

Traffic Evaluation Libertyville Sports Complex Modifications

Libertyville, Illinois



Prepared For:



March 5, 2020

1. Introduction

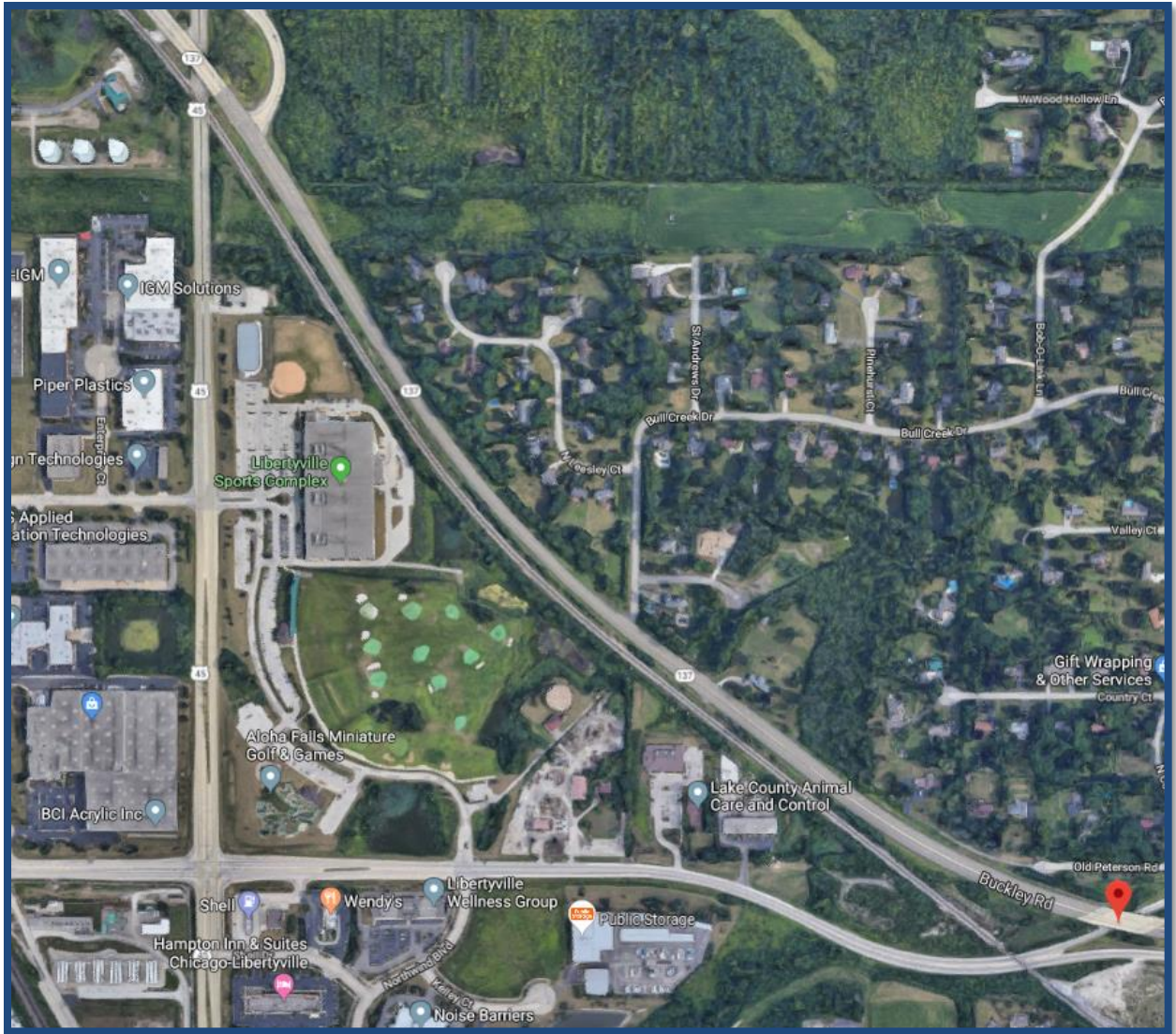
This report summarizes the methodologies, results, and findings of a traffic evaluation conducted by Kenig, Lindgren, O'Hara, Aboona, Inc. (KLOA, Inc.) regarding the proposed modifications to the Libertyville Sports Complex (LSC). The LSC is located in the northeast quadrant of the intersection of U.S. Route 45 with Peterson Road and contains the following facilities:

- An *Indoor Event Center* which contains two indoor artificial surface fields used for soccer, lacrosse, football, baseball, and other sports, eight basketball courts also used for volleyball, floor hockey, and futsal, a climbing mountain, several party rooms, and a conference room. In addition, the Indoor Event Center can be rented for special events such as basketball tournaments, graduation ceremonies, school fun fairs, fundraising events, and other special event rental uses.
- A *Fitness Center* which provides two levels of workout space that includes a weight room and locker rooms.
- A *softball field* that has lights for night-time play and hosts league games, tournaments, and other rental usage of the field.
- An *outdoor hockey rink* that is used for skating and hockey in the winter, weather permitting, and roller hockey and in-line skating during off-season.
- A *golf driving range and miniature golf course* that are currently closed due to the pending redevelopment of the properties.

Access to the LSC is currently provided via a full access road on U.S. Route 45 opposite Tempel Drive and a full access road on Peterson Road opposite Northwind Boulevard. **Figure 1** shows an aerial view of the LSC.

The golf driving range and miniature golf course which are located along the southern portion of the LSC site are to be sold and redeveloped. As currently proposed, the property is to be redeveloped with the following two uses:

- A warehouse/distribution development that will contain two buildings with a total of approximately 331,300 square feet.
- A fuel center that is to contain 20 passenger vehicle fueling positions, three commercial fueling positions, a convenience store, and a car wash.



Aerial View of Site

Figure 1

Access to the redevelopment is to be provided via the existing full access road on Peterson Road, a proposed right-turn in/right-turn out access drive on Peterson Road, a proposed right-turn in/right-turn out access drive on U.S. Route 45, and cross access with the LSC site and its intersection with U.S. Route 45. The redevelopment of the golf driving range/miniature golf course properties necessitates several modifications to the LSC site including the elimination and relocation of some parking lots, changes to the on-site circulation, and the elimination of the direct access to Peterson Road.

The purpose of this study is to evaluate the impact that the modifications will have on accessibility to and from the LSC site and circulation through the LSC site. It is important to note that the evaluation was performed in conjunction with the traffic impact study conducted for the redevelopment project.

2. Existing Conditions

LSC Access

Access to the LSC is currently provided via the following two access roads:

- A full access road located on U.S. Route 45 opposite Tempel Drive and approximately 1,400 feet north of Peterson Road. The LSC access road has one approximately 24-foot wide inbound lane and one approximately 24-foot wide outbound lane divided by a median island. While not currently striped, the outbound lane operates as a shared left-turn/through lane and a separate right-turn lane. The Tempel Drive approach at U.S. Route 45 has one westbound (inbound) lane and one wide eastbound (outbound) lane that operates as a shared left-turn/through lane and a separate right-turn lane. Both the LSC access road and Tempel Drive are under stop sign control at their intersection with U.S. Route 45. Separate right-turn lanes and separate left-turn lanes are provided on U.S. Route 45 serving both the LSC access road and Tempel Drive.
- A full access road located on Peterson Road opposite Northwind Boulevard and approximately 1,000 feet east of U.S. Route 45. The LSC access road has one inbound lane and two outbound lanes that operate as a shared left-turn/through lane and a separate right-turn lane. Northwind Boulevard at Peterson Road has one southbound (inbound) lane and two northbound (outbound) lanes striped for a separate left-turn lane and a separate right-turn lane. Both the LSC access road and Northwind Boulevard are under stop sign control at their intersection with Peterson Road. Separate right-turn lanes and separate left-turn lanes are provided on Peterson Road serving both the LSC access road and Northwind Boulevard.

LSC Circulation

Circulation through the LSC is provided via two main circulation roads and the parking aisles of the various parking lots serving the LSC. The following summarizes the two circulation roads serving the LSC.

- The *east-west circulation* road extends between U.S. Route 45 and front of the Indoor Event Center/Fitness Center. It has one wide lane in each direction divided by a median with the eastern end of the circulation road terminating as a drop-off/pick-up circle at the Indoor Event Center/Fitness Center main entrance. The east-west circulation road provides access to the north-south circulation road and the two primary parking lots serving the LSC facilities except for the golf driving range and miniature golf course.
- The *north-south circulation* road extends between Peterson Road and the east-west circulation road. It has one lane in each direction and is aligned opposite one of the access drives to the northern parking lot at its intersection with the east-west circulation road. The north-south circulation road provides access to the generally all of the parking lots, the golf driving range and miniature golf course, and access to/from Peterson Road.

In addition, the LSC has a circulation road that extends around the north, east, and south sides of the Indoor Event Center/Fitness Center that is primarily used for deliveries and emergency access and circulation.

LSC Parking

Parking for the LSC is provided via five parking lots. The three northern parking lots generally serve all of the LSC facilities except the golf driving range and miniature golf course and the two southern parking lots serve the golf driving range and miniature golf course.

