

THE SHOPPES AT KEARNEY
TRAFFIC STUDY
REVIEW AND ANALYSIS

ADDENDUM

FOR
CITY OF KEARNEY
MISSOURI

JANUARY 2010

A. Introduction

This addendum to the document *The Shoppes At Kearney Traffic Study Review and Analysis* addresses the concerns of the City of Kearney in regards to the traffic study prepared by Cook, Flatt, & Strobel Engineers, P.A (CFS). These concerns were as follows:

- ✖ What will the traffic conditions be at the time the proposed development is completed (assumed to be year 2013)?
- ✖ Are the traffic counts completed in November 2009 by TranSystems Corporation valid (CFS did not conduct new traffic counts)?
- ✖ What year do the traffic models represent?

B. Analysis of Traffic Conditions

CFS's additional analysis consists of a geometric layout for a Right In only entrance to the existing gas station located at the southwest corner of MO Route 92 and Regency Drive. The Right In only entrance would be to the south of MO Route 92, in addition two entrances would be constructed from the gas station to Regency Drive. One entrance would be located at the intersection of Regency Drive and Drive A, and another midway between this intersection and MO Route 92. These traffic models have been named *AM* and *PM Peak 2013 CFS*, and as before "w/Connection" has been added to show the results of a connection of Drive A to the south at West 19th Street. The conceptual geometric layout for this scenario can be found in Figure 4 of Appendix A of the document *The Shoppes At Kearney Traffic Study Review and Analysis*. The Synchro traffic analysis of these conditions can be found in the appendix of this document.

The Level of Service (LOS) and average delay results for these scenarios can be seen in Table 1. The delay shown is in seconds.

Table 1. LOS and average delay for models *AM* and *PM 2013 CFS*

Intersection <i>Movement</i>	No connection				w/ connection			
	AM Peak		PM Peak		AM Peak		PM Peak	
	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay
Route 92 & Platte Clay Way <i>All Movements (Signalized)</i>	A	9.8	B	15.3	B	10.4	B	14.6
Drive A & Regency Drive								
<i>Southbound Left Turn</i>	A	7.6	A	9.2	A	7.8	A	8.8
<i>Northbound Left Turn*</i>	A	1.2	A	0.3	A	0.5	A	0.2
<i>Westbound (Shared Left/Thru)**</i>	B	12.1	E	35.4	B	12.3	D	26.2
<i>Westbound Right Turn</i>	A	9.5	B	11.2	A	9.3	B	10.4
<i>Eastbound (Shared Left/Thru/Right)*</i>	C	16.0	E	47.9	B	12.1	C	21.0
Route 92 & Entrance*								
<i>Northbound Right Turn</i>	--	--	--	--	--	--	--	--
Drive A & Entrance 1*								
<i>Northbound Left Turn</i>	A	0.2	A	0.2	A	0.2	A	0.2
<i>Eastbound (Shared Left/Right)</i>	A	9.5	B	11.9	A	9.4	B	11.5

* Not included in Lutjen or TranSystems traffic analysis

** Westbound Thru not included in Lutjen or TranSystems traffic analysis

C. Traffic Counts

CFS used the traffic counts conducted by TranSystems for this traffic analysis and CFS believes these counts to be accurate as only two months had passed between when the counts were taken (November 2009) and when this report was written (January 2010). Additionally the Missouri Department of Transportation considers counts taken up to two years previous can be admissible in a traffic study.

D. Timeframe

The traffic models included in the document *The Shoppes At Kearney Traffic Study Review and Analysis* were created using a design year of 2025. This is standard in most traffic studies to conduct traffic analysis based on traffic 15-20 years in the future and is done using a standard growth rate between 2-3 percent based on past traffic growth. Again, the traffic volumes used were taken from TranSystems' analysis completed in November 2009.

