UPDATED

TRAFFIC IMPACT STUDY

For The Proposed

The Hub Development

City of East Lansing, Ingham County, MI

October, 2017

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EXECUTIVE SUMMARY

Traffic Engineering Associates, Inc. (TEA) conducted a traffic impact study for the proposed The Hub development, in the City of East Lansing, Ingham County, Michigan. The Hub development is located on the south side of Grand River Avenue (M-43) between Bogue Street and Cedar Street.

The proposed The Hub development consists of a ten (10) story building with residential and commercial uses. The first floor is projected to contain a 2,500 square foot 7-Eleven store, a 2,000 square foot Georgio's restaurant, an additional 7,720 square feet of commercial space, and a 2,628 square foot amenities space, which will include a residential lobby and combined leasing office. An additional amenity space for the residents is located on the first floor mezzanine, which could include such services as a fitness area, computer lab and study lounge. The remaining nine (9) stories will include 347 residential apartment units that are expected to be marketed to college students in the area. The project has an anticipated completion date by the fall of 2019.

TEA, Inc. conducted vehicle turning movement surveys during the morning and afternoon peak periods in September, 2017, after the MSU students were back in school. In addition to vehicular volumes, bicycle and pedestrian volumes were also collected. Along the Grand River Avenue (M-43) corridor, the intersections of Kedzie Street, Bogue Street, Durand Street, Cedar Street, and Gunson Street were studied. In addition, the intersections of Bogue Street and the Alley, as well as Cedar Street and the Alley were counted. The existing weekday AM and PM peak hour traffic volumes are 7:30 – 8:30 AM and 4:30 – 5:30 PM, respectively.

All existing turning movements at the studied intersections operate at an acceptable level of service (LOS D or better) except at the intersection of Grand River Avenue (M-43) and Cedar Street. During the PM peak hour, the northbound left-right movement from Cedar Street operates at a LOS E. Overall, the intersection of Grand River Avenue (M-43) and Cedar Street operates at a LOS A.

Background traffic represents future volumes without the traffic generated by the proposed The Hub development. The target year for completion is fall of 2019; therefore, a two (2) year growth rate was applied to the existing traffic volumes.

Under background conditions, all studied intersections overall are expected to operate at an acceptable level of service (LOS D or better). All background turning movements at the studied intersections are projected to operate at an acceptable level of service (LOS D or better) except at the intersection of Grand River Avenue (M-43) and Cedar Street. During the PM peak hour, the northbound left-right movement from Cedar Street is anticipated to operate at a LOS E. Overall, the intersection of Grand River Avenue (M-43) and Cedar Street is projected to operate at LOS A.

To mitigate the delay for northbound Cedar Street, a two-lane northbound approach was analyzed which included a left turn and right turn lane at Grand River Avenue (M-43). During the PM peak hour with the additional lane, the northbound left turn is expected to operate at LOS F and the northbound right is anticipated to operate at LOS C. The approach is projected to operate at LOS D.

The trip generation rates for the proposed The Hub development were derived from the ITE TRIP GENERATION MANUAL (10th edition). It is projected that the proposed The Hub development will generate 103 vehicle trips in the AM peak hour, 158 vehicle trips in the PM peak hour, and 2,891 weekday trips.

Under future conditions, all studied intersections overall are expected to operate at an acceptable level of service (LOS D or better). All background turning movements at the studied intersections are projected to operate at an acceptable level of service (LOS D or better) except at the intersection of Grand River Avenue (M-43) and Cedar Street. During the PM peak hour, the northbound left-right movement from Cedar Street is anticipated to operate at a LOS F. Overall, the intersection of Grand River Avenue (M-43) and Cedar Street is projected to operate at LOS A.

As with background conditions, a two-lane northbound approach was analyzed on Cedar Street which included a left turn and right turn lane at Grand River Avenue (M-43). During the PM peak hour with the additional lane, the northbound left turn is expected to operate at LOS F and the northbound right is anticipated to operate at LOS D. The approach is projected to operate at LOS E.

The proposed The Hub development has provided sidewalks along Grand River Avenue (M-43), Bogue Street, and Cedar Street around its facility with bike racks and trees along the roadway as a buffer between traffic and pedestrians. All driveways along Grand River Avenue (M-43) have been removed with the proposed site layout.

The proposed development has a driveway to the upper residential parking facility adjacent to the street level parking driveway for the east parking lot. The findings of this study show that the height of the parking garage wall should be designed such that it allows traffic exiting both driveways to have enough sight distance to see each other when exiting the two driveways.

INTRODUCTION

PROJECT DESCRIPTION

The purpose of this study is to determine the impact on the public road system from the new traffic generated by the proposed The Hub development in the City of East Lansing, Ingham County, Michigan. The Hub is located on the south side of Grand River Avenue (M-43) between Bogue Street and Cedar Street.

The proposed The Hub development consists of a ten (10) story building with residential and commercial uses. The first floor is projected to contain a 2,500 square foot 7-Eleven store, a 2,000 square foot Georgio's restaurant, an additional 7,720 square feet of commercial space, and a 2,628 square foot amenities space, which will include a residential lobby and combined leasing office. An additional amenity space for the residents is located on the first floor mezzanine, which could include such services as a fitness area, computer lab and study lounge. The remaining nine (9) stories will include 347 residential apartment units that are expected to be marketed to college students in the area. The project has an anticipated completion date by the fall of 2019.

There are six (6) proposed driveways for the development. On the west side of the development, there is a one-way internal circulation system that provides one (1) enter only driveway from Bogue Street and one (1) exit only driveway to the alley south of the development which will service the new 7-11 Store. There are two (2) full access driveways from the alley for residential parking, one (1) that provides access to the lower level parking facility and one (1) that provides access to the upper level parking facility. The remaining two (2) driveways provide full access on the east side of the development with one (1) driveway on Cedar Street and one (1) driveway on the alley.

Retail parking will be provided at street level on site. Residential parking will be provided on one lower level of parking, as well as on the level 1 mezzanine, and level 2 of the development in an attached parking facility. There is a proposed covered moped parking at street level as well as a covered bicycle parking facilities on the first floor mezzanine and second floor adjacent to the vehicular parking facilities.

SCOPE OF WORK

The scope of work contained in this report is as follows:

- Analysis of existing traffic conditions on the adjoining street system, including the following intersections;

    - Grand River Avenue (M-43) and Kedzie Street
    - Grand River Avenue (M-43) and Bogue Street
    - Grand River Avenue (M-43) and Durand Street
    - Grand River Avenue (M-43) and Cedar Street
    - Grand River Avenue (M-43) and Gunson Street
    - Bogue Street and the Alley
    - Cedar Street and the Alley

- Analysis of background traffic conditions on the adjoining street system, which includes the above listed intersections, for the future year 2019 volumes without the proposed The Hub development.

- Projection of future traffic volumes to be generated by the proposed The Hub development for the future year.

- Analysis of the impact of future traffic for the proposed The Hub development at the above listed intersections.

- Determination of what roadway and traffic control improvements, if any, will be needed to accommodate future traffic volumes for the proposed The Hub development.

EXISTING CONDITIONS

ROADWAYS AND INTERSECTIONS

Roadways

Grand River Avenue (M-43) is a five-lane roadway east of Bogue Street and a five-lane divided boulevard west of Bogue Street with curb and gutter and sidewalk on both sides. The posted speed limit is 25 mph west of Bogue Street and 35 MPH east of Bogue Street. The roadway is under the jurisdiction of the Michigan Department of Transportation (MDOT). There are no bicycle lanes on Grand River Avenue (M-43).

Kedzie Street is a north-south, two-lane roadway in the project area with curb and gutter and sidewalk on both sides. There is no posted speed limit on Kedzie Street. The roadway is under the jurisdiction of the City of East Lansing. There are no bicycle lanes on Kedzie Street.

Bogue Street is a north-south, four-lane roadway with a center boulevard with two lanes northbound and two lanes southbound. Bogue Street is paved with curb and gutter and sidewalk on both sides of the street. The posted speed limit is 25 mph. The roadway is under the jurisdiction of the City of East Lansing. There are no bicycle lanes on Bogue Street; however, there are pavement markings on Bogue denoting bicycles and vehicles should share the road.

