Traffic Impact Study

413 E. Huron Street
Ann Arbor, Michigan

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Executive Summary

The proposed 413 E Huron Street development is located at the northeast corner of E Huron Street and N Division Street in the City of Ann Arbor. Currently the site contains a vacant commercial building and a residential house that includes limited commercial use on the ground floor and an upstairs apartment. The current site is to be demolished to provide for the construction of a 14-story, 216 unit high rise apartment building containing 533 bedrooms and 4,900 sq feet of ground level retail.

The proposed development will include 146 off-street parking spaces in two locations: 10 on the ground level accessed only from N Division Street, and 136 underground parking spaces accessible only form E Huron Street. There are two access driveways proposed: one serving each parking area. The E Huron Street driveway will be a right turn only ingress and egress driveway. The N Division Street driveway will also be a right turn only ingress and egress driveway. Thus with the limited access movements, some new vehicular trips will be rerouted indirectly to E Huron Street.

During the am peak hour there will be a total of 99 new vehicle trips associated with the development. The pm peak hour will realize a total of 112 new vehicle trips will be created. This traffic study assumed that all of these trips would represent vehicles not currently traveling in the area. As a result no "pass-by" or "trip credits" due to multiple trip purposes were used to reduce the total number of trips associated with the proposal. This resulted in traffic volume predictions that are conservative and most likely higher than those that will ultimately be experienced.

Traffic data was collected at eight intersections over the past 3 years. A new traffic count was taken at 5th Avenue and E Huron Street in response to the completion of the 5th Avenue Parking Garage to verify any travel pattern changes associated with its completion, as well as the completion of the new municipal court building.

Traffic simulation models were created to predict existing, proposed and proposed with a new left-turn phase configuration for both the am and pm peak traffic hours. These models predicted not only the current traffic service levels, but also future service levels under the assumption that 413 E Huron Street would be occupied in the fall of 2014.

This traffic study did not identify significant traffic service level degradations that could be reasonably associated with the development of the 413 E Huron Street site. The single most effective element included in the traffic analysis is the modification of the traffic signal at 5th Avenue and E Huron Street to include a left-turn phase for west-to-south traffic movements. However, since 413 E Huron Street only contributes 2 new vehicles to this movement during each of the peak traffic hours, and since this intersection is remote from the frontage of the proposed site, it should not be incumbent upon the developer to fund this traffic signal modification as part of a traffic mitigation plan.

Introduction

A 14-Story building, containing 216 apartments and 533 bedrooms, is proposed for a site located in the City of Ann Arbor on the block bordered by E. Huron Street, N Division Street, N State Street, and E Ann Street. There will also be approximately 4,900 sq ft of ground level retail developed on the site. Currently the site includes a commercial building with an apartment. Access to the site will be provided by two access driveways: one located on E. Huron Street and one located on N Division Street. The aerial below shows the location of the site relative to the four bordering streets.

Parking on-site will be provided for 146 spaces divided into two separated parking areas within the building's lower level, with 10 spaces located on a ground-level parking area accessible from N Division Street and 136 spaces accessible underground accessible from E. Huron Street. The existing driveway curb cuts already on site at those two locations will be reconstructed per the proposed site plan and there is no connection between the two parking areas.

This traffic impact study is intended to evaluate the impact that the proposed development will have on the adjacent street system. The 413 E Huron project will be constructed starting in the spring of 2013 and it is planned to open by August of 2014.

Data Collection

New traffic counts were recorded at three intersections adjacent to the project site: 5TH Avenue and E Huron Street, N Division and E Ann Street and N Division and Catherine Street. Previously, traffic video cameras were installed at four other area intersections in 2011 and the data processed into intersection turning movement counts. These counts were obtained for The Varsity development currently under construction. The four intersections counted for The Varsity development and incorporated into this traffic study are: E Huron Street and Division Street; E Huron Street and State Street; Washington Street and Division Street; and Washington Street and State Street.

Additionally, during the MDOT permit approval process for The Varsity, one other intersection traffic count was obtained: Fifth Avenue and Liberty Street. While this intersection is too far removed from the site of interest, it was included in the traffic models since it forms part of the downtown traffic signal system.

Since the traffic counts obtained as part of The Varsity project's site plan approvals are less than 3 years old, they were combined with the additional intersections counted for the 413 E Huron traffic report. The supplemental traffic counts allowed the traffic simulation models created in The Varsity report to be revised and modified with new current counts.

Traffic counts were obtained for the peak traffic hours as were identified in The Varsity traffic report. The morning peak hour occurs between 7:45-8:45 AM and the evening peak hour occurs between 4:45-5:45 PM.

The resulting existing peak hour volumes are illustrated on Figure 1 (AM) and Figure 2 (PM) on pages 4 and 5 respectively.

There were pedestrian movements at each of the intersections included in this traffic study, as the site is very close to the University of Michigan Campus. The pedestrian movements were included in the data counts and SimTraffic models, as they influence traffic at the study intersections.

Printouts of the processed count data collected at each of the intersections are included in the Appendix.

