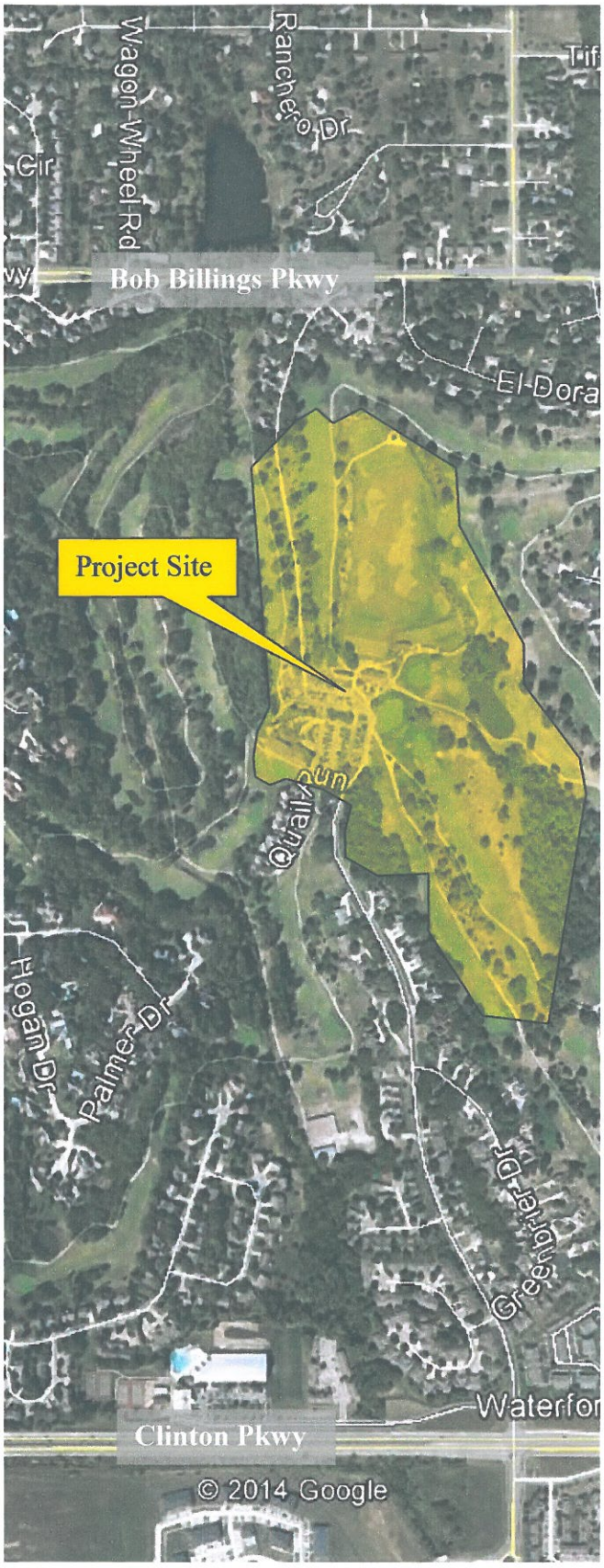


Amended Traffic Impact Study

for

Proposed Alvamar Inc One Addition

Crossgate Drive, Between
Bob Billings Pkwy and Clinton Pkwy

Lawrence, Kansas

Prepared
for
Paul Werner Architects

Prepared By

MGineering Solutions

Serving Communities Through Excellence
Kansas - Missouri - Michigan - California

MEHRDAD GIVECHI
LICENSED
2/22/16
14522
KANSAS
PROFESSIONAL ENGINEER

Mehrdad Givechi, PE, PTOE

February 2016

TABLE OF CONTENTS

Introduction

Background

This document is prepared as an amendment to the Traffic Impact Study (TIS) dated 1/15/2015 that was prepared for "Alvamar Inc. One Addition" development located along Crossgate Drive between Bob Billings Parkway and Clinton Parkway, all nested in the existing Alvamar Golf Courses and clubhouse site, in Lawrence, Kansas (See Location Map, Figure 1 of Appendix I). The purpose of this amendment is to re-assess impact of traffic resulted by a number of changes to the previously submitted site plan.

Revised Land Use

The new site plan for this development consists of:

- 256 Apartments (ITE Land Use Code 220) – 168 units on Lot #2A and 88 units on Lot #2B. *This is a reduction of 76 units from the previous plan.*
- 8 Owned Patio Homes / Townhomes (ITE Land Use Code 230) – all on Lot #2B. *This is a reduction of 88 units from the previous plan.*
- 24 Owned Condos (ITE Land Use Code 230) – all on Lot #2B. *This is a reduction of 72 units from the previous plan.*
- Owned Luxury Condos (ITE Land Use Code 233) are eliminated. *This is a reduction of 88 units from the previous plan.*
- A new Senior Adult Housing – Attached (ITE Land Use Code 252) with 100 dwelling units.
- The existing 36-hole golf course will be operating as a 27-hole course to make room for the proposed development. In addition, the existing clubhouse will be renovated and expanded having a total square footage of approximately 30,000 for use by club members; those playing golf; and participants of the special events and tournaments held on the golf course. The clubhouse will have a number of amenities (all of which are designated under ITE Land Use Code 430 "Golf Course", except as noted) including:
    - Banquet / event facility;
    - Outdoor snack bar/grill;
    - Swimming pools;

    - A 1,500 square feet Kansas Golf Hall of Fame (ITE Land Use Code 580). *This is a slight increase (by 300 square feet) from the previous plan;* and
    - A 2,000 square feet office space for golf course administration use.
- Extended stay cabins/suites are eliminated. *This is a reduction of 24 units from the previous plan.*
- A new sports medicine office building (ITE Land Use Code 720) on Lot #3 with a floor area of approximately 19,200 square.
- A new Fitness/Wellness Center (ITE Land Use Code 492) on Lot #3 with a floor area of approximately 18,000 square feet.
- Renovation and expansion of the existing KU practice facility on Lot #3 from 2,000 square feet to 10,000 with no change in the current uses (ITE Land Use 492).
- Under the revised development plan, no specific use for Lot #4 is being proposed.

Revised Access

Under the revised plan, project site traffic will access Bob Billings Parkway via a new street connection west of Crossgate Drive, which will also serve the existing residential dwelling units just to the south of Bob Billings Parkway (See Site Plan, Figure 2 of Appendix I). Provision of this access drive requires a median break on Bob Billings Parkway. The existing Crossgate Drive (private) will be utilized as the emergency access only. Access to the south will remain at signalized intersection on Clinton Parkway.

Revised Trip Generation Analysis

Using the same methodology mentioned in the original TIS and the ITE Land Use Codes mentioned earlier in this report, the trip generation numbers are recalculated to reflect the proposed changes.

Assumptions

- The trips for the entire development site are broken into two components – residential and non-residential because they have different distribution patterns during the peak-hours;
- The trips for the golf course includes all trips for the clubhouse amenities as described in the ITE Trip Generation Manual with the exception of trips for Kansas Golf Hall of Fame; and
- All trips are assumed to be "primary (new)" trips with zero "pass-by" trips. In addition, it is assumed that the "internal capture" rate between the residential component and the non-residential component is zero to account for a "conservative" scenario.
- At the time this amendment was prepared, no specific use for Lot #4 was planned. Therefore, for the purpose of this amendment, Lot #4 is assumed to be undeveloped.

The results, as summarized in Appendix II, indicate that the revised development plan will likely add new trips to the adjacent street network as follows:

- On average, 209 trip-ends (68 inbound and 141 outbound) during the morning peak-hour of a typical weekday. *A reduction of approximately 45% from the previous plan.*
- On average, 311 trip-ends (171 inbound and 140 outbound) during the afternoon peak-hour of a typical weekday. *A reduction of approximately 33% from the previous plan*; and
- On average, 3,116 trip-ends during 24-hour period of a typical weekday. *A reduction of approximately 33% from the previous plan*.

Analysis Time Period

An overview of existing traffic volumes in the study area and their peak characteristics, in conjunction with estimated trips generated from the proposed development, indicate that the most critical peak period will likely occur during the *afternoon peak-hour* of a typical weekday. For this study, however, both morning and afternoon peak-hours are selected for analysis.

Revised Trip Distribution and Assignment Analysis

Using the trip distribution patterns mentioned in the original TIS (illustrated in Figures 6 and 7 of Appendix I of this Amendment), site-generated trips are assigned to individual movements within the study area (See Figure 8 of Appendix I).

Impact Assessment for Revised Development

Volume/Capacity Analysis

Results of the volume/capacity analysis, as shown in Appendix III and illustrated in Figures 9 and 10 of Appendix I, indicate that LOS for individual movements in the study area will remain the same as that of the previous plan.

Dedicated Turn Lane Analysis

Results of the turn lane analysis indicate that a dedicated westbound left-turn lane on Bob Billings Parkway at the new access drive location is required. This improvement requires modification of the existing median on Bob Billings Parkway. The results also indicate that provision of a dedicated eastbound right-turn lane on Bob Billings Parkway at this location is not required.

Findings

This amendment evaluates impact of the revised "Alvamar Inc One Addition" development plan on the intersections under study during the critical analysis period (morning and afternoon peak-hours of a typical weekday) and recommends mitigation measures resulted thereof. Results of the analysis indicate that the revised plan generates significantly less trips than the previous plan:

- 45% less during the morning peak-hour of a typical weekday;
- 33% less during the afternoon peak-hour of a typical weekday; and
- 33% less over a typical 24-hour period.

In summary, number of trips generated by the revised plan is approximately 67% of that of the previous plan. The recommended off-site improvements, however, is the same as what is mentioned in the original TIS report as follows:

1. With added trips generated by the proposed development site, LOS for the intersection of Clinton Parkway and Crossgate Drive (as a whole) will remain at acceptable LOS "C" or higher with reserve capacity for both east and west approaches. The north and south approaches, however, will experience excessive delays with northbound left-turn movement at LOS "F" and southbound left-turn movement at LOS "E".

   Recommended Improvement: Modify signal timing plan at this intersection while maintaining the existing 120 second cycle length for coordination purposes and reassigning the green time in favor of north/south approaches.

2. With the added trips generated by the proposed development site, the requirements for provision of a dedicated westbound left-turn lane on Bob Billings Parkway at Crossgate Drive are met.

   Recommended Improvement: Provide a dedicated westbound left-turn lane on Bob Billings Parkway at Crossgate Drive. This lane should have a *minimum* storage length of 75' with a desirable deceleration and taper length.