Durand Street is a north-south, two-lane roadway in the project area with curb and gutter and sidewalk on both sides. There is no posted speed limit on Durand Street. The roadway is under the jurisdiction of the City of East Lansing. There are no bicycle lanes on Durand Street.

Cedar Street is a two-lane, north-south roadway, with concrete curb and gutter and sidewalks on both sides. There is no posted speed limit on Cedar Street. The roadway is under the jurisdiction of the City of East Lansing. There are no bicycle lanes on Cedar Street.

Gunson Street is a two-lane, north-south roadway, with concrete curb and gutter and sidewalks on both sides. There is no posted speed limit on Gunson Street. The roadway is under the jurisdiction of the City of East Lansing. There are no bicycle lanes on Cedar Street.

The Alley is an east-west, two-lane roadway with an unposted speed limit. The roadway is under the jurisdiction of the City of East Lansing.

Intersections

Grand River Avenue (M-43) and Kedzie Street

The intersection of Grand River Avenue (M-43) and Kedzie Street is a "T" intersection and is controlled by a stop sign for southbound Kedzie Street. The north approach on Kedzie Street has two (2) lanes; one (1) right turn lane and one (1) outbound lane. The east approach on Grand River Avenue (M-43) has three (3) lanes with two (2) thru lanes and one (1) thru-right turn lane. Grand River Avenue (M-43) is a divided boulevard and the eastbound lanes do not impact the Kedzie Street intersection.

Grand River Avenue (M-43) and Bogue Street

The intersection of Bogue Street and Grand River Avenue (M-43) is a "T" intersection and is controlled by a traffic signal. The south approach on Bogue Street (MSU entrance) has four (4) lanes; one (1) left turn lane, one (1) right turn lane, and two (2) outbound lanes with a boulevard separating the inbound and outbound lanes. The east approach on Grand River Avenue (M-43) has five (5) lanes; one (1) left turn lane lane, two (2) thru lanes and two (2) outbound lanes. The west approach on Grand River Avenue (M-43) has six (6) lanes; two (2) thru lanes, one (1) right turn lane and three (3) outbound lanes. There is a grass median separating the eastbound and westbound traffic. There are marked pedestrian crosswalks on the south and east approaches with pedestrian crossing signals.

Grand River Avenue (M-43) and Durand Street

The intersection of Durand Street and Grand River Avenue (M-43) is a "T" intersection where southbound Durand Street stops for Grand River Avenue (M-43). The north approach on Durand Street has two (2) lanes; one (1) left-right turn lane and one (1) outbound lane. The east approach on Grand River Avenue (M-43) has five (5) lanes; one (1) two-way left turn lane, one (1) thru lane, one (1) thru-right turn lane and two (2) outbound lanes. The west approach on Grand River Avenue (M-43) has five lanes; one (1) two-way left turn lane, two (2) thru lanes, and two (2) outbound lanes. This is a stop sign controlled intersection with marked pedestrian crosswalks on Durand Street.

Grand River Avenue (M-43) and Cedar Street

The intersection of Cedar Street and Grand River Avenue (M-43) is a "T" intersection and is controlled by a stop sign for northbound Cedar Street. The south approach on Cedar Street has two (2) lanes; one (1) left-right turn lane and one (1) outbound lane. The east approach on Grand River Avenue (M-43) has five lanes; one (1) two-way left turn lane, two (2) thru lanes, and two (2) outbound lanes. The west approach on Grand River Avenue (M-43) has five (5) lanes; one (1) two-way left turn lane, one (1) thru lane, one (1) thru-right turn lane and two (2) outbound lanes. There are marked pedestrian crosswalks on Cedar Street.

Grand River Avenue (M-43) and Gunson Street

The intersection of Gunson Street and Grand River Avenue (M-43) is a "T" intersection where southbound Gunson Street stops for Grand River Avenue (M-43). The north approach on Gunson Street has two (2) lanes; one (1) left-right turn lane and one (1) outbound lane. The east approach on Grand River Avenue (M-43) has five (5) lanes; one (1) two-way left turn lane, one (1) thru lane, one (1) thru-right turn lane and two (2) outbound lanes. The west

approach on Grand River Avenue (M-43) has five lanes; one (1) two-way left turn lane, two (2) thru lanes, and two (2) outbound lanes. This is a stop sign controlled intersection with marked pedestrian crosswalks on Gunson Street.

Bogue Street and the Alley

The intersection of Bogue Street and the Alley is a "T" intersection where westbound traffic on the Alley stops for northbound Bogue Street. The east approach on the Alley has two (2) lanes; one (1) right turn lane and one (1) outbound lane. The south approach on Bogue Street has four (4) lanes; one (1) thru lane, one (1) thru-right turn lane, and two (2) outbound lanes. Bogue Street is a divided boulevard and the southbound lanes do not impact the Alley intersection.

Cedar Street and the Alley

The intersection of Cedar Street and the Alley is a "T" intersection where eastbound traffic on the Alley stops for northbound and southbound Cedar Street. The west approach on the Alley has two (2) lanes; one (1) left-right turn lane and one (1) outbound lane. The north approach on Cedar Street has two (2) lanes with one (1) thru-right turn lane and one (1) outbound lane. The south approach on Cedar Street has two (2) lanes with one (1) left-thru lane and one (1) outbound lane.

LAND USE

The proposed The Hub development will consist of retail space, restaurant space, and residential rental units. The majority of existing uses along the Grand River Avenue (M-43) corridor and in downtown East Lansing are commercial/retail in nature, which includes service providers, restaurants, entertainment and various other uses.

Currently the project site has a 7-Eleven Store and a Georgio's restaurant. On the west side of Bogue Street is the Michigan State University (MSU) campus and to the south of the site is apartments. On the east side of Cedar Street is a McDonald's restaurant and on the north side of Grand River Avenue (M-43) is a mix of commercial uses and office space.

PUBLIC TRANSPORTATION

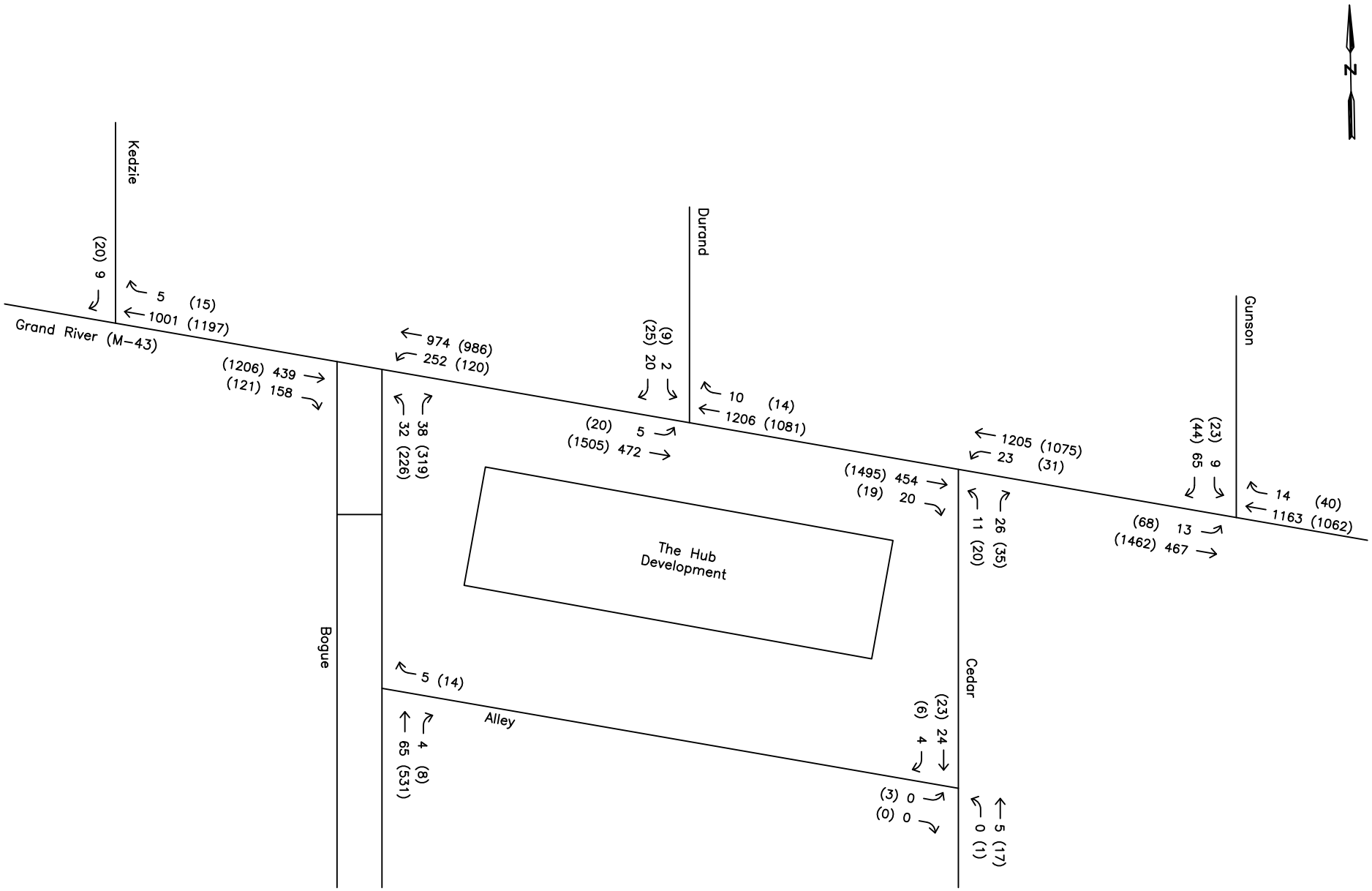
The CATA buses run on Grand River Avenue (M-43) and Bogue Street. There is a CATA bus stop directly in front of the proposed development for eastbound travel.

