



Traffic Impact Analysis
**92 Highway and I-35
Commercial
Development**
Kearney, Missouri

Prepared for:
City of Kearney, Missouri

November 2009





November 5, 2009

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Mr. David Pavlich
Community Development Director
100 E. Washington
P.O. Box 797
Kearney, Missouri 64060

**Re: Traffic Impact Study for the 92 Highway and I-35 Commercial Development
Kearney, Missouri**

Dear Mr. Pavlich:

In response to your request and authorization, TranSystems Corporation has completed a traffic impact study for the proposed commercial development located on the southeast corner of the Route 92 and I-35 interchange. The purpose of this study was to assess the impact of the proposed development on the surrounding transportation system.

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

- Existing Conditions
- Existing plus Proposed Development Conditions
- Future (Year 2025) Conditions

We trust that the enclosed information proves beneficial to you in this phase of the development process. We appreciate the opportunity to be of service to you and we will be available to review this study with you at your convenience.

Sincerely,

By: 
Jeff D. McKerrow, PE, PTOE

JDM:jm:P101090264

Introduction

TranSystems Corporation has completed a traffic study for the proposed 92 Highway and I-35 Commercial Development for the City of Kearney, Missouri. The proposed development is located south of Route 92 and east of I-35 in Kearney, Missouri. The purpose of this study is to assess the impact of the proposed development on the surrounding transportation system. The location of the proposed development relative to the major streets in the area is shown on *Figure A-1* in *Appendix A*.

Included in this study is a discussion of the anticipated impact of the proposed development on the existing and future transportation system. In addition to a description of the proposed development and the surrounding transportation infrastructure, this study includes:

- the amount of traffic estimated to be generated by the development;
- the projected distribution patterns of the development traffic onto the surrounding transportation system;
- an analysis of existing intersection operating conditions;
- an analysis of the intersection operating conditions with the addition of the proposed development;
- an analysis of future intersection operating conditions; and
- an identification of improvements to the surrounding transportation system to mitigate the potential impact of the proposed development, if necessary.

Proposed Development Plan

The proposed development site is located on the south side of Route 92 between I-35 and Regency Drive in Kearney, Missouri. The proposed development consists of a retail development of approximately 170,000 square feet. Access to the site will be provided off of Regency Drive and a limited access driveway on Route 92. A copy of the site plan used for this study is included in *Figure A-2* and was dated February 19, 2009.

Study Area

To assess the impacts of the proposed development, several intersections were identified for study during the A.M. and P.M. peak hours based on discussions with City staff. The intersections are located in the immediate area of the site and include:

- I-35 Ramps and Route 92 (two intersections);
- McDonald's Drive and Route 92;
- Shell Drive/Main Entrance and Route 92;
- Regency Drive and Route 92; and
- Site Driveways.

Traffic Counts

A.M. and P.M. peak hour traffic volumes were collected at the existing study intersections on October 27 and 28, 2009, from 7:00 a.m. to 9:00 a.m. and from 4:00 p.m. to 6:00 p.m. In general, the peak hours for all study intersections were determined to be from 7:00 a.m. to 8:00 a.m. and from 4:30 p.m. to 5:30 p.m. School was in session on the days counts were conducted. The existing lane configurations and traffic control devices, A.M. Peak Hour Traffic Volumes and P.M. Peak Hour Traffic Volumes are shown on *Figures A-3* through *A-5*, respectively.

Street Network

Route 92 serves as the major east/west arterial in the City of Kearney, and adjacent to the proposed development it consists of two-through lanes in each direction and a center two-way left-turn lane. Route 92 transitions to a two-lane facility as it passes under I-35 to the west. Regency Drive is a collector roadway serving predominately residential land uses south of Route 92.

With the proposed development, Regency Drive will be realigned by extending the main portion of roadway into the proposed development. Regency Drive will “tee” into this new extension south of Route 92. Ultimately, it is assumed this new connection will be continued to the south connecting with a new interchange on I-35.

Surrounding Land Use

The proposed development is bordered by I-35 on the west, commercial businesses on the north and residential to the south and east.

Analysis

The scope of analysis for the assessment of the proposed development's impact on the surrounding transportation system is based in large part on the recommended practices of the Institute of Transportation Engineers (ITE), as outlined in their Traffic Engineering Handbook. ITE is a nationally-recognized organization of transportation professionals with members from both private and public sectors.

The analysis of the proposed development's impact includes:

- Trip Generation estimates;
- Trip Distribution assumptions;
- Operational Analysis of the surrounding transportation system for various development assumptions (including existing conditions); and
- Sight Distance Evaluations at new entry points and public intersections. ;

Each of these analysis methodologies and findings are described in more detail in the subsequent sections of the report.

Trip Generation

The vehicle trips generated by the proposed development were estimated using the Institute of Transportation Engineers' (ITE) Trip Generation, 7th Edition. The estimated daily, A.M. Peak Hour and P.M. Peak Hour traffic volumes associated with this development are shown in *Table 1*.

Of the external trips, some of the traffic that enters or leaves a site, particularly for a retail development, is often already on the adjacent street and would be on the road network regardless of the development. These are referred to as *pass-by trips* which turn in and out of the driveways, but are not new to the surrounding street system. The *net new trips* is calculated by subtracting the pass-by trips from the external trips and represents the increase in traffic to the adjacent street system.

The procedures for calculating the internal trips and pass-by traffic were based on the methodologies outlined in the Institute of Transportation Engineers Trip Generation Handbook.

Table 1
Trip Generation

Land Use	Intensity	ITE Code	Average Weekday	A.M. Peak Hour			P.M. Peak Hour		
				Total	In	Out	Total	In	Out
Proposed Development									
Shopping Center	169,025 sf	820	9,550	210	128	82	904	443	461
			Pass-By Trips	3,150	0	0	298	149	149
			Net New Trips	6,400	210	128	606	294	312

The proposed development is anticipated to generate approximately 6,400 daily net new trips, with 210 trips in the A.M. peak hour and 606 trips in the P.M. peak hour.

Trip Distribution

The estimated peak hour trips generated by the proposed development were distributed onto the street system based on the trip distributions summarized below. *Table 2* illustrates the general distributions used in this study which were derived based on existing travel patterns and site geometry. The detailed distribution patterns through the study intersections are documented in *Appendix B*.

Table 2
Trip Distribution

Direction To/From	Percentage
West on Route 92	25%
North on I-29	10%
South on I-29	25%
North on Platte Clay Way	10%
East on Route 92	25%
South on Regency Drive	5%
Total	100%

Traffic Operation Assessment

The study intersections were evaluated based on the methodologies outlined in the Highway Capacity Manual (HCM), 2000 Edition, published by the Transportation Research Board. The operating conditions at an intersection are graded by the “level of service” experienced by drivers. Level of service (LOS) describes the quality of traffic operating conditions and is rated from “A” to “F”. LOS A represents the most desirable condition with free-flow movement of traffic with minimal delays. LOS F generally indicates severely congested conditions with excessive delays to motorists. Intermediate grades of B, C, D, and E reflect incremental increases in the average delay per stopped vehicle. Delay is measured in seconds per vehicle. *Table 3* shows the upper limit of delay associated with each level of service for signalized and unsignalized intersections.

Table 3
Intersection Level of Service Delay Thresholds

Level of Service (LOS)	Signalized	Unsignalized
A	< 10 Seconds	< 10 Seconds
B	< 20 Seconds	< 15 Seconds
C	< 35 Seconds	< 25 Seconds
D	< 55 Seconds	< 35 Seconds
E	< 80 Seconds	< 50 Seconds
F	≥ 80 Seconds	≥ 50 Seconds

While one of the primary measurements of traffic operations, LOS, applies to both signalized and unsignalized intersections, there are significant differences between how these intersections operate and how they are evaluated. LOS for signalized intersections reflects the operation of the intersection as a whole. While the individual movements may operate with varying LOS ratings, that is largely a function of the signal timings and how the intersection is operating relative to other signals in the vicinity. As an example, in coordinated system of multiple signalized intersections, some minor side-street approaches may have LOS ratings of D, E or even F. This can be the result of the length of time provided to the major movements and do not reflect a condition where the intersection is operating over capacity or is judged to be operating poorly.

Unsignalized intersections, in contrast, are evaluated based on the movement grouping which are required to yield to other traffic. Typically, this is the left-turns off of the major street and the side-street approaches for two-way stop-controlled intersections. Lower LOS ratings (D, E and F) do not, in themselves, indicate significant difficulties or the need for additional improvements. Many times there are convenient alternative paths to avoid the longer delays. Other times, the volumes on the unsignalized approaches are relative minor when compared to the major street traffic.

The decision to install a traffic signal, which is often considered when lower LOS ratings are projected, should be based on engineering studies and the warrants for traffic signal installation as outlined in the Federal Highway Administration's Manual on Uniform Traffic Control Devices. Signals are typically not recommended in locations where there are convenient alternative paths, or the installation of a traffic signal would have negative impacts on the surrounding transportation system. For instance, if the new signalized intersection is located too close to existing traffic signals it may not be recommended despite meeting the minimum warrants.

In addition to delay (and the corresponding Level of Service), a secondary means of evaluation is often utilized to assess the overall capacity of the intersection or unsignalized movement. This evaluation is a ratio of volume to capacity (v/c) that reflects, regardless of delay, the ability to accommodate the existing or projected traffic volumes over the course of a peak hour. A v/c ratio of 1.00 reflects the capacity of the intersection or movement.

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

The LOS rating deemed acceptable varies by community, facility type and traffic control device. In communities similar to Kearney, a LOS C for signalized intersections is often found to be acceptable. As communities expand and grow, oftentimes these LOS thresholds for signalized intersections increase to LOS D, as providing a LOS C becomes difficult without significant expenses. However, at unsignalized intersections LOS D, E and above are often accepted for low to moderate traffic volumes where the installation of a traffic signal is not warranted by the conditions at the intersection or the location has been deemed undesirable for signalization for other reasons, e.g. the close proximity of an existing traffic signal or the presence of a convenient alternative path.

The Synchro software package was used to evaluate signalized and stop controlled intersections. Documented results are based on HCM methodology and have been included in *Appendix C*.

Existing Conditions

The results of the intersection analysis for the existing conditions during A.M. and P.M. peak hour are summarized in Table 4. The study intersections were evaluated with the lane configurations shown on Figure A-3. The existing traffic volumes are shown on Figures A-4 and A-5. Appendix C contains the analyses output files from Synchro.

Table 4
Intersection Operational Analysis
Existing Conditions

Intersection Movement	A.M. Peak Hour			P.M. Peak Hour		
	LOS ¹	Delay ²	v/c ³	LOS ¹	Delay ²	v/c ³
Route 92 and Southbound I-35 Ramps <i>All Movements (Signalized Intersection)</i>	B	16.6	0.50	B	13.1	0.49
Route 92 and Northbound I-35 Ramps <i>All Movements (Signalized Intersection)</i>	A	9.3	0.47	C	28.5	0.86
Route 92 and McDonald's Drive						
<i>Eastbound Left-Turn</i>	B	11.0	0.10	A	9.8	0.11
<i>Southbound Left-Turn</i>	E	44.1	0.24	F	80.1	0.46
<i>Southbound Right-Turn</i>	B	11.0	0.19	B	10.5	0.11
Route 92 and Shell Drive						
<i>Eastbound Left-Turn</i>	B	10.8	0.10	A	9.2	0.01
<i>Southbound Left-Turn</i>	E	40.8	0.23	E	43.1	0.24
<i>Southbound Right-Turn</i>	B	10.2	0.16	A	9.7	0.03
Route 92 and Platte Clay Way <i>All Movements (Signalized Intersection)</i>	B	16.8	0.50	C	20.6	0.58

1 – Level of Service

2 – Delay in seconds per vehicle

3 – Volume/Capacity Ratio

The study intersections are all projected to operate at acceptable levels of service. While the unsignalized left-turns operate with higher delays, this is not uncommon for side-street movements onto a major roadway.

Existing Plus Development Conditions

Intersection analyses were then conducted to determine the impact on existing conditions with the addition of the proposed development. The results for the intersection analyses of existing plus proposed development peak hour conditions have been summarized in *Table 5*. The results reflect the improvements considered for this scenario.

The assessment of existing plus development conditions is an iterative process that begins by applying development traffic volumes to the existing street system. As deficiencies were identified, improvements were considered and evaluated to achieve acceptable levels of service.

The study intersections were evaluated with the existing plus development lane configurations, traffic volumes, and traffic controls shown on Figures A-6 through A-8. Appendix C contains the analysis output files from Synchro.

Table 5
Intersection Operational Analysis
Existing Plus Development Conditions

Intersection Movement	A.M. Peak Hour			P.M. Peak Hour		
	LOS ¹	Delay ²	v/c ³	LOS ¹	Delay ²	v/c ³
Route 92 and Southbound I-35 Ramps <i>All Movements (Signalized Intersection)</i>	B	17.9	0.53	B	14.6	0.56
Route 92 and Northbound I-35 Ramps <i>All Movements (Signalized Intersection)</i>	A	9.9	0.48	B	19.9	0.68
Route 92 and McDonald's Drive						
<i>Eastbound Left-Turn</i>	B	11.0	0.10	B	11.0	0.14
<i>Southbound Left-Turn</i>	E	49.0	0.27	F	>120	0.78
<i>Southbound Right-Turn</i>	B	10.2	0.16	B	11.7	0.13
Route 92 and Shell Drive/Main Entrance						
<i>Eastbound Left-Turn</i>	B	10.6	0.01	B	10.2	0.01
<i>Westbound Left-Turn</i>	A	9.1	0.03	C	17.3	0.32
<i>Northbound Right-Turn</i>	B	10.3	0.02	C	16.2	0.21
<i>Southbound Left-Turn</i>	F	51.9	0.23	F	>120	1.50
<i>Southbound Right-Turn</i>	A	9.3	0.02	B	10.6	0.30
Route 92 and Platte Clay Way <i>All Movements (Signalized Intersection)</i>	C	22.2	0.48	C	31.0	0.74
Development Drive and Regency Drive						
<i>Westbound Left-Turn</i>	A	7.6	0.09	A	9.5	0.30
<i>Northbound Left-Turn</i>	B	11.4	0.01	D	32.8	0.11
<i>Northbound Right-Turn</i>	A	9.8	0.24	B	13.7	0.36
Development Drive and Main Entrance <i>All Movements (Roundabout)</i>	A	N/A	0.10	A	N/A	0.36

1 – Level of Service

2 – Delay in seconds per vehicle

3 – Volume/Capacity Ratio

As with the existing conditions, the unsignalized left-turns onto Route 92 experience longer delays than desired. This condition is somewhat worsened with the addition of the proposed development. Ideally, alternative access to Platte Clay Way would be desired on the north side to provide alternative paths for drivers.

Several improvements were identified at the study intersections to achieve an acceptable Level of Service and manage projected vehicular queues for the impact of the proposed development on existing conditions. These improvements include:

- Construction of a second right-turn lane on the northbound I-35 exit ramp to Route 92, approximately 250 feet in length, plus taper.
- Construction of a right-turn lane on eastbound Route 92 and the Main Entrance, approximately 150 feet in length (plus taper).
- Construction of a third northbound lane on Regency Drive at Route 92, providing for an exclusive left-turn lane, a shared left and through lane and an exclusive right-turn lane. The two left-turn lanes should provide approximately 250 feet of storage and the right-turn lane approximately 150 feet, plus taper.

Future Conditions

Intersection analyses were then conducted to determine the impact based on future growth for along Route 92. The growth in traffic on Route 92 was estimated from previous studies conducted in the area. The results for the intersection analyses of future peak hour conditions have been summarized in *Table 6*. The results reflect the improvements considered for this scenario.

The study intersections were evaluated with the existing plus development lane configurations, traffic volumes, and traffic controls shown on Figures A-9 through A-11. Appendix C contains the analysis output files from Synchro.

Table 6 Intersection Operational Analysis Future Conditions							
Intersection	Movement	A.M. Peak Hour			P.M. Peak Hour		
		LOS ¹	Delay ²	v/c ³	LOS ¹	Delay ²	v/c ³
Route 92 and Southbound I-35 Ramps <i>All Movements (Signalized Intersection)</i>	B	19.8	0.60		C	24.3	0.85
Route 92 and Northbound I-35 Ramps <i>All Movements (Signalized Intersection)</i>	B	15.1	0.60		D	42.5	0.99
Route 92 and McDonald's Drive							
	<i>Eastbound Left-Turn</i>	B	12.5	0.12	C	18.0	0.26
	<i>Southbound Left-Turn</i>	F	58.7	0.31	F	>120	1.22
	<i>Southbound Right-Turn</i>	B	10.4	0.17	B	10.9	0.11
Route 92 and Shell Drive/Main Entrance							
	<i>Eastbound Left-Turn</i>	B	11.8	0.01	B	14.8	0.01
	<i>Westbound Left-Turn</i>	A	9.5	0.03	E	43.0	0.61
	<i>Northbound Right-Turn</i>	B	10.4	0.02	C	16.6	0.22
	<i>Southbound Left-Turn</i>	F	75.6	0.31	F	>120	3.67
	<i>Southbound Right-Turn</i>	A	9.7	0.02	B	10.4	0.03
Route 92 and Platte Clay Way <i>All Movements (Signalized Intersection)</i>	C	24.3	0.57		D	45.9	0.93
Development Drive and Regency Drive							
	<i>Westbound Left-Turn</i>	A	7.6	0.09	A	9.5	0.30
	<i>Northbound Left-Turn</i>	B	11.4	0.01	D	32.8	0.11
	<i>Northbound Right-Turn</i>	A	9.8	0.24	B	13.7	0.36
Development Drive and Main Entrance <i>All Movements (Roundabout)</i>	A	N/A	0.10		A	N/A	0.36

1 – Level of Service

2 – Delay in seconds per vehicle

3 – Volume/Capacity Ratio

As with the previous conditions, the unsignalized left-turns onto Route 92 experience longer delays than desired. This condition is somewhat worsened with the continued growth of traffic volumes along Route 92.

With the projected increase in traffic, interchange improvements will be required at I-35, including the addition of several turn lanes and the continuation of two through lanes in each direction west of I-35.

Summary

This study documents the transportation impact of the proposed 92 Highway and I-35 Commercial Development for the City of Kearney, Missouri.. Included in this report is a review of the anticipated impact of the proposed development on the existing and future transportation system, specifically:

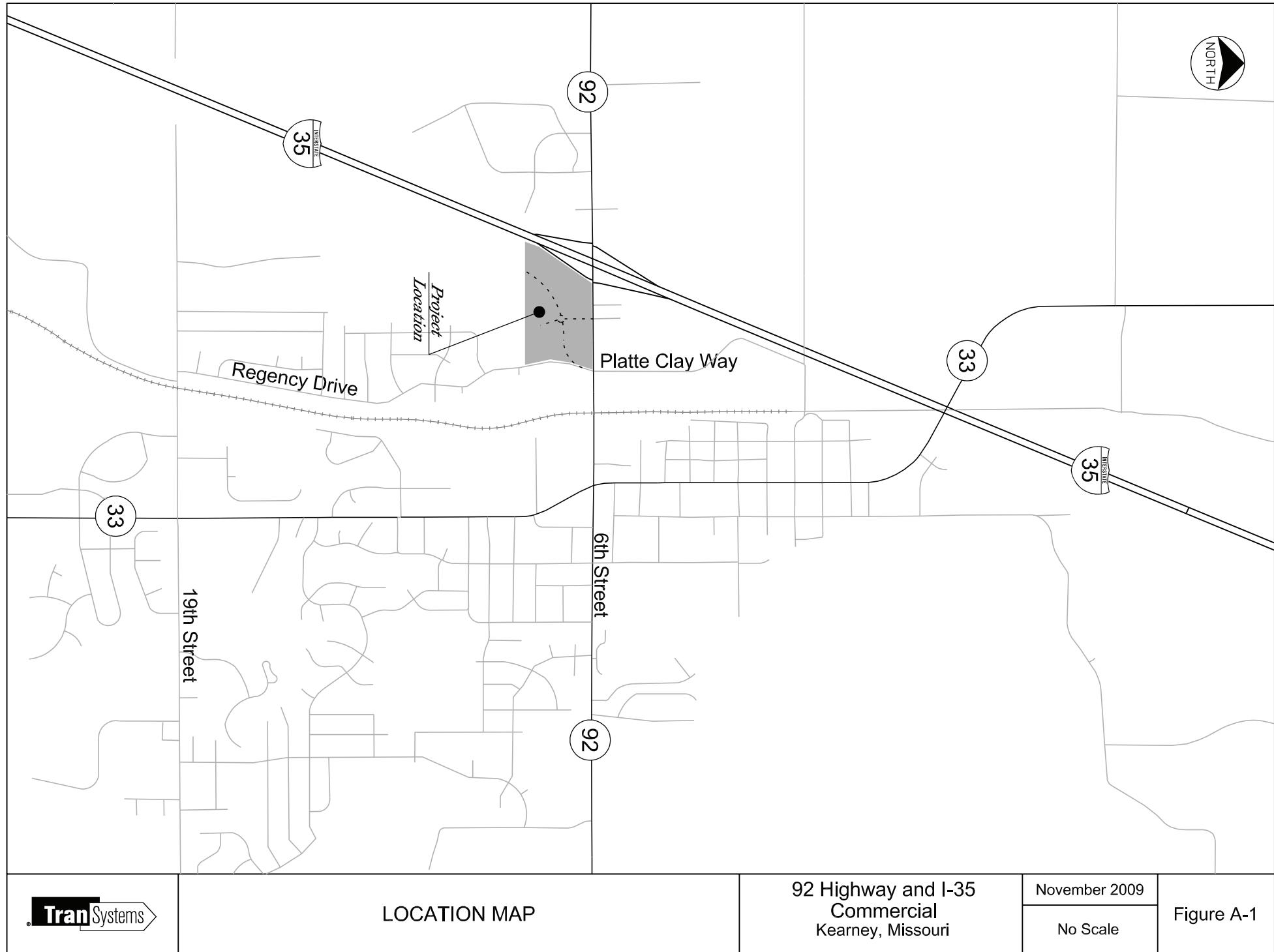
- the amount of traffic estimated to be generated by the development;
- the projected distribution patterns of the development traffic onto the surrounding transportation system;
- an analysis of existing intersection operating conditions;
- an analysis of the intersection operating conditions with the addition of the proposed development;
- an analysis of future intersection operating conditions; and
- an identification of improvements to the surrounding transportation system to mitigate the potential impact of the proposed development.

