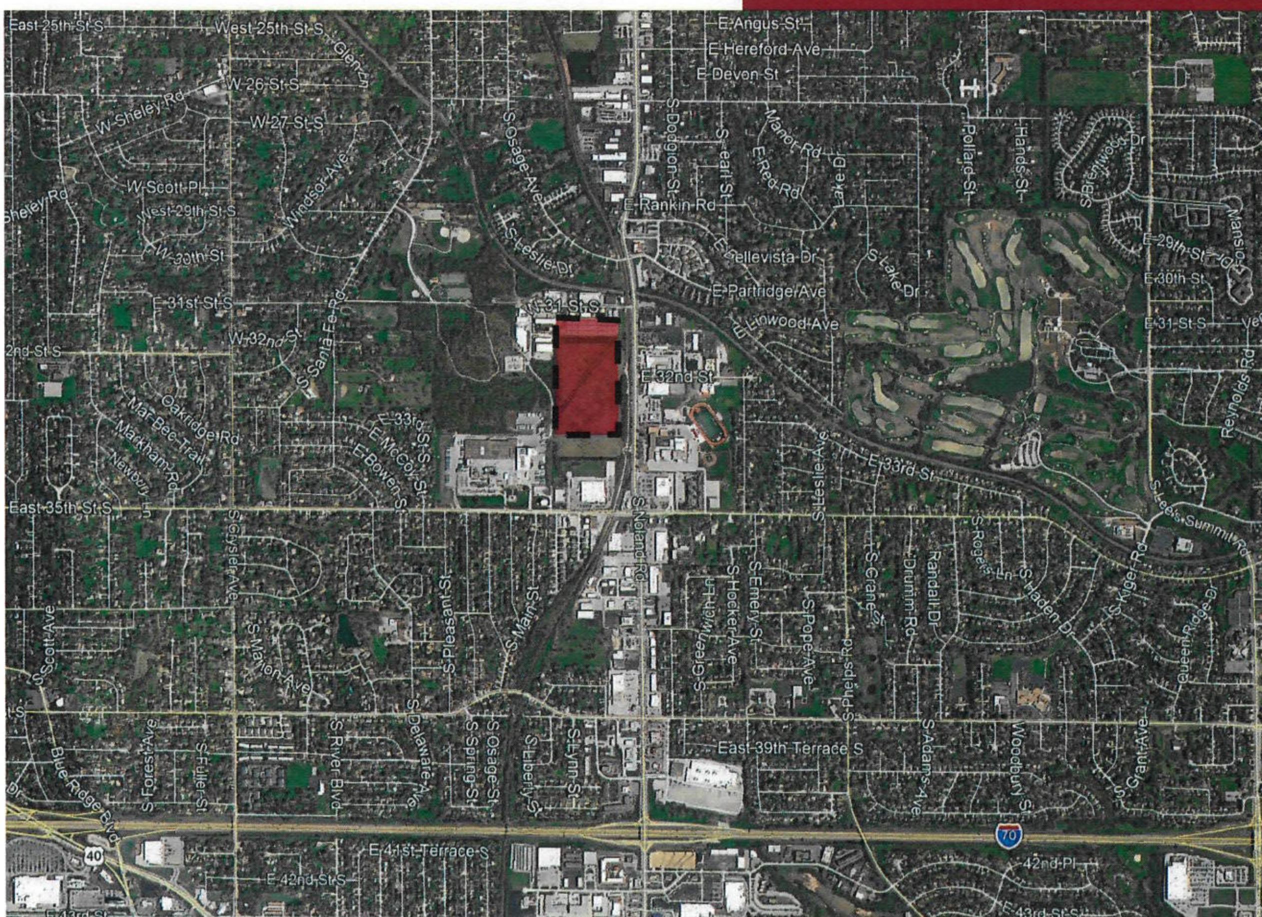
Cargo Largo Traffic Impact Study

35th Street and Noland Road
Independence, Missouri



Prepared for:
Recovery Management Corporation

Prepared by TranSystems
November 2018

TranSystems
EXPERIENCE | Transportation

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November 28, 2018

Mr. Louis D. Pack
Recovery Management Corporation
13900 E. 35th Street
Independence, MO 64055

**RE: Cargo Largo Traffic Impact Study
35th Street and Noland Road
Independence, Missouri**

Dear Mr. Pack:

In response to your request and authorization, TranSystems has completed a traffic impact study for the proposed Cargo Largo warehouse and retail store to be located generally on the west side of the Noland Road, between 31st Street and 35th Street in Independence, Missouri. The purpose of this study was to assess the impact of the proposed development on the surrounding transportation system.

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

- Existing Conditions
- Existing plus Development Conditions
- Future (Year 2029) Conditions

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

Sincerely,
TRANSYSTEMS

By: ______________________ By: ______________________
Jeffrey J. Wilke, PE, PTOE Tobin Bonnell, PE, PTOE

STATE OF MISSOURI
JEFFREY J. WILKE
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TTB:JJW/tb/P101180167
Enclosure

Introduction

TranSystems has completed a traffic impact study for the proposed Cargo Largo warehouse and retail store development to be located generally along the west side of Noland Road, between 31st Street and 35th Street in Independence, Missouri. The purpose of this study was to assess the impact of the proposed development on the surrounding transportation system. The location of the development site relative to the major streets in the area is shown on ***Figure A-1*** in ***Appendix A***.

This study also contains a description of the proposed development and the surrounding transportation infrastructure along with trip generation estimates, trip distribution estimates, capacity analyses, and a summary of the findings.

Proposed Development Plan

The proposed development consists of approximately 463,500 square feet of new warehouse and retail store facility. The proposed facility will replace the existing 75,000 square-foot retail facility, which currently sits just to the south of the proposed site. The proposed warehouse facility includes several truck loading/unloading docks along with parking areas for passenger cars.

Access to the site will be provided via a new access drive that intersects Noland Road approximately 800 feet north of 35th Street, and via connections to Weatherford Road. The new access point on Noland Road is referred to as 33rd Street in this study. As part of the proposed site improvements, Weatherford Road will be extended to connect to the existing Lynn Court, which provides access to 35th Street. Weatherford Road connects to 31st Street, which provides access to Noland Road. A copy of the proposed site plan showing the access points is included on ***Figure A-2*** in ***Appendix A*** for reference.

Cargo Largo has unique operational conditions that are specific to the business. There is a retail store that will have regular business hours for customers. Bid sales are special events held every Thursday from 3:00 P.M. to 8:00 P.M. As many as 800 customers may attend a bid sale over the five hour duration. Customer arrivals and departures are typically spread out over the course of the bid sale, with the peak of the arrivals occurring between 5:00 P.M. and 7:00 P.M.

On Fridays after the bid sales, as many as 375 winning bidders arrive to pick up their merchandise. Pick-up or load-out operations are spread out over the course of the day from 6:30 A.M. to 6:30 P.M. Customers may use cars, light trucks, panel trucks, flatbed trailers, and occasionally semi-trailers for load-out. Most of the trucks used for load-out do not exceed 24 feet in length.

Merchandise is brought into the warehouse on a daily basis by trucks. Delivery trucks are driven by employees and independent operators. The delivery truck route to the site will be via 35th Street and Lynn Court, and Cargo Largo has indicated that they will communicate this truck routing to their drivers.

Study Area

To assess the impacts of the proposed development, the intersections listed below were identified for study during the A.M. and P.M. peak periods.

- 31st Street and Noland Road
- 33rd Street and Noland Road
- 35th Street and Noland Road
- 35th Street and Lynn Court

Traffic Counts

Turning-movement traffic volume counts were collected at the existing study intersections on Tuesday September 11, 2018. The counts were collected at each existing intersection from 7:00 to 9:00 A.M. and from 4:00 to 6:00 P.M. In general, the A.M. peak hour occurred from 7:00 A.M. to 8:00 A.M., and the P.M. peak hour occurred from 4:30 to 5:30 P.M. The volume of truck traffic was also collected during the counts for use in analysis. The existing lane configurations, traffic control devices, and peak hour traffic volumes have been illustrated on ***Figures A-3*** through ***A-5***. Traffic counts are shown in ***Appendix B***.

Surrounding Street Network and Land Uses

The development site is located on primarily undeveloped land. The site is bounded on the east by Union Pacific Railroad, which runs north/south along the west side of Noland Road. To the north, the site is bounded by the existing storage facility that is currently on the south side of 31st Street. The site is bounded on the west by the existing Weatherford Road and existing warehouses that are on the west side of Weatherford Road. To the south, the site is bounded by the existing Cargo Largo retail facility, which sits near the northeast corner of 35th Street and Lynn Court.

Truman High School is located along the east side of Noland Road, across from the development site. The high school is in session from 7:20 A.M. to 2:20 P.M. The school has several driveways onto Noland Road, and other access points have been constructed in recent years. The school has a driveway north to provide access to/from 32nd Street. The school also has two driveways extending south to 35th Street. The developer has had conversations with Independence School District staff, and they do not have any concerns related to the proposed Cargo Largo development or its access to Noland Road.

Noland Road is a major arterial roadway with two lanes in each direction and curbs and gutters along each side. Along the east side of the roadway, there is continuous concrete sidewalk. In the vicinity of the proposed development, the southbound direction has a continuous left-turn lane to allow motorists to access the businesses and institutions along the east side of Noland Road. A northbound left-turn lane is generally not present in the vicinity of the proposed development, but there is a continuous 11-foot-wide painted median that runs adjacent to the southbound left-turn lane. At the signalized intersection of 31st Street, there is a northbound left-turn lane approximately 150 feet long. The posted speed limit on Noland Road is 35 mph adjacent to the proposed development site.

To the west of Noland Road, 35th Street is a minor arterial roadway with one lane in each direction, a two-way left-turn lane, and a posted 35 mph speed limit. To the east of Noland Road, 35th Street is designated as a collector roadway with one lane in each direction and a 25 mph speed limit. Within the vicinity of the proposed development, 35th Street has curb and gutters and sidewalk on both sides of the roadway. Union Pacific Railroad crosses 35th Street approximately 250 feet to the west of the intersection with Noland Road. The traffic signal at 35th Street and Noland Road allows for pre-emption from activation of the gate and signal at this at-grade crossing, and the northbound left-turn movement is halted during times of train passage. Approximately 550 feet west of the Union Pacific Railroad crossing, 35th Street intersects Lynn Court. The south leg of this unsignalized intersection consists of an access drive for a vacant commercial property. The north- and southbound movements from Lynn Court onto 35th Street are stop-controlled, while the east-and westbound approaches are uncontrolled.

There is an existing pavement stub approximately 800 feet north of 35th Street that has an at-grade crossing with Union Pacific Railroad approximately 35 feet west of Noland Road. The at-grade crossing has signals and gates in place. This pavement currently has traffic barriers placed across its width so as to prevent access. This existing pavement will be used as the location for the proposed development's primary customer access to Noland Road and the surrounding roadway network. The proposed site plan on ***Figure A-2*** refers to this proposed access drive as 33rd Street.

Both 31st Street and Weatherford Road are local streets that generally serve existing industrial and warehouse land uses. Both of these roadways include one lane in each direction. Both roadways lack curb and gutter and sidewalk. Union Pacific Railroad crosses 31st Street at-grade approximately 35 feet to the west of the signalized intersection with Noland Road.

Lynn Court is an existing city street that serves as access to the existing Cargo Largo retail site and the Mid-Continent Public Library. Lynn Court has one lane in each direction and a cul-de-sac approximately 450 feet to the north of 35th Street.

Analysis

The scope of analysis for the assessment of the proposed development's impact on the surrounding transportation system is based in large part on the recommended practices of the Institute of Transportation Engineers (ITE), as outlined in their Traffic Engineering Handbook. ITE is a nationally-recognized organization of transportation professionals with members from both private and public sectors. The analysis of the proposed development's impact included development of trip generation and trip distribution estimates as well as a traffic operations assessment for each study scenario. Each of the analysis methodologies and findings are described in the subsequent sections.

Trip Generation

Trip generation estimates were prepared using the Institute of Transportation Engineer's Trip Generation, 10th Edition. ***Table 1*** on the following page shows the expected trips to be generated by the proposed development. It is assumed that approximately 20 percent of the development trips consist of truck traffic, as Trip Generation indicates that surveyed sites with warehouse type land uses have encountered as much as 20 percent truck trips.

Table 1
Trip Generation

Land Use	Intensity		ITE Code	Average Weekday	A.M. Peak Hour			P.M. Peak Hour		
					Total	In	Out	Total	In	Out
Warehouse	485.2	ksf	150	812	84	65	19	87	24	63
Retail	73.4	ksf	862	2,256	115	66	49	172	85	87
			Total Trips	***3,068***	***199***	***131***	***68***	***259***	***109***	***150***

Trip Distribution

Based on the proposed roadway layout shown with the site plan in ***Figure A-2***, the proposed development will utilize three points of access, 31st Street, 33rd Street, and Lynn Court. The estimated trips generated by the proposed development were distributed onto the surrounding street network based on the trip distributions summarized in ***Table 2***. These distributions are based on the existing travel patterns in the A.M. and P.M. peak hours, knowledge of the proposed land uses, and engineering judgment. The detailed distribution patterns through the study intersections are shown in ***Appendix B***.

Table 2
Trip Distribution

Direction To/From	Percentage
North on Noland Road	20%
West on 35th Street	15%
South on Noland Road	50%
East on 35th Street	15%
Total	**100%**

Traffic Operation Assessment

An assessment of traffic operations was made for the scenarios listed below.

- Existing Conditions
- Existing plus Development Conditions
- Future (Year 2029) Conditions

The analyses for each of these scenarios account for the high percentage of truck traffic that is projected to travel through the study intersections on a daily basis by accounting for the volume of trucks in the capacity analysis. The analysis assumes that 20 percent of the trip generation for the proposed development is truck traffic.

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

Table 3
Intersection Level of Service Delay Thresholds

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

While LOS measurements apply to both signalized and unsignalized intersections, there are significant differences between how these intersections operate and how they are evaluated. LOS for signalized intersections reflects the operation of the intersection as a whole.

Unsignalized intersections, in contrast, are evaluated based on the movement groupings which are required to yield to other traffic. Typically, these are the left turns off of the major street and the side-street approaches for two-way stop-controlled intersections. At unsignalized intersections lower LOS ratings (D, E and F) do not, in themselves, indicate the need for additional improvements. Many times there are convenient alternative routes to avoid the longer delays. Other times the volumes on the unsignalized approaches are relatively minor when compared to the major street traffic, and improvements such as traffic signal installation may increase the average delay to all users of the intersection.

The decision to install a traffic signal, which is often considered when lower LOS ratings are projected, should be based on engineering studies and the warrants for traffic signal installation as outlined in the Federal Highway Administration's Manual on Uniform Traffic Control Devices (MUTCD). Signals are typically not recommended in locations where there are convenient alternative paths, or if the installation of a traffic signal would have negative impacts on the surrounding transportation system.

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

The LOS rating deemed acceptable varies by community, facility type and traffic control device. Most communities in the region have identified LOS D as the minimum desirable goal for signalized intersections. However, at unsignalized intersections LOS D, E, or even F are often considered acceptable for low to moderate traffic volumes where the installation of a traffic signal is not warranted by the conditions at the intersection, or the location has been deemed undesirable for signalization.

Existing Conditions

The results of the existing conditions intersection analyses are summarized below in ***Table 4***. The study intersections were evaluated with the lane configurations, traffic volumes, and traffic control devices shown on ***Figures A-3*** through ***A-5***. The Synchro output files are included in ***Appendix C***.

Table 4
Intersection Operational Analysis
Existing Conditions

Intersection	A.M. Peak Hour		P.M. Peak Hour	
Movement	**LOS[1]**	**Delay[2]**	**LOS[1]**	**Delay[2]**
31st Street and Noland Road				
Traffic Signal	A	4.1	A	4.7
35th Street and Noland Road				
Traffic Signal	C	24.5	C	30.5
35th Street and Lynn Court				
Eastbound Left Turn	A	7.7	A	8.1
Westbound Left Turn	A	0.0	A	0.0
Northbound	A	0.0	C	20.3
Southbound Left Turn	A	0.0	C	21.3
Southbound Through/Right Turn	A	9.4	B	10.4

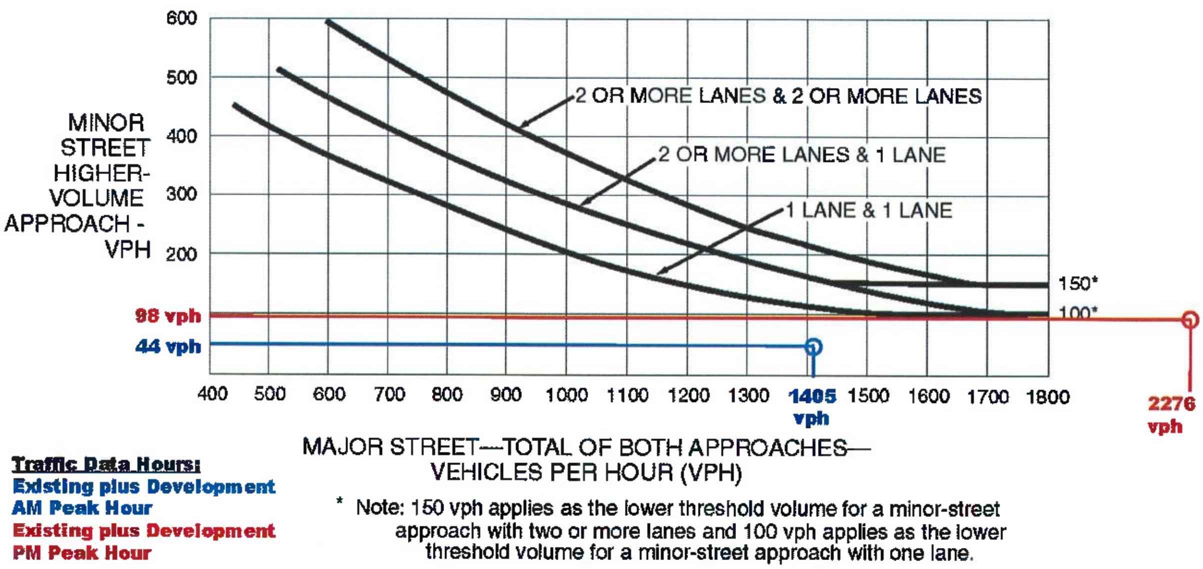
1 – Level of Service
2 – Delay in seconds per vehicle

Table 4 shows that all movements at the existing intersections within the study area are operating at acceptable levels of service during the existing peak hours. In addition to levels of service, queue lengths of intersection approaches were reviewed for comparison with existing turn lane lengths. This review found that the existing lane geometry is sufficient to serve existing vehicle queues at the study intersections, with the exception of the eastbound left-turn movement at 35th Street and Noland Road. Traffic models show that the queues in this lane exceed the existing 90-foot length of left-turn lane during the P.M. peak hour. This lane is geometrically constrained by the proximity of the Union Pacific Railroad, and it is understood that operation of the railroad crossing preempts the traffic signal to ensure that clearance sequence time is provided. The addition of another left-turn lane would be challenging due to the existing geometric constraints.

Existing plus Development Conditions

Given that the proposed development is anticipated to utilize 33rd Street as the primary point of access for customers, review of applicable traffic signal warrants and other access management considerations were evaluated at this location. Based on the traffic volumes anticipated for the peak hours of traffic for the surrounding roadway network, the intersection of 33rd Street and Noland Road was assessed for traffic signal installation. Traffic volumes for the existing plus development scenario were assessed based on procedures outlined in the MUTCD for the Peak Hour Volume Warrant (Warrant 3). ***Figure 1*** below shows the existing plus development traffic volumes plotted relative to the graph from the MUTCD for Warrant 3. The figure shows that with the addition of development-generated traffic, the volumes are projected to be near the threshold for satisfaction of Warrant 3 during the P.M. peak hour scenario.

