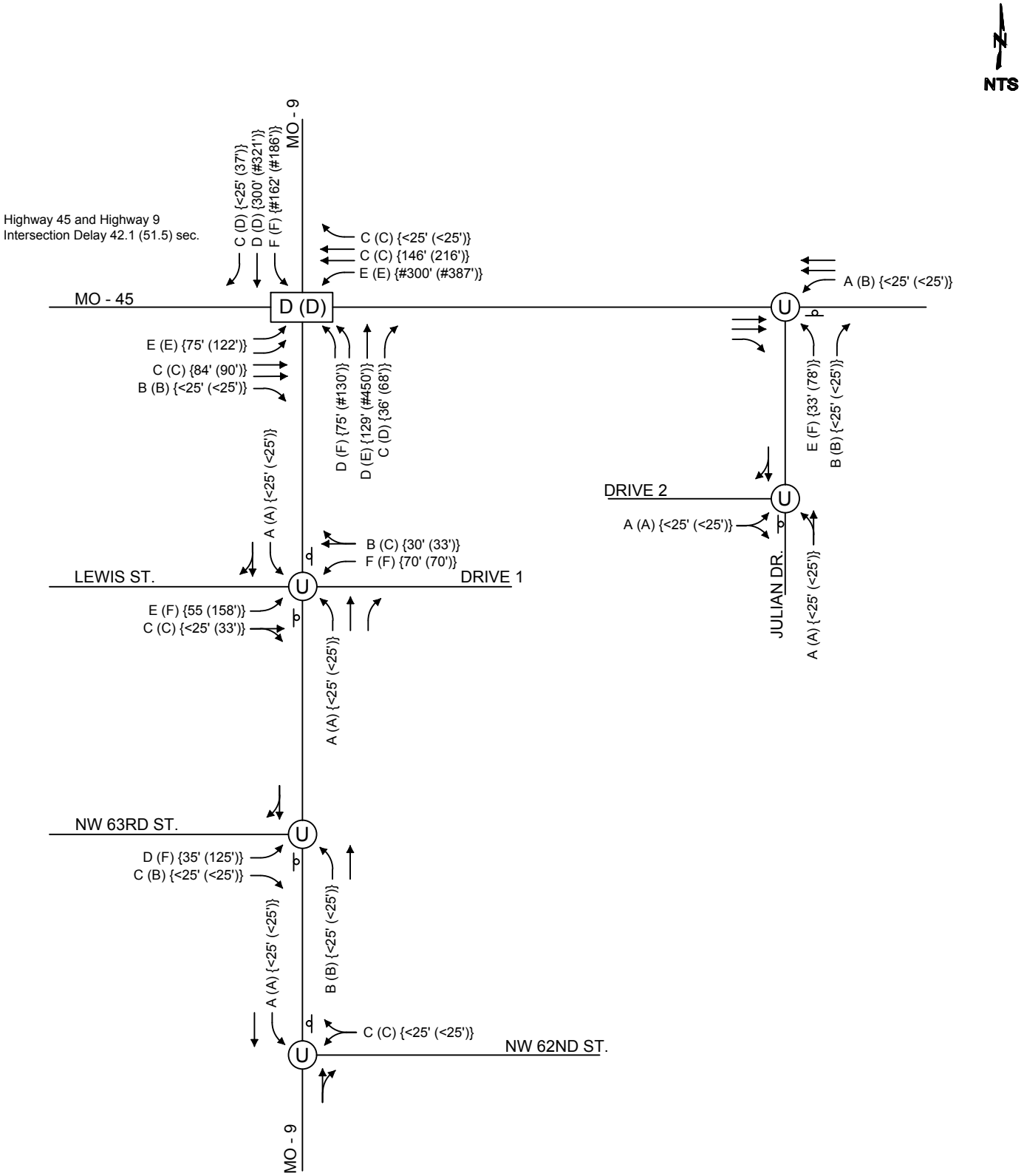
PROJECT NO: 012-2561	Existing + Development Lane Configurations and Traffic Control	OLSSON ASSOCIATES	FIGURE
DRAWN BY: JMS		7301 West 133rd Street Suite 200 Overland Park, KS 66213-4750 TEL 913.381.1170 FAX 913.381.1174	10
DATE: 2/26/2015			



LEGEND

- (U) Unsignalized Intersection
- [X (X)] AM (PM) Level of Service
- Stop Sign
- XX (XX) {XX (XX)} — AM (PM) Level of Service; {AM (PM)} 95th Percentile Queue Length
- # 95th percentile volume exceeds capacity, queue may be longer

PROJECT NO: 012-2561	Existing + Development Level of Service with Drive 3	OLSSON ASSOCIATES	FIGURE
DRAWN BY: JMS		7301 West 133rd Street Suite 200 Overland Park, KS 66213-4750 TEL 913.381.1170 FAX 913.381.1174	11
DATE: 2/26/2015			



LEGEND

- (U) Unsignalized Intersection
- X (X) AM (PM) Level of Service
- Stop Sign
- XX (XX) {XX (XX)} AM (PM) Level of Service {AM (PM)} 95th Percentile Queue Length
- # 95th percentile volume exceeds capacity, queue may be longer

PROJECT NO: 012-2561	Existing + Development Level of Service without Drive 3	OLSSON ASSOCIATES	FIGURE
DRAWN BY: JMS		7301 West 133rd Street Suite 200 Overland Park, KS 66213-4750 TEL 913.381.1170 FAX 913.381.1174	12
DATE: 2/26/2015			

5.0 FUTURE YEAR 2035 CONDITIONS

The future year 2035 conditions consider the proposed QuikTrip development plus growth of background traffic volumes. To account for any potential growth in the study area, MoDOT agreed to a growth rate of 1% annually. The growth rate was applied to existing thru volumes at the study intersections and to thru and turning movements at the intersection of Highway 45 and Highway 9 to obtain future year background volumes.

The background additional volumes were added to the existing plus development volumes resulting in future year 2035 traffic volumes, illustrated in **Figure 13**. Future year 2035 intersection geometrics and traffic control include recommendations listed in **Section 4.6** for the study area intersections and are illustrated in **Figure 14.** Future recommendations to the intersection of Highway 45 and Highway 9 include the addition of dual left-turn lanes for the westbound direction as well as extending the southbound left-turn lane to 300' to accommodate future background traffic growth. Highway 9 was widened to include an additional northbound lane and southbound lane starting north of Highway 45 proceeding south past Lewis Street due to background traffic growth.

5.1 Capacity Analysis

Capacity analysis was performed using the methodologies described in **Section 3.4**. **Table 7** represents the LOS and delay associated with the signalized study intersection of Highway 45 and Highway 9 with the assumption Drive 3 has been constructed as well as the improvements mentioned at the beginning of this section. To complete signalized capacity analysis, signal timings were reviewed and updated as necessary to account for changes in traffic volumes and intersection geometrics at study intersections for the future year 2035. Capacity analysis sheets are included in the **Appendix**.

Table 7: Future Year 2035 Signalized Intersections Analysis

Intersection	AM Peak Hour *	PM Peak Hour *
Highway 45 and Highway 9	D (38.7)	D (46.5)

*LOS (Delay in Seconds)

Overall, the signalized study intersection of Highway 45 and Highway 9 is expected to operate at a LOS D. All left-turn movements at the intersection are expected to operate at a LOS E during the AM and PM peak hour periods. Queuing at the intersection is not expected to be a concern as no movements queue lengths exceed their available storage lengths with recommended improvements.

Capacity analyses were also completed for unsignalized intersections. Based on existing plus development analysis with Drive 3, all individual movements are expected to operate at similar LOS of the existing plus development conditions. Improvements along Highway 9 can be expected to improve operations at side-streets along the improved stretch as depicted in the figures. Without the additional thru lanes the queue length at Highway 45

and Highway 9 is expected to extend past the adjacent intersection of Highway 9 and Lewis Street during the PM peak hour. Side-street movements at Julian Drive and Lewis Street are expected to continue to operate with some deficiencies. Unsignalized side street movements can be expected to operate at a lower level of service during the peak hour periods as higher major street movements are accommodated.

The future scenario intersection geometrics and traffic control for the study intersections are illustrated in **Figure 14**, individual intersection and movement level of service and 95th percentile queue lengths are shown in **Figure 15**. Capacity analysis sheets are included in the **Appendix**.

5.2 Future Year 2035 Recommendations

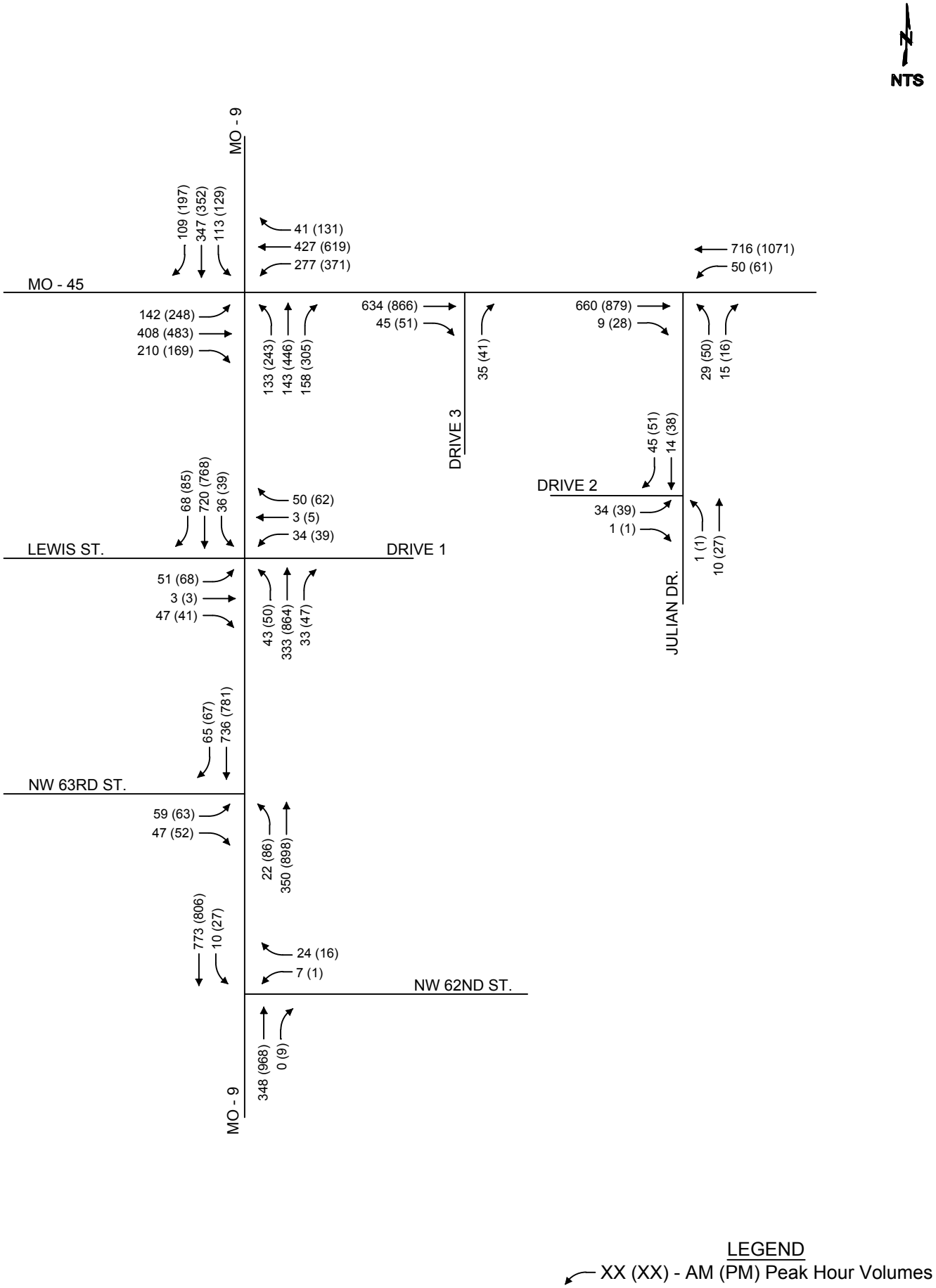
Increased queuing and delay along the corridor during the future scenario can be attributed to an increase in background traffic and is not associated with the proposed development. Signalized and unsignalized intersections are expected to operate at unacceptable levels or service without improvements along Highway 9 and at the intersection of Highway 45 and Highway 9. With the addition of the future growth volumes, the following roadway improvements are recommended:

Highway 45 & Highway 9

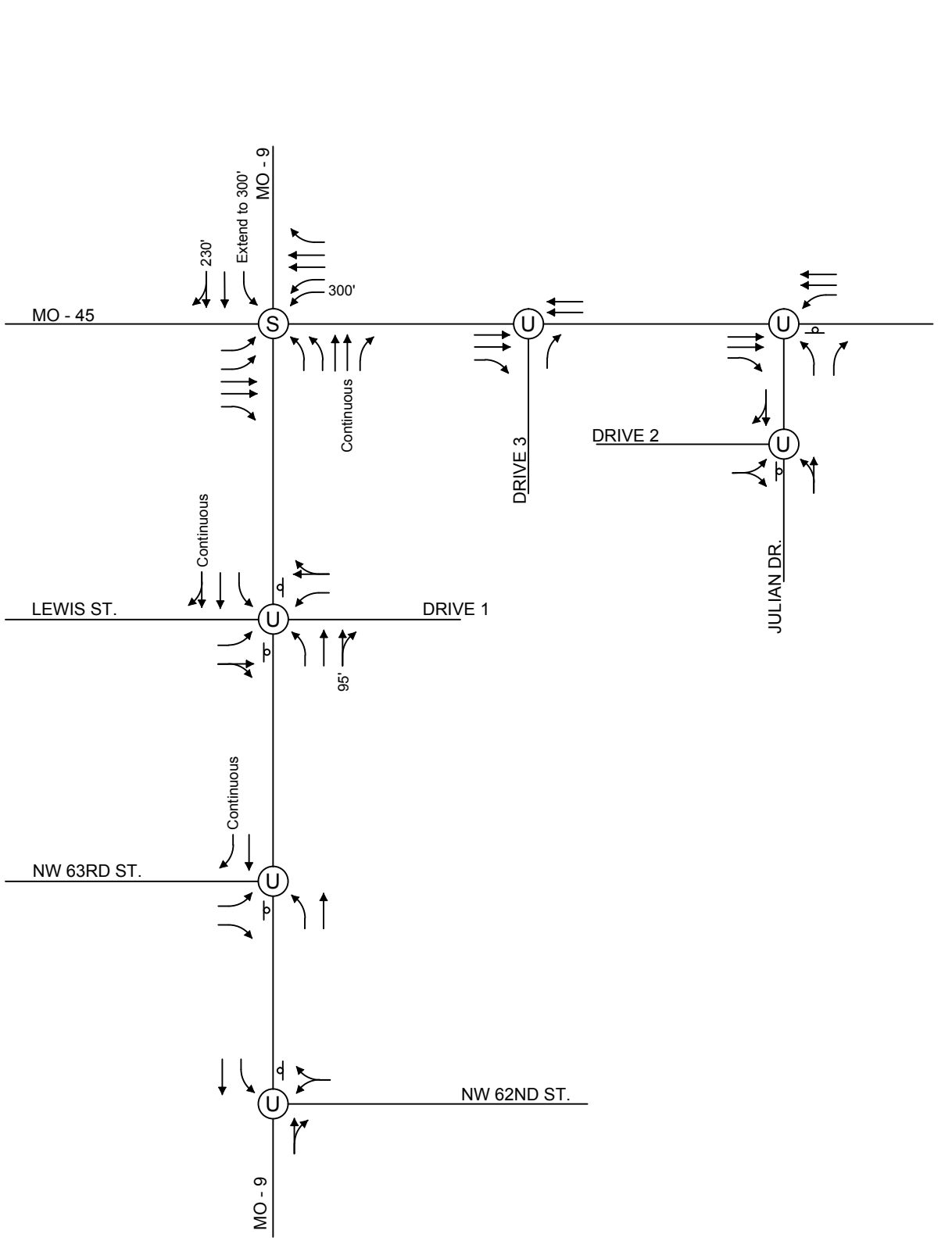
- Add a northbound thru lane extending from the existing northbound right-turn lane at Highway 9 and Lewis Street.
    - This improvement is recommended due to potential queuing between the intersections of Highway 45 and Lewis Street along Highway 9.
- Modify the southbound right-turn lane to a right/thru-lane that will continue south to 63rd Street.
- Add an additional westbound left-turn lane with a 300’ storage lane.
- Extend the southbound left-turn lane to 300’

Highway 9 & NW 63rd Street

- Add a southbound right-turn lane that will terminate the thru lane that extends past Highway 45 along Highway 9.



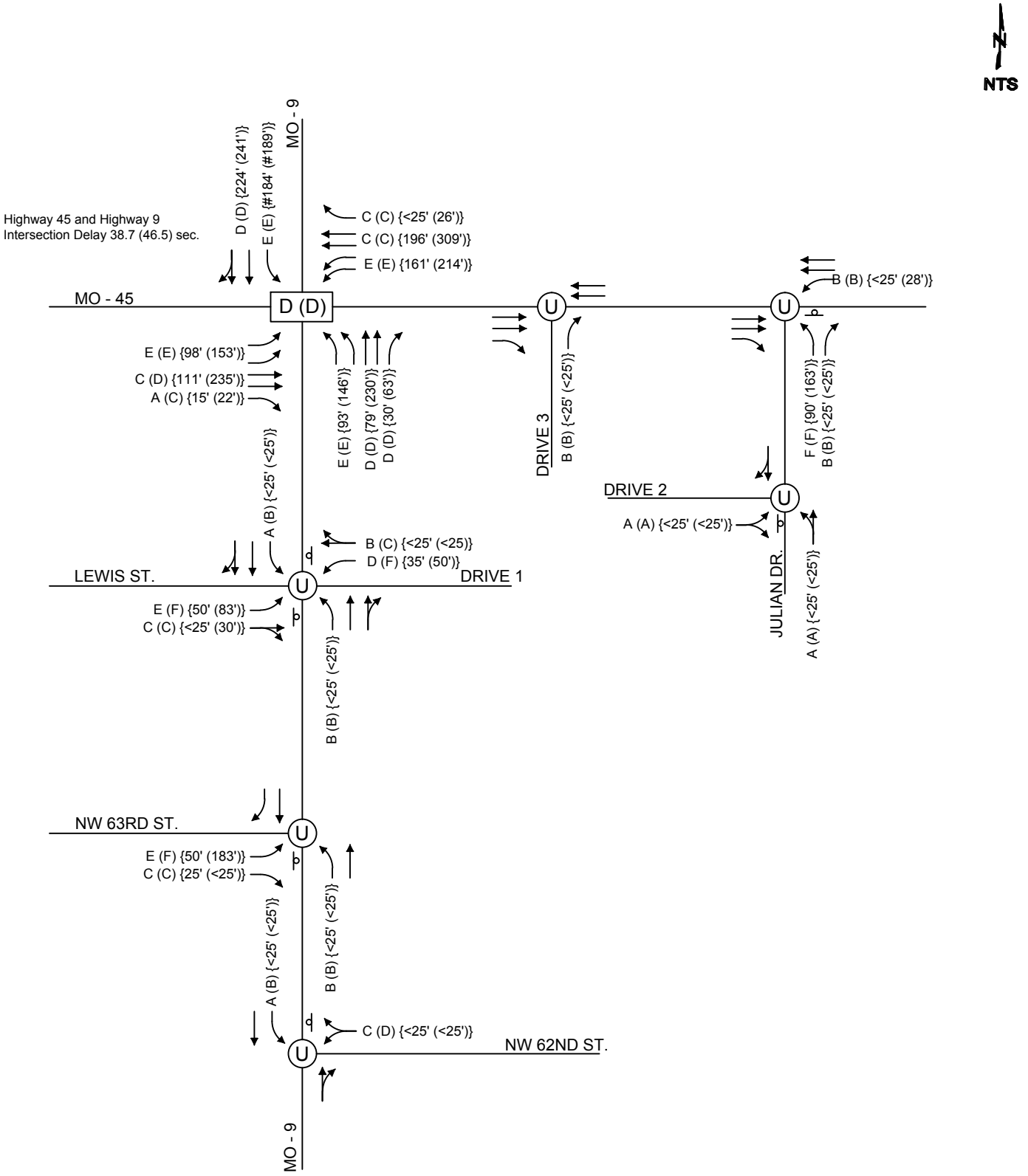
PROJECT NO: 012-2561	Future Year 2035 Peak Hour Volumes	OLSSON ASSOCIATES	FIGURE
DRAWN BY: JMS		7301 West 133rd Street Suite 200 Overland Park, KS 66213-4750 TEL 913.381.1170 FAX 913.381.1174	13
DATE: 2/26/2015			



LEGEND

- (U) Unsignalized Intersection
- (S) Signalized Intersection
- Stop Sign
- XX' Turn Bay Storage Length

PROJECT NO: 012-2561	Future Year 2035 Lane Configurations & Traffic Control	OLSSON ASSOCIATES	FIGURE
DRAWN BY: JMS		7301 West 133rd Street Suite 200 Overland Park, KS 66213-4750 TEL 913.381.1170 FAX 913.381.1174	14
DATE: 2/26/2015			



LEGEND

- (U) Unsignalized Intersection
- [X (X)] AM (PM) Level of Service
- Stop Sign
- XX (XX) {XX (XX)} — AM (PM) Level of Service; {AM (PM)} 95th Percentile Queue Length
- # 95th percentile volume exceeds capacity, queue may be longer

PROJECT NO: 012-2561	Future Year 2035 Level of Service	OLSSON ASSOCIATES	FIGURE
DRAWN BY: JMS		7301 West 133rd Street Suite 200 Overland Park, KS 66213-4750 TEL 913.381.1170 FAX 913.381.1174	15
DATE: 2/26/2015			

6.0 RECOMMENDATIONS & CONCLUSIONS

This study considered the impact of a proposed convenience market with fueling positions located in the southeast quadrant of the intersection of Highway 45 and Highway 9 in Parkville, Missouri. The study determined the impacts that the proposed QuikTrip will have on traffic operations. Based on the results of the capacity analyses and field observations, the following conclusions and recommendations are made for the study area.

Existing Conditions

Study intersections are currently operating overall at acceptable levels of service during the AM and PM peak hour periods with the exception of the eastbound side street movements at the unsignalized intersections of Highway 9 with Lewis Street and NW 63rd Street, specifically during the PM peak hour period. Current volumes at the above intersections are on the threshold for satisfying the Peak Hour Warrant, Warrant 3, for signalization. Based on both signal warrant and intersection spacing criteria conditions at these unsignalized intersections will be monitored under the existing plus development scenario to determine whether intersection improvements are necessary. At remaining unsignalized study intersections, queuing is not expected to exceed one vehicle. The following roadway improvements are recommended regardless of whether the proposed development moves forward or not:

Highway 45 & Highway 9

- Complete the concept study, “Highway 9 Corridor Study”, to review Highway 9 in depth and make recommendations for improving capacity, walkability, and aesthetics.

Highway 9 & Lewis Street

- Add an eastbound left-turn lane at the intersection with storage of approximately 75’.

Existing plus Development Conditions

Signal warrants at Highway 9 and Lewis Street are just over the threshold for warranting a signal in the PM peak hour period only. This is primarily due to existing background volumes. Meeting one of the eight warrants for signalization does not indicate that a signal be installed considering none of the other warrants for signalization are met at the intersection as well as MoDOT recommended spacing criteria. Considering this, operations at the unsignalized intersection of Highway 9 and Lewis Street can be expected to decrease slightly for side street traffic, specifically the eastbound movement. However, vehicles utilizing the eastbound leg at Highway 9 and Lewis Street may be inclined to utilize other public streets to enter Highway 9 via the Lewis Street access to Highway 45 just northwest of the site due to operations at the intersection. With the addition of the proposed development volumes, the following roadway improvements are recommended:

Highway 9 & Lewis Street

- Restripe the existing westbound left-turn lane to allow for a 75' storage lane.

Highway 45 & Drive 3

- Capacity analysis with and without the proposed Drive 3 is similar, however, internal site circulation is improved with the right-in/right-out centrally located drive. Drive 3 is recommended to be installed as far from Highway 9 to come as close as possible to suggested drive spacing.
- Install a 150' minimum eastbound right-turn lane (plus taper length) at the Drive 3 entrance.
- Consideration should be given to control vehicles east and westbound on the internal site drive to allow vehicles entering the site free-flow.

Highway 45 & Site Drives

- All proposed site drives shall have a minimum of 75' throat distance and are recommended to be installed with the development.

Highway 45 & Julian Drive

- Provide striping for two northbound exiting lanes and a single entering lane along the length of available 3-lane roadway to define lane assignment, approximately 90'.

Future Year 2035 Conditions

Increased queuing and delay along the corridor during the future scenario can be attributed to an increase in background traffic and is not associated with the proposed development. Signalized and unsignalized intersections are expected to operate at unacceptable levels or service without improvements along Highway 9 and at the intersection of Highway 45 and Highway 9. With the addition of the future growth volumes, the following roadway improvements are recommended:

Highway 45 & Highway 9

- Add a northbound thru lane extending from the existing northbound right-turn lane at Highway 9 and Lewis Street.
    - This improvement is recommended due to potential queuing between the intersections of Highway 45 and Lewis Street along Highway 9.
- Modify the southbound right-turn lane to a right/thru-lane that will continue south to 63rd Street.
- Add an additional westbound left-turn lane with a 300' storage lane.
- Extend the southbound left-turn lane to 300'

Highway 9 & NW 63rd Street

- Add a southbound right-turn lane that will terminate the thru lane that extends past Highway 45 along Highway 9.

APPENDIX:

- Existing Conditions
  - Traffic Count Data
  - Signal Warrants Analysis
  - Capacity Analysis
- Existing plus Development Conditions
  - Trip Generation Analysis
  - Signal Warrants Analysis
  - Capacity Analysis
- Future Year 2035 Conditions
  - Future Volumes Worksheet
  - Signal Warrant Analysis
  - Capacity Analysis

We appreciate the opportunity to be of service to you on this project. If you should have any questions or need any additional information, please feel free to contact us.

Respectfully Submitted,

Olsson Associates

X _____

Todd Fredericksen, PE, PTOE

X _____

Tom Fulton, Senior Project Manager

Existing

Traffic Count Data

OBSERVER: Garrett / Katie

DATE: 5/24/2012

COUNTY: PLATTE

STATE: MISSOURI

WEATHER: Clear, 80

DAY: THURSDAY

INTERSECTION OF: HIGHWAY 45 AT HIGHWAY 9

15 Minute Time Period	HIGHWAY 9 NORTHBOUND			HIGHWAY 9 SOUTHBOUND			HIGHWAY 45 EASTBOUND			HIGHWAY 45 WESTBOUND		
	Left	Through	Right	Left	Through	Right	Left	Through	Right	Left	Through	Right
6:00 - 6:15	6	15	9	19	31	5	5	32	15	22	20	2
6:15 - 6:30	14	27	23	3	39	3	11	45	19	19	48	2
6:30 - 6:45	13	32	36	11	35	13	15	57	25	18	40	2
6:45 - 7:00	14	29	26	20	48	8	11	67	46	40	50	10
7:00 - 7:15	14	19	33	14	64	15	16	89	46	27	62	7
7:15 - 7:30	18	31	38	19	74	23	25	124	40	34	99	20
7:30 - 7:45	26	36	34	23	84	28	19	73	33	51	78	5
7:45 - 8:00	25	28	45	19	76	20	19	75	43	68	82	3
8:00 - 8:15	24	38	32	18	68	10	22	87	41	51	71	4
8:15 - 8:30	25	31	39	23	64	32	35	73	31	55	99	5
8:30 - 8:45	30	45	45	18	66	25	37	80	44	46	94	9
8:45 - 9:00	19	44	38	13	45	23	26	71	38	61	98	9

15 Minute Time Period	HIGHWAY 9 NORTHBOUND			HIGHWAY 9 SOUTHBOUND			HIGHWAY 45 EASTBOUND			HIGHWAY 45 WESTBOUND		
	Left	Through	Right	Left	Through	Right	Left	Through	Right	Left	Through	Right
3:00 - 3:15	19	57	64	29	26	23	37	85	25	55	95	22
3:15 - 3:30	29	56	60	12	46	23	30	83	34	38	103	16
3:30 - 3:45	42	58	52	16	49	28	32	91	26	44	79	12
3:45 - 4:00	31	63	55	27	55	25	44	81	29	46	140	24
4:00 - 4:15	33	64	47	18	46	50	31	75	31	62	80	19
4:15 - 4:30	44	55	44	15	59	29	39	93	24	57	121	30
4:30 - 4:45	37	71	60	24	49	46	37	93	32	60	131	24
4:45 - 5:00	50	85	55	26	65	44	54	90	43	65	112	17
5:00 - 5:15	33	80	44	22	70	48	49	91	30	68	146	25
5:15 - 5:30	39	80	66	20	70	25	44	94	25	81	125	19
5:30 - 5:45	25	70	52	23	70	40	50	97	28	61	117	29
5:45 - 6:00	41	72	48	22	68	29	35	90	25	75	140	27

Note: Through Volumes Adjusted Upwards to Balance Volumes Between Intersections

Exhibit D - Peak Hour Traffic Count Data
Highway 45 at Highway 9

OBSERVER: Brett DATE: 5/24/2012 COUNTY: PLATTE STATE: MISSOURI

WEATHER: Clear, 80 DAY: THURSDAY

INTERSECTION OF: HIGHWAY 9 AT LEWIS STREET / BANK ENTRANCE

15 Minute Time Period	HIGHWAY 9 NORTHBOUND			HIGHWAY 9 SOUTHBOUND			LEWIS STREET / BANK ENTRANCE EASTBOUND			LEWIS STREET / BANK ENTRANCE WESTBOUND		
	Left	Through	Right	Left	Through	Right	Left	Through	Right	Left	Through	Right
6:00 - 6:15	3	24	0	0	64	4	6	0	5	0	0	0
6:15 - 6:30	6	59	1	0	72	5	5	0	5	0	0	0
6:30 - 6:45	5	75	0	1	70	7	6	0	11	0	0	0
6:45 - 7:00	6	62	0	0	121	13	7	0	10	1	0	0
7:00 - 7:15	4	58	0	1	121	15	8	0	12	0	0	0
7:15 - 7:30	8	79	1	2	127	19	8	1	8	0	0	0
7:30 - 7:45	5	87	1	0	155	13	8	0	19	0	0	1
7:45 - 8:00	16	88	1	0	170	17	8	1	13	0	0	2
8:00 - 8:15	9	82	0	6	135	19	9	0	17	1	1	3
8:15 - 8:30	6	79	0	4	130	16	16	0	8	1	0	0
8:30 - 8:45	12	102	0	1	139	16	18	0	9	0	0	0
8:45 - 9:00	13	84	2	0	131	13	15	0	16	0	0	2

15 Minute Time Period	HIGHWAY 9 NORTHBOUND			HIGHWAY 9 SOUTHBOUND			LEWIS STREET / BANK ENTRANCE EASTBOUND			LEWIS STREET / BANK ENTRANCE WESTBOUND		
	Left	Through	Right	Left	Through	Right	Left	Through	Right	Left	Through	Right
3:00 - 3:15	16	118	5	1	85	20	15	1	8	1	2	7
3:15 - 3:30	15	128	2	3	87	28	16	0	23	1	1	1
3:30 - 3:45	9	132	1	5	99	15	17	2	19	0	1	3
3:45 - 4:00	13	128	5	3	105	22	19	1	18	1	0	2
4:00 - 4:15	10	129	3	1	121	17	13	0	11	1	0	2
4:15 - 4:30	5	134	2	1	124	15	8	1	7	0	1	1
4:30 - 4:45	11	157	1	3	125	13	11	0	5	1	2	0
4:45 - 5:00	8	172	3	4	139	30	17	1	2	1	1	1
5:00 - 5:15	9	136	0	3	143	22	17	0	11	2	2	4
5:15 - 5:30	16	168	3	3	161	12	16	0	11	1	0	1
5:30 - 5:45	17	129	1	2	136	21	18	0	17	2	0	0
5:45 - 6:00	21	142	1	2	147	19	17	0	11	1	0	2

Note: Through Volumes Adjusted Upwards to Balance Volumes Between Intersections

Exhibit C - Peak Hour Traffic Count Data
Highway 9 at Lewis Street / Bank Entrance

OBSERVER: Steve

WEATHER: Clear, 80

INTERSECTION OF: HIGHWAY 45 AT JULIAN DRIVE

DATE: 5/24/2012

DAY: THURSDAY

COUNTY: PLATTE

STATE: MISSOURI

15 Minute Time Period	JULIAN DRIVE NORTHBOUND			JULIAN DRIVE SOUTHBOUND			HIGHWAY 45 EASTBOUND			HIGHWAY 45 WESTBOUND		
	Left	Through	Right	Left	Through	Right	Left	Through	Right	Left	Through	Right
6:00 - 6:15	0		0					58	2	0	44	
6:15 - 6:30	0		1					71	0	0	69	
6:30 - 6:45	0		1					102	2	0	60	
6:45 - 7:00	1		1					111	2	2	99	
7:00 - 7:15	1		0					135	1	3	95	
7:15 - 7:30	1		1					180	1	1	152	
7:30 - 7:45	0		2					129	1	2	134	
7:45 - 8:00	2		4					136	3	0	151	
8:00 - 8:15	1		1					135	2	4	125	
8:15 - 8:30	0		1					134	1	1	159	
8:30 - 8:45	1		0					140	3	0	148	
8:45 - 9:00	2		1					121	1	2	166	

15 Minute Time Period	JULIAN DRIVE NORTHBOUND			JULIAN DRIVE SOUTHBOUND			HIGHWAY 45 EASTBOUND			HIGHWAY 45 WESTBOUND		
	Left	Through	Right	Left	Through	Right	Left	Through	Right	Left	Through	Right
3:00 - 3:15	7		1					174	4	5	165	
3:15 - 3:30	4		1					148	7	3	153	
3:30 - 3:45	11		2					152	7	8	124	
3:45 - 4:00	4		3					157	6	5	206	
4:00 - 4:15	4		2					136	4	3	157	
4:15 - 4:30	7		3					146	6	6	201	
4:30 - 4:45	6		2					171	6	5	209	
4:45 - 5:00	8		0					163	8	3	186	
5:00 - 5:15	4		1					153	4	0	235	
5:15 - 5:30	3		0					175	5	4	222	
5:30 - 5:45	6		5					161	11	3	201	
5:45 - 6:00	7		3					156	4	0	235	

Note: Through Volumes Adjusted Upwards to Balance Volumes Between Intersections

Exhibit E - Peak Hour Traffic Count Data
Highway 45 at Julian Drive

Olsson Associates

7301 West 133rd Street, Suite 200
Overland Park, Kansas 66213
www.olssonassociates.com

Default Comments
Change These in The Preferences Window
Select File/Preference in the Main Scree
Then Click the Comments Tab

File Name : HWY 9 & 63RD ST (7-9AM)
Site Code : 00000000
Start Date : 1/4/2012
Page No : 1