Appendix

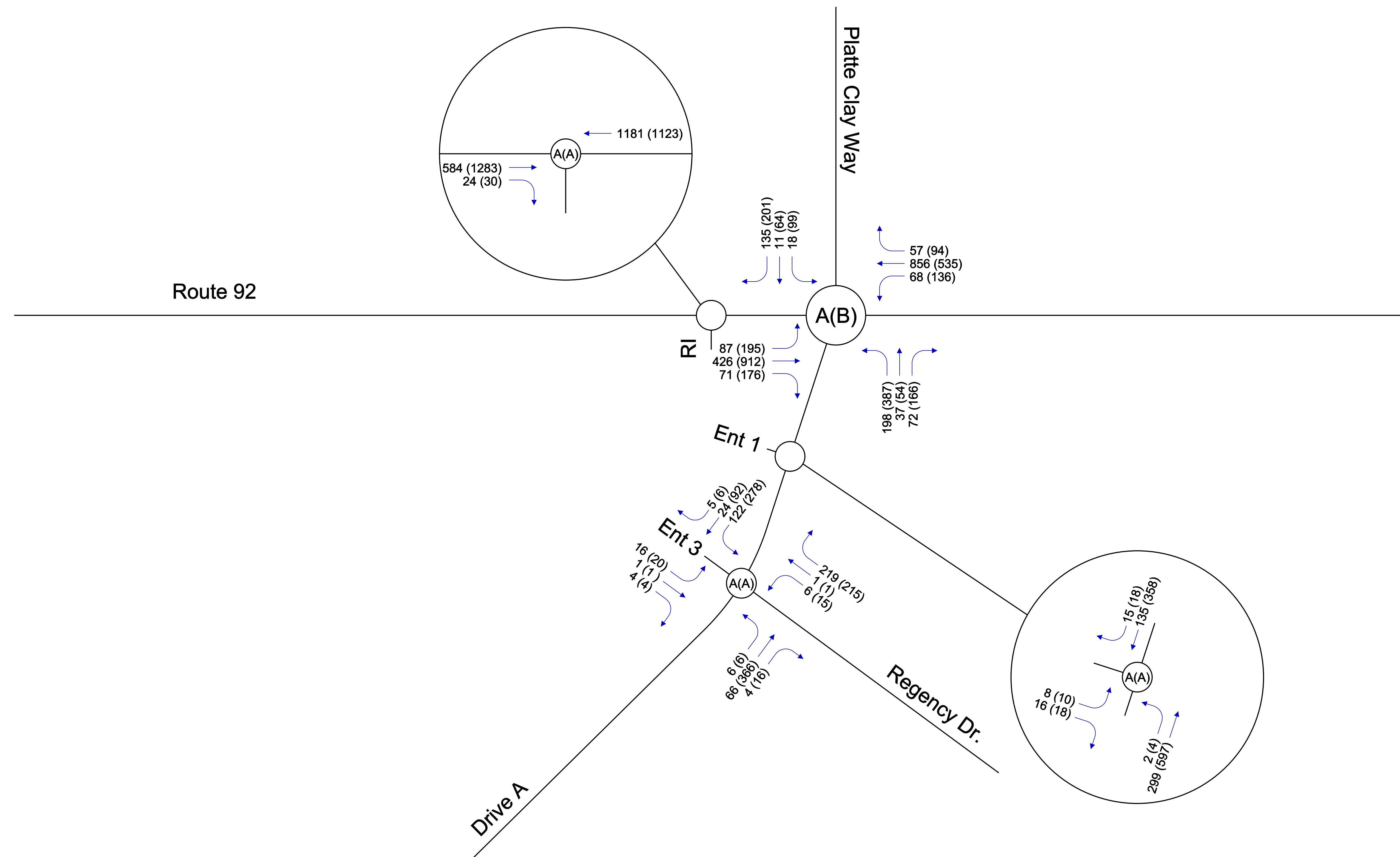


Figure 15.
Levels of Service and Traffic Volumes for Model
AM (PM) Peak CFS 2013

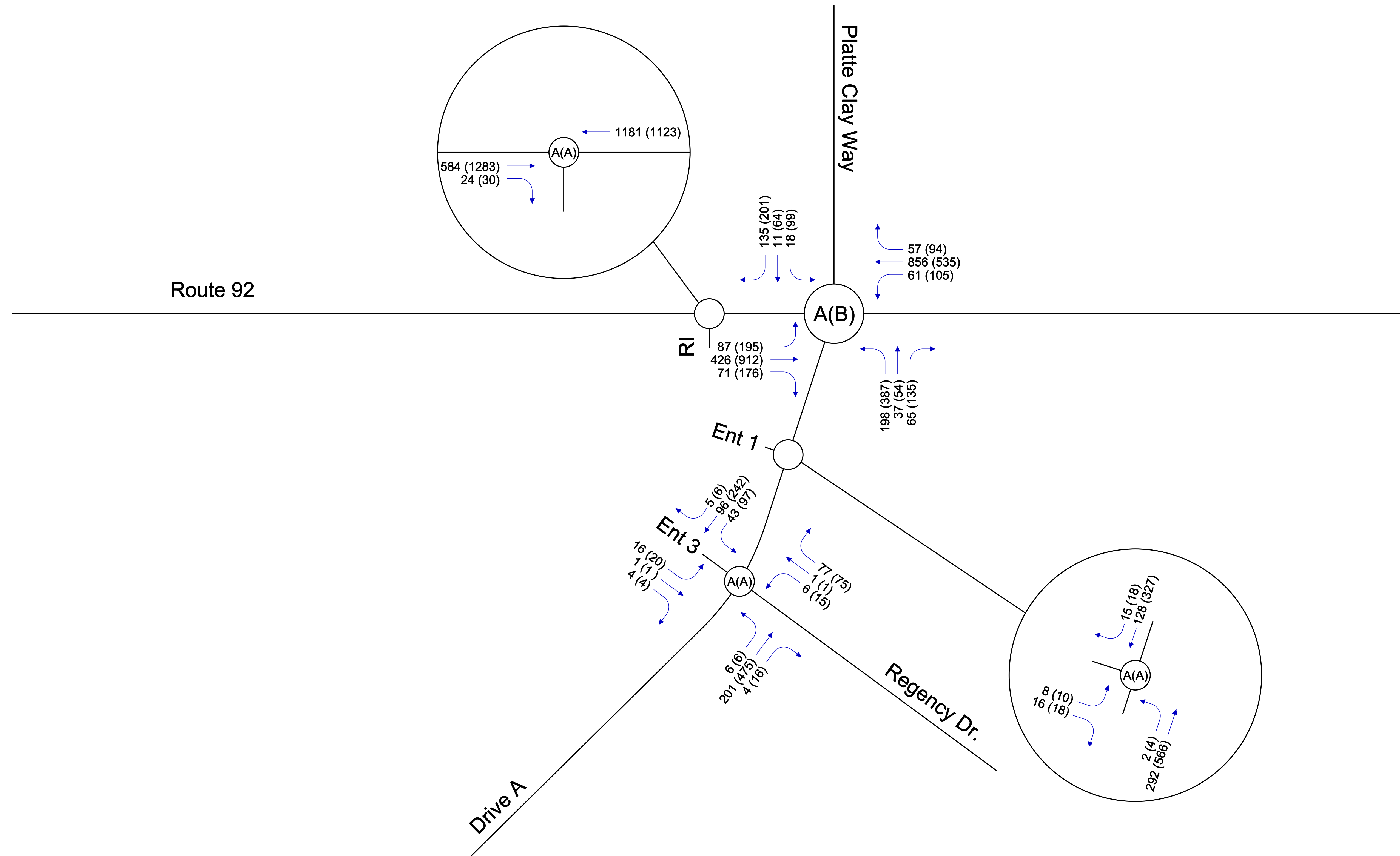
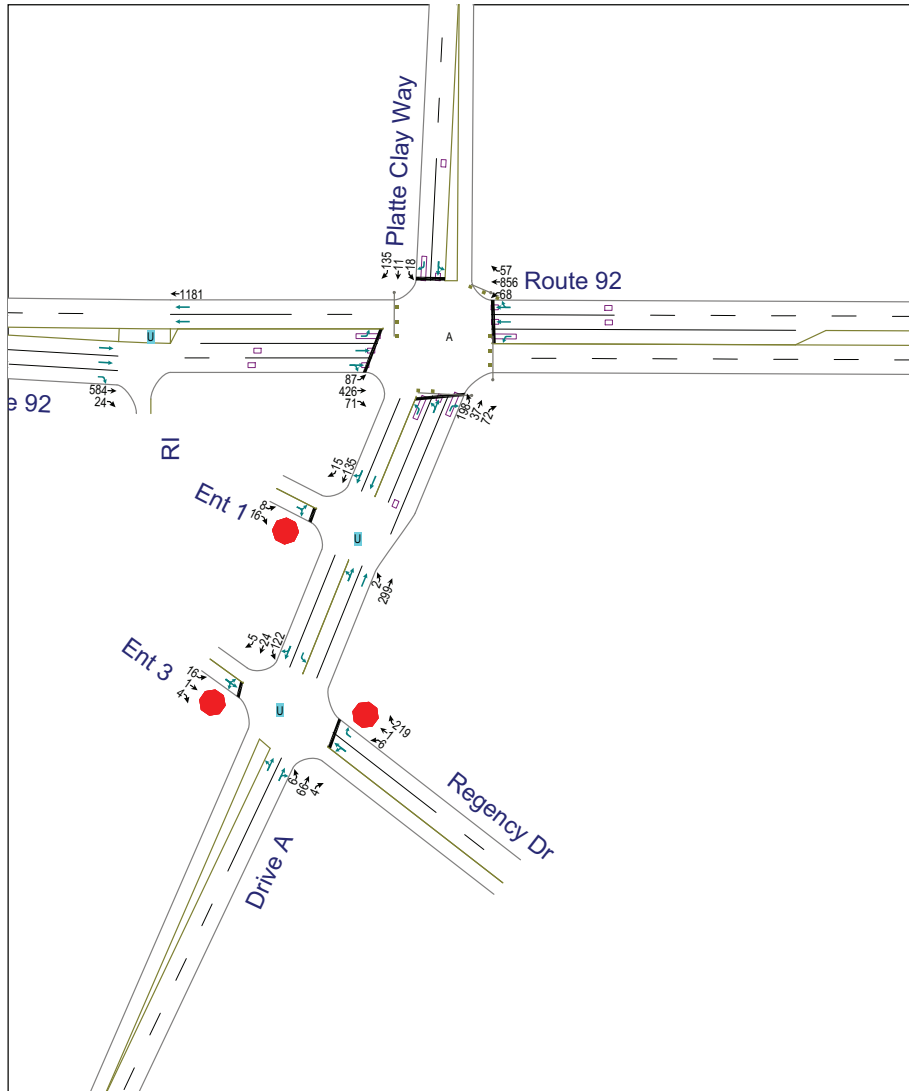