3. To minimize delay for the northbound movement at the intersection of Bob Billings Parkway and Crossgate Drive, it is desirable to separate the northbound left-turn and northbound right-turn movements from one another.

   Recommended Improvement: Provide a dedicated northbound right-turn lane (or left-turn lane) on Crossgate Drive at Bob Billings Parkway with minimum storage length of 50'.

APPENDIX I

Figures

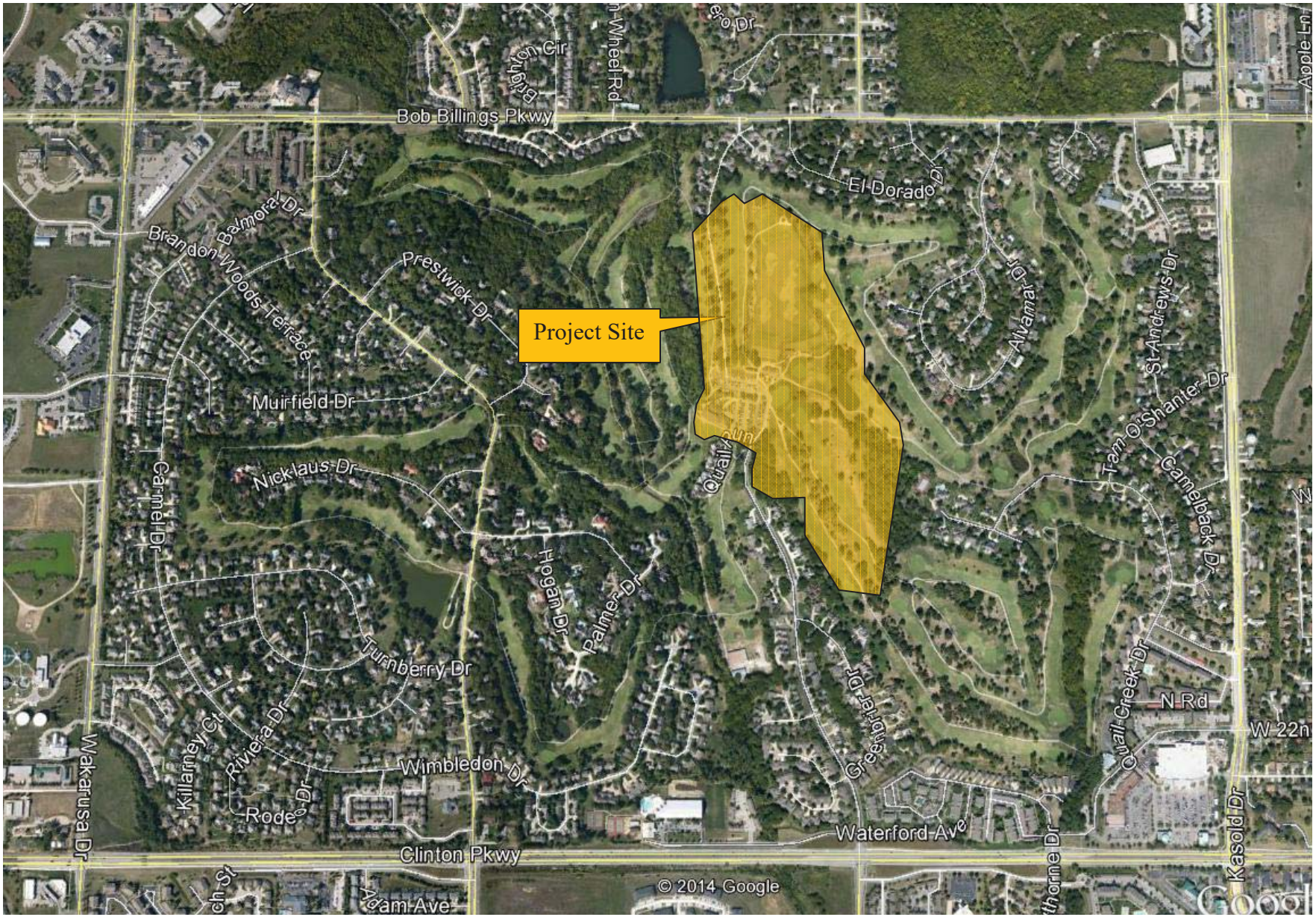
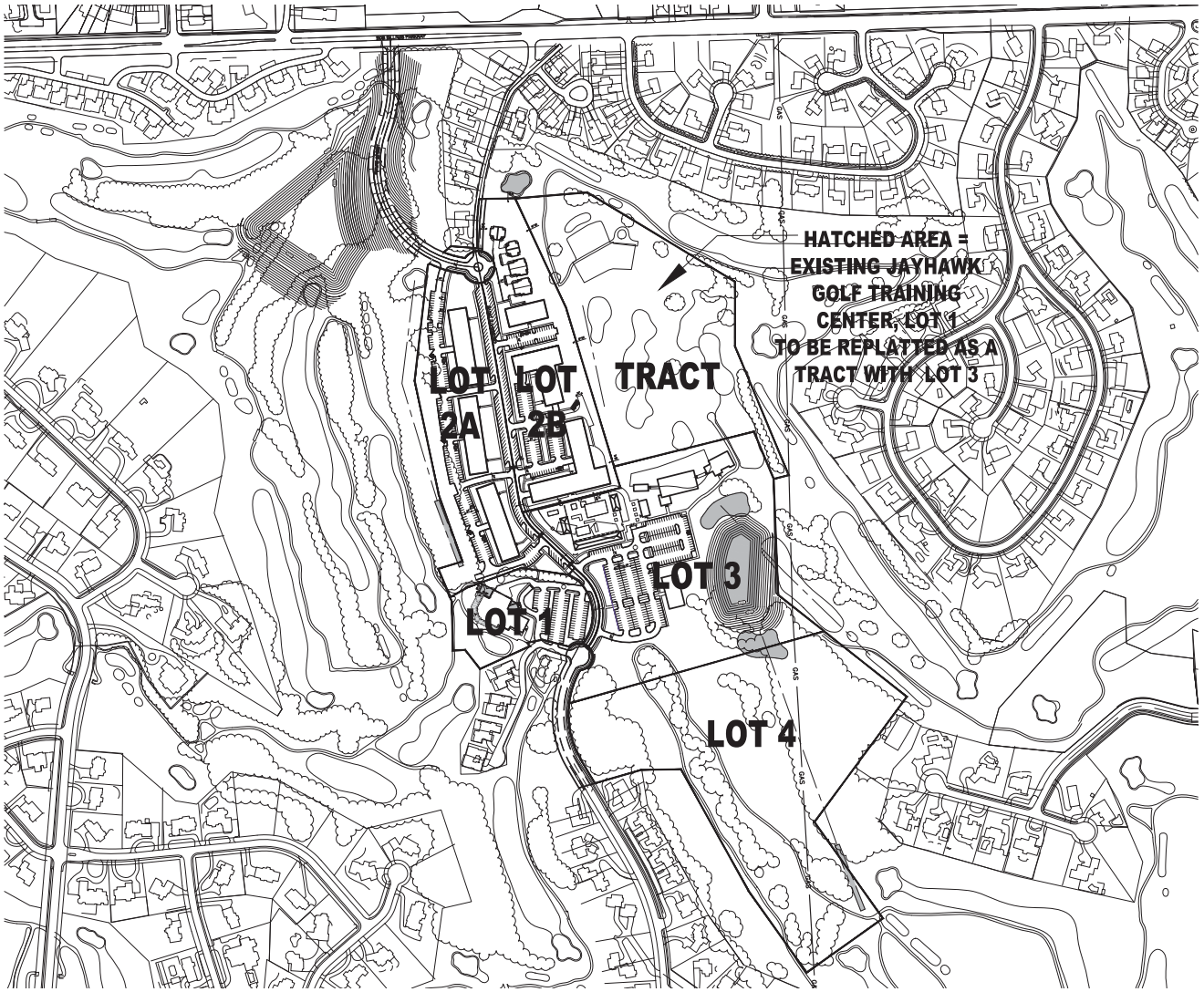


