

MEMORANDUM TO: Ryan Gillingham, P.E.  
Director of Public Works, Village of La Grange Director of Public Works

FROM: Eric D. Russell, P.E., PTOE, PTP, LEED AP ND  
Principal

DATE: November 16, 2015

SUBJECT: Park Road Multiway Stop Control “Before” and “After” Comparison  
LTHS North Campus

This memorandum is in follow-up to our Draft Traffic Circulation and Pedestrian Safety Study (dated July 23, 2015) for Lyons Township High School (LTHS) North Campus. The study produced a series of potential measures to better organize vehicular circulation on campus while reducing vehicle-pedestrian conflicts and increasing pedestrian safety.

Two of the measures required approval of an ordinance by the Board of Trustees, and approval was granted on September 14, 2015. These measures include:

1. Installation of multiway stop control at the Cossitt Avenue/Park Road intersection
2. Installation of multiway stop control at the Elm Avenue/Park Road intersection

Three additional measures required Village staff approval, including:

3. Installation of an In-Street Schoolchildren Crossing sign at the Cossitt Avenue midblock crosswalk between Brainard Avenue and Park Road
4. Installation of an In-Street Pedestrian Crossing sign with School plaque at the Brainard Avenue crosswalk at Elm Avenue
5. Removal of the pedestrian crossing sign on eastbound Cossitt Avenue at Park Road

All five of these measures were implemented on September 25, 2015.

During the Village Board meeting on September 14<sup>th</sup> there was discussion on the potential implications (both positive and negative) of the multiway stop control at the two Park Road intersections. To provide context for follow-up discussions on the multiway stop control, Staff directed KLOA, Inc. to collect traffic volume and pedestrian crossing data at three intersections along Park Road (Cossitt Avenue, Elm Avenue, Maple Avenue) before the multiway stop installation and after the installation, and to observe traffic and pedestrian movements while the data is collected. KLOA, Inc. was also directed to compare the “before” and “after” data, and analyze the data, to identify any significant changes in traffic patterns or operational efficiency. The following sections describe the observations, data comparison and analysis.

## Traffic and Pedestrian Volumes

Traffic and pedestrian volume counts were performed manually by KLOA, Inc. at the intersections of Park Road with Cossitt Avenue, Elm Avenue, and Maple Avenue during the peak hours of traffic activity at LTHS, which include the hour preceding the school start time (7:45 A.M.) in the morning and the hour following the school dismissal time (3:04 P.M.) in the afternoon. The counts were conducted both before and after the installation of the multiway stop control.

### Volumes Before Multiway Stop Installation

**Figure 1** shows the peak hour traffic counts collected before multiway stop control was installed at the Park Road intersections. The data was collected on Thursday, September 24, 2015, which was identified by District 204 staff as a typical school day. **Figure 2** shows the peak hour pedestrian crossing volumes at these intersections during the same time periods.

### Volumes After Multiway Stop Installation

**Figure 3** shows the peak hour traffic counts collected after multiway stop control was installed at the Park Road intersections. The data was collected on Wednesday, October 14, 2015, which was also identified by District 204 staff as a typical school day. **Figure 4** shows the peak hour pedestrian crossing volumes at these intersections during the same time periods.

