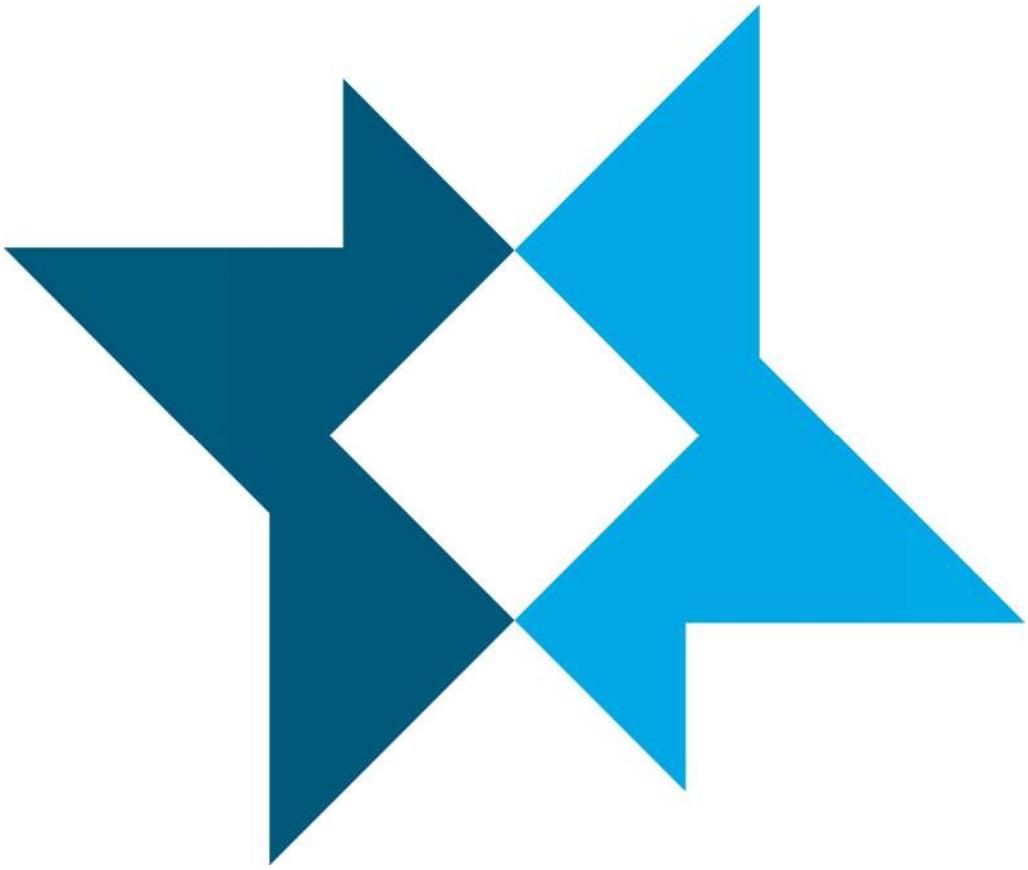
ADM High School
Traffic Impact Study



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ADM High School

Traffic Impact Study

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Prepared for

ADM Community Schools

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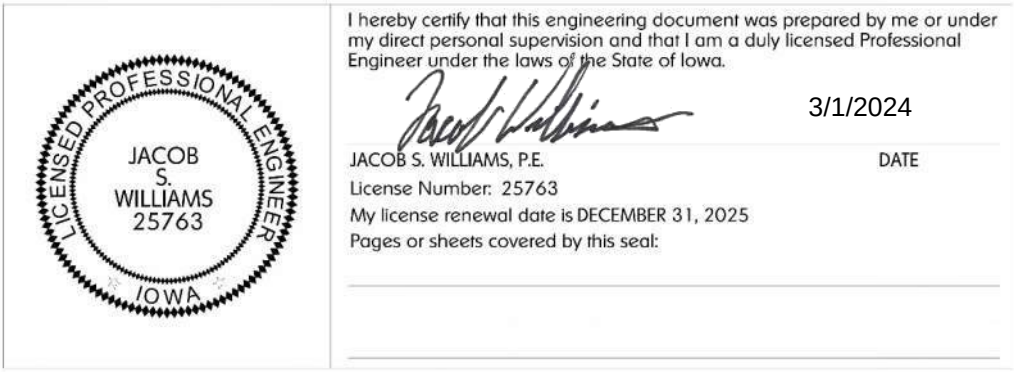

EXECUTIVE SUMMARY

A traffic impact study was performed for the US Highway 6/169 (Nile Kinnick Drive) Corridor between Meadow Road and Southbridge Drive to determine the appropriate traffic control, roadway geometric requirements, and impacts of the proposed Adel/De Soto/Minburn (ADM) High School in Adel. The study also considers the impact of additional site generated traffic from the proposed Southbridge Development, which is adjacent to the proposed high school site. The proposed site is approximately 77 acres on the west side of US Highway 6/169 near its intersections with Common Place and 302nd Place as shown in Figure 1.

Figure 1: Site Location

The proposed high school is anticipated to have a 2025 opening day enrollment of 700 students, with the ability to accommodate 1,000 students in the future. It is estimated that the proposed high school will generate approximately 1,350 vehicles per day in the opening year and approximately 1,950 vehicles per day when maximum enrollment is reached.

The following are key takeaways from the study:

- Existing traffic on US Highway 6/169 through the study area is approximately 9,200 vehicles per day.
- Available crash data for intersections within the study area indicates there have only been crashes at the intersections of US Highway 6/169 at Meadow Road and US Highway 6/169 at 302nd Place. The data indicates there are less crashes occurring then expected for similar intersection types within Iowa. The most prevalent crash type is rear-end crashes involving

vehicles on US Highway 6/169. The addition of dedicated left and right turn lanes at these intersections is a potential mitigation strategy.