EXISTING TRAFFIC VOLUMES

TEA, Inc. conducted vehicle turning movement surveys during the morning and afternoon peak periods in September, 2017, after the MSU students were back in school at the following locations:

- Grand River Avenue (M-43) and Kedzie Street
- Grand River Avenue (M-43) and Bogue Street
- Grand River Avenue (M-43) and Durand Street
- Grand River Avenue (M-43) and Cedar Street
- Grand River Avenue (M-43) and Gunson Street
- Bogue Street and the Alley
- Cedar Street and the Alley

The existing weekday AM and PM peak hour traffic volumes are 7:30 – 8:30 AM and 4:30 – 5:30 PM, respectively. In addition to vehicular volumes, bicycle and pedestrian volumes were collected. The existing traffic volumes are illustrated in **Figure 1A** and the existing non-motorized traffic volumes are illustrated in **Figure 1B**.



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LEGEND

XXX AM Pk Hr (7:30-8:30 AM) Volumes

(XXX) PM Pk Hr (4:30-5:30 PM) Volumes

Figure 1A: Existing Traffic – Peak Hours

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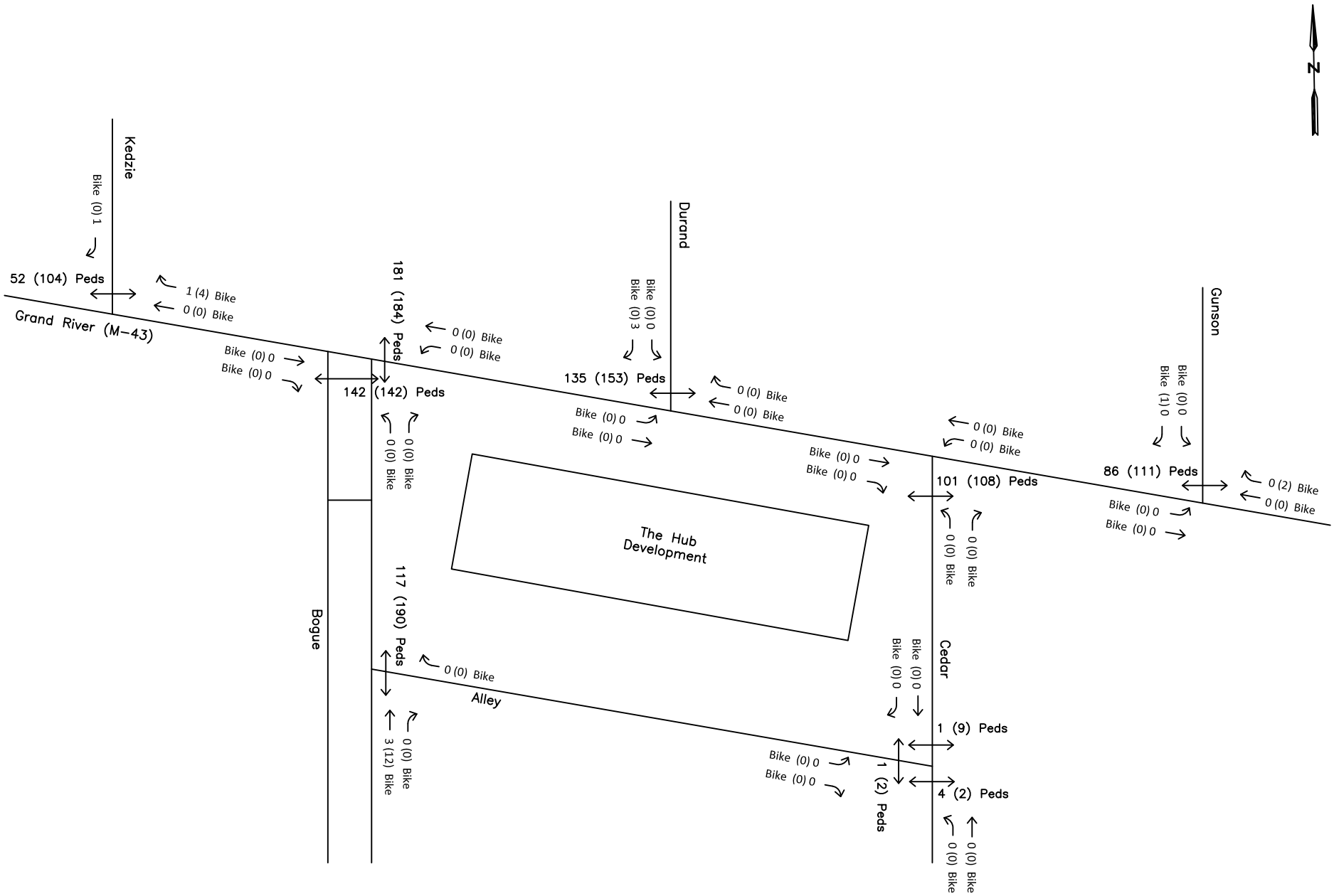

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LEGEND

XXX AM Pk Hr (7:30-8:30 AM) Volumes
(XXX) PM Pk Hr (4:30-5:30 PM) Volumes

Figure 1B: Existing Non-Motorized Traffic - Peak Hours

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LEVEL OF SERVICE ANALYSIS FOR EXISTING TRAFFIC

The critical intersections defined for this study were analyzed according to the methodologies published in the most recent edition of the *Highway Capacity Manual.* The analysis determines the "Level of Service" of the intersections and is based on factors such as the number and types of lanes, signal timing, traffic volumes, pedestrian activity, etc. The level of service (LOS) is defined by average vehicle delay in seconds created by a traffic control device for a given traffic movement or intersection approach.

Level of Service	Delay per Vehicle (seconds)	
	Non-Signalized	Signalized
A	< 10	<10
B	10 to 15	10 to 20
C	15 to 25	20 to 35
D	25 to 35	35 to 55
E	35 to 50	55 to 80
F	> 50	> 80

Levels of Service are expressed in a range from "A" to "F," with "A" being the highest LOS and "F" representing the lowest LOS. Level of service "D" is considered the minimum acceptable LOS in an urban area. The above table shows the thresholds for Levels of Service "A" through "F" for non-signalized and signalized intersections, respectively.

All Level of Service computations contained in this report were based upon the Synchro software package which is approved by the Michigan Department of Transportation (MDOT). Delay per vehicle includes initial deceleration delay, queue move-up time, stopped delay, and final acceleration delay.

The Level of Service analysis for existing traffic at the subject intersections during the peak hours is summarized in **Table 1.** All existing turning movements at the studied intersections operate at an acceptable level of service (LOS D or better) except at the intersection of Grand River Avenue (M-43) and Cedar Street. During the PM peak hour, the northbound left-right movement from Cedar Street operates at a LOS E with a vehicle delay of 44.4 seconds. Overall, the intersection of Grand River Avenue (M-43) and Cedar Street operates at LOS A with 1.3 seconds of delay.