Groups Printed- Unshifted - Bank 1

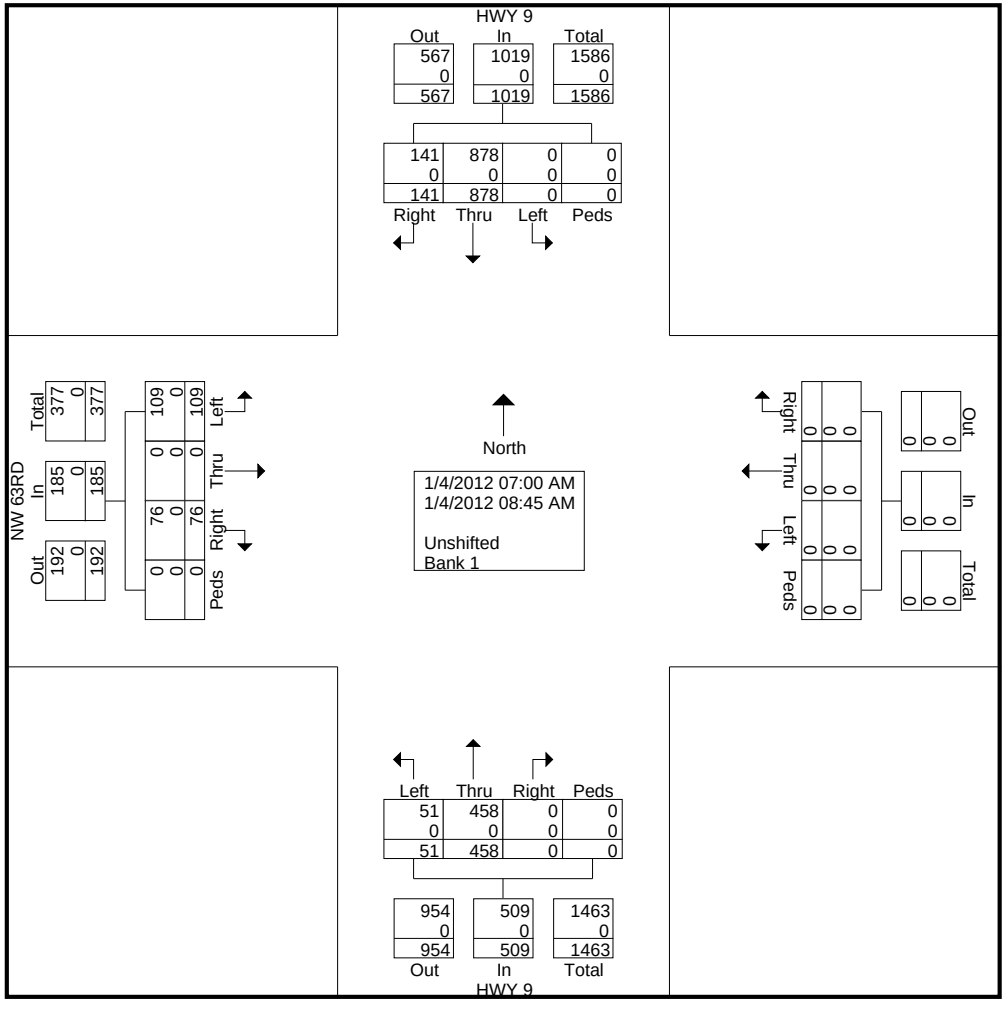
	HWY 9 From North					From East					HWY 9 From South					NW 63RD From West					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
07:00 AM	4	99	0	0	103	0	0	0	0	0	0	33	5	0	38	3	0	16	0	19	160
07:15 AM	11	88	0	0	99	0	0	0	0	0	0	63	8	0	71	8	0	14	0	22	192
07:30 AM	18	122	0	0	140	0	0	0	0	0	0	63	8	0	71	15	0	11	0	26	237
07:45 AM	22	154	0	0	176	0	0	0	0	0	0	58	5	0	63	10	0	13	0	23	262
Total	55	463	0	0	518	0	0	0	0	0	0	217	26	0	243	36	0	54	0	90	851
08:00 AM	19	110	0	0	129	0	0	0	0	0	0	55	4	0	59	8	0	16	0	24	212
08:15 AM	7	101	0	0	108	0	0	0	0	0	0	68	8	0	76	9	0	15	0	24	208
08:30 AM	16	104	0	0	120	0	0	0	0	0	0	67	5	0	72	20	0	14	0	34	226
08:45 AM	44	100	0	0	144	0	0	0	0	0	0	51	8	0	59	3	0	10	0	13	216
Total	86	415	0	0	501	0	0	0	0	0	0	241	25	0	266	40	0	55	0	95	862
Grand Total	141	878	0	0	1019	0	0	0	0	0	0	458	51	0	509	76	0	109	0	185	1713
Apprch %	13.8	86.2	0	0		0	0	0	0		0	90	10	0		41.1	0	58.9	0		
Total %	8.2	51.3	0	0	59.5	0	0	0	0	0	0	26.7	3	0	29.7	4.4	0	6.4	0	10.8	
Unshifted	141	878	0	0	1019	0	0	0	0	0	0	458	51	0	509	76	0	109	0	185	1713
% Unshifted	100	100	0	0	100	0	0	0	0	0	0	100	100	0	100	100	0	100	0	100	100
Bank 1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
% Bank 1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Olsson Associates

7301 West 133rd Street, Suite 200
Overland Park, Kansas 66213
www.olssonassociates.com

Default Comments
Change These in The Preferences Window
Select File/Preference in the Main Scree
Then Click the Comments Tab

File Name : HWY 9 & 63RD ST (7-9AM)
Site Code : 00000000
Start Date : 1/4/2012
Page No : 2



Olsson Associates

7301 West 133rd Street, Suite 200
Overland Park, Kansas 66213
www.olssonassociates.com

Default Comments
Change These in The Preferences Window
Select File/Preference in the Main Scree
Then Click the Comments Tab

File Name : HWY 9 & 63RD ST (4-6PM)
Site Code : 00000000
Start Date : 1/4/2012
Page No : 1

Groups Printed- Unshifted - Bank 1

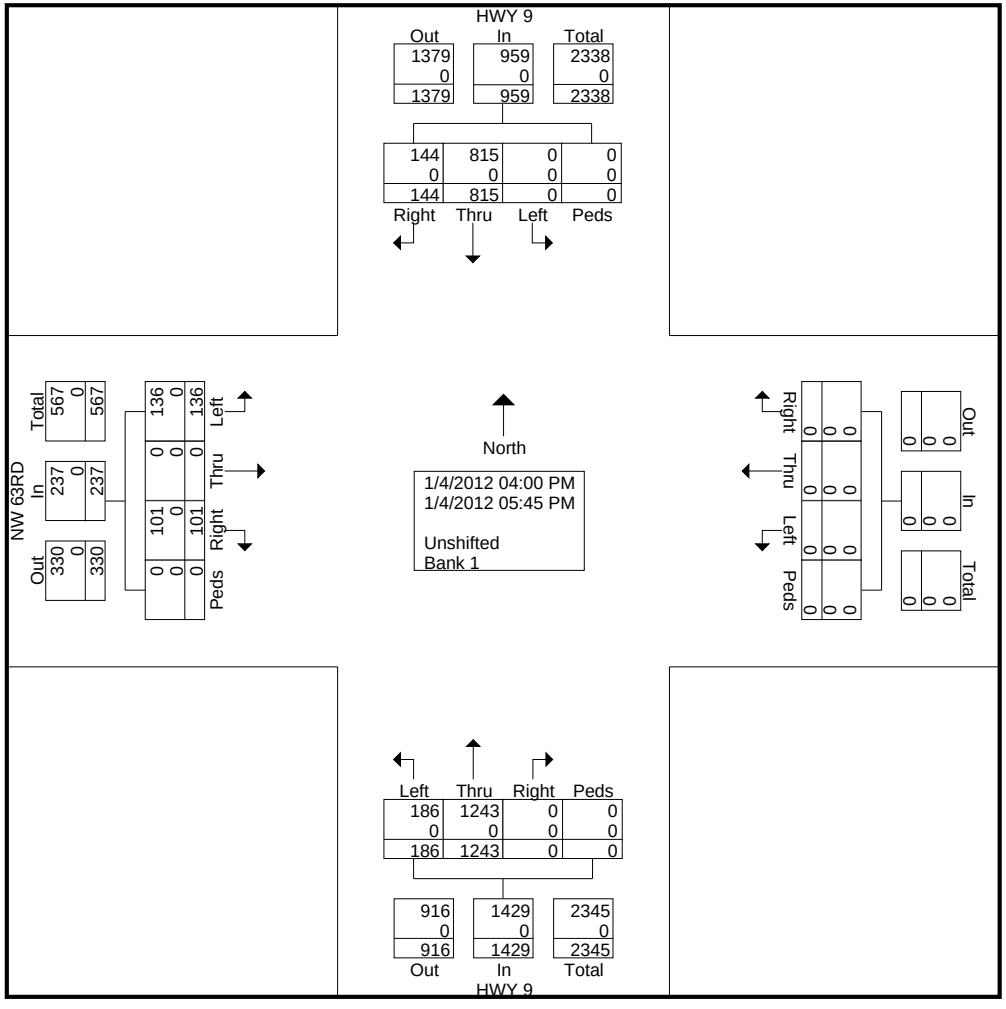
	HWY 9 From North					From East					HWY 9 From South					NW 63RD From West					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
04:00 PM	28	91	0	0	119	0	0	0	0	0	0	124	28	0	152	12	0	20	0	32	303
04:15 PM	22	85	0	0	107	0	0	0	0	0	0	129	19	0	148	12	0	24	0	36	291
04:30 PM	16	99	0	0	115	0	0	0	0	0	0	150	24	0	174	13	0	22	0	35	324
04:45 PM	16	98	0	0	114	0	0	0	0	0	0	151	23	0	174	15	0	13	0	28	316
Total	82	373	0	0	455	0	0	0	0	0	0	554	94	0	648	52	0	79	0	131	1234
05:00 PM	23	118	0	0	141	0	0	0	0	0	0	175	13	0	188	11	0	15	0	26	355
05:15 PM	18	97	0	0	115	0	0	0	0	0	0	183	15	0	198	12	0	18	0	30	343
05:30 PM	9	108	0	0	117	0	0	0	0	0	0	172	35	0	207	14	0	16	0	30	354
05:45 PM	12	119	0	0	131	0	0	0	0	0	0	159	29	0	188	12	0	8	0	20	339
Total	62	442	0	0	504	0	0	0	0	0	0	689	92	0	781	49	0	57	0	106	1391
Grand Total	144	815	0	0	959	0	0	0	0	0	0	1243	186	0	1429	101	0	136	0	237	2625
Apprch %	15	85	0	0		0	0	0	0		0	87	13	0		42.6	0	57.4	0		
Total %	5.5	31	0	0	36.5	0	0	0	0	0	0	47.4	7.1	0	54.4	3.8	0	5.2	0	9	
Unshifted	144	815	0	0	959	0	0	0	0	0	0	1243	186	0	1429	101	0	136	0	237	2625
% Unshifted	100	100	0	0	100	0	0	0	0	0	0	100	100	0	100	100	0	100	0	100	100
Bank 1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
% Bank 1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Olsson Associates

7301 West 133rd Street, Suite 200
Overland Park, Kansas 66213
www.olssonassociates.com

Default Comments
Change These in The Preferences Window
Select File/Preference in the Main Scree
Then Click the Comments Tab

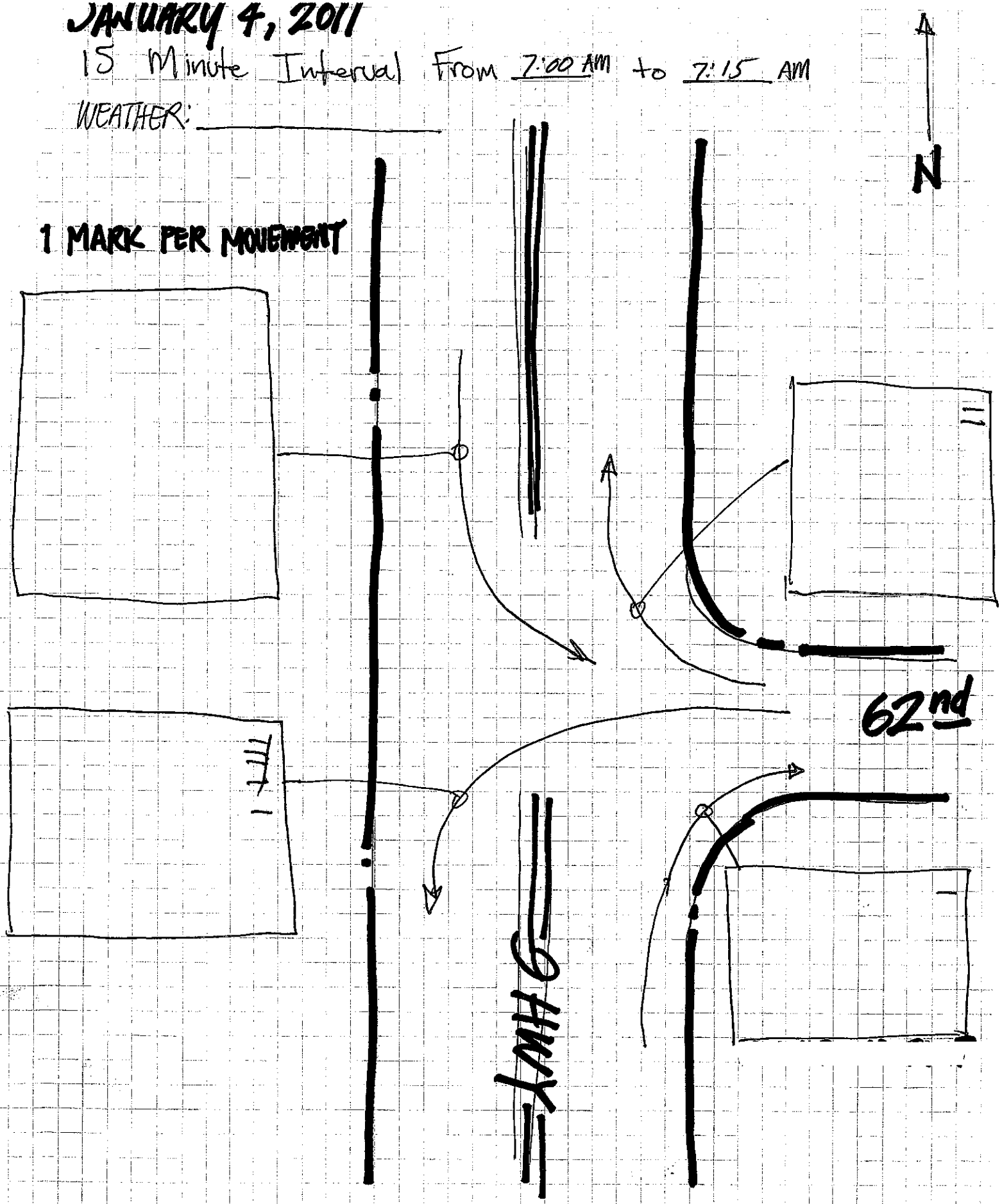
File Name : HWY 9 & 63RD ST (4-6PM)
Site Code : 00000000
Start Date : 1/4/2012
Page No : 2



