081247

City of Milwaukee

Department of Public Works
Infrastructure Services Division

Jeffrey J. Mantes
Commissioner of Public Works

James P. Purko
Director of Operations

Jeffrey S. Polenske
City Enginaer

January 28, 2009

To the Public Safety Committee

Subject: Common Council File No. 081247
Traffic Signal Operation
West Good Hope Road and North 107th Street

Dear Honorable Members:

Common Council File No. 081247, if adopted, would direct the Department of Public Works to install a new left turn arrow signal phase for northbound traffic on North 107th Street to go west on West Good Hope Road. The file also directs that the new left turn signal only be operational from 6:30 to 9:00 A.M. and from 4:00 to 6:00 P.M. This file was introduced following an investigation by the Department of Public Works of a request to add the left turn signal phase to reduce delay and improve safety for the northbound left turn, which revealed that the signal modification requested was not warranted at this time and recommended that the signal phase not be implemented.

As with the introduction of any unwarranted traffic control devices, the investigation also revealed that implementation of the requested signal timing and phasing modifications could have an overall detrimental impact on traffic operation and safety at this intersection, as well as roadways leading to and from the intersection. Additionally, the signal phasing change proposed could potentially reduce the capability of the roadway system to support continued development and expansion of land use in the area without further significant roadway improvements.

Over the past 30 years, the intersection of West Good Hope Road and North 107th Street has experienced a series of significant operational and safety problems. To address these problems and to support the significant land use development in the area, most noteworthy being the development at Park Place, Metro Center, and Heritage Heights, significant roadway and traffic control improvements have been implemented in the area. Currently, a balance has been struck to minimize the severe levels of congestion which this area has been faced with, as well as to eliminate significant accident problems which have developed and to support the growth of development in this area.

West Good Hope Road between the Zoo Freeway and the North 107th Street intersection carries the second highest traffic volume of any surface arterial roadway in the City of Milwaukee. Current traffic volume counts, copies of which are attached, indicate that West Good Hope Road carries nearly 46,000 vehicles west of North 107th Street on an average weekday, and drops to a volume of 30,500 vehicles on weekdays east of North 107th Street. Conversely, North 107th Street carries 25,000 vehicles per day north of West Good Hope Road, and only 12,000 vehicles per day south of West Good Hope Road. As can be expected due to the change in volume on these roadways at the West Good Hope and North 107th Street intersection, there is a heavy eastbound left turn movement to go northbound on North 107th Street, and a similar level of southbound right turns to head west on West Good Hope Road. Although somewhat dated, a manual turning movement count completed in 2001 is attached to illustrate the order of magnitude of the various traffic movements through the intersection. We have also attached a ranked summary of the highest traffic-carrying street segments in the City of Milwaukee for your information.

The traffic signal at the intersection operates in a coordinated/actuated mode during times when the arrows are proposed to be provided. This means that the signal will operate in a fixed cycle length which varies by time of day to allow coordination with the signal at West Park Place and North 107th Street, but that the actual timing of signal phases are adjusted by the signal controller based on detection of vehicles present on the approaches to the intersection.

Protected-only left turn phases are currently provided for eastbound and westbound traffic on West Good Hope Road to preserve safe movement from the dual left turn lanes provided on these approaches. Under this type of phasing, left turns are allowed to be made only on the left turn signal. On North 107th Street, due to the volume of southbound left turns, a left turn arrow is provided for the southbound left turn movement. However, intersection geometrics allow the left turn to operate on a protected/permissive basis, where left turns are allowed to move both during the left turn arrow and the following through green phase as gaps in opposing traffic allow.

Being a coordinated/actuated intersection, the amount of green time for the left turn phases on West Good Hope Road and all traffic movements on North 107th Street will vary based on traffic demand, as noted above. The green phases for these traffic movements will extend as traffic demand increases on any given movement up to a preset maximum. When maximum green times are not needed for any particular phase, the unused time is given to the through movements on West Good Hope Road.