Figure 1
Location Map

ALVAMAR

LOT 1, 2A, 2B & 3 PRELIMINARY DEVELOPMENT PLAN
LAWRENCE, KANSAS



paulwerner ARCHITECTS

123 W. 8TH STREET
SUITE 82
LAWRENCE, KS 66044

OFFICE: 785.832.0804
FAX: 785.832.0880

BUILDER:
GENE FRITZEL CONSTRUCTION
640 MASSACHUSETTS
SUITE 300
LAWRENCE, KS 66044
OFFICE: 785.841.1555
FAX: 785.841.1342

ALVAMAR LOT 1, 2A, 2B & 3
PRELIMINARY
DEVELOPMENT PLAN
LAWRENCE, KANSAS

PROJECT # 213-560

RELEASE: 1.0
DATE: 2.16.16

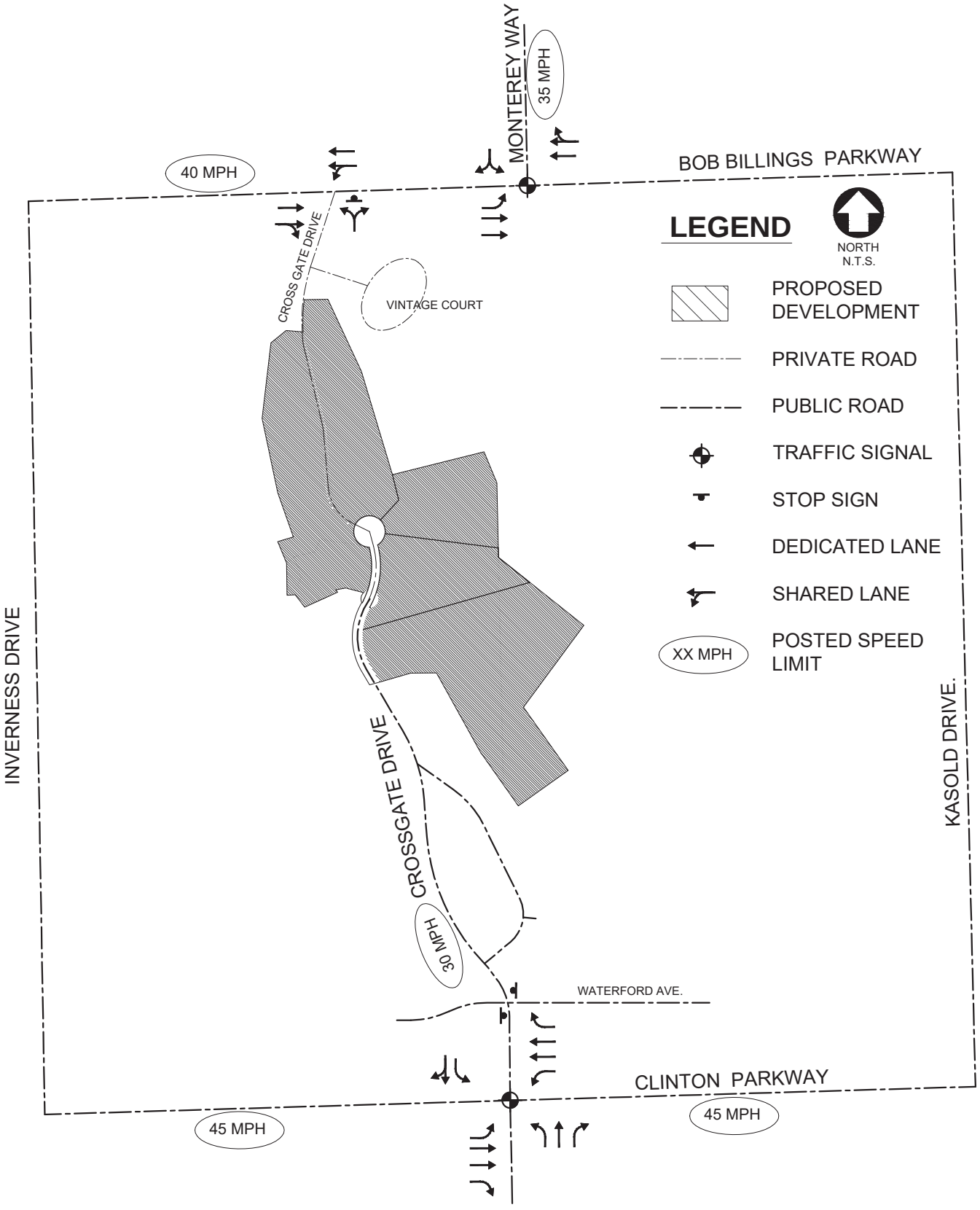


FIGURE 3
EXISTING LANE CONFIGURATIONS AND POSTED SPEED LIMITS (DECEMBER 2014)

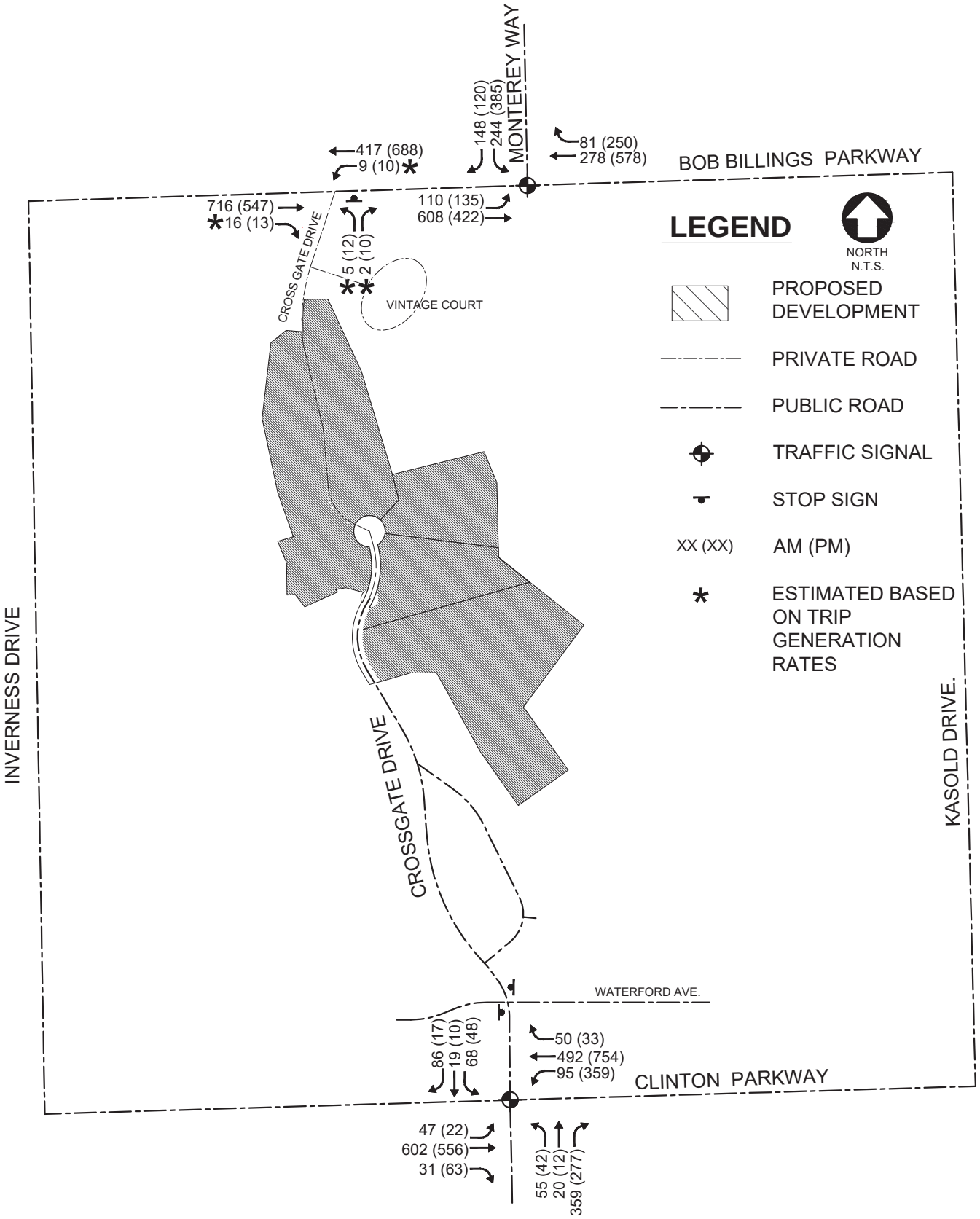


FIGURE 4
EXISTING PEAK HOUR TRAFFIC VOLUMES
(TYPICAL WEEKDAY, FEB. 2012 AND APR. 2013)