JANUARY 4, 2011

15 Minute Interval From 7:00 AM to 7:15 AM

WEATHER: _____

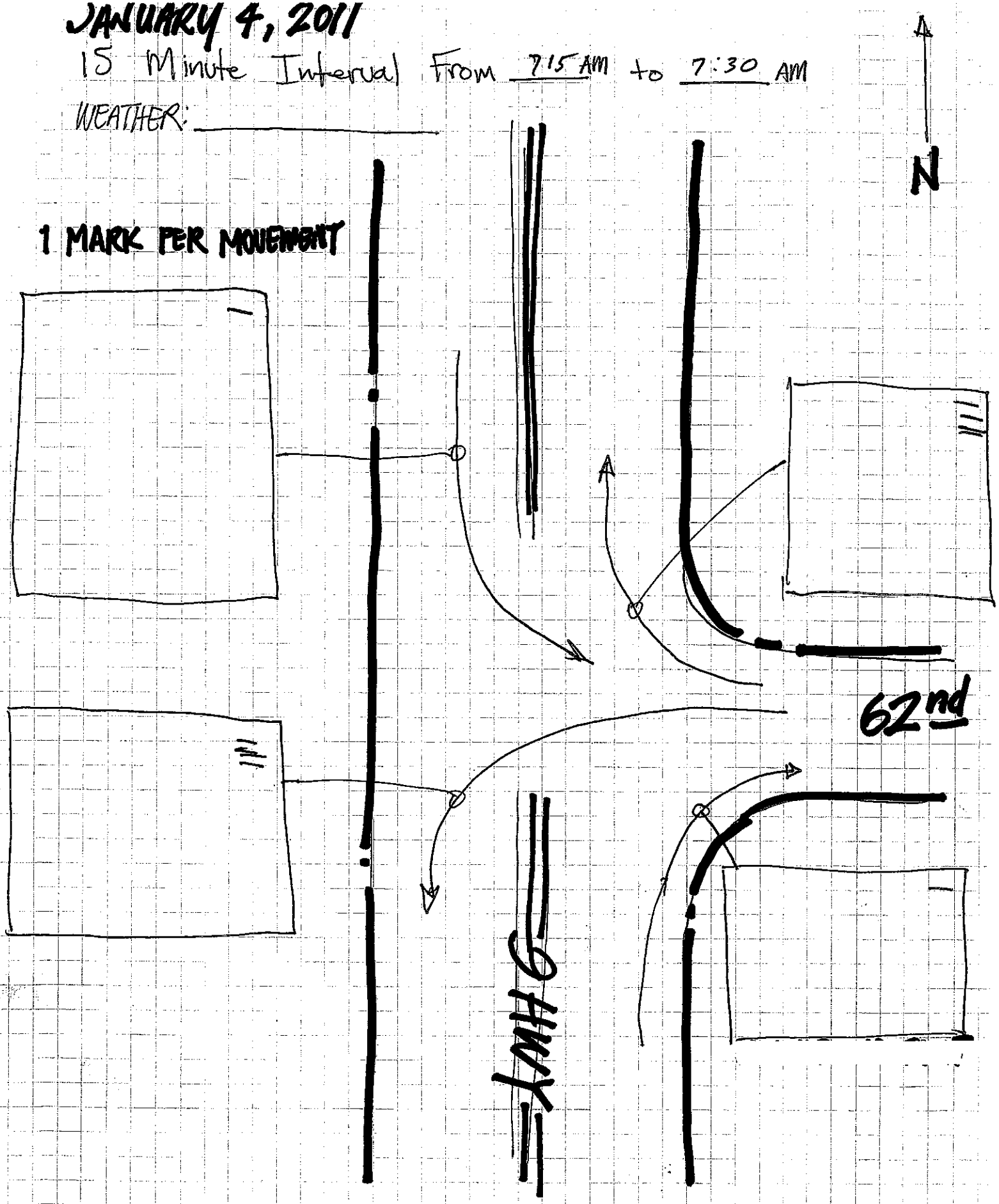


JANUARY 4, 2011

15 Minute Interval From 7:15 AM to 7:30 AM

WEATHER: _____

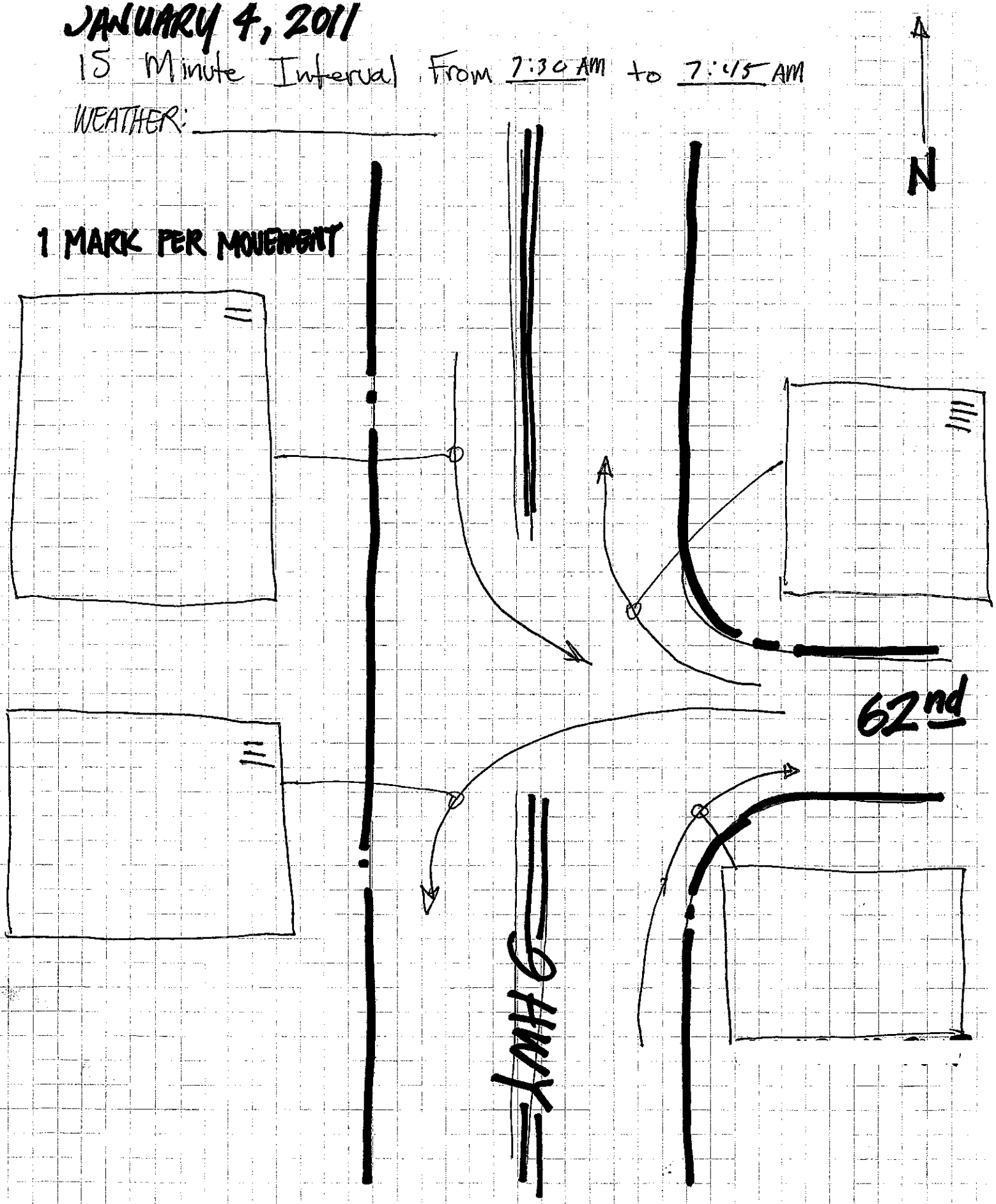
1 MARK PER MOVEMENT



JANUARY 4, 2011

15 Minute Interval From 7:30 AM to 7:45 AM

WEATHER: _____

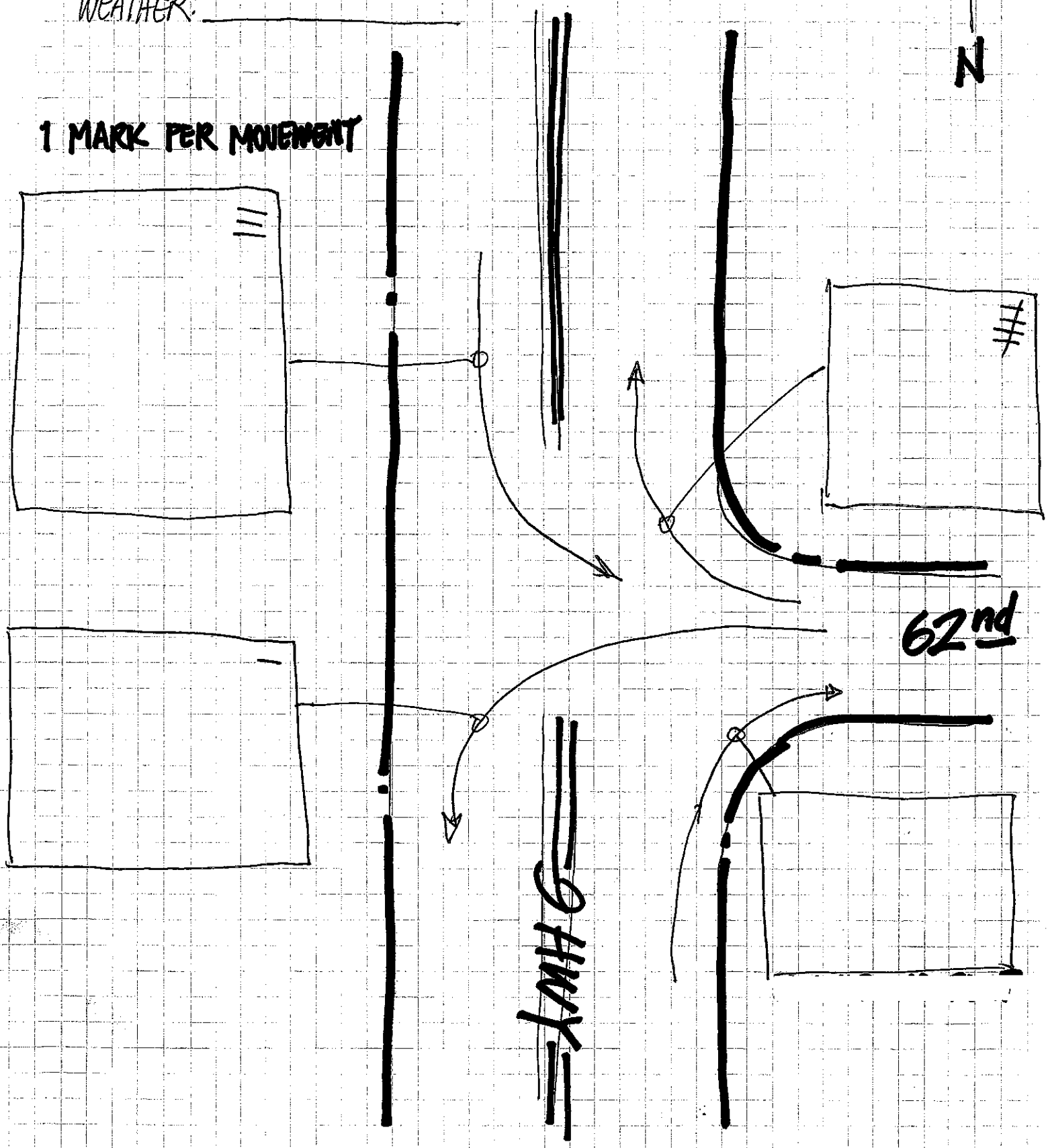


JANUARY 4, 2011

15 Minute Interval From 7:45 AM to 8:00 AM

WEATHER: _____

1 MARK PER MOVEMENT

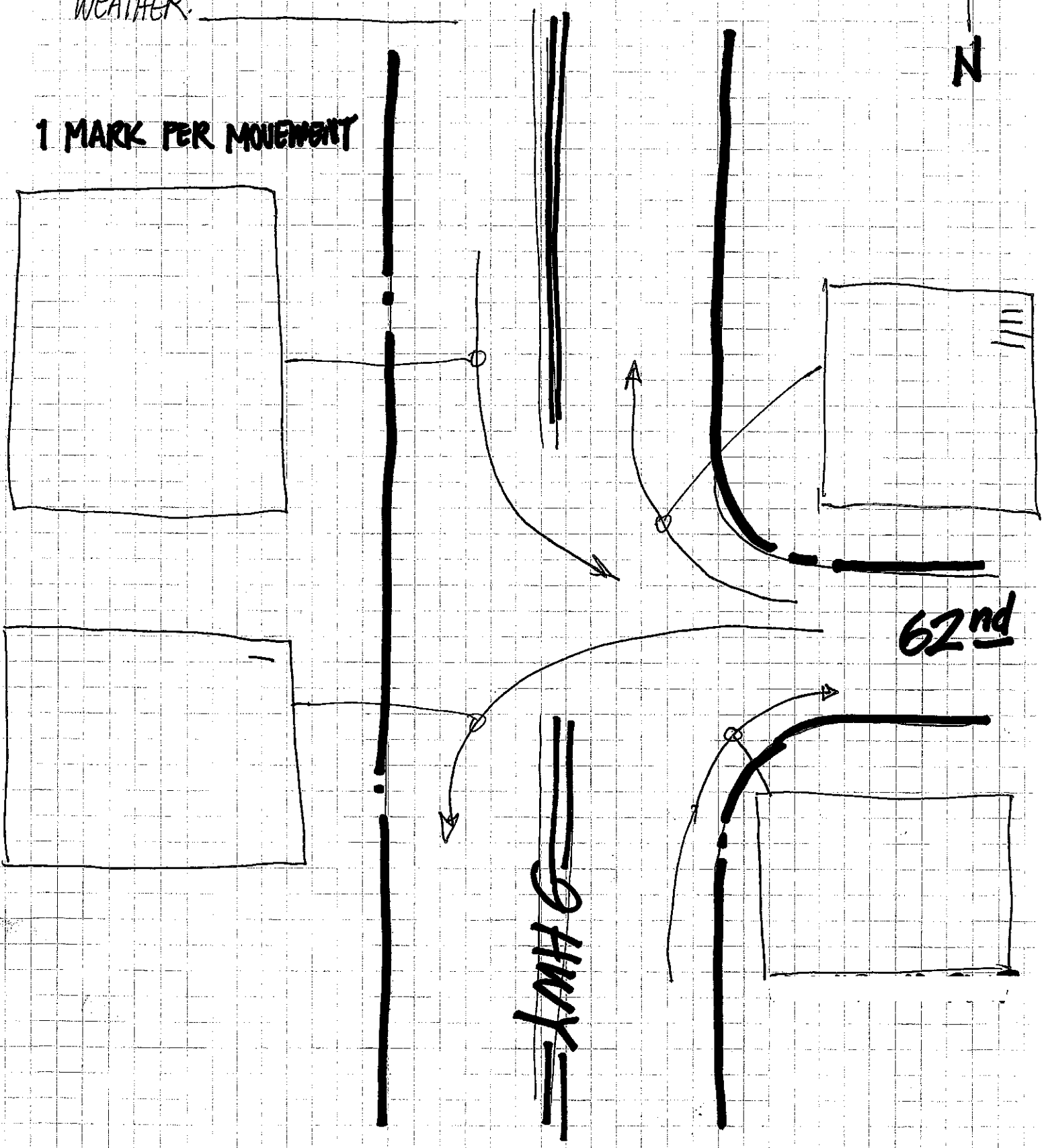


JANUARY 4, 2011

15 Minute Interval From 8:00 AM to 8:15 AM

WEATHER: _____

1 MARK PER MOVEMENT

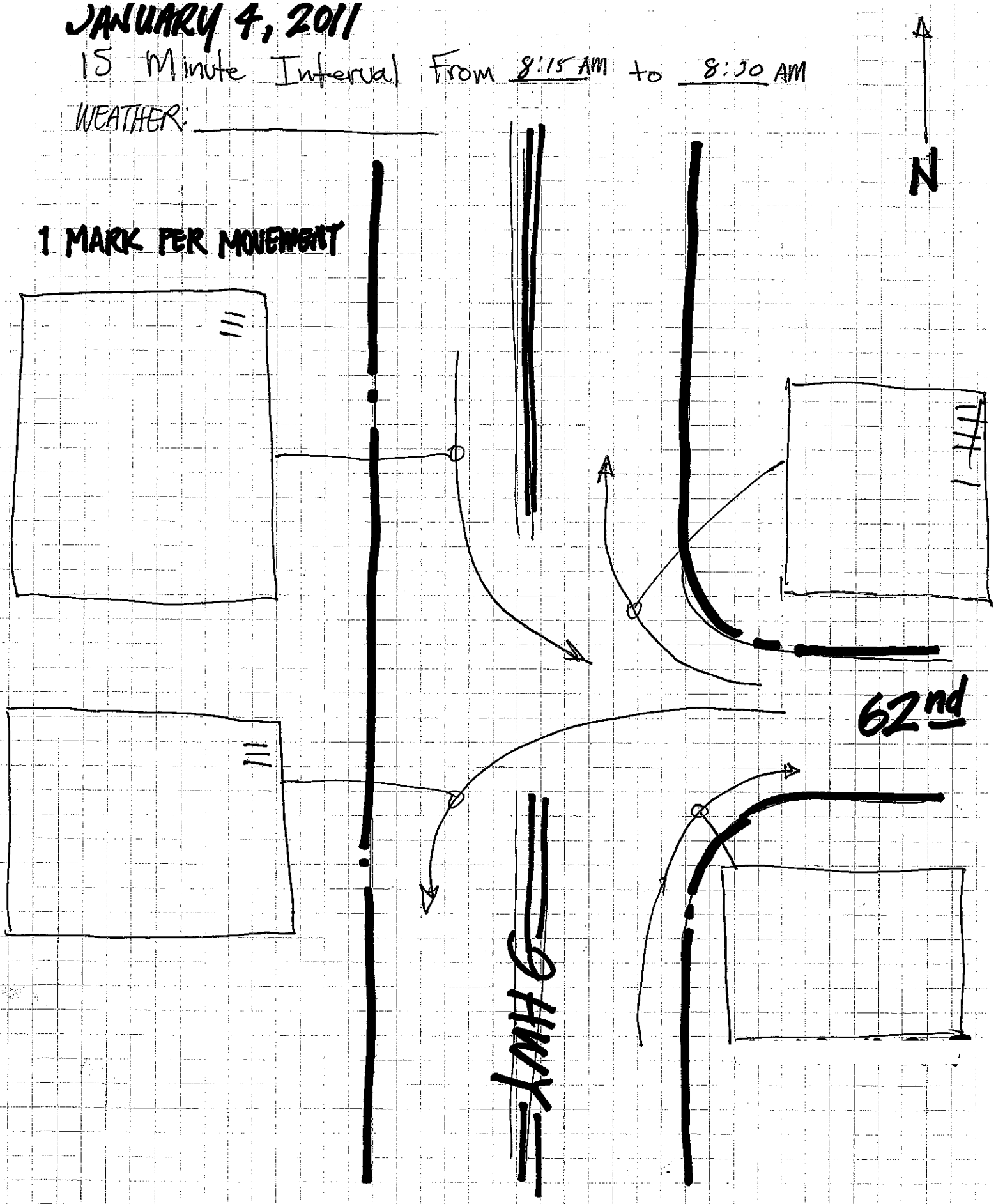


JANUARY 4, 2011

15 Minute Interval From 8:15 AM to 8:30 AM

WEATHER: _____

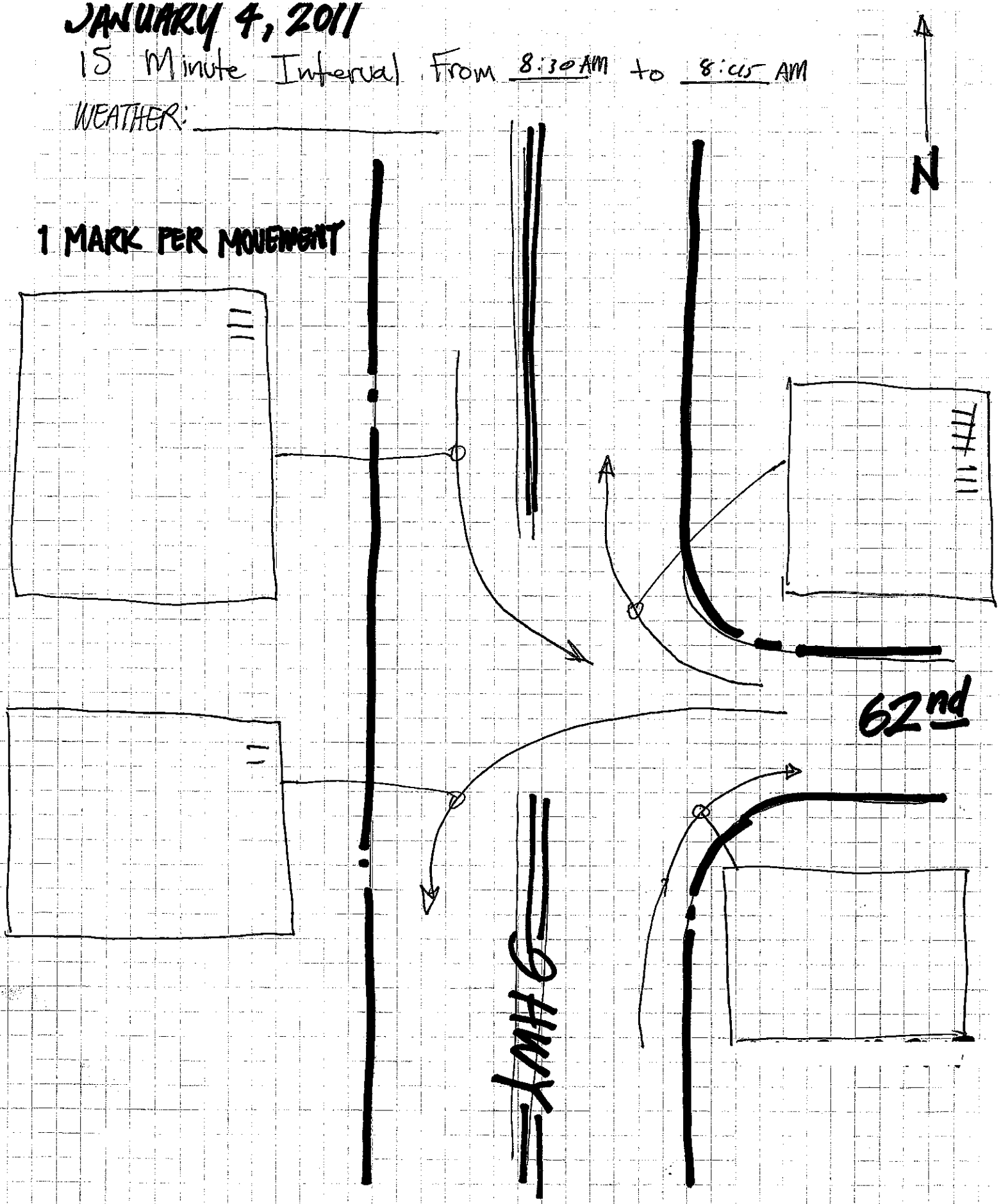
1 MARK PER MOVEMENT



JANUARY 4, 2011

15 Minute Interval From 8:30 AM to 8:45 AM

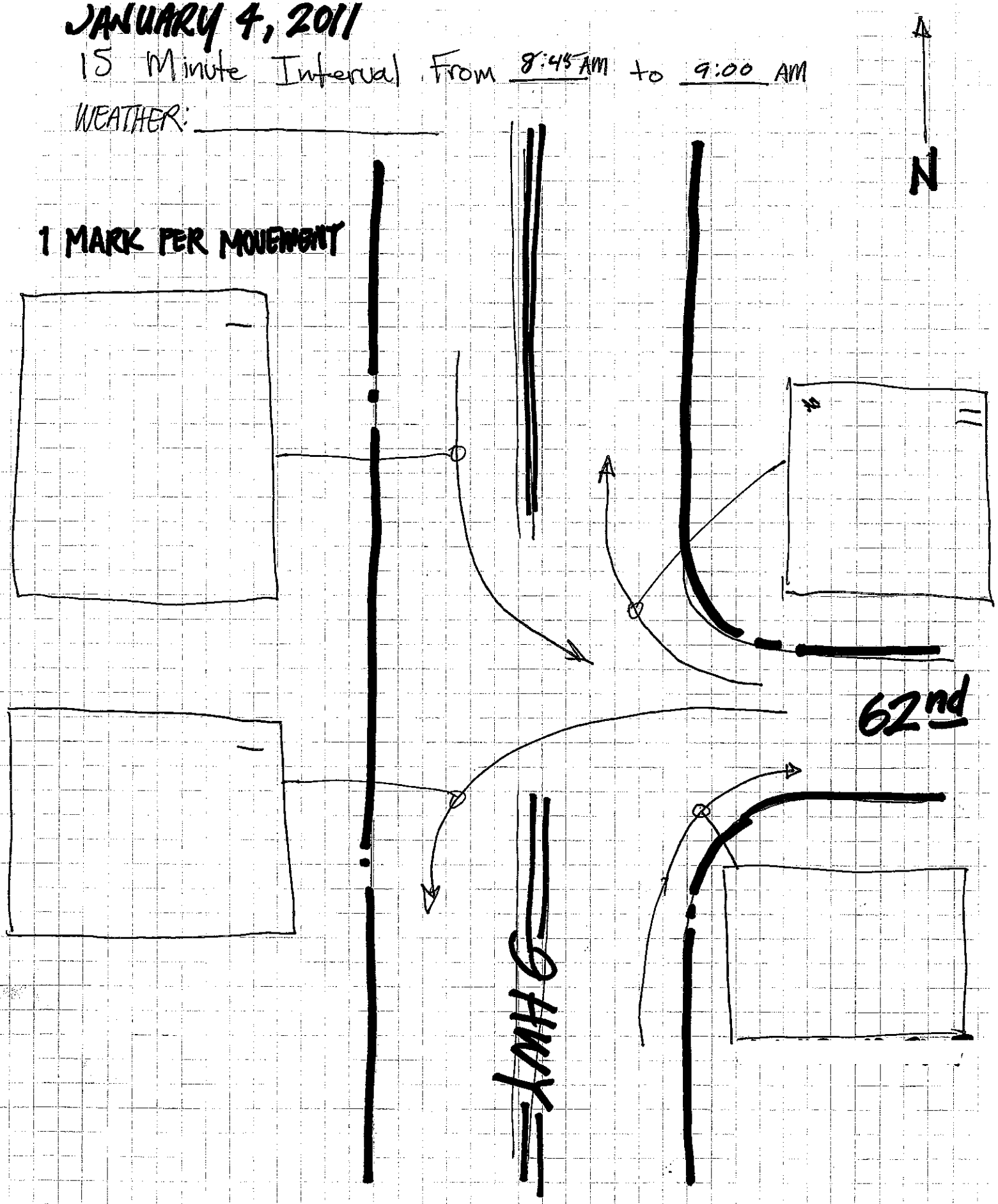
WEATHER: _____



JANUARY 4, 2011

15 Minute Interval From 8:45 AM to 9:00 AM

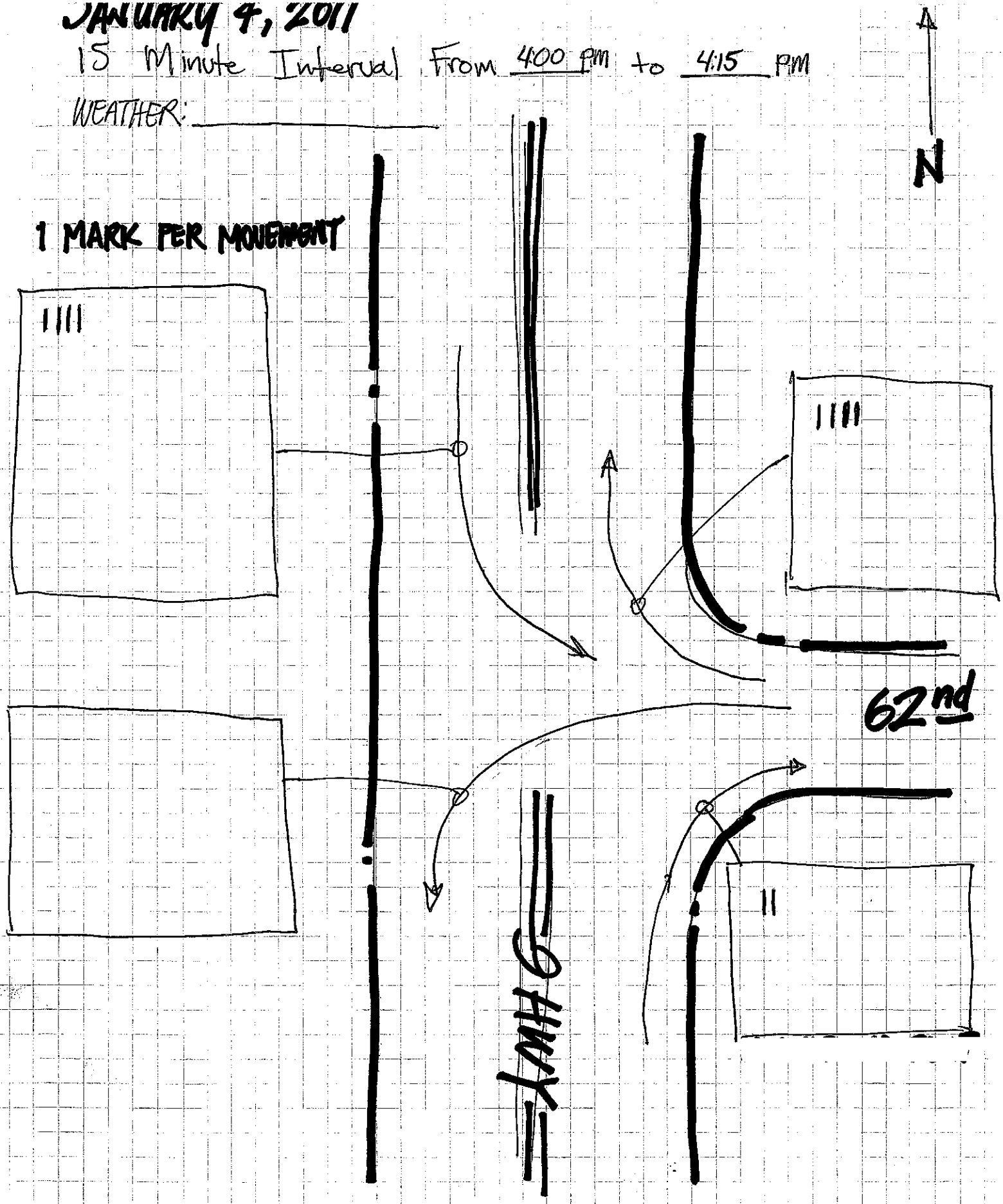
WEATHER: _____



JANUARY 4, 2011

15 Minute Interval From 400 PM to 4:15 PM

WEATHER: _____

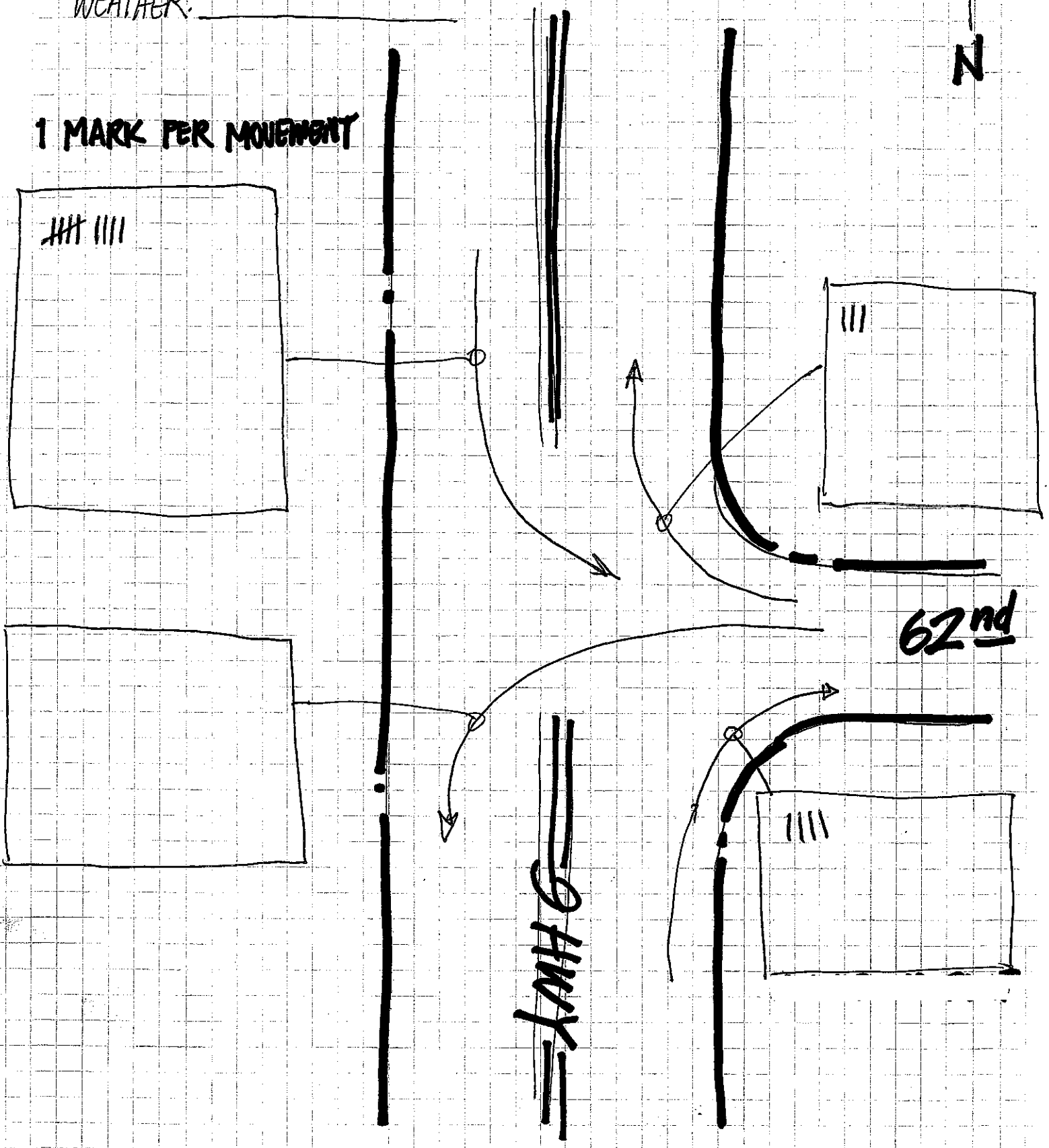


JANUARY 4, 2011

15 Minute Interval From 4:15 pm to 4:30 pm

WEATHER: _____

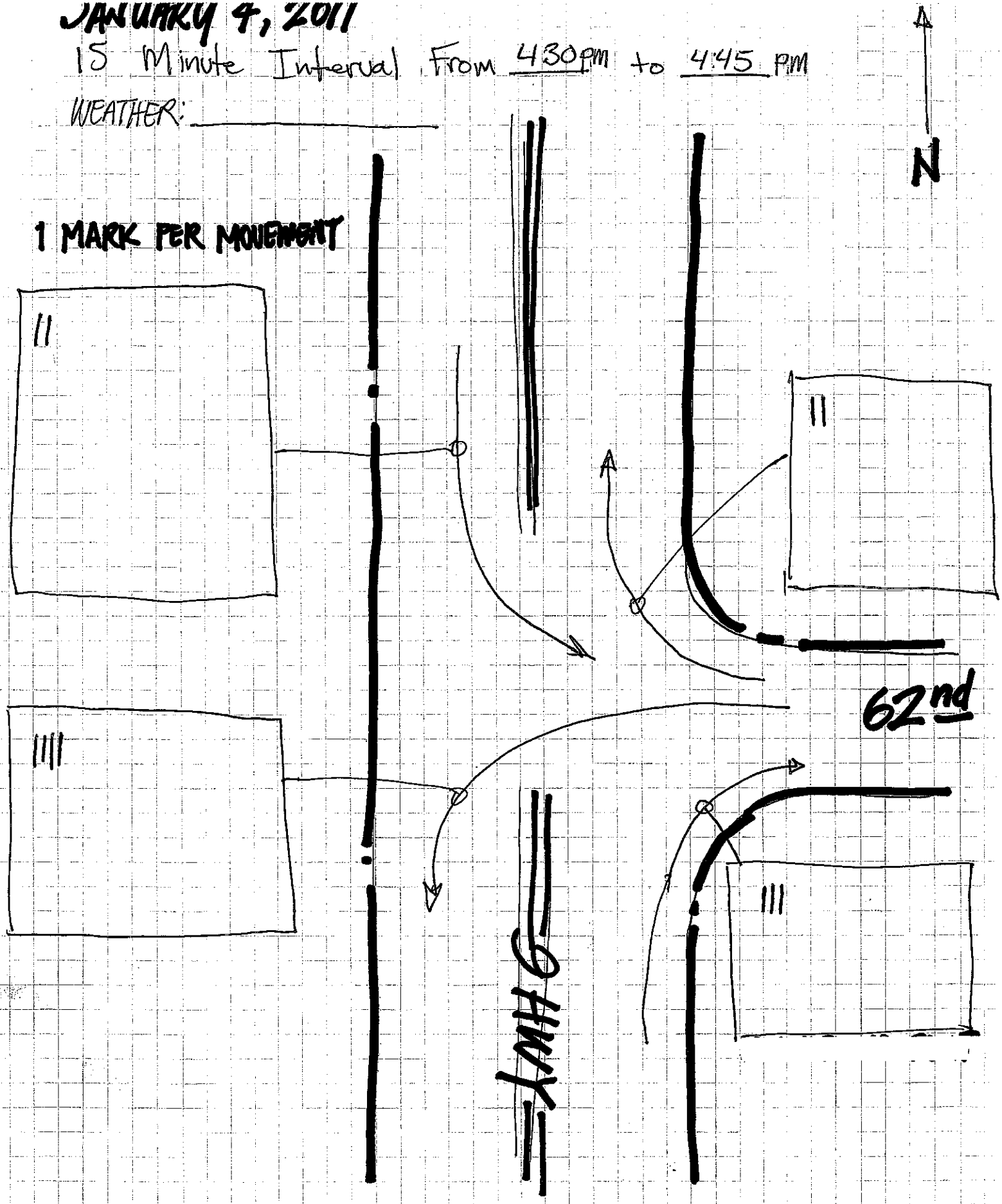
1 MARK PER MOVEMENT



JANUARY 4, 2011

15 Minute Interval From 430pm to 4:45 PM

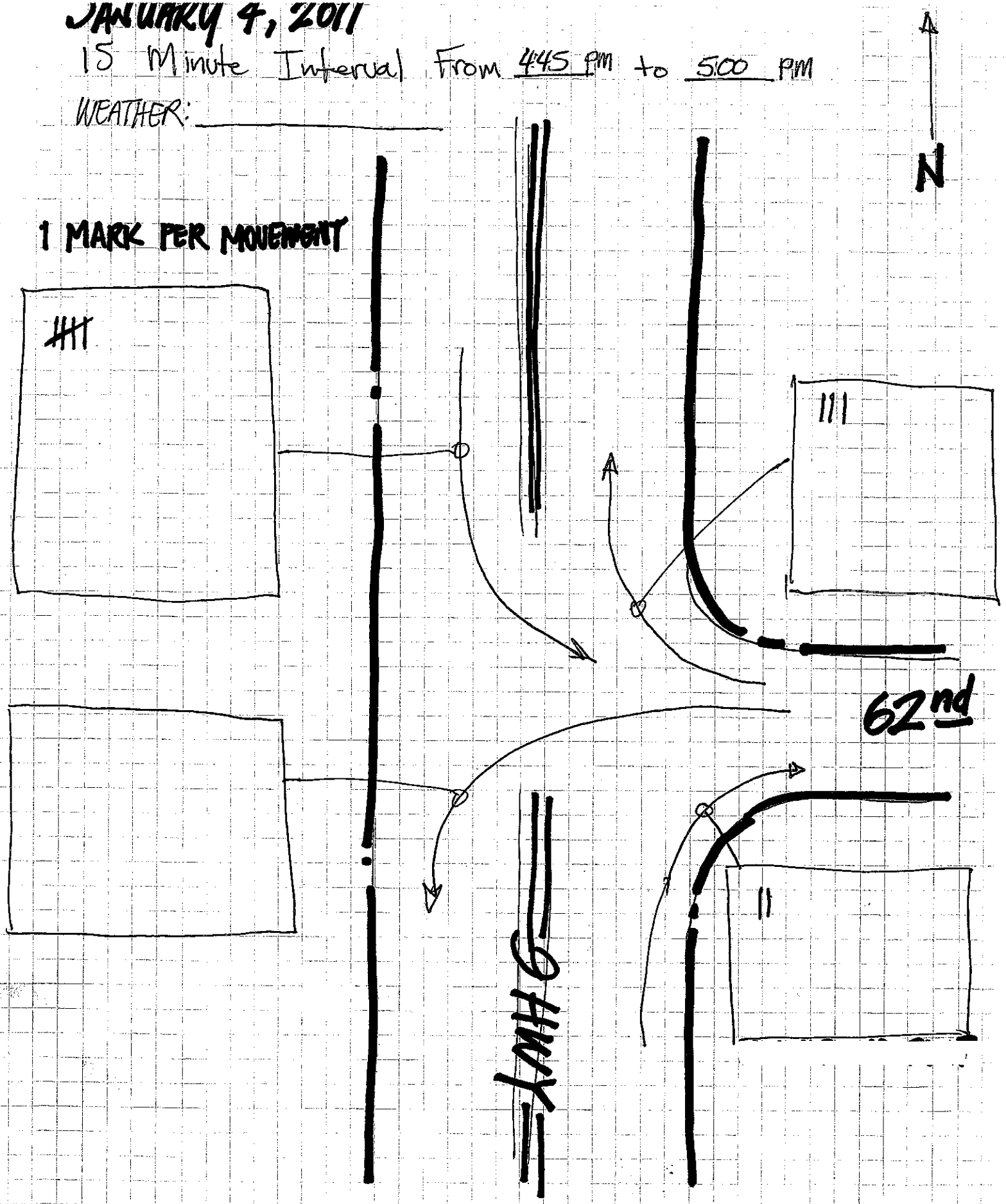
WEATHER: _____



JANUARY 4, 2011

15 Minute Interval From 4:45 PM to 5:00 PM

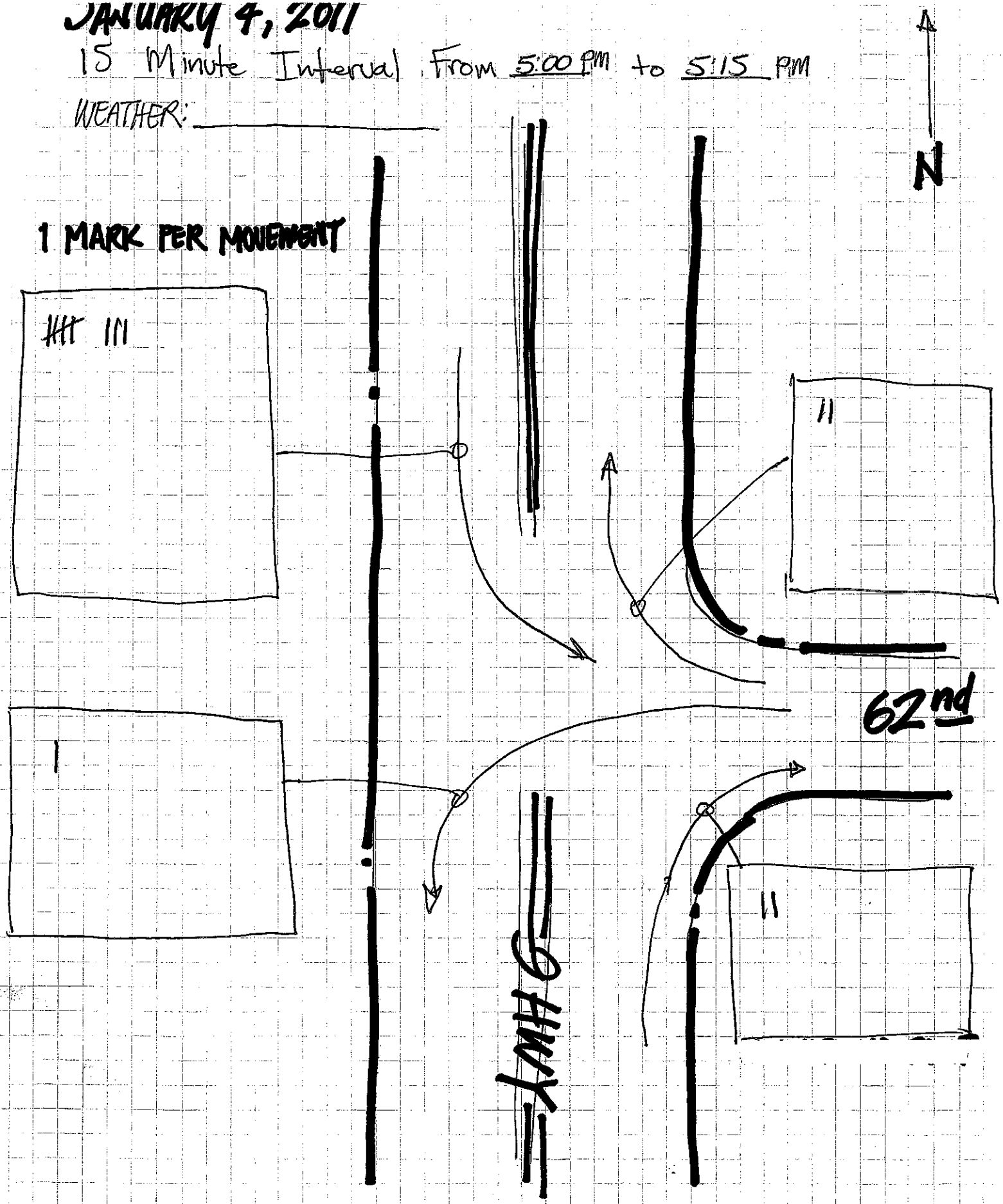
WEATHER: _____



JANUARY 4, 2011

15 Minute Interval From 5:00 PM to 5:15 PM

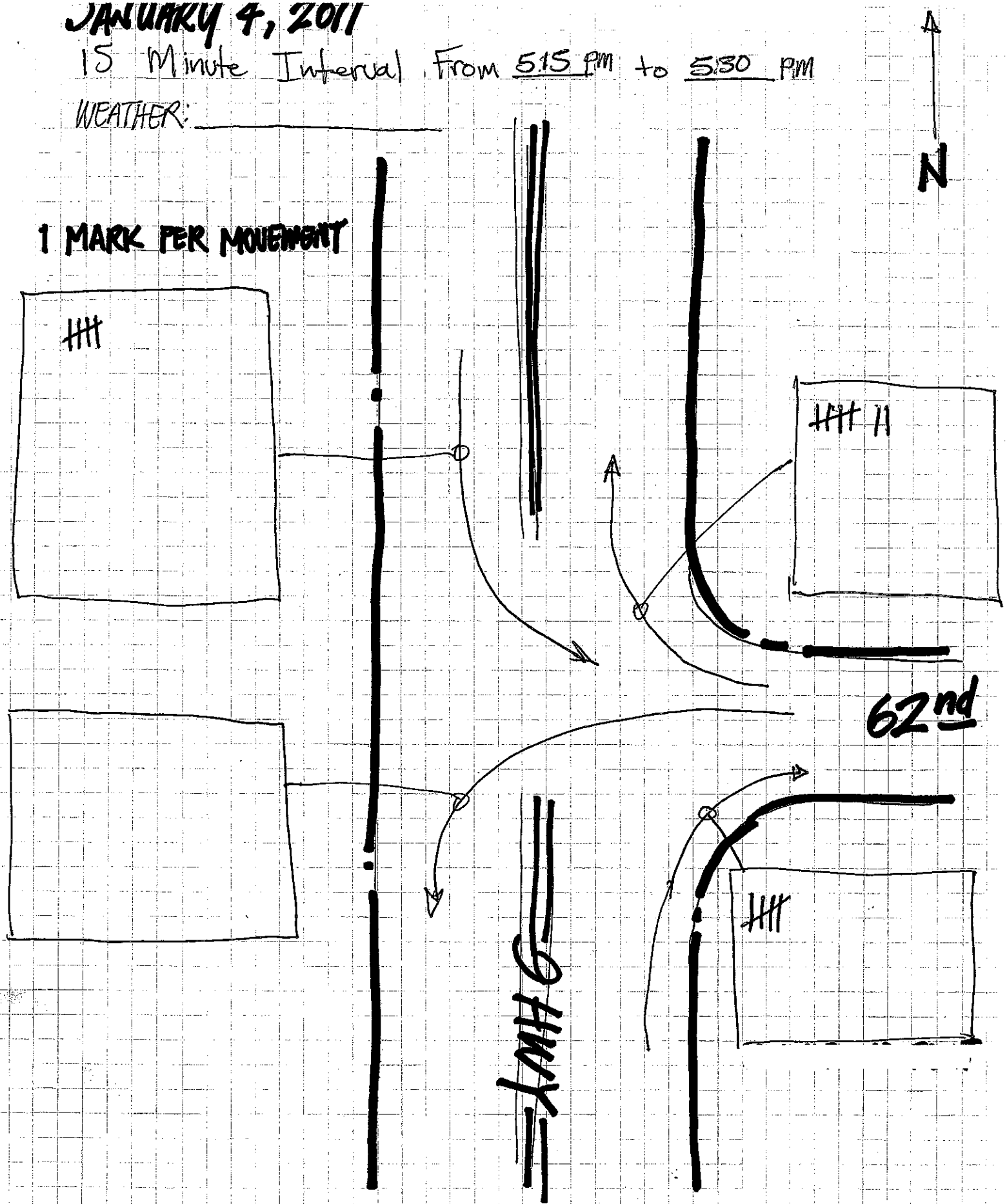
WEATHER: _____



JANUARY 4, 2011

15 Minute Interval From 5:15 PM to 5:30 PM

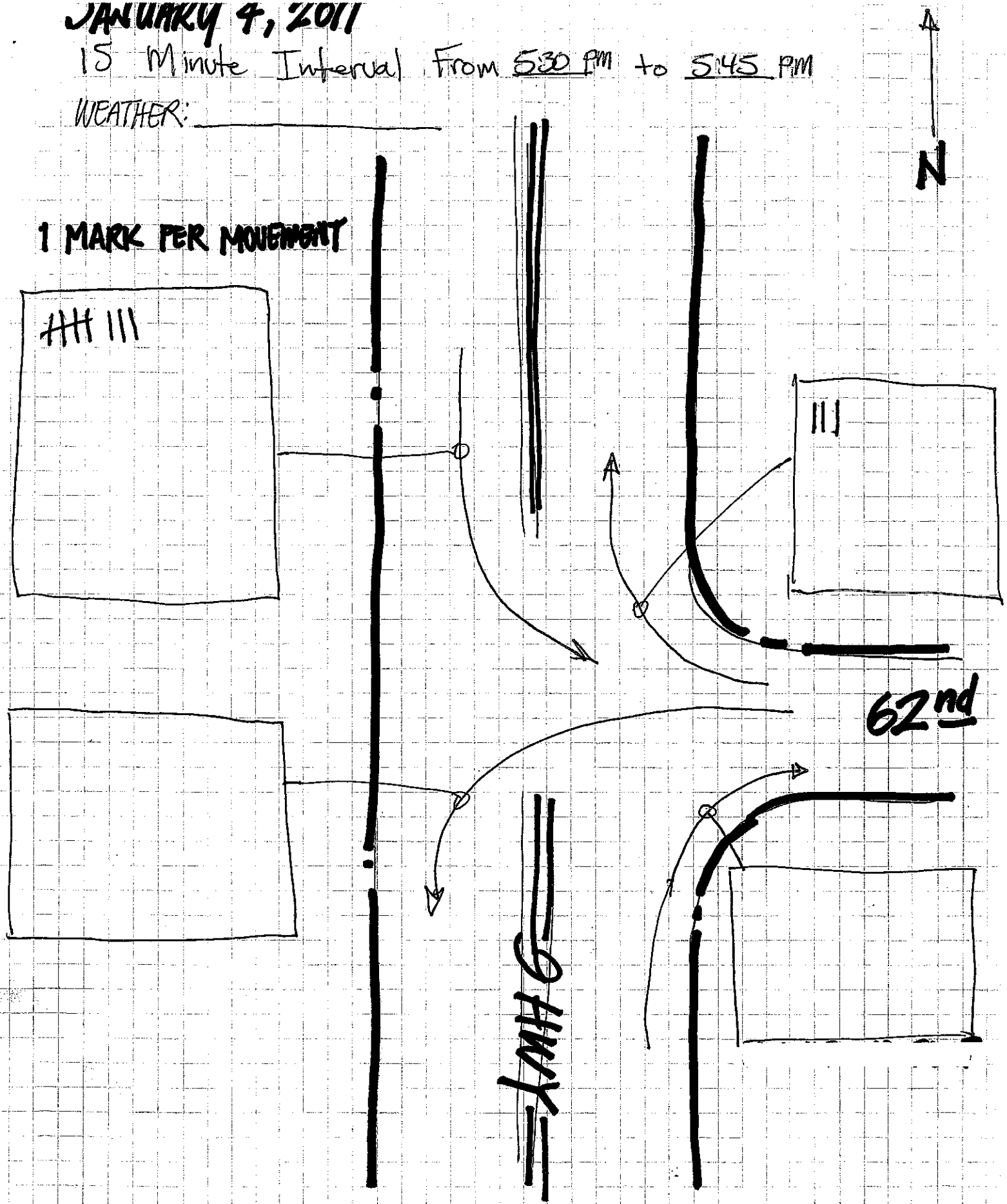
WEATHER: _____



JANUARY 4, 2011

15 Minute Interval From 5:30 PM to 5:45 PM

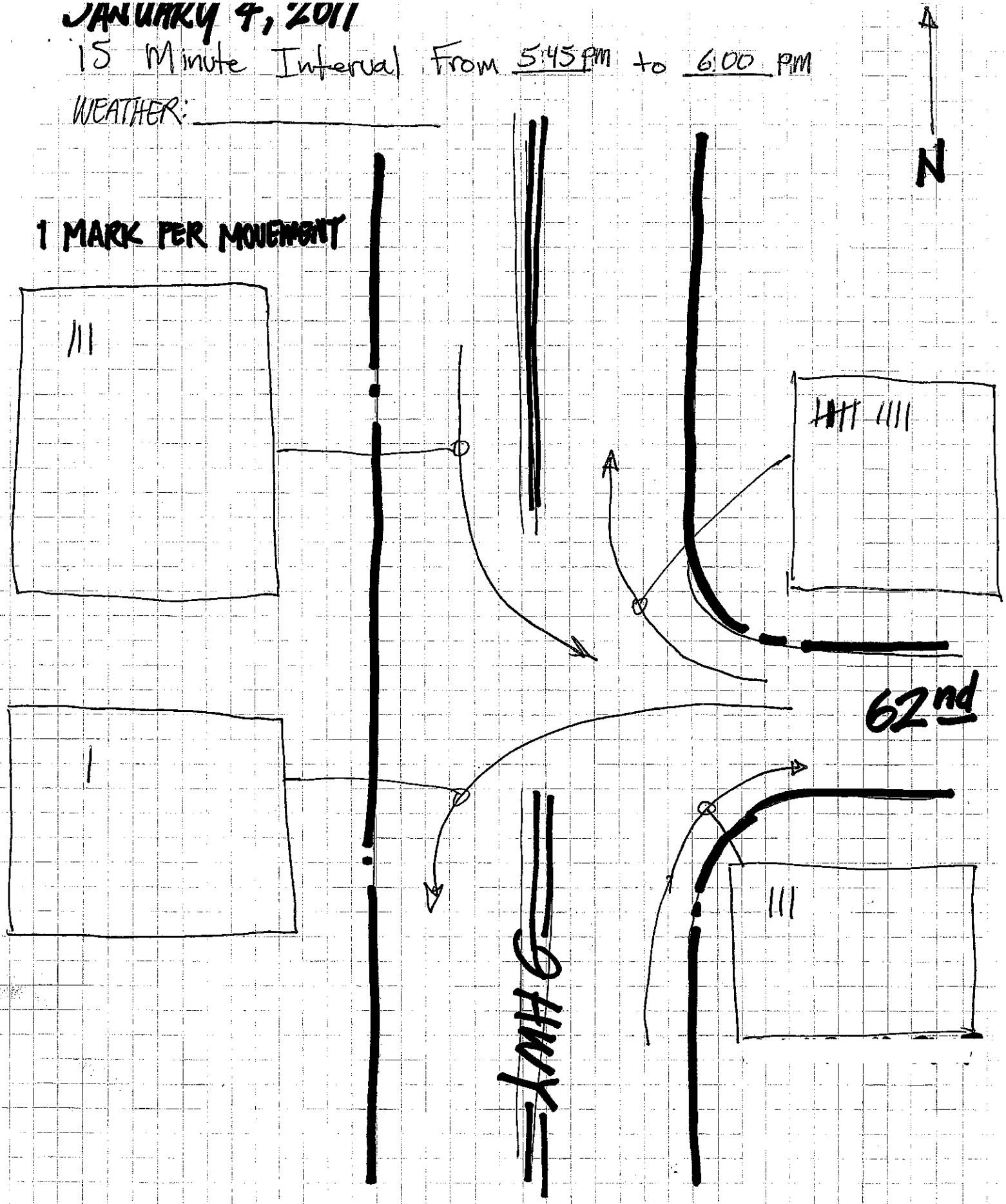
WEATHER: _____



JANUARY 4, 2011

15 Minute Interval From 5:45 PM to 6:00 PM

WEATHER: _____



AM PEAK HOUR TURNING MOVEMENT COUNTS

North/South Street: **MO 9 HIGHWAY**	
East/West Street: **CLARK AVENUE**	
Date: **2-5-13**	
Time Period: **7:30 - 8:30 AM**	
Conditions: **Sunny. No rain or inclement weather.**	