### Before and After Traffic Comparison

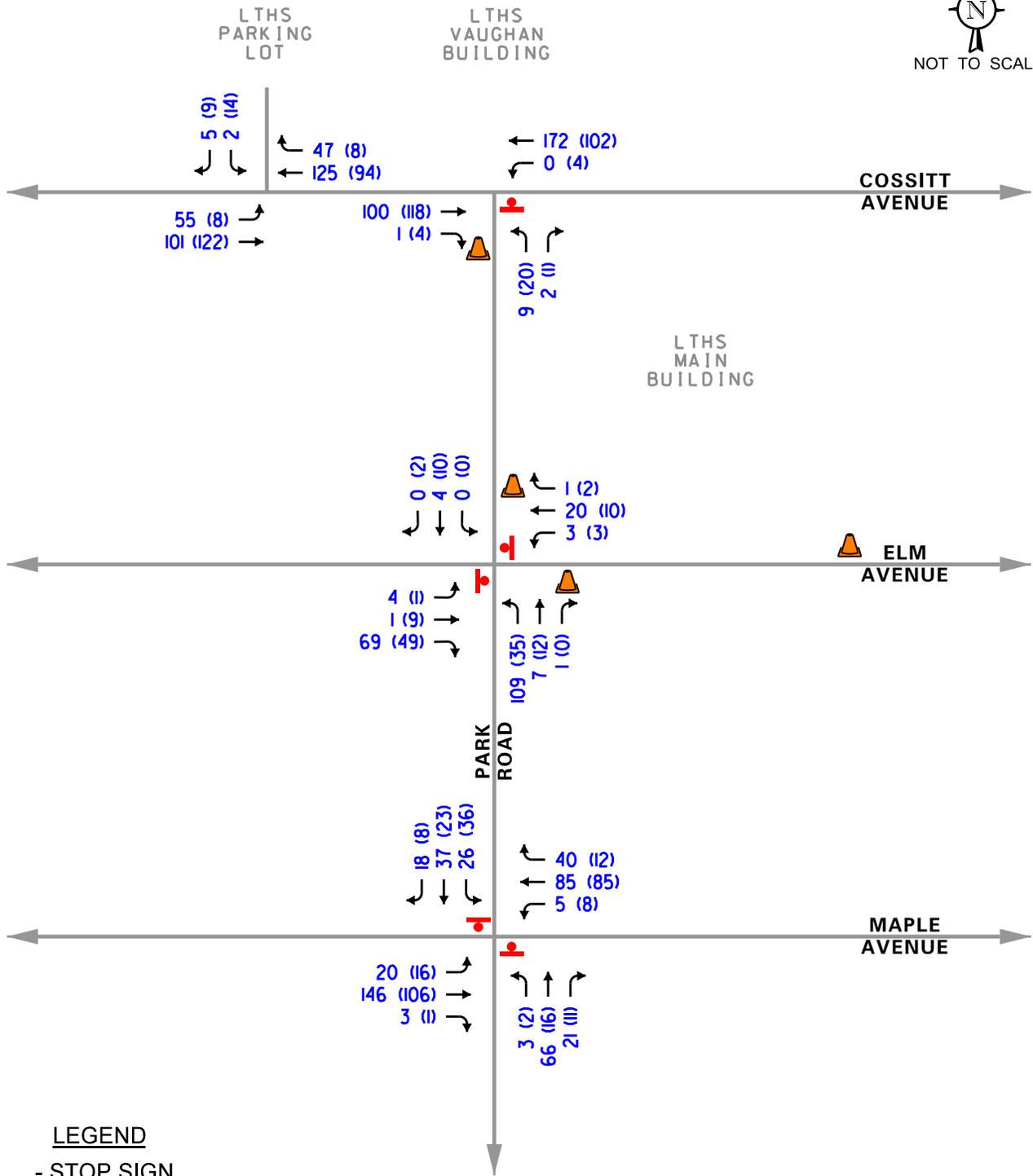
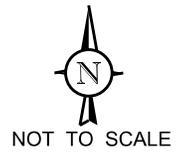
**Table 1** shows a comparison of the eastbound traffic volume on Cossitt Avenue, Elm Avenue and Maple Avenue during the morning and afternoon peak hours of school traffic activity before and after the multiway stop installation. **Table 2** shows a similar comparison for the westbound traffic volume on these three streets.

Table 1  
EASTBOUND TRAFFIC VOLUME COMPARISON

Street	Before Multiway Stop		After Multiway Stop		Net Change	
	AM Peak Hour	PM Peak Hour	AM Peak Hour	PM Peak Hour	AM Peak Hour	PM Peak Hour
Cossitt Avenue	156	130	222	161	+66 (+42%)	+31 (+24%)
Elm Avenue	74	59	96	50	+22 (+30%)	-9 (-15%)
Maple Avenue	<u>169</u>	<u>123</u>	<u>159</u>	<u>107</u>	<u>-10 (-6%)</u>	<u>-16 (-13%)</u>
Total Combined	399	312	477	318	+78 (+30%)	+6 (+2%)

Table 2  
WESTBOUND TRAFFIC VOLUME COMPARISON

Street	Before Multiway Stop		After Multiway Stop		Net Change	
	AM Peak Hour	PM Peak Hour	AM Peak Hour	PM Peak Hour	AM Peak Hour	PM Peak Hour
Cossitt Avenue	172	106	181	119	+9 (+5%)	+13 (+12%)
Elm Avenue	24	15	38	11	+14 (+58%)	-4 (-27%)
Maple Avenue	<u>130</u>	<u>105</u>	<u>131</u>	<u>79</u>	<u>+1 (+1%)</u>	<u>-26 (-25%)</u>
Total Combined	326	226	350	209	+24 (+7%)	-17 (-7.5%)



**LEGEND**

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- PORTABLE DO NOT ENTER SIGNS (SCHOOL HOURS ONLY)
- 00** - AM PEAK HOUR (7:00-8:00 AM)
- (00)** - PM PEAK HOUR (3:00-4:00 PM)

PROJECT:

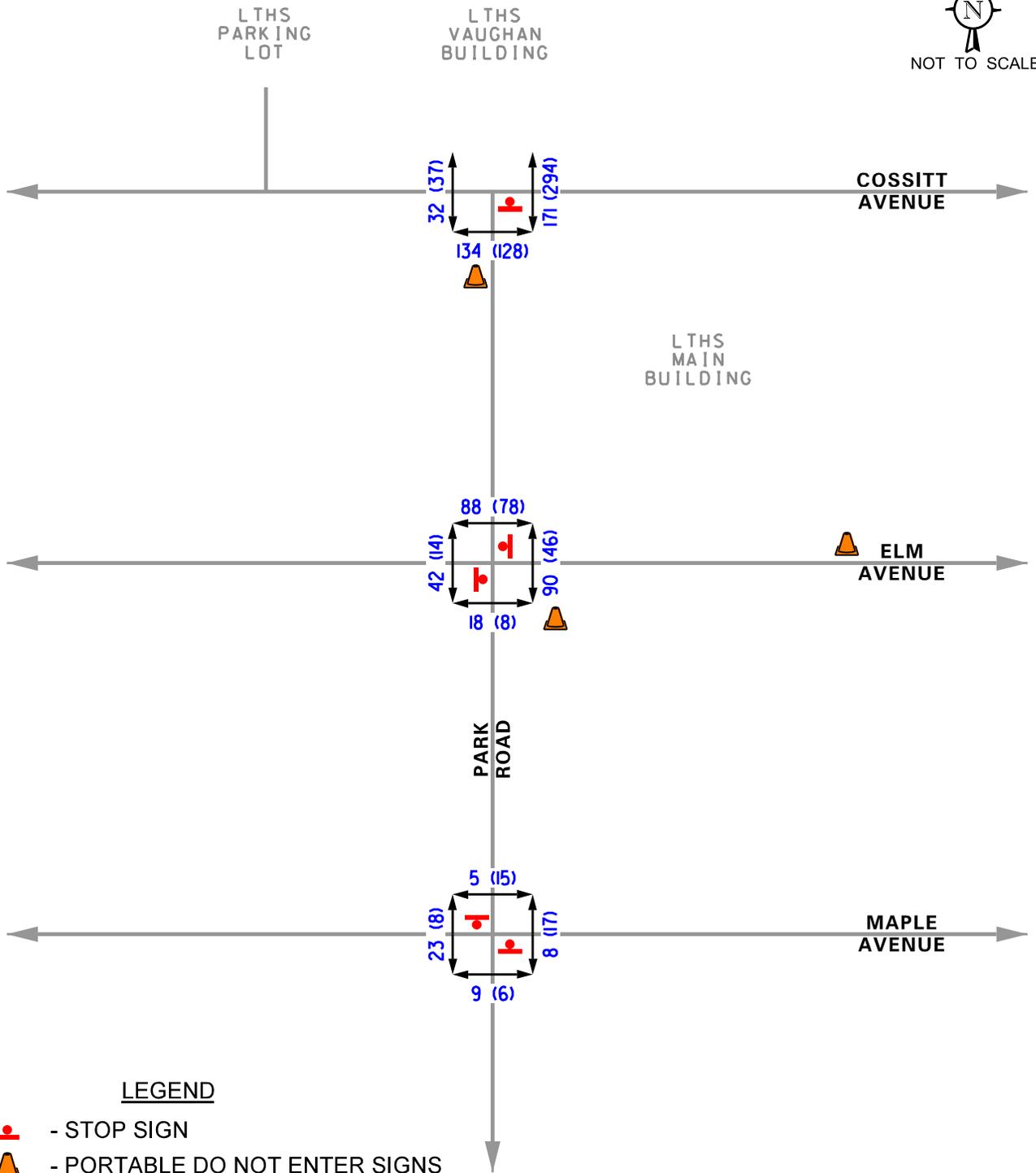
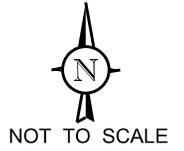
LTHS North Campus  
La Grange, Illinois

TITLE:

Existing Traffic Volumes  
Before to All-Way Stop Installation  
Thursday, September 24, 2015