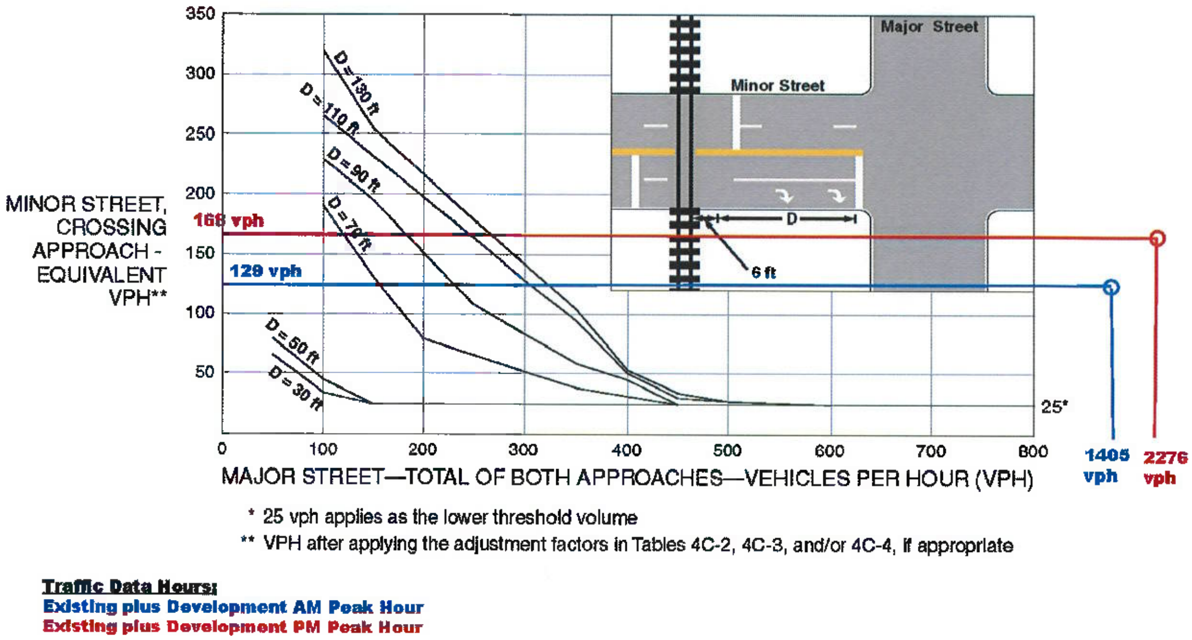
Figure 1: Warrant 3, Peak Hour



Another critical factor within the study area that must be considered is Union Pacific Railroad, due to the close proximity to the intersection of 33rd Street and Noland Road. The MUTCD includes the Intersection Near a Grade Crossing Warrant (Warrant 9) for situations such as these. Traffic volumes for the existing plus development scenario were assessed based on procedures outlined in the MUTCD for the Warrant 9. ***Figure 2*** on the following page shows the existing plus development traffic volumes plotted relative to the graph from the MUTCD for Warrant 9. It is important to note that this assessment assumes that trains could use the adjacent railroad at the same time as the peak hour of traffic operations. The figure shows that conversion of the existing pavement stub to a full access intersection would clearly warrant traffic signal installation based on Warrant 9, considering the development-generated traffic volumes and a D distance of approximately 30 feet that currently exists.

Given the results of the analysis, a traffic signal would be warranted for installation at the intersection of 33rd Street and Noland Road with the construction of the proposed development. The MUTCD also recommends that, if Warrant 9 is met, the proposed traffic signal have actuation on the minor street and railroad pre-emption control. It also states that the grade crossing have flashing lights and gates, which exist at the grade crossing today. Furthermore, the MUTCD states that a pre-signal should be considered if an intersection controlled by a traffic signal is located within 50 feet of an at-grade crossing, as is being proposed in this situation. In this case, the pre-signal would be applicable to eastbound traffic, and would display a steady red signal indication during the track clearance portion of the signal pre-emption sequence.

Figure 2: Warrant 9, Intersection Near a Grade Crossing (Two or More Approach Lanes at the Track Crossing)



With the installation of a traffic signal at the intersection of 33rd Street and Noland Road, other turn lanes should be considered. A northbound left-turn lane would be warranted, based on the peak hour traffic volumes and MoDOT access management guidelines. The northbound left-turn lane should have a minimum storage length of 200 feet plus appropriate taper. This turn lane can be provided using the existing pavement that is already striped as a northbound left-turn lane. Additional signing and pavement markings may be needed in the area to instruct queued drivers not to block adjacent driveways and intersections. There is not a warranted need for a southbound right turn lane at this intersection, based on MoDOT access management guidelines. The existing pavement stub that will be converted to be the eastbound approach of this proposed intersection is currently 24 feet wide, which will accommodate two outgoing lanes. The proposed site plan allows for this four-lane section to be extended to the west to a point at which 350 feet of eastbound queue length is provided to the west of the existing railroad crossing gates.

The results of the existing plus development conditions intersection analyses are summarized on the next page in ***Table 5***. This study scenario assessed the street system with the addition of traffic generated by the proposed development, as well as the aforementioned intersection improvements. The study intersections were evaluated with the lane configurations, traffic volumes, and traffic control devices shown on ***Figures A-6*** through ***A-8***. The Synchro output files are included in ***Appendix C***.

Table 5
Intersection Operational Analysis
Existing plus Development Conditions

Intersection / *Movement*	A.M. Peak Hour LOS[1]	A.M. Peak Hour Delay[2]	P.M. Peak Hour LOS[1]	P.M. Peak Hour Delay[2]
31st Street and Noland Road				
Traffic Signal	A	4.4	A	4.5
33rd Street (Access Drive) and Noland Road				
Traffic Signal	A	5.0	A	5.6
35th Street and Noland Road				
Traffic Signal	C	24.3	C	30.8
35th Street and Lynn Court				
Eastbound Left Turn	A	8.0	A	8.4
Westbound Left Turn	A	0.0	A	0.0
Northbound	A	0.0	C	22.9
Southbound Left Turn	B	13.3	D	26.9
Southbound Through/Right Turn	A	9.7	B	11.0

1 – Level of Service
2 – Delay in seconds per vehicle

Table 5 shows that, with the addition of the traffic generated by the proposed development, all movements at the existing intersections within the study area are anticipated to operate at acceptable levels of service during the peak hours of traffic. Some increases in delay for the southbound movements at the intersection of 35th Street and Lynn Court are notable, but these movements are anticipated to operate at acceptable levels of service.

To accommodate the proposed truck route to the site, improvements are need at the 35th Street and Lynn Court intersection. The corner radius in the northeast corner of the intersection will need to be enlarged to accommodate truck turning movements. While not needed for capacity, it would be beneficial to widen 35th Street to provide a westbound right-turn lane at Lynn Court in conjunction with the intersection improvements. The turn lane would extend roughly 250 feet, to tie into the second westbound lane that currently terminates at an existing driveway.

The queue lengths of intersection approaches were reviewed for comparison with the lengths of existing turn lanes. The only queue that is anticipated to exceed the storage length of turn lanes is the eastbound left-turn movement at the intersection of 35th Street and Noland Road during the P.M. peak hour. This situation also occurs in the existing conditions scenario, and the proposed development is not anticipated to contribute to the traffic volumes for this movement.

Future Conditions

The results of the future conditions intersection analyses are summarized below in ***Table 6***. This study scenario assessed the study intersections with the addition of traffic generated by the proposed development, as well as assumed background traffic growth on the surrounding roadway network. A one percent annual growth rate was applied to the existing traffic volumes over the planning horizon. Development-generated traffic volumes were included in the future traffic volume projections, but a growth factor was not applied to these trips. The planning horizon was assumed to project to the year 2029, for purposes of this study. The study intersections were evaluated with the lane configurations, traffic volumes, and traffic control devices shown on ***Figures A-9*** through ***A-11***. The Synchro output files are included in ***Appendix C***.

Table 6
Intersection Operational Analysis
Future Conditions

Intersection	A.M. Peak Hour		P.M. Peak Hour	
Movement	LOS[1]	Delay[2]	LOS[1]	Delay[2]
31st Street and Noland Road				
Traffic Signal	A	4.6	A	4.9
33rd Street (Access Drive) and Noland Road				
Traffic Signal	A	4.8	A	5.3
35th Street and Noland Road				
Traffic Signal	C	25.2	C	32.6
35th Street and Lynn Court				
Eastbound Left Turn	A	8.0	A	8.6
Westbound Left Turn	A	0.0	A	0.0
Northbound	A	0.0	C	26.5
Southbound Left Turn	B	13.9	D	33.4
Southbound Through/Right Turn	A	9.8	B	11.3

1 – Level of Service
2 – Delay in seconds per vehicle

Table 6 shows that, with the addition of the traffic generated by the proposed development, as well as assumed planning horizon traffic growth to/from the surrounding roadway network, all movements at the existing intersections within the study area are anticipated to operate at acceptable levels of service during the peak hours of traffic.

As in the previous scenarios, queue lengths of intersection approaches were reviewed for comparison with the lengths of existing turn lanes. Again, the only queue that is anticipated to exceed the length of turn lanes is the eastbound left-turn movement at the intersection of 35th Street during the P.M. peak hour.

Summary

TranSystems has completed a traffic impact study for the proposed Cargo Largo warehouse and retail store development to be located generally along the west side of Noland Road, between 31st Street and 35th Street in Independence, Missouri. The purpose of this study was to assess the impact of the proposed development on the surrounding transportation system.

In the Existing Conditions scenario, all study intersections were found to operate at an acceptable level of service during the peak hours of traffic on the surrounding roadway network. Queuing for the eastbound left turn movement at the intersection of 35th Street and Noland Road can exceed the length of existing left-turn lane during the P.M. peak hour.

This study was prepared understanding that, upon implementation of the proposed site improvements, the existing pavement stub that sits 800 feet north of the intersection of 35th Street and Noland Road will be modified to be the primary point of access for the site, and will be referred to as 33rd Street. The following improvements are identified to accommodate traffic generated by the proposed development.

33rd Street and Noland Road

- Install a fully-actuated traffic signal that is coordinated with the other signals on the Noland Road corridor and provides railroad pre-emption control. Traffic signal infrastructure will include an eastbound pre-signal.
- Provide a northbound left-turn lane with a 200-foot storage length.
- Provide two outbound lanes in the eastbound direction.

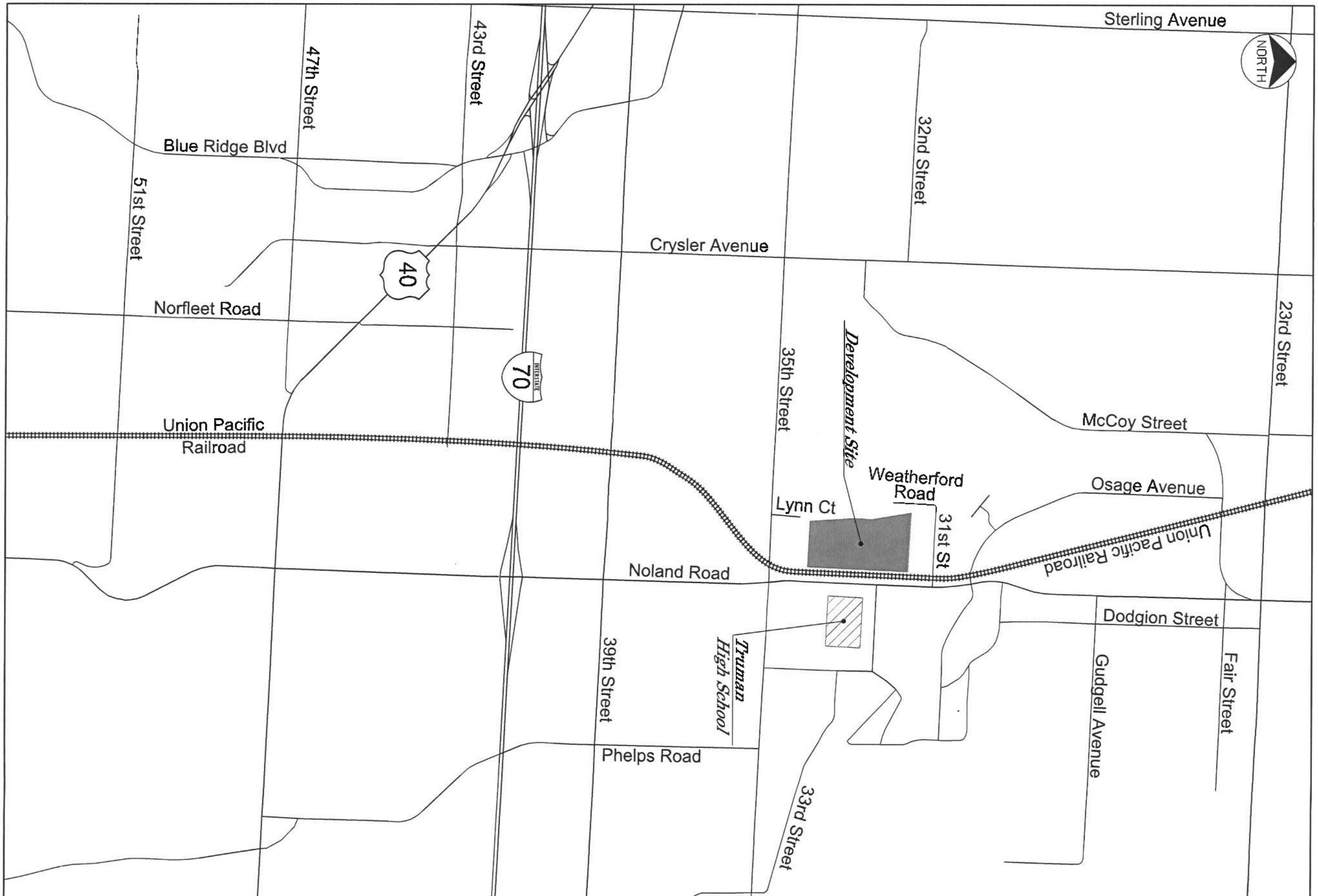
35th Street and Lynn Court

- Enlarge corner radius in the northeast corner to accommodate truck turning movements.
- Construct a westbound right-turn to extend roughly 250 feet, to tie into the second westbound lane that currently terminates at an existing driveway.

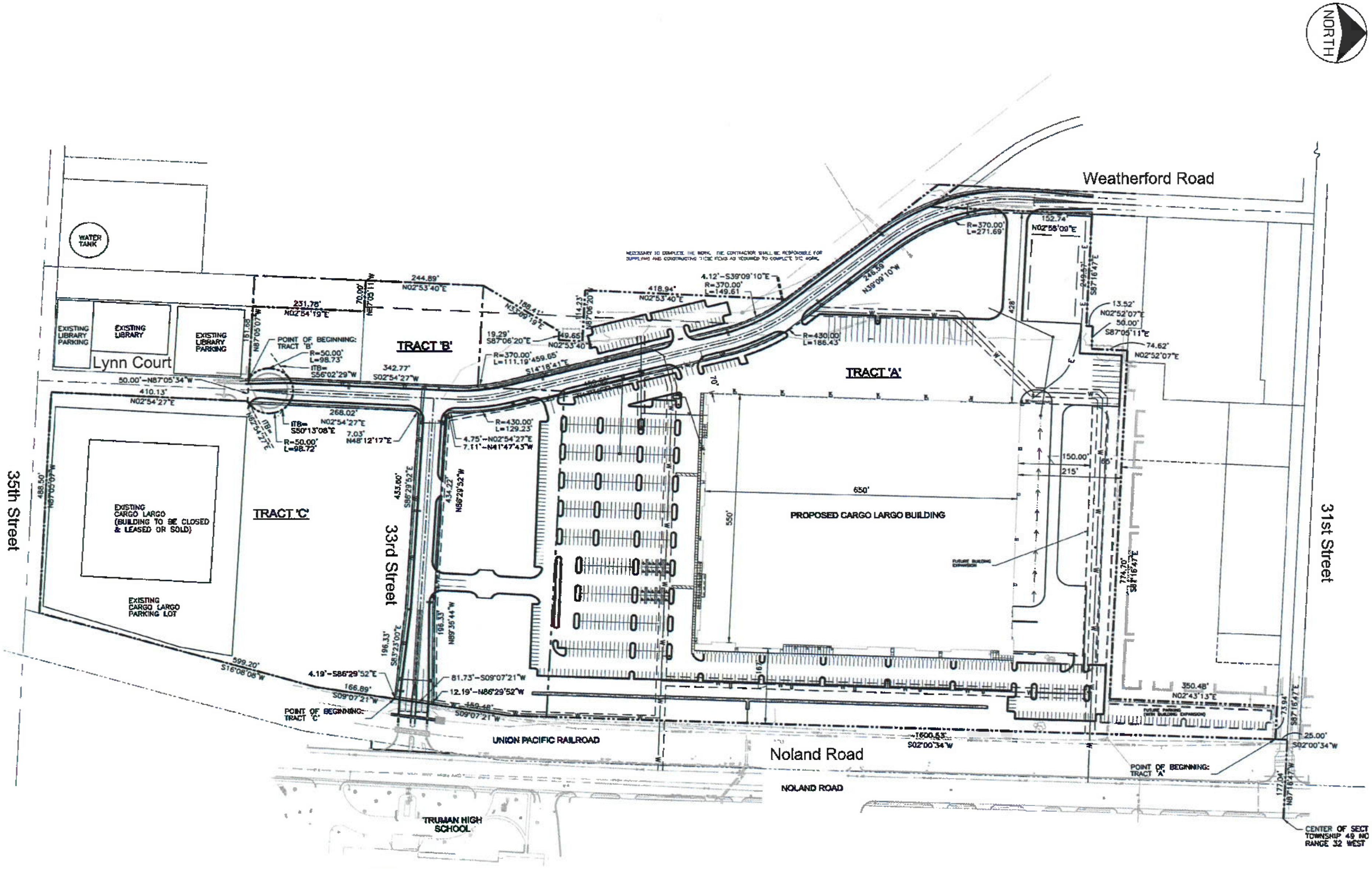
With the addition of traffic from the proposed development and the aforementioned improvements, all movements within the study intersections are projected to operate at an acceptable level of service during the peak hours. Queues for the eastbound left-turn movement are anticipated to continue to exceed the available storage at the intersection of 35th Street and Noland Road, but the proposed development will not add any traffic volume to this movement.

