HENRY FORD HEALTH SYSTEM

TRAFFIC IMPACT STUDY

CAMPUS EXPANSION

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FINAL REPORT VER. 1.0

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1 INTRODUCTION

This report has been prepared by WSP Michigan, Inc ("WSP") to document the analysis findings related to the anticipated traffic impacts of the planned Henry Ford Health System ("HFHS") southern and eastern campus expansion projects in Detroit, MI. The southern expansion includes a hospital tower and podium, shared services building, utilities building, and parking garage. The existing hospital facility will remain in operation after the new tower is commissioned, transferring most services to the new facility in a steady transition while retaining some operational capacity and beds. The eastern expansion includes new residential buildings and conversion of the existing One Ford Place building to residential housing. The initial phase of eastern expansion will also include a new seven story research building and companion parking garage to replace a portion of the existing parking lot west of Third Street and south of the railroad tracks that run just south of Baltimore Street.

1.1 STUDY AREA

Thirty-two (32) intersections were identified for analysis due to their proximity to the proposed development areas as depicted in **Figure 1**. These locations were shared with the City of Detroit Traffic Engineering Department (TED) for concurrence prior to initiating analysis activities and were selected due to their relationship with site circulation and vehicle routing within the local area and to the freeway system. South campus is bordered by Grand to the north, the southbound John C. Lodge Service Drive to the east, and Baltimore, Holden, Milwaukee, and Poe to the south and west. East Campus spans from Holden in the south to the railroad viaduct in the north, where the John C. Lodge Freeway (M-10), Second, Amsterdam, and York represent the other borders. **Figures 2 and 3** show the site plans provided for South and East Campus, respectively.

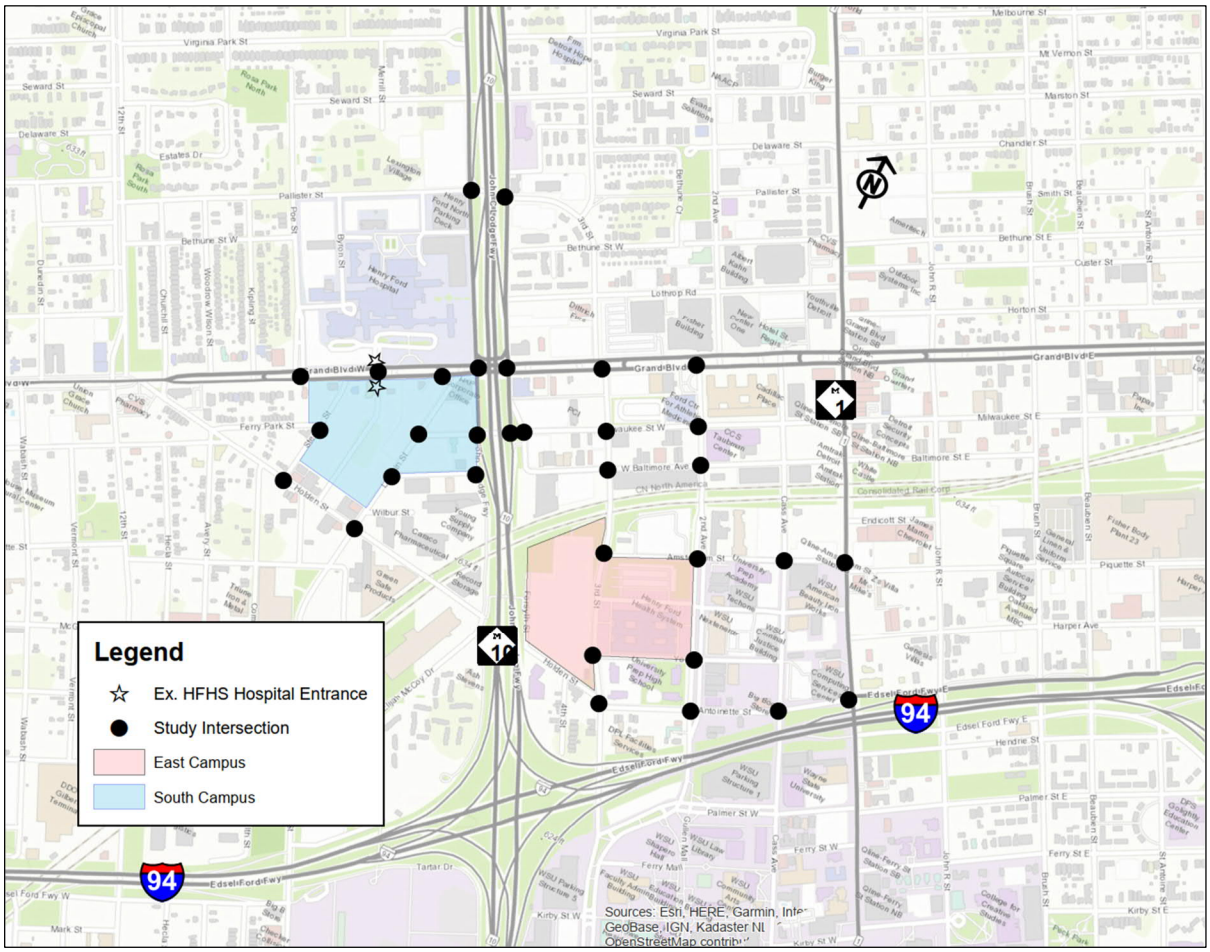


Figure 1 - Study Area

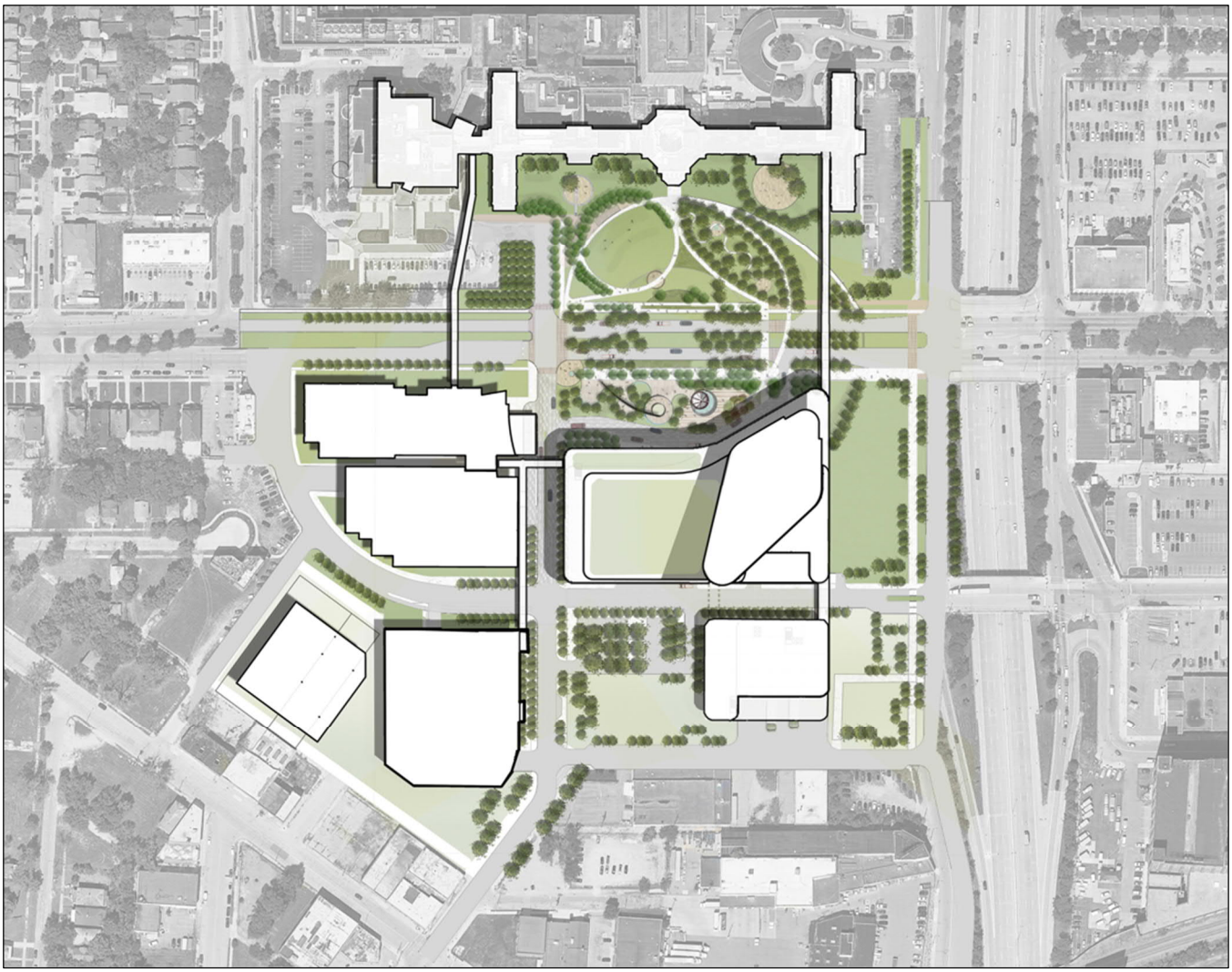


Figure 2 - South Campus Site Plan

Figure 3 - East Campus Site Plan

There are several different land use components contained within each expansion site that generate trips for passenger vehicles, emergency vehicles, pedestrians, bicyclists, transit, and commercial vehicles with variations in activity throughout the day and week. **Table 1** provides a summary of the anticipated land use types contained within each development, including the independent variable and quantity used as a basis for trip generation.

Table 1 - Planned Land Use by Development and ITE Trip Generation Variable

		Trip Generation Independent Variable					
Campus	**Location**	Operating Rooms	Beds	Residential Units	Office SF	Retail SF	Employees
	One Ford Place			403 *new*	*626,953 ex.*	15,000	
East	Research Building				335,000		
	New Residential (R-2)			154		5,000	
	Future Development			105			
	Phase I Hospital Tower		432				
South	D&T Podium	24					
	Shared Services Building						927

1.2 DATA SOURCES

Several different sources of data were needed to assess inbound and outbound flows associated with each facility. For example, the HFHS Logistics team was engaged to determine the delivery schedule, type of vehicle, and type of delivery planned for the Shared Service Building (SSB) each day and hour of the week as summarized in **Table 2**. This was needed to estimate the number of deliveries anticipated for the SSB throughout the day, which is expected to support other HFHS facilities in Metro Detroit in addition to the hospital. **Appendix A-1** contains additional volume and time of day information for each delivery shown.

Table 2 - Anticipated SSB Delivery Information

No	**Entity**	**Days of Week**	**Time Slot**	**AAHSTO Category**	**General Category**
1	US Foods	M, W, F	6:00 AM	WB-67	Food
2	Amerisource Bergen (Pharmacy/Drugs)	M, T, W, TH, F	6:00 AM	SU-30	Pharmacy
3	Praxair (Medical Gases)	M, T, W, TH, F	8:00 AM - 12:00 PM	WB-40	Medical Supplies
4	Pepsi	TU, W, TH	8:00 AM - 11:00 AM	WB-40	Food
5	Bakery	M, TH	6:00 AM - 8:00 AM	SU-30	Food
6	Fresh Produce	M, W, F	9:00 AM - 10:00 AM	SU-30	Food
7	Fresh Meat		8:00 AM - 10:00 AM	SU-30	Food
8	Fresh Milk		11:00 AM - 1:00 PM	SU-30	Food
9	Dialysis Supplies	W, F	10:00AM - 12:00 PM	WB-40	Medical Supplies
10	Allied Eagle (EVS supplies)	Varies	8:00 AM - 12:00 PM	SU-30	Medical Supplies
11	BioResource deliveries	T	6:00 AM - 9:00 AM	SU-30	Medical Supplies
12	ISCS (Internal HFH System Deliveries / Pickups)	M, T, W, TH, F	5:00 AM, 10:00 AM, 12:30 PM	SU-30	Internal HFHS/ISCS
13	ISCS		6:00 AM - 12:00 PM	SU-30	Internal HFHS/ISCS
14	Cardinal Health	M, T, W, TH, F, Sa, S	10:00 AM - 2:00 PM	WB-67	Medical Supplies
15	Cardinal Health	M, T, W, TH, F, Sun	9:30PM, 12:00AM - 4:00AM (2-3 deliveries)	WB-67	Medical Supplies
16	FedEx Express - Delivery	M, T, W, TH, F	8:00 AM - 10:00 AM	SU-30	Fedex / UPS
17	FedEx Ground - Delivery	M, T, W, TH, F	8:00 AM - 10:00 AM	SU-30	Fedex / UPS
18	UPS- Delivery	M, T, W, TH, F	8:00 AM - 10:00 AM	SU-30	Fedex / UPS

No	Entity	Days of Week	Time Slot	AAHSTO Category	General Category
19	FedEx Express - Pick Up	M, T, W, TH, F	2:30 PM - 4:30 PM	SU-30	Fedex / UPS
20	FedEx Ground - Pick Up	M, T, W, TH, F	2:30 PM - 4:30 PM	SU-30	Fedex / UPS
21	UPS - Pick Up	M, T, W, TH, F	2:30 PM - 4:30 PM	SU-30	Fedex / UPS
22	Fisher Scientific	T, F	11:00 AM - 1:00 PM	SU-30	Medical Supplies
23	HFHS Clinical Lab	M,T,W,TH,F,Sa,S	7:00 AM - 6:00 PM	P	Clinical Lab
26	Outgoing Food Deliveries (Incl. Truck Arrival)	M, W, F	7:00 AM - 6:00 PM (4 per day)	P	Food

The information provided in **Table 2** was then processed further to determine the volume of trucks anticipated for each day of the week at various times per day. This was necessary to determine the magnitude of anticipated deliveries relative to the vehicular peak periods and to provide recommendations for circulation based on time-of-day. **Table 3** provides a summary of the estimated truck volume destined for the Shared Services Bay (SSB) planned for South Campus, where a maximum of 8 trucks are expected during the AM peak hour.