Existing Traffic Volumes

In order to determine current traffic conditions at the LSC, KLOA, Inc. conducted 12-hour traffic counts at the following two intersections:

- U.S. Route 45 with the LSC access road and Tempel Drive
- Peterson Road with the LSC access road and Northwind Boulevard

The traffic counts were conducted on Tuesday, March 5, 2019 from 6:00 A.M. to 6:00 P.M. The results of the traffic counts show that the peak hours of traffic generally occur between 6:45 A.M. and 7:45 A.M. during the morning peak period and between 4:30 P.M. and 5:30 P.M. during the evening peak period. All of the figures from the traffic study performed for the redevelopment project are located in the Appendix. Figure 4 from the redevelopment project traffic study illustrates the existing peak hour vehicle traffic volumes.

3. Projected Conditions

Proposed Redevelopment Project

As currently proposed, the southern portion of the LSC site is to be redeveloped with the following two uses:

- A warehouse/distribution development that will contain two buildings with a total of approximately 296,000 square feet and will be located on the northern portion of the site.
- A fuel center that is to contain 20 passenger vehicle fueling positions, three commercial fueling positions, a convenience store, and a car wash and will be located in the southwest corner of the site.

Redevelopment Project Proposed Access

Access to the proposed redevelopment project is to be provided via the following three access roads/drives and cross access:

- The existing full access road that intersects Peterson Road aligned opposite Northwind Boulevard.
- A restricted right-turn in/right-turn out access drive on Peterson Road located on the north side of the road approximately halfway between U.S. Route 45 and the existing access road/Northwind Boulevard and will provide direct access to the fuel center. This access drive will provide one inbound lane and one outbound lane channelized and signed to prohibit left-turn movements. The outbound lane will be under stop sign control. A separate right-turn lane will be provided on U.S. Route 45 serving the access drive.
- A restricted right-turn in/right-turn out access drive on U.S. Route 45 located on the east side of the road approximately halfway between Peterson Road and the existing access road/Tempel Drive and will provide direct access to the warehouse/distribution development. This access drive will provide one inbound lane and one outbound lane channelized and signed to prohibit left-turn movements. The outbound lane will be under stop sign control. A separate right-turn lane will be provided on Peterson Road serving the access drive.
- Cross access through the LSC site and its access road with U.S. Route 45 aligned opposite Tempel Drive. Only passenger vehicles will be permitted to use the cross access and traverse the LSC site.

Redevelopment Project Proposed Circulation

As part of the redevelopment project, the existing north-south circulation within the southern section of the LSC site will be realigned. As proposed, the realigned north-south circulation road will extend around the south and west sides of the warehouse/distribution development and will continue to intersect Peterson Road and the east-west circulation road at its current locations. The realigned circulation road will provide direct access to the fuel center, the warehouse/distribution development, the LSC site, and the proposed U.S. Route 45 right-turn in/right-turn out access drive. As such, the LSC will have cross access to the redevelopment project and Peterson Road.

It is anticipated that a portion of the LSC-generated traffic will chose not to traverse the redevelopment to access Peterson Road given (1) the realigned north-south circulation road will be a less convenient option given its circuitous alignment around the warehouse/distribution development and (2) some LSC patrons and employees will not want to traverse around a warehouse/distribution development. As such, per the direction of the Village of Libertyville officials, the traffic study for the redevelopment project and the traffic signal warrant study in the next section assumed only that 20 percent of the Peterson Road access road traffic will be redistributed to the U.S. Route 45 access road. Figure 8 from the redevelopment project traffic study illustrates the redistribution of the LSC traffic volumes.

No-Build Traffic Volumes with LSC Redistributed Traffic Volumes

Figure 10 from the redevelopment traffic study illustrates the Year 2025 no-build traffic volumes with the LSC redistributed traffic volumes, which consist of the following traffic volumes:

- The existing traffic volumes (see Figure 4)
- A 5.9 percent increase in the existing traffic volumes to account for ambient traffic growth
- The redistribution of 20 percent of the LSC traffic at the Peterson Road access road to the U.S. Route 45 access road (see Figure 8)

Total Projected Traffic Volumes

Figure 11 from the redevelopment traffic study illustrates the Year 2025 total projected peak hour traffic volumes, which consist of the following traffic volumes:

- The existing traffic volumes (see Figure 4)
- A 5.9 percent increase in the existing traffic volumes to account for ambient traffic growth
- The redistribution of 20 percent of the LSC traffic at the Peterson Road access road to the U.S. Route 45 access road (see Figure 8)
- The traffic to be generated by the proposed redevelopment project (see Figures 6 and 7)

Capacity Analyses

Intersection capacity analyses were conducted at the U.S. Route 45/LSC access road/Tempel Drive intersection during the weekday morning and weekday evening peak hours for the following scenarios:

- Existing (Year 2019) traffic volumes
- Year 2025 no-build traffic volumes with LSC redistributed traffic volumes
- Year 2025 projected traffic volumes

The traffic analyses were performed using the methodologies outlined in the Transportation Research Board's *Highway Capacity Manual (HCM), 6th Edition* and analyzed using Synchro/SimTraffic 10 software. The analyses for the unsignalized intersections determine the average control delay to vehicles at an intersection. Control delay is the elapsed time from a vehicle joining the queue at a stop sign (includes the time required to decelerate to a stop) until its departure from the stop sign and resumption of free flow speed. The methodology analyzes each intersection approach controlled by a stop sign and considers traffic volumes on all approaches and lane characteristics.

The ability of an intersection to accommodate traffic flow is expressed in terms of level of service, which is assigned a letter from A to F based on the average control delay experienced by vehicles passing through the intersection. The *Highway Capacity Manual* definitions for levels of service and the corresponding control delay for signalized intersections and unsignalized intersections are included in the Appendix of this report.

Summaries of the capacity analyses at the U.S. Route 45/LSC access road/Tempel Drive for the existing and Year 2025 total projected conditions are presented in **Tables 1** and **2**. The capacity analyses were conducted assuming the existing stop sign control and traffic signal control at this intersection. Under the traffic signal control analysis, it was assumed that the Tempel Drive and LSC access road approaches will be modified/widened as follows:

- The median along the LSC access road will be removed and the access road will be restriped to provide one inbound lane and three outbound lanes striped for a separate left-turn lane, a through lane, and a separate right-turn lane.
- The Tempel Drive approach will be widened to provide one westbound lane and two eastbound lanes striped for a separate left-turn lane and a shared through/right-turn lane.

Table 1
 CAPACITY ANALYSIS RESULTS
 U.S. ROUTE 45 WITH LSC ACCESS ROAD AND TEMPEL DRIVE
 EXISTING STOP SIGN CONTROL

Intersection	Weekday Morning Peak Hour		Weekday Evening Peak Hour	
	LOS	Delay	LOS	Delay
Existing Conditions				
• Eastbound Left Turn/Through	F	91.4	E	49.9
• Eastbound Right Turn	C	19.2	B	12.0
• Westbound Left Turn/Through	D	30.0	F	51.7
• Westbound Right Turn	B	10.5	C	16.4
• Northbound Left Turn	C	18.0	B	11.2
• Southbound Left Turn	A	9.0	B	14.6
Year 2025 No-Build Traffic Volumes and Redistributed Traffic Volumes				
• Eastbound Through/Left Turn	F	111.1	F	58.7
• Eastbound Right Turn	C	20.5	B	12.3
• Westbound Through/Left Turn	D	34.1	F	82.3
• Westbound Right Turn	B	10.7	C	17.4
• Northbound Left Turn	C	19.5	B	11.5
• Southbound Left Turn	A	9.2	C	15.9
Year 2025 Total Projected Traffic Volumes				
• Eastbound Through/Left Turn	F	128.4	F	73.8
• Eastbound Right Turn	C	20.5	B	12.3
• Westbound Through/Left Turn	E	40.5	F	122.1
• Westbound Right Turn	B	10.8	C	17.8
• Northbound Left Turn	C	19.4	B	11.5
• Southbound Left Turn	A	9.8	C	18.2
LOS = Level of Service Delay is measured in seconds.				

Table 2
 CAPACITY ANALYSIS RESULTS
 U.S. ROUTE 45 WITH LSC ACCESS ROAD AND TEMPEL DRIVE
 SIGNALIZED

	Peak Hour	Eastbound			Westbound			Northbound			Southbound			Overall
		L	T	R	L	T	R	L	T	R	L	T	R	
Year 2025 Projected Traffic Volumes	Weekday Morning Peak Hour	D 53.7	D 54.0	E 62.0	--	D 53.2	A 5.1	A 2.4	A 1.0	A 1.8	A 7.5	A 1.5	A 6.7	
		D – 53.8			E – 60.9			A – 2.5			A – 7.1			
	Weekday Evening Peak Hour	D 53.7	E 62.5	D 48.0	D 54.0	E 66.6	A 2.2	A 4.2	A 1.1	A 8.3	A 6.3	A 2.0	A 8.4	
		D – 56.5			E – 57.0			A – 4.0			A – 6.4			
Letter denotes Level of Service L – Left Turns R – Right Turns Delay is measured in seconds. T – Through														

Existing Conditions

The results of the capacity analyses indicate that currently the LSC access road left-turn/through movement operates at LOS D during the weekday morning peak hour and LOS F during the weekday evening peak hour. While the outbound traffic from the access road is able to exit onto U.S. Route 45, during the peak periods this traffic experiences additional delay. This is generally common for stop sign controlled approaches along major roadways such as U.S. Route 45. Similar to the LSC access road left-turn/through movement, the Tempel Drive left-turn/through movement currently operates at LOS F during the weekday morning peak hour and at LOS E during the weekday evening peak hour. Further, all the other critical movements currently operate at LOS C or better during both peak hours.