Figure 16.
Levels of Service and Traffic Volumes for Model
AM (PM) Peak CFS 2013 w/ Connection

AM Peak CFS 2013
Levels of Service

CFSE
1/15/2010



Kearney, MO

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HCM Signalized Intersection Capacity Analysis

AM Peak 2013 CFS

1: Route 92 &

1/15/2010

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	87	426	71	68	856	57	198	37	72	18	11	135
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0	4.0		4.0	4.0
Lane Util. Factor	1.00	0.95		1.00	0.95		0.95	0.95	1.00		1.00	1.00
Flt	1.00	0.98		1.00	0.99		1.00	1.00	0.85		1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00		0.95	0.97	1.00		0.97	1.00
Satd. Flow (prot)	1770	3463		1770	3506		1681	1711	1583		1807	1583
Flt Permitted	0.26	1.00		0.45	1.00		0.74	0.79	1.00		0.84	1.00
Satd. Flow (perm)	482	3463		847	3506		1304	1402	1583		1567	1583
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	92	448	75	72	901	60	208	39	76	19	12	142
RTOR Reduction (vph)	0	21	0	0	7	0	0	0	57	0	0	107
Lane Group Flow (vph)	92	502	0	72	954	0	123	124	19	0	31	35
Turn Type	Perm			Perm			Perm			Perm		Perm
Protected Phases	4			8			2			2		6
Permitted Phases	4			8			2			2		6
Actuated Green, G (s)	41.0	41.0		41.0	41.0		16.0	16.0	16.0		16.0	16.0
Effective Green, g (s)	41.0	41.0		41.0	41.0		16.0	16.0	16.0		16.0	16.0
Actuated g/C Ratio	0.63	0.63		0.63	0.63		0.25	0.25	0.25		0.25	0.25
Clearance Time (s)	4.0	4.0		4.0	4.0		4.0	4.0	4.0		4.0	4.0
Lane Grp Cap (vph)	304	2184		534	2211		321	345	390		386	390
v/s Ratio Prot	0.15			c0.27			c0.09			0.01		0.02
v/s Ratio Perm	0.19			0.09			0.09		0.01		0.02	0.02
v/c Ratio	0.30	0.23		0.13	0.43		0.38	0.36	0.05		0.08	0.09
Uniform Delay, d1	5.5	5.2		4.8	6.1		20.4	20.3	18.7		18.8	18.9
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00	1.00		1.00	1.00
Incremental Delay, d2	2.5	0.2		0.5	0.6		3.4	2.9	0.2		0.4	0.5
Delay (s)	8.0	5.4		5.4	6.7		23.8	23.2	18.9		19.2	19.3
Level of Service	A	A		A	A		C	C	B		B	B
Approach Delay (s)	5.8			6.6			22.4					19.3
Approach LOS	A			A			C					B

Intersection Summary			
HCM Average Control Delay	9.8	HCM Level of Service	A
HCM Volume to Capacity ratio	0.42		
Actuated Cycle Length (s)	65.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	53.4%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

CFS

Synchro 7 - Report

Queues
1: Route 92 &

AM Peak 2013 CFS
1/15/2010

									
Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	NBR	SBT	SBR
Lane Group Flow (vph)	92	523	72	961	123	124	76	31	142
v/c Ratio	0.30	0.24	0.13	0.43	0.38	0.36	0.17	0.08	0.29
Control Delay	8.8	4.9	5.6	6.7	24.6	23.9	6.7	19.6	5.9
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	8.8	4.9	5.6	6.7	24.6	23.9	6.7	19.6	5.9
Queue Length 50th (ft)	14	35	10	84	43	43	0	9	0
Queue Length 95th (ft)	39	54	24	118	89	88	28	28	38
Internal Link Dist (ft)		167		388		103		210	
Turn Bay Length (ft)	250		250						
Base Capacity (vph)	304	2204	535	2219	321	345	447	386	497
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.30	0.24	0.13	0.43	0.38	0.36	0.17	0.08	0.29
Intersection Summary									

HCM Unsignalized Intersection Capacity Analysis
2: Drive A & Ent 3

AM Peak 2013 CFS
1/15/2010

												
Movement	NBL	NBT	NBR	SBL	SBT	SBR	SEL	SET	SER	NWL	NWT	NWR
Lane Configurations												
Volume (veh/h)	6	66	4	122	24	5	16	1	4	6	1	219
Sign Control		Free			Free			Stop				Stop
Grade		0%			0%			0%				0%
Peak Hour Factor	0.92	0.95	0.95	0.95	0.95	0.92	0.92	0.92	0.92	0.95	0.92	0.95
Hourly flow rate (vph)	7	69	4	128	25	5	17	1	4	6	1	231
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage (veh)												
Upstream signal (ft)					490							
pX, platoon unblocked												
vC, conflicting volume	31			74			564	372	28	372	372	37
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	31			74			564	372	28	372	372	37
tC, single (s)	4.1			4.1			7.5	6.5	6.9	7.5	6.5	6.9
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	100			92			94	100	100	99	100	78
cM capacity (veh/h)	1580			1524			295	508	1041	519	508	1027
Direction, Lane #	NB 1	NB 2	SB 1	SB 2	SE 1	NW 1	NW 2					
Volume Total	41	39	128	31	23	7	231					
Volume Left	7	0	128	0	17	6	0					
Volume Right	0	4	0	5	4	0	231					
cSH	1580	1700	1524	1700	350	518	1027					
Volume to Capacity	0.00	0.02	0.08	0.02	0.07	0.01	0.22					
Queue Length 95th (ft)	0	0	7	0	5	1	22					
Control Delay (s)	1.2	0.0	7.6	0.0	16.0	12.1	9.5					
Lane LOS	A		A		C	B	A					
Approach Delay (s)	0.6		6.1		16.0	9.6						
Approach LOS					C	A						
Intersection Summary												
Average Delay					7.3							
Intersection Capacity Utilization			30.2%		ICU Level of Service				A			
Analysis Period (min)			15									

HCM Unsignalized Intersection Capacity Analysis 3: Route 92 & RI

AM Peak 2013 CFS
1/15/2010

						
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Volume (veh/h)	584	24	0	1181	0	0
Sign Control	Free			Free	Yield	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	635	26	0	1284	0	0
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None			None		
Median storage (veh)						
Upstream signal (ft)				247		
pX, platoon unblocked					0.87	
vC, conflicting volume			661		1277	317
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			661		1013	317
tC, single (s)			4.1		6.8	6.9
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			100		100	100
cM capacity (veh/h)			923		204	678
Direction, Lane #	EB 1	EB 2	EB 3	WB 1	WB 2	
Volume Total	317	317	26	642	642	
Volume Left	0	0	0	0	0	
Volume Right	0	0	26	0	0	
cSH	1700	1700	1700	1700	1700	
Volume to Capacity	0.19	0.19	0.02	0.38	0.38	
Queue Length 95th (ft)	0	0	0	0	0	
Control Delay (s)	0.0	0.0	0.0	0.0	0.0	
Lane LOS						
Approach Delay (s)	0.0			0.0		
Approach LOS						
Intersection Summary						
Average Delay			0.0			
Intersection Capacity Utilization			36.0%		ICU Level of Service	A
Analysis Period (min)			15			

