

TRAFFIC IMPACT STUDY

TO: John Brehm, ASLA, Hy-Vee, Inc.
FROM: Brian Willham, PE, PTOE
John Witt, PE, PTOE
DATE: September 12, 2014
RE: Proposed Hy-Vee Gas Station/Convenience Store
Windsor Heights, Iowa
Traffic Impact Study

A new Hy-Vee convenience store with gasoline pumps is proposed within the parking lot of an existing Hy-Vee grocery store located in Windsor Heights, Iowa. The convenience store will be located in the northwest quadrant of the intersection of University Avenue and 70th Street. This study identifies the potential impacts to the operations of the intersections of University Avenue and 70th Street, 70th Street and the Hy-Vee Entrance, and a proposed right-in/right-out access on 70th Street that would result from the additional traffic generated by the proposed convenience store. The proposed convenience store is approximately 3,000 square feet with 16 fueling positions for vehicles. The proposed site includes modification of the existing grocery store parking lot, relocation of the 70th Street entrance approximately 100 feet north of its current location, and the addition of a right-in/right-out access on University Avenue approximately 200 feet west of the University Avenue and 70th Street intersection. The proposed site location can be seen in Figure 1.

The study intersections were reviewed for capacity, queuing, verifying access locations, and other safety considerations. Traffic volume data, crash data, and other pertinent information were also collected for the study area.

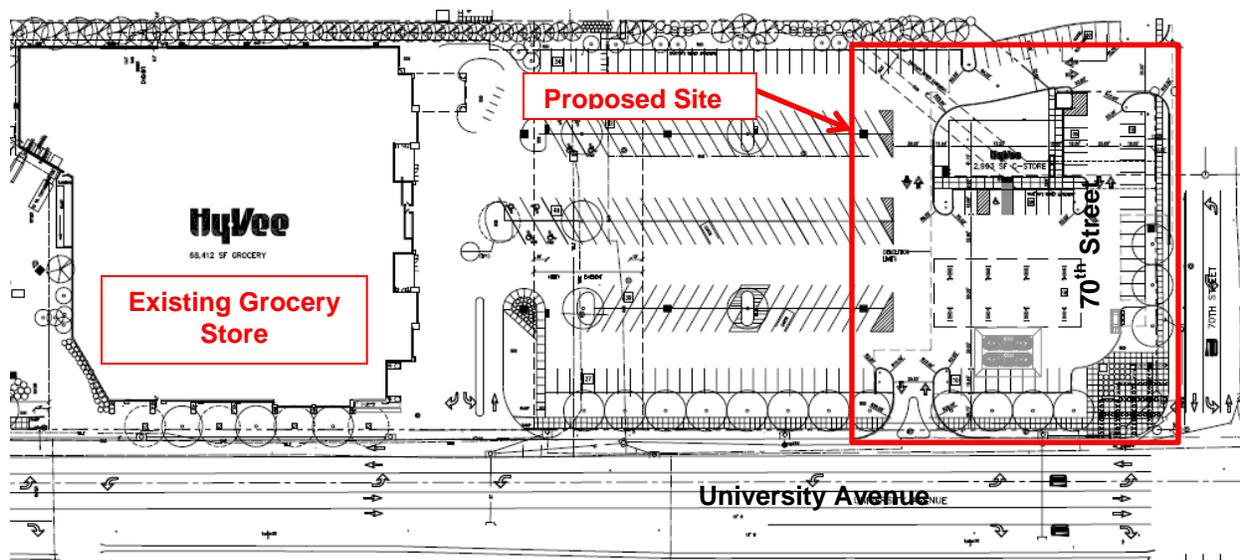


Figure 1: Proposed Site Location

EXISTING CONDITIONS

University Avenue is a four-lane undivided roadway with turn lanes at higher volume intersections that runs east/west through the cities of Windsor Heights and Des Moines. It is classified as a Minor Arterial and has a posted speed limit of 25 MPH through the study area. The 2012 Average Annual Daily Traffic

(AADT) was 13,200 vehicles per day west of 70th Street and 21,000 vehicles per day east of 70th Street.

70th Street is a two-lane roadway that runs north/south through the city of Windsor Heights. It is classified as a Collector Roadway and has a posted speed limit of 25 MPH through the study area. The 2012 AADT was 6,600 vehicles per day north of University Avenue, while south of University Avenue it was approximated to be 2,600 vehicles per day. 70th Street south of University Avenue serves as access to a few businesses and as a back entrance into a Wal-Mart/Sam's Club site.