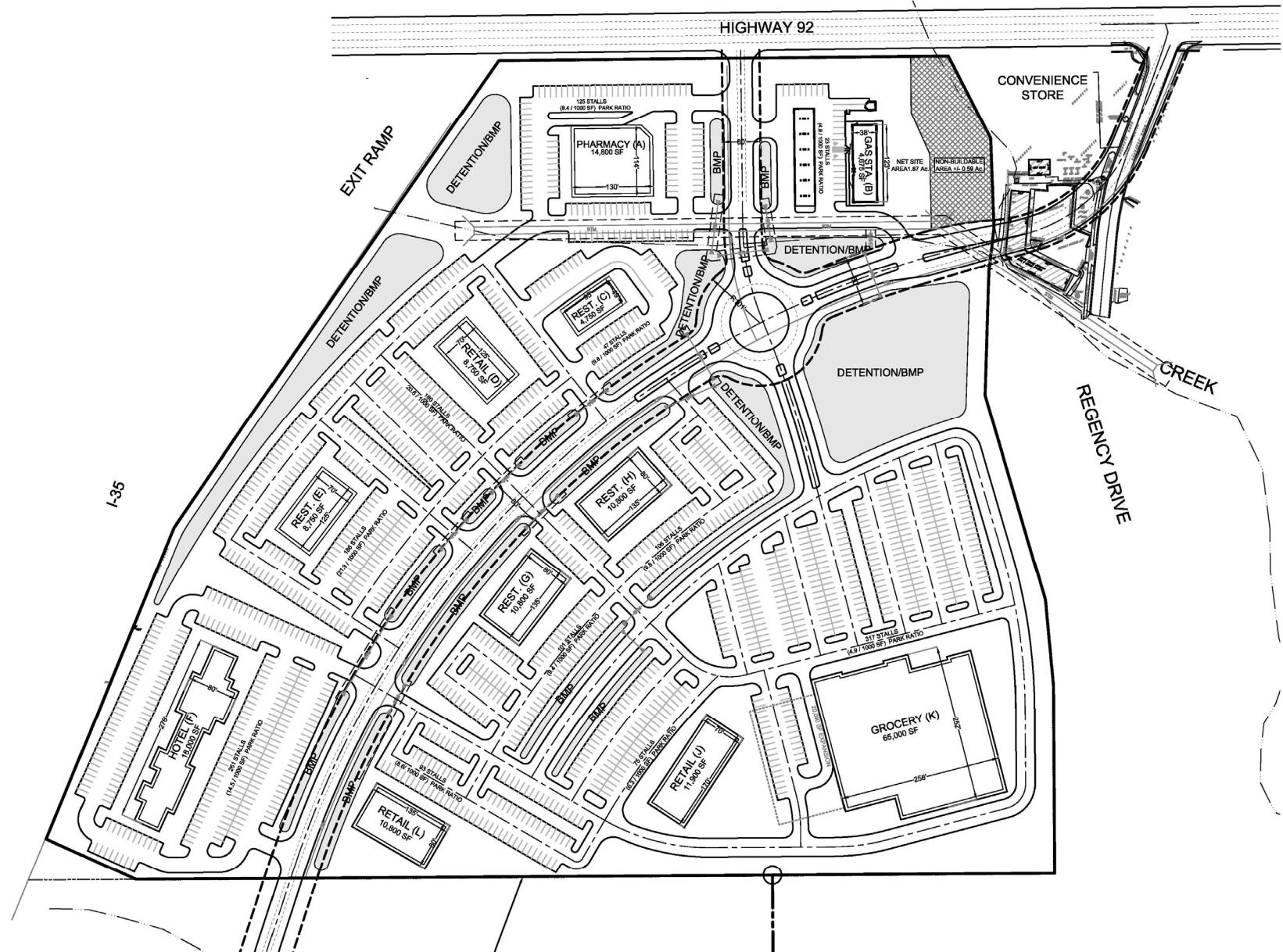
The proposed development is anticipated to generate approximately 6,400 daily net new trips, with 210 trips in the A.M. peak hour and 606 trips in the P.M. peak hour. The following improvements are recommended to mitigate the impact of the proposed development on the existing transportation system:

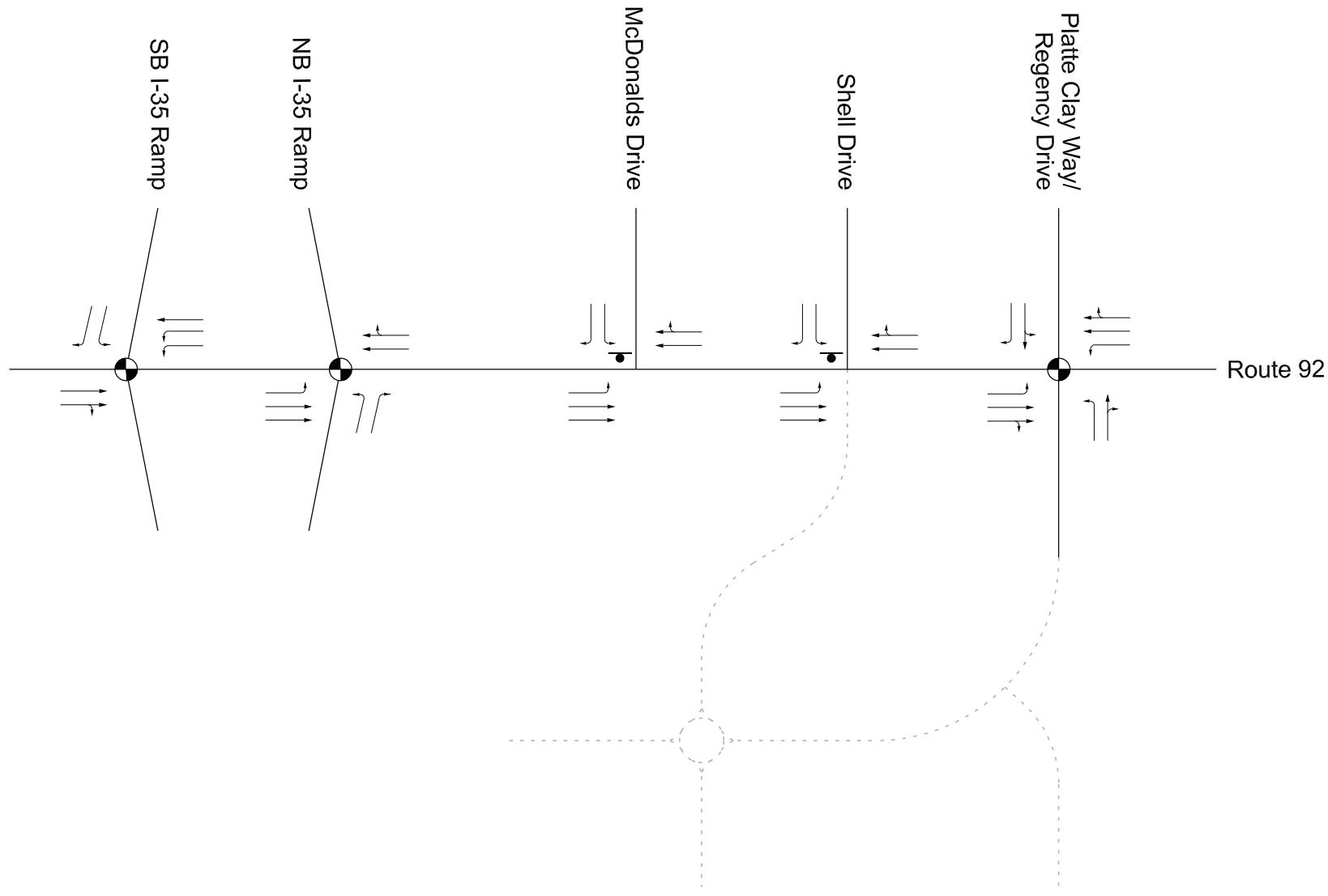
- Construction of a second right-turn lane on the northbound I-35 exit ramp to Route 92, approximately 250 feet in length, plus taper.
- Construction of a right-turn lane on eastbound Route 92 and the Main Entrance, approximately 150 feet in length (plus taper).
- Construction of a third northbound lane on Regency Drive at Route 92, providing for an exclusive left-turn lane, a shared left and through lane and an exclusive right-turn lane. The two left-turn lanes should provide approximately 250 feet of storage and the right-turn lane approximately 150 feet, plus taper.

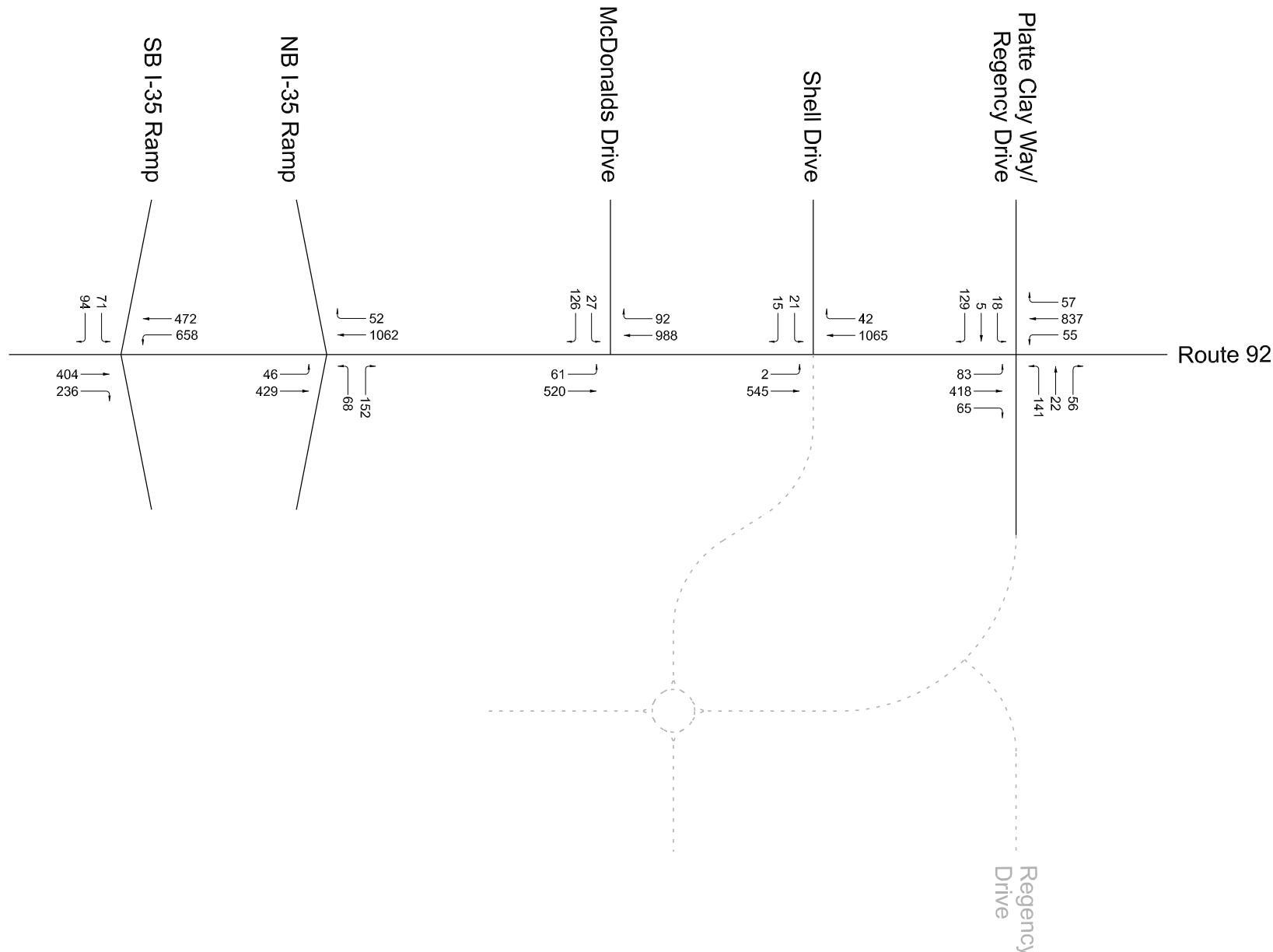
Appendix A - Figures

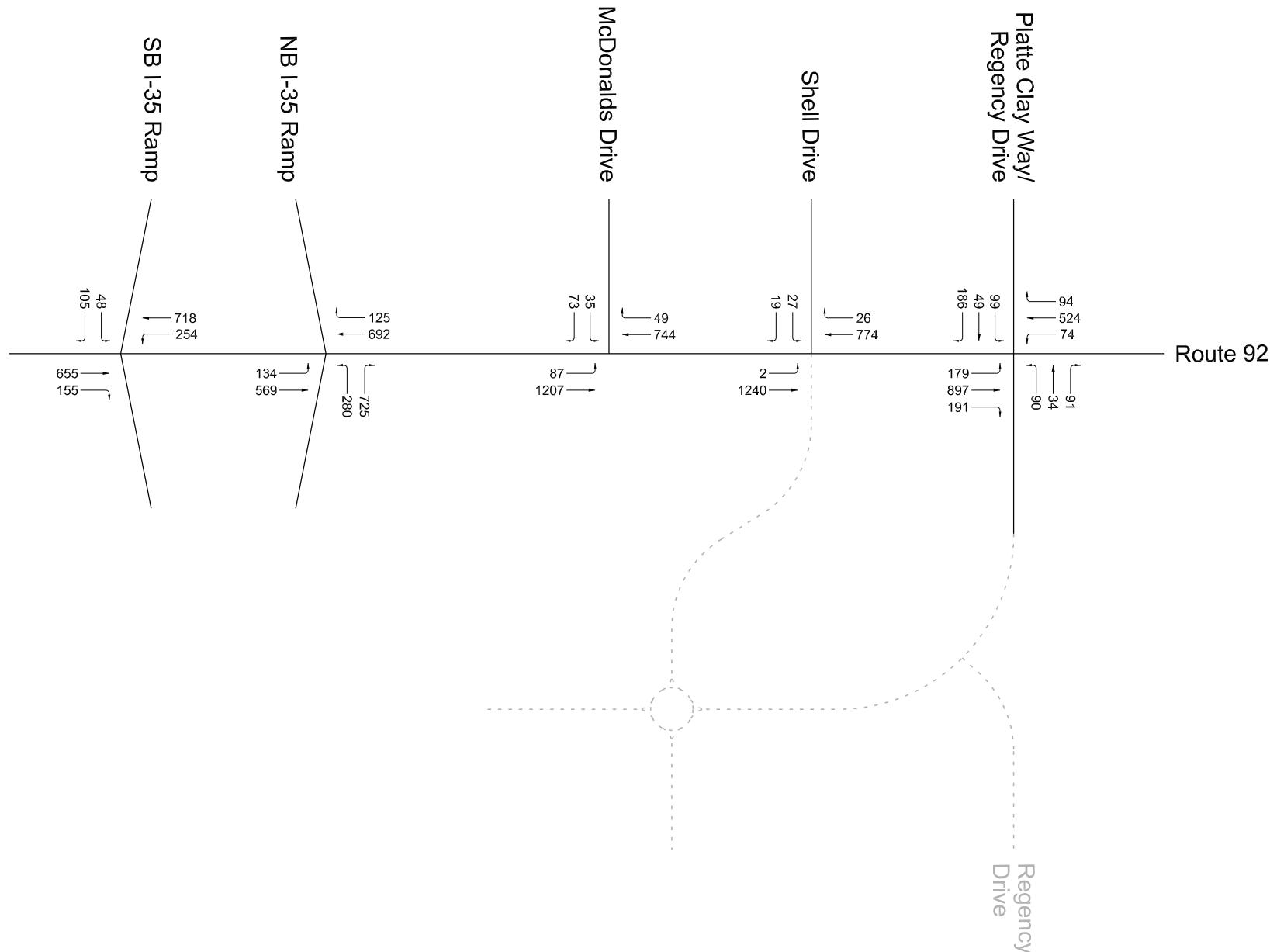
- Figure A-1 Location Map
- Figure A-2 Site Plan
- Figure A-3 Existing - Lane Configurations
- Figure A-4 Existing - A.M. Peak Hour Traffic Volumes
- Figure A-5 Existing - P.M. Peak Hour Traffic Volumes
- Figure A-6 Existing plus Proposed Development Conditions - Lane Configurations
- Figure A-7 Existing plus Proposed Development Conditions - A.M. Peak Hour Traffic Volumes
- Figure A-8 Existing plus Proposed Development Conditions - P.M. Peak Hour Traffic Volumes
- Figure A-9 Future Conditions - Lane Configurations
- Figure A-10 Future Conditions - A.M. Peak Hour Traffic Volumes
- Figure A-11 Future Conditions - P.M. Peak Hour Traffic Volumes