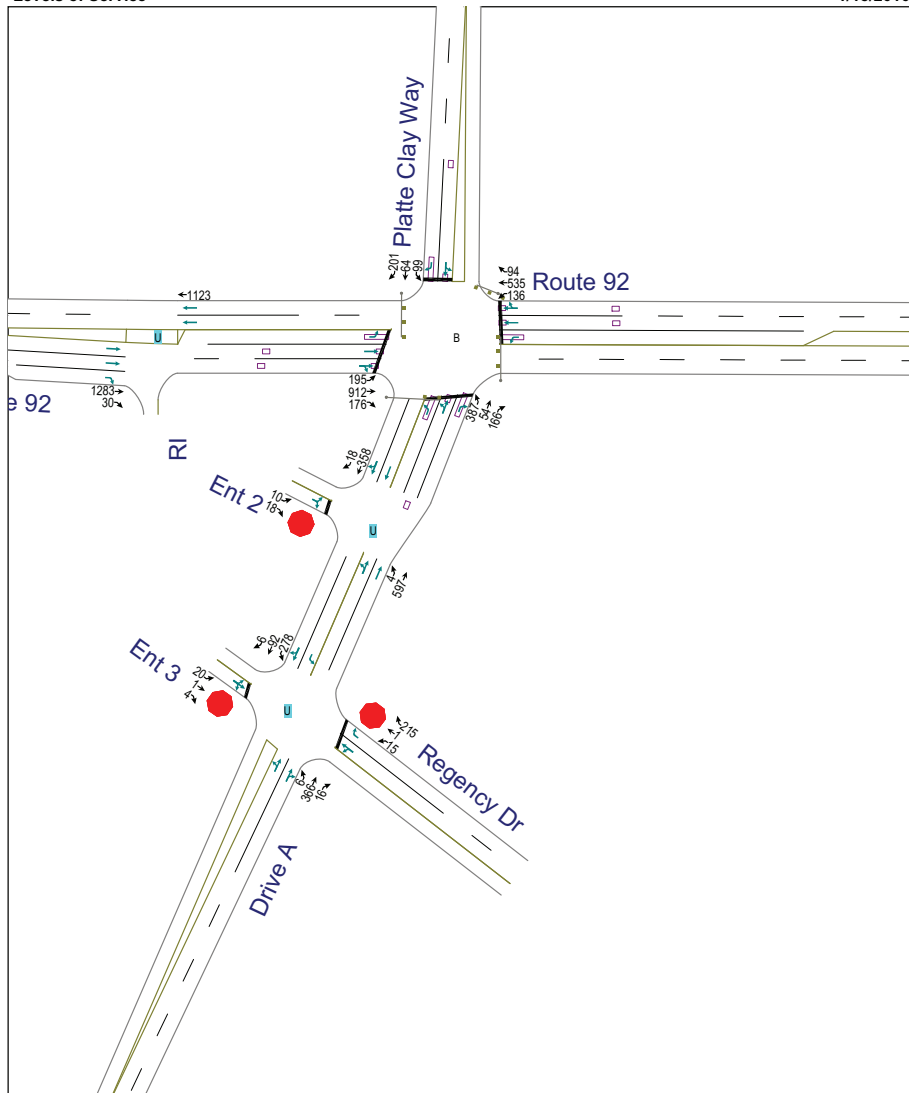
HCM Unsignalized Intersection Capacity Analysis 5: Ent 1 &

AM Peak 2013 CFS
1/15/2010

						
Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (veh/h)	8	16	2	299	135	15
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	9	17	2	325	147	16
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage (veh)						
Upstream signal (ft)					183	
pX, platoon unblocked						
vC, conflicting volume	322	82	163			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	322	82	163			
tC, single (s)	6.8	6.9	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	99	98	100			
cM capacity (veh/h)	646	962	1413			
Direction, Lane #	EB 1	NB 1	NB 2	SB 1	SB 2	
Volume Total	26	111	217	98	65	
Volume Left	9	2	0	0	0	
Volume Right	17	0	0	0	16	
cSH	827	1413	1700	1700	1700	
Volume to Capacity	0.03	0.00	0.13	0.06	0.04	
Queue Length 95th (ft)	2	0	0	0	0	
Control Delay (s)	9.5	0.2	0.0	0.0	0.0	
Lane LOS	A	A				
Approach Delay (s)	9.5	0.1		0.0		
Approach LOS	A					
Intersection Summary						
Average Delay			0.5			
Intersection Capacity Utilization			19.7%		ICU Level of Service	A
Analysis Period (min)			15			

PM Peak CFS 2013
Levels of Service

CFSE
1/15/2010



Kearney, MO

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HCM Signalized Intersection Capacity Analysis

PM Peak 2013 CFS

1: Route 92 &

1/15/2010

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	195	912	176	136	535	94	387	54	166	99	64	201
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0	4.0		4.0	4.0
Lane Util. Factor	1.00	0.95		1.00	0.95		0.95	0.95	1.00		1.00	1.00
Frt	1.00	0.98		1.00	0.98		1.00	1.00	0.85		1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00		0.95	0.96	1.00		0.97	1.00
Satd. Flow (prot)	1770	3453		1770	3460		1681	1705	1583		1808	1583
Flt Permitted	0.37	1.00		0.19	1.00		0.62	0.64	1.00		0.62	1.00
Satd. Flow (perm)	697	3453		345	3460		1099	1135	1583		1164	1583
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	205	960	185	143	563	99	407	57	175	104	67	212
RTOR Reduction (vph)	0	25	0	0	22	0	0	0	88	0	0	150
Lane Group Flow (vph)	205	1120	0	143	640	0	228	236	87	0	171	62
Turn Type	Perm			Perm			Perm		Perm	Perm		Perm
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2			2	6	6
Actuated Green, G (s)	38.0	38.0		38.0	38.0		19.0	19.0	19.0		19.0	19.0
Effective Green, g (s)	38.0	38.0		38.0	38.0		19.0	19.0	19.0		19.0	19.0
Actuated g/C Ratio	0.58	0.58		0.58	0.58		0.29	0.29	0.29		0.29	0.29
Clearance Time (s)	4.0	4.0		4.0	4.0		4.0	4.0	4.0		4.0	4.0
Lane Grp Cap (vph)	407	2019		202	2023		321	332	463		340	463
v/s Ratio Prot		0.32			0.18							
v/s Ratio Perm	0.29			c0.41			0.21	c0.21	0.05		0.15	0.04
v/c Ratio	0.50	0.55		0.71	0.32		0.71	0.71	0.19		0.50	0.13
Uniform Delay, d1	7.9	8.3		9.6	6.9		20.5	20.5	17.2		19.1	16.9
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00	1.00		1.00	1.00
Incremental Delay, d2	4.4	1.1		18.9	0.4		12.5	12.2	0.9		5.2	0.6
Delay (s)	12.3	9.4		28.5	7.3		33.1	32.7	18.1		24.3	17.5
Level of Service	B	A		C	A		C	C	B		C	B
Approach Delay (s)		9.9			11.1			28.9			20.6	
Approach LOS		A			B			C			C	

