



Memorandum

To: Michael Mertens, Assistant Village Manager
Village of Tinley Park

From: Will Van Dyke
Jim Renshaw
Michelle Meyer

Date: May 27, 2005

Subject: Additional Downtown Traffic and Parking Analysis
Village of Tinley Park

Introduction

Kimley-Horn and Associates, Inc., has prepared this memorandum at the request of the Village of Tinley Park to respond to several questions raised related to downtown traffic and parking following completion of the *Downtown Parking and Traffic Study*. The specific questions include the following:

- With respect to the North Street Development, is there any advantage to making North Street and 173rd Street a one-way couple?
- What is the best location for the entrance and exit to the proposed parking structure on North Street?
- Is a traffic signal needed, or recommended, at 173rd Street and Oak Park Avenue for the proposed North Street development?
- What are the advantages and disadvantages of the proposed Center Street for the North Street development?

Summary and Conclusions

Potential One-Way Operation of 173rd Street and North Street

- The conversion of 173rd Street and North Street to one-way operation was evaluated using the future traffic volumes. Consideration was given to one-way traffic flow in a clockwise direction and in a counterclockwise direction, although clockwise flow is usually used for small one-way couplets.
- One-way traffic flow is usually recommended in large downtown street networks to increase capacity and minimize conflicts at intersections.



However, it does limit storefront exposure and access, which is vital in a downtown business location.

- The disadvantages of the counterclockwise one-way flow outweigh any advantages for the specific situation in Tinley Park for the following reasons:
 - Potential for wrong-way travel by those unfamiliar with the downtown
 - Adds left-turn traffic at 173rd Street
 - A signal would be needed at 173rd Street/Oak Park Avenue; however, it is too close to the signal at North Street to yield good traffic progression.
 - Traffic exiting the garage on the west side would conflict with pedestrians crossing North Street between garage and the North Street development.
- The clockwise one-way flow is less well received by motorists than the counterclockwise flow. It does relieve the left-turn conditions at 173rd Street, but it has the same potential for wrong-way travel by motorists and would increase the number of vehicles crossing the pedestrian walkway from the garage to the North Street Development.
- We do not recommend a one-way operation for the North Street/173rd Street couple. Both streets will work effectively as two-way streets with the projected traffic volumes. The two-way street system will be much easier for drivers to understand and will result in fewer pedestrian/vehicle conflicts with traffic entering or exiting the proposed parking structure.

Proposed Parking Structure-Entry/Exit Locations

- Three separate schemes have been considered for the proposed parking structure on North Street. The schemes were developed to understand how the options would work internally and where to locate entrances and exits.
- The three schemes, illustrated diagrammatically in the text, are as follows:
 - Option 1—Level Floor with Two-Way Traffic
 - Option 2—Double Helix with Two-Way Traffic
 - Option 3—Double Helix with One-Way Traffic
- Each of the schemes has advantages and disadvantages that are discussed in the text, but all three configurations would have an entry/exit on the west end on North Street. Options 1 and 2 would have a second entry/exit on the east to 173rd Street, and Option 3 would have an exit only on the east to 173rd Street. In any case, the location of the entrances and exits on the ends of the garage is beneficial to minimize garage related traffic on North



Street at the pedestrian crosswalk to the North Street Development and the cinema complex.

Potential Traffic Signal at 173rd Street/Oak Park Avenue

- The 173rd Street/Oak Park Avenue intersection only meets the PM peak-hour traffic signal warrant. Based on projected traffic, a traffic signal is not warranted. This signal is also too close to the one at North Street to yield good traffic progression. A dedicated right-turn and left-turn lane on 173rd Street would be desirable so right-turning vehicles are not delayed by vehicles waiting to make a right turn onto Oak Park Avenue.

Potential Center Street in North Street Development

- The proposed two-way Center Street extension of 67th Court between 173rd Street and North Street is beneficial for several reasons. It provides additional on-street parking for nearby businesses, it provides a direct vehicle and pedestrian connection to the project and the Metra station from the north, it helps disperse traffic and it continues the street grid north of the project.

Traffic Analysis of One-Way Street Operation: 173rd and North Streets

Background/Data Collection

Kimley-Horn used the forecast volumes from the *Tinley Park Downtown Traffic and Parking Study* as the benchmark for evaluating the circulation network related to the proposed parking structure. These forecast volumes included the trip generation potential of the proposed downtown developments. Figure 1 illustrates the forecast peak-hour turning movement volumes near the study area with the proposed developments, assuming the existing two-way streets continue to exist.

Evaluation of One-Way Traffic

Using the aforementioned peak-hour turning movement volume forecasts for the two-way street network, peak-hour turning movement volumes were estimated for two different scenarios: conversion of North Street and 173rd Street into a one-way pair, with traffic circulating in the counter-clockwise direction, and conversion of North Street and 173rd Street into a one-way pair with traffic circulating in a clockwise direction. The results of this effort are presented in Figures 2 and 3, respectively.

A capacity analysis was performed using the methodologies contained in the *2000 Highway Capacity Manual* on the signalized intersection of Oak Park Avenue and 173rd Place/North Place, and the unsignalized intersection of Oak Park Avenue and 173rd Street, using the turning movement volumes presented in Figures 1 through 3. The results of this effort are presented in Table 1.

LEGEND

- XX -MORNING PEAK HOUR TRAFFIC VOLUME
- (XX) -EVENING PEAK HOUR TRAFFIC VOLUME
- ⊙ -SIGNALIZED INTERSECTION
- -DIRECTION OF TRAFFIC FLOW



NOT TO SCALE

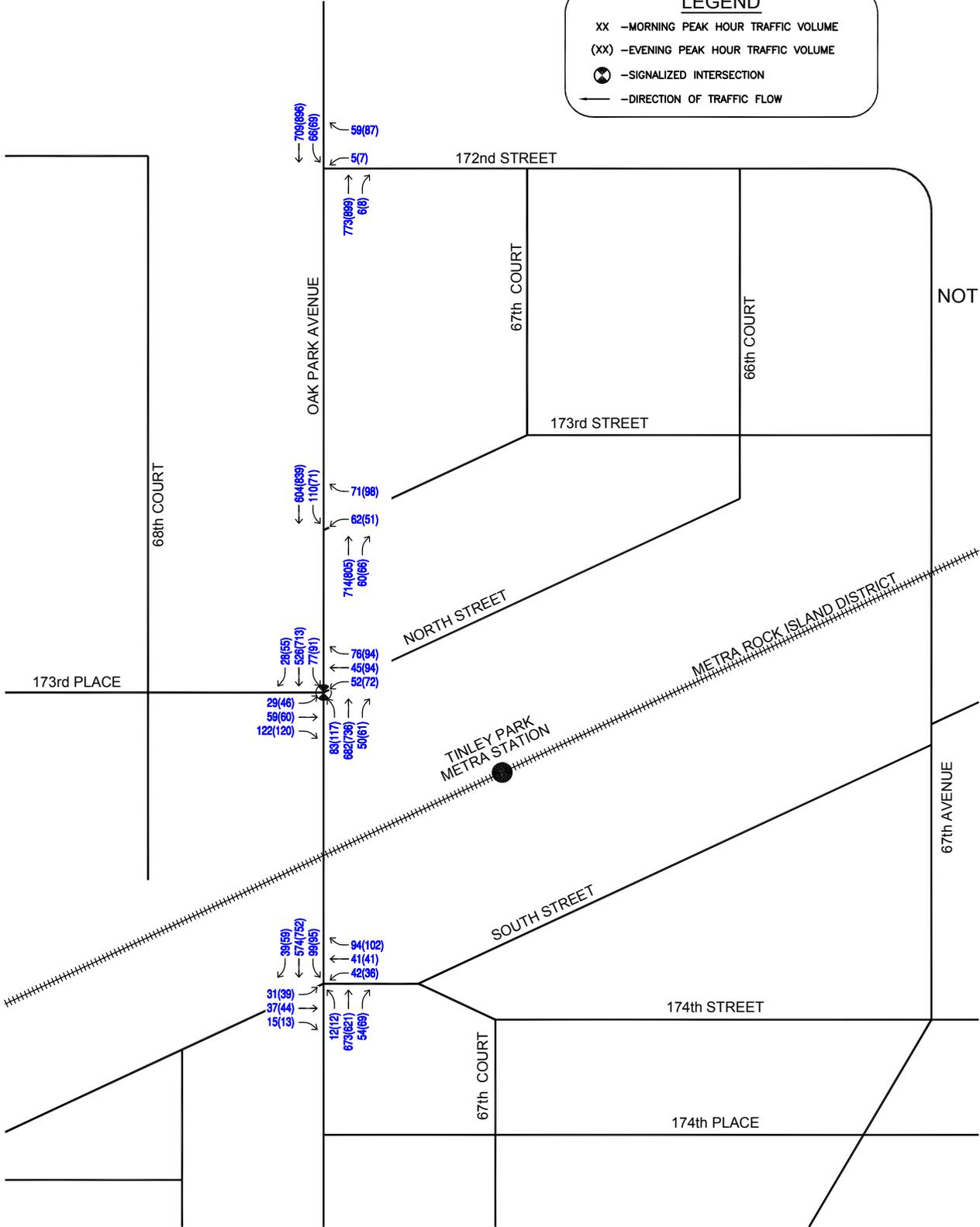


FIGURE 1
 FUTURE TRAFFIC VOLUMES
 WITH TWO-WAY STREETS
 TINLEY PARK, ILLINOIS



LEGEND

- XX -MORNING PEAK HOUR TRAFFIC VOLUME
- (XX) -EVENING PEAK HOUR TRAFFIC VOLUME
- ⊗ -SIGNALIZED INTERSECTION
- ← -DIRECTION OF TRAFFIC FLOW