With respect to the northbound left turn movement, a separate left turn lane is provided and the traffic signal provides timing of a single signal phase for northbound through, left and right turning traffic. To provide the most efficient operation of the intersection, the southbound left turn phase is displayed prior to northbound traffic being released. Since the southbound through phase operates concurrently with the southbound left turn phase, the standing traffic on the southbound approach is be allowed to begin to clear the intersection, after which the northbound left turn will be able to proceed as gaps in the opposing southbound through traffic phase permit. It should be noted that the presence of northbound left turning vehicles waiting for gaps in southbound traffic will extend the northbound through green phase up to the maximum allowable phase length.

Accidents have been a significant problem at this intersection dating back to the early '80s. In 1982 and 1983, a total of 49 accidents with 27 injuries and 47 accidents with 24 injuries occurred in these years respectively. This represents one of the highest accident frequencies of all intersections in the City of Milwaukee during those years. With improvements implemented by Wisconsin Department of Transportation prior to the jurisdictional transfer of this intersection to the City of Milwaukee, accidents were reduced to a total of 18 accidents with 7 injuries in 1984.

More recently, following a series of roadway improvements and signalization changes implemented over this period of time, the accident frequency over the three year period from 2005 through 2007 was 7 accidents with 3 injuries in 2005, 15 accidents with 14 injuries in 2006, and 8 accidents with 4 injuries in 2007. Of particular interest, of the 30 accidents which occurred at this intersection over that three year period, only 1 accident involved a northbound vehicle making a left turn.

As noted above, accidents doubled in 2006. Due to this increase, yellow and all red change and clearance interval timings were adjusted at the intersection to compensate for the possibility of red light running and other aggressive driver behavior related to congested conditions. The accident frequency the following year was reduced to 8 accidents following implementation of these timing changes.

Beginning in the late '80s, a comprehensive land use and transportation study and detailed environmental impact statement were prepared for portions of the City of Milwaukee and Village of Menomonee Falls served by the Good Hope Road/USH 41 and 45/ STH100 interchange in support of roadway system improvements now implemented and planned for the future. Roadway improvements implemented as part of the recommendations of this study were the reconstruction of the Good Hope Road

Interchange, construction of the northbound USH 45 ramp to Metro Center, reconstruction of the North Interchange with USH 45 and the Fond du Lac Freeway, the extension of North 124th Street to West Brown Deer Road, and the construction of the 124th Street ramps to the freeway, among other changes.

Particularly noteworthy, while other additional long range improvements are recommended in this area, these studies both indicated that by the end of the study design period, the growth of traffic at the West Good Hope Road and North 107th Street intersection due to land use expansion in the area cannot be supported without the construction of a grade-separated interchange. Under this scenario, North 107th would cross over West Good Hope Road and a diamond interchange would be constructed to replace the current at-grade intersection.

In the mid '90s, during an evaluation of the proposed development of Metro Center and the Heritage Heights subdivision, it was found that the full development of these sites south of West Good Hope Road as proposed would have forced the construction of the grade separation to support site access needs. The first phase of the Metro Center Development was subsequently approved based on the condition that the vehicle trips generated would not exceed the capacity of the supporting arterial system, with subsequent site expansion contingent on further system improvements to support this use.

To support a first phase of development, a series of roadway improvements were designed and constructed to allow the development of Metro Center and Heritage Heights to begin. These improvements included the widening of North 107th Street and other minor changes necessary to maximize the capacity of the West Good Hope Road intersection with North 107th Street to the extent practical without the need to grade separate the intersection. Other changes implemented included the adjustment of signal timing and phasing to maximize traffic throughput while preserving safety of operation. Metro Boulevard was also extended to North 107th Street, and the intersection of West Fond du Lac Avenue, Metro Boulevard and North 107th Street was signalized. These improvements now successfully support traffic demand associated with Metro Center and Heritage Heights as they currently exist.