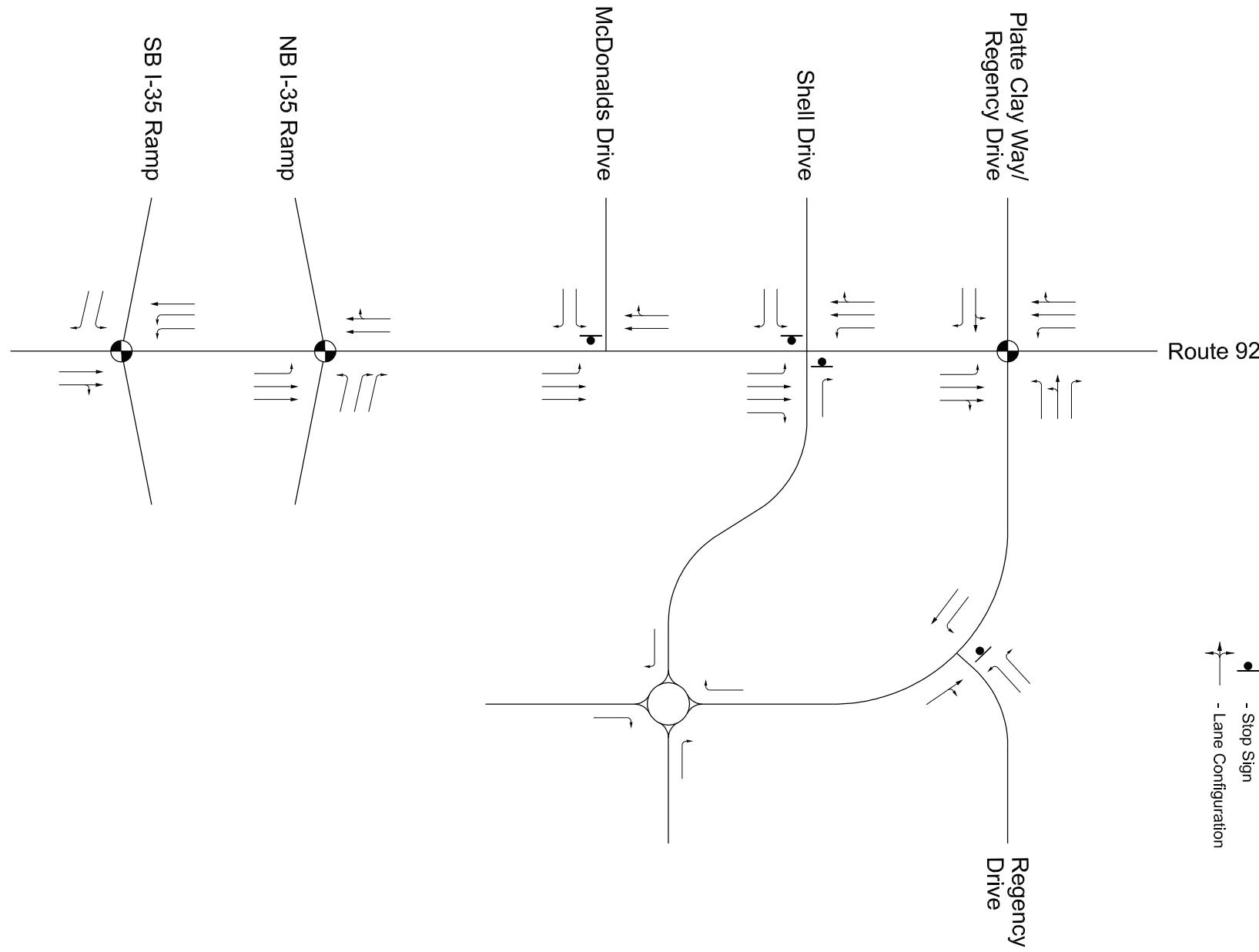






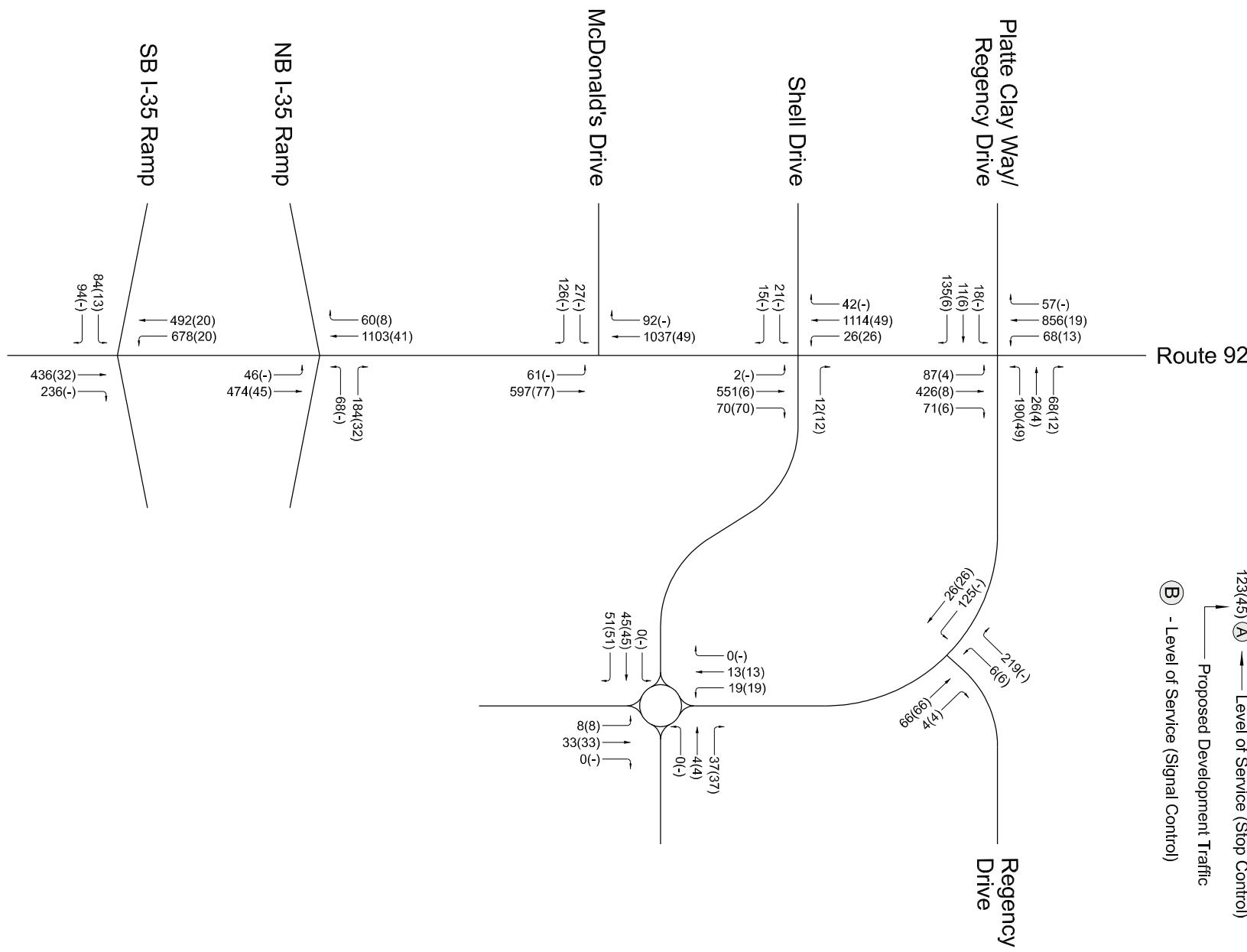






Legend

- Traffic Signal
- Stop Sign
- Lane Configuration



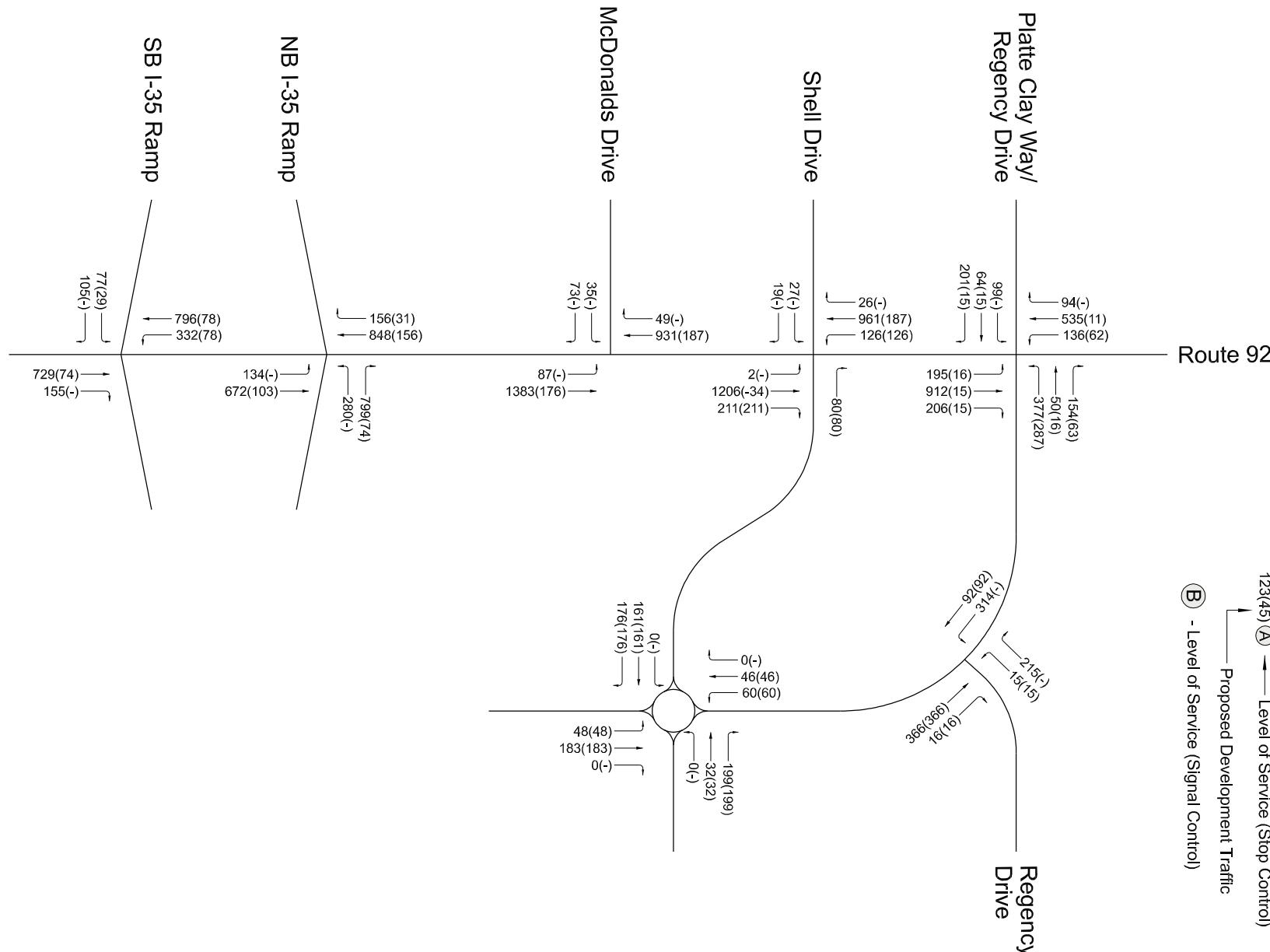
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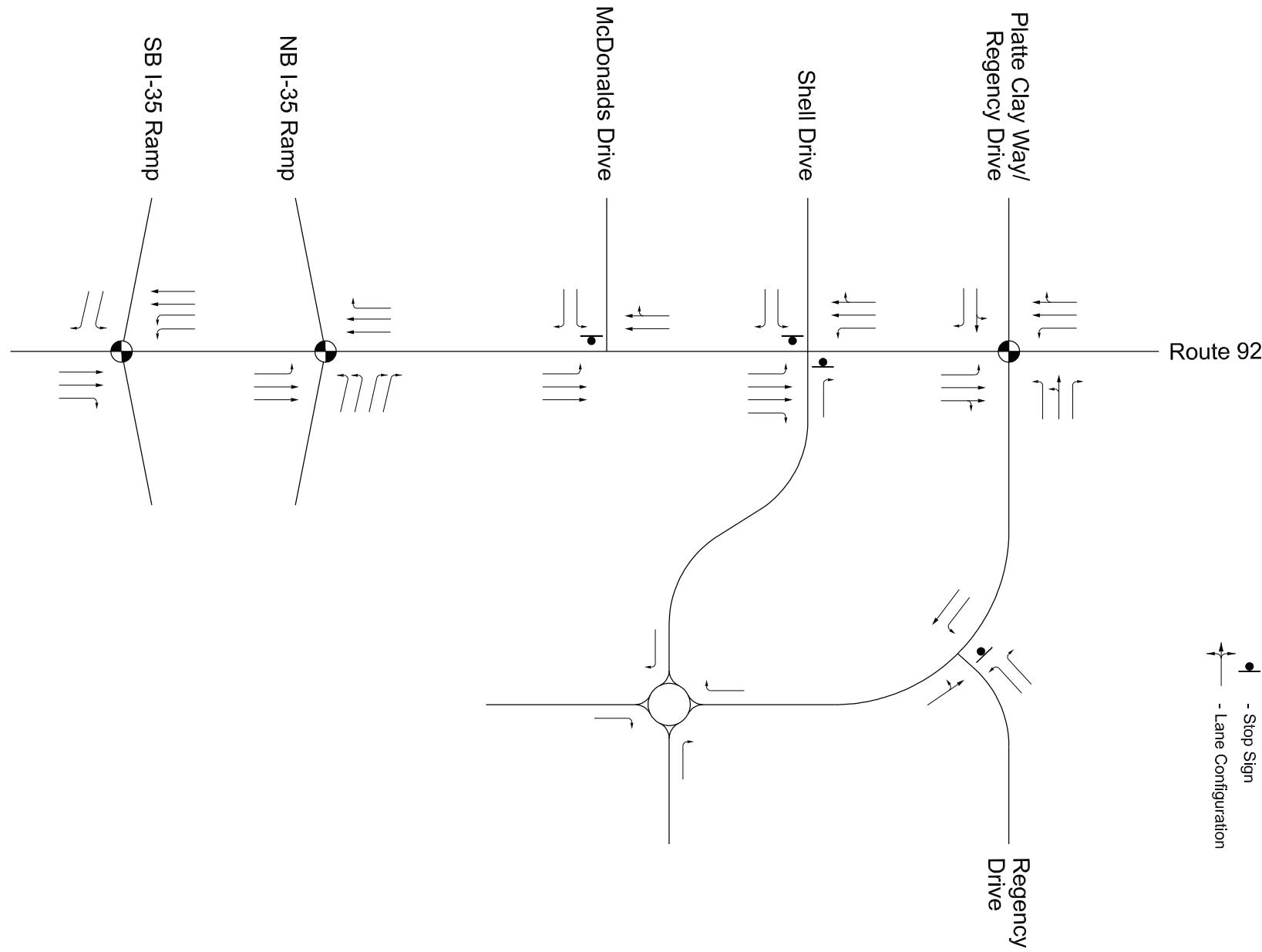
EXISTING PLUS PROPOSED DEVELOPMENT CONDITIONS A.M. PEAK HOUR TRAFFIC VOLUMES

**92 Highway and I-35
Commercial
Kearney, Missouri**

No Scale

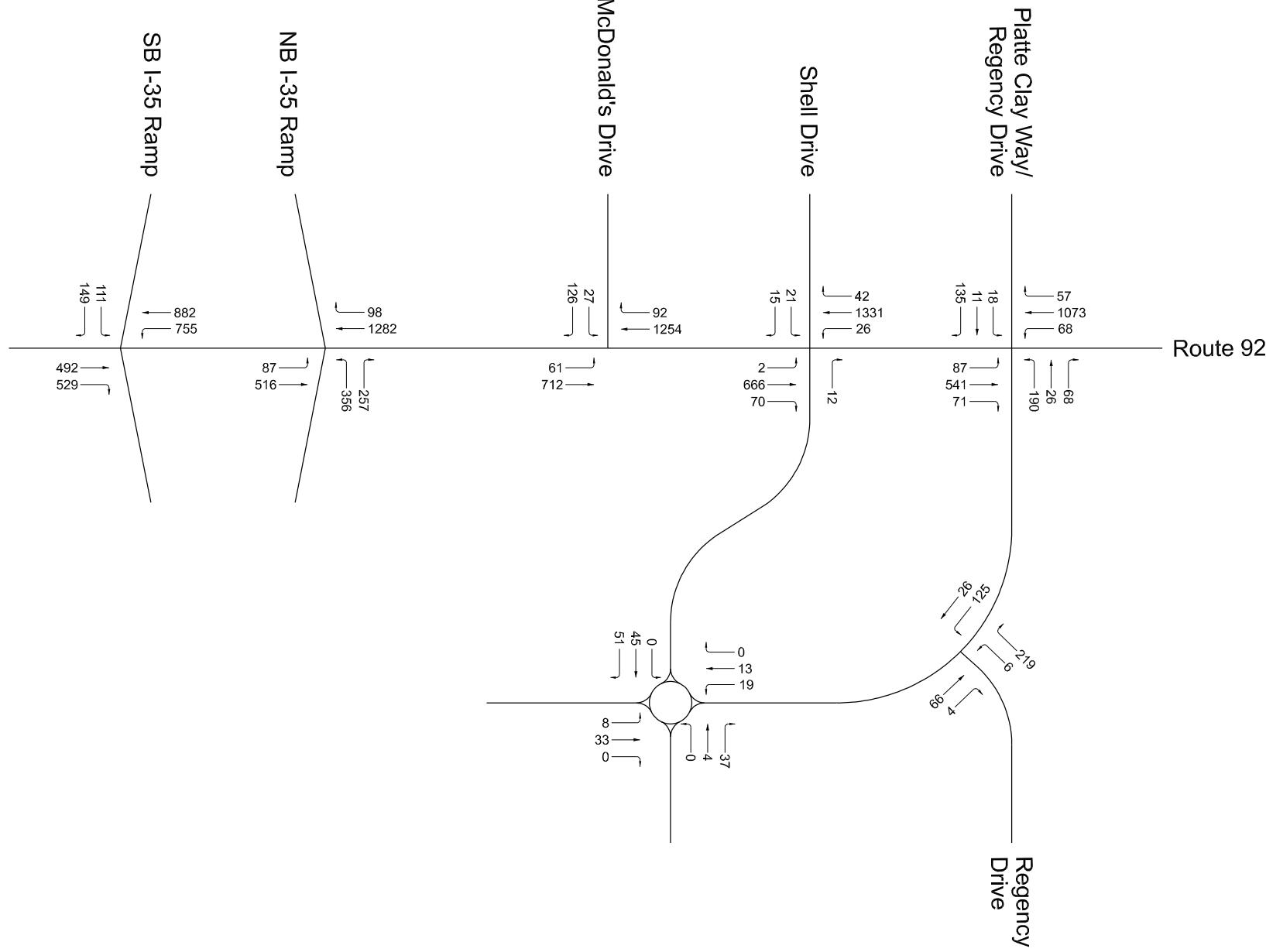
Figure A-7

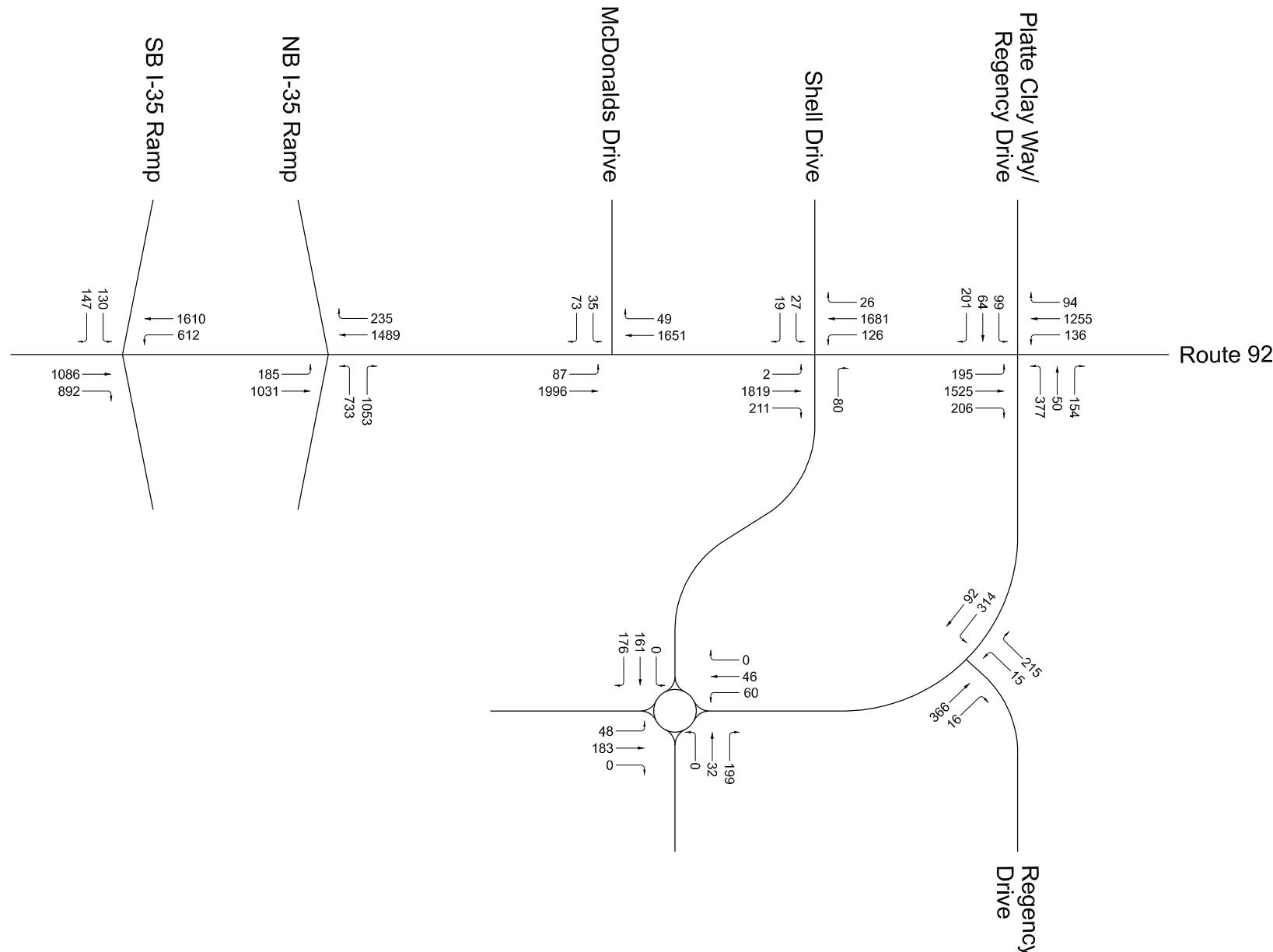




Legend

- Traffic Signal
- Stop Sign
- Lane Configuration





Appendix B – Trip Generation and Distribution

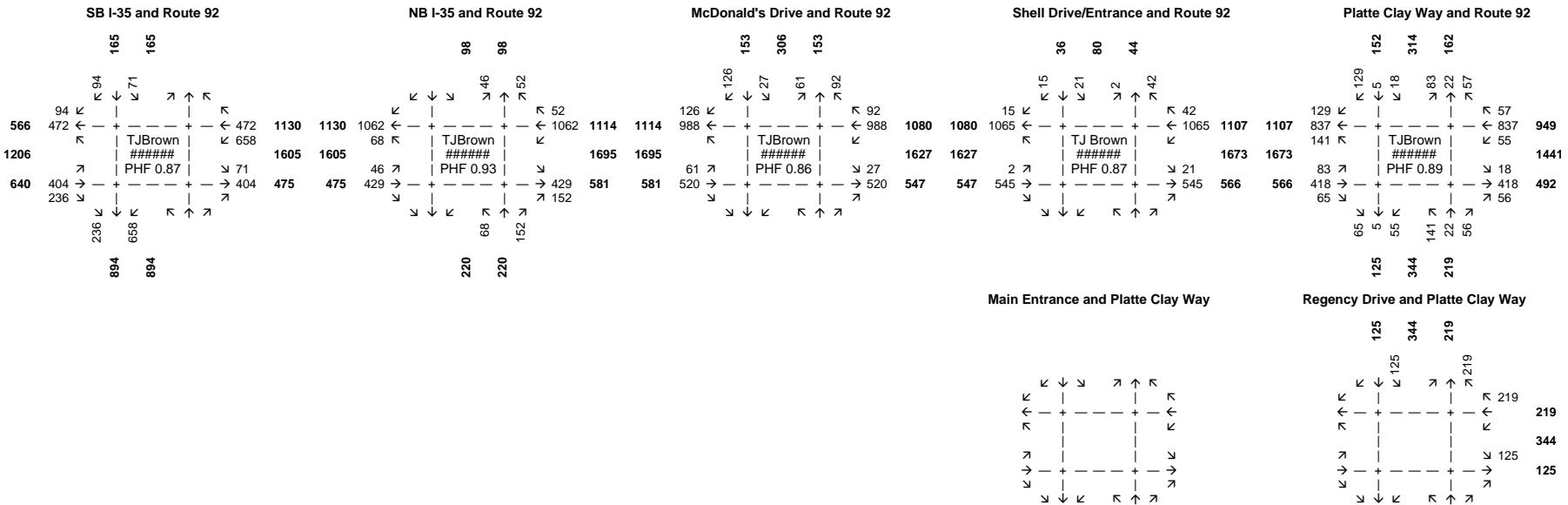
See attached worksheets.

I-35 and 92 Highway Commercial
Kearney, Missouri
Trip Generation

Shopping Center	169,025 sf	820	9,550	210	61%	39%	128	82	904	49%	51%	443	461
	<i>Pass-By Trips (33%)</i>	<i>3,150</i>		<i>0</i>			<i>0</i>	<i>0</i>	<i>298</i>			<i>149</i>	<i>149</i>
	<i>Net New External Trips</i>	<i>6,400</i>		<i>210</i>			<i>128</i>	<i>82</i>	<i>606</i>			<i>294</i>	<i>312</i>

I-35 and 92 Highway Commercial Kearney, Missouri

Existing Traffic Volumes AM Peak Hour (7:00 AM to 8:00 AM)

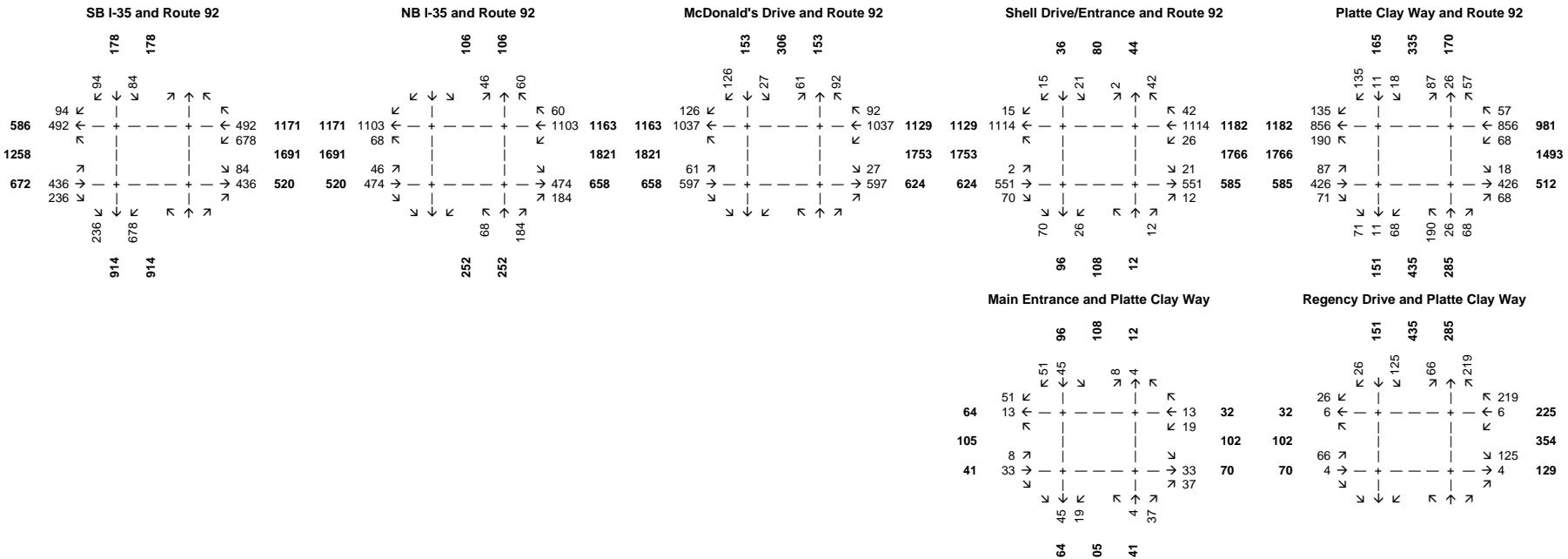


I-35 and 92 Highway Commercial Kearney, Missouri

Existing Traffic Volumes PM Peak Hour (4:30 P.M. to 5:30 P.M.)