Appendix A - Figures

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



TranSystems | LOCATION MAP | Cargo Largo Traffic Impact Study Independence, Missouri | November 2018 No Scale | Figure A-1 pw:\\hq-pwint01.a-e.transyscorp.com:transyscorp-pw1\Documents\Projects_2018\KC101 - Kansas City\P101180167 - Cargo Largo\310.00 - Traffic\310.03 - Studies\figs_V8l_8.5x11



TranSystems	SITE PLAN	Cargo Largo Traffic Impact Study Independence, Missouri	November 2018 No Scale	Figure A-2

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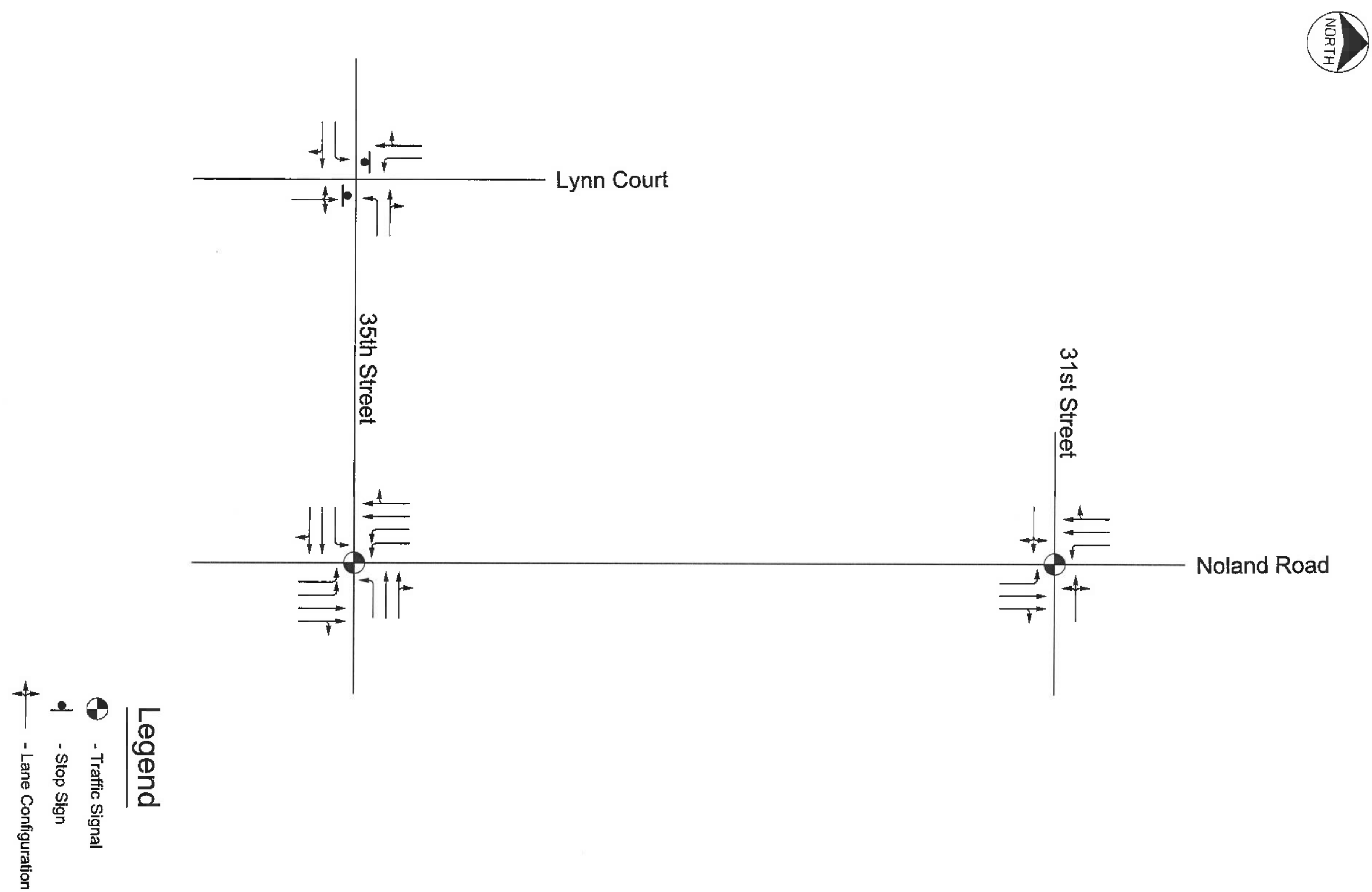

TranSystems

EXISTING LANE CONFIGURATIONS

Cargo Largo
Traffic Impact Study
Independence, Missouri

November 2018

No Scale

Figure A-3

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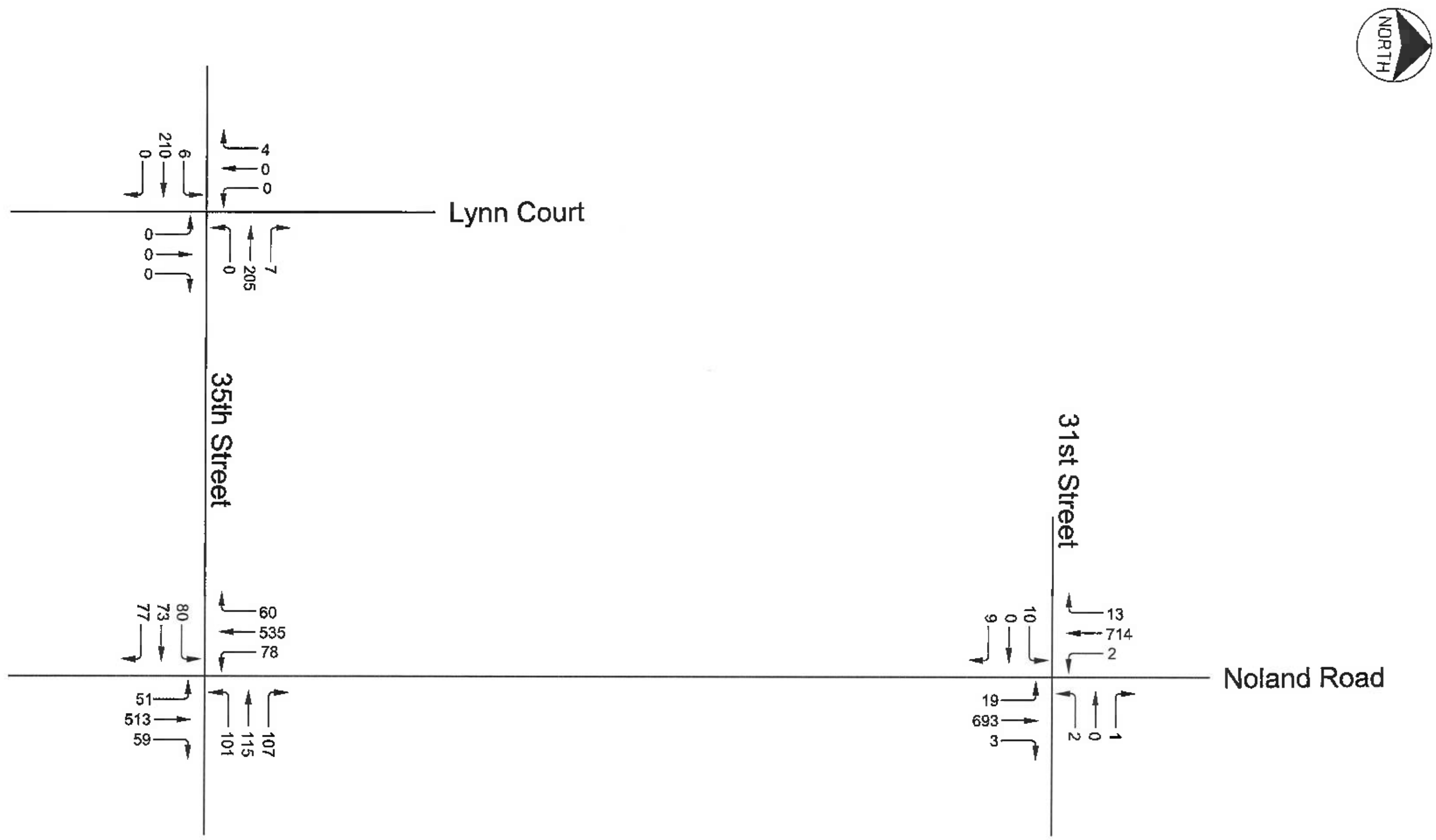

EXISTING A.M. PEAK HOUR
TRAFFIC VOLUMES

Cargo Largo
Traffic Impact Study
Independence, Missouri

November 2018

No Scale

Figure A-4

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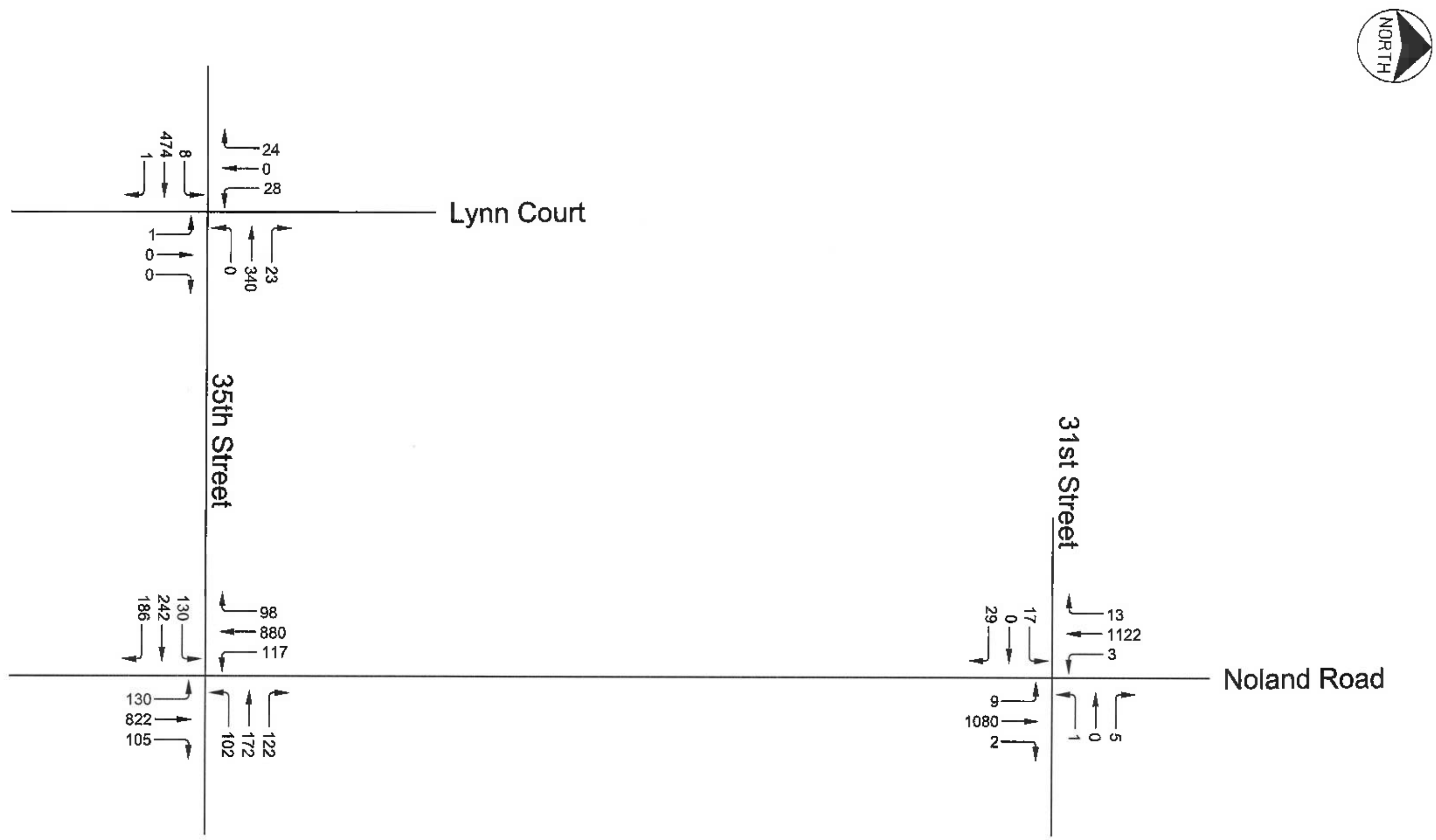


Tran Systems

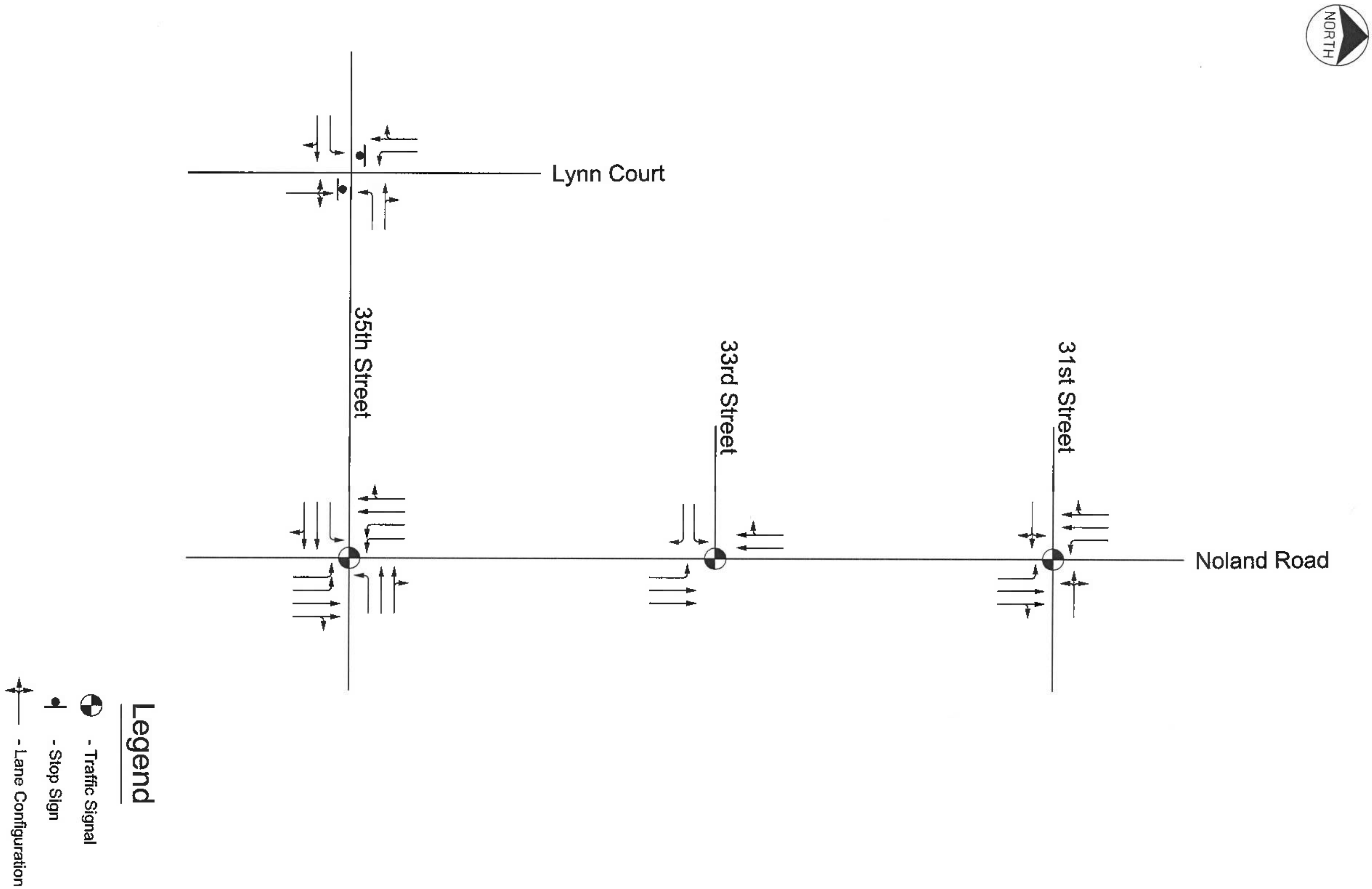
EXISTING P.M. PEAK HOUR
TRAFFIC VOLUMES

Cargo Largo
Traffic Impact Study
Independence, Missouri

November 2018

No Scale

Figure A-5



TranSystems

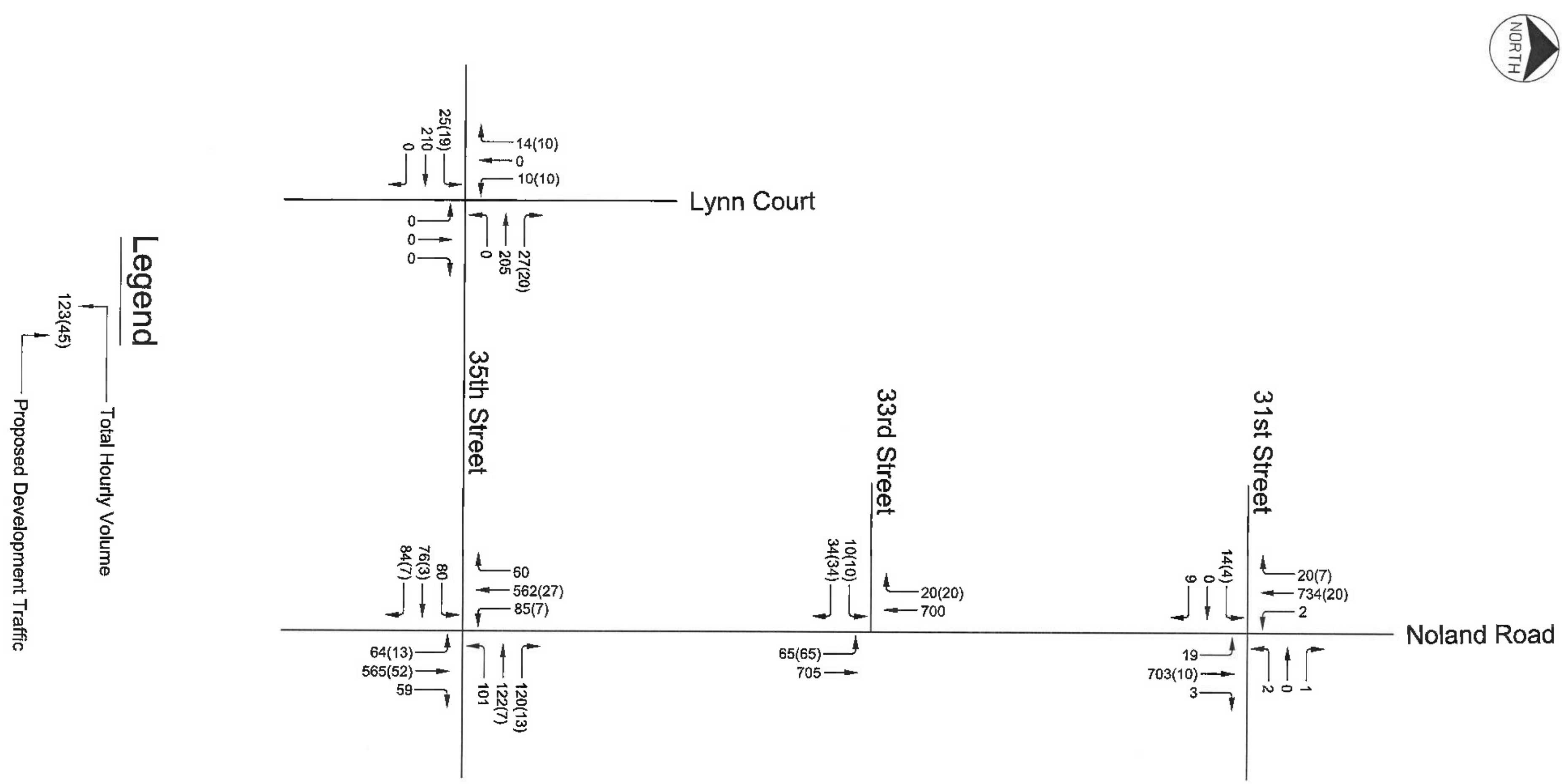
EXISTING PLUS DEVELOPMENT LANE CONFIGURATIONS