Table 3 - South Campus Anticipated Truck Delivery Schedule

TIME OF DAY	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY	SATURDAY	SUNDAY
Early Morning	5	3	4	3	4	0	0
Morning	8	7	8	8	8	0	0
Lunch	3	3	3	2	4	1	1
Afternoon	3	3	3	3	3	0	0
Evening	1	1	1	1	1	0	1
Overnight	2	2	2	2	2	0	2
Total	**22**	**19**	**21**	**19**	**22**	**1**	**4**

The Program and Service Planning team was engaged to provide data for estimating patient volumes (emergency and non-emergency), employee parking, shuttle usage, emergency vehicle arrivals, special deliveries (flowers, food delivery, and clinical lab volumes each day). Front of house food and flower deliveries were estimated to generate 250 trips per day for the existing hospital facility and were distributed based on hourly counts collected on Grand Boulevard to approximate a maximum hourly flow for analysis. For parking information, self-parking data was provided for the period when they were able to collect revenue and track volume by locations which was from January 2019 to March 2020. There is a gap in the data set from April 2020 to December 2020. Starting in January 2021, HFHS began tracking only valet car volume, which was also provided through December 2022 which represents the end of the dataset. Patient volumes were provided from January 1, 2022, to October 31, 2022, and aggregated based on the following categories: emergency department (ED), outpatient, surgeries, and admissions aggregated by hour. A sample of this information is provided in **Figure 4**, which displays the average daily emergency visit volume for each day of the week.

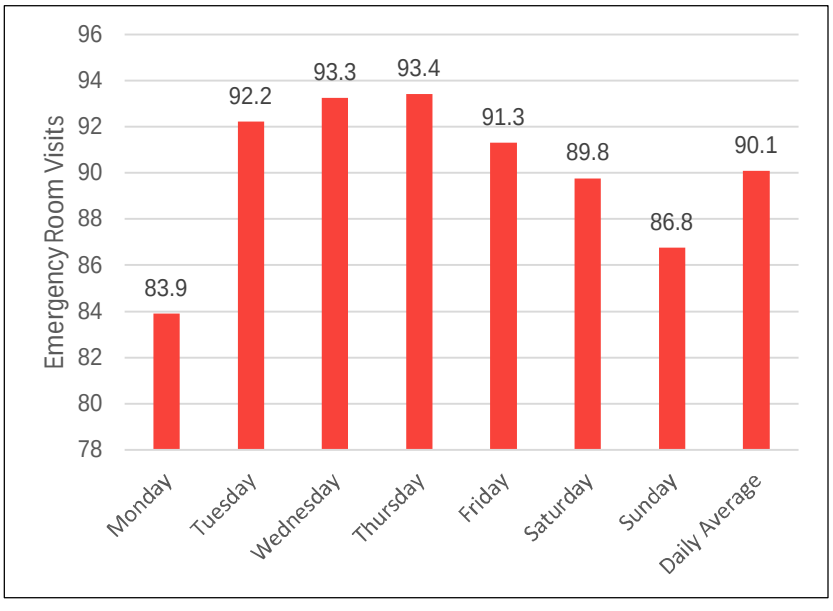


Figure 4 - Average Daily Ambulance Volume by Day of Week for Existing HFHS Hospital Facility

When comparing average values throughout the week, a typical peak value for the existing hospital is nearly 94 emergency room visits in a single day, disbursed throughout a twenty-four-hour period. Upon closer inspection, the maximum number of emergency room visits for any one hour within the dataset was 9 visits, which could include patients arriving via ambulance or personal vehicle as shown in **Table 4**. A similar exercise found that the maximum number of non-emergency department visits for any one hour within the entire dataset was 123 visits, which includes mainly patients arriving for outpatient procedures or visitors. Lastly, the dataset included information on ambulance arrivals specifically, where a maximum of 8 ambulances could arrive in one hour, where 6 are destined for the emergency department and 2 are supporting non-emergency department needs. This information was used as a basis for assigning trips to the new facility as a conservative approach, since the total number of beds between the existing hospital and new south campus expansion are proportional to the existing service condition. These trips could also occur at any time of the day due to the sporadic nature of emergencies and were applied with the same magnitude during AM and PM peak hour to observe impacts on the roadway. Additional discussion on trips to the new facility is provided in **Section 3.1**.

Table 4 - Observed Maximum Hourly Volumes for Existing HFHS Hospital Facility (2022)

Destination	Maximum Hourly Volume
Emergency Department Drive Up	9
Non-Emergency Department Drive Up	123
Emergency Department Ambulance	6
Non-ED Ambulance	2
Surgery Visits and Scheduled Admissions	9
Front of House Deliveries (Flowers, Door Dash, etc.)	6

An anticipated weekly truck delivery schedule was also provided by the HFHS design team for East Campus, where a standalone truck bay is programmed for the research building and is expected to see a maximum of four (4) WB-67 sized trucks in a single day as shown in **Table 5** which was used as the basis for assessing circulation and determining site impacts.

Table 5 - East Campus Deliveries by Day of Week and Type

Item	AASHTO Classification (Truck Type)	No. of Deliveries by Day of Week					Total
		Monday	Tuesday	Wednesday	Thursday	Friday	
Waste/Recycling	WB-67	1		1		1	3
Dry Ice	WB-67	1					1
Liquid Nitrogen	WB-67	1					1
Lab Support	WB-67	1					1
Laundry	SU-30					1	1
Lab Support #2	SU-30	1		1		1	3
FedEx/UPS	SU-30	2	2	2	2	2	10
USPS	SU-30	1	1	1	1	1	5
FedEx Express (outgoing)	SU-30	1	1	1	1	1	5
Other Delivery Vendors (Amazon, Office Depot, Nichols, etc.)	SU-30	2	2	2	2	2	10
Total		11	6	8	6	9	40

2 EXISTING TRAFFIC CONDITIONS

2.1 TRAFFIC VOLUMES

Traffic volumes were collected for AM and PM peak hours from a variety of sources, including past traffic impact studies completed by WSP for HFHS that included collection of turning movement counts by WSP personnel to confirm trip patterns and distribution post COVID and provide supplemental data for adjacent intersections, data from previous traffic signal optimization completed by WSP for MDOT in 2019 on Woodward Ave. (M-1), and as obtained from Replica who is a probe data vendor that provides turning movement counts aggregated by season and on an hourly basis for intersections that meet a minimum volume threshold. **Table 6** shows each study intersection and source volume data set for reference.

Table 6 - Volume Sources by Intersection

Intersection	Source (Year)	Adjustment
Grand Blvd. and SB Lodge Service Drive	Previous TIS (2015 & 2019), WSP Data Collection (2023)	Confirmed distribution with 2023 hourly count and developed adjustment factor for other locations utilizing 2015 and 2019 data.
Grand Blvd. and NB Lodge Service Drive	Previous TIS (2015 & 2019), WSP Data Collection (2023)	
Grand Blvd. and Milwaukee Ave., Poe Ave.	Previous TIS (2015)	Applied 2015 to 2023 adjustment factor.
Grand Blvd. and 2nd Ave.	Replica (2022)	Through volumes were balanced with adjacent intersections using 2023 collected data.
Grand Blvd. and 3rd St.	Replica (2022)	
Pallister and SB Lodge Service Drive	Previous TIS (2015 & 2019)	Applied 2019 to 2023 adjustment factor.
Pallister and NB Lodge Service Drive	Previous TIS (2015 & 2019)	Applied 2019 to 2023 adjustment factor.
Woodward Ave. (M-1) and Antoinette St.	MDOT (2019)	Applied 2019 to 2023 adjustment factor.
Holden St. and Lincoln St., Trumbull St.	Previous TIS (2015)	Applied 2015 to 2023 adjustment factor.
Amsterdam St. and Woodward Ave. (M-1)	MDOT (2019)	Applied 2019 to 2023 adjustment factor. Volume balanced with TMC collected at Burroughs St. and Baltimore St.
Amsterdam St. and 2nd Ave.	HFM-PPC TIS (2017)	Adjusted future volumes by applying 2017 to 2023 adjustment factor. 15-min short counts conducted in 2023 to confirm distribution at 3rd/Amsterdam.
Amsterdam St. and 3rd St.		
Milwaukee Ave. and 2nd Ave.	Replica (2022)	No adjustments applied.
Baltimore Ave. and 2nd Ave.	Replica (2022)	No adjustments applied.
Baltimore Ave. and 3rd St.	Volume Balancing (2023)	Deduced based on volume balancing with known volumes at adjacent intersections as described in this table.
Milwaukee Ave. and 3rd St.	Volume Balancing (2023)	
Milwaukee Ave. and SB Lodge Service Drive	Previous TIS (2015)	Applied 2015 to 2023 adjustment factor.
Milwaukee Ave. and NB Lodge Service Drive	Previous TIS (2015)	Applied 2015 to 2023 adjustment factor.
Milwaukee Ave. and Baltimore Ave.	Previous TIS (2015)	Applied 2015 to 2023 adjustment factor.
Milwaukee Ave. and Lincoln St.	Previous TIS (2015)	Applied 2015 to 2023 adjustment factor.
Baltimore Ave. and SB Lodge Service Drive	Previous TIS (2015)	Applied 2015 to 2023 adjustment factor.
Baltimore Ave. and Lincoln St.	Previous TIS (2015)	Applied 2015 to 2023 adjustment factor.

There is ongoing construction that started in 2020 and is still in progress as of writing this report, that requires a full closure of Antoinette to support construction related to the Second Avenue bridge replacement and within the I-94/M-10 interchange. This work includes the installation of a new bridge over I-94 and removal of the existing Third Street bridge over I-94 which is not to be replaced. This means that there is no passthrough volume on Third anymore and that only vehicles destined for the existing One Ford Place parking lot, local schools, or other smaller commercial facilities will access the area. This finding impacts the study intersections of Antionette and Holden, York and Third., Antoinette and Second, Antoinette and Cass, and

Amsterdam and Cass. As a result, counts were estimated for these locations based on short counts collected by WSP to identify the turning movement distribution for each intersection. This was also supported by in-field observations completed during the AM and PM peak hours, where the primary traffic generator observed was the One Ford Place parking lot. As a result, the re-assigned volumes contained in the TIS submitted for the nearby Pistons Practice Facility were utilized for the intersections on Amsterdam St. at Third St. and at Second Ave. and adjusted from 2017 to 2023 accordingly. Furthermore, source traffic counts required additional adjustment to develop a single set of existing year volumes for 2023 since they were collected in different prior years. This process involved WSP collecting counts in 2023 at higher volume locations that overlapped with those collected during previous traffic impact study efforts in 2015 and 2019, such as the Lodge Service Drive, Milwaukee and Grand. **Table 7** provides a summary of the growth factors for each reference year using data collected at the Lodge Service Drive and Grand Boulevard intersections.

Table 7 – Summary of Adjustment Factor Input and Tabulation

Total Intersection Volume (throughput) – John C. Lodge Service Drive and Grand Boulevard			
Location	**2015 (TDC)**	**2019 (TDC)**	**2023 (WSP)**
NB AM Peak	3,303	3,001	2,278
NB PM Peak	3,404	3,114	2,649
SB AM Peak	3,087	2,999	2,370
SB PM Peak	3,162	2,921	2,704
Total	12,956	12,035	10,001
Adjustment Factor Tabulation			
Range	**Straight-Line**	**n**	**Compound Annual Growth Rate**
2015 to 2019	-7.1%	4	-1.8%
2015 to 2023	-22.8%	8	-3.2%
2019 to 2023	-16.9%	4	-4.5%
2017 to 2023*	-19.9%	6	-3.9%
*Based on the average of 2015 and 2019 adjustment factors.			

Analysis shows that there was a 22.8 percent decrease in overall intersection throughput from 2015 to 2023, a finding that is attributed to changes in travel patterns that were a result of implementing hybrid work schedules during the COVID pandemic. Prior to the pandemic, volumes were found to decrease by 7.1 percent from 2015 to 2019, which is a pre-COVID trend that demonstrates limited growth in the region. Still, this sets a baseline condition for 2023, which is assumed to grow from there at a rate of 0.5 percent per year, consistent with other recent studies conducted in the City. This provides for background growth scenarios that show an increase in traffic relative to the baseline as a basis for assessment. In practice, this would represent the organic growth in the surrounding land use that isn't captured in the trip generation conducted for this study as part of the proposed HFHS development plan.

2.2 GEOMETRY

For the existing condition, roadway geometry contained within the Synchro model that was developed by WSP in 2019 for the employee parking garage traffic impact study was used as the basis for this analysis and verified using Google Earth. Additional intersections were added beyond the scope of the previous TIS to consider the impacts of East Campus, which reach further east than what is anticipated for the South Campus expansion. Google Earth was used as the primary tool for collecting geometry measurements for the newly added intersections and supplemented by observations made during traffic data collection activities. The Synchro model also included intersections adjacent to study intersections identified in **Figure 1** to support volume balancing within the model. Future scenarios were developed based on the site plan provided by the HFHS design team, which included graphical depictions of intended roadway usage of public and private facilities impacted by the development as shown in **Figures 2 and 3**. For reference, the WSP team was consulted during the site plan design process to minimize potential impacts with the surrounding roadway infrastructure by providing feedback on traffic circulation and operations for each component of the proposed site. This process included preliminary analysis based on existing volumes to support design team engagement ahead of formal traffic impact analyses.

2.2.1 TRANSIT INFRASTRUCTURE

There are several bus stops in the vicinity of the existing hospital facility on Grand and along Second near One Ford Place and the planned East Campus expansion. These are in addition to the existing Detroit Amtrak station located at Baltimore and Woodward (M-1), which is pland for near-term redevelopment, and the Q-Line light rail system which runs down Woodward (M-1) from just north of W. Grand Blvd to Downtown Detroit just short of the river. **Figure 5** below shows the locations of the bus stops in the study area in context with the development.