While the proposed signalization change can physically be implemented, the change would have a significant impact on capacity and delay at the intersection. Due to existing volumes of traffic on West Good Hope Road, it is not unusual to see signal cycle failures, characterized by standing traffic queues on individual movements unable to clear the intersection in a single cycle. This most commonly occurs for the eastbound left turns and westbound through movements on West Good Hope Road. It is not unusual to see

standing vehicle queues on these intersection approaches in excess of several blocks in length. The introduction of a northbound left turn phase would require a reallocation of the time available for all of the other individual signal phases. This reallocation of green time would result in an overall reduction in green time available for other more critical movements through the intersection. This would result in queues extending further than they already do on critical intersection movements, and may also congest other movements on North 107th Street which currently only experience minor congestion.

While we do not doubt that the northbound left turn may occasionally see cycle failures and that drivers would be required to wait an additional cycle to get through, our observations of traffic operation at the intersection have shown that this is not typical of the operation during the peak periods. Additionally, the northbound left turn is relatively minor in magnitude when compared to other movements that are consistently experiencing cycle failures regularly on a daily basis throughout the weekday rush hours. Therefore, it would not be prudent to congest these movements further by reallocating green times for a low volume movement which only may experience an occasional random failure of a single signal cycle.

With respect to safety of the intersection, research has indicated a correlation between congestion and increased accident frequency. The additional delay and queuing which would occur due to the introduction of the turn phase can reasonably be expected to increase aggressive driving by motorists, as well as increase the incidence of red light running. Additionally, as the vehicle backups extend further back, the likelihood of rear end collisions typically will also increase.

While safety is a stated concern in the request for the northbound arrow, it should be noted that the arrow would operate on a protected/permissive basis. In this instance, vehicles would still be allowed to turn left in gaps on the opposing southbound through movement. However, the gaps that currently exist in the southbound traffic stream provided through the current signal timing would be reduced or eliminated, as the southbound traffic would be held back for the proposed northbound left turn phase, making left turns on the permissive basis more difficult.

The proposal to add a left turn signal phase for North 107th Street is clearly not warranted by current traffic conditions, and would only serve the purpose of convenience for motorists making this turn, since the turn maneuver is reasonably accommodated under the current signal phasing. Additionally the introduction of an unwarranted control would in turn increase congestion and delay for the overall operation of the intersection, which could in turn affect safety at the intersection. We therefore recommend that this resolution not be approved.

As can be noted by the many improvements implemented at this intersection over the course of the past 30 years to improve intersection efficiency and safety, we are not averse to implementing improvements to the intersection when they are warranted. They are not in this particular case. We will continue to monitor the performance of this intersection as a whole and will continue to implement changes as warranted to maintain the safest and most efficient operation of this intersection possible.

Very truly yours,

Jeffrey S. Polenske, P.E.
City Engineer

Jeffrey J. Mantes
Commissioner of Public Works

RWB:sdp

Attachments

c: Alderman James A. Bohl, Jr.

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Traffic Volume at W. Good Hope Rd., West of N. 107 St.

Monday, May 21, 2007

	East Bound		West Bound		Total	
2400 to 0100	145		126		271	
0100 to 0200	87		78		165	
0200 to 0300	80		64		144	
0300 to 0400	118		96		214	
0400 to 0500	227		194		421	
0500 to 0600	871		589		1460	
0600 to 0615	263		242		505	
0615 to 0630	343	1554	263	1183	606	2737
0630 to 0645	477		348		825	
0645 to 0700	471		330		801	
0700 to 0715	493		408		901	
0715 to 0730	545	2230	449	1761	994	3991
0730 to 0745	560		465		1025	
0745 to 0800	632		439		1071	
0800 to 0815	519		401		920	
0815 to 0830	442	1790	342	1423	784	3213
0830 to 0845	428		367		795	
0845 to 0900	401		313		714	
0900 to 1000	1098		1058		2156	
1000 to 1100	978		1126		2104	
1100 to 1200	1076		1248		2324	
1200 to 1300	1134		1185		2319	
1300 to 1400	1202		1262		2464	
1400 to 1500	1364		1624		2988	
1500 to 1515	370		495		865	
1515 to 1530	411	1562	447	1827	858	3389
1530 to 1545	374		471		845	
1545 to 1600	407		414		821	
1600 to 1615	403		454		857	
1615 to 1630	445	1828	457	1901	902	3729
1630 to 1645	488		501		989	
1645 to 1700	492		489		981	
1700 to 1715	488		495		983	
1715 to 1730	545	1900	487	1822	1032	3722
1730 to 1745	475		440		915	
1745 to 1800	392		400		792	
1800 to 1900	1215		1246		2461	
1900 to 2000	809		697		1506	
2000 to 2100	738		636		1374	
2100 to 2200	636		490		1126	
2200 to 2300	501		364		865	
2300 to 2400	270		296		566	
24 Hr Total	23413		22296		45709	
1630 to 1730	2013		1972		3985	
Peak Hour East 0715 to 0815	2256		1754		4010	
					Total	
Peak Hour West 1630 to 1730	2013		1972		3985	
K Factor 1630 to 1730 in percent	8.7%					
D Factor for East Bound in percent	56.3%					