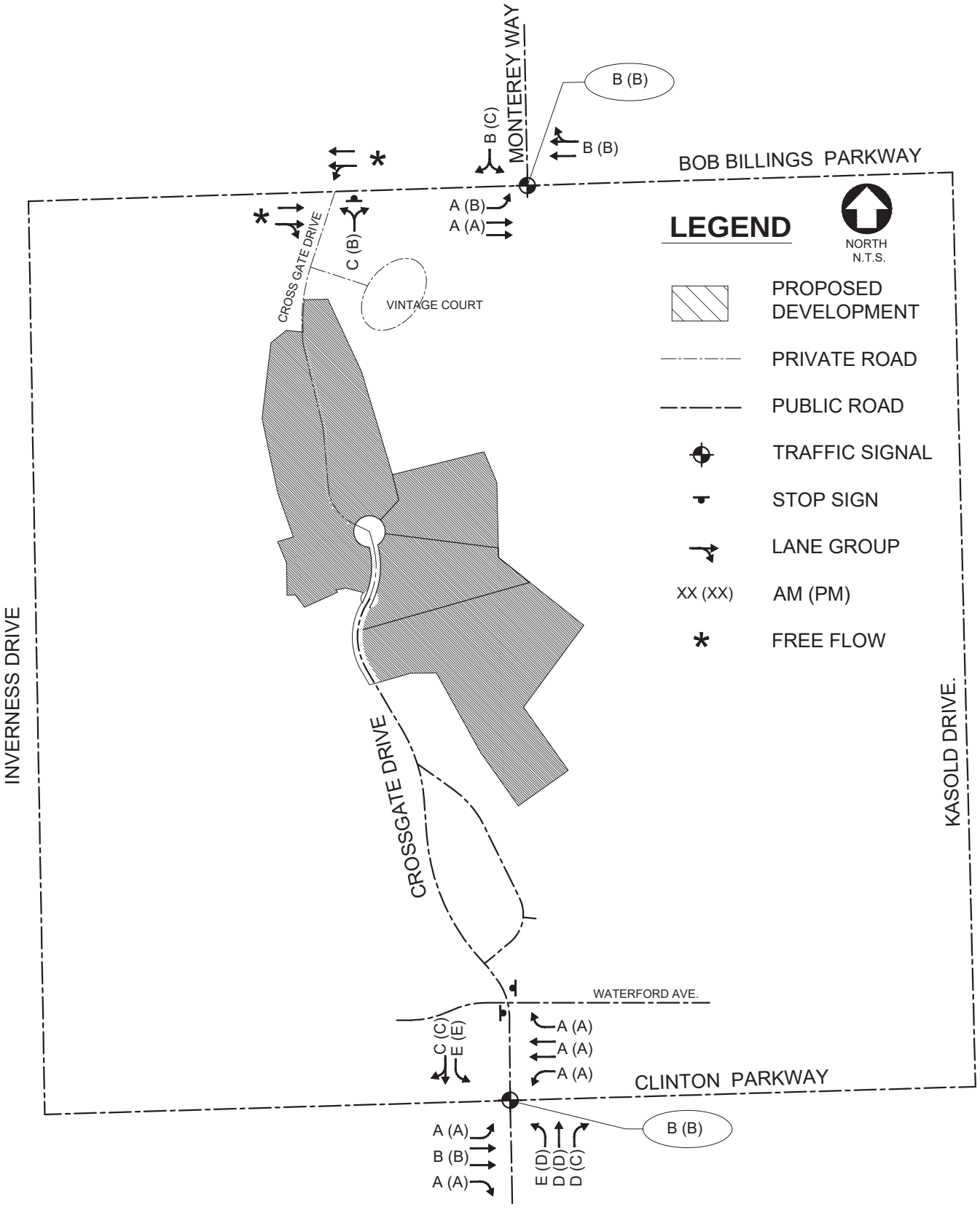
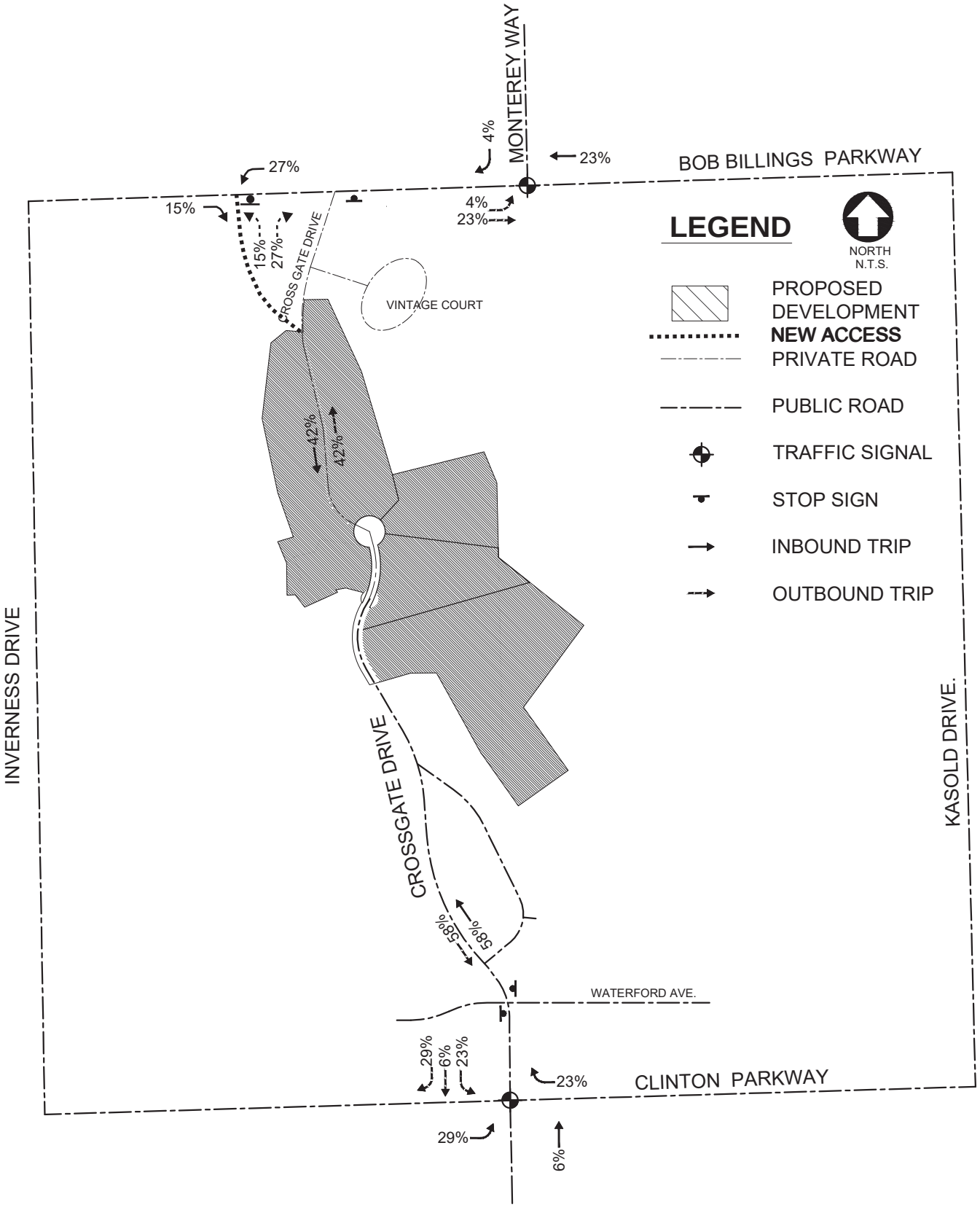
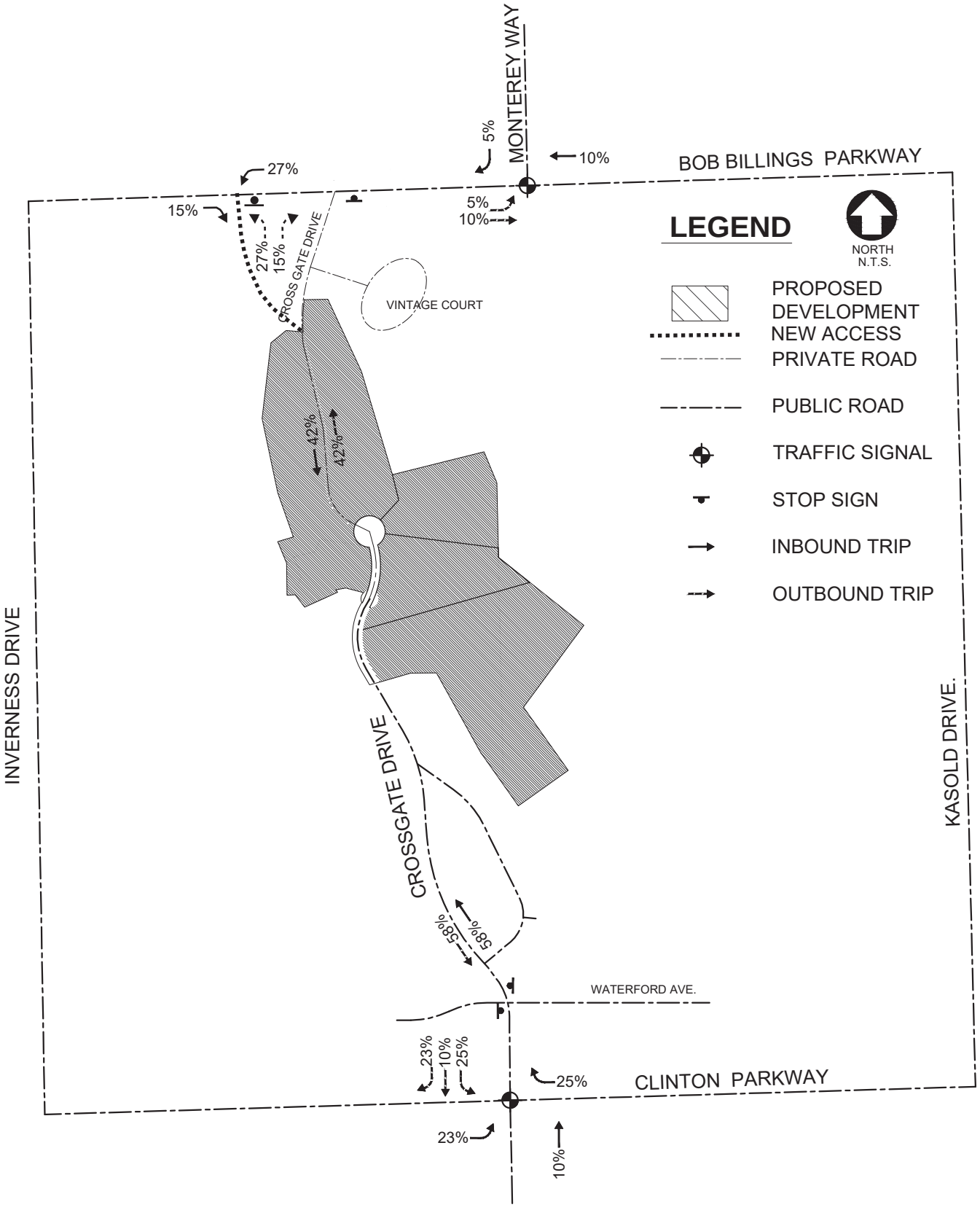


FIGURE 5
SUMMARY OF L.O.S. FOR EXISTING CONDITIONS
(PEAK HOURS OF A TYPICAL WEEKDAY)



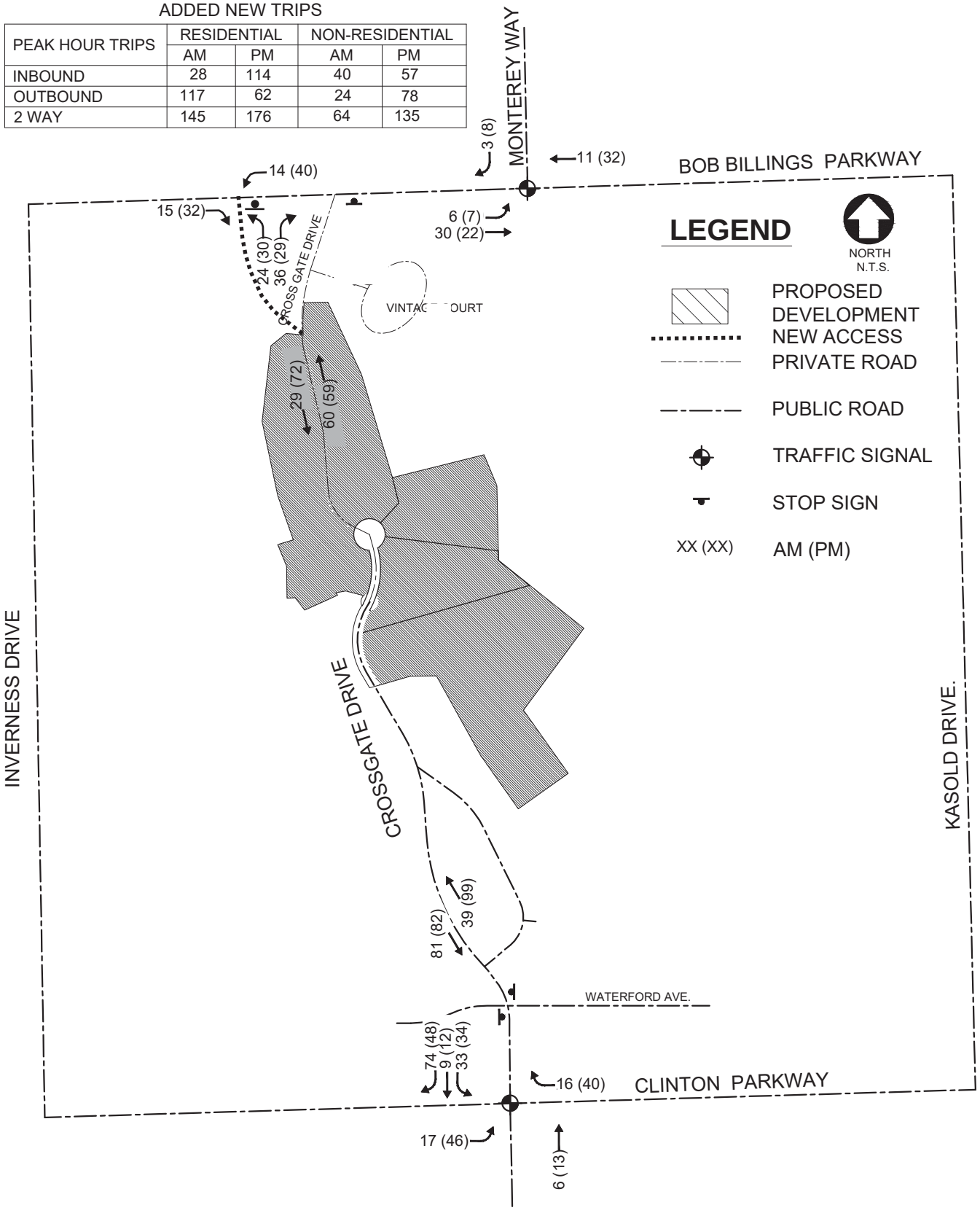
REVISED FIGURE 6
TRIP DISTRIBUTION PATTERNS FOR RESIDENTIAL
COMPONENT OF PROPOSED DEVELOPMENT
(PEAK HOURS OF A TYPICAL WEEKDAY)