No-Build Traffic Volumes with Redistributed Traffic Volumes

Under Year 2025 no-build traffic volumes with the LSC redistributed traffic volumes, the LSC access road left-turn/through movement is projected to continue to operate at a LOS D during the weekday morning peak hour and a LOS F during the weekday evening peak hour. The LSC access road left-turn/through movement is projected to experience an approximate 30 second increase in delay during the weekday evening peak period over existing conditions. However, the 95th percentile queue along the access road is not projected to extend within the first internal intersection along the east-west circulation road. The Tempel Drive left-turn/through movement is projected to continue to operate at a LOS F during the weekday morning peak hour and at LOS F during the weekday evening peak hour. Further, all the other critical movements are projected to continue to operate at a LOS C or better during both peak hours.

Projected Traffic Volumes Assuming the Existing Stop Sign Control

Assuming the projected traffic volumes and the existing stop sign control, the LSC access road left-turn/through movement is projected to operate at a LOS E during the weekday morning peak hour and a LOS F during the weekday evening peak hour. The LSC access road left-turn/through movement is projected to experience an approximate 70 second increase in delay during the weekday evening peak period over existing conditions. However, the 95th percentile queue along the access road is not projected to extend within the first internal intersection along the east-west circulation road. All other critical movements at this intersection are projected to continue to operate at LOS C or better except the Tempel Drive left-turn/through movement, which is projected to operate at LOS F during the weekday morning and evening peak hours. Further, the 95th percentile queue along the access road is not projected to extend within the first internal intersection along the east-west circulation road.

Projected Traffic Volumes Assuming Traffic Signal Control

The results of the capacity analysis assuming the installation of a traffic signal and the modifications to the Tempel Drive and LSC access road approaches indicate that the overall intersection is projected to operate at LOS A during the weekday morning and weekday evening peak hours. The LSC access road and the Tempel Drive movements are projected to operate at LOS D or E during both peak hours. However, this is expected given that U.S. Route 45 is the major road at this intersection and will receive most of the green time and that the traffic signal will operate on a longer cycle length. It is important to note that the delay along the access road approaches are projected to be reduced significantly and will be similar to current conditions. Further, the 95th percentile queue along the access road is not projected to extend within the first internal intersection along the east-west circulation road.

4. Traffic Signal Warrant Study

A traffic signal warrant analysis was conducted to determine whether a traffic signal will be warranted at the intersection of U.S. Route 45 with the LSC access road and Tempel Drive with the redevelopment project. Installation of a traffic signal requires that one or more of the nine signal warrants outlined in the *Manual on Uniform Traffic Control Devices* (MUTCD 2009) is met. This traffic signal analysis focused on Warrants 1, 2, and 3.

Existing Conditions

U.S. Route 45 is a north-south, major arterial roadway that generally has a four-lane divided cross section. At its intersection with the LSC access road/Tempel Drive, U.S. Route 45 provides separate left-turn lanes and right-turn lanes serving both the LSC access road and Tempel Drive. U.S. Route 45 is under the jurisdiction of the Illinois Department of Transportation (IDOT), is not classified as a Strategic Regional Arterial (SRA) route, and has a posted speed limit of 45 mph.

The LSC access road has one approximately 24-foot wide inbound lane and one approximately 24-foot wide outbound lane divided by a median island. While not currently striped, the outbound lane operates as a shared left-turn/through lane and a separate right-turn lane. The Tempel Drive approach at U.S. Route 45 has one eastbound lane and one wide westbound lane that operates as a left-turn/through lane and a separate right-turn lane.

As indicated previously, KLOA, Inc. conducted 12-hour traffic counts at the intersections of U.S. Route 45/LSC access road/Tempel Drive and Peterson Road/LSC access road/Northwind Boulevard from 6:00 A.M. to 6:00 P.M. The hourly results of the traffic counts at the U.S. Route 45/LSC access road/Tempel Drive intersection are shown in **Table 3**.

Projected Traffic Volumes

The projected traffic volumes at the intersection of U.S. Route 45 with the LSC access road and Tempel Drive consisted of the following additional traffic volumes:

- The redistribution of 20 percent of the LSC traffic currently using the Peterson Road access drive. to the U.S. Route 45 access road.
- The hourly traffic volumes projected to be generated by the redevelopment project, which were based on (1) trip rates provided in the Institute of Transportation Engineers (ITE) *Trip Generation Manual*, 10th Edition and (2) the hourly distribution percentage developed by the Wisconsin Department of Transportation.

Table 4 shows the hourly estimated traffic that will be redistributed from the Peterson Road access road to the subject intersection and **Table 5** shows the hourly projected traffic volumes to be generated by the redevelopment project at the subject intersection. **Table 6** shows the hourly total projected traffic volumes at the subject intersection.

Summary of Signal Warrant Analysis

Table 7 summarizes the *existing* two-way traffic volumes on U.S. Route 45 (major road) and the projected hourly traffic volumes on the Tempel Drive and the LSC access road approaches (minor roads) and **Table 8** summarizes the *total projected* two-way traffic volumes on U.S. Route 45 (major road) and the projected hourly traffic volumes on the Tempel Drive and the LSC access road approaches (minor roads). The tables also highlight which hours of the day satisfy the volume warrants. Both the Tempel Drive and the LSC access road have single lane approaches. However, while not currently striped as such, the LSC access road and Tempel Drive approaches operate as a shared left-turn/through lane and a separate right-turn lane and were evaluated this way as part of the traffic signal warrant analysis. Per the IDOT traffic signal warrant guidelines, the right-turn volumes from the minor approaches were reduced between 40 and 75 percent when determining the total minor roadway approach volumes. Further, since U.S. Route 45 has a posted speed limit of 45 mph, the 70 percent factored warrants were used for the analyses.

The following and Tables 7 and 8 summarize the results of the evaluation of the existing traffic volumes:

- Warrant 1A: None of the existing or total projected hourly volumes satisfy the minimum volumes when eight hours are required.
- Warrant 1B: Only one hour of the existing and total projected traffic volumes satisfies the minimum volumes when eight hours are required.
- Combination of Warrants 1A/1B: Only one hour of the existing and total projected traffic volumes satisfies the minimum volumes when eight hours are required.
- Warrant 2: Only one hour of the existing and total projected traffic volumes satisfies the minimum volumes when four hours are required.
- Warrant 3: One hour of the existing and total projected traffic volumes satisfies the minimum volumes when one hours are required.

As such, the existing and total projected traffic volumes warrant a traffic signal at the subject intersection as the volumes meet Warrant 3 (Peak Hour Volume). It should be noted that the Tempel Drive approach meets Warrant 3 (Peak Hour Volume) as opposed to the LSC access road approach.

If a traffic signal is installed at this intersection, the LSC access road and Temple Drive approaches will need to be modified/widened as follows:

- The median along the access road will need to be removed and the access road restriped to provide three outbound lanes striped for a separate left-turn lane, a through lane, and a separate right-turn lane.
- The Tempel Drive approach will need to be widened to provide two eastbound lanes striped for a separate left-turn lane and a shared through/right-turn lane.