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Traffic Volume at W. Good Hope Rd., East of N. 107 St.

Monday May 21, 2007

	East Bound		West Bound		Total	
2400 to 0100		89		80		169
0100 to 0200		62		55		117
0200 to 0300		56		37		93
0300 to 0400		89		78		167
0400 to 0500		165		96		261
0500 to 0600		603		322		925
0600 to 0615	179		110		289	
0615 to 0630	214	1016	163	688	377	1704
0630 to 0645	297		216		513	
0645 to 0700	326		199		525	
0700 to 0715	306		255		561	
0715 to 0730	347	1403	266	1121	613	2524
0730 to 0745	347		296		643	
0745 to 0800	403		304		707	
0800 to 0815	342		276		618	
0815 to 0830	296	1180	239	990	535	2170
0830 to 0845	286		252		538	
0845 to 0900	256		223		479	
0900 to 1000		800		709		1509
1000 to 1100		739		758		1497
1100 to 1200		774		835		1609
1200 to 1300		816		845		1661
1300 to 1400		852		830		1682
1400 to 1500		937		1107		2044
1500 to 1515	257		318		575	
1515 to 1530	272	1051	320	1238	592	2289
1530 to 1545	258		314		572	
1545 to 1600	264		286		550	
1600 to 1615	273		298		571	
1615 to 1630	295	1216	287	1219	582	2435
1630 to 1645	318		314		632	
1645 to 1700	330		320		650	
1700 to 1715	319		307		626	
1715 to 1730	375	1251	320	1171	695	2422
1730 to 1745	308		288		596	
1745 to 1800	249		256		505	
1800 to 1900		827		779		1606
1900 to 2000		536		452		988
2000 to 2100		493		417		910
2100 to 2200		433		315		748
2200 to 2300		333		224		557
2300 to 2400		181		180		361
24 Hr Total		15902		14546		30448
1630 to 1730		1342		1261		2603
Peak Hour East 0715 to 0815		1439		1142		2581

Traffic Volume at W. Good Hope Rd. East of N. 107 St.
Monday May 21, 2007

	East Bound	West Bound	Total
Peak Hour West 1630 to 1730	1342	1261	2603
K Factor 1630 to 1730 in percent	8.5%		
D Factor for East Bound in percent	55.8%		

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Traffic Volume at N. 107 St., North of W. Good Hope Rd.