The signalized intersection of University Avenue and 70th Street is located directly adjacent to the site. Protected/permissive left-turn phasing is provided on all four legs of the intersection. The intersection includes the following lane configurations:

- West Leg – 2 WB thru, 1 EB left, 2 EB thru, 1 EB right
- North Leg – 1 NB thru, 1 SB left, 1 SB thru, 1 SB thru/right
- East Leg – 2 EB thru, 1 WB left, 1 WB thru, 1 WB thru/right
- South Leg – 2 SB thru, 1 NB left, 1 NB thru/right

The thru-stop controlled intersection of 70th Street and the Hy-Vee Entrance is also located directly adjacent to the site and includes the following lane configurations:

- West Leg (stop controlled) – 1 WB thru, 1 EB left, 1 EB right
- North Leg – 1 NB thru, 1 SB thru, 1 SB thru/right
- South Leg – 2 SB thru, 1 NB left, 1 NB thru

Two business driveways are located on the east side of 70th Street directly across from the Hy-Vee Entrance, but were not taken into account in this study due to the low traffic volumes observed using the driveways during the AM and PM peak hours.

Detailed turning movement counts were collected at University Avenue and 70th Street and 70th Street and the existing Hy-Vee Entrance on August 28, 2014.

CRASH HISTORY ANALYSIS

Crash data from January 2011 through July 2014 was obtained from the Iowa Crash Mapping Analysis Tool (CMAT) and was analyzed for University Avenue at 70th Street and 70th Street at the Hy-Vee Entrance. The intersection of University Avenue and 70th Street had 6 reported crashes in this time period and the Hy-Vee Entrance at 70th Street had zero reported Crashes. The crash analysis is summarized in Tables 1 and 2 below.

Table 1: Intersection Crash Summary (2011 to 2014)*

Intersection	Crash Severity						Common Crash Types		
	Fatal	Major Injury	Minor Injury	Possible Injury	Property Damage Only	Total Crashes	Rear End	Left Turn	Broadside
University Avenue at 70th Street	0	0	0	0	6	6	2	2	2
70th Street at Hy-Vee Entrance	0	0	0	0	0	0	0	0	0

*Crash data is through July of 2014

Table 2: Intersection Crash Analysis (2011 to 2014)

Intersection	ADT*	Total Crashes	Crash Rate**	Average Crash Rate***
University Avenue at 70th Street	21,695	6	0.21	0.8

*Entering ADT is approximate based on low a DOT data and existing counts

**Crash rates are per Million Entering Vehicles

***Average crash rates are for similar intersections within the State of low a

Analysis of the crashes indicates that the intersection of University Avenue at 70th Street is below the statewide average for intersections with similar entering ADT volumes. The rear end and left-turn crashes at the intersection are expected types of crashes based on these being common crash types at signalized intersections. The broadside crashes are less common at signalized intersections and further investigation of the two at this intersection revealed they were a result of vehicles running a red light.

TRIP GENERATION AND DISTRIBUTION

Projected trips entering and exiting the proposed convenience store were calculated based on the Institute of Transportation Engineers (ITE) Trip Generation Manual, 9th Edition. The land use chosen for the trip generation analysis was Gasoline Service Station with Convenience Market and is summarized in Table 3.

Table 3: Hy-Vee Convenience Store Trip Generation

Land Use	ITE Code	Basis/Units	AM Peak Hour Trips		PM Peak Hour Trips		Daily Trips	
			In (50%)	Out (50%)	In (50%)	Out (50%)	In (50%)	Out (50%)
Gasoline/Service Station with Convenience Market	945	16 pumps	82	82	109	109	1303	1303

Refer to the Appendix for 2015 Build traffic volumes and turning movement diagrams that were used to develop the traffic models, including the 2035 No Build and 2035 Build scenarios. Trips were distributed to the network based on existing travel patterns. Below is a summary of the proposed trip distribution that was assumed for the proposed site:

- 31% to/from the west on University Avenue
- 15% to/from the north on 70th Street
- 48% to/from the east on University Avenue
- 6% to/from the south on 70th Street

Trips entering/exiting the proposed site were distributed to the accesses as follows:

- Trips to/from the north and south were added to the 70th Street at Hy-Vee Entrance intersection.
- Trips from the west were routed through the University Avenue at 70th Street intersection to the 70th Street at Hy-Vee Entrance intersection.
- Trips to the west were added to the proposed right-in/right-out access on University Avenue.
- Trips from the east were routed through the University Avenue at 70th Street intersection to the proposed right-in/right-out access on University Avenue.
- Trips to the east were added to the 70th Street at Hy-Vee Entrance intersection and

routed through the University Avenue at 70th Street intersection.