Table 3
 EXISTING TRAFFIC VOLUMES
 U.S. ROUTE 45 WITH LSC ACCESS ROAD AND TEMPEL DRIVE

	Eastbound Tempel Drive			Westbound LSC Access Road			Northbound U.S. Route 45			Southbound U.S. Route 45		
	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
6:00 A.M.	6	0	7	6	0	5	17	411	5	6	1,239	79
7:00 A.M.	19	0	7	17	0	4	36	685	15	5	1,633	95
8:00 A.M.	9	0	17	6	0	9	25	782	16	17	1,046	36
9:00 A.M.	9	0	19	11	0	13	27	588	11	24	716	19
10:00 A.M.	15	0	15	0	0	18	15	476	14	18	609	14
11:00 A.M.	21	1	45	3	0	26	22	585	16	14	631	18
12:00 Noon	26	1	28	10	1	17	45	635	9	11	679	25
1:00 P.M.	11	0	20	21	0	18	21	645	3	10	658	19
2:00 P.M.	25	0	29	5	0	11	23	809	7	7	861	37
3:00 P.M.	112	5	69	18	1	20	13	1,131	23	25	934	56
4:00 P.M.	60	3	55	17	0	34	12	1,357	91	40	874	20
5:00 P.M.	41	1	28	26	1	51	17	1,377	107	53	815	26

Table 4

REDISTRIBUTION OF PETERSON ROAD/ACCESS ROAD/NORTHWIND BOULEVARD TRAFFIC
 U.S. ROUTE 45 WITH LSC ACCESS ROAD AND TEMPEL DRIVE

	Eastbound Tempel Drive			Westbound LSC Access Road			Northbound U.S. Route 45			Southbound U.S. Route 45		
	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
6:00 A.M.	0	0	0	3	0	0	0	0	3	0	0	0
7:00 A.M.	0	0	0	6	0	0	0	0	2	0	0	0
8:00 A.M.	0	0	0	4	0	0	0	0	7	0	0	0
9:00 A.M.	0	0	0	7	0	0	0	0	4	0	0	0
10:00 A.M.	0	0	0	4	0	0	0	0	3	0	0	0
11:00 A.M.	0	0	0	4	0	0	0	0	3	0	0	0
12:00 Noon	0	0	0	4	0	0	0	0	3	0	0	0
1:00 P.M.	0	0	0	4	0	0	0	0	3	0	0	0
2:00 P.M.	0	0	0	3	0	0	0	0	3	0	0	0
3:00 P.M.	0	0	0	7	0	0	0	0	12	0	0	0
4:00 P.M.	0	0	0	10	0	0	0	0	24	0	0	0
5:00 P.M.	0	0	0	23	0	0	0	0	29	0	0	0

Table 5
 REDEVELOPMENT PROJECT TRAFFIC VOLUMES
 U.S. ROUTE 45 WITH LSC ACCESS ROAD AND TEMPEL DRIVE

	Eastbound Tempel Drive			Westbound LSC Access Road			Northbound U.S. Route 45			Southbound U.S. Route 45		
	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
6:00 A.M.	0	0	0	2	0	0	0	18	0	18	0	0
7:00 A.M.	0	0	0	3	0	0	0	23	0	23	0	0
8:00 A.M.	0	0	0	2	0	0	0	17	0	17	0	0
9:00 A.M.	0	0	0	2	0	0	0	15	0	15	0	0
10:00 A.M.	0	0	0	3	0	0	0	12	0	12	0	0
11:00 A.M.	0	0	0	5	0	0	0	17	0	17	0	0
12:00 Noon	0	0	0	5	0	0	0	22	0	22	0	0
1:00 P.M.	0	0	0	3	0	0	0	16	0	16	0	0
2:00 P.M.	0	0	0	6	0	0	0	22	0	22	0	0
3:00 P.M.	0	0	0	11	0	0	0	24	0	24	0	0
4:00 P.M.	0	0	0	8	0	0	0	21	0	21	0	0
5:00 P.M.	0	0	0	6	0	0	0	20	0	20	0	0

Table 6
 TOTAL PROJECTED TRAFFIC VOLUMES
 U.S. ROUTE 45 WITH LSC ACCESS ROAD AND TEMPEL DRIVE

	Eastbound Tempel Drive			Westbound LSC Access Road			Northbound U.S. Route 45			Southbound U.S. Route 45		
	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
6:00 A.M.	6	0	7	11	0	5	17	429	8	24	1,239	79
7:00 A.M.	19	0	7	26	0	4	36	708	17	28	1,633	95
8:00 A.M.	9	0	17	12	0	9	25	799	23	34	1,046	36
9:00 A.M.	9	0	19	21	0	13	27	603	15	39	716	19
10:00 A.M.	15	0	15	7	0	18	15	488	17	30	609	14
11:00 A.M.	21	1	45	12	0	26	22	602	19	31	631	18
12:00 Noon	26	1	28	19	1	17	45	657	12	33	679	25
1:00 P.M.	11	0	20	28	0	18	21	661	6	26	658	19
2:00 P.M.	25	0	29	13	0	11	23	831	10	29	861	37
3:00 P.M.	112	5	69	35	1	20	13	1,155	35	49	934	56
4:00 P.M.	60	3	35	35	0	34	12	1,378	115	61	874	20
5:00 P.M.	41	1	28	55	1	51	17	1,397	136	73	815	26

Table 7
 TRAFFIC SIGNAL WARRANT ANALYSIS
 EXISTING TRAFFIC VOLUMES
 U.S. ROUTE 45 WITH LSC ACCESS ROAD AND TEMPEL DRIVE

Hour	U.S. Route 45 (Major)	Temple Drive (Minor)	LSC Access Road (Minor)	Signal Warrants					
				Warrant 1				Warrant 2 (4-Hour)	Warrant 3 (1-Hour)
				Warrant 1A (8-Hour)	Warrant 1B (8-Hour)	Combination			
						1A 80%	1B 80%		
6:00 to 7:00 AM	1,757	9	7	No	No	No	No	No	No
7:00 to 8:00 AM	2,469	23	18	No	No	No	No	No	No
8:00 to 9:00 AM	1,922	15	9	No	No	No	No	No	No
9:00 to 10:00 AM	1,385	14	14	No	No	No	No	No	No
10:00 to 11:00 AM	1,146	19	5	No	No	No	No	No	No
11:00 AM to 12:00 PM	1,286	33	10	No	No	No	No	No	No
12:00 to 1:00 PM	1,404	34	15	No	No	No	No	No	No
1:00 to 2:00 PM	1,356	16	26	No	No	No	No	No	No
2:00 to 3:00 PM	1,744	34	8	No	No	No	No	No	No
3:00 to 4:00 PM	2,182	141	26	No	Yes	Yes	Yes	Yes	Yes
4:00 to 5:00 PM	2,394	74	32	No	No	No	Yes	No	No
5:00 to 6:00 PM	2,395	50	50	No	No	No	No	No	No
Total Hours Met:				0	1	1	2	1	1
Required Hours:				8	8	8	8	4	1
Warrant Satisfied:				No	No	No		No	Yes

Table 8
 TRAFFIC SIGNAL WARRANT ANALYSIS
 TOTAL PROJECTED TRAFFIC VOLUMES
 U.S. ROUTE 45 WITH LSC ACCESS ROAD AND TEMPEL DRIVE

Hour	U.S. Route 45 (Major)	Temple Drive (Minor)	LSC Access Road (Minor)	Signal Warrants					
				Warrant 1				Warrant 2 (4-Hour)	Warrant 3 (1-Hour)
				Warrant 1A (8-Hour)	Warrant 1B (8-Hour)	Combination			
						1A 80%	1B 80%		
6:00 to 7:00 AM	1,797	9	12	No	No	No	No	No	No
7:00 to 8:00 AM	2,518	23	27	No	No	No	No	No	No
8:00 to 9:00 AM	1,962	15	15	No	No	No	No	No	No
9:00 to 10:00 AM	1,419	14	24	No	No	No	No	No	No
10:00 to 11:00 AM	1,172	19	11	No	No	No	No	No	No
11:00 AM to 12:00 PM	1,322	33	19	No	No	No	No	No	No
12:00 to 1:00 PM	1,451	34	24	No	No	No	No	No	No
1:00 to 2:00 PM	1,391	16	32	No	No	No	No	No	No
2:00 to 3:00 PM	1,790	34	16	No	No	No	No	No	No
3:00 to 4:00 PM	2,243	141	44	No	Yes	Yes	Yes	Yes	Yes
4:00 to 5:00 PM	2,460	74	50	No	No	No	Yes	No	No
5:00 to 6:00 PM	2,465	50	79	No	No	No	Yes	No	No
Total Hours Met:				0	1	1	3	1	1
Required Hours:				8	8	8	8	4	1
Warrant Satisfied:				No	No	No		No	Yes

5. Review of LSC Modified Access and Circulation Plan

The following provides a review of the proposed modifications to the LSC access and circulation system and summarizes the recommendations developed to enhance operations.

Proposed Access and Circulation Modifications

Circulation System

As part of the redevelopment project, the existing north-south circulation within the southern section of the LSC site will be realigned. As proposed, the realigned north-south circulation road will extend around the south and west sides of the warehouse/distribution development and will continue to intersect Peterson Road and the east-west circulation road at its current locations. The realigned circulation road will provide direct access to the fuel center, the warehouse/distribution development, the LSC site, and the proposed U.S. Route 45 right-turn in/right-turn out access drive. As such, the LSC will have cross access to the redevelopment project and Peterson Road.

Access System

Primary access to and from the LSC will be provided via the east-west circulation road and its intersection with U.S. Route 45. Given the cross access between the LSC and the redevelopment project, secondary access will be provided via the existing Peterson Road access road and the proposed right-turn in and right-turn out only access drives on U.S. Route 45 and Peterson Road.

Parking System

Other than the elimination of the parking lots serving the golf driving range and miniature golf course, no other modifications are proposed to the parking lots serving the LSC site.

Proposed Recommendations

Based on the results of the traffic study and the review of the proposed redevelopment plan, KLOA, Inc. developed several recommendations to enhance the operation of the LSC access and circulation systems. The recommendations are summarized below and illustrated in Figure A in the Appendix.