NORTH

	Southbound Right	Southbound Thru
7:30 - 7:45	21	147
7:45 - 8:00	18	127
8:00 - 8:15	11	131
8:15 - 8:30	17	147

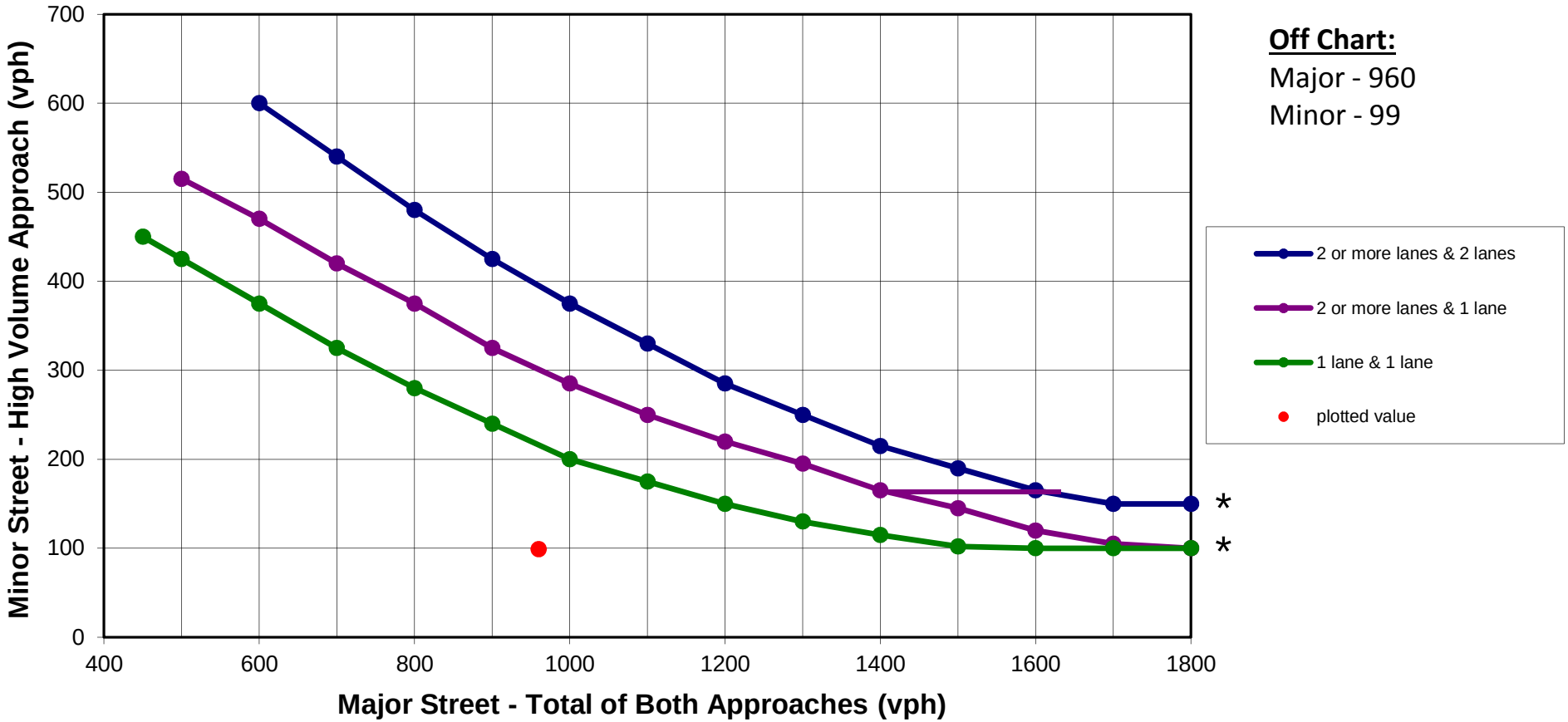
z

	Eastbound Left	Eastbound Right
7:30 - 7:45	4	2
7:45 - 8:00	16	4
8:00 - 8:15	12	4
8:15 - 8:30	7	2

	Northbound Left	Northbound Thru
7:30 - 7:45	1	55
7:45 - 8:00	11	45
8:00 - 8:15	2	39
8:15 - 8:30	3	57

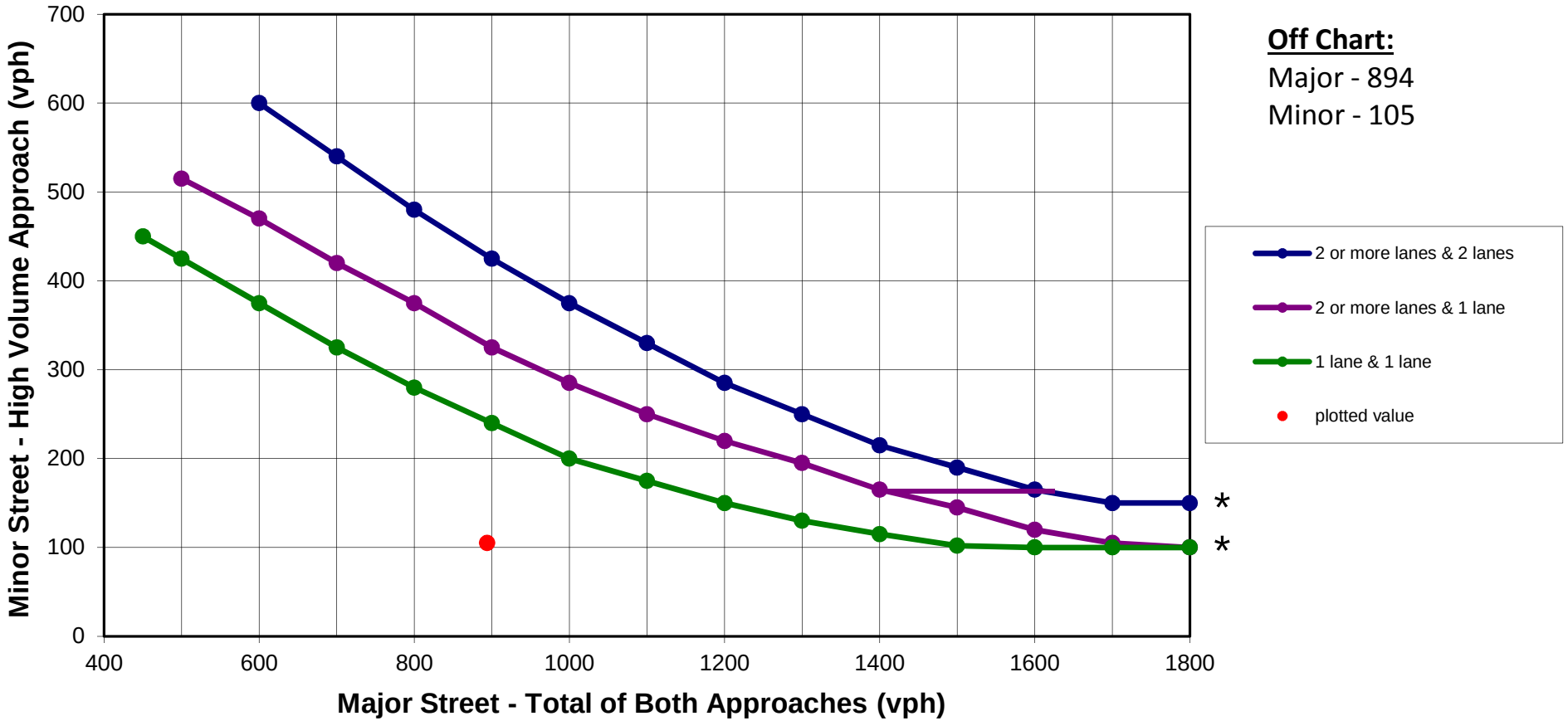
Signal Warrants Analysis

Existing AM Peak Hour Volume Warrant
Missouri Route 9 & Lewis Street



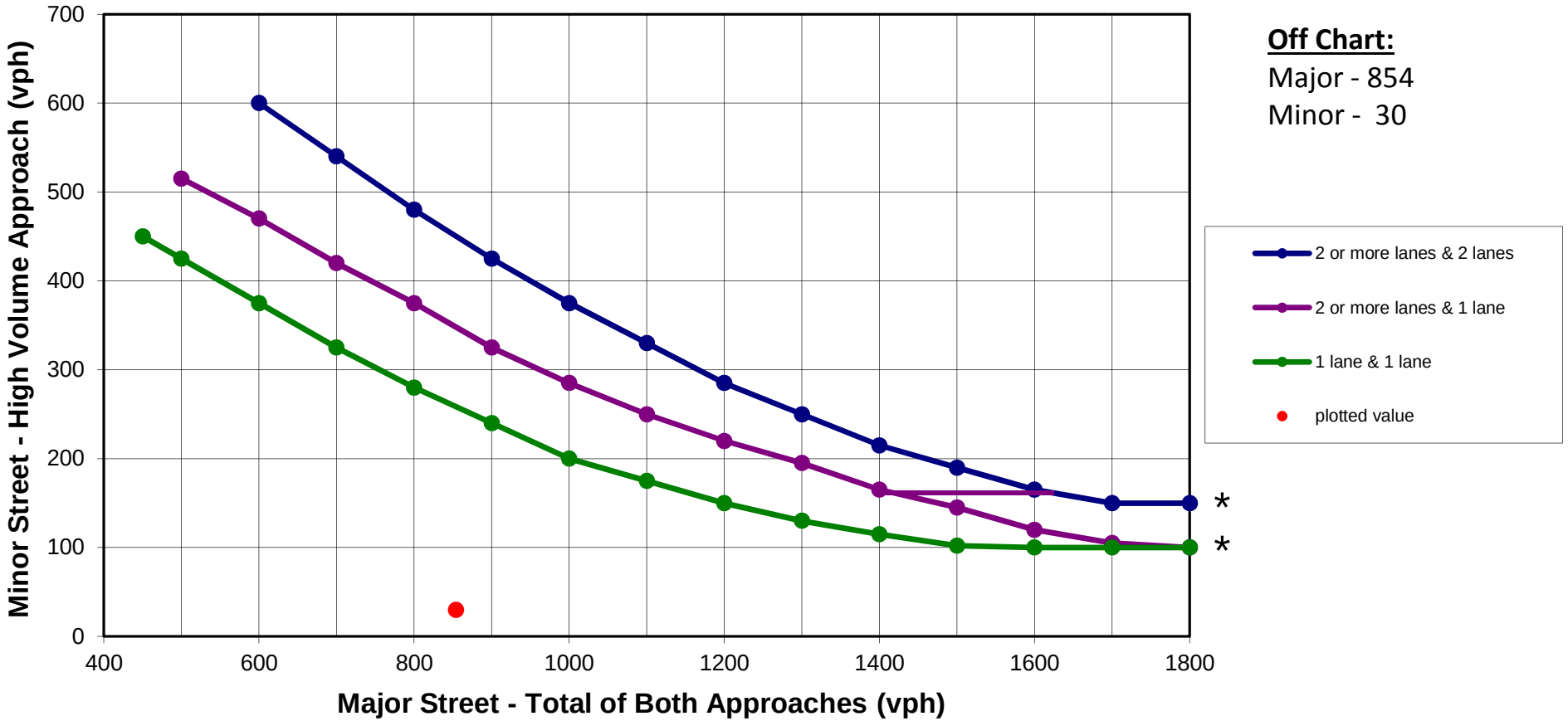
*Note: 150 vph applies as the lower threshold volume for a minor street approach with two or more lanes

Existing AM Peak Hour Volume Warrant
Missouri Route 9 & NW 63rd Street



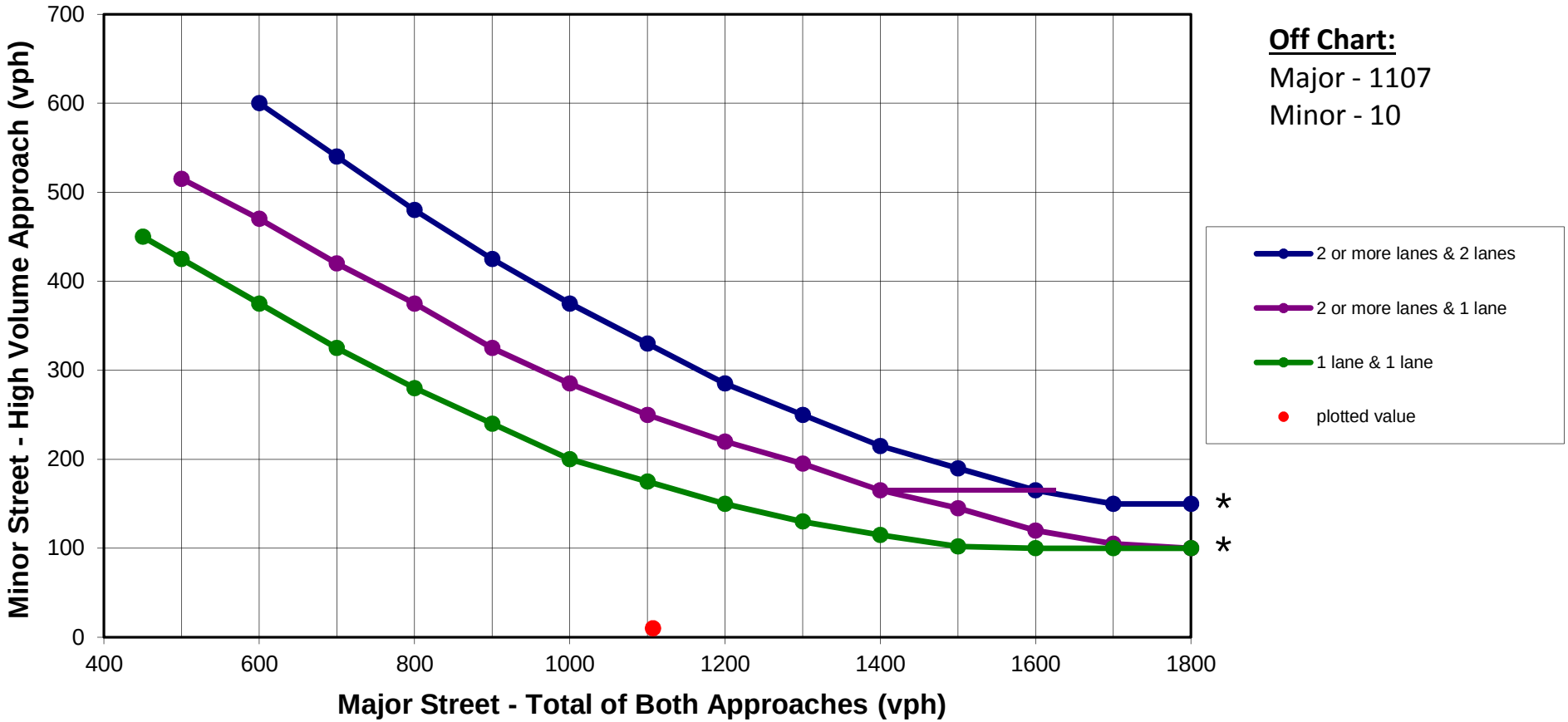
*Note: 150 vph applies as the lower threshold volume for a minor street approach with two or more lanes

Existing AM Peak Hour Volume Warrant
Missouri Route 9 & NW 62nd Street



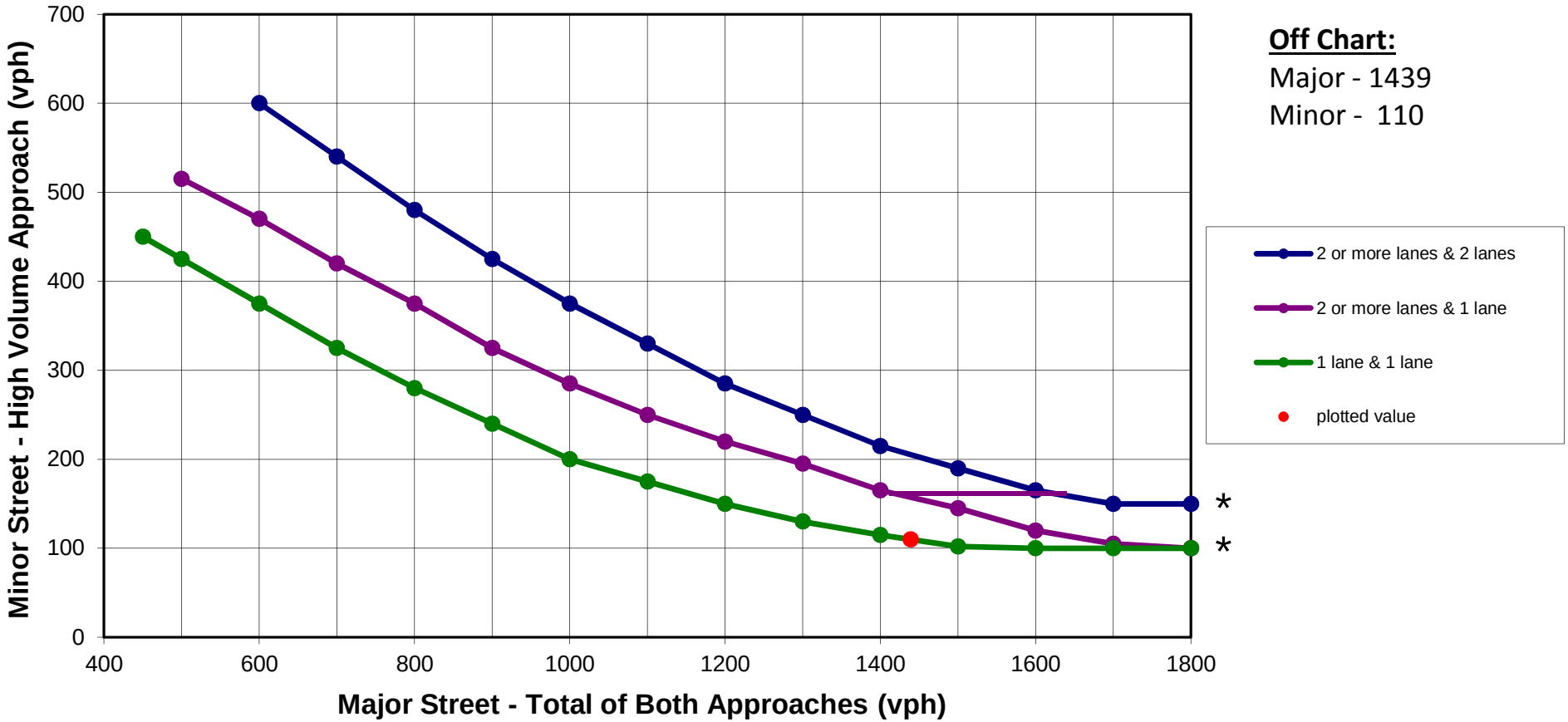
*Note: 150 vph applies as the lower threshold volume for a minor street approach with two or more lanes

Existing AM Peak Hour Volume Warrant
Missouri Route 45 & Julian Drive



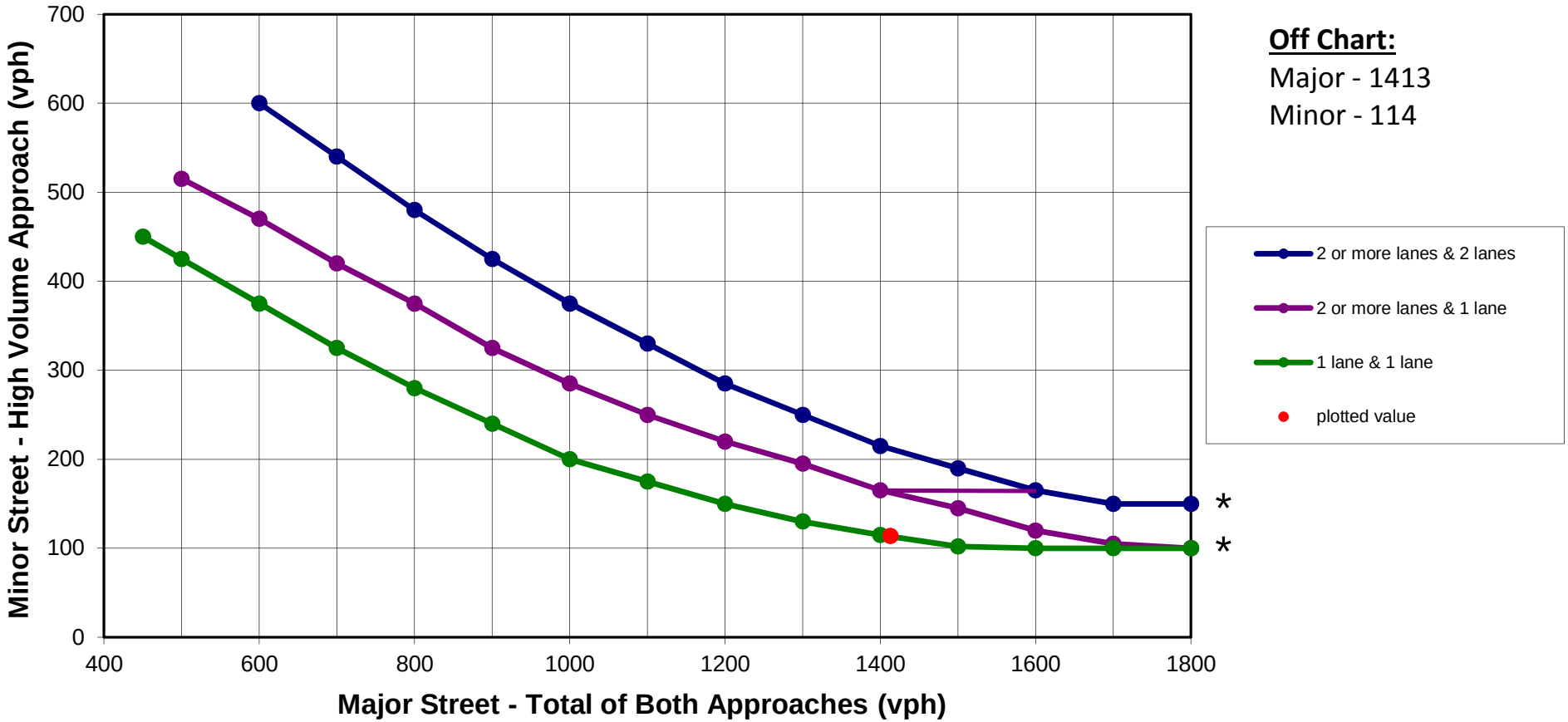
*Note: 150 vph applies as the lower threshold volume for a minor street approach with two or more lanes and 100 vph applies as the lower threshold volume for a minor street approach with one lane.

Existing PM Peak Hour Volume Warrant
Missouri Route 9 & Lewis Street



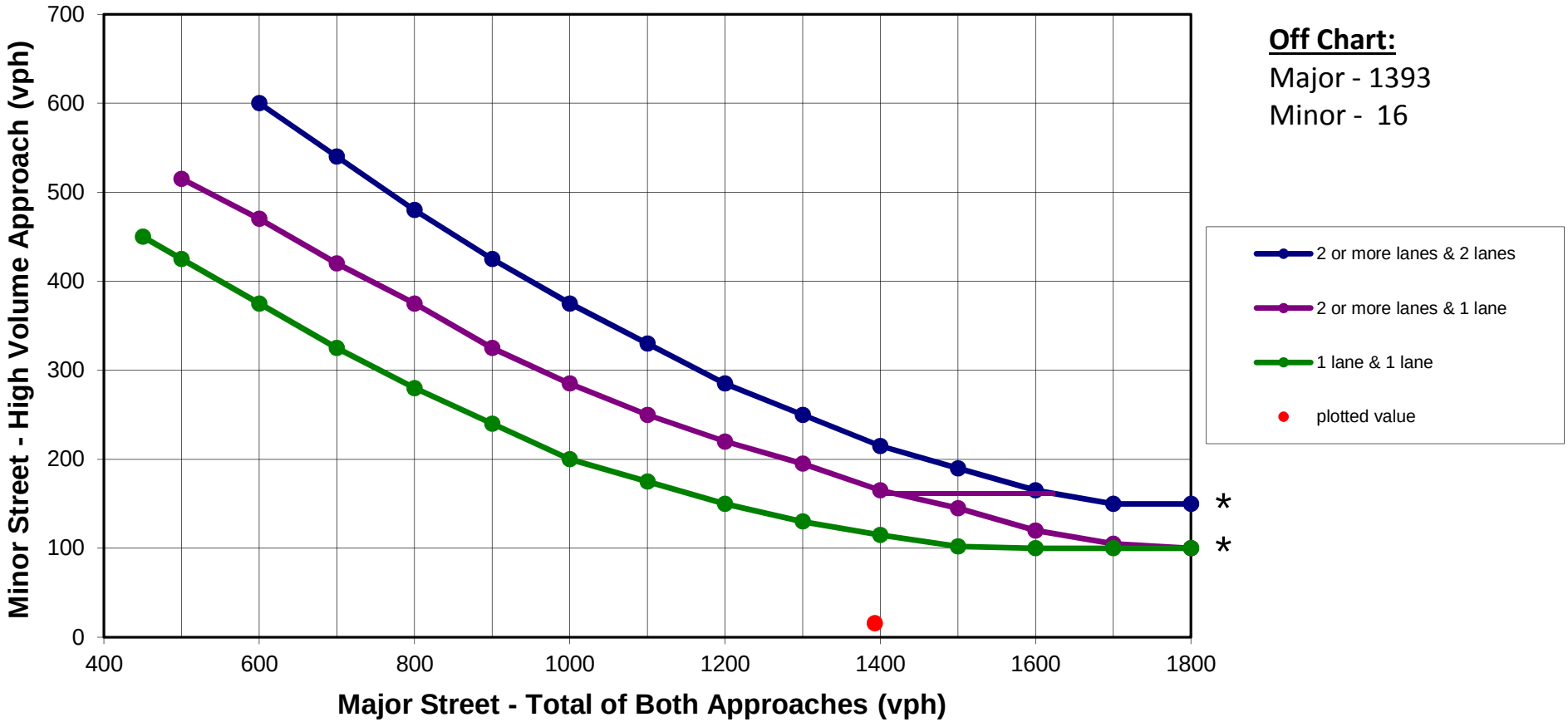
*Note: 150 vph applies as the lower threshold volume for a minor street approach with two or more lanes and 100 vph applies as the lower threshold volume for a minor street approach with one lane.

Existing PM Peak Hour Volume Warrant
MIssouri Route 9 & NW 63rd Street



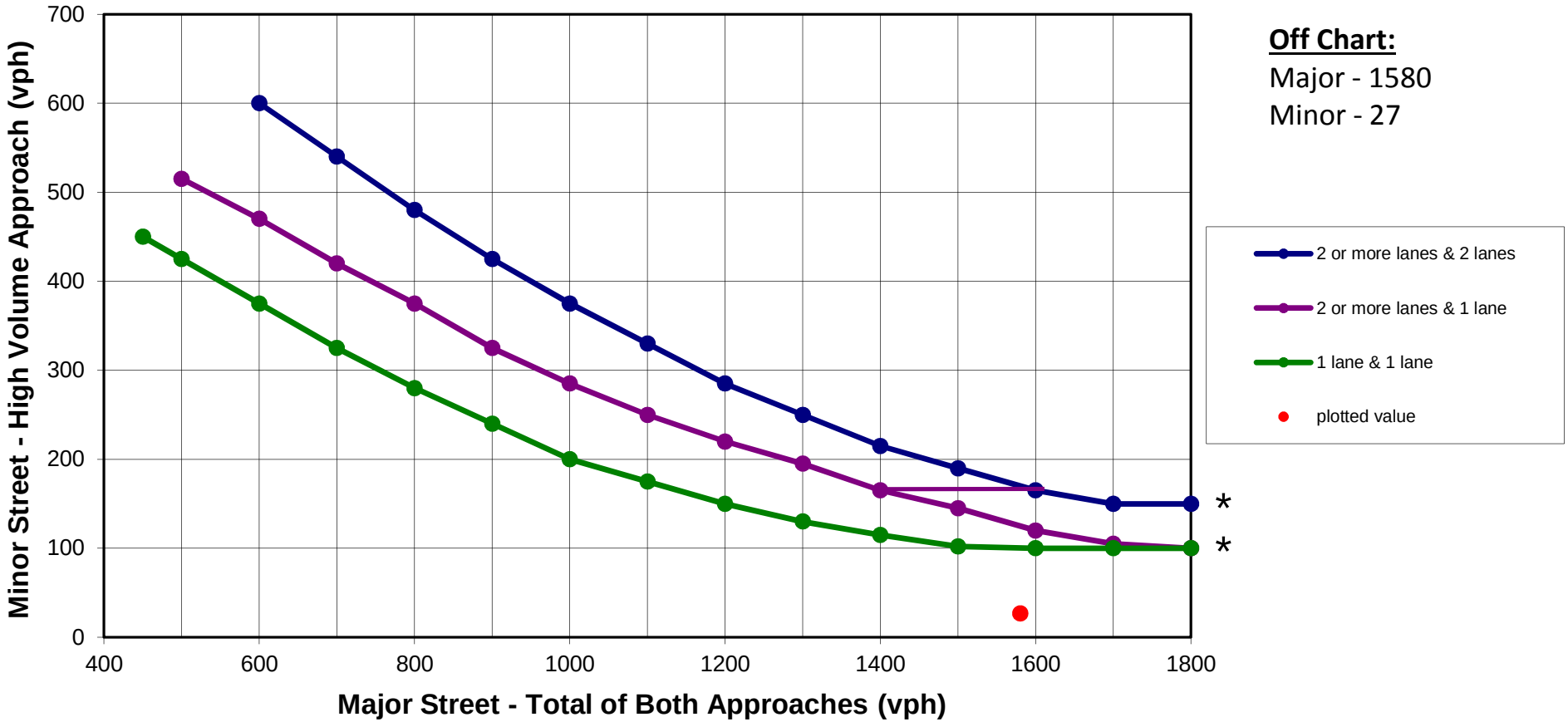
*Note: 150 vph applies as the lower threshold volume for a minor street approach with two or more lanes and 100 vph applies as the lower threshold volume for a minor street approach with one lane.

Existing PM Peak Hour Volume Warrant
MIssouri Route 9 & NW 62nd Street



*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.