**I-35 and 92 Highway Commercial
Kearney, Missouri**

**Existing Plus Development Trips
AM Peak Hour**

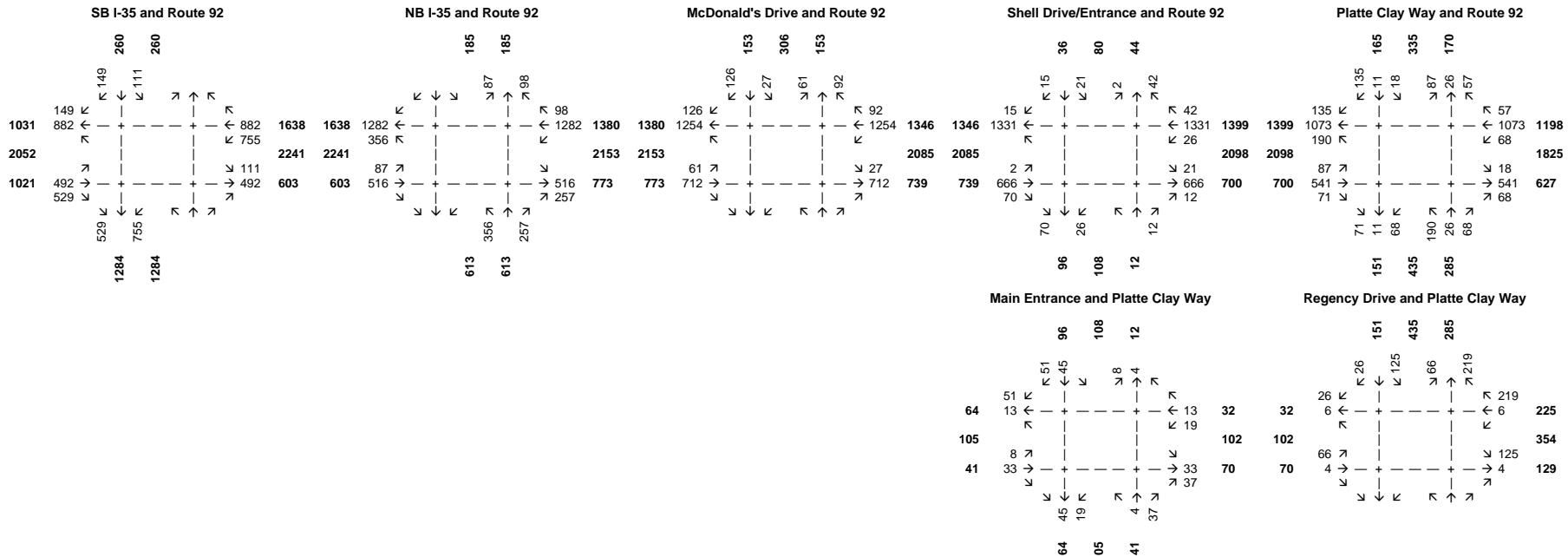


I-35 and 92 Highway Commercial Kearney, Missouri

Existing Plus Development Trips PM Peak Hour

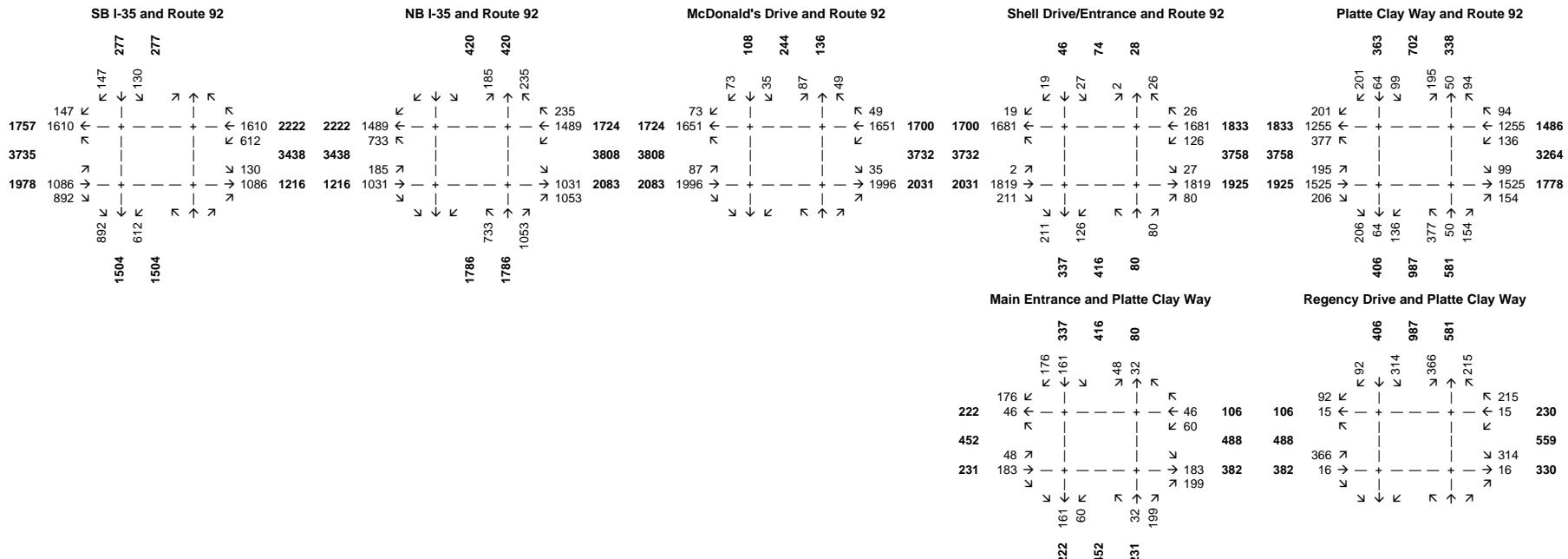
I-35 and 92 Highway Commercial Kearney, Missouri

2025 Projections AM Peak Hour



I-35 and 92 Highway Commercial Kearney, Missouri

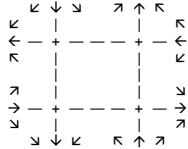
2025 Projections PM Peak Hour



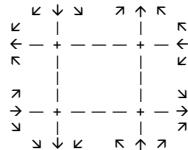
**I-35 and 92 Highway Commercial
Kearney, Missouri**

**Pass-By Trips
Percentages**

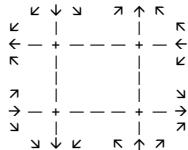
SB I-35 and Route 92



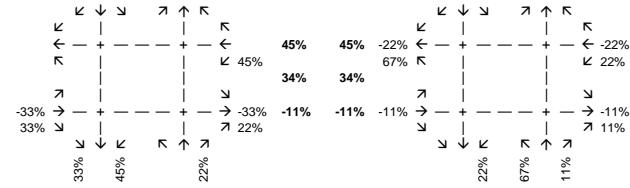
NB I-35 and Route 92



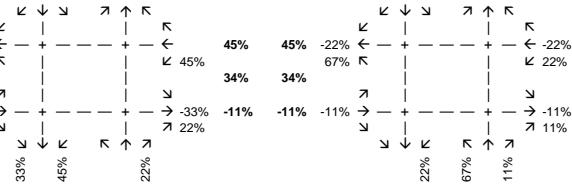
McDonald's Drive and Route 92



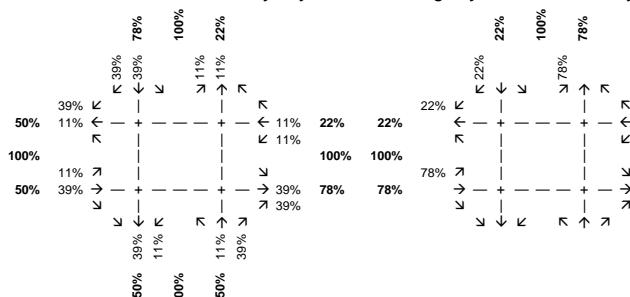
Shell Drive/Entrance and Route 92



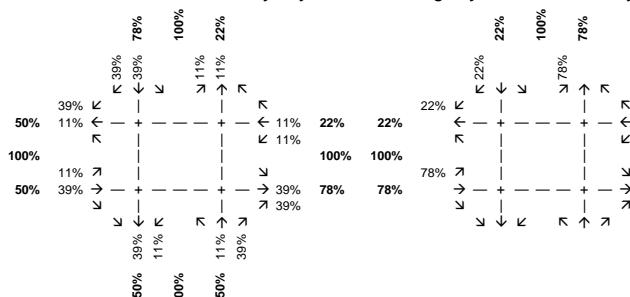
Platte Clay Way and Route 92



Main Entrance and Platte Clay Way



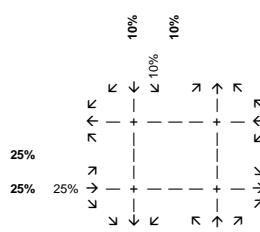
Regency Drive and Platte Clay Way



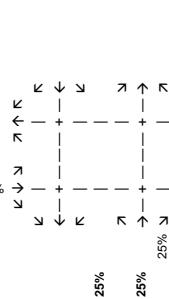
**I-35 and 92 Highway Commercial
Kearney, Missouri**

**Inbound Trip Distribution
Percentages**

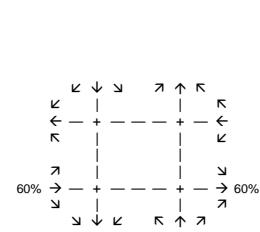
SB I-35 and Route 92



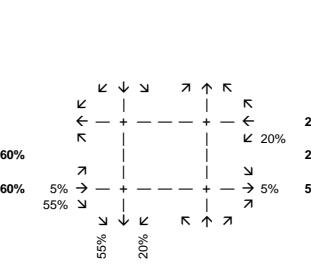
NB I-35 and Route 92



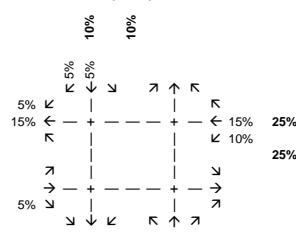
McDonald's Drive and Route 92



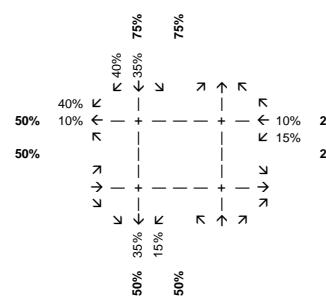
Shell Drive/Entrance and Route 92



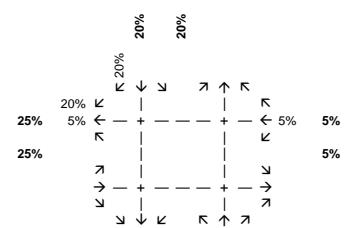
Platte Clay Way and Route 92



Main Entrance and Platte Clay Way

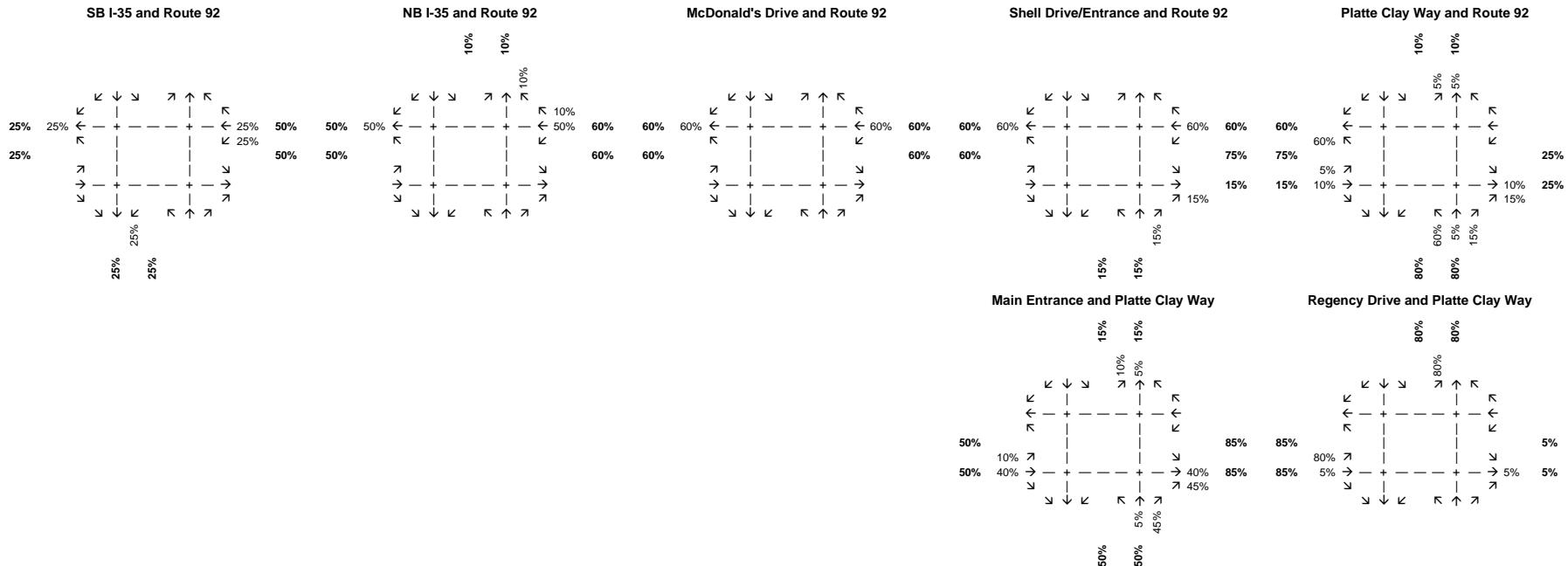


Regency Drive and Platte Clay Way



**I-35 and 92 Highway Commercial
Kearney, Missouri**

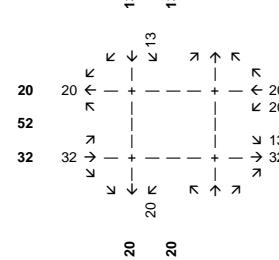
**Outbound Trip Distribution
Percentages**



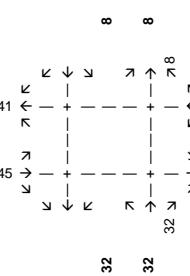
**I-35 and 92 Highway Commercial
Kearney, Missouri**

**Development Trips
AM Peak Hour**

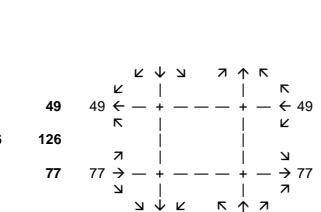
SB I-35 and Route 92



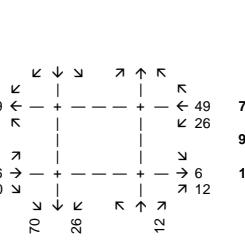
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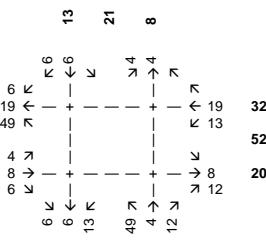
McDonald's Drive and Route 92



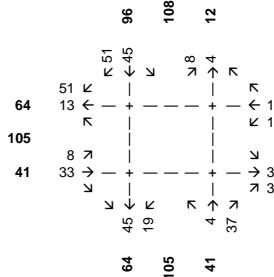
Shell Drive/Entrance and Route 92



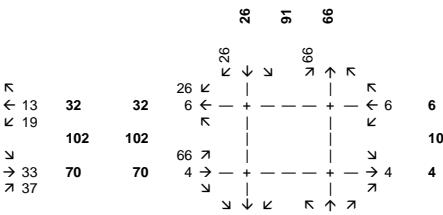
Platte Clay Way and Route 92



Main Entrance and Platte Clay Way

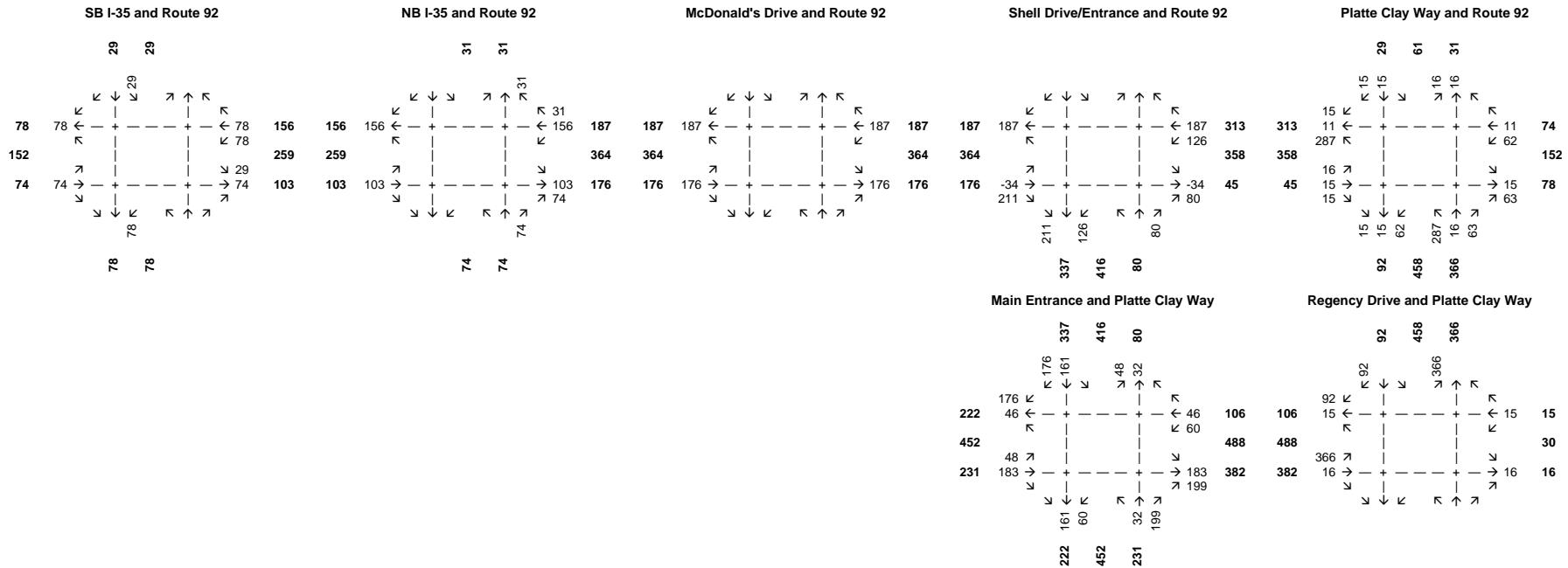


Regency Drive and Platte Clay Way



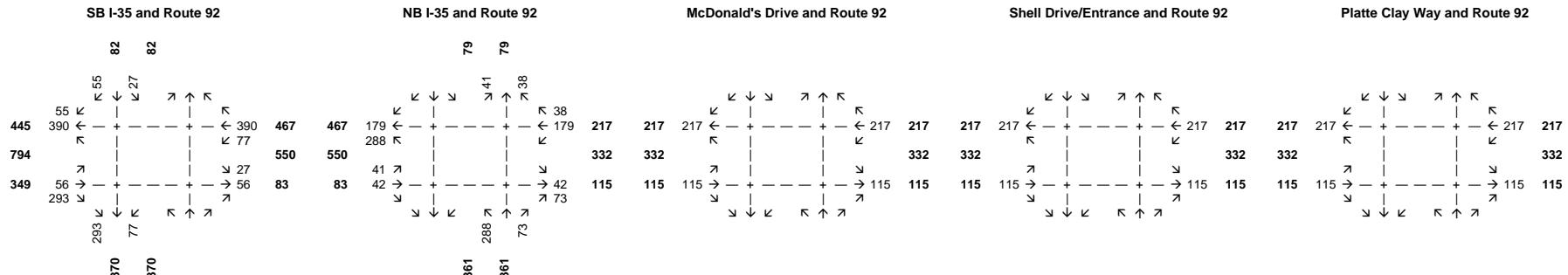
I-35 and 92 Highway Commercial Kearney, Missouri

Development Trips PM Peak Hour



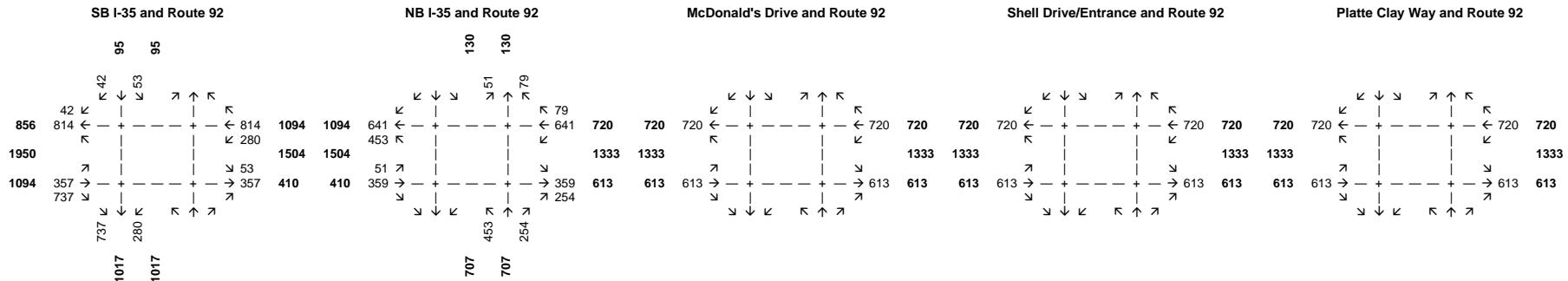
**I-35 and 92 Highway Commercial
Kearney, Missouri**

**Background Growth
AM Peak Hour**

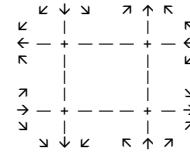


**I-35 and 92 Highway Commercial
Kearney, Missouri**

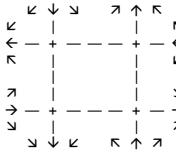
**Background Growth
PM Peak Hour**



Main Entrance and Platte Clay Way



Regency Drive and Platte Clay Way



Appendix C – Capacity Analysis Reports

See attached reports.