Table 1
Level of Service (LOS) Summary
Existing Traffic

Location	Movement	Weekday AM Peak Hour		Weekday PM Peak Hour	
		Avg. Delay	LOS	Avg. Delay	LOS
Grand River Avenue (M-43) and Bogue Street	EB Thru	19.6	B	44.3	D
	EB Right	3.8	A	6.7	A
	WB Left	23.5	C	36.4	D
	WB Thru	13.0	B	15.6	B
	NB Left	26.3	C	26.1	C
	NB Right	5.4	A	20.3	C
	Intersection	15.3	B	29.0	C
Grand River Avenue (M-43) and Kedzie Street	WB Thru-Right	0.0	A	0.0	A
	SB Right	16.6	C	19.1	C
	Intersection	0.2	A	0.4	A
Grand River Avenue (M-43) and Durand Street	EB Left	14.7	B	12.3	B
	EB Thru	0.0	A	0.0	A
	WB Thru-Right	0.0	A	0.0	A
	SB Left-Right	23.0	C	25.0	D
	Intersection	0.4	A	0.5	A
Grand River Avenue (M-43) and Cedar Street	EB Thru-Right	0.0	A	0.0	A
	WB Left	8.9	A	15.7	C
	WB Thru	0.0	A	0.0	A
	NB Left-Right	14.9	B	44.4	E
	Intersection	0.5	A	1.3	A

Note: Delay = Average control delay per vehicle in seconds.
LOS = Level of Service

Table 1 (Continued)
Level of Service (LOS) Summary
Existing Traffic

Location	Movement	Weekday AM Peak Hour		Weekday PM Peak Hour	
		Avg. Delay	LOS	Avg. Delay	LOS
Grand River Avenue (M-43) and Gunson Street	EB Left	14.1	B	12.6	B
	EB Thru	0.0	A	0.0	A
	WB Thru-Right	0.0	A	0.0	A
	SB Left-Right	28.2	D	30.0	D
	Intersection	1.5	A	1.1	A
Bogue Street and the Alley	WB Right	9.6	A	13.8	B
	NB Thru-Right	0.0	A	0.0	A
	Intersection	1.0	A	0.4	A
Cedar Street and the Alley	EB Left-Right	0.0	A	8.8	A
	NB Left-Thru	0.0	A	7.3	A
	SB Thru-Right	0.0	A	0.0	A
	Intersection	0.0	A	0.8	A

Note: Delay = Average control delay per vehicle in seconds.
LOS = Level of Service

BACKGROUND CONDITIONS

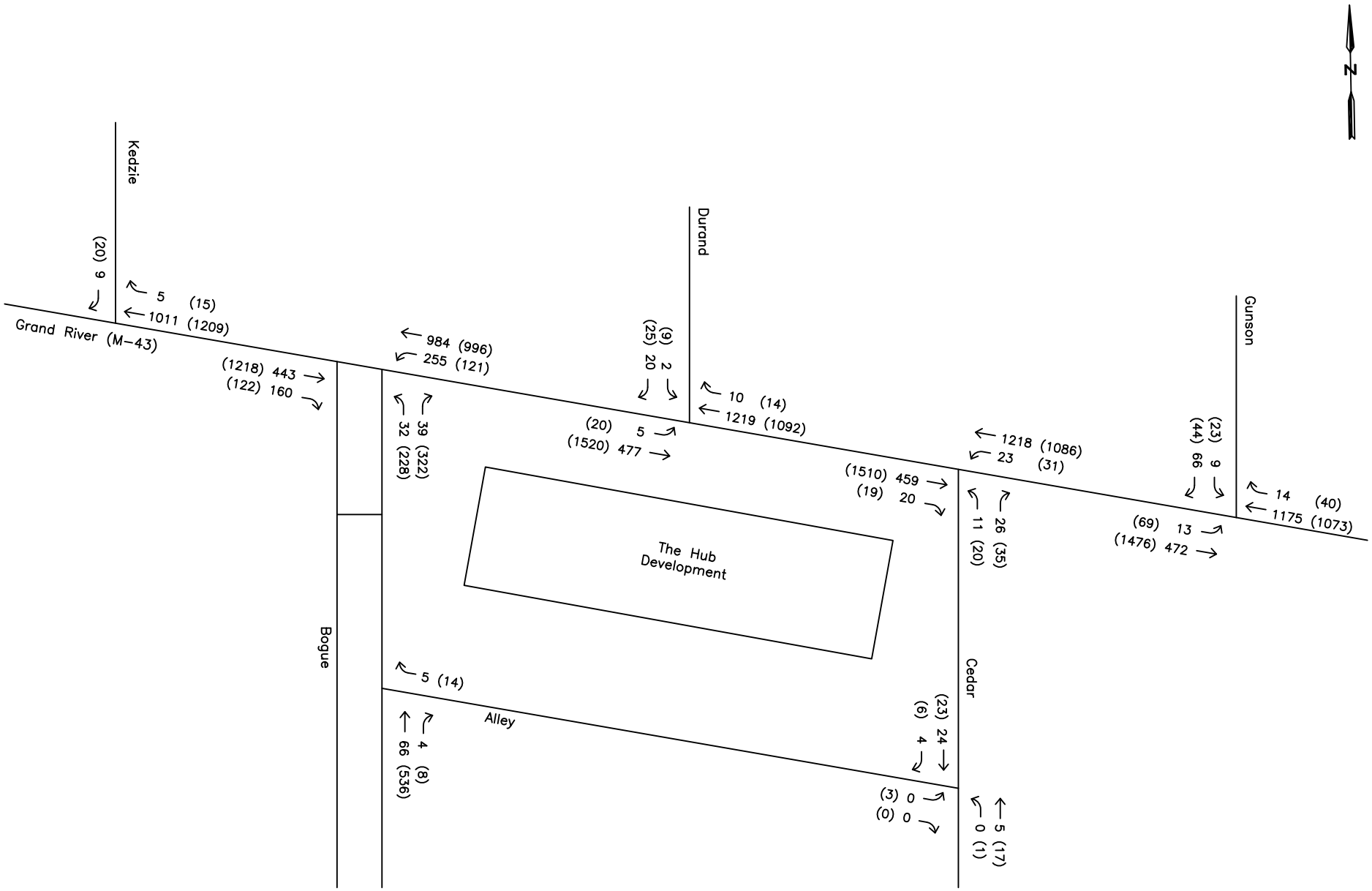
BACKGROUND TRAFFIC VOLUMES – GROWTH RELATED

Background traffic represents future volumes without the traffic generated by the proposed The Hub development. The target year for completion is fall of 2019; therefore, a two (2) year growth rate was applied to the existing traffic volumes.

According to the US Census Bureau, the annual growth rate for the population of the City of East Lansing from 2010 to 2016 was zero point four two percent (0.42%) over the six (6) year period, and the annual growth rate for the population of Ingham County was zero point one percent (0.10%) for the same time period. For the purposes of this study, a half percent (0.5%) growth rate was applied over two (2) years to the completion date of 2019. Background traffic growth volumes are illustrated in **Figure 2**.

BACKGROUND TRAFFIC VOLUMES – DEVELOPMENT RELATED

There were no new developments with completed traffic impact studies identified in the area that would have an impact on traffic at the studied intersections. Therefore, background development traffic volumes were not included in this study.



TRAFFIC ENGINEERING ASSOCIATES, INC. PO Box 100 Saranac, MI 48881 PHONE: (517) 627-6028	LEGEND XXX AM Pk Hr (7:30-8:30 AM) Volumes (XXX) PM Pk Hr (4:30-5:30 PM) Volumes	Figure 2: Background Traffic – Peak Hours		
		DATE: October, 2017	SCALE: NTS	PAGE: 17

LEVEL OF SERVICE ANALYSIS FOR BACKGROUND TRAFFIC

The level of service analysis for background 2019 traffic is summarized in **Table 2**. All existing roadway geometrics and traffic control devices were utilized for the background analysis. Under background conditions, all studied intersections overall are expected to operate at an acceptable level of service (LOS D or better). All background turning movements at the studied intersections are projected to operate at an acceptable level of service (LOS D or better) except at the intersection of Grand River Avenue (M-43) and Cedar Street. During the PM peak hour, the northbound left-right movement from Cedar Street is anticipated to operate at a LOS E with a vehicle delay of 45.3 seconds. Overall, the intersection of Grand River Avenue (M-43) and Cedar Street is projected to operate at a LOS A with 1.3 seconds of delay.