Figure 1 – AM Peak Hour Existing Volumes

Figure 2 – PM Peak Hour Existing Volumes

Trip Generation

Trip generation was performed utilizing established trip generation rates and equations documented in the ITE Trip Generation Manual, 9th Edition for the proposed land uses on the site. The ITE land uses that are considered appropriate for the proposed site are "Land Use 222 – High-Rise Apartment" and "Land Use 826 – Specialty Retail Center".

For the High-Rise Apartment land use, am peak hour trips are predicted to total 65 total trips with 16 vehicles entering the site and 49 vehicles exiting the site. During the pm peak hour 87 vehicles are anticipated to be generated with 53 vehicles entering the site and 34 vehicles exiting the site. These figures use the number of apartment units as the independent variable.

For the Specialty Retail Center, total am peak hour trips are predicted to be 34 total trips with 16 vehicles entering and 18 vehicles exiting the site. During the pm peak hour, the retail use will generate 25 total trips with 14 trips entering the site and 11 trips leaving the site. It is noted that there is no parking facilities provided for the retail land use element of 413 E Huron, but the retail trips are included in the total figures for trip generation purposes.

During the am peak hour, a total of 99 new trips are predicted, with 32 trips entering the site and 67 trips leaving the site. During the pm peak hour, a total of 112 vehicles will be generated at the site with 67 entering vehicles and 45 exiting vehicles.

The result of the trip generation process is illustrated in the following table:

Trip Generation Summary Table

ITE Land Use	AM Peak Hour			PM Peak Hour		
	Inbound	Outbound	Total Trips	Inbound	Outbound	Total Trips
222 – High Rise Apartment Building 216 Units	16	18	65	53	34	87
826 – Specialty Retail Center 4900 sq ft	16	18	34	14	11	25
Total Trip Volume	32	67	99	67	45	112

The appendix contains the ITE Land Use sheets used in the trip generation calculations.

Trip Distribution

Traffic generated by the proposed development is distributed to the street system according directional distribution percentages obtained during the data collection element of this study. When these distribution percentages were applied to the trip generation values for the intended land uses, the new trips illustrated in Figures 3 (AM) and 4 (PM) resulted. The specific path these vehicles will take depends upon whether they arrive or depart at the northern site driveway to Division Street (10 parking spaces) or if vehicles arrive or depart at the southern site driveway to E Huron Street (136 parking spaces).

Since Division Street is one-way northbound some turning movements are assumed to occur elsewhere in order to reach the two site driveways. Vehicles that exit the Division site driveway must all turn to the north along Division Street. The study did not limit turning movements to or from either site driveway.

Figures 3 (AM) and 4 (PM) illustrate the site generated traffic volume as it enters and exits the area to/from the two site drives. The overall trip distribution percentages are also included on these two figures with the green labeled percentages representing the inbound trips and the blue labeled percentages representing the outbound trips.