Intersection Summary		
HCM Average Control Delay	15.3	HCM Level of Service B
HCM Volume to Capacity ratio	0.71	
Actuated Cycle Length (s)	65.0	Sum of lost time (s) 8.0
Intersection Capacity Utilization	67.2%	ICU Level of Service C
Analysis Period (min)	15	

c Critical Lane Group

CFS

Synchro 7 - Report

Queues
1: Route 92 &

PM Peak 2013 CFS
1/15/2010

									
Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	NBR	SBT	SBR
Lane Group Flow (vph)	205	1145	143	662	228	236	175	171	212
v/c Ratio	0.50	0.56	0.71	0.32	0.71	0.71	0.32	0.50	0.35
Control Delay	13.4	9.2	33.8	6.8	35.5	35.2	8.2	25.3	4.8
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	13.4	9.2	33.8	6.8	35.5	35.2	8.2	25.3	4.8
Queue Length 50th (ft)	42	122	36	56	84	87	14	56	0
Queue Length 95th (ft)	98	172	#135	83	#188	#192	56	112	42
Internal Link Dist (ft)		167		388		94		210	
Turn Bay Length (ft)	250		250						
Base Capacity (vph)	407	2044	202	2045	321	331	551	340	613
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.50	0.56	0.71	0.32	0.71	0.71	0.32	0.50	0.35

Intersection Summary

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

HCM Unsignalized Intersection Capacity Analysis
2: Drive A & Ent 3

PM Peak 2013 CFS
1/15/2010

												
Movement	NBL	NBT	NBR	SBL	SBT	SBR	SEL	SET	SER	NWL	NWT	NWR
Lane Configurations												
Volume (veh/h)	6	366	16	278	92	6	20	1	4	15	1	215
Sign Control		Free			Free			Stop				Stop
Grade		0%			0%			0%				0%
Peak Hour Factor	0.92	0.95	0.95	0.95	0.95	0.92	0.92	0.92	0.92	0.95	0.92	0.95
Hourly flow rate (vph)	7	385	17	293	97	7	22	1	4	16	1	226
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage (veh)												
Upstream signal (ft)					481							
pX, platoon unblocked												
vC, conflicting volume	103			402			1118	1101	100	1094	1095	201
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	103			402			1118	1101	100	1094	1095	201
tC, single (s)	4.1			4.1			7.5	6.5	6.9	7.5	6.5	6.9
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	100			75			77	99	100	88	99	72
cM capacity (veh/h)	1486			1153			93	157	936	134	158	806

Direction, Lane #	NB 1	NB 2	SB 1	SB 2	SE 1	NW 1	NW 2
Volume Total	199	209	293	103	27	17	226
Volume Left	7	0	293	0	22	16	0
Volume Right	0	17	0	7	4	0	226
cSH	1486	1700	1153	1700	111	135	806
Volume to Capacity	0.00	0.12	0.25	0.06	0.25	0.12	0.28
Queue Length 95th (ft)	0	0	25	0	23	10	29
Control Delay (s)	0.3	0.0	9.2	0.0	47.9	35.4	11.2
Lane LOS	A		A		E	E	B
Approach Delay (s)	0.1		6.8		47.9	12.9	
Approach LOS					E	B	

Intersection Summary

Average Delay	6.7
Intersection Capacity Utilization	44.3%
ICU Level of Service	A
Analysis Period (min)	15

HCM Unsignalized Intersection Capacity Analysis

3: Route 92 & RI

PM Peak 2013 CFS
1/15/2010

						
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Volume (veh/h)	1283	30	0	1123	0	0
Sign Control	Free			Free	Yield	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	1395	33	0	1221	0	0
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None			None		
Median storage (veh)						
Upstream signal (ft)				247		
pX, platoon unblocked					0.93	
vC, conflicting volume			1427		2005	697
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			1427		1927	697
tC, single (s)			4.1		6.8	6.9
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			100		100	100
cM capacity (veh/h)			472		54	383
Direction, Lane #	EB 1	EB 2	EB 3	WB 1	WB 2	
Volume Total	697	697	33	610	610	
Volume Left	0	0	0	0	0	
Volume Right	0	0	33	0	0	
cSH	1700	1700	1700	1700	1700	
Volume to Capacity	0.41	0.41	0.02	0.36	0.36	
Queue Length 95th (ft)	0	0	0	0	0	
Control Delay (s)	0.0	0.0	0.0	0.0	0.0	
Lane LOS						
Approach Delay (s)	0.0			0.0		
Approach LOS						
Intersection Summary						
Average Delay			0.0			
Intersection Capacity Utilization			38.8%		ICU Level of Service	A
Analysis Period (min)			15			