- An eastbound left-turn lane should be painted at the US Highway 6/169 and Meadow Road intersection. The current width of this leg of the intersection can accommodate a dedicated left-turn lane and this would match the existing cross section of the westbound approach.
- A traffic impact study was completed for the Southbridge Development adjacent to the proposed high school site. The Southbridge Development is anticipated to generate approximately 19,000 trips per day by 2045.
- Within the study area, US Highway 6/169 is forecasted to have approximately 11,600 vehicles per day by 2025 and 22,600 vehicles per day by 2045. Most of the traffic growth is attributable to the Southbridge Development and the large commercial development assumed in it.
- Analysis of the 2023 Existing traffic indicates that all five study intersections are operating at acceptable levels.
- In 2025, with the addition of the proposed high school traffic, operations are anticipated to remain at acceptable levels for all study intersections except US 6/169 at Common Place. The intersection is anticipated to have high levels of delay for vehicles exiting the high school access.
- For the intersection of US 6/169 at Common Place it is recommended that a single-lane roundabout be constructed for opening day of the proposed high school. The design should be able to accommodate expansion to a hybrid multi-lane roundabout in the future if needed.
- Include pedestrian accomodations for any intersection control type.
- Designate the area a school zone with a reduced speed limit during AM and PM peak hours.
- 2045 forecasted traffic volumes, with and without the proposed high school, indicate all five intersections are anticipated to have unacceptable operations and require mitigation through geometric and traffic control changes.
- Although not analyzed as part of this study, the following mitigation strategies are recommended to be explored in the future as traffic volumes grow as a result of the Southbridge Development:
    - With the close proximity of accesses into the Southbridge Development, an access management strategy for US Highway 6/169 at 302nd Place and US Highway 6/169 at Bradfield Street should be considered. As development continues, conversion of those two intersections to ¾ accesses (left/right in, right-out only) could be beneficial to the corridor.
    - Roundabouts should be considered for the intersections of US Highway 6/169 at Meadow Road, US Highway 6/169 at Common Place, and US Highway 6/169 at Southbridge Drive.
    - As traffic volumes continue to increase, dedicated left and right turn lanes should be constructed on US Highway 6/169 as was recommended in the Southbridge Development Study.

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1. INTRODUCTION

A traffic impact study was performed for the US Highway 6/169 (Nikle Kinnick Drive) Corridor to determine the appropriate traffic control, roadway geometric requirements, and impacts of the proposed Adel/De Soto/Minburn (ADM) High School in the study area. The study also takes into account the impact of additional site generated traffic from the proposed Southbridge Development, which is adjacent to the proposed high school site. The project location/study area can be seen in Figure 1.

2. ANALYSIS OF EXISTING CONDITIONS

The study area boundaries for the proposed high school include the US Highway 6/169 corridor from Southbridge Drive to Meadow Road. The study area, site location, and five study intersections are shown in Figure 1**.** The proposed high school would add a fourth leg to the intersection of US Highway 6/169 at Common Place. The study area's current land use is agricultural on the west side of US Highway 6/169, including the proposed site location. The east side of US Highway 6/169 is within the city limits of Adel and includes a mixture of residential and commercial land uses.

The following intersections were included in the study as shown in Figure 1:

- US Highway 6/169 at Meadow Road
- US Highway 6/169 at 302nd Place
- US Highway 6/169 at Common Place
- US Highway 6/169 at Bradfield Street
- US Highway 6/169 at Southbridge Drive

US Highway 6/169 is a two-lane principal arterial with a rural cross-section that runs north/south through the study area. To the north it extends through the City of Adel and to the south it extends past the Interstate 80 interchange. The posted speed limit through the study area is 55 miles per hour (mph).

Meadow Road is a local road with commercial accesses west of US Highway 6/169 and residential homes along the roadway to the east. The speed limit along Meadow Road is 25 mph. Meadow Road has a dedicated left turn lane for the westbound approach at US Highway 6/169. The intersection is two-way stop controlled on the eastbound and westbound approaches.

302nd Place is a local road east of Nile Kinnick Drive/US Highway 6/169 accesses to a church and local residential road connections. The speed limit along 302nd Place is 25 mph. 302nd Place has a dedicated left and right turn lane for the westbound approach at US Highway 6/169. The intersection is stop controlled on the westbound approach.

Common Place is a two-lane divided local road east of US Highway 6/169 with local road connections. The speed limit along Common Place is 25 mph. Common Place has a dedicated left and right turn lane for the westbound approach at US Highway 6/169. The intersection is stop controlled on the westbound approach.

Bradfield Street is a local road east of US Highway 6/169 with local residential road connections. The speed limit along Bradfield Street is 25 mph. Bradfield Street has a dedicated left and right turn lane for the westbound approach at US Highway 6/169. The intersection is stop controlled on the westbound approach.

Southbridge Drive is a local road east of US Highway 6/169 with local residential road connections. The speed limit along Southbridge Drive is 25 mph. Southbridge Drive has a dedicated left and right turn lane for the westbound approach at US Highway 6/169. The intersection is stop controlled on the westbound approach.

The existing intersection geometry and traffic control for each of the study intersections can be seen in Appendix A

Traffic Data

Video traffic count data was collected by Foth and processed by Miovision in November of 2023 for each of the study intersections, except for US Highway 6/169 at Meadow Road, which had recent data available through the Iowa DOT. The existing traffic volume exhibits can be found in Appendix B and the raw traffic count data can be found in Appendix G.

The AM peak hour in the area is 7:15-8:15 AM, School PM peak hour is from 3:00 PM – 4:00 PM and the PM peak hour is 4:30-5:30 PM. The heavy vehicles percentage on US Highway 6/169 is 8.3 percent for northbound thru traffic and 6.3 percent for southbound thru traffic. A heavy vehicle percentage of two percent was used for all local roads within the study area.

The existing Average Daily Traffic (ADT) is shown in Table 1 for US Highway 6/169. AM, School PM, and PM peak hour expansion factors (k factors) were calculated using the 24-hour count data available form the Iowa DOT. ADT volumes were calculated for the different locations along US Highway 6/169 using the peak hour traffic data and calculated expansion factors.

Table 1: 2023 ADTs

Roadway	Location	2023 ADT
US Highway 6/169	North of Meadow Road	9,400
	302nd Place to Meadow Road	9,350
	Common Place to 302nd Place	9,200
	Bradfield Street to Common Place	9,200
	Southbridge Drive to Bradfield Street	9,350
	South of Southbridge Drive	9,400

It was determined that a background growth rate of 1.8 percent per year would be used for thru-traffic along US Highway 6/169. The background growth rate was obtained from the Iowa DOT Office of Systems Planning. Other movement to and from local roads were assumed to have a background growth rate of 0.5 percent per year. Forecasted traffic volumes from the Southbridge Development Traffic Study, completed in July 2019, were also incorporated into the future traffic volumes.