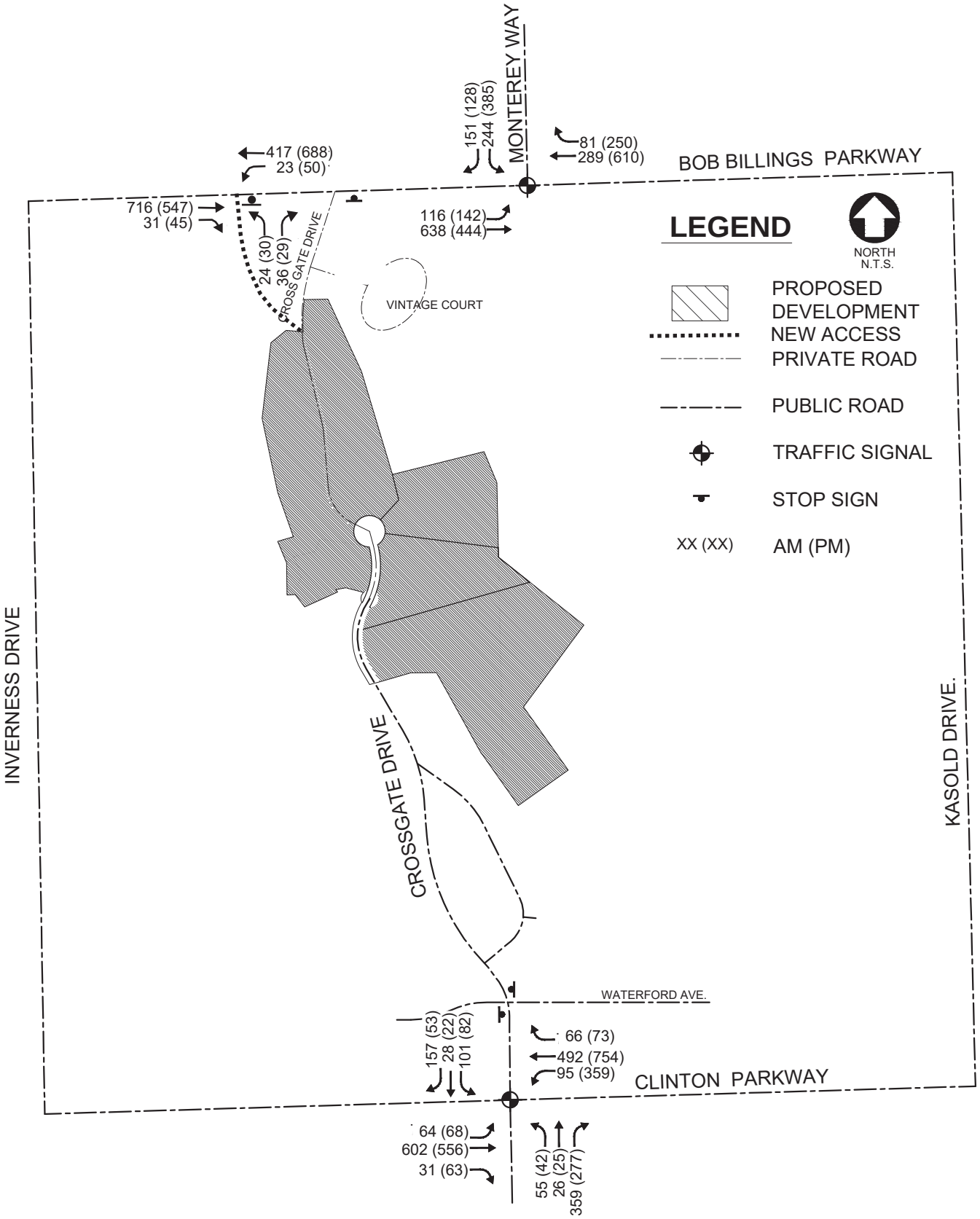
REVISED FIGURE 7
TRIP DISTRIBUTION PATTERNS FOR NON-RESIDENTIAL
COMPONENT OF PROPOSED DEVELOPMENT
(PEAK HOURS OF A TYPICAL WEEKDAY)

ADDED NEW TRIPS

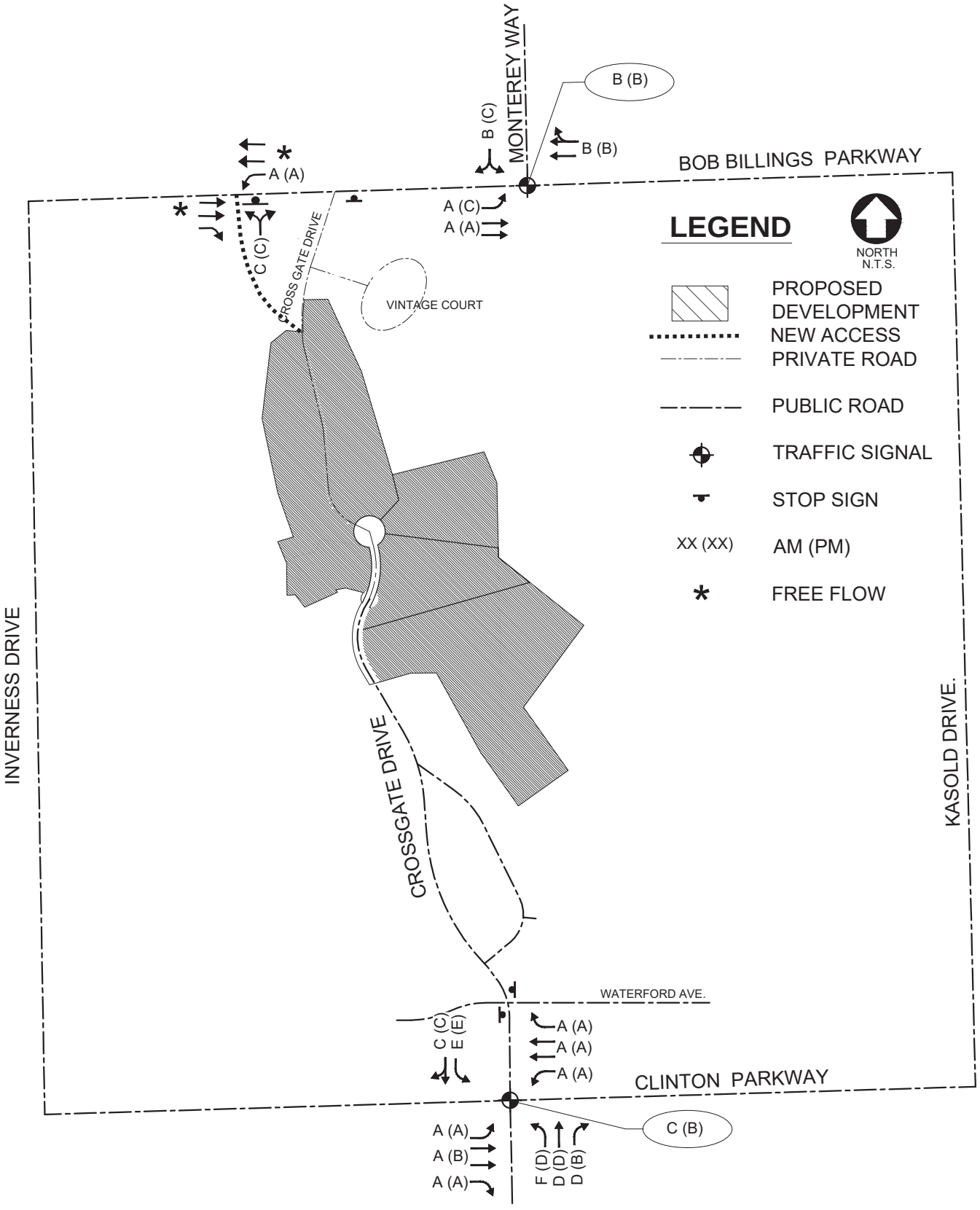
PEAK HOUR TRIPS	RESIDENTIAL		NON-RESIDENTIAL	
	AM	PM	AM	PM
INBOUND	28	114	40	57
OUTBOUND	117	62	24	78
2 WAY	145	176	64	135



REVISED FIGURE 8
SITE-GENERATED TRIPS FOR PROPOSED DEVELOPMENT
(PEAK HOURS OF A TYPICAL WEEKDAY)



REVISED FIGURE 9
"EXISTING + PROPOSED DEVELOPMENT"
PEAK HOUR TRAFFIC VOLUMES
(TYPICAL WEEKDAY)



REVISED FIGURE 10
SUMMARY OF L.O.S. FOR "EXISTING + REVISED DEVELOPMENT" TRAFFIC CONDITIONS
(PEAK HOURS OF A TYPICAL WEEKDAY)

APPENDIX II

Results of Trip Generation Analysis

Using

ITE Trip Generation Manual, 9th Edition

Trip Generation Summary - Existing townhomes/patio homes just S/O BB Pkwy
Average Weekday Driveway Volumes

Project: Alvamar Inc One Addition — Open Date: 12/28/2014
Alternative: Existing Conditions — Analysis 12/28/2014

ITE	Land Use	Average Daily Trips Enter	Average Daily Trips Exit	Average Daily Trips Total	AM Peak Hour Adjacent Street Traffic Enter	AM Peak Hour Adjacent Street Traffic Exit	AM Peak Hour Adjacent Street Traffic Total	PM Peak Hour Adjacent Street Traffic Enter	PM Peak Hour Adjacent Street Traffic Exit	PM Peak Hour Adjacent Street Traffic Total
230	CONDO 1	82	81	163	2	10	12	10	5	15
	28 Dwelling Units									
Unadjusted Driveway Volume		82	81	163	2	10	12	10	5	15
Unadjusted Pass-By Trips		0	0	0	0	0	0	0	0	0
Internal Capture Trips		0	0	0	0	0	0	0	0	0
Adjusted Driveway Volume		82	81	163	2	10	12	10	5	15
Adjusted Pass-By Trips		0	0	0	0	0	0	0	0	0
Adjusted Volume Added to Adjacent Streets		82	81	163	2	10	12	10	5	15