Cargo Largo
Traffic Impact Study
Independence, Missouri

November 2018

No Scale

Figure A-6



TranSystems

EXISTING PLUS DEVELOPMENT
A.M. PEAK HOUR TRAFFIC VOLUMES

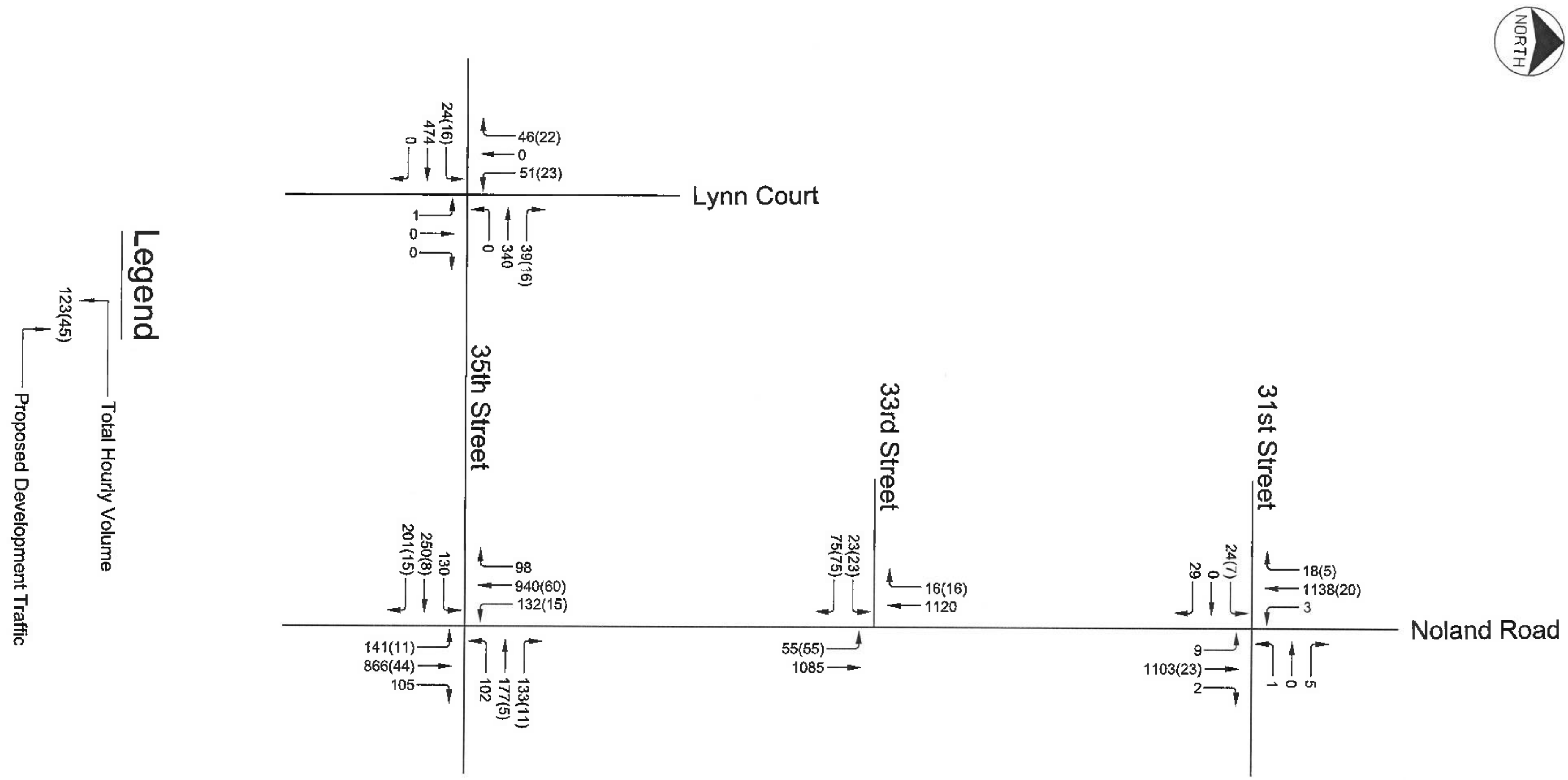
Cargo Largo
Traffic Impact Study
Independence, Missouri

November 2018

No Scale

Figure A-7

pw:\\hq-pwint01.a-e.transyscorp.com:transyscorp-pw1\Documents\Projects_2018\KC101 - Kansas City\P101180167 - Cargo Largo\310.00 - Traffic\310.03 - Studies\figs_V8_8.5x11



TranSystems

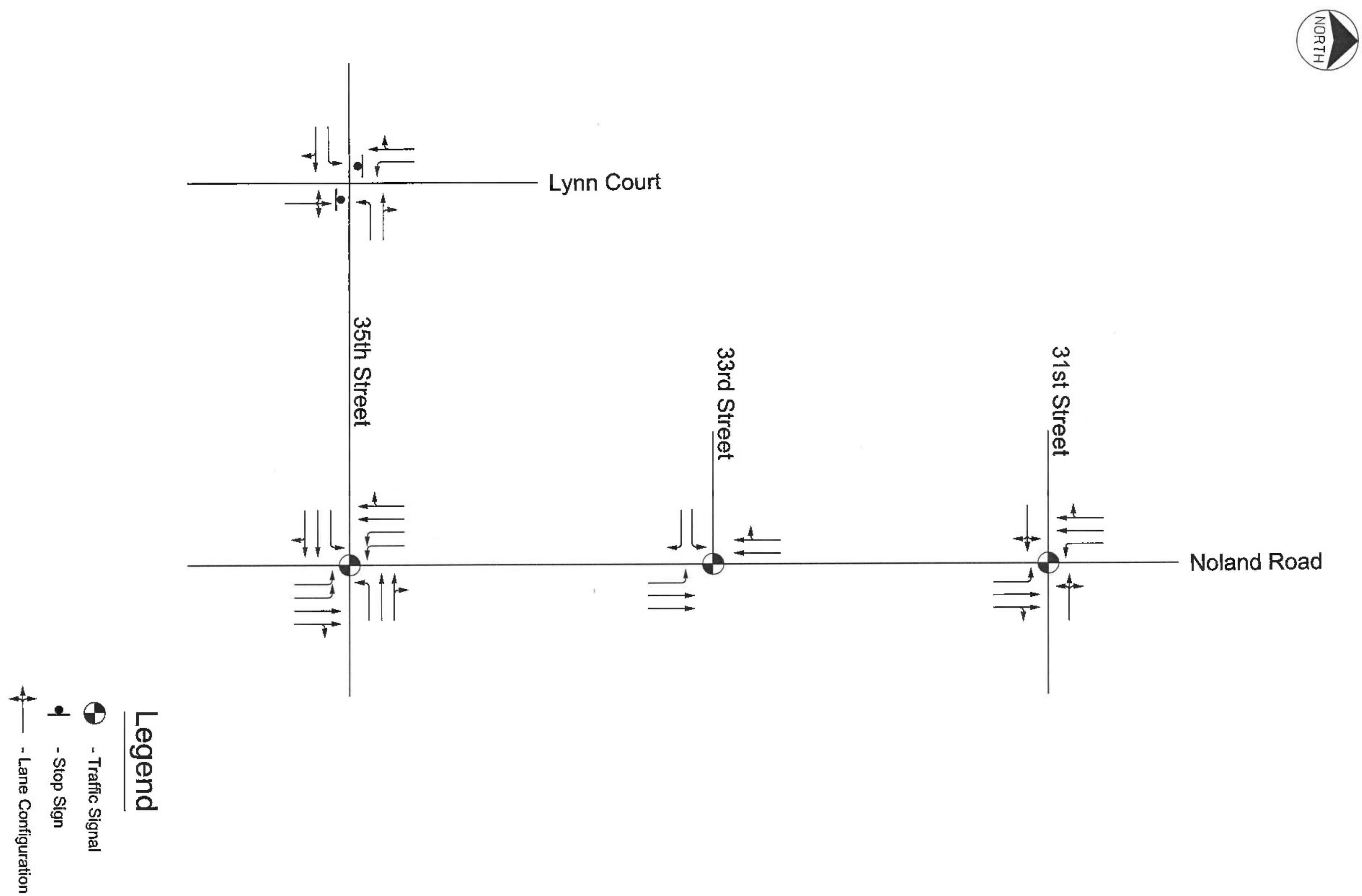
EXISTING PLUS DEVELOPMENT
P.M. PEAK HOUR TRAFFIC VOLUMES

Cargo Largo
Traffic Impact Study
Independence, Missouri

November 2018

No Scale

Figure A-8



TranSystems

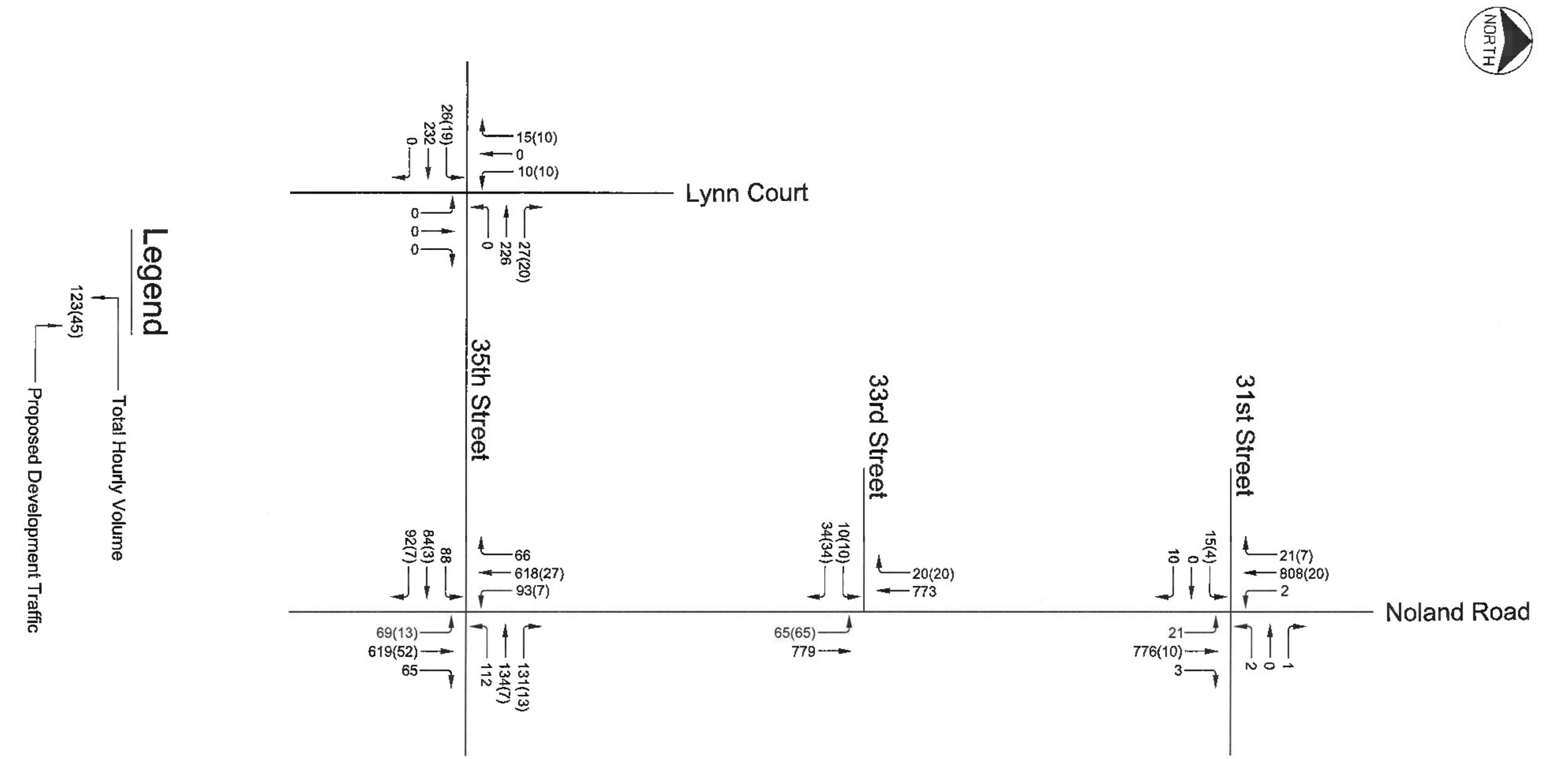
FUTURE LANE CONFIGURATIONS

Cargo Largo
Traffic Impact Study
Independence, Missouri

November 2018

No Scale

Figure A-9



TranSystems

FUTURE A.M. PEAK HOUR
TRAFFIC VOLUMES

Cargo Largo
Traffic Impact Study
Independence, Missouri

November 2018

No Scale

Figure A-10

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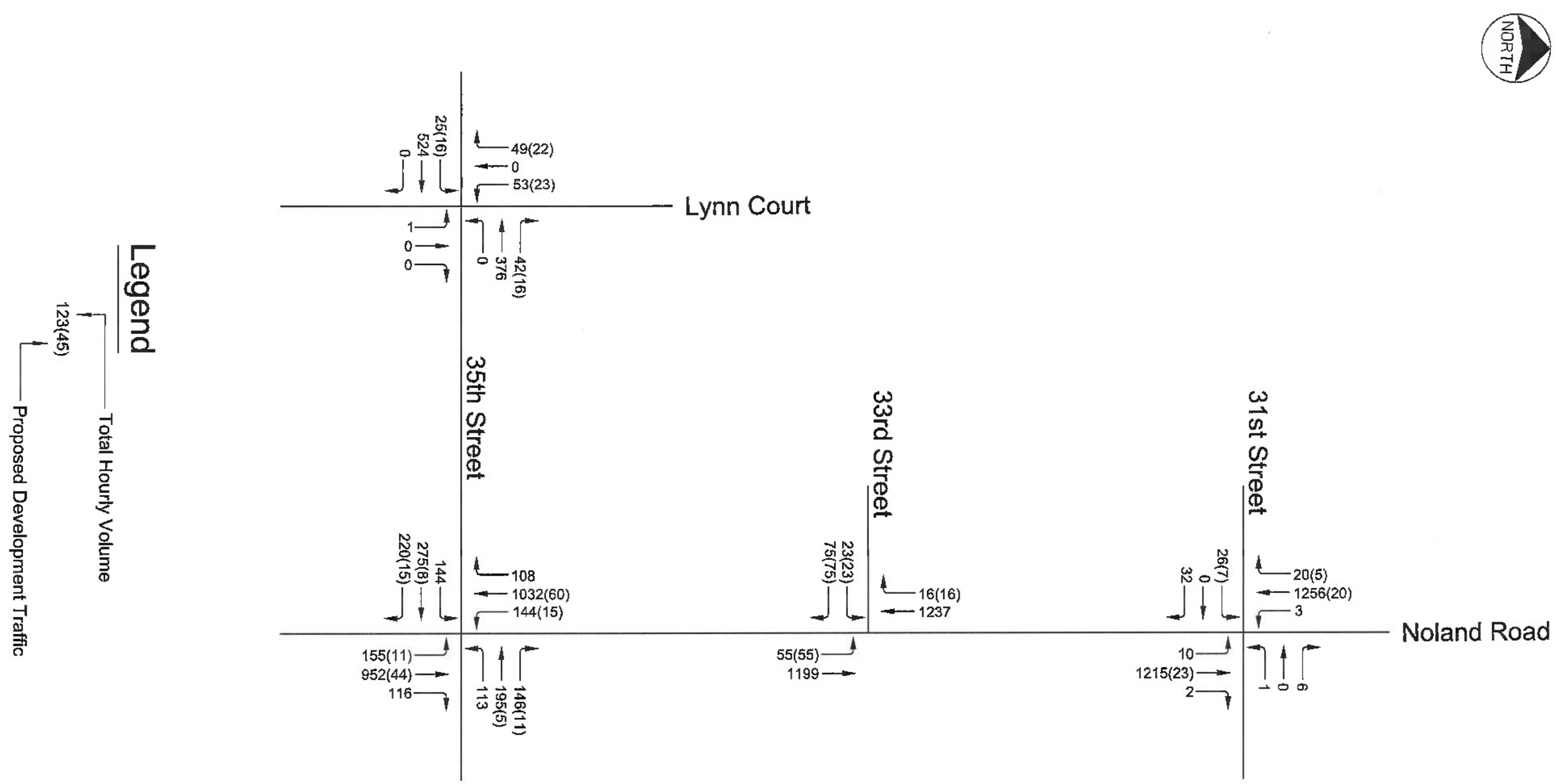


TranSystems

FUTURE P.M. PEAK HOUR
TRAFFIC VOLUMES

Cargo Largo
Traffic Impact Study
Independence, Missouri

November 2018

No Scale

Figure A-11

Appendix B – Trip Generation and Distribution

See attached worksheets.

Cargo Largo Traffic Impact Study

Independence, Missouri

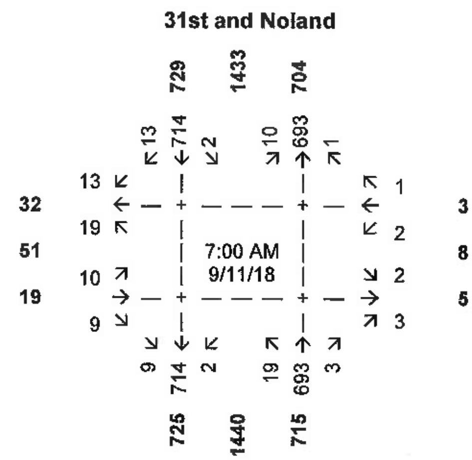
Trip Generation - Proposed Development

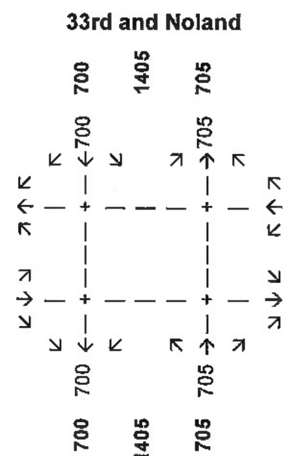
		ITE		A.M. Peak Hour					P.M. Peak Hour				
Land Use	**Intensity**	**Code**	**Daily**	**Total**	**% In**	**% Out**	**In**	**Out**	**Total**	**% In**	**% Out**	**In**	**Out**
Warehousing	485.2 ksf	150	812	84	77%	23%	65	19	87	27%	73%	24	63
Retail	73.4 ksf	862	2,256	115	57%	43%	66	49	172	49%	51%	85	87
	Total Development Trips		***3,068***	***199***			***131***	***68***	***259***			***109***	***150***

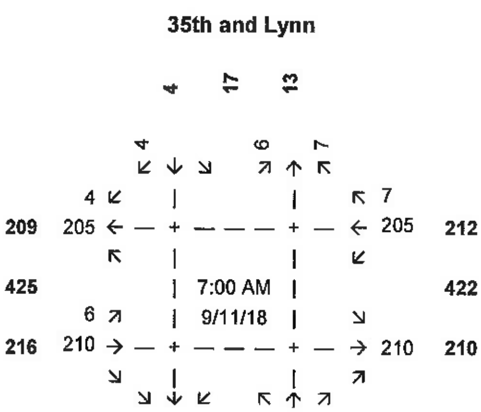
Trip generation estimates based on 10th edition; Office space has been grouped under the "Warehousing" land use, as allowed per land use description; Retail land use assessed as "Home Improvement Superstore", based on available similar sample sets

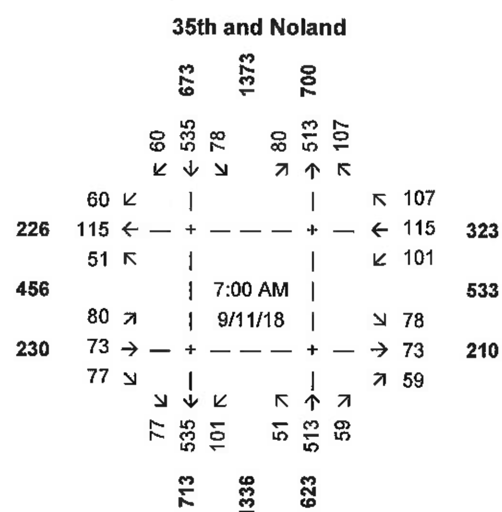
Cargo Largo Traffic Impact Study
Independence, Missouri