Developments like the proposed convenience store will attract a portion of their trips from traffic passing the site on the way from an origin to an ultimate destination. These types of trips are known as pass-by trips, which ITE defines as intermediate stops on the way from an origin to a primary destination without a route diversion. For the purpose of this study pass-by trips were considered those with primary routes along University Avenue and 70th Street. Pass-by trip data is available in the ITE Trip Generation Handbook, Second Edition for various land uses for the AM and PM peak hours. Table 4 below summarizes the percentage of pass-by trips used for the proposed Hy-Vee convenience store.

Table 4: Hy-Vee Convenience Store Pass-By Trips

Land Use	ITE Code Used	% Pass-By Trips		Pass-By Trips	
		AM	PM	AM	PM
Gasoline/Service Station with Convenience Market	945	62%	56%	102	122

Pass-by traffic reductions were applied to the through traffic on University Avenue and 70th Street based on the trip distributions outlined previously. In situations like this, where there is a grocery store on the same site as the proposed convenience store with gasoline pumps, there would likely be trips to the convenience market from customers already at the site to visit the grocery store. These are known as internal trips, but for the purposes of this study they were not subtracted from the trip generation in order to provide a more conservative analysis.

The estimated traffic generated was added to the existing peak hour traffic for the AM and PM Peak hours to determine the 2015 Build traffic. 2015 Build traffic volumes are attached in the Appendix for reference.

2035 traffic volumes were estimated by analyzing historical AADT traffic volumes along University Avenue and 70th Street. Based on the historical traffic volumes a growth rate of 1% per year of the existing traffic volumes was assumed to determine the 2035 No Build traffic volumes without the proposed development traffic. The estimated traffic generated by the proposed development was then added to the 2035 No Build traffic volumes to determine the final 2035 Build traffic volumes.

OPERATIONAL ANALYSIS

Traffic operations analysis was completed for the traffic volume scenarios; 2014 Existing, 2015 Build, 2035 No Build and 2035 Build for the AM and PM peak hours. The analysis was performed using the methodology of the 2010 Highway Capacity Manual through Synchro/SimTraffic a traffic analysis software program by Trafficware.

Results of the analysis are displayed as measures of effectiveness.

Measures of effectiveness display quantitative information about the performance of an intersection or network of intersections. The primary measures that are used in this study are level of service and delay.

The operational analysis results are described as a Level of Service (LOS) ranging from A to F. These letters serve to describe a range of operating conditions for different types of facilities. Levels of Service are calculated based on the 2010 Highway Capacity Manual, which defines the level of service, based on control delay. Control delay is the delay experienced by vehicles slowing down as they are approaching the intersection, the wait time at the intersection, and the time for the vehicle to speed up through the intersection and enter into the traffic stream. The average intersection control delay is a volume weighted average of delay experienced by all motorists entering the intersection on all intersection approaches for unsignalized and signalized intersections. Level of Service C is considered acceptable for opening year operations and LOS D is commonly taken as an acceptable long term future year LOS. The level of

service and its associated intersection delay for a signalized and unsignalized intersection is presented below in Table 5. The delay threshold for unsignalized intersections is lower for each LOS compared to signalized intersections, which accounts for the fact that people expect a higher level of service when at a stop-controlled intersection.

Table 5: Level of Service Criteria

LOS	Signalized Intersection	Unsignalized Intersection
	Control Delay per Vehicle (sec.)	Control Delay per Vehicle (sec.)
A	≤ 10	≤ 10
B	>10 and ≤ 20	>10 and ≤ 15
C	>20 and ≤ 35	>15 and ≤ 25
D	>35 and ≤ 55	>25 and ≤ 35
E	>55 and ≤ 80	>35 and ≤ 50
F	>80	>50

Existing lane configurations referenced in the Existing Conditions section of the report were used for the 2014 existing analysis for the intersections of University Avenue at 70th Street and 70th Street at the Hy-Vee Entrance. For the future scenarios the existing lane configurations were used for the University Avenue and 70th Street intersection. With the Hy-Vee Entrance moving approximately 100 feet north on 70th Street as a result of the proposed convenience store, the southbound approach of the intersection would change to a single thru/right lane, while the rest of the lane configurations would remain the same.

Table 6 and Table 7 below summarize the operational analysis for the four scenarios analyzed.