Crash History

Crash data from 2018 to 2022 was obtained from the Iowa Crash Analysis Tool (ICAT) and was analyzed for the study intersections. The crash analysis is summarized in Table 2 below. The intersections of US Highway 6/169 at Common Place, Bradfield Street, and Southbridge Drive have zero reported crashes.

Both the intersection of US Highway 6/169 at Meadow Road and US Highway 6/169 at 302nd Place have negligible Potential for Crash Reduction (PCR) values, indicating that the intersections have less crashes then expected for similar intersection types within Iowa.

Of the 15 crashes between the two intersections, six were rear-end crashes involving vehicles on US Highway 6/169. The addition of dedicated left and right turn lanes at the intersections is a potential mitigation strategy.

Table 2: Intersection Crash Summary (2018 to 2022)

Intersection	Crash Severity						Common Crash Types				
	Fatal	Serious Injury	Minor Injury	Possible Injury	Property Damage Only	Total Crashes	Rear End	Left Turn	Broadside	Sideswipe	Not Reported/ Other
US Highway 6/169 at Meadow Road	0	0	1	2	6	**9**	2	0	2	3	2
US Highway 6/169 at 302nd Place	0	1	0	1	4	**6**	4	0	1	0	1
US Highway 6/169 at Common Place	0	0	0	0	0	**0**	0	0	0	0	0
US Highway 6/169 at Bradfield Street	0	0	0	0	0	**0**	0	0	0	0	0
US Highway 6/169 at Southbridge Drive	0	0	0	0	1	**1**	0	0	0	0	1

3. PROPOSED DEVELOPMENT

The Adel/De Soto/Minburn Community School District is proposing a new High School towards the southern city limits of Adel. The proposed site is approximately 77 acres on the west side of US Highway 6/169 near its intersections with Common Place and 302nd Place. The proposed site layout includes a single connection to US Highway 6/169 with what would be the fourth leg at the Common Place intersection. The anticipated opening day is in the fall of 2025 with approximately 700 students. By 2045 the school is anticipated to have approximately 1,000 students.

The proposed development site plan is shown below in Figure 2.

Figure 2: Proposed Development

4. ANALYSIS OF FUTURE CONDITIONS

The following traffic volume scenarios were considered for this analysis:

- 2023 Existing
- 2025 Build – Includes proposed high school
- 2045 No Build – Excludes proposed high school, includes proposed Southbridge Development traffic
- 2045 Build – Includes proposed high school, includes proposed Southbridge Development traffic

Trip Generation

Based on information provided by the ADM Community School District and the proposed site plan, a trip generation estimate was performed using the Institute of Transportation Engineers (ITE) Trip Generation, 11th Edition. Peak hour trips were estimated for the AM, School PM, and PM peak hours. Two scenarios were included to account for opening day 2025 with 700 students and the future 2045 scenario with 1,000 students. The trip generation estimates for 2025 and 2045 are shown in Table 3.

Table 3: Trip Generation Summary

Site	Land Use	ITE Code	Bases/Units	AM Peak* Hour Trips		School PM Peak* Hour Trips		PM Peak Hour Trips		Daily Trips		Build Year Analysis Inclusion
				In	Out	In	Out	In	Out	In	Out	
ADM High School	HIGH SCHOOL	525	700 Students	292	137	84	178	47	51	679	679	2025
			1000 Students	376	177	109	232	67	73	970	970	2045

**fitted curve equation used*

A traffic impact study for the Southbridge Development was completed for the City of Adel in 2019 and is included in the Appendix H. The Southbridge Development includes the following land uses:

- Single Family Housing – 532 units
- Townhouse/Duplex – 20 units
- Multifamily Housing (Apartments) – 96 units
- Senior Adult Living – 60 units
- Assisted Living – 90 units
- Elementary School – 400 students
- Shopping Center – 285,900 ft^2

For the purposes of this traffic impact study, the Southbridge Development entering and exiting peak hour traffic for the intersections of US Highway 6/169 at 302nd Place, US Highway 6/169 at Common Place, US Highway 6/169 at Bradfield Street, and US Highway 6/169 at Southbridge Drive were included in the analysis volumes. These volumes are shown in Figures 9 and 10 of the Southbridge Development traffic impact study attached in Appendix H.

The School PM peak hour was not analyzed in the Southbridge Development traffic impact study. For this analysis, the traffic entering and existing the Southbridge Development during the School PM peak hour was estimated using Vehicle Time of Day Distributions made available by ITE through their ITETripGen Appendices. The forecasted PM peak hour volumes entering and exiting the Southbridge Development were reduced by 16.3 percent for entering traffic and 15.1 percent for existing traffic to determine the School PM peak hour volumes.

Trip Distribution and Assignment

Trips generated by the proposed high school were distributed to the surrounding and proposed road network based on the proposed site access location and the ADM Community School District Enrollment Analysis Report that was completed in May 2022. All generated trips from the proposed high school were assumed to enter/exit the study network from one of nine gates. The percentages entering/exiting each gate were estimated based on the school district attendance boundaries, the school district student density heat map, and existing school enrollment data that is available in the ADM Enrollment Report. The following is summary of the trip distribution used for the proposed high school:

- 36% to/from US Highway 6/169 north of Meadow Road
- 30% to/from Meadow Road west of US Highway 6/169
- 1% to/from Meadow Road east of US Highway 6/169
- 4% to/from 302nd Place east of US Highway 6/169
- 5% to/from Common Place east of US Highway 6/169
- 2% to/from Bradfield Street east of US Highway 6/169
- 2% to/from Southbridge Drive east of US Highway 6/169
- 20% to/from US Highway 6/169 south of Southbridge Drive

Future Traffic Volumes

The forecasted/projected traffic volumes were developed for future scenarios using the following process:

- 2023 AM, School PM, and PM peak hour volumes were projected to 2025 and 2045 future background volumes using annual growth rates. A background growth rate of 1.8 percent per year was used for thru movements on US Highway 6/169 within the study area. A 0.5 percent per year background growth rate was used for all other traffic movements within the study area.