Queues

3: Route 92 & SB I-35 Ramps

11/4/2009

Lane Group	EBT	WBL	WBT	SBL	SBR
Lane Group Flow (vph)	696	715	513	77	102
v/c Ratio	0.58	0.62	0.39	0.22	0.26
Control Delay	21.6	15.7	2.2	32.1	8.4
Queue Delay	0.0	0.0	0.1	0.0	0.0
Total Delay	21.6	15.7	2.3	32.1	8.4
Queue Length 50th (ft)	134	104	24	37	0
Queue Length 95th (ft)	191	149	31	76	41
Internal Link Dist (ft)	682		406		
Turn Bay Length (ft)		200			
Base Capacity (vph)	1209	1144	1325	354	398
Starvation Cap Reductn	0	0	152	0	0
Spillback Cap Reductn	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0
Reduced v/c Ratio	0.58	0.63	0.44	0.22	0.26

Intersection Summary

HCM Signalized Intersection Capacity Analysis

3: Route 92 & SB I-35 Ramps

11/4/2009

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	0	404	236	658	472	0	0	0	0	71	0	94
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
Lane Util. Factor		0.95		0.97		1.00				1.00		1.00
Frt		0.94		1.00		1.00				1.00		0.85
Flt Protected		1.00		0.95		1.00				0.95		1.00
Satd. Flow (prot)		3343		3433		1863				1770		1583
Flt Permitted		1.00		0.95		1.00				0.95		1.00
Satd. Flow (perm)		3343		3433		1863				1770		1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	439	257	715	513	0	0	0	0	77	0	102
RTOR Reduction (vph)	0	94	0	0	0	0	0	0	0	0	0	82
Lane Group Flow (vph)	0	602	0	715	513	0	0	0	0	77	0	20
Turn Type										custom		custom
Protected Phases		4		3		8						
Permitted Phases										6		6
Actuated Green, G (s)	30.0		30.0	64.0						18.0		18.0
Effective Green, g (s)	30.0		30.0	64.0						18.0		18.0
Actuated g/C Ratio	0.33		0.33	0.71						0.20		0.20
Clearance Time (s)	4.0		4.0	4.0						4.0		4.0
Vehicle Extension (s)	3.0		3.0	3.0						3.0		3.0
Lane Grp Cap (vph)	1114		1144	1325						354		317
v/s Ratio Prot	c0.18		c0.21	0.28								
v/s Ratio Perm										c0.04		0.01
v/c Ratio	0.54		0.62	0.39						0.22		0.06
Uniform Delay, d1	24.4		25.3	5.2						30.1		29.2
Progression Factor	1.00		0.52	0.27						1.00		1.00
Incremental Delay, d2	1.9		0.9	0.7						1.4		0.4
Delay (s)	26.3		14.2	2.2						31.5		29.6
Level of Service	C		B	A						C		C
Approach Delay (s)	26.3		9.2				0.0			30.4		
Approach LOS	C		A				A			C		

Intersection Summary

HCM Average Control Delay

16.6

HCM Level of Service

B

HCM Volume to Capacity ratio

0.50

Actuated Cycle Length (s)

90.0

Sum of lost time (s)

12.0

Intersection Capacity Utilization

51.4%

ICU Level of Service

A

Analysis Period (min)

15

c Critical Lane Group

Queues

6: Route 92 & NB I-35 Ramps

11/4/2009

Lane Group	EBL	EBT	WBT	NBL	NBR
Lane Group Flow (vph)	50	466	1211	74	165
v/c Ratio	0.16	0.36	0.55	0.20	0.36
Control Delay	2.5	2.4	8.1	30.9	7.4
Queue Delay	0.0	0.3	0.0	0.0	0.0
Total Delay	2.5	2.7	8.1	30.9	7.4
Queue Length 50th (ft)	1	50	128	35	0
Queue Length 95th (ft)	m2	24	167	72	50
Internal Link Dist (ft)		406	261		
Turn Bay Length (ft)					
Base Capacity (vph)	319	1304	2215	374	464
Starvation Cap Reductn	0	325	0	0	0
Spillback Cap Reductn	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0
Reduced v/c Ratio	0.16	0.48	0.55	0.20	0.36

Intersection Summary

m Volume for 95th percentile queue is metered by upstream signal.

HCM Signalized Intersection Capacity Analysis

6: Route 92 & NB I-35 Ramps

11/4/2009

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	46	429	0	0	1062	52	68	0	152	0	0	0
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			
Lane Util. Factor	1.00	1.00			0.95		1.00		1.00			
Frt	1.00	1.00			0.99		1.00		0.85			
Flt Protected	0.95	1.00			1.00		0.95		1.00			
Satd. Flow (prot)	1770	1863			3514		1770		1583			
Flt Permitted	0.16	1.00			1.00		0.95		1.00			
Satd. Flow (perm)	292	1863			3514		1770		1583			
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	50	466	0	0	1154	57	74	0	165	0	0	0
RTOR Reduction (vph)	0	0	0	0	4	0	0	0	130	0	0	0
Lane Group Flow (vph)	50	466	0	0	1208	0	74	0	35	0	0	0
Turn Type	pm+pt						custom		custom			
Protected Phases	7	4			8							
Permitted Phases	4						2		2			
Actuated Green, G (s)	63.0	63.0			55.0		19.0		19.0			
Effective Green, g (s)	63.0	63.0			55.0		19.0		19.0			
Actuated g/C Ratio	0.70	0.70			0.61		0.21		0.21			
Clearance Time (s)	4.0	4.0			4.0		4.0		4.0			
Vehicle Extension (s)	3.0	3.0			3.0		3.0		3.0			
Lane Grp Cap (vph)	270	1304			2147		374		334			
v/s Ratio Prot	0.01	c0.25			c0.34							
v/s Ratio Perm	0.12						c0.04		0.02			
v/c Ratio	0.19	0.36			0.56		0.20		0.10			
Uniform Delay, d1	6.5	5.4			10.4		29.2		28.6			
Progression Factor	0.35	0.32			0.69		1.00		1.00			
Incremental Delay, d2	0.3	0.7			1.0		1.2		0.6			
Delay (s)	2.5	2.4			8.2		30.4		29.3			
Level of Service	A	A			A		C		C			
Approach Delay (s)		2.4			8.2			29.6		0.0		
Approach LOS		A			A		C		A			

Intersection Summary

HCM Average Control Delay

9.3

HCM Level of Service

A

HCM Volume to Capacity ratio

0.47

Actuated Cycle Length (s)

90.0

Sum of lost time (s)

12.0

Intersection Capacity Utilization

51.4%

ICU Level of Service

A

Analysis Period (min)

15

c Critical Lane Group

Queues

10: Route 92 & Plate Clay Way

11/4/2009

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBT	SBR
Lane Group Flow (vph)	90	525	60	972	153	85	25	140
v/c Ratio	0.31	0.30	0.13	0.57	0.35	0.14	0.09	0.33
Control Delay	9.5	9.1	9.3	18.2	24.5	9.3	31.1	8.2
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	9.5	9.1	9.3	18.2	24.5	9.3	31.1	8.2
Queue Length 50th (ft)	14	45	14	204	63	9	12	0
Queue Length 95th (ft)	30	84	30	265	111	41	34	48
Internal Link Dist (ft)		580		999		606	578	
Turn Bay Length (ft)								
Base Capacity (vph)	291	1770	463	1719	439	595	291	418
Starvation Cap Reductn	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.31	0.30	0.13	0.57	0.35	0.14	0.09	0.33

Intersection Summary

HCM Signalized Intersection Capacity Analysis

10: Route 92 & Plate Clay Way

11/4/2009

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↑	↑↑	↑	↑	↑↑	↑	↑	↑	↑	↑	↑	↑
Volume (vph)	83	418	65	55	837	57	141	22	56	18	5	129
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	
Lane Util. Factor	1.00	0.95		1.00	0.95		1.00	1.00		1.00	1.00	
Frt	1.00	0.98		1.00	0.99		1.00	0.89		1.00	0.85	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.96	1.00	
Satd. Flow (prot)	1770	3467		1770	3505		1770	1662		1791	1583	
Flt Permitted	0.19	1.00		0.43	1.00		0.60	1.00		0.81	1.00	
Satd. Flow (perm)	351	3467		801	3505		1121	1662		1510	1583	
Peak-hour factor, PHF	0.92	0.92		0.92	0.92		0.92	0.92		0.92	0.92	
Adj. Flow (vph)	90	454		71	60		910	62		61	20	
RTOR Reduction (vph)	0	14		0	5		0	41		0	0	
Lane Group Flow (vph)	90	511		0	60		967	0	153	44	0	25
Turn Type	pm+pt			pm+pt			pm+pt			Perm		Perm
Protected Phases	7	4		3	8		5	2		6		6
Permitted Phases	4			8			2			6		6
Actuated Green, G (s)	49.6	44.8		46.4	43.2		30.0	30.0		17.3	17.3	
Effective Green, g (s)	49.6	44.8		46.4	43.2		30.0	30.0		17.3	17.3	
Actuated g/C Ratio	0.55	0.50		0.52	0.48		0.33	0.33		0.19	0.19	
Clearance Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	269	1726		447	1682		436	554		290	304	
v/s Ratio Prot	c0.02	0.15		0.00	c0.28		c0.03	0.03				
v/s Ratio Perm	0.17			0.06			c0.08			0.02	0.02	
v/c Ratio	0.33	0.30		0.13	0.57		0.35	0.08		0.09	0.09	
Uniform Delay, d1	11.3	13.3		11.0	16.8		22.0	20.5		29.9	29.9	
Progression Factor	0.79	0.68		1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	0.7	0.4		0.1	1.4		0.5	0.3		0.6	0.6	
Delay (s)	9.6	9.5		11.1	18.2		22.5	20.8		30.4	30.4	
Level of Service	A	A		B			C	C		C	C	
Approach Delay (s)		9.6			17.8			21.9		30.4		
Approach LOS		A			B			C		C		

Intersection Summary

HCM Average Control Delay

16.8

B

HCM Volume to Capacity ratio

0.50

Actuated Cycle Length (s)

90.0

16.0

Intersection Capacity Utilization

54.0%

A

Analysis Period (min)

15

c Critical Lane Group

HCM Unsignalized Intersection Capacity Analysis

12: Route 92 & McDonald's Drive

11/4/2009

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (veh/h)	61	520	988	92	27	126
Sign Control	Free	Free	Stop			
Grade	0%	0%	0%			
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	66	565	1074	100	29	137
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None	None				
Median storage veh)						
Upstream signal (ft)	341	800				
pX, platoon unblocked	0.85		0.85	0.85		
vC, conflicting volume	1174		1539	587		
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	846		1277	154		
tC, single (s)	4.1		6.8	6.9		
tC, 2 stage (s)						
tF (s)	2.2		3.5	3.3		
p0 queue free %	90		76	81		
cM capacity (veh/h)	667		121	733		
Direction, Lane #	EB 1	EB 2	EB 3	WB 1	WB 2	SB 1
Volume Total	66	283	283	716	458	29
Volume Left	66	0	0	0	0	29
Volume Right	0	0	0	100	0	137
cSH	667	1700	1700	1700	1700	121
Volume to Capacity	0.10	0.17	0.17	0.42	0.27	0.24
Queue Length 95th (ft)	8	0	0	0	22	17
Control Delay (s)	11.0	0.0	0.0	0.0	44.1	11.0
Lane LOS	B			E		B
Approach Delay (s)	1.2		0.0		16.9	
Approach LOS				C		
Intersection Summary						
Average Delay			1.8			
Intersection Capacity Utilization	47.0%		ICU Level of Service	A		
Analysis Period (min)	15					

HCM Unsignalized Intersection Capacity Analysis

14: Route 92 & Shell Drive

11/4/2009

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (veh/h)	61	520	988	92	27	126
Sign Control	Free	Free	Stop			
Grade	0%	0%	0%			
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	66	565	1074	100	29	137
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	660				
pX, platoon unblocked	0.82		0.82	0.82		
vC, conflicting volume	1174		1539	587		
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	760		1208	40		
tC, single (s)	4.1		6.8	6.9		
tC, 2 stage (s)						
tF (s)	2.2		3.5	3.3		
p0 queue free %	90		77	84		
cM capacity (veh/h)	691		129	833		
Direction, Lane #	EB 1	EB 2	EB 3	WB 1	WB 2	SB 1
Volume Total	66	283	283	716	458	29
Volume Left	66	0	0	0	0	29
Volume Right	0	0	0	100	0	137
cSH	691	1700	1700	1700	1700	129
Volume to Capacity	0.10	0.17	0.17	0.42	0.27	0.23
Queue Length 95th (ft)	8	0	0	0	0	21
Control Delay (s)	10.8	0.0	0.0	0.0	0.0	40.8
Lane LOS	B			E		B
Approach Delay (s)	1.1		0.0		15.6	
Approach LOS			C			
Intersection Summary						
Average Delay			1.7			
Intersection Capacity Utilization	47.0%		ICU Level of Service	A		
Analysis Period (min)	15					

Queues

3: Route 92 & SB I-35 Ramps

11/4/2009

Lane Group	EBT	WBL	WBT	SBL	SBR
Lane Group Flow (vph)	880	276	780	52	114
v/c Ratio	0.48	0.52	0.58	0.16	0.29
Control Delay	14.0	23.8	4.8	32.0	8.5
Queue Delay	0.0	0.0	0.4	0.0	0.0
Total Delay	14.0	23.8	5.1	32.0	8.5
Queue Length 50th (ft)	150	72	36	25	0
Queue Length 95th (ft)	198	m96	m79	57	44
Internal Link Dist (ft)	682		406		
Turn Bay Length (ft)		200			
Base Capacity (vph)	1818	534	1346	334	391
Starvation Cap Reductn	0	0	186	0	0
Spillback Cap Reductn	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0
Reduced v/c Ratio	0.48	0.52	0.67	0.16	0.29

Intersection Summary

m Volume for 95th percentile queue is metered by upstream signal.

HCM Signalized Intersection Capacity Analysis

3: Route 92 & SB I-35 Ramps

11/4/2009

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	0	655	155	254	718	0	0	0	0	48	0	105
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
Lane Util. Factor		0.95		0.97		1.00				1.00		1.00
Frt		0.97		1.00		1.00				1.00		0.85
Flt Protected		1.00		0.95		1.00				0.95		1.00
Satd. Flow (prot)		3438		3433		1863				1770		1583
Flt Permitted		1.00		0.95		1.00				0.95		1.00
Satd. Flow (perm)		3438		3433		1863				1770		1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	712	168	276	780	0	0	0	0	52	0	114
RTOR Reduction (vph)	0	23	0	0	0	0	0	0	0	0	0	92
Lane Group Flow (vph)	0	857	0	276	780	0	0	0	0	52	0	22
Turn Type										Prot	custom	custom
Protected Phases										4	3	8
Permitted Phases												6
Actuated Green, G (s)		47.0		14.0		65.0					17.0	17.0
Effective Green, g (s)		47.0		14.0		65.0					17.0	17.0
Actuated g/C Ratio		0.52		0.16		0.72					0.19	0.19
Clearance Time (s)		4.0		4.0		4.0					4.0	4.0
Vehicle Extension (s)		3.0		3.0		3.0					3.0	3.0
Lane Grp Cap (vph)		1795		534		1346					334	299
v/s Ratio Prot		0.25		0.08		c0.42						
v/s Ratio Perm											c0.03	0.01
v/c Ratio		0.48		0.52		0.58					0.16	0.07
Uniform Delay, d1		13.7		34.9		6.0					30.5	30.0
Progression Factor		1.00		0.61		0.56					1.00	1.00
Incremental Delay, d2		0.9		0.6		1.2					1.0	0.5
Delay (s)		14.6		21.8		4.6					31.5	30.5
Level of Service		B		C		A					C	C
Approach Delay (s)		14.6				9.1			0.0			30.8
Approach LOS		B				A			A			C

Intersection Summary

HCM Average Control Delay	13.1	HCM Level of Service	B
HCM Volume to Capacity ratio	0.49		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	81.5%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Queues

6: Route 92 & NB I-35 Ramps

11/4/2009

Lane Group	EBL	EBT	WBT	NBL	NBR
Lane Group Flow (vph)	146	618	888	304	788
v/c Ratio	0.66	0.81	0.87	0.34	0.91
Control Delay	38.0	20.9	32.4	15.0	33.2
Queue Delay	0.0	0.0	0.0	0.0	0.0
Total Delay	38.0	20.9	32.4	15.0	33.2
Queue Length 50th (ft)	30	93	141	100	331
Queue Length 95th (ft)	#105	#488	#330	157	#599
Internal Link Dist (ft)		406	261		
Turn Bay Length (ft)					
Base Capacity (vph)	220	766	1015	885	867
Starvation Cap Reductn	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0
Reduced v/c Ratio	0.66	0.81	0.87	0.34	0.91

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.

Queue shown is maximum after two cycles.

HCM Signalized Intersection Capacity Analysis

6: Route 92 & NB I-35 Ramps

11/4/2009

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	134	569	0	0	692	125	280	0	725	0	0	0
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			
Lane Util. Factor	1.00	1.00			0.95		1.00		1.00			
Frt	1.00	1.00			0.98		1.00		0.85			
Flt Protected	0.95	1.00			1.00		0.95		1.00			
Satd. Flow (prot)	1770	1863			3458		1770		1583			
Flt Permitted	0.13	1.00			1.00		0.95		1.00			
Satd. Flow (perm)	248	1863			3458		1770		1583			
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	146	618	0	0	752	136	304	0	788	0	0	0
RTOR Reduction (vph)	0	0	0	0	16	0	0	0	76	0	0	0
Lane Group Flow (vph)	146	618	0	0	872	0	304	0	713	0	0	0
Turn Type	pm+pt						custom		custom			
Protected Phases	7	4					8					
Permitted Phases	4							2	2			
Actuated Green, G (s)	37.0	37.0			26.0		45.0		45.0			
Effective Green, g (s)	37.0	37.0			26.0		45.0		45.0			
Actuated g/C Ratio	0.41	0.41			0.29		0.50		0.50			
Clearance Time (s)	4.0	4.0			4.0		4.0		4.0			
Vehicle Extension (s)	3.0	3.0			3.0		3.0		3.0			
Lane Grp Cap (vph)	220	766			999		885		792			
v/s Ratio Prot	0.05	c0.33			0.25							
v/s Ratio Perm	0.22						0.17		c0.45			
v/c Ratio	0.66	0.81			0.87		0.34		0.90			
Uniform Delay, d1	20.3	23.4			30.4		13.6		20.4			
Progression Factor	1.34	0.50			0.72		1.00		1.00			
Incremental Delay, d2	6.6	8.1			10.0		1.1		15.2			
Delay (s)	33.9	19.8			31.9		14.6		35.7			
Level of Service	C	B			C		B		D			
Approach Delay (s)		22.5			31.9			29.8		0.0		
Approach LOS		C			C		C		A			

Intersection Summary

HCM Average Control Delay

28.5

HCM Level of Service

C

HCM Volume to Capacity ratio

0.86

Actuated Cycle Length (s)

90.0

Sum of lost time (s)

8.0

Intersection Capacity Utilization

81.5%

ICU Level of Service

D

Analysis Period (min)

15

c Critical Lane Group

Queues

10: Route 92 & Plate Clay Way

11/4/2009

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBT	SBR
Lane Group Flow (vph)	195	1183	80	672	98	136	155	202
v/c Ratio	0.46	0.69	0.36	0.45	0.27	0.22	0.48	0.37
Control Delay	11.2	19.0	13.6	18.6	23.4	8.5	36.1	6.7
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	11.2	19.0	13.6	18.6	23.4	8.5	36.1	6.7
Queue Length 50th (ft)	46	270	19	133	39	14	78	0
Queue Length 95th (ft)	m59	m334	38	182	76	54	142	54
Internal Link Dist (ft)		580		999		606	578	
Turn Bay Length (ft)								
Base Capacity (vph)	437	1705	225	1505	364	619	326	540
Starvation Cap Reductn	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.45	0.69	0.36	0.45	0.27	0.22	0.48	0.37

Intersection Summary

m Volume for 95th percentile queue is metered by upstream signal.