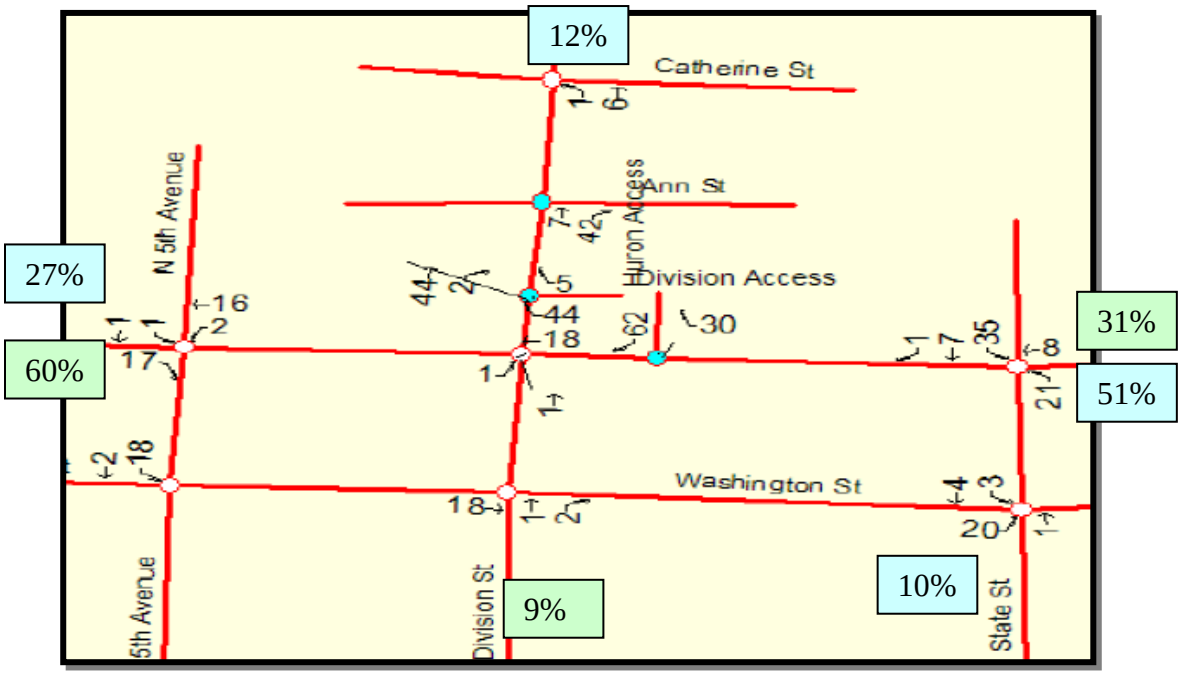


Figure 3 – AM Peak Hour Trip Distribution

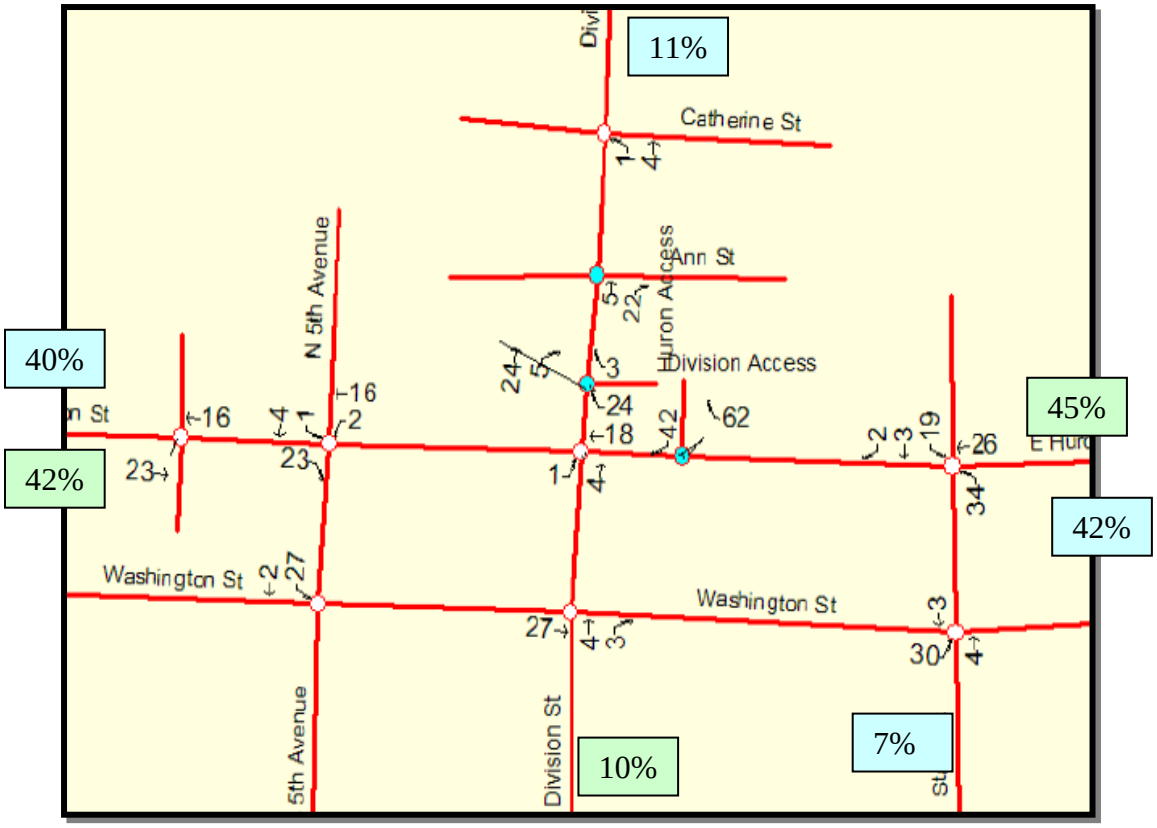


Figure 4 - PM Peak Hour Trip Distribution

The AM and PM peak hour trip distributions were added to each respective peak hour volume and the models re-run: this time to represent future traffic conditions. Since the construction period for 413 E Huron is only one year, no background traffic growth values were accounted for in the future condition models.

Figure 5 illustrates the projected AM peak hour volumes and Figure 6 illustrates the PM peak hour.

Figure 5 – AM Peak Hour Proposed Traffic

Figure 6 – PM Peak Hour Proposed Traffic

Intersection Analysis

The Synchro / SimTraffic program (version 7, build 761) was utilized to model the existing and forecast traffic for this traffic study. At the request of the City, an additional scenario was modeled to represent an altered traffic signal operation at the intersection of 5th Avenue and E Huron Street. In this new scenario, a permissive/protected left-turn phase was modeled. There were thus a total of six models created to represent existing, proposed and proposed with the new left-turn phase conditions. The six models were created for the am and pm peak hours.

In Synchro, each intersection is considered separately with progression factors that are applied to the calculated delays to accommodate for the influence of other nearby signalized intersections on the individual study intersections. In SimTraffic, the simulation portion of the software package, vehicles are sent through the model in real time, and travel statistics are recorded providing delays that are directly affected by storage lengths, signal timing, and intersection spacing.

Turning movements per 15-minute intervals were directly read into the traffic model during the peak hours to provide a more accurate model of traffic conditions in the area. Each scenario was run 10 times to produce an average of the delays shown in this report. Some forecast delays may be less than existing conditions due to this averaging process; however this is an indication that the development traffic has minimal effect on those particular movements. The SimTraffic results that show the delays and queues for each of the study intersections are identified in the following nine intersections, and are included in the Appendix:

5th Avenue and E Huron Street
E Huron Street and Division Street
E Huron Street and State Street
Washington Street and S Division Street
Washington Street and S State Street
N Division Street and E Ann Street
N Division Street and Catherine Street
E Huron Street and Site Driveway
N Division Street and Site Driveway

The table below shows the delay ranges for each level of service for signalized and unsignalized intersections. These delays are control delays which are calculated differently than the SimTraffic Model which is a model time minus free flow time value rather than the equations from the Highway Capacity Manual. However driver acceptance follows the same general principle of the delay ranges shown below.