To mitigate the delay for northbound Cedar Street, a two-lane northbound approach was analyzed which included a left turn and right turn lane at Grand River Avenue (M-43). During the PM peak hour with the additional lane, the northbound left turn is expected to operate at LOS F with 56.1 seconds of delay and the northbound right is anticipated to operate at LOS C with 22.2 seconds of delay. The approach is projected to operate at LOS D with 34.5 seconds of delay.

Table 2
Level of Service (LOS) Summary
Background Traffic

Location	Movement	Weekday AM Peak Hour		Weekday PM Peak Hour	
		Avg. Delay	LOS	Avg. Delay	LOS
Grand River Avenue (M-43) and Bogue Street	EB Thru	19.6	B	46.0	D
	EB Right	3.8	A	6.8	A
	WB Left	24.1	C	36.6	D
	WB Thru	13.3	B	15.8	B
	NB Left	26.3	C	26.1	C
	NB Right	5.3	A	20.5	C
	Intersection	15.4	B	29.7	C
Grand River Avenue (M-43) and Kedzie Street	WB Thru-Right	0.0	A	0.0	A
	SB Right	16.7	C	19.2	C
	Intersection	0.2	A	0.4	A
Grand River Avenue (M-43) and Durand Street	EB Left	14.9	B	12.4	B
	EB Thru	0.0	A	0.0	A
	WB Thru-Right	0.0	A	0.0	A
	SB Left-Right	23.3	C	25.2	D
	Intersection	0.4	A	0.5	A
Grand River Avenue (M-43) and Cedar Street	EB Thru-Right	0.0	A	0.0	A
	WB Left	8.9	A	15.9	C
	WB Thru	0.0	A	0.0	A
	NB Left-Right	15.0	C	45.3	E
	Intersection	0.5	A	1.3	A

Note: Delay = Average control delay per vehicle in seconds.
LOS = Level of Service

Table 2 (Continued)
Level of Service (LOS) Summary
Background Traffic (continued)

Location	Movement	Weekday AM Peak Hour		Weekday PM Peak Hour	
		Avg. Delay	LOS	Avg. Delay	LOS
Grand River Avenue (M-43) and Gunson Street	EB Left	14.2	B	12.7	B
	EB Thru	0.0	A	0.0	A
	WB Thru-Right	0.0	A	0.0	A
	SB Left-Right	28.8	D	30.4	D
	Intersection	1.5	A	1.1	A
Bogue Street and the Alley	WB Right	9.6	A	13.8	B
	NB Thru-Right	0.0	A	0.0	A
	Intersection	0.9	A	0.4	A
Cedar Street and the Alley	EB Left-Right	0.0	A	8.8	A
	NB Left-Thru	0.0	A	7.3	A
	SB Thru-Right	0.0	A	0.0	A
	Intersection	0.0	A	0.8	A

Note: Delay = Average control delay per vehicle in seconds.
LOS = Level of Service

FUTURE CONDITIONS

SITE TRAFFIC GENERATION

The trip generation rates for the proposed The Hub development were derived from the ITE TRIP GENERATION MANUAL (10th edition). The site is currently occupied with a Georgio's restaurant and a 7-Eleven store. The existing Georgio's restaurant is approximately 1,735 square feet, and the proposed restaurant is approximately 2,000 square feet, for an increase of 265 square feet.

The existing 7-Eleven store is approximately 2,138 square feet and the proposed store is approximately 2,500 square feet, for an increase of 362 square feet. For the purposes of this study, a comparison was completed to determine the anticipated increase in traffic with the increase in square footage.

The ITE trip generation rates for Fast Casual Restaurant (Land Use Code 930) were chosen to represent the existing and proposed Georgio's restaurant. The ITE description of Fast Casual Restaurant is as follows:

A fast casual restaurant is a sit down restaurant with no wait staff or table service. Customers typically order off a menu board, pay for food before the food is prepared and seat themselves. The menu generally contains higher quality made to order food items with fewer frozen or processed ingredients than fast food restaurants.

The ITE trip generation rates for Convenience Market (Land Use Code 851) were selected to represent the existing and proposed 7-Eleven Store. The ITE description of Convenience Market is as follows:

The convenience markets in this classification are open between 15 and 24 hours per day. These markets sell convenience foods, newspapers, magazines, and often beer and wine; they do not have gasoline pumps.

It is projected that the proposed increase in traffic for the Georgio's Restaurant and the 7-Eleven Store will be 22 vehicle trips in the AM peak hour, 21 vehicle trips in the PM peak hour, and 359 weekday trips. The projected increase in traffic is summarized in **Table 3**.

Table 3
Vehicle Trip Generation Summary
Increase Trip Generation for Existing Uses

Land Use	Size	AM Peak Hour			PM Peak Hour			Weekday
		In	Out	Total	In	Out	Total	
Fast Casual Restaurant, Land Use Code 930 (Georgio's)	1,735 sq. ft.	3	1	4	14	11	25	547
Fast Casual Restaurant, Land Use Code 930 (Georgio's)	2,000 sq. ft.	3	1	4	15	13	28	630
Increase in Trips		**0**	**0**	**0**	**1**	**2**	**3**	**83**
Convenience Market, Land Use Code 851 (7-Eleven)	2,138 sq. ft.	67	67	134	54	51	105	1,630
Convenience Market, Land Use Code 851 (7-Eleven)	2,500 sq. ft.	78	78	156	63	60	123	1,906
Increase in Trips		**11**	**11**	**22**	**9**	**9**	**18**	**276**
Increase in Total Trips		**11**	**11**	**22**	**10**	**11**	**21**	**359**

The ITE trip generation rates for Off-Campus Student Apartment (Land Use Code 225) were chosen to represent the 347 units of student apartments, which includes 585 bedrooms. The setting/location chosen from the ITE Trip Generation Manual for trip generation was "adjacent to campus," which best represents the proposed The Hub development's proximity to the Michigan State University campus. The ITE description for Off-Campus Student Apartment is as follows:

An off-campus student apartment is part of an apartment complex that serves college or university students. These properties are generally located nearby and within walking distance of a college campus. Most apartments include student-related amenities such as free high-speed internet, study lounges, fitness centers, sports courts, and swimming pools. Apartments included in this land use can be furnished or unfurnished and range in size from studio apartments to apartments with four bedrooms. Units typically have washer and dryers in each unit. Most facilities also include security and 24-hour emergency maintenance.

There are four commercial spaces proposed on the site for a total of 7,720 square feet. It is unknown what will be in these spaces; however, it is anticipated that the uses could include restaurants with a bar or retail spaces that sell hard goods. For the purposes of this study, the four units were broken into two categories to represent what might be onsite future use. There are four units of approximately the following sizes: 1,780 square feet, 1,460 square feet, 1,720 square feet, and 2,760 square feet. They were combined to create two spaces of approximately 3,500 square feet and 4,220 square feet.

The ITE trip generation rates for High-Turnover (Sit-Down) Restaurant (Land Use Code 932) were selected to represent the approximate 4,220 square foot restaurant. The ITE description for High-Turnover (Sit-Down) Restaurant is as follows:

This land use consists of sit-down, full-service eating establishments with typical duration of stay of approximately one hour. This type of restaurant is usually moderately priced and frequently belongs to a restaurant chain. Generally, these restaurants serve lunch and dinner; they may also be open for breakfast and are sometimes open 24 hours per day. These restaurants typically do not take reservations. Patrons commonly wait to be seated, are served by a waiter/waitress, order from menus and pay for their meal after they eat. Some facilities contained within this land use may also contain a bar area for serving food and alcoholic drinks.

Given the small square footage of the retail spaces, a land use code was selected that had samples with similar square footages and sold hard goods. The ITE trip generation rates for Apparel Store (Land Use Code 876) were selected to represent the 3,500 square foot store space. The ITE description for Apparel Store is as follows:

An apparel store is an individual store specializing in the sale of clothing.