HCM Signalized Intersection Capacity Analysis

10: Route 92 & Plate Clay Way

11/4/2009

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↑	↑↑	↑	↑	↑↑	↑	↑	↑	↑	↑	↑	↑
Volume (vph)	179	897	191	74	524	94	90	34	91	99	43	186
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	
Lane Util. Factor	1.00	0.95		1.00	0.95		1.00	1.00		1.00	1.00	
Frt	1.00	0.97		1.00	0.98		1.00	0.89		1.00	0.85	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.97	1.00	
Satd. Flow (prot)	1770	3446		1770	3459		1770	1659		1800	1583	
Flt Permitted	0.28	1.00		0.13	1.00		0.50	1.00		0.71	1.00	
Satd. Flow (perm)	515	3446		248	3459		924	1659		1331	1583	
Peak-hour factor, PHF	0.92	0.92		0.92	0.92		0.92	0.92		0.92	0.92	
Adj. Flow (vph)	195	975	208	80	570	102	98	37	99	108	47	202
RTOR Reduction (vph)	0	20	0	0	16	0	0	65	0	0	0	153
Lane Group Flow (vph)	195	1163	0	80	656	0	98	71	0	0	155	49
Turn Type	pm+pt			pm+pt			pm+pt			Perm		Perm
Protected Phases	7	4		3	8		5	2		6		6
Permitted Phases										6		6
Actuated Green, G (s)	51.2	42.4		42.8	38.0		30.8	30.8		22.0	22.0	
Effective Green, g (s)	51.2	42.4		42.8	38.0		30.8	30.8		22.0	22.0	
Actuated g/C Ratio	0.57	0.47		0.48	0.42		0.34	0.34		0.24	0.24	
Clearance Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	421	1623		199	1460		361	568		325	387	
v/s Ratio Prot	c0.05	c0.34		0.02	0.19		c0.01	0.04				
v/s Ratio Perm	0.22			0.17			0.08			c0.12	0.03	
v/c Ratio	0.46	0.72		0.40	0.45		0.27	0.12		0.48	0.13	
Uniform Delay, d1	10.6	19.0		14.9	18.5		20.9	20.3		29.1	26.5	
Progression Factor	1.00	0.98		1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	0.4	1.5		1.3	1.0		0.4	0.5		4.9	0.7	
Delay (s)	11.1	20.1		16.2	19.5		21.3	20.8		34.0	27.2	
Level of Service	B	C		B	B		C	C		C	C	
Approach Delay (s)		18.8			19.2			21.0		30.2		
Approach LOS		B			B			C		C		

Intersection Summary

HCM Average Control Delay	20.6	HCM Level of Service	C
HCM Volume to Capacity ratio	0.58		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	63.5%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

HCM Unsignalized Intersection Capacity Analysis

12: Route 92 & McDonald's Drive

11/4/2009

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (veh/h)	87	1207	744	49	35	73
Sign Control	Free	Free	Stop			
Grade	0%	0%	0%			
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	95	1312	809	53	38	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)	341	800				
pX, platoon unblocked	0.92		0.92	0.92		
vC, conflicting volume	862		1680	431		
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	672		1563	203		
tC, single (s)	4.1		6.8	6.9		
tC, 2 stage (s)						
tF (s)	2.2		3.5	3.3		
p0 queue free %	89		54	89		
cM capacity (veh/h)	840		83	739		
Direction, Lane #	EB 1	EB 2	EB 3	WB 1	WB 2	SB 1
Volume Total	95	656	656	539	323	38
Volume Left	95	0	0	0	0	38
Volume Right	0	0	0	0	53	0
cSH	840	1700	1700	1700	1700	83
Volume to Capacity	0.11	0.39	0.39	0.32	0.19	0.46
Queue Length 95th (ft)	9	0	0	0	0	47
Control Delay (s)	9.8	0.0	0.0	0.0	0.0	80.1
Lane LOS	A			F		B
Approach Delay (s)	0.7		0.0		33.0	
Approach LOS				D		
Intersection Summary						
Average Delay		2.0				
Intersection Capacity Utilization	43.4%		ICU Level of Service	A		
Analysis Period (min)	15					

HCM Unsignalized Intersection Capacity Analysis

14: Route 92 & Shell Drive

11/4/2009

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (veh/h)	2	1240	774	26	27	19
Sign Control	Free	Free	Stop			
Grade	0%	0%	0%			
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	2	1348	841	28	29	21
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	660				
pX, platoon unblocked	0.90		0.90	0.90		
vC, conflicting volume	870		1534	435		
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	633		1371	150		
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		76	97		
cM capacity (veh/h)	851		123	783		
Direction, Lane #	EB 1	EB 2	EB 3	WB 1	WB 2	SB 1
Volume Total	2	674	674	561	309	29
Volume Left	2	0	0	0	0	29
Volume Right	0	0	0	0	28	0
cSH	851	1700	1700	1700	1700	123
Volume to Capacity	0.00	0.40	0.40	0.33	0.18	0.24
Queue Length 95th (ft)	0	0	0	0	0	22
Control Delay (s)	9.2	0.0	0.0	0.0	0.0	43.1
Lane LOS	A			F		B
Approach Delay (s)	0.0		0.0		29.3	
Approach LOS				D		
Intersection Summary						
Average Delay		0.7				
Intersection Capacity Utilization	44.3%		ICU Level of Service	A		
Analysis Period (min)	15					

Queues

3: Route 92 & SB I-35 Ramps

11/4/2009

Lane Group	EBT	WBL	WBT	SBL	SBR
Lane Group Flow (vph)	731	737	535	91	102
v/c Ratio	0.57	0.63	0.39	0.29	0.28
Control Delay	23.6	17.0	1.9	38.3	9.4
Queue Delay	0.0	0.0	0.1	0.0	0.0
Total Delay	23.6	17.0	2.1	38.3	9.4
Queue Length 50th (ft)	164	113	23	51	0
Queue Length 95th (ft)	223	163	30	97	44
Internal Link Dist (ft)	682		406		
Turn Bay Length (ft)		200			
Base Capacity (vph)	1279	1167	1379	319	369
Starvation Cap Reductn	0	0	180	0	0
Spillback Cap Reductn	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0
Reduced v/c Ratio	0.57	0.63	0.45	0.29	0.28

Intersection Summary

HCM Signalized Intersection Capacity Analysis

3: Route 92 & SB I-35 Ramps

11/4/2009

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	0	436	236	678	492	0	0	0	0	84	0	94
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
Lane Util. Factor		0.95		0.97		1.00				1.00		1.00
Frt		0.95		1.00		1.00				1.00		0.85
Flt Protected		1.00		0.95		1.00				0.95		1.00
Satd. Flow (prot)		3353		3433		1863				1770		1583
Flt Permitted		1.00		0.95		1.00				0.95		1.00
Satd. Flow (perm)		3353		3433		1863				1770		1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	474	257	737	535	0	0	0	0	91	0	102
RTOR Reduction (vph)	0	72	0	0	0	0	0	0	0	0	0	84
Lane Group Flow (vph)	0	659	0	737	535	0	0	0	0	91	0	18
Turn Type										custom		custom
Protected Phases		4		3		8						
Permitted Phases										6		6
Actuated Green, G (s)	36.0		34.0	74.0						18.0		18.0
Effective Green, g (s)	36.0		34.0	74.0						18.0		18.0
Actuated g/C Ratio	0.36		0.34	0.74						0.18		0.18
Clearance Time (s)	4.0		4.0	4.0						4.0		4.0
Vehicle Extension (s)	3.0		3.0	3.0						3.0		3.0
Lane Grp Cap (vph)	1207		1167	1379						319		285
v/s Ratio Prot	c0.20		c0.21	0.29								
v/s Ratio Perm										c0.05		0.01
v/c Ratio	0.55		0.63	0.39						0.29		0.06
Uniform Delay, d1	25.5		27.7	4.7						35.4		34.0
Progression Factor	1.00		0.53	0.25						1.00		1.00
Incremental Delay, d2	1.8		1.0	0.7						2.2		0.4
Delay (s)	27.3		15.5	1.9						37.7		34.4
Level of Service	C		B	A						D		C
Approach Delay (s)	27.3			9.8				0.0		36.0		
Approach LOS	C			A				A		D		
Intersection Summary												
HCM Average Control Delay		17.9			HCM Level of Service					B		
HCM Volume to Capacity ratio		0.53										
Actuated Cycle Length (s)		100.0			Sum of lost time (s)					12.0		
Intersection Capacity Utilization		53.6%			ICU Level of Service					A		
Analysis Period (min)		15										
c Critical Lane Group												

Queues

6: Route 92 & NB I-35 Ramps

11/4/2009

Lane Group	EBL	EBT	WBT	NBL	NBR
Lane Group Flow (vph)	50	515	1264	74	200
v/c Ratio	0.16	0.37	0.55	0.23	0.30
Control Delay	1.8	2.1	8.1	37.4	6.5
Queue Delay	0.0	0.3	0.0	0.0	0.0
Total Delay	1.8	2.4	8.1	37.4	6.5
Queue Length 50th (ft)	1	10	151	41	0
Queue Length 95th (ft)	m1	15	183	82	32
Internal Link Dist (ft)		406	261		
Turn Bay Length (ft)					
Base Capacity (vph)	316	1379	2309	319	666
Starvation Cap Reductn	0	350	0	0	0
Spillback Cap Reductn	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0
Reduced v/c Ratio	0.16	0.50	0.55	0.23	0.30

Intersection Summary

m Volume for 95th percentile queue is metered by upstream signal.

HCM Signalized Intersection Capacity Analysis

6: Route 92 & NB I-35 Ramps

11/4/2009

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↑	↑	↑	↑↑	↑↑	↑↑	↑	↑↑	↑↑	↑↑	↑↑	↑↑
Volume (vph)	46	474	0	0	1103	60	68	0	184	0	0	0
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			
Lane Util. Factor	1.00	1.00			0.95		1.00		0.88			
Frt	1.00	1.00			0.99		1.00		0.85			
Flt Protected	0.95	1.00			1.00		0.95		1.00			
Satd. Flow (prot)	1770	1863			3512		1770		2787			
Flt Permitted	0.15	1.00			1.00		0.95		1.00			
Satd. Flow (perm)	288	1863			3512		1770		2787			
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	50	515	0	0	1199	65	74	0	200	0	0	0
RTOR Reduction (vph)	0	0	0	0	4	0	0	0	164	0	0	0
Lane Group Flow (vph)	50	515	0	0	1260	0	74	0	36	0	0	0
Turn Type	pm+pt						custom		custom			
Protected Phases	7	4					8					
Permitted Phases	4							2	2			
Actuated Green, G (s)	74.0	74.0			64.9		18.0		18.0			
Effective Green, g (s)	74.0	74.0			64.9		18.0		18.0			
Actuated g/C Ratio	0.74	0.74			0.65		0.18		0.18			
Clearance Time (s)	4.0	4.0			4.0		4.0		4.0			
Vehicle Extension (s)	3.0	3.0			3.0		3.0		3.0			
Lane Grp Cap (vph)	289	1379			2279		319		502			
v/s Ratio Prot	0.01	c0.28			c0.36							
v/s Ratio Perm	0.12						c0.04		0.01			
v/c Ratio	0.17	0.37			0.55		0.23		0.07			
Uniform Delay, d1	5.9	4.7			9.6		35.1		34.1			
Progression Factor	0.23	0.30			0.75		1.00		1.00			
Incremental Delay, d2	0.2	0.7			0.9		1.7		0.3			
Delay (s)	1.6	2.1			8.0		36.8		34.3			
Level of Service	A	A			A		D		C			
Approach Delay (s)		2.0			8.0			35.0		0.0		
Approach LOS		A			A			C		A		

Intersection Summary

HCM Average Control Delay 9.9 HCM Level of Service A

HCM Volume to Capacity ratio 0.48

Actuated Cycle Length (s) 100.0 Sum of lost time (s) 12.0

Intersection Capacity Utilization 53.6% ICU Level of Service A

Analysis Period (min) 15

c Critical Lane Group

Queues

10: Route 92 & Plate Clay Way

11/4/2009

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	NBR	SBT	SBR
Lane Group Flow (vph)	95	540	74	992	116	119	74	32	147
v/c Ratio	0.35	0.31	0.17	0.63	0.43	0.44	0.23	0.11	0.29
Control Delay	11.7	8.5	11.5	23.5	43.6	43.6	10.9	37.1	12.0
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	11.7	8.5	11.5	23.5	43.6	43.6	10.9	37.1	12.0
Queue Length 50th (ft)	14	45	20	250	71	72	0	18	22
Queue Length 95th (ft)	43	73	41	319	129	132	39	45	70
Internal Link Dist (ft)		580		999		418		578	
Turn Bay Length (ft)									
Base Capacity (vph)	279	1732	434	1569	269	273	315	289	516
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	0.31	0.17	0.63	0.43	0.44	0.23	0.11	0.28

Intersection Summary

HCM Signalized Intersection Capacity Analysis

10: Route 92 & Plate Clay Way

11/4/2009

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↑	↑↑	↑	↑	↑↑	↑	↑	↑	↑	↑	↑	↑
Volume (vph)	87	426	71	68	856	57	190	26	68	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	4.0	4.0	4.0
Lane Util. Factor	1.00	0.95	1.00	0.95	0.95	0.95	0.95	1.00	1.00	0.85	1.00	1.00
Frt	1.00	0.98	1.00	0.99	1.00	1.00	1.00	1.00	1.00	1.00	0.85	1.00
Flt Protected	0.95	1.00	0.95	1.00	0.95	0.96	1.00	0.95	1.00	0.97	1.00	1.00
Satd. Flow (prot)	1770	3464	1770	3506	1681	1704	1583	1806	1583			
Flt Permitted	0.15	1.00	0.44	1.00	0.95	0.96	1.00	0.95	1.00	0.97	1.00	1.00
Satd. Flow (perm)	288	3464	813	3506	1681	1704	1583	1806	1583			
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	95	463	77	74	930	62	207	28	74	20	12	147
RTOR Reduction (vph)	0	13	0	0	5	0	0	0	62	0	0	77
Lane Group Flow (vph)	95	527	0	74	987	0	116	119	12	0	32	70
Turn Type	pm+pt		pm+pt				Split		Perm	Split		pm+ov
Protected Phases	7	4		3	8		2	2		6	6	7
Permitted Phases					8					2		6
Actuated Green, G (s)	56.0	48.8		47.8	44.6		16.0	16.0	16.0	16.0	16.0	23.4
Effective Green, g (s)	56.0	48.8		47.8	44.6		16.0	16.0	16.0	16.0	16.0	23.4
Actuated g/C Ratio	0.56	0.49		0.48	0.45		0.16	0.16	0.16	0.16	0.16	0.23
Clearance Time (s)	4.0	4.0		4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	271	1690		419	1564		269	273	253		289	434
v/s Ratio Prot	c0.03	0.15		0.01	c0.28		0.07	c0.07		0.02	c0.01	
v/s Ratio Perm	0.17			0.08						0.01		0.03
v/c Ratio	0.35	0.31		0.18	0.63		0.43	0.44	0.05	0.11	0.16	
Uniform Delay, d1	13.3	15.5		14.2	21.4		37.9	37.9	35.5		35.9	30.5
Progression Factor	0.79	0.55		1.00	1.00		1.00	1.00	1.00		1.00	1.00
Incremental Delay, d2	0.8	0.5		0.2	1.9		5.0	5.0	0.3	0.8	0.2	
Delay (s)	11.3	8.9		14.4	23.3		42.9	42.9	35.9		36.7	30.7
Level of Service	B	A		B	C		D	D	D	D	C	
Approach Delay (s)		9.3			22.7			41.2		31.7		
Approach LOS		A			C			D		C		

Intersection Summary

HCM Average Control Delay

HCM Volume to Capacity ratio

Actuated Cycle Length (s)

Intersection Capacity Utilization

Analysis Period (min)

c Critical Lane Group

HCM Unsignalized Intersection Capacity Analysis

12: Route 92 & McDonald's Drive

11/4/2009

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (veh/h)	61	597	1037	92	27	126
Sign Control	Free	Free		Stop		
Grade	0%	0%		0%		
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	66	649	1127	100	29	137
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None	None				
Median storage veh)						
Upstream signal (ft)	341	800				
pX, platoon unblocked	0.80		0.80	0.80		
vC, conflicting volume	1227		1634	614		
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	793		1300	30		
tC, single (s)	4.1		6.8	6.9		
tC, 2 stage (s)						
tF (s)	2.2		3.5	3.3		
p0 queue free %	90		73	84		
cM capacity (veh/h)	662		110	834		
Direction, Lane #	EB 1	EB 2	EB 3	WB 1	WB 2	SB 1
Volume Total	66	324	324	751	476	29
Volume Left	66	0	0	0	0	29
Volume Right	0	0	0	100	0	137
cSH	662	1700	1700	1700	1700	110
Volume to Capacity	0.10	0.19	0.19	0.44	0.28	0.27
Queue Length 95th (ft)	8	0	0	0	0	25
Control Delay (s)	11.0	0.0	0.0	0.0	0.0	49.0
Lane LOS	B			E		B
Approach Delay (s)	1.0		0.0		17.0	
Approach LOS				C		
Intersection Summary						
Average Delay			1.7			
Intersection Capacity Utilization	48.3%		ICU Level of Service	A		
Analysis Period (min)	15					

HCM Unsignalized Intersection Capacity Analysis

14: Route 92 & Shell Drive

11/4/2009

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	2	551	70	26	1114	42	0	0	12	21	0	15
Sign Control	Free				Free		Stop			Stop		
Grade	0%				0%		0%			0%		
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	2	599	76	28	1211	46	0	0	13	23	0	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)		481			660							
pX, platoon unblocked	0.79					0.79	0.79		0.79	0.79	0.79	0.79
vC, conflicting volume	1257			675		1282	1916	299	1607	1970	628	
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	801			675		833	1633	299	1243	1700	9	
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		100	100	98	77	100	98	
cM capacity (veh/h)	649			912		198	77	697	99	70	849	
Direction, Lane #	EB 1	EB 2	EB 3	EB 4	WB 1	WB 2	WB 3	NB 1	SB 1	SB 2		
Volume Total	2	299	299	76	28	807	449	13	23	16		
Volume Left	2	0	0	0	28	0	0	0	23	0		
Volume Right	0	0	0	76	0	0	46	13	0	16		
cSH	649	1700	1700	1700	912	1700	697	99	849			
Volume to Capacity	0.00	0.18	0.18	0.04	0.03	0.47	0.26	0.02	0.23	0.02		
Queue Length 95th (ft)	0	0	0	0	2	0	0	1	21	1		
Control Delay (s)	10.6	0.0	0.0	0.0	9.1	0.0	0.0	10.3	51.9	9.3		
Lane LOS	B				A			B	F	A		
Approach Delay (s)	0.0				0.2			10.3	34.2			
Approach LOS								B	D			
Intersection Summary												
Average Delay			0.9									
Intersection Capacity Utilization	42.1%		ICU Level of Service	A								
Analysis Period (min)	15											

HCM Unsignalized Intersection Capacity Analysis
17: Development Drive & Regency Drive

11/4/2009

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Volume (veh/h)	66	4	125	26	6	219
Sign Control	Free		Free	Stop		
Grade	0%		0%	0%		
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	72	4	136	28	7	238
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None		None			
Median storage veh)						
Upstream signal (ft)			498			
pX, platoon unblocked						
VC, conflicting volume		76		374		74
VC1, stage 1 conf vol						
VC2, stage 2 conf vol						
VCu, unblocked vol		76		374		74
tC, single (s)		4.1		6.4		6.2
tC, 2 stage (s)						
tF (s)		2.2		3.5		3.3
p0 queue free %		91		99		76
cM capacity (veh/h)		1523		571		988
Direction, Lane #	EB 1	WB 1	WB 2	NB 1	NB 2	
Volume Total	76	136	28	7	238	
Volume Left	0	136	0	7	0	
Volume Right	4	0	0	0	238	
cSH	1700	1523	1700	571	988	
Volume to Capacity	0.04	0.09	0.02	0.01	0.24	
Queue Length 95th (ft)	0	7	0	1	24	
Control Delay (s)	0.0	7.6	0.0	11.4	9.8	
Lane LOS	A		B	A		
Approach Delay (s)	0.0	6.3		9.8		
Approach LOS				A		
Intersection Summary						
Average Delay		7.1				
Intersection Capacity Utilization		23.9%		ICU Level of Service		A
Analysis Period (min)		15				

HCM Unsignalized Intersection Capacity Analysis
18: Development Drive &

11/4/2009

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Right Turn Channelized												
Volume (veh/h)	10	33	10	19	13	10	10	10	37	10	45	51
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	11	36	11	21	14	11	11	11	40	11	49	55
Approach Volume (veh/h)												
Crossing Volume (veh/h)	58				46				62			115
High Capacity (veh/h)	80				33				58			46
High v/c (veh/h)	1300				1350				1324			1336
Low Capacity (veh/h)	0.04				0.03				0.05			0.09
Low v/c (veh/h)	1085				1130				1106			1117
Intersection Summary												
Maximum v/c High									0.09			
Maximum v/c Low									0.10			
Intersection Capacity Utilization								18.5%		ICU Level of Service		A

Queues

3: Route 92 & SB I-35 Ramps

11/4/2009

Lane Group	EBT	WBL	WBT	SBL	SBR
Lane Group Flow (vph)	960	361	865	84	114
v/c Ratio	0.55	0.56	0.63	0.27	0.30
Control Delay	16.3	27.7	3.8	34.6	8.9
Queue Delay	0.0	0.0	0.5	0.0	0.0
Total Delay	16.3	27.7	4.3	34.6	8.9
Queue Length 50th (ft)	180	92	29	42	0
Queue Length 95th (ft)	237	141	76	84	45
Internal Link Dist (ft)	682		406		
Turn Bay Length (ft)		200			
Base Capacity (vph)	1744	648	1366	315	375
Starvation Cap Reductn	0	0	172	0	0
Spillback Cap Reductn	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0
Reduced v/c Ratio	0.55	0.56	0.72	0.27	0.30

Intersection Summary

HCM Signalized Intersection Capacity Analysis

3: Route 92 & SB I-35 Ramps

11/4/2009

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vphpl)	0	729	155	332	796	0	0	0	0	77	0	105
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
Lane Util. Factor	0.95		0.97	1.00						1.00		1.00
Frt	0.97		1.00	1.00						1.00		0.85
Flt Protected	1.00		0.95	1.00						0.95		1.00
Satd. Flow (prot)	3446		3433	1863						1770		1583
Flt Permitted	1.00		0.95	1.00						0.95		1.00
Satd. Flow (perm)	3446		3433	1863						1770		1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	792	168	361	865	0	0	0	0	84	0	114
RTOR Reduction (vph)	0	20	0	0	0	0	0	0	0	0	0	94
Lane Group Flow (vph)	0	940	0	361	865	0	0	0	0	84	0	20
Turn Type										Prot	custom	custom
Protected Phases		4		3	8							
Permitted Phases										6	6	
Actuated Green, G (s)	45.0		17.0	66.0						16.0	16.0	
Effective Green, g (s)	45.0		17.0	66.0						16.0	16.0	
Actuated g/C Ratio	0.50		0.19	0.73						0.18	0.18	
Clearance Time (s)	4.0		4.0	4.0						4.0	4.0	
Vehicle Extension (s)	3.0		3.0	3.0						3.0	3.0	
Lane Grp Cap (vph)	1723		648	1366						315	281	
v/s Ratio Prot	0.27		0.11	c0.46								
v/s Ratio Perm										c0.05	0.01	
v/c Ratio	0.55		0.56	0.63						0.27	0.07	
Uniform Delay, d1	15.5		33.1	6.0						31.9	30.8	
Progression Factor	1.00		0.75	0.33						1.00	1.00	
Incremental Delay, d2	1.2		0.8	1.7						2.1	0.5	
Delay (s)	16.7		25.6	3.7						34.0	31.3	
Level of Service	B		C	A						C	C	
Approach Delay (s)	16.7			10.1				0.0			32.5	
Approach LOS	B			B				A			C	
Intersection Summary												
HCM Average Control Delay			14.6							B		
HCM Volume to Capacity ratio			0.56									
Actuated Cycle Length (s)			90.0							8.0		
Intersection Capacity Utilization			70.0%							C		
Analysis Period (min)			15									
c Critical Lane Group												