Level of Service Criteria for Signalized Intersections from HCM Exhibit 16-2 in Control Delay per Vehicle (s/veh):

LOS A < 10
LOS B >10 and < 20
LOS C >20 and < 35
LOS D >35 and < 55
LOS E >55 and < 80
LOS F >80

Level of Service for Signalized Intersections

Level of Service (LOS) Criteria for Unsignalized Intersections from HCM Exhibit 17-2 in Control Delay per Vehicle (sec):

LOS A < 10
LOS B >10 and < 15
LOS C >15 and < 25
LOS D >25 and < 35
LOS E >35 and < 50
LOS F >50

Level of Service for Unsignalized Intersections

Intersection Analysis – 5th Avenue and E. Huron Street

The intersection of 5th Avenue and E Huron Street, the intersection west of the proposed development along E Huron Street, is the intersection of a one-way southbound 5th Avenue and E Huron Street. 5th Avenue forms one half of a one-way pair of arterial streets: the other half is northbound Division Street. The intersection is controlled by a two-phase traffic signal operating on a 90-second cycle length as part of a coordinated traffic control system. 5th Avenue north of E Huron Street consists of three traffic lanes: one of which is an exclusive left-turn lane onto eastbound E Huron Street.

South of E Huron Street, 5th Avenue is transformed into its Central Business District configuration consisting of two southbound 25 mph traffic lanes and one parking lane. Recent construction of a municipal government building at the intersection's northeast corner, and completion of streetscape improvements associated with a new parking structure to the south have resulted in both geometric changes and changes to traffic movements at the intersection.

At the request of the City, this intersection was analyzed both in its existing traffic control configuration as well as an additional scenario where the westbound left-turn from E Huron Street on to southbound 5th Avenue was provided with a protected/permissive left-turn traffic signal phase. For this scenario, the 90-second cycle length was maintained for signal coordination purposes, and a protected/permissive

westbound left-turn movement was provided for with the protected left-turn signal phase lagging behind the permissive movement time period. The left-turn phase scenario also included left-turn lane vehicle detection in order to activate the protected left-turn signal indication.

The SimTraffic model results for the intersection are shown below. No signal timing or lane improvement changes were made to the Forecast scenario so that conditions are the same as existing, but with the additional site traffic added to the study intersections. The additional model which includes the permissive/protected left-turn movement described above was the only change to the traffic signal operations analyzed.

It should be noted that 413 E Huron will contribute only 2 left-turning vehicles during each of the AM and PM peak traffic hours.

SimTraffic Results – Morning Peak Hour (7:45-8:45 AM)
Intersection of 5th Avenue and E Huron Street

Existing Conditions	Huron Street		Huron Street		5th Avenue		
AM Peak	Eastbound		Westbound		Southbound		
Movement	Thru	Right	Left	Thru	Left	Thru	Right
Volume	1061	87	57	468	77	542	23
Delay (sec)	12.4	9.2	49.1	22.6	27.3	22.9	14.9
LOS	B	A	D	C	C	C	B
Queue (ft)	252	227	89	294	82	189	179

Forecast Conditions	Huron Street		Huron Street		5th Avenue		
AM Peak	Eastbound		Westbound		Southbound		
Movement	Thru	Right	Left	Thru	Left	Thru	Right
Volume	1061	104	59	484	78	543	23
Delay (sec)	12.6	9.5	51.6	23.5	27.1	23.0	16.2
LOS	B	A	D	C	C	C	B
Queue (ft)	260	237	89	297	76	202	186

Forecast w/ LEFT-TURN	Huron Street		Huron Street		5th Avenue		
AM Peak	Eastbound		Westbound		Southbound		
Movement	Thru	Right	Left	Thru	Left	Thru	Right
Volume	1061	104	59	484	78	543	23
Delay (sec)	9.7	7.5	37.9	15.0	33.1	34.5	30.9
LOS	A	A	D	B	C	C	C
Queue (ft)	233	216	78	267	85	255	246

During the am peak hour all movements currently operate at acceptable service levels. This condition is maintained for both the proposed and left-turn models. The provision of a left-turn phase at this intersection for westbound traffic will reduce vehicular delay and queue lengths.