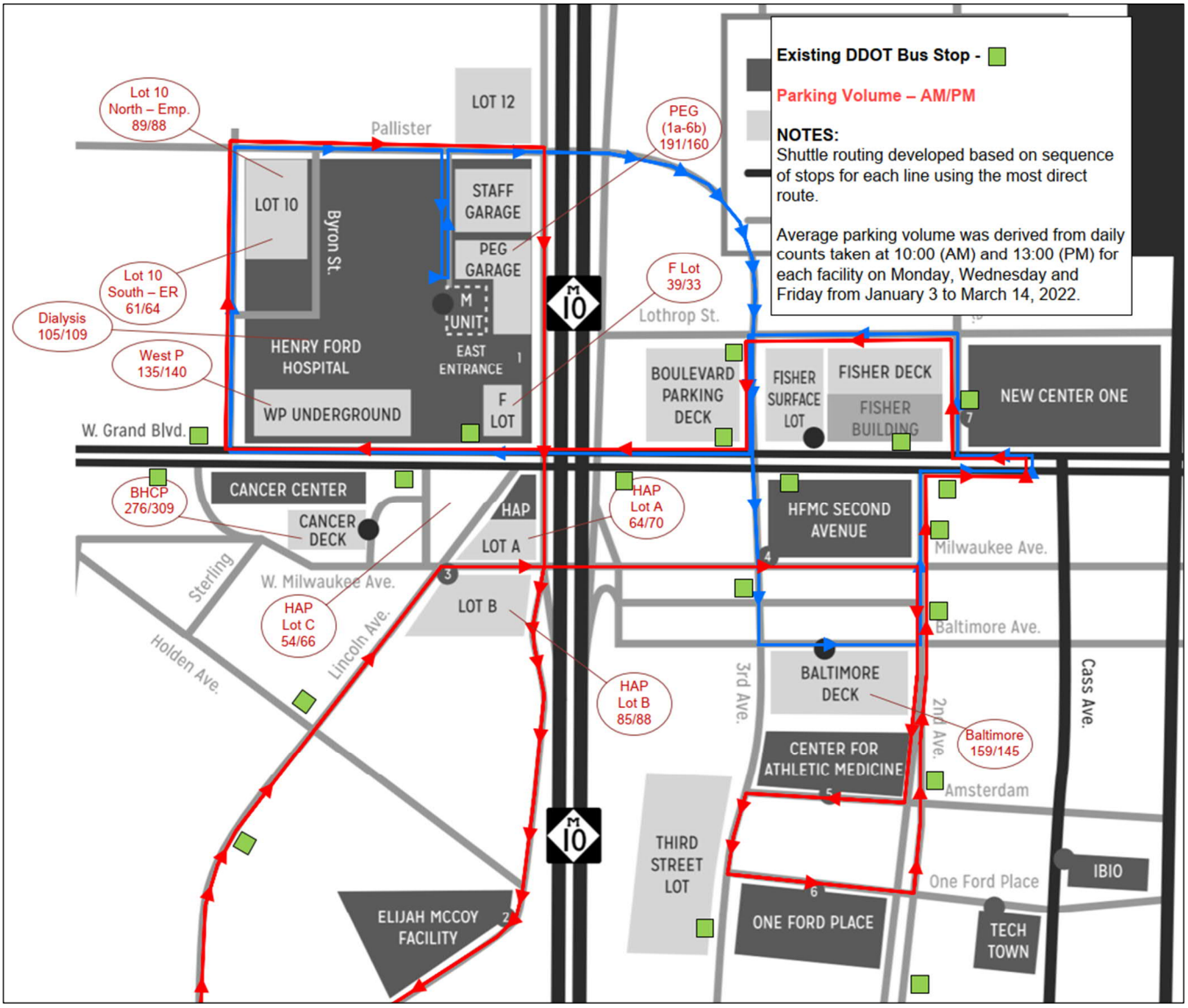


Figure 5 - Existing HFHS Shuttle Route and DDOT Bus Stops

These stops were observed during field review as serving several users based on the amount of people seen waiting at the existing bus stops. Integrating these bus stops into the proposed site plan is critical to providing access to the facility via the local transit network. At present, they are placed in position to take advantage of the proposed pedestrian area located in between the existing and proposed hospitals and spanning Grand. Providing a companion shuttle stop servicing the other Henry Ford facilities and coordinating with the local transit authorities, including DDOT and SMART, is recommended for right sizing this shelter within the context of project rider populations and service routing.

2.2.2 THIRD STREET

As shown in **Figure 6**, the existing cross-section of Third Street is two-lanes in each direction with 44-feet of space measured curb to curb, which was the result of a recent conversion from one-way to two-way operation that occurred with the development of the nearby Detroit Pistons training facility. In addition, MDOT recently removed the Third Street bridge over I-94, which use to provide a connection to development to the south in a one-way pair with Second. Since then, Second has also been converted to two-way operations with no plans to replace the Third Street bridge to reduce ongoing maintenance costs and because the connectivity was no longer needed.

Figure 6 - Existing Third Street Cross-Section from Holden to Amsterdam

2.3 ANALYSIS

Traffic impact analysis shows where vehicular and nonmotorized impacts may exist throughout campus by utilizing Synchro to assess traffic conditions and developing site circulation diagrams to determine anticipated traffic flows to provide feedback within the context of the proposed infrastructure within the project site and along Grand as part of a planned road diet scheduled for completion before hospital construction. Source data collected for the existing condition was input into Synchro 11, a traffic modeling software that determines the theoretical traffic signal control delay and the corresponding level of service (LOS) for each intersection. Existing signal timing was used for signalized study intersections based on timing permits obtained from the TED. Signal timing was optimized for all future scenarios. For reference, LOS is based on the amount of delay experience by drivers traveling along the roadway through an intersection, where the criteria used by Synchro 11 for unsignalized, and signalized intersections are provided in the Highway Capacity Manual (HCM) 6th Edition and shown in **Table 8**. As a point of reference, LOS D or better is considered acceptable for operations in urban areas.

Table 8 - Level of Service (LOS) Delay Criteria

LOS	Brief Description	Delay Per Vehicle (Seconds)	
		Unsignalized Intersection	Signalized Intersection
A	Represent excellent operation with minimal or no delays.	0-10	0-10
B		>10-15	>10-20
C	Typical operating levels when some delays occur.	>15-25	>20-35
D		>25-35	>35-55
E	Congested situations and improvements are usually considered at these levels.	>35-50	>55-80
F		>50	>80

The HFHS project team provided a planned schedule of construction activity for both campuses, which have an anticipated completion in Q1 2029 as of report writing which is subject to change. As such, 2029 was assumed as opening year for both campuses and used as the future condition for analysis. Consequently, the ten years after condition was assessed for 2039, where a growth factor was applied to consider background traffic growth in addition to growth as a direct result of the campus expansion and development.

The following scenarios were analyzed with capacity analysis:

- **Existing (2023)** – Existing geometry and normalized 2023 volumes modeled in Synchro.
- **Background (2029 and 2039)** – Existing geometry with source volumes grown by 0.5 percent per year modeled in Synchro to represent a scenario if the existing hospital facility remained without modification or construction of a new facility. Two separate background scenarios were prepared to provide a basis for comparison with the Future Condition and Ten Years After Future Condition scenarios.
- **Future Condition (2029)** – Proposed site plan geometry with background traffic, reassigned hospital traffic accounting for net difference in traffic between the proposed hospital and existing hospital, and newly generated traffic for East Campus during opening year.
- **Ten Years After Future Condition (2039)** – Future condition scenario grown by 0.5 percent annually to assess traffic impacts of new hospital and research facilities ten years after they open.

2.3.1 EXISTING CONDITIONS

Existing conditions were assessed to identify what issues are present within the study roadway network today when using current signal timing, volumes, and geometry. This scenario provides a baseline for analysis, where individual movements are assessed for capacity and is the base to apply future growth for the background scenario. **Table 9** provides the overall delay and level of service that were observed using data normalized for 2023 at each study intersection during the AM and PM peak hour periods.

Table 9 - Overall LOS and Delay by Intersection (Existing Condition)

Intersection	LOS (Delay)	
	AM Peak Hour	PM Peak Hour
Grand and SB Lodge Service Drive	B (17.7”)	B (17.0”)
Grand and NB Lodge Service Drive	B (12.3”)	B (17.2”)
Grand, Milwaukee, and Poe	B (10.5”)	A (9.6”)
Grand and Second	B (10.2”)	B (14.6”)
Grand and Third	B (10.1”)	B (14.2”)
Pallister and SB Lodge Service Drive	D (48.1”)	C (20.7”)
Pallister and NB Lodge Service Drive	A (7.2”)	A (6.8”)
Woodward (M-1) and Antoinette	C (24.5”)	B (12.1”)
Holden, Lincoln, Trumbull	B (17.8”)	C (21.9”)
Antoinette and Cass	C (28.2”)	B (9.0”)
Antoinette and Second	A (8.5”)	A (6.0”)
Antoinette, Holden, and Third	A (8.9”)	A (8.7”)
York and Third	C (16.3”)	A (6.8”)
Amsterdam and Woodward (M-1)	A (0.0”)	B (12.0”)
Amsterdam and Cass	A (9.3”)	B (10.7”)
Amsterdam and Second	B (14.2”)	A (5.3”)
Amsterdam, Ex. OFP Parking and Third	C (21.6”)	D (31.8”)
Milwaukee and Second	B (17.7”)	B (14.8”)
Milwaukee and Third	B (15.9”)	B (12.0”)
Milwaukee and SB Lodge Service Drive	B (11.8”)	B (17.6”)
Milwaukee and NB Lodge Service Drive	C (26.7”)	B (17.2”)
Milwaukee and Baltimore	C (34.5”)	F (379.5”)
Milwaukee and Lincoln	A (8.9”)	B (11.7”)
Baltimore and Third	B (19.9”)	A (9.4”)
Milwaukee and Third	B (16.5”)	A (9.8”)
Baltimore and SB Lodge Service Drive	A (6.6”)	A (7.1”)
Baltimore and Lincoln	B (10.1”)	B (11.1”)

LOS C or better was found for all intersections within the study area, except for:

- Milwaukee and Baltimore – The intersection is an overall LOS F during the PM peak hour due to capacity issues with the south leg of the intersection which includes a single through lane serving 194 through vehicles and 178 left-turning vehicles. This intersection also exists immediately to the east of the northbound off-ramp from the John C. Lodge Freeway to Milwaukee Ave which limits downstream storage for vehicles making a left from Baltimore onto Milwaukee and creates a situation where the queue can spillback onto Baltimore and prevent through traffic from proceeding.
- Southbound John C. Lodge Exit Ramp to Pallister – The exit ramp reports an LOS E with 78.5 seconds of delay and a 95th percentile queue of 308 feet or approximately 16 vehicles during the AM peak hour. A single through lane is provided for the southbound service drive adjacent to the freeway off-ramp, where through traffic is competing with right-turning traffic, approaching the limits of available capacity. This finding is mitigated with timing adjustments in the background and background with development future scenarios for reference.

- Third, Existing One Ford Place Parking Lot, and Amsterdam – Stop controlled intersection with LOS D during PM peak hour which is due to the LOS F found for the parking lot exit which has a 95th percentile queue length of 280 feet which is approximately 14 vehicles.

3 DIRECT IMPACTS OF DEVELOPMENT

Development activity is assessed by quantifying the number of trips by mode anticipated for each land use, distributing those trips on the roadway network, and then assessing the impacts of those trips on an intersection-by-intersection basis for each corridor impacted by site traffic. This approach provides a basis for recommending countermeasures for implementation with site construction and for planning future infrastructure investment and enhancements in the area. Detailed discussions on trip generation, trip distribution, and site circulation anticipated for each transportation mode are contained in the following subsections.

3.1 TRIP GENERATION

Estimating trips for each land use was conducted using a variety of source data, including the *Institute of Transportation Engineers (ITE) Trip Generation Manual 11th Edition*, as provided by the HFHS design team for the existing 877-bed hospital facility north of Grand, and by applying engineering judgment for where data was unavailable as noted for each land use where appropriate.

SOUTH CAMPUS

Since there is an existing facility that already generates trips on the roadway network and will reduce utilization in the future scenario, it is necessary to determine the difference in trips anticipated for each facility as those will constitute the trips destined for the new hospital. As such, the ITE Trip Gen manual was used to generate trips for the proposed Phase I Tower and the existing facility for comparison as shown in **Table 10**, where there is an entry shown for the existing hospital at full and reduced capacity for comparison purposes. For reference, the estimated trip numbers provided in the table are the total entering and exiting traffic for that mode. The specific distribution between entering and exiting trips was applied directly as indicated in the ITE Trip Gen manual.

Table 10 - South Campus Trip Generation (ITE Trip Gen 11th Edition)

Name	Land Use Code	AM Peak				PM Peak			
		VEH	PED	BIKE	TRANSIT^	VEH	PED	BIKE	TRANSIT
Phase I Tower 432 beds	610 - Hospital	773	65	28	136	730	N/A		
Ex. Hospital 877 beds	610 - Hospital	1,570	132	56	277	1,482	N/A		
Ex. Hospital Reduced to 445 beds	610 - Hospital	797	67	29	140	752	N/A		
D&T Podium	Included w/Phase I Tower Land Use Description								
SSB*	130 – Industrial Park	400	N/A			398	N/A		

*Note: See Table 2 for anticipated SSB truck delivery schedule. The SSB will support all North Campus delivery traffic at build-out.
^Note: Assumed 6:1 Transit:Bike ratio based on generated East Campus data since those were not provided for the hospital land use code in the ITE Trip Generation Manual

Other vehicles, such as trucks and ambulances, were quantified and assessed in consultation with the HFHS design team based on the services provided with the existing hospital which will transfer to the new facility. In addition, the SSB will include consolidated services within the HFHS, which required estimation of additional trips not captured with the existing facility. This was accomplished by applying the anticipated employee count for the SSB to determine vehicles trips destined for the facility as indicated in **Table 9**. For truck volumes, the HFHS design team was consulted to determine how many truck deliveries the SSB is expected to support as shown in **Table 2** and detailed in **Appendix A-1**.

EAST CAMPUS

A similar condition exists for east campus, where the existing One Ford Place facility generates trips on the surrounding roadway network that are primarily destined for the existing parking lot that will be replaced by the planned parking structure and research building. These existing trips are also different in nature as they are for office space and not residential space as planned under the future condition. This means that the difference between the existing office-based trips and future residential trips will represent the future development condition within this area. Furthermore, mode selection also changes, where the residential land use will generate more pedestrian, bike and transit trips when compared to the existing office space at One Ford Place. As such, the values shown for One Ford Place in **Table 11** represent the difference between existing and proposed land use, where the other developments shown represent entirely new trips to the area.

Table 11 - East Campus Trip Generation (ITE Trip Gen 11th Edition)

Name	Land Use Code	AM Peak					PM Peak				
		VEH	PED	BIKE	TRUCK	TRANSIT	VEH	PED	BIKE	TRUCK	TRANSIT
One Ford Place*	710 – General Office Building (Dense Multi-Use Urban (ex.) 231 – Mid-Rise Residential w/Ground Floor Commercial (Dense Multi-Use Urban) (prop.)	(671)	257	10	(6)	55	(633)	284	6	(6)	0
New Residential Building	231 – Mid-Rise Residential w/Ground Floor Commercial (Dense Multi-Use Urban) (prop.)	54	124	6	0	31	49	187	5	0	17
Future Development (Residential)	231 – Mid-Rise Residential w/Ground Floor Commercial (Dense Multi-Use Urban) (prop.)	21	46	3	0	23	29	86	7	0	59
Research Building^	760 – Research and Development Center (General Urban/Suburban)	116	See Residential		4	13	45	See Residential		4	13

*Note: One Ford Place is a residential conversion where the net difference in trips w/the existing office land use is shown. Residential walking trips are those destined for Research Building.
^Note: Vehicle trips generated for research building were discounted based on the assumption that 60% of all pedestrian trips generated by the One Ford Place converted residential space and the New Residential Building are destined for the Research Building. Truck volumes were determined based on the proposed delivery schedule provided in Table 4.