HCM Unsignalized Intersection Capacity Analysis

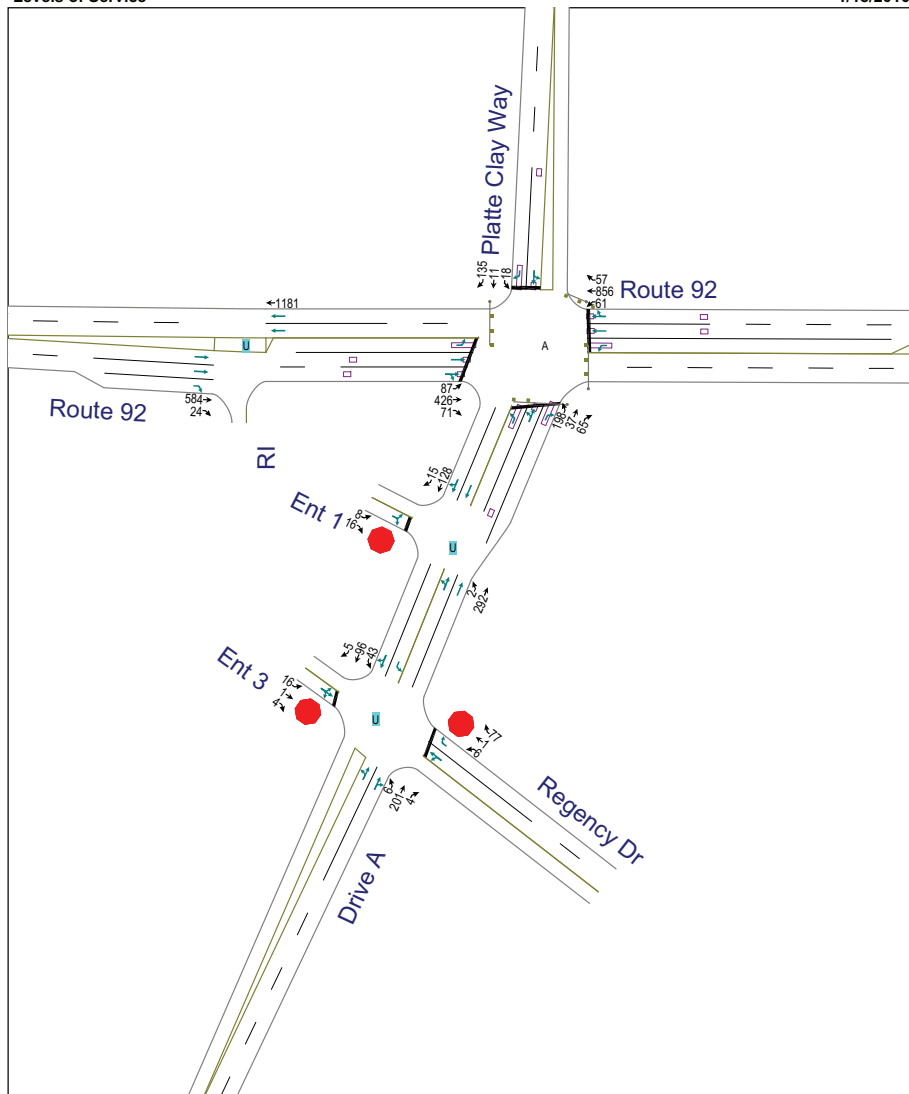
5: Ent 2 &

PM Peak 2013 CFS
1/15/2010

						
Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (veh/h)	10	18	4	597	358	18
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	11	20	4	649	389	20
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage (veh)						
Upstream signal (ft)					174	
pX, platoon unblocked						
vC, conflicting volume	732	204	409			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	732	204	409			
tC, single (s)	6.8	6.9	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	97	98	100			
cM capacity (veh/h)	355	802	1147			
Direction, Lane #	EB 1	EB 2	NB 1	NB 2	SB 1	SB 2
Volume Total	30	221	433	259	149	
Volume Left	11	4	0	0	0	
Volume Right	20	0	0	0	20	
cSH	553	1147	1700	1700	1700	
Volume to Capacity	0.06	0.00	0.25	0.15	0.09	
Queue Length 95th (ft)	4	0	0	0	0	
Control Delay (s)	11.9	0.2	0.0	0.0	0.0	
Lane LOS	B	A				
Approach Delay (s)	11.9	0.1		0.0		
Approach LOS	B					
Intersection Summary						
Average Delay			0.4			
Intersection Capacity Utilization			29.3%		ICU Level of Service	A
Analysis Period (min)			15			

AM Peak CFS 2013 w/ Connection
Levels of Service

CFSE
1/18/2010



Kearney, MO

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HCM Signalized Intersection Capacity Analysis

AM Peak 2013 CFS w/ Connection

1: Route 92 &

1/18/2010

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	87	426	71	61	856	57	198	37	65	18	11	135
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0	4.0		4.0	4.0
Lane Util. Factor	1.00	0.95		1.00	0.95		0.95	0.95	1.00		1.00	1.00
Flt	1.00	0.98		1.00	0.99		1.00	1.00	0.85		1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00		0.95	0.97	1.00		0.97	1.00
Satd. Flow (prot)	1770	3463		1770	3506		1681	1711	1583		1807	1583
Flt Permitted	0.25	1.00		0.45	1.00		0.74	0.80	1.00		0.85	1.00
Satd. Flow (perm)	459	3463		834	3506		1304	1418	1583		1586	1583
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	92	448	75	64	901	60	208	39	68	19	12	142
RTOR Reduction (vph)	0	21	0	0	7	0	0	0	48	0	0	100
Lane Group Flow (vph)	92	502	0	64	954	0	123	124	20	0	31	42
Turn Type	Perm			Perm			Perm			Perm		
Protected Phases	4			8			2			6		
Permitted Phases	4			8			2			6		
Actuated Green, G (s)	38.0	38.0		38.0	38.0		19.0	19.0	19.0		19.0	19.0
Effective Green, g (s)	38.0	38.0		38.0	38.0		19.0	19.0	19.0		19.0	19.0
Actuated g/C Ratio	0.58	0.58		0.58	0.58		0.29	0.29	0.29		0.29	0.29
Clearance Time (s)	4.0	4.0		4.0	4.0		4.0	4.0	4.0		4.0	4.0
Lane Grp Cap (vph)	268	2025		488	2050		381	414	463		464	463
v/s Ratio Prot	0.15			c0.27			c0.09			0.01		
v/s Ratio Perm	0.20			0.08			0.09		0.01		0.02	0.03
v/c Ratio	0.34	0.25		0.13	0.47		0.32	0.30	0.04		0.07	0.09
Uniform Delay, d1	7.0	6.6		6.1	7.7		18.0	17.8	16.5		16.6	16.7
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00	1.00		1.00	1.00
Incremental Delay, d2	3.5	0.3		0.6	0.8		2.2	1.8	0.2		0.3	0.4
Delay (s)	10.5	6.9		6.6	8.5		20.2	19.7	16.7		16.9	17.1
Level of Service	B			A			C			B		
Approach Delay (s)	7.4			8.3			19.2			17.1		
Approach LOS	A			A			B			B		

Intersection Summary			
HCM Average Control Delay	10.4	HCM Level of Service	B
HCM Volume to Capacity ratio	0.42		
Actuated Cycle Length (s)	65.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	53.4%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

CFS

Synchro 7 - Report

Queues
1: Route 92 &

AM Peak 2013 CFS w/ Connection
1/18/2010

									
Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	NBR	SBT	SBR
Lane Group Flow (vph)	92	523	64	961	123	124	68	31	142
v/c Ratio	0.34	0.26	0.13	0.47	0.32	0.30	0.13	0.07	0.25
Control Delay	11.5	6.3	7.0	8.5	20.9	20.3	5.9	17.2	5.0
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	11.5	6.3	7.0	8.5	20.9	20.3	5.9	17.2	5.0
Queue Length 50th (ft)	17	42	10	99	40	40	0	9	0
Queue Length 95th (ft)	46	64	26	138	83	82	25	26	35
Internal Link Dist (ft)		167		388		103		210	
Turn Bay Length (ft)	250		250						
Base Capacity (vph)	269	2044	488	2058	381	414	511	464	563
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.34	0.26	0.13	0.47	0.32	0.30	0.13	0.07	0.25
Intersection Summary									

HCM Unsignalized Intersection Capacity Analysis
2: Drive A & Ent 3

AM Peak 2013 CFS w/ Connection
1/18/2010

												
Movement	NBL	NBT	NBR	SBL	SBT	SBR	SEL	SET	SER	NWL	NWT	NWR
Lane Configurations												
Volume (veh/h)	6	201	4	43	96	5	16	1	4	6	1	77
Sign Control		Free			Free			Stop				Stop
Grade		0%			0%			0%				0%
Peak Hour Factor	0.92	0.95	0.95	0.95	0.95	0.92	0.92	0.92	0.92	0.95	0.92	0.95
Hourly flow rate (vph)	7	212	4	45	101	5	17	1	4	6	1	81
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage (veh)												
Upstream signal (ft)					490							
pX, platoon unblocked												
vC, conflicting volume	106			216			395	423	104	423	424	108
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	106			216			395	423	104	423	424	108
tC, single (s)	4.1			4.1			7.5	6.5	6.9	7.5	6.5	6.9
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	100			97			96	100	100	99	100	91
cM capacity (veh/h)	1482			1351			477	501	931	497	501	925
Direction, Lane #	NB 1	NB 2	SB 1	SB 2	SE 1	NW 1	NW 2					
Volume Total	112	110	45	106	23	7	81					
Volume Left	7	0	45	0	17	6	0					
Volume Right	0	4	0	5	4	0	81					
cSH	1482	1700	1351	1700	527	497	925					
Volume to Capacity	0.00	0.06	0.03	0.06	0.04	0.01	0.09					
Queue Length 95th (ft)	0	0	3	0	3	1	7					
Control Delay (s)	0.5	0.0	7.8	0.0	12.1	12.3	9.3					
Lane LOS	A		A		B	B	A					
Approach Delay (s)	0.2		2.3		12.1	9.5						
Approach LOS					B	A						
Intersection Summary												
Average Delay				3.1								
Intersection Capacity Utilization			29.1%		ICU Level of Service				A			
Analysis Period (min)			15									