SimTraffic Results - Evening Peak Hour (4:45-5:45 PM)
Intersection of 5th Avenue and E Huron Street

Existing Conditions	Huron Street		Huron Street		5th Avenue		
PM Peak	Eastbound		Westbound		Southbound		
Movement	Thru	Right	Left	Thru	Left	Thru	Right
Volume	660	86	128	1086	120	446	64
Delay (sec)	16.3	14.1	113.4	118.2	28.5	22.7	17.8
LOS	B	B	F	F	C	C	B
Queue (ft)	197	185	128	605	114	165	165

Forecast Conditions	Huron Street		Huron Street		5th Avenue		
PM Peak	Eastbound		Westbound		Southbound		
Movement	Thru	Right	Left	Thru	Left	Thru	Right
Volume	660	109	130	1100	121	450	64
Delay (sec)	21.2	18.5	95.2	110.1	67.4	37.0	28.0
LOS	C	B	F	F	E	D	C
Queue (ft)	212	208	124	605	193	167	162

Forecast w/ LEFT-TURN	Huron Street		Huron Street		5th Avenue		
PM Peak	Eastbound		Westbound		Southbound		
Movement	Thru	Right	Left	Thru	Left	Thru	Right
Volume	660	109	130	1100	121	450	64
Delay (sec)	10.9	8.8	30.8	35.1	38.0	31.7	25.7
LOS	B	A	C	D	D	C	C
Queue (ft)	183	176	120	431	134	200	190

During the pm peak hour the intersection experiences undesirable service levels on the westbound approach. With the proposed model these conditions continue for the westbound approach and the southbound approach also experiences a lower service level: although not one that is considered undesirable during peak traffic times.

The left-turn phase model predicted that all service levels will be appreciably improved should the intersection be modified to incorporate permissive/protected left turns for the westbound approach.

Intersection Analysis – E. Huron Street and Division Street

The intersection of Huron Street and Division Street, located southwest of the development, is controlled by a three phase traffic signal. Phase 1 is east and westbound Huron Street with permitted left-turns from eastbound Huron Street. Phase 2 is an actuated protected left-turn phase for eastbound traffic in which through traffic continues on green from Phase 1. Phase 3 is northbound Division Street.

The traffic signal operates on a fixed 90 second cycle with Phases 1 and 3 always receive the maximum amount of green time. The intersection is coordinated with nearby intersections which also operate on a 90 second cycle.

Division Street is one-way northbound with a northbound approach consisting of a left-turn only lane, two through only lanes, and a shared through/right lane. The speed limit on Division is 25 MPH.

Huron Street is a two-way street with an eastbound approach that consists of a left-turn only lane and two through lanes. Given that N. Division is one-way, there are no eastbound right-turns. The westbound approach consists of a through only lane and a shared through/right lane. There are no left-turns from westbound E. Huron Street. The speed limit on Huron Street is 30 MPH.

The SimTraffic model results for the intersection are shown on the following page. No signal timing or lane improvement changes were made to the Forecast scenario so that conditions are the same as existing, but with the additional site traffic added to the study intersections.

SimTraffic Results - Morning Peak Hour (7:45-8:45 AM)
Intersection of Huron Street and Division Street

Existing Conditions AM Peak	Huron Street Eastbound		Huron Street Westbound		Division Street Northbound		
Movement	Left	Thru	Thru	Right	Left	Thru	Right
Volume	201	706	456	84	84	480	87
Delay (sec)	28.9	11.0	10.6	4.8	21.6	17.0	13.7
LOS	C	B	B	A	C	B	B
Queue (ft)	199	228	107	107	82	107	132

Forecast Conditions	Huron Street		Huron Street		Division Street		
AM Peak	Eastbound		Westbound		Northbound		
Movement	Left	Thru	Thru	Right	Left	Thru	Right
Volume	202	706	474	128	84	481	87
Delay (sec)	30.2	10.9	11.5	5.9	22.9	16.2	12.7
LOS	C	B	B	A	C	B	B
Queue (ft)	198	222	122	132	95	81	95

Forecast w/ LEFT-TURN	Huron Street		Huron Street		Division Street		
AM Peak	Eastbound		Westbound		Northbound		
Movement	Left	Thru	Thru	Right	Left	Thru	Right
Volume	202	706	474	128	84	481	87
Delay (sec)	29.1	10.5	11.3	6.5	22.6	16.7	12.7
LOS	C	B	B	A	C	B	B
Queue (ft)	188	226	120	128	86	109	132

During the am peak hour all movements at this intersection operate at acceptable service levels.

SimTraffic Results - Afternoon Peak Hour (4:45-5:45 PM)
Intersection of Huron Street and Division Street

Existing Conditions	Huron Street		Huron Street		Division Street		
PM Peak	Eastbound		Westbound		Northbound		
Movement	Left	Thru	Thru	Right	Left	Thru	Right
Volume	165	571	806	89	194	871	82
Delay (sec)	47.3	9.6	17.0	11.9	66.6	40.9	37.8
LOS	D	A	B	B	E	D	D
Queue (ft)	199	187	186	181	156	328	285

Forecast Conditions	Huron Street		Huron Street		Division Street		
PM Peak	Eastbound		Westbound		Northbound		
Movement	Left	Thru	Thru	Right	Left	Thru	Right
Volume	166	571	823	113	194	875	82
Delay (sec)	48.8	21.0	19.9	15.5	86.3	51.1	42.8
LOS	D	C	B	B	F	D	D
Queue (ft)	183	266	213	212	158	336	314

Forecast w/ LEFT-TURN	Huron Street		Huron Street		Division Street		
PM Peak	Eastbound		Westbound		Northbound		
Movement	Left	Thru	Thru	Right	Left	Thru	Right
Volume	166	571	823	113	194	875	82
Delay (sec)	38.6	9.0	19.4	15.8	35.7	27.0	24.7
LOS	D	A	B	B	D	C	C
Queue (ft)	186	155	214	210	144	262	257

During the proposed pm peak hour the northbound left-turn is expected to degrade from the existing LOS E condition to a LOS F condition: indicating that some form of mitigation may be needed to restore acceptable traffic operations during this peak hour.