The research facility is anticipated to operate on a 24-hour schedule with scientist team members entering and exiting the facility in the evenings, at night, early morning, and weekends as they conduct experiments, and bioresources staff running in three shifts with a maximum of twenty (20) employees per shift. This operation is supported by the new residential building and conversion of One Ford Place to provide housing for research building employees as they are assigned to various research activities and experiments. As noted in the table, this creates a scenario where research scientists will walk to the building instead of using a vehicle, which substantially reduces the number of trips estimated for this specific land use type, which is based on data collected from more vehicle focused suburban sites. The displaced office trips that are destined for the One Ford Place parking lot under the existing condition are assumed to utilize the excess capacity generated in North Campus upon final buildout since HFHS plans to convert unused floors of the existing hospital to support a portion of personnel currently seated in One Ford Place. Furthermore, a portion of these trips are also planned for reassignment to other facilities in the system and are subject to hybrid working arrangements that are not captured by the reference trip generation numbers shown for the existing office-based land use at One Ford Place.

3.2 TRIP DISTRIBUTION

Separate distributions were used for South and East campus to account for the differing populations anticipated for each facility, along with the routes used to access them. For South Campus, the same distribution used for the recent impact study provided for the Henry Ford Cancer Center was utilized to distribute traffic. This information was previously accepted by the City of Detroit TED for the study area and is based upon personnel and patient data obtained from HFHS for the existing hospital. This information as also used as a basis for distributing vehicular trips destined for East Campus, where personnel are expected to park in the garage adjacent to the new research facility and traverse to and from the hospital as part of their daily activities. For both sites, the distribution was applied by studying the most logical and direct route to the facility from surrounding freeways and major local roadways. **Figure 7** shows the distribution for South Campus, where the percentages listed in each bubble indicate the percent of trips expected to traverse to and from that section of roadway. For example, the 5 percent shown just east of the northbound John C. Lodge service drive on Grand are local trips that will enter or exit the site from the east on Grand. Similarly, the 20 percent shown along the left edge of the figure represents local trips along with those coming from I-96 which has interchange with Grand west of the hospital. In general, 65 percent of the users destined for the facility are expected to arrive using the John C. Lodge Freeway.

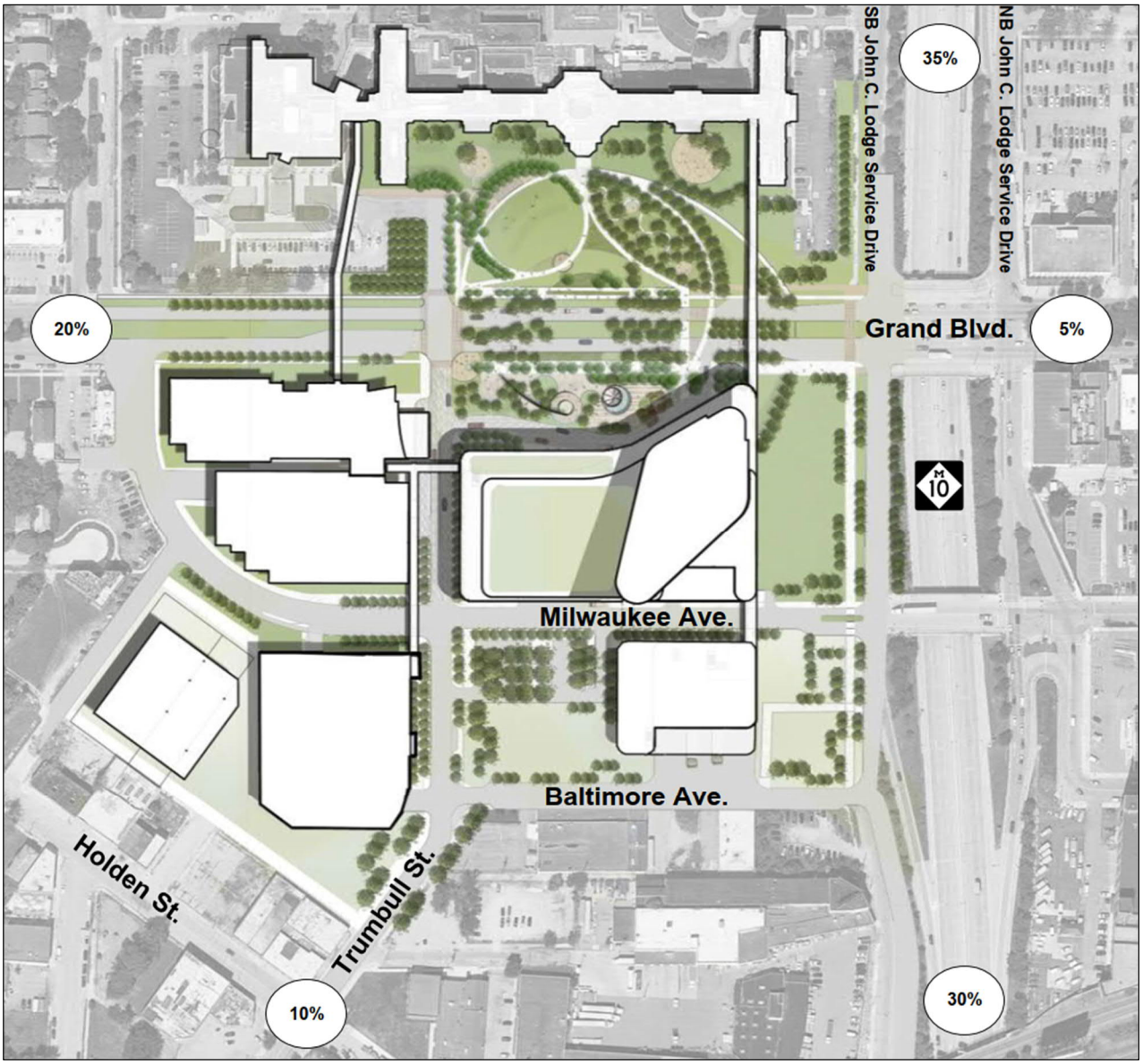


Figure 7 - South Campus Trip Distribution

For East Campus, there are two primary ingress points to the facility with vehicles using either the John C. Lodge Freeway to seek Grand, Milwaukee, and Third, or I-94 to seek Antoinette as primary routes, where the percentages used for South Campus were aggregated and applied as shown in **Figure 8**. For reference, this information is used with the TIA tool in Synchro to manually select routes within the modelled roadway network to apply the generated trips based on these percentages to determine relative impacts on the roadway system.

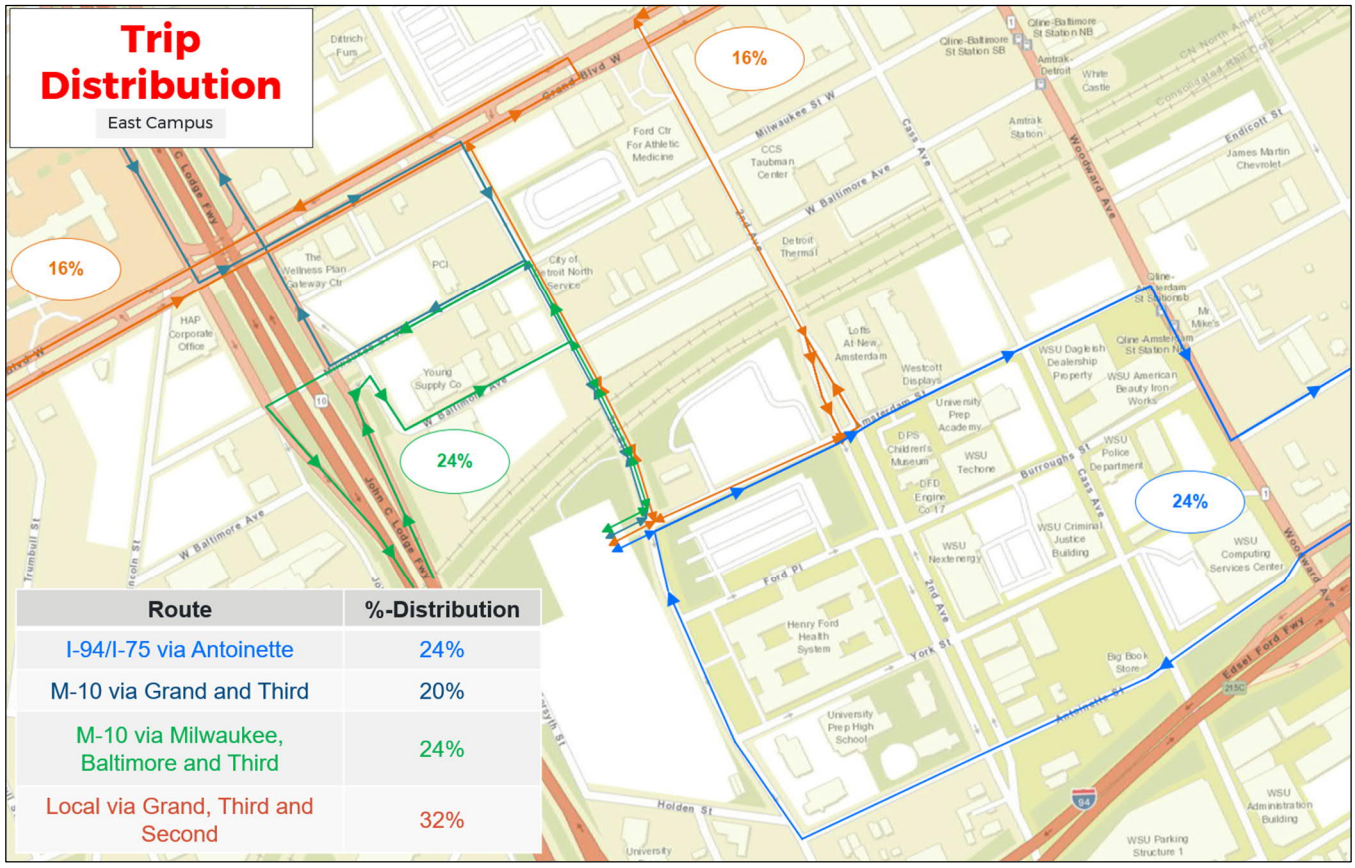


Figure 8 - East Campus Trip Distribution

3.3 SITE SPECIFIC CIRCULATION AND ROUTING

There are several different users anticipated for South Campus, including emergency department arrivals via ambulance and passenger car, commercial vehicles accessing the loading dock, patients arriving for scheduled surgeries, visitors accessing the new parking garage or using valet, and other front of house deliveries, where each requires different considerations for routing and accessibility. Staff are expected to continue parking under the same arrangements that are in place for the existing hospital on North Campus, where a new parking garage was recently constructed at Pallister and the southbound John C. Lodge Service Drive. This section details the anticipated routing for each user destined for the proposed South and East Campus developments, where the HFHS design team was engaged during the preliminary design process to assess movements of these different user groups and provide feedback to limit impacts and conflicts where possible.

3.3.1 EMERGENCY DEPARTMENT

Patients seeking the emergency department can arrive via an ambulance or by passenger vehicle and will enter through the south side of the new hospital tower using Milwaukee. A parking lot is provided west of the SSB and south of Milwaukee to allow ED patients arriving via passenger car to quickly park and access the facility. Ambulances will have their own bay provided on the south side of the hospital as depicted in **Figure 9**. Since this arrangement uses the Service Drive and runs through the Grand Boulevard intersection, ensuring the intersection is clear in the event of a crash is critical for maintaining flow in this area for emergency vehicles. A cursory review of the most recent five years of available crash data from 2018 to 2022 found that 46 crashes[1] or approximately 9 per year occurred within 250 feet of the intersection limits. HFHS should coordinate with local first responders and consider developing an emergency response plan to provide an expedited response to clear crashed vehicles from this intersection.

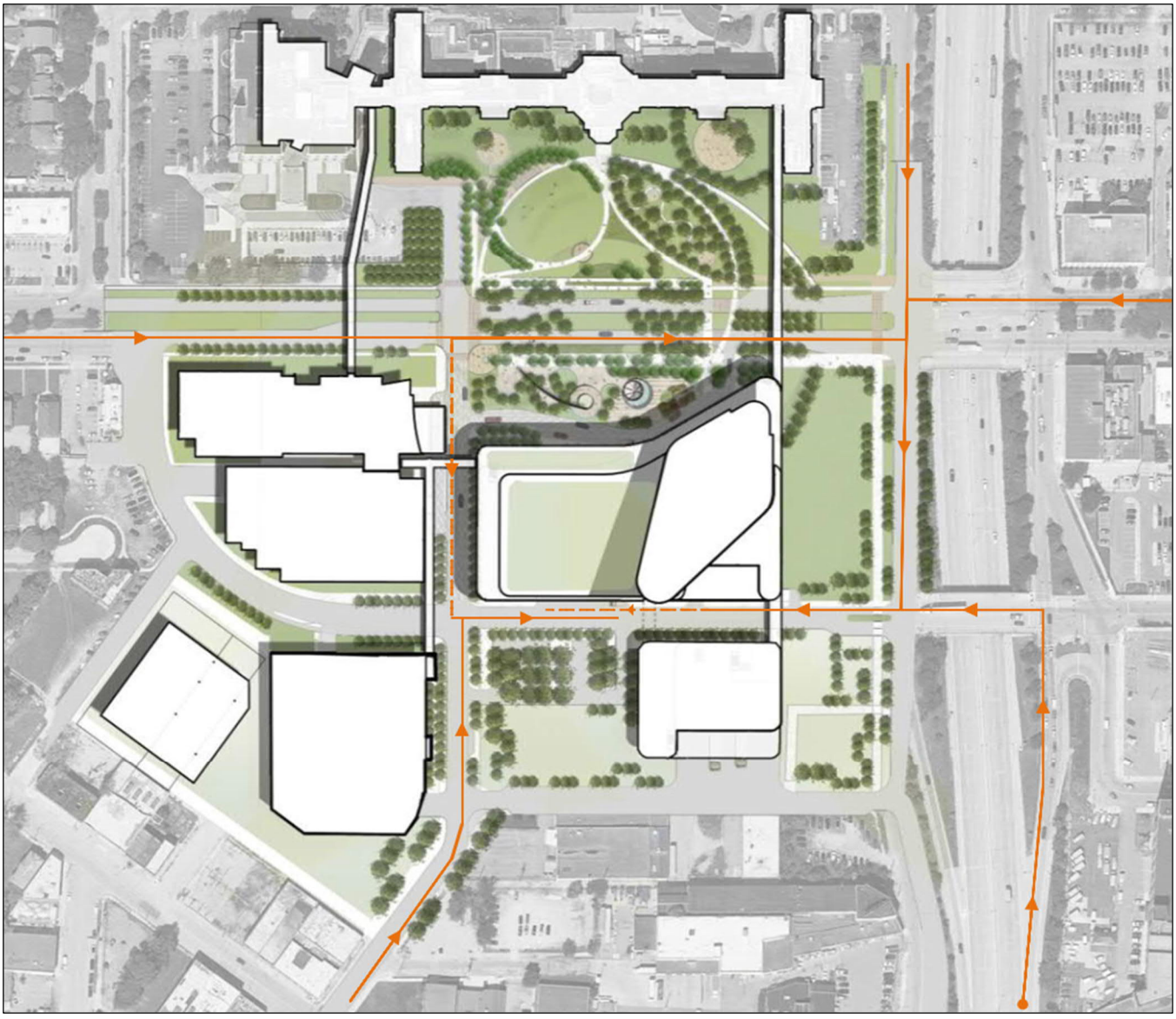


Figure 9 – South Campus Emergency Department Site Circulation

[1] https://www.michigantrafficcrashfacts.org/querytool/lists/0#q1:0:2022,2021,2020,2019,2018;j82029417,42.366845,-83.082159;0,54:1&p0,0:0,14:0,15:0,2:0,25:0,3:0,4:0,49:0,5:0,50:0,51|0|90|7,asc:0,asc:1,asc:2,asc:3,asc:4,asc:5,asc:6,asc:8,asc:9,asc:10,asc