HCM Unsignalized Intersection Capacity Analysis 3: Route 92 & RI

AM Peak 2013 CFS w/ Connection
1/18/2010

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑↑	↑		↑↑		
Volume (veh/h)	584	24	0	1181	0	0
Sign Control	Free			Free	Yield	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	635	26	0	1284	0	0
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None			None		
Median storage (veh)						
Upstream signal (ft)				247		
pX, platoon unblocked					0.85	
vC, conflicting volume			661		1277	317
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			661		972	317
tC, single (s)			4.1		6.8	6.9
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			100		100	100
cM capacity (veh/h)			923		212	678
Direction, Lane #	EB 1	EB 2	EB 3	WB 1	WB 2	
Volume Total	317	317	26	642	642	
Volume Left	0	0	0	0	0	
Volume Right	0	0	26	0	0	
cSH	1700	1700	1700	1700	1700	
Volume to Capacity	0.19	0.19	0.02	0.38	0.38	
Queue Length 95th (ft)	0	0	0	0	0	
Control Delay (s)	0.0	0.0	0.0	0.0	0.0	
Lane LOS						
Approach Delay (s)	0.0			0.0		
Approach LOS						
Intersection Summary						
Average Delay			0.0			
Intersection Capacity Utilization			36.0%		ICU Level of Service	A
Analysis Period (min)			15			

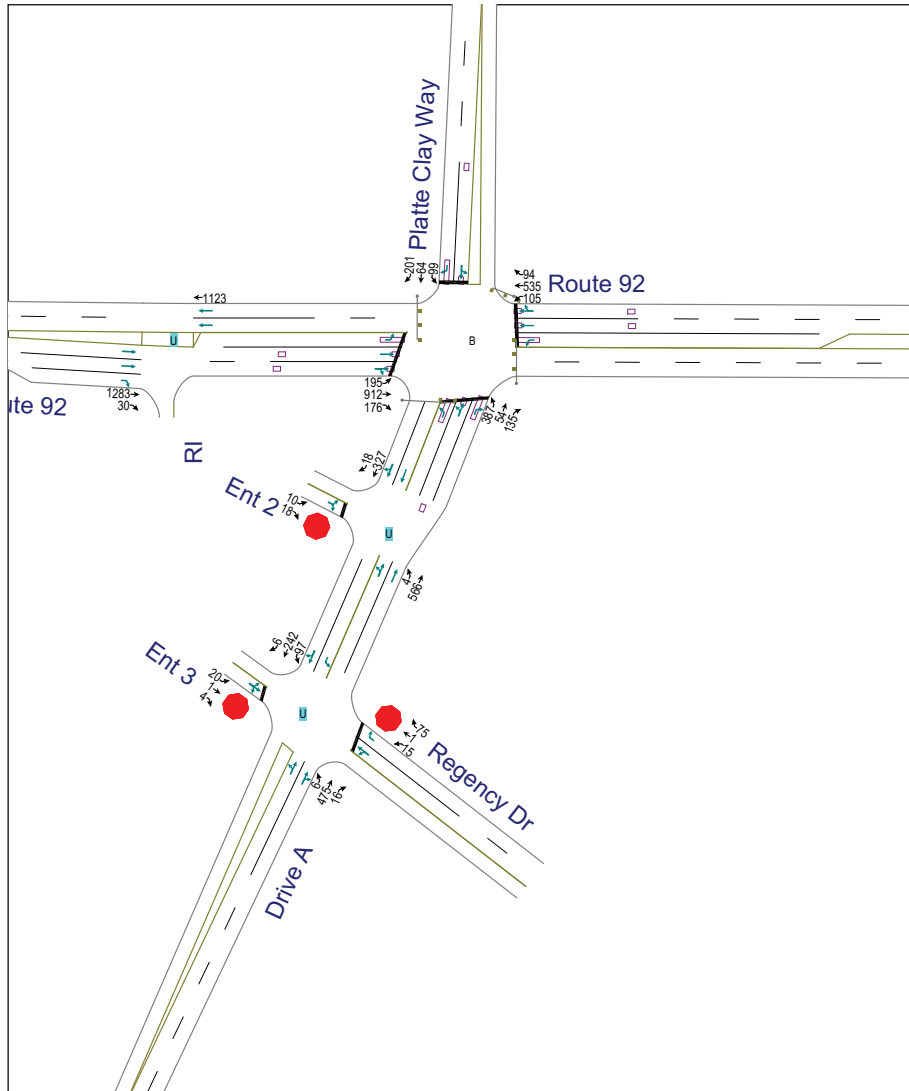
HCM Unsignalized Intersection Capacity Analysis 5: Ent 1 &

AM Peak 2013 CFS w/ Connection
1/18/2010

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations	↑			↑↑	↑↑	
Volume (veh/h)	8	16	2	292	128	15
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	9	17	2	317	139	16
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage (veh)						
Upstream signal (ft)					183	
pX, platoon unblocked						
vC, conflicting volume	310	78	155			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	310	78	155			
tC, single (s)	6.8	6.9	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	99	98	100			
cM capacity (veh/h)	657	967	1422			
Direction, Lane #	EB 1	NB 1	NB 2	SB 1	SB 2	
Volume Total	26	108	212	93	63	
Volume Left	9	2	0	0	0	
Volume Right	17	0	0	0	16	
cSH	835	1422	1700	1700	1700	
Volume to Capacity	0.03	0.00	0.12	0.05	0.04	
Queue Length 95th (ft)	2	0	0	0	0	
Control Delay (s)	9.4	0.2	0.0	0.0	0.0	
Lane LOS	A	A				
Approach Delay (s)	9.4	0.1		0.0		
Approach LOS	A					
Intersection Summary						
Average Delay			0.5			
Intersection Capacity Utilization			19.5%		ICU Level of Service	A
Analysis Period (min)			15			

PM Peak CFS 2013 w/Connection
Levels of Service

CFSE
1/15/2010



Kearney, MO

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HCM Signalized Intersection Capacity Analysis