- The estimated traffic generated by the proposed high school and the Southbridge Development were then added to the future background volume for each scenario to obtain the final future peak hour turning movement volumes that were utilized for the future operational analyses. Exhibits for future background volumes, future new site trips, other volume (Southbridge Development traffic), and future total volumes for 2025 and 2045, can be found in Appendix B.

- For the 2045 No Build scenario, the proposed high school trips were not added to the future background volumes. The Southbridge Development traffic was included in this analysis. Exhibits for the 2045 No Build forecasted traffic volumes can be found in Appendix B.

Using the forecasted peak hour turning movement counts, Annual Daily Traffic (ADT) volumes for US Highway 6/169 within the study area were determined. AM, School PM, and PM peak hour expansion factors (k factors) were calculated using 24-hour count data for US Highway 6/169 at Meadow Road from the Iowa DOT. The projected future 2025 Build, 2045 Build, and 2045 No Build ADTs on US Highway 6/169 are listed below in Table 4.

Table 4: Existing and Future ADTs

Roadway	Location	2023 ADT	2025 Build ADT	2045 No Build ADT	2045 Build ADT
US Highway 6/169	North of Meadow Road	9,400	10,800	20,100	21,300
	302nd Place to Meadow Road	9,350	11,700	19,900	22,500
	Common Place to 302nd Place	9,200	11,600	19,700	22,600
	Bradfield Street to Common Place	9,200	10,200	20,000	20,900
	Southbridge Drive to Bradfield Street	9,350	10,300	19,400	20,300
	South of Southbridge Drive	9,400	10,300	19,300	20,100

Warrants Analysis

Right Turn Lane Warrants (major roadway)

Iowa DOT Chapter 6-1 of the Design Manual was used to determine the need for turn lanes on US Highway 6/169 at Meadow Road and Common Place. Figure 1 from the Design Manual (shown below in Figure 3) was used to determine if right or left-turn lanes are warranted. The intersections of US Highway 6/169 at 302nd Place, US Highway 6/169 at Bradfield Street, and US Highway 6/169 at Southbridge Drive were not included in the analysis as northbound right-turn lanes were recommended at each of these intersections in the Southbridge Development Traffic Impact Study.

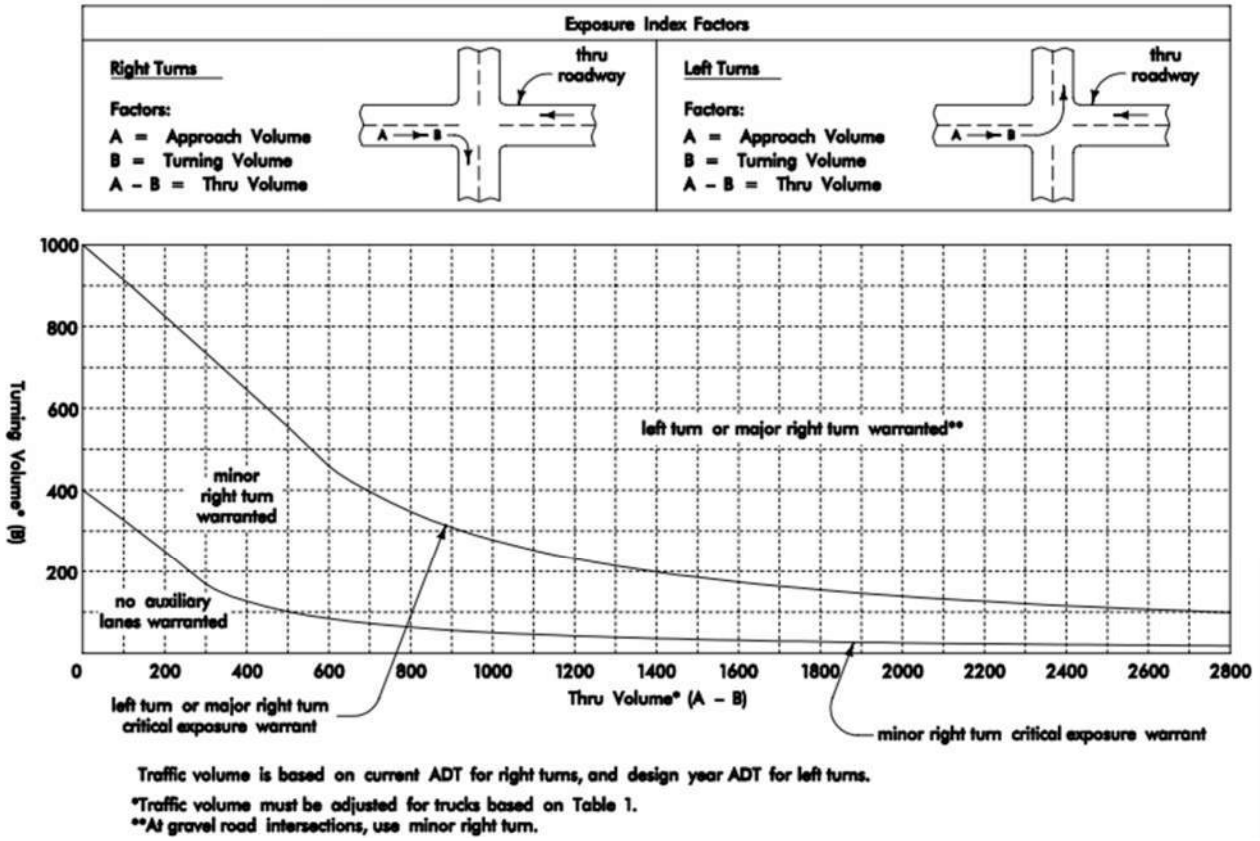

Figure 3: Iowa DOT Chapter 6-1
Rural Two-lane Highway Auxiliary Lane Warrants

The 2025 Build volumes were used to determine the right-turn lane warrants and 2045 volumes were used to determine the left-turn lane warrants. Points were unable to be plotted on Figure 3 because the through volume ADT are beyond the extents of the graph. The threshold for left-turns and major right turn lanes are 100 daily turning movements. The southbound right-turn movement meets the major right-turn lane warrant for 2025 build scenario. The northbound left-turn lane warrant is met for the 2045 build scenario.