3.3.2 COMMERCIAL VEHICLES

There are several different pathways available for commercial vehicles to access the south side of the SSB using Baltimore, where the John C. Lodge Freeway provides the most immediate opportunity for access when exiting northbound at Milwaukee or southbound at Pallister. There are train tracks that are aligned east west and use viaducts to cross over the existing roadways. As a result, there are height restrictions for larger sized trucks, where they cannot access the site from the south using Trumbull or the Lodge Service Drive as a result, which are the preferred routes for accessing the site if the viaducts are improved in the future and re-constructed to allow trucks to travel underneath. This is noted in **Figure 10**, where the viaduct over the John C. Lodge Service Drive is marked with a callout noting this height restriction. At present, the posted height for that viaduct is 13' 10" which is considered substandard. A similar scenario is in place for East Campus, where viaducts restrict truck movement to and from the north, providing for a route utilizing Antoinette and Amsterdam to enter or exit the facility and access I-94 as shown in **Figure 11**.

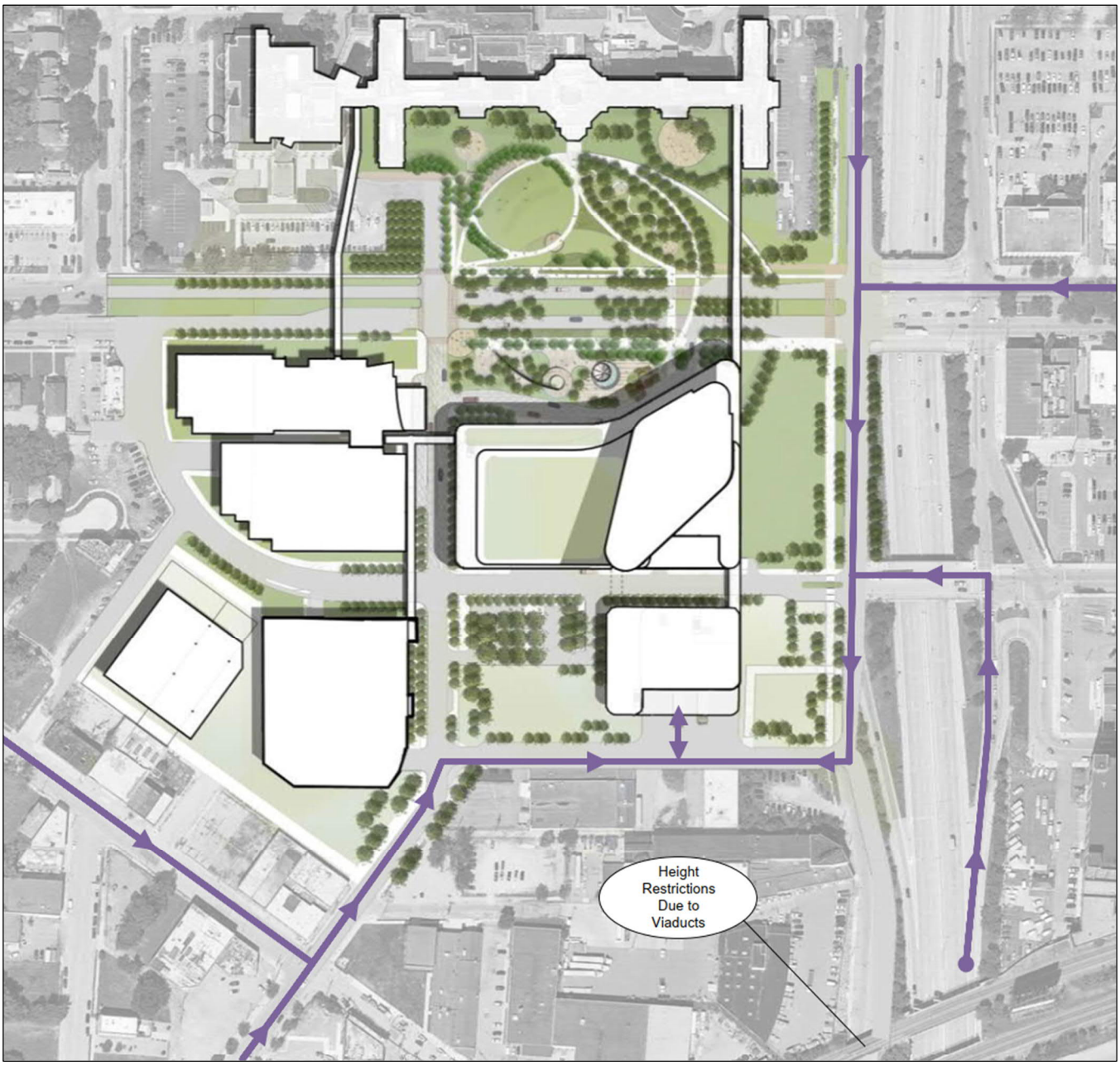


Figure 10 – South Campus Commercial Vehicle Site Circulation

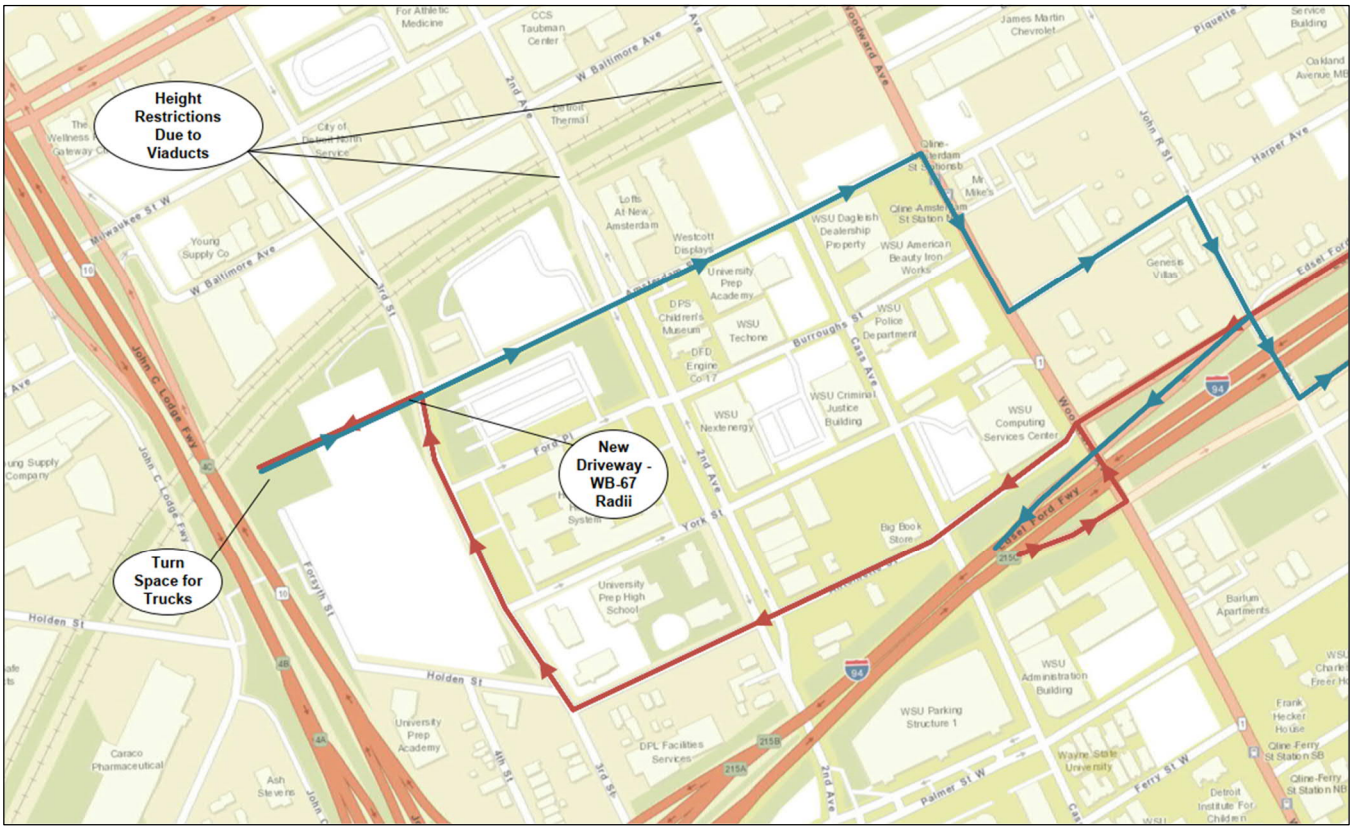


Figure 11 - East Campus Commercial Vehicle Site Circulation

3.3.3 NON-EMERGENCY PATIENT DROP-OFF AND VALET

Non-emergency visits include those arriving for scheduled surgery, visitors to patients already at the facility, and rideshare or other services like flower delivery that utilize the front of house for their operations. As a result, these trips are destined primarily to the front entrance of the hospital, where a small subset may skip the front entrance in favor of traveling directly to the parking garage as noted in **Figure 12** with the blue callouts. As a preview to recommendations, the figure also notes a restriction on Milwaukee, prohibiting southbound right-turns and marking this as an emergency department entrance to limit pass-through traffic where possible. This is necessary to reduce conflicts between ambulances and passenger car ED arrivals who are time critical. Milwaukee is still expected to have full access under this arrangement.

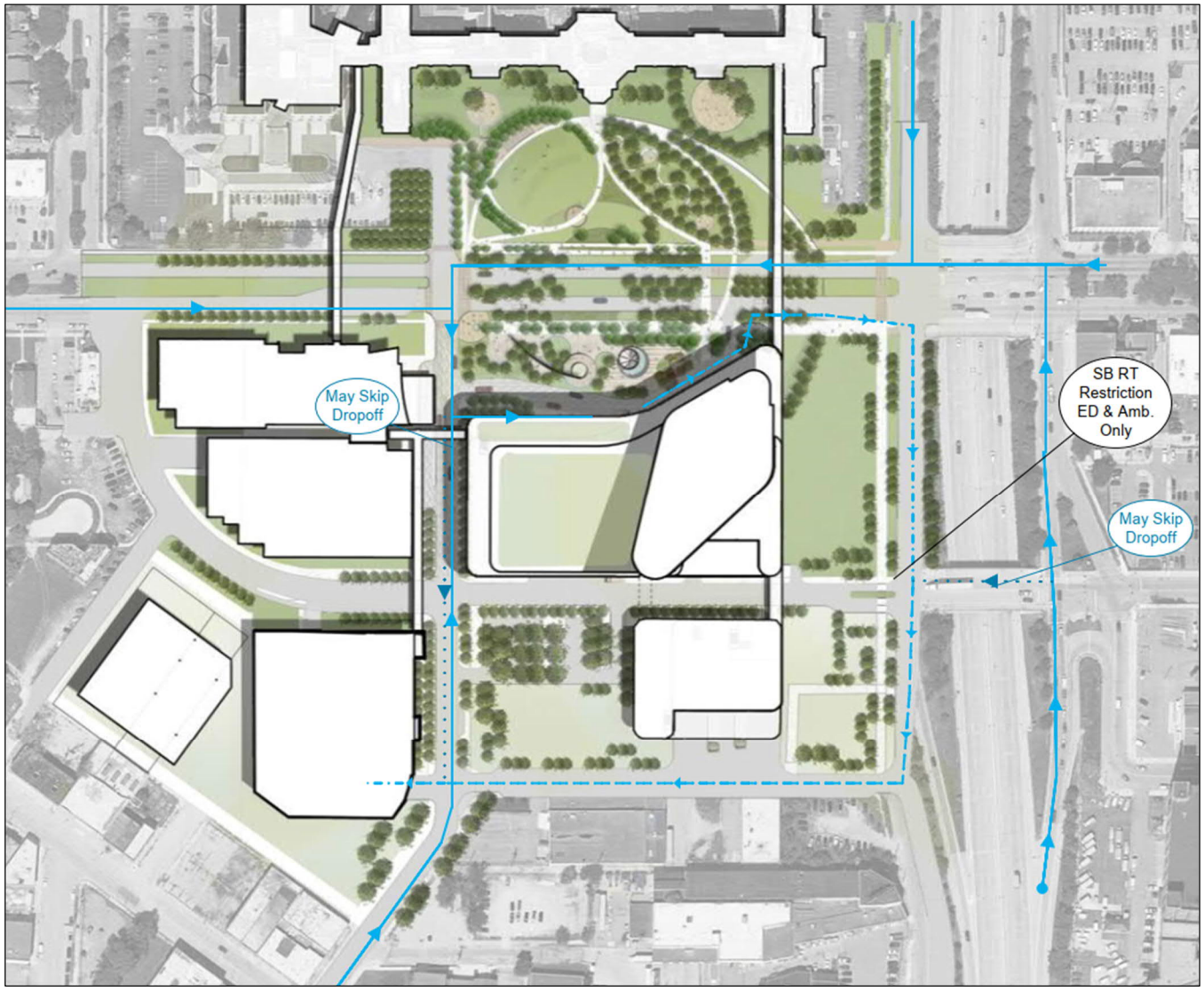


Figure 12 – South Campus Non-Emergency Patient Site Circulation

The valet stand is located near the front entrance as indicated by the start of the valet path in **Figure 13**, where they are expected to utilize the service drive to complete an around the block maneuver to gain access to Baltimore and ultimately the new parking garage. From there, they will utilize the surface sidewalk or skywalk to walk back to the valet stand. There are also several callouts that are shown in the figure indicated level of service and delay for each movement specific to valet operations during the peak periods. This was necessary to inform the design team of staffing requirements and limitations with this arrangement due to retrieval and parking times.