Monday May 21, 2007

	North Bound		South Bound		Total	
2400 to 0100		90		66		156
0100 to 0200		49		41		90
0200 to 0300		46		33		79
0300 to 0400		41		28		69
0400 to 0500		83		90		173
0500 to 0600		337		277		614
0600 to 0615	95		139		234	
0615 to 0630	158	772	144	674	302	1446
0630 to 0645	231		189		420	
0645 to 0700	288		202		490	
0700 to 0715	249		277		526	
0715 to 0730	303	1322	308	1213	611	2535
0730 to 0745	355		335		690	
0745 to 0800	415		293		708	
0800 to 0815	304		219		523	
0815 to 0830	249	961	191	721	440	1682
0830 to 0845	205		172		377	
0845 to 0900	203		139		342	
0900 to 1000		504		500		1004
1000 to 1100		459		486		945
1100 to 1200		599		598		1197
1200 to 1300		677		646		1323
1300 to 1400		603		610		1213
1400 to 1500		772		858		1630
1500 to 1515	210		300		511	
1515 to 1530	218	875	202	1047	420	1922
1530 to 1545	202		285		487	
1545 to 1600	244		260		504	
1600 to 1615	242		333		575	
1615 to 1630	254	1030	266	1256	520	2286
1630 to 1645	262		347		609	
1645 to 1700	272		310		582	
1700 to 1715	267		403		670	
1715 to 1730	297	1078	298	1167	595	2245
1730 to 1745	282		258		540	
1745 to 1800	232		208		440	
1800 to 1900		651		695		1346
1900 to 2000		476		428		904
2000 to 2100		439		372		811
2100 to 2200		370		273		643
2200 to 2300		293		245		538
2300 to 2400		155		191		346
24 Hr Total		12682		12515		25197
1630 to 1730		1098		1358		2456
Peak Hour North 0715 to 0815		1377		1155		2532
Peak Hour South 1630 to 1730		1098		1358		2456
K Factor 1630 to 1730 in percent			9.7%			
D Factor for North Bound in percent			54.4%			

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Traffic Volume at N. 107 St., South of W. Good Hope Rd.

Monday May 22, 2007

	North Bound		South Bound		Total	
2400 to 0100		51		38		89
0100 to 0200		35		24		59
0200 to 0300		31		17		48
0300 to 0400		19		9		28
0400 to 0500		49		23		72
0500 to 0600		149		70		219
0600 to 0615	46		40		86	
0615 to 0630	52	338	42	254	94	592
0630 to 0645	93		77		170	
0645 to 0700	147		95		242	
0700 to 0715	102		137		239	
0715 to 0730	124	591	139	599	263	1190
0730 to 0745	162		166		328	
0745 to 0800	203		157		360	
0800 to 0815	119		110		229	
0815 to 0830	92	372	77	318	169	690
0830 to 0845	81		68		149	
0845 to 0900	80		63		143	
0900 to 1000		250		220		470
1000 to 1100		260		209		469
1100 to 1200		318		256		574
1200 to 1300		359		294		653
1300 to 1400		353		273		626
1400 to 1500		416		380		796
1500 to 1515	109		134		243	
1515 to 1530	101	445	100	474	201	919
1530 to 1545	111		121		232	
1545 to 1600	124		119		243	
1600 to 1615	109		169		278	
1615 to 1630	136	492	133	633	269	1125
1630 to 1645	115		179		294	
1645 to 1700	132		152		284	
1700 to 1715	136		186		322	
1715 to 1730	134	498	143	528	277	1026
1730 to 1745	117		121		238	
1745 to 1800	111		78		189	
1800 to 1900		364		327		691
1900 to 2000		263		207		470
2000 to 2100		277		220		497
2100 to 2200		224		159		383
2200 to 2300		142		125		267
2300 to 2400		95		93		188
24 Hr Total		6391		5750		12141
1630 to 1730		517		660		1177
Peak Hour North 0715 to 0815		608		572		1180
Peak Hour South 1630 to 1730		517		660		1177
K Factor 1630 to 1730 in percent			9.7%			
D Factor for South Bound in percent			56.1%			

