Date: April 6, 2011

Technical Memorandum

To: Vanessa Koster
Chris Fornal
City of Milwaukee

From: Michael May, P.E., PTOE

cc List: Alderman Michael Murphy

Subject Walmart Market Development – 70th Street & Main Street
Store Number 5697-00
Operations with 70th Street Access Only

PART A – INTRODUCTION

A Walmart Market is proposed to be located southwest of the South 70th Street intersection with West Main Street in the City of Milwaukee. To ensure a safe and efficient roadway network upon completion of the store, Traffic Analysis & Design, Inc. submitted a traffic impact analysis (TIA) on March 31st, 2011 that outlined peak hour operating conditions and recommendations at study area intersections both with and without the proposed development. The TIA was prepared following applicable City, State and National guidance for the proper investigation and analysis of development-related traffic impacts.

At the request of the City of Milwaukee Department of Public Works, a second analysis of the Walmart Market site with access only to 70th Street has been performed to determine the impacts that may be anticipated with such an alternative. This technical memorandum summarizes the alternative analysis of the Walmart Market with access only to 70th Street.

PART B – ALTERNATIVE TRAFFIC VOLUMES

If no access is provided from the Walmart Market site to Main Street, the Market's service area is not expected to change. As such, the trip generation and trip distribution calculations determined in the March 31st TIA are also anticipated to be the same. The trip generation and distribution summarized in the March 31st TIA are shown again in Exhibit 1 of this technical memorandum

The primary difference in traffic volumes comes through the assignment of Walmart Market trips to the study area intersections. The alternative Walmart Market new trips are shown in Exhibit 2. The alternative Walmart Market pass-by trips (i.e. trips that occur when motorists on the adjacent roadway system stop off at a development prior to continuing on their intended route) are shown in Exhibit 3. The alternative Walmart Market driveway trips, which are the sum of the alternative new trips and pass-by trips, are shown in Exhibit 4.

The alternative Walmart Market driveway trips (Exhibit 4) were added to the Year 2011 background traffic (Exhibit 5) to determine the alternative Year 2011 total traffic volumes shown in Exhibit 6.

PART C – ALTERNATIVE OPERATIONS & ALTERNATIVE IMPROVEMENTS

Like with the March 31st TIA, the study area intersections were analyzed based on the procedures set forth in the *2000 Highway Capacity Manual* (HCM). Intersection operation is defined by "level of service" (LOS), a quantitative measure that refers to the overall quality of flow at an intersection ranging from very good, represented by LOS 'A', to very poor, represented by LOS 'F'. LOS D or better operations (fewer than 35-seconds of average vehicle delay at stop sign controlled intersections, fewer than 55-seconds of average vehicle delay at traffic signal controlled intersections) are defined as acceptable peak hour operating conditions.

Recall from the March 31st TIA that the traffic signalized Main Street intersections with 76th Street and 70th Street currently operate acceptably at LOS C or better conditions. Stop-sign controlled intersections along Main Street operate acceptably at LOS B or better conditions. These operations are expected to be maintained with access located along both Main Street and 70th Street.

C1. Alternative Year 2011 Total Traffic – Without Improvements

Table A shows the alternative Year 2011 total traffic (with Walmart Market) peak hour operating conditions at the study area intersections without improvements. The traffic analysis was conducted using the alternative Year 2011 total traffic volumes shown in Exhibit 6, existing lane configurations, and existing traffic signal timings obtained from the City of Milwaukee.

Table A
Alternative Year 2011 Total Traffic Operations
With Existing Geometrics and Traffic Control

Intersection	Traffic Control	Peak Hour	Level of Service per Movement by Approach											
			Eastbound			Westbound			Northbound			Southbound		
			LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Main Street & 76th Street	Traffic Signal	PM	B	B	B	C	C	C	A	A	A	A	A	A
		SAT	C	C	C	C	C	C	A	A	A	A	A	A
Main Street & 75th Street	Two-Way Stop Sign	PM	A	*	-	-	*	*	-	-	-	A	-	A
		SAT	A	*	-	-	*	*	-	-	-	A	-	A
Main Street & 74th Street	Two-Way Stop Sign	PM	A	*	*	A	*	*	B	B	B	B	B	B
		SAT	A	*	*	A	*	*	B	B	B	A	A	A
Main Street & 73rd Street	Two-Way Stop Sign	PM	A	*	-	-	*	*	-	-	-	B	-	B
		SAT	A	*	-	-	*	*	-	-	-	A	-	A
Main Street & 72nd Street	Two-Way Stop Sign	PM	A	*	*	A	*	*	B	B	B	B	B	B
		SAT	A	*	*	A	*	*	B	B	B	B	B	B
Main Street & 71st Street	Two-Way Stop Sign	PM	-	*	-	-	*	-	-	-	-	B	-	B
		SAT	-	*	-	-	*	-	-	-	-	A	-	A
Main Street & Public Alley	Two-Way Stop Sign	PM	-	*	*	A	*	-	B	-	B	-	-	-
		SAT	-	*	*	A	*	-	A	-	A	-	-	-
Main Street & 70th Street	Traffic Signal	PM	C	C	C	C	C	C	B	B	B	A	A	A
		SAT	B	B	B	B	B	B	B	A	A	A	A	A
70th Street & Proposed North Access	Two-Way Stop Sign	PM	**F[1]**	**F[1]**	**F[1]**	-	-	-	A	*	-	-	*	*
		SAT	D	-	D	-	-	-	A	*	-	-	*	*
70th Street & Dickinson Street/ Proposed South Access	Two-Way Stop Sign	PM	C	C	C	**F[2]**	**F[2]**	**F[2]**	A	*	*	A	*	*
		SAT	B	B	B	C	C	C	A	*	*	A	*	*

Notes: (-) indicates a movement that is not possible or is prohibited. (*) indicates uncontrolled or free-flow movement.
1. 203.2 sec of average delay, or 168.2-sec beyond LOS D/E threshold. Operational improvements necessary
2. 23.2-sec of average delay beyond LOS D/E threshold, 10 vehicles. Operational improvements not necessary

As shown in Table A, the eastbound Walmart Market north access approach to 70th Street is expected to operate unacceptably at LOS F conditions with over three minutes of average vehicle delay. If the 70th Street access-only alternative would be chosen, additional improvements would be necessary to the roadway network.

C2. Alternative Year 2011 Total Traffic – With Alternative Improvements

To provide acceptable operations for all movements under the 70th Street-only access alternative, alternative improvements would be necessary. More specifically, and as shown in Exhibit 7:

Main Street & 76th Street

- No improvements are anticipated to be necessary, which matches the March 31st TIA.

Main Street & 75th Street

- No improvements are anticipated to be necessary, which matches the March 31st TIA.

Main Street & 74th Street

- No improvements are anticipated to be necessary, which matches the March 31st TIA.

Main Street & 73rd Street

- No improvements are anticipated to be necessary, which matches the March 31st TIA.

Main Street & 72nd Street

- No improvements are anticipated to be necessary, which matches the March 31st TIA.

Main Street & 71st Street

- No improvements are anticipated to be necessary, as the proposed west access would not be constructed.

Main Street & Public Alley

- Install a stop sign to control the public alley northbound approach, which matches the March 31st TIA.

Main Street & 70th Street

- No improvements are anticipated to be necessary, which matches the March 31st TIA.

70th Street & Proposed North Access

- Construct the Walmart Market north access on the west side of 70th Street approximately half-way between Main Street and Dickinson Street. Restrict the north access to right-in/right-out movements.
- Install a stop sign to control the Walmart Market eastbound approach, which matches the March 31st TIA.

70th Street & Proposed South Access

- Construct the Walmart Market south access on the west side of 70th Street opposite Dickinson Street, which matches the March 31st TIA.
- Traffic signal warrants are expected to be met. Install traffic signal control. No exclusive left-turn or right-turn indications are expected to be necessary. Coordinate the traffic signal with the 70th Street intersection with Main Street to the north.
- Consider installing a MUTCD-compliant "NO RIGHT TURNS ON RED" sign on the Dickinson Street westbound approach. This improvement would be used along with the traffic signal operations to correct an existing intersection sight distance issue on the westbound approach and is not caused by the Walmart Market.
- It is encouraged to contact the City of West Allis so that the traffic signals at the 70th Street intersections with Washington Street (east and west legs are offset) may be coordinated into the system to improve operations along 70th Street in both communities.

General Improvements

- Recall that the Jetz gas station/convenience store and Air Comfort Systems business are expected to remain when the Walmart Market access points to 70th Street are constructed. Both businesses, as well as the Roman Electric business on the east side of 70th Street, have off-site parking accommodations. Consideration may be given to removing parking on the west side of 70th Street to improve visibility for motorists exiting the Walmart Market, Jetz, and HVAC sites. This consideration for parking removal on the west side of 70th Street matches that made in the March 31st TIA.

Table B shows the alternative Year 2011 total traffic (with Walmart Market) peak hour operating conditions at the study area intersections with the alternative improvements. The alternative Year 2011 total traffic reassignment, shown in Exhibit 8, is included to show revised traffic patterns due to the alternative improvements. The alternative Year 2011 total traffic expected maximum queues are shown in Exhibit 9. A traffic signal warrant analysis is included in the appendix of this technical memorandum.

Table B
Alternative Year 2011 Total Traffic Operations
With Alternative Improvements and Traffic Control

Intersection	Traffic Control	Peak Hour	Level of Service per Movement by Approach											
			Eastbound			Westbound			Northbound			Southbound		
			LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Main Street & 76th Street	Traffic Signal	PM	B	B	B	C	C	C	A	A	A	A	A	A
		SAT	C	C	C	C	C	C	A	A	A	A	A	A
Main Street & 75th Street	Two-Way Stop Sign	PM	A	*	-	-	*	*	-	-	-	A	-	A
		SAT	A	*	-	-	*	*	-	-	-	A	-	A
Main Street & 74th Street	Two-Way Stop Sign	PM	A	*	*	A	*	*	B	B	B	B	B	B
		SAT	A	*	*	A	*	*	B	B	B	A	A	A
Main Street & 73rd Street	Two-Way Stop Sign	PM	A	*	-	-	*	*	-	-	-	B	-	B
		SAT	A	*	-	-	*	*	-	-	-	A	-	A
Main Street & 72nd Street	Two-Way Stop Sign	PM	A	*	*	A	*	*	B	B	B	B	B	B
		SAT	A	*	*	A	*	*	B	B	B	B	B	B
Main Street & 71st Street	Two-Way Stop Sign	PM	-	*	-	-	*	-	-	-	-	B	-	B
		SAT	-	*	-	-	*	-	-	-	-	A	-	A
Main Street & Public Alley	Two-Way Stop Sign	PM	-	*	*	A	*	-	B	-	B	-	-	-
		SAT	-	*	*	A	*	-	A	-	A	-	-	-
Main Street & 70th Street	Traffic Signal	PM	C	C	C	C	C	C	A	A	A	A	A	A
		SAT	B	B	B	B	B	B	B	A	A	A	A	A
70th Street & Proposed North Access	Two-Way Stop Sign	PM	-	-	A	-	-	-	-	*	-	-	*	*
		SAT	-	-	A	-	-	-	-	*	-	-	*	*
70th Street & Dickinson Street/ Proposed South Access	Traffic Signal	PM	C	C	C	B	B	B	B	B	B	A	A	A
		SAT	C	C	C	B	B	B	A	A	A	A	A	A

Notes: (-) indicates a movement that is not possible or is prohibited. (*) indicates uncontrolled or free-flow movement.

As shown in Table B, all movements are expected to operate acceptably at LOS C or better conditions with the alternative improvements and traffic control.

PART D – CONCLUSION

The traffic signalized Main Street intersections with 76th Street and 70th Street are expected to continue to operate acceptably at LOS C or better conditions 1) without development, 2) with

development and with access to both Main Street and 70th Street, and 3) with development and access only to 70th Street. Stop-sign controlled intersections along Main Street operate acceptably at LOS B or better conditions both with and without development and with or without access to Main Street as well. That is, the Walmart Market does not have a significant impact on the operations along the whole of Main Street from 76th Street to 70th Street.

Volumes on Main Street west of 71st Street are expected to be the same regardless of whether or not Walmart Market has access to Main Street. That being stated, several benefits of providing access to both Main Street and 70th Street, as opposed to 70th Street alone, are stated below.

- The traffic volume traveling through the Main Street signalized intersection with 70th Street is less – particularly on the northbound and eastbound approaches – with access provided to both Main Street and 70th Street.
- With access provided to both Main Street and 70th Street, a traffic signal is not warranted at the 70th Street intersection with Dickinson Street/the proposed south access. There are at least two benefits of having one less signal along 70th Street: 1) there is one less potential stopping point for traffic traveling north/south on 70th Street, which translates to less overall delay to existing roadway users; and 2) there is one less signal that will need to be maintained, which translates to less expense to the City of Milwaukee.
- Per comments received from the public at our latest neighborhood meeting, the proposed south access is the only access designed and designated to accommodate delivery trucks. Constructing access to both Main Street and 70th Street provides patrons additional options for separation from delivery truck movements.

In conclusion, while the alternative improvements listed in this technical memorandum would result in safe and efficient operations if access were provided to 70th Street only, the improvements identified in the March 31st TIA are expected to result in safe and more efficient operations – for both existing and future users – with access along both Main Street and 70th Street.

Walmart Market Trip Generation Table

Land Use	ITE Code	Proposed Size	Weekday Daily	AM Peak In	AM Peak Out	AM Peak Total	PM Peak In	PM Peak Out	PM Peak Total	SAT Peak In	SAT Peak Out	SAT Peak Total
Walmart	850	40 x 1,000 SF	4,090 (102.24)	90 (61%)	55 (39%)	145 (3.59)	215 (51%)	205 (49%)	420 (10.50)	220 (51%)	210 (49%)	430 (10.81)
Total Driveway Trips			**4,090**	**90**	**55**	**145**	**215**	**205**	**420**	**220**	**210**	**430**
Minus Pass-by Trips	*	*20%*	*820*	*10*	*10*	*20*	*40*	*40*	*80*	*40*	*40*	*80*
Total New Trips			**3,270**	**80**	**45**	**125**	**175**	**165**	**340**	**180**	**170**	**350**

* Pass-by trips taken from driveway trips. The ins/outs were made equal, as every in needs an equal out.

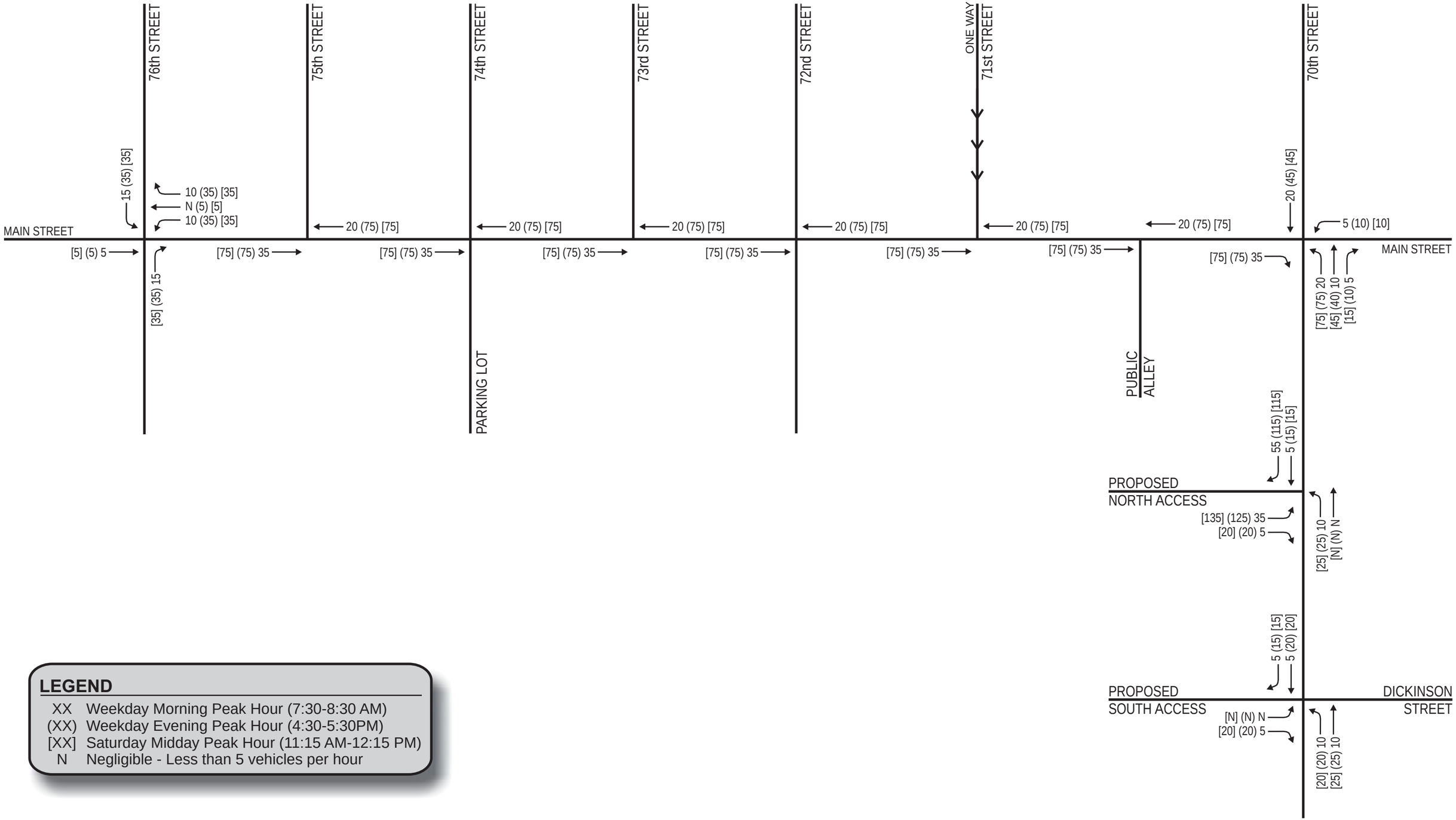
TRIP DISTRIBUTION

North on 76th Street	20%	650	15	10	35	35	35	35
South on 76th Street	20%	650	15	10	35	35	35	35
North on 70th Street	25%	820	20	10	45	40	45	45
South on 70th Street	25%	820	20	10	45	40	45	40
West on Main Street	3%	100	5	0	5	5	5	5
East on Main Street	7%	230	5	5	10	10	15	10
	100%	***3270***	***80***	***45***	***175***	***165***	***180***	***170***
	Total Correct?	***TRUE***	***TRUE***	***TRUE***	***TRUE***	***TRUE***	***TRUE***	***TRUE***

TRAFFIC ANALYSIS & DESIGN, INC.

04-06-11

EXHIBIT 1
WALMART MARKET TRIP GENERATION TABLE
- FROM MARCH 31, 2011 TIA -
MILWAUKEE, WISCONSIN



LEGEND

XX	Weekday Morning Peak Hour (7:30-8:30 AM)
(XX)	Weekday Evening Peak Hour (4:30-5:30PM)
[XX]	Saturday Midday Peak Hour (11:15 AM-12:15 PM)
N	Negligible - Less than 5 vehicles per hour

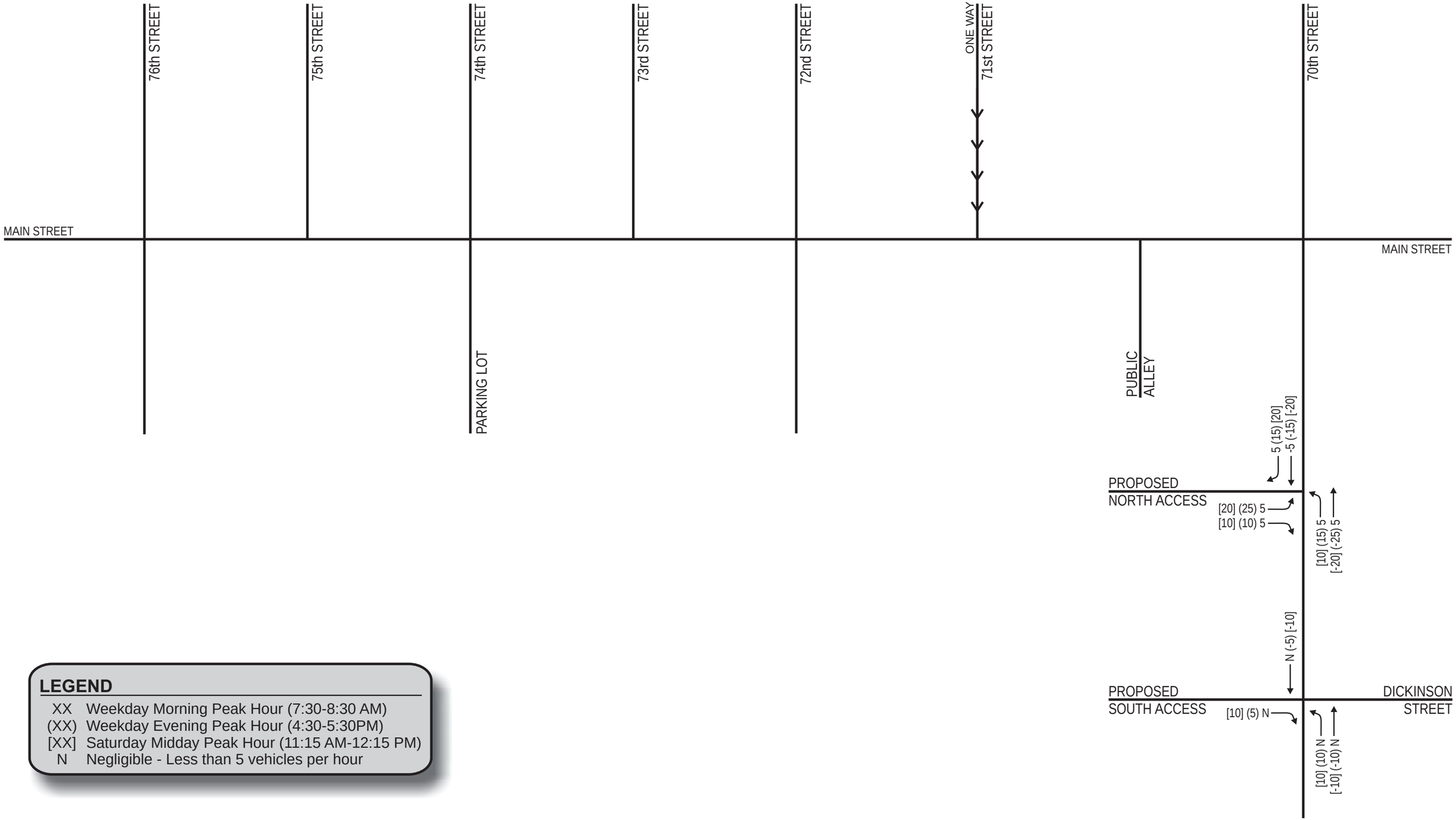
TRAFFIC ANALYSIS & DESIGN, INC.

04-06-11

N

NOT TO SCALE

EXHIBIT 2
ALTERNATIVE WALMART MARKET NEW TRIPS
- 70TH STREET ACCESS ONLY -
MILWAUKEE, WISCONSIN



LEGEND

XX	Weekday Morning Peak Hour (7:30-8:30 AM)
(XX)	Weekday Evening Peak Hour (4:30-5:30PM)
[XX]	Saturday Midday Peak Hour (11:15 AM-12:15 PM)
N	Negligible - Less than 5 vehicles per hour

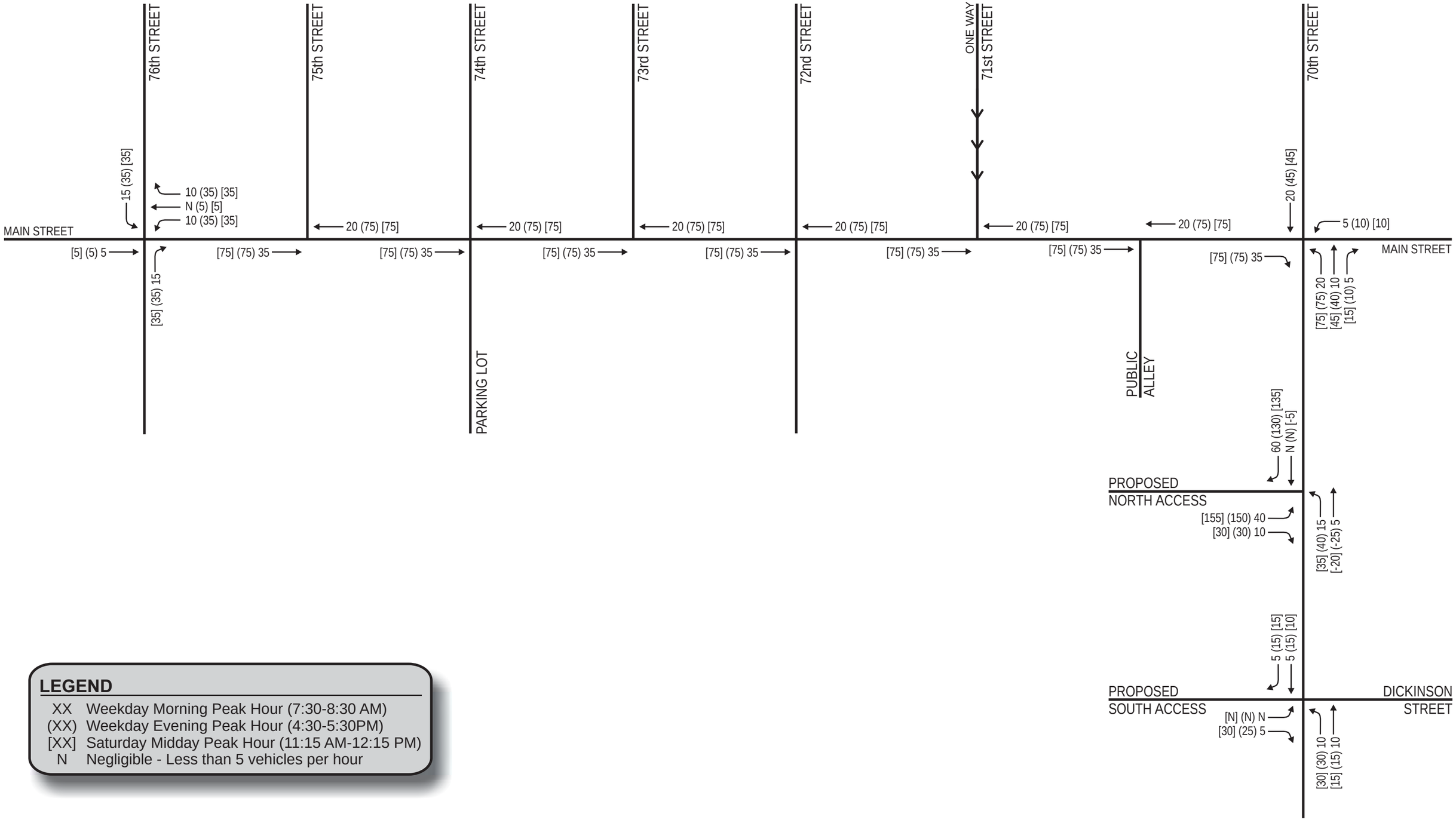
TRAFFIC ANALYSIS & DESIGN, INC.