Primary Trips

Primary trips are made for the specific purpose of visiting the generator (The Hub development). Primary trips do add new traffic to the adjoining road system.

Internal Trip Capture

The ITE Trip Generation Manual estimates trip generation for single-use sites. With multi-use developments, like the proposed The Hub development, it is common for there to be interaction between buildings within the development which would reduce the sum total trips to the site. This phenomenon is known as "internal trip capture," where trips remain internal to the site. The ITE Trip Generation Manual provides rates for origin and destination trips between various land use types, including office, retail, restaurant, cinema/ entertainment, residential, and hotel. These rates were applied for the proposed The Hub development.

In addition, a reduction was applied to the retail and restaurant traffic volumes to account for the pedestrian and transit users in the area. According to the "City of East Lansing Non-Motorized Transportation Plan" from May, 2011, twenty-two percent (22%) of the population walks to work and four point three percent (4.3%) of the population utilizes public transit. For this study, the twenty-two percent (22%) pedestrian population and four percent (4%) transit population were applied to the trip generation volumes for the restaurant and retail.

It is projected that the proposed The Hub development will generate 103 vehicle trips in the AM peak hour, 158 vehicle trips in the PM peak hour, and 2,891 weekday trips. The projected traffic to be generated by the The Hub development is summarized in **Table 4**.

Table 4
Vehicle Trip Generation Summary
The Hub Development

Land Use	Size	AM Peak Hour			PM Peak Hour			Weekday
		In	Out	Total	In	Out	Total	
Convenience Market, Land Use Code 851 (7-Eleven)	362 sq. ft.	11	11	22	9	9	18	276
Apparel Store, Land Use Code 876	3,500 sq. ft.	3	1	4	7	7	14	232
Fast Casual Restaurant, Land Use Code 930 (Georgio's)	265 sq. ft.	0	0	0	1	2	3	83
High-Turnover (Sit-Down) Restaurant, Land Use Code 932	4,220 sq. ft.	23	19	42	25	16	41	473
Off-Campus Student Apartment, Land Use Code 225	585 bedrooms	29	41	70	71	72	143	1,827
Total Trips		**66**	**72**	**138**	**113**	**106**	**219**	**2,891**
Retail	3,862 sq. ft.	1	3	4	9	9	18	
Restaurant	4,485 sq. ft.	7	2	9	9	10	19	
Residential	585 bedrooms	2	5	7	7	6	13	
Total Internal Trip Capture Trips		**10**	**10**	**20**	**25**	**25**	**50**	
External Trips		**56**	**62**	**118**	**88**	**81**	**169**	
Convenience Market, Land Use Code 851 (7-Eleven)	362 sq. ft.	10	8	18	4	4	8	276
Apparel Store, Land Use Code 876	3,500 sq. ft.	3	1	4	3	3	6	232
Fast Casual Restaurant, Land Use Code 930 (Georgio's)	265 sq. ft.	0	0	0	1	1	2	83
High-Turnover (Sit-Down) Restaurant, Land Use Code 932	4,220 sq. ft.	16	17	33	16	7	23	473
Off-Campus Student Apartment, Land Use Code 225	585 bedrooms	27	36	63	64	66	130	1827
Total External Trips By Use		**56**	**62**	**118**	**88**	**81**	**169**	**2891**

Table 4 (Continued)
Vehicle Trip Generation Summary
The Hub Development

Land Use	Size	AM Peak Hour			PM Peak Hour			Weekday
		In	Out	Total	In	Out	Total	
Convenience Market, Land Use Code 851 (7-Eleven)	362 sq. ft.	2	2	4	1	1	2	
Apparel Store, Land Use Code 876	3,500 sq. ft.	1	0	1	1	1	2	
Fast Casual Restaurant, Land Use Code 930 (Georgio's)	265 sq. ft.	0	0	0	0	0	0	
High-Turnover (Sit-Down) Restaurant, Land Use Code 932	4,220 sq. ft.	4	4	8	4	2	6	
Total Pedestrian Trips		**7**	**6**	**13**	**6**	**4**	**10**	
Convenience Market, Land Use Code 851 (7-Eleven)	362 sq. ft.	0	0	0	0	0	0	
Apparel Store, Land Use Code 876	3,500 sq. ft.	0	0	0	0	0	0	
Fast Casual Restaurant, Land Use Code 930 (Georgio's)	265 sq. ft.	0	0	0	0	0	0	
High-Turnover (Sit-Down) Restaurant, Land Use Code 932	4,220 sq. ft.	1	1	2	1	0	1	
Total Transit Trips		**1**	**1**	**2**	**1**	**0**	**1**	
Convenience Market, Land Use Code 851 (7-Eleven)	362 sq. ft.	8	6	14	3	3	6	276
Apparel Store, Land Use Code 876	3,500 sq. ft.	2	1	3	2	2	4	232
Fast Casual Restaurant, Land Use Code 930 (Georgio's)	265 sq. ft.	0	0	0	1	1	2	83
High-Turnover (Sit-Down) Restaurant, Land Use Code 932	4,220 sq. ft.	11	12	23	11	5	16	473
Off-Campus Student Apartment, Land Use Code 225	585 bedrooms	27	36	63	64	66	130	1827
Total Primary Trips		**48**	**55**	**103**	**81**	**77**	**158**	**2,891**

SITE TRAFFIC DISTRIBUTION

Traffic distribution for the proposed The Hub development was based on the surrounding roadway patterns. Separate distributions were determined for the residential use and the commercial uses as they have different traffic patterns associated with their individual uses. Typically, a residential facility has a traffic pattern where vehicles are exiting in the morning and entering in the evening; therefore, the existing exiting traffic pattern on the roadway system during the morning and the entering traffic pattern during the evening generated the distribution for this study. The distribution for the residential generated traffic is as follows.

Residential Trip Distribution

Direction of Approach and Departure	AM Peak Hour	PM Peak Hour
TO/FROM the West on Grand River Avenue	50%	42%
TO/FROM the East on Grand River Avenue	24%	35%
TO/FROM the South on Bogue Street	21%	18%
TO/FROM the North on Durand Street	1%	1%
TO/FROM the South on Cedar Street	2%	2%
TO/FROM the North on Gunson Street	2%	2%

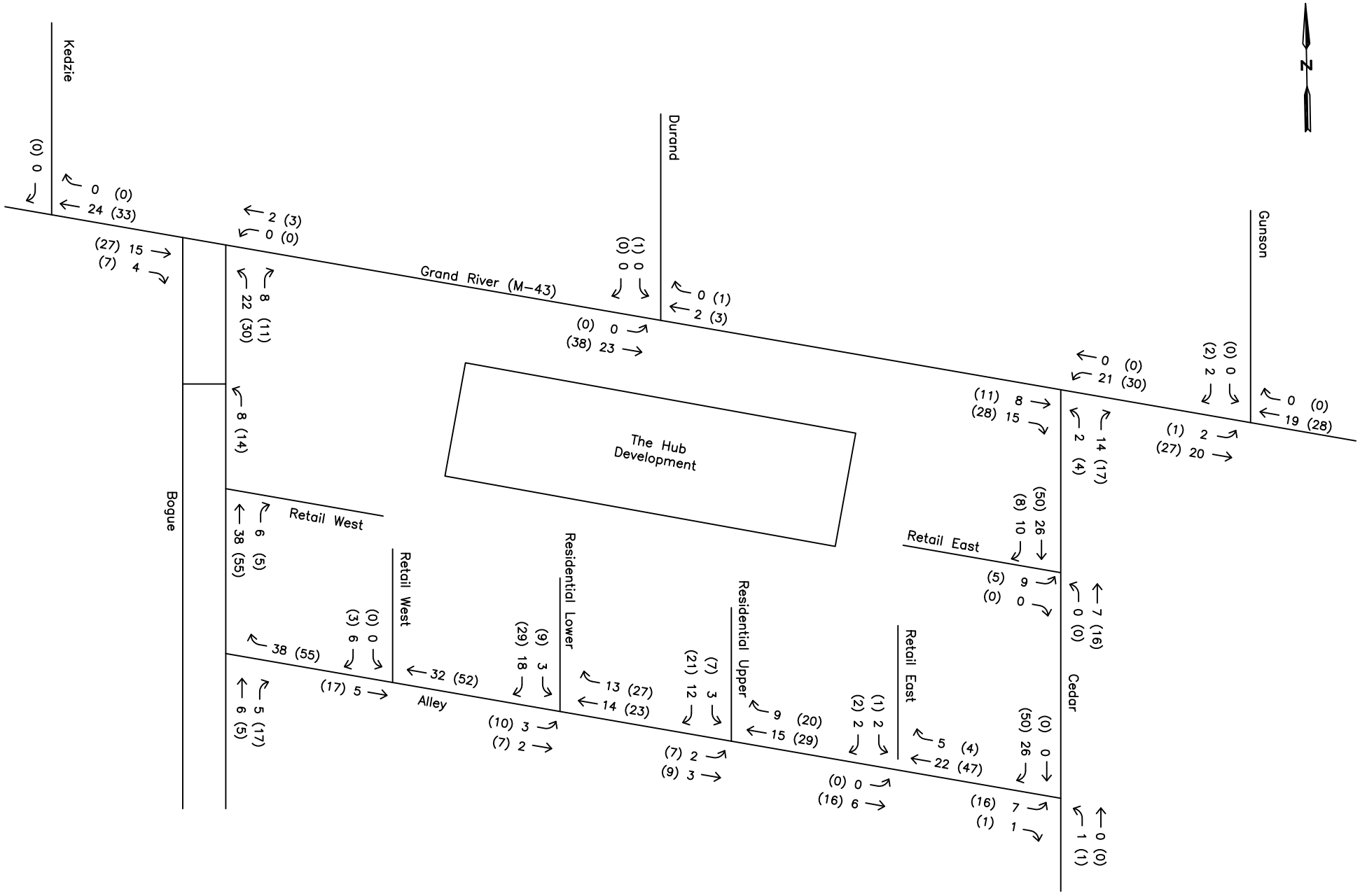
For this study, the commercial traffic distribution was based on existing traffic volumes that entered the project area, based on the fact that a retail establishment is a destination, not origin type of facility. The peak hour distribution for the commercial generated traffic is below.