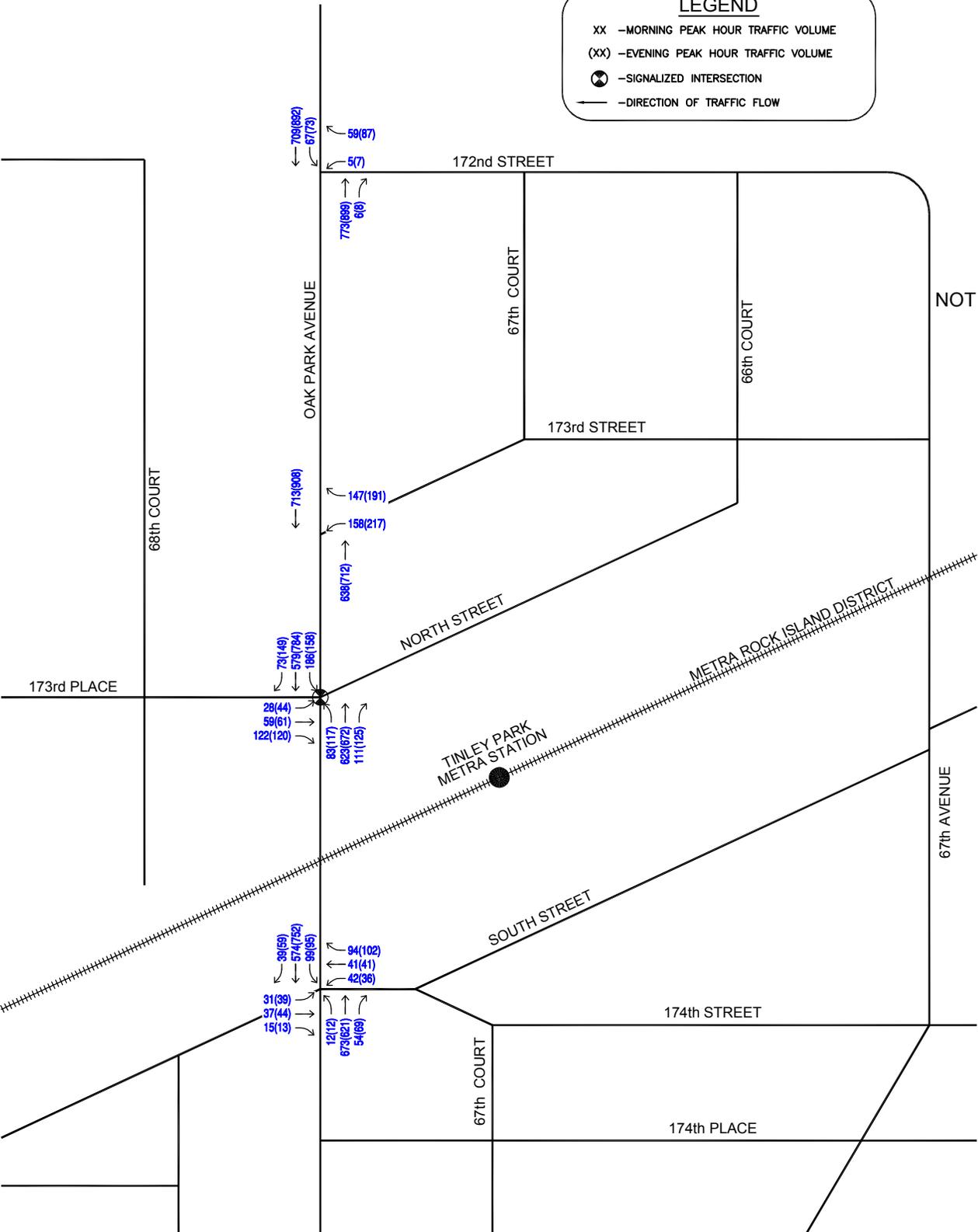
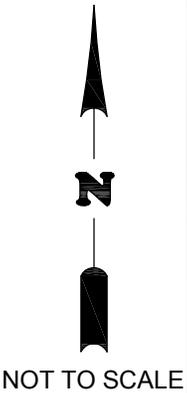


FIGURE 2
 FUTURE TRAFFIC VOLUMES
 COUNTER CLOCKWISE ONE-WAY COUPLET: AS PROPOSED
 TINLEY PARK, ILLINOIS



LEGEND

- XX -MORNING PEAK HOUR TRAFFIC VOLUME
- (XX) -EVENING PEAK HOUR TRAFFIC VOLUME
- ⊙ -SIGNALIZED INTERSECTION
- -DIRECTION OF TRAFFIC FLOW



NOT TO SCALE

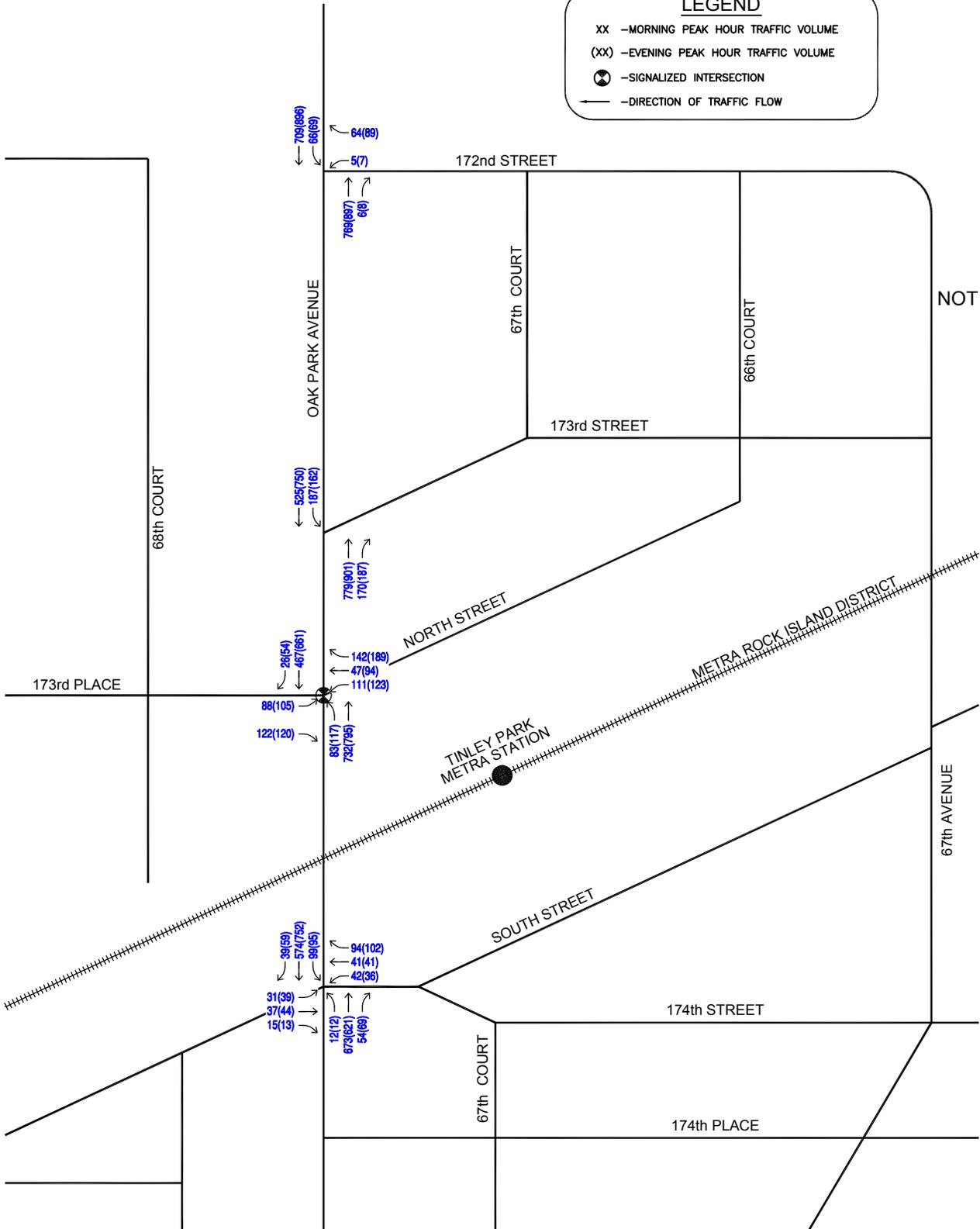


FIGURE 3
 FUTURE TRAFFIC VOLUMES
 CLOCKWISE ONE-WAY COUPLET: ALTERNATIVE CONFIGURATION
 TINLEY PARK, ILLINOIS





Table 1
Level of Service Analysis

Intersection	Scenario	Approach/ Movement	AM Peak		PM Peak	
			Delay (Sec.)	LOS	Delay (Sec.)	LOS
Oak Park Avenue and 173 rd Street (Unsignalized)	Two-Way	Eastbound	—	—	—	—
		Westbound	93.3	F	156.0	F
		Northbound	—	—	—	—
		Southbound	10.1	B	10.3	B
		Average	93.3	F	156.0	F
	One-Way Counter Clockwise	Eastbound	—	—	—	—
		Westbound	92.2	F	362.8	F
		Northbound	—	—	—	—
		Southbound	—	—	—	—
		Average	16.9	B	72.9	F
	One-Way Clockwise	Eastbound	—	—	—	—
		Westbound	—	—	—	—
		Northbound	—	—	—	—
		Southbound	7.0	A	7.9	A
		Average	3.0	A	3.6	A
Oak Park Avenue and 173 rd Place/ North Street (Signalized)	Two-Way	Eastbound	41.1	D	22.2	C
		Westbound	45	D	31	C
		Northbound	8.4	A	11.6	B
		Southbound	4.2	A	10.8	A
		Average	14.1	B	14.6	B
	One-Way Counter Clockwise	Eastbound	45.0	D	35.3	D
		Westbound	—	—	—	—
		Northbound	17.4	B	29.0	C
		Southbound	10.8	B	32.2	C
		Average	17.5	B	31.2	C
	One-Way Clockwise	Eastbound	25.2	C	33.4	C
		Westbound	22.8	C	26.1	C
		Northbound	19.2	B	21.7	C
		Southbound	9.1	A	9.2	A
		Average	17.7	B	19.7	B