04-06-11

N

NOT TO SCALE

EXHIBIT 3
ALTERNATIVE WALMART MARKET PASS-BY TRIPS
- 70TH STREET ACCESS ONLY -
MILWAUKEE, WISCONSIN



LEGEND

XX	Weekday Morning Peak Hour (7:30-8:30 AM)
(XX)	Weekday Evening Peak Hour (4:30-5:30PM)
[XX]	Saturday Midday Peak Hour (11:15 AM-12:15 PM)
N	Negligible - Less than 5 vehicles per hour

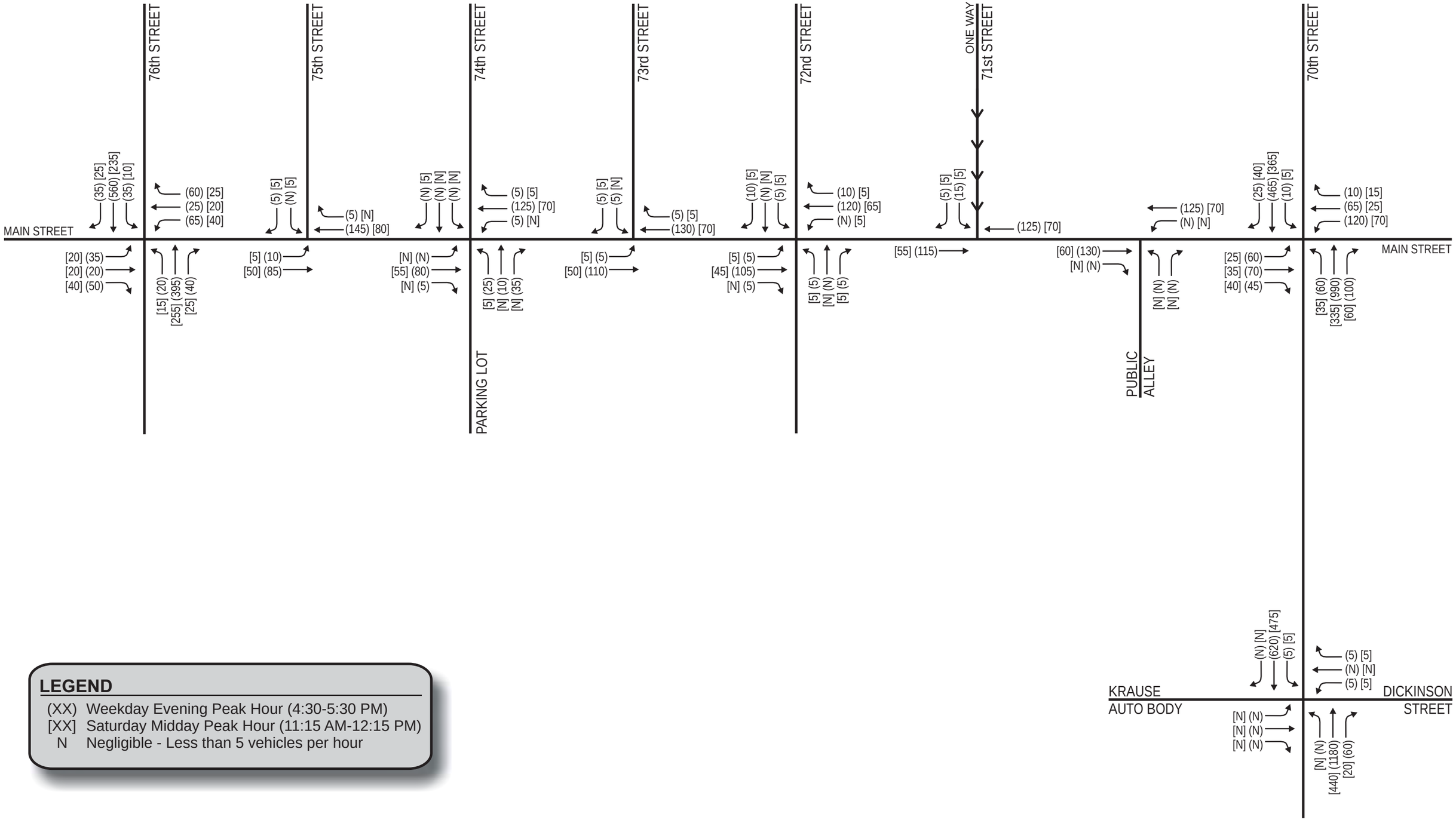
TRAFFIC ANALYSIS & DESIGN, INC.

04-06-11

N

NOT TO SCALE

EXHIBIT 4
ALTERNATIVE WALMART MARKET DRIVEWAY TRIPS
- 70TH STREET ACCESS ONLY -
MILWAUKEE, WISCONSIN



LEGEND

(XX)	Weekday Evening Peak Hour (4:30-5:30 PM)
[XX]	Saturday Midday Peak Hour (11:15 AM-12:15 PM)
N	Negligible - Less than 5 vehicles per hour

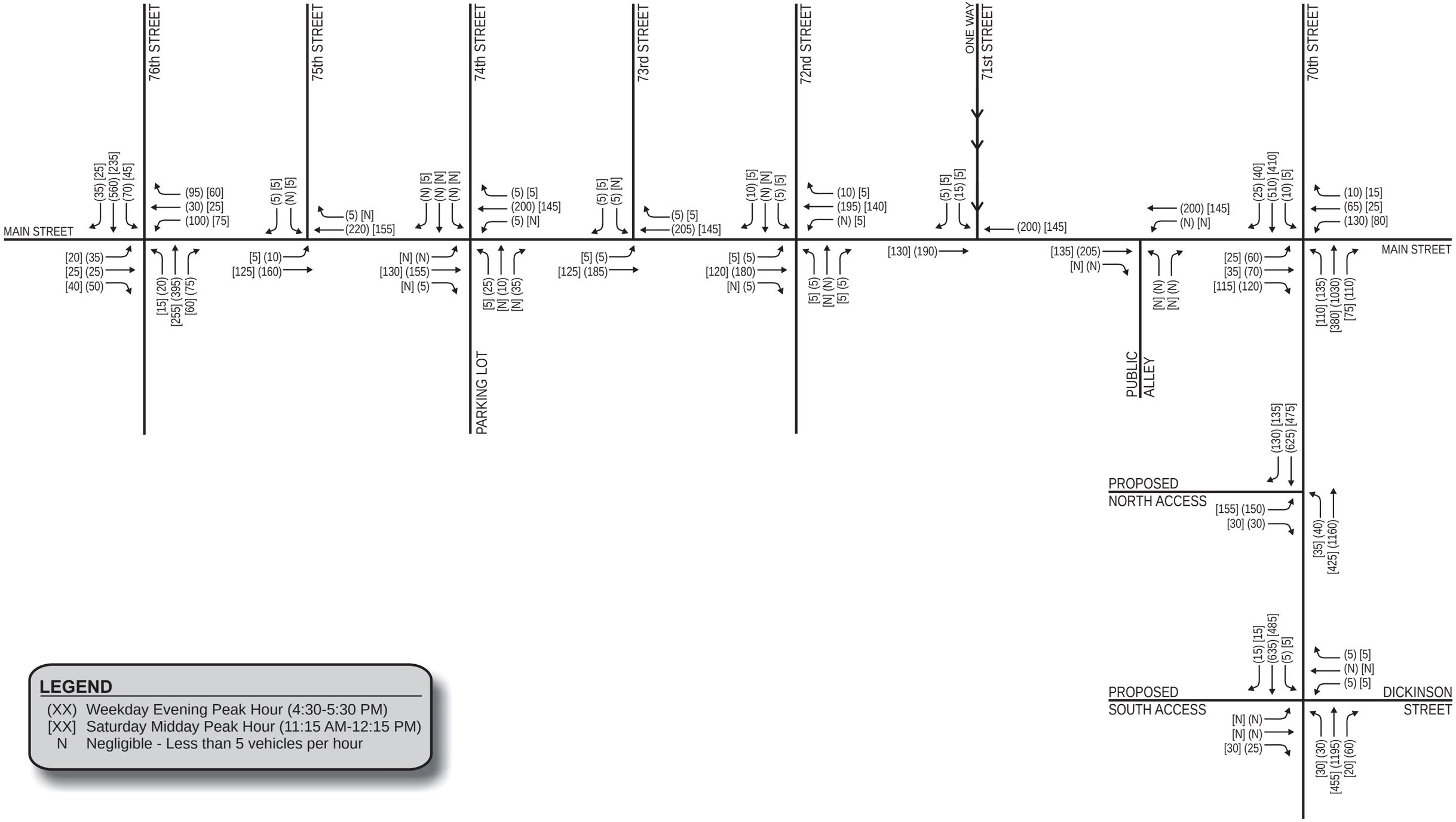
TRAFFIC ANALYSIS & DESIGN, INC.

04-06-11

N

NOT TO SCALE

EXHIBIT 5
YEAR 2011 BACKGROUND TRAFFIC
- FROM MARCH 31, 2011 TIA -
MILWAUKEE, WISCONSIN



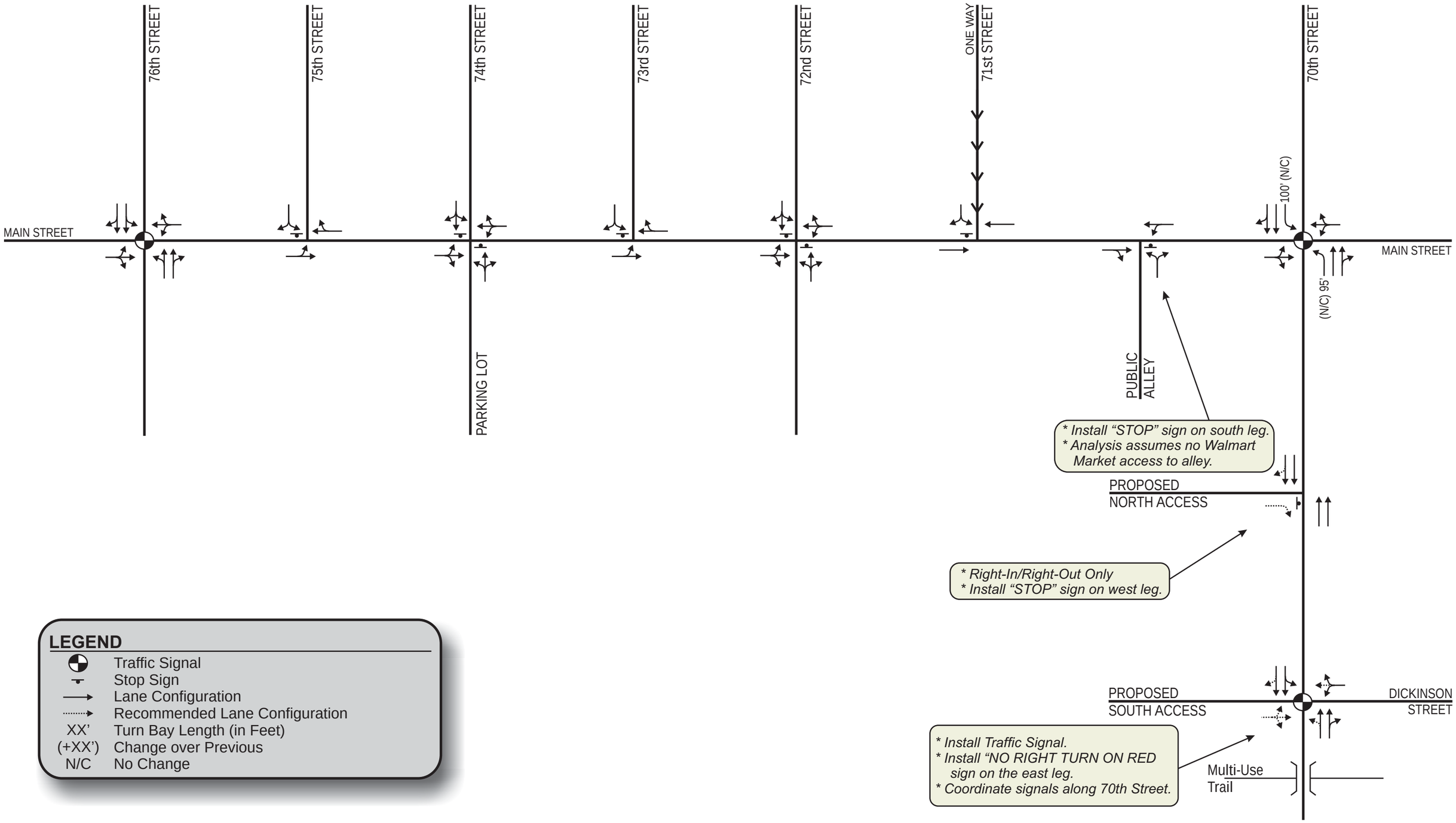
LEGEND

(XX) Weekday Evening Peak Hour (4:30-5:30 PM)
[XX] Saturday Midday Peak Hour (11:15 AM-12:15 PM)
N Negligible - Less than 5 vehicles per hour

TRAFFIC ANALYSIS & DESIGN, INC.
04-06-11

N
NOT TO SCALE

EXHIBIT 6
ALTERNATIVE YEAR 2011 TOTAL TRAFFIC
- 70TH STREET ACCESS ONLY -
MILWAUKEE, WISCONSIN



LEGEND

⊕	Traffic Signal
⊥	Stop Sign
⟶	Lane Configuration
⇢	Recommended Lane Configuration
XX'	Turn Bay Length (in Feet)
(+XX')	Change over Previous
N/C	No Change

TRAFFIC ANALYSIS & DESIGN, INC.

04-06-11

N

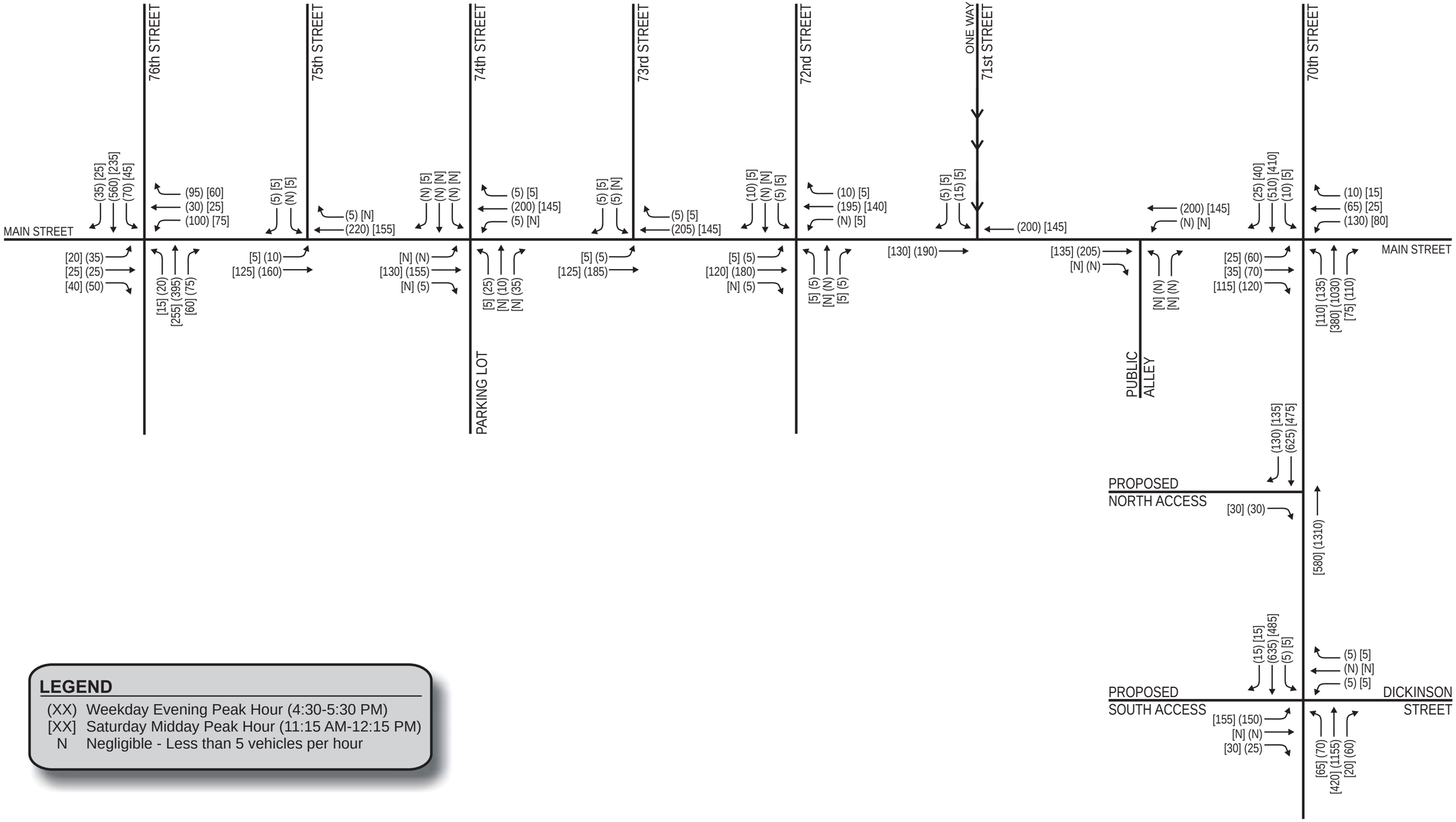
NOT TO SCALE

EXHIBIT 7

ALTERNATIVE YEAR 2011 TOTAL TRAFFIC: ALTERNATIVE IMPROVEMENTS

- 70TH STREET ACCESS ONLY -

MILWAUKEE, WISCONSIN



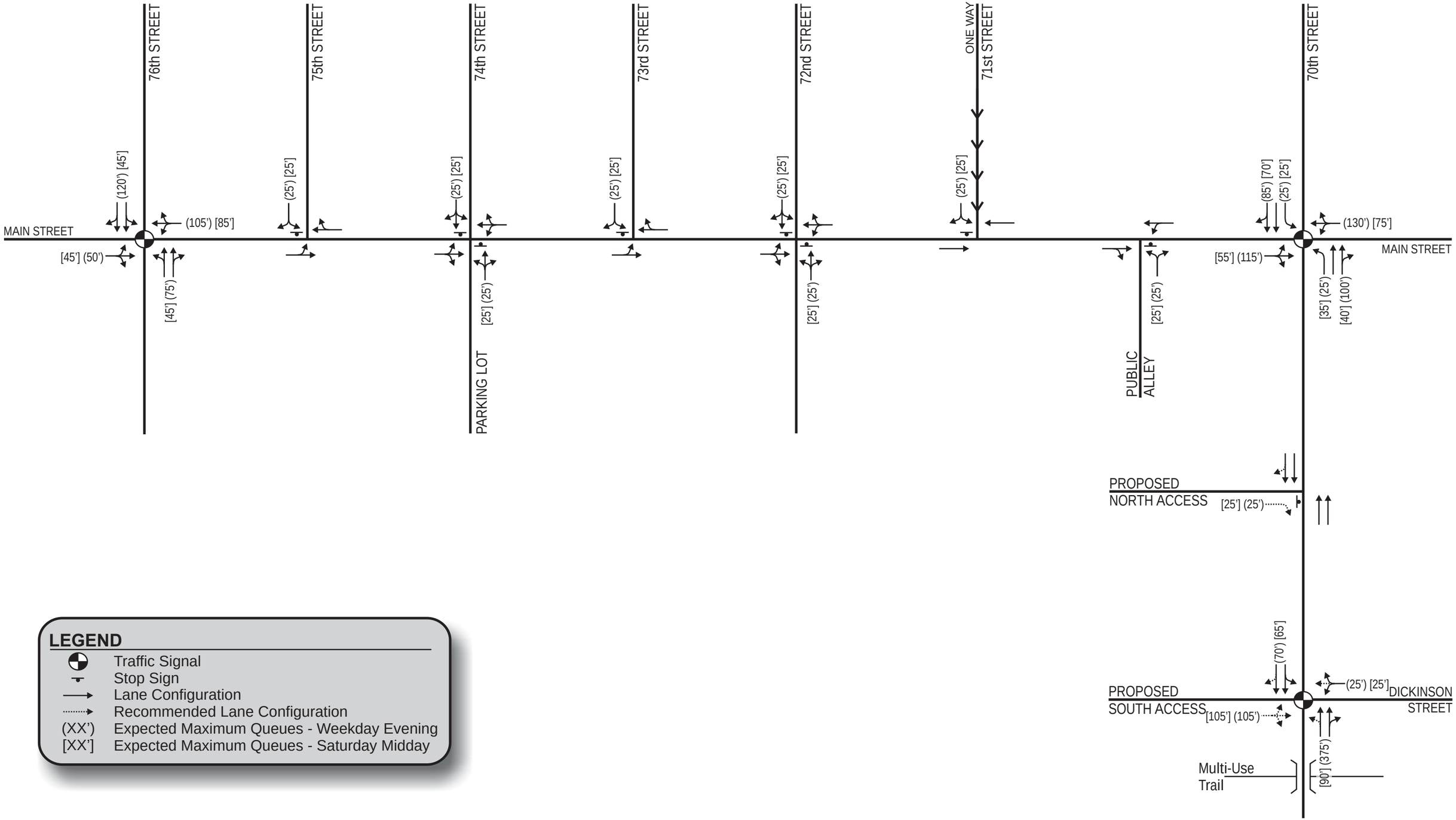
LEGEND

(XX) Weekday Evening Peak Hour (4:30-5:30 PM)
[XX] Saturday Midday Peak Hour (11:15 AM-12:15 PM)
N Negligible - Less than 5 vehicles per hour

TRAFFIC ANALYSIS & DESIGN, INC.
04-06-11

N
NOT TO SCALE

EXHIBIT 8
ALTERNATIVE YEAR 2011 TOTAL TRAFFIC: REASSIGNMENT WITH IMPROVEMENTS
- 70TH STREET ACCESS ONLY -
MILWAUKEE, WISCONSIN



TRAFFIC ANALYSIS & DESIGN, INC.