If the left-turn phase modification is made at 5th Avenue and E Huron Street, there will be a net improvement experienced here as all service levels will be restored to acceptable service levels.

Intersection Analysis – Huron Street and State Street

The intersection of Huron Street and State Street, located northeast of the development, is controlled by a two phase traffic signal. Phase 1 is east and westbound Huron Street with no left-turns allowed from Huron Street (a few vehicles and buses left). Phase 2 is north and southbound State Street.

The traffic signal operates on a fixed 90 second cycle and Phases 1 and 2 always receive the maximum amount of green time. The intersection is coordinated with nearby intersections which also operate on a 90 second cycle.

Huron Street is a two-way street with an eastbound and westbound approach that consists of a through only lane and a through/right lane. The speed limit on Huron Street is 30 MPH.

State Street is a two-way street with a northbound and southbound approach that consists of a left-turn lane and a shared through/right lane. The speed limit on State Street is 25 MPH.

The SimTraffic model results for the intersection are shown on the following page. The few prohibited eastbound and westbound left-turns are edited out of this table, but are included in the appendix and did not have a significant impact on through delays. No signal timing or lane improvement changes were made to the Forecast scenario so that conditions are the same as existing, but with the additional site traffic added to the study intersections.

SimTraffic Results - Morning Peak Hour (7:45-8:45 AM)
Intersection of Huron Street and State Street

Existing Conditions	Huron Street		Huron Street		State Street			State Street		
AM Peak	Eastbound		Westbound		Northbound			Southbound		
Movement	Thru	Right	Thru	Right	Left	Thru	Right	Left	Thru	Right
Volume	632	139	440	15	69	108	82	71	209	48
Delay (sec)	8.8	13.1	10.5	5.6	28.6	14.5	10.2	41.9	30.8	23.6
LOS	A	B	B	A	C	B	B	D	C	C
Queue (ft)	166	179	123	109	96	158	158	121	275	275

Forecast Conditions	Huron Street		Huron Street		State Street			State Street		
AM Peak	Eastbound		Westbound		Northbound			Southbound		
Movement	Thru	Right	Thru	Right	Left	Thru	Right	Left	Thru	Right
Volume	632	139	448	15	90	108	82	106	216	49
Delay (sec)	8.9	13.4	10.4	4.8	35.2	16.5	12.2	45.7	36.0	26.0
LOS	A	B	B	A	D	B	B	D	D	C
Queue (ft)	165	181	127	114	120	190	190	133	295	295

w/ LEFT-TURN	Huron Street		Huron Street		State Street			State Street		
AM Peak	Eastbound		Westbound		Northbound			Southbound		
Movement	Thru	Right	Thru	Right	Left	Thru	Right	Left	Thru	Right
Volume	632	139	448	15	90	108	82	106	216	49
Delay (sec)	8.6	12.9	10.8	5.1	33.0	15.8	10.9	39.2	29.7	22.6
LOS	A	B	B	A	C	B	B	D	C	C
Queue (ft)	151	169	126	115	114	167	167	130	267	267

During the am peak hour all intersection movements operate at acceptable service levels. This condition is predicted to continue with the proposed traffic model and also with the left-turn model.

SimTraffic Results - Afternoon Peak Hour (4:45-5:45 PM)
Intersection of Huron Street and State Street

Existing Conditions	Huron Street		Huron Street		State Street			State Street		
PM Peak	Eastbound		Westbound		Northbound			Southbound		
Movement	Thru	Right	Thru	Right	Left	Thru	Right	Left	Thru	Right
Volume	542	101	721	28	120	151	85	55	140	57
Delay (sec)	10.0	9.8	12.3	6.7	28.1	16.7	14.4	31.7	23.7	16.7
LOS	B	A	B	A	C	B	B	C	C	B
Queue (ft)	128	135	191	177	132	202	202	95	180	180

Forecast Conditions	Huron Street		Huron Street		State Street			State Street		
PM Peak	Eastbound		Westbound		Northbound			Southbound		
Movement	Thru	Right	Thru	Right	Left	Thru	Right	Left	Thru	Right
Volume	542	101	747	28	154	151	85	74	143	59
Delay (sec)	10.6	10.4	13.0	8.6	32.9	18.2	15.4	49.0	33.4	32.4
LOS	B	B	B	A	C	B	B	D	C	C
Queue (ft)	140	149	213	197	140	240	240	104	203	203

w/LEFT-TURN	Huron Street		Huron Street		State Street			State Street		
PM Peak	Eastbound		Westbound		Northbound			Southbound		
Movement	Thru	Right	Thru	Right	Left	Thru	Right	Left	Thru	Right
Volume	542	101	747	28	154	151	85	74	143	59
Delay (sec)	11.9	12.6	12.6	7.9	33.6	19.2	17.3	36.4	24.3	17.9
LOS	B	B	B	A	C	B	B	D	C	B
Queue (ft)	155	167	217	211	143	235	235	111	195	195

During the pm peak hour the intersection also operates at acceptable service levels for all modeled pm peak hour scenarios. The left-turn model results do not predict major benefits to traffic operations at this intersection.