Total AM Peak Hour Internal Capture = 0 Percent

Total PM Peak Hour Internal Capture = 0 Percent

Source: Institute of Transportation Engineers, Trip Generation Manual 9th Edition, 2012

Trip Generation Summary - Existing Conditions

Project: Alvamar Inc One Addition
Alternative: Existing Conditions

Open Date: 2/19/2016
Analysis Date: 2/19/2016

ITE	Land Use	Average Daily Trips			AM Peak Hour of Adjacent Street Traffic			PM Peak Hour of Adjacent Street Traffic		
		Enter	Exit	Total	Enter	Exit	Total	Enter	Exit	Total
430	GOLF 1	644	643	1287	58	16	74	54	51	105
	36 Golf Holes									
492	CLUBHEALTH 1	33	33	66	2	1	3	4	3	7
	2 Gross Floor Area 1000 SF									
Unadjusted Volume		677	676	1353	60	17	77	58	54	112
Internal Capture Trips		0	0	0	0	0	0	0	0	0
Pass-By Trips		0	0	0	0	0	0	0	0	0
Volume Added to Adjacent Streets		677	676	1353	60	17	77	58	54	112

Total AM Peak Hour Internal Capture = 0 Percent

Total PM Peak Hour Internal Capture = 0 Percent

Source: Institute of Transportation Engineers, Trip Generation Manual 9th Edition, 2012

Trip Generation Summary - Proposed Conditions

Project: Alvamar Inc One Addition
Alternative: Proposed Conditions

Open Date: 2/19/2016
Analysis Date: 2/19/2016

ITE	Land Use	Average Daily Trips Enter	Average Daily Trips Exit	Average Daily Trips Total	AM Peak Hour of Adjacent Street Traffic Enter	AM Peak Hour of Adjacent Street Traffic Exit	AM Peak Hour of Adjacent Street Traffic Total	PM Peak Hour of Adjacent Street Traffic Enter	PM Peak Hour of Adjacent Street Traffic Exit	PM Peak Hour of Adjacent Street Traffic Total
220	APT 1	851	851	1702	26	105	131	103	56	159
	256 Dwelling Units									
230	CONDO 1	93	93	186	2	12	14	11	6	17
	32 Dwelling Units									
430	GOLF 1	483	482	965	44	12	56	40	39	79
	27 Golf Holes									
492	CLUBHEALTH 1	297	296	593	13	12	25	36	28	64
	18 Gross Floor Area 1000 SF									
492	CLUBHEALTH 2	165	164	329	7	7	14	20	15	35
	10 Gross Floor Area 1000 SF									
580	MUSEUM 1				0	0	0	0	0	0
	1.5 Gross Floor Area 1000 SF									
720	OFFICEMEDICAL 2	347	347	694	36	10	46	19	50	69
	19.2 Gross Floor Area 1000 SF									
	Unadjusted Volume	2236	2233	4469	128	158	286	229	194	423
	Internal Capture Trips	0	0	0	1	1	2	3	3	6
	Pass-By Trips	0	0	0	0	0	0	0	0	0
	Volume Added to Adjacent Streets	2236	2233	4469	127	157	284	226	191	417

Total AM Peak Hour Internal Capture = 1 Percent

Total PM Peak Hour Internal Capture = 1 Percent

Source: Institute of Transportation Engineers, Trip Generation Manual 9th Edition, 2012

Trip Generation Summary - Existing Golf Course

Project: Alvamar Inc One Addition
Alternative: Existing Conditions

Open Date: 2/19/2016
Analysis Date: 2/19/2016

ITE	Land Use	Average Daily Trips			AM Peak Hour of Adjacent Street Traffic			PM Peak Hour of Adjacent Street Traffic		
		Enter	Exit	Total	Enter	Exit	Total	Enter	Exit	Total
430	GOLF 1 36 Golf Holes	644	643	1287	58	16	74	54	51	105
Unadjusted Volume		0	0	0	0	0	0	0	0	0
Internal Capture Trips		0	0	0	0	0	0	0	0	0
Pass-By Trips		0	0	0	0	0	0	0	0	0
Volume Added to Adjacent Streets		0	0	0	0	0	0	0	0	0

Total AM Peak Hour Internal Capture = 0 Percent

Total PM Peak Hour Internal Capture = 0 Percent

Source: Institute of Transportation Engineers, Trip Generation Manual 9th Edition, 2012

Trip Generation Summary - Practice Facility

Project: Alvamar Inc One Addition
Alternative: Existing Conditions

Open Date: 2/19/2016
Analysis Date: 2/19/2016

ITE	Land Use	Average Daily Trips			AM Peak Hour of Adjacent Street Traffic			PM Peak Hour of Adjacent Street Traffic		
		Enter	Exit	Total	Enter	Exit	Total	Enter	Exit	Total
492	CLUBHEALTH 1	33	33	66	2	1	3	4	3	7
	2 Gross Floor Area 1000 SF									
Unadjusted Volume		0	0	0	0	0	0	0	0	0
Internal Capture Trips		0	0	0	0	0	0	0	0	0
Pass-By Trips		0	0	0	0	0	0	0	0	0
Volume Added to Adjacent Streets		0	0	0	0	0	0	0	0	0

Total AM Peak Hour Internal Capture = 0 Percent

Total PM Peak Hour Internal Capture = 0 Percent

Source: Institute of Transportation Engineers, Trip Generation Manual 9th Edition, 2012

Trip Generation Summary - Apartments

Project: Alvamar Inc One Addition
Alternative: Proposed Conditions

Open Date: 2/19/2016
Analysis Date: 2/19/2016

ITE	Land Use	Average Daily Trips			AM Peak Hour of Adjacent Street Traffic			PM Peak Hour of Adjacent Street Traffic		
		Enter	Exit	Total	Enter	Exit	Total	Enter	Exit	Total
220	APT 1	851	851	1702	26	105	131	103	56	159
	256 Dwelling Units									
Unadjusted Volume		0	0	0	0	0	0	0	0	0
Internal Capture Trips		0	0	0	0	0	0	0	0	0
Pass-By Trips		0	0	0	0	0	0	0	0	0
Volume Added to Adjacent Streets		0	0	0	0	0	0	0	0	0

Total AM Peak Hour Internal Capture = 0 Percent

Total PM Peak Hour Internal Capture = 0 Percent

Source: Institute of Transportation Engineers, Trip Generation Manual 9th Edition, 2012

Trip Generation Summary - Owned Condos/Patio Homes/Townhomes

Project: Alvamar Inc One Addition
Alternative: Proposed Conditions

Open Date: 2/19/2016
Analysis Date: 2/19/2016

ITE	Land Use	Average Daily Trips			AM Peak Hour of Adjacent Street Traffic			PM Peak Hour of Adjacent Street Traffic		
		Enter	Exit	Total	Enter	Exit	Total	Enter	Exit	Total
230	CONDO 1	93	93	186	2	12	14	11	6	17
	32 Dwelling Units									
Unadjusted Volume		0	0	0	0	0	0	0	0	0
Internal Capture Trips		0	0	0	0	0	0	0	0	0
Pass-By Trips		0	0	0	0	0	0	0	0	0
Volume Added to Adjacent Streets		0	0	0	0	0	0	0	0	0

Total AM Peak Hour Internal Capture = 0 Percent

Total PM Peak Hour Internal Capture = 0 Percent

Source: Institute of Transportation Engineers, Trip Generation Manual 9th Edition, 2012

Trip Generation Summary - 27-Hole Golf Course

Project: Alvamar Inc One Addition
Alternative: Proposed Conditions

Open Date: 2/19/2016
Analysis Date: 2/19/2016

ITE	Land Use	Average Daily Trips			AM Peak Hour of Adjacent Street Traffic			PM Peak Hour of Adjacent Street Traffic		
		Enter	Exit	Total	Enter	Exit	Total	Enter	Exit	Total
430	GOLF 1 27 Golf Holes	483	482	965	44	12	56	40	39	79
Unadjusted Volume		0	0	0	0	0	0	0	0	0
Internal Capture Trips		0	0	0	0	0	0	0	0	0
Pass-By Trips		0	0	0	0	0	0	0	0	0
Volume Added to Adjacent Streets		0	0	0	0	0	0	0	0	0

Total AM Peak Hour Internal Capture = 0 Percent

Total PM Peak Hour Internal Capture = 0 Percent

Source: Institute of Transportation Engineers, Trip Generation Manual 9th Edition, 2012

Trip Generation Summary - KS Golf Hall of Fame

Project: Alvamar Inc One Addition
Alternative: Proposed Conditions

Open Date: 2/19/2016
Analysis Date: 2/19/2016

ITE	Land Use	Average Daily Trips			AM Peak Hour of Adjacent Street Traffic			PM Peak Hour of Adjacent Street Traffic		
		Enter	Exit	Total	Enter	Exit	Total	Enter	Exit	Total
580	MUSEUM 1				0	0	0	0	0	0
	1.5 Gross Floor Area 1000 SF									
Unadjusted Volume		0	0	0	0	0	0	0	0	0
Internal Capture Trips		0	0	0	0	0	0	0	0	0
Pass-By Trips		0	0	0	0	0	0	0	0	0
Volume Added to Adjacent Streets		0	0	0	0	0	0	0	0	0

Total AM Peak Hour Internal Capture = 0 Percent

Total PM Peak Hour Internal Capture = 0 Percent

Source: Institute of Transportation Engineers, Trip Generation Manual 9th Edition, 2012

Trip Generation Summary - Sport Medicine Office

Project: Alvamar Inc One Addition
Alternative: Proposed Conditions

Open Date: 2/19/2016
Analysis Date: 2/19/2016

ITE	Land Use	Average Daily Trips			AM Peak Hour of Adjacent Street Traffic			PM Peak Hour of Adjacent Street Traffic		
		Enter	Exit	Total	Enter	Exit	Total	Enter	Exit	Total
720	OFFICEMEDICAL 2	347	347	694	36	10	46	19	50	69
	19.2 Gross Floor Area 1000 SF									
Unadjusted Volume		0	0	0	0	0	0	0	0	0
Internal Capture Trips		0	0	0	0	0	0	0	0	0
Pass-By Trips		0	0	0	0	0	0	0	0	0
Volume Added to Adjacent Streets		0	0	0	0	0	0	0	0	0