Whenever a conversion from a two-way network to a one-way network is being considered, certain factors should be taken into account, including the following:

- Most traffic engineers agree that one-way streets (in large downtown networks, not necessarily germane to this exercise) increase capacity by about 10 to 20 percent by helping signal progression.
- Most traffic engineers agree that in large downtown networks a one-way street has fewer vehicular conflicts at intersections and better facilitates curbside activity.
- One-way streets force drivers to follow out-of-direction routes causing an increase in miles of travel.
- Although not intuitively apparent, one-way streets present greater difficulties to the pedestrian (due to the number of vehicle/pedestrian sequences a pedestrian must encounter crossing a one-way street) and due to the greater vehicular travel speeds that often result when a one-way pair is designated.
- One-way streets may limit storefront exposure and access to vital downtown businesses.

Notwithstanding the above, a review of the traffic model, capacity evaluation, and operational considerations reveals the following, specific to Tinley Park, as summarized in Table 2.

Conclusion

We do not recommend a one-way operation for the North Street/173rd Street couple. Both streets will work effectively as two-way streets with the projected traffic volumes. The two-way street system will be much easier for drivers to understand and will result in fewer pedestrian/vehicle conflicts with traffic entering or exiting the proposed parking structure.

Proposed Parking Structure-Entrance/Exit Locations

Background

The proposed parking structure would be located on the north side of the Metra commuter rail tracks along North Street. The garage would be two bays wide, or about 120 feet, since that is the approximate width of the current Village parking lot that occupies most of the proposed garage site. The precise configuration of the garage and the layout have not yet been determined. However, in order to make recommendations for the location of the entrances and exits, we have done some preliminary parking structure planning to provide enough information to make an assessment about the entry locations. Based on discussions with the Village, we have assumed that daytime use of the garage by



Table 2
Network Operational Pros and Cons

Pro	Con
One-Way Counterclockwise	
<ul style="list-style-type: none"> • Counterclockwise flow is usually deployed in small one-way couplets and should be received better than clockwise flow. • Counterclockwise flow facilitates better use of the existing southbound left-turn lane at North. 	<ul style="list-style-type: none"> • Counterclockwise flow adds traffic to movements that are already projected to operate at a poor level of service (after development occurs). • Although 173rd Street will need a signal (and it is warranted), it is too close to the signal at North to yield good traffic progression. The model indicates that traffic queues will extend between the two signals if 173rd is signalized making westbound left turns difficult at peak times. • Two-way traffic on 173rd Street between North Street/66th Court and 67th Avenue could create confusion for unfamiliar motorists. • Potential increase of left turns onto Oak Park Avenue if motorists elect to travel on the one-way couplet without parking (or if parking space cannot be found). • Potential for wrong-way travel.
One-Way Clockwise	
<ul style="list-style-type: none"> • Relieves level of service problem at 173rd Street. • Major movement of traffic circulation is right turns (which is more efficient than left turns). If unfamiliar motorists must make another pass within the couplet, then it is right-turns on Oak Park (more efficient than left-turns). • Better utilization of the existing signal at North (173rd Place) • Eliminates westbound movement and lengthy delays at 173rd Street without severely decreasing delay at 173rd Place/North Street. 	<ul style="list-style-type: none"> • Counterclockwise flow is usually deployed in small one-way couplets and should be received better than clockwise flow; however, there is no apparent reason that one-way flow is needed (wrong directional travel may result). • A southbound dedicated left-turn lane is recommended on Oak Park Avenue/173rd Street for this scenario. • Potential for wrong way travel.



Metra parkers would be controlled with permits, the same as is currently done in the Village lots. Parking for other users such as shoppers, restaurant patrons, movie patrons, and others would be free, with no gates or other controls at the entrance or exit.

Garage Alternatives

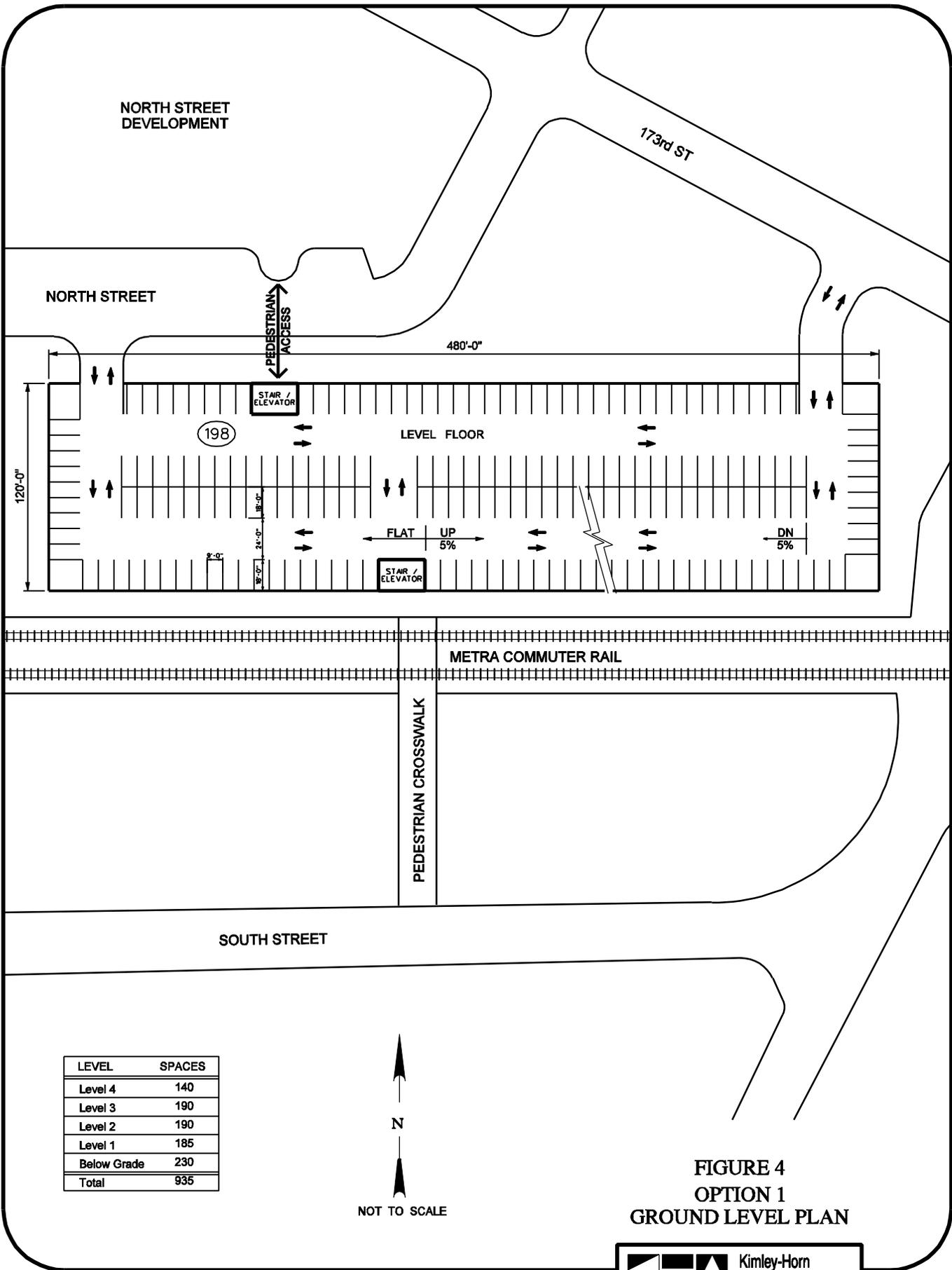
Three separate alternatives have been developed for the site. Each option would have two parking bays—that is, parking on each side of a travel lane, similar to the parking lot that now occupies the site. These options are presented and discussed below.

Option 1—Level Floor/Sloping Floor with Two-Way Traffic

Figure 4 shows the schematic ground level traffic flow plan for Option 1, and Figure 5 shows a schematic traffic flow diagram and geometric plan of the garage. Option 1 would have two-way traffic with level floors along North Street and a sloping bay on the south for travel up and down through the garage. The advantage of this configuration is that the garage along North Street would have level floors, with no sloping floors, which is beneficial architecturally. The disadvantage to this concept is that the travel up or down requires vehicles to circulate on a level floor in each rotation. This increases the travel time to go up or down in the garage, compared with a garage with two sloping floors, as in the next two options. In any case, the garage could have two entrance/exit locations—one on the west to North Street and one on the east to 173rd Street. This provides drivers with two ways to enter or exit the garage and helps disperse the traffic.