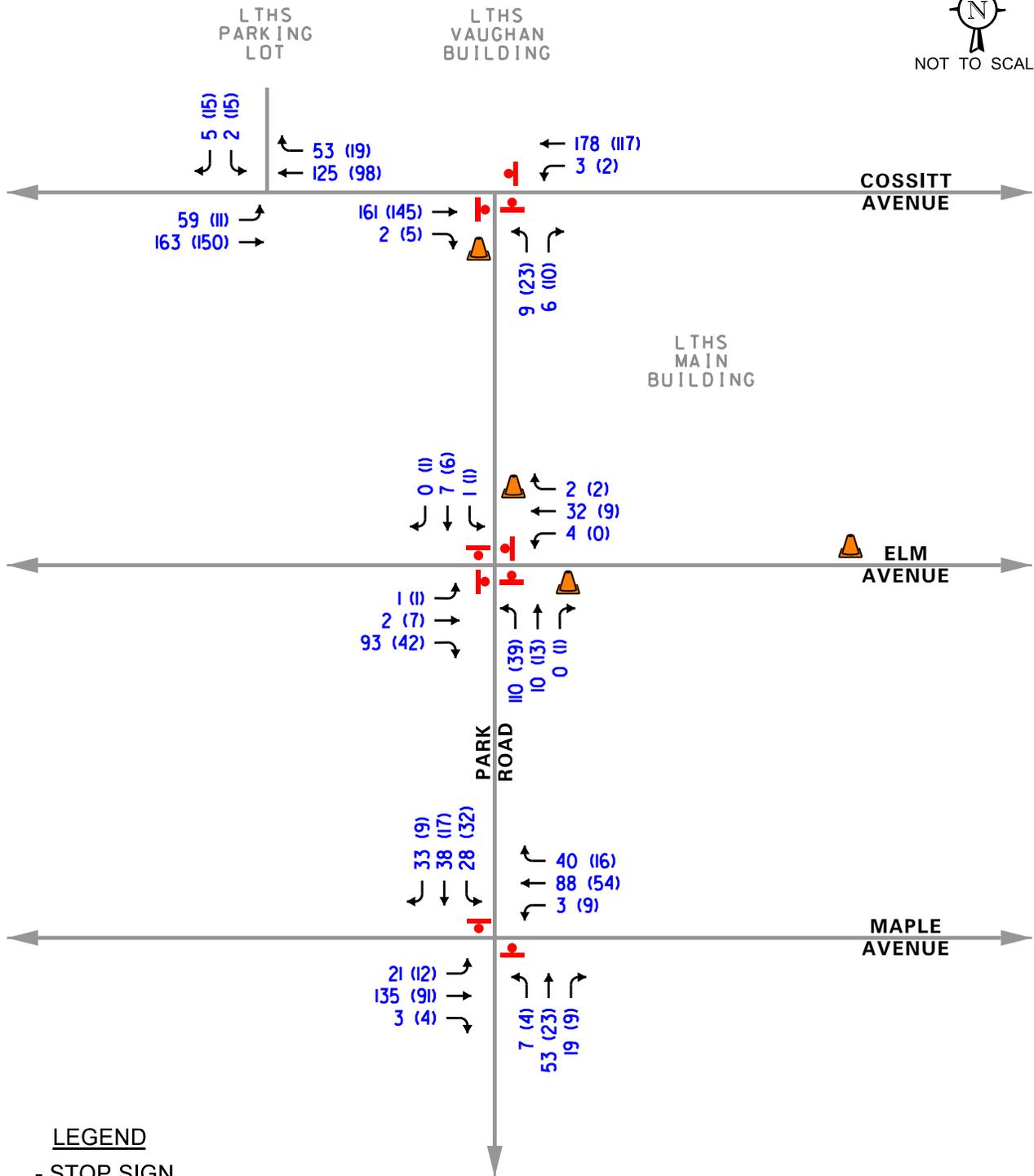
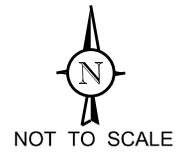
Figure: 1



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- (00) - PM PEAK HOUR (3:00-4:00 PM)
- 00 (00) - PEDESTRIAN VOLUME

<p>PROJECT: LTHS North Campus La Grange, Illinois</p>	<p>TITLE: Existing Pedestrian Volumes Before to All-Way Stop Installation Thursday, September 24, 2015</p>	<p><b>KLOA</b> Job No: 15-120 Figure: 2</p>
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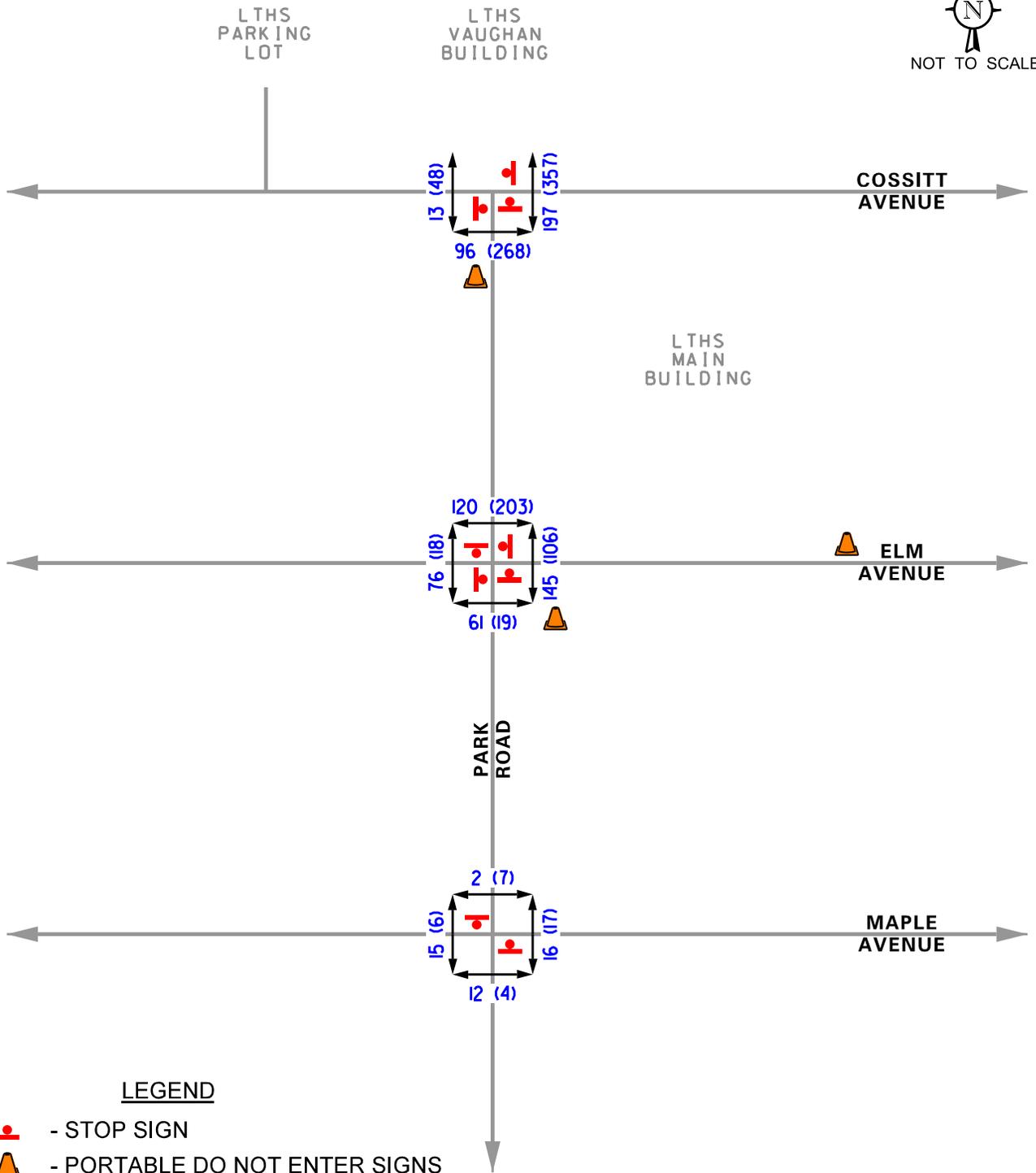
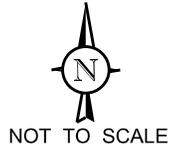