- The north-south circulation road within the remaining portion of the LSC site should not be realigned and should continue to intersect the east-west circulation road at its current location.
- Given that the stacking from the U.S. Route 45 intersection may stack beyond the first internal intersection along the east-west access road, the first internal intersection should be modified so that the westbound leg is under stop sign control in addition to the north and south legs of the intersection (three-way stop sign control). This will allow the eastbound (inbound) traffic to operate under free flow conditions and eliminate any potential back-ups along the inbound lane. Further, “Do Not Block Intersection” signs should be installed along the three stop-sign controlled legs of the intersection.
- Additional stop bars and signs are recommended at several internal intersections.
- Signs indicating that truck traffic is not permitted to traverse the LSC site except for LSC deliveries should be installed (1) along the north-south circulation road with the redevelopment project and (2) at the U.S. Route 45 access road.

6. Conclusion

Based on the preceding analyses and recommendations, the following conclusions have been made:

- The redevelopment of the southern portion of the LSC will result in the following access and circulation modifications:
 - The realignment of the north-south circulation around the south and west side of the warehouse/distribution development. The realigned circulation road will provide cross access to the redevelopment project and the Peterson Road full access drive. It is important to note that only passenger vehicles will be permitted to use the cross access and traverse the LSC.
 - Primary access to and from the LSC will be provided via the east-west circulation road and its intersection with U.S. Route 45. Secondary access will be provided via the existing Peterson Road access road and the proposed right-turn in and right-turn out only access drives on U.S. Route 45 and Peterson Road.
 - Other than the elimination of the parking lots serving the golf driving range and miniature golf course, no other modifications are proposed to the parking lots serving the LSC.
- With the redevelopment project, it is anticipated that 20 percent of the LSC traffic currently using the Peterson Road access road will be redistributed to the U.S. Route 45 access road.
- The results of the capacity analyses at the U.S. Route 45/LSC access road/Tempel Drive intersection shows that the access road left-turn/through lane is currently operating at LOS F during the evening peak hour. Assuming the total projected traffic volumes with the redevelopment project, the access road left-turn/through lane is projected to continue to operate at LOS F assuming the existing stop sign control with significant increases in delay and queueing. If a traffic signal is installed at this intersection, the results of the capacity analysis show that the intersection will operate at a good level of service and the operation of the access road will be significantly improved.

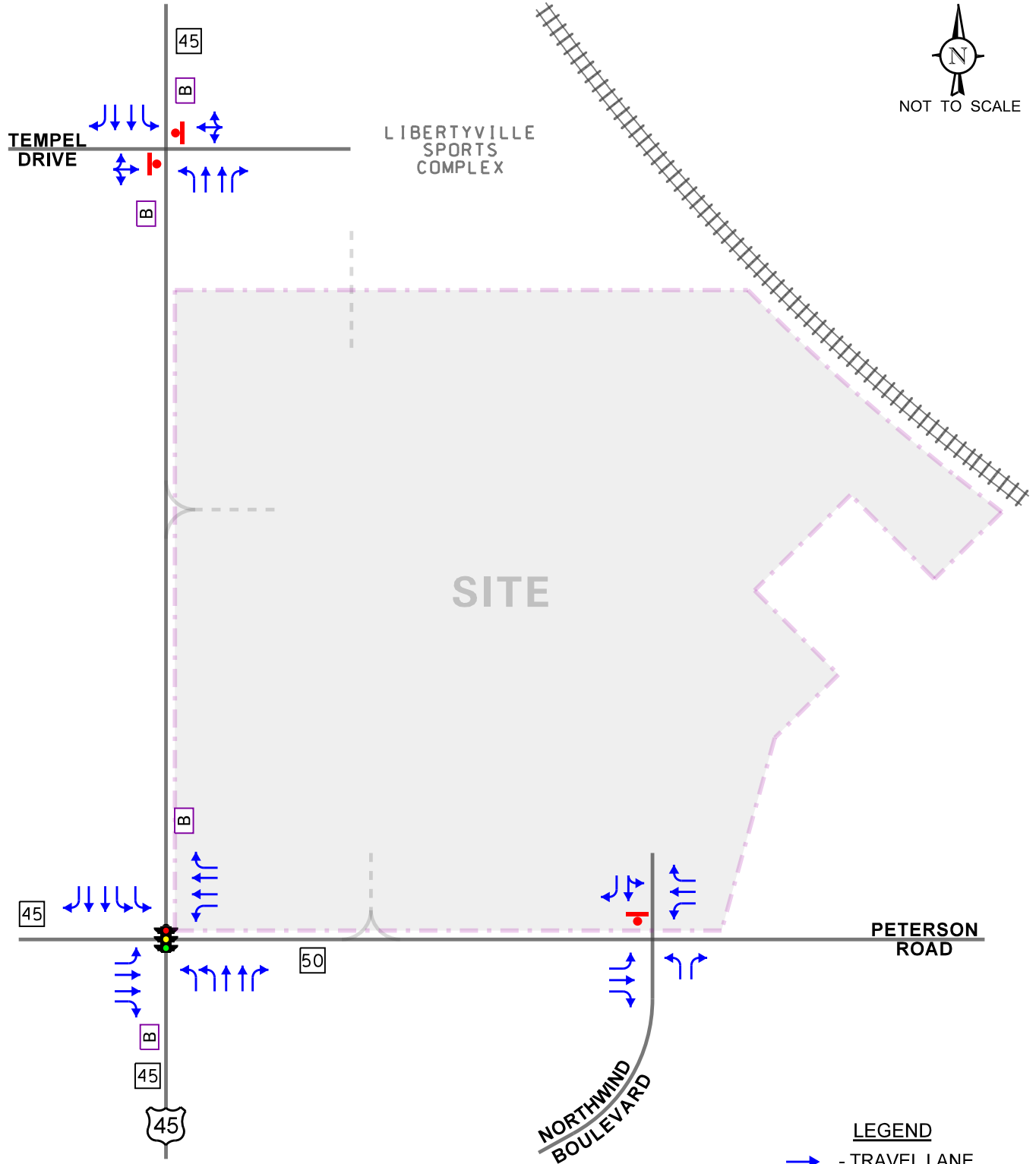
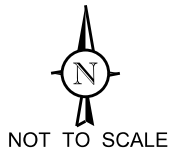
- A traffic signal warrant study performed at the U.S. Route 45/LSC access road/Tempel Drive intersection show that a traffic signal is warranted under existing and total projected traffic volumes. If a traffic signal is installed at this intersection, the LSC access road and Temple Drive approaches will need to be modified/widened as follows:
 - The median along the access road will need to be removed and the access road restriped to provide three outbound lanes striped for a separate left-turn lane, a through lane, and a separate right-turn lane.
 - The Tempel Drive approach will need to be widened to provide two eastbound lanes striped for a separate left-turn lane and a shared through/right-turn lane.






- Based on the results of the traffic study and the review of the redevelopment plan, the following recommendations were developed to enhance the operations of the LSC access and circulation systems:
 - The north-south circulation road within the remaining portion of the LSC site should not be realigned and should continue to intersect the east-west circulation road at its current location.
 - The first internal intersection should be modified so that the westbound leg is under stop sign control in addition to the north and south legs of the intersection (three-way stop sign control). Further, “Do Not Block Intersection” signs should be installed along the three stop-sign controlled legs of the intersection.
 - Additional stop bars and signs are recommended at several internal intersections.
 - Signs indicating that truck traffic is not permitted to traverse the LSC site except for LSC deliveries should be installed (1) along the north-south circulation road with the redevelopment project and (2) at the U.S. Route 45 access road.

Appendix

Redevelopment Project Traffic Study Figures
Level of Service Table
LSC Recommendations Exhibit