Option 2—Double Helix with Two-Way Traffic

Figure 6 shows the schematic ground level traffic flow plan for Option 2, and Figure 7 shows a schematic traffic flow diagram and geometric plan of the garage. Option 2 would have two-way traffic and level floors on the west side of the garage with two double helix sloping bays on the east for travel up and down through the garage. The advantage of this configuration, compared with Option 1, is that the circulation up or down would be much faster, with vehicles going up or down two levels for every 360-degree turn, compared with just one level for Option 1. The garage could have two entrance/exit locations—one on the west to North Street and one on the east to 173rd Street, similar to Option 1. This type of configuration, with two-way traffic, works best for Metra commuter use with almost all the traffic flowing one way inbound in the morning and outbound in the afternoon. Also, because the trains arrive at intervals, there would be no heavy surge of inbound or outbound traffic. The two-way circulation scheme does not work as well for a use such as the theater complex with high volumes of arriving and departing traffic mingling at the same time inside the garage.



LEVEL	SPACES
Level 4	140
Level 3	190
Level 2	190
Level 1	185
Below Grade	230
Total	935

FIGURE 4
OPTION 1
GROUND LEVEL PLAN

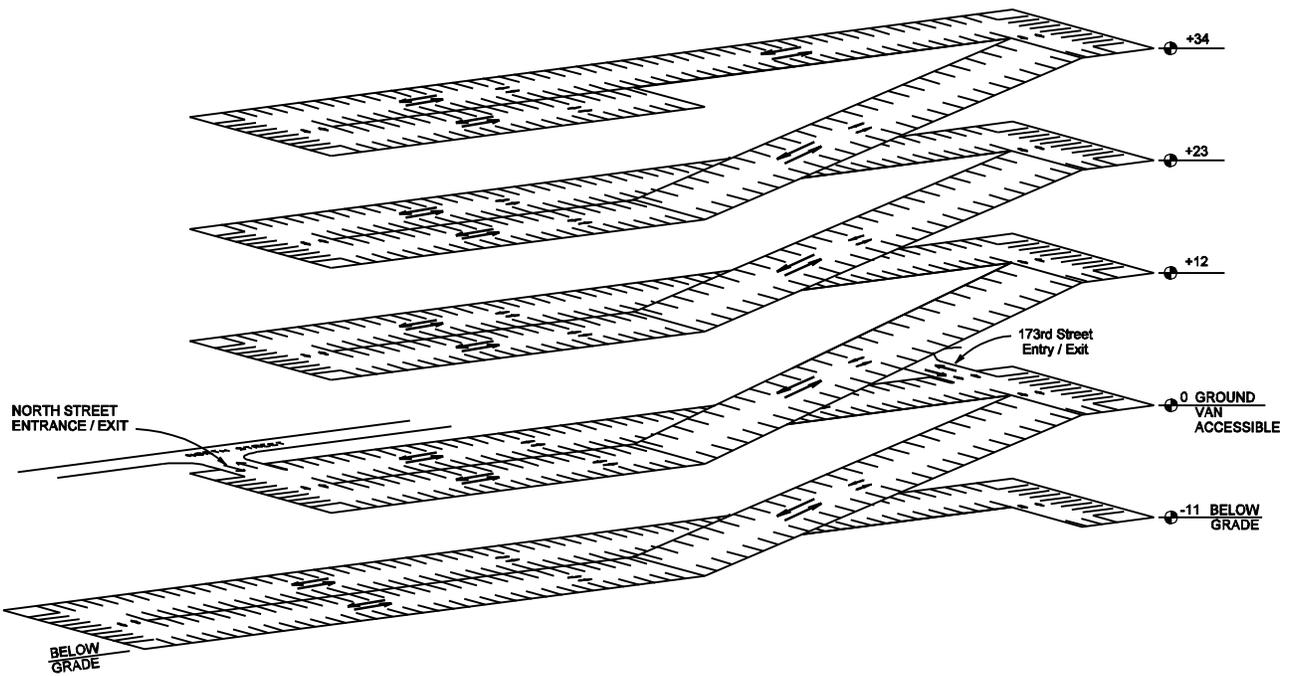
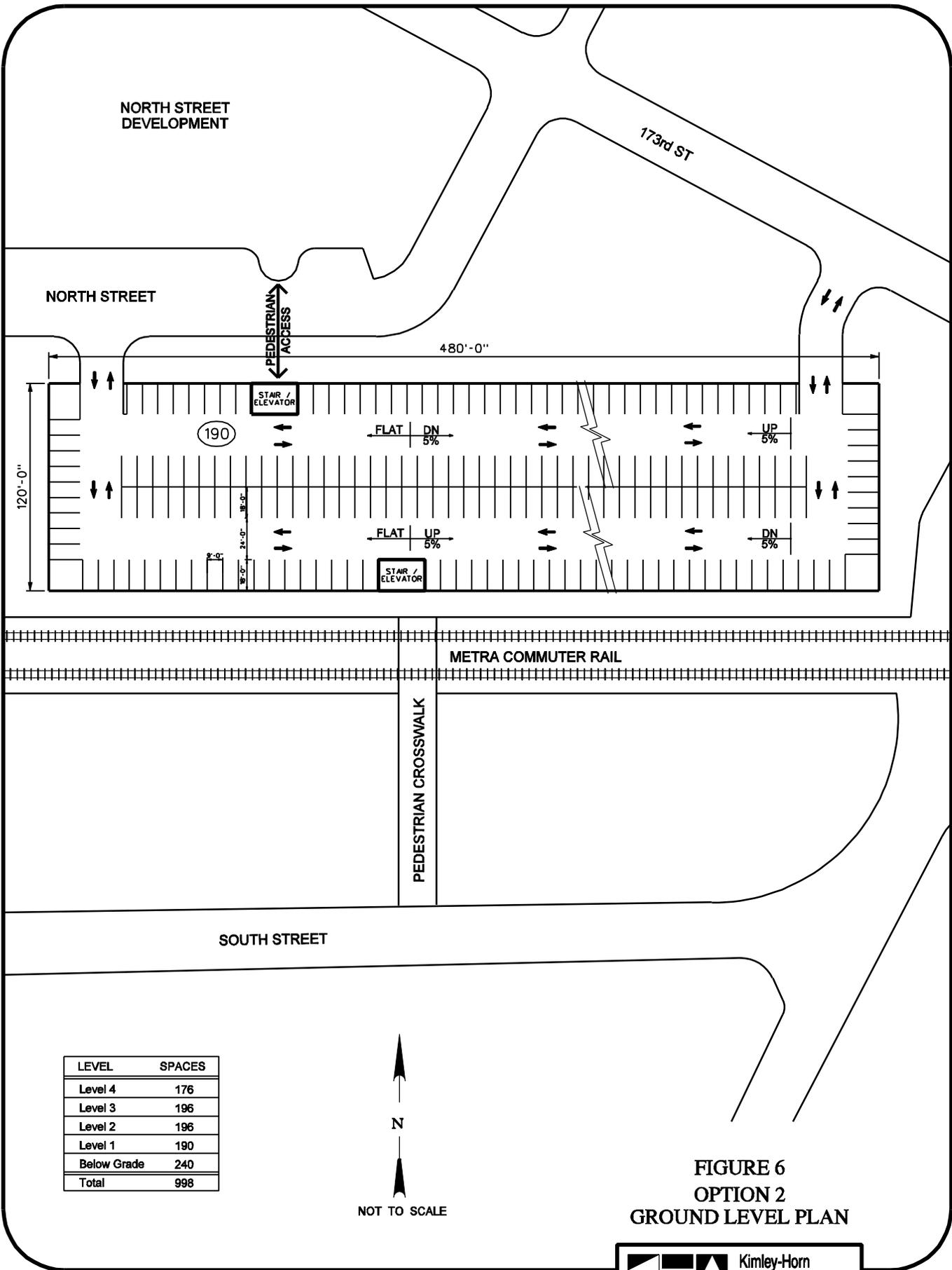


FIGURE 5
 OPTION 1
 LEVEL FLOOR / SLOPED FLOOR
 WITH TWO WAY TRAFFIC
 SCHEMATIC TRAFFIC FLOW DIAGRAM



LEVEL	SPACES
Level 4	176
Level 3	196
Level 2	196
Level 1	190
Below Grade	240
Total	998