Existing Traffic Volumes
A.M. Peak Hour





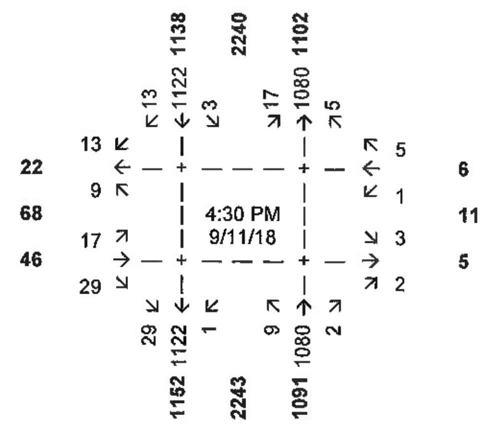




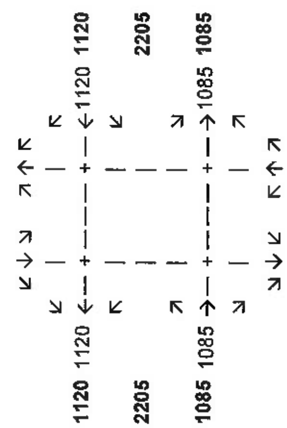
Cargo Largo Traffic Impact Study
Independence, Missouri

Existing Traffic Volumes
P.M. Peak Hour

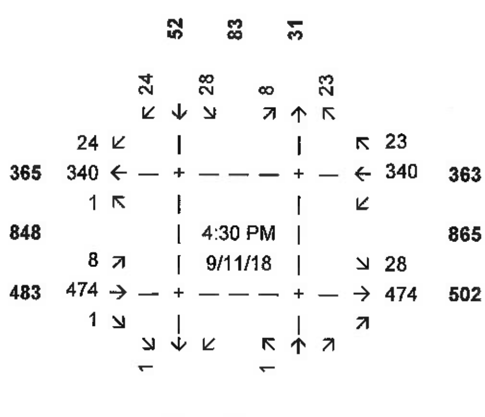
31st and Noland



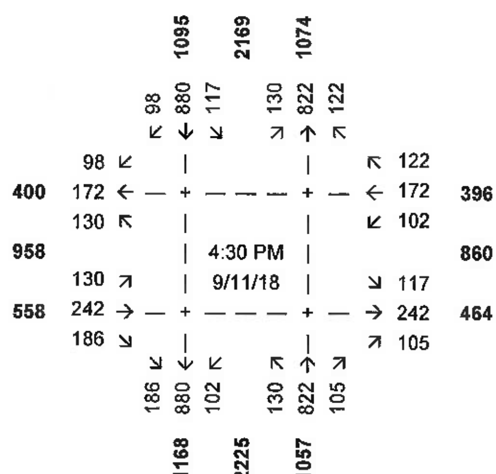
33rd and Noland



35th and Lynn



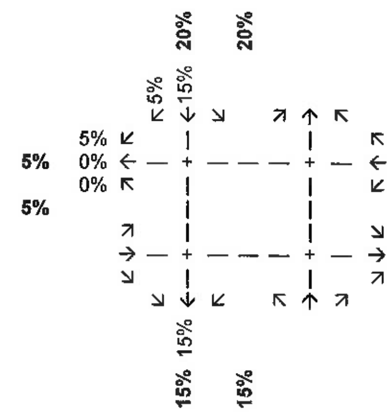
35th and Noland



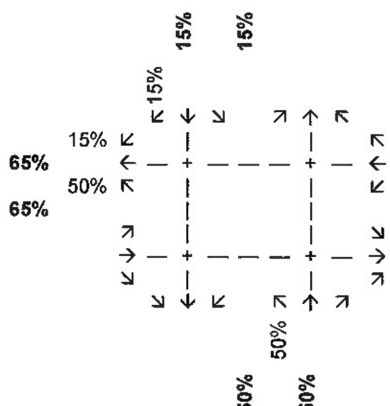
Cargo Largo Traffic Impact Study
Independence, Missouri

Trip Distribution
INBOUND

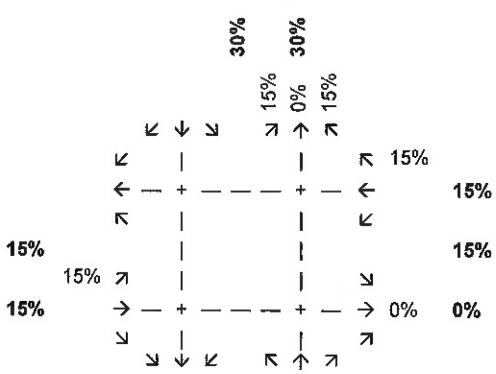
31st and Noland



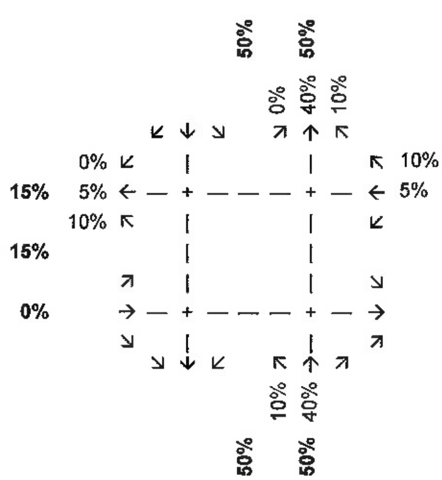
33rd and Noland



35th and Lynn



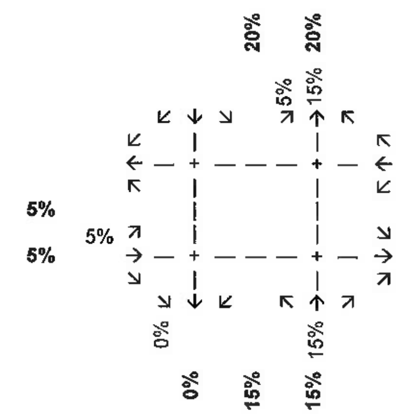
35th and Noland



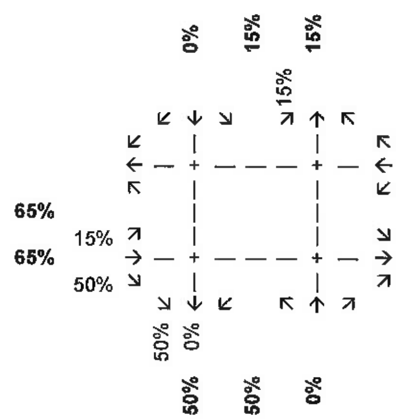
Cargo Largo Traffic Impact Study
Independence, Missouri

Trip Distribution
OUTBOUND

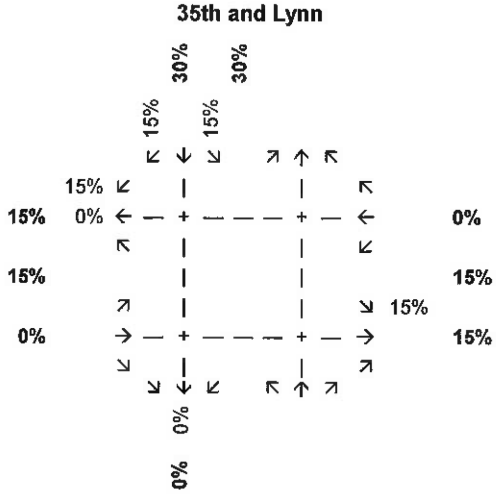
31st and Noland



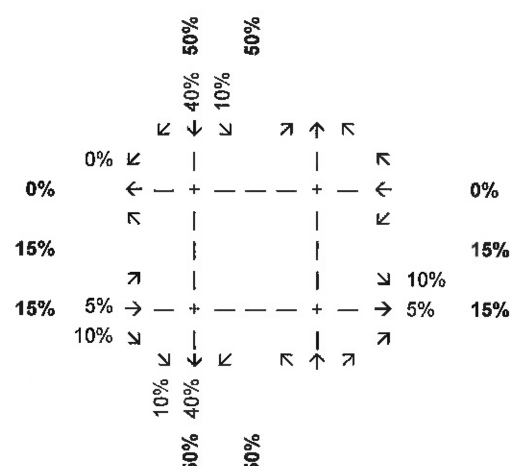
33rd and Noland



35th and Lynn



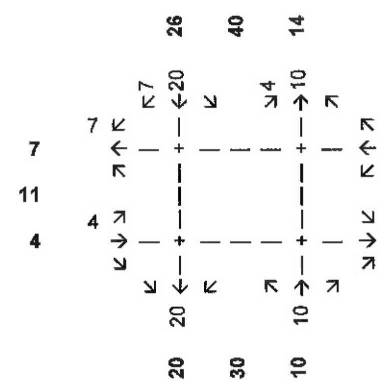
35th and Noland



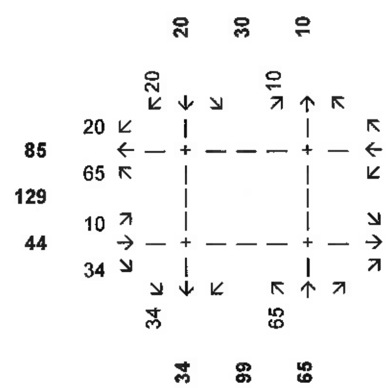
Cargo Largo Traffic Impact Study
Independence, Missouri

Development-Generated Traffic Volumes
A.M. Peak Hour

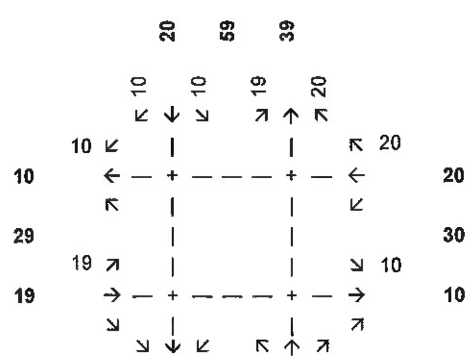
31st and Noland



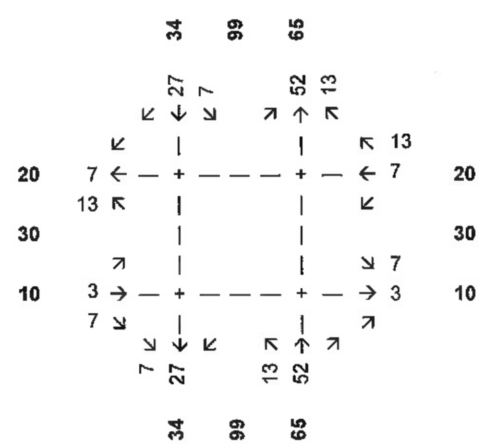
33rd and Noland



35th and Lynn

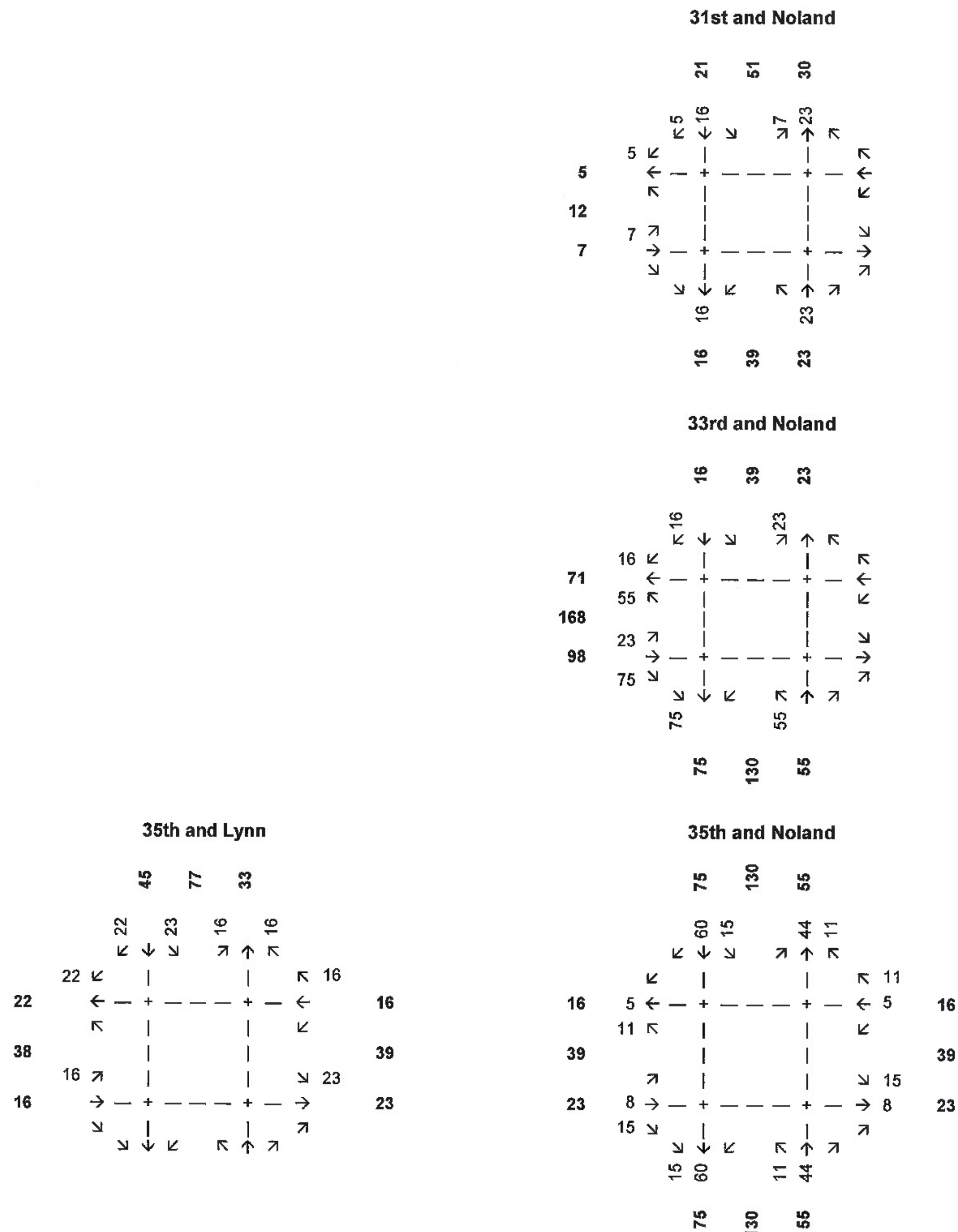


35th and Noland



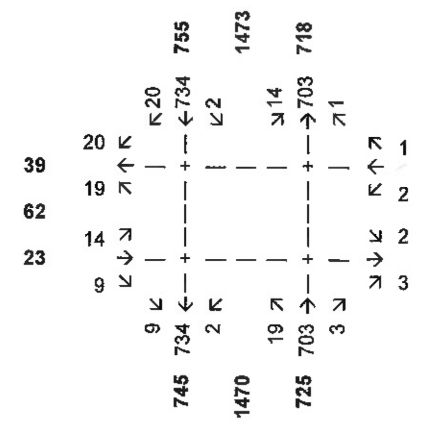
Cargo Largo Traffic Impact Study
Independence, Missouri

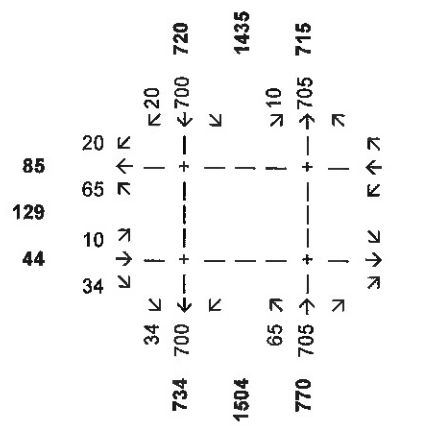
Development-Generated Traffic Volumes
P.M. Peak Hour

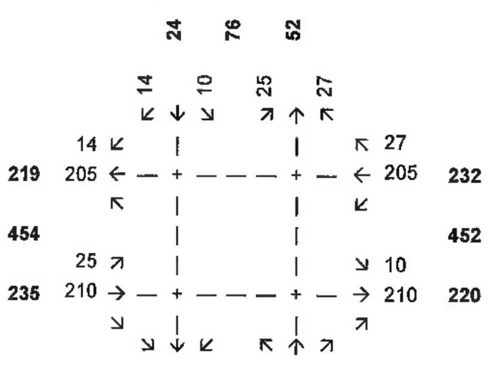


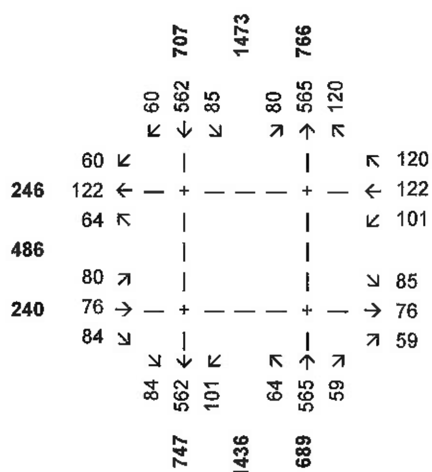
Cargo Largo Traffic Impact Study
Independence, Missouri

Existing + Development Traffic Volumes
A.M. Peak Hour





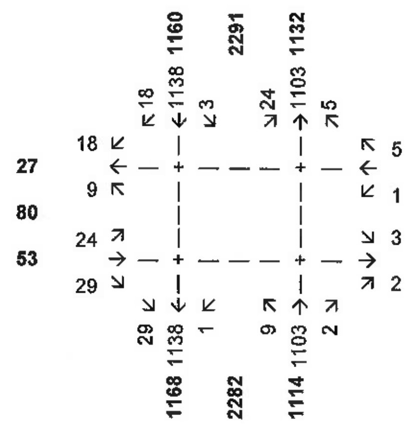




Cargo Largo Traffic Impact Study
Independence, Missouri

Existing + Development Traffic Volumes
P.M. Peak Hour

31st and Noland



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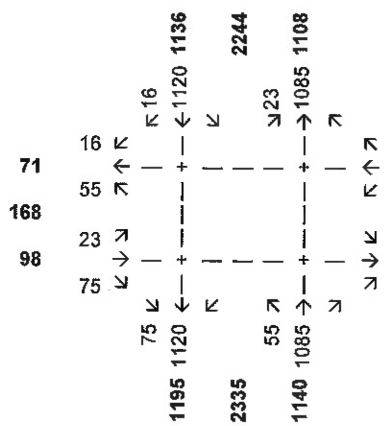
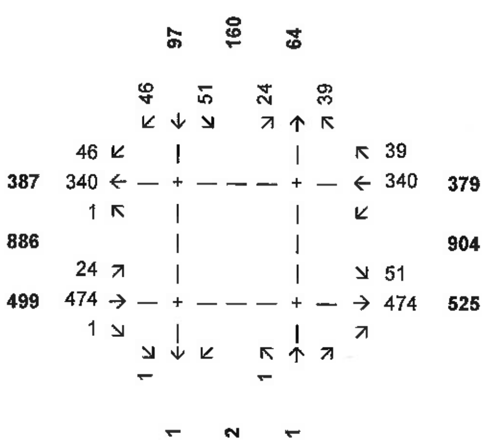
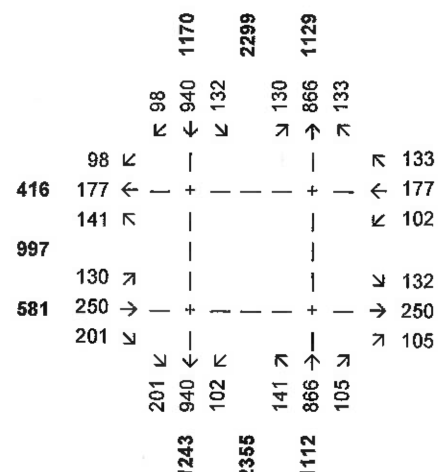