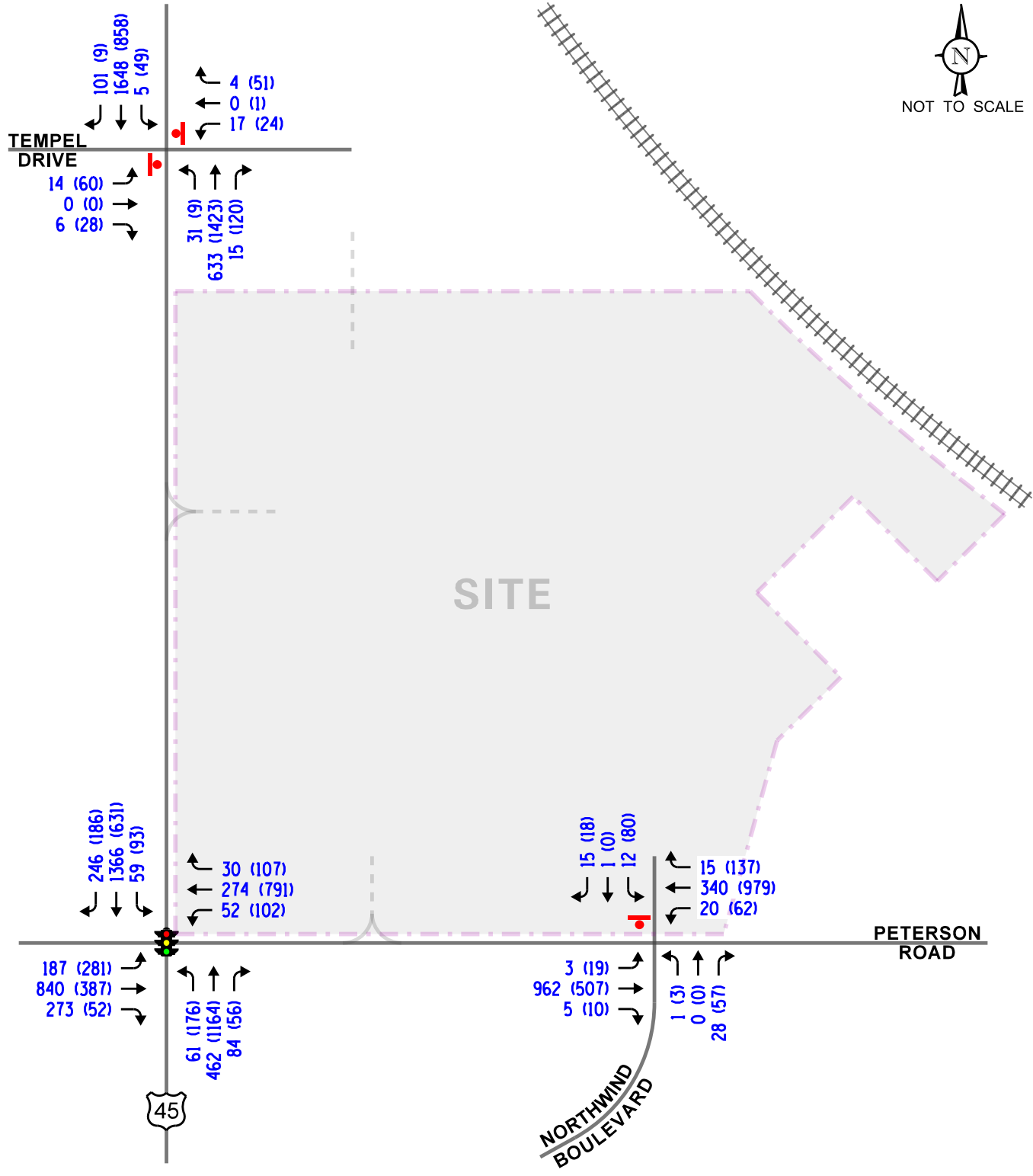
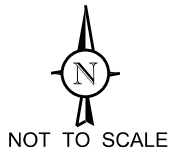
Redevelopment Project Traffic Study Figures



- LEGEND**
-  - TRAVEL LANE
 -  - TRAFFIC SIGNAL
 -  - STOP SIGN
 -  - SPEED LIMIT
 -  - BUS STOP

Mixed-Use
Development
Libertyville, Illinois

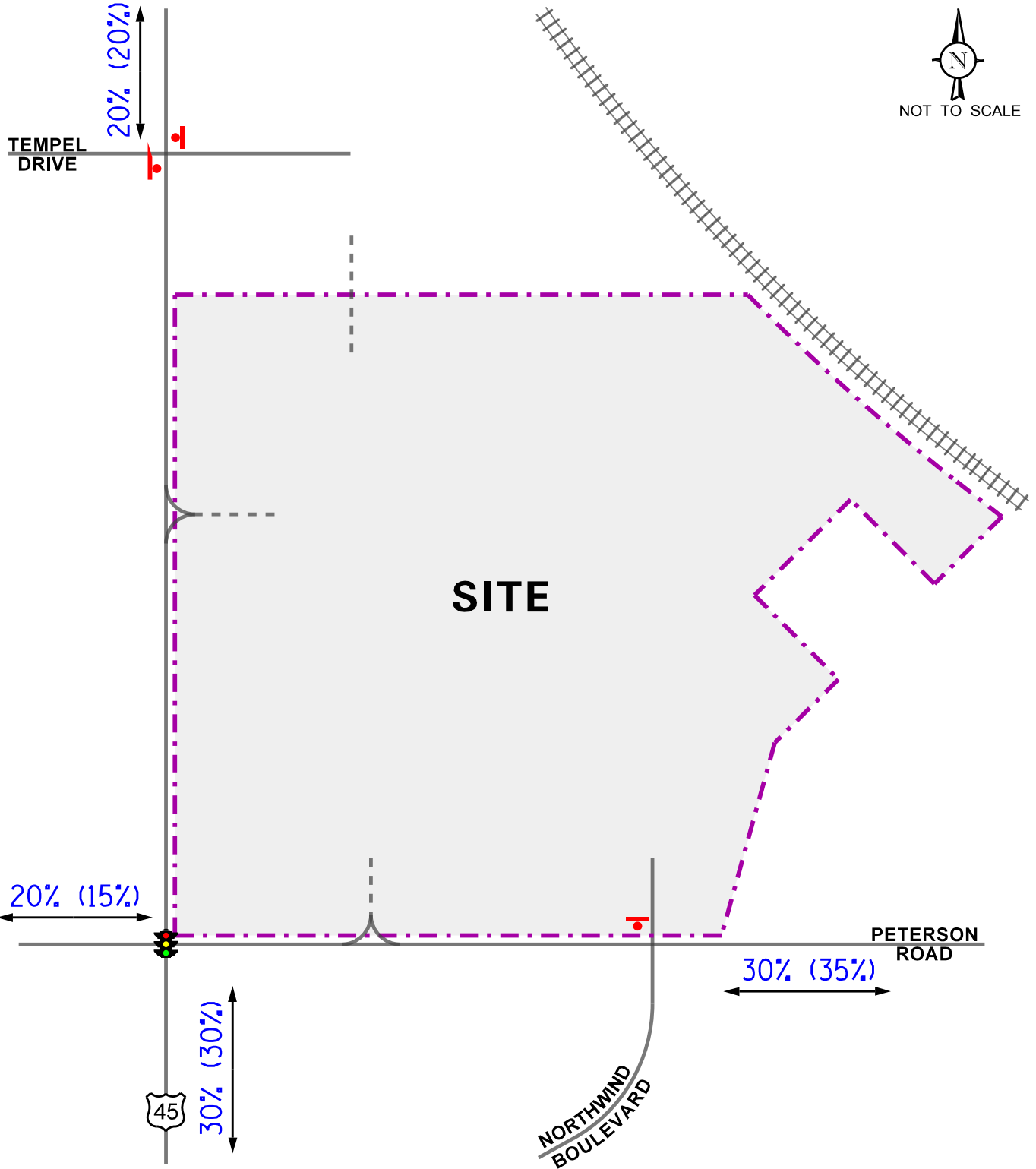
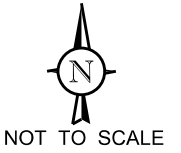
Existing Roadway Characteristics



LEGEND
 00 - AM PEAK HOUR (6:45-7:45 AM)
 (00) - PM PEAK HOUR (4:30-5:30 PM)