Existing PM Peak Hour Volume Warrant
Missouri Route 45 & Julian Drive



*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

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Group Flow (vph)	149	492	189	272	398	81	94	141	142	92	334	128
v/c Ratio	0.48	0.47	0.32	0.92	0.30	0.12	0.42	0.36	0.30	0.84	0.77	0.25
Control Delay	62.0	28.0	3.3	81.2	26.1	0.3	55.4	38.1	4.3	103.9	52.0	3.1
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	62.0	28.0	3.3	81.2	26.1	0.3	55.4	38.1	4.3	103.9	52.0	3.1
Queue Length 50th (ft)	56	107	0	193	107	0	33	81	0	66	218	0
Queue Length 95th (ft)	75	86	14	#300	150	0	58	120	29	#148	286	0
Internal Link Dist (ft)		1113			871			429			798	
Turn Bay Length (ft)	310		360	325		340	180		180	235		230
Base Capacity (vph)	434	1041	597	296	1313	698	224	460	522	109	453	517
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.34	0.47	0.32	0.92	0.30	0.12	0.42	0.31	0.27	0.84	0.74	0.25

Intersection Summary

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

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	113	315	159	220	346	21	82	111	126	78	274	87
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	11	11	11	11	11	11	12	12	12	12	12	12
Total Lost time (s)	6.6	6.6	6.6	6.7	6.7	6.7	6.8	6.8	6.8	7.2	7.2	7.2
Lane Util. Factor	0.97	0.95	1.00	1.00	0.95	1.00	0.97	1.00	1.00	1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3319	3421	1531	1711	3421	1531	3433	1863	1583	1770	1863	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3319	3421	1531	1711	3421	1531	3433	1863	1583	1770	1863	1583
Peak-hour factor, PHF	0.76	0.64	0.84	0.81	0.87	0.26	0.87	0.79	0.89	0.85	0.82	0.68
Adj. Flow (vph)	149	492	189	272	398	81	94	141	142	92	334	128
RTOR Reduction (vph)	0	0	134	0	0	51	0	0	110	0	0	98
Lane Group Flow (vph)	149	492	55	272	398	30	94	141	32	92	334	30
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Perm
Protected Phases	1	6		5	2		7	4		3	8	
Permitted Phases			6			2			4			8
Actuated Green, G (s)	10.3	32.0	32.0	19.1	40.8	40.8	5.8	24.8	24.8	6.8	25.8	25.8
Effective Green, g (s)	10.3	32.0	32.0	19.1	40.8	40.8	5.8	24.8	24.8	6.8	25.8	25.8
Actuated g/C Ratio	0.09	0.29	0.29	0.17	0.37	0.37	0.05	0.23	0.23	0.06	0.23	0.23
Clearance Time (s)	6.6	6.6	6.6	6.7	6.7	6.7	6.8	6.8	6.8	7.2	7.2	7.2
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	4.0	5.0	5.0	4.0	5.0	5.0
Lane Grp Cap (vph)	310	995	445	297	1268	567	181	420	356	109	436	371
v/s Ratio Prot	0.04	c0.14		c0.16	0.12		0.03	0.08		c0.05	c0.18	
v/s Ratio Perm			0.04			0.02			0.02			0.02
v/c Ratio	0.48	0.49	0.12	0.92	0.31	0.05	0.52	0.34	0.09	0.84	0.77	0.08
Uniform Delay, d1	47.3	32.3	28.7	44.7	24.6	22.2	50.7	35.7	33.7	51.1	39.3	32.8
Progression Factor	1.21	0.82	0.41	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	1.2	1.7	0.6	31.0	0.6	0.2	3.3	1.0	0.2	43.0	9.2	0.2
Delay (s)	58.5	28.1	12.4	75.7	25.3	22.4	54.1	36.7	33.9	94.1	48.5	33.0
Level of Service	E	C	B	E	C	C	D	D	C	F	D	C
Approach Delay (s)		30.0			43.2			40.0			52.5	
Approach LOS		C			D			D			D	

Intersection Summary			
HCM 2000 Control Delay	40.4	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.71		
Actuated Cycle Length (s)	110.0	Sum of lost time (s)	27.3
Intersection Capacity Utilization	62.2%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

Intersection	
Int Delay, s/veh	0.3

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Vol, veh/h	510	9	5	583	4	6
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	75	160	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	76	75	31	88	50	38
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	671	12	16	662	8	16

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	671	0	1035	336
Stage 1	-	-	-	-	671	-
Stage 2	-	-	-	-	364	-
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	-	-	915	-	228	660
Stage 1	-	-	-	-	470	-
Stage 2	-	-	-	-	673	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	915	-	224	660
Mov Cap-2 Maneuver	-	-	-	-	224	-
Stage 1	-	-	-	-	470	-
Stage 2	-	-	-	-	661	-

Approach	EB	WB	NB
HCM Control Delay, s	0	0.2	14.6
HCM LOS			B

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	399	-	-	915	-
HCM Lane V/C Ratio	0.06	-	-	0.018	-
HCM Control Delay (s)	14.6	-	-	9	-
HCM Lane LOS	B	-	-	A	-
HCM 95th %tile Q(veh)	0.2	-	-	0.1	-

Intersection	
Int Delay, s/veh	0.9

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Vol, veh/h	7	23	248	0	9	597
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	60	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	29	72	79	25	75	76
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	24	32	314	0	12	786

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	1124	314	0	0	314	0
Stage 1	314	-	-	-	-	-
Stage 2	810	-	-	-	-	-
Critical Hdwy	6.42	6.22	-	-	4.12	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	-	-	2.218	-
Pot Cap-1 Maneuver	227	726	-	-	1246	-
Stage 1	741	-	-	-	-	-
Stage 2	438	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	225	726	-	-	1246	-
Mov Cap-2 Maneuver	225	-	-	-	-	-
Stage 1	741	-	-	-	-	-
Stage 2	434	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	16.4	0	0.1
HCM LOS	C		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	371	1246	-
HCM Lane V/C Ratio	-	-	0.151	0.01	-
HCM Control Delay (s)	-	-	16.4	7.9	-
HCM Lane LOS	-	-	C	A	-
HCM 95th %tile Q(veh)	-	-	0.5	0	-

Intersection	
Int Delay, s/veh	2.6

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Vol, veh/h	58	47	22	249	559	64
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	0	130	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	91	59	69	91	76	36
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	64	80	32	274	736	178

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	1161	824	913	0	-	0
Stage 1	824	-	-	-	-	-
Stage 2	337	-	-	-	-	-
Critical Hdwy	6.42	6.22	4.12	-	-	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	2.218	-	-	-
Pot Cap-1 Maneuver	216	373	746	-	-	-
Stage 1	431	-	-	-	-	-
Stage 2	723	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	207	373	746	-	-	-
Mov Cap-2 Maneuver	207	-	-	-	-	-
Stage 1	431	-	-	-	-	-
Stage 2	692	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	22.9	1	0
HCM LOS	C		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	EBLn2	SBT	SBR
Capacity (veh/h)	746	-	207	373	-	-
HCM Lane V/C Ratio	0.043	-	0.308	0.214	-	-
HCM Control Delay (s)	10	-	29.9	17.3	-	-
HCM Lane LOS	B	-	D	C	-	-
HCM 95th %tile Q(veh)	0.1	-	1.2	0.8	-	-

Intersection	
Int Delay, s/veh	3.7

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Vol, veh/h	51	1	47	2	1	5	43	263	1	11	574	68
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	40	-	-	65	-	95	80	-	-
Veh in Median Storage, #	-	1	-	-	1	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	71	25	62	50	25	42	67	86	25	46	84	90
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	72	4	76	4	4	12	64	306	4	24	683	76

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	1211	1203	721	1243	1241	306	759	0	0	306	0	0
Stage 1	769	769	-	434	434	-	-	-	-	-	-	-
Stage 2	442	434	-	809	807	-	-	-	-	-	-	-
Critical Hdwy	7.12	6.52	6.22	7.12	6.52	6.22	4.12	-	-	4.12	-	-
Critical Hdwy Stg 1	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Follow-up Hdwy	3.518	4.018	3.318	3.518	4.018	3.318	2.218	-	-	2.218	-	-
Pot Cap-1 Maneuver	159	184	427	151	175	734	852	-	-	1255	-	-
Stage 1	394	411	-	600	581	-	-	-	-	-	-	-
Stage 2	594	581	-	374	394	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	144	167	427	114	159	734	852	-	-	1255	-	-
Mov Cap-2 Maneuver	257	281	-	191	249	-	-	-	-	-	-	-
Stage 1	364	403	-	555	537	-	-	-	-	-	-	-
Stage 2	536	537	-	299	386	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	25.7	14.9	1.6	0.2
HCM LOS	D	B		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	WBLn2	SBL	SBT	SBR
Capacity (veh/h)	852	-	-	322	191	493	1255	-	-
HCM Lane V/C Ratio	0.075	-	-	0.471	0.021	0.032	0.019	-	-
HCM Control Delay (s)	9.6	-	-	25.7	24.3	12.5	7.9	-	-
HCM Lane LOS	A	-	-	D	C	B	A	-	-
HCM 95th %tile Q(veh)	0.2	-	-	2.4	0.1	0.1	0.1	-	-

Queues
13: MO9 & MO45

2/3/2015

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Group Flow (vph)	216	388	173	324	581	120	223	378	296	117	281	199
v/c Ratio	0.58	0.43	0.32	0.92	0.48	0.18	0.78	0.92	0.53	1.07	0.76	0.42
Control Delay	62.0	27.6	3.0	75.3	29.9	1.5	68.4	70.1	9.5	157.0	55.2	8.1
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	62.0	27.6	3.0	75.3	29.9	1.5	68.4	70.1	9.5	157.0	55.2	8.1
Queue Length 50th (ft)	83	67	0	224	167	0	80	260	13	~92	187	0
Queue Length 95th (ft)	122	91	5	#387	220	0	98	#430	60	#171	#297	37
Internal Link Dist (ft)		1113			871			429			798	
Turn Bay Length (ft)	310		360	325		340	180		180	235		230
Base Capacity (vph)	555	899	533	362	1216	659	287	426	573	109	386	485
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.39	0.43	0.32	0.90	0.48	0.18	0.78	0.89	0.52	1.07	0.73	0.41

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

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

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	197	372	126	295	500	90	165	352	243	91	275	157
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	11	11	11	11	11	11	12	12	12	12	12	12
Total Lost time (s)	6.6	6.6	6.6	6.7	6.7	6.7	6.8	6.8	6.8	7.2	7.2	7.2
Lane Util. Factor	0.97	0.95	1.00	1.00	0.95	1.00	0.97	1.00	1.00	1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3319	3421	1531	1711	3421	1531	3433	1863	1583	1770	1863	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3319	3421	1531	1711	3421	1531	3433	1863	1583	1770	1863	1583
Peak-hour factor, PHF	0.91	0.96	0.73	0.91	0.86	0.75	0.74	0.93	0.82	0.78	0.98	0.79
Adj. Flow (vph)	216	388	173	324	581	120	223	378	296	117	281	199
RTOR Reduction (vph)	0	0	128	0	0	77	0	0	212	0	0	159
Lane Group Flow (vph)	216	388	45	324	581	43	223	378	84	117	281	40
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Perm
Protected Phases	1	6		5	2		7	4		3	8	
Permitted Phases			6			2			4			8
Actuated Green, G (s)	12.4	28.9	28.9	22.6	39.1	39.1	9.2	24.4	24.4	6.8	22.0	22.0
Effective Green, g (s)	12.4	28.9	28.9	22.6	39.1	39.1	9.2	24.4	24.4	6.8	22.0	22.0
Actuated g/C Ratio	0.11	0.26	0.26	0.21	0.36	0.36	0.08	0.22	0.22	0.06	0.20	0.20
Clearance Time (s)	6.6	6.6	6.6	6.7	6.7	6.7	6.8	6.8	6.8	7.2	7.2	7.2
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	374	898	402	351	1216	544	287	413	351	109	372	316
v/s Ratio Prot	0.07	0.11		c0.19	c0.17		0.06	c0.20		c0.07	0.15	
v/s Ratio Perm			0.03			0.03			0.05			0.03
v/c Ratio	0.58	0.43	0.11	0.92	0.48	0.08	0.78	0.92	0.24	1.07	0.76	0.13
Uniform Delay, d1	46.3	33.7	30.8	42.8	27.5	23.5	49.4	41.8	35.2	51.6	41.5	36.1
Progression Factor	1.22	0.76	0.31	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	2.1	1.5	0.6	29.1	1.3	0.3	12.4	24.5	0.4	107.3	8.5	0.2
Delay (s)	58.4	26.9	10.0	72.0	28.9	23.8	61.8	66.3	35.5	158.9	49.9	36.3
Level of Service	E	C	B	E	C	C	E	E	D	F	D	D
Approach Delay (s)		31.9			41.9			55.0			66.7	

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Approach LOS		C			D			E			E	

Intersection Summary			
HCM 2000 Control Delay	47.6	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.79		
Actuated Cycle Length (s)	110.0	Sum of lost time (s)	27.3
Intersection Capacity Utilization	72.9%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

Intersection	
Int Delay, s/veh	7.4

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Vol, veh/h	62	52	86	681	580	66
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	0	130	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	86	87	61	93	89	72
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	72	60	141	732	652	92

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	1712	698	743	0	-	0
Stage 1	698	-	-	-	-	-
Stage 2	1014	-	-	-	-	-
Critical Hdwy	6.42	6.22	4.12	-	-	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	2.218	-	-	-
Pot Cap-1 Maneuver	100	440	864	-	-	-
Stage 1	494	-	-	-	-	-
Stage 2	350	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	84	440	864	-	-	-
Mov Cap-2 Maneuver	84	-	-	-	-	-
Stage 1	494	-	-	-	-	-
Stage 2	293	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	87.8	1.6	0
HCM LOS	F		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	EBLn2	SBT	SBR
Capacity (veh/h)	864	-	84	440	-	-
HCM Lane V/C Ratio	0.163	-	0.858	0.136	-	-
HCM Control Delay (s)	10	-	148.5	14.5	-	-
HCM Lane LOS	A	-	F	B	-	-
HCM 95th %tile Q(veh)	0.6	-	4.5	0.5	-	-

Intersection	
Int Delay, s/veh	0.7

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Vol, veh/h	1	15	752	9	26	606
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	60	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	25	42	94	45	72	85
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	4	36	800	20	36	713

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	1595	810	0	0	820	0
Stage 1	810	-	-	-	-	-
Stage 2	785	-	-	-	-	-
Critical Hdwy	6.42	6.22	-	-	4.12	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	-	-	2.218	-
Pot Cap-1 Maneuver	118	380	-	-	809	-
Stage 1	438	-	-	-	-	-
Stage 2	449	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	113	380	-	-	809	-
Mov Cap-2 Maneuver	113	-	-	-	-	-
Stage 1	438	-	-	-	-	-
Stage 2	429	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	18.5	0	0.5
HCM LOS	C		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	307	809	-
HCM Lane V/C Ratio	-	-	0.129	0.045	-
HCM Control Delay (s)	-	-	18.5	9.7	-
HCM Lane LOS	-	-	C	A	-
HCM 95th %tile Q(veh)	-	-	0.4	0.1	-

Intersection	
Int Delay, s/veh	1.2

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Vol, veh/h	678	28	10	864	21	6
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	75	160	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	93	64	31	90	48	30
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	729	44	32	960	44	20

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	729	0	1274	365
Stage 1	-	-	-	-	729	-
Stage 2	-	-	-	-	545	-
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	-	-	871	-	159	632
Stage 1	-	-	-	-	438	-
Stage 2	-	-	-	-	545	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	871	-	153	632
Mov Cap-2 Maneuver	-	-	-	-	153	-
Stage 1	-	-	-	-	438	-
Stage 2	-	-	-	-	525	-

Approach	EB	WB	NB
HCM Control Delay, s	0	0.3	31
HCM LOS			D

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	201	-	-	871	-
HCM Lane V/C Ratio	0.317	-	-	0.037	-
HCM Control Delay (s)	31	-	-	9.3	-
HCM Lane LOS	D	-	-	A	-
HCM 95th %tile Q(veh)	1.3	-	-	0.1	-

Intersection	
Int Delay, s/veh	5.8

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Vol, veh/h	68	1	41	6	3	6	50	686	7	12	599	85
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	40	-	-	65	-	95	80	-	-
Veh in Median Storage, #	-	1	-	-	1	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	89	25	45	75	38	25	60	88	35	60	90	71
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	76	4	91	8	8	24	83	780	20	20	666	120

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	1727	1711	725	1759	1771	780	785	0	0	780	0	0
Stage 1	765	765	-	946	946	-	-	-	-	-	-	-
Stage 2	962	946	-	813	825	-	-	-	-	-	-	-
Critical Hdwy	7.12	6.52	6.22	7.12	6.52	6.22	4.12	-	-	4.12	-	-
Critical Hdwy Stg 1	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Follow-up Hdwy	3.518	4.018	3.318	3.518	4.018	3.318	2.218	-	-	2.218	-	-
Pot Cap-1 Maneuver	~ 70	91	425	66	83	395	834	-	-	837	-	-
Stage 1	396	412	-	314	340	-	-	-	-	-	-	-
Stage 2	308	340	-	372	387	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	~ 58	80	425	46	73	395	834	-	-	837	-	-
Mov Cap-2 Maneuver	154	188	-	127	170	-	-	-	-	-	-	-
Stage 1	357	402	-	283	306	-	-	-	-	-	-	-
Stage 2	254	306	-	282	378	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	53.5	21.8	0.9	0.2
HCM LOS	F	C		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	WBLn2	SBL	SBT	SBR
Capacity (veh/h)	834	-	-	234	127	298	837	-	-
HCM Lane V/C Ratio	0.1	-	-	0.733	0.063	0.107	0.024	-	-
HCM Control Delay (s)	9.8	-	-	53.5	35.2	18.5	9.4	-	-
HCM Lane LOS	A	-	-	F	E	C	A	-	-
HCM 95th %tile Q(veh)	0.3	-	-	5	0.2	0.4	0.1	-	-

Notes

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

Existing + Development Conditions

Existing + Development Trip Generation

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
853/1670	Convenience Market w/ Gasoline Pumps	18	Positions	Average	9,767	50%	50%	4,884	4,883
Total					**9,767**			**4,884**	**4,883**

AM Peak Hour Trip Generation

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
853/1671	Convenience Market w/ Gasoline Pumps	18	Positions	Average	299	50%	50%	150	149
Total					**299**			**150**	**149**

PM Peak Hour Trip Generation

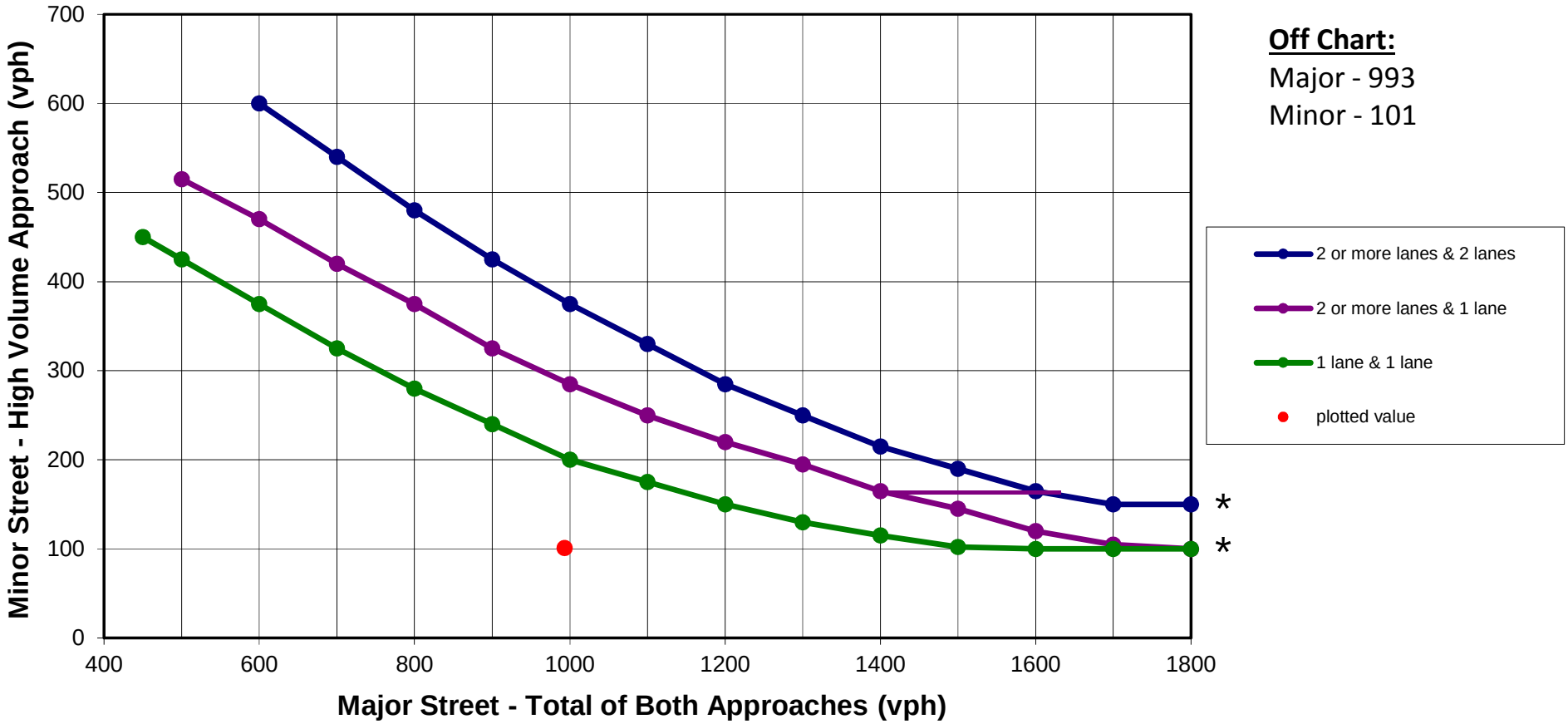
ITE Code/Page	Land Use	Size		Trip Gen. Avg. Rate/Eq.	PM Peak Hour Trips	Trip Distribution Enter	Trip Distribution Exit	PM Peak Hour Trips Enter	PM Peak Hour Trips Exit
853/1672	Convenience Market w/ Gasoline Pumps	18	Positions	Average	344	50%	50%	172	172
Total					**344**			**172**	**172**

Land Use	AM Peak Hour Trips		Pass-by Calculations				
			Pass-by	Pass-by Trips		Primary Trips	
	Enter	Exit	Percentage	Enter	Exit	Enter	Exit
Convenience Market w/Gas Pumps	150	149	40%	60	60	90	89
Total	**150**	**149**		**60**	**60**	**90**	**89**

Land Use	PM Peak Hour Trips		Pass-by Calculations				
			Pass-by	Pass-by Trips		Primary Trips	
	Enter	Exit	Percentage	Enter	Exit	Enter	Exit
Convenience Market w/Gas Pumps	172	172	40%	69	69	103	103
Total	**172**	**172**		**69**	**69**	**103**	**103**

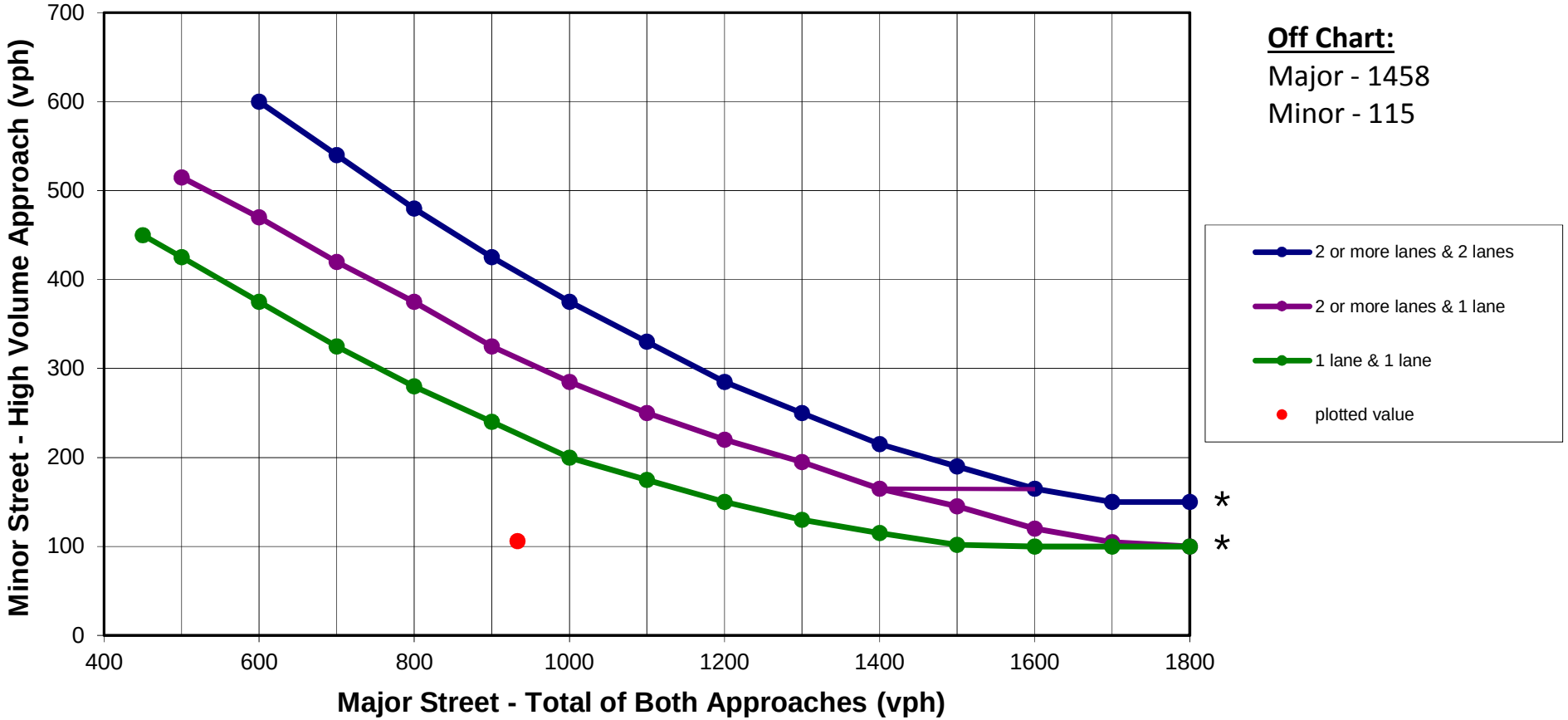
Existing + Development Signal Warrants Analysis

Existing + Development with Drive 3
AM Peak Hour Volume Warrant
Missouri Route 9 & Lewis Street



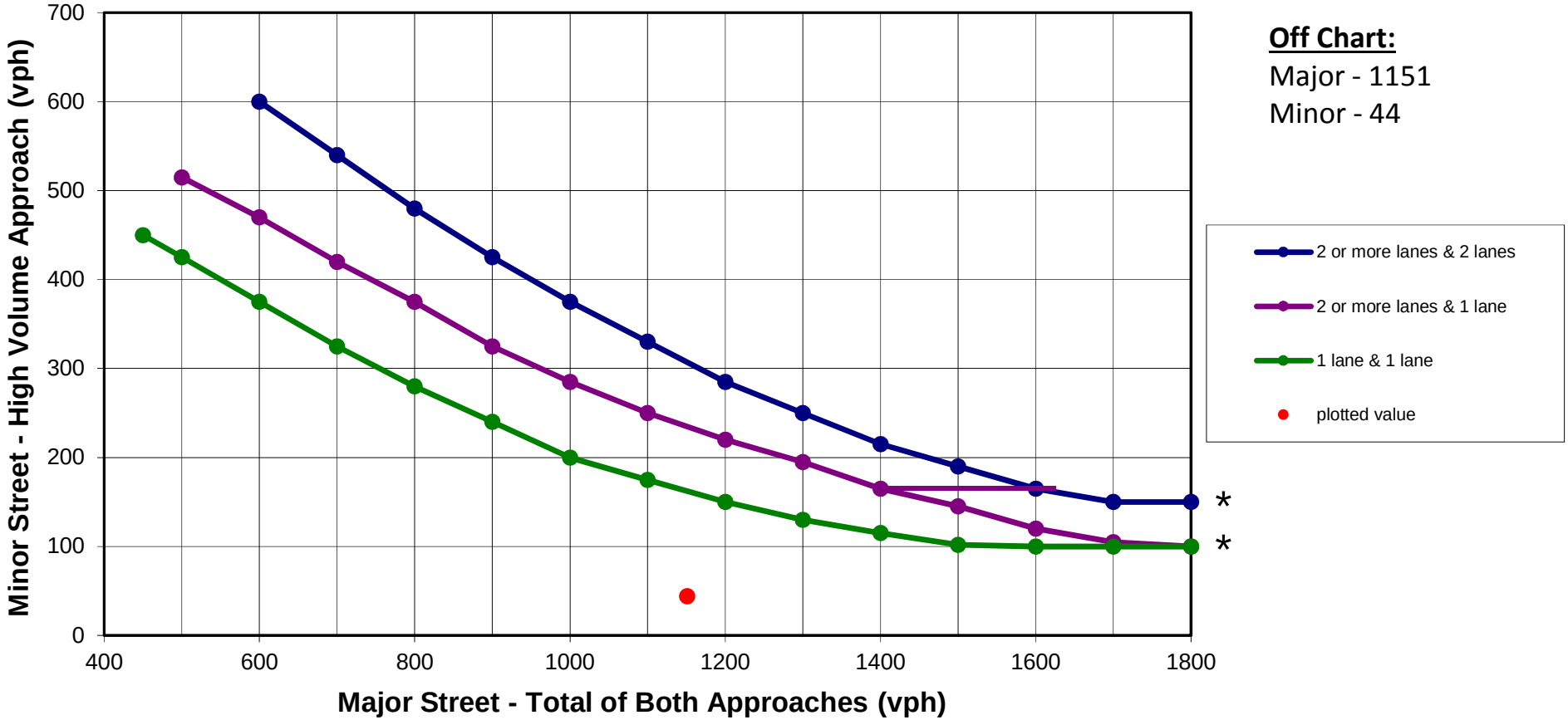
*Note: 150 vph applies as the lower threshold volume for a minor street approach with two or more lanes

Existing + Development with Drive 3
AM Peak Hour Volume Warrant
Missouri Route 9 & NW 63rd Street



*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.

Existing + Development with Drive 3
AM Peak Hour Volume Warrant
Missouri Route 45 & Julian Drive



*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.

8th Hour Warrant Analysis - MO Highway 9 and Lewis Street

Project: MO-9 and MO-45 QuikTrip TIA Job #: 012-2561
Designed by: Olsson Associates - JSS Checked by:

Intersection: MO Highway 9 and Lewis Street (with Drive 3)

Time Frame: PM Peak Hour

Major Street: MO Highway 9 Lanes: 1 Number of Through Lanes
Total Volume: 1479

Minor Street: Lewis Street Lanes: 1 Number of Through Lanes
Volume of One Approach: 112

Peak is What Percent of Daily Traffic: 10% Must be Between 7 and 15
8th Hour Factor: 0.0571
Volume Reductions: no (Yes or No) Population under 10,000 or 85th percentile speed exceeds 40 mph.

Projected 8th Hour Volumes:
Major Street: 845
Minor Street: 64

Condition A - Minimum Vehicular Volume

	Required Volume	Meets Warrant	
Major Street:	500	YES	**DOES NOT MEET WARRANT**
Minor Street:	150	NO	

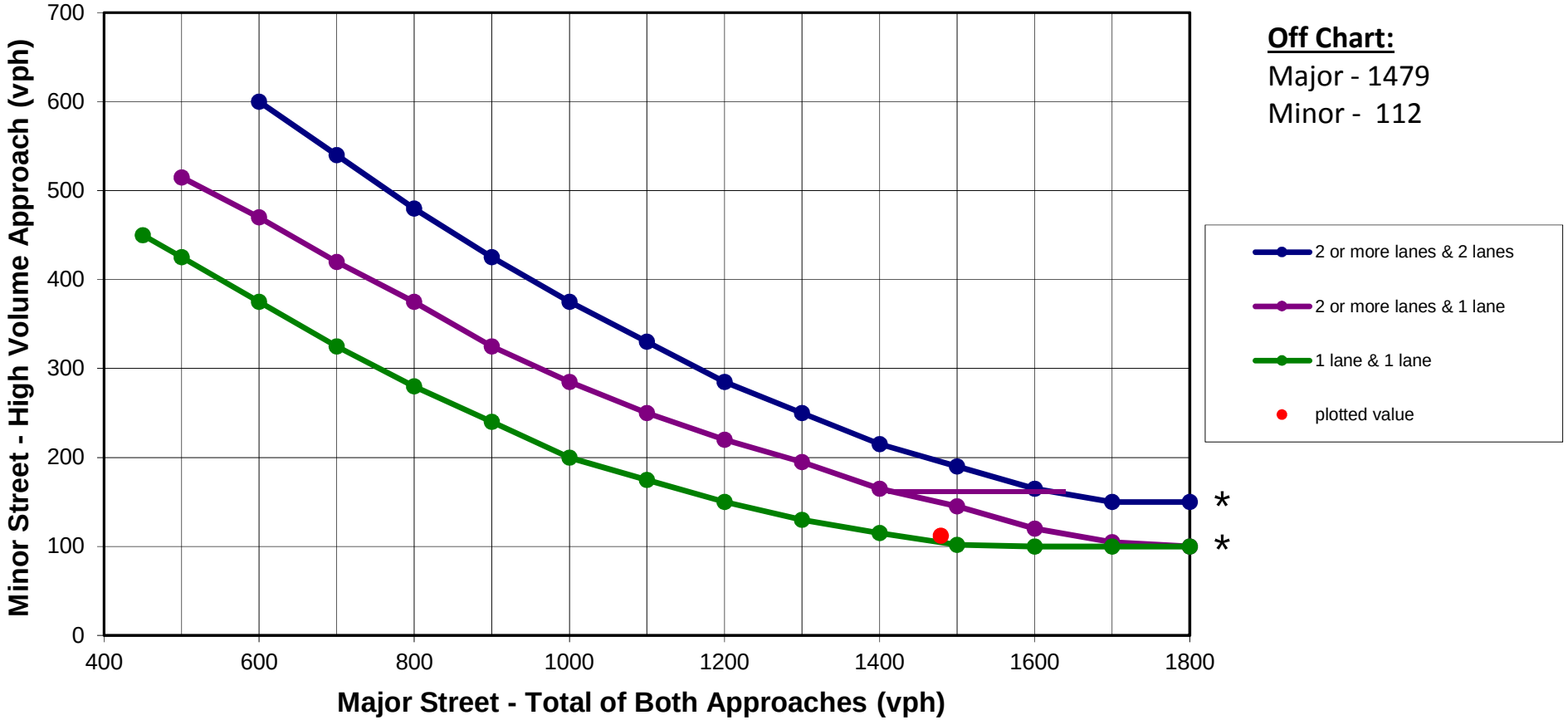
Condition B - Interruption of Continuous Traffic

	Required Volume	Meets Warrant	
Major Street:	750	YES	**DOES NOT MEET WARRANT**
Minor Street:	75	NO	

s

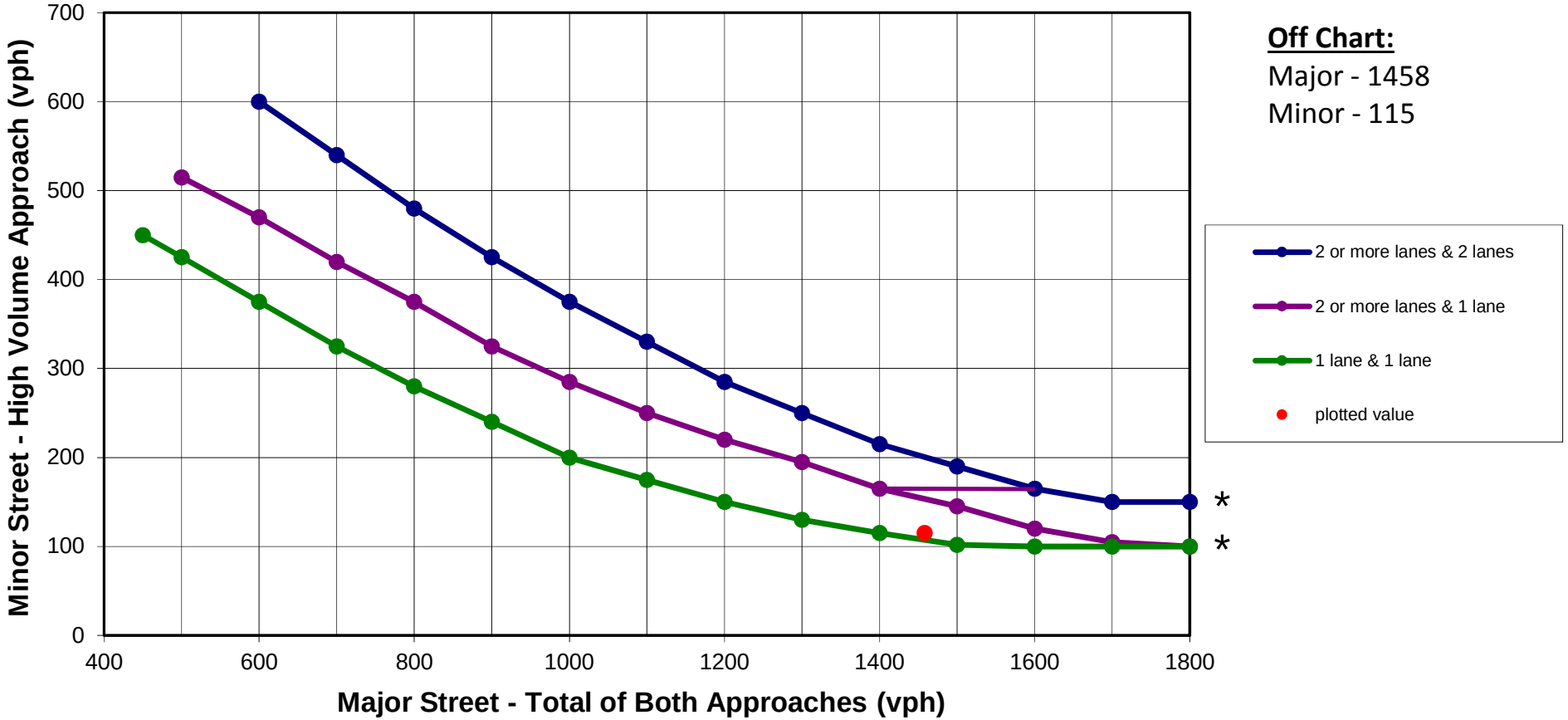
s

Existing + Development with Drive 3
PM Peak Hour Volume Warrant
Missouri Route 9 & Lewis Street



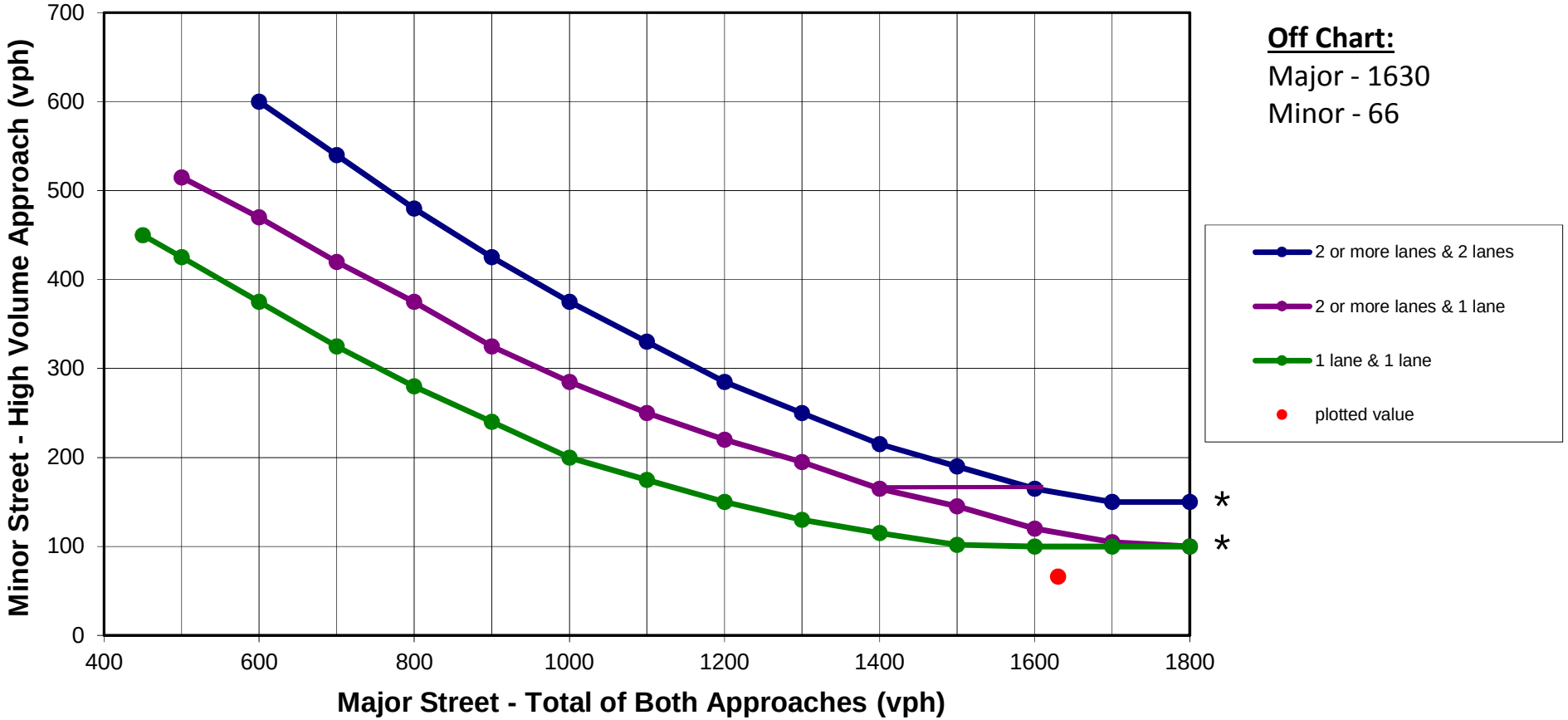
*Note: 150 vph applies as the lower threshold volume for a minor street approach with two or more lanes and 100 vph applies as the lower threshold volume for a minor street approach with one lane.