PROJECT:  
LTHS North Campus  
La Grange, Illinois

TITLE:  
Existing Traffic Volumes  
After All-Way Stop Installation  
Wednesday, October 14, 2015

**KLOA**  
Job No: 15-120

Figure: 3



**LEGEND**

- STOP SIGN
- PORTABLE DO NOT ENTER SIGNS (SCHOOL HOURS ONLY)
- 00 - AM PEAK HOUR (7:00-8:00 AM)
- (00) - PM PEAK HOUR (3:00-4:00 PM)
- 00 (00) - PEDESTRIAN VOLUME

PROJECT:

LTHS North Campus  
La Grange, Illinois

TITLE:

Existing Pedestrian Volumes  
After All-Way Stop Installation  
Wednesday, October 14, 2015



Figure: 4

The traffic comparison for Cossitt Avenue indicates that traffic movements on the street were higher in both directions of travel and during both peak hours after multiway stop control was installed at the Cossitt Avenue/Park Road intersection. This suggests that traffic did not divert onto other parallel streets once the multiway stop control was installed.

The traffic comparison for Elm Avenue indicates that traffic movements on the street were higher in the morning peak hour after multiway stop control was installed at the Elm Avenue/Park Road intersection, but lower in the afternoon peak hour. The volume decrease in the afternoon ranged from four to nine vehicles, which may have diverted onto other streets and/or could have been part of the volume increase on Cossitt Avenue.

Maple Avenue is the only street of the three streets analyzed that did not have multiway stop installed at Park Road. The traffic comparison for Maple Avenue indicates that traffic movements on the street were lower in both directions of travel during the afternoon peak hour and in the eastbound direction during the morning peak hour. The volumes were generally unchanged in the westbound direction during the morning peak hour. This suggests that traffic from Cossitt Avenue and Elm Avenue did not divert onto Maple Avenue once multiway stop control was installed on Cossitt and Elm.

Before and After Pedestrian Comparison

**Table 3** shows a comparison of the pedestrian crossing volume through each of the three intersections during the morning and afternoon peak hours of school traffic activity before and after the multiway stop installation.

Table 3  
PEDESTRIAN CROSSING VOLUME COMPARISON

Intersection	Before Multiway Stop		After Multiway Stop		Net Change	
	AM Peak Hour	PM Peak Hour	AM Peak Hour	PM Peak Hour	AM Peak Hour	PM Peak Hour
Cossitt Ave/Park Rd	337	459	306	673	-31 (-9%)	+214 (+47%)
Elm Ave/Park Rd	238	146	402	346	+164 (+69%)	+200 (+137%)
Maple Ave/Park Rd	<u>45</u>	<u>46</u>	<u>45</u>	<u>34</u>	<u>0 (0%)</u>	<u>-12 (-26%)</u>
Total Combined	620	651	753	1,053	+133 (+21%)	+402 (+62%)

The pedestrian comparison of the Cossitt Avenue/Park Road intersection during the morning peak hour indicates that total pedestrian crossings at the intersection were slightly lower after multiway stop control was installed while the number of pedestrian crossings on Cossitt Avenue alone was slightly higher. In the afternoon peak hour, the total pedestrian crossings at the intersection were considerably higher after multiway stop control was installed, as were the number of crossings of Cossitt Avenue alone.