Table 6: University Avenue at 70th Street Operational Analysis - Signalized

Approach/ Movement	Existing				2015 Build				2035 No Build				2035 Build			
	AM		PM		AM		PM		AM		PM		AM		PM	
	Delay (s)	LOS	Delay (s)	LOS	Delay (s)	LOS	Delay (s)	LOS	Delay (s)	LOS	Delay (s)	LOS	Delay (s)	LOS	Delay (s)	LOS
EB Left	10.5	B	14.7	B	10.9	B	16.6	B	11.2	B	18.3	B	11.9	B	23.2	C
EB Thru	7.7	A	10.9	B	8.0	A	11.4	B	8.0	A	11.5	B	8.4	A	13.3	B
EB Right	2.0	A	2.5	A	2.1	A	2.0	A	1.7	A	1.9	A	1.9	A	2.0	A
WB Left	8.3	A	11.2	B	8.8	A	11.4	B	9.2	A	11.7	B	9.2	A	14.1	B
WB Thru	7.7	A	12.3	B	8.7	A	14.0	B	9.1	A	13.8	B	9.4	A	18.5	B
WB Right	3.2	A	7.2	A	3.7	A	8.1	A	3.7	A	8.9	A	4.5	A	13.2	B
NB Left	17.2	B	28.1	C	23.1	C	28.7	C	23.2	C	25.9	C	20.2	C	30.2	C
NB Thru	11.8	B	35.1	D	20.8	C	37.3	D	21.2	C	37.5	D	23.0	C	42.7	D
NB Right	3.8	A	11.7	B	4.9	A	12.9	B	4.2	A	12.9	B	5.0	A	17.5	B
SB Left	13.4	B	22.7	C	14.5	B	27.6	C	14.3	B	24.8	C	15.8	B	29.6	C
SB Thru	10.4	B	21.1	C	14.6	B	24.4	C	14.9	B	25.2	C	15.3	B	25.0	C
SB Right	4.2	A	5.8	A	4.7	A	5.7	A	4.8	A	7.3	A	5.3	A	6.2	A
Intersection	7.5	A	13.0	B	8.6	A	14.8	B	8.4	A	14.3	B	9.2	A	18.0	B

Table 7: 70th Street at Hy-Vee Entrance Operational Analysis - Stop Controlled

Approach/ Movement	Existing				2015 Build				2035 No Build				2035 Build			
	AM		PM		AM		PM		AM		PM		AM		PM	
	Delay (s)	LOS	Delay (s)	LOS	Delay (s)	LOS	Delay (s)	LOS	Delay (s)	LOS	Delay (s)	LOS	Delay (s)	LOS	Delay (s)	LOS
EB Left	4.9	A	8.6	A	5.9	A	9.3	A	6.0	A	9.5	A	7.6	A	11.4	B
EB Right	3.2	A	3.3	A	3.1	A	3.7	A	3.0	A	3.6	A	3.4	A	4.1	A
NB Left	2.5	A	3.4	A	3.4	A	4.0	A	3.4	A	3.1	A	3.8	A	4.1	A
NB Thru	0.6	A	1.0	A	0.7	A	1.1	A	0.7	A	1.0	A	0.8	A	1.1	A
SB Thru	0.3	A	0.4	A	0.7	A	1.2	A	0.3	A	0.5	A	0.7	A	1.2	A
SB Right	0.1	A	0.2	A	0.3	A	0.5	A	0.1	A	0.1	A	0.7	A	0.5	A
Intersection	N/A		N/A		N/A		N/A		N/A		N/A		N/A		N/A	

QUEUEING ANALYSIS

The maximum queue lengths were reviewed for the existing and 2015 Build scenarios. Tables 6 and 7 are summaries of the maximum queue lengths anticipated for the intersections within the study limits.

Table 8: University Avenue at 70th Street Maximum Queuing

Approach/ Movement	Existing		2015 Build	
	AM	PM	AM	PM
	Max Queue	Max Queue	Max Queue	Max Queue
EB Left	70	140	75	130
EB Thru	105	165	95	160
EB Thru	100	160	105	160
EB Right	30	25	35	25
WB Left	60	90	55	100
WB Thru	130	185	120	200
WB Thru/Right	135	180	135	215
NB Left	30	45	45	50
NB Thru/Right	35	110	45	130
SB Left	85	135*	105	165
SB Thru	35	120	35	210
SB Thru/Right	85	90	90	95

*Queue Length exceeds turn lane storage length

Table 9: 70th Street at Hy-Vee Entrance Maximum Queuing

Approach/ Movement	Existing		2015 Build	
	AM	PM	AM	PM
	Max Queue	Max Queue	Max Queue	Max Queue
EB Left	35	95	30	90
EB Right	60	85	60	110
NB Left	35*	55*	60	80*
SB Thru/Right	5	10	5	25

*Queue Length exceeds turn lane storage length

Analysis of the existing traffic volumes indicates that the intersections are operating at acceptable levels during the AM and PM peak hours. Analysis of the maximum queuing for the existing traffic scenario indicates the following:

- During the PM peak hour the southbound left-turn lane queue at the intersection of University Avenue and 70th Street exceeds the turn lane storage length seven percent of the hour.
- At the intersection of 70th Street and the Hy-Vee Entrance the northbound left queue exceeds the turn lane storage length one percent of the AM peak hour and three percent of PM peak hour.