04-06-11

N

NOT TO SCALE

EXHIBIT 9

ALTERNATIVE YEAR 2011 TOTAL TRAFFIC: EXPECTED MAXIMUM QUEUES

- 70TH STREET ACCESS ONLY -

MILWAUKEE, WISCONSIN

April 6, 2011

APPENDIX A

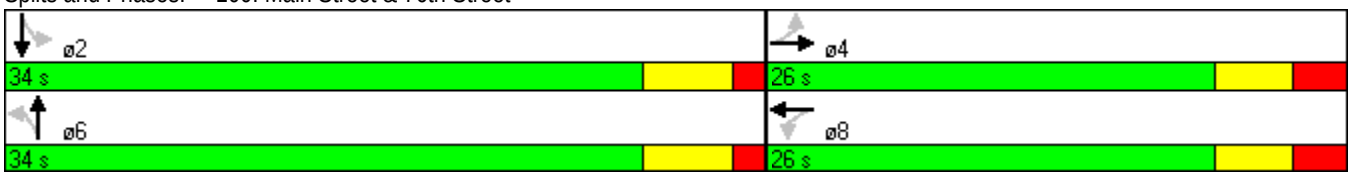
ALTERNATIVE YEAR 2011 TOTAL TRAFFIC
PEAK HOUR ANALYSIS
NO IMPROVEMENTS

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	35	25	50	100	30	95	20	395	75	70	560	35
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (ft)	12	12	12	12	12	12	11	11	11	11	11	11
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	0.95	0.95	0.95	0.95	0.95	0.95
Frt		0.938			0.943			0.977			0.992	
Flt Protected		0.984			0.978			0.998			0.995	
Satd. Flow (prot)	0	1719	0	0	1735	0	0	3369	0	0	3410	0
Flt Permitted		0.842			0.815			0.918			0.850	
Satd. Flow (perm)	0	1471	0	0	1446	0	0	3099	0	0	2913	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		52			66			47			13	
Link Speed (mph)		20			25			30			30	
Link Distance (ft)		338			338			579			529	
Travel Time (s)		11.5			9.2			13.2			12.0	
Peak Hour Factor	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Heavy Vehicles (%)	2%	2%	2%	1%	1%	1%	1%	1%	1%	1%	1%	1%
Adj. Flow (vph)	36	26	52	103	31	98	21	407	77	72	577	36
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	114	0	0	232	0	0	505	0	0	685	0
Turn Type	Perm			Perm			Perm			Perm		
Protected Phases		4			8			6			2	
Permitted Phases	4			8			6			2		
Detector Phase	4	4		8	8		6	6		2	2	
Switch Phase												
Minimum Initial (s)	10.0	10.0		10.0	10.0		14.0	14.0		14.0	14.0	
Minimum Split (s)	16.0	16.0		16.0	16.0		19.5	19.5		19.5	19.5	
Total Split (s)	26.0	26.0	0.0	26.0	26.0	0.0	34.0	34.0	0.0	34.0	34.0	0.0
Total Split (%)	43.3%	43.3%	0.0%	43.3%	43.3%	0.0%	56.7%	56.7%	0.0%	56.7%	56.7%	0.0%
Maximum Green (s)	20.0	20.0		20.0	20.0		28.5	28.5		28.5	28.5	
Yellow Time (s)	3.5	3.5		3.5	3.5		4.0	4.0		4.0	4.0	
All-Red Time (s)	2.5	2.5		2.5	2.5		1.5	1.5		1.5	1.5	
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	6.0	6.0	4.0	6.0	6.0	4.0	5.5	5.5	4.0	5.5	5.5	4.0
Lead/Lag												
Lead-Lag Optimize?												
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Recall Mode	None	None		None	None		C-Max	C-Max		C-Max	C-Max	
Walk Time (s)				7.0	7.0		7.0	7.0		7.0	7.0	
Flash Dont Walk (s)				13.0	13.0		7.0	7.0		7.0	7.0	
Pedestrian Calls (#/hr)				0	0		0	0		0	0	
v/c Ratio		0.31			0.62			0.28			0.40	
Control Delay		13.0			21.9			6.7			8.2	
Queue Delay		0.0			0.0			0.0			0.0	
Total Delay		13.0			21.9			6.7			8.2	
90th %ile Green (s)	18.9	18.9		18.9	18.9		29.6	29.6		29.6	29.6	
90th %ile Term Code	Hold	Hold		Gap	Gap		Coord	Coord		Coord	Coord	
70th %ile Green (s)	15.2	15.2		15.2	15.2		33.3	33.3		33.3	33.3	
70th %ile Term Code	Hold	Hold		Gap	Gap		Coord	Coord		Coord	Coord	

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
50th %ile Green (s)	12.6	12.6		12.6	12.6		35.9	35.9		35.9	35.9	
50th %ile Term Code	Hold	Hold		Gap	Gap		Coord	Coord		Coord	Coord	
30th %ile Green (s)	10.0	10.0		10.0	10.0		38.5	38.5		38.5	38.5	
30th %ile Term Code	Min	Min		Min	Min		Coord	Coord		Coord	Coord	
10th %ile Green (s)	10.0	10.0		10.0	10.0		38.5	38.5		38.5	38.5	
10th %ile Term Code	Hold	Hold		Min	Min		Coord	Coord		Coord	Coord	
Queue Length 50th (ft)		19			54			35			57	
Queue Length 95th (ft)		48			102			75			117	
Internal Link Dist (ft)		258			258			499			449	
Turn Bay Length (ft)												
Base Capacity (vph)		525			526			1835			1713	
Starvation Cap Reductn		0			0			0			0	
Spillback Cap Reductn		0			0			0			0	
Storage Cap Reductn		0			0			0			0	
Reduced v/c Ratio		0.22			0.44			0.28			0.40	

Intersection Summary	
Area Type:	Other
Cycle Length: 60	
Actuated Cycle Length: 60	
Offset: 49 (82%), Referenced to phase 2:SBTL and 6:NBTL, Start of Green	
Natural Cycle: 40	
Control Type: Actuated-Coordinated	

Splits and Phases: 100: Main Street & 76th Street



HCM Signalized Intersection Capacity Analysis
100: Main Street & 76th Street

4/4/2011

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	35	25	50	100	30	95	20	395	75	70	560	35
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	12	12	12	12	12	12	11	11	11	11	11	11
Total Lost time (s)		6.0			6.0			5.5			5.5	
Lane Util. Factor		1.00			1.00			0.95			0.95	
Frt		0.94			0.94			0.98			0.99	
Flt Protected		0.98			0.98			1.00			0.99	
Satd. Flow (prot)		1721			1735			3369			3410	
Flt Permitted		0.84			0.81			0.92			0.85	
Satd. Flow (perm)		1472			1445			3100			2914	
Peak-hour factor, PHF	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Adj. Flow (vph)	36	26	52	103	31	98	21	407	77	72	577	36
RTOR Reduction (vph)	0	40	0	0	51	0	0	19	0	0	5	0
Lane Group Flow (vph)	0	74	0	0	181	0	0	486	0	0	680	0
Heavy Vehicles (%)	2%	2%	2%	1%	1%	1%	1%	1%	1%	1%	1%	1%
Turn Type	Perm			Perm			Perm			Perm		
Protected Phases		4			8			6			2	
Permitted Phases	4			8			6			2		
Actuated Green, G (s)		13.3			13.3			35.2			35.2	
Effective Green, g (s)		13.3			13.3			35.2			35.2	
Actuated g/C Ratio		0.22			0.22			0.59			0.59	
Clearance Time (s)		6.0			6.0			5.5			5.5	
Vehicle Extension (s)		3.0			3.0			3.0			3.0	
Lane Grp Cap (vph)		326			320			1819			1710	
v/s Ratio Prot												
v/s Ratio Perm		0.05			c0.13			0.16			c0.23	
v/c Ratio		0.23			0.56			0.27			0.40	
Uniform Delay, d1		19.1			20.8			6.1			6.7	
Progression Factor		1.00			1.00			1.00			1.00	
Incremental Delay, d2		0.4			2.3			0.4			0.7	
Delay (s)		19.5			23.1			6.4			7.4	
Level of Service		B			C			A			A	
Approach Delay (s)		19.5			23.1			6.4			7.4	
Approach LOS		B			C			A			A	

Intersection Summary			
HCM Average Control Delay	10.3	HCM Level of Service	B
HCM Volume to Capacity ratio	0.44		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	11.5
Intersection Capacity Utilization	66.3%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	10	160	220	5	1	5
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt			0.997		0.884	
Flt Protected		0.997			0.993	
Satd. Flow (prot)	0	1876	1876	0	1651	0
Flt Permitted		0.997			0.993	
Satd. Flow (perm)	0	1876	1876	0	1651	0
Link Speed (mph)		25	25		25	
Link Distance (ft)		338	319		300	
Travel Time (s)		9.2	8.7		8.2	
Peak Hour Factor	0.88	0.88	0.88	0.88	0.88	0.88
Heavy Vehicles (%)	1%	1%	1%	1%	1%	1%
Adj. Flow (vph)	11	182	250	6	1	6
Shared Lane Traffic (%)						
Lane Group Flow (vph)	0	193	256	0	7	0
Sign Control		Free	Free		Stop	

Intersection Summary	
Area Type:	Other
Control Type: Unsignalized	

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (veh/h)	10	160	220	5	1	5
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.88	0.88	0.88	0.88	0.88	0.88
Hourly flow rate (vph)	11	182	250	6	1	6
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (ft)		338				
pX, platoon unblocked						
vC, conflicting volume	256				457	253
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	256				457	253
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	99				100	99
cM capacity (veh/h)	1315				558	788

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total	193	256	7
Volume Left	11	0	1
Volume Right	0	6	6
cSH	1315	1700	738
Volume to Capacity	0.01	0.15	0.01
Queue Length 95th (ft)	1	0	1
Control Delay (s)	0.5	0.0	9.9
Lane LOS	A		A
Approach Delay (s)	0.5	0.0	9.9
Approach LOS			A

Intersection Summary			
Average Delay	0.4		
Intersection Capacity Utilization	26.6%	ICU Level of Service	A
Analysis Period (min)	15		

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	1	155	5	5	200	5	25	10	35	1	1	1
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.996			0.997			0.932			0.955	
Flt Protected					0.999			0.983			0.984	
Satd. Flow (prot)	0	1802	0	0	1769	0	0	1723	0	0	1768	0
Flt Permitted					0.999			0.983			0.984	
Satd. Flow (perm)	0	1802	0	0	1769	0	0	1723	0	0	1768	0
Link Speed (mph)		25			25			25			25	
Link Distance (ft)		319			323			156			301	
Travel Time (s)		8.7			8.8			4.3			8.2	
Peak Hour Factor	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91
Heavy Vehicles (%)	5%	5%	5%	7%	7%	7%	1%	1%	1%	1%	1%	1%
Adj. Flow (vph)	1	170	5	5	220	5	27	11	38	1	1	1
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	176	0	0	230	0	0	76	0	0	3	0
Sign Control		Free			Free			Stop			Stop	

Intersection Summary	
Area Type:	Other
Control Type: Unsignalized	

HCM Unsignalized Intersection Capacity Analysis
120: Main Street & 74th Street

4/4/2011

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	1	155	5	5	200	5	25	10	35	1	1	1
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91
Hourly flow rate (vph)	1	170	5	5	220	5	27	11	38	1	1	1
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (ft)		657			1293							
pX, platoon unblocked												
vC, conflicting volume	225			176			410	412	173	453	412	223
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	225			176			410	412	173	453	412	223
tC, single (s)	4.1			4.2			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.3			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	100			100			95	98	96	100	100	100
cM capacity (veh/h)	1326			1371			550	529	873	486	529	820

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	177	231	77	3
Volume Left	1	5	27	1
Volume Right	5	5	38	1
cSH	1326	1371	670	581
Volume to Capacity	0.00	0.00	0.11	0.01
Queue Length 95th (ft)	0	0	10	0
Control Delay (s)	0.1	0.2	11.1	11.2
Lane LOS	A	A	B	B
Approach Delay (s)	0.1	0.2	11.1	11.2
Approach LOS			B	B

Intersection Summary			
Average Delay	1.9		
Intersection Capacity Utilization	26.4%	ICU Level of Service	A
Analysis Period (min)	15		

Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	5	185	205	5	5	5
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt			0.997		0.932	
Flt Protected		0.999			0.976	
Satd. Flow (prot)	0	1825	1804	0	1711	0
Flt Permitted		0.999			0.976	
Satd. Flow (perm)	0	1825	1804	0	1711	0
Link Speed (mph)		25	25		25	
Link Distance (ft)		323	318		300	
Travel Time (s)		8.8	8.7		8.2	
Peak Hour Factor	0.81	0.81	0.81	0.81	0.81	0.81
Heavy Vehicles (%)	4%	4%	5%	5%	1%	1%
Adj. Flow (vph)	6	228	253	6	6	6
Shared Lane Traffic (%)						
Lane Group Flow (vph)	0	234	259	0	12	0
Sign Control		Free	Free		Stop	

Intersection Summary	
Area Type:	Other
Control Type: Unsignalized	

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (veh/h)	5	185	205	5	5	5
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.81	0.81	0.81	0.81	0.81	0.81
Hourly flow rate (vph)	6	228	253	6	6	6
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (ft)		980	970			
pX, platoon unblocked						
vC, conflicting volume	259				497	256
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	259				497	256
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	100				99	99
cM capacity (veh/h)	1294				532	785

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total	235	259	12
Volume Left	6	0	6
Volume Right	0	6	6
cSH	1294	1700	634
Volume to Capacity	0.00	0.15	0.02
Queue Length 95th (ft)	0	0	1
Control Delay (s)	0.2	0.0	10.8
Lane LOS	A		B
Approach Delay (s)	0.2	0.0	10.8
Approach LOS			B

Intersection Summary			
Average Delay	0.4		
Intersection Capacity Utilization	23.8%	ICU Level of Service	A
Analysis Period (min)	15		

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	5	180	5	1	195	10	5	1	5	5	1	10
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.997			0.993			0.938			0.912	
Flt Protected		0.999						0.977			0.985	
Satd. Flow (prot)	0	1874	0	0	1850	0	0	1724	0	0	1552	0
Flt Permitted		0.999						0.977			0.985	
Satd. Flow (perm)	0	1874	0	0	1850	0	0	1724	0	0	1552	0
Link Speed (mph)		25			25			25			25	
Link Distance (ft)		318			327			300			301	
Travel Time (s)		8.7			8.9			8.2			8.2	
Peak Hour Factor	0.79	0.79	0.79	0.79	0.79	0.79	0.79	0.79	0.79	0.79	0.79	0.79
Heavy Vehicles (%)	1%	1%	1%	2%	2%	2%	1%	1%	1%	10%	10%	10%
Adj. Flow (vph)	6	228	6	1	247	13	6	1	6	6	1	13
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	240	0	0	261	0	0	13	0	0	20	0
Sign Control		Free			Free			Stop			Stop	

Intersection Summary	
Area Type:	Other
Control Type: Unsignalized	

HCM Unsignalized Intersection Capacity Analysis
140: Main Street & 72nd Street

4/4/2011

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	5	180	5	1	195	10	5	1	5	5	1	10
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.79	0.79	0.79	0.79	0.79	0.79	0.79	0.79	0.79	0.79	0.79	0.79
Hourly flow rate (vph)	6	228	6	1	247	13	6	1	6	6	1	13
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (ft)		1298			652							
pX, platoon unblocked												
vC, conflicting volume	259			234			513	506	231	506	503	253
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	259			234			513	506	231	506	503	253
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.2	6.6	6.3
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.6	4.1	3.4
p0 queue free %	100			100			99	100	99	99	100	98
cM capacity (veh/h)	1311			1333			463	468	811	457	457	766

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	241	261	14	20
Volume Left	6	1	6	6
Volume Right	6	13	6	13
cSH	1311	1333	576	611
Volume to Capacity	0.00	0.00	0.02	0.03
Queue Length 95th (ft)	0	0	2	3
Control Delay (s)	0.2	0.0	11.4	11.1
Lane LOS	A	A	B	B
Approach Delay (s)	0.2	0.0	11.4	11.1
Approach LOS			B	B

Intersection Summary			
Average Delay	0.8		
Intersection Capacity Utilization	23.3%	ICU Level of Service	A
Analysis Period (min)	15		

Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	0	190	200	0	15	5
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt					0.968	
Flt Protected					0.963	
Satd. Flow (prot)	0	1881	1827	0	1754	0
Flt Permitted					0.963	
Satd. Flow (perm)	0	1881	1827	0	1754	0
Link Speed (mph)		25	25		25	
Link Distance (ft)		327	155		300	
Travel Time (s)		8.9	4.2		8.2	
Peak Hour Factor	0.77	0.77	0.77	0.77	0.77	0.77
Heavy Vehicles (%)	1%	1%	4%	4%	1%	1%
Adj. Flow (vph)	0	247	260	0	19	6
Shared Lane Traffic (%)						
Lane Group Flow (vph)	0	247	260	0	25	0
Sign Control		Free	Free		Stop	

Intersection Summary	
Area Type:	Other
Control Type: Unsignalized	

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (veh/h)	0	190	200	0	15	5
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.77	0.77	0.77	0.77	0.77	0.77
Hourly flow rate (vph)	0	247	260	0	19	6
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (ft)			325			
pX, platoon unblocked						
vC, conflicting volume	260				506	260
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	260				506	260
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	100				96	99
cM capacity (veh/h)	1311				528	781

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total	247	260	26
Volume Left	0	0	19
Volume Right	0	0	6
cSH	1700	1700	574
Volume to Capacity	0.15	0.15	0.05
Queue Length 95th (ft)	0	0	4
Control Delay (s)	0.0	0.0	11.6
Lane LOS			B
Approach Delay (s)	0.0	0.0	11.6
Approach LOS			B

Intersection Summary			
Average Delay	0.6		
Intersection Capacity Utilization	20.5%	ICU Level of Service	A
Analysis Period (min)	15		

Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Volume (vph)	205	1	1	200	1	1
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt	0.999				0.932	
Flt Protected					0.976	
Satd. Flow (prot)	1879	0	0	1827	1711	0
Flt Permitted					0.976	
Satd. Flow (perm)	1879	0	0	1827	1711	0
Link Speed (mph)	25			25	25	
Link Distance (ft)	155			170	141	
Travel Time (s)	4.2			4.6	3.8	
Peak Hour Factor	0.77	0.77	0.77	0.77	0.77	0.77
Heavy Vehicles (%)	1%	1%	4%	4%	1%	1%
Adj. Flow (vph)	266	1	1	260	1	1
Shared Lane Traffic (%)						
Lane Group Flow (vph)	267	0	0	261	2	0
Sign Control	Free			Free	Stop	

Intersection Summary	
Area Type:	Other
Control Type: Unsignalized	

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Volume (veh/h)	205	1	1	200	1	1
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.77	0.77	0.77	0.77	0.77	0.77
Hourly flow rate (vph)	266	1	1	260	1	1
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None			None		
Median storage veh)						
Upstream signal (ft)				170		
pX, platoon unblocked					0.98	
vC, conflicting volume			268		529	267
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			268		508	267
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			100		100	100
cM capacity (veh/h)			1285		515	774

Direction, Lane #	EB 1	WB 1	NB 1
Volume Total	268	261	3
Volume Left	0	1	1
Volume Right	1	0	1
cSH	1700	1285	618
Volume to Capacity	0.16	0.00	0.00
Queue Length 95th (ft)	0	0	0
Control Delay (s)	0.0	0.0	10.8
Lane LOS		A	B
Approach Delay (s)	0.0	0.0	10.8
Approach LOS			B

Intersection Summary			
Average Delay	0.1		
Intersection Capacity Utilization	21.3%	ICU Level of Service	A
Analysis Period (min)	15		

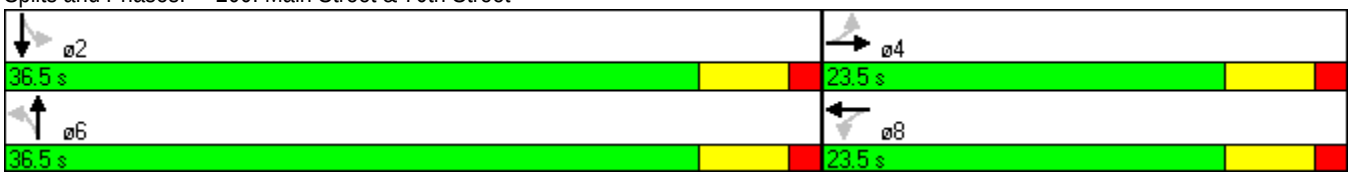
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	60	70	120	130	65	10	135	1030	110	10	510	25
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (ft)	12	12	12	12	12	12	10	11	11	10	11	11
Storage Length (ft)	0		0	0		0	95		0	100		0
Storage Lanes	0		0	0		0	1		0	1		0
Taper Length (ft)	50		50	50		50	50		50	50		50
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.95	0.95	1.00	0.95	0.95
Frt		0.935			0.993			0.986			0.993	
Flt Protected		0.988			0.969		0.950			0.950		
Satd. Flow (prot)	0	1738	0	0	1810	0	1668	3407	0	1668	3431	0
Flt Permitted		0.882			0.641		0.434			0.154		
Satd. Flow (perm)	0	1551	0	0	1197	0	762	3407	0	270	3431	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		80			5			28			12	
Link Speed (mph)		25			25			30			30	
Link Distance (ft)		170			300			253			883	
Travel Time (s)		4.6			8.2			5.8			20.1	
Peak Hour Factor	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Heavy Vehicles (%)	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%
Adj. Flow (vph)	64	74	128	138	69	11	144	1096	117	11	543	27
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	266	0	0	218	0	144	1213	0	11	570	0
Turn Type	Perm			Perm			Perm			Perm		
Protected Phases		4			8			6			2	
Permitted Phases	4			8			6			2		
Detector Phase	4	4		8	8		6	6		2	2	
Switch Phase												
Minimum Initial (s)	18.0	18.0		18.0	18.0		31.0	31.0		31.0	31.0	
Minimum Split (s)	23.5	23.5		23.5	23.5		36.5	36.5		36.5	36.5	
Total Split (s)	23.5	23.5	0.0	23.5	23.5	0.0	36.5	36.5	0.0	36.5	36.5	0.0
Total Split (%)	39.2%	39.2%	0.0%	39.2%	39.2%	0.0%	60.8%	60.8%	0.0%	60.8%	60.8%	0.0%
Maximum Green (s)	18.0	18.0		18.0	18.0		31.0	31.0		31.0	31.0	
Yellow Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
All-Red Time (s)	1.5	1.5		1.5	1.5		1.5	1.5		1.5	1.5	
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.5	5.5	4.0	5.5	5.5	4.0	5.5	5.5	4.0	5.5	5.5	4.0
Lead/Lag												
Lead-Lag Optimize?												
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Recall Mode	Max	Max		Max	Max		C-Max	C-Max		C-Max	C-Max	
Walk Time (s)	7.0	7.0		7.0	7.0		21.0	21.0		21.0	21.0	
Flash Dont Walk (s)	11.0	11.0		11.0	11.0		10.0	10.0		10.0	10.0	
Pedestrian Calls (#/hr)	0	0		0	0		0	0		0	0	
v/c Ratio		0.51			0.60		0.37	0.68		0.08	0.32	
Control Delay		16.0			25.8		12.1	13.1		9.1	8.8	
Queue Delay		0.0			0.0		0.0	0.0		0.0	0.0	
Total Delay		16.0			25.8		12.1	13.1		9.1	8.8	
90th %ile Green (s)	18.0	18.0		18.0	18.0		31.0	31.0		31.0	31.0	

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
90th %ile Term Code	MaxR	MaxR		MaxR	MaxR		Coord	Coord		Coord	Coord	
70th %ile Green (s)	18.0	18.0		18.0	18.0		31.0	31.0		31.0	31.0	
70th %ile Term Code	MaxR	MaxR		MaxR	MaxR		Coord	Coord		Coord	Coord	
50th %ile Green (s)	18.0	18.0		18.0	18.0		31.0	31.0		31.0	31.0	
50th %ile Term Code	MaxR	MaxR		MaxR	MaxR		Coord	Coord		Coord	Coord	
30th %ile Green (s)	18.0	18.0		18.0	18.0		31.0	31.0		31.0	31.0	
30th %ile Term Code	MaxR	MaxR		MaxR	MaxR		Coord	Coord		Coord	Coord	
10th %ile Green (s)	18.0	18.0		18.0	18.0		31.0	31.0		31.0	31.0	
10th %ile Term Code	MaxR	MaxR		MaxR	MaxR		Coord	Coord		Coord	Coord	
Queue Length 50th (ft)		52			65		28	153		2	55	
Queue Length 95th (ft)		113			#131		66	217		9	84	
Internal Link Dist (ft)		90			220			173			803	
Turn Bay Length (ft)							95			100		
Base Capacity (vph)		521			363		394	1774		140	1778	
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		0.51			0.60		0.37	0.68		0.08	0.32	

Intersection Summary

Area Type: Other
Cycle Length: 60
Actuated Cycle Length: 60
Offset: 39 (65%), Referenced to phase 2:SBTL and 6:NBTL, Start of Green
Natural Cycle: 60
Control Type: Actuated-Coordinated
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 200: Main Street & 70th Street