Intersection Analysis – Washington Street and Division Street

The intersection of Washington Street and Division Street, located southwest of the development, is controlled by a two phase traffic signal. Phase 1 is northbound Division Street. Phase 2 is eastbound and westbound Washington Street.

The traffic signal operates on a fixed 90 second cycle with Phases 1 and 2 always receive the maximum amount of green time. The intersection is coordinated with nearby intersections which also operate on a 90 second cycle.

Washington Street is a two-way street with an eastbound approach that consists of a left-turn only lane and a through only lane. The westbound approach consists of a through only lane and a right turn only lane. The speed limit on Washington Street is 25 MPH.

Division Street is a one-way street with a northbound approach that consists of a left/through lane, a through only lane, and a through/right lane. The speed limit on Division Street is 25 MPH.

The SimTraffic model results for the intersection are shown on the following page. No signal timing or lane improvement changes were made to the Forecast scenario so that conditions are the same as existing, but with the additional site traffic added to the study intersections.

SimTraffic Results - Morning Peak Hour (7:45-8:45 AM)
Intersection of Washington Street and Division Street

Existing Conditions AM Peak	Washington Street Eastbound		Washington Street Westbound		Division Street Northbound		
Movement	Left	Thru	Thru	Right	Left	Thru	Right
Volume	69	285	52	56	27	541	67
Delay (sec)	22.5	22.1	8.1	4.1	17.0	15.2	10.1
LOS	C	C	A	A	B	B	B
Queue (ft)	252	174	52	49	129	127	134

Forecast Conditions	Washington Street		Washington Street		Division Street		
AM Peak	Eastbound		Westbound		Northbound		
Movement	Left	Thru	Thru	Right	Left	Thru	Right
Volume	69	303	52	56	27	542	69
Delay (sec)	22.1	23.6	7.2	4.2	17.8	15.2	9.6
LOS	C	C	A	A	B	B	A
Queue (ft)	282	174	47	48	128	127	134

w/ LEFT-TURN	Washington Street		Washington Street		Division Street		
AM Peak	Eastbound		Westbound		Northbound		
Movement	Left	Thru	Thru	Right	Left	Thru	Right
Volume	69	303	52	56	27	542	69
Delay (sec)	20.3	22.5	7.2	4.0	17.7	15.3	10.1
LOS	C	C	A	A	B	B	B
Queue (ft)	288	178	48	51	130	128	135

During the am peak hour this intersection will operate at acceptable service levels for all modeling conditions included in this analysis.

SimTraffic Results - Afternoon Peak Hour (4:45-5:45 PM)
Intersection of Washington Street and Division Street

Existing Conditions	Washington Street		Washington Street		Division Street		
PM Peak	Eastbound		Westbound		Northbound		
Movement	Left	Thru	Thru	Right	Left	Thru	Right
Volume	62	126	244	215	47	836	51
Delay (sec)	41.9	16.4	36.8	38.1	37.2	28.6	15.4
LOS	D	B	D	D	D	C	B
Queue (ft)	104	123	453	95	328	262	239

Forecast Conditions	Washington Street		Washington Street		Division Street		
PM Peak	Eastbound		Westbound		Northbound		
Movement	Left	Thru	Thru	Right	Left	Thru	Right
Volume	62	153	244	215	47	840	54
Delay (sec)	71.9	28.3	83.1	90.8	85.3	76.4	61.2
LOS	E	C	E	F	F	E	E
Queue (ft)	241	144	663	94	398	325	293

w/LEFT-TURN	Washington Street		Washington Street		Division Street		
PM Peak	Eastbound		Westbound		Northbound		
Movement	Left	Thru	Thru	Right	Left	Thru	Right
Volume	62	153	244	215	47	840	54
Delay (sec)	32.5	17.1	15.6	12.0	22.6	18.4	12.2
LOS	C	B	B	B	C	B	B
Queue (ft)	108	144	209	94	220	179	176

During the pm peak hour the intersection currently experiences acceptable service levels at all approaches. These degrade with the proposed development model along all

approaches: although there is not a large increase in traffic volumes attributed to the development under consideration.

If the left-turn model is implemented, then this intersection is predicted to operate at restored service levels.

Intersection Analysis – Washington Street and State Street

The intersection of Washington Street and State Street, located southeast of the development, is controlled with a two phase signal. Phase 1 is northbound and southbound State Street and Phase 2 is eastbound and westbound Washington Street.

The traffic signal operates on a fixed 90 second cycle with Phases 1 and 2 always receive the maximum amount of green time. The intersection is coordinated with nearby intersections which also operate on a 90 second cycle.

Washington Street is a two-way street with an eastbound approach that consists of a single lane for all turning movements. The westbound approach consists of a left turn lane and a through/right lane. The speed limit on Washington Street is 25 MPH.

State Street is a two-way street with a northbound and southbound approach that consists of only a single lane for all turning movements. The speed limit on State Street is 25 MPH.