Commercial Trip Distribution

Direction of Approach and Departure	AM Peak Hour	PM Peak Hour
TO/FROM the West on Grand River Avenue	30%	42%
TO/FROM the East on Grand River Avenue	60%	35%
TO/FROM the South on Bogue Street	3%	18%
TO/FROM the North on Durand Street	1%	1%
TO/FROM the South on Cedar Street	2%	2%
TO/FROM the North on Gunson Street	4%	2%

The total estimated site generated traffic for the proposed The Hub development during the AM and PM peak hours is illustrated in **Figure 3**.

Adding the total site generated traffic (Figure 3) to the total background traffic volumes (Figure 2) results in the total future traffic volumes for the weekday AM and PM peak hours, which are illustrated in **Figure 4**.



TRAFFIC ENGINEERING ASSOCIATES, INC.
PO Box 100
Saranac, MI 48881
PHONE: (517) 627-6028

LEGEND

XXX AM Pk Hr (7:30-8:30 AM) Volumes

(XXX) PM Pk Hr (4:30-5:30 PM) Volumes

Figure 3: Site Traffic – Peak Hours

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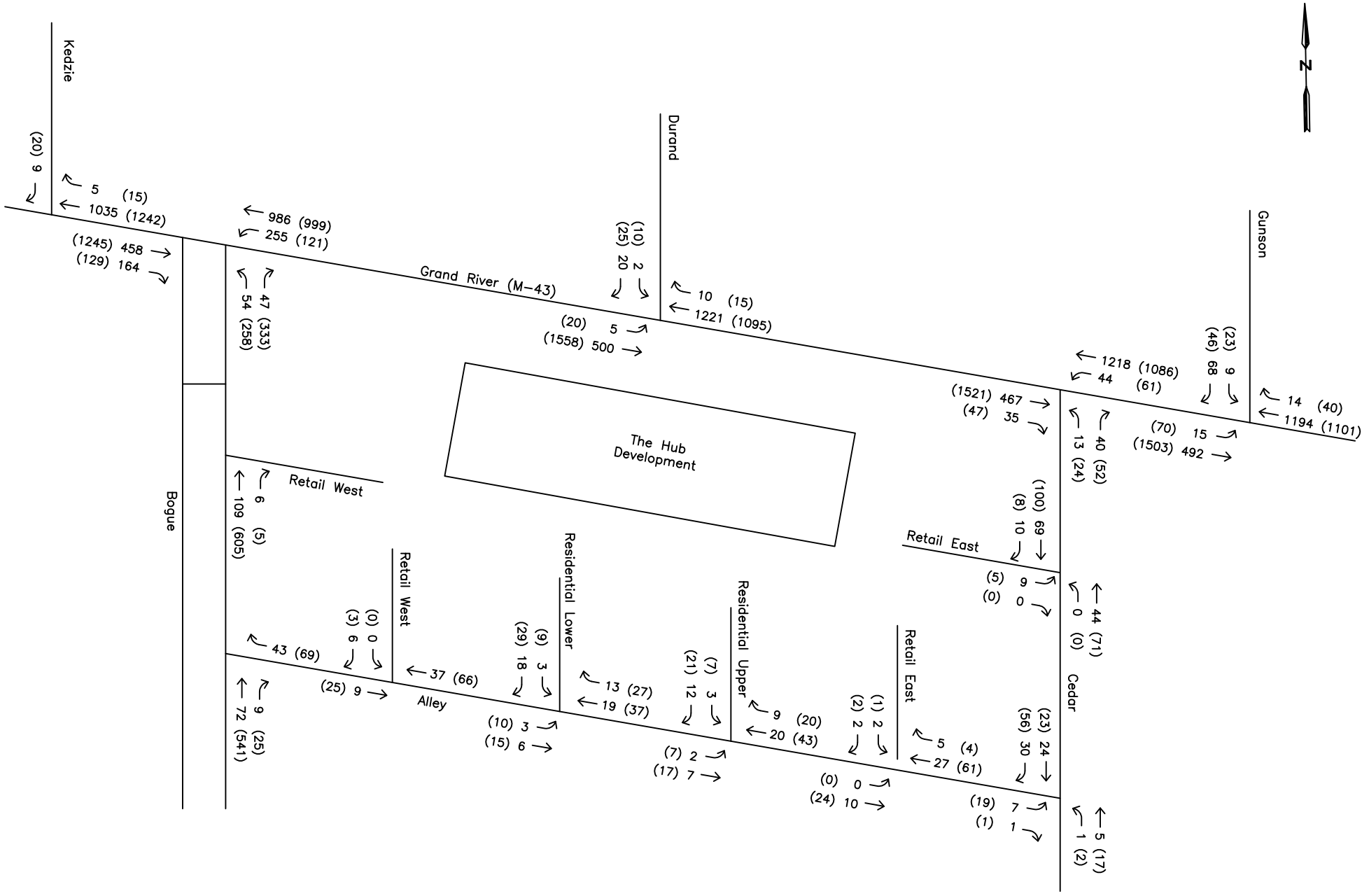

TRAFFIC ENGINEERING ASSOCIATES, INC.
PO Box 100
Saranac, MI 48881
PHONE: (517) 627-6028

LEGEND

XXX AM Pk Hr (7:30-8:30 AM) Volumes

(XXX) PM Pk Hr (4:30-5:30 PM) Volumes

Figure 4: Future Traffic – Peak Hours

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LEVEL OF SERVICE ANALYSIS FOR FUTURE TRAFFIC

The level of service analysis for future traffic is summarized in **Table 5**. Comparing future level of service conditions to background level of service conditions determines the impact that can be expected from the addition of traffic generated from The Hub development.

Under future conditions, all studied intersections overall are expected to operate at an acceptable level of service (LOS D or better). All background turning movements at the studied intersections are projected to operate at an acceptable level of service (LOS D or better), except at the intersection of Grand River Avenue (M-43) and Cedar Street. During the PM peak hour, the northbound left-right movement from Cedar Street is anticipated to operate at a LOS F with a vehicle delay of 61.3 seconds, an increase of 16 seconds from background conditions. Overall, the intersection of Grand River Avenue (M-43) and Cedar Street is projected to operate at LOS A with 2.4 seconds of delay.