35th and Lynn

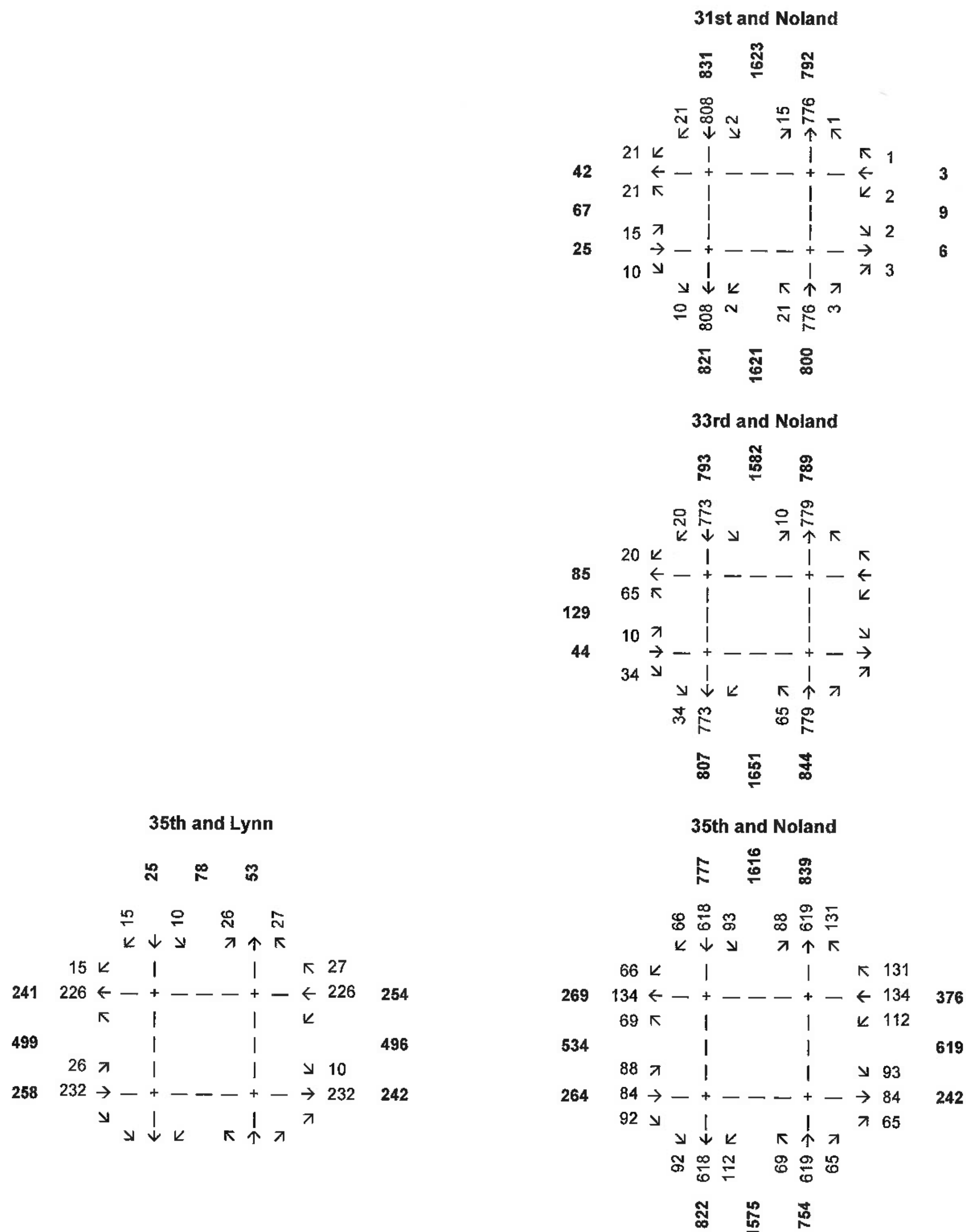


35th and Noland



Cargo Largo Traffic Impact Study
Independence, Missouri

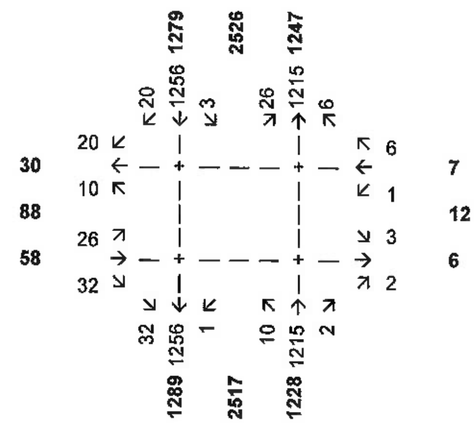
Future (Year 2029) Traffic Volumes
A.M. Peak Hour



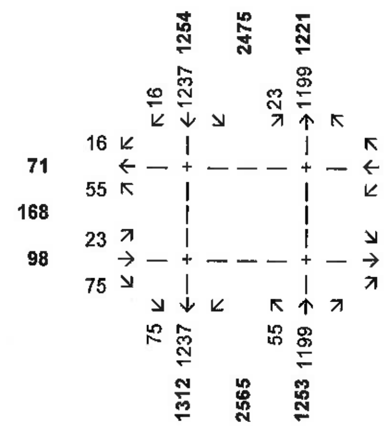
Cargo Largo Traffic Impact Study
Independence, Missouri

Future (Year 2029) Traffic Volumes
P.M. Peak Hour

31st and Noland



33rd and Noland



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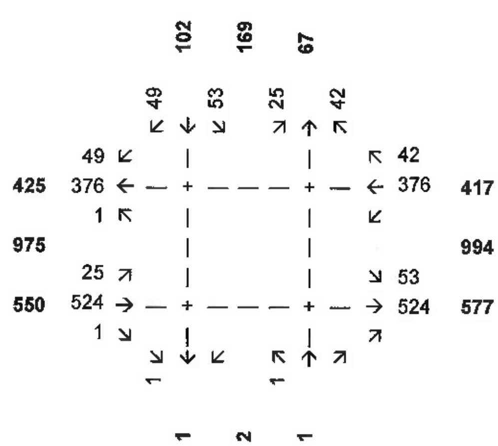

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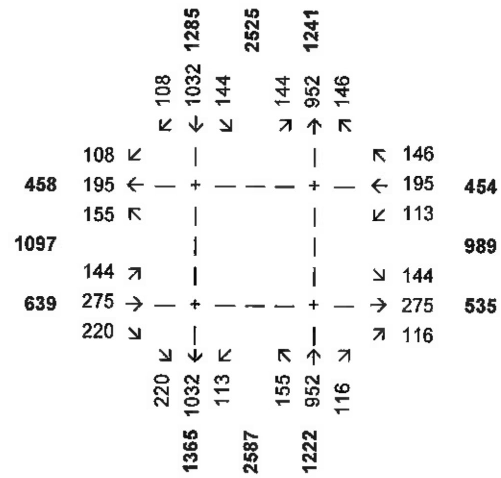
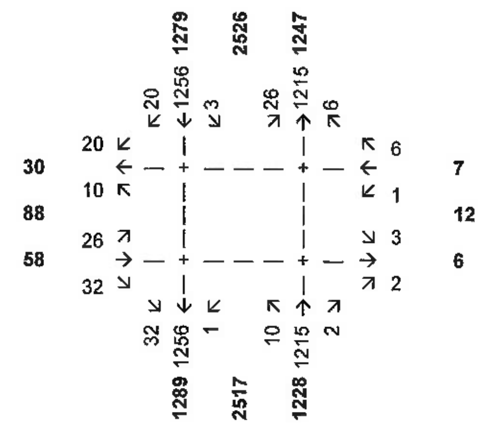


Cargo Largo Traffic Impact Study
Independence, Missouri

Future (Year 2029) Traffic Volumes
P.M. Peak Hour

31st and Noland



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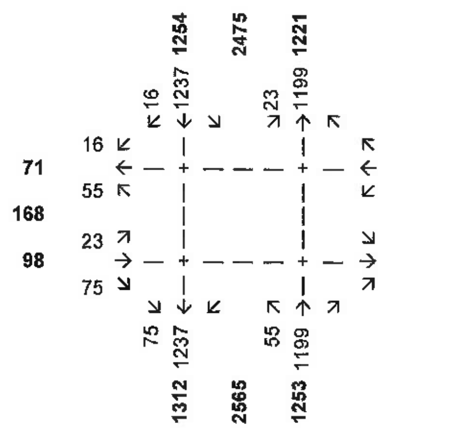

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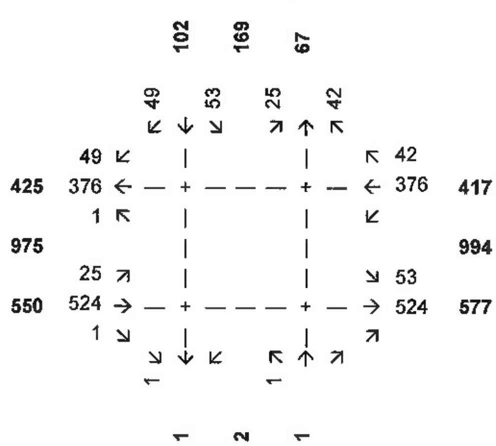

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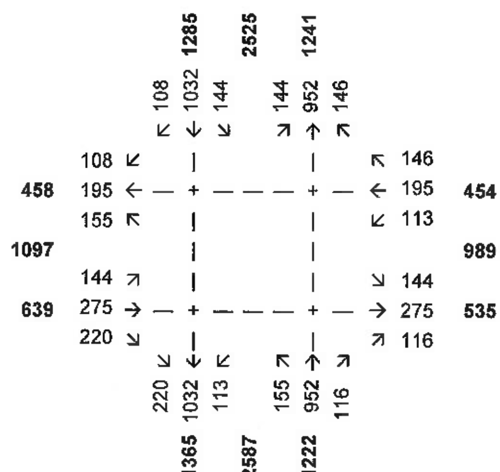
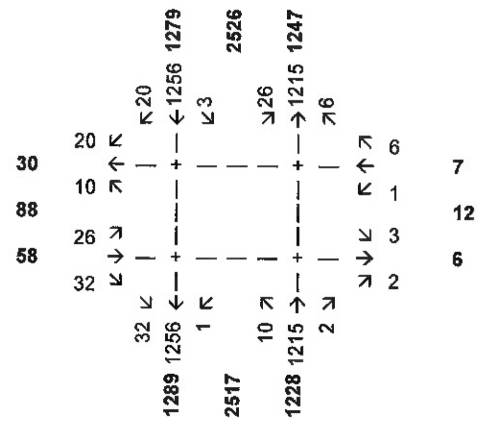


Cargo Largo Traffic Impact Study
Independence, Missouri

Future (Year 2029) Traffic Volumes
P.M. Peak Hour

31st and Noland



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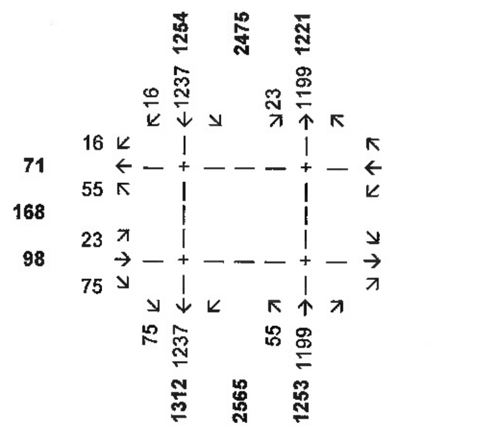
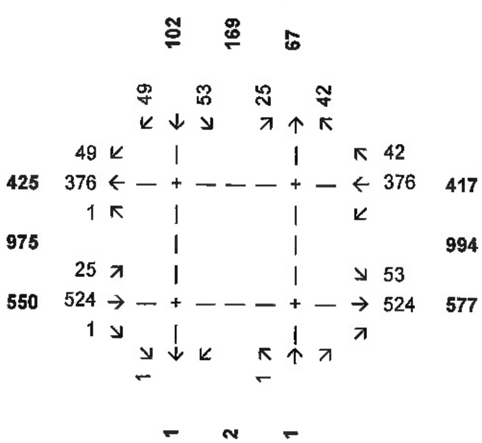
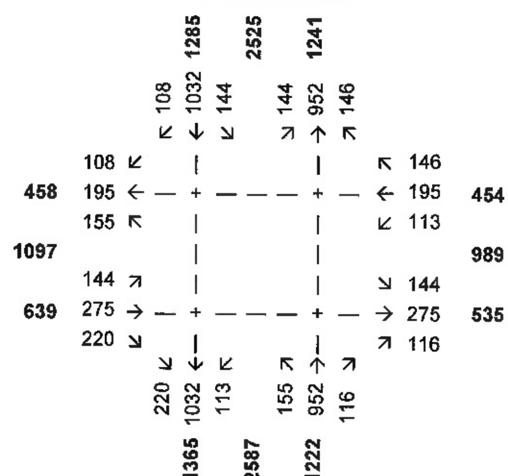


35th and Lynn



35th and Noland



Appendix C – Capacity Analysis Reports

See attached reports.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↑↱		↰	↑↱		↰↰	↑↱		↰↰	↑↱	
Traffic Volume (vph)	80	73	77	101	115	107	51	513	59	78	535	60
Future Volume (vph)	80	73	77	101	115	107	51	513	59	78	535	60
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.5	4.5		4.5	4.5		4.5	4.5		4.5	4.5	
Lane Util. Factor	1.00	0.95		1.00	0.95		0.97	0.95		0.97	0.95	
Frt	1.00	0.92		1.00	0.93		1.00	0.98		1.00	0.98	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	3266		1770	3284		3433	3485		3433	3486	
Flt Permitted	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (perm)	1770	3266		1770	3284		3433	3485		3433	3486	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	87	79	84	110	125	116	55	558	64	85	582	65
RTOR Reduction (vph)	0	77	0	0	103	0	0	5	0	0	5	0
Lane Group Flow (vph)	87	86	0	110	138	0	55	617	0	85	642	0
Turn Type	Prot	NA		Prot	NA		Prot	NA		Prot	NA	
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases												
Actuated Green, G (s)	9.4	9.3		12.1	12.0		6.1	63.7		6.9	64.5	
Effective Green, g (s)	9.4	9.3		12.1	12.0		6.1	63.7		6.9	64.5	
Actuated g/C Ratio	0.09	0.08		0.11	0.11		0.06	0.58		0.06	0.59	
Clearance Time (s)	4.5	4.5		4.5	4.5		4.5	4.5		4.5	4.5	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	151	276		194	358		190	2018		215	2044	
v/s Ratio Prot	0.05	0.03		c0.06	c0.04		0.02	0.18		c0.02	c0.18	
v/s Ratio Perm												
v/c Ratio	0.58	0.31		0.57	0.38		0.29	0.31		0.40	0.31	
Uniform Delay, d1	48.4	47.3		46.5	45.6		49.9	11.8		49.5	11.5	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		0.93	0.73	
Incremental Delay, d2	5.2	0.6		3.8	0.7		0.8	0.4		1.2	0.4	
Delay (s)	53.6	48.0		50.2	46.3		50.7	12.2		47.4	8.8	
Level of Service	D	D		D	D		D	B		D	A	
Approach Delay (s)		49.9			47.5			15.4			13.3	
Approach LOS		D			D			B			B	

Intersection Summary			
HCM 2000 Control Delay	24.5	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.37		
Actuated Cycle Length (s)	110.0	Sum of lost time (s)	18.0
Intersection Capacity Utilization	46.9%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↰↑↱			↰↑↱		↰	↑↑↱		↰	↑↑↱	
Traffic Volume (vph)	10	0	9	2	0	1	19	693	3	2	714	13
Future Volume (vph)	10	0	9	2	0	1	19	693	3	2	714	13
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.5			4.5		4.5	4.5		4.5	4.5	
Lane Util. Factor		1.00			1.00		1.00	0.95		1.00	0.95	
Frt		0.94			0.95		1.00	1.00		1.00	1.00	
Flt Protected		0.97			0.97		0.95	1.00		0.95	1.00	
Satd. Flow (prot)		1699			1722		1770	3537		1770	3530	
Flt Permitted		0.97			0.97		0.95	1.00		0.36	1.00	
Satd. Flow (perm)		1699			1722		1770	3537		680	3530	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	11	0	10	2	0	1	21	753	3	2	776	14
RTOR Reduction (vph)	0	21	0	0	3	0	0	0	0	0	0	0
Lane Group Flow (vph)	0	0	0	0	0	0	21	756	0	2	790	0
Turn Type	Split	NA		Split	NA		Prot	NA		Perm	NA	
Protected Phases	4	4		8	8		5	2			6	
Permitted Phases										6		
Actuated Green, G (s)		2.2			1.1		3.3	93.2		85.4	85.4	
Effective Green, g (s)		2.2			1.1		3.3	93.2		85.4	85.4	
Actuated g/C Ratio		0.02			0.01		0.03	0.85		0.78	0.78	
Clearance Time (s)		4.5			4.5		4.5	4.5		4.5	4.5	
Vehicle Extension (s)		3.0			3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)		33			17		53	2996		527	2740	
v/s Ratio Prot		c0.00			c0.00		0.01	c0.21			c0.22	
v/s Ratio Perm										0.00		
v/c Ratio		0.01			0.00		0.40	0.25		0.00	0.29	
Uniform Delay, d1		52.8			53.9		52.4	1.6		2.8	3.5	
Progression Factor		1.00			1.00		1.03	0.70		1.00	1.00	
Incremental Delay, d2		0.2			0.0		4.7	0.2		0.0	0.3	
Delay (s)		53.0			53.9		58.6	1.3		2.8	3.8	
Level of Service		D			D		E	A		A	A	
Approach Delay (s)		53.0			53.9			2.9			3.8	
Approach LOS		D			D			A			A	

Intersection Summary			
HCM 2000 Control Delay	4.1	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.28		
Actuated Cycle Length (s)	110.0	Sum of lost time (s)	18.0
Intersection Capacity Utilization	31.8%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↱		↰	↱			✥		↰	↱	
Traffic Volume (veh/h)	6	210	0	0	205	7	0	0	0	0	0	4
Future Volume (Veh/h)	6	210	0	0	205	7	0	0	0	0	0	4
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	7	228	0	0	223	8	0	0	0	0	0	4
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (ft)					866							
pX, platoon unblocked	0.97						0.97	0.97		0.97	0.97	0.97
vC, conflicting volume	231			228			469	473	228	469	469	227
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	198			228			442	446	228	442	442	193
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	99			100			100	100	100	100	100	100
cM capacity (veh/h)	1340			1340			508	492	811	510	494	826

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1	SB 1	SB 2
Volume Total	7	228	0	231	0	0	4
Volume Left	7	0	0	0	0	0	0
Volume Right	0	0	0	8	0	0	4
cSH	1340	1700	1700	1700	1700	1700	826
Volume to Capacity	0.01	0.13	0.00	0.14	0.00	0.00	0.00
Queue Length 95th (ft)	0	0	0	0	0	0	0
Control Delay (s)	7.7	0.0	0.0	0.0	0.0	0.0	9.4
Lane LOS	A				A	A	A
Approach Delay (s)	0.2		0.0		0.0	9.4	
Approach LOS					A	A	