**FIGURE 6
OPTION 2
GROUND LEVEL PLAN**

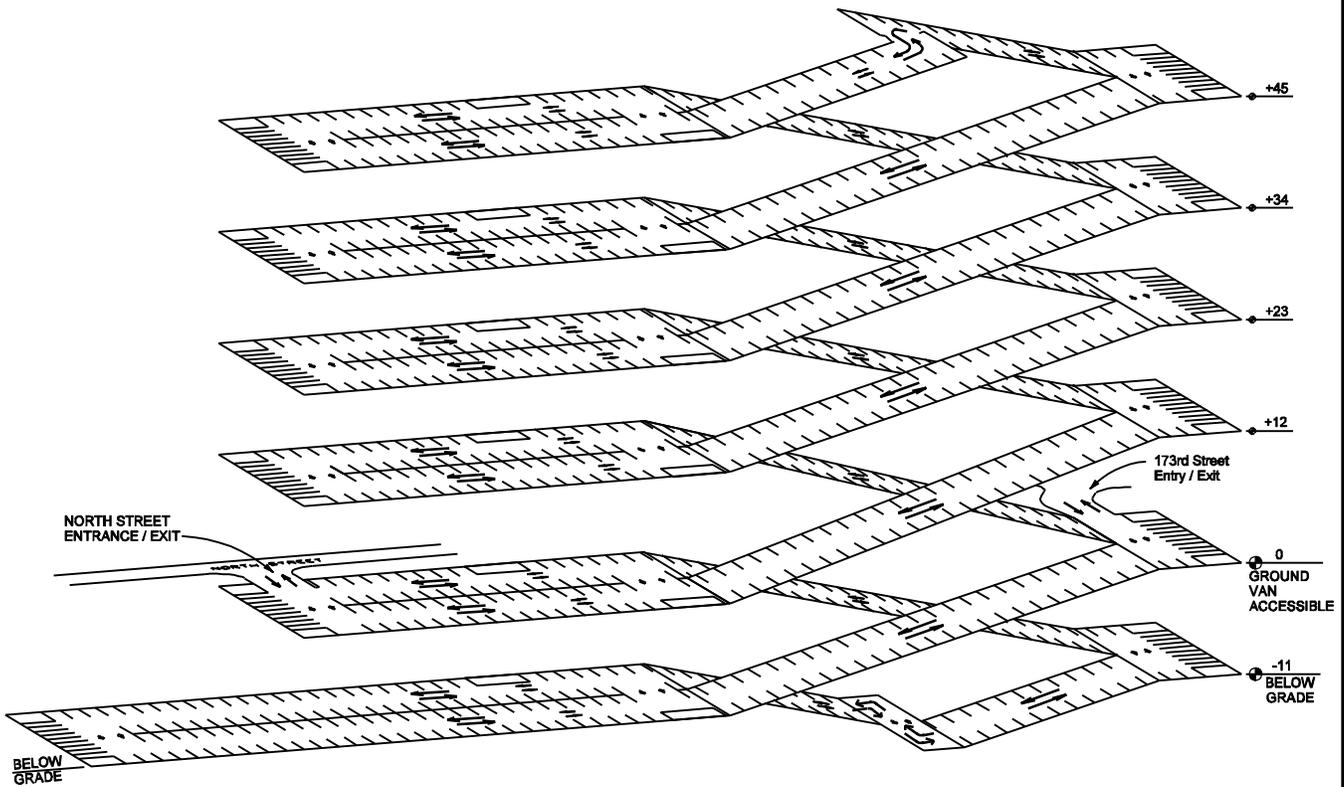


FIGURE 7
 OPTION 2
 DOUBLE HELIX WITH
 TWO WAY TRAFFIC
 SCHEMATIC TRAFFIC FLOW DIAGRAM



Option 3—Double Helix with One-Way Traffic

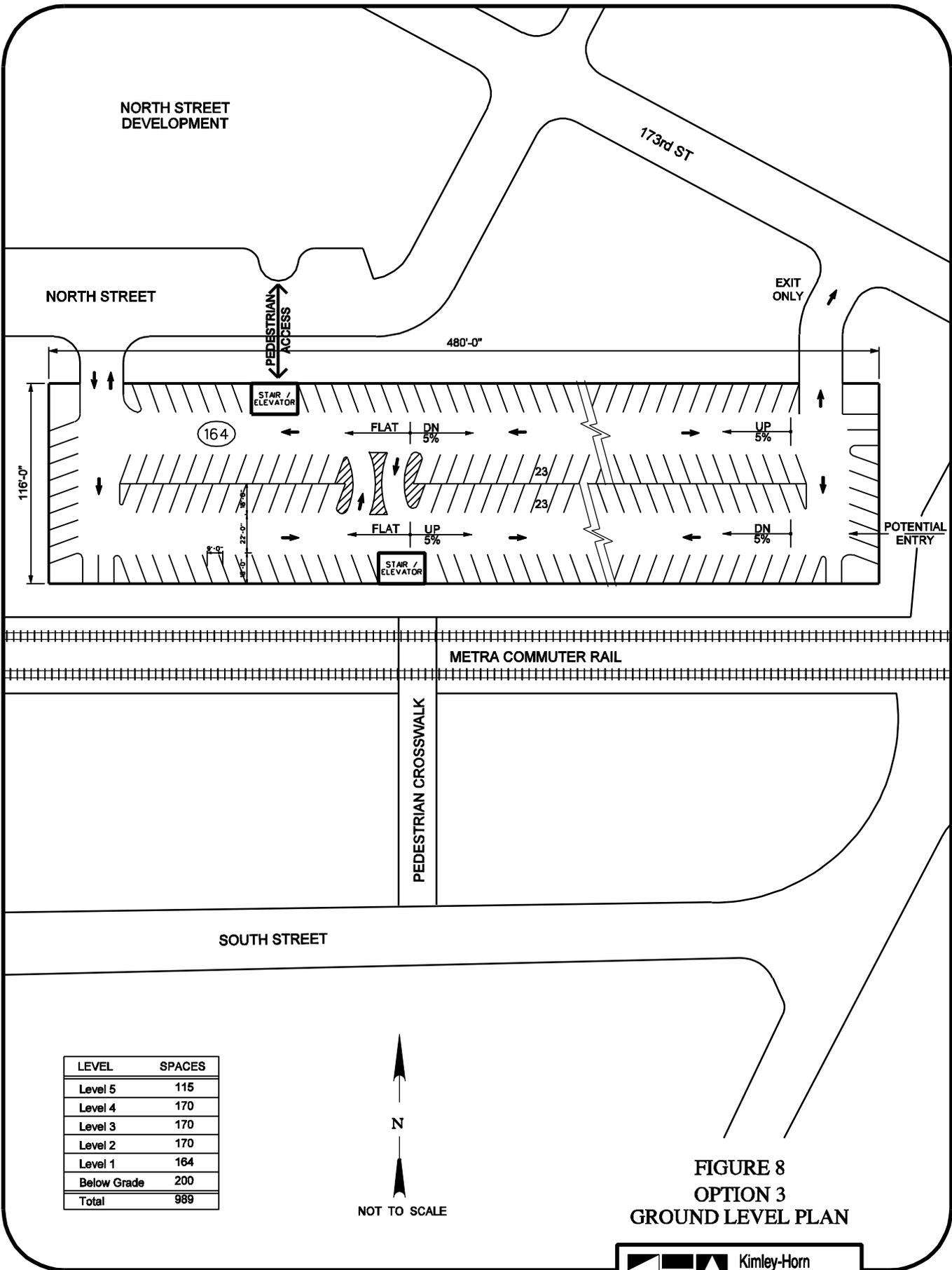
Figure 8 shows the schematic ground level traffic flow plan for Option 3, and Figure 9 shows a schematic traffic flow diagram and geometric plan of the garage. Option 3 would have one-way traffic and level floors on the west side of the garage with two double helix sloping bay on the east for travel up and down through the garage. This configuration is similar to Option 2, except that the traffic flow would be one-way. This is particularly beneficial for the theater because entering and exiting traffic would be separated. The garage could have one entrance/exit location on the west to North Street and an exit on the east to 173rd Street. Figure 8 shows a potential entry from 66th Court; however, this entry is very near the Metra tracks, and there is the potential for the queue of south-bound vehicles entering the garage to extend across the tracks, which would not be desirable. This configuration works best for the cinema, but the one-way double helix configuration is more confusing for patrons than either Option 1 or Option 2.

Conclusion

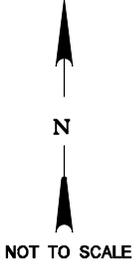
All three configurations proposed for the garage would have an entry/exit on the west. Two of the options would have an entry/exit on the east, except for Option 3, which would only have an exit on the east. Of the three options considered, Option 2, with two-way traffic, offers the most flexibility for entry/exit, ease of internal circulation, and ease of user understanding; however, it would not function as well during the peak times for cinema use when inbound and outbound patronage occurs at the same time. Option 3, with one-way traffic, works best for the cinema patrons with two drawbacks: The one-way double helix is not as user-friendly as the two-way concept, and it would have an exit on the east side, but no entry.

Potential Traffic Signal at 173rd Street and Oak Park Avenue

The intersection of Oak Park Avenue with 173rd Street was evaluated based on future traffic volumes to determine whether the intersection warrants installation of a traffic signal. The signal warrant analysis was prepared based on the *Manual on Uniform Traffic Control Devices (MUTCD)*, 2000 Edition. Warrant 3, the Peak-Hour Warrant, evaluation was prepared for the intersection. A copy of Figure 4C-3 Warrant 3—Peak Hour is provided in Appendix. Based on the projected future volumes, it is anticipated that the intersection will meet the Peak-Hour Warrant in the PM peak hour. However, this is generally the first warrant to be met, and most agencies will not justify the installation of a signal based solely on this warrant. The AM peak hour would not meet the peak-hour warrant, so it is anticipated that only a few hours of the day would have sufficient traffic to meet the warrant. Because of the poor location of the intersection, signalization is not recommended. The adjacent intersection at North Street is very close, and signal progression would be difficult to achieve. The installation of a signal would likely have a negative impact on the flow of traffic on Oak Park Avenue. Queuing is also a concern at this intersection. The



LEVEL	SPACES
Level 5	115
Level 4	170
Level 3	170
Level 2	170
Level 1	164
Below Grade	200
Total	989