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D.P.W. - City of Milwaukee

№ 109487

Intersection Count Summary

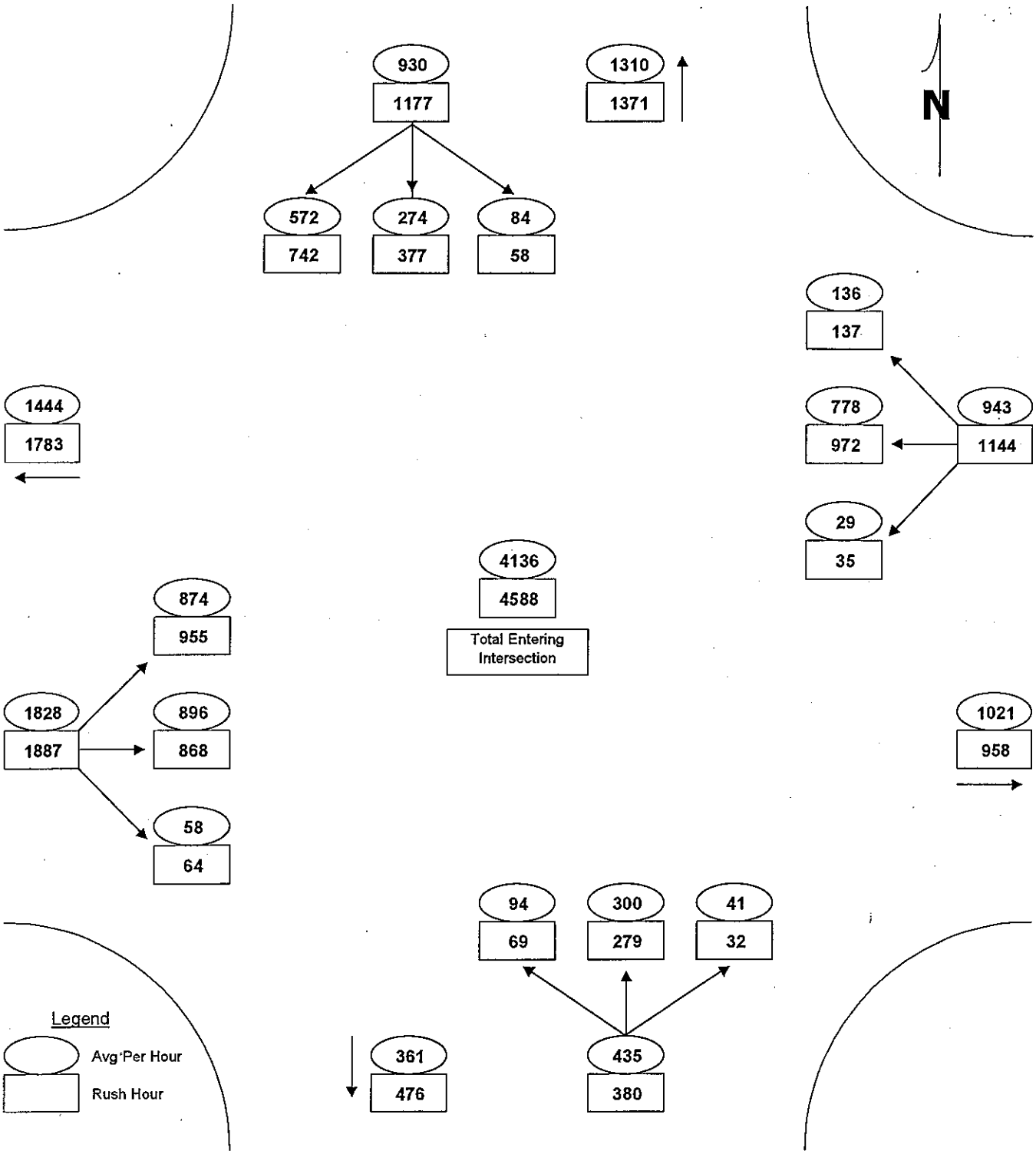
Location: W. Good Hope Rd. & N. 107th St.