Analysis of the 2015 Build scenario indicates that with the addition of traffic from the proposed development the intersections are anticipated to have slight increases in delay, while continuing to operate at acceptable service levels during the AM and PM peak hours. With the Hy-Vee entrance at 70th Street needing to be moved approximately 100 feet north of its current location, there is an opportunity to modify the length of the left-turn lanes for the northbound movement at 70th Street and the Hy-Vee Entrance and the southbound movement at University Avenue and 70th Street. If the existing shared taper length of the back-to-back left-turn lanes is maintained then it is recommended that the southbound left-turn lane be lengthened to approximately 120 feet and the northbound left-turn lane be lengthened to approximately 70 feet. Analysis of the maximum queuing for the 2015 Build traffic scenario indicates the following:

- During the PM peak hour the southbound left-turn lane queue at the intersection of University Avenue and 70th Street is anticipated to exceed the turn lane storage length 10 percent of the hour.

Analysis of the 2035 No Build and 2035 Build traffic scenarios indicates that the intersections are anticipated to operate at acceptable levels of delay, with moderate increases in delay for some individual movements.

In addition to the intersections of University Avenue at 70th Street and 70th Street at the Hy-Vee Entrance, the proposed right-in/right-out intersection with University Avenue was analyzed. Based on the analysis the proposed right-in/right-out intersection is anticipated to operate at LOS B or better during peak hours with 2015 Build and 2035 Build traffic levels.

PROPOSED SITE CIRCULATION ANALYSIS

A review of the site plan for the proposed Hy-Vee Convenience Store/Gas Station was also completed to look at any potential traffic circulation issues. Potential queuing of traffic exiting the proposed site from the right-in/right-out access as well as the 70th Street access was analyzed. Based on the analysis it is anticipated that vehicle queuing associated with these access points will not be a problem or have any adverse effects on site circulation.

CONCLUSIONS & RECOMMENDATIONS

Based on the traffic analysis of the existing, 2015 Build, 2035 No Build, and 2035 Build scenarios, the conclusions and recommendations for the proposed Hy-Vee gas station/convenience store are as follows:

- Analysis of existing crash data indicates that the crash rate for University Avenue at 70th Street is below the average for similar intersections within the State of Iowa.
- The proposed development is anticipated to generate 164 trips in the AM peak hour and 218 trips in the PM peak hour. Pass-by trips were taken into account for the trip generation analysis and account for 102 of the AM peak hour trips and 122 of the PM peak hour trips. This results in 62 new trips in AM peak hour and 96 new trips in the PM peak hour.
- Traffic operations analysis of existing traffic levels indicates that intersections within the study area are operating at acceptable levels during the peak hours.
- Traffic operations analysis indicates that with the addition of traffic from the proposed development the intersections within the study area are anticipated to operate at acceptable service levels in 2015 and 2035.
- Queuing analysis of the intersections within the study area indicates that the following left-turn lane lengths should be modified when the 70th Street at Hy-Vee entrance intersection is moved north:
 - The southbound left-turn lane for University Avenue at 70th Street should be lengthened to approximately 120 feet
 - The northbound left-turn lane for the 70th Street at Hy-Vee Entrance should be lengthened to approximately 70 feet.
- Analysis of the proposed right-in/right-out access on University Avenue is anticipated to operate at LOS B or better during the peak hours with the proposed development traffic and future background traffic growth.
- It is anticipated that internal vehicle queuing associated with the proposed access points on University Avenue and 70th Street will not be a problem or have any adverse effects on site circulation.
- The existing traffic signal timing at University Avenue and 70th Street will remain adequate with the addition of the proposed development traffic, however it is recommended that traffic operations be observed in the field upon the opening of the development and traffic signal timings be modified based on observed delay and queuing.
- The traffic signals along University Avenue are currently not running in coordination during the peak hours, but it is recommended that the City of Windsor Heights consider coordinating the closely spaced signals along University Avenue to improve overall traffic operations and progression of the corridor.