**FIGURE 8
OPTION 3
GROUND LEVEL PLAN**

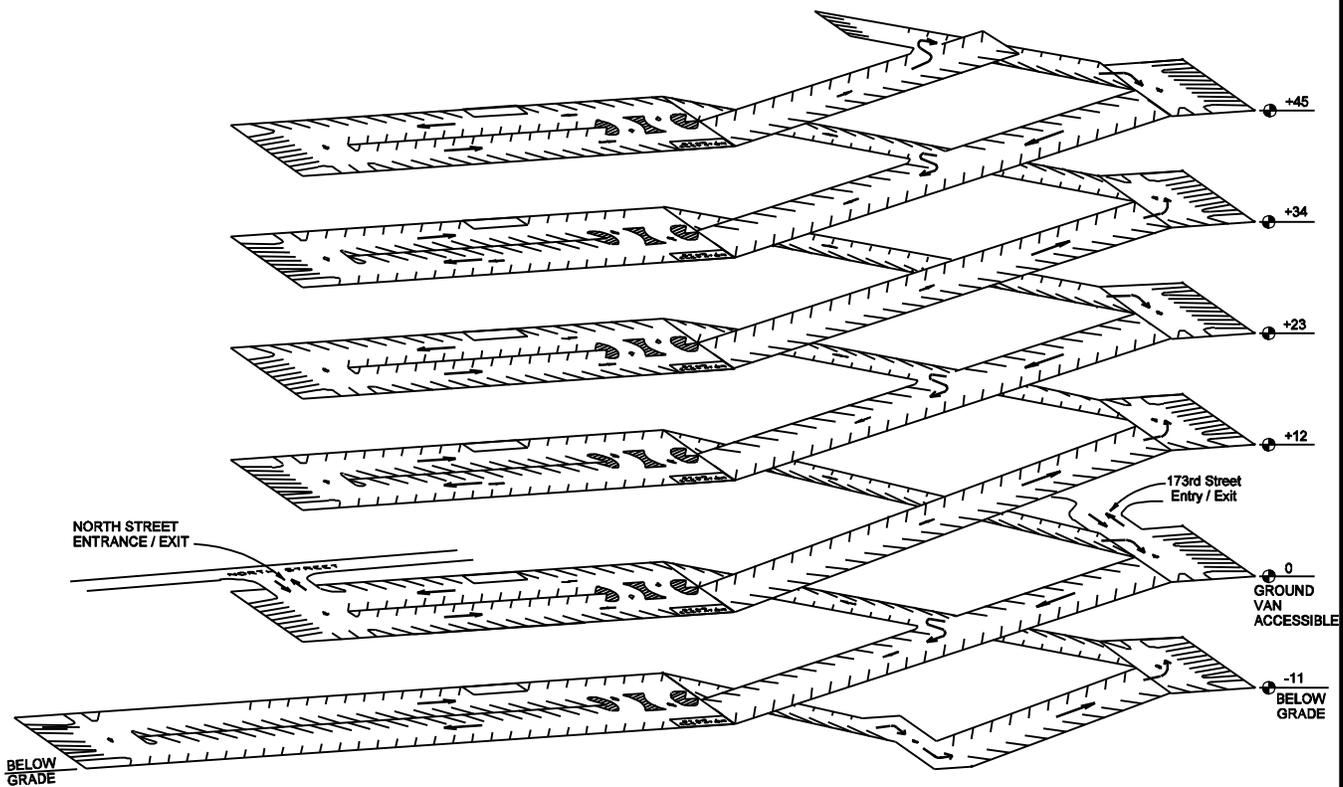


FIGURE 9
 OPTION 3
 DOUBLE HELIX WITH
 ONE WAY TRAFFIC
 SCHEMATIC TRAFFIC PLAN DIAGRAM



close spacing between the Metra crossing, North Street, and 173rd Street may cause queuing problems when southbound queues at North Street extend past the 173rd Street intersection. Even when traffic on 173rd Street has a green light, there might still not be any progression because of the queues. It is our opinion that the benefits to traffic on 173rd Street of this signal are not worth the negative impact a signal would have on Oak Park Avenue traffic. However, if this signal is installed, we would recommend a southbound left-turn lane and a westbound left-turn lane at this intersection.

Potential Center Street in North Street Development

The North Street developer has proposed a new street, Center Street, bisecting the development site. Center Street would run north/south as an extension of 67th Court through to North Street. The street is planned as two-way, with head-in curb parking on both sides of the street. We believe the addition of this street will enhance circulation, both vehicular and pedestrian, for the North Street development and offer a direct connection to the Metra rail station and the various shops and businesses of the development. It is also consistent with the street grid pattern to the north. The additional on-street parking on Center Street also provides convenient short-term parking, which is vital to the success of the new street-level businesses that will be part of the North Street development. Finally, Center Street would help disperse traffic and provide an alternative route to and from downtown Tinley Park.



Kimley-Horn
and Associates, Inc.

Appendix

HCM Unsignalized Intersection Capacity Analysis
47: 173rd Street & Oak Park Ave

5/11/2005



Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations	↶	↷	↷			↷
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Volume (veh/h)	157	146	637	0	0	712
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (veh/h)	165	154	671	0	0	749
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None					
Median storage (veh)						
Upstream signal (ft)			340			
pX, platoon unblocked						
vC, conflicting volume	1420	671			671	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1420	671			671	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	0	66			100	
cM capacity (veh/h)	150	457			920	

Direction, Lane #	WB 1	WB 2	NB 1	SB 1
Volume Total	165	154	671	749
Volume Left	165	0	0	0
Volume Right	0	154	0	0
cSH	150	457	1700	920
Volume to Capacity	1.10	0.34	0.39	0.00
Queue Length (ft)	221	37	0	0
Control Delay (s)	162.2	16.8	0.0	0.0
Lane LOS	F	C		
Approach Delay (s)	92.2		0.0	0.0
Approach LOS	F			

Intersection Summary			
Average Delay		16.9	
Intersection Capacity Utilization	55.3%	ICU Level of Service	A

HCM Unsignalized Intersection Capacity Analysis
 47: 173rd Street & Oak Park Ave

5/11/2005

						
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Volume (veh/h)	216	191	711	0	0	907
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (veh/h)	227	201	748	0	0	955
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None					
Median storage (veh)						
Upstream signal (ft)	340					
pX, platoon unblocked						
vC, conflicting volume	1703	748			748	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1703	748			748	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	0	51			100	
cM capacity (veh/h)	101	412			860	
Direction, Lane #	WB 1	WB 2	NB 1	SB 1		
Volume Total	227	201	748	955		
Volume Left	227	0	0	0		
Volume Right	0	201	0	0		
cSH	101	412	1700	860		
Volume to Capacity	2.26	0.49	0.44	0.00		
Queue Length (ft)	502	65	0	0		
Control Delay (s)	664.3	21.8	0.0	0.0		
Lane LOS	F	C				
Approach Delay (s)	362.8		0.0	0.0		
Approach LOS	F					
Intersection Summary						
Average Delay			72.9			
Intersection Capacity Utilization			69.5%	ICU Level of Service	B	

HCM Signalized Intersection Capacity Analysis
70: 173rd PI & Oak Park Ave

5/11/2005

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0					4.0	4.0		4.0	4.0	
Lane Util. Factor		1.00					1.00	1.00		1.00	1.00	
Fr't		0.92					1.00	0.98		1.00	0.98	
Flt Protected		0.99					0.95	1.00		0.95	1.00	
Satd. Flow (prot)		1704					1770	1821		1770	1832	
Flt Permitted		0.99					0.30	1.00		0.18	1.00	
Satd. Flow (perm)		1704					568	1821		342	1832	
Volume (vph)	28	59	122	0	0	0	83	622	110	186	578	72
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	29	62	128	0	0	0	87	655	116	196	608	76
Lane Group Flow (vph)	0	219	0	0	0	0	87	771	0	196	684	0
Turn Type	Perm						pm+pt			pm+pt		
Protected Phases		4					5	2		1	6	
Permitted Phases	4						2			6		
Actuated Green, G (s)		18.0					59.0	53.0		66.0	57.0	
Effective Green, g (s)		17.0					57.0	52.0		65.0	56.0	
Actuated g/C Ratio		0.19					0.63	0.58		0.72	0.62	
Clearance Time (s)		3.0					3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)		322					427	1052		390	1140	
v/s Ratio Prot							0.01	c0.42		c0.05	0.37	
v/s Ratio Perm		c0.13					0.12			0.31		
v/c Ratio		0.68					0.20	0.73		0.50	0.60	
Uniform Delay, d1		34.0					7.4	13.9		10.2	10.2	
Progression Factor		1.00					1.00	1.00		1.51	0.61	
Incremental Delay, d2		11.0					1.1	4.5		4.2	2.1	
Delay (s)		45.0					8.5	18.4		19.5	8.3	
Level of Service		D					A	B		B	A	
Approach Delay (s)		45.0			0.0			17.4			10.8	
Approach LOS		D			A			B			B	

Intersection Summary			
HCM Average Control Delay	17.5	HCM Level of Service	B
HCM Volume to Capacity ratio	0.70		
Cycle Length (s)	90.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	75.1%	ICU Level of Service	C

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
70: 173rd Pl & Oak Park Ave