HCM Signalized Intersection Capacity Analysis
200: Main Street & 70th Street

4/4/2011

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	60	70	120	130	65	10	135	1030	110	10	510	25
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	12	12	12	12	12	12	10	11	11	10	11	11
Total Lost time (s)		5.5			5.5		5.5	5.5		5.5	5.5	
Lane Util. Factor		1.00			1.00		1.00	0.95		1.00	0.95	
Frt		0.94			0.99		1.00	0.99		1.00	0.99	
Flt Protected		0.99			0.97		0.95	1.00		0.95	1.00	
Satd. Flow (prot)		1738			1811		1668	3405		1668	3431	
Flt Permitted		0.88			0.64		0.43	1.00		0.15	1.00	
Satd. Flow (perm)		1552			1198		761	3405		270	3431	
Peak-hour factor, PHF	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Adj. Flow (vph)	64	74	128	138	69	11	144	1096	117	11	543	27
RTOR Reduction (vph)	0	56	0	0	4	0	0	14	0	0	6	0
Lane Group Flow (vph)	0	210	0	0	215	0	144	1199	0	11	564	0
Heavy Vehicles (%)	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%
Turn Type	Perm			Perm			Perm			Perm		
Protected Phases		4			8			6			2	
Permitted Phases	4			8			6			2		
Actuated Green, G (s)		18.0			18.0		31.0	31.0		31.0	31.0	
Effective Green, g (s)		18.0			18.0		31.0	31.0		31.0	31.0	
Actuated g/C Ratio		0.30			0.30		0.52	0.52		0.52	0.52	
Clearance Time (s)		5.5			5.5		5.5	5.5		5.5	5.5	
Vehicle Extension (s)		3.0			3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)		466			359		393	1759		140	1773	
v/s Ratio Prot								c0.35			0.16	
v/s Ratio Perm		0.14			c0.18		0.19			0.04		
v/c Ratio		0.45			0.60		0.37	0.68		0.08	0.32	
Uniform Delay, d1		17.0			17.9		8.6	10.8		7.3	8.4	
Progression Factor		1.00			1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2		3.1			7.2		2.6	2.2		1.1	0.5	
Delay (s)		20.1			25.1		11.3	13.0		8.4	8.9	
Level of Service		C			C		B	B		A	A	
Approach Delay (s)		20.1			25.1			12.8			8.9	
Approach LOS		C			C			B			A	

Intersection Summary			
HCM Average Control Delay	13.8	HCM Level of Service	B
HCM Volume to Capacity ratio	0.65		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	11.0
Intersection Capacity Utilization	97.1%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (vph)	150	30	40	1160	625	130
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width (ft)	12	12	11	11	11	11
Lane Util. Factor	1.00	1.00	0.95	0.95	0.95	0.95
Frt	0.978				0.974	
Flt Protected	0.960			0.998		
Satd. Flow (prot)	1766	0	0	3448	3365	0
Flt Permitted	0.960			0.998		
Satd. Flow (perm)	1766	0	0	3448	3365	0
Link Speed (mph)	25			30	30	
Link Distance (ft)	165			240	253	
Travel Time (s)	4.5			5.5	5.8	
Peak Hour Factor	0.94	0.94	0.94	0.94	0.94	0.94
Heavy Vehicles (%)	1%	1%	1%	1%	1%	1%
Adj. Flow (vph)	160	32	43	1234	665	138
Shared Lane Traffic (%)						
Lane Group Flow (vph)	192	0	0	1277	803	0
Sign Control	Stop			Free	Free	

Intersection Summary	
Area Type:	Other
Control Type: Unsignalized	

HCM Unsignalized Intersection Capacity Analysis
210: Proposed North Access & 70th Street

4/4/2011

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (veh/h)	150	30	40	1160	625	130
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.94	0.94	0.94	0.94	0.94	0.94
Hourly flow rate (vph)	160	32	43	1234	665	138
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (ft)					253	
pX, platoon unblocked	0.92	0.92	0.92			
vC, conflicting volume	1436	402	803			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1304	182	617			
tC, single (s)	6.8	6.9	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	0	96	95			
cM capacity (veh/h)	135	768	890			

Direction, Lane #	EB 1	NB 1	NB 2	SB 1	SB 2
Volume Total	191	454	823	443	360
Volume Left	160	43	0	0	0
Volume Right	32	0	0	0	138
cSH	156	890	1700	1700	1700
Volume to Capacity	1.23	0.05	0.48	0.26	0.21
Queue Length 95th (ft)	274	4	0	0	0
Control Delay (s)	203.2	1.4	0.0	0.0	0.0
Lane LOS	F	A			
Approach Delay (s)	203.2	0.5		0.0	
Approach LOS	F				

Intersection Summary			
Average Delay	17.4		
Intersection Capacity Utilization	74.8%	ICU Level of Service	D
Analysis Period (min)	15		

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	1	1	25	5	1	5	30	1195	60	5	635	15
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (ft)	12	12	12	12	12	12	11	11	11	11	11	11
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	0.95	0.95	0.95	0.95	0.95	0.95
Frt		0.874			0.939			0.993			0.997	
Flt Protected		0.998			0.978			0.999				
Satd. Flow (prot)	0	1641	0	0	1728	0	0	3427	0	0	3445	0
Flt Permitted		0.998			0.978			0.999				
Satd. Flow (perm)	0	1641	0	0	1728	0	0	3427	0	0	3445	0
Link Speed (mph)		25			25			30			30	
Link Distance (ft)		165			300			512			240	
Travel Time (s)		4.5			8.2			11.6			5.5	
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
Heavy Vehicles (%)	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%
Adj. Flow (vph)	1	1	27	5	1	5	33	1299	65	5	690	16
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	29	0	0	11	0	0	1397	0	0	711	0
Sign Control		Stop			Stop			Free			Free	

Intersection Summary	
Area Type:	Other
Control Type: Unsignalized	

HCM Unsignalized Intersection Capacity Analysis
220: Proposed South Access & 70th Street

4/4/2011

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	1	1	25	5	1	5	30	1195	60	5	635	15
Sign Control		Stop			Stop			Free			Free	
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)	1	1	27	5	1	5	33	1299	65	5	690	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)											493	
pX, platoon unblocked												
vC, conflicting volume	1430	2139	353	1780	2114	682	707			1364		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1430	2139	353	1780	2114	682	707			1364		
tC, single (s)	7.5	6.5	6.9	7.5	6.5	6.9	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	99	98	96	89	98	99	96			99		
cM capacity (veh/h)	90	47	646	48	48	395	894			505		

Direction, Lane #	EB 1	WB 1	NB 1	NB 2	SB 1	SB 2
Volume Total	29	12	682	715	351	361
Volume Left	1	5	33	0	5	0
Volume Right	27	5	0	65	0	16
cSH	379	79	894	1700	505	1700
Volume to Capacity	0.08	0.15	0.04	0.42	0.01	0.21
Queue Length 95th (ft)	6	13	3	0	1	0
Control Delay (s)	15.3	58.2	1.0	0.0	0.4	0.0
Lane LOS	C	F	A		A	
Approach Delay (s)	15.3	58.2	0.5		0.2	
Approach LOS	C	F				

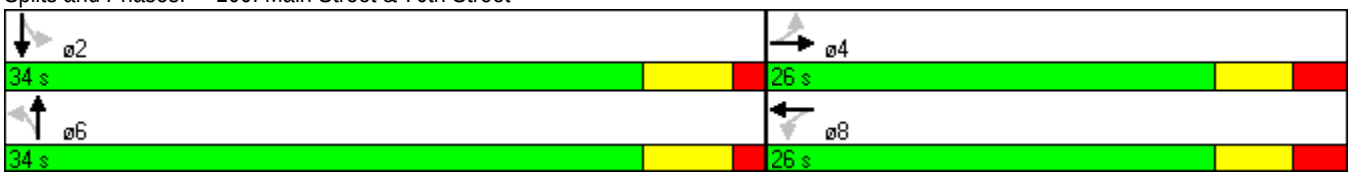
Intersection Summary			
Average Delay	0.9		
Intersection Capacity Utilization	66.6%	ICU Level of Service	C
Analysis Period (min)	15		

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	20	25	40	75	25	60	15	255	60	45	235	25
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (ft)	12	12	12	12	12	12	11	11	11	11	11	11
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	0.95	0.95	0.95	0.95	0.95	0.95
Frt		0.936			0.949			0.973			0.988	
Flt Protected		0.989			0.977			0.998			0.993	
Satd. Flow (prot)	0	1741	0	0	1727	0	0	3355	0	0	3390	0
Flt Permitted		0.894			0.806			0.937			0.869	
Satd. Flow (perm)	0	1574	0	0	1425	0	0	3150	0	0	2966	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		43			54			60			21	
Link Speed (mph)		20			25			30			30	
Link Distance (ft)		338			338			579			529	
Travel Time (s)		11.5			9.2			13.2			12.0	
Peak Hour Factor	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Heavy Vehicles (%)	1%	1%	1%	2%	2%	2%	1%	1%	1%	1%	1%	1%
Adj. Flow (vph)	21	27	43	80	27	64	16	271	64	48	250	27
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	91	0	0	171	0	0	351	0	0	325	0
Turn Type	Perm			Perm			Perm			Perm		
Protected Phases		4			8			6			2	
Permitted Phases	4			8			6			2		
Detector Phase	4	4		8	8		6	6		2	2	
Switch Phase												
Minimum Initial (s)	10.0	10.0		10.0	10.0		14.0	14.0		14.0	14.0	
Minimum Split (s)	16.0	16.0		16.0	16.0		19.5	19.5		19.5	19.5	
Total Split (s)	26.0	26.0	0.0	26.0	26.0	0.0	34.0	34.0	0.0	34.0	34.0	0.0
Total Split (%)	43.3%	43.3%	0.0%	43.3%	43.3%	0.0%	56.7%	56.7%	0.0%	56.7%	56.7%	0.0%
Maximum Green (s)	20.0	20.0		20.0	20.0		28.5	28.5		28.5	28.5	
Yellow Time (s)	3.5	3.5		3.5	3.5		4.0	4.0		4.0	4.0	
All-Red Time (s)	2.5	2.5		2.5	2.5		1.5	1.5		1.5	1.5	
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	6.0	6.0	4.0	6.0	6.0	4.0	5.5	5.5	4.0	5.5	5.5	4.0
Lead/Lag												
Lead-Lag Optimize?												
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Recall Mode	None	None		None	None		C-Max	C-Max		C-Max	C-Max	
Walk Time (s)				7.0	7.0		7.0	7.0		7.0	7.0	
Flash Dont Walk (s)				13.0	13.0		7.0	7.0		7.0	7.0	
Pedestrian Calls (#/hr)				0	0		0	0		0	0	
v/c Ratio		0.27			0.53			0.16			0.16	
Control Delay		13.9			20.8			4.5			5.1	
Queue Delay		0.0			0.0			0.0			0.0	
Total Delay		13.9			20.8			4.5			5.1	
90th %ile Green (s)	15.8	15.8		15.8	15.8		32.7	32.7		32.7	32.7	
90th %ile Term Code	Hold	Hold		Gap	Gap		Coord	Coord		Coord	Coord	
70th %ile Green (s)	12.6	12.6		12.6	12.6		35.9	35.9		35.9	35.9	
70th %ile Term Code	Hold	Hold		Gap	Gap		Coord	Coord		Coord	Coord	

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
50th %ile Green (s)	10.3	10.3		10.3	10.3		38.2	38.2		38.2	38.2	
50th %ile Term Code	Hold	Hold		Gap	Gap		Coord	Coord		Coord	Coord	
30th %ile Green (s)	10.0	10.0		10.0	10.0		38.5	38.5		38.5	38.5	
30th %ile Term Code	Min	Min		Min	Min		Coord	Coord		Coord	Coord	
10th %ile Green (s)	0.0	0.0		0.0	0.0		54.5	54.5		54.5	54.5	
10th %ile Term Code	Skip	Skip		Skip	Skip		Coord	Coord		Coord	Coord	
Queue Length 50th (ft)		15			39			18			19	
Queue Length 95th (ft)		44			82			43			44	
Internal Link Dist (ft)		258			258			499			449	
Turn Bay Length (ft)												
Base Capacity (vph)		553			511			2175			2036	
Starvation Cap Reductn		0			0			0			0	
Spillback Cap Reductn		0			0			0			0	
Storage Cap Reductn		0			0			0			0	
Reduced v/c Ratio		0.16			0.33			0.16			0.16	

Intersection Summary	
Area Type:	Other
Cycle Length: 60	
Actuated Cycle Length: 60	
Offset: 49 (82%), Referenced to phase 2:SBTL and 6:NBTL, Start of Green	
Natural Cycle: 40	
Control Type: Actuated-Coordinated	

Splits and Phases: 100: Main Street & 76th Street



HCM Signalized Intersection Capacity Analysis
100: Main Street & 76th Street

4/4/2011

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	20	25	40	75	25	60	15	255	60	45	235	25
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	12	12	12	12	12	12	11	11	11	11	11	11
Total Lost time (s)		6.0			6.0			5.5			5.5	
Lane Util. Factor		1.00			1.00			0.95			0.95	
Frt		0.94			0.95			0.97			0.99	
Flt Protected		0.99			0.98			1.00			0.99	
Satd. Flow (prot)		1741			1728			3353			3387	
Flt Permitted		0.89			0.81			0.94			0.87	
Satd. Flow (perm)		1574			1425			3148			2965	
Peak-hour factor, PHF	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Adj. Flow (vph)	21	27	43	80	27	64	16	271	64	48	250	27
RTOR Reduction (vph)	0	36	0	0	45	0	0	21	0	0	7	0
Lane Group Flow (vph)	0	55	0	0	126	0	0	330	0	0	318	0
Heavy Vehicles (%)	1%	1%	1%	2%	2%	2%	1%	1%	1%	1%	1%	1%
Turn Type	Perm			Perm			Perm			Perm		
Protected Phases		4			8			6			2	
Permitted Phases	4			8			6			2		
Actuated Green, G (s)		9.7			9.7			38.8			38.8	
Effective Green, g (s)		9.7			9.7			38.8			38.8	
Actuated g/C Ratio		0.16			0.16			0.65			0.65	
Clearance Time (s)		6.0			6.0			5.5			5.5	
Vehicle Extension (s)		3.0			3.0			3.0			3.0	
Lane Grp Cap (vph)		254			230			2036			1917	
v/s Ratio Prot												
v/s Ratio Perm		0.03			c0.09			0.10			c0.11	
v/c Ratio		0.22			0.55			0.16			0.17	
Uniform Delay, d1		21.8			23.1			4.2			4.2	
Progression Factor		1.00			1.00			1.00			1.00	
Incremental Delay, d2		0.4			2.6			0.2			0.2	
Delay (s)		22.3			25.8			4.4			4.4	
Level of Service		C			C			A			A	
Approach Delay (s)		22.3			25.8			4.4			4.4	
Approach LOS		C			C			A			A	

Intersection Summary			
HCM Average Control Delay	10.0	HCM Level of Service	B
HCM Volume to Capacity ratio	0.24		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	11.5
Intersection Capacity Utilization	53.3%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	5	125	155	1	5	5
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt			0.999		0.932	
Flt Protected		0.998			0.976	
Satd. Flow (prot)	0	1859	1861	0	1711	0
Flt Permitted		0.998			0.976	
Satd. Flow (perm)	0	1859	1861	0	1711	0
Link Speed (mph)		25	25		25	
Link Distance (ft)		338	319		300	
Travel Time (s)		9.2	8.7		8.2	
Peak Hour Factor	0.93	0.93	0.93	0.93	0.93	0.93
Heavy Vehicles (%)	2%	2%	2%	2%	1%	1%
Adj. Flow (vph)	5	134	167	1	5	5
Shared Lane Traffic (%)						
Lane Group Flow (vph)	0	139	168	0	10	0
Sign Control		Free	Free		Stop	

Intersection Summary	
Area Type:	Other
Control Type: Unsignalized	

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (veh/h)	5	125	155	1	5	5
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.93	0.93	0.93	0.93	0.93	0.93
Hourly flow rate (vph)	5	134	167	1	5	5
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (ft)		338				
pX, platoon unblocked						
vC, conflicting volume	168				312	167
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	168				312	167
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	100				99	99
cM capacity (veh/h)	1410				680	880

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total	140	168	11
Volume Left	5	0	5
Volume Right	0	1	5
cSH	1410	1700	767
Volume to Capacity	0.00	0.10	0.01
Queue Length 95th (ft)	0	0	1
Control Delay (s)	0.3	0.0	9.8
Lane LOS	A		A
Approach Delay (s)	0.3	0.0	9.8
Approach LOS			A

Intersection Summary			
Average Delay	0.5		
Intersection Capacity Utilization	20.6%	ICU Level of Service	A
Analysis Period (min)	15		

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	1	130	1	1	145	5	5	1	1	1	1	5
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.999			0.995			0.983			0.899	
Flt Protected								0.964			0.994	
Satd. Flow (prot)	0	1879	0	0	1853	0	0	1783	0	0	1681	0
Flt Permitted								0.964			0.994	
Satd. Flow (perm)	0	1879	0	0	1853	0	0	1783	0	0	1681	0
Link Speed (mph)		25			25			25			25	
Link Distance (ft)		319			323			156			301	
Travel Time (s)		8.7			8.8			4.3			8.2	
Peak Hour Factor	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89
Heavy Vehicles (%)	1%	1%	1%	2%	2%	2%	1%	1%	1%	1%	1%	1%
Adj. Flow (vph)	1	146	1	1	163	6	6	1	1	1	1	6
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	148	0	0	170	0	0	8	0	0	8	0
Sign Control		Free			Free			Stop			Stop	

Intersection Summary	
Area Type:	Other
Control Type: Unsignalized	

HCM Unsignalized Intersection Capacity Analysis
120: Main Street & 74th Street

4/4/2011

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	1	130	1	1	145	5	5	1	1	1	1	5
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89
Hourly flow rate (vph)	1	146	1	1	163	6	6	1	1	1	1	6
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (ft)		657			1293							
pX, platoon unblocked												
vC, conflicting volume	169			147			323	320	147	319	317	166
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	169			147			323	320	147	319	317	166
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
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			100			99	100	100	100	100	99
cM capacity (veh/h)	1415			1435			626	598	903	634	600	881

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	148	170	8	8
Volume Left	1	1	6	1
Volume Right	1	6	1	6
cSH	1415	1435	650	785
Volume to Capacity	0.00	0.00	0.01	0.01
Queue Length 95th (ft)	0	0	1	1
Control Delay (s)	0.1	0.1	10.6	9.6
Lane LOS	A	A	B	A
Approach Delay (s)	0.1	0.1	10.6	9.6
Approach LOS			B	A

Intersection Summary			
Average Delay	0.5		
Intersection Capacity Utilization	18.6%	ICU Level of Service	A
Analysis Period (min)	15		

Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	5	125	145	5	1	5
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt			0.995		0.884	
Flt Protected		0.998			0.993	
Satd. Flow (prot)	0	1877	1872	0	1651	0
Flt Permitted		0.998			0.993	
Satd. Flow (perm)	0	1877	1872	0	1651	0
Link Speed (mph)		25	25		25	
Link Distance (ft)		323	318		300	
Travel Time (s)		8.8	8.7		8.2	
Peak Hour Factor	0.86	0.86	0.86	0.86	0.86	0.86
Heavy Vehicles (%)	1%	1%	1%	1%	1%	1%
Adj. Flow (vph)	6	145	169	6	1	6
Shared Lane Traffic (%)						
Lane Group Flow (vph)	0	151	175	0	7	0
Sign Control		Free	Free		Stop	

Intersection Summary	
Area Type:	Other
Control Type: Unsignalized	

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (veh/h)	5	125	145	5	1	5
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.86	0.86	0.86	0.86	0.86	0.86
Hourly flow rate (vph)	6	145	169	6	1	6
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (ft)		980	970			
pX, platoon unblocked						
vC, conflicting volume	174				328	172
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	174				328	172
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	100				100	99
cM capacity (veh/h)	1408				665	875

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total	151	174	7
Volume Left	6	0	1
Volume Right	0	6	6
cSH	1408	1700	831
Volume to Capacity	0.00	0.10	0.01
Queue Length 95th (ft)	0	0	1
Control Delay (s)	0.3	0.0	9.4
Lane LOS	A		A
Approach Delay (s)	0.3	0.0	9.4
Approach LOS			A

Intersection Summary			
Average Delay	0.3		
Intersection Capacity Utilization	20.6%	ICU Level of Service	A
Analysis Period (min)	15		

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	5	120	1	5	140	5	5	1	5	5	1	5
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.999			0.995			0.938			0.938	
Flt Protected		0.998			0.998			0.977			0.977	
Satd. Flow (prot)	0	1876	0	0	1832	0	0	1527	0	0	1724	0
Flt Permitted		0.998			0.998			0.977			0.977	
Satd. Flow (perm)	0	1876	0	0	1832	0	0	1527	0	0	1724	0
Link Speed (mph)		25			25			25			25	
Link Distance (ft)		318			327			300			301	
Travel Time (s)		8.7			8.9			8.2			8.2	
Peak Hour Factor	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84
Heavy Vehicles (%)	1%	1%	1%	3%	3%	3%	14%	14%	14%	1%	1%	1%
Adj. Flow (vph)	6	143	1	6	167	6	6	1	6	6	1	6
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	150	0	0	179	0	0	13	0	0	13	0
Sign Control		Free			Free			Stop			Stop	

Intersection Summary	
Area Type:	Other
Control Type: Unsignalized	

HCM Unsignalized Intersection Capacity Analysis
140: Main Street & 72nd Street

4/4/2011

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	5	120	1	5	140	5	5	1	5	5	1	5
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84
Hourly flow rate (vph)	6	143	1	6	167	6	6	1	6	6	1	6
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (ft)		1298			652							
pX, platoon unblocked												
vC, conflicting volume	173			144			343	340	143	343	338	170
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	173			144			343	340	143	343	338	170
tC, single (s)	4.1			4.1			7.2	6.6	6.3	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.6	4.1	3.4	3.5	4.0	3.3
p0 queue free %	100			100			99	100	99	99	100	99
cM capacity (veh/h)	1410			1432			580	558	873	604	580	877

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	150	179	13	13
Volume Left	6	6	6	6
Volume Right	1	6	6	6
cSH	1410	1432	682	700
Volume to Capacity	0.00	0.00	0.02	0.02
Queue Length 95th (ft)	0	0	1	1
Control Delay (s)	0.3	0.3	10.4	10.2
Lane LOS	A	A	B	B
Approach Delay (s)	0.3	0.3	10.4	10.2
Approach LOS			B	B

Intersection Summary			
Average Delay	1.0		
Intersection Capacity Utilization	19.6%	ICU Level of Service	A
Analysis Period (min)	15		

Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	0	130	145	0	5	5
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt					0.932	
Flt Protected					0.976	
Satd. Flow (prot)	0	1881	1845	0	1711	0
Flt Permitted					0.976	
Satd. Flow (perm)	0	1881	1845	0	1711	0
Link Speed (mph)		25	25		25	
Link Distance (ft)		327	155		300	
Travel Time (s)		8.9	4.2		8.2	
Peak Hour Factor	0.82	0.82	0.82	0.82	0.82	0.82
Heavy Vehicles (%)	1%	1%	3%	3%	1%	1%
Adj. Flow (vph)	0	159	177	0	6	6
Shared Lane Traffic (%)						
Lane Group Flow (vph)	0	159	177	0	12	0
Sign Control		Free	Free		Stop	

Intersection Summary	
Area Type:	Other
Control Type: Unsignalized	

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (veh/h)	0	130	145	0	5	5
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.82	0.82	0.82	0.82	0.82	0.82
Hourly flow rate (vph)	0	159	177	0	6	6
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (ft)			325			
pX, platoon unblocked						
vC, conflicting volume	177				335	177
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	177				335	177
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	100				99	99
cM capacity (veh/h)	1405				662	869

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total	159	177	12
Volume Left	0	0	6
Volume Right	0	0	6
cSH	1700	1700	751
Volume to Capacity	0.09	0.10	0.02
Queue Length 95th (ft)	0	0	1
Control Delay (s)	0.0	0.0	9.9
Lane LOS			A
Approach Delay (s)	0.0	0.0	9.9
Approach LOS			A

Intersection Summary			
Average Delay	0.3		
Intersection Capacity Utilization	17.6%	ICU Level of Service	A
Analysis Period (min)	15		

Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Volume (vph)	135	1	1	145	1	1
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt	0.999				0.932	
Flt Protected					0.976	
Satd. Flow (prot)	1879	0	0	1845	1711	0
Flt Permitted					0.976	
Satd. Flow (perm)	1879	0	0	1845	1711	0
Link Speed (mph)	25			25	25	
Link Distance (ft)	155			170	141	
Travel Time (s)	4.2			4.6	3.8	
Peak Hour Factor	0.82	0.82	0.82	0.82	0.82	0.82
Heavy Vehicles (%)	1%	1%	3%	3%	1%	1%
Adj. Flow (vph)	165	1	1	177	1	1
Shared Lane Traffic (%)						
Lane Group Flow (vph)	166	0	0	178	2	0
Sign Control	Free			Free	Stop	

Intersection Summary	
Area Type:	Other
Control Type: Unsignalized	

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Volume (veh/h)	135	1	1	145	1	1
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.82	0.82	0.82	0.82	0.82	0.82
Hourly flow rate (vph)	165	1	1	177	1	1
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None			None		
Median storage veh)						
Upstream signal (ft)				170		
pX, platoon unblocked					1.00	
vC, conflicting volume			166		345	165
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			166		344	165
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			100		100	100
cM capacity (veh/h)			1406		654	882

Direction, Lane #	EB 1	WB 1	NB 1
Volume Total	166	178	2
Volume Left	0	1	1
Volume Right	1	0	1
cSH	1700	1406	751
Volume to Capacity	0.10	0.00	0.00
Queue Length 95th (ft)	0	0	0
Control Delay (s)	0.0	0.1	9.8
Lane LOS		A	A
Approach Delay (s)	0.0	0.1	9.8
Approach LOS			A

Intersection Summary			
Average Delay	0.1		
Intersection Capacity Utilization	18.4%	ICU Level of Service	A
Analysis Period (min)	15		