Existing + Development with Drive 3
PM Peak Hour Volume Warrant
Missouri Route 9 & NW 63rd Street



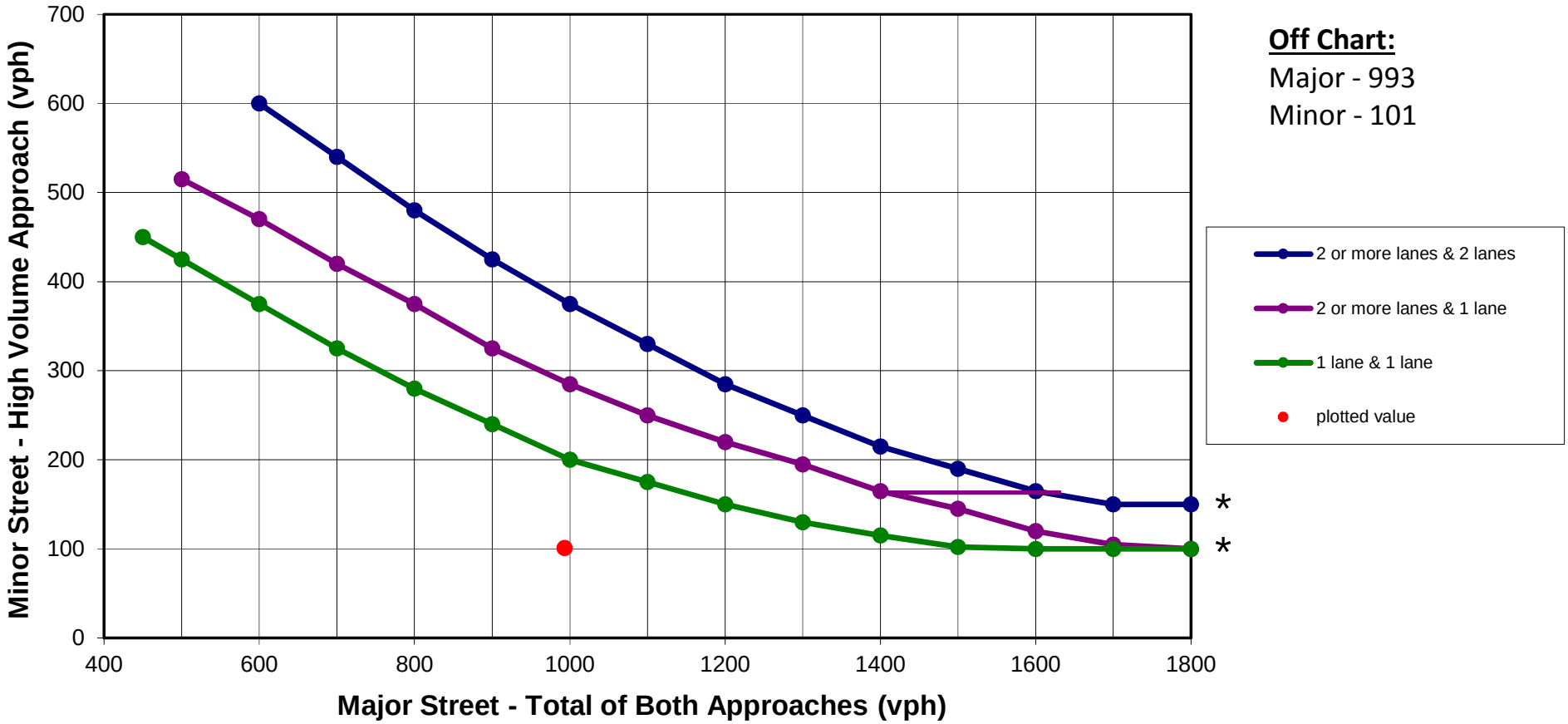
*Note: 150 vph applies as the lower threshold volume for a minor street approach with two or more lanes and 100 vph applies as the lower threshold volume for a minor street approach with one lane.

Existing + Development with Drive 3
PM Peak Hour Volume Warrant
Missouri Route 45 & Julian Drive



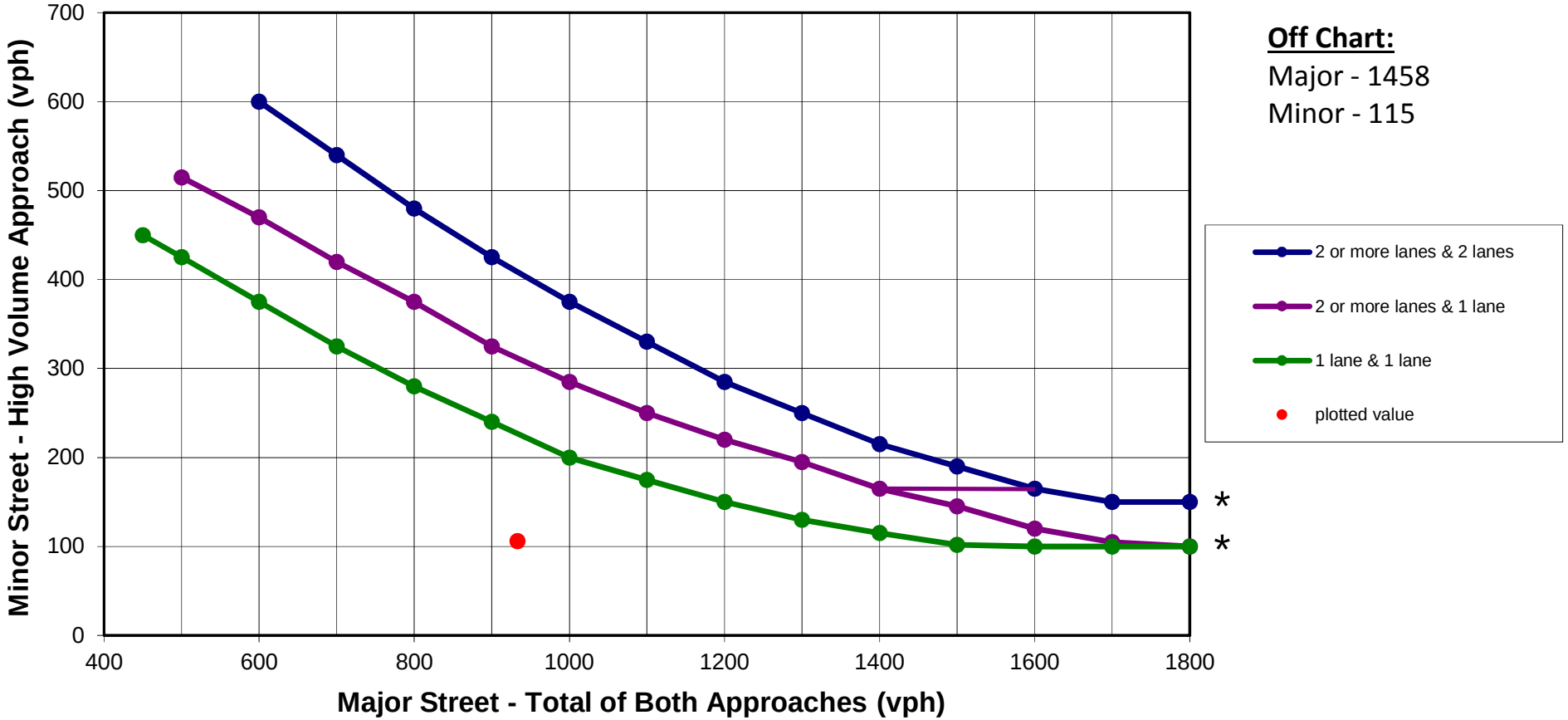
*Note: 150 vph applies as the lower threshold volume for a minor street approach with two or more lanes and 100 vph applies as the lower threshold volume for a minor street approach with one lane.

Existing + Development with Drive 3
AM Peak Hour Volume Warrant
Missouri Route 9 & Lewis Street



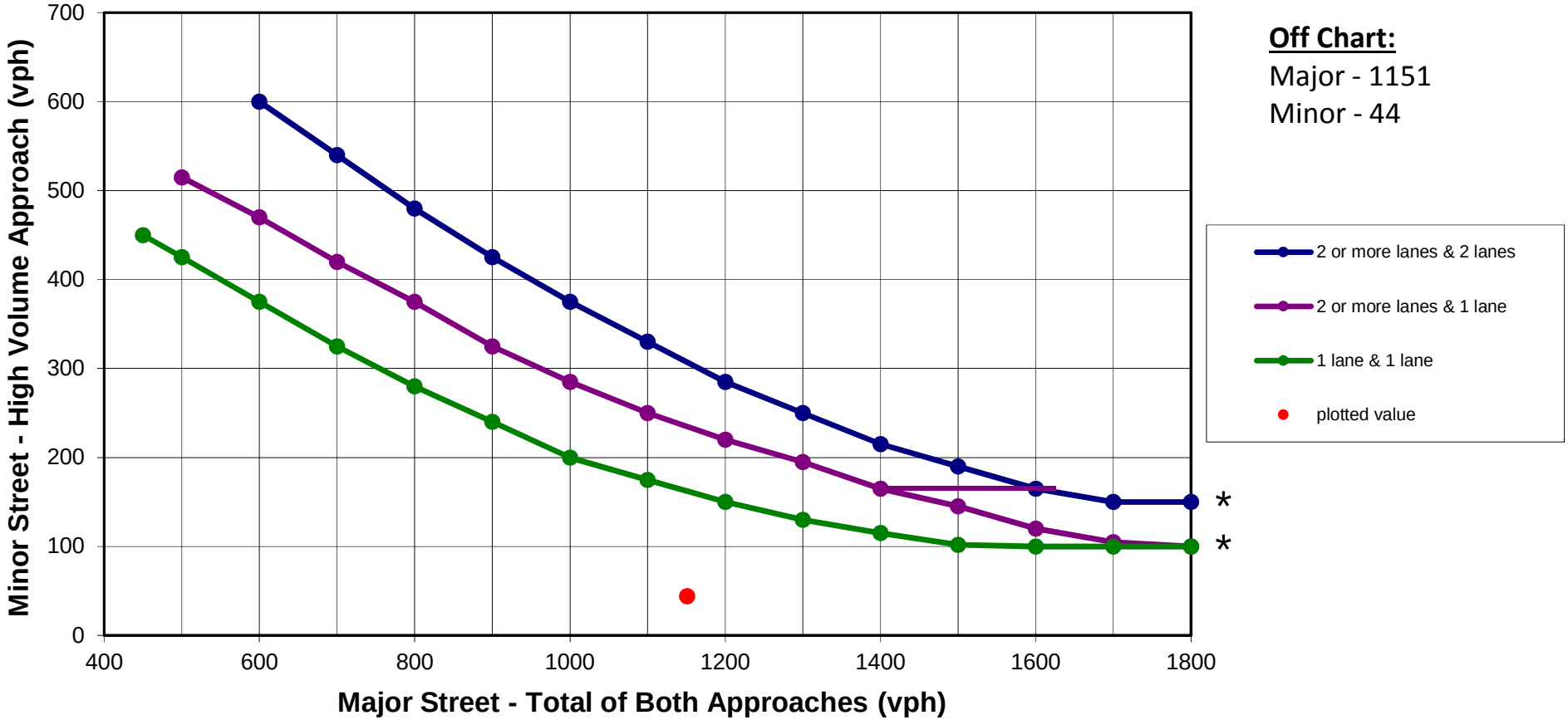
*Note: 150 vph applies as the lower threshold volume for a minor street approach with two or more lanes

Existing + Development with Drive 3
AM Peak Hour Volume Warrant
Missouri Route 9 & NW 63rd Street



*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.

Existing + Development with Drive 3
AM Peak Hour Volume Warrant
Missouri Route 45 & Julian Drive



*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.

8th Hour Warrant Analysis - MO Highway 9 and Lewis Street

Project: MO-9 and MO-45 QuikTrip TIA Job #: 012-2561
Designed by: Olsson Associates - JSS Checked by:

Intersection: MO Highway 9 and Lewis Street (with Drive 3)

Time Frame: PM Peak Hour

Major Street: MO Highway 9 Lanes: 1 Number of Through Lanes
Total Volume: 1479

Minor Street: Lewis Street Lanes: 1 Number of Through Lanes
Volume of One Approach: 112

Peak is What Percent of Daily Traffic: 10% Must be Between 7 and 15
8th Hour Factor: 0.0571
Volume Reductions: no (Yes or No) Population under 10,000 or 85th percentile speed exceeds 40 mph.

Projected 8th Hour Volumes:
Major Street: 845
Minor Street: 64

Condition A - Minimum Vehicular Volume

	Required Volume	Meets Warrant	
Major Street:	500	YES	**DOES NOT MEET WARRANT**
Minor Street:	150	NO	

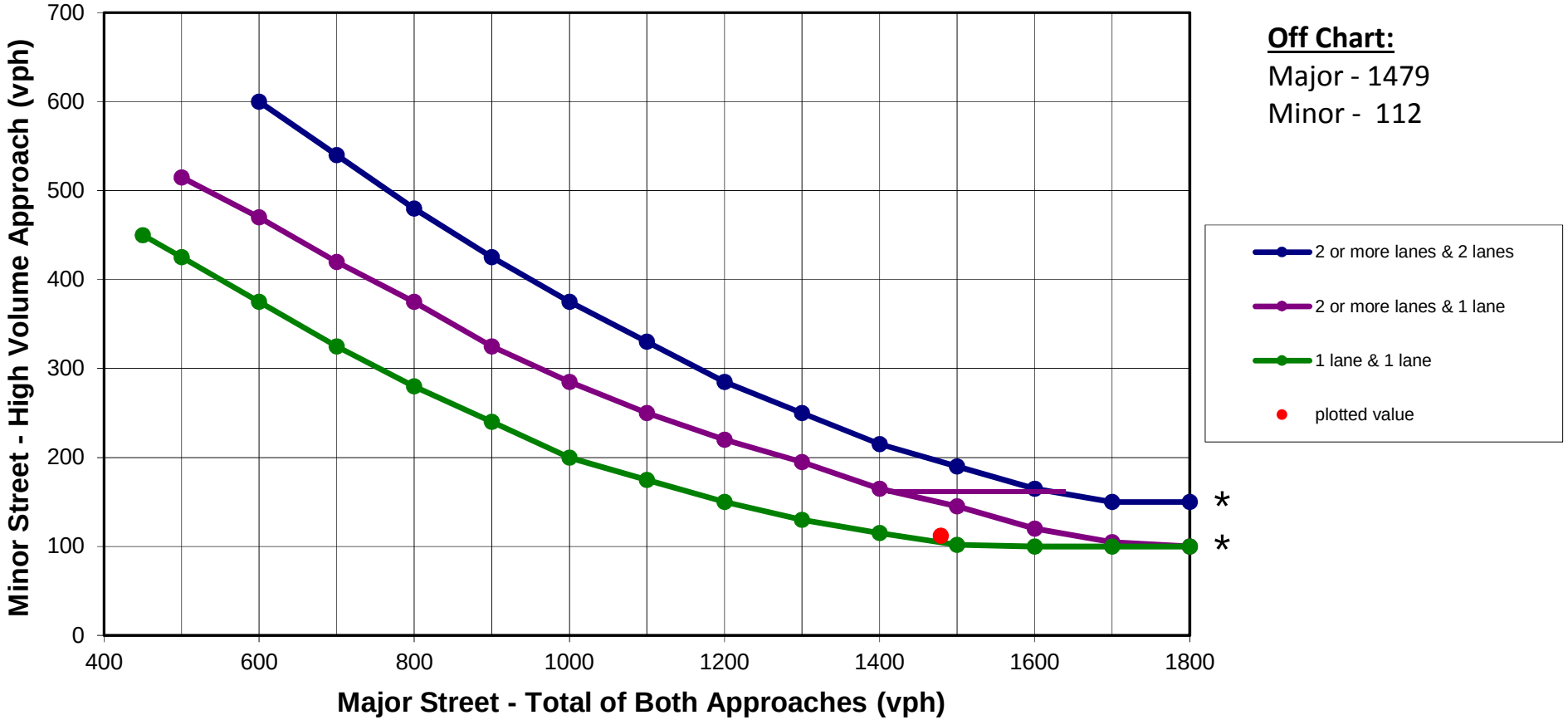
Condition B - Interruption of Continuous Traffic

	Required Volume	Meets Warrant	
Major Street:	750	YES	**DOES NOT MEET WARRANT**
Minor Street:	75	NO	

s

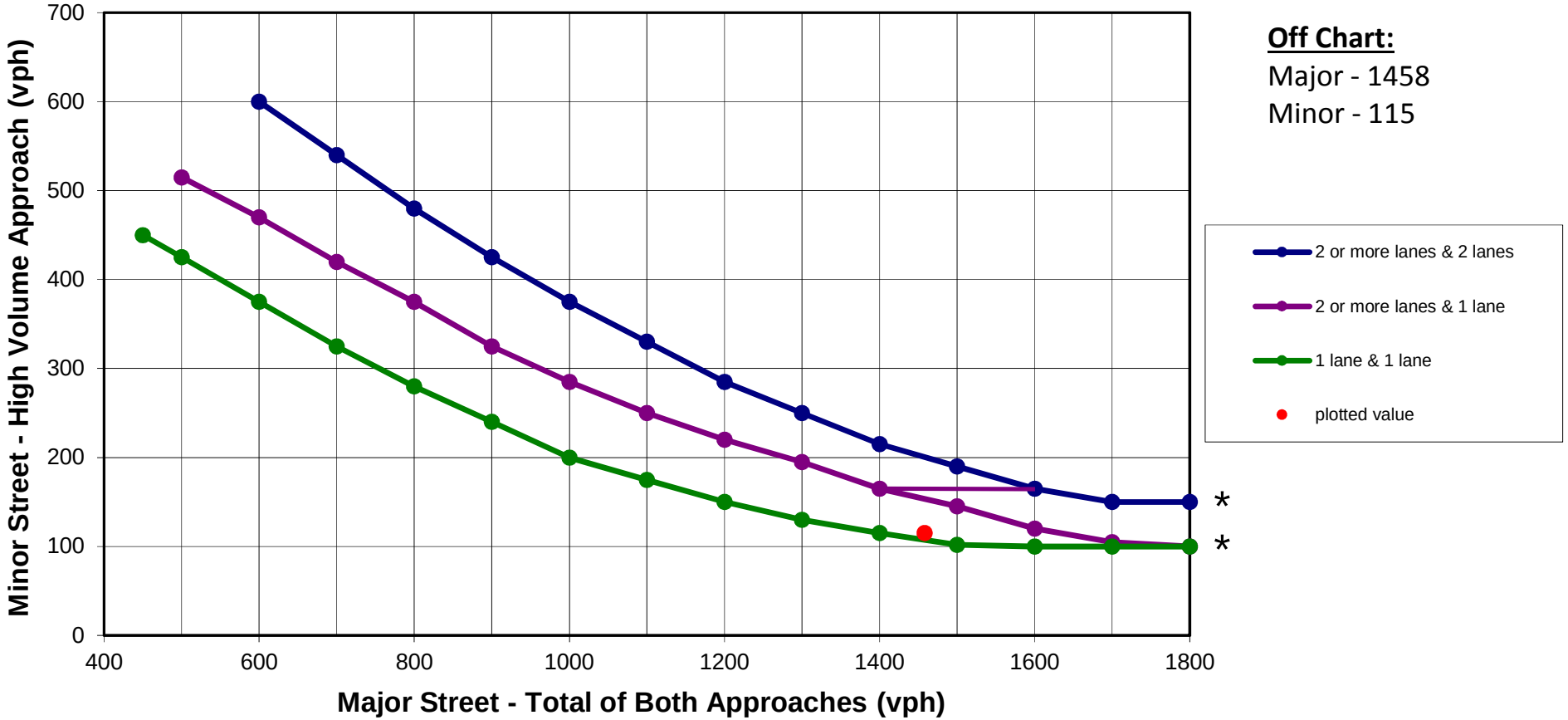
s

Existing + Development with Drive 3
PM Peak Hour Volume Warrant
Missouri Route 9 & Lewis Street



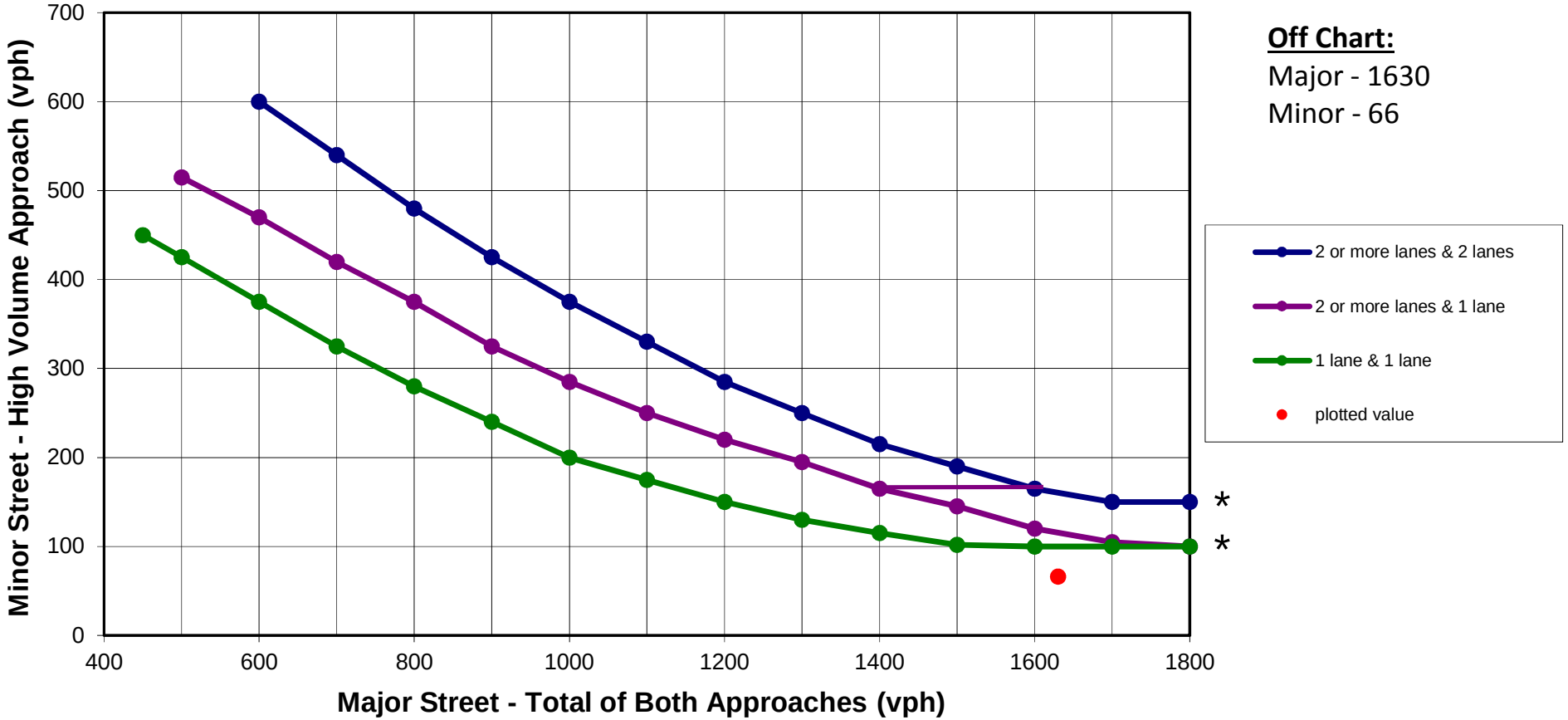
*Note: 150 vph applies as the lower threshold volume for a minor street approach with two or more lanes and 100 vph applies as the lower threshold volume for a minor street approach with one lane.

Existing + Development with Drive 3
PM Peak Hour Volume Warrant
Missouri Route 9 & NW 63rd Street



*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.

Existing + Development with Drive 3
PM Peak Hour Volume Warrant
Missouri Route 45 & Julian Drive



*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.

Existing + Development Capacity Analysis

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Group Flow (vph)	149	511	201	272	389	138	129	144	142	109	338	128
v/c Ratio	0.48	0.52	0.34	0.92	0.31	0.20	0.58	0.34	0.29	1.00	0.80	0.26
Control Delay	62.6	29.4	3.5	81.9	26.7	2.4	60.6	37.2	4.1	139.2	55.4	3.1
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	62.6	29.4	3.5	81.9	26.7	2.4	60.6	37.2	4.1	139.2	55.4	3.1
Queue Length 50th (ft)	56	118	0	193	105	0	46	83	0	78	221	0
Queue Length 95th (ft)	75	90	14	#300	146	0	75	122	29	#179	290	0
Internal Link Dist (ft)		1113			142			429			798	
Turn Bay Length (ft)	310		360	325		340	180		180	235		230
Base Capacity (vph)	434	984	583	295	1254	674	224	460	522	109	453	517
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.34	0.52	0.34	0.92	0.31	0.20	0.58	0.31	0.27	1.00	0.75	0.25

Intersection Summary

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

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	113	327	169	220	338	36	112	114	126	93	277	87
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	11	11	11	11	11	11	12	12	12	12	12	12
Total Lost time (s)	6.6	6.6	6.6	6.7	6.7	6.7	6.8	6.8	6.8	7.2	7.2	7.2
Lane Util. Factor	0.97	0.95	1.00	1.00	0.95	1.00	0.97	1.00	1.00	1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3319	3421	1531	1711	3421	1531	3433	1863	1583	1770	1863	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3319	3421	1531	1711	3421	1531	3433	1863	1583	1770	1863	1583
Peak-hour factor, PHF	0.76	0.64	0.84	0.81	0.87	0.26	0.87	0.79	0.89	0.85	0.82	0.68
Adj. Flow (vph)	149	511	201	272	389	138	129	144	142	109	338	128
RTOR Reduction (vph)	0	0	143	0	0	87	0	0	109	0	0	99
Lane Group Flow (vph)	149	511	58	272	389	51	129	144	33	109	338	29
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Perm
Protected Phases	1	6		5	2		7	4		3	8	
Permitted Phases			6			2			4			8
Actuated Green, G (s)	10.3	31.6	31.6	19.0	40.3	40.3	7.2	25.3	25.3	6.8	24.9	24.9
Effective Green, g (s)	10.3	31.6	31.6	19.0	40.3	40.3	7.2	25.3	25.3	6.8	24.9	24.9
Actuated g/C Ratio	0.09	0.29	0.29	0.17	0.37	0.37	0.07	0.23	0.23	0.06	0.23	0.23
Clearance Time (s)	6.6	6.6	6.6	6.7	6.7	6.7	6.8	6.8	6.8	7.2	7.2	7.2
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	4.0	5.0	5.0	4.0	5.0	5.0
Lane Grp Cap (vph)	310	982	439	295	1253	560	224	428	364	109	421	358
v/s Ratio Prot	0.04	c0.15		c0.16	0.11		0.04	0.08		c0.06	c0.18	
v/s Ratio Perm			0.04			0.03			0.02			0.02
v/c Ratio	0.48	0.52	0.13	0.92	0.31	0.09	0.58	0.34	0.09	1.00	0.80	0.08
Uniform Delay, d1	47.3	32.8	29.0	44.8	24.9	22.8	49.9	35.3	33.3	51.6	40.2	33.5
Progression Factor	1.23	0.82	0.42	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	1.2	1.9	0.6	32.6	0.6	0.3	4.2	1.0	0.2	86.2	12.0	0.2
Delay (s)	59.1	28.9	12.9	77.4	25.6	23.2	54.2	36.3	33.5	137.8	52.2	33.7
Level of Service	E	C	B	E	C	C	D	D	C	F	D	C
Approach Delay (s)		30.4			42.8			40.9			64.3	
Approach LOS		C			D			D			E	

Intersection Summary			
HCM 2000 Control Delay	43.1	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.73		
Actuated Cycle Length (s)	110.0	Sum of lost time (s)	27.3
Intersection Capacity Utilization	62.7%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

Intersection	
Int Delay, s/veh	3

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Vol, veh/h	59	47	22	350	736	65
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	0	130	-	-	0
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	91	59	69	91	76	36
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	65	80	32	385	968	181

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	1416	968	968	0	-	0
Stage 1	968	-	-	-	-	-
Stage 2	448	-	-	-	-	-
Critical Hdwy	6.42	6.22	4.12	-	-	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	2.218	-	-	-
Pot Cap-1 Maneuver	151	308	712	-	-	-
Stage 1	368	-	-	-	-	-
Stage 2	644	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	144	308	712	-	-	-
Mov Cap-2 Maneuver	144	-	-	-	-	-
Stage 1	368	-	-	-	-	-
Stage 2	615	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	33.4	0.8	0
HCM LOS	D		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	EBLn2	SBT	SBR
Capacity (veh/h)	712	-	144	308	-	-
HCM Lane V/C Ratio	0.045	-	0.45	0.259	-	-
HCM Control Delay (s)	10.3	-	49	20.7	-	-
HCM Lane LOS	B	-	E	C	-	-
HCM 95th %tile Q(veh)	0.1	-	2	1	-	-

Intersection	
Int Delay, s/veh	1

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Vol, veh/h	7	24	348	0	10	773
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	60	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	29	72	79	25	75	76
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	24	33	441	0	13	1017

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	1485	441	0	0	441	0
Stage 1	441	-	-	-	-	-
Stage 2	1044	-	-	-	-	-
Critical Hdwy	6.42	6.22	-	-	4.12	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	-	-	2.218	-
Pot Cap-1 Maneuver	137	616	-	-	1119	-
Stage 1	648	-	-	-	-	-
Stage 2	339	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	135	616	-	-	1119	-
Mov Cap-2 Maneuver	135	-	-	-	-	-
Stage 1	648	-	-	-	-	-
Stage 2	335	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	23.9	0	0.1
HCM LOS	C		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	247	1119	-
HCM Lane V/C Ratio	-	-	0.233	0.012	-
HCM Control Delay (s)	-	-	23.9	8.3	-
HCM Lane LOS	-	-	C	A	-
HCM 95th %tile Q(veh)	-	-	0.9	0	-

Intersection	
Int Delay, s/veh	3

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Vol, veh/h	34	1	1	10	14	45
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	37	1	1	11	15	49

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	53	40	64	0	-	0
Stage 1	40	-	-	-	-	-
Stage 2	13	-	-	-	-	-
Critical Hdwy	6.42	6.22	4.12	-	-	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	2.218	-	-	-
Pot Cap-1 Maneuver	955	1031	1538	-	-	-
Stage 1	982	-	-	-	-	-
Stage 2	1010	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	954	1031	1538	-	-	-
Mov Cap-2 Maneuver	954	-	-	-	-	-
Stage 1	982	-	-	-	-	-
Stage 2	1009	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	8.9	0.7	0
HCM LOS	A		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	1538	-	956	-	-
HCM Lane V/C Ratio	0.001	-	0.04	-	-
HCM Control Delay (s)	7.3	0	8.9	-	-
HCM Lane LOS	A	A	A	-	-
HCM 95th %tile Q(veh)	0	-	0.1	-	-

Intersection	
Int Delay, s/veh	0.3

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Vol, veh/h	634	45	0	745	0	35
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	105	110	-	-	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	689	49	0	810	0	38

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	689	0	1013	345
Stage 1	-	-	-	-	689	-
Stage 2	-	-	-	-	324	-
Critical Hdwy	-	-	4.14	-	6.29	6.94
Critical Hdwy Stg 1	-	-	-	-	5.84	-
Critical Hdwy Stg 2	-	-	-	-	6.04	-
Follow-up Hdwy	-	-	2.22	-	3.67	3.32
Pot Cap-1 Maneuver	-	-	901	-	268	651
Stage 1	-	-	-	-	447	-
Stage 2	-	-	-	-	669	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	901	-	268	651
Mov Cap-2 Maneuver	-	-	-	-	268	-
Stage 1	-	-	-	-	447	-
Stage 2	-	-	-	-	669	-

Approach	EB	WB	NB
HCM Control Delay, s	0	0	10.9
HCM LOS			B

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	651	-	-	901	-
HCM Lane V/C Ratio	0.058	-	-	-	-
HCM Control Delay (s)	10.9	-	-	0	-
HCM Lane LOS	B	-	-	A	-
HCM 95th %tile Q(veh)	0.2	-	-	0	-

Intersection	
Int Delay, s/veh	5.1

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Vol, veh/h	660	9	50	716	29	15
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	75	160	-	0	0
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	76	75	31	88	50	38
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	868	12	161	814	58	39

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	868	0	1597	434
Stage 1	-	-	-	-	868	-
Stage 2	-	-	-	-	729	-
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	-	-	772	-	97	570
Stage 1	-	-	-	-	371	-
Stage 2	-	-	-	-	438	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	772	-	77	570
Mov Cap-2 Maneuver	-	-	-	-	77	-
Stage 1	-	-	-	-	371	-
Stage 2	-	-	-	-	347	-

Approach	EB	WB	NB
HCM Control Delay, s	0	1.8	84.4
HCM LOS			F

Minor Lane/Major Mvmt	NBLn1	NBLn2	EBT	EBR	WBL	WBT
Capacity (veh/h)	77	570	-	-	772	-
HCM Lane V/C Ratio	0.753	0.069	-	-	0.209	-
HCM Control Delay (s)	133.8	11.8	-	-	10.9	-
HCM Lane LOS	F	B	-	-	B	-
HCM 95th %tile Q(veh)	3.6	0.2	-	-	0.8	-

Intersection	
Int Delay, s/veh	5

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Vol, veh/h	51	3	47	34	3	50	43	333	33	36	720	68
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	75	-	-	40	-	-	65	-	95	80	-	-
Veh in Median Storage, #	-	1	-	-	1	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	71	25	62	50	25	42	67	86	25	46	84	90
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	72	12	76	68	12	119	64	387	132	78	857	76