Intersection Summary			
Average Delay	0.2		
Intersection Capacity Utilization	21.2%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	130	242	186	102	172	122	130	822	105	117	880	98
Future Volume (vph)	130	242	186	102	172	122	130	822	105	117	880	98
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.5	4.5		4.5	4.5		4.5	4.5		4.5	4.5	
Lane Util. Factor	1.00	0.95		1.00	0.95		0.97	0.95		0.97	0.95	
Frt	1.00	0.93		1.00	0.94		1.00	0.98		1.00	0.98	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	3309		1770	3319		3433	3479		3433	3486	
Flt Permitted	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (perm)	1770	3309		1770	3319		3433	3479		3433	3486	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	141	263	202	111	187	133	141	893	114	127	957	107
RTOR Reduction (vph)	0	135	0	0	116	0	0	8	0	0	7	0
Lane Group Flow (vph)	141	330	0	111	204	0	141	999	0	127	1057	0
Turn Type	Prot	NA		Prot	NA		Prot	NA		Prot	NA	
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases												
Actuated Green, G (s)	13.5	16.1		11.5	14.1		9.2	55.6		8.8	55.2	
Effective Green, g (s)	13.5	16.1		11.5	14.1		9.2	55.6		8.8	55.2	
Actuated g/C Ratio	0.12	0.15		0.10	0.13		0.08	0.51		0.08	0.50	
Clearance Time (s)	4.5	4.5		4.5	4.5		4.5	4.5		4.5	4.5	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	217	484		185	425		287	1758		274	1749	
v/s Ratio Prot	c0.08	c0.10		0.06	0.06		c0.04	0.29		0.04	c0.30	
v/s Ratio Perm												
v/c Ratio	0.65	0.68		0.60	0.48		0.49	0.57		0.46	0.60	
Uniform Delay, d1	46.0	44.5		47.1	44.5		48.2	18.9		48.3	19.6	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		0.97	0.84	
Incremental Delay, d2	6.6	3.9		5.2	0.9		1.3	1.3		1.2	1.5	
Delay (s)	52.6	48.5		52.2	45.4		49.5	20.2		47.9	18.0	
Level of Service	D	D		D	D		D	C		D	B	
Approach Delay (s)		49.4			47.2			23.8			21.2	
Approach LOS		D			D			C			C	

Intersection Summary			
HCM 2000 Control Delay	30.5	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.63		
Actuated Cycle Length (s)	110.0	Sum of lost time (s)	18.0
Intersection Capacity Utilization	64.9%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		✣			✣		↰	↑↱		↰	↑↱	
Traffic Volume (vph)	17	0	29	1	0	5	9	1080	2	3	1122	13
Future Volume (vph)	17	0	29	1	0	5	9	1080	2	3	1122	13
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.5			4.5		4.5	4.5		4.5	4.5	
Lane Util. Factor		1.00			1.00		1.00	0.95		1.00	0.95	
Frt		0.91			0.89		1.00	1.00		1.00	1.00	
Flt Protected		0.98			0.99		0.95	1.00		0.95	1.00	
Satd. Flow (prot)		1672			1640		1770	3538		1770	3533	
Flt Permitted		0.98			0.99		0.95	1.00		0.24	1.00	
Satd. Flow (perm)		1672			1640		1770	3538		448	3533	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	18	0	32	1	0	5	10	1174	2	3	1220	14
RTOR Reduction (vph)	0	48	0	0	6	0	0	0	0	0	0	0
Lane Group Flow (vph)	0	2	0	0	0	0	10	1176	0	3	1234	0
Turn Type	Split	NA		Split	NA		Prot	NA		Perm	NA	
Protected Phases	4	4		8	8		5	2			6	
Permitted Phases										6		
Actuated Green, G (s)		4.4			1.1		1.5	91.0		85.0	85.0	
Effective Green, g (s)		4.4			1.1		1.5	91.0		85.0	85.0	
Actuated g/C Ratio		0.04			0.01		0.01	0.83		0.77	0.77	
Clearance Time (s)		4.5			4.5		4.5	4.5		4.5	4.5	
Vehicle Extension (s)		3.0			3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)		66			16		24	2926		346	2730	
v/s Ratio Prot		c0.00			c0.00		0.01	c0.33			c0.35	
v/s Ratio Perm										0.01		
v/c Ratio		0.03			0.00		0.42	0.40		0.01	0.45	
Uniform Delay, d1		50.7			53.9		53.8	2.5		2.9	4.4	
Progression Factor		1.00			1.00		0.87	0.63		1.00	1.00	
Incremental Delay, d2		0.2			0.1		9.6	0.3		0.0	0.5	
Delay (s)		50.9			54.0		56.7	1.9		2.9	4.9	
Level of Service		D			D		E	A		A	A	
Approach Delay (s)		50.9			54.0			2.4			4.9	
Approach LOS		D			D			A			A	

Intersection Summary			
HCM 2000 Control Delay	4.7	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.43		
Actuated Cycle Length (s)	110.0	Sum of lost time (s)	18.0
Intersection Capacity Utilization	44.2%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	8	474	1	0	340	23	1	0	0	28	0	24
Future Volume (Veh/h)	8	474	1	0	340	23	1	0	0	28	0	24
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	9	515	1	0	370	25	1	0	0	30	0	26
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (ft)					866							
pX, platoon unblocked	0.93						0.93	0.93		0.93	0.93	0.93
vC, conflicting volume	395			516			930	928	516	916	916	382
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	312			516			887	886	516	872	873	299
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	99			100			100	100	100	88	100	96
cM capacity (veh/h)	1161			1050			236	262	559	251	266	689

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1	SB 1	SB 2
Volume Total	9	516	0	395	1	30	26
Volume Left	9	0	0	0	1	30	0
Volume Right	0	1	0	25	0	0	26
cSH	1161	1700	1700	1700	236	251	689
Volume to Capacity	0.01	0.30	0.00	0.23	0.00	0.12	0.04
Queue Length 95th (ft)	1	0	0	0	0	10	3
Control Delay (s)	8.1	0.0	0.0	0.0	20.3	21.3	10.4
Lane LOS	A				C	C	B
Approach Delay (s)	0.1		0.0		20.3	16.3	
Approach LOS					C	C	

Intersection Summary			
Average Delay	1.0		
Intersection Capacity Utilization	35.0%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	80	76	84	101	122	120	64	565	59	85	562	60
Future Volume (vph)	80	76	84	101	122	120	64	565	59	85	562	60
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.5	4.5		4.5	4.5		4.5	4.5		4.5	4.5	
Lane Util. Factor	1.00	0.95		1.00	0.95		0.97	0.95		0.97	0.95	
Frt	1.00	0.92		1.00	0.93		1.00	0.99		1.00	0.99	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	3262		1770	3277		3433	3489		3433	3488	
Flt Permitted	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (perm)	1770	3262		1770	3277		3433	3489		3433	3488	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	87	83	91	110	133	130	70	614	64	92	611	65
RTOR Reduction (vph)	0	83	0	0	115	0	0	5	0	0	5	0
Lane Group Flow (vph)	87	91	0	110	148	0	70	673	0	92	671	0
Turn Type	Prot	NA		Prot	NA		Prot	NA		Prot	NA	
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases												
Actuated Green, G (s)	9.4	9.6		12.1	12.3		6.5	63.2		7.1	63.8	
Effective Green, g (s)	9.4	9.6		12.1	12.3		6.5	63.2		7.1	63.8	
Actuated g/C Ratio	0.09	0.09		0.11	0.11		0.06	0.57		0.06	0.58	
Clearance Time (s)	4.5	4.5		4.5	4.5		4.5	4.5		4.5	4.5	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	151	284		194	366		202	2004		221	2023	
v/s Ratio Prot	0.05	0.03		c0.06	c0.05		0.02	c0.19		c0.03	0.19	
v/s Ratio Perm												
v/c Ratio	0.58	0.32		0.57	0.40		0.35	0.34		0.42	0.33	
Uniform Delay, d1	48.4	47.1		46.5	45.4		49.7	12.3		49.5	12.0	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		0.92	0.60	
Incremental Delay, d2	5.2	0.7		3.8	0.7		1.0	0.5		1.2	0.4	
Delay (s)	53.6	47.8		50.2	46.2		50.7	12.8		46.7	7.6	
Level of Service	D	D		D	D		D	B		D	A	
Approach Delay (s)		49.7			47.4			16.3			12.3	
Approach LOS		D			D			B			B	

Intersection Summary			
HCM 2000 Control Delay	24.3	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.39		
Actuated Cycle Length (s)	110.0	Sum of lost time (s)	18.0
Intersection Capacity Utilization	48.3%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	14	0	9	2	0	1	19	703	3	2	734	20
Future Volume (vph)	14	0	9	2	0	1	19	703	3	2	734	20
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.5			4.5		4.5	4.5		4.5	4.5	
Lane Util. Factor		1.00			1.00		1.00	0.95		1.00	0.95	
Frt		0.95			0.95		1.00	1.00		1.00	1.00	
Flt Protected		0.97			0.97		0.95	1.00		0.95	1.00	
Satd. Flow (prot)		1589			1722		1570	3537		1770	3513	
Flt Permitted		0.97			0.97		0.95	1.00		0.36	1.00	
Satd. Flow (perm)		1589			1722		1570	3537		672	3513	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	15	0	10	2	0	1	21	764	3	2	798	22
RTOR Reduction (vph)	0	24	0	0	3	0	0	0	0	0	1	0
Lane Group Flow (vph)	0	1	0	0	0	0	21	767	0	2	819	0
Heavy Vehicles (%)	15%	2%	2%	2%	2%	2%	15%	2%	2%	2%	2%	15%
Turn Type	Split	NA		Split	NA		Prot	NA		Perm	NA	
Protected Phases	4	4		8	8		5	2			6	
Permitted Phases										6		
Actuated Green, G (s)		3.3			1.1		3.4	92.1		84.2	84.2	
Effective Green, g (s)		3.3			1.1		3.4	92.1		84.2	84.2	
Actuated g/C Ratio		0.03			0.01		0.03	0.84		0.77	0.77	
Clearance Time (s)		4.5			4.5		4.5	4.5		4.5	4.5	
Vehicle Extension (s)		3.0			3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)		47			17		48	2961		514	2689	
v/s Ratio Prot		c0.00			c0.00		c0.01	0.22			c0.23	
v/s Ratio Perm										0.00		
v/c Ratio		0.02			0.00		0.44	0.26		0.00	0.30	
Uniform Delay, d1		51.8			53.9		52.4	1.9		3.0	3.9	
Progression Factor		1.00			1.00		0.99	0.67		1.00	1.00	
Incremental Delay, d2		0.1			0.0		6.2	0.2		0.0	0.3	
Delay (s)		51.9			53.9		57.9	1.5		3.0	4.2	
Level of Service		D			D		E	A		A	A	
Approach Delay (s)		51.9			53.9			3.0			4.2	
Approach LOS		D			D			A			A	

Intersection Summary			
HCM 2000 Control Delay	4.4	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.30		
Actuated Cycle Length (s)	110.0	Sum of lost time (s)	18.0
Intersection Capacity Utilization	32.6%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations	↰	↱	↰	↑↑	↑↱	
Traffic Volume (vph)	10	34	65	705	700	20
Future Volume (vph)	10	34	65	705	700	20
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.5	4.5	4.5	4.5	4.5	
Lane Util. Factor	1.00	1.00	1.00	0.95	0.95	
Frt	1.00	0.85	1.00	1.00	1.00	
Flt Protected	0.95	1.00	0.95	1.00	1.00	
Satd. Flow (prot)	1504	1346	1504	3539	3507	
Flt Permitted	0.95	1.00	0.95	1.00	1.00	
Satd. Flow (perm)	1504	1346	1504	3539	3507	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	11	37	71	766	761	22
RTOR Reduction (vph)	0	36	0	0	1	0
Lane Group Flow (vph)	11	1	71	766	782	0
Heavy Vehicles (%)	20%	20%	20%	2%	2%	20%
Turn Type	Prot	Perm	Prot	NA	NA	
Protected Phases	4		5	2	6	
Permitted Phases		4				
Actuated Green, G (s)	4.4	4.4	9.3	96.6	82.8	
Effective Green, g (s)	4.4	4.4	9.3	96.6	82.8	
Actuated g/C Ratio	0.04	0.04	0.08	0.88	0.75	
Clearance Time (s)	4.5	4.5	4.5	4.5	4.5	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	60	53	127	3107	2639	
v/s Ratio Prot	c0.01		c0.05	0.22	c0.22	
v/s Ratio Perm		0.00				
v/c Ratio	0.18	0.03	0.56	0.25	0.30	
Uniform Delay, d1	51.1	50.7	48.4	1.0	4.3	
Progression Factor	1.00	1.00	0.90	0.83	0.43	
Incremental Delay, d2	1.5	0.2	5.1	0.2	0.3	
Delay (s)	52.5	51.0	48.4	1.1	2.1	
Level of Service	D	D	D	A	A	
Approach Delay (s)	51.3			5.1	2.1	
Approach LOS	D			A	A	

Intersection Summary			
HCM 2000 Control Delay	5.0	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.32		
Actuated Cycle Length (s)	110.0	Sum of lost time (s)	13.5
Intersection Capacity Utilization	39.6%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	25	210	0	0	205	27	0	0	0	10	0	14
Future Volume (Veh/h)	25	210	0	0	205	27	0	0	0	10	0	14
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	27	228	0	0	223	29	0	0	0	11	0	15
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (ft)					866							
pX, platoon unblocked	0.97						0.97	0.97		0.97	0.97	0.97
vC, conflicting volume	252			228			520	534	228	520	520	238
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	212			228			489	503	228	488	488	197
tC, single (s)	4.2			4.1			7.1	6.5	6.2	7.2	6.7	6.4
tC, 2 stage (s)												
tF (s)	2.3			2.2			3.5	4.0	3.3	3.6	4.1	3.4
p0 queue free %	98			100			100	100	100	98	100	98
cM capacity (veh/h)	1245			1340			458	446	811	447	438	787

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1	SB 1	SB 2
Volume Total	27	228	0	252	0	11	15
Volume Left	27	0	0	0	0	11	0
Volume Right	0	0	0	29	0	0	15
cSH	1245	1700	1700	1700	1700	447	787
Volume to Capacity	0.02	0.13	0.00	0.15	0.00	0.02	0.02
Queue Length 95th (ft)	2	0	0	0	0	2	1
Control Delay (s)	8.0	0.0	0.0	0.0	0.0	13.3	9.7
Lane LOS	A				A	B	A
Approach Delay (s)	0.8		0.0		0.0	11.2	
Approach LOS					A	B	

Intersection Summary				
Average Delay	0.9			
Intersection Capacity Utilization	29.1%	ICU Level of Service	A	
Analysis Period (min)	15			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↑↱		↰	↑↱		↰↰	↑↱		↰↰	↑↱	
Traffic Volume (vph)	130	250	201	102	177	133	141	866	105	132	940	98
Future Volume (vph)	130	250	201	102	177	133	141	866	105	132	940	98
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.5	4.5		4.5	4.5		4.5	4.5		4.5	4.5	
Lane Util. Factor	1.00	0.95		1.00	0.95		*0.97	0.95		*0.97	0.95	
Frt	1.00	0.93		1.00	0.94		1.00	0.98		1.00	0.99	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	3303		1770	3311		3433	3482		3433	3489	
Flt Permitted	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (perm)	1770	3303		1770	3311		3433	3482		3433	3489	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	141	272	218	111	192	145	153	941	114	143	1022	107
RTOR Reduction (vph)	0	139	0	0	125	0	0	8	0	0	7	0
Lane Group Flow (vph)	141	351	0	111	212	0	153	1047	0	143	1122	0
Turn Type	Prot	NA		Prot	NA		Prot	NA		Prot	NA	
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases												
Actuated Green, G (s)	13.5	16.8		11.5	14.8		9.6	54.6		9.1	54.1	
Effective Green, g (s)	13.5	16.8		11.5	14.8		9.6	54.6		9.1	54.1	
Actuated g/C Ratio	0.12	0.15		0.10	0.13		0.09	0.50		0.08	0.49	
Clearance Time (s)	4.5	4.5		4.5	4.5		4.5	4.5		4.5	4.5	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	217	504		185	445		299	1728		284	1715	
v/s Ratio Prot	c0.08	c0.11		0.06	0.06		c0.04	0.30		0.04	c0.32	
v/s Ratio Perm												
v/c Ratio	0.65	0.70		0.60	0.48		0.51	0.61		0.50	0.65	
Uniform Delay, d1	46.0	44.2		47.1	44.0		48.0	20.0		48.3	20.9	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.10	0.73	
Incremental Delay, d2	6.6	4.2		5.2	0.8		1.5	1.6		1.3	1.8	
Delay (s)	52.6	48.4		52.2	44.8		49.4	21.5		54.6	17.2	
Level of Service	D	D		D	D		D	C		D	B	
Approach Delay (s)		49.3			46.6			25.1			21.4	
Approach LOS		D			D			C			C	

Intersection Summary			
HCM 2000 Control Delay	30.8	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.66		
Actuated Cycle Length (s)	110.0	Sum of lost time (s)	18.0
Intersection Capacity Utilization	67.3%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	24	0	29	1	0	5	9	1103	2	3	1138	18
Future Volume (vph)	24	0	29	1	0	5	9	1103	2	3	1138	18
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.5			4.5		4.5	4.5		4.5	4.5	
Lane Util. Factor		1.00			1.00		1.00	0.95		1.00	0.95	
Frt		0.93			0.89		1.00	1.00		1.00	1.00	
Flt Protected		0.98			0.99		0.95	1.00		0.95	1.00	
Satd. Flow (prot)		1595			1640		1570	3538		1770	3524	
Flt Permitted		0.98			0.99		0.95	1.00		0.23	1.00	
Satd. Flow (perm)		1595			1640		1570	3538		437	3524	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	26	0	32	1	0	5	10	1199	2	3	1237	20
RTOR Reduction (vph)	0	56	0	0	6	0	0	0	0	0	0	0
Lane Group Flow (vph)	0	2	0	0	0	0	10	1201	0	3	1257	0
Heavy Vehicles (%)	15%	2%	2%	2%	2%	2%	15%	2%	2%	2%	2%	15%
Turn Type	Split	NA		Split	NA		Prot	NA		Perm	NA	
Protected Phases	4	4		8	8		5	2			6	
Permitted Phases										6		
Actuated Green, G (s)		4.5			1.1		1.5	90.9		84.9	84.9	
Effective Green, g (s)		4.5			1.1		1.5	90.9		84.9	84.9	
Actuated g/C Ratio		0.04			0.01		0.01	0.83		0.77	0.77	
Clearance Time (s)		4.5			4.5		4.5	4.5		4.5	4.5	
Vehicle Extension (s)		3.0			3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)		65			16		21	2923		337	2719	
v/s Ratio Prot		c0.00			c0.00		0.01	c0.34			c0.36	
v/s Ratio Perm										0.01		
v/c Ratio		0.04			0.00		0.48	0.41		0.01	0.46	
Uniform Delay, d1		50.7			53.9		53.9	2.5		2.9	4.5	
Progression Factor		1.00			1.00		1.39	0.15		1.00	1.00	
Incremental Delay, d2		0.2			0.1		15.2	0.4		0.0	0.6	
Delay (s)		50.9			54.0		89.9	0.8		2.9	5.0	
Level of Service		D			D		F	A		A	A	
Approach Delay (s)		50.9			54.0			1.5			5.0	
Approach LOS		D			D			A			A	

Intersection Summary			
HCM 2000 Control Delay	4.5	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.44		
Actuated Cycle Length (s)	110.0	Sum of lost time (s)	18.0
Intersection Capacity Utilization	46.5%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	23	75	55	1085	1120	16
Future Volume (vph)	23	75	55	1085	1120	16
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.5	4.5	4.5	4.5	4.5	
Lane Util. Factor	1.00	1.00	1.00	0.95	0.95	
Frt	1.00	0.85	1.00	1.00	1.00	
Flt Protected	0.95	1.00	0.95	1.00	1.00	
Satd. Flow (prot)	1504	1346	1504	3539	3523	
Flt Permitted	0.95	1.00	0.95	1.00	1.00	
Satd. Flow (perm)	1504	1346	1504	3539	3523	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	25	82	60	1179	1217	17
RTOR Reduction (vph)	0	77	0	0	1	0
Lane Group Flow (vph)	25	5	60	1179	1233	0
Heavy Vehicles (%)	20%	20%	20%	2%	2%	20%
Turn Type	Prot	Perm	Prot	NA	NA	
Protected Phases	4		5	2	6	
Permitted Phases		4				
Actuated Green, G (s)	6.6	6.6	8.6	94.4	81.3	
Effective Green, g (s)	6.6	6.6	8.6	94.4	81.3	
Actuated g/C Ratio	0.06	0.06	0.08	0.86	0.74	
Clearance Time (s)	4.5	4.5	4.5	4.5	4.5	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	90	80	117	3037	2603	
v/s Ratio Prot	c0.02		c0.04	0.33	c0.35	
v/s Ratio Perm		0.00				
v/c Ratio	0.28	0.06	0.51	0.39	0.47	
Uniform Delay, d1	49.4	48.8	48.7	1.7	5.8	
Progression Factor	1.00	1.00	1.00	0.73	0.50	
Incremental Delay, d2	1.7	0.3	3.1	0.3	0.6	
Delay (s)	51.1	49.1	51.5	1.5	3.5	
Level of Service	D	D	D	A	A	
Approach Delay (s)	49.6			3.9	3.5	
Approach LOS	D			A	A	