Mixed-Use
 Development
 Libertyville, Illinois

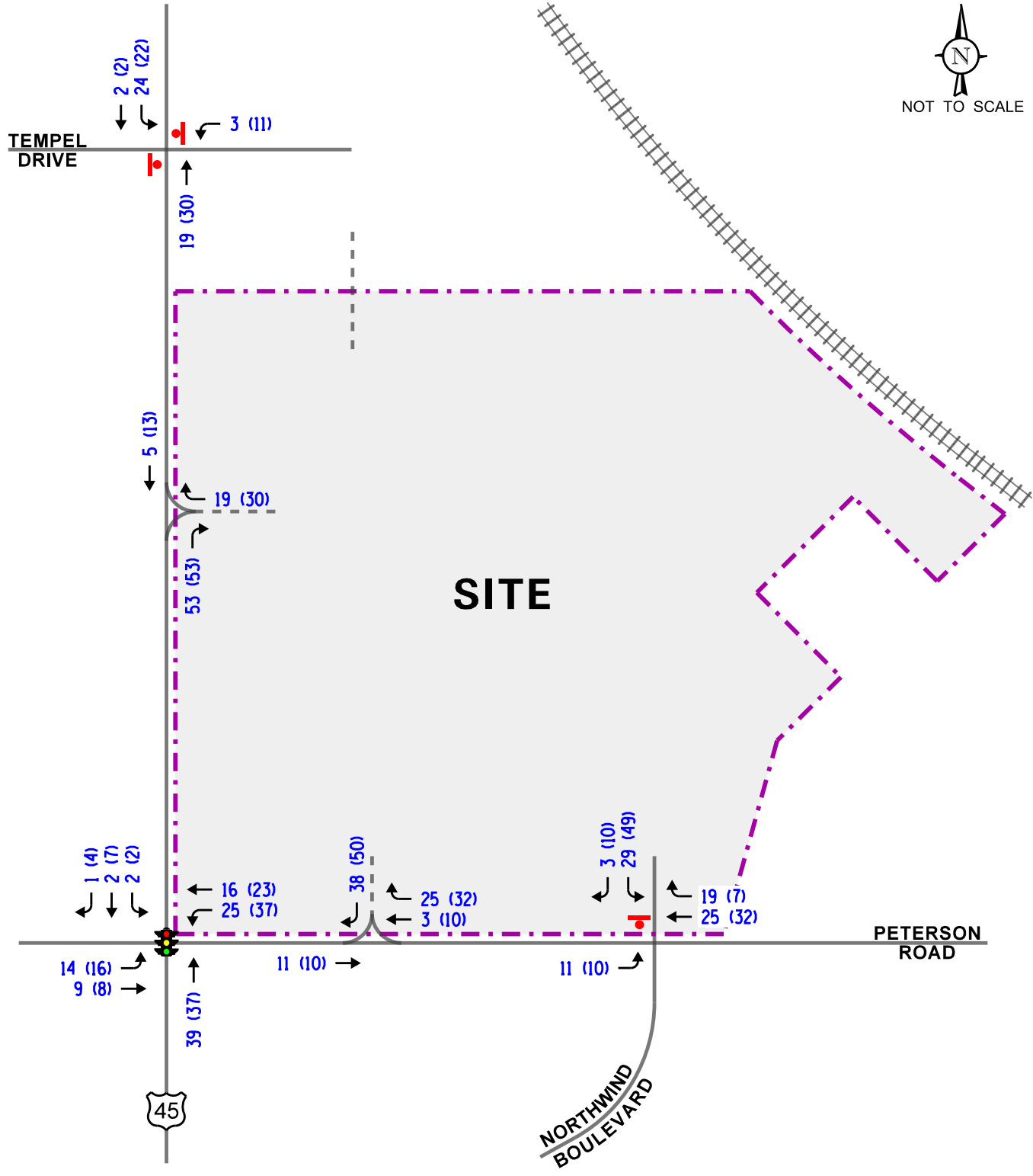
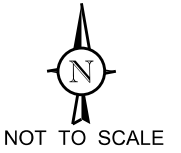
Existing Traffic Volumes



Mixed-Use
Development
Libertyville, Illinois

Estimated Directional Distribution





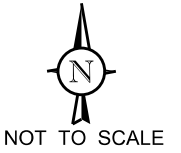
LEGEND

- 00 - AM PEAK HOUR (6:45-7:45 AM)
- (00) - PM PEAK HOUR (4:30-5:30 PM)

Mixed-Use
Development
Libertyville, Illinois

Estimated Site-Generated
Traffic Volumes





TEMPEL DRIVE

-7 (-7)
+7 (+7)

SITE

-7 (-7)

+30 (+30)

-30 (-30)
+47 (+47)

-7 (-7)

+7 (+7)

+37 (+37)

+30 (+30)
-30 (-30)

+17 (+17)

PETERSON ROAD

+17 (+17)
-17 (-17)

-17 (-17)

-17 (-17)



NORTHWIND BOULEVARD

LEGEND

- 00 - AM PEAK HOUR (6:45-7:45 AM)
- (00) - PM PEAK HOUR (4:30-5:30 PM)

Mixed-Use Development
Libertyville, Illinois

Pass-By Traffic Volumes





NOT TO SCALE

TEMPEL DRIVE

+5 (+20)

+4 (+31)

SITE

+2 (+3)
+1 (+1)
+2 (+16)

+3 (+27)
-2 (-3)
-1 (-1)

-3 (-4)
0 (0)
-2 (-16)

-3 (-27)
+3 (+27)

PETERSON ROAD

+1 (+3)
-1 (-3)
0 (+1)
0 (-1)

-1 (-4)
+2 (+16)



NORTHWIND BOULEVARD

LEGEND

00 - AM PEAK HOUR (6:45-7:45 AM)

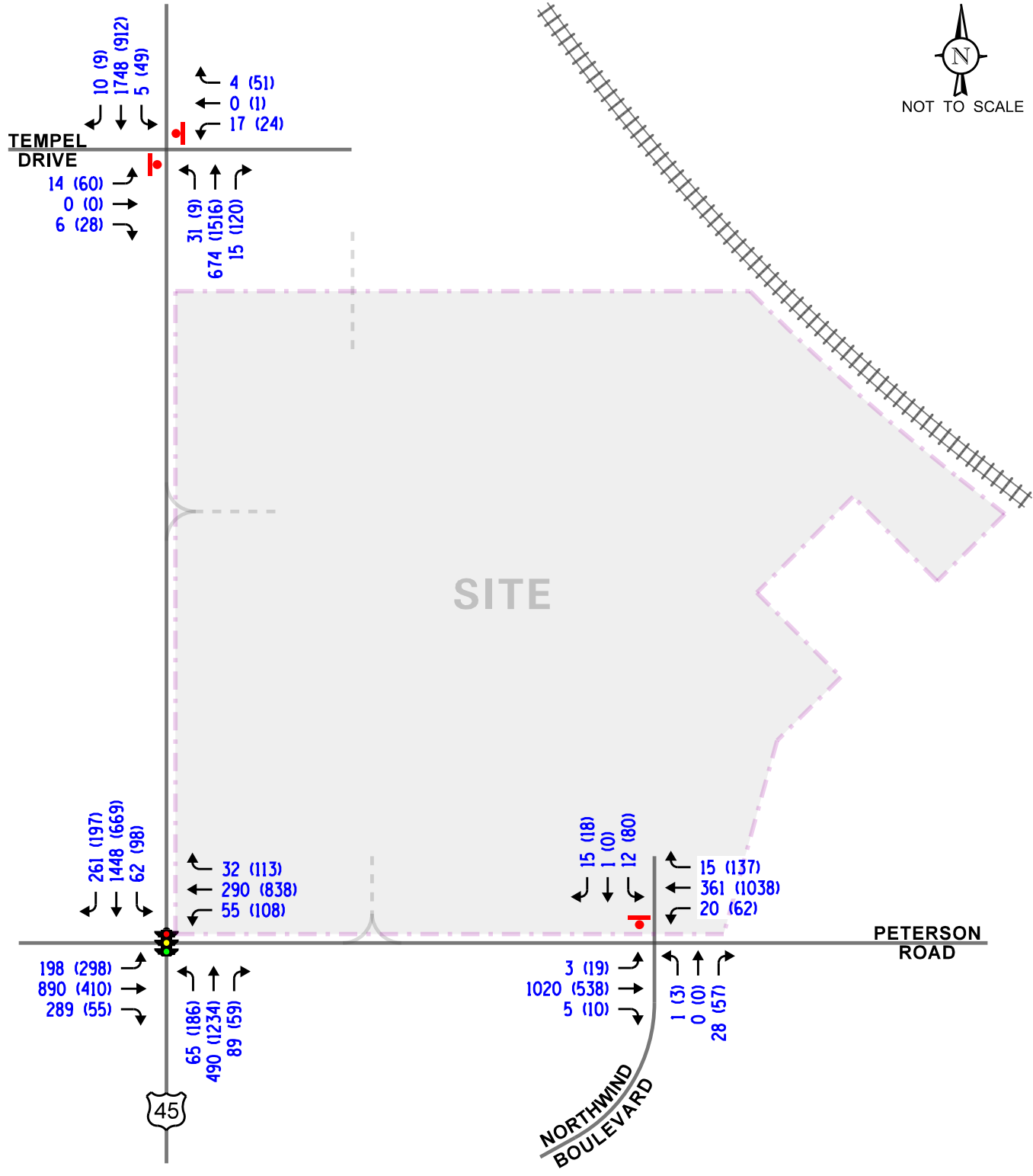
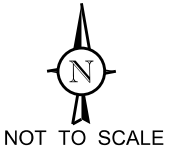
(00) - PM PEAK HOUR (4:30-5:30 PM)