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	1379	1699	466	1173	1671	260	933	0	0	519	0	0
Stage 1	1051	1051	-	582	582	-	-	-	-	-	-	-
Stage 2	328	648	-	591	1089	-	-	-	-	-	-	-
Critical Hdwy	7.54	6.54	6.94	7.54	6.54	6.94	4.14	-	-	4.14	-	-
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	3.52	4.02	3.32	3.52	4.02	3.32	2.22	-	-	2.22	-	-
Pot Cap-1 Maneuver	104	91	543	147	95	739	729	-	-	1043	-	-
Stage 1	243	302	-	466	497	-	-	-	-	-	-	-
Stage 2	659	464	-	460	290	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	72	77	543	106	80	739	729	-	-	1043	-	-
Mov Cap-2 Maneuver	161	175	-	202	158	-	-	-	-	-	-	-
Stage 1	222	279	-	425	453	-	-	-	-	-	-	-
Stage 2	491	423	-	350	268	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	28.6	19.7	1.1	0.7
HCM LOS	D	C		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	EBLn2	WBLn1	WBLn2	SBL	SBT	SBR
Capacity (veh/h)	729	-	-	161	422	202	553	1043	-	-
HCM Lane V/C Ratio	0.088	-	-	0.446	0.208	0.337	0.237	0.075	-	-
HCM Control Delay (s)	10.4	-	-	44.2	15.8	31.6	13.5	8.7	-	-
HCM Lane LOS	B	-	-	E	C	D	B	A	-	-
HCM 95th %tile Q(veh)	0.3	-	-	2	0.8	1.4	0.9	0.2	-	-

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Group Flow (vph)	216	403	188	324	570	144	272	382	296	136	287	199
v/c Ratio	0.58	0.45	0.35	0.92	0.47	0.22	0.95	0.92	0.53	1.25	0.77	0.42
Control Delay	62.0	27.9	3.4	75.3	29.8	2.8	92.2	71.2	9.7	210.2	56.2	8.1
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	62.0	27.9	3.4	75.3	29.8	2.8	92.2	71.2	9.7	210.2	56.2	8.1
Queue Length 50th (ft)	83	72	0	224	164	0	100	263	14	~120	191	0
Queue Length 95th (ft)	121	94	7	#387	216	7	#130	#435	62	#202	#306	37
Internal Link Dist (ft)		1113			142			429			798	
Turn Bay Length (ft)	310		360	325		340	180		180	235		230
Base Capacity (vph)	555	896	539	362	1213	658	287	426	570	109	386	485
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.39	0.45	0.35	0.90	0.47	0.22	0.95	0.90	0.52	1.25	0.74	0.41

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

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

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	197	387	137	295	490	108	201	355	243	106	281	157
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	11	11	11	11	11	11	12	12	12	12	12	12
Total Lost time (s)	6.6	6.6	6.6	6.7	6.7	6.7	6.8	6.8	6.8	7.2	7.2	7.2
Lane Util. Factor	0.97	0.95	1.00	1.00	0.95	1.00	0.97	1.00	1.00	1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3319	3421	1531	1711	3421	1531	3433	1863	1583	1770	1863	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3319	3421	1531	1711	3421	1531	3433	1863	1583	1770	1863	1583
Peak-hour factor, PHF	0.91	0.96	0.73	0.91	0.86	0.75	0.74	0.93	0.82	0.78	0.98	0.79
Adj. Flow (vph)	216	403	188	324	570	144	272	382	296	136	287	199
RTOR Reduction (vph)	0	0	139	0	0	93	0	0	210	0	0	159
Lane Group Flow (vph)	216	403	49	324	570	51	272	382	86	136	287	40
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Perm
Protected Phases	1	6		5	2		7	4		3	8	
Permitted Phases			6			2			4			8
Actuated Green, G (s)	12.4	28.8	28.8	22.6	39.0	39.0	9.2	24.5	24.5	6.8	22.1	22.1
Effective Green, g (s)	12.4	28.8	28.8	22.6	39.0	39.0	9.2	24.5	24.5	6.8	22.1	22.1
Actuated g/C Ratio	0.11	0.26	0.26	0.21	0.35	0.35	0.08	0.22	0.22	0.06	0.20	0.20
Clearance Time (s)	6.6	6.6	6.6	6.7	6.7	6.7	6.8	6.8	6.8	7.2	7.2	7.2
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	374	895	400	351	1212	542	287	414	352	109	374	318
v/s Ratio Prot	0.07	0.12		c0.19	c0.17		c0.08	c0.21		0.08	0.15	
v/s Ratio Perm			0.03			0.03			0.05			0.03
v/c Ratio	0.58	0.45	0.12	0.92	0.47	0.09	0.95	0.92	0.24	1.25	0.77	0.13
Uniform Delay, d1	46.3	34.0	31.0	42.8	27.5	23.7	50.2	41.8	35.1	51.6	41.5	36.0
Progression Factor	1.22	0.76	0.34	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	2.1	1.6	0.6	29.1	1.3	0.3	38.8	25.9	0.4	167.0	9.1	0.2
Delay (s)	58.5	27.3	11.2	72.0	28.8	24.1	89.0	67.8	35.5	218.6	50.6	36.2
Level of Service	E	C	B	E	C	C	F	E	D	F	D	D
Approach Delay (s)		31.9			41.6			63.8			82.7	
Approach LOS		C			D			E			F	

Intersection Summary			
HCM 2000 Control Delay	53.0	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.81		
Actuated Cycle Length (s)	110.0	Sum of lost time (s)	27.3
Intersection Capacity Utilization	74.3%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

Intersection	
Int Delay, s/veh	18

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Vol, veh/h	63	52	86	898	781	67
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	0	130	-	-	0
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	86	87	61	93	89	72
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	73	60	141	966	878	93

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	2126	878	878	0	-	0
Stage 1	878	-	-	-	-	-
Stage 2	1248	-	-	-	-	-
Critical Hdwy	6.42	6.22	4.12	-	-	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	2.218	-	-	-
Pot Cap-1 Maneuver	~ 55	347	769	-	-	-
Stage 1	406	-	-	-	-	-
Stage 2	271	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	~ 45	347	769	-	-	-
Mov Cap-2 Maneuver	~ 45	-	-	-	-	-
Stage 1	406	-	-	-	-	-
Stage 2	221	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	286.8	1.4	0
HCM LOS	F		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	EBLn2	SBT	SBR
Capacity (veh/h)	769	-	45	347	-	-
HCM Lane V/C Ratio	0.183	-	1.628	0.172	-	-
HCM Control Delay (s)	10.7	-	$ 506.6	17.5	-	-
HCM Lane LOS	B	-	F	C	-	-
HCM 95th %tile Q(veh)	0.7	-	7.3	0.6	-	-

Notes

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

Intersection	
Int Delay, s/veh	0.7

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Vol, veh/h	1	16	968	9	27	806
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	60	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	25	42	94	45	72	85
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	4	38	1030	20	38	948

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	2063	1040	0	0	1050	0
Stage 1	1040	-	-	-	-	-
Stage 2	1023	-	-	-	-	-
Critical Hdwy	6.42	6.22	-	-	4.12	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	-	-	2.218	-
Pot Cap-1 Maneuver	60	280	-	-	663	-
Stage 1	341	-	-	-	-	-
Stage 2	347	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	57	280	-	-	663	-
Mov Cap-2 Maneuver	57	-	-	-	-	-
Stage 1	341	-	-	-	-	-
Stage 2	327	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	27.2	0	0.4
HCM LOS	D		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	204	663	-
HCM Lane V/C Ratio	-	-	0.206	0.057	-
HCM Control Delay (s)	-	-	27.2	10.8	-
HCM Lane LOS	-	-	D	B	-
HCM 95th %tile Q(veh)	-	-	0.8	0.2	-

Intersection	
Int Delay, s/veh	2.4

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Vol, veh/h	39	1	1	27	38	51
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	42	1	1	29	41	55

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	101	69	97	0	-	0
Stage 1	69	-	-	-	-	-
Stage 2	32	-	-	-	-	-
Critical Hdwy	6.42	6.22	4.12	-	-	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	2.218	-	-	-
Pot Cap-1 Maneuver	898	994	1496	-	-	-
Stage 1	954	-	-	-	-	-
Stage 2	991	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	897	994	1496	-	-	-
Mov Cap-2 Maneuver	897	-	-	-	-	-
Stage 1	954	-	-	-	-	-
Stage 2	990	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	9.2	0.3	0
HCM LOS	A		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	1496	-	899	-	-
HCM Lane V/C Ratio	0.001	-	0.048	-	-
HCM Control Delay (s)	7.4	0	9.2	-	-
HCM Lane LOS	A	A	A	-	-
HCM 95th %tile Q(veh)	0	-	0.2	-	-

Intersection	
Int Delay, s/veh	0.2

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Vol, veh/h	866	51	0	1121	0	41
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	105	110	-	-	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	941	55	0	1218	0	45

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	941	0	1428	471
Stage 1	-	-	-	-	941	-
Stage 2	-	-	-	-	487	-
Critical Hdwy	-	-	4.14	-	6.29	6.94
Critical Hdwy Stg 1	-	-	-	-	5.84	-
Critical Hdwy Stg 2	-	-	-	-	6.04	-
Follow-up Hdwy	-	-	2.22	-	3.67	3.32
Pot Cap-1 Maneuver	-	-	724	-	154	539
Stage 1	-	-	-	-	331	-
Stage 2	-	-	-	-	550	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	724	-	154	539
Mov Cap-2 Maneuver	-	-	-	-	154	-
Stage 1	-	-	-	-	331	-
Stage 2	-	-	-	-	550	-

Approach	EB	WB	NB
HCM Control Delay, s	0	0	12.3
HCM LOS			B

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	539	-	-	724	-
HCM Lane V/C Ratio	0.083	-	-	-	-
HCM Control Delay (s)	12.3	-	-	0	-
HCM Lane LOS	B	-	-	A	-
HCM 95th %tile Q(veh)	0.3	-	-	0	-

Intersection	
Int Delay, s/veh	13.5

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Vol, veh/h	879	28	61	1071	50	16
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	75	160	-	0	0
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	93	64	31	90	78	78
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	945	44	197	1190	64	21

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	945	0	1934	473
Stage 1	-	-	-	-	945	-
Stage 2	-	-	-	-	989	-
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	-	-	722	-	~ 58	538
Stage 1	-	-	-	-	338	-
Stage 2	-	-	-	-	321	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	722	-	~ 42	538
Mov Cap-2 Maneuver	-	-	-	-	~ 42	-
Stage 1	-	-	-	-	338	-
Stage 2	-	-	-	-	233	-

Approach	EB	WB	NB
HCM Control Delay, s	0	1.7	$ 365.9
HCM LOS			F

Minor Lane/Major Mvmt	NBLn1	NBLn2	EBT	EBR	WBL	WBT
Capacity (veh/h)	42	538	-	-	722	-
HCM Lane V/C Ratio	1.526	0.038	-	-	0.273	-
HCM Control Delay (s)	$ 479.1	12	-	-	11.8	-
HCM Lane LOS	F	B	-	-	B	-
HCM 95th %tile Q(veh)	6.5	0.1	-	-	1.1	-

Notes

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

Intersection	
Int Delay, s/veh	5.6

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Vol, veh/h	68	3	41	39	5	62	50	864	47	39	768	85
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	75	-	-	40	-	-	65	-	95	80	-	-
Veh in Median Storage, #	-	1	-	-	1	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	89	25	45	78	78	78	60	88	35	60	90	71
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	76	12	91	50	6	79	83	982	134	65	853	120

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	1704	2326	487	1779	2319	558	973	0	0	1116	0	0
Stage 1	1043	1043	-	1216	1216	-	-	-	-	-	-	-
Stage 2	661	1283	-	563	1103	-	-	-	-	-	-	-
Critical Hdwy	7.54	6.54	6.94	7.54	6.54	6.94	4.14	-	-	4.14	-	-
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	3.52	4.02	3.32	3.52	4.02	3.32	2.22	-	-	2.22	-	-
Pot Cap-1 Maneuver	~ 59	37	526	52	37	473	704	-	-	622	-	-
Stage 1	245	305	-	192	252	-	-	-	-	-	-	-
Stage 2	418	234	-	478	285	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	~ 39	29	526	~ 33	29	473	704	-	-	622	-	-
Mov Cap-2 Maneuver	120	97	-	107	101	-	-	-	-	-	-	-
Stage 1	216	273	-	169	222	-	-	-	-	-	-	-
Stage 2	298	206	-	338	255	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	44	35.1	0.8	0.7
HCM LOS	E	E		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	EBLn2	WBLn1	WBLn2	SBL	SBT	SBR
Capacity (veh/h)	704	-	-	120	347	107	371	622	-	-
HCM Lane V/C Ratio	0.118	-	-	0.637	0.297	0.467	0.232	0.105	-	-
HCM Control Delay (s)	10.8	-	-	76.9	19.7	65.2	17.6	11.5	-	-
HCM Lane LOS	B	-	-	F	C	F	C	B	-	-
HCM 95th %tile Q(veh)	0.4	-	-	3.3	1.2	2	0.9	0.3	-	-

Notes

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

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Group Flow (vph)	149	480	225	272	389	108	129	154	153	100	348	128
v/c Ratio	0.48	0.49	0.38	0.93	0.31	0.16	0.58	0.36	0.31	0.92	0.82	0.26
Control Delay	62.7	28.9	3.6	83.5	26.9	0.8	60.6	37.4	5.2	118.7	56.6	3.1
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	62.7	28.9	3.6	83.5	26.9	0.8	60.6	37.4	5.2	118.7	56.6	3.1
Queue Length 50th (ft)	56	100	0	193	105	0	46	90	0	72	230	0
Queue Length 95th (ft)	75	84	14	#300	146	0	75	129	36	#162	300	0
Internal Link Dist (ft)		1113			871			429			798	
Turn Bay Length (ft)	310		360	325		340	180		180	235		230
Base Capacity (vph)	434	980	598	293	1246	671	224	460	522	109	453	517
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.34	0.49	0.38	0.93	0.31	0.16	0.58	0.33	0.29	0.92	0.77	0.25

Intersection Summary

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

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	113	307	189	220	338	28	112	122	136	85	285	87
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	11	11	11	11	11	11	12	12	12	12	12	12
Total Lost time (s)	6.6	6.6	6.6	6.7	6.7	6.7	6.8	6.8	6.8	7.2	7.2	7.2
Lane Util. Factor	0.97	0.95	1.00	1.00	0.95	1.00	0.97	1.00	1.00	1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3319	3421	1531	1711	3421	1531	3433	1863	1583	1770	1863	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3319	3421	1531	1711	3421	1531	3433	1863	1583	1770	1863	1583
Peak-hour factor, PHF	0.76	0.64	0.84	0.81	0.87	0.26	0.87	0.79	0.89	0.85	0.82	0.68
Adj. Flow (vph)	149	480	225	272	389	108	129	154	153	100	348	128
RTOR Reduction (vph)	0	0	161	0	0	69	0	0	118	0	0	99
Lane Group Flow (vph)	149	480	64	272	389	39	129	154	35	100	348	29
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Perm
Protected Phases	1	6		5	2		7	4		3	8	
Permitted Phases			6			2			4			8
Actuated Green, G (s)	10.3	31.5	31.5	18.9	40.1	40.1	7.2	25.5	25.5	6.8	25.1	25.1
Effective Green, g (s)	10.3	31.5	31.5	18.9	40.1	40.1	7.2	25.5	25.5	6.8	25.1	25.1
Actuated g/C Ratio	0.09	0.29	0.29	0.17	0.36	0.36	0.07	0.23	0.23	0.06	0.23	0.23
Clearance Time (s)	6.6	6.6	6.6	6.7	6.7	6.7	6.8	6.8	6.8	7.2	7.2	7.2
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	4.0	5.0	5.0	4.0	5.0	5.0
Lane Grp Cap (vph)	310	979	438	293	1247	558	224	431	366	109	425	361
v/s Ratio Prot	0.04	c0.14		c0.16	0.11		0.04	0.08		c0.06	c0.19	
v/s Ratio Perm			0.04			0.03			0.02			0.02
v/c Ratio	0.48	0.49	0.15	0.93	0.31	0.07	0.58	0.36	0.10	0.92	0.82	0.08
Uniform Delay, d1	47.3	32.6	29.2	44.9	25.1	22.8	49.9	35.4	33.2	51.3	40.3	33.4
Progression Factor	1.23	0.82	0.42	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	1.2	1.7	0.7	33.9	0.7	0.2	4.2	1.1	0.2	60.8	13.1	0.2
Delay (s)	59.2	28.3	13.0	78.7	25.7	23.0	54.2	36.5	33.4	112.1	53.4	33.6
Level of Service	E	C	B	E	C	C	D	D	C	F	D	C
Approach Delay (s)		29.7			44.1			40.6			59.2	
Approach LOS		C			D			D			E	

Intersection Summary			
HCM 2000 Control Delay	42.1	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.72		
Actuated Cycle Length (s)	110.0	Sum of lost time (s)	27.3
Intersection Capacity Utilization	62.6%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

Intersection	
Int Delay, s/veh	2.7

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Vol, veh/h	59	47	22	268	578	65
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	0	130	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	91	59	69	91	76	36
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	65	80	32	295	761	181

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	1209	851	941	0	-	0
Stage 1	851	-	-	-	-	-
Stage 2	358	-	-	-	-	-
Critical Hdwy	6.42	6.22	4.12	-	-	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	2.218	-	-	-
Pot Cap-1 Maneuver	202	360	729	-	-	-
Stage 1	419	-	-	-	-	-
Stage 2	707	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	193	360	729	-	-	-
Mov Cap-2 Maneuver	193	-	-	-	-	-
Stage 1	419	-	-	-	-	-
Stage 2	676	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	24.5	1	0
HCM LOS	C		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	EBLn2	SBT	SBR
Capacity (veh/h)	729	-	193	360	-	-
HCM Lane V/C Ratio	0.044	-	0.336	0.221	-	-
HCM Control Delay (s)	10.2	-	32.8	17.8	-	-
HCM Lane LOS	B	-	D	C	-	-
HCM 95th %tile Q(veh)	0.1	-	1.4	0.8	-	-

You created this PDF from an application that is not licensed to print to novaPDF printer (http://www.novapdf.com)

Intersection	
Int Delay, s/veh	0.9

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Vol, veh/h	7	24	266	0	10	615
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	60	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	29	72	79	25	75	76
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	24	33	337	0	13	809

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	1173	337	0	0	337	0
Stage 1	337	-	-	-	-	-
Stage 2	836	-	-	-	-	-
Critical Hdwy	6.42	6.22	-	-	4.12	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	-	-	2.218	-
Pot Cap-1 Maneuver	212	705	-	-	1222	-
Stage 1	723	-	-	-	-	-
Stage 2	425	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	210	705	-	-	1222	-
Mov Cap-2 Maneuver	210	-	-	-	-	-
Stage 1	723	-	-	-	-	-
Stage 2	420	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	17.1	0	0.1
HCM LOS	C		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	354	1222	-
HCM Lane V/C Ratio	-	-	0.162	0.011	-
HCM Control Delay (s)	-	-	17.1	8	-
HCM Lane LOS	-	-	C	A	-
HCM 95th %tile Q(veh)	-	-	0.6	0	-

You created this PDF from an application that is not licensed to print to novaPDF printer (http://www.novapdf.com)

Intersection	
Int Delay, s/veh	3.5

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Vol, veh/h	51	1	1	10	14	62
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	55	1	1	11	15	67

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	62	49	83	0	-	0
Stage 1	49	-	-	-	-	-
Stage 2	13	-	-	-	-	-
Critical Hdwy	6.42	6.22	4.12	-	-	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	2.218	-	-	-
Pot Cap-1 Maneuver	944	1020	1514	-	-	-
Stage 1	973	-	-	-	-	-
Stage 2	1010	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	943	1020	1514	-	-	-
Mov Cap-2 Maneuver	943	-	-	-	-	-
Stage 1	973	-	-	-	-	-
Stage 2	1009	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	9.1	0.7	0
HCM LOS	A		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	1514	-	944	-	-
HCM Lane V/C Ratio	0.001	-	0.06	-	-
HCM Control Delay (s)	7.4	0	9.1	-	-
HCM Lane LOS	A	A	A	-	-
HCM 95th %tile Q(veh)	0	-	0.2	-	-

You created this PDF from an application that is not licensed to print to novaPDF printer (http://www.novapdf.com)

Intersection	
Int Delay, s/veh	2.9

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Vol, veh/h	502	26	50	565	21	40
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	75	160	-	0	0
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	76	75	31	88	50	38
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	661	35	161	642	42	105

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	661	0	1305	330
Stage 1	-	-	-	-	661	-
Stage 2	-	-	-	-	644	-
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	-	-	923	-	152	666
Stage 1	-	-	-	-	475	-
Stage 2	-	-	-	-	485	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	923	-	125	666
Mov Cap-2 Maneuver	-	-	-	-	125	-
Stage 1	-	-	-	-	475	-
Stage 2	-	-	-	-	400	-

Approach	EB	WB	NB
HCM Control Delay, s	0	2	21.8
HCM LOS			C

Minor Lane/Major Mvmt	NBLn1	NBLn2	EBT	EBR	WBL	WBT
Capacity (veh/h)	125	666	-	-	923	-
HCM Lane V/C Ratio	0.336	0.158	-	-	0.175	-
HCM Control Delay (s)	47.7	11.4	-	-	9.7	-
HCM Lane LOS	E	B	-	-	A	-
HCM 95th %tile Q(veh)	1.3	0.6	-	-	0.6	-

You created this PDF from an application that is not licensed to print to novaPDF printer (http://www.novapdf.com)

Intersection	
Int Delay, s/veh	7.9

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT
Vol, veh/h	51	3	47	34	3	68	43	251	33	64	562
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-
Storage Length	75	-	-	40	-	-	65	-	95	80	-
Veh in Median Storage, #	-	1	-	-	1	-	-	0	-	-	0
Grade, %	-	0	-	-	0	-	-	0	-	-	0
Peak Hour Factor	71	25	62	50	25	42	67	86	25	46	84
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	72	12	76	68	12	162	64	292	132	139	669

Major/Minor	Minor2			Minor1			Major1			Major2	
Conflicting Flow All	1492	1405	707	1449	1443	292	745	0	0	292	0
Stage 1	985	985	-	420	420	-	-	-	-	-	-
Stage 2	507	420	-	1029	1023	-	-	-	-	-	-
Critical Hdwy	7.12	6.52	6.22	7.12	6.52	6.22	4.12	-	-	4.12	-
Critical Hdwy Stg 1	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-
Critical Hdwy Stg 2	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-
Follow-up Hdwy	3.518	4.018	3.318	3.518	4.018	3.318	2.218	-	-	2.218	-
Pot Cap-1 Maneuver	102	139	435	109	132	747	863	-	-	1270	-
Stage 1	299	326	-	611	589	-	-	-	-	-	-
Stage 2	548	589	-	282	313	-	-	-	-	-	-
Platoon blocked, %								-	-		-
Mov Cap-1 Maneuver	~ 66	115	435	74	109	747	863	-	-	1270	-
Mov Cap-2 Maneuver	150	205	-	117	177	-	-	-	-	-	-
Stage 1	277	290	-	566	545	-	-	-	-	-	-
Stage 2	389	545	-	199	279	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	31.8	29.6	1.3	1.3
HCM LOS	D	D		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	EBLn2	WBLn1	WBLn2	SBL	SBT	SBR
Capacity (veh/h)	863	-	-	150	377	117	611	1270	-	-
HCM Lane V/C Ratio	0.074	-	-	0.479	0.233	0.581	0.285	0.11	-	-
HCM Control Delay (s)	9.5	-	-	49.3	17.4	71.6	13.2	8.2	-	-
HCM Lane LOS	A	-	-	E	C	F	B	A	-	-
HCM 95th %tile Q(veh)	0.2	-	-	2.2	0.9	2.8	1.2	0.4	-	-

Notes

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

You created this PDF from an application that is not licensed to print to novaPDF printer (http://www.novapdf.com)

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Group Flow (vph)	216	377	222	324	570	132	272	391	311	126	295	199
v/c Ratio	0.58	0.42	0.40	0.92	0.47	0.20	0.95	0.94	0.55	1.16	0.78	0.42
Control Delay	62.0	27.7	3.6	75.3	29.9	2.2	92.2	73.4	10.3	180.6	57.1	8.0
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	62.0	27.7	3.6	75.3	29.9	2.2	92.2	73.4	10.3	180.6	57.1	8.0
Queue Length 50th (ft)	83	65	0	224	164	0	100	271	19	~105	198	0
Queue Length 95th (ft)	122	90	7	#387	216	1	#130	#450	68	#186	#321	37
Internal Link Dist (ft)		1113			871			429			798	
Turn Bay Length (ft)	310		360	325		340	180		180	235		230
Base Capacity (vph)	555	889	562	362	1206	655	287	426	576	109	386	485
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.39	0.42	0.40	0.90	0.47	0.20	0.95	0.92	0.54	1.16	0.76	0.41

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

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

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	197	362	162	295	490	99	201	364	255	98	289	157
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	11	11	11	11	11	11	12	12	12	12	12	12
Total Lost time (s)	6.6	6.6	6.6	6.7	6.7	6.7	6.8	6.8	6.8	7.2	7.2	7.2
Lane Util. Factor	0.97	0.95	1.00	1.00	0.95	1.00	0.97	1.00	1.00	1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3319	3421	1531	1711	3421	1531	3433	1863	1583	1770	1863	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3319	3421	1531	1711	3421	1531	3433	1863	1583	1770	1863	1583
Peak-hour factor, PHF	0.91	0.96	0.73	0.91	0.86	0.75	0.74	0.93	0.82	0.78	0.98	0.79
Adj. Flow (vph)	216	377	222	324	570	132	272	391	311	126	295	199
RTOR Reduction (vph)	0	0	164	0	0	85	0	0	215	0	0	159
Lane Group Flow (vph)	216	377	58	324	570	47	272	391	96	126	295	40
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Perm
Protected Phases	1	6		5	2		7	4		3	8	
Permitted Phases			6			2			4			8
Actuated Green, G (s)	12.4	28.6	28.6	22.6	38.8	38.8	9.2	24.7	24.7	6.8	22.3	22.3
Effective Green, g (s)	12.4	28.6	28.6	22.6	38.8	38.8	9.2	24.7	24.7	6.8	22.3	22.3
Actuated g/C Ratio	0.11	0.26	0.26	0.21	0.35	0.35	0.08	0.22	0.22	0.06	0.20	0.20
Clearance Time (s)	6.6	6.6	6.6	6.7	6.7	6.7	6.8	6.8	6.8	7.2	7.2	7.2
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	374	889	398	351	1206	540	287	418	355	109	377	320
v/s Ratio Prot	0.07	0.11		c0.19	c0.17		c0.08	c0.21		0.07	0.16	
v/s Ratio Perm			0.04			0.03			0.06			0.03
v/c Ratio	0.58	0.42	0.15	0.92	0.47	0.09	0.95	0.94	0.27	1.16	0.78	0.13
Uniform Delay, d1	46.3	33.9	31.3	42.8	27.7	23.8	50.2	41.9	35.2	51.6	41.6	35.9
Progression Factor	1.22	0.76	0.34	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	2.1	1.4	0.7	29.1	1.3	0.3	38.8	28.1	0.4	134.2	10.1	0.2
Delay (s)	58.5	27.1	11.3	72.0	29.0	24.1	89.0	70.0	35.6	185.8	51.7	36.1
Level of Service	E	C	B	E	C	C	F	E	D	F	D	D
Approach Delay (s)		31.1			41.9			64.3			73.9	
Approach LOS		C			D			E			E	

Intersection Summary			
HCM 2000 Control Delay	51.5	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.81		
Actuated Cycle Length (s)	110.0	Sum of lost time (s)	27.3
Intersection Capacity Utilization	73.7%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

Intersection	
Int Delay, s/veh	8.7

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Vol, veh/h	63	52	86	703	602	67
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	0	130	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	86	87	61	93	89	72
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	73	60	141	756	676	93

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	1761	723	769	0	-	0
Stage 1	723	-	-	-	-	-
Stage 2	1038	-	-	-	-	-
Critical Hdwy	6.42	6.22	4.12	-	-	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	2.218	-	-	-
Pot Cap-1 Maneuver	93	426	845	-	-	-
Stage 1	481	-	-	-	-	-
Stage 2	341	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	77	426	845	-	-	-
Mov Cap-2 Maneuver	77	-	-	-	-	-
Stage 1	481	-	-	-	-	-
Stage 2	284	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	107.3	1.6	0
HCM LOS	F		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	EBLn2	SBT	SBR
Capacity (veh/h)	845	-	77	426	-	-
HCM Lane V/C Ratio	0.167	-	0.951	0.14	-	-
HCM Control Delay (s)	10.1	-	182.7	14.8	-	-
HCM Lane LOS	B	-	F	B	-	-
HCM 95th %tile Q(veh)	0.6	-	5	0.5	-	-

You created this PDF from an application that is not licensed to print to novaPDF printer (http://www.novapdf.com)

Intersection	
Int Delay, s/veh	0.7

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Vol, veh/h	1	16	773	9	27	627
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	60	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	25	42	94	45	72	85
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	4	38	822	20	38	738

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	1645	832	0	0	842	0
Stage 1	832	-	-	-	-	-
Stage 2	813	-	-	-	-	-
Critical Hdwy	6.42	6.22	-	-	4.12	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	-	-	2.218	-
Pot Cap-1 Maneuver	109	369	-	-	794	-
Stage 1	427	-	-	-	-	-
Stage 2	436	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	104	369	-	-	794	-
Mov Cap-2 Maneuver	104	-	-	-	-	-
Stage 1	427	-	-	-	-	-
Stage 2	415	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	19.1	0	0.5
HCM LOS	C		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	297	794	-
HCM Lane V/C Ratio	-	-	0.142	0.047	-
HCM Control Delay (s)	-	-	19.1	9.8	-
HCM Lane LOS	-	-	C	A	-
HCM 95th %tile Q(veh)	-	-	0.5	0.1	-

You created this PDF from an application that is not licensed to print to novaPDF printer (http://www.novapdf.com)

Intersection	
Int Delay, s/veh	2.9

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Vol, veh/h	59	1	1	27	38	69
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	64	1	1	29	41	75

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	111	79	116	0	-	0
Stage 1	79	-	-	-	-	-
Stage 2	32	-	-	-	-	-
Critical Hdwy	6.42	6.22	4.12	-	-	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	2.218	-	-	-
Pot Cap-1 Maneuver	886	981	1473	-	-	-
Stage 1	944	-	-	-	-	-
Stage 2	991	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	885	981	1473	-	-	-
Mov Cap-2 Maneuver	885	-	-	-	-	-
Stage 1	944	-	-	-	-	-
Stage 2	990	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	9.4	0.3	0
HCM LOS	A		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	1473	-	886	-	-
HCM Lane V/C Ratio	0.001	-	0.074	-	-
HCM Control Delay (s)	7.4	0	9.4	-	-
HCM Lane LOS	A	A	A	-	-
HCM 95th %tile Q(veh)	0	-	0.2	-	-

You created this PDF from an application that is not licensed to print to novaPDF printer (http://www.novapdf.com)

Intersection	
Int Delay, s/veh	4.3

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Vol, veh/h	669	46	61	843	41	45
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	75	160	-	0	0
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	93	64	31	90	78	78
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	719	72	197	937	53	58

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	719	0	1581	360
Stage 1	-	-	-	-	719	-
Stage 2	-	-	-	-	862	-
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	-	-	878	-	100	637
Stage 1	-	-	-	-	444	-
Stage 2	-	-	-	-	374	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	878	-	78	637
Mov Cap-2 Maneuver	-	-	-	-	78	-
Stage 1	-	-	-	-	444	-
Stage 2	-	-	-	-	290	-

Approach	EB	WB	NB
HCM Control Delay, s	0	1.8	61.6
HCM LOS			F

Minor Lane/Major Mvmt	NBLn1	NBLn2	EBT	EBR	WBL	WBT
Capacity (veh/h)	78	637	-	-	878	-
HCM Lane V/C Ratio	0.674	0.091	-	-	0.224	-
HCM Control Delay (s)	117	11.2	-	-	10.3	-
HCM Lane LOS	F	B	-	-	B	-
HCM 95th %tile Q(veh)	3.1	0.3	-	-	0.9	-

You created this PDF from an application that is not licensed to print to novaPDF printer (http://www.novapdf.com)

Intersection	
Int Delay, s/veh	15.6

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT
Vol, veh/h	68	3	41	39	5	83	50	669	47	72	589
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-
Storage Length	75	-	-	40	-	-	65	-	95	80	-
Veh in Median Storage, #	-	1	-	-	1	-	-	0	-	-	0
Grade, %	-	0	-	-	0	-	-	0	-	-	0
Peak Hour Factor	89	25	45	78	78	78	60	88	35	60	90
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	76	12	91	50	6	106	83	760	134	120	654

Major/Minor	Minor2			Minor1			Major1			Major2	
Conflicting Flow All	1937	1881	714	1933	1941	760	774	0	0	760	0
Stage 1	954	954	-	927	927	-	-	-	-	-	-
Stage 2	983	927	-	1006	1014	-	-	-	-	-	-
Critical Hdwy	7.12	6.52	6.22	7.12	6.52	6.22	4.12	-	-	4.12	-
Critical Hdwy Stg 1	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-
Critical Hdwy Stg 2	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-
Follow-up Hdwy	3.518	4.018	3.318	3.518	4.018	3.318	2.218	-	-	2.218	-
Pot Cap-1 Maneuver	~ 49	71	431	50	65	406	842	-	-	852	-
Stage 1	311	337	-	322	347	-	-	-	-	-	-
Stage 2	299	347	-	291	316	-	-	-	-	-	-
Platoon blocked, %								-	-		-
Mov Cap-1 Maneuver	~ 29	55	431	~ 30	50	406	842	-	-	852	-
Mov Cap-2 Maneuver	~ 62	130	-	81	128	-	-	-	-	-	-
Stage 1	280	290	-	290	313	-	-	-	-	-	-
Stage 2	195	313	-	189	271	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	140.2	45.3	0.8	1.3
HCM LOS	F	E		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	EBLn2	WBLn1	WBLn2	SBL	SBT	SBR
Capacity (veh/h)	842	-	-	62	340	81	361	852	-	-
HCM Lane V/C Ratio	0.099	-	-	1.232	0.303	0.617	0.313	0.141	-	-
HCM Control Delay (s)	9.7	-	-	$ 302.2	20.1	103.9	19.4	9.9	-	-
HCM Lane LOS	A	-	-	F	C	F	C	A	-	-
HCM 95th %tile Q(veh)	0.3	-	-	6.3	1.3	2.8	1.3	0.5	-	-

Notes

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

You created this PDF from an application that is not licensed to print to novaPDF printer (http://www.novapdf.com)