Auxiliary Turn Lane Warrants (minor roadway)

NCHRP Report 457 for Two-Way Stop-Controlled Intersections defines turn lane warrants based on peak hour traffic volumes in urban settings. To determine the need for additional minor road turn lanes at US Highway 6/169 at Meadow Road and US Highway 6/169 at Common Place, Figure 2-4 from NCHRP Report 457 was used. The intersections of US Highway 6/169 at 302nd Place, US Highway 6/169 at Bradfield Street, and US Highway 6/169 at Southbridge Drive were not included in the analysis as auxiliary turn lanes for the minor approaches were recommended at each of these intersections in the Southbridge Development traffic impact study.

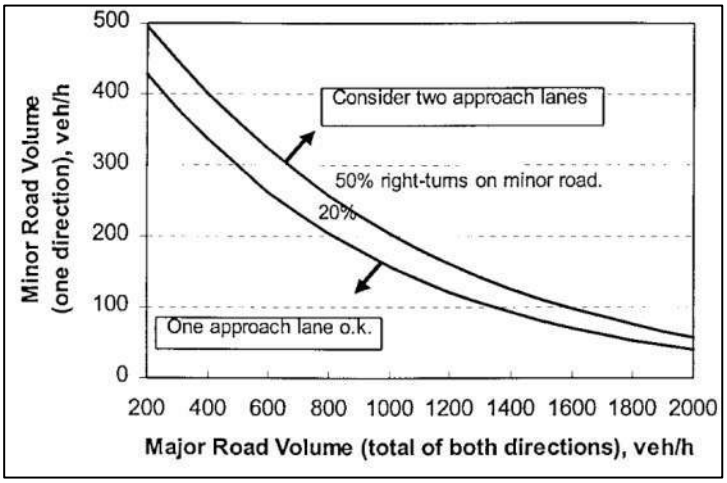

Figure 4: NCHRP Report 457 Figure 2-4:
Minor Road Approach Geometry at TWSC intersections

The major road approach volumes and minor road approach volumes in Table 5 were compared to Figure 2-4 for both the 2025 Build and 2045 Build scenarios.

Table 5: Turn Lane Warrants on Minor Approaches

Intersection	Approach	Peak Hour	2025 Build					2045 Build				
			Minor Right-Turn Volumes	Minor Total Volumes	% Right-Turns	Major Volume	Warranted Y/N	Minor Right-Turn Volumes	Minor Total Volumes	% Right-Turns	Major Volume	Warranted Y/N
US Highway 6/169 at Meadow Road	EB	AM	157	202	78%	1091	N	189	239	79%	2001	Y
		School PM	72	122	59%	879	N	85	141	60%	1764	Y
		PM	52	91	57%	982	N	62	106	58%	2041	Y
	WB	AM	30	53	57%	1091	N	33	59	56%	2001	N
		School PM	15	39	38%	879	N	17	44	39%	1764	N
		PM	19	29	66%	982	N	21	34	62%	2041	N
US Highway 6/169 at Common Place	EB	AM	33	137	24%	1207	Y	43	177	24%	2120	Y
		School PM	44	178	25%	775	N	56	232	24%	1637	Y
		PM	12	51	24%	913	N	17	73	23%	1953	Y

An eastbound right-turn lane is warranted at US Highway 6/169 and Meadow Road based on forecasted 2045 Build traffic. An eastbound right-turn lane is warranted at US Highway 6/169 and Common Place based on projected 2025 and 2045 Build traffic volumes, while a westbound right-turn lane was recommended in the Southbridge Development traffic impact study.

Traffic Signals Warrants

A preliminary traffic signal warrant analysis in accordance with Section 4C of the *Manual on Uniform Traffic Control Devices* (MUTCD) was performed using the AM, School PM, and PM forecasted peak hours at US Highway 6/169 and Common Place for the 2025 and 2045 Build scenarios. Traffic signal warrant reports can be found in Appendix E. Table 6 below provides a summary for the warrants analysis results. The traffic signal warrants analysis shows that Warrants 1 (Eight-Hour Vehicular Volume), 2 (Four-Hour Vehicular Volume), and 3 (Peak Hour) are not met for the intersection based on forecasted 2025 Build traffic volumes. Warrants 1, 2 and 3 are all met based on forecasted 2045 Build traffic volumes.

Table 6: Traffic Signal Warrants Summary

Intersection	2025			2045		
	Warrant 1	Warrant 2	Warrant 3	Warrant 1	Warrant 2	Warrant 3
US Highway 6/169 at Common Place	Not Met	Not Met	Not Met	Met	Met	Met

Functional Area Analysis

The intersections of US Highway 6/169 at 302nd Place and US Highway 6/169 at Bradfield Street are each approximately 900' from the proposed high school access location that would be the fourth leg to the US Highway 6/169 at Common Place intersection. The upstream functional distance as defined in the Iowa DOT Access Manual is composed of three parts:

d1 = distance traveled during the approaching driver's perception-reaction time
d2 = distance traveled during deceleration to a stop if that is necessary
d3 = queue storage length created by a stop condition or the queue activity occurring in a left or right turn lane

Table 11 from the Iowa DOT Access Management Manual provides values for d1 and d2 based on a 55 mph posted speed limit. The value for d2 was determined assuming the presence of turn lanes, as warrants for turn lanes are met. To determine d3, the greatest 95th percentile queue length was used from the future scenarios capacity analysis. Table 7 below shows values for d1, d2 and d3.

Table 7: 2045 US Highway 6/169 at Common Place Functional Area of the Intersection

Control Type	Posted Speed	Direction	D1	D2	D3	Total
Traffic Signal	55	NB	200	500	35	735
	55	SB	200	500	125	825
Multi-Lane Roundabout	55	NB	200	500	80	780
	55	SB	200	500	115	815

The functional area of the intersection is less than the distance to each adjacent intersection for both traffic signal control or a roundabout.