Queues

6: Route 92 & NB I-35 Ramps

11/4/2009

Lane Group	EBL	EBT	WBT	NBL	NBR
Lane Group Flow (vph)	146	730	1092	304	868
v/c Ratio	0.53	0.68	0.71	0.52	0.74
Control Delay	29.3	11.1	14.6	27.9	19.2
Queue Delay	0.0	0.0	0.0	0.0	0.0
Total Delay	29.3	11.1	14.6	27.9	19.2
Queue Length 50th (ft)	35	71	210	138	142
Queue Length 95th (ft)	91	138	270	218	222
Internal Link Dist (ft)	406	261			
Turn Bay Length (ft)					
Base Capacity (vph)	299	1076	1529	590	1174
Starvation Cap Reductn	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0
Reduced v/c Ratio	0.49	0.68	0.71	0.52	0.74

Intersection Summary

HCM Signalized Intersection Capacity Analysis

6: Route 92 & NB I-35 Ramps

11/4/2009

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	134	672	0	0	848	156	280	0	799	0	0	0
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			
Lane Util. Factor	1.00	1.00			0.95		1.00		0.88			
Frt	1.00	1.00			0.98		1.00		0.85			
Flt Protected	0.95	1.00			1.00		0.95		1.00			
Satd. Flow (prot)	1770	1863			3457		1770		2787			
Flt Permitted	0.12	1.00			1.00		0.95		1.00			
Satd. Flow (perm)	221	1863			3457		1770		2787			
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	146	730	0	0	922	170	304	0	868	0	0	0
RTOR Reduction (vph)	0	0	0	0	16	0	0	0	245	0	0	0
Lane Group Flow (vph)	146	730	0	0	1076	0	304	0	623	0	0	0
Turn Type	pm+pt						custom		custom			
Protected Phases	7	4			8							
Permitted Phases	4						2		2			
Actuated Green, G (s)	52.0	52.0			39.4		30.0		30.0			
Effective Green, g (s)	52.0	52.0			39.4		30.0		30.0			
Actuated g/C Ratio	0.58	0.58			0.44		0.33		0.33			
Clearance Time (s)	4.0	4.0			4.0		4.0		4.0			
Vehicle Extension (s)	3.0	3.0			3.0		3.0		3.0			
Lane Grp Cap (vph)	276	1076			1513		590		929			
v/s Ratio Prot	0.05	c0.39			0.31							
v/s Ratio Perm	0.26						0.17		c0.22			
v/c Ratio	0.53	0.68			0.71		0.52		0.67			
Uniform Delay, d1	13.2	13.2			20.7		24.1		25.8			
Progression Factor	2.34	0.59			0.58		1.00		1.00			
Incremental Delay, d2	1.6	3.0			2.4		3.2		3.8			
Delay (s)	32.5	10.8			14.5		27.3		29.6			
Level of Service	C	B			B		C		C			
Approach Delay (s)		14.4			14.5			29.0		0.0		
Approach LOS		B			B		C		A			

Intersection Summary

HCM Average Control Delay

19.9

HCM Level of Service

B

HCM Volume to Capacity ratio

0.68

Actuated Cycle Length (s)

90.0

Sum of lost time (s)

8.0

Intersection Capacity Utilization

70.0%

ICU Level of Service

C

Analysis Period (min)

15

c Critical Lane Group

Queues

10: Route 92 & Plate Clay Way

11/4/2009

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	NBR	SBT	SBR
Lane Group Flow (vph)	212	1215	148	684	230	234	167	178	218
v/c Ratio	0.56	0.89	0.67	0.57	0.77	0.40	0.55	0.36	
Control Delay	14.5	29.3	32.5	26.1	53.9	54.0	8.6	41.1	15.4
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Total Delay	14.5	29.3	32.5	26.1	53.9	54.0	8.6	41.1	15.4
Queue Length 50th (ft)	50	288	43	160	132	134	0	93	57
Queue Length 95th (ft)	m81	#453	#123	227	#251	#254	53	160	110
Internal Link Dist (ft)		580		999		418		578	
Turn Bay Length (ft)									
Base Capacity (vph)	424	1359	220	1198	299	303	419	322	645
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	0.89	0.67	0.57	0.77	0.77	0.40	0.55	0.34

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.

Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.

HCM Signalized Intersection Capacity Analysis

10: Route 92 & Plate Clay Way

11/4/2009

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	195	912	206	136	535	94	377	50	154	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	1.00
Frt	1.00	0.97		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	3441		1770	3460		1681	1704	1583	1808	1583	
Flt Permitted	0.23	1.00		0.13	1.00		0.95	0.96	1.00	0.97	1.00	
Satd. Flow (perm)	419	3441		242	3460		1681	1704	1583	1808	1583	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	212	991	224	148	582	102	410	54	167	108	70	218
RTOR Reduction (vph)	0	21	0	0	15	0	0	0	137	0	0	53
Lane Group Flow (vph)	212	1194	0	148	669	0	230	234	30	0	178	165
Turn Type	pm+pt			pm+pt			Split		Perm	Split		pm+ov
Protected Phases	7	4		3	8		2	2	6	6	6	7
Permitted Phases					8				2			6
Actuated Green, G (s)	46.0	35.0		37.8	30.8		16.0	16.0	16.0	16.0	16.0	27.2
Effective Green, g (s)	46.0	35.0		37.8	30.8		16.0	16.0	16.0	16.0	16.0	27.2
Actuated g/C Ratio	0.51	0.39		0.42	0.34		0.18	0.18	0.18	0.18	0.18	0.30
Clearance Time (s)	4.0	4.0		4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	382	1338		220	1184		299	303	281	321	349	
v/s Ratio Prot	c0.07	c0.35		0.05	0.19		0.14	c0.14		c0.10	c0.04	
v/s Ratio Perm	0.21			0.23					0.02		0.07	
v/c Ratio	0.55	0.89		0.67	0.56		0.77	0.77	0.11	0.55	0.30	
Uniform Delay, d1	13.9	25.7		19.8	24.1		35.2	35.3	31.0	33.7	24.1	
Progression Factor	0.80	0.84		1.00	1.00		1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	1.3	7.4		7.9	2.0		17.2	17.2	0.8	6.8	0.3	
Delay (s)	12.5	29.0		27.7	26.1		52.5	52.5	31.8	40.5	24.4	
Level of Service	B	C		C	C		D	D	C	D	C	
Approach Delay (s)		26.5			26.4			47.0		31.6		
Approach LOS		C			C			D		C		

Intersection Summary

HCM Average Control Delay

31.0

HCM Level of Service

C

HCM Volume to Capacity ratio

0.74

Sum of lost time (s)

12.0

Intersection Capacity Utilization

67.7%

ICU Level of Service

C

Analysis Period (min)

15

c Critical Lane Group

HCM Unsignalized Intersection Capacity Analysis

12: Route 92 & McDonald's Drive

11/4/2009

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (veh/h)	87	1383	931	49	35	73
Sign Control	Free	Free		Stop		
Grade	0%	0%		0%		
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	95	1503	1012	53	38	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)	341	800				
pX, platoon unblocked	0.92		0.92	0.92		
vC, conflicting volume	1065		1979	533		
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	903		1894	326		
tC, single (s)	4.1		6.8	6.9		
tC, 2 stage (s)						
tF (s)	2.2		3.5	3.3		
p0 queue free %	86		22	87		
cM capacity (veh/h)	691		49	618		
Direction, Lane #	EB 1	EB 2	EB 3	WB 1	WB 2	SB 1
Volume Total	95	752	752	675	391	38
Volume Left	95	0	0	0	0	38
Volume Right	0	0	0	0	53	0
cSH	691	1700	1700	1700	1700	49
Volume to Capacity	0.14	0.44	0.44	0.40	0.23	0.78
Queue Length 95th (ft)	12	0	0	0	0	79
Control Delay (s)	11.0	0.0	0.0	0.0	196.3	11.7
Lane LOS	B			F		B
Approach Delay (s)	0.7		0.0		71.5	
Approach LOS				F		
Intersection Summary						
Average Delay			3.4			
Intersection Capacity Utilization	48.2%		ICU Level of Service	A		
Analysis Period (min)	15					

HCM Unsignalized Intersection Capacity Analysis

14: Route 92 & Shell Drive

11/4/2009

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	2	1206	211	126	961	26	0	0	80	27	0	19
Sign Control	Free				Free				Stop			Stop
Grade	0%				0%				0%			0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	2	1311	229	137	1045	28	0	0	87	29	0	21
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			660							
pX, platoon unblocked	0.90						0.90	0.90		0.90	0.90	0.90
vC, conflicting volume	1073			1540			2132	2662	655	2079	2877	536
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	859			1540			2036	2624	655	1977	2864	263
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			68			100	100	79	0	100	97
cM capacity (veh/h)	700			427			22	14	408	20	10	662
Direction, Lane #	EB 1	EB 2	EB 3	EB 4	WB 1	WB 2	WB 3	NB 1	SB 1	SB 2		
Volume Total	2	655	655	229	137	696	376	87	29	21		
Volume Left	2	0	0	0	137	0	0	0	29	0		
Volume Right	0	0	0	229	0	0	28	87	0	21		
cSH	700	1700	1700	1700	427	1700	1700	408	20	662		
Volume to Capacity	0.00	0.39	0.39	0.13	0.32	0.41	0.22	0.21	1.50	0.03		
Queue Length 95th (ft)	0	0	0	0	34	0	0	20	100	2		
Control Delay (s)	10.2	0.0	0.0	0.0	17.3	0.0	0.0	16.2	672.9	10.6		
Lane LOS	B				C			C	F	B		
Approach Delay (s)	0.0				2.0			16.2	399.3		C	F
Approach LOS												
Intersection Summary												
Average Delay			8.2									
Intersection Capacity Utilization	53.7%		ICU Level of Service	A								
Analysis Period (min)	15											

HCM Unsignalized Intersection Capacity Analysis

17: Development Drive & Regency Drive

11/4/2009

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Volume (veh/h)	366	16	314	92	15	215
Sign Control	Free		Free	Stop		
Grade	0%		0%	0%		
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	398	17	341	100	16	234
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None		None			
Median storage veh)						
Upstream signal (ft)			498			
pX, platoon unblocked						
VC, conflicting volume		415		1189		407
VC1, stage 1 conf vol						
VC2, stage 2 conf vol						
VCu, unblocked vol		415		1189		407
tC, single (s)		4.1		6.4		6.2
tC, 2 stage (s)						
tF (s)		2.2		3.5		3.3
p0 queue free %		70		89		64
cM capacity (veh/h)		1144		146		644
Direction, Lane #	EB 1	WB 1	WB 2	NB 1	NB 2	
Volume Total	415	341	100	16	234	
Volume Left	0	341	0	16	0	
Volume Right	17	0	0	0	234	
cSH	1700	1144	1700	146	644	
Volume to Capacity	0.24	0.30	0.06	0.11	0.36	
Queue Length 95th (ft)	0	32	0	9	41	
Control Delay (s)	0.0	9.5	0.0	32.8	13.7	
Lane LOS	A		D	B		
Approach Delay (s)	0.0	7.3		15.0		
Approach LOS			B			
Intersection Summary						
Average Delay		6.3				
Intersection Capacity Utilization		51.0%		ICU Level of Service		A
Analysis Period (min)		15				

HCM Unsignalized Intersection Capacity Analysis

18: Development Drive &

11/4/2009

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Right Turn Channelized												
Volume (veh/h)	48	183	10	60	46	10	10	32	199	10	161	176
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	52	199	11	65	50	11	11	35	216	11	175	191
Approach Volume (veh/h)		262			126			262			377	
Crossing Volume (veh/h)		251			98			262			126	
High Capacity (veh/h)		1137			1283			1128			1255	
High v/c (veh/h)		0.23			0.10			0.23			0.30	
Low Capacity (veh/h)		937			1069			928			1043	
Low v/c (veh/h)		0.28			0.12			0.28			0.36	
Intersection Summary												
Maximum v/c High								0.30				
Maximum v/c Low								0.36				
Intersection Capacity Utilization					43.9%			ICU Level of Service			A	

Queues

3: Route 92 & SB I-35 Ramps

11/4/2009

Lane Group	EBT	EBR	WBL	WBT	SBL	SBR
Lane Group Flow (vph)	535	575	821	959	121	162
v/c Ratio	0.35	0.65	0.75	0.35	0.47	0.44
Control Delay	22.1	12.3	28.7	0.9	49.9	10.6
Queue Delay	0.0	0.0	0.2	0.2	0.0	0.0
Total Delay	22.1	12.3	28.9	1.1	49.9	10.6
Queue Length 50th (ft)	131	107	252	7	79	0
Queue Length 95th (ft)	174	231	324	25	140	60
Internal Link Dist (ft)	682			406		
Turn Bay Length (ft)			200			
Base Capacity (vph)	1512	885	1092	2767	257	369
Starvation Cap Reductn	0	0	24	868	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.35	0.65	0.77	0.51	0.47	0.44

Intersection Summary

HCM Signalized Intersection Capacity Analysis

3: Route 92 & SB I-35 Ramps

11/4/2009

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	0	492	529	755	882	0	0	0	0	111	0	149
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	
Lane Util. Factor	0.95	1.00	0.97	0.95						1.00	1.00	
Frt	1.00	0.85	1.00	1.00						1.00	0.85	
Flt Protected	1.00	1.00	0.95	1.00						0.95	1.00	
Satd. Flow (prot)	3539	1583	3433	3539						1770	1583	
Flt Permitted	1.00	1.00	0.95	1.00						0.95	1.00	
Satd. Flow (perm)	3539	1583	3433	3539						1770	1583	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	535	575	821	959	0	0	0	0	121	0	162
RTOR Reduction (vph)	0	0	209	0	0	0	0	0	0	0	0	138
Lane Group Flow (vph)	0	535	366	821	959	0	0	0	0	121	0	24
Turn Type							Perm	Prot			custom	custom
Protected Phases		4					3	8				
Permitted Phases										6	6	
Actuated Green, G (s)	47.0	47.0	35.0	86.0						16.0	16.0	
Effective Green, g (s)	47.0	47.0	35.0	86.0						16.0	16.0	
Actuated g/C Ratio	0.43	0.43	0.32	0.78						0.15	0.15	
Clearance Time (s)	4.0	4.0	4.0	4.0						4.0	4.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0						3.0	3.0	
Lane Grp Cap (vph)	1512	676	1092	2767						257	230	
v/s Ratio Prot	0.15		c0.24	0.27								
v/s Ratio Perm			c0.23							c0.07	0.01	
v/c Ratio	0.35	0.54	0.75	0.35						0.47	0.10	
Uniform Delay, d1	21.3	23.5	33.6	3.6						43.1	40.8	
Progression Factor	1.00	1.00	0.73	0.18						1.00	1.00	
Incremental Delay, d2	0.7	3.1	2.3	0.3						6.1	0.9	
Delay (s)	21.9	26.6	27.0	0.9						49.2	41.7	
Level of Service	C	C	C	A						D	D	
Approach Delay (s)	24.3			12.9				0.0		44.9		
Approach LOS	C			B				A		D		
Intersection Summary												
HCM Average Control Delay			19.8				HCM Level of Service			B		
HCM Volume to Capacity ratio			0.60									
Actuated Cycle Length (s)			110.0				Sum of lost time (s)			12.0		
Intersection Capacity Utilization			70.4%				ICU Level of Service			C		
Analysis Period (min)			15									
c Critical Lane Group												

Queues

6: Route 92 & NB I-35 Ramps

11/4/2009

Lane Group	EBL	EBT	WBT	WBR	NBL	NBR
Lane Group Flow (vph)	95	561	1393	107	387	279
v/c Ratio	0.37	0.22	0.64	0.11	0.54	0.35
Control Delay	15.9	0.2	9.9	1.1	42.0	5.6
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	15.9	0.2	9.9	1.1	42.0	5.6
Queue Length 50th (ft)	13	0	166	1	126	0
Queue Length 95th (ft)	43	0	195	m4	175	37
Internal Link Dist (ft)	406	261				
Turn Bay Length (ft)						
Base Capacity (vph)	281	2542	2179	1016	718	803
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.34	0.22	0.64	0.11	0.54	0.35

Intersection Summary

m Volume for 95th percentile queue is metered by upstream signal.

HCM Signalized Intersection Capacity Analysis

6: Route 92 & NB I-35 Ramps

11/4/2009

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↑	↑↑		0	0	↑↑	↑↑	↑↑	↑↑	↑↑	↑↑	0
Volume (vph)	87	516		0	0	1282	98	356	0	257	0	0
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
Lane Util. Factor	1.00	0.95				0.95	1.00	0.97				0.88
Frt	1.00	1.00				1.00	0.85	1.00				0.85
Flt Protected	0.95	1.00				1.00	1.00	0.95				1.00
Satd. Flow (prot)	1770	3539				3539	1583	3433		2787		
Flt Permitted	0.11	1.00				1.00	1.00	0.95				1.00
Satd. Flow (perm)	214	3539				3539	1583	3433		2787		
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	95	561	0	0	1393	107	387	0	279	0	0	0
RTOR Reduction (vph)	0	0	0	0	0	41	0	0	221	0	0	0
Lane Group Flow (vph)	95	561	0	0	1393	66	387	0	58	0	0	0
Turn Type	pm+pt						Perm	custom		custom		
Protected Phases	7	4					8					
Permitted Phases	4							8	2		2	
Actuated Green, G (s)	79.0	79.0				67.7	67.7	23.0		23.0		
Effective Green, g (s)	79.0	79.0				67.7	67.7	23.0		23.0		
Actuated g/C Ratio	0.72	0.72				0.62	0.62	0.21		0.21		
Clearance Time (s)	4.0	4.0				4.0	4.0	4.0		4.0		
Vehicle Extension (s)	3.0	3.0				3.0	3.0	3.0		3.0		
Lane Grp Cap (vph)	257	2542				2178	974	718		583		
v/s Ratio Prot	c0.02	0.16				c0.39						
v/s Ratio Perm	0.24						0.04	c0.11		0.02		
v/c Ratio	0.37	0.22				0.64	0.07	0.54		0.10		
Uniform Delay, d1	9.8	5.2				13.4	8.5	38.8		35.1		
Progression Factor	2.56	0.00				0.63	0.50	1.00		1.00		
Incremental Delay, d2	0.9	0.2				1.2	0.1	2.9		0.3		
Delay (s)	26.1	0.2				9.6	4.4	41.7		35.5		
Level of Service	C	A				A	A	D		D		
Approach Delay (s)		3.9				9.3			39.1		0.0	
Approach LOS		A				A		D		A		

Intersection Summary

HCM Average Control Delay

15.1

HCM Level of Service

B

HCM Volume to Capacity ratio

0.60

Actuated Cycle Length (s)

110.0

Sum of lost time (s)

12.0

Intersection Capacity Utilization

70.4%

ICU Level of Service

C

Analysis Period (min)

15

c Critical Lane Group

Queues

10: Route 92 & Plate Clay Way

11/4/2009

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	NBR	SBT	SBR
Lane Group Flow (vph)	95	665	74	1228	116	119	74	32	147
v/c Ratio	0.41	0.35	0.18	0.71	0.47	0.48	0.25	0.12	0.32
Control Delay	21.5	10.8	10.7	24.6	50.3	50.4	12.1	42.3	19.4
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	21.5	10.8	10.7	24.6	50.3	50.4	12.1	42.3	19.4
Queue Length 50th (ft)	28	81	20	342	80	82	0	20	42
Queue Length 95th (ft)	72	118	40	433	142	146	42	49	97
Internal Link Dist (ft)		580		999		418		578	
Turn Bay Length (ft)									
Base Capacity (vph)	247	1894	405	1734	245	248	293	263	470
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	0.38	0.35	0.18	0.71	0.47	0.48	0.25	0.12	0.31

Intersection Summary

HCM Signalized Intersection Capacity Analysis

10: Route 92 & Plate Clay Way

11/4/2009

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↑	↑↑	↑	↑	↑↑	↑	↑	↑	↑	↑	↑	↑
Volume (vph)	87	541	71	68	1073	57	190	26	68	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	4.0
Lane Util. Factor	1.00	0.95		1.00	0.95		0.95	0.95	1.00	1.00	1.00	1.00
Frt	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	0.96	1.00	0.97	1.00	
Satd. Flow (prot)	1770	3478		1770	3512		1681	1704	1583	1806	1583	
Flt Permitted	0.11	1.00		0.37	1.00		0.95	0.96	1.00	0.97	1.00	
Satd. Flow (perm)	197	3478		692	3512		1681	1704	1583	1806	1583	
Peak-hour factor, PHF	0.92	0.92		0.92	0.92		0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	95	588		77	74		1166	62	207	28	74	20
RTOR Reduction (vph)	0	9		0	4		0	0	0	63	0	56
Lane Group Flow (vph)	95	656		0	74		1224	0	116	119	11	0
Turn Type	pm+pt			pm+pt			Split		Perm	Split		pm+ov
Protected Phases	7	4		3	8		2	2		6	6	7
Permitted Phases					8					2		6
Actuated Green, G (s)	66.0	58.8		57.4	54.2		16.0	16.0	16.0	16.0	16.0	23.8
Effective Green, g (s)	66.0	58.8		57.4	54.2		16.0	16.0	16.0	16.0	16.0	23.8
Actuated g/C Ratio	0.60	0.53		0.52	0.49		0.15	0.15	0.15	0.15	0.15	0.22
Clearance Time (s)	4.0	4.0		4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	230	1859		392	1730		245	248	230		263	400
v/s Ratio Prot	c0.03	0.19		0.01	c0.35		0.07	c0.07		0.02	c0.02	
v/s Ratio Perm	0.22			0.09						0.01		0.04
v/c Ratio	0.41	0.35		0.19	0.71		0.47	0.48	0.05	0.12	0.23	
Uniform Delay, d1	15.0	14.7		13.2	21.7		43.1	43.2	40.4	40.9	35.5	
Progression Factor	1.71	0.72		1.00	1.00		1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	1.2	0.5		0.2	2.5		6.4	6.5	0.4	0.9	0.3	
Delay (s)	26.9	11.1		13.4	24.2		49.6	49.7	40.8	41.8	35.8	
Level of Service	C	B		B	C		D	D	D	D	D	
Approach Delay (s)		13.1			23.6			47.5		36.9		
Approach LOS	B			C			D			D		