Total AM Peak Hour Internal Capture = 0 Percent

Total PM Peak Hour Internal Capture = 0 Percent

Source: Institute of Transportation Engineers, Trip Generation Manual 9th Edition, 2012

Trip Generation Summary - Fittness/Wellness Center

Project: Alvamar Inc One Addition
Alternative: Proposed Conditions

Open Date: 2/19/2016
Analysis Date: 2/19/2016

ITE	Land Use	Average Daily Trips			AM Peak Hour of Adjacent Street Traffic			PM Peak Hour of Adjacent Street Traffic		
		Enter	Exit	Total	Enter	Exit	Total	Enter	Exit	Total
492	CLUBHEALTH 1	297	296	593	13	12	25	36	28	64
	18 Gross Floor Area 1000 SF									
Unadjusted Volume		0	0	0	0	0	0	0	0	0
Internal Capture Trips		0	0	0	0	0	0	0	0	0
Pass-By Trips		0	0	0	0	0	0	0	0	0
Volume Added to Adjacent Streets		0	0	0	0	0	0	0	0	0

Total AM Peak Hour Internal Capture = 0 Percent

Total PM Peak Hour Internal Capture = 0 Percent

Source: Institute of Transportation Engineers, Trip Generation Manual 9th Edition, 2012

Trip Generation Summary - Practice Facility

Project: Alvamar Inc One Addition
Alternative: Proposed Conditions

Open Date: 2/19/2016
Analysis Date: 2/19/2016

ITE	Land Use	Average Daily Trips			AM Peak Hour of Adjacent Street Traffic			PM Peak Hour of Adjacent Street Traffic		
		Enter	Exit	Total	Enter	Exit	Total	Enter	Exit	Total
492	CLUBHEALTH 2	165	164	329	7	7	14	20	15	35
	10 Gross Floor Area 1000 SF									
Unadjusted Volume		0	0	0	0	0	0	0	0	0
Internal Capture Trips		0	0	0	0	0	0	0	0	0
Pass-By Trips		0	0	0	0	0	0	0	0	0
Volume Added to Adjacent Streets		0	0	0	0	0	0	0	0	0

Total AM Peak Hour Internal Capture = 0 Percent

Total PM Peak Hour Internal Capture = 0 Percent

Source: Institute of Transportation Engineers, Trip Generation Manual 9th Edition, 2012

APPENDIX III

Results of Highway Capacity Analysis

Using

Synchro 8 Software

(HCM 2010 Methodology)

Intersection	
Int Delay, s/veh	1.3

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Vol, veh/h	716	31	23	417	29	38
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	6	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	778	34	25	453	32	41

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	812	0	1072	406
Stage 1	-	-	-	-	795	-
Stage 2	-	-	-	-	277	-
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	-	-	810	-	215	594
Stage 1	-	-	-	-	405	-
Stage 2	-	-	-	-	745	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	810	-	206	594
Mov Cap-2 Maneuver	-	-	-	-	206	-
Stage 1	-	-	-	-	405	-
Stage 2	-	-	-	-	714	-

Approach	EB	WB	NB
HCM Control Delay, s	0	0.7	19.1
HCM LOS			C

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	327	-	-	810	-
HCM Lane V/C Ratio	0.223	-	-	0.031	-
HCM Control Delay (s)	19.1	-	-	9.6	0.2
HCM Lane LOS	C	-	-	A	A
HCM 95th %tile Q(veh)	0.8	-	-	0.1	-

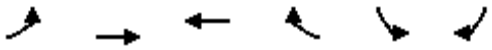
Intersection	
Int Delay, s/veh	1.9

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Vol, veh/h	547	55	50	688	42	39
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	6	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	595	60	54	748	46	42

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	654	0	1107	327
Stage 1	-	-	-	-	624	-
Stage 2	-	-	-	-	483	-
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	-	-	929	-	204	669
Stage 1	-	-	-	-	496	-
Stage 2	-	-	-	-	586	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	929	-	184	669
Mov Cap-2 Maneuver	-	-	-	-	184	-
Stage 1	-	-	-	-	496	-
Stage 2	-	-	-	-	528	-

Approach	EB	WB	NB
HCM Control Delay, s	0	1	23.4
HCM LOS			C

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	283	-	-	929	-
HCM Lane V/C Ratio	0.311	-	-	0.059	-
HCM Control Delay (s)	23.4	-	-	9.1	0.4
HCM Lane LOS	C	-	-	A	A
HCM 95th %tile Q(veh)	1.3	-	-	0.2	-



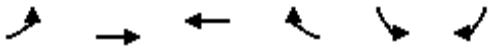
Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	116	638	289	81	244	151
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width (ft)	11	11	11	11	16	16
Grade (%)		6%	6%		0%	
Storage Length (ft)	100			0	0	0
Storage Lanes	1			0	1	0
Taper Length (ft)	25				25	
Lane Util. Factor	1.00	0.95	0.95	0.95	1.00	1.00
Frt			0.967		0.948	
Flt Protected	0.950				0.970	
Satd. Flow (prot)	1659	3319	3209	0	1941	0
Flt Permitted	0.355				0.970	
Satd. Flow (perm)	620	3319	3209	0	1941	0
Right Turn on Red				Yes		Yes
Satd. Flow (RTOR)			78		63	
Link Speed (mph)		40	40		35	
Link Distance (ft)		670	328		355	
Travel Time (s)		11.4	5.6		6.9	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	126	693	314	88	265	164
Shared Lane Traffic (%)						
Lane Group Flow (vph)	126	693	402	0	429	0
Turn Type	pm+pt	NA	NA		Prot	
Protected Phases	5	2	6		7	
Permitted Phases	2					
Detector Phase	5	2	6		7	
Switch Phase						
Minimum Initial (s)	4.0	4.0	4.0		4.0	
Minimum Split (s)	8.6	20.6	20.6		8.6	
Total Split (s)	9.0	31.0	22.0		19.0	
Total Split (%)	18.0%	62.0%	44.0%		38.0%	
Yellow Time (s)	3.6	3.6	3.6		3.6	
All-Red Time (s)	1.0	1.0	1.0		1.0	
Lost Time Adjust (s)	0.0	0.0	0.0		0.0	
Total Lost Time (s)	4.6	4.6	4.6		4.6	
Lead/Lag	Lead		Lag			
Lead-Lag Optimize?	Yes		Yes			
Recall Mode	None	None	None		None	
Act Effct Green (s)	16.9	16.9	10.3		12.0	
Actuated g/C Ratio	0.44	0.44	0.27		0.31	
v/c Ratio	0.32	0.48	0.44		0.66	
Control Delay	9.0	8.9	12.2		16.7	
Queue Delay	0.0	0.0	0.0		0.0	
Total Delay	9.0	8.9	12.2		16.7	
LOS	A	A	B		B	
Approach Delay		8.9	12.2		16.7	
Approach LOS		A	B		B	
Queue Length 50th (ft)	16	52	33		68	

Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Queue Length 95th (ft)	38	88	64		#163	
Internal Link Dist (ft)		590	248		275	
Turn Bay Length (ft)	100					
Base Capacity (vph)	396	2346	1560		798	
Starvation Cap Reductn	0	0	0		0	
Spillback Cap Reductn	0	0	0		0	
Storage Cap Reductn	0	0	0		0	
Reduced v/c Ratio	0.32	0.30	0.26		0.54	

Intersection Summary			
Area Type:	Other		
Cycle Length: 50			
Actuated Cycle Length: 38.6			
Natural Cycle: 50			
Control Type: Actuated-Uncoordinated			
Maximum v/c Ratio: 0.66			
Intersection Signal Delay: 11.7		Intersection LOS: B	
Intersection Capacity Utilization 51.3%		ICU Level of Service A	
Analysis Period (min) 15			

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

Splits and Phases: 4: Bob Billings Pkwy & Monterey Way



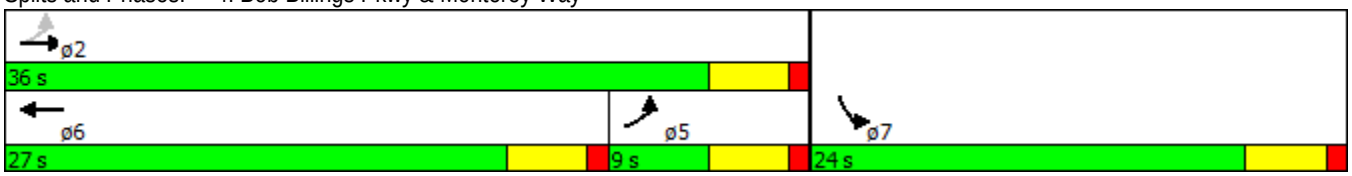
Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	142	444	610	250	385	128
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width (ft)	11	11	11	11	16	16
Grade (%)		6%	6%		0%	
Storage Length (ft)	100			0	0	0
Storage Lanes	1			0	1	0
Taper Length (ft)	25				25	
Lane Util. Factor	1.00	0.95	0.95	0.95	1.00	1.00
Frt			0.956		0.966	
Flt Protected	0.950				0.964	
Satd. Flow (prot)	1659	3319	3173	0	1966	0
Flt Permitted	0.198				0.964	
Satd. Flow (perm)	346	3319	3173	0	1966	0
Right Turn on Red				Yes		Yes
Satd. Flow (RTOR)			118		29	
Link Speed (mph)		40	40		35	
Link Distance (ft)		670	328		355	
Travel Time (s)		11.4	5.6		6.9	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	154	483	663	272	418	139
Shared Lane Traffic (%)						
Lane Group Flow (vph)	154	483	935	0	557	0
Turn Type	pm+pt	NA	NA		Prot	
Protected Phases	5	2	6		7	
Permitted Phases	2					
Detector Phase	5	2	6		7	
Switch Phase						
Minimum Initial (s)	4.0	4.0	4.0		4.0	
Minimum Split (s)	8.6	20.6	20.6		8.6	
Total Split (s)	9.0	36.0	27.0		24.0	
Total Split (%)	15.0%	60.0%	45.0%		40.0%	
Yellow Time (s)	3.6	3.6	3.6		3.6	
All-Red Time (s)	1.0	1.0	1.0		1.0	
Lost Time Adjust (s)	0.0	0.0	0.0		0.0	
Total Lost Time (s)	4.6	4.6	4.6		4.6	
Lead/Lag	Lag		Lead			
Lead-Lag Optimize?	Yes		Yes			
Recall Mode	None	None	None		None	
Act Effct Green (s)	27.6	26.2	19.6		17.9	
Actuated g/C Ratio	0.51	0.49	0.36		0.33	
v/c Ratio	0.53	0.30	0.76		0.83	
Control Delay	22.1	8.6	18.4		30.3	
Queue Delay	0.0	0.0	0.0		0.0	
Total Delay	22.1	8.6	18.4		30.3	
LOS	C	A	B		C	
Approach Delay		11.9	18.4		30.3	
Approach LOS		B	B		C	
Queue Length 50th (ft)	27	46	130		176	