5/11/2005

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0	4.0				4.0	4.0		4.0	4.0	
Lane Util. Factor		1.00	1.00				1.00	1.00		1.00	1.00	
Fr _t		1.00	0.85				1.00	0.98		1.00	0.98	
Fl _t Protected		0.98	1.00				0.95	1.00		0.95	1.00	
Satd. Flow (prot)		1825	1583				1770	1819		1770	1818	
Fl _t Permitted		0.98	1.00				0.95	1.00		0.95	1.00	
Satd. Flow (perm)		1825	1583				1770	1819		1770	1818	
Volume (vph)	43	61	120	0	0	0	117	672	125	157	784	148
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	45	64	126	0	0	0	123	707	132	165	825	156
Lane Group Flow (vph)	0	109	126	0	0	0	123	839	0	165	981	0
Turn Type	Split		Perm				Prot			Prot		
Protected Phases	4	4					5	2		1	6	
Permitted Phases			4									
Actuated Green, G (s)		18.0	18.0				12.0	50.0		13.0	51.0	
Effective Green, g (s)		17.0	17.0				11.0	49.0		12.0	50.0	
Actuated g/C Ratio		0.19	0.19				0.12	0.54		0.13	0.56	
Clearance Time (s)		3.0	3.0				3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)		345	299				216	990		236	1010	
v/s Ratio Prot		0.06					0.07	0.46		c0.09	c0.54	
v/s Ratio Perm			c0.08									
v/c Ratio		0.32	0.42				0.57	0.85		0.70	0.97	
Uniform Delay, d ₁		31.5	32.2				37.3	17.3		37.3	19.3	
Progression Factor		1.00	1.00				1.00	1.00		1.06	0.64	
Incremental Delay, d ₂		2.4	4.3				10.5	8.9		10.6	16.9	
Delay (s)		33.9	36.5				47.7	26.3		50.2	29.2	
Level of Service		C	D				D	C		D	C	
Approach Delay (s)		35.3			0.0			29.0			32.2	
Approach LOS		D			A			C			C	

Intersection Summary

HCM Average Control Delay	31.2	HCM Level of Service	C
HCM Volume to Capacity ratio	0.78		
Cycle Length (s)	90.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	78.1%	ICU Level of Service	C

c Critical Lane Group

HCM Unsignalized Intersection Capacity Analysis
 47: 173rd Street & Oak Park Ave

5/11/2005



Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations			↕			↕
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Volume (veh/h)	0	0	779	169	187	525
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (veh/h)	0	0	820	178	197	553
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None					
Median storage (veh)						
Upstream signal (ft)			340			
pX, platoon unblocked						
vC, conflicting volume	1855	909			998	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1855	909			998	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	100	100			72	
cM capacity (veh/h)	58	333			694	

Direction, Lane #	NB 1	SB 1
Volume Total	998	749
Volume Left	0	197
Volume Right	178	0
cSH	1700	694
Volume to Capacity	0.59	0.28
Queue Length (ft)	0	29
Control Delay (s)	0.0	7.0
Lane LOS		A
Approach Delay (s)	0.0	7.0
Approach LOS		

Intersection Summary			
Average Delay		3.0	
Intersection Capacity Utilization	100.6%	ICU Level of Service	F

HCM Unsignalized Intersection Capacity Analysis
 47: 173rd Street & Oak Park Ave

5/11/2005



Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations			↕			↕
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Volume (veh/h)	0	0	900	187	161	749
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (veh/h)	0	0	947	197	169	788
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None					
Median storage (veh)						
Upstream signal (ft)			340			
pX, platoon unblocked						
vC, conflicting volume	2173	1046			1144	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	2173	1046			1144	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	100	100			72	
cM capacity (veh/h)	37	278			611	
Direction, Lane #	NB 1	SB 1				
Volume Total	1144	958				
Volume Left	0	169				
Volume Right	197	0				
cSH	1700	611				
Volume to Capacity	0.67	0.28				
Queue Length (ft)	0	28				
Control Delay (s)	0.0	7.9				
Lane LOS		A				
Approach Delay (s)	0.0	7.9				
Approach LOS						
Intersection Summary						
Average Delay			3.6			
Intersection Capacity Utilization		119.3%		ICU Level of Service		G

HCM Signalized Intersection Capacity Analysis
70: 173rd Pl & Oak Park Ave

5/11/2005

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕		↗	↘		↗	↘		↗	↘	
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0		4.0	4.0		4.0	4.0			4.0	
Lane Util. Factor		1.00		1.00	1.00		1.00	1.00			1.00	
Flt		0.92		1.00	0.89		1.00	1.00			0.99	
Flt Protected		0.98		0.95	1.00		0.95	1.00			1.00	
Satd. Flow (prot)		1681		1770	1652		1770	1863			1849	
Flt Permitted		0.80		0.59	1.00		0.36	1.00			1.00	
Satd. Flow (perm)		1376		1098	1652		666	1863			1849	
Volume (vph)	87	0	122	111	46	141	83	732	0	0	467	25
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	92	0	128	117	48	148	87	771	0	0	492	26
Lane Group Flow (vph)	0	220	0	117	196	0	87	771	0	0	518	0
Turn Type	Perm		Perm		Perm		Perm		Perm		Perm	
Protected Phases		4			8			2				6
Permitted Phases	4			8			2			6		
Actuated Green, G (s)		33.0		33.0	33.0		51.0	51.0			51.0	
Effective Green, g (s)		32.0		32.0	32.0		50.0	50.0			50.0	
Actuated g/C Ratio		0.36		0.36	0.36		0.56	0.56			0.56	
Clearance Time (s)		3.0		3.0	3.0		3.0	3.0			3.0	
Lane Grp Cap (vph)		489		390	587		370	1035			1027	
v/s Ratio Prot					0.12			c0.41			0.28	
v/s Ratio Perm		c0.16		0.11			0.13					
v/c Ratio		0.45		0.30	0.33		0.24	0.74			0.50	
Uniform Delay, d1		22.2		20.9	21.2		10.2	15.2			12.3	
Progression Factor		1.00		1.00	1.00		1.00	1.00			0.61	
Incremental Delay, d2		3.0		2.0	1.5		1.5	4.9			1.5	
Delay (s)		25.2		22.9	22.7		11.7	20.0			9.1	
Level of Service		C		C	C		B	C			A	
Approach Delay (s)		25.2			22.8			19.2			9.1	
Approach LOS		C			C			B			A	

Intersection Summary			
HCM Average Control Delay	17.7	HCM Level of Service	B
HCM Volume to Capacity ratio	0.63		
Cycle Length (s)	90.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	92.7%	ICU Level of Service	E

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis

70: 173rd Pl & Oak Park Ave

5/11/2005



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕		↖	↗		↖	↗		↖	↗	
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0		4.0	4.0		4.0	4.0			4.0	
Lane Util. Factor		1.00		1.00	1.00		1.00	1.00			1.00	
Flt		0.93		1.00	0.90		1.00	1.00			0.99	
Flt Protected		0.98		0.95	1.00		0.95	1.00			1.00	
Satd. Flow (prot)		1689		1770	1676		1770	1863			1842	
Flt Permitted		0.61		0.58	1.00		0.20	1.00			1.00	
Satd. Flow (perm)		1057		1087	1676		374	1863			1842	
Volume (vph)	104	0	120	122	93	189	117	795	0	0	661	54
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	109	0	126	128	98	199	123	837	0	0	696	57
Lane Group Flow (vph)	0	235	0	128	297	0	123	837	0	0	753	0
Turn Type	Perm		Perm			Perm			Perm			
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2			6		
Actuated Green, G (s)		32.0		32.0	32.0		52.0	52.0			52.0	
Effective Green, g (s)		31.0		31.0	31.0		51.0	51.0			51.0	
Actuated g/C Ratio		0.34		0.34	0.34		0.57	0.57			0.57	
Clearance Time (s)		3.0		3.0	3.0		3.0	3.0			3.0	
Lane Grp Cap (vph)		364		374	577		212	1056			1044	
v/s Ratio Prot					0.18			c0.45			0.41	
v/s Ratio Perm		c0.22		0.12			0.33					
v/c Ratio		0.65		0.34	0.51		0.58	0.79			0.72	
Uniform Delay, d1		24.9		21.9	23.5		12.6	15.3			14.3	
Progression Factor		1.00		1.00	1.00		1.00	1.00			0.52	
Incremental Delay, d2		8.6		2.5	3.3		11.1	6.1			1.8	
Delay (s)		33.4		24.4	26.8		23.7	21.5			9.2	
Level of Service		C		C	C		C	C			A	
Approach Delay (s)		33.4			26.1			21.7			9.2	
Approach LOS		C			C			C			A	

Intersection Summary

HCM Average Control Delay	19.7	HCM Level of Service	B
HCM Volume to Capacity ratio	0.74		
Cycle Length (s)	90.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	102.7%	ICU Level of Service	F

c Critical Lane Group

TRAFFIC SIGNAL VOLUME WARRANT ANALYSIS (2000 MUTCD)

MAJOR STREET: Oak Park NB SB # OF APPROACH LANES: 2

MINOR STREET: 173rd Street EB WB # OF APPROACH LANES: 2

CITY, STATE: Tinley Park, IL

COMMENTS: Future Conditions with One-way couplet (173rd Street Eastbound Only)
Right Turn Volume included

ISOLATED COMMUNITY WITH POPULATION LESS THAN 10,000 (Y OR N): N

85TH PERCENTILE SPEED GREATER THAN 40 MPH ON MAJOR STREET (Y OR N): N

			Oak Park		Total	173rd Street		Minor Street Heavy Leg
			NB Approach	SB Approach		EB Approach	WB Approach	
06:00 AM	TO	07:00 AM			0			0
07:00 AM	TO	08:00 AM			0			0
08:00 AM	TO	09:00 AM	638	713	1351	305		305
09:00 AM	TO	10:00 AM			0			0
10:00 AM	TO	11:00 AM			0			0
11:00 AM	TO	12:00 PM			0			0
12:00 PM	TO	01:00 PM			0			0
01:00 PM	TO	02:00 PM			0			0
02:00 PM	TO	03:00 PM			0			0
03:00 PM	TO	04:00 PM			0			0
04:00 PM	TO	05:00 PM	712	908	1620	408		408
05:00 PM	TO	06:00 PM			0			0
06:00 PM	TO	07:00 PM			0			0
07:00 PM	TO	08:00 PM			0			0
08:00 PM	TO	09:00 PM			0			0
09:00 PM	TO	10:00 PM			0			0