The pedestrian comparison of the Elm Avenue/Park Road intersection indicates that the total pedestrian crossings at the intersection were considerably higher during both peak hours after multiway stop control was installed, as were the number of crossings of Park Road alone.

There were no changes in traffic control at the Maple Avenue/Park Road intersection. Consequently, the total number of pedestrian crossings at the intersection was unchanged in the morning peak hour after multiway stop control was installed at the Park Road intersections with Cossitt Avenue and Elm Avenue, and was only slightly lower in the afternoon peak hour, likely due to more students crossing Park Road at Elm Avenue instead.

## **Field Observations**

KLOA, Inc. observed traffic flow and pedestrian movements at the Cossitt Avenue/Park Road intersection at the same time periods that the traffic and pedestrian volume data was collected. Notes were made related to student drop-off/pick-up activity, vehicle queuing, stop sign compliance, and the interaction between vehicles and pedestrians.

### Before Multiway Stop Installation

The following observations were made before multiway stop control was installed at the Cossitt Avenue/Park Road intersection:

- Many vehicles dropped-off/picked-up students along Cossitt Avenue between the LTHS parking lot entrance and Brainard Avenue.
- Many pedestrians entered the Cossitt Avenue/Park Road intersection assuming eastbound and westbound vehicles on Cossitt Avenue would stop for them.
- Most vehicles did stop for pedestrians attempting to cross Cossitt Avenue at the Park Road intersection.
  - When pedestrians crossed at the near side crosswalk (to the vehicle), the vehicles tended to stop an adequate distance in advance of the crosswalk.
  - When pedestrians crossed the far side crosswalk (from the vehicle), the vehicles tended to stop either on the near side crosswalk or in the middle of the intersection.
- Traffic queues on Cossitt Avenue originated from the mid-block crosswalk where vehicles stopped for pedestrians crossing between the two LTHS buildings.
- Peak queues occurred during the 15-minute period prior to the school start bell and the 15-minute period after the school dismissal bell.
- Peak westbound queues extended back to the Brainard Avenue intersection, occasionally delaying traffic on Brainard (both directions) attempting to turn onto westbound Cossitt.
- Peak eastbound queues extended back through the Park Road intersection by a couple of vehicles. Vehicles stopped in the intersection were conscious not to stop directly on the crosswalk, leaving gaps for pedestrians in the crosswalks to use to walk between the queued vehicles. These stopped vehicles, however, did delay buses waiting to turn westbound from northbound Park Road.

### After Multiway Stop Installation

The following observations were made after multiway stop control was installed at the Cossitt Avenue/Park Road intersection:

- Compliance with the multiway stop control was 100% during the morning peak hour. During the afternoon peak hour, there were three occasions where vehicles on Cossitt Avenue failed to stop for the new stop signs.
- Vehicles continued to drop-off/pick-up students along Cossitt Avenue between the LTHS parking lot entrance and Brainard Avenue.
- All vehicles remained stopped at the stop signs on Cossitt Avenue when pedestrians were crossing Cossitt Avenue at Park Road, regardless of whether the pedestrians were using the east or west crosswalks at the intersection.
- Traffic queues on Cossitt Avenue continued to originate from the mid-block crosswalk as the number of pedestrian crossings at this location remained considerably higher than at the Cossitt Avenue/Park Road intersection.
- The peak vehicle queues occurred during the 15-minute period prior to the school start bell and the 15-minute period after the school dismissal bell.
- Peak westbound queues continued to extend back to the Brainard Avenue intersection, occasionally delaying traffic on Brainard (both directions) attempting to turn onto westbound Cossitt.
- Peak eastbound queues continued to extend beyond the Park Road intersection by a couple of vehicles.
- When the eastbound queues extended past the Park Road intersection, eastbound vehicles approaching Park Road would dwell at the stop sign and only proceed through the intersection when the queue dissipated enough to allow them to clear the intersection.
- With eastbound Cossitt Avenue vehicles stopping at the stop sign at Park Road, buses were never blocked from turning from northbound Park Road to westbound Cossitt Avenue.
- During the afternoon dismissal time, vehicles stand along the south curb of Cossitt Avenue to the west of Park Road waiting to pick up students (this condition also existed before the multiway stop control was installed), which forces eastbound traffic to encroach beyond the center of the street to bypass the parked cars. When the bypassing traffic stopped at the stop sign at Park Road, it made turning movements more difficult for buses turning west from northbound Park Road, and these buses had to navigate the turn at a slower speed.