Day & Date: Tuesday Sept 11, 2001

Weather: Clear

Temp: 65 Degrees

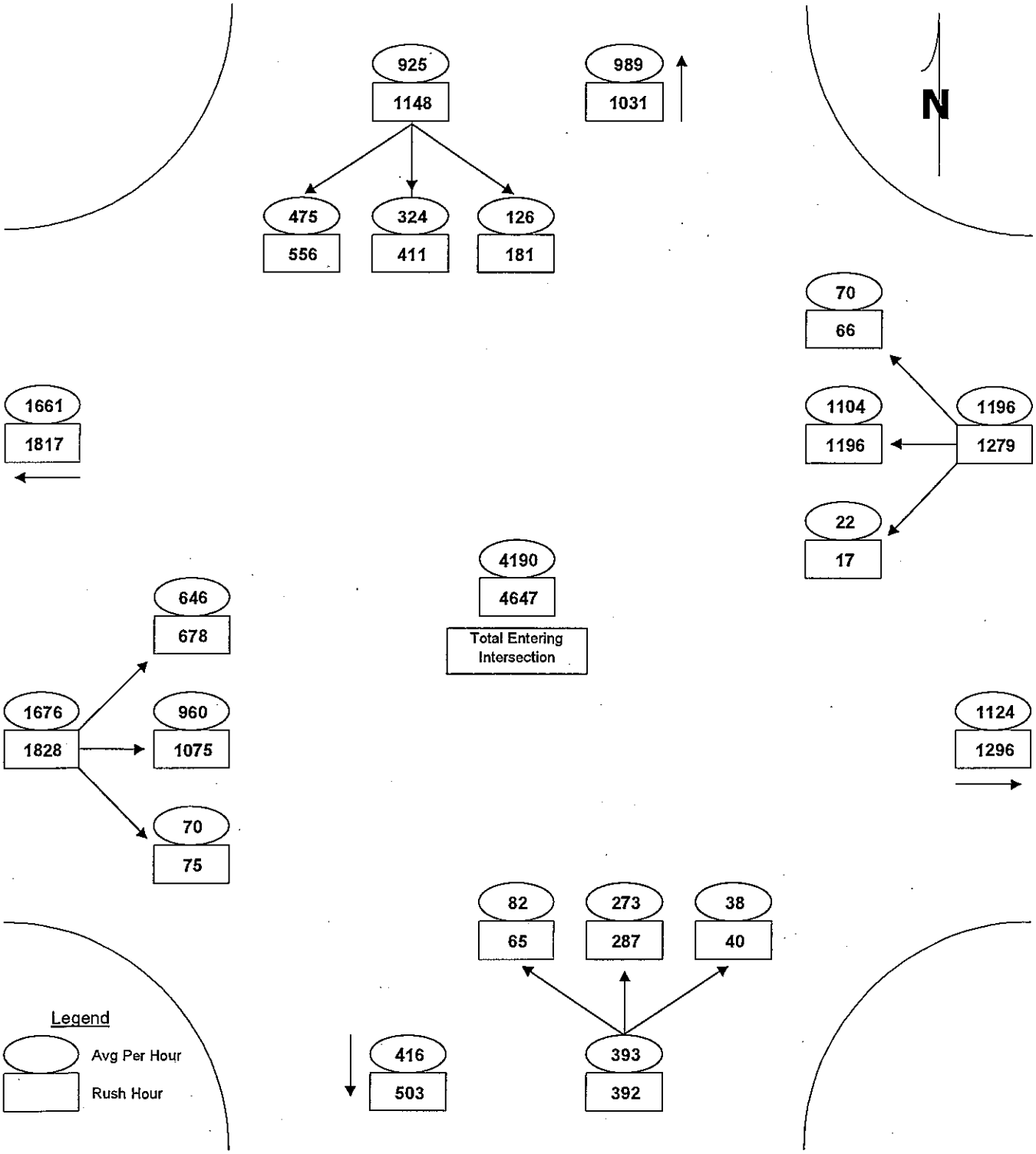
Time 0630 to 0900



Intersection Count Summary

Location: W. Good Hope Rd. & N. 107th St. Day & Date: Tuesday Sep 11, 2001

Weather: Clear Temp: 65 Degrees Time 1530 to 1800



			Location		Month	Day	Year	Total Volume	PM	Volume NB/EB	Volume SB/WB
S.	60th St.	North of	W.	Cold Spring Rd.	Jan	16	2007	55867	755	30419	25448
W.	Good Hope Rd.	West of	N.	107th St.	May	21	2007	45709	3985	23413	22296
S.	27th Street	North of	W.	Ohio Av.	Aug	2	2006	45457	3298	23710	21747
S.	27th St.	North of	W.	Layton Av.	November	14	2005	42422	3447	20840	21582
S.	27th St.	North of	W.	Edgerton Av.	June	27	2005	41587	3444	23556	18031
W.	Capitol Dr.	West of	N.	27th St.	Sep	26	2007	40953	3243	19505	21448
S.	Howell Av.	North of	W.	Grange Av.	June	28	2005	39994	3158	20053	19941
E.	Capitol Dr.	West of	N.	Richards St.	Jul	24	2007	39945	3118	19867	20078
W.	Brown Deer Rd.	West of	N.	76th St.	May	9	2007	39810	3506	21076	18734
W.	Capitol Dr.	East of	N.	Sherman Bd.	February	15	2005	38860	3022	21585	17275
W.	Capitol Dr.	West of	N.	Teutonia Av.	Jul	25	2007	38243	2967	18728	19515
W.	Lisbon Av.	West of	W.	North Av.	Dec	3	2007	38112	3101	20629	17483
W.	Layton Av.	West of	S.	13th St.	June	28	2005	37850	2827	19932	17918
W.	Brown Deer Rd.	East of	N.	91st St.	May	9	2007	37695	3369	19173	18522
E.	Layton Av.	West of	S.	Pennsylvania Av.	November	16	2005	37478	3208	18358	19120
S.	27th St.	North of	W.	Ramsey Av.	June	27	2005	37425	2955	17827	19598
W.	Layton Av.	East of	S.	20th St.	June	28	2005	37244	2813	17346	19898
N.	Sherman Bd.	South of	W.	Burleigh St.	Oct	23	2007	37044	3448	14991	22053