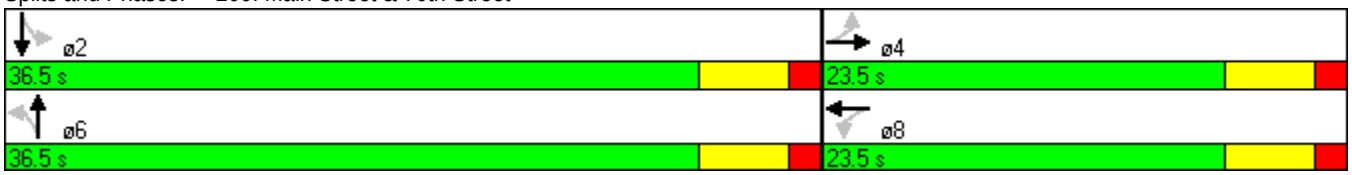
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	25	35	115	80	25	15	110	380	75	5	410	40
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (ft)	12	12	12	12	12	12	10	11	11	10	11	11
Storage Length (ft)	0		0	0		0	95		0	100		0
Storage Lanes	0		0	0		0	1		0	1		0
Taper Length (ft)	50		50	50		50	50		50	50		50
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.95	0.95	1.00	0.95	0.95
Frt		0.911			0.983			0.975			0.987	
Flt Protected		0.993			0.968		0.950			0.950		
Satd. Flow (prot)	0	1702	0	0	1790	0	1652	3336	0	1668	3410	0
Flt Permitted		0.944			0.720		0.466			0.464		
Satd. Flow (perm)	0	1618	0	0	1331	0	810	3336	0	815	3410	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		129			12			56			25	
Link Speed (mph)		25			25			30			30	
Link Distance (ft)		170			300			253			883	
Travel Time (s)		4.6			8.2			5.8			20.1	
Peak Hour Factor	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89
Heavy Vehicles (%)	1%	1%	1%	1%	1%	1%	2%	2%	2%	1%	1%	1%
Adj. Flow (vph)	28	39	129	90	28	17	124	427	84	6	461	45
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	196	0	0	135	0	124	511	0	6	506	0
Turn Type	Perm			Perm			Perm			Perm		
Protected Phases		4			8			6			2	
Permitted Phases	4			8			6			2		
Detector Phase	4	4		8	8		6	6		2	2	
Switch Phase												
Minimum Initial (s)	18.0	18.0		18.0	18.0		31.0	31.0		31.0	31.0	
Minimum Split (s)	23.5	23.5		23.5	23.5		36.5	36.5		36.5	36.5	
Total Split (s)	23.5	23.5	0.0	23.5	23.5	0.0	36.5	36.5	0.0	36.5	36.5	0.0
Total Split (%)	39.2%	39.2%	0.0%	39.2%	39.2%	0.0%	60.8%	60.8%	0.0%	60.8%	60.8%	0.0%
Maximum Green (s)	18.0	18.0		18.0	18.0		31.0	31.0		31.0	31.0	
Yellow Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
All-Red Time (s)	1.5	1.5		1.5	1.5		1.5	1.5		1.5	1.5	
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.5	5.5	4.0	5.5	5.5	4.0	5.5	5.5	4.0	5.5	5.5	4.0
Lead/Lag												
Lead-Lag Optimize?												
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Recall Mode	Max	Max		Max	Max		C-Max	C-Max		C-Max	C-Max	
Walk Time (s)	7.0	7.0		7.0	7.0		21.0	21.0		21.0	21.0	
Flash Dont Walk (s)	11.0	11.0		11.0	11.0		10.0	10.0		10.0	10.0	
Pedestrian Calls (#/hr)	0	0		0	0		0	0		0	0	
v/c Ratio		0.34			0.33		0.30	0.29		0.01	0.29	
Control Delay		8.4			17.6		10.7	7.8		7.2	8.3	
Queue Delay		0.0			0.0		0.0	0.0		0.0	0.0	
Total Delay		8.4			17.6		10.7	7.8		7.2	8.3	
90th %ile Green (s)	18.0	18.0		18.0	18.0		31.0	31.0		31.0	31.0	

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
90th %ile Term Code	MaxR	MaxR		MaxR	MaxR		Coord	Coord		Coord	Coord	
70th %ile Green (s)	18.0	18.0		18.0	18.0		31.0	31.0		31.0	31.0	
70th %ile Term Code	MaxR	MaxR		MaxR	MaxR		Coord	Coord		Coord	Coord	
50th %ile Green (s)	18.0	18.0		18.0	18.0		31.0	31.0		31.0	31.0	
50th %ile Term Code	MaxR	MaxR		MaxR	MaxR		Coord	Coord		Coord	Coord	
30th %ile Green (s)	18.0	18.0		18.0	18.0		31.0	31.0		31.0	31.0	
30th %ile Term Code	MaxR	MaxR		MaxR	MaxR		Coord	Coord		Coord	Coord	
10th %ile Green (s)	18.0	18.0		18.0	18.0		31.0	31.0		31.0	31.0	
10th %ile Term Code	MaxR	MaxR		MaxR	MaxR		Coord	Coord		Coord	Coord	
Queue Length 50th (ft)		17			34		23	43		1	47	
Queue Length 95th (ft)		57			73		50	64		6	71	
Internal Link Dist (ft)		90			220			173			803	
Turn Bay Length (ft)							95			100		
Base Capacity (vph)		576			408		419	1751		421	1774	
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			0.33		0.30	0.29		0.01	0.29	

Intersection Summary

Area Type: Other
Cycle Length: 60
Actuated Cycle Length: 60
Offset: 24 (40%), Referenced to phase 2:SBTL and 6:NBTL, Start of Green
Natural Cycle: 60
Control Type: Actuated-Coordinated

Splits and Phases: 200: Main Street & 70th Street



HCM Signalized Intersection Capacity Analysis
200: Main Street & 70th Street

4/4/2011

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	25	35	115	80	25	15	110	380	75	5	410	40
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	12	12	12	12	12	12	10	11	11	10	11	11
Total Lost time (s)		5.5			5.5		5.5	5.5		5.5	5.5	
Lane Util. Factor		1.00			1.00		1.00	0.95		1.00	0.95	
Frt		0.91			0.98		1.00	0.98		1.00	0.99	
Flt Protected		0.99			0.97		0.95	1.00		0.95	1.00	
Satd. Flow (prot)		1702			1790		1652	3337		1668	3409	
Flt Permitted		0.94			0.72		0.47	1.00		0.46	1.00	
Satd. Flow (perm)		1619			1331		810	3337		814	3409	
Peak-hour factor, PHF	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89
Adj. Flow (vph)	28	39	129	90	28	17	124	427	84	6	461	45
RTOR Reduction (vph)	0	90	0	0	8	0	0	27	0	0	12	0
Lane Group Flow (vph)	0	106	0	0	127	0	124	484	0	6	494	0
Heavy Vehicles (%)	1%	1%	1%	1%	1%	1%	2%	2%	2%	1%	1%	1%
Turn Type	Perm			Perm			Perm			Perm		
Protected Phases		4			8			6			2	
Permitted Phases	4			8			6			2		
Actuated Green, G (s)		18.0			18.0		31.0	31.0		31.0	31.0	
Effective Green, g (s)		18.0			18.0		31.0	31.0		31.0	31.0	
Actuated g/C Ratio		0.30			0.30		0.52	0.52		0.52	0.52	
Clearance Time (s)		5.5			5.5		5.5	5.5		5.5	5.5	
Vehicle Extension (s)		3.0			3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)		486			399		419	1724		421	1761	
v/s Ratio Prot								0.15			0.14	
v/s Ratio Perm		0.07			c0.10		c0.15			0.01		
v/c Ratio		0.22			0.32		0.30	0.28		0.01	0.28	
Uniform Delay, d1		15.7			16.2		8.3	8.2		7.1	8.2	
Progression Factor		0.99			1.00		0.99	0.99		1.00	1.00	
Incremental Delay, d2		1.0			2.1		1.8	0.4		0.1	0.4	
Delay (s)		16.6			18.3		10.0	8.5		7.1	8.6	
Level of Service		B			B		B	A		A	A	
Approach Delay (s)		16.6			18.3			8.8			8.6	
Approach LOS		B			B			A			A	

Intersection Summary			
HCM Average Control Delay	10.6	HCM Level of Service	B
HCM Volume to Capacity ratio	0.30		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	11.0
Intersection Capacity Utilization	87.8%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (vph)	155	30	35	425	475	135
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width (ft)	12	12	11	11	11	11
Lane Util. Factor	1.00	1.00	0.95	0.95	0.95	0.95
Frt	0.978				0.967	
Flt Protected	0.960			0.996		
Satd. Flow (prot)	1766	0	0	3408	3341	0
Flt Permitted	0.960			0.996		
Satd. Flow (perm)	1766	0	0	3408	3341	0
Link Speed (mph)	25			30	30	
Link Distance (ft)	165			240	253	
Travel Time (s)	4.5			5.5	5.8	
Peak Hour Factor	0.89	0.89	0.89	0.89	0.89	0.89
Heavy Vehicles (%)	1%	1%	2%	2%	1%	1%
Adj. Flow (vph)	174	34	39	478	534	152
Shared Lane Traffic (%)						
Lane Group Flow (vph)	208	0	0	517	686	0
Sign Control	Stop			Free	Free	

Intersection Summary	
Area Type:	Other
Control Type: Unsignalized	

HCM Unsignalized Intersection Capacity Analysis
210: Proposed North Access & 70th Street

4/4/2011

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (veh/h)	155	30	35	425	475	135
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.89	0.89	0.89	0.89	0.89	0.89
Hourly flow rate (vph)	174	34	39	478	534	152
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (ft)					253	
pX, platoon unblocked	0.94	0.94	0.94			
vC, conflicting volume	927	343	685			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	798	178	542			
tC, single (s)	6.8	6.9	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	41	96	96			
cM capacity (veh/h)	294	789	963			

Direction, Lane #	EB 1	NB 1	NB 2	SB 1	SB 2
Volume Total	208	199	318	356	330
Volume Left	174	39	0	0	0
Volume Right	34	0	0	0	152
cSH	327	963	1700	1700	1700
Volume to Capacity	0.64	0.04	0.19	0.21	0.19
Queue Length 95th (ft)	103	3	0	0	0
Control Delay (s)	33.4	2.1	0.0	0.0	0.0
Lane LOS	D	A			
Approach Delay (s)	33.4	0.8		0.0	
Approach LOS	D				

Intersection Summary			
Average Delay	5.2		
Intersection Capacity Utilization	50.6%	ICU Level of Service	A
Analysis Period (min)	15		

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	1	1	30	5	1	5	30	455	20	5	485	15
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (ft)	12	12	12	12	12	12	11	11	11	11	11	11
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	0.95	0.95	0.95	0.95	0.95	0.95
Frt		0.873			0.939			0.994			0.996	
Flt Protected		0.999			0.978			0.997				
Satd. Flow (prot)	0	1641	0	0	1728	0	0	3391	0	0	3441	0
Flt Permitted		0.999			0.978			0.997				
Satd. Flow (perm)	0	1641	0	0	1728	0	0	3391	0	0	3441	0
Link Speed (mph)		25			25			30			30	
Link Distance (ft)		165			300			512			240	
Travel Time (s)		4.5			8.2			11.6			5.5	
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
Heavy Vehicles (%)	1%	1%	1%	1%	1%	1%	2%	2%	2%	1%	1%	1%
Adj. Flow (vph)	1	1	33	5	1	5	33	495	22	5	527	16
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	35	0	0	11	0	0	550	0	0	548	0
Sign Control		Stop			Stop			Free			Free	

Intersection Summary	
Area Type:	Other
Control Type: Unsignalized	

HCM Unsignalized Intersection Capacity Analysis
220: Proposed South Access & 70th Street

4/4/2011

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	1	1	30	5	1	5	30	455	20	5	485	15
Sign Control		Stop			Stop			Free			Free	
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)	1	1	33	5	1	5	33	495	22	5	527	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)											493	
pX, platoon unblocked												
vC, conflicting volume	865	1128	272	878	1125	258	543			516		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	865	1128	272	878	1125	258	543			516		
tC, single (s)	7.5	6.5	6.9	7.5	6.5	6.9	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	100	99	96	98	99	99	97			99		
cM capacity (veh/h)	240	197	729	225	198	744	1022			1053		

Direction, Lane #	EB 1	WB 1	NB 1	NB 2	SB 1	SB 2
Volume Total	35	12	280	269	269	280
Volume Left	1	5	33	0	5	0
Volume Right	33	5	0	22	0	16
cSH	635	324	1022	1700	1053	1700
Volume to Capacity	0.05	0.04	0.03	0.16	0.01	0.16
Queue Length 95th (ft)	4	3	2	0	0	0
Control Delay (s)	11.0	16.5	1.3	0.0	0.2	0.0
Lane LOS	B	C	A		A	
Approach Delay (s)	11.0	16.5	0.7		0.1	
Approach LOS	B	C				

Intersection Summary			
Average Delay	0.9		
Intersection Capacity Utilization	41.4%	ICU Level of Service	A
Analysis Period (min)	15		

April 6, 2011

APPENDIX B

ALTERNATIVE YEAR 2011 TOTAL TRAFFIC PEAK HOUR ANALYSIS

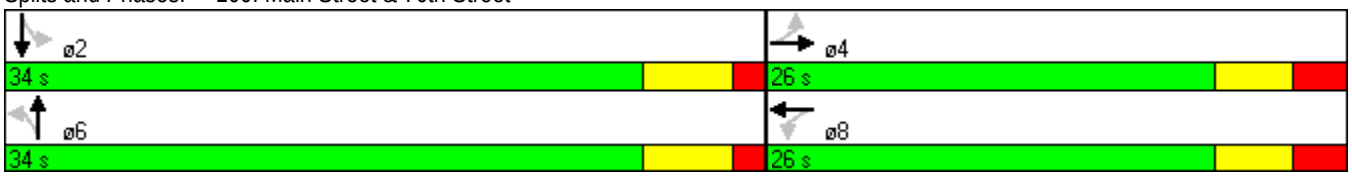
WITH ALTERNATIVE IMPROVEMENTS

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	35	25	50	100	30	95	20	395	75	70	560	35
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (ft)	12	12	12	12	12	12	11	11	11	11	11	11
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	0.95	0.95	0.95	0.95	0.95	0.95
Frt		0.938			0.943			0.977			0.992	
Flt Protected		0.984			0.978			0.998			0.995	
Satd. Flow (prot)	0	1719	0	0	1735	0	0	3369	0	0	3410	0
Flt Permitted		0.842			0.815			0.918			0.850	
Satd. Flow (perm)	0	1471	0	0	1446	0	0	3099	0	0	2913	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		52			66			47			13	
Link Speed (mph)		20			25			30			30	
Link Distance (ft)		338			338			579			529	
Travel Time (s)		11.5			9.2			13.2			12.0	
Peak Hour Factor	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Heavy Vehicles (%)	2%	2%	2%	1%	1%	1%	1%	1%	1%	1%	1%	1%
Adj. Flow (vph)	36	26	52	103	31	98	21	407	77	72	577	36
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	114	0	0	232	0	0	505	0	0	685	0
Turn Type	Perm			Perm			Perm			Perm		
Protected Phases		4			8			6			2	
Permitted Phases	4			8			6			2		
Detector Phase	4	4		8	8		6	6		2	2	
Switch Phase												
Minimum Initial (s)	10.0	10.0		10.0	10.0		14.0	14.0		14.0	14.0	
Minimum Split (s)	16.0	16.0		16.0	16.0		19.5	19.5		19.5	19.5	
Total Split (s)	26.0	26.0	0.0	26.0	26.0	0.0	34.0	34.0	0.0	34.0	34.0	0.0
Total Split (%)	43.3%	43.3%	0.0%	43.3%	43.3%	0.0%	56.7%	56.7%	0.0%	56.7%	56.7%	0.0%
Maximum Green (s)	20.0	20.0		20.0	20.0		28.5	28.5		28.5	28.5	
Yellow Time (s)	3.5	3.5		3.5	3.5		4.0	4.0		4.0	4.0	
All-Red Time (s)	2.5	2.5		2.5	2.5		1.5	1.5		1.5	1.5	
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	6.0	6.0	4.0	6.0	6.0	4.0	5.5	5.5	4.0	5.5	5.5	4.0
Lead/Lag												
Lead-Lag Optimize?												
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Recall Mode	None	None		None	None		C-Max	C-Max		C-Max	C-Max	
Walk Time (s)				7.0	7.0		7.0	7.0		7.0	7.0	
Flash Dont Walk (s)				13.0	13.0		7.0	7.0		7.0	7.0	
Pedestrian Calls (#/hr)				0	0		0	0		0	0	
v/c Ratio		0.31			0.62			0.28			0.40	
Control Delay		13.0			21.9			6.7			8.2	
Queue Delay		0.0			0.0			0.0			0.0	
Total Delay		13.0			21.9			6.7			8.2	
90th %ile Green (s)	18.9	18.9		18.9	18.9		29.6	29.6		29.6	29.6	
90th %ile Term Code	Hold	Hold		Gap	Gap		Coord	Coord		Coord	Coord	
70th %ile Green (s)	15.2	15.2		15.2	15.2		33.3	33.3		33.3	33.3	
70th %ile Term Code	Hold	Hold		Gap	Gap		Coord	Coord		Coord	Coord	

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
50th %ile Green (s)	12.6	12.6		12.6	12.6		35.9	35.9		35.9	35.9	
50th %ile Term Code	Hold	Hold		Gap	Gap		Coord	Coord		Coord	Coord	
30th %ile Green (s)	10.0	10.0		10.0	10.0		38.5	38.5		38.5	38.5	
30th %ile Term Code	Min	Min		Min	Min		Coord	Coord		Coord	Coord	
10th %ile Green (s)	10.0	10.0		10.0	10.0		38.5	38.5		38.5	38.5	
10th %ile Term Code	Hold	Hold		Min	Min		Coord	Coord		Coord	Coord	
Queue Length 50th (ft)		19			54			35			57	
Queue Length 95th (ft)		48			102			75			117	
Internal Link Dist (ft)		258			258			499			449	
Turn Bay Length (ft)												
Base Capacity (vph)		525			526			1835			1713	
Starvation Cap Reductn		0			0			0			0	
Spillback Cap Reductn		0			0			0			0	
Storage Cap Reductn		0			0			0			0	
Reduced v/c Ratio		0.22			0.44			0.28			0.40	

Intersection Summary	
Area Type:	Other
Cycle Length: 60	
Actuated Cycle Length: 60	
Offset: 49 (82%), Referenced to phase 2:SBTL and 6:NBTL, Start of Green	
Natural Cycle: 40	
Control Type: Actuated-Coordinated	

Splits and Phases: 100: Main Street & 76th Street



HCM Signalized Intersection Capacity Analysis
100: Main Street & 76th Street

4/4/2011

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	35	25	50	100	30	95	20	395	75	70	560	35
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	12	12	12	12	12	12	11	11	11	11	11	11
Total Lost time (s)		6.0			6.0			5.5			5.5	
Lane Util. Factor		1.00			1.00			0.95			0.95	
Frt		0.94			0.94			0.98			0.99	
Flt Protected		0.98			0.98			1.00			0.99	
Satd. Flow (prot)		1721			1735			3369			3410	
Flt Permitted		0.84			0.81			0.92			0.85	
Satd. Flow (perm)		1472			1445			3100			2914	
Peak-hour factor, PHF	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Adj. Flow (vph)	36	26	52	103	31	98	21	407	77	72	577	36
RTOR Reduction (vph)	0	40	0	0	51	0	0	19	0	0	5	0
Lane Group Flow (vph)	0	74	0	0	181	0	0	486	0	0	680	0
Heavy Vehicles (%)	2%	2%	2%	1%	1%	1%	1%	1%	1%	1%	1%	1%
Turn Type	Perm			Perm			Perm			Perm		
Protected Phases		4			8			6			2	
Permitted Phases	4			8			6			2		
Actuated Green, G (s)		13.3			13.3			35.2			35.2	
Effective Green, g (s)		13.3			13.3			35.2			35.2	
Actuated g/C Ratio		0.22			0.22			0.59			0.59	
Clearance Time (s)		6.0			6.0			5.5			5.5	
Vehicle Extension (s)		3.0			3.0			3.0			3.0	
Lane Grp Cap (vph)		326			320			1819			1710	
v/s Ratio Prot												
v/s Ratio Perm		0.05			c0.13			0.16			c0.23	
v/c Ratio		0.23			0.56			0.27			0.40	
Uniform Delay, d1		19.1			20.8			6.1			6.7	
Progression Factor		1.00			1.00			1.00			1.00	
Incremental Delay, d2		0.4			2.3			0.4			0.7	
Delay (s)		19.5			23.1			6.4			7.4	
Level of Service		B			C			A			A	
Approach Delay (s)		19.5			23.1			6.4			7.4	
Approach LOS		B			C			A			A	

Intersection Summary			
HCM Average Control Delay	10.3	HCM Level of Service	B
HCM Volume to Capacity ratio	0.44		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	11.5
Intersection Capacity Utilization	66.3%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	10	160	220	5	1	5
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt			0.997		0.884	
Flt Protected		0.997			0.993	
Satd. Flow (prot)	0	1876	1876	0	1651	0
Flt Permitted		0.997			0.993	
Satd. Flow (perm)	0	1876	1876	0	1651	0
Link Speed (mph)		25	25		25	
Link Distance (ft)		338	319		300	
Travel Time (s)		9.2	8.7		8.2	
Peak Hour Factor	0.88	0.88	0.88	0.88	0.88	0.88
Heavy Vehicles (%)	1%	1%	1%	1%	1%	1%
Adj. Flow (vph)	11	182	250	6	1	6
Shared Lane Traffic (%)						
Lane Group Flow (vph)	0	193	256	0	7	0
Sign Control		Free	Free		Stop	

Intersection Summary	
Area Type:	Other
Control Type: Unsignalized	

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (veh/h)	10	160	220	5	1	5
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.88	0.88	0.88	0.88	0.88	0.88
Hourly flow rate (vph)	11	182	250	6	1	6
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (ft)		338				
pX, platoon unblocked						
vC, conflicting volume	256				457	253
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	256				457	253
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	99				100	99
cM capacity (veh/h)	1315				558	788

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total	193	256	7
Volume Left	11	0	1
Volume Right	0	6	6
cSH	1315	1700	738
Volume to Capacity	0.01	0.15	0.01
Queue Length 95th (ft)	1	0	1
Control Delay (s)	0.5	0.0	9.9
Lane LOS	A		A
Approach Delay (s)	0.5	0.0	9.9
Approach LOS			A

Intersection Summary			
Average Delay	0.4		
Intersection Capacity Utilization	26.6%	ICU Level of Service	A
Analysis Period (min)	15		

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	1	155	5	5	200	5	25	10	35	1	1	1
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.996			0.997			0.932			0.955	
Flt Protected					0.999			0.983			0.984	
Satd. Flow (prot)	0	1802	0	0	1769	0	0	1723	0	0	1768	0
Flt Permitted					0.999			0.983			0.984	
Satd. Flow (perm)	0	1802	0	0	1769	0	0	1723	0	0	1768	0
Link Speed (mph)		25			25			25			25	
Link Distance (ft)		319			323			156			301	
Travel Time (s)		8.7			8.8			4.3			8.2	
Peak Hour Factor	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91
Heavy Vehicles (%)	5%	5%	5%	7%	7%	7%	1%	1%	1%	1%	1%	1%
Adj. Flow (vph)	1	170	5	5	220	5	27	11	38	1	1	1
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	176	0	0	230	0	0	76	0	0	3	0
Sign Control		Free			Free			Stop			Stop	

Intersection Summary	
Area Type:	Other
Control Type: Unsignalized	

HCM Unsignalized Intersection Capacity Analysis
120: Main Street & 74th Street

4/4/2011

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	1	155	5	5	200	5	25	10	35	1	1	1
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91
Hourly flow rate (vph)	1	170	5	5	220	5	27	11	38	1	1	1
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (ft)		657			1293							
pX, platoon unblocked												
vC, conflicting volume	225			176			410	412	173	453	412	223
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	225			176			410	412	173	453	412	223
tC, single (s)	4.1			4.2			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.3			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	100			100			95	98	96	100	100	100
cM capacity (veh/h)	1326			1371			550	529	873	486	529	820

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	177	231	77	3
Volume Left	1	5	27	1
Volume Right	5	5	38	1
cSH	1326	1371	670	581
Volume to Capacity	0.00	0.00	0.11	0.01
Queue Length 95th (ft)	0	0	10	0
Control Delay (s)	0.1	0.2	11.1	11.2
Lane LOS	A	A	B	B
Approach Delay (s)	0.1	0.2	11.1	11.2
Approach LOS			B	B

Intersection Summary			
Average Delay	1.9		
Intersection Capacity Utilization	26.4%	ICU Level of Service	A
Analysis Period (min)	15		

Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	5	185	205	5	5	5
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt			0.997		0.932	
Flt Protected		0.999			0.976	
Satd. Flow (prot)	0	1825	1804	0	1711	0
Flt Permitted		0.999			0.976	
Satd. Flow (perm)	0	1825	1804	0	1711	0
Link Speed (mph)		25	25		25	
Link Distance (ft)		323	318		300	
Travel Time (s)		8.8	8.7		8.2	
Peak Hour Factor	0.81	0.81	0.81	0.81	0.81	0.81
Heavy Vehicles (%)	4%	4%	5%	5%	1%	1%
Adj. Flow (vph)	6	228	253	6	6	6
Shared Lane Traffic (%)						
Lane Group Flow (vph)	0	234	259	0	12	0
Sign Control		Free	Free		Stop	