## Capacity Analysis

Intersection capacity analyses were performed for the intersections of Park Road with Cossitt Avenue, Elm Avenue and Maple Avenue to determine the operation of the roadway system and compare the intersection operations before and after the installation of the multiway stop control. The analyses were performed for conditions during the morning and afternoon peak hours of school traffic activity. Table 4 summarizes the results of the analysis.

Table 4  
INTERSECTION CAPACITY ANALYSIS RESULTS

Intersection	Before Multiway Stop				After Multiway Stop			
	AM Peak Hour		PM Peak Hour		AM Peak Hour		PM Peak Hour	
Cossitt Ave / Park Rd	B <sup>1</sup> 12.6		B <sup>1</sup> 12.4		A <sup>7</sup> 8.2		A <sup>7</sup> 7.9	
Elm Ave / Park Rd	B <sup>2</sup> 13.3	A <sup>3</sup> 9.5	B <sup>2</sup> 10.4	A <sup>3</sup> 9.1	A <sup>7</sup> 7.7		A <sup>7</sup> 7.1	
Maple Ave / Park Rd	B <sup>4</sup> 12.2	B <sup>5</sup> 12.1	B <sup>4</sup> 11.5	B <sup>5</sup> 10.5	B <sup>4</sup> 11.9	B <sup>5</sup> 11.9	B <sup>4</sup> 10.7	B <sup>5</sup> 10.4
Cossitt Ave/ LTHS Parking Lot Dr	A <sup>6</sup> 9.7		A <sup>6</sup> 9.6		A <sup>6</sup> 9.9		A <sup>6</sup> 9.7	
<sup>1</sup> Reflects operation of northbound movement on Park Road under stop control. <sup>2</sup> Reflects operation of westbound movement on Elm Avenue under stop control. <sup>3</sup> Reflects operation of eastbound movement on Elm Avenue under stop control. <sup>4</sup> Reflects operation of southbound movement on Park Road under stop control. <sup>5</sup> Reflects operation of northbound movement on Park Road under stop control. <sup>6</sup> Reflects operation of southbound movement on LTHS parking lot drive under stop control. <sup>7</sup> Reflects intersection operations under multiway stop control.								

The capacity analyses were performed using SYNCHRO computer software, which generally follows the methodologies outlined in the Transportation Research Board's Highway Capacity Manual (HCM) 2010. The methodologies use traffic control, traffic volumes, and street characteristics to determine the average control delay and levels of service for vehicles at an intersection. The ability of an intersection to accommodate traffic flow is expressed in terms of level of service, which is a qualitative term developed to express intersection operating conditions. Alpha designations from A to F are assigned based on the average control delay experienced by vehicles passing through the intersection. Control delay is that portion of the total delay attributed to the stop sign control operation, and includes initial deceleration delay, queue move-up time, stopped delay, and final acceleration delay until resumption of free flow speed. Level of Service A is the highest grade (best traffic flow, least delays), Level of Service E represents saturated or at-capacity conditions, and Level of Service F is the lowest grade (oversaturated conditions, extensive delays). Typically, Level of Service D is the lowest acceptable grade for peak-hour conditions in a suburban environment such as La Grange.

For multiway stop controlled (MWSC) intersections, levels of service are calculated based on the weighted average of the delay on each of the intersection approaches. For two-way stop controlled (TWSC) intersections, levels of service are only calculated for the approaches controlled by a stop sign. Level of Service F at TWSC intersections occurs when there are not enough suitable gaps in the flow of traffic on the major (uncontrolled) street to allow minor-street traffic to safely enter the major street flow or cross the major street. The Highway Capacity Manual criteria for levels of service and the corresponding control delay for unsignalized intersections is contained in the Appendix of this report.

#### Before Multiway Stop Installation

The Cossitt Avenue/Park Road intersection operated with stop control on the Park Road approach only before multiway stop control was installed at the intersection. Between Cossitt Avenue and Elm Avenue, Park Road is restricted to buses only during school hours, as well as traffic from residents that live on the block. Under stop control, the Park Road approach to Cossitt Avenue operated at a Level of Service B during the morning and afternoon peak hours.

The Elm Avenue/Park Road intersection operated with stop control on Elm Avenue only before multiway stop control was installed at the intersection. Between Brainard Avenue and Park Road, Elm Avenue is restricted to buses only during school hours, as well as residents that live on the block. Under stop control, the eastbound Elm Avenue approach to Park Road operated at a Level of Service A during the morning and afternoon peak hours while the westbound Elm Avenue approach operated at Level of Service B during the peak hours.

The Maple Avenue/Park Road intersection operated with stop control on Park Road only before multiway stop control was installed at the Park Road intersections with Cossitt Avenue and Elm Avenue. Under stop control, the Park Road approaches to Maple Avenue operated at a Level of Service B during the morning and afternoon peak hours.

The Cossitt Avenue intersection with the east driveway to the LTHS parking lot operated with stop control on the driveway only before multiway stop control was installed at the Park Road intersections with Cossitt Avenue and Elm Avenue. Under stop control, the LTHS parking lot driveway operated at a Level of Service A during the morning and afternoon peak hours.