N.	Harbor Dr.	North of		O'Donnell Park	May	8	2006	36886	3489	16802	20084
W.	Brown Deer Rd.	East of	N.	85th St.	May	9	2007	36310	3160	18278	18032
W.	Fond du Lac Av.	East of	W.	Maxwell Pl.	February	14	2005	36275	2772	18837	17438
W.	McKinley Av.	West of	N.	6th St.	Jan	8	2007	35971	3133	16091	19880
S.	27th St.	North of	W.	Morgan Av.	October	4	2005	35757	2713	18062	17695
N.	Lincoln Memorial	North of	E.	Clybourn St.	May	23	2006	35469	3229	15144	20325
N.	Lincoln Memorial	South of		Juneau Park Pkwy	July	31	2006	35439	3149	17412	18027
W.	Layton Av.	West of	S.	6th St.	June	28	2005	35403	2751	16949	18454
S.	27th St.	South of	W.	Bolivar Av.	November	14	2005	35356	2822	17918	17438
S.	27th St.	North of	W.	Grange Av.	June	27	2005	35158	2694	18014	17144
E.	Layton Av.	East of	S.	Howell Av.	November	16	2005	35031	3089	16900	18131
W.	Fond du Lac Av.	East of	N.	Sherman Bd.	Sep	25	2007	34972	2626	17346	17626
W.	Howard Av	West of	S.	Howell Av.	June	29	2005	34846	2733	19942	14904
S.	27th St.	North of	W.	Cold Spring Rd.	November	21	2005	34705	2696	17126	17579
W.	Fond du Lac Av.	East of	W.	Maxwell Pl.	February	14	2005	34591	2726	16485	18106
S.	27th St.	North of	W.	College Av.	June	27	2005	34326	2698	17137	17189
W.	Fond du lac Av.	West of	N.	6th St.	Oct	25	2006	34120	3059	12724	21396
W.	Fond du Lac Av.	West of	N.	Sherman Bd.	Sep	24	2007	34077	2690	20011	14066
E.	Layton Av.	East of	S.	Pine Av.	November	16	2005	33418	2931	15927	17491
W.	Capitol Dr.	West of	N.	Sherman Bd.	Aug	8	2007	33165	2610	16117	17048
W.	Fond du Lac Av.	West of	W.	Ely Pl.	February	14	2005	33096	2549	16776	16320
W.	Capitol Dr.	West of	W.	Atkinson Av.	Jul	24	2007	32939	2554	16577	16362