Intersection Summary	
Area Type:	Other
Control Type: Unsignalized	

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (veh/h)	5	185	205	5	5	5
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.81	0.81	0.81	0.81	0.81	0.81
Hourly flow rate (vph)	6	228	253	6	6	6
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (ft)		980	970			
pX, platoon unblocked						
vC, conflicting volume	259				497	256
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	259				497	256
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	100				99	99
cM capacity (veh/h)	1294				532	785

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total	235	259	12
Volume Left	6	0	6
Volume Right	0	6	6
cSH	1294	1700	634
Volume to Capacity	0.00	0.15	0.02
Queue Length 95th (ft)	0	0	1
Control Delay (s)	0.2	0.0	10.8
Lane LOS	A		B
Approach Delay (s)	0.2	0.0	10.8
Approach LOS			B

Intersection Summary			
Average Delay	0.4		
Intersection Capacity Utilization	23.8%	ICU Level of Service	A
Analysis Period (min)	15		

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	5	180	5	1	195	10	5	1	5	5	1	10
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.997			0.993			0.938			0.912	
Flt Protected		0.999						0.977			0.985	
Satd. Flow (prot)	0	1874	0	0	1850	0	0	1724	0	0	1552	0
Flt Permitted		0.999						0.977			0.985	
Satd. Flow (perm)	0	1874	0	0	1850	0	0	1724	0	0	1552	0
Link Speed (mph)		25			25			25			25	
Link Distance (ft)		318			327			300			301	
Travel Time (s)		8.7			8.9			8.2			8.2	
Peak Hour Factor	0.79	0.79	0.79	0.79	0.79	0.79	0.79	0.79	0.79	0.79	0.79	0.79
Heavy Vehicles (%)	1%	1%	1%	2%	2%	2%	1%	1%	1%	10%	10%	10%
Adj. Flow (vph)	6	228	6	1	247	13	6	1	6	6	1	13
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	240	0	0	261	0	0	13	0	0	20	0
Sign Control		Free			Free			Stop			Stop	

Intersection Summary	
Area Type:	Other
Control Type: Unsignalized	

HCM Unsignalized Intersection Capacity Analysis
140: Main Street & 72nd Street

4/4/2011

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	5	180	5	1	195	10	5	1	5	5	1	10
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.79	0.79	0.79	0.79	0.79	0.79	0.79	0.79	0.79	0.79	0.79	0.79
Hourly flow rate (vph)	6	228	6	1	247	13	6	1	6	6	1	13
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (ft)		1298			652							
pX, platoon unblocked												
vC, conflicting volume	259			234			513	506	231	506	503	253
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	259			234			513	506	231	506	503	253
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.2	6.6	6.3
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.6	4.1	3.4
p0 queue free %	100			100			99	100	99	99	100	98
cM capacity (veh/h)	1311			1333			463	468	811	457	457	766

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	241	261	14	20
Volume Left	6	1	6	6
Volume Right	6	13	6	13
cSH	1311	1333	576	611
Volume to Capacity	0.00	0.00	0.02	0.03
Queue Length 95th (ft)	0	0	2	3
Control Delay (s)	0.2	0.0	11.4	11.1
Lane LOS	A	A	B	B
Approach Delay (s)	0.2	0.0	11.4	11.1
Approach LOS			B	B

Intersection Summary			
Average Delay	0.8		
Intersection Capacity Utilization	23.3%	ICU Level of Service	A
Analysis Period (min)	15		

Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	0	190	200	0	15	5
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt					0.968	
Flt Protected					0.963	
Satd. Flow (prot)	0	1881	1827	0	1754	0
Flt Permitted					0.963	
Satd. Flow (perm)	0	1881	1827	0	1754	0
Link Speed (mph)		25	25		25	
Link Distance (ft)		327	155		300	
Travel Time (s)		8.9	4.2		8.2	
Peak Hour Factor	0.77	0.77	0.77	0.77	0.77	0.77
Heavy Vehicles (%)	1%	1%	4%	4%	1%	1%
Adj. Flow (vph)	0	247	260	0	19	6
Shared Lane Traffic (%)						
Lane Group Flow (vph)	0	247	260	0	25	0
Sign Control		Free	Free		Stop	

Intersection Summary	
Area Type:	Other
Control Type: Unsignalized	

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (veh/h)	0	190	200	0	15	5
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.77	0.77	0.77	0.77	0.77	0.77
Hourly flow rate (vph)	0	247	260	0	19	6
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (ft)			325			
pX, platoon unblocked						
vC, conflicting volume	260				506	260
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	260				506	260
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	100				96	99
cM capacity (veh/h)	1311				528	781

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total	247	260	26
Volume Left	0	0	19
Volume Right	0	0	6
cSH	1700	1700	574
Volume to Capacity	0.15	0.15	0.05
Queue Length 95th (ft)	0	0	4
Control Delay (s)	0.0	0.0	11.6
Lane LOS			B
Approach Delay (s)	0.0	0.0	11.6
Approach LOS			B

Intersection Summary			
Average Delay	0.6		
Intersection Capacity Utilization	20.5%	ICU Level of Service	A
Analysis Period (min)	15		

Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Volume (vph)	205	1	1	200	1	1
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt	0.999				0.932	
Flt Protected					0.976	
Satd. Flow (prot)	1879	0	0	1827	1711	0
Flt Permitted					0.976	
Satd. Flow (perm)	1879	0	0	1827	1711	0
Link Speed (mph)	25			25	25	
Link Distance (ft)	155			170	141	
Travel Time (s)	4.2			4.6	3.8	
Peak Hour Factor	0.77	0.77	0.77	0.77	0.77	0.77
Heavy Vehicles (%)	1%	1%	4%	4%	1%	1%
Adj. Flow (vph)	266	1	1	260	1	1
Shared Lane Traffic (%)						
Lane Group Flow (vph)	267	0	0	261	2	0
Sign Control	Free			Free	Stop	

Intersection Summary	
Area Type:	Other
Control Type: Unsignalized	

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Volume (veh/h)	205	1	1	200	1	1
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.77	0.77	0.77	0.77	0.77	0.77
Hourly flow rate (vph)	266	1	1	260	1	1
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None			None		
Median storage veh)						
Upstream signal (ft)				170		
pX, platoon unblocked					0.98	
vC, conflicting volume			268		529	267
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			268		508	267
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			100		100	100
cM capacity (veh/h)			1285		515	774

Direction, Lane #	EB 1	WB 1	NB 1
Volume Total	268	261	3
Volume Left	0	1	1
Volume Right	1	0	1
cSH	1700	1285	618
Volume to Capacity	0.16	0.00	0.00
Queue Length 95th (ft)	0	0	0
Control Delay (s)	0.0	0.0	10.8
Lane LOS		A	B
Approach Delay (s)	0.0	0.0	10.8
Approach LOS			B

Intersection Summary			
Average Delay	0.1		
Intersection Capacity Utilization	21.3%	ICU Level of Service	A
Analysis Period (min)	15		

Volume
200: Main Street & 70th Street

4/4/2011

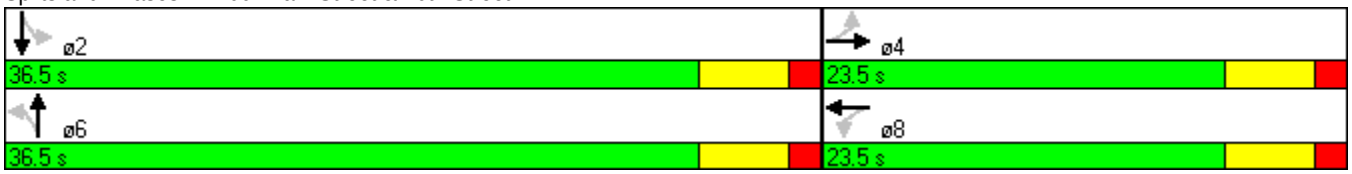
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	60	70	120	130	65	10	135	1030	110	10	510	25
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (ft)	12	12	12	12	12	12	10	11	11	10	11	11
Storage Length (ft)	0		0	0		0	95		0	100		0
Storage Lanes	0		0	0		0	1		0	1		0
Taper Length (ft)	50		50	50		50	50		50	50		50
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.95	0.95	1.00	0.95	0.95
Frt		0.935			0.993			0.986			0.993	
Flt Protected		0.988			0.969		0.950			0.950		
Satd. Flow (prot)	0	1738	0	0	1810	0	1668	3407	0	1668	3431	0
Flt Permitted		0.882			0.641		0.434			0.154		
Satd. Flow (perm)	0	1551	0	0	1197	0	762	3407	0	270	3431	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		80			5			28			12	
Link Speed (mph)		25			25			30			30	
Link Distance (ft)		170			300			253			883	
Travel Time (s)		4.6			8.2			5.8			20.1	
Peak Hour Factor	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Heavy Vehicles (%)	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%
Adj. Flow (vph)	64	74	128	138	69	11	144	1096	117	11	543	27
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	266	0	0	218	0	144	1213	0	11	570	0
Turn Type	Perm			Perm			Perm			Perm		
Protected Phases		4			8			6			2	
Permitted Phases	4			8			6			2		
Detector Phase	4	4		8	8		6	6		2	2	
Switch Phase												
Minimum Initial (s)	18.0	18.0		18.0	18.0		31.0	31.0		31.0	31.0	
Minimum Split (s)	23.5	23.5		23.5	23.5		36.5	36.5		36.5	36.5	
Total Split (s)	23.5	23.5	0.0	23.5	23.5	0.0	36.5	36.5	0.0	36.5	36.5	0.0
Total Split (%)	39.2%	39.2%	0.0%	39.2%	39.2%	0.0%	60.8%	60.8%	0.0%	60.8%	60.8%	0.0%
Maximum Green (s)	18.0	18.0		18.0	18.0		31.0	31.0		31.0	31.0	
Yellow Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
All-Red Time (s)	1.5	1.5		1.5	1.5		1.5	1.5		1.5	1.5	
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.5	5.5	4.0	5.5	5.5	4.0	5.5	5.5	4.0	5.5	5.5	4.0
Lead/Lag												
Lead-Lag Optimize?												
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Recall Mode	Max	Max		Max	Max		C-Max	C-Max		C-Max	C-Max	
Walk Time (s)	7.0	7.0		7.0	7.0		21.0	21.0		21.0	21.0	
Flash Dont Walk (s)	11.0	11.0		11.0	11.0		10.0	10.0		10.0	10.0	
Pedestrian Calls (#/hr)	0	0		0	0		0	0		0	0	
v/c Ratio		0.51			0.60		0.37	0.68		0.08	0.32	
Control Delay		16.0			25.8		7.1	7.0		9.1	8.8	
Queue Delay		0.0			0.0		0.0	0.0		0.0	0.0	
Total Delay		16.0			25.8		7.1	7.0		9.1	8.8	
90th %ile Green (s)	18.0	18.0		18.0	18.0		31.0	31.0		31.0	31.0	

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
90th %ile Term Code	MaxR	MaxR		MaxR	MaxR		Coord	Coord		Coord	Coord	
70th %ile Green (s)	18.0	18.0		18.0	18.0		31.0	31.0		31.0	31.0	
70th %ile Term Code	MaxR	MaxR		MaxR	MaxR		Coord	Coord		Coord	Coord	
50th %ile Green (s)	18.0	18.0		18.0	18.0		31.0	31.0		31.0	31.0	
50th %ile Term Code	MaxR	MaxR		MaxR	MaxR		Coord	Coord		Coord	Coord	
30th %ile Green (s)	18.0	18.0		18.0	18.0		31.0	31.0		31.0	31.0	
30th %ile Term Code	MaxR	MaxR		MaxR	MaxR		Coord	Coord		Coord	Coord	
10th %ile Green (s)	18.0	18.0		18.0	18.0		31.0	31.0		31.0	31.0	
10th %ile Term Code	MaxR	MaxR		MaxR	MaxR		Coord	Coord		Coord	Coord	
Queue Length 50th (ft)		52			65		13	53		2	55	
Queue Length 95th (ft)		113			#131		m25	98		9	84	
Internal Link Dist (ft)		90			220			173			803	
Turn Bay Length (ft)							95			100		
Base Capacity (vph)		521			363		394	1774		140	1778	
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		0.51			0.60		0.37	0.68		0.08	0.32	

Intersection Summary

Area Type: Other
Cycle Length: 60
Actuated Cycle Length: 60
Offset: 39 (65%), Referenced to phase 2:SBTL and 6:NBTL, Start of Green
Natural Cycle: 60
Control Type: Actuated-Coordinated
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.

Splits and Phases: 200: Main Street & 70th Street



HCM Signalized Intersection Capacity Analysis
200: Main Street & 70th Street

4/4/2011

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	60	70	120	130	65	10	135	1030	110	10	510	25
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	12	12	12	12	12	12	10	11	11	10	11	11
Total Lost time (s)		5.5			5.5		5.5	5.5		5.5	5.5	
Lane Util. Factor		1.00			1.00		1.00	0.95		1.00	0.95	
Frt		0.94			0.99		1.00	0.99		1.00	0.99	
Flt Protected		0.99			0.97		0.95	1.00		0.95	1.00	
Satd. Flow (prot)		1738			1811		1668	3405		1668	3431	
Flt Permitted		0.88			0.64		0.43	1.00		0.15	1.00	
Satd. Flow (perm)		1552			1198		761	3405		270	3431	
Peak-hour factor, PHF	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Adj. Flow (vph)	64	74	128	138	69	11	144	1096	117	11	543	27
RTOR Reduction (vph)	0	56	0	0	4	0	0	14	0	0	6	0
Lane Group Flow (vph)	0	210	0	0	215	0	144	1199	0	11	564	0
Heavy Vehicles (%)	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%
Turn Type	Perm			Perm			Perm			Perm		
Protected Phases		4			8			6			2	
Permitted Phases	4			8			6			2		
Actuated Green, G (s)		18.0			18.0		31.0	31.0		31.0	31.0	
Effective Green, g (s)		18.0			18.0		31.0	31.0		31.0	31.0	
Actuated g/C Ratio		0.30			0.30		0.52	0.52		0.52	0.52	
Clearance Time (s)		5.5			5.5		5.5	5.5		5.5	5.5	
Vehicle Extension (s)		3.0			3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)		466			359		393	1759		140	1773	
v/s Ratio Prot								c0.35			0.16	
v/s Ratio Perm		0.14			c0.18		0.19			0.04		
v/c Ratio		0.45			0.60		0.37	0.68		0.08	0.32	
Uniform Delay, d1		17.0			17.9		8.6	10.8		7.3	8.4	
Progression Factor		1.00			1.00		0.56	0.51		1.00	1.00	
Incremental Delay, d2		3.1			7.2		1.8	1.4		1.1	0.5	
Delay (s)		20.1			25.1		6.6	7.0		8.4	8.9	
Level of Service		C			C		A	A		A	A	
Approach Delay (s)		20.1			25.1			6.9			8.9	
Approach LOS		C			C			A			A	

Intersection Summary			
HCM Average Control Delay	10.5	HCM Level of Service	B
HCM Volume to Capacity ratio	0.65		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	11.0
Intersection Capacity Utilization	97.1%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (vph)	0	30	0	1310	625	130
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width (ft)	12	12	11	11	11	11
Lane Util. Factor	1.00	1.00	1.00	0.95	0.95	0.95
Frt		0.865			0.974	
Flt Protected						
Satd. Flow (prot)	0	1627	0	3455	3365	0
Flt Permitted						
Satd. Flow (perm)	0	1627	0	3455	3365	0
Link Speed (mph)	25			30	30	
Link Distance (ft)	165			240	253	
Travel Time (s)	4.5			5.5	5.8	
Peak Hour Factor	0.94	0.94	0.94	0.94	0.94	0.94
Heavy Vehicles (%)	1%	1%	1%	1%	1%	1%
Adj. Flow (vph)	0	32	0	1394	665	138
Shared Lane Traffic (%)						
Lane Group Flow (vph)	0	32	0	1394	803	0
Sign Control	Stop			Free	Free	

Intersection Summary	
Area Type:	Other
Control Type: Unsignalized	

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (veh/h)	0	30	0	1310	625	130
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.94	0.94	0.94	0.94	0.94	0.94
Hourly flow rate (vph)	0	32	0	1394	665	138
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (ft)				240	253	
pX, platoon unblocked	0.77	0.92	0.92			
vC, conflicting volume	1431	402	803			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	516	182	617			
tC, single (s)	6.8	6.9	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	100	96	100			
cM capacity (veh/h)	380	768	890			

Direction, Lane #	EB 1	NB 1	NB 2	SB 1	SB 2
Volume Total	32	697	697	443	360
Volume Left	0	0	0	0	0
Volume Right	32	0	0	0	138
cSH	768	1700	1700	1700	1700
Volume to Capacity	0.04	0.41	0.41	0.26	0.21
Queue Length 95th (ft)	3	0	0	0	0
Control Delay (s)	9.9	0.0	0.0	0.0	0.0
Lane LOS	A				
Approach Delay (s)	9.9	0.0		0.0	
Approach LOS	A				

Intersection Summary			
Average Delay	0.1		
Intersection Capacity Utilization	39.5%	ICU Level of Service	A
Analysis Period (min)	15		

Volume
220: Proposed South Access & 70th Street

4/4/2011

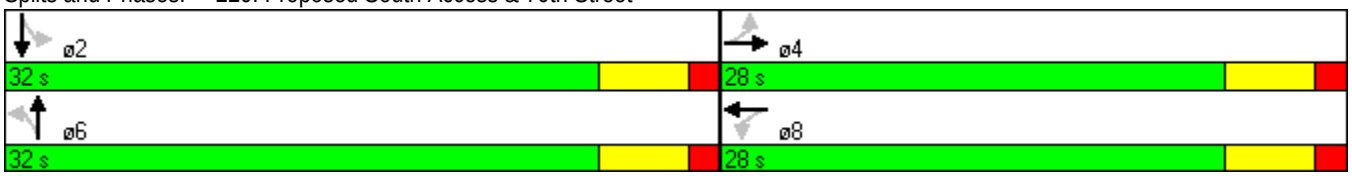
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	150	1	25	5	1	5	70	1155	60	5	635	15
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (ft)	12	12	12	12	12	12	11	11	11	11	11	11
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	0.95	0.95	0.95	0.95	0.95	0.95
Frt		0.981			0.939			0.993			0.997	
Flt Protected		0.959			0.978			0.997				
Satd. Flow (prot)	0	1770	0	0	1728	0	0	3421	0	0	3445	0
Flt Permitted		0.750			0.861			0.867			0.945	
Satd. Flow (perm)	0	1384	0	0	1521	0	0	2975	0	0	3255	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		16			5			10			5	
Link Speed (mph)		25			25			30			30	
Link Distance (ft)		165			300			512			240	
Travel Time (s)		4.5			8.2			11.6			5.5	
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
Heavy Vehicles (%)	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%
Adj. Flow (vph)	163	1	27	5	1	5	76	1255	65	5	690	16
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	191	0	0	11	0	0	1396	0	0	711	0
Turn Type	Perm			Perm			Perm			Perm		
Protected Phases		4			8			6			2	
Permitted Phases	4			8			6			2		
Detector Phase	4	4		8	8		6	6		2	2	
Switch Phase												
Minimum Initial (s)	10.0	10.0		10.0	10.0		15.0	15.0		15.0	15.0	
Minimum Split (s)	15.5	15.5		27.5	27.5		20.5	20.5		27.5	27.5	
Total Split (s)	28.0	28.0	0.0	28.0	28.0	0.0	32.0	32.0	0.0	32.0	32.0	0.0
Total Split (%)	46.7%	46.7%	0.0%	46.7%	46.7%	0.0%	53.3%	53.3%	0.0%	53.3%	53.3%	0.0%
Maximum Green (s)	22.5	22.5		22.5	22.5		26.5	26.5		26.5	26.5	
Yellow Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
All-Red Time (s)	1.5	1.5		1.5	1.5		1.5	1.5		1.5	1.5	
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.5	5.5	4.0	5.5	5.5	4.0	5.5	5.5	4.0	5.5	5.5	4.0
Lead/Lag												
Lead-Lag Optimize?												
Vehicle Extension (s)	2.0	2.0		2.0	2.0		3.0	3.0		3.0	3.0	
Minimum Gap (s)	2.0	2.0		2.0	2.0		2.0	2.0		2.0	2.0	
Time Before Reduce (s)	0.0	0.0		0.0	0.0		20.0	20.0		20.0	20.0	
Time To Reduce (s)	0.0	0.0		0.0	0.0		10.0	10.0		10.0	10.0	
Recall Mode	None	None		None	None		C-Max	C-Max		C-Max	C-Max	
Walk Time (s)				7.0	7.0					7.0	7.0	
Flash Dont Walk (s)				15.0	15.0					15.0	15.0	
Pedestrian Calls (#/hr)				0	0					0	0	
v/c Ratio		0.61			0.03			0.78			0.36	
Control Delay		27.6			13.2			14.7			5.0	
Queue Delay		0.0			0.0			0.0			0.0	
Total Delay		27.6			13.2			14.7			5.0	
90th %ile Green (s)	18.1	18.1		18.1	18.1		30.9	30.9		30.9	30.9	

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
90th %ile Term Code	Gap	Gap		Hold	Hold		Coord	Coord		Coord	Coord	
70th %ile Green (s)	14.6	14.6		14.6	14.6		34.4	34.4		34.4	34.4	
70th %ile Term Code	Gap	Gap		Hold	Hold		Coord	Coord		Coord	Coord	
50th %ile Green (s)	12.1	12.1		12.1	12.1		36.9	36.9		36.9	36.9	
50th %ile Term Code	Gap	Gap		Hold	Hold		Coord	Coord		Coord	Coord	
30th %ile Green (s)	10.0	10.0		10.0	10.0		39.0	39.0		39.0	39.0	
30th %ile Term Code	Min	Min		Hold	Hold		Coord	Coord		Coord	Coord	
10th %ile Green (s)	10.0	10.0		10.0	10.0		39.0	39.0		39.0	39.0	
10th %ile Term Code	Min	Min		Hold	Hold		Coord	Coord		Coord	Coord	
Queue Length 50th (ft)		58			2			163			31	
Queue Length 95th (ft)		102			11			#376			67	
Internal Link Dist (ft)		85			220			432			160	
Turn Bay Length (ft)												
Base Capacity (vph)		529			574			1791			1957	
Starvation Cap Reductn		0			0			0			0	
Spillback Cap Reductn		0			0			0			0	
Storage Cap Reductn		0			0			0			0	
Reduced v/c Ratio		0.36			0.02			0.78			0.36	

Intersection Summary

Area Type: Other
Cycle Length: 60
Actuated Cycle Length: 60
Offset: 39 (65%), Referenced to phase 2:SBTL and 6:NBTL, Start of Green
Natural Cycle: 70
Control Type: Actuated-Coordinated
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 220: Proposed South Access & 70th Street



HCM Signalized Intersection Capacity Analysis
220: Proposed South Access & 70th Street

4/4/2011

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	150	1	25	5	1	5	70	1155	60	5	635	15
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	12	12	12	12	12	12	11	11	11	11	11	11
Total Lost time (s)		5.5			5.5			5.5			5.5	
Lane Util. Factor		1.00			1.00			0.95			0.95	
Frt		0.98			0.94			0.99			1.00	
Flt Protected		0.96			0.98			1.00			1.00	
Satd. Flow (prot)		1770			1727			3422			3442	
Flt Permitted		0.75			0.86			0.87			0.95	
Satd. Flow (perm)		1383			1520			2973			3255	
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)	163	1	27	5	1	5	76	1255	65	5	690	16
RTOR Reduction (vph)	0	13	0	0	4	0	0	4	0	0	2	0
Lane Group Flow (vph)	0	178	0	0	7	0	0	1392	0	0	709	0
Heavy Vehicles (%)	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%
Turn Type	Perm			Perm			Perm			Perm		
Protected Phases		4			8			6			2	
Permitted Phases	4			8			6			2		
Actuated Green, G (s)		13.0			13.0			36.0			36.0	
Effective Green, g (s)		13.0			13.0			36.0			36.0	
Actuated g/C Ratio		0.22			0.22			0.60			0.60	
Clearance Time (s)		5.5			5.5			5.5			5.5	
Vehicle Extension (s)		2.0			2.0			3.0			3.0	
Lane Grp Cap (vph)		300			329			1784			1953	
v/s Ratio Prot												
v/s Ratio Perm		c0.13			0.00			c0.47			0.22	
v/c Ratio		0.59			0.02			0.78			0.36	
Uniform Delay, d1		21.1			18.5			9.0			6.1	
Progression Factor		1.00			1.00			1.00			0.65	
Incremental Delay, d2		2.1			0.0			3.5			0.5	
Delay (s)		23.2			18.5			12.5			4.5	
Level of Service		C			B			B			A	
Approach Delay (s)		23.2			18.5			12.5			4.5	
Approach LOS		C			B			B			A	