#### After Multiway Stop Installation

Park Road remained restricted to buses only during school hours, as well as traffic from residents that live on the block, between Cossitt Avenue and Elm Avenue. Under multiway stop control, the Cossitt Avenue/Park Road intersection operated at a Level of Service A during the morning and afternoon peak hours.

Elm Avenue remained restricted to buses only during school hours, as well as residents that live on the block, between Brainard Avenue and Park Road. Under multiway stop control, the Elm Avenue/Park Road intersection operated at Level of Service A during the morning and afternoon peak hours.

The Maple Avenue/Park Road intersection continued to operate with stop control on Park Road only after multiway stop control was installed at the Park Road intersections with Cossitt Avenue and Elm

Avenue. After the multiway stop installations, the Park Road approaches to Maple Avenue continued to operate at a Level of Service B during the morning and afternoon peak hours.

The Cossitt Avenue intersection with the east driveway to the LTHS parking lot continued to operate with stop control on the driveway only after multiway stop control was installed at the Park Road intersections with Cossitt Avenue and Elm Avenue. After the multiway stop installations, the LTHS parking lot driveway continued to operate at a Level of Service A during the morning and afternoon peak hours.

#### Before and After Comparison

The Cossitt Avenue/Park Road intersection operated with less overall delay to all vehicles at the intersection, when averaged together, under multiway stop control than under stop control on Park Road. Further, the level of service improved from B to A during both peak hours.

The Elm Avenue/Park Road intersection operated with less overall delay to all vehicles at the intersection, when averaged together, under multiway stop control than under stop control on Elm Avenue. Further the level of service improved from B to A during the morning peak hour while remaining unchanged in the afternoon peak hour.

Traffic operations at the Maple Avenue/Park Road intersection generally remained the same after multiway stop control was installed at the Park Road intersections with Cossitt Avenue and Elm Avenue.

Traffic operations at the intersection of Cossitt Avenue with the east driveway to the LTHS parking lot generally remained the same after multiway stop control was installed at the Park Road intersections with Cossitt Avenue and Elm Avenue.

## **Conclusions**

Based on field observations, traffic analysis, and a comparison of the traffic and pedestrian volume data collected before and after multiway stop control was installed at the Park Road intersections with Cossitt Avenue and Elm Avenue, the following conclusions are drawn:

- Traffic volumes on Cossitt Avenue were higher after multiway stop control was installed, suggesting that traffic did not divert onto other parallel streets.
- Traffic volumes on Maple Avenue were either lower or unchanged after multiway stop control was installed, suggesting that traffic from Cossitt Avenue and Elm Avenue did not divert onto Maple Avenue.
- Traffic volumes on Elm Avenue were higher in the morning peak hour after multiway stop control was installed but lower in the afternoon peak hour by 4-9 vehicles. This small reduction of traffic may have contributed to the higher volumes on Cossitt Avenue but likely did not divert onto Maple Avenue where traffic levels were lower after the multiway stop installations.
- The number of pedestrians crossing Cossitt Avenue at Park Road increased considerably after multiway stop control was installed.

- The number of pedestrians crossing Park Road at Elm Avenue increased considerably after multiway stop control was installed.
- The number of pedestrians traversing the Maple Avenue/Park Road intersection was generally unchanged after the multiway stop installations.
- The level of service improved and average vehicle delay was reduced at the Cossitt Avenue/Park Road and the Elm Avenue/Park Road intersections after multiway stop control was installed.
- Traffic operations at the Maple Avenue/Park Road intersection and the Cossitt Avenue intersection with the east driveway to the LTHS parking lot generally remained the same after the multiway stop installations.
- Compliance with the new multiway stop control was very good.
- The multiway stop control did not change student drop-off/pick-up patterns along Cossitt Avenue between the LTHS parking lot entrance and Brainard Avenue.
- While traffic volumes were higher on Cossitt Avenue after the multiway stop installations, vehicle queue lengths in both directions on Cossitt Avenue were comparable to conditions before the multiway stop installations.
- The multiway stop control at the Cossitt Avenue/Park Road intersection has improved safety for pedestrians crossing Cossitt Avenue as it removes the uncertainty as to whether vehicles will stop for them to cross and it defines a marked location (i.e., stop line, stop sign) outside of the intersection for the vehicles to stop.
- The multiway stop condition at the Cossitt Avenue/Park Road intersection has also reduced the propensity for vehicles to queue back through the intersection, or stop within the intersection for pedestrians, which has eliminated the occasional delays to buses turning from northbound Park Road to westbound Cossitt Avenue.

# **APPENDIX**

## LEVEL OF SERVICE CRITERIA

### Unsignalized Intersections

Level of Service	Average Control Delay (seconds per vehicle)
A	0-10
B	>10-15
C	>15-25
D	>25-35
E	>35-50
F	>50

Source: *Highway Capacity Manual*, 2010.