PM Peak CFS 2013 w/Connection

1: Route 92 &

1/15/2010

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	195	912	176	105	535	94	387	54	135	99	64	201
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	0.95		1.00	0.95		0.95	0.95	1.00		1.00	1.00
Frt	1.00	0.98		1.00	0.98		1.00	1.00	0.85		1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00		0.95	0.96	1.00		0.97	1.00
Satd. Flow (prot)	1770	3453		1770	3460		1681	1705	1583		1808	1583
Flt Permitted	0.37	1.00		0.18	1.00		0.63	0.65	1.00		0.67	1.00
Satd. Flow (perm)	684	3453		326	3460		1115	1152	1583		1242	1583
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	205	960	185	111	563	99	407	57	142	104	67	212
RTOR Reduction (vph)	0	25	0	0	22	0	0	0	74	0	0	144
Lane Group Flow (vph)	205	1120	0	111	640	0	228	236	68	0	171	68
Turn Type	Perm			Perm			Perm			Perm		Perm
Protected Phases	4			8			2			2		6
Permitted Phases	4			8			2			2		6
Actuated Green, G (s)	36.0	36.0		36.0	36.0		21.0	21.0	21.0		21.0	21.0
Effective Green, g (s)	36.0	36.0		36.0	36.0		21.0	21.0	21.0		21.0	21.0
Actuated g/C Ratio	0.55	0.55		0.55	0.55		0.32	0.32	0.32		0.32	0.32
Clearance Time (s)	4.0	4.0		4.0	4.0		4.0	4.0	4.0		4.0	4.0
Lane Grp Cap (vph)	379	1912		181	1916		360	372	511		401	511
v/s Ratio Prot	0.32			0.19			0.20			0.04		0.14
v/s Ratio Perm	0.30			c0.34			0.20	c0.20	0.04		0.14	0.04
v/c Ratio	0.54	0.59		0.61	0.33		0.63	0.63	0.13		0.43	0.13
Uniform Delay, d1	9.2	9.6		9.8	7.9		18.7	18.7	15.6		17.3	15.6
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00	1.00		1.00	1.00
Incremental Delay, d2	5.5	1.3		14.6	0.5		8.2	8.0	0.5		3.3	0.5
Delay (s)	14.7	10.9		24.3	8.4		26.9	26.7	16.1		20.6	16.1
Level of Service	B	B		C	A		C	C	B		C	B
Approach Delay (s)	11.5			10.7			24.3			18.1		
Approach LOS	B			B			C			B		

Intersection Summary		
HCM Average Control Delay	14.6	HCM Level of Service B
HCM Volume to Capacity ratio	0.62	
Actuated Cycle Length (s)	65.0	Sum of lost time (s) 8.0
Intersection Capacity Utilization	65.4%	ICU Level of Service C
Analysis Period (min)	15	

c Critical Lane Group

Queues
1: Route 92 &

PM Peak CFS 2013 w/Connection
1/15/2010

									
Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	NBR	SBT	SBR
Lane Group Flow (vph)	205	1145	111	662	228	236	142	171	212
v/c Ratio	0.54	0.59	0.61	0.34	0.63	0.63	0.24	0.43	0.32
Control Delay	15.9	10.6	29.1	7.9	28.4	28.1	6.8	21.4	4.3
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	15.9	10.6	29.1	7.9	28.4	28.1	6.8	21.4	4.3
Queue Length 50th (ft)	47	135	27	62	80	82	9	52	0
Queue Length 95th (ft)	110	189	#107	92	#163	#165	43	103	40
Internal Link Dist (ft)		167		388		94		210	
Turn Bay Length (ft)	250		250						
Base Capacity (vph)	379	1938	181	1939	360	372	586	401	655
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.54	0.59	0.61	0.34	0.63	0.63	0.24	0.43	0.32

Intersection Summary

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

HCM Unsignalized Intersection Capacity Analysis
2: Drive A & Ent 3

PM Peak CFS 2013 w/Connection
1/15/2010

												
Movement	NBL	NBT	NBR	SBL	SBT	SBR	SEL	SET	SER	NWL	NWT	NWR
Lane Configurations												
Volume (veh/h)	6	475	16	97	242	6	20	1	4	15	1	75
Sign Control		Free			Free			Stop				Stop
Grade		0%			0%			0%				0%
Peak Hour Factor	0.92	0.95	0.95	0.95	0.95	0.92	0.92	0.92	0.92	0.95	0.92	0.95
Hourly flow rate (vph)	7	500	17	102	255	7	22	1	4	16	1	79
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage (veh)												
Upstream signal (ft)					481							
pX, platoon unblocked												
vC, conflicting volume	261			517			805	992	258	985	987	258
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	261			517			805	992	258	985	987	258
tC, single (s)	4.1			4.1			7.5	6.5	6.9	7.5	6.5	6.9
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	99			90			90	100	99	91	100	89
cM capacity (veh/h)	1300			1045			225	219	741	185	221	741

Direction, Lane #	NB 1	NB 2	SB 1	SB 2	SE 1	NW 1	NW 2
Volume Total	257	267	102	261	27	17	79
Volume Left	7	0	102	0	22	16	0
Volume Right	0	17	0	7	4	0	79
cSH	1300	1700	1045	1700	253	187	741
Volume to Capacity	0.01	0.16	0.10	0.15	0.11	0.09	0.11
Queue Length 95th (ft)	0	0	8	0	9	7	9
Control Delay (s)	0.2	0.0	8.8	0.0	21.0	26.2	10.4
Lane LOS	A		A		C	D	B
Approach Delay (s)	0.1		2.5		21.0	13.2	
Approach LOS					C	B	

Intersection Summary

Average Delay	2.8
Intersection Capacity Utilization	45.0%
ICU Level of Service	A
Analysis Period (min)	15

HCM Unsignalized Intersection Capacity Analysis 3: Route 92 & RI

PM Peak CFS 2013 w/Connection
1/15/2010

						
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Volume (veh/h)	1283	30	0	1123	0	0
Sign Control	Free			Free	Yield	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	1395	33	0	1221	0	0
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None			None		
Median storage (veh)						
Upstream signal (ft)				247		
pX, platoon unblocked					0.92	
vC, conflicting volume			1427		2005	697
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			1427		1918	697
tC, single (s)			4.1		6.8	6.9
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			100		100	100
cM capacity (veh/h)			472		54	383
Direction, Lane #	EB 1	EB 2	EB 3	WB 1	WB 2	
Volume Total	697	697	33	610	610	
Volume Left	0	0	0	0	0	
Volume Right	0	0	33	0	0	
cSH	1700	1700	1700	1700	1700	
Volume to Capacity	0.41	0.41	0.02	0.36	0.36	
Queue Length 95th (ft)	0	0	0	0	0	
Control Delay (s)	0.0	0.0	0.0	0.0	0.0	
Lane LOS						
Approach Delay (s)	0.0			0.0		
Approach LOS						
Intersection Summary						
Average Delay			0.0			
Intersection Capacity Utilization			38.8%		ICU Level of Service	A
Analysis Period (min)			15			

HCM Unsignalized Intersection Capacity Analysis 5: Ent 2 &

PM Peak CFS 2013 w/Connection
1/15/2010

						
Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (veh/h)	10	18	4	566	327	18
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	11	20	4	615	355	20
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage (veh)						
Upstream signal (ft)					174	
pX, platoon unblocked						
vC, conflicting volume	682	188	375			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	682	188	375			
tC, single (s)	6.8	6.9	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	97	98	100			
cM capacity (veh/h)	382	823	1180			
Direction, Lane #	EB 1	NB 1	NB 2	SB 1	SB 2	
Volume Total	30	209	410	237	138	
Volume Left	11	4	0	0	0	
Volume Right	20	0	0	0	20	
cSH	583	1180	1700	1700	1700	
Volume to Capacity	0.05	0.00	0.24	0.14	0.08	
Queue Length 95th (ft)	4	0	0	0	0	
Control Delay (s)	11.5	0.2	0.0	0.0	0.0	
Lane LOS	B	A				
Approach Delay (s)	11.5	0.1		0.0		
Approach LOS	B					
Intersection Summary						
Average Delay			0.4			
Intersection Capacity Utilization			28.4%		ICU Level of Service	A
Analysis Period (min)			15			