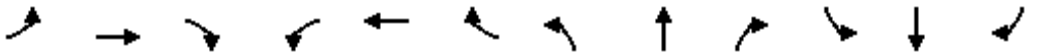
Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Queue Length 95th (ft)	#55	71	195		#341	
Internal Link Dist (ft)		590	248		275	
Turn Bay Length (ft)	100					
Base Capacity (vph)	291	2048	1463		767	
Starvation Cap Reductn	0	0	0		0	
Spillback Cap Reductn	0	0	0		0	
Storage Cap Reductn	0	0	0		0	
Reduced v/c Ratio	0.53	0.24	0.64		0.73	

Intersection Summary			
Area Type:	Other		
Cycle Length: 60			
Actuated Cycle Length: 53.8			
Natural Cycle: 55			
Control Type: Actuated-Uncoordinated			
Maximum v/c Ratio: 0.83			
Intersection Signal Delay: 19.6		Intersection LOS: B	
Intersection Capacity Utilization 73.4%		ICU Level of Service D	
Analysis Period (min) 15			

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

Splits and Phases: 4: Bob Billings Pkwy & Monterey Way





Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	64	602	31	95	492	66	55	26	359	101	28	157
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	265		155	325		200	0		0	0		0
Storage Lanes	1		1	1		1	1		1	1		0
Taper Length (ft)	75			75			0			0		
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt			0.850			0.850			0.850		0.888	
Flt Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	1770	3539	1583	1770	3539	1583	1770	1863	1583	1770	1654	0
Flt Permitted	0.436			0.363			0.195			0.728		
Satd. Flow (perm)	812	3539	1583	676	3539	1583	363	1863	1583	1356	1654	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)			73			85			100		151	
Link Speed (mph)		45			45			30			30	
Link Distance (ft)		800			600			150			100	
Travel Time (s)		12.1			9.1			3.4			2.3	
Peak Hour Factor	0.56	0.93	0.79	0.94	0.91	0.78	0.92	0.58	0.90	0.75	0.42	0.79
Adj. Flow (vph)	114	647	39	101	541	85	60	45	399	135	67	199
Shared Lane Traffic (%)												
Lane Group Flow (vph)	114	647	39	101	541	85	60	45	399	135	266	0
Turn Type	pm+pt	NA	Perm	pm+pt	NA	Perm	Perm	NA	pm+ov	Perm	NA	
Protected Phases	5	2		1	6			8	1		4	
Permitted Phases	2		2	6		6	8		8	4		
Detector Phase	5	2	2	1	6	6	8	8	1	4	4	
Switch Phase												
Minimum Initial (s)	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	
Minimum Split (s)	11.0	35.0	35.0	11.0	35.0	35.0	36.0	36.0	11.0	37.0	37.0	
Total Split (s)	22.0	46.0	46.0	22.0	46.0	46.0	52.0	52.0	22.0	52.0	52.0	
Total Split (%)	18.3%	38.3%	38.3%	18.3%	38.3%	38.3%	43.3%	43.3%	18.3%	43.3%	43.3%	
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	
All-Red Time (s)	1.0	2.0	2.0	1.0	2.0	2.0	2.0	2.0	1.0	2.0	2.0	
Lost Time Adjust (s)	-2.0	-3.0	-3.0	-2.0	-3.0	-3.0	-3.0	-3.0	-2.0	-3.0	-3.0	
Total Lost Time (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	
Lead/Lag	Lead	Lag	Lag	Lead	Lag	Lag			Lead			
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes	Yes			Yes			
Recall Mode	None	C-Max	C-Max	None	C-Max	C-Max	None	None	None	None	None	
Act Effct Green (s)	88.6	79.1	79.1	92.1	81.0	81.0	20.5	20.5	34.9	20.5	20.5	
Actuated g/C Ratio	0.74	0.66	0.66	0.77	0.68	0.68	0.17	0.17	0.29	0.17	0.17	
v/c Ratio	0.17	0.28	0.04	0.16	0.23	0.08	0.97	0.14	0.75	0.58	0.65	
Control Delay	4.6	10.0	0.6	4.4	8.6	2.2	157.0	40.7	36.8	55.0	26.6	
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	4.6	10.0	0.6	4.4	8.6	2.2	157.0	40.7	36.8	55.0	26.6	
LOS	A	A	A	A	A	A	F	D	D	E	C	
Approach Delay		8.8			7.2			51.5			36.2	
Approach LOS		A			A			D			D	
Queue Length 50th (ft)	17	100	0	15	76	0	47	30	215	97	82	
Queue Length 95th (ft)	25	173	1	37	130	14	#120	38	286	124	13	
Internal Link Dist (ft)		720			520			70			20	

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Turn Bay Length (ft)	265		155	325		200						
Base Capacity (vph)	784	2332	1068	699	2388	1095	148	760	625	553	764	
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	0.15	0.28	0.04	0.14	0.23	0.08	0.41	0.06	0.64	0.24	0.35	

Intersection Summary			
Area Type:	Other		
Cycle Length: 120			
Actuated Cycle Length: 120			
Offset: 38 (32%), Referenced to phase 2:EBTL and 6:WBTL, Start of Green			
Natural Cycle: 85			
Control Type: Actuated-Coordinated			
Maximum v/c Ratio: 0.97			
Intersection Signal Delay: 21.7		Intersection LOS: C	
Intersection Capacity Utilization 54.5%		ICU Level of Service A	
Analysis Period (min) 15			
# 95th percentile volume exceeds capacity, queue may be longer.			
Queue shown is maximum after two cycles.			

Splits and Phases: 3: Clinton Pkwy / Clinton Pkwy & Crossgate Dr.

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	68	556	63	359	754	73	42	25	277	82	22	53
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	265		155	325		200	0		0	0		0
Storage Lanes	1		1	1		1	1		1	1		0
Taper Length (ft)	75			75			0			0		
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt			0.850			0.850			0.850		0.907	
Flt Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	1770	3539	1583	1770	3539	1583	1770	1863	1583	1770	1690	0
Flt Permitted	0.340			0.359			0.564			0.728		
Satd. Flow (perm)	633	3539	1583	669	3539	1583	1051	1863	1583	1356	1690	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)			109			97			120		67	
Link Speed (mph)		45			45			30			30	
Link Distance (ft)		800			600			150			100	
Travel Time (s)		12.1			9.1			3.4			2.3	
Peak Hour Factor	0.91	0.93	0.58	0.84	0.91	0.73	0.85	0.57	0.81	0.68	0.54	0.79
Adj. Flow (vph)	75	598	109	427	829	100	49	44	342	121	41	67
Shared Lane Traffic (%)												
Lane Group Flow (vph)	75	598	109	427	829	100	49	44	342	121	108	0
Turn Type	pm+pt	NA	Perm	pm+pt	NA	Perm	Perm	NA	pm+ov	Perm	NA	
Protected Phases	5	2		1	6			8	1		4	
Permitted Phases	2		2	6		6	8		8	4		
Detector Phase	5	2	2	1	6	6	8	8	1	4	4	
Switch Phase												
Minimum Initial (s)	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	
Minimum Split (s)	11.0	35.0	35.0	11.0	36.0	36.0	36.0	36.0	11.0	38.0	38.0	
Total Split (s)	24.0	46.0	46.0	24.0	46.0	46.0	50.0	50.0	24.0	50.0	50.0	
Total Split (%)	20.0%	38.3%	38.3%	20.0%	38.3%	38.3%	41.7%	41.7%	20.0%	41.7%	41.7%	
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	
All-Red Time (s)	1.0	2.0	2.0	1.0	2.0	2.0	2.0	2.0	1.0	2.0	2.0	
Lost Time Adjust (s)	-2.0	-3.0	-3.0	-2.0	-3.0	-3.0	-3.0	-3.0	-2.0	-3.0	-3.0	
Total Lost Time (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	
Lead/Lag	Lead	Lag	Lag	Lead	Lag	Lag			Lead			
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes	Yes			Yes			
Recall Mode	None	C-Max	C-Max	None	C-Max	C-Max	None	None	None	None	None	
Act Effct Green (s)	76.9	68.1	68.1	94.8	85.2	85.2	19.2	19.2	45.9	19.2	19.2	
Actuated g/C Ratio	0.64	0.57	0.57	0.79	0.71	0.71	0.16	0.16	0.38	0.16	0.16	
v/c Ratio	0.15	0.30	0.12	0.57	0.33	0.09	0.29	0.15	0.50	0.56	0.33	
Control Delay	6.4	15.8	3.7	7.3	8.1	1.9	46.9	42.1	18.8	55.4	20.7	
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	6.4	15.8	3.7	7.3	8.1	1.9	46.9	42.1	18.8	55.4	20.7	
LOS	A	B	A	A	A	A	D	D	B	E	C	
Approach Delay		13.2			7.4			24.3			39.1	
Approach LOS		B			A			C			D	
Queue Length 50th (ft)	10	122	0	75	122	1	34	30	127	87	28	
Queue Length 95th (ft)	27	205	4	132	194	12	64	37	140	103	26	
Internal Link Dist (ft)		720			520			70			20	

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Turn Bay Length (ft)	265		155	325		200						
Base Capacity (vph)	665	2009	946	758	2512	1152	411	729	696	531	702	
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	0.11	0.30	0.12	0.56	0.33	0.09	0.12	0.06	0.49	0.23	0.15	

Intersection Summary			
Area Type:	Other		
Cycle Length: 120			
Actuated Cycle Length: 120			
Offset: 90 (75%), Referenced to phase 2:EBTL and 6:WBTL, Start of Green			
Natural Cycle: 85			
Control Type: Actuated-Coordinated			
Maximum v/c Ratio: 0.57			
Intersection Signal Delay: 14.2		Intersection LOS: B	
Intersection Capacity Utilization 56.5%		ICU Level of Service B	
Analysis Period (min) 15			

Splits and Phases: 3: Clinton Pkwy / Clinton Pkwy & Crossgate Dr.