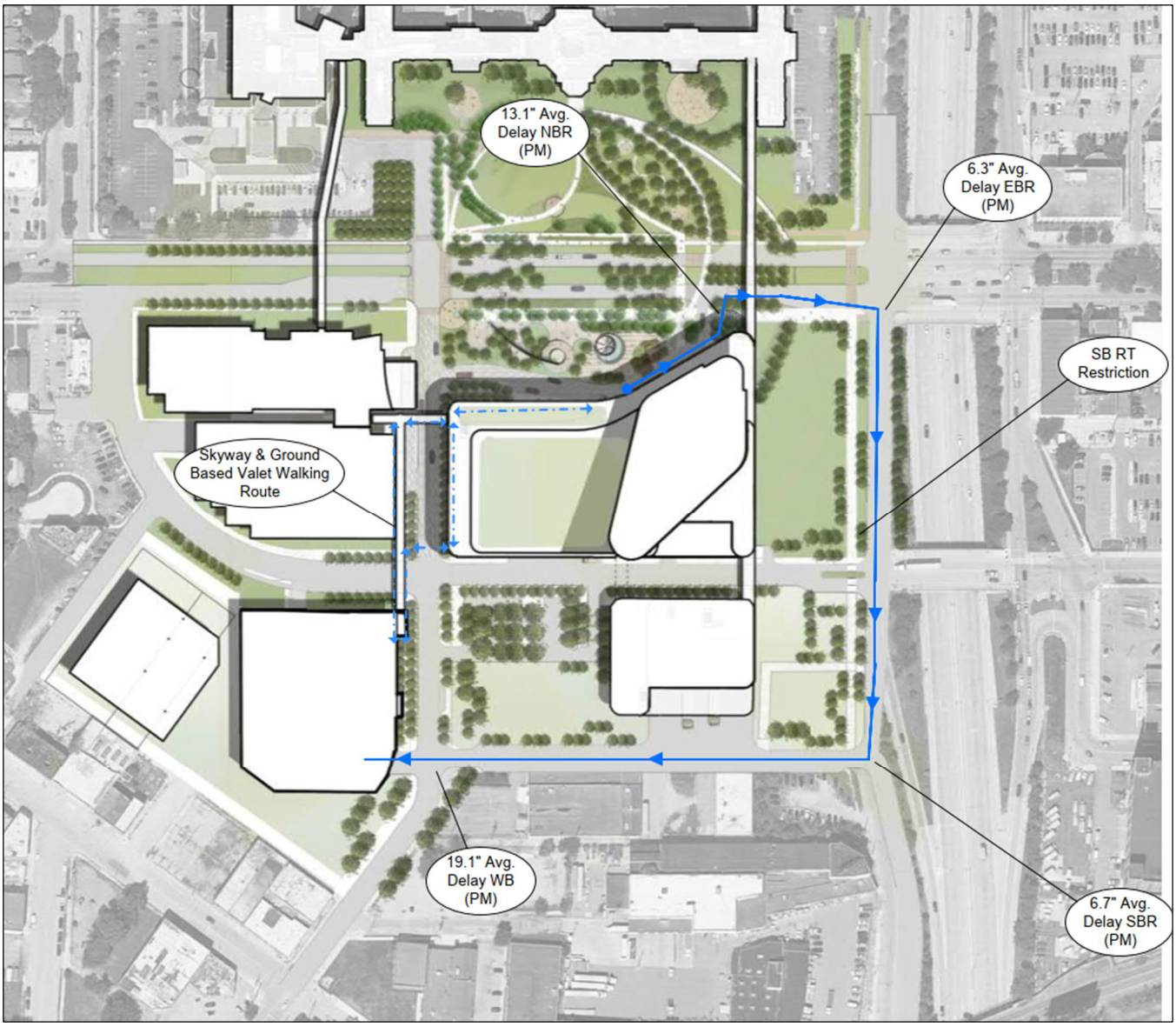


Figure 13 – South Campus Valet Site Circulation

3.3.4 CAMPUS CONNECTIVITY

Connections between the campuses are critical to supporting services offered by the hospital and for researchers to conduct their study. For example, the HFHS design team anticipates several hundred trips per day between the South and East campus, where research scientists are expected to start their day in the research building and then walk or drive to the hospital to complete rounds and follow up on studies. This requires that they use one of two pathways, either via the existing pedestrian bridge that spans the John C. Lodge Freeway south of the viaduct, or by using Third to connect with Milwaukee and use that bridge over the lodge to reach the new hospital. These paths are diagramed in **Figure 14.**

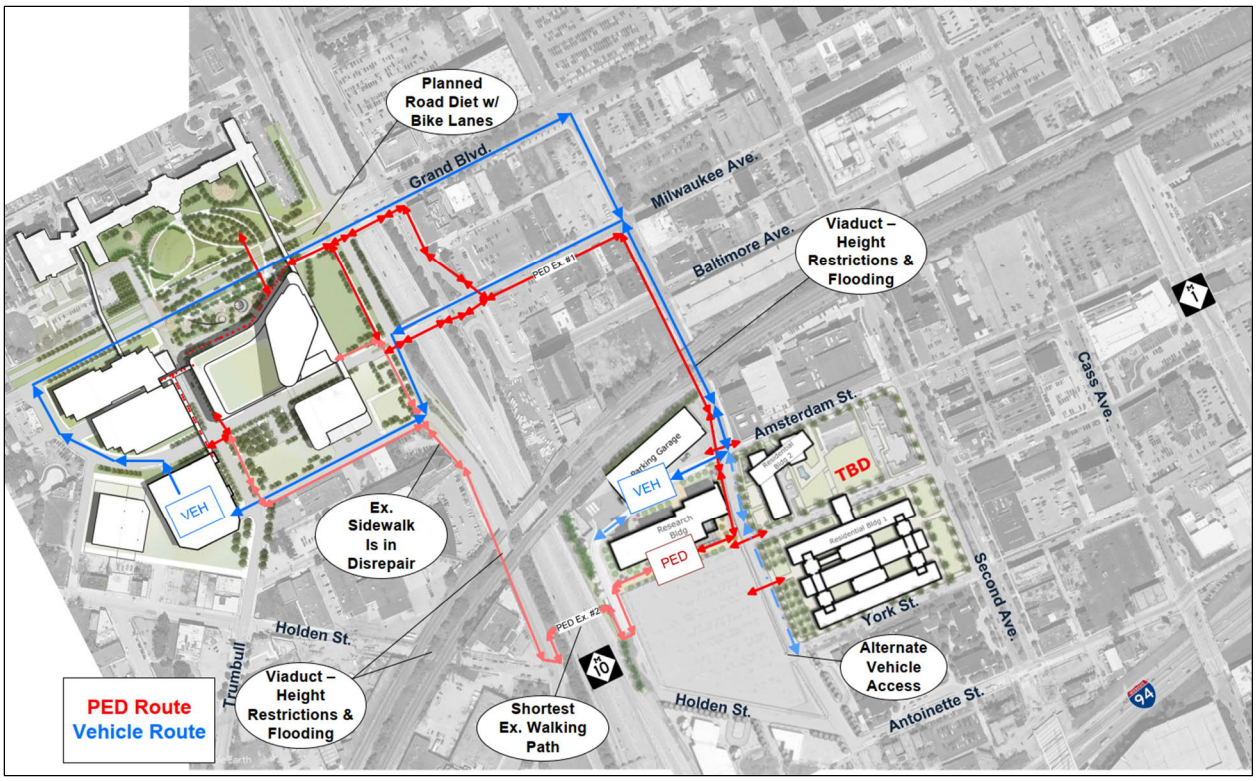


Figure 14 – South and East Campus Connectivity

Table 13 provides estimated trip times for pedestrians and vehicles traversing between facilities. Both pathways have noted issues related to the viaducts which are subject to flooding. In addition, the sidewalk infrastructure west of the Lodge is in poor condition and requires rehabilitation to support this route based on field observations completed in June 2023.

Table 12 - Estimated Trip Times between Campuses

Name	Distance (Miles)	No. of Signalized Intersections	Estimated Travel Time (Min)
Pedestrian Route #1 Milwaukee Connection	0.50	4	15.3
Pedestrian Route #2 Ex. Pedestrian Bridge over M-10	0.44	0	11.1
Vehicular Milwaukee Connection	0.58	4	4.1

The estimated travel time for pedestrians was calculated based on a 3.5 feet per second walking speed and assuming 30 seconds of delay at minor signalized intersections (Third/Baltimore, Third/Milwaukee), 45 seconds of delay at Milwaukee and Baltimore, and 60 seconds of delay at Milwaukee and the southbound John C. Lodge Service Drive. The same delay values were applied to vehicular traffic impacted by those intersections. A 25 MPH driving speed was assumed for vehicles. The signalized intersection of Holden and Third was also assumed to incur a 30 second delay, consistent with the values used for Milwaukee and Baltimore where they intersect Third.

3.3.5 PATIENT DISCHARGE AND NON-EMERGENCY AMBULANCE TRANSFERS (SOUTH CAMPUS)

The idea of separating front of house traffic streams with other lower volume traffic flows like patient discharge and non-emergency ambulance drop-off was raised as a consideration for reducing conflicts at the main entrance when workshopping the site design with HFHS stakeholders. As such, the operations, and geometrics of providing a new curb cut on the Lodge Service Drive, south of Grand Boulevard were analyzed to provide recommendations and support the permitting process with MDOT who owns the Lodge Service Drive and City of Detroit who is responsible for maintenance. This arrangement was assumed to operate with right-in and right-out (RIRO) movements only, as the Lodge Service Drive is one-way southbound in this section as shown in **Figure 15**.

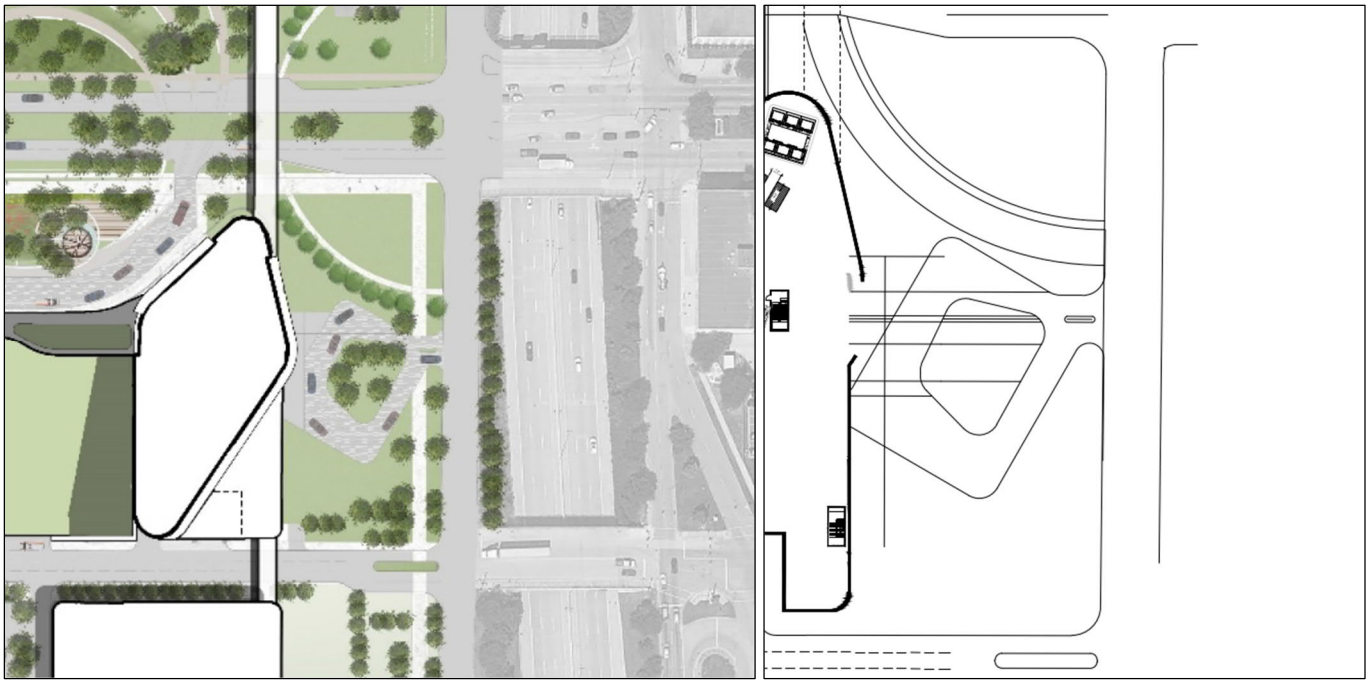


Figure 15 – Depiction of Potential RIRO Driveway (SB Lodge Service Drive)

3.3.6 SCHOOL PICK-UP / DROP-OFF (EAST CAMPUS)

There are two schools operated by the University Prep Academy as shown in **Figure 16**, that are within the vicinity of the research building that have peak periods that occur from 7:45 AM to 8:25 AM and from 3:20 PM to 3:45 PM throughout the school year. The following observations were collected during field review and from discussions with the school administrators on site during field review:

1. UPA Elementary (Ellen Thompson Campus)

- Uses Holden west of Third for on-street drop off and pickup of students.
- Vehicles stack EB after U-Turn at west end of block.
- Approximately 420 enrolled, nearly all driven.
- Parents/School may benefit from a proper turnaround.

2. UPA High (Ed Parks Campus)

- Dropoff/Pickup points, located on Antoinette, Third, and Second. Antoinette is used for half while Third and Second split the other half.
- Enrollment of 500 students

3. UPA Elementary (Mark Murray Campus)

- Located at Cass and Amsterdam; may cause delay to EB Amsterdam traffic.