Mixed-Use Development
Libertyville, Illinois

Redistribution of Libertyville Sports Complex
Traffic Volumes



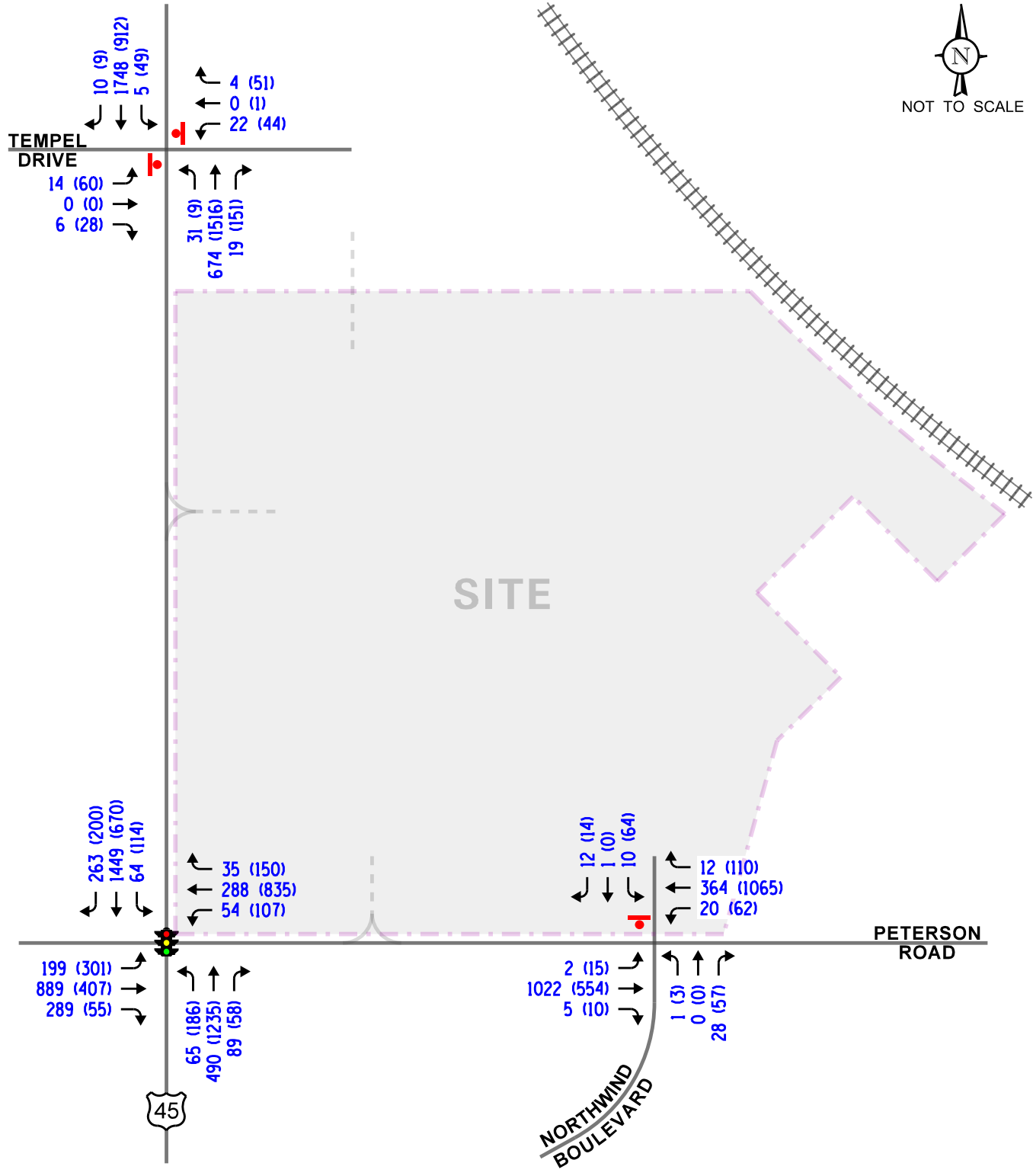
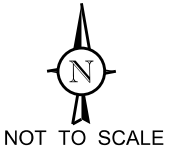
Job No: 19-215 Figure: 8



LEGEND
 00 - AM PEAK HOUR (6:45-7:45 AM)
 (00) - PM PEAK HOUR (4:30-5:30 PM)

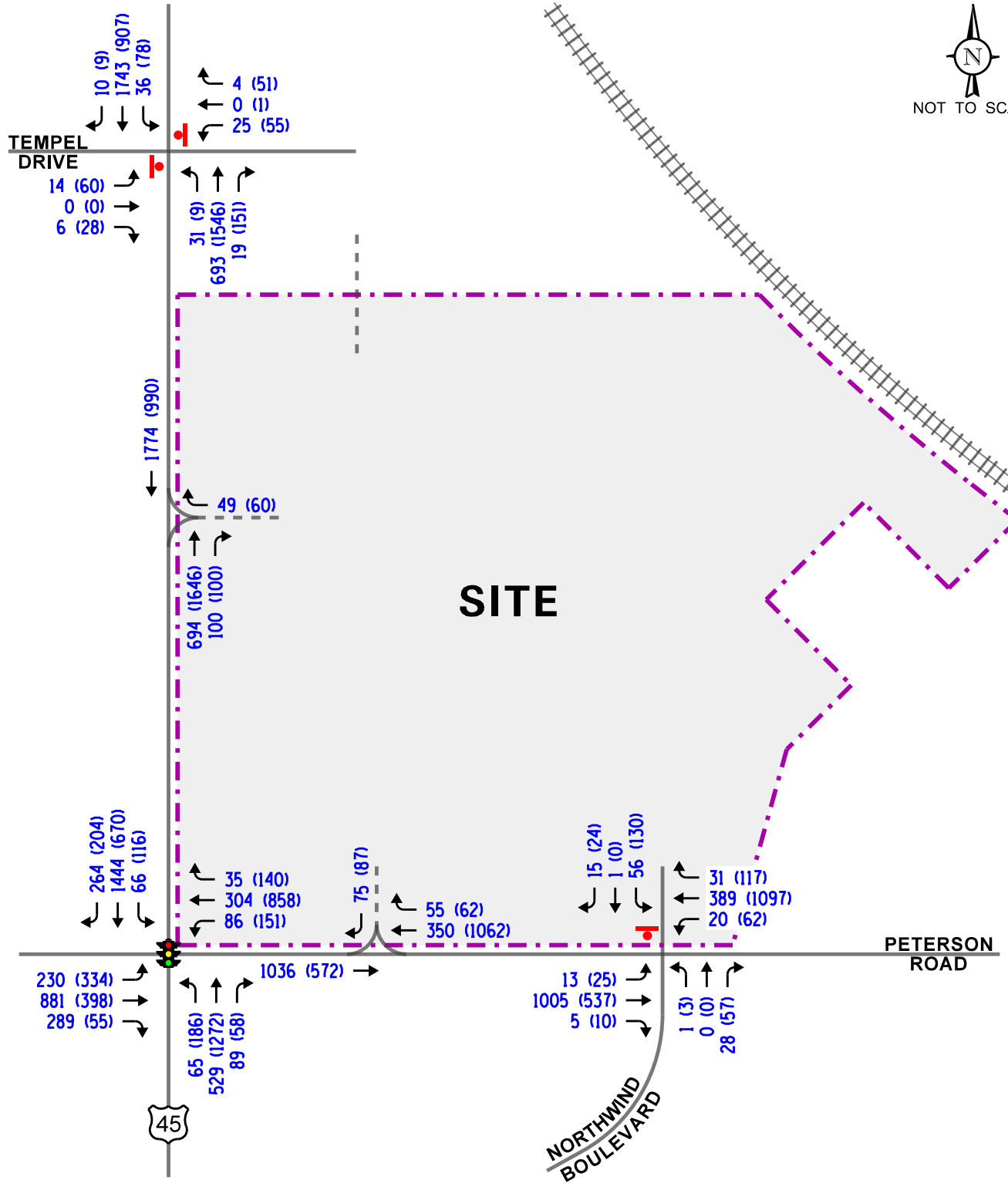
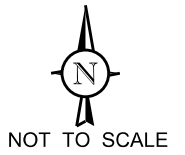
Mixed-Use
 Development
 Libertyville, Illinois

Year 2025 No-Build Traffic Volumes



Mixed-Use
Development
Libertyville, Illinois

Year 2025 No-Build Traffic Volumes
With Redistribution of
Libertyville Sports Complex Traffic



LEGEND
 00 - AM PEAK HOUR (6:45-7:45 AM)
 (00) - PM PEAK HOUR (4:30-5:30 PM)

Mixed-Use
 Development
 Libertyville, Illinois

Year 2025 Total Projected Traffic Volumes



Job No: 19-215 Figure: 11

Level of Service Table

LEVEL OF SERVICE CRITERIA

Signalized Intersections		
Level of Service	Interpretation	Average Control Delay (seconds per vehicle)
A	Favorable progression. Most vehicles arrive during the green indication and travel through the intersection without stopping.	≤10
B	Good progression, with more vehicles stopping than for Level of Service A.	>10 - 20
C	Individual cycle failures (i.e., one or more queued vehicles are not able to depart as a result of insufficient capacity during the cycle) may begin to appear. Number of vehicles stopping is significant, although many vehicles still pass through the intersection without stopping.	>20 - 35
D	The volume-to-capacity ratio is high and either progression is ineffective or the cycle length is too long. Many vehicles stop and individual cycle failures are noticeable.	>35 - 55
E	Progression is unfavorable. The volume-to-capacity ratio is high and the cycle length is long. Individual cycle failures are frequent.	>55 - 80
F	The volume-to-capacity ratio is very high, progression is very poor, and the cycle length is long. Most cycles fail to clear the queue.	>80.0
Unsignalized Intersections		
Level of Service	Average Total Delay (SEC/VEH)	
A	0 - 10	
B	> 10 - 15	
C	> 15 - 25	
D	> 25 - 35	
E	> 35 - 50	
F	> 50	

Source: *Highway Capacity Manual*, 2010.

LSC Recommendations Exhibit



LEGEND

- EXISTING STOP BAR
- PROPOSED STOP BAR
- MAINTAIN NORTH-SOUTH CIRCULATION ROAD AND DIRECT CONNECTION TO REDEVELOPMENT PROJECT