Capacity Analysis

Capacity/traffic operations analysis was completed for the traffic volume scenarios Existing, 2025 Build, 2045 No Build, and 2045 Build for the AM, School PM, and PM peak hours. The analysis was performed using the methodology of the Highway Capacity Manual 7th Edition through Vistro, a traffic analysis software program by PTV.

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 Highway Capacity Manual 7th Edition, 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 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. Typically LOS D is the minimum acceptable LOS for signalized intersections and approaches during peak hours, although LOS F can be acceptable for left-turns and movements from STOP controlled approaches on minor streets during peak hours. The level of service and its associated intersection delay for signalized and unsignalized intersections is presented below in Table 8.

Table 8: Level of Service Criteria

LOS	Signalized Intersection Control Delay per Vehicle (sec.)	Unsignalized Intersection Control Delay per Vehicle (sec.)
A	Less than 10	Less than 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	Greater than 80	Greater than 50

For this traffic study, the purpose of the operational analysis was to determine the impact the proposed high school would have on the intersections within the study area. As the traffic forecasts have shown, the Southbridge Development is anticipated to generate significantly more traffic than the proposed high school. In terms of mitigation strategies, the intersection of US Highway 6/169 at Common Place was the focus of this analysis. The other four intersections within the study area are anticipated to need mitigation in the future as well and general recommendations are addressed in this analysis. The analysis results from the four scenarios considered are summarized below. The outputs from the *Vistro* model can be found in Appendix D.

The following parameters and assumptions were used for the traffic operational analysis models:

- Peak hour factors for each intersection and time period were used from the turning movement counts collected
- An eastbound left-turn lane was assumed for each analysis period at the US Highway 6/169 and Meadow Road intersection. The current width of this leg of the intersection can accommodate a dedicated left-turn lane and this would match the existing cross section of the westbound approach.
- All future analyses assume dedicated northbound and southbound left-turn lanes on US Highway 6/169 for the study intersections. These turn lanes are either warranted based on existing traffic volumes or are recommended in the Southbridge Development study.
- All future analyses assume dedicated northbound right-turn lanes for the intersections of US Highway 6/169 at 302nd Place, US Highway 6/169 at Common Place, US Highway 6/169 at Bradfield Street, and US Highway 6/169 at Southbridge Drive. These turn lanes were recommended in the Southbridge Development study.

2023 Existing

The 2023 existing peak hour operations are summarized below in Table 9. Operations at all five intersections are currently at acceptable levels. The side-street left-turn movements at US Highway 6/169 and Meadow Road have delays that are nearing LOS E, but this is acceptable for an unsignalized approach during peak hours.

Table 9: 2023 Existing Peak Hour Operational Analysis

Intersection and Traffic Control	Peak Hour	Maximum Delay-LOS**		Limiting Movement***
US Highway 6/169 at Meadow Road *Side-Street Stop*	AM	29.8	D	EBL
	School PM	25.5	D	EBL
	PM	30.5	D	EBL
US Highway 6/169 at 302nd Place Side-Street Stop	AM	21.7	C	WBL
	School PM	16.8	C	WBL
	PM	18.4	C	WBL
US Highway 6/169 at Common Place Side-Street Stop	AM	19.1	C	WBL
	School PM	15.3	C	WBL
	PM	17.5	C	WBL
US Highway 6/169 at Bradfield Street Side-Street Stop	AM	18.6	C	WBL
	School PM	15.4	C	WBL
	PM	17.8	C	WBL
US Highway 6/169 at Southbridge Drive Side-Street Stop	AM	19.8	C	WBL
	School PM	15.1	C	WBL
	PM	17.5	C	WBL

*Delay in seconds per vehicle

**Maximum delay and LOS on any approach and/or movement

***Limiting Movement is the highest delay movement or approach

2025 Build

The 2025 Build peak hour operations are summarized below in Table 10. Operations are anticipated to remain at acceptable levels with the existing geometry and traffic control for the US Highway 6/169 at 302nd Place, US Highway 6/169 at Bradfield Street, and US Highway 6/169 at Southbridge Drive intersections. Although the side-street left-turn movements at US Highway 6/169 and Meadow Road have delays that are LOS E/F, the volumes for these movements are relatively low. With the lower volumes, that amount of delay is acceptable for an unsignalized approach during peak hours.

With the addition of traffic from the proposed high school, the intersection of US Highway 6/169 at Common Place is anticipated to have high levels of delay for vehicles exiting the high school access. With many of the motorists likely to be young drivers a change in traffic control should be made for the intersection. Mitigation strategies for this intersection are detailed in Table 13 and discussed at the end of this section of the report.

Table 10: 2025 Build Peak Hour Operational Analysis

Intersection and Traffic Control	Peak Hour	Maximum Delay-LOS**		Limiting Movement***
US Highway 6/169 at Meadow Road *Side-Street Stop*	AM	74.7	F	WBL
	School PM	48.1	E	EBL
	PM	38.5	E	EBL
US Highway 6/169 at 302nd Place Side-Street Stop	AM	42.0	E	WBL
	School PM	22.2	C	WBL
	PM	20.8	C	WBL
US Highway 6/169 at Common Place Side-Street Stop	AM	138.7	F	EBL
	School PM	31.4	D	EBL
	PM	25.2	D	EBL
US Highway 6/169 at Bradfield Street Side-Street Stop	AM	21.9	C	WBL
	School PM	17.2	C	WBL
	PM	19.0	C	WBL
US Highway 6/169 at Southbridge Drive Side-Street Stop	AM	23.1	C	WBL
	School PM	16.7	C	WBL
	PM	18.6	C	WBL

*Delay in seconds per vehicle

**Maximum delay and LOS on any approach and/or movement

***Limiting Movement is the highest delay movement or approach

2045 No Build and 2045 Build

The 2045 No Build and 2045 Build peak hour operations are summarized below in Tables 11 and 12. For both scenarios, all five intersections are anticipated to have unacceptable operations and require mitigation through geometric and traffic control changes. The intent of the no build analysis is to show future operational issues are mainly attributable to the significant amount of traffic forecasted to be generated by the Southbridge Development.