05/27/05

Kimley-Horn and Associates

TRAFFIC SIGNAL VOLUME WARRANT ANALYSIS (2000 MUTCD)

MAJOR STREET: Oak Park NB SB # OF APPROACH LANES:

MINOR STREET: 173rd Street EB WB # OF APPROACH LANES:

CITY, STATE: Tinley Park, IL

COMMENTS: Future Conditions with One-way couplet (173rd Street Eastbound Only)
Right Turn Volume included

ISOLATED COMMUNITY WITH POPULATION LESS THAN 10,000 (Y OR N):
 85TH PERCENTILE SPEED GREATER THAN 40 MPH ON MAJOR STREET (Y OR N):

	MAJOR ST TWO-WAY TRAFFIC	MINOR ST TRAFFIC HEAVY LEG	WARRANT 1 - Condition A, Part 1			WARRANT 1 - Condition B, Part 1			WARRANT 1 - Condition A, Part 2			WARRANT 1 - Condition B, Part 2			WARRANT 2	WARRANT 3
			MAIN LINE	SIDE STREET	BOTH MET	MAIN LINE	SIDE STREET	BOTH MET	MAIN LINE	SIDE STREET	BOTH MET	MAIN LINE	SIDE STREET	BOTH MET	Four-Hour	Peak Hour
THRESHOLD VALUES			600	200		900	100		480	160		720	80			
06:00 AM TO 07:00 AM	0	0														
07:00 AM TO 08:00 AM	0	0														
08:00 AM TO 09:00 AM	1,351	305	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
09:00 AM TO 10:00 AM	0	0														
10:00 AM TO 11:00 AM	0	0														
11:00 AM TO 12:00 PM	0	0														
12:00 PM TO 01:00 PM	0	0														
01:00 PM TO 02:00 PM	0	0														
02:00 PM TO 03:00 PM	0	0														
03:00 PM TO 04:00 PM	0	0														
04:00 PM TO 05:00 PM	1,620	408	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
05:00 PM TO 06:00 PM	0	0														
06:00 PM TO 07:00 PM	0	0														
07:00 PM TO 08:00 PM	0	0														
08:00 PM TO 09:00 PM	0	0														
09:00 PM TO 10:00 PM	0	0														
	2,971	713	2	2	2	2	2	2	2	2	2	2	2	2	2	2
			8 HOURS NEEDED			8 HOURS NEEDED			8 HOURS NEEDED for both Condition A & B						4 HRS NEEDED	1 HR NEEDED
			NOT SATISFIED			NOT SATISFIED			NOT SATISFIED						NOT SATISFIED	SATISFIED

TRAFFIC SIGNAL VOLUME WARRANT ANALYSIS (2000 MUTCD)

MAJOR STREET: Oak Park NB SB # OF APPROACH LANES:

MINOR STREET: 173rd Street EB WB # OF APPROACH LANES:

CITY, STATE: Tinley Park, IL

COMMENTS: Future Conditions with Two-way Traffic
Right Turn Volume included

ISOLATED COMMUNITY WITH POPULATION LESS THAN 10,000 (Y OR N):
85TH PERCENTILE SPEED GREATER THAN 40 MPH ON MAJOR STREET (Y OR N):

	MAJOR ST TWO-WAY TRAFFIC	MINOR ST TRAFFIC HEAVY LEG	WARRANT 1 - Condition A, Part 1			WARRANT 1 - Condition B, Part 1			WARRANT 1 - Condition A, Part 2			WARRANT 1 - Condition B, Part 2			WARRANT 2	WARRANT 3
			MAIN LINE	SIDE STREET	BOTH MET	MAIN LINE	SIDE STREET	BOTH MET	MAIN LINE	SIDE STREET	BOTH MET	MAIN LINE	SIDE STREET	BOTH MET	Four-Hour	Peak Hour
THRESHOLD VALUES			600	150		900	75		480	120		720	60			
06:00 AM TO 07:00 AM	0	0														
07:00 AM TO 08:00 AM	0	0														
08:00 AM TO 09:00 AM	1,488	133	Y			Y	Y	Y	Y	Y	Y	Y	Y	Y		
09:00 AM TO 10:00 AM	0	0														
10:00 AM TO 11:00 AM	0	0														
11:00 AM TO 12:00 PM	0	0														
12:00 PM TO 01:00 PM	0	0														
01:00 PM TO 02:00 PM	0	0														
02:00 PM TO 03:00 PM	0	0														
03:00 PM TO 04:00 PM	0	0														
04:00 PM TO 05:00 PM	1,781	149	Y			Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	
05:00 PM TO 06:00 PM	0	0														
06:00 PM TO 07:00 PM	0	0														
07:00 PM TO 08:00 PM	0	0														
08:00 PM TO 09:00 PM	0	0														
09:00 PM TO 10:00 PM	0	0														
	3,269	282	2	0	0	2	2	2	2	2	2	2	2	2	1	
			8 HOURS NEEDED			8 HOURS NEEDED			8 HOURS NEEDED for both Condition A & B						4 HRS NEEDED	1 HR NEEDED
			NOT SATISFIED			NOT SATISFIED			NOT SATISFIED						NOT SATISFIED	SATISFIED

TRAFFIC SIGNAL VOLUME WARRANT ANALYSIS (2000 MUTCD)

MAJOR STREET: Oak Park NB SB # OF APPROACH LANES:

MINOR STREET: 173rd Street EB WB # OF APPROACH LANES:

CITY, STATE: Tinley Park, IL

COMMENTS: Future Conditions with Two-way Traffic
Right Turn Volume included

ISOLATED COMMUNITY WITH POPULATION LESS THAN 10,000 (Y OR N):
85TH PERCENTILE SPEED GREATER THAN 40 MPH ON MAJOR STREET (Y OR N):

	MAJOR ST TWO-WAY TRAFFIC	MINOR ST TRAFFIC HEAVY LEG	WARRANT 1 - Condition A, Part 1			WARRANT 1 - Condition B, Part 1			WARRANT 1 - Condition A, Part 2			WARRANT 1 - Condition B, Part 2			WARRANT 2	WARRANT 3
			MAIN LINE	SIDE STREET	BOTH MET	MAIN LINE	SIDE STREET	BOTH MET	MAIN LINE	SIDE STREET	BOTH MET	MAIN LINE	SIDE STREET	BOTH MET	Four-Hour	Peak Hour
THRESHOLD VALUES			600	150		900	75		480	120		720	60			
06:00 AM TO 07:00 AM	0	0														
07:00 AM TO 08:00 AM	0	0														
08:00 AM TO 09:00 AM	1,488	133	Y			Y	Y	Y	Y	Y	Y	Y	Y	Y		
09:00 AM TO 10:00 AM	0	0														
10:00 AM TO 11:00 AM	0	0														
11:00 AM TO 12:00 PM	0	0														
12:00 PM TO 01:00 PM	0	0														
01:00 PM TO 02:00 PM	0	0														
02:00 PM TO 03:00 PM	0	0														
03:00 PM TO 04:00 PM	0	0														
04:00 PM TO 05:00 PM	1,781	149	Y			Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	
05:00 PM TO 06:00 PM	0	0														
06:00 PM TO 07:00 PM	0	0														
07:00 PM TO 08:00 PM	0	0														
08:00 PM TO 09:00 PM	0	0														
09:00 PM TO 10:00 PM	0	0														
	3,269	282	2	0	0	2	2	2	2	2	2	2	2	2	1	
			8 HOURS NEEDED			8 HOURS NEEDED			8 HOURS NEEDED for both Condition A & B						4 HRS NEEDED	1 HR NEEDED
			NOT SATISFIED			NOT SATISFIED			NOT SATISFIED						NOT SATISFIED	SATISFIED

TRAFFIC SIGNAL VOLUME WARRANT ANALYSIS (2000 MUTCD)

MAJOR STREET: Oak Park NB SB # OF APPROACH LANES: 2

MINOR STREET: 173rd Street EB WB # OF APPROACH LANES: 1

CITY, STATE: Tinley Park, IL

COMMENTS: Future Conditions with Two-way Traffic
Right Turn Volume included

ISOLATED COMMUNITY WITH POPULATION LESS THAN 10,000 (Y OR N): N

85TH PERCENTILE SPEED GREATER THAN 40 MPH ON MAJOR STREET (Y OR N): N

			Oak Park		Total	173rd Street		Minor Street Heavy Leg
			NB Approach	SB Approach		EB Approach	WB Approach	
06:00 AM	TO	07:00 AM			0			0
07:00 AM	TO	08:00 AM			0			0
08:00 AM	TO	09:00 AM	774	714	1488	133		133
09:00 AM	TO	10:00 AM			0			0
10:00 AM	TO	11:00 AM			0			0
11:00 AM	TO	12:00 PM			0			0
12:00 PM	TO	01:00 PM			0			0
01:00 PM	TO	02:00 PM			0			0
02:00 PM	TO	03:00 PM			0			0
03:00 PM	TO	04:00 PM			0			0
04:00 PM	TO	05:00 PM	871	910	1781	149		149
05:00 PM	TO	06:00 PM			0			0
06:00 PM	TO	07:00 PM			0			0
07:00 PM	TO	08:00 PM			0			0
08:00 PM	TO	09:00 PM			0			0
09:00 PM	TO	10:00 PM			0			0

05/27/05
 Kimley-Horn and Associates