Future Year 2035 Conditions

Future Volumes Worksheet

Highway 45 and Highway 9

AM PEAK HOUR

Existing Volumes

	87	274	78	
113				21
315	1% Annual Growth Volumes			346
159				220
	82	111	126	

2035 AM Growth

	22	70	20	
29				5
81				89
41				57
	21	29	32	

PM PEAK HOUR

Existing Volumes

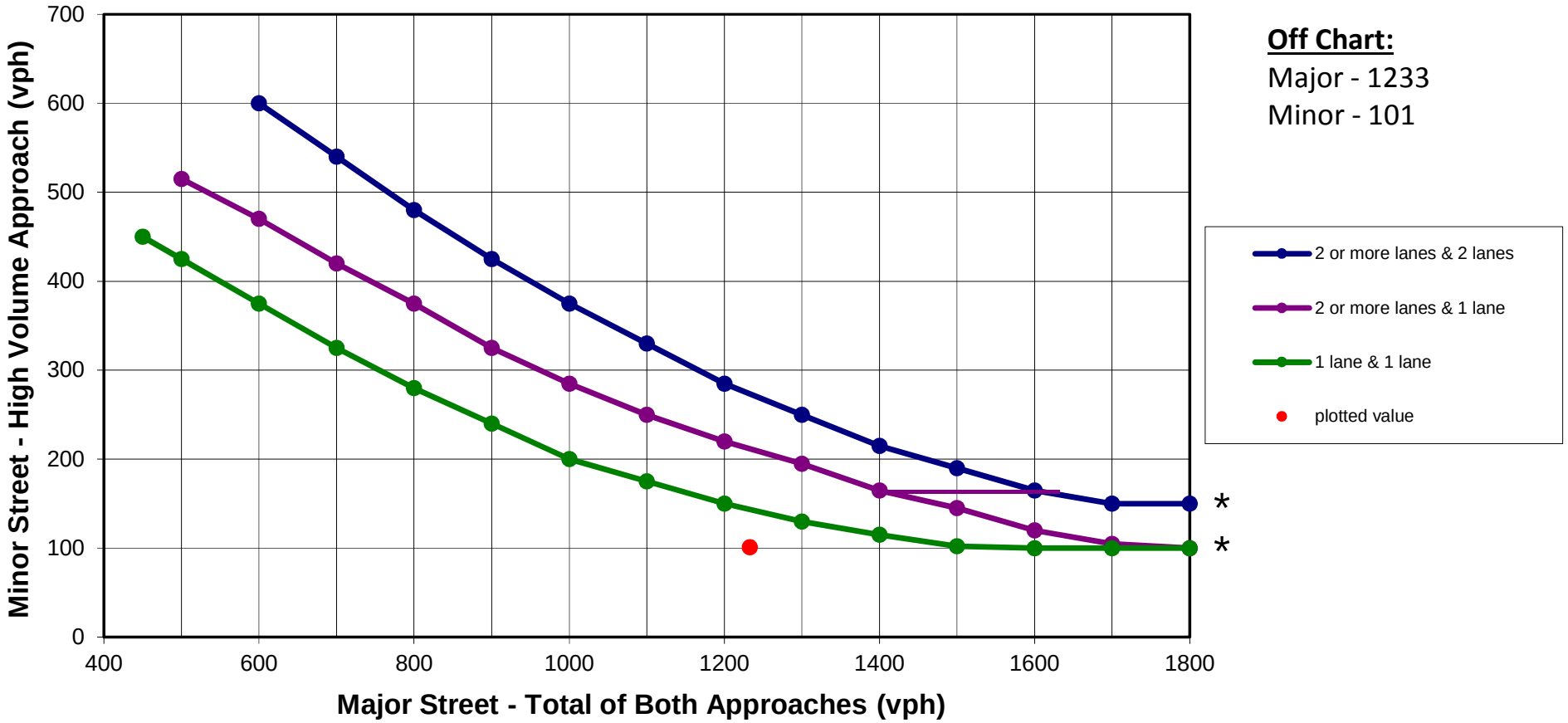
	157	275	91	
197				90
372	1% Annual Growth Volumes			500
126				295
	165	352	243	

2035 PM Growth

	40	71	23	
51				23
96				129
32				76
	42	91	62	

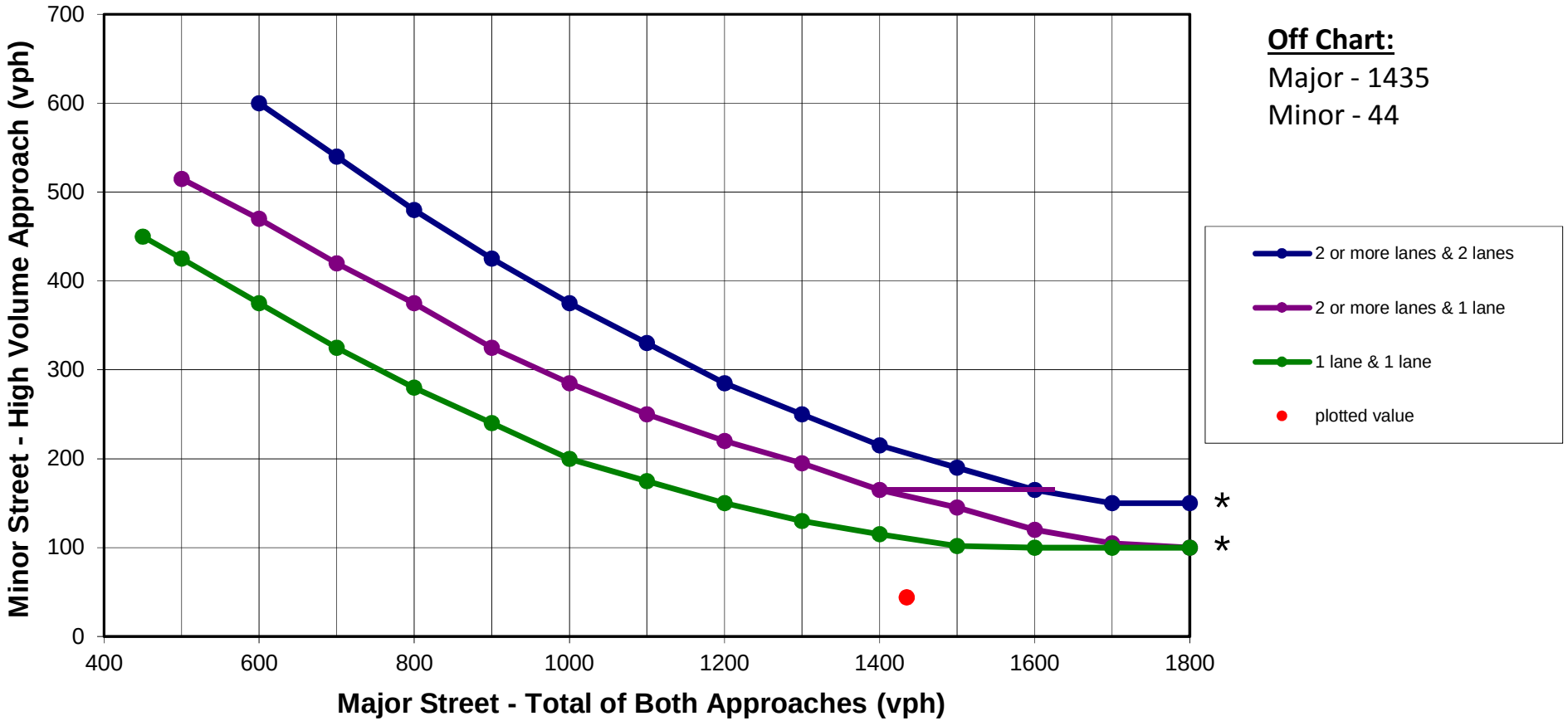
Future Signal Warrants Analysis

Future Year 2035 AM Peak Hour Volume Warrant
Missouri Route 9 & Lewis Street



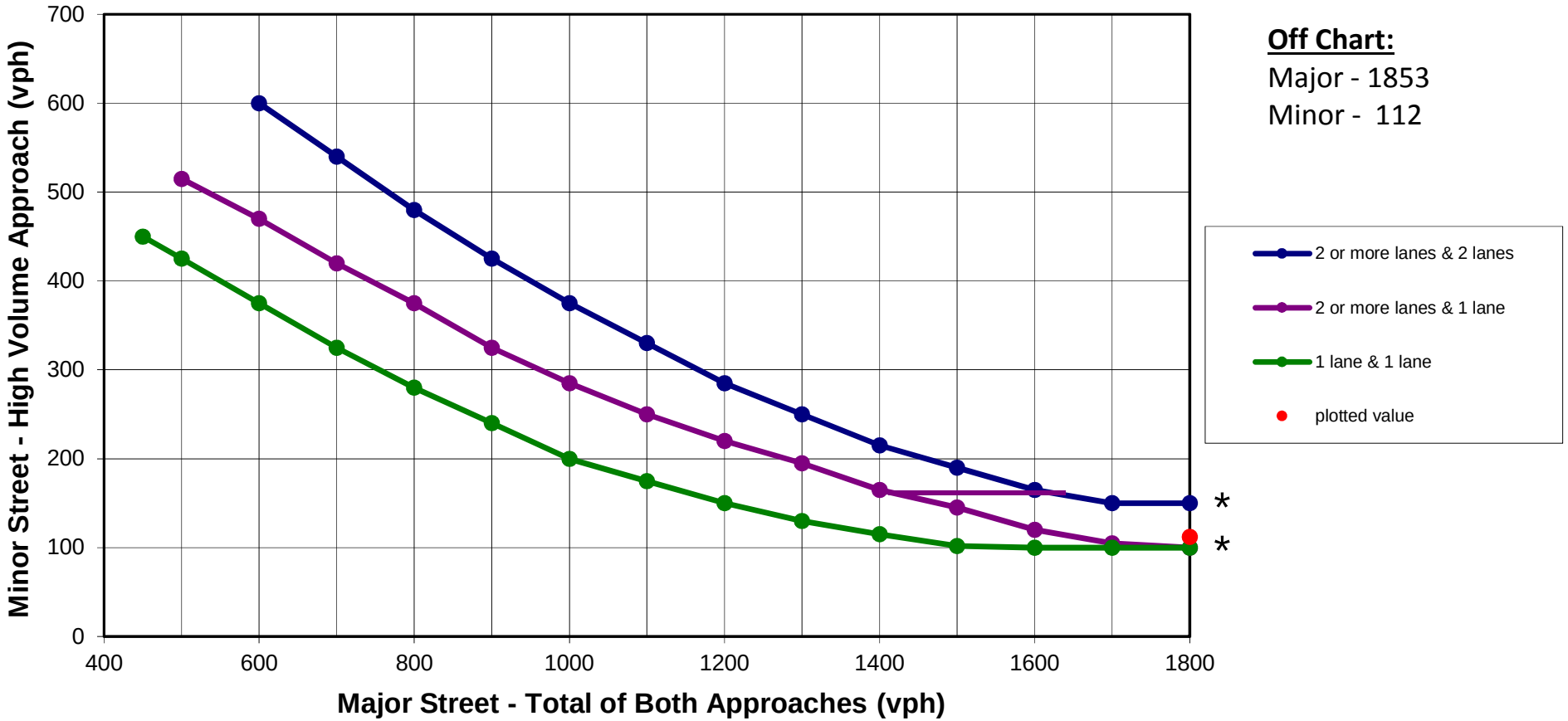
*Note: 150 vph applies as the lower threshold volume for a minor street approach with two or more lanes

Future Year 2035 AM Peak Hour Volume Warrant
Missouri Route 45 & Julian Drive



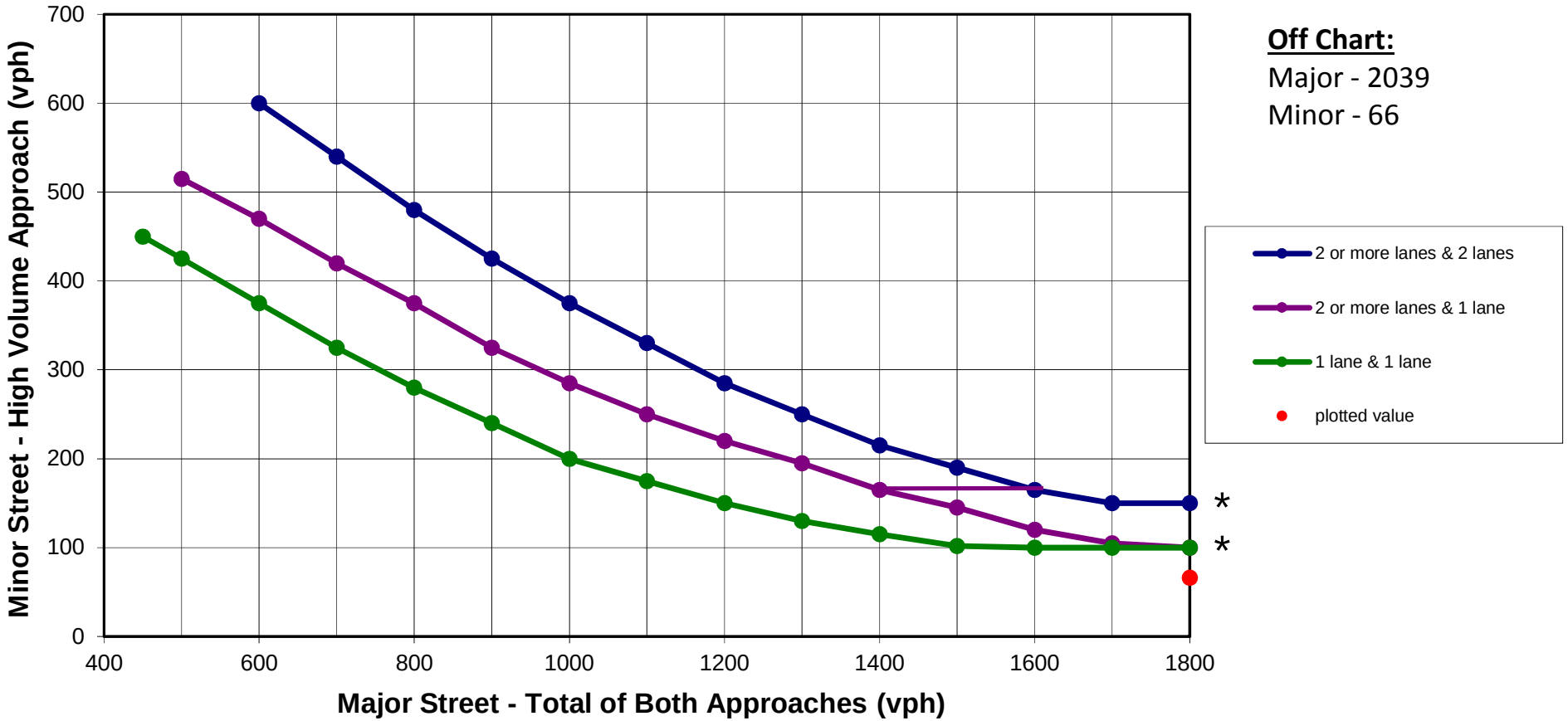
*Note: 150 vph applies as the lower threshold volume for a minor street approach with two or more lanes and 100 vph applies as the lower threshold volume for a minor street approach with one lane.

Future Year 2035 PM Peak Hour Volume Warrant
Missouri Route 9 & Lewis Street



*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.

Future Year 2035 PM Peak Hour Volume Warrant
Missouri Route 45 & Julian Drive



*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.

Future Capacity Analysis

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT
Lane Group Flow (vph)	187	638	238	342	491	158	153	181	178	133	583
v/c Ratio	0.60	0.56	0.36	0.74	0.38	0.23	0.65	0.25	0.36	0.78	0.71
Control Delay	70.1	26.5	2.6	59.5	29.0	5.0	68.3	40.3	4.3	82.5	44.0
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	70.1	26.5	2.6	59.5	29.0	5.0	68.3	40.3	4.3	82.5	44.0
Queue Length 50th (ft)	78	123	0	131	145	0	60	62	0	102	203
Queue Length 95th (ft)	98	111	15	161	196	0	93	79	30	#184	224
Internal Link Dist (ft)		1113			142			429			798
Turn Bay Length (ft)	310		360	325		340	180		180	300	
Base Capacity (vph)	329	1143	670	512	1300	681	234	861	548	174	960
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.57	0.56	0.36	0.67	0.38	0.23	0.65	0.21	0.32	0.76	0.61

Intersection Summary

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

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	142	408	200	277	427	41	133	143	158	113	347	109
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	11	11	11	11	11	11	12	12	12	12	12	12
Total Lost time (s)	6.6	6.6	6.6	6.7	6.7	6.7	6.8	6.8	6.8	7.2	7.2	
Lane Util. Factor	0.97	0.95	1.00	0.97	0.95	1.00	0.97	0.95	1.00	1.00	0.95	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.96	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	3319	3421	1531	3319	3421	1531	3433	3539	1583	1770	3394	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (perm)	3319	3421	1531	3319	3421	1531	3433	3539	1583	1770	3394	
Peak-hour factor, PHF	0.76	0.64	0.84	0.81	0.87	0.26	0.87	0.79	0.89	0.85	0.82	0.68
Adj. Flow (vph)	187	638	238	342	491	158	153	181	178	133	423	160
RTOR Reduction (vph)	0	0	159	0	0	98	0	0	142	0	35	0
Lane Group Flow (vph)	187	638	79	342	491	60	153	181	36	133	548	0
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Perm	Prot	NA	
Protected Phases	1	6		5	2		7	4		3	8	
Permitted Phases			6			2			4			
Actuated Green, G (s)	11.2	40.0	40.0	16.8	45.6	45.6	8.2	24.3	24.3	11.6	27.7	
Effective Green, g (s)	11.2	40.0	40.0	16.8	45.6	45.6	8.2	24.3	24.3	11.6	27.7	
Actuated g/C Ratio	0.09	0.33	0.33	0.14	0.38	0.38	0.07	0.20	0.20	0.10	0.23	
Clearance Time (s)	6.6	6.6	6.6	6.7	6.7	6.7	6.8	6.8	6.8	7.2	7.2	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	4.0	5.0	5.0	4.0	5.0	
Lane Grp Cap (vph)	309	1140	510	464	1299	581	234	716	320	171	783	
v/s Ratio Prot	0.06	c0.19		c0.10	c0.14		0.04	0.05		c0.08	c0.16	
v/s Ratio Perm			0.05			0.04			0.02			
v/c Ratio	0.61	0.56	0.16	0.74	0.38	0.10	0.65	0.25	0.11	0.78	0.70	
Uniform Delay, d1	52.3	32.8	28.1	49.5	26.9	24.0	54.5	40.2	39.1	52.9	42.3	
Progression Factor	1.18	0.71	0.26	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	3.2	1.9	0.6	6.0	0.8	0.4	7.1	0.4	0.3	20.7	3.6	
Delay (s)	65.2	25.3	8.1	55.5	27.8	24.4	61.6	40.6	39.4	73.6	45.9	
Level of Service	E	C	A	E	C	C	E	D	D	E	D	
Approach Delay (s)		28.5			36.8			46.5			51.1	
Approach LOS		C			D			D			D	

Intersection Summary			
HCM 2000 Control Delay	38.7	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.68		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	27.3
Intersection Capacity Utilization	59.2%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

Intersection	
Int Delay, s/veh	3

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Vol, veh/h	59	47	22	350	736	65
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	0	130	-	-	0
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	91	59	69	91	76	36
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	65	80	32	385	968	181

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	1416	968	968	0	-	0
Stage 1	968	-	-	-	-	-
Stage 2	448	-	-	-	-	-
Critical Hdwy	6.42	6.22	4.12	-	-	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	2.218	-	-	-
Pot Cap-1 Maneuver	151	308	712	-	-	-
Stage 1	368	-	-	-	-	-
Stage 2	644	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	144	308	712	-	-	-
Mov Cap-2 Maneuver	144	-	-	-	-	-
Stage 1	368	-	-	-	-	-
Stage 2	615	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	33.4	0.8	0
HCM LOS	D		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	EBLn2	SBT	SBR
Capacity (veh/h)	712	-	144	308	-	-
HCM Lane V/C Ratio	0.045	-	0.45	0.259	-	-
HCM Control Delay (s)	10.3	-	49	20.7	-	-
HCM Lane LOS	B	-	E	C	-	-
HCM 95th %tile Q(veh)	0.1	-	2	1	-	-

Intersection	
Int Delay, s/veh	1

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Vol, veh/h	7	24	348	0	10	773
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	60	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	29	72	79	25	75	76
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	24	33	441	0	13	1017

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	1485	441	0	0	441	0
Stage 1	441	-	-	-	-	-
Stage 2	1044	-	-	-	-	-
Critical Hdwy	6.42	6.22	-	-	4.12	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	-	-	2.218	-
Pot Cap-1 Maneuver	137	616	-	-	1119	-
Stage 1	648	-	-	-	-	-
Stage 2	339	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	135	616	-	-	1119	-
Mov Cap-2 Maneuver	135	-	-	-	-	-
Stage 1	648	-	-	-	-	-
Stage 2	335	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	23.9	0	0.1
HCM LOS	C		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	247	1119	-
HCM Lane V/C Ratio	-	-	0.233	0.012	-
HCM Control Delay (s)	-	-	23.9	8.3	-
HCM Lane LOS	-	-	C	A	-
HCM 95th %tile Q(veh)	-	-	0.9	0	-

Intersection	
Int Delay, s/veh	3

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Vol, veh/h	34	1	1	10	14	45
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	37	1	1	11	15	49

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	53	40	64	0	-	0
Stage 1	40	-	-	-	-	-
Stage 2	13	-	-	-	-	-
Critical Hdwy	6.42	6.22	4.12	-	-	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	2.218	-	-	-
Pot Cap-1 Maneuver	955	1031	1538	-	-	-
Stage 1	982	-	-	-	-	-
Stage 2	1010	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	954	1031	1538	-	-	-
Mov Cap-2 Maneuver	954	-	-	-	-	-
Stage 1	982	-	-	-	-	-
Stage 2	1009	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	8.9	0.7	0
HCM LOS	A		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	1538	-	956	-	-
HCM Lane V/C Ratio	0.001	-	0.04	-	-
HCM Control Delay (s)	7.3	0	8.9	-	-
HCM Lane LOS	A	A	A	-	-
HCM 95th %tile Q(veh)	0	-	0.1	-	-

Intersection	
Int Delay, s/veh	5.1

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Vol, veh/h	660	9	50	716	29	15
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	75	160	-	0	0
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	76	75	31	88	50	38
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	868	12	161	814	58	39

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	868	0	1597	434
Stage 1	-	-	-	-	868	-
Stage 2	-	-	-	-	729	-
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	-	-	772	-	97	570
Stage 1	-	-	-	-	371	-
Stage 2	-	-	-	-	438	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	772	-	77	570
Mov Cap-2 Maneuver	-	-	-	-	77	-
Stage 1	-	-	-	-	371	-
Stage 2	-	-	-	-	347	-

Approach	EB	WB	NB
HCM Control Delay, s	0	1.8	84.4
HCM LOS			F

Minor Lane/Major Mvmt	NBLn1	NBLn2	EBT	EBR	WBL	WBT
Capacity (veh/h)	77	570	-	-	772	-
HCM Lane V/C Ratio	0.753	0.069	-	-	0.209	-
HCM Control Delay (s)	133.8	11.8	-	-	10.9	-
HCM Lane LOS	F	B	-	-	B	-
HCM 95th %tile Q(veh)	3.6	0.2	-	-	0.8	-

Intersection	
Int Delay, s/veh	5

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR
Vol, veh/h	51	3	47	34	3	50	43	333	33
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None
Storage Length	75	-	-	40	-	-	65	-	95
Veh in Median Storage, #	-	1	-	-	1	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-
Peak Hour Factor	71	25	62	50	25	42	67	86	25
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2
Mvmt Flow	72	12	76	68	12	119	64	387	132

Major/Minor	Minor2			Minor1			Major1		
Conflicting Flow All	1379	1699	466	1173	1671	260	933	0	0
Stage 1	1051	1051	-	582	582	-	-	-	-
Stage 2	328	648	-	591	1089	-	-	-	-
Critical Hdwy	7.54	6.54	6.94	7.54	6.54	6.94	4.14	-	-
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	3.52	4.02	3.32	3.52	4.02	3.32	2.22	-	-
Pot Cap-1 Maneuver	104	91	543	147	95	739	729	-	-
Stage 1	243	302	-	466	497	-	-	-	-
Stage 2	659	464	-	460	290	-	-	-	-
Platoon blocked, %								-	-
Mov Cap-1 Maneuver	72	77	543	106	80	739	729	-	-
Mov Cap-2 Maneuver	161	175	-	202	158	-	-	-	-
Stage 1	222	279	-	425	453	-	-	-	-
Stage 2	491	423	-	350	268	-	-	-	-

Approach	EB	WB	NB
HCM Control Delay, s	28.6	19.7	1.1
HCM LOS	D	C	

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	EBLn2	WBLn1	WBLn2	SBL	SBT	SBR
Capacity (veh/h)	729	-	-	161	422	202	553	1043	-	-
HCM Lane V/C Ratio	0.088	-	-	0.446	0.208	0.337	0.237	0.075	-	-
HCM Control Delay (s)	10.4	-	-	44.2	15.8	31.6	13.5	8.7	-	-
HCM Lane LOS	B	-	-	E	C	D	B	A	-	-
HCM 95th %tile Q(veh)	0.3	-	-	2	0.8	1.4	0.9	0.2	-	-

Intersection			
Int Delay, s/veh			

Movement	SBL	SBT	SBR
Vol, veh/h	36	720	68
Conflicting Peds, #/hr	0	0	0
Sign Control	Free	Free	Free
RT Channelized	-	-	None
Storage Length	80	-	-
Veh in Median Storage, #	-	0	-
Grade, %	-	0	-
Peak Hour Factor	46	84	90
Heavy Vehicles, %	2	2	2
Mvmt Flow	78	857	76

Major/Minor	Major2		
Conflicting Flow All	519	0	0
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	1043	-	-
Stage 1	-	-	-
Stage 2	-	-	-
Platoon blocked, %		-	-
Mov Cap-1 Maneuver	1043	-	-
Mov Cap-2 Maneuver	-	-	-
Stage 1	-	-	-
Stage 2	-	-	-

Approach	SB
HCM Control Delay, s	0.7
HCM LOS	

Minor Lane/Major Mvmt

Queues
13: MO9 & MO45

2/24/2015

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT
Lane Group Flow (vph)	273	503	232	408	720	175	328	480	372	165	608
v/c Ratio	0.70	0.48	0.37	0.79	0.61	0.27	0.87	0.69	0.63	0.84	0.79
Control Delay	61.0	36.7	6.2	60.2	36.1	5.7	75.8	50.2	10.6	85.6	43.1
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	61.0	36.7	6.2	60.2	36.1	5.7	75.8	50.2	10.6	85.6	43.1
Queue Length 50th (ft)	105	170	0	156	247	0	130	182	15	127	184
Queue Length 95th (ft)	153	235	22	214	309	26	146	230	63	#189	241
Internal Link Dist (ft)		1113			142			429			798
Turn Bay Length (ft)	310		360	325		340	180		180	300	
Base Capacity (vph)	414	1057	633	549	1190	646	377	831	638	203	902
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.66	0.48	0.37	0.74	0.61	0.27	0.87	0.58	0.58	0.81	0.67

Intersection Summary

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

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	248	483	169	371	619	131	243	446	305	129	352	197
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	11	11	11	11	11	11	12	12	12	12	12	12
Total Lost time (s)	6.6	6.6	6.6	6.7	6.7	6.7	6.8	6.8	6.8	7.2	7.2	
Lane Util. Factor	0.97	0.95	1.00	0.97	0.95	1.00	0.97	0.95	1.00	1.00	0.95	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.94	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	3319	3421	1531	3319	3421	1531	3433	3539	1583	1770	3322	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (perm)	3319	3421	1531	3319	3421	1531	3433	3539	1583	1770	3322	
Peak-hour factor, PHF	0.91	0.96	0.73	0.91	0.86	0.75	0.74	0.93	0.82	0.78	0.98	0.79
Adj. Flow (vph)	273	503	232	408	720	175	328	480	372	165	359	249
RTOR Reduction (vph)	0	0	160	0	0	114	0	0	281	0	111	0
Lane Group Flow (vph)	273	503	72	408	720	61	328	480	91	165	497	0
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Perm	Prot	NA	
Protected Phases	1	6		5	2		7	4		3	8	
Permitted Phases			6			2			4			
Actuated Green, G (s)	14.1	37.0	37.0	18.8	41.7	41.7	13.2	23.5	23.5	13.4	23.7	
Effective Green, g (s)	14.1	37.0	37.0	18.8	41.7	41.7	13.2	23.5	23.5	13.4	23.7	
Actuated g/C Ratio	0.12	0.31	0.31	0.16	0.35	0.35	0.11	0.20	0.20	0.11	0.20	
Clearance Time (s)	6.6	6.6	6.6	6.7	6.7	6.7	6.8	6.8	6.8	7.2	7.2	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	389	1054	472	519	1188	532	377	693	310	197	656	
v/s Ratio Prot	0.08	0.15		c0.12	c0.21		c0.10	0.14		0.09	c0.15	
v/s Ratio Perm			0.05			0.04			0.06			
v/c Ratio	0.70	0.48	0.15	0.79	0.61	0.11	0.87	0.69	0.29	0.84	0.76	
Uniform Delay, d1	50.9	33.7	30.1	48.7	32.4	26.6	52.6	44.9	41.2	52.2	45.4	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	5.6	1.5	0.7	7.7	2.3	0.4	19.1	3.0	0.5	25.4	5.0	
Delay (s)	56.6	35.2	30.8	56.4	34.7	27.0	71.6	47.9	41.7	77.7	50.5	
Level of Service	E	D	C	E	C	C	E	D	D	E	D	
Approach Delay (s)		40.0			40.4			52.5			56.3	
Approach LOS		D			D			D			E	

Intersection Summary			
HCM 2000 Control Delay	46.5	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.74		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	27.3
Intersection Capacity Utilization	69.9%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

Intersection	
Int Delay, s/veh	18

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Vol, veh/h	63	52	86	898	781	67
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	0	130	-	-	0
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	86	87	61	93	89	72
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	73	60	141	966	878	93

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	2126	878	878	0	-	0
Stage 1	878	-	-	-	-	-
Stage 2	1248	-	-	-	-	-
Critical Hdwy	6.42	6.22	4.12	-	-	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	2.218	-	-	-
Pot Cap-1 Maneuver	~ 55	347	769	-	-	-
Stage 1	406	-	-	-	-	-
Stage 2	271	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	~ 45	347	769	-	-	-
Mov Cap-2 Maneuver	~ 45	-	-	-	-	-
Stage 1	406	-	-	-	-	-
Stage 2	221	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	286.8	1.4	0
HCM LOS	F		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	EBLn2	SBT	SBR
Capacity (veh/h)	769	-	45	347	-	-
HCM Lane V/C Ratio	0.183	-	1.628	0.172	-	-
HCM Control Delay (s)	10.7	-	$ 506.6	17.5	-	-
HCM Lane LOS	B	-	F	C	-	-
HCM 95th %tile Q(veh)	0.7	-	7.3	0.6	-	-

Notes

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

Intersection	
Int Delay, s/veh	0.7

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Vol, veh/h	1	16	968	9	27	806
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	60	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	25	42	94	45	72	85
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	4	38	1030	20	38	948

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	2063	1040	0	0	1050	0
Stage 1	1040	-	-	-	-	-
Stage 2	1023	-	-	-	-	-
Critical Hdwy	6.42	6.22	-	-	4.12	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	-	-	2.218	-
Pot Cap-1 Maneuver	60	280	-	-	663	-
Stage 1	341	-	-	-	-	-
Stage 2	347	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	57	280	-	-	663	-
Mov Cap-2 Maneuver	57	-	-	-	-	-
Stage 1	341	-	-	-	-	-
Stage 2	327	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	27.2	0	0.4
HCM LOS	D		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	204	663	-
HCM Lane V/C Ratio	-	-	0.206	0.057	-
HCM Control Delay (s)	-	-	27.2	10.8	-
HCM Lane LOS	-	-	D	B	-
HCM 95th %tile Q(veh)	-	-	0.8	0.2	-

Intersection	
Int Delay, s/veh	2.4

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Vol, veh/h	39	1	1	27	38	51
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	42	1	1	29	41	55

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	101	69	97	0	-	0
Stage 1	69	-	-	-	-	-
Stage 2	32	-	-	-	-	-
Critical Hdwy	6.42	6.22	4.12	-	-	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	2.218	-	-	-
Pot Cap-1 Maneuver	898	994	1496	-	-	-
Stage 1	954	-	-	-	-	-
Stage 2	991	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	897	994	1496	-	-	-
Mov Cap-2 Maneuver	897	-	-	-	-	-
Stage 1	954	-	-	-	-	-
Stage 2	990	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	9.2	0.3	0
HCM LOS	A		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	1496	-	899	-	-
HCM Lane V/C Ratio	0.001	-	0.048	-	-
HCM Control Delay (s)	7.4	0	9.2	-	-
HCM Lane LOS	A	A	A	-	-
HCM 95th %tile Q(veh)	0	-	0.2	-	-

Intersection	
Int Delay, s/veh	13.5

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Vol, veh/h	879	28	61	1071	50	16
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	75	160	-	0	0
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	93	64	31	90	78	78
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	945	44	197	1190	64	21

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	945	0	1934	473
Stage 1	-	-	-	-	945	-
Stage 2	-	-	-	-	989	-
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	-	-	722	-	~ 58	538
Stage 1	-	-	-	-	338	-
Stage 2	-	-	-	-	321	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	722	-	~ 42	538
Mov Cap-2 Maneuver	-	-	-	-	~ 42	-
Stage 1	-	-	-	-	338	-
Stage 2	-	-	-	-	233	-

Approach	EB	WB	NB
HCM Control Delay, s	0	1.7	$ 365.9
HCM LOS			F

Minor Lane/Major Mvmt	NBLn1	NBLn2	EBT	EBR	WBL	WBT
Capacity (veh/h)	42	538	-	-	722	-
HCM Lane V/C Ratio	1.526	0.038	-	-	0.273	-
HCM Control Delay (s)	$ 479.1	12	-	-	11.8	-
HCM Lane LOS	F	B	-	-	B	-
HCM 95th %tile Q(veh)	6.5	0.1	-	-	1.1	-

Notes

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

Intersection	
Int Delay, s/veh	5.6

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR
Vol, veh/h	68	3	41	39	5	62	50	864	47
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None
Storage Length	75	-	-	40	-	-	65	-	95
Veh in Median Storage, #	-	1	-	-	1	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-
Peak Hour Factor	89	25	45	78	78	78	60	88	35
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2
Mvmt Flow	76	12	91	50	6	79	83	982	134

Major/Minor	Minor2			Minor1			Major1		
Conflicting Flow All	1704	2326	487	1779	2319	558	973	0	0
Stage 1	1043	1043	-	1216	1216	-	-	-	-
Stage 2	661	1283	-	563	1103	-	-	-	-
Critical Hdwy	7.54	6.54	6.94	7.54	6.54	6.94	4.14	-	-
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	3.52	4.02	3.32	3.52	4.02	3.32	2.22	-	-
Pot Cap-1 Maneuver	~ 59	37	526	52	37	473	704	-	-
Stage 1	245	305	-	192	252	-	-	-	-
Stage 2	418	234	-	478	285	-	-	-	-
Platoon blocked, %								-	-
Mov Cap-1 Maneuver	~ 39	29	526	~ 33	29	473	704	-	-
Mov Cap-2 Maneuver	120	97	-	107	101	-	-	-	-
Stage 1	216	273	-	169	222	-	-	-	-
Stage 2	298	206	-	338	255	-	-	-	-

Approach	EB	WB	NB
HCM Control Delay, s	44	35.1	0.8
HCM LOS	E	E	

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	EBLn2	WBLn1	WBLn2	SBL	SBT	SBR
Capacity (veh/h)	704	-	-	120	347	107	371	622	-	-
HCM Lane V/C Ratio	0.118	-	-	0.637	0.297	0.467	0.232	0.105	-	-
HCM Control Delay (s)	10.8	-	-	76.9	19.7	65.2	17.6	11.5	-	-
HCM Lane LOS	B	-	-	F	C	F	C	B	-	-
HCM 95th %tile Q(veh)	0.4	-	-	3.3	1.2	2	0.9	0.3	-	-

Notes

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

Intersection			
Int Delay, s/veh			

Movement	SBL	SBT	SBR
Vol, veh/h	39	768	85
Conflicting Peds, #/hr	0	0	0
Sign Control	Free	Free	Free
RT Channelized	-	-	None
Storage Length	80	-	-
Veh in Median Storage, #	-	0	-
Grade, %	-	0	-
Peak Hour Factor	60	90	71
Heavy Vehicles, %	2	2	2
Mvmt Flow	65	853	120

Major/Minor	Major2		
Conflicting Flow All	1116	0	0
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	622	-	-
Stage 1	-	-	-
Stage 2	-	-	-
Platoon blocked, %		-	-
Mov Cap-1 Maneuver	622	-	-
Mov Cap-2 Maneuver	-	-	-
Stage 1	-	-	-
Stage 2	-	-	-

Approach	SB
HCM Control Delay, s	0.7
HCM LOS	

Minor Lane/Major Mvmt