Although not analyzed as part of this study, the following mitigation strategies are recommended to be explored further in the future as traffic volumes grow as a result of the Southbridge Development:

- With the close proximity of accesses into the Southbridge Development, an access management strategy for US Highway 6/169 at 302nd Place and US Highway 6/169 at Bradfield Street should be considered. As development continues, conversion of those two intersections to ¾ accesses (left/right in, right out only) could be beneficial to the corridor.
    - The surrounding local street network, along with geometric and traffic control changes at the other intersections would help support this access management strategy.
- Roundabouts should be considered for the intersections of US Highway 6/169 at Meadow Road, US Highway 6/169 at Common Place, and US Highway 6/169 at Southbridge Drive.
- As traffic volumes continue to increase, dedicated left and right turn lanes should be constructed on US Highway 6/169 as was recommended in the Southbridge Development Study.

Table 11: 2045 No-Build Peak Hour Operational Analysis

Intersection and Traffic Control	Peak Hour	Maximum Delay-LOS**		Limiting Movement***
US Highway 6/169 at Meadow Road *Side-Street Stop*	AM	649.1	F	EBL
	School PM	780.9	F	EBL
	PM	986.4	F	EBL
US Highway 6/169 at 302nd Place Side-Street Stop	AM	186.0	F	WBL
	School PM	248.5	F	WBL
	PM	451.1	F	WBL
US Highway 6/169 at Common Place Side-Street Stop	AM	243.3	F	WBL
	School PM	340.0	F	WBL
	PM	842.1	F	WBL
US Highway 6/169 at Bradfield Street Side-Street Stop	AM	351.4	F	WBL
	School PM	559.9	F	WBL
	PM	1270.7	F	WBL
US Highway 6/169 at Southbridge Drive Side-Street Stop	AM	379.0	F	WBL
	School PM	90.3	F	WBL
	PM	257.8	F	WBL

*Delay in seconds per vehicle

**Maximum delay and LOS on any approach and/or movement

***Limiting Movement is the highest delay movement or approach

Table 12: 2045 Build Peak Hour Operational Analysis

Intersection and Traffic Control	Peak Hour	Maximum Delay-LOS**		Limiting Movement***
US Highway 6/169 at Meadow Road *Side-Street Stop*	AM	3736.6	F	WBL
	School PM	3246.1	F	EBL
	PM	1285.6	F	EBL
US Highway 6/169 at 302nd Place Side-Street Stop	AM	745.8	F	WBL
	School PM	588.5	F	WBL
	PM	610.7	F	WBL
US Highway 6/169 at Common Place Side-Street Stop	AM	1752.2	F	WBL
	School PM	2640.2	F	EBL
	PM	1344.5	F	EBL
US Highway 6/169 at Bradfield Street Side-Street Stop	AM	517.3	F	WBL
	School PM	730.5	F	WBL
	PM	1373.5	F	WBL
US Highway 6/169 at Southbridge Drive Side-Street Stop	AM	552.3	F	WBL
	School PM	119.2	F	WBL
	PM	283.7	F	WBL

*Delay in seconds per vehicle

**Maximum delay and LOS on any approach and/or movement

***Limiting Movement is the highest delay movement or approach

US 6/169 at Common Place Mitigation Strategies

The US Highway 6/169 at Common Place mitigation strategies operational analysis is summarized below in Table 13. A roundabout and a traffic signal with dedicated turn lanes were analyzed for the 2025 Build and 2045 Build Scenarios. In 2025, a single lane roundabout and a traffic are anticipated to provide acceptable operations.

In 2045, a traffic signal would continue to result in acceptable operations, while a roundabout would need to be expanded to included two entrance and exit lanes for the north and south legs of the intersection. Based on the 2045 forecasted traffic volumes of approximately 22,000 vehicles per day on US Highway 6/169, it is likely that the corridor would need to be expanded to a five-lane section to accommodate those volumes.

A roundabout or traffic signal would provide acceptable traffic operations into the future, but a roundabout is the recommended traffic control for this intersection. A roundabout is anticipated to result in less overall delay during peak hours and throughout all times of the day, while also providing a safer alternative than a traffic signal. For the initial build it is recommended that a single-lane roundabout be constructed, while the design should be able to accommodate expansion to a hybrid multi-lane roundabout in the future when needed.

Table 13: US Highway 6/169 at Common Place Mitigation Strategies - Operational Analysis

Scenario and Traffic Control	Peak Hour	Intersection Delay*- LOS		Maximum Delay-LOS**		Limiting Movement***
2025 Build *Single-Lane Roundabout*	AM	6.7	A	7.0	A	SB
	School PM	5.8	A	7.0	A	NB
	PM	6.1	A	7.0	A	NB
2025 Build *Signalized*	AM	10.0	A	37.6	D	EBL
	School PM	10.1	B	26.1	C	EBL
	PM	6.9	A	32.7	C	EBL
2045 Build *Single-Lane Roundabout*	AM	85.4	F	122.8	F	SB
	School PM	33.4	D	54.2	F	NB
	PM	33.4	D	46.2	E	NB
2045 Build *Hybrid Multi-Lane Roundabout* ****	AM	10.6	B	18.8	C	EB
	School PM	9.9	A	18.1	C	EB
	PM	8.8	A	18.8	C	WB
2045 *Signalized*	AM	27.0	C	50.5	D	EBL
	School PM	30.9	C	47.5	D	EBL
	PM	25.2	C	41.8	D	WBL

*Delay in seconds per vehicle **Maximum delay and LOS on any approach and/or movement

***Limiting Movement is the highest delay movement or approach.

****Two entrance and exit lanes for north/south legs; one entrance and exit lane for east/west legs

Intersection Queue Analysis

The 95th percentile queue is defined to be the queue length (in vehicles) that has only a 5-percent probability of being exceeded during the analysis period. A 95th percentile queue analysis is used to determine turn lane storage lengths for intersections. Queue analyses for the 2025 and 2045 Build scenarios were performed for AM, School PM, and PM peak hours for US Highway 6/169 at Common Place and are shown below in Tables 14 and 15.

2045 single lane roundabout analysis show excessive ninety-fifth percentile queues for the north and southbound movements during each analysis period. This also occurs in the 2045 traffic signal analysis. As north and southbound through volumes increase the two-lane road begins to reach capacity and should be expanded to a four-lane cross section. The expansion to a hybrid roundabout when needed reduces the ninety-fifth percentile queues with a maximum of five vehicles for the southbound movement in the AM peak hour.