Intersection Summary

HCM Average Control Delay	24.3	HCM Level of Service	C
HCM Volume to Capacity ratio	0.57		
Actuated Cycle Length (s)	110.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	58.9%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

HCM Unsignalized Intersection Capacity Analysis

12: Route 92 & McDonald's Drive

11/4/2009

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (veh/h)	61	712	1254	92	27	126
Sign Control	Free	Free		Stop		
Grade	0%	0%		0%		
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	66	774	1363	100	29	137
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None	None				
Median storage veh)						
Upstream signal (ft)	341	800				
pX, platoon unblocked	0.74		0.76	0.74		
vC, conflicting volume	1463		1933	732		
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	911		1342	0		
tC, single (s)	4.1		6.8	6.9		
tC, 2 stage (s)						
tF (s)	2.2		3.5	3.3		
p0 queue free %	88		69	83		
cM capacity (veh/h)	547		95	798		
Direction, Lane #	EB 1	EB 2	EB 3	WB 1	WB 2	SB 1
Volume Total	66	387	387	909	554	29
Volume Left	66	0	0	0	0	29
Volume Right	0	0	0	0	100	0
cSH	547	1700	1700	1700	1700	95
Volume to Capacity	0.12	0.23	0.23	0.53	0.33	0.31
Queue Length 95th (ft)	10	0	0	0	0	29
Control Delay (s)	12.5	0.0	0.0	0.0	0.0	58.7
Lane LOS	B			F		B
Approach Delay (s)	1.0		0.0		19.0	
Approach LOS				C		
Intersection Summary						
Average Delay			1.6			
Intersection Capacity Utilization	54.3%		ICU Level of Service	A		
Analysis Period (min)	15					

HCM Unsignalized Intersection Capacity Analysis

14: Route 92 & Shell Drive

11/4/2009

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	2	666		70	26	1331	42	0	0	12	21	0
Sign Control	Free			Free			Stop			Stop		Stop
Grade	0%			0%			0%			0%		0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	2	724		76	28	1447	46	0	0	13	23	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)		481				660						
pX, platoon unblocked	0.73			0.98			0.74	0.74	0.98	0.74	0.74	0.73
vC, conflicting volume	1492			800			1524	2277	362	1905	2330	746
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	931			748			867	1884	300	1382	1956	0
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			100	100	98	69	100	98
cM capacity (veh/h)	532			837			174	50	680	73	45	790
Direction, Lane #	EB 1	EB 2	EB 3	EB 4	WB 1	WB 2	WB 3	NB 1	SB 1	SB 2		
Volume Total	2	362	362	76	28	964	528	13	23	16		
Volume Left	2	0	0	0	28	0	0	0	23	0		
Volume Right	0	0	0	76	0	0	46	13	0	16		
cSH	532	1700	1700	1700	837	1700	1700	680	73	790		
Volume to Capacity	0.00	0.21	0.21	0.04	0.03	0.57	0.31	0.02	0.31	0.02		
Queue Length 95th (ft)	0	0	0	0	3	0	0	1	29	2		
Control Delay (s)	11.8	0.0	0.0	0.0	9.5	0.0	0.0	10.4	75.6	9.7		
Lane LOS	B				A			B	F	A		
Approach Delay (s)	0.0				0.2			10.4	48.1		B	E
Approach LOS												
Intersection Summary												
Average Delay			1.0									
Intersection Capacity Utilization	48.1%		ICU Level of Service	A								
Analysis Period (min)	15											

HCM Unsignalized Intersection Capacity Analysis
17: Development Drive & Regency Drive

11/4/2009

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Volume (veh/h)	66	4	125	26	6	219
Sign Control	Free		Free	Stop		
Grade	0%		0%	0%		
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	72	4	136	28	7	238
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None		None			
Median storage veh)						
Upstream signal (ft)			498			
pX, platoon unblocked						
VC, conflicting volume		76		374		74
VC1, stage 1 conf vol						
VC2, stage 2 conf vol						
VCu, unblocked vol		76		374		74
tC, single (s)		4.1		6.4		6.2
tC, 2 stage (s)						
tF (s)		2.2		3.5		3.3
p0 queue free %		91		99		76
cM capacity (veh/h)		1523		571		988
Direction, Lane #	EB 1	WB 1	WB 2	NB 1	NB 2	
Volume Total	76	136	28	7	238	
Volume Left	0	136	0	7	0	
Volume Right	4	0	0	0	238	
cSH	1700	1523	1700	571	988	
Volume to Capacity	0.04	0.09	0.02	0.01	0.24	
Queue Length 95th (ft)	0	7	0	1	24	
Control Delay (s)	0.0	7.6	0.0	11.4	9.8	
Lane LOS	A		B	A		
Approach Delay (s)	0.0	6.3		9.8		
Approach LOS				A		
Intersection Summary						
Average Delay		7.1				
Intersection Capacity Utilization		23.9%		ICU Level of Service		A
Analysis Period (min)		15				

HCM Unsignalized Intersection Capacity Analysis
18: Development Drive &

11/4/2009

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Right Turn Channelized												
Volume (veh/h)	10	33	10	19	13	10	10	10	37	10	45	51
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	11	36	11	21	14	11	11	11	40	11	49	55
Approach Volume (veh/h)												
Crossing Volume (veh/h)	58				46				62			
High Capacity (veh/h)	80				33				58			
High v/c (veh/h)	1300				1350				1324			
Low Capacity (veh/h)	0.04				0.03				0.05			
Low v/c (veh/h)	0.05				0.04				0.06			
Intersection Summary												
Maximum v/c High									0.09			
Maximum v/c Low									0.10			
Intersection Capacity Utilization									18.5%		ICU Level of Service	A

Queues

3: Route 92 & SB I-35 Ramps

11/4/2009

Lane Group	EBT	EBR	WBL	WBT	SBL	SBR
Lane Group Flow (vph)	1180	970	665	1750	141	160
v/c Ratio	0.60	0.90	0.93	0.62	0.60	0.61
Control Delay	19.1	25.5	53.5	5.7	60.4	41.9
Queue Delay	0.0	0.0	0.0	0.6	0.0	0.0
Total Delay	19.1	25.5	53.5	6.3	60.4	41.9
Queue Length 50th (ft)	304	406	269	204	104	75
Queue Length 95th (ft)	371	#790	m#298	m226	174	150
Internal Link Dist (ft)	682			406		
Turn Bay Length (ft)			200			
Base Capacity (vph)	1976	1076	715	2831	236	261
Starvation Cap Reductn	0	0	0	607	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.60	0.90	0.93	0.79	0.60	0.61

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.

Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.

HCM Signalized Intersection Capacity Analysis

3: Route 92 & SB I-35 Ramps

11/4/2009

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↑↑	↑↑	↑↑	↑↑	↑↑						
Volume (vph)	0	1086	892	612	1610	0	0	0	0	130	0	147
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	
Lane Util. Factor	0.95	1.00	0.97	0.95						1.00	1.00	
Frt	1.00	0.85	1.00	1.00						1.00	0.85	
Flt Protected	1.00	1.00	0.95	1.00						0.95	1.00	
Satd. Flow (prot)	3539	1583	3433	3539						1770	1583	
Flt Permitted	1.00	1.00	0.95	1.00						0.95	1.00	
Satd. Flow (perm)	3539	1583	3433	3539						1770	1583	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	1180	970	665	1750	0	0	0	0	141	0	160
RTOR Reduction (vph)	0	0	192	0	0	0	0	0	0	0	0	50
Lane Group Flow (vph)	0	1180	778	665	1750	0	0	0	0	141	0	110
Turn Type					Perm	Prot				custom	custom	
Protected Phases		4			3	8						
Permitted Phases										6	6	
Actuated Green, G (s)	67.0	67.0	25.0	96.0						16.0	16.0	
Effective Green, g (s)	67.0	67.0	25.0	96.0						16.0	16.0	
Actuated g/C Ratio	0.56	0.56	0.21	0.80						0.13	0.13	
Clearance Time (s)	4.0	4.0	4.0	4.0						4.0	4.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0						3.0	3.0	
Lane Grp Cap (vph)	1976	884	715	2831						236	211	
v/s Ratio Prot	0.33	c0.49	c0.19	0.49						c0.08	0.07	
v/s Ratio Perm		c0.49										
v/c Ratio	0.60	0.88	0.93	0.62						0.60	0.52	
Uniform Delay, d1	17.6	23.0	46.6	4.7						49.0	48.4	
Progression Factor	1.00	1.00	0.89	1.08						1.00	1.00	
Incremental Delay, d2	1.3	12.2	10.2	0.5						10.7	8.9	
Delay (s)	18.9	35.2	51.8	5.6						59.7	57.3	
Level of Service	B	D	D	A						E	E	
Approach Delay (s)	26.3			18.3				0.0		58.4		
Approach LOS	C			B				A		E		

Intersection Summary

HCM Average Control Delay

24.3

HCM Level of Service

C

HCM Volume to Capacity ratio

0.85

Actuated Cycle Length (s)

120.0

Sum of lost time (s)

12.0

Intersection Capacity Utilization

89.9%

ICU Level of Service

E

Analysis Period (min)

15

c Critical Lane Group

Queues

6: Route 92 & NB I-35 Ramps

11/4/2009

Lane Group	EBL	EBT	WBT	WBR	NBL	NBR
Lane Group Flow (vph)	201	1121	1618	255	797	1145
v/c Ratio	0.96	0.54	0.98	0.30	0.66	1.07
Control Delay	85.6	3.0	38.1	4.5	36.3	80.7
Queue Delay	0.0	0.1	0.0	0.0	0.0	0.0
Total Delay	85.6	3.1	38.1	4.5	36.3	80.7
Queue Length 50th (ft)	83	52	613	16	267	~513
Queue Length 95th (ft)	#248	60	m#782	m22	336	#661
Internal Link Dist (ft)		406	261			
Turn Bay Length (ft)						
Base Capacity (vph)	210	2064	1652	837	1202	1072
Starvation Cap Reductn	0	203	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.96	0.60	0.98	0.30	0.66	1.07

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.

m Volume for 95th percentile queue is metered by upstream signal.

HCM Signalized Intersection Capacity Analysis

6: Route 92 & NB I-35 Ramps

11/4/2009

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↑	↑↑		0	0	↑↑	↑↑	0	0	↑↑	0	0
Volume (vph)	185	1031		0	0	1489	235	733	0	1053	0	0
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		
Lane Util. Factor	1.00	0.95				0.95	1.00	0.97		0.88		
Frt	1.00	1.00				1.00	0.85	1.00		0.85		
Flt Protected	0.95	1.00				1.00	1.00	0.95		1.00		
Satd. Flow (prot)	1770	3539				3539	1583	3433		2787		
Flt Permitted	0.07	1.00				1.00	1.00	0.95		1.00		
Satd. Flow (perm)	124	3539				3539	1583	3433		2787		
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	201	1121	0	0	1618	255	797	0	1145	0	0	0
RTOR Reduction (vph)	0	0	0	0	0	99	0	0	97	0	0	0
Lane Group Flow (vph)	201	1121	0	0	1618	156	797	0	1048	0	0	0
Turn Type	pm+pt						Perm	custom		custom		
Protected Phases	7	4					8					
Permitted Phases			4					8	2		2	
Actuated Green, G (s)	70.0	70.0				56.0	56.0	42.0		42.0		
Effective Green, g (s)	70.0	70.0				56.0	56.0	42.0		42.0		
Actuated g/C Ratio	0.58	0.58				0.47	0.47	0.35		0.35		
Clearance Time (s)	4.0	4.0				4.0	4.0	4.0		4.0		
Vehicle Extension (s)	3.0	3.0				3.0	3.0	3.0		3.0		
Lane Grp Cap (vph)	210	2064				1652	739	1202		975		
v/s Ratio Prot	c0.08	0.32				0.46						
v/s Ratio Perm	c0.48						0.10	0.23		c0.38		
v/c Ratio	0.96	0.54				0.98	0.21	0.66		1.08		
Uniform Delay, d1	37.2	15.2				31.4	18.9	33.0		39.0		
Progression Factor	1.45	0.14				0.78	0.68	1.00		1.00		
Incremental Delay, d2	43.5	0.8				12.6	0.4	2.9		51.2		
Delay (s)	97.3	3.0				37.2	13.2	35.9		90.2		
Level of Service	F	A				D	B	D		F		
Approach Delay (s)		17.3				33.9		67.9		0.0		
Approach LOS		B				C		E		A		
Intersection Summary												
HCM Average Control Delay						42.5						D
HCM Volume to Capacity ratio						0.99						
Actuated Cycle Length (s)						120.0						8.0
Intersection Capacity Utilization						89.9%						E
Analysis Period (min)						15						
c Critical Lane Group												

Queues

10: Route 92 & Plate Clay Way

11/4/2009

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	NBR	SBT	SBR
Lane Group Flow (vph)	212	1882	148	1466	230	234	167	178	218
v/c Ratio	0.82	1.01	0.90	0.87	0.97	0.45	0.74	0.48	
Control Delay	52.1	38.0	74.6	34.9	102.0	102.7	11.2	69.0	36.0
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Total Delay	52.1	38.0	74.6	34.9	102.0	102.7	11.2	69.0	36.0
Queue Length 50th (ft)	102	~572	65	531	189	192	0	134	124
Queue Length 95th (ft)	m143	m#823	#194	642	#357	#363	63	#238	201
Internal Link Dist (ft)		580		999		418		578	
Turn Bay Length (ft)									
Base Capacity (vph)	282	1863	165	1688	238	241	368	241	477
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	0.75	1.01	0.90	0.87	0.97	0.97	0.45	0.74	0.46
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.									
m Volume for 95th percentile queue is metered by upstream signal.									

HCM Signalized Intersection Capacity Analysis

10: Route 92 & Plate Clay Way

11/4/2009

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↑	↑↑	↑	↑	↑↑	↑	↑	↑	↑	↑	↑	↑
Volume (vph)	195	1525	206	136	1255	94	377	50	154	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	1.00
Frt	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	0.96	1.00	0.97	1.00	
Satd. Flow (prot)	1770	3476		1770	3502		1681	1704	1583	1808	1583	
Flt Permitted	0.06	1.00		0.07	1.00		0.95	0.96	1.00	0.97	1.00	
Satd. Flow (perm)	121	3476		129	3502		1681	1704	1583	1808	1583	
Peak-hour factor, PHF	0.92	0.92		0.92	0.92		0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	212	1658		224	148		1364	102	410	54	167	108
RTOR Reduction (vph)	0	9		0	5		0	0	0	143	0	0
Lane Group Flow (vph)	212	1873		0	148		1461	0	230	234	24	0
Turn Type	pm+pt			pm+pt					Split	Perm	Split	pm+ov
Protected Phases	7	4		3	8			2	2	6	6	7
Permitted Phases					8					2		6
Actuated Green, G (s)	75.0	64.0		64.7	57.7		17.0	17.0	17.0	16.0	29.3	
Effective Green, g (s)	75.0	64.0		64.7	57.7		17.0	17.0	17.0	16.0	29.3	
Actuated g/C Ratio	0.62	0.53		0.54	0.48		0.14	0.14	0.14	0.13	0.24	
Clearance Time (s)	4.0	4.0		4.0	4.0		4.0	4.0	4.0	4.0	4.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	258	1854		165	1684		238	241	224	241	439	
v/s Ratio Prot	c0.09	c0.54		0.05	0.42		0.14	c0.14		c0.10	0.05	
v/s Ratio Perm	0.42			0.43						0.01		0.08
v/c Ratio	0.82	1.01		0.90	0.87		0.97	0.97	0.11	0.74	0.46	
Uniform Delay, d1	35.0	28.0		30.7	27.8		51.2	51.3	44.9	50.0	38.6	
Progression Factor	1.25	0.63		1.00	1.00		1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	12.7	19.3		41.4	6.3		50.3	51.0	0.9	18.3	0.8	
Delay (s)	56.2	36.8		72.0	34.1		101.5	102.2	45.8	68.3	39.4	
Level of Service	E	D		E	C		F	F	D	E	D	
Approach Delay (s)		38.8			37.6			87.0		52.4		
Approach LOS		D			D			F		D		

Intersection Summary

HCM Average Control Delay

45.9

HCM Volume to Capacity ratio

0.93

Actuated Cycle Length (s)

120.0

Sum of lost time (s)

12.0

Intersection Capacity Utilization

84.7%

ICU Level of Service

E

Analysis Period (min)

15

c Critical Lane Group

HCM Unsignalized Intersection Capacity Analysis

12: Route 92 & McDonald's Drive

11/4/2009

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (veh/h)	87	1996	1651	49	35	73
Sign Control	Free	Free		Stop		
Grade	0%	0%		0%		
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	95	2170	1795	53	38	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)	341	800				
pX, platoon unblocked	0.64		0.74	0.64		
vC, conflicting volume	1848		3095	924		
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1197		1945	0		
tC, single (s)	4.1		6.8	6.9		
tC, 2 stage (s)						
tF (s)	2.2		3.5	3.3		
p0 queue free %	74		0	89		
cM capacity (veh/h)	370		31	693		
Direction, Lane #	EB 1	EB 2	EB 3	WB 1	WB 2	SB 1
Volume Total	95	1085	1085	1196	651	38
Volume Left	95	0	0	0	0	38
Volume Right	0	0	0	0	53	0
cSH	370	1700	1700	1700	1700	31
Volume to Capacity	0.26	0.64	0.64	0.70	0.38	1.22
Queue Length 95th (ft)	25	0	0	0	0	106
Control Delay (s)	18.0	0.0	0.0	0.0	0.0	428.0
Lane LOS	C			F		B
Approach Delay (s)	0.8		0.0		146.1	
Approach LOS				F		
Intersection Summary						
Average Delay			4.5			
Intersection Capacity Utilization	65.3%		ICU Level of Service	C		
Analysis Period (min)	15					

HCM Unsignalized Intersection Capacity Analysis

14: Route 92 & Shell Drive

11/4/2009

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	2	1819	211	126	1681	26	0	0	80	27	0	19
Sign Control	Free			Free			Stop			Stop		
Grade	0%			0%			0%			0%		
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	2	1977	229	137	1827	28	0	0	87	29	0	21
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			660							
pX, platoon unblocked	0.63			0.82			0.73	0.73	0.82	0.73	0.73	0.63
vC, conflicting volume	1855			2207			3190	4111	989	3195	4326	928
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1195			2030			2134	3405	542	2142	3702	0
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			39			100	100	78	0	100	97
cM capacity (veh/h)	368			225			10	2	397	8	1	688
Direction, Lane #	EB 1	EB 2	EB 3	EB 4	WB 1	WB 2	WB 3	NB 1	SB 1	SB 2		
Volume Total	2	989	989	229	137	1218	637	87	29	21		
Volume Left	2	0	0	0	137	0	0	0	29	0		
Volume Right	0	0	0	229	0	0	28	87	0	21		
cSH	368	1700	1700	1700	225	1700	1700	397	8	688		
Volume to Capacity	0.01	0.58	0.58	0.13	0.61	0.72	0.37	0.22	3.67	0.03		
Queue Length 95th (ft)	0	0	0	0	88	0	0	21	Err	2		
Control Delay (s)	14.8	0.0	0.0	0.0	43.0	0.0	0.0	16.6	Err	10.4		
Lane LOS	B			E			C	F	B			
Approach Delay (s)	0.0				3.0			16.6	5873.3			
Approach LOS							C	F				
Intersection Summary												
Average Delay			4.5				69.4					
Intersection Capacity Utilization	65.3%			70.6%			ICU Level of Service	C				
Analysis Period (min)	15			15								

HCM Unsignalized Intersection Capacity Analysis

17: Development Drive & Regency Drive

11/4/2009

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Volume (veh/h)	366	16	314	92	15	215
Sign Control	Free		Free	Stop		
Grade	0%		0%	0%		
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	398	17	341	100	16	234
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None		None			
Median storage veh)						
Upstream signal (ft)			498			
pX, platoon unblocked						
VC, conflicting volume		415		1189		407
VC1, stage 1 conf vol						
VC2, stage 2 conf vol						
VCu, unblocked vol		415		1189		407
tC, single (s)		4.1		6.4		6.2
tC, 2 stage (s)						
tF (s)		2.2		3.5		3.3
p0 queue free %		70		89		64
cM capacity (veh/h)		1144		146		644
Direction, Lane #	EB 1	WB 1	WB 2	NB 1	NB 2	
Volume Total	415	341	100	16	234	
Volume Left	0	341	0	16	0	
Volume Right	17	0	0	0	234	
cSH	1700	1144	1700	146	644	
Volume to Capacity	0.24	0.30	0.06	0.11	0.36	
Queue Length 95th (ft)	0	32	0	9	41	
Control Delay (s)	0.0	9.5	0.0	32.8	13.7	
Lane LOS	A		D	B		
Approach Delay (s)	0.0	7.3		15.0		
Approach LOS			B			
Intersection Summary						
Average Delay		6.3				
Intersection Capacity Utilization		51.0%		ICU Level of Service		A
Analysis Period (min)		15				

HCM Unsignalized Intersection Capacity Analysis

18: Development Drive &

11/4/2009

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Right Turn Channelized												
Volume (veh/h)	48	183	10	60	46	10	10	32	199	10	161	176
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	52	199	11	65	50	11	11	35	216	11	175	191
Approach Volume (veh/h)		262			126			262			377	
Crossing Volume (veh/h)		251			98			262			126	
High Capacity (veh/h)		1137			1283			1128			1255	
High v/c (veh/h)		0.23			0.10			0.23			0.30	
Low Capacity (veh/h)		937			1069			928			1043	
Low v/c (veh/h)		0.28			0.12			0.28			0.36	
Intersection Summary												
Maximum v/c High								0.30				
Maximum v/c Low								0.36				
Intersection Capacity Utilization							43.9%		ICU Level of Service		A	