Figure 16 - School Pick-Up and Drop Off Locations

4 TRAFFIC IMPACTS OF PROPOSED DEVELOPMENT

Traffic generated for each development was applied to the modelled roadway network using the Traffic Impact Analysis (TIA) module within Synchro 11 which provides the ability to enter origin-destination pairs and distribute volume based on the distributions presented in Section 3. Several scenarios were analyzed, including:

- Existing Conditions (2023)
- Opening Year (2029) with and without development traffic
- Ten years After Opening (2039) with and without development traffic

These scenarios provide a basis for assessing the impact of development traffic in context with background traffic growth which is assumed to occur at a rate of 0.5 percent per year. In addition, all future conditions were assumed to include the road diet planned for Grand which is scheduled for construction in 2024 and 2025 to install buffer separate bike lanes and reduce the travel lanes on Grand from Holden to Cass. The existing hospital is also assumed to remain in operation during opening year, with employees utilizing the recently opened parking garage, and operations reduced proportionally to the new hospital facility as specified during trip generation. Operational results for opening year with and without development volumes are shown in **Table 14**, where only intersections with a movement exhibiting LOS D, E and F are shown, as those represent opportunity for improvement.

Table 13 - Poorly Performing Intersection Movements during Opening Year (LOS and Delay per Vehicle)

Intersection	Opening Year (2029) Background		Opening Year (2029) Background + Development	
	AM	PM	AM	PM
NB John C. Lodge Service Drive and Milwaukee	NBT – LOS D (35.3”)	WBT – LOS D (40.6”) NBT – LOS D (41.9")	NBT – LOS E (56.8”)	WBT – LOS E (55.5”) NBT – LOS E (56.8”)
Milwaukee and Baltimore	NBT – LOS E (66.6”)	NBT – LOS F (108.5”)	NBT – LOS F (111.1”)	NBT – LOS F (108.9”)
SB John C. Lodge Service Drive, Off Ramp and Pallister	SBT (Srvc. Drive) – LOS D (35.6”) Exit Ramp – LOS D (42.8”)		SBT (Srvc. Drive) – LOS D (35.6”) Exit Ramp – LOS D (42.8”)	
Antoinette and Woodward (M-1)	WBT – LOS D (46.7”) NBL – LOS D (43.2”)		WBT – LOS D (47.6”) NBL – LOS D (52.4”)	
Parking Lot, Third and Amsterdam		EB – LOS F (79.6”)	EB – LOS E (42.3”) WB – LOS D (26.2”)	
Holden, Antoinette, and Third			SB – LOS D (35.2”)	

LOS C or better was found for all intersection movements except as follows:

- **Northbound John C. Lodge Service Drive and Milwaukee –**

  The added vehicular traffic using the exit ramp to gain access to the South Campus competes with the minimum split required for the eastbound and westbound movements which results in an LOS E with the added development traffic. A similar condition exists for the PM peak hour, where the LOS D in the background condition changes to LOS E with the added background traffic. This intersection is subject to automatic pedestrian phasing which necessitates a 24 second minimum split for east-west traffic, which reduces the amount of available capacity to the northbound approach.

- **Milwaukee and Baltimore (E. of NB Lodge Service Drive/Milwaukee) –**

  The northbound approach features shared left and through movements which limits the available capacity of this movement during both peak periods. This finding is consistent with both future scenarios, which suggests that the added development traffic is of minimal impact at this location with a delay differential of less than 15 seconds during the PM peak hour.

- **Southbound John C. Lodge Exit Ramp to Pallister –**

  There is limited available capacity for the southbound approach that competes with off-ramp traffic, where each is serviced with a separate signal phase. As a result, there is limited available time each cycle, which provides for LOS D in both future AM scenarios.

- **Antoinette and Woodward (M-1) –**

  This result was initially counterintuitive as the model suggested that adding more traffic to the westbound approach with development would provide for an improved condition over background growth. Upon inspection, this was due to the interaction between the permissive northbound left-turn movement and the westbound approach within the model framework, where the NBL shows an LOS D with 52.4 seconds of delay when development volumes are applied compared to LOS D with 43.2 seconds of delay under the background condition.

- **Parking Lot, Third, and Amsterdam –**

  This location is subject to exiting office traffic with the existing One Ford Place which provides for an LOS F during the PM peak hour under the background condition, which provides for a 95th percentile queue length of 323 feet or nearly 17 vehicles.

- **Holden, Antoinette, and Third –**

  The added development traffic is enough to just reach the threshold for LOS D which is 35 seconds during the AM peak hour. Otherwise, this approach is subject to the school volumes noted in Section 3.3 which provide for LOS C or better during the AM peak hour under the background condition.

A similar exercise was conducted for the future condition ten years after development, where background and development traffic are subjected to additional growth, leading to additional impacts without mitigation. **Table 15** contains a summary of the LOS and delay for poorly performing movements by intersection within the study area.

Table 14 - Poorly Performing Intersection Movements Ten Years after Opening (LOS and Delay per Vehicle)

Intersection	Ten Years After Opening (2039) Background		Ten years After Opening (2039) Background + Development	
	AM	PM	AM	PM
NB John C. Lodge Service Drive and Milwaukee	NBT – LOS D (54.6”)	NBT - LOS D (41.9”) WBT – LOS E (58.4”)	NBT – LOS F (81.7”)	NBT – LOS E (63.4”) WBT – LOS E (58.4”)
Milwaukee and Baltimore	NBT – LOS F (118.3”)	NBT – LOS F (107.9”)	NBT – LOS F (130.1”)	NBT – LOS F (117.8”)
SB John C. Lodge Service Drive, Off Ramp and Pallister	SBT (Srvc. Drive) – LOS D (38.0”) Exit Ramp – LOS D (45.4”)		SBT (Srvc. Drive) – LOS D (38.0”) Exit Ramp – LOS D (45.4”)	
Antoinette and Woodward (M-1)	WBT – LOS E (55.4”) NBL – LOS E (70.1”)		WBT – LOS E (57.2”) NBL – LOS F (86.5”)	
Parking Lot, Third and Amsterdam	EB – LOS D (26.5”) WB – LOS D (26.6”)	EB - LOS F (115.6”)	EB – LOS F (55.2”) WB – LOS D (30.9”)	EB – LOS E (37.3”)
Holden, Antoinette, and Third			SB – LOS D (37.1”)	
SB John C. Lodge Service Drive and Grand			EBT – LOS E (55.9”)	

LOS C or better was found for all intersection movements except as follows:

- **Northbound John C. Lodge Service Drive and Milwaukee –**

  The added vehicular traffic using the exit ramp to gain access to the South Campus competes with the minimum split required for the eastbound and westbound movements which results in an LOS F with the added development traffic exceeding capacity ten years after opening. A similar condition exists for the PM peak hour, where the LOS D in the background condition changes to LOS E with the added background traffic.

- **Milwaukee and Baltimore (E. of NB Lodge Service Drive/Milwaukee) –**

  The northbound approach features shared left and through movements which limits the available capacity of this movement which is compounded by traffic growth ten years after opening. This finding is consistent with both future scenarios, which suggests that the added development traffic is of minimal impact at this location with a delay differential of ten seconds during the PM peak hour.

- **Southbound John C. Lodge Exit Ramp to Pallister –**

  There is limited available capacity for the southbound approach that competes with off-ramp traffic, where each is serviced with a separate signal phase. As a result, there is limited available time each cycle, which provides for LOS D in both future AM scenarios. This result is similar to the opening year condition which suggests that there is still some excess capacity available for this approach.

- **Antoinette and Woodward (M-1) –**

  This result was initially counterintuitive as the model suggested adding more traffic with development to the westbound approach would provide for an improve condition over background growth. Upon inspection, this was due to the interaction between the permissive northbound left-turn movement and the westbound approach within the model framework, where the NBL shows an LOS F when development volumes are applied compared to LOS E under the background condition. Both future models suggest that there is a 95th percentile queue of approximately 310 feet regardless of development traffic which suggests minimal impacts due to development.

- **Parking Lot, Third, and Amsterdam –**

  Additional growth over a ten-year period with the background condition provides for an LOS F for the eastbound and approach during the AM peak hour as there are less gaps with more traffic on the unconstrained northbound and southbound approaches.

- **Holden, Antoinette, and Third –**

  The added development traffic is enough to just reach the threshold for LOS D which is 35 seconds during the AM peak hour. Otherwise, this approach is subject to the school volumes noted in Section 3.3 which provide for LOS C or better during the AM peak hour under the background condition.

- **SB John C. Lodge Service Drive and Grand –**

  Ten years after development, when factoring in growth and the development traffic, the eastbound through movement reports an LOS E with 55.9 seconds of delay and a 95th percentile queue of 216 feet or 11 vehicles per lane. The eastbound right-turn movement reports an LOS A with 5.1 seconds of delay during this time, which provides for an overall approach LOS D with 44.5 seconds of delay. This finding is attributed to the road diet which limits capacity by reducing the count of travel lanes from three to two in this section.

4.1.1 NEW LINCOLN GEOMETRICS AND TRAFFIC CONTROL

The proposed site plan includes a new alignment and cross-section for Lincoln and access points to the new facility intersecting Lincoln and Milwaukee to support ingress and egress to the parking structure, ambulance bays, emergency department parking lot, and front door access to the south campus hospital tower. These modifications create a deviation from existing local travel patterns and accessibility that necessitates a review of traffic control to make recommendations for each intersection.

Traffic Control

- New Lincoln Alignment and Grand Boulevard –

  This intersection was tested with stop control due to the low volumes anticipated for the northbound and southbound approaches that original from north and south campus, respectively. The geometrics assumed that left turns were allowed, with full access to and from both entrances as depicted in the proposed site plan. This arrangement was found to operate acceptable due to the metering of adjacent traffic signals at Holden and Grand, and John C. Lodge Service Drive and Grand when conducting simulation of the 2029 and 2039 mitigation Synchro models in SimTraffic. However, with the number of pedestrians anticipated, the need for emergency vehicles to have reliable access, and the presence of an existing signal at Lincoln and Grand, there is enough justification to support maintaining a traffic signal with the new alignment.

  Recommendation: Maintain the traffic signal and modernize to support the new intersection layout

- Sterling and Milwaukee –

  This location is not anticipated to support hospital circulation and access and was found to exhibit low volumes of traffic under the existing condition (less than ten (10) vehicles during the PM peak hour). There is also minimal traffic on Milwaukee, where only a portion of inbound vehicles will utilize Milwaukee to access the campus, primarily those bound for the emergency department. As such, when reviewing these volumes in Synchro, LOS A was found for the Sterling approach to Milwaukee when using stop control on Sterling and allowing free-flow on Milwaukee.

  Recommendation: stop control for Sterling only

- Sterling and Holden –

  This is a three-legged intersection that is not expected to support hospital circulation with the final site plan. A review of turning movement counts collected in 2015 found that only six (6) vehicles utilize Sterling during the PM peak hour. When assessing a nominal value of at least five vehicles for each movement at this intersection in Synchro during the PM peak hour, LOS A was found for the Sterling approach to Holden when using stop control on Sterling and allowing uninterrupted flow on Holden under all future scenarios.

  Recommendation: stop control for Sterling only

- South Campus Parking Structure –

  The primary entrance is aligned with Baltimore and was tested with stop control on the Baltimore and parking garage approach to assess performance, where LOS C was found for the Baltimore approach during AM and PM peak hours. The parking garage has two exits specified (primary on Lincoln, secondary on Milwaukee), where a scenario that pushes all exiting volume to the primary entrance and exit on Lincoln was found to produce LOS C in the 2039 AM peak hour and LOS F during the 2039 PM peak hour with a 95^{th} percentile queue of 104-feet or approximately 5 vehicles. This was considered acceptable for operations as the roadways will have efficient flow and the parking garage will store the queue spillback measured during the 2039 PM peak hour.

  Recommendation: two-way stop control with free-flow operations on Lincoln

Geometrics

Several different alignments and geometric cross-sections were considered by the development team for Lincoln to consolidate and support efficient flow of vehicles seeking the new front entrance, existing cancer center garage, or to access Grand or North Campus. As such, traffic modeling focused on the minimum viable cross-section for operations, which consisted of a single through lane for each direction and shared turning movements at the Milwaukee and Grand Boulevard intersections. This means that auxiliary lanes are not required for acceptable operations upon full build out. The following guidance is recommended when developing the final site plan:

- The selected cross-section should seek to reduce conflicts between vehicles, where consolidating the movements exiting the existing cancer center garage is preferrable.
- Consider implementing a boulevard to restrict movements north of Milwaukee if right-of-way allows relative to the building footprint.

- Consider incorporating a southbound left-turn lane to support the left-turn into the main driveway for the new hospital tower. The northbound left-turn should still be allowed from Lincoln to the existing Cancer Center garage under this arrangement.

4.1.2 MID-BLOCK PEDESTRIAN CROSSING ON GRAND BOULEVARD

A mid-block crossing is proposed for pedestrian traffic crossing the green space provided in front of the north and south campus facilities adjacent to Grand Boulevard. There are plans to implement a road diet on Grand Boulevard which includes a reduction from three to two travel lanes in each direction, which is a benefit to pedestrians by reducing the crossing distance from approximately 42 feet to 24 feet when considering travel lane conflicts. During opening year, Grand is expected to serve between 1,700 and 2,300 vehicles when considering both bounds, which means that this location would warrant a HAWK signal with as few as 20 pedestrians during the peak hours as shown in **Figure 17** and indicated by the red line which is for a HAWK crossing measuring 34 feet. Similarly, RRFB thresholds are also met, where 20 pedestrians represent the lower threshold and approximately 200 pedestrians represent the upper threshold when considering the total volume of both Grand approaches. That said, because the pedestrian crossing is at a boulevard with a proper median refuge, the most appropriate pedestrian crossing treatment is standard vehicular and pedestrian signals that are able to operate in coordination with the adjacent traffic signal at Lincoln.