Intersection Summary			
HCM 2000 Control Delay	5.6	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.46		
Actuated Cycle Length (s)	110.0	Sum of lost time (s)	13.5
Intersection Capacity Utilization	51.1%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	24	474	1	0	340	39	1	0	0	51	0	46
Future Volume (Veh/h)	24	474	1	0	340	39	1	0	0	51	0	46
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	26	515	1	0	370	42	1	0	0	55	0	50
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (ft)					866							
pX, platoon unblocked	0.93						0.93	0.93		0.93	0.93	0.93
vC, conflicting volume	412			516			988	980	516	958	959	391
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	326			516			947	939	516	915	916	304
tC, single (s)	4.2			4.1			7.1	6.5	6.2	7.2	6.5	6.4
tC, 2 stage (s)												
tF (s)	2.3			2.2			3.5	4.0	3.3	3.6	4.0	3.4
p0 queue free %	98			100			100	100	100	75	100	92
cM capacity (veh/h)	1079			1050			203	239	559	219	246	655

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1	SB 1	SB 2
Volume Total	26	516	0	412	1	55	50
Volume Left	26	0	0	0	1	55	0
Volume Right	0	1	0	42	0	0	50
cSH	1079	1700	1700	1700	203	219	655
Volume to Capacity	0.02	0.30	0.00	0.24	0.00	0.25	0.08
Queue Length 95th (ft)	2	0	0	0	0	24	6
Control Delay (s)	8.4	0.0	0.0	0.0	22.9	26.9	11.0
Lane LOS	A				C	D	B
Approach Delay (s)	0.4		0.0		22.9	19.3	
Approach LOS					C	C	

Intersection Summary			
Average Delay	2.1		
Intersection Capacity Utilization	35.0%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↑↱		↰	↑↱		↰↰	↑↱		↰↰	↑↱	
Traffic Volume (vph)	88	84	92	112	134	131	69	619	65	93	618	66
Future Volume (vph)	88	84	92	112	134	131	69	619	65	93	618	66
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.5	4.5		4.5	4.5		4.5	4.5		4.5	4.5	
Lane Util. Factor	1.00	0.95		1.00	0.95		0.97	0.95		0.97	0.95	
Frt	1.00	0.92		1.00	0.93		1.00	0.99		1.00	0.99	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	3261		1770	3277		3433	3489		3433	3488	
Flt Permitted	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (perm)	1770	3261		1770	3277		3433	3489		3433	3488	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	96	91	100	122	146	142	75	673	71	101	672	72
RTOR Reduction (vph)	0	92	0	0	128	0	0	5	0	0	5	0
Lane Group Flow (vph)	96	99	0	122	160	0	75	739	0	101	739	0
Turn Type	Prot	NA		Prot	NA		Prot	NA		Prot	NA	
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases												
Actuated Green, G (s)	11.3	8.9		12.9	10.5		6.6	61.6		8.6	63.6	
Effective Green, g (s)	11.3	8.9		12.9	10.5		6.6	61.6		8.6	63.6	
Actuated g/C Ratio	0.10	0.08		0.12	0.10		0.06	0.56		0.08	0.58	
Clearance Time (s)	4.5	4.5		4.5	4.5		4.5	4.5		4.5	4.5	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	181	263		207	312		205	1953		268	2016	
v/s Ratio Prot	0.05	0.03		c0.07	c0.05		0.02	0.21		c0.03	c0.21	
v/s Ratio Perm												
v/c Ratio	0.53	0.38		0.59	0.51		0.37	0.38		0.38	0.37	
Uniform Delay, d1	46.8	47.9		46.0	47.3		49.7	13.5		48.2	12.4	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		0.98	0.63	
Incremental Delay, d2	3.0	0.9		4.2	1.4		1.1	0.6		0.9	0.5	
Delay (s)	49.8	48.8		50.3	48.7		50.8	14.1		48.0	8.3	
Level of Service	D	D		D	D		D	B		D	A	
Approach Delay (s)		49.2			49.2			17.4			13.1	
Approach LOS		D			D			B			B	

Intersection Summary			
HCM 2000 Control Delay	25.2	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.43		
Actuated Cycle Length (s)	110.0	Sum of lost time (s)	18.0
Intersection Capacity Utilization	51.1%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		✣			✣		↰	↑↱		↰	↑↱	
Traffic Volume (vph)	15	0	10	2	0	1	21	776	3	2	808	21
Future Volume (vph)	15	0	10	2	0	1	21	776	3	2	808	21
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.5			4.5		4.5	4.5		4.5	4.5	
Lane Util. Factor		1.00			1.00		1.00	0.95		1.00	0.95	
Frt		0.94			0.95		1.00	1.00		1.00	1.00	
Flt Protected		0.97			0.97		0.95	1.00		0.95	1.00	
Satd. Flow (prot)		1590			1722		1570	3537		1770	3514	
Flt Permitted		0.97			0.97		0.95	1.00		0.33	1.00	
Satd. Flow (perm)		1590			1722		1570	3537		622	3514	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	16	0	11	2	0	1	23	843	3	2	878	23
RTOR Reduction (vph)	0	26	0	0	3	0	0	0	0	0	1	0
Lane Group Flow (vph)	0	1	0	0	0	0	23	846	0	2	900	0
Heavy Vehicles (%)	15%	2%	2%	2%	2%	2%	15%	2%	2%	2%	2%	15%
Turn Type	Split	NA		Split	NA		Prot	NA		Perm	NA	
Protected Phases	4	4		8	8		5	2			6	
Permitted Phases										6		
Actuated Green, G (s)		3.3			1.1		3.5	92.1		84.1	84.1	
Effective Green, g (s)		3.3			1.1		3.5	92.1		84.1	84.1	
Actuated g/C Ratio		0.03			0.01		0.03	0.84		0.76	0.76	
Clearance Time (s)		4.5			4.5		4.5	4.5		4.5	4.5	
Vehicle Extension (s)		3.0			3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)		47			17		49	2961		475	2686	
v/s Ratio Prot		c0.00			c0.00		c0.01	0.24			c0.26	
v/s Ratio Perm										0.00		
v/c Ratio		0.02			0.00		0.47	0.29		0.00	0.34	
Uniform Delay, d1		51.8			53.9		52.3	1.9		3.1	4.1	
Progression Factor		1.00			1.00		0.99	0.78		1.00	1.00	
Incremental Delay, d2		0.1			0.0		6.8	0.2		0.0	0.3	
Delay (s)		51.9			53.9		58.5	1.7		3.1	4.4	
Level of Service		D			D		E	A		A	A	
Approach Delay (s)		51.9			53.9			3.2			4.4	
Approach LOS		D			D			A			A	

Intersection Summary			
HCM 2000 Control Delay	4.6	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.32		
Actuated Cycle Length (s)	110.0	Sum of lost time (s)	18.0
Intersection Capacity Utilization	34.7%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	10	34	65	779	773	20
Future Volume (vph)	10	34	65	779	773	20
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.5	4.5	4.5	4.5	4.5	
Lane Util. Factor	1.00	1.00	1.00	0.95	0.95	
Frt	1.00	0.85	1.00	1.00	1.00	
Flt Protected	0.95	1.00	0.95	1.00	1.00	
Satd. Flow (prot)	1504	1346	1504	3539	3510	
Flt Permitted	0.95	1.00	0.95	1.00	1.00	
Satd. Flow (perm)	1504	1346	1504	3539	3510	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	11	37	71	847	840	22
RTOR Reduction (vph)	0	36	0	0	1	0
Lane Group Flow (vph)	11	1	71	847	861	0
Heavy Vehicles (%)	20%	20%	20%	2%	2%	20%
Turn Type	Prot	Perm	Prot	NA	NA	
Protected Phases	4		5	2	6	
Permitted Phases		4				
Actuated Green, G (s)	4.4	4.4	9.3	96.6	82.8	
Effective Green, g (s)	4.4	4.4	9.3	96.6	82.8	
Actuated g/C Ratio	0.04	0.04	0.08	0.88	0.75	
Clearance Time (s)	4.5	4.5	4.5	4.5	4.5	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	60	53	127	3107	2642	
v/s Ratio Prot	c0.01		c0.05	0.24	c0.25	
v/s Ratio Perm		0.00				
v/c Ratio	0.18	0.03	0.56	0.27	0.33	
Uniform Delay, d1	51.1	50.7	48.4	1.1	4.5	
Progression Factor	1.00	1.00	0.88	1.08	0.37	
Incremental Delay, d2	1.5	0.2	5.0	0.2	0.3	
Delay (s)	52.5	51.0	47.7	1.4	2.0	
Level of Service	D	D	D	A	A	
Approach Delay (s)	51.3			4.9	2.0	
Approach LOS	D			A	A	

Intersection Summary			
HCM 2000 Control Delay	4.8	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.34		
Actuated Cycle Length (s)	110.0	Sum of lost time (s)	13.5
Intersection Capacity Utilization	41.6%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↱		↰	↱			✥		↰	↱	
Traffic Volume (veh/h)	26	232	0	0	226	27	0	0	0	10	0	15
Future Volume (Veh/h)	26	232	0	0	226	27	0	0	0	10	0	15
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	28	252	0	0	246	29	0	0	0	11	0	16
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (ft)					866							
pX, platoon unblocked	0.96						0.96	0.96		0.96	0.96	0.96
vC, conflicting volume	275			252			570	583	252	568	568	260
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	220			252			528	542	252	526	526	205
tC, single (s)	4.2			4.1			7.1	6.5	6.2	7.2	6.7	6.4
tC, 2 stage (s)												
tF (s)	2.3			2.2			3.5	4.0	3.3	3.6	4.1	3.4
p0 queue free %	98			100			100	100	100	97	100	98
cM capacity (veh/h)	1221			1313			424	419	787	416	410	769

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1	SB 1	SB 2
Volume Total	28	252	0	275	0	11	16
Volume Left	28	0	0	0	0	11	0
Volume Right	0	0	0	29	0	0	16
cSH	1221	1700	1700	1700	1700	416	769
Volume to Capacity	0.02	0.15	0.00	0.16	0.00	0.03	0.02
Queue Length 95th (ft)	2	0	0	0	0	2	2
Control Delay (s)	8.0	0.0	0.0	0.0	0.0	13.9	9.8
Lane LOS	A				A	B	A
Approach Delay (s)	0.8		0.0		0.0	11.5	
Approach LOS					A	B	

Intersection Summary			
Average Delay	0.9		
Intersection Capacity Utilization	30.2%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↑↱		↰	↑↱		↰↰	↑↱		↰↰	↑↱	
Traffic Volume (vph)	144	275	220	113	195	146	155	952	116	144	1032	108
Future Volume (vph)	144	275	220	113	195	146	155	952	116	144	1032	108
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.5	4.5		4.5	4.5		4.5	4.5		4.5	4.5	
Lane Util. Factor	1.00	0.95		1.00	0.95		0.97	0.95		0.97	0.95	
Frt	1.00	0.93		1.00	0.94		1.00	0.98		1.00	0.99	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	3303		1770	3312		3433	3482		3433	3489	
Flt Permitted	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (perm)	1770	3303		1770	3312		3433	3482		3433	3489	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	157	299	239	123	212	159	168	1035	126	157	1122	117
RTOR Reduction (vph)	0	137	0	0	127	0	0	8	0	0	7	0
Lane Group Flow (vph)	157	401	0	123	244	0	168	1153	0	157	1232	0
Turn Type	Prot	NA		Prot	NA		Prot	NA		Prot	NA	
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases												
Actuated Green, G (s)	13.6	17.7		11.8	15.9		8.9	53.7		8.8	53.6	
Effective Green, g (s)	13.6	17.7		11.8	15.9		8.9	53.7		8.8	53.6	
Actuated g/C Ratio	0.12	0.16		0.11	0.14		0.08	0.49		0.08	0.49	
Clearance Time (s)	4.5	4.5		4.5	4.5		4.5	4.5		4.5	4.5	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	218	531		189	478		277	1699		274	1700	
v/s Ratio Prot	c0.09	c0.12		0.07	0.07		c0.05	0.33		0.05	c0.35	
v/s Ratio Perm												
v/c Ratio	0.72	0.76		0.65	0.51		0.61	0.68		0.57	0.72	
Uniform Delay, d1	46.4	44.1		47.1	43.4		48.9	21.5		48.8	22.4	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.14	0.72	
Incremental Delay, d2	11.1	6.1		7.8	0.9		3.7	2.2		2.6	2.4	
Delay (s)	57.5	50.1		54.9	44.3		52.6	23.8		58.0	18.5	
Level of Service	E	D		D	D		D	C		E	B	
Approach Delay (s)		51.8			46.9			27.4			23.0	
Approach LOS		D			D			C			C	

Intersection Summary			
HCM 2000 Control Delay	32.6	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.73		
Actuated Cycle Length (s)	110.0	Sum of lost time (s)	18.0
Intersection Capacity Utilization	72.3%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	26	0	32	1	0	6	10	1215	2	3	1256	20
Future Volume (vph)	26	0	32	1	0	6	10	1215	2	3	1256	20
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.5			4.5		4.5	4.5		4.5	4.5	
Lane Util. Factor		1.00			1.00		1.00	0.95		1.00	0.95	
Frt		0.93			0.88		1.00	1.00		1.00	1.00	
Flt Protected		0.98			0.99		0.95	1.00		0.95	1.00	
Satd. Flow (prot)		1595			1633		1570	3538		1770	3524	
Flt Permitted		0.98			0.99		0.95	1.00		0.20	1.00	
Satd. Flow (perm)		1595			1633		1570	3538		379	3524	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	28	0	35	1	0	7	11	1321	2	3	1365	22
RTOR Reduction (vph)	0	60	0	0	8	0	0	0	0	0	0	0
Lane Group Flow (vph)	0	3	0	0	0	0	11	1323	0	3	1387	0
Heavy Vehicles (%)	15%	2%	2%	2%	2%	2%	15%	2%	2%	2%	2%	15%
Turn Type	Split	NA		Split	NA		Prot	NA		Perm	NA	
Protected Phases	4	4		8	8		5	2			6	
Permitted Phases										6		
Actuated Green, G (s)		4.6			1.1		1.6	90.8		84.7	84.7	
Effective Green, g (s)		4.6			1.1		1.6	90.8		84.7	84.7	
Actuated g/C Ratio		0.04			0.01		0.01	0.83		0.77	0.77	
Clearance Time (s)		4.5			4.5		4.5	4.5		4.5	4.5	
Vehicle Extension (s)		3.0			3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)		66			16		22	2920		291	2713	
v/s Ratio Prot		c0.00			c0.00		0.01	c0.37			c0.39	
v/s Ratio Perm										0.01		
v/c Ratio		0.04			0.01		0.50	0.45		0.01	0.51	
Uniform Delay, d1		50.6			53.9		53.8	2.7		2.9	4.8	
Progression Factor		1.00			1.00		1.36	0.28		1.00	1.00	
Incremental Delay, d2		0.2			0.1		15.6	0.5		0.1	0.7	
Delay (s)		50.8			54.0		88.6	1.2		3.0	5.5	
Level of Service		D			D		F	A		A	A	
Approach Delay (s)		50.8			54.0			1.9			5.5	
Approach LOS		D			D			A			A	

Intersection Summary			
HCM 2000 Control Delay	4.9	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.49		
Actuated Cycle Length (s)	110.0	Sum of lost time (s)	18.0
Intersection Capacity Utilization	51.1%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations	↰	↱	↰	↑↑	↑↱	
Traffic Volume (vph)	23	75	55	1199	1237	16
Future Volume (vph)	23	75	55	1199	1237	16
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.5	4.5	4.5	4.5	4.5	
Lane Util. Factor	1.00	1.00	1.00	0.95	0.95	
Frt	1.00	0.85	1.00	1.00	1.00	
Flt Protected	0.95	1.00	0.95	1.00	1.00	
Satd. Flow (prot)	1504	1346	1504	3539	3525	
Flt Permitted	0.95	1.00	0.95	1.00	1.00	
Satd. Flow (perm)	1504	1346	1504	3539	3525	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	25	82	60	1303	1345	17
RTOR Reduction (vph)	0	77	0	0	1	0
Lane Group Flow (vph)	25	5	60	1303	1361	0
Heavy Vehicles (%)	20%	20%	20%	2%	2%	20%
Turn Type	Prot	Perm	Prot	NA	NA	
Protected Phases	4		5	2	6	
Permitted Phases		4				
Actuated Green, G (s)	6.6	6.6	8.6	94.4	81.3	
Effective Green, g (s)	6.6	6.6	8.6	94.4	81.3	
Actuated g/C Ratio	0.06	0.06	0.08	0.86	0.74	
Clearance Time (s)	4.5	4.5	4.5	4.5	4.5	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	90	80	117	3037	2605	
v/s Ratio Prot	c0.02		0.04	c0.37	c0.39	
v/s Ratio Perm		0.00				
v/c Ratio	0.28	0.06	0.51	0.43	0.52	
Uniform Delay, d1	49.4	48.8	48.7	1.8	6.1	
Progression Factor	1.00	1.00	0.98	0.56	0.48	
Incremental Delay, d2	1.7	0.3	2.8	0.3	0.7	
Delay (s)	51.1	49.1	50.5	1.3	3.6	
Level of Service	D	D	D	A	A	
Approach Delay (s)	49.6			3.5	3.6	
Approach LOS	D			A	A	

Intersection Summary			
HCM 2000 Control Delay	5.3	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.51		
Actuated Cycle Length (s)	110.0	Sum of lost time (s)	13.5
Intersection Capacity Utilization	54.3%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	25	524	1	0	376	42	1	0	0	53	0	49
Future Volume (Veh/h)	25	524	1	0	376	42	1	0	0	53	0	49
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	27	570	1	0	409	46	1	0	0	58	0	53
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (ft)					866							
pX, platoon unblocked	0.91						0.91	0.91		0.91	0.91	0.91
vC, conflicting volume	455			571			1086	1080	570	1056	1057	432
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	356			571			1047	1040	570	1014	1015	331
tC, single (s)	4.2			4.1			7.1	6.5	6.2	7.2	6.7	6.4
tC, 2 stage (s)												
tF (s)	2.3			2.2			3.5	4.0	3.3	3.6	4.1	3.4
p0 queue free %	97			100			99	100	100	68	100	91
cM capacity (veh/h)	1036			1002			169	205	521	184	201	623

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1	SB 1	SB 2
Volume Total	27	571	0	455	1	58	53
Volume Left	27	0	0	0	1	58	0
Volume Right	0	1	0	46	0	0	53
cSH	1036	1700	1700	1700	169	184	623
Volume to Capacity	0.03	0.34	0.00	0.27	0.01	0.32	0.09
Queue Length 95th (ft)	2	0	0	0	0	32	7
Control Delay (s)	8.6	0.0	0.0	0.0	26.5	33.4	11.3
Lane LOS	A				D	D	B
Approach Delay (s)	0.4		0.0		26.5	22.8	
Approach LOS					D	C	

Intersection Summary			
Average Delay	2.4		
Intersection Capacity Utilization	37.6%	ICU Level of Service	A
Analysis Period (min)	15		