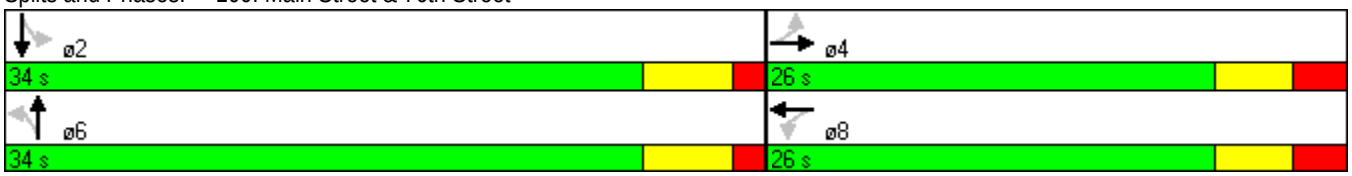
Intersection Summary			
HCM Average Control Delay	10.9	HCM Level of Service	B
HCM Volume to Capacity ratio	0.73		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	11.0
Intersection Capacity Utilization	84.3%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	20	25	40	75	25	60	15	255	60	45	235	25
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (ft)	12	12	12	12	12	12	11	11	11	11	11	11
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	0.95	0.95	0.95	0.95	0.95	0.95
Frt		0.936			0.949			0.973			0.988	
Flt Protected		0.989			0.977			0.998			0.993	
Satd. Flow (prot)	0	1741	0	0	1727	0	0	3355	0	0	3390	0
Flt Permitted		0.894			0.806			0.937			0.869	
Satd. Flow (perm)	0	1574	0	0	1425	0	0	3150	0	0	2966	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		43			54			60			21	
Link Speed (mph)		20			25			30			30	
Link Distance (ft)		338			338			579			529	
Travel Time (s)		11.5			9.2			13.2			12.0	
Peak Hour Factor	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Heavy Vehicles (%)	1%	1%	1%	2%	2%	2%	1%	1%	1%	1%	1%	1%
Adj. Flow (vph)	21	27	43	80	27	64	16	271	64	48	250	27
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	91	0	0	171	0	0	351	0	0	325	0
Turn Type	Perm			Perm			Perm			Perm		
Protected Phases		4			8			6			2	
Permitted Phases	4			8			6			2		
Detector Phase	4	4		8	8		6	6		2	2	
Switch Phase												
Minimum Initial (s)	10.0	10.0		10.0	10.0		14.0	14.0		14.0	14.0	
Minimum Split (s)	16.0	16.0		16.0	16.0		19.5	19.5		19.5	19.5	
Total Split (s)	26.0	26.0	0.0	26.0	26.0	0.0	34.0	34.0	0.0	34.0	34.0	0.0
Total Split (%)	43.3%	43.3%	0.0%	43.3%	43.3%	0.0%	56.7%	56.7%	0.0%	56.7%	56.7%	0.0%
Maximum Green (s)	20.0	20.0		20.0	20.0		28.5	28.5		28.5	28.5	
Yellow Time (s)	3.5	3.5		3.5	3.5		4.0	4.0		4.0	4.0	
All-Red Time (s)	2.5	2.5		2.5	2.5		1.5	1.5		1.5	1.5	
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	6.0	6.0	4.0	6.0	6.0	4.0	5.5	5.5	4.0	5.5	5.5	4.0
Lead/Lag												
Lead-Lag Optimize?												
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Recall Mode	None	None		None	None		C-Max	C-Max		C-Max	C-Max	
Walk Time (s)				7.0	7.0		7.0	7.0		7.0	7.0	
Flash Dont Walk (s)				13.0	13.0		7.0	7.0		7.0	7.0	
Pedestrian Calls (#/hr)				0	0		0	0		0	0	
v/c Ratio		0.27			0.53			0.16			0.16	
Control Delay		13.9			20.8			4.5			5.1	
Queue Delay		0.0			0.0			0.0			0.0	
Total Delay		13.9			20.8			4.5			5.1	
90th %ile Green (s)	15.8	15.8		15.8	15.8		32.7	32.7		32.7	32.7	
90th %ile Term Code	Hold	Hold		Gap	Gap		Coord	Coord		Coord	Coord	
70th %ile Green (s)	12.6	12.6		12.6	12.6		35.9	35.9		35.9	35.9	
70th %ile Term Code	Hold	Hold		Gap	Gap		Coord	Coord		Coord	Coord	

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
50th %ile Green (s)	10.3	10.3		10.3	10.3		38.2	38.2		38.2	38.2	
50th %ile Term Code	Hold	Hold		Gap	Gap		Coord	Coord		Coord	Coord	
30th %ile Green (s)	10.0	10.0		10.0	10.0		38.5	38.5		38.5	38.5	
30th %ile Term Code	Min	Min		Min	Min		Coord	Coord		Coord	Coord	
10th %ile Green (s)	0.0	0.0		0.0	0.0		54.5	54.5		54.5	54.5	
10th %ile Term Code	Skip	Skip		Skip	Skip		Coord	Coord		Coord	Coord	
Queue Length 50th (ft)		15			39			18			19	
Queue Length 95th (ft)		44			82			43			44	
Internal Link Dist (ft)		258			258			499			449	
Turn Bay Length (ft)												
Base Capacity (vph)		553			511			2175			2036	
Starvation Cap Reductn		0			0			0			0	
Spillback Cap Reductn		0			0			0			0	
Storage Cap Reductn		0			0			0			0	
Reduced v/c Ratio		0.16			0.33			0.16			0.16	

Intersection Summary	
Area Type:	Other
Cycle Length: 60	
Actuated Cycle Length: 60	
Offset: 49 (82%), Referenced to phase 2:SBTL and 6:NBTL, Start of Green	
Natural Cycle: 40	
Control Type: Actuated-Coordinated	

Splits and Phases: 100: Main Street & 76th Street



HCM Signalized Intersection Capacity Analysis
100: Main Street & 76th Street

4/4/2011

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	20	25	40	75	25	60	15	255	60	45	235	25
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	12	12	12	12	12	12	11	11	11	11	11	11
Total Lost time (s)		6.0			6.0			5.5			5.5	
Lane Util. Factor		1.00			1.00			0.95			0.95	
Frt		0.94			0.95			0.97			0.99	
Flt Protected		0.99			0.98			1.00			0.99	
Satd. Flow (prot)		1741			1728			3353			3387	
Flt Permitted		0.89			0.81			0.94			0.87	
Satd. Flow (perm)		1574			1425			3148			2965	
Peak-hour factor, PHF	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Adj. Flow (vph)	21	27	43	80	27	64	16	271	64	48	250	27
RTOR Reduction (vph)	0	36	0	0	45	0	0	21	0	0	7	0
Lane Group Flow (vph)	0	55	0	0	126	0	0	330	0	0	318	0
Heavy Vehicles (%)	1%	1%	1%	2%	2%	2%	1%	1%	1%	1%	1%	1%
Turn Type	Perm			Perm			Perm			Perm		
Protected Phases		4			8			6			2	
Permitted Phases	4			8			6			2		
Actuated Green, G (s)		9.7			9.7			38.8			38.8	
Effective Green, g (s)		9.7			9.7			38.8			38.8	
Actuated g/C Ratio		0.16			0.16			0.65			0.65	
Clearance Time (s)		6.0			6.0			5.5			5.5	
Vehicle Extension (s)		3.0			3.0			3.0			3.0	
Lane Grp Cap (vph)		254			230			2036			1917	
v/s Ratio Prot												
v/s Ratio Perm		0.03			c0.09			0.10			c0.11	
v/c Ratio		0.22			0.55			0.16			0.17	
Uniform Delay, d1		21.8			23.1			4.2			4.2	
Progression Factor		1.00			1.00			1.00			1.00	
Incremental Delay, d2		0.4			2.6			0.2			0.2	
Delay (s)		22.3			25.8			4.4			4.4	
Level of Service		C			C			A			A	
Approach Delay (s)		22.3			25.8			4.4			4.4	
Approach LOS		C			C			A			A	

Intersection Summary			
HCM Average Control Delay	10.0	HCM Level of Service	B
HCM Volume to Capacity ratio	0.24		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	11.5
Intersection Capacity Utilization	53.3%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	5	125	155	1	5	5
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt			0.999		0.932	
Flt Protected		0.998			0.976	
Satd. Flow (prot)	0	1859	1861	0	1711	0
Flt Permitted		0.998			0.976	
Satd. Flow (perm)	0	1859	1861	0	1711	0
Link Speed (mph)		25	25		25	
Link Distance (ft)		338	319		300	
Travel Time (s)		9.2	8.7		8.2	
Peak Hour Factor	0.93	0.93	0.93	0.93	0.93	0.93
Heavy Vehicles (%)	2%	2%	2%	2%	1%	1%
Adj. Flow (vph)	5	134	167	1	5	5
Shared Lane Traffic (%)						
Lane Group Flow (vph)	0	139	168	0	10	0
Sign Control		Free	Free		Stop	

Intersection Summary	
Area Type:	Other
Control Type: Unsignalized	

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (veh/h)	5	125	155	1	5	5
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.93	0.93	0.93	0.93	0.93	0.93
Hourly flow rate (vph)	5	134	167	1	5	5
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (ft)		338				
pX, platoon unblocked						
vC, conflicting volume	168				312	167
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	168				312	167
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	100				99	99
cM capacity (veh/h)	1410				680	880

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total	140	168	11
Volume Left	5	0	5
Volume Right	0	1	5
cSH	1410	1700	767
Volume to Capacity	0.00	0.10	0.01
Queue Length 95th (ft)	0	0	1
Control Delay (s)	0.3	0.0	9.8
Lane LOS	A		A
Approach Delay (s)	0.3	0.0	9.8
Approach LOS			A

Intersection Summary			
Average Delay	0.5		
Intersection Capacity Utilization	20.6%	ICU Level of Service	A
Analysis Period (min)	15		

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	1	130	1	1	145	5	5	1	1	1	1	5
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.999			0.995			0.983			0.899	
Flt Protected								0.964			0.994	
Satd. Flow (prot)	0	1879	0	0	1853	0	0	1783	0	0	1681	0
Flt Permitted								0.964			0.994	
Satd. Flow (perm)	0	1879	0	0	1853	0	0	1783	0	0	1681	0
Link Speed (mph)		25			25			25			25	
Link Distance (ft)		319			323			156			301	
Travel Time (s)		8.7			8.8			4.3			8.2	
Peak Hour Factor	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89
Heavy Vehicles (%)	1%	1%	1%	2%	2%	2%	1%	1%	1%	1%	1%	1%
Adj. Flow (vph)	1	146	1	1	163	6	6	1	1	1	1	6
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	148	0	0	170	0	0	8	0	0	8	0
Sign Control		Free			Free			Stop			Stop	

Intersection Summary	
Area Type:	Other
Control Type: Unsignalized	

HCM Unsignalized Intersection Capacity Analysis
120: Main Street & 74th Street

4/4/2011

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	1	130	1	1	145	5	5	1	1	1	1	5
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89
Hourly flow rate (vph)	1	146	1	1	163	6	6	1	1	1	1	6
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (ft)		657			1293							
pX, platoon unblocked												
vC, conflicting volume	169			147			323	320	147	319	317	166
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	169			147			323	320	147	319	317	166
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
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			100			99	100	100	100	100	99
cM capacity (veh/h)	1415			1435			626	598	903	634	600	881

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	148	170	8	8
Volume Left	1	1	6	1
Volume Right	1	6	1	6
cSH	1415	1435	650	785
Volume to Capacity	0.00	0.00	0.01	0.01
Queue Length 95th (ft)	0	0	1	1
Control Delay (s)	0.1	0.1	10.6	9.6
Lane LOS	A	A	B	A
Approach Delay (s)	0.1	0.1	10.6	9.6
Approach LOS			B	A

Intersection Summary			
Average Delay	0.5		
Intersection Capacity Utilization	18.6%	ICU Level of Service	A
Analysis Period (min)	15		

Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	5	125	145	5	1	5
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt			0.995		0.884	
Flt Protected		0.998			0.993	
Satd. Flow (prot)	0	1877	1872	0	1651	0
Flt Permitted		0.998			0.993	
Satd. Flow (perm)	0	1877	1872	0	1651	0
Link Speed (mph)		25	25		25	
Link Distance (ft)		323	318		300	
Travel Time (s)		8.8	8.7		8.2	
Peak Hour Factor	0.86	0.86	0.86	0.86	0.86	0.86
Heavy Vehicles (%)	1%	1%	1%	1%	1%	1%
Adj. Flow (vph)	6	145	169	6	1	6
Shared Lane Traffic (%)						
Lane Group Flow (vph)	0	151	175	0	7	0
Sign Control		Free	Free		Stop	

Intersection Summary	
Area Type:	Other
Control Type: Unsignalized	

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (veh/h)	5	125	145	5	1	5
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.86	0.86	0.86	0.86	0.86	0.86
Hourly flow rate (vph)	6	145	169	6	1	6
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (ft)		980	970			
pX, platoon unblocked						
vC, conflicting volume	174				328	172
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	174				328	172
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	100				100	99
cM capacity (veh/h)	1408				665	875

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total	151	174	7
Volume Left	6	0	1
Volume Right	0	6	6
cSH	1408	1700	831
Volume to Capacity	0.00	0.10	0.01
Queue Length 95th (ft)	0	0	1
Control Delay (s)	0.3	0.0	9.4
Lane LOS	A		A
Approach Delay (s)	0.3	0.0	9.4
Approach LOS			A

Intersection Summary			
Average Delay	0.3		
Intersection Capacity Utilization	20.6%	ICU Level of Service	A
Analysis Period (min)	15		

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	5	120	1	5	140	5	5	1	5	5	1	5
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.999			0.995			0.938			0.938	
Flt Protected		0.998			0.998			0.977			0.977	
Satd. Flow (prot)	0	1876	0	0	1832	0	0	1527	0	0	1724	0
Flt Permitted		0.998			0.998			0.977			0.977	
Satd. Flow (perm)	0	1876	0	0	1832	0	0	1527	0	0	1724	0
Link Speed (mph)		25			25			25			25	
Link Distance (ft)		318			327			300			301	
Travel Time (s)		8.7			8.9			8.2			8.2	
Peak Hour Factor	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84
Heavy Vehicles (%)	1%	1%	1%	3%	3%	3%	14%	14%	14%	1%	1%	1%
Adj. Flow (vph)	6	143	1	6	167	6	6	1	6	6	1	6
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	150	0	0	179	0	0	13	0	0	13	0
Sign Control		Free			Free			Stop			Stop	

Intersection Summary	
Area Type:	Other
Control Type: Unsignalized	

HCM Unsignalized Intersection Capacity Analysis
140: Main Street & 72nd Street

4/4/2011

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	5	120	1	5	140	5	5	1	5	5	1	5
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84
Hourly flow rate (vph)	6	143	1	6	167	6	6	1	6	6	1	6
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (ft)		1298			652							
pX, platoon unblocked												
vC, conflicting volume	173			144			343	340	143	343	338	170
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	173			144			343	340	143	343	338	170
tC, single (s)	4.1			4.1			7.2	6.6	6.3	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.6	4.1	3.4	3.5	4.0	3.3
p0 queue free %	100			100			99	100	99	99	100	99
cM capacity (veh/h)	1410			1432			580	558	873	604	580	877

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	150	179	13	13
Volume Left	6	6	6	6
Volume Right	1	6	6	6
cSH	1410	1432	682	700
Volume to Capacity	0.00	0.00	0.02	0.02
Queue Length 95th (ft)	0	0	1	1
Control Delay (s)	0.3	0.3	10.4	10.2
Lane LOS	A	A	B	B
Approach Delay (s)	0.3	0.3	10.4	10.2
Approach LOS			B	B

Intersection Summary			
Average Delay	1.0		
Intersection Capacity Utilization	19.6%	ICU Level of Service	A
Analysis Period (min)	15		

Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	0	130	145	0	5	5
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt					0.932	
Flt Protected					0.976	
Satd. Flow (prot)	0	1881	1845	0	1711	0
Flt Permitted					0.976	
Satd. Flow (perm)	0	1881	1845	0	1711	0
Link Speed (mph)		25	25		25	
Link Distance (ft)		327	155		300	
Travel Time (s)		8.9	4.2		8.2	
Peak Hour Factor	0.82	0.82	0.82	0.82	0.82	0.82
Heavy Vehicles (%)	1%	1%	3%	3%	1%	1%
Adj. Flow (vph)	0	159	177	0	6	6
Shared Lane Traffic (%)						
Lane Group Flow (vph)	0	159	177	0	12	0
Sign Control		Free	Free		Stop	

Intersection Summary	
Area Type:	Other
Control Type: Unsignalized	

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (veh/h)	0	130	145	0	5	5
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.82	0.82	0.82	0.82	0.82	0.82
Hourly flow rate (vph)	0	159	177	0	6	6
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (ft)			325			
pX, platoon unblocked						
vC, conflicting volume	177				335	177
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	177				335	177
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	100				99	99
cM capacity (veh/h)	1405				662	869

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total	159	177	12
Volume Left	0	0	6
Volume Right	0	0	6
cSH	1700	1700	751
Volume to Capacity	0.09	0.10	0.02
Queue Length 95th (ft)	0	0	1
Control Delay (s)	0.0	0.0	9.9
Lane LOS			A
Approach Delay (s)	0.0	0.0	9.9
Approach LOS			A

Intersection Summary			
Average Delay	0.3		
Intersection Capacity Utilization	17.6%	ICU Level of Service	A
Analysis Period (min)	15		

Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Volume (vph)	135	1	1	145	1	1
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt	0.999				0.932	
Flt Protected					0.976	
Satd. Flow (prot)	1879	0	0	1845	1711	0
Flt Permitted					0.976	
Satd. Flow (perm)	1879	0	0	1845	1711	0
Link Speed (mph)	25			25	25	
Link Distance (ft)	155			170	141	
Travel Time (s)	4.2			4.6	3.8	
Peak Hour Factor	0.82	0.82	0.82	0.82	0.82	0.82
Heavy Vehicles (%)	1%	1%	3%	3%	1%	1%
Adj. Flow (vph)	165	1	1	177	1	1
Shared Lane Traffic (%)						
Lane Group Flow (vph)	166	0	0	178	2	0
Sign Control	Free			Free	Stop	

Intersection Summary	
Area Type:	Other
Control Type: Unsignalized	

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Volume (veh/h)	135	1	1	145	1	1
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.82	0.82	0.82	0.82	0.82	0.82
Hourly flow rate (vph)	165	1	1	177	1	1
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None			None		
Median storage veh)						
Upstream signal (ft)				170		
pX, platoon unblocked					1.00	
vC, conflicting volume			166		345	165
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			166		344	165
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			100		100	100
cM capacity (veh/h)			1406		654	882

Direction, Lane #	EB 1	WB 1	NB 1
Volume Total	166	178	2
Volume Left	0	1	1
Volume Right	1	0	1
cSH	1700	1406	751
Volume to Capacity	0.10	0.00	0.00
Queue Length 95th (ft)	0	0	0
Control Delay (s)	0.0	0.1	9.8
Lane LOS		A	A
Approach Delay (s)	0.0	0.1	9.8
Approach LOS			A

Intersection Summary			
Average Delay	0.1		
Intersection Capacity Utilization	18.4%	ICU Level of Service	A
Analysis Period (min)	15		

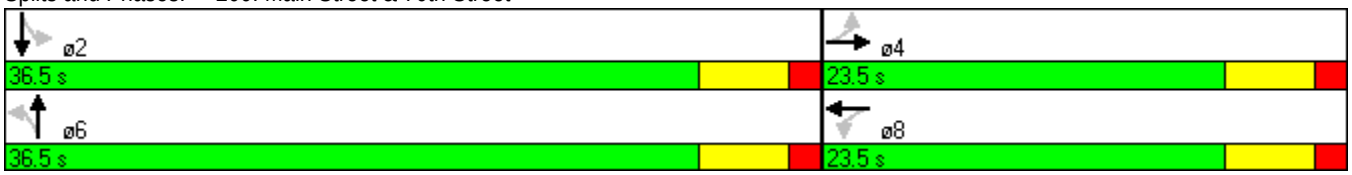
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	25	35	115	80	25	15	110	380	75	5	410	40
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (ft)	12	12	12	12	12	12	10	11	11	10	11	11
Storage Length (ft)	0		0	0		0	95		0	100		0
Storage Lanes	0		0	0		0	1		0	1		0
Taper Length (ft)	50		50	50		50	50		50	50		50
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.95	0.95	1.00	0.95	0.95
Frt		0.911			0.983			0.975			0.987	
Flt Protected		0.993			0.968		0.950			0.950		
Satd. Flow (prot)	0	1702	0	0	1790	0	1652	3336	0	1668	3410	0
Flt Permitted		0.944			0.720		0.466			0.464		
Satd. Flow (perm)	0	1618	0	0	1331	0	810	3336	0	815	3410	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		129			12			56			25	
Link Speed (mph)		25			25			30			30	
Link Distance (ft)		170			300			253			883	
Travel Time (s)		4.6			8.2			5.8			20.1	
Peak Hour Factor	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89
Heavy Vehicles (%)	1%	1%	1%	1%	1%	1%	2%	2%	2%	1%	1%	1%
Adj. Flow (vph)	28	39	129	90	28	17	124	427	84	6	461	45
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	196	0	0	135	0	124	511	0	6	506	0
Turn Type	Perm			Perm			Perm			Perm		
Protected Phases		4			8			6			2	
Permitted Phases	4			8			6			2		
Detector Phase	4	4		8	8		6	6		2	2	
Switch Phase												
Minimum Initial (s)	18.0	18.0		18.0	18.0		31.0	31.0		31.0	31.0	
Minimum Split (s)	23.5	23.5		23.5	23.5		36.5	36.5		36.5	36.5	
Total Split (s)	23.5	23.5	0.0	23.5	23.5	0.0	36.5	36.5	0.0	36.5	36.5	0.0
Total Split (%)	39.2%	39.2%	0.0%	39.2%	39.2%	0.0%	60.8%	60.8%	0.0%	60.8%	60.8%	0.0%
Maximum Green (s)	18.0	18.0		18.0	18.0		31.0	31.0		31.0	31.0	
Yellow Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
All-Red Time (s)	1.5	1.5		1.5	1.5		1.5	1.5		1.5	1.5	
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.5	5.5	4.0	5.5	5.5	4.0	5.5	5.5	4.0	5.5	5.5	4.0
Lead/Lag												
Lead-Lag Optimize?												
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Recall Mode	Max	Max		Max	Max		C-Max	C-Max		C-Max	C-Max	
Walk Time (s)	7.0	7.0		7.0	7.0		21.0	21.0		21.0	21.0	
Flash Dont Walk (s)	11.0	11.0		11.0	11.0		10.0	10.0		10.0	10.0	
Pedestrian Calls (#/hr)	0	0		0	0		0	0		0	0	
v/c Ratio		0.34			0.33		0.30	0.29		0.01	0.29	
Control Delay		8.4			17.6		7.8	5.5		7.2	8.3	
Queue Delay		0.0			0.0		0.0	0.0		0.0	0.0	
Total Delay		8.4			17.6		7.8	5.5		7.2	8.3	
90th %ile Green (s)	18.0	18.0		18.0	18.0		31.0	31.0		31.0	31.0	

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
90th %ile Term Code	MaxR	MaxR		MaxR	MaxR		Coord	Coord		Coord	Coord	
70th %ile Green (s)	18.0	18.0		18.0	18.0		31.0	31.0		31.0	31.0	
70th %ile Term Code	MaxR	MaxR		MaxR	MaxR		Coord	Coord		Coord	Coord	
50th %ile Green (s)	18.0	18.0		18.0	18.0		31.0	31.0		31.0	31.0	
50th %ile Term Code	MaxR	MaxR		MaxR	MaxR		Coord	Coord		Coord	Coord	
30th %ile Green (s)	18.0	18.0		18.0	18.0		31.0	31.0		31.0	31.0	
30th %ile Term Code	MaxR	MaxR		MaxR	MaxR		Coord	Coord		Coord	Coord	
10th %ile Green (s)	18.0	18.0		18.0	18.0		31.0	31.0		31.0	31.0	
10th %ile Term Code	MaxR	MaxR		MaxR	MaxR		Coord	Coord		Coord	Coord	
Queue Length 50th (ft)		17			34		19	35		1	47	
Queue Length 95th (ft)		57			73		35	37		6	71	
Internal Link Dist (ft)		90			220			173			803	
Turn Bay Length (ft)							95			100		
Base Capacity (vph)		576			408		419	1751		421	1774	
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			0.33		0.30	0.29		0.01	0.29	

Intersection Summary

Area Type: Other
Cycle Length: 60
Actuated Cycle Length: 60
Offset: 24 (40%), Referenced to phase 2:SBTL and 6:NBTL, Start of Green
Natural Cycle: 60
Control Type: Actuated-Coordinated