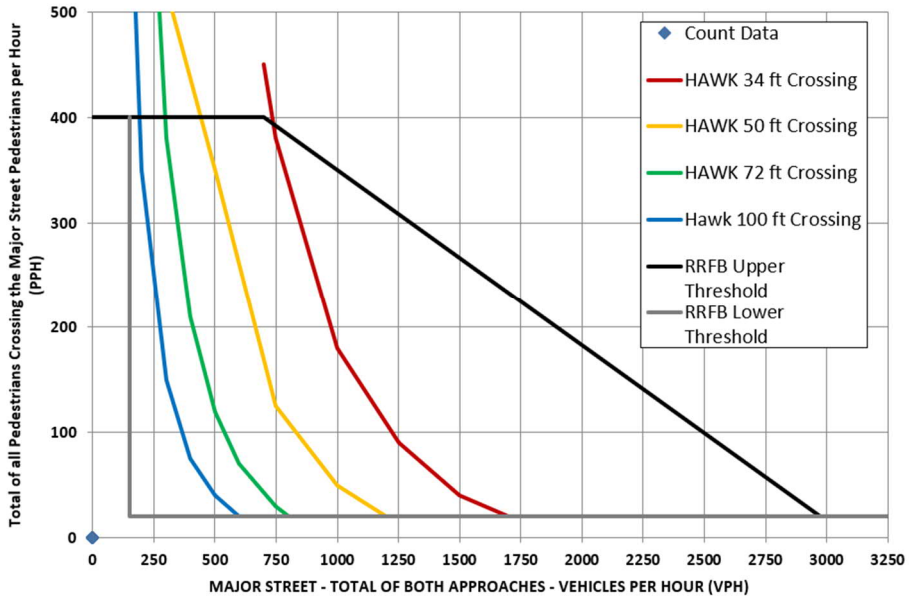


Figure 17 - MMUTCD Pedestrian Device Threshold (Source: MDOT Signal Warrants Spreadsheet)

4.1.3 ROAD DIET ON THIRD

The cross-section for Third running through East Campus originally supported a higher volume of through traffic seeking to cross I-94 to the south. Recently, the bridge for Third over I-94 was removed while MDOT improved the bridge for Second, with no plans to install a new bridge in place of the removed one. As such, implementing a road diet on Third as shown in **Figure 17** provides the opportunity to improve safety for nonmotorized users by reducing the number of lanes to cross, while enhancing the ability to access the site with on-street parking to support ingress and egress to the planned first floor commercial spaces in the residential development.

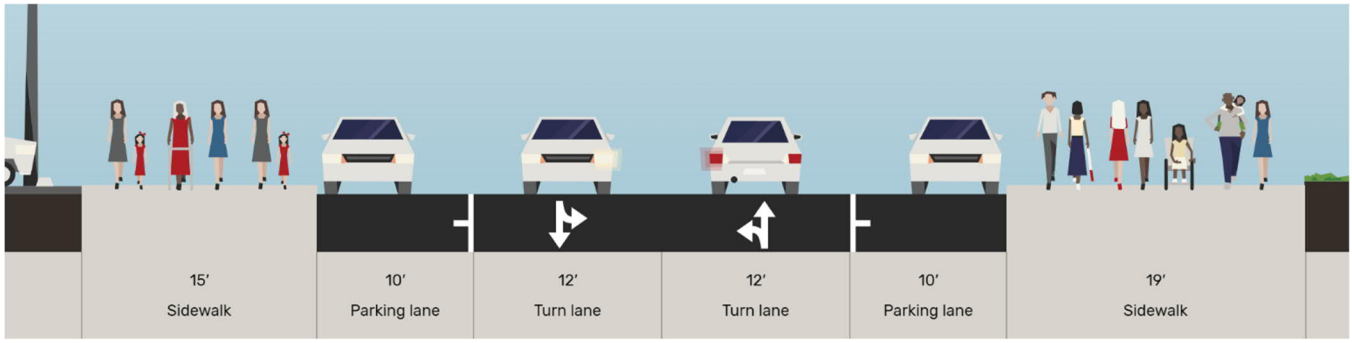


Figure 18 - Third Avenue Road Diet with On-Street Parking

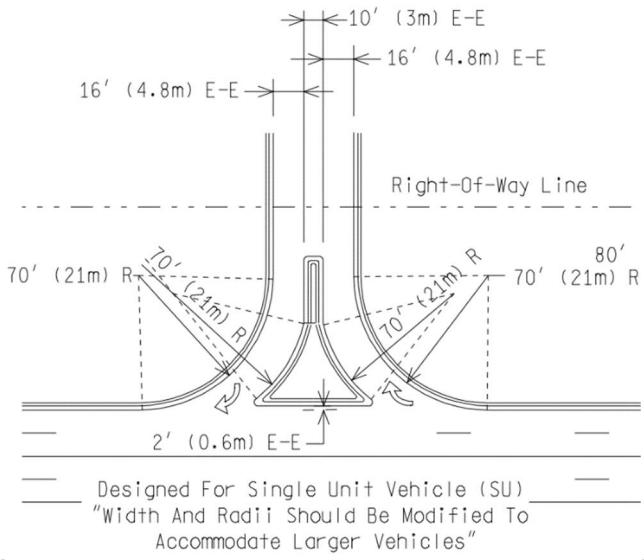
Using this cross-section, the Synchro model found that Third and Amsterdam would still operate at an overall LOS A for the northbound and southbound approaches ring all peak periods, with reduced capacity on Third (only a single through lane in each direction). York and Ford Pl were also found to provide LOS A with sufficient capacity on Third. The signal with Holden reported an overall LOS C during the opening year AM peak which is considered acceptable. This concept would still accommodate auxiliary lanes at the Third and Amsterdam intersection, by limiting parking near the intersection itself to provide the width necessary for those lanes. This concept was tested with the mitigation Synchro models during the 2029 and 2039 future years for both peak hours.

4.1.4 SOUTH CAMPUS PATIENT DISCHARGE CIRCULATION AND ACCESS

The proposed site plan includes a new curb cut along the southbound John C. Lodge Service Drive, south of Grand Boulevard to support patient discharge activities and reduce conflicts with valet, visitor and other front of house traffic streams anticipated for the main driveway. As such, this entrance is expected to be low volume but support the sensitive process of discharging a patient after their stay in the hospital by providing them with ample curb space and reducing impediment on other more time-sensitive activities, such as valet. An assessment of the patient discharge information collected from the existing hospital found that a maximum of 9 discharges will occur within any single hour, independent of the adjacent road peak period. When accounting for future growth, the anticipated maximum number of discharges ten years after facility opening is 11 patients, where the assumption is that a single vehicle is used for pickup to represent a conservative analysis scenario. When applying this number to the proposed driveway during the AM and PM peak hours, it was determined that no additional delay was incurred by vehicles on the SB Lodge Service Drive. For the proposed entrance, when applying stop control, LOS B was found with a delay of 10.1 seconds and nothing substantial for queuing (95th percentile is <1 foot), which suggests that the driveway is sized appropriately for the anticipated patient load.

Geometrics

The geometric configuration was reviewed in context with MDOT and City of Detroit standards, where the right-in right-out configuration was assessed for compliance. The MDOT Geo series of exhibits and Access Management Guidebook were considered, along with the Detroit Street Design Guide, Right-of-Way Permitting Standards, and the City of Detroit Standard



Specifications for Construction. MDOT GEO-680-B[2] specifies that a design that accommodates a Single Unit (SU) vehicle, such as an ambulance, must provide a 70' minimum radius for the inbound and outbound turning movements as shown in **Figure 19**.

In addition, the spacing between the signalized intersections to the north and south of the proposed driveway needed to be adequate. The Detroit Street Design Guide resource states that driveways must be set back 100 feet from signalized intersections where high traffic conditions are present. To determine if the East drop off zone driveway was within this guideline, measurements were made from the driveway to the north intersection at John C. Lodge Service Drive & Grand Blvd. and to the south intersection at John C. Lodge Service Drive & Milwaukee Ave. The measurements from the driveway to these intersections were 190 feet and 214 feet, respectively. This means the proposed driveway placement satisfies the City of Detroit guidelines [3]requiring driveways to be placed at least 100 feet from signalized intersections.

[2] https://mdotjboss.state.mi.us/TSSD/getCategoryDocuments.htm?categoryPrjNumbers=1403850,1403851&category=Geometrics

[3] https://detroitmi.gov/sites/detroitmi.localhost/files/2021-12/SFP_DesignGuide_20210930%20%283%29.pdf

5 TRAFFIC IMPACT MITIGATION

This section was developed to document countermeasures that could be implemented to mitigate issues identified in the previous section that were the result of applying development volumes to the background condition. The following locations were examined for possible mitigation opportunities using the ten years after development scenario as a conservative approach and to better understand the limits of low-cost countermeasures like signal timing adjustments, as well as other treatments such as signal upgrades and geometric modifications were also considered.

- **Northbound John C. Lodge Service Drive and Milwaukee –**

  One mitigation approach was tested with an acceptable outcome:

  (1) A scenario that considers the installation of pushbuttons allows for a minimum split reduction from 24 to 18 seconds for the eastbound and westbound approaches, which provides for an LOS D during the worst-case scenario which was ten years after development during the AM peak hour. A similar approach was applied during the PM peak hour, which was found to provide an LOS D for NB and WB approaches.

- **Milwaukee and Baltimore (E. of NB Lodge Service Drive/Milwaukee) –**

  Three mitigation approaches were tested with one resulting in a marginally acceptable outcome with an LOS E for one movement:

  (1) A scenario that considers the installation of pushbuttons allows for a minimum split reduction from 24 to 18 seconds for the eastbound and westbound approaches. This did not improve the LOS F condition for the NB approach which still showed an LOS F for both peak periods due to the phasing arrangement.

  (2) Another scenario involved adding an exclusive left-turn lane for the northbound approach, while keeping the permissive left-turn phasing and installing pushbuttons. This improved delay by approximately 20 seconds but still resulted in an LOS F for the left-turn movement with 113.1 seconds of delay. The northbound through movement does improve with this arrangement to LOS C with 26.8 seconds of delay.

  (3) A third scenario involved adding an exclusive left-turn lane, modifying the signal equipment, adjusting phasing to provide a protected left-turn movement, and adding in pushbuttons. This provided LOS F for the left-turn while eliminating the gains introduced for the through movement with Scenario 2 since the protected left-turn phase takes time away from the through approach with this arrangement.

  Ultimately, the second option, the pavement marking of an exclusive left-turn lane is recommended along with the strategy of simply adjusting signal timing as-needed based on the impacts that would result due to the failure of each approach, where the northbound Lodge is first and critical, eastbound Milwaukee is second to reduce impacts on the southbound Lodge Service Drive intersection, and northbound Baltimore receives the remaining time in the cycle. There may be times of heightened queuing on Baltimore, where there will be a natural upstream shift of apportion of that traffic to westbound Milwaukee via 3rd Street, a movement that is compatible with the eastbound Milwaukee movement.

- **Southbound John C. Lodge Exit Ramp to Pallister –**

  No additional modifications are needed as LOS D is considered acceptable operational performance for the urban environment.

- **Antoinette and Woodward (M-1) –**

  Three mitigation approaches were tested with one resulting in an acceptable outcome:

  (1) Re-allocating green time from the eastbound and westbound approaches to northbound was found to provide an LOS E for the WB through and NB left-turn movement which is marginally acceptable.

  (2) Installing pushbuttons for crossing Woodward (M-1) would allow for a reduction in minimum split times for the eastbound and westbound approaches, which provides a greater ability to adjust the balance of green time within each cycle. This provides for a condition that would favor either the westbound through movement or northbound left, as one will have to operate with LOS E at the expense of the other improving to LOS D or better.

(3) Modifying the signal equipment to allow for a protected turning movement was also tested, where an LOS D or better was found for all movements while maintaining the existing cycle length and adding a protected left-turn phase with 10 seconds of green time which is an acceptable outcome.

- **Parking Lot, Third, and Amsterdam –**

The proposed condition includes stop control which provides for 56.7 and 50.4 seconds of delay per vehicle for the eastbound and westbound, respectively. As such, two mitigation approaches were tested, one that included stop control on the northbound and southbound approaches, and another that introduced a signal, where both resulted in an acceptable outcome.

(1) Implementing stop control on all approaches was found to provide LOS B for the eastbound and westbound approaches while maintaining LOS B for northbound during the AM peak hour of opening year. The southbound approach was found to operate with 35.2 seconds of delay and a 95th percentile queue of 11.3 vehicles during opening year, and a queue of 14.7 vehicles ten years after opening. LOS C or better was observed for all approaches during the PM peak hour opening year and ten years after opening. This suggests that all way stop control is appropriate for this intersection and would support pedestrian movements across Third with minimal traffic impacts. Further study should be conducted after the development is open to determine if any signal warrants are satisfied.

(2) Installing a pretimed traffic signal was found to mitigate delay issues completely, where LOS B or better was found for all movements during the AM peak hour ten years after opening. This scenario, like the all-way stop control considered previously, includes an exclusive left-turn lane for the northbound and southbound approaches for reference.

- **Holden, Antoinette, and Third –**

No additional modifications are needed as LOS D is considered acceptable for typical urban operational performance.

- **SB John C. Lodge Service Drive and Grand –**

One mitigation approached was tested, resulting in an acceptable outcome.

(1) Green time was re-allocated from the dominate southbound approach to the eastbound movement which resulted in an LOS D for the eastbound through and southbound left-turn movement during the AM peak hour with development traffic, ten years after opening.

6 SUMMARY

This report prepared by WSP Michigan, Inc. provides an analysis of the anticipated traffic impacts of the planned Henry Ford Health System (HFHS) southern and eastern campus expansion projects in Detroit, MI. The report presents findings based on an analysis of 28 intersections in proximity to the development areas, and considers several different data sources, including historical and recently collected traffic volumes, anticipated operational schedules and staffing, land use programming, and site plans. The analysis includes different scenarios, including existing conditions, opening year (2029) with and without development traffic, and ten years after opening (2039) with and without development traffic.

The operational results indicate that most intersection movements exhibit satisfactory levels of service (LOS C or better) in both existing and future scenarios. There were also some intersections reporting LOS D for a subset of movements which is considered acceptable for urban operations in this setting. However, a few intersections did show opportunities for improvement as they reported an LOS E and F for at least one movement, including:

- Northbound John C. Lodge Service Drive and Milwaukee
- Milwaukee and Baltimore
- Southbound John C. Lodge Exit Ramp to Pallister
- Antoinette and Woodward (M-1)
- Holden, Antoinette and Third

Mitigation measures were explored for these intersections, such as signal timing adjustments, signal equipment upgrades, and geometric modifications, with all scenarios resulting in acceptable outcomes except for the intersection of Milwaukee and Baltimore which resulted in a marginally acceptable outcome (one movement reporting an LOS E with mitigation ten years after development). Overall, the report provides a comprehensive analysis of the traffic impacts anticipated for the HFHS campus expansion projects, identifies areas for improvement, and proposes potential mitigation measures to address traffic congestion and optimize traffic operations in surrounding areas.

APPENDIX

A TRAFFIC VOLUMES

APPENDIX

A-1 TRUCK VOLUMES AND SCHEDULING

B SYNCHRO REPORTS