Table 14: US Highway 6/169 at Common Place 2025 Build Queue Analysis

Traffic Control	Peak Hour	95th Percentile Queue (ft)							
		NBL	NBT	SBL	SBT	EBL	EBT	WBL	WBT
Side-Street Stop	AM	8	-	0	-	152	11	2	14
	School PM	2	-	0	-	83	10	2	2
	PM	1	-	1	-	16	3	3	2
Single-Lane Roundabout	AM		70		154		21		3
	School PM		56		40		23		2
	PM		59		42		5		2
Signalized	AM	14	121	1	250	84	30	29	26
	School PM	4	117	3	128	89	33	3	6
	PM	1	108	3	114	40	15	8	11

Table 15: US Highway 6/169 at Common Place 2045 Build Queue Analysis

Traffic Control	Peak Hour	95th Percentile Queue (ft)							
		NBL	NBT	SBL	SBT	EBL	EBT	WBL	WBT
Side-Street Stop	AM	18	-	5	-	329	58	128	140
	School PM	3	-	6	-	585	454	242	38
	PM	2	-	8	-	190	13	273	46
Single-Lane Roundabout	AM		564		1064		64		25
	School PM		514		232		80		53
	PM		517		305		17		61
Hybrid Multi-Lane Roundabout	AM		79		112		64		25
	School PM		75		51		80		53
	PM		75		58		17		61
Signalized	AM	36	417	21	786	161	53	31	57
	School PM	9	701	19	490	208	66	77	80
	PM	3	713	15	435	56	4	93	3

Other Considerations

The existing conditions on the east side of Common Place do not include pedestrian accommodations. The Southbridge development includes 648 units of residential dwellings. When additional dwellings are constructed the number of pedestrians is expected to increase. All intersection control types at the intersection of US 6/169 and Common Place should include pedestrian accommodations.

The existing speed zone in the area is 55 mph and is reduced to 50 mph north of 302nd Place. It may be beneficial to advise road users with signs or plaques that they are approaching a school. Consideration should also be made for the area to be designated as a school zone with a reduced speed limit. Signing should be included for the School Area, Zone and any crossings along with flashing warning beacons.

5. CONCLUSIONS & RECOMMENDATIONS

Based on the traffic analysis of the 2023 Existing, 2025 Build, 2045 No Build, and 2045 Build scenarios, the conclusions and recommendations for the ADM High School Traffic Impact Study are as follows:

- Existing traffic on US Highway 6/169 through the study area is approximately 9,200 vehicles per day.
- Available crash data for intersections within the study area indicates there have only been crashes at the intersections of US Highway 6/169 at Meadow Road and US Highway 6/169 at 302nd Place. The data indicates there are less crashes occurring then expected for similar intersection types within Iowa. The most prevalent crash type is rear-end crashes involving vehicles on US Highway 6/169. The addition of dedicated left and right turn lanes at these intersections is a potential mitigation strategy.
- An eastbound left-turn lane should be painted at the US Highway 6/169 and Meadow Road intersection. The current width of this leg of the intersection can accommodate a dedicated left-turn lane and this would match the existing cross section of the westbound approach.
- The proposed high school is anticipated to have a 2025 opening day enrollment of 700 students and an enrollment of 1,000 students by 2045.
- The proposed high school is anticipated to generate approximately 1,350 vehicles per day in 2025 and 1,950 vehicles per day by 2045.
- A traffic impact study was completed for the Southbridge Development adjacent to the proposed high school site. The Southbridge Development is anticipated to generate approximately 19,000 trips per day by 2045.
- Within the study area, US Highway 6/169 is forecasted to have approximately 11,600 vehicles per day by 2025 and 22,600 vehicles per day by 2045. Most of the traffic growth is attributable to the Southbridge Development and the large commercial development assumed in it.
- Analysis of the 2023 Existing traffic indicates that all five study intersections are operating at acceptable levels.
- In 2025, with the addition of the proposed high school traffic, operations are anticipated to remain at acceptable levels with the existing geometry and traffic control for the US Highway 6/169 at Meadow Road, US Highway 6/169 at 302nd Place, US Highway 6/169 at Bradfield Street, and US Highway 6/169 at Southbridge Drive intersections.
- With the addition of traffic from the proposed high school, the intersection of US Highway 6/169 at Common Place is anticipated to have high levels of delay for vehicles exiting the high school access, if the traffic control were to be stop-controlled.
    - It is recommended that a single-lane roundabout be constructed for opening day of the proposed high school. The design should be able to accommodate expansion to a hybrid multi-lane roundabout in the future if needed.
- Include pedestrian accomodations for any intersection control type.
- Designate the area a school zone with a reduced speed limit during AM and PM peak hours.

- 2045 forecasted traffic volumes, with and without the proposed high school, indicate all five intersections are anticipated to have unacceptable operations and require mitigation through geometric and traffic control changes.

- Although not analyzed as part of this study, the following mitigation strategies are recommended to be explored in the future as traffic volumes grow as a result of the Southbridge Development:

    - With the close proximity of accesses into the Southbridge Development, an access management strategy for US Highway 6/169 at 302nd Place and US Highway 6/169 at Bradfield Street should be considered. As development continues, conversion of those two intersections to ¾ accesses (left/right in, right-out only) could be beneficial to the corridor.
    - Roundabouts should be considered for the intersections of US Highway 6/169 at Meadow Road, US Highway 6/169 at Common Place, and US Highway 6/169 at Southbridge Drive.
    - As traffic volumes continue to increase, dedicated left and right turn lanes should be constructed on US Highway 6/169 as was recommended in the Southbridge Development Study.

6. APPENDICES

Appendix A – Lane Configuration and Traffic Control (Existing, 2025, 2045)

Appendix B – Site Plan

Appendix C – Traffic Volumes (Existing, 2025, No-build 2045, 2045)

Appendix D – Operational Analysis (Existing, 2025, No-build 2045, 2045)

Appendix E – Traffic Signal Warrants (2025, 2045)

Appendix F – Crash Data

Appendix G – Turning Movement Counts

Appendix H – Southbridge Phase II Traffic Impact Study