Splits and Phases: 200: Main Street & 70th Street



HCM Signalized Intersection Capacity Analysis
200: Main Street & 70th Street

4/4/2011

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	25	35	115	80	25	15	110	380	75	5	410	40
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	12	12	12	12	12	12	10	11	11	10	11	11
Total Lost time (s)		5.5			5.5		5.5	5.5		5.5	5.5	
Lane Util. Factor		1.00			1.00		1.00	0.95		1.00	0.95	
Frt		0.91			0.98		1.00	0.98		1.00	0.99	
Flt Protected		0.99			0.97		0.95	1.00		0.95	1.00	
Satd. Flow (prot)		1702			1790		1652	3337		1668	3409	
Flt Permitted		0.94			0.72		0.47	1.00		0.46	1.00	
Satd. Flow (perm)		1619			1331		810	3337		814	3409	
Peak-hour factor, PHF	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89
Adj. Flow (vph)	28	39	129	90	28	17	124	427	84	6	461	45
RTOR Reduction (vph)	0	90	0	0	8	0	0	27	0	0	12	0
Lane Group Flow (vph)	0	106	0	0	127	0	124	484	0	6	494	0
Heavy Vehicles (%)	1%	1%	1%	1%	1%	1%	2%	2%	2%	1%	1%	1%
Turn Type	Perm			Perm			Perm			Perm		
Protected Phases		4			8			6			2	
Permitted Phases	4			8			6			2		
Actuated Green, G (s)		18.0			18.0		31.0	31.0		31.0	31.0	
Effective Green, g (s)		18.0			18.0		31.0	31.0		31.0	31.0	
Actuated g/C Ratio		0.30			0.30		0.52	0.52		0.52	0.52	
Clearance Time (s)		5.5			5.5		5.5	5.5		5.5	5.5	
Vehicle Extension (s)		3.0			3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)		486			399		419	1724		421	1761	
v/s Ratio Prot								0.15			0.14	
v/s Ratio Perm		0.07			c0.10		c0.15			0.01		
v/c Ratio		0.22			0.32		0.30	0.28		0.01	0.28	
Uniform Delay, d1		15.7			16.2		8.3	8.2		7.1	8.2	
Progression Factor		0.99			1.00		0.68	0.69		1.00	1.00	
Incremental Delay, d2		1.0			2.1		1.7	0.4		0.1	0.4	
Delay (s)		16.6			18.3		7.4	6.0		7.1	8.6	
Level of Service		B			B		A	A		A	A	
Approach Delay (s)		16.6			18.3			6.3			8.6	
Approach LOS		B			B			A			A	

Intersection Summary			
HCM Average Control Delay	9.5	HCM Level of Service	A
HCM Volume to Capacity ratio	0.30		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	11.0
Intersection Capacity Utilization	87.8%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (vph)	0	30	0	580	475	135
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width (ft)	12	12	11	11	11	11
Lane Util. Factor	1.00	1.00	1.00	0.95	0.95	0.95
Frt		0.865			0.967	
Flt Protected						
Satd. Flow (prot)	0	1627	0	3421	3341	0
Flt Permitted						
Satd. Flow (perm)	0	1627	0	3421	3341	0
Link Speed (mph)	25			30	30	
Link Distance (ft)	165			240	253	
Travel Time (s)	4.5			5.5	5.8	
Peak Hour Factor	0.89	0.89	0.89	0.89	0.89	0.89
Heavy Vehicles (%)	1%	1%	2%	2%	1%	1%
Adj. Flow (vph)	0	34	0	652	534	152
Shared Lane Traffic (%)						
Lane Group Flow (vph)	0	34	0	652	686	0
Sign Control	Stop			Free	Free	

Intersection Summary	
Area Type:	Other
Control Type: Unsignalized	

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (veh/h)	0	30	0	580	475	135
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.89	0.89	0.89	0.89	0.89	0.89
Hourly flow rate (vph)	0	34	0	652	534	152
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (ft)				240	253	
pX, platoon unblocked	0.96	0.94	0.94			
vC, conflicting volume	935	343	685			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	682	178	542			
tC, single (s)	6.8	6.9	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	100	96	100			
cM capacity (veh/h)	370	789	963			

Direction, Lane #	EB 1	NB 1	NB 2	SB 1	SB 2
Volume Total	34	326	326	356	330
Volume Left	0	0	0	0	0
Volume Right	34	0	0	0	152
cSH	789	1700	1700	1700	1700
Volume to Capacity	0.04	0.19	0.19	0.21	0.19
Queue Length 95th (ft)	3	0	0	0	0
Control Delay (s)	9.8	0.0	0.0	0.0	0.0
Lane LOS	A				
Approach Delay (s)	9.8	0.0		0.0	
Approach LOS	A				

Intersection Summary			
Average Delay	0.2		
Intersection Capacity Utilization	27.4%	ICU Level of Service	A
Analysis Period (min)	15		

Volume
220: Proposed South Access & 70th Street

4/4/2011

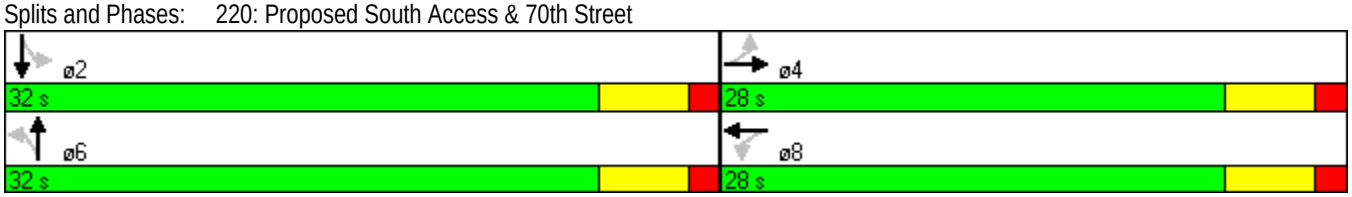
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	155	1	30	5	1	5	65	420	20	5	485	15
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (ft)	12	12	12	12	12	12	11	11	11	11	11	11
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	0.95	0.95	0.95	0.95	0.95	0.95
Frt		0.978			0.939			0.994			0.996	
Flt Protected		0.960			0.978			0.994				
Satd. Flow (prot)	0	1766	0	0	1728	0	0	3380	0	0	3441	0
Flt Permitted		0.754			0.859			0.827			0.951	
Satd. Flow (perm)	0	1387	0	0	1517	0	0	2812	0	0	3273	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		19			5			9			6	
Link Speed (mph)		25			25			30			30	
Link Distance (ft)		165			300			512			240	
Travel Time (s)		4.5			8.2			11.6			5.5	
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
Heavy Vehicles (%)	1%	1%	1%	1%	1%	1%	2%	2%	2%	1%	1%	1%
Adj. Flow (vph)	168	1	33	5	1	5	71	457	22	5	527	16
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	202	0	0	11	0	0	550	0	0	548	0
Turn Type	Perm			Perm			Perm			Perm		
Protected Phases		4			8			6			2	
Permitted Phases	4			8			6			2		
Detector Phase	4	4		8	8		6	6		2	2	
Switch Phase												
Minimum Initial (s)	10.0	10.0		10.0	10.0		12.0	12.0		12.0	12.0	
Minimum Split (s)	15.5	15.5		27.5	27.5		17.5	17.5		27.5	27.5	
Total Split (s)	28.0	28.0	0.0	28.0	28.0	0.0	32.0	32.0	0.0	32.0	32.0	0.0
Total Split (%)	46.7%	46.7%	0.0%	46.7%	46.7%	0.0%	53.3%	53.3%	0.0%	53.3%	53.3%	0.0%
Maximum Green (s)	22.5	22.5		22.5	22.5		26.5	26.5		26.5	26.5	
Yellow Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
All-Red Time (s)	1.5	1.5		1.5	1.5		1.5	1.5		1.5	1.5	
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.5	5.5	4.0	5.5	5.5	4.0	5.5	5.5	4.0	5.5	5.5	4.0
Lead/Lag												
Lead-Lag Optimize?												
Vehicle Extension (s)	2.0	2.0		2.0	2.0		3.0	3.0		3.0	3.0	
Minimum Gap (s)	2.0	2.0		2.0	2.0		2.0	2.0		2.0	2.0	
Time Before Reduce (s)	0.0	0.0		0.0	0.0		20.0	20.0		20.0	20.0	
Time To Reduce (s)	0.0	0.0		0.0	0.0		10.0	10.0		10.0	10.0	
Recall Mode	None	None		None	None		C-Max	C-Max		C-Max	C-Max	
Walk Time (s)				7.0	7.0					7.0	7.0	
Flash Dont Walk (s)				15.0	15.0					15.0	15.0	
Pedestrian Calls (#/hr)				0	0					0	0	
v/c Ratio		0.63			0.03			0.33			0.28	
Control Delay		27.6			12.9			7.3			5.4	
Queue Delay		0.0			0.0			0.0			0.0	
Total Delay		27.6			12.9			7.3			5.4	
90th %ile Green (s)	18.6	18.6		18.6	18.6		30.4	30.4		30.4	30.4	

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
90th %ile Term Code	Gap	Gap		Hold	Hold		Coord	Coord		Coord	Coord	
70th %ile Green (s)	15.0	15.0		15.0	15.0		34.0	34.0		34.0	34.0	
70th %ile Term Code	Gap	Gap		Hold	Hold		Coord	Coord		Coord	Coord	
50th %ile Green (s)	12.5	12.5		12.5	12.5		36.5	36.5		36.5	36.5	
50th %ile Term Code	Gap	Gap		Hold	Hold		Coord	Coord		Coord	Coord	
30th %ile Green (s)	10.0	10.0		10.0	10.0		39.0	39.0		39.0	39.0	
30th %ile Term Code	Min	Min		Hold	Hold		Coord	Coord		Coord	Coord	
10th %ile Green (s)	10.0	10.0		10.0	10.0		39.0	39.0		39.0	39.0	
10th %ile Term Code	Min	Min		Hold	Hold		Coord	Coord		Coord	Coord	
Queue Length 50th (ft)		61			2			43			36	
Queue Length 95th (ft)		106			11			89			66	
Internal Link Dist (ft)		85			220			432			160	
Turn Bay Length (ft)												
Base Capacity (vph)		532			572			1680			1954	
Starvation Cap Reductn		0			0			0			0	
Spillback Cap Reductn		0			0			0			0	
Storage Cap Reductn		0			0			0			0	
Reduced v/c Ratio		0.38			0.02			0.33			0.28	

Intersection Summary

Area Type: Other
Cycle Length: 60
Actuated Cycle Length: 60
Offset: 28 (47%), Referenced to phase 2:SBTL and 6:NBTL, Start of Green
Natural Cycle: 55
Control Type: Actuated-Coordinated

Splits and Phases: 220: Proposed South Access & 70th Street



HCM Signalized Intersection Capacity Analysis
220: Proposed South Access & 70th Street

4/4/2011

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	155	1	30	5	1	5	65	420	20	5	485	15
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	12	12	12	12	12	12	11	11	11	11	11	11
Total Lost time (s)		5.5			5.5			5.5			5.5	
Lane Util. Factor		1.00			1.00			0.95			0.95	
Frt		0.98			0.94			0.99			1.00	
Flt Protected		0.96			0.98			0.99			1.00	
Satd. Flow (prot)		1766			1727			3379			3438	
Flt Permitted		0.75			0.86			0.83			0.95	
Satd. Flow (perm)		1388			1517			2812			3272	
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)	168	1	33	5	1	5	71	457	22	5	527	16
RTOR Reduction (vph)	0	15	0	0	4	0	0	4	0	0	2	0
Lane Group Flow (vph)	0	187	0	0	7	0	0	546	0	0	546	0
Heavy Vehicles (%)	1%	1%	1%	1%	1%	1%	2%	2%	2%	1%	1%	1%
Turn Type	Perm			Perm			Perm			Perm		
Protected Phases		4			8			6			2	
Permitted Phases	4			8			6			2		
Actuated Green, G (s)		13.2			13.2			35.8			35.8	
Effective Green, g (s)		13.2			13.2			35.8			35.8	
Actuated g/C Ratio		0.22			0.22			0.60			0.60	
Clearance Time (s)		5.5			5.5			5.5			5.5	
Vehicle Extension (s)		2.0			2.0			3.0			3.0	
Lane Grp Cap (vph)		305			334			1678			1952	
v/s Ratio Prot												
v/s Ratio Perm		c0.13			0.00			c0.19			0.17	
v/c Ratio		0.61			0.02			0.33			0.28	
Uniform Delay, d1		21.1			18.3			6.1			5.9	
Progression Factor		1.00			1.00			1.00			0.76	
Incremental Delay, d2		2.6			0.0			0.5			0.3	
Delay (s)		23.7			18.3			6.6			4.8	
Level of Service		C			B			A			A	
Approach Delay (s)		23.7			18.3			6.6			4.8	
Approach LOS		C			B			A			A	

Intersection Summary			
HCM Average Control Delay	8.6	HCM Level of Service	A
HCM Volume to Capacity ratio	0.40		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	11.0
Intersection Capacity Utilization	59.0%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

SIGNAL WARRANT: Appleton Ave & Northfield Drive/Flint Ext.

2011 UNSEASONALLY FACTORED EXISTING TRAFFIC VOLUMES

	NB		SB			EB					WB				
Start Time	Lt	Total	LT	Total	Total	Lt	Th	Rt	Lt + Th	ALL	Lt	Th	Rt	Lt + Th	ALL
6-7a	0	225	9	412	637	0	0	0	0	0	4	0	6	4	10
7-8a	0	442	2	801	1243	0	0	1	0	0	9	0	4	9	15
8-9a	0	375	0	826	1201	0	0	0	0	0	8	0	4	8	10
9-10a	0	338	3	501	839	2	1	4	3	5	5	0	6	5	10
10-11a	0	419	4	456	875	0	0	0	0	0	9	0	3	9	10
11-12p	0	574	4	487	1061	1	0	0	1	0	11	0	7	11	20
12-1p	0	616	2	663	1279	0	1	0	1	0	19	0	2	19	20
1-2p	0	572	2	539	1111	1	0	1	1	0	13	0	6	13	20
2-3p	0	632	6	528	1160	0	0	2	0	0	6	0	7	6	15
3-4p	0	791	7	579	1370	1	1	2	2	5	13	0	6	13	20
4-5p	0	1047	10	589	1636	0	0	2	0	0	14	0	4	14	20
5-6p	0	974	1	538	1512	0	0	1	0	0	8	1	3	9	10

2011 BACKGROUND TRAFFIC VOLUMES (ROUNDED TO NEAREST 5)

1.087	NB		SB			EB					WB				
Start Time	Lt	Total	LT	Total	Total	Lt	Th	Rt	Lt + Th	ALL	Lt	Th	Rt	Lt + Th	ALL
6-7a	0	245	10	450	695	0	0	0	0	0	5	0	5	5	10
7-8a	0	480	5	870	1350	0	0	0	0	0	10	0	5	10	15
8-9a	0	410	0	900	1310	0	0	0	0	0	10	0	5	10	15
9-10a	0	365	5	545	910	5	0	5	5	10	5	0	5	5	10
10-11a	0	455	5	495	950	0	0	0	0	0	10	0	5	10	15
11-12p	0	625	5	530	1155	0	0	0	0	0	10	0	10	10	20
12-1p	0	670	5	720	1390	0	0	0	0	0	20	0	5	20	25
1-2p	0	620	5	585	1205	0	0	0	0	0	15	0	5	15	20
2-3p	0	685	5	575	1260	0	0	5	0	5	5	0	10	5	15
3-4p	0	860	10	630	1490	0	0	5	0	5	15	0	5	15	20
4-5p	0	1140	10	640	1780	0	0	5	0	5	15	0	5	15	20
5-6p	0	1060	0	585	1645	0	0	0	0	0	10	0	5	10	15

1.3% annual growth rate, per forecasts from WisDOT.

WALMART MARKET DRIVEWAY TRIPS

	NB		SB			EB					WB				
Start Time	Lt	Total	LT	Total	Total	Lt	Th	Rt	Lt + Th	ALL	Lt	Th	Rt	Lt + Th	ALL
6-7a	5	5	0	0	5	10	0	0	10	10	0	0	0	0	0
7-8a	10	10	0	5	15	20	0	5	20	25	0	0	0	0	0
8-9a	20	20	0	15	35	65	0	10	65	75	0	0	0	0	0
9-10a	30	30	0	20	50	90	0	15	90	105	0	0	0	0	0
10-11a	40	40	0	20	60	100	0	15	100	115	0	0	0	0	0
11-12p	40	40	0	25	65	130	0	20	130	150	0	0	0	0	0
12-1p	40	40	0	25	65	130	0	20	130	150	0	0	0	0	0
1-2p	35	35	0	25	60	115	0	20	115	135	0	0	0	0	0
2-3p	45	45	0	25	70	120	0	20	120	140	0	0	0	0	0
3-4p	50	50	0	30	80	145	0	25	145	170	0	0	0	0	0
4-5p	50	50	0	30	80	160	0	25	160	185	0	0	0	0	0
5-6p	55	55	0	35	90	170	0	30	170	200	0	0	0	0	0
	25% in	25% in		2.5%in +		75% out		12.5% out							

IN	OUT
20	15
45	25
80	85
120	120
155	135
155	170
155	170
140	155
185	160
195	195
200	215
210	225

Daily In	Daily Out	
2045	2045	
0%	0%	<--% Reduction (Test)
2045	2045	
1.0%	0.8%	<-- Estimated
2.2%	1.3%	<-- From ITE 850
4.0%	4.2%	<-- Estimated
5.8%	5.8%	<-- Estimated
7.6%	6.5%	<-- From ITE 820
7.6%	8.4%	<-- From ITE 820
7.6%	8.2%	<-- From ITE 820
6.9%	7.5%	<-- From ITE 820
9.0%	7.8%	<-- From ITE 820
9.6%	9.5%	<-- From ITE 820
9.7%	10.4%	<-- From ITE 820
10.3%	11.0%	<-- From ITE 820
81.3%	81.4%	

12.5% out

YEAR 2011 Total Traffic - No Access to Main Street

	NB		SB			EB					WB				
Start Time	Lt	Total	LT	Total	Total	Lt	Th	Rt	Lt + Th	ALL	Lt	Th	Rt	Lt + Th	ALL
6-7a	5	250	10	450	700	10	0	0	10	10	5	0	5	5	10
7-8a	10	490	5	875	1365	20	0	5	20	25	10	0	5	10	15
8-9a	20	430	0	915	1345	65	0	10	65	75	10	0	5	10	15
9-10a	30	395	5	565	960	95	0	20	95	115	5	0	5	5	10
10-11a	40	495	5	515	1010	100	0	15	100	115	10	0	5	10	15
11-12p	40	665	5	555	1220	130	0	20	130	150	10	0	10	10	20
12-1p	40	710	5	745	1455	130	0	20	130	150	20	0	5	20	25
1-2p	35	655	5	610	1265	115	0	20	115	135	15	0	5	15	20
2-3p	45	730	5	600	1330	120	0	25	120	145	5	0	10	5	15
3-4p	50	910	10	660	1570	145	0	30	145	175	15	0	5	15	20
4-5p	50	1190	10	670	1860	160	0	30	160	190	15	0	5	15	20
5-6p	55	1115	0	620	1735	170	0	30	170	200	10	0	5	10	15

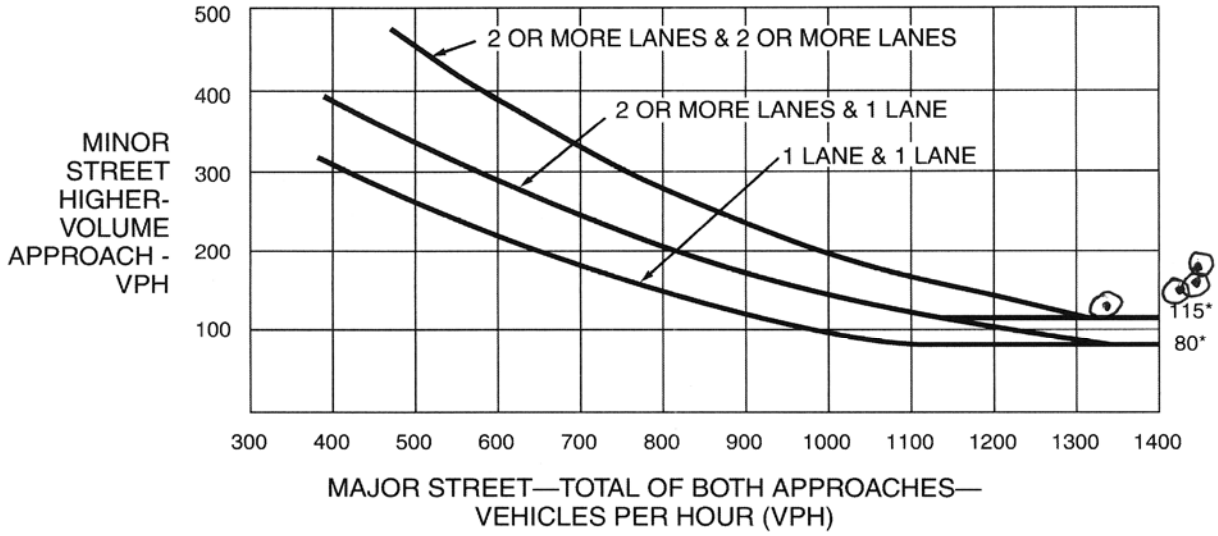
WARRANT 1 - HIGHER VOLUME SIDESTREET APPROACH LT+TH IS THE MINOR STREET

	1A		**1B**		**1C**		**1D**	
Start Time	MAJOR	MINOR	MAJOR	MINOR	MAJOR	MINOR	MAJOR	MINOR
	NO	NO	NO	NO	NO	NO	NO	NO
6-7a	YES	NO	NO	NO	YES	NO	NO	NO
7-8a	YES	NO	YES	NO	YES	NO	YES	NO
8-9a	YES	NO	YES	NO	YES	NO	YES	YES
9-10a	YES	NO	YES	YES	YES	NO	YES	YES
10-11a	YES	NO	YES	YES	YES	NO	YES	YES
11-12p	YES	NO	YES	YES	YES	YES	YES	YES
12-1p	YES	NO	YES	YES	YES	YES	YES	YES
1-2p	YES	NO	YES	YES	YES	NO	YES	YES
2-3p	YES	NO	YES	YES	YES	YES	YES	YES
3-4p	YES	NO	YES	YES	YES	YES	YES	YES
4-5p	YES	YES	YES	YES	YES	YES	YES	YES
5-6p	YES	YES	YES	YES	YES	YES	YES	YES
	NO	NO	NO	NO	NO	NO	NO	NO
REQ'S	600	150	900	75	480	120	720	60
MET?		**NO**		**YES**		**NO**		

Minor Rts Excluded
2 & 1
Urban Warrants (Rts Excluded)

ALT. YEAR 2011 TOTAL TRAFFIC - 70TH & DICKINSON

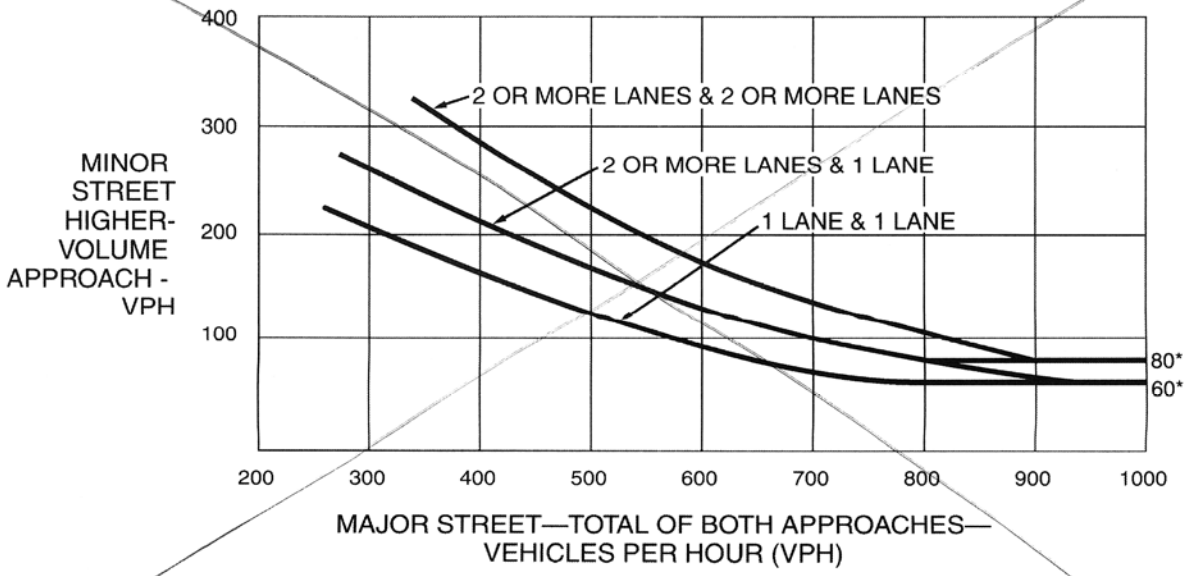
Figure 4C-1. Warrant 2, Four-Hour Vehicular Volume → MET



*Note: 115 vph applies as the lower threshold volume for a minor-street approach with two or more lanes and 80 vph applies as the lower threshold volume for a minor-street approach with one lane.

Figure 4C-2. Warrant 2, Four-Hour Vehicular Volume (70% Factor)

(COMMUNITY LESS THAN 10,000 POPULATION OR ABOVE 40 MPH ON MAJOR STREET)



*Note: 80 vph applies as the lower threshold volume for a minor-street approach with two or more lanes and 60 vph applies as the lower threshold volume for a minor-street approach with one lane.