As with background conditions, a two-lane northbound approach was analyzed on Cedar Street which included a left turn and right turn lane at Grand River Avenue (M-43). During the PM peak hour with the additional lane, the northbound left turn is expected to operate at LOS F with 67.2 seconds of delay and the northbound right is anticipated to operate at LOS D with 25.1 seconds of delay. The approach overall is projected to operate at LOS E with 38.4 seconds of delay.

Table 5
Level of Service (LOS) Summary
Future Traffic

Location	Movement	Weekday AM Peak Hour		Weekday PM Peak Hour	
		Avg. Delay	LOS	Avg. Delay	LOS
Grand River Avenue (M-43) and Bogue Street	EB Thru	19.8	B	50.2	D
	EB Right	3.8	A	7.3	A
	WB Left	24.9	C	36.6	D
	WB Thru	14.0	B	16.4	B
	NB Left	26.9	C	27.2	C
	NB Right	5.0	A	21.2	C
	Intersection	16.1	B	31.8	C
Grand River Avenue (M-43) and Kedzie Street	WB Thru-Right	0.0	A	0.0	A
	SB Right	17.0	C	19.7	C
	Intersection	0.2	A	0.4	A
Grand River Avenue (M-43) and Durand Street	EB Left	14.9	B	12.4	B
	EB Thru	0.0	A	0.0	A
	WB Thru-Right	0.0	A	0.0	A
	SB Left-Right	23.3	C	26.0	D
	Intersection	0.3	A	0.5	A
Grand River Avenue (M-43) and Cedar Street	EB Thru-Right	0.0	A	0.0	A
	WB Left	9.1	A	17.6	C
	WB Thru	0.0	A	0.0	A
	NB Left-Right	15.6	C	61.3	F
	Intersection	0.7	A	2.4	A

Note: Delay = Average control delay per vehicle in seconds.
LOS = Level of Service

Table 5 (Continued)
Level of Service (LOS) Summary
Future Traffic

Location	Movement	Weekday AM Peak Hour		Weekday PM Peak Hour	
		Avg. Delay	LOS	Avg. Delay	LOS
Grand River Avenue (M-43) and Gunson Street	EB Left	14.5	B	12.9	B
	EB Thru	0.0	A	0.0	A
	WB Thru-Right	0.0	A	0.0	A
	SB Left-Right	29.9	D	31.7	D
	Intersection	1.6	A	1.2	A
Bogue Street and the Alley	WB Right	10.1	A	16.2	C
	NB Thru-Right	0.0	A	0.0	A
	Intersection	4.5	A	2.0	A
Cedar Street and the Alley	EB Left-Right	8.8	A	9.1	A
	NB Left-Thru	1.2	A	7.4	A
	SB Thru-Right	0.0	A	0.0	A
	Intersection	1.2	A	2.1	A
Retail West Driveway and the Alley	EB Thru	0.0	A	0.0	A
	WB Thru	0.0	A	0.0	A
	SB Left-Right	8.6	A	8.7	A
	Intersection	0.7	A	0.2	A

Note: Delay = Average control delay per vehicle in seconds.
LOS = Level of Service

Table 5 (Continued)
Level of Service (LOS) Summary
Future Traffic

Location	Movement	Weekday AM Peak Hour		Weekday PM Peak Hour	
		Avg. Delay	LOS	Avg. Delay	LOS
Residential Lower Parking Driveway and the Alley	EB Left-Thru WB Thru-Right SB Left-Right Intersection	2.4 0.0 8.6 2.5	A A A A	3.0 0.0 8.9 2.8	A A A A
Residential Upper Parking Driveway and the Alley	EB Left-Thru WB Thru-Right SB Left-Right Intersection	1.6 0.0 8.6 2.1	A A A A	2.2 0.0 8.9 2.2	A A A A
Retail East Driveway and the Alley	EB Left-Thru WB Thru-Right SB Left-Right Intersection	0.0 0.0 8.7 0.5	A A A A	0.0 0.0 8.9 0.2	A A A A
Retail East Driveway and Cedar Street	EB Left-Right NB Left-Thru SB Thru-Right Intersection	9.4 0.0 0.0 0.5	A A A A	9.8 0.0 0.0 0.2	A A A A

Note: Delay = Average control delay per vehicle in seconds.
LOS = Level of Service

SIGNIFICANT FINDINGS

CRASH ANALYSIS

Traffic Engineering Associates, Inc. (TEA) conducted a traffic crash analysis at the five (5) studied intersections for three (3) years; 2014 through 2016. There were no apparent correctable crashes at the intersections. A summary of the crashes are in the Supplemental Section.

- Kedzie Street and Grand River Avenue – This intersection experienced only four (4) crashes for the 3 year period.

- Durand Street and Grand River Avenue – This intersection experienced ten (10) crashes during the 3 year period with six (6) of the total being right angle crashes. There are no visibility issues when stopped on southbound Durand Street. These crashes occurred due to driver error and heavy traffic volumes on Grand River Avenue.

- Gunson Street and Grand River Avenue – This intersection experienced twenty (20) crashes for the 3 year period; eight (8) in 2014, six (6) in 2015 and six (6) in 2016. Eleven (11) of the total crashes in the 3 year period were right angle crashes. A review of this intersection showed that the sight distance to the east when stopped on Gunson Street is blocked by the existing building, and there are heavy traffic volumes on Grand River Avenue. There are no corrections recommended for this intersection.

- Cedar Street and Grand River Avenue – This intersection experienced eleven (11) crashes in the 3 year period; five (5) in 2014, two (2) in 2015 and four (4) in 2016. There are no recommendations for corrections at this intersection.

- Bogue Street and Grand River Avenue – There were a total of twenty six (26) crashes at this intersection during the 3 year studied period; five (5) in 2014, nine (9) in 2015 and twelve (12) in 2016. Twenty three (23) of the twenty six (26) crashes at this intersection were rear end crashes. This is typical for a signalized intersection. It was also observed that the eastbound and westbound traffic on Grand River Avenue experience long backups during the AM and PM peak hours and many rear end crashes occur away from the intersection due to the long queues. There are no recommendations for corrections at this intersection.

NON-MOTORIZED TRANSPORTATION

The "City of East Lansing Non-motorized Transportation Plan," dated May, 2011, outlines existing conditions and potential improvements that could be made to the non-motorized infrastructure within the city. According to the study, Bogue Street in the project area has a sidewalk rating B, which is a facility with a buffer, such as a lawn extension, but no vertical elements. Grand River Avenue (M-43) at the project site has a sidewalk rating C, which is a facility along the curb with no buffer between the sidewalk and the roadway. A sidewalk rating A is given to a facility with vertical buffers, such as trees and lights, between the sidewalk and the roadway. (pgs. 20-21)

The proposed The Hub development has provided sidewalks along all public roadways around its facility. On Bogue Street there is a proposed seven (7) foot sidewalk with bike racks and trees along the roadway as a buffer between traffic and pedestrians. On Cedar Street, there is a minimum six (6) foot sidewalk with bike racks and trees along the roadway. Likewise, on Grand River Avenue (M-43) there is a proposed ten (10) foot sidewalk with bike racks and trees along the roadway. All driveways along Grand River Avenue (M-43) have been removed with the proposed site layout.

In addition to street level bike racks, there is proposed covered moped parking at street level as well as a covered bicycle parking facilities on the first floor mezzanine and second floor adjacent to the vehicular parking facilities.

DESIGN CONSIDERATIONS

Currently, the existing geometrics and traffic control devices for the majority of the roadway system is sufficient to handle the background traffic and the proposed The Hub development. The proposed driveways were modeled as single lane entering and exiting, except for the one way driveways which were modeled as single lane. The capacity analysis shows that this design should operate sufficiently under future conditions.

The proposed development has a driveway to the upper residential parking facility adjacent to the street level parking driveway for the east parking lot. The height of the parking garage wall should be designed such that it allows traffic exiting both driveways to have enough sight distance to see each other when exiting the two driveways.

RECOMMENDATIONS

The findings of this study show that the following mitigation is recommended for this project.

- The height of the parking garage wall at the driveway to the upper residential parking facility should be designed so that vehicles exiting the two driveways simultaneously will be able to observe the other vehicle.

SUPPLEMENTAL INFORMATION

Supplemental Information

Proposed Site Plan
Signal Timing Permits
Census Data
Vehicle Turning Movement Counts
Crash Analysis
LOS Computations