The construction shown on the aerial has been completed and the intersection is designed as described above.

The SimTraffic model results are shown on the following page. No signal timing or lane improvement changes were made to the Forecast scenario so that conditions are the same as existing, but with the additional site traffic added to the study intersections.

SimTraffic Results – Morning Peak Hour (7:45-8:45 AM)
Intersection of Washington Street and State Street

Existing Conditions	Washington Street			Washington Street			State Street			State Street		
AM Peak	Eastbound			Westbound			Northbound			Southbound		
Movement	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
Volume	13	151	53	14	73	53	20	197	16	111	172	26
Delay (sec)	40.9	20.0	25.2	24.8	14.0	6.4	23.1	18.5	12.4	24.8	16.6	15.1
LOS	D	C	C	C	B	A	C	B	B	C	B	B
Queue (ft)	228	228	228	33	94	94	198	198	198	231	231	231

Forecast Conditions	Washington Street			Washington Street			State Street			State Street		
AM Peak	Eastbound			Westbound			Northbound			Southbound		
Movement	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
Volume	33	151	53	14	73	53	20	198	16	114	176	26
Delay (sec)	40.6	21.7	29.4	28.1	13.9	6.6	24.9	19.8	11.8	24.7	17.6	16.0
LOS	D	C	C	C	B	A	C	B	B	C	B	B
Queue (ft)	276	276	276	34	95	95	212	212	212	233	233	233

w/ LEFT-TURN	Washington Street			Washington Street			State Street			State Street		
AM Peak	Eastbound			Westbound			Northbound			Southbound		
Movement	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
Volume	33	151	53	14	73	53	20	198	16	114	176	26
Delay (sec)	40.9	20.7	29.8	26.4	16.1	7.6	23.7	19.0	12.9	23.7	15.2	14.9
LOS	D	C	C	C	B	A	C	B	B	C	B	B
Queue (ft)	250	250	250	38	105	105	205	205	205	218	218	218

During the am peak hour all intersection movements operate at acceptable service levels under all modeled scenarios.

SimTraffic Results - Afternoon Peak Hour (4:45-5:45 PM)
Intersection of Washington Street and State Street

Existing Conditions	Washington Street			Washington Street			State Street			State Street		
PM Peak	Eastbound			Westbound			Northbound			Southbound		
Movement	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
Volume	28	71	79	26	269	135	46	200	19	28	202	28
Delay (sec)	62.1	37.1	32.9	25.0	21.9	16.6	28.0	20.9	15.1	19.3	12.4	9.4
LOS	E	D	C	C	C	B	C	C	B	B	B	A
Queue (ft)	230	230	230	70	306	306	209	209	209	156	156	156

Forecast Conditions	Washington Street			Washington Street			State Street			State Street		
PM Peak	Eastbound			Westbound			Northbound			Southbound		
Movement	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
Volume	58	71	79	26	269	135	46	204	19	28	205	28
Delay (sec)	72.8	51.7	57.4	54.9	64.1	51.4	53.6	44.3	24.6	23.1	19.9	33.4
LOS	E	D	E	D	E	D	D	D	C	C	B	C
Queue (ft)	345	345	345	65	365	365	304	304	304	186	186	186

w/LEFT-TURN PM Peak	Washington Street Eastbound			Washington Street Westbound			State Street Northbound			State Street Southbound		
Movement	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
Volume	58	71	79	26	269	135	46	204	19	28	205	28
Delay (sec)	74.9	49.2	51.4	30.3	22.9	16.5	30.7	23.5	20.0	23.1	13.8	10.7
LOS	E	D	D	C	C	B	C	C	C	C	B	B
Queue (ft)	330	330	330	67	295	295	241	241	241	175	175	175

As with the other study intersections, the development traffic would not significantly adversely impact the delays at the intersection of Washington Street and State Street. With the exception of one turning movement during the existing and forecast evening peak conditions, all movements operate at acceptable levels of service D or better.

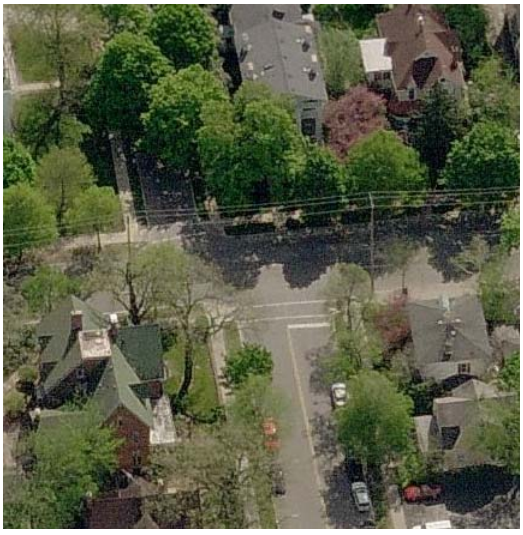
Of concern is the eastbound left-turn from Washington onto State Street which is currently operating at a level of service E during the evening peak hour. The models assign new trips associated with 413 E Huron to this movement and would be anticipated that this movement would degrade in response to increased turning volumes.

Mitigation is not recommended at this intersection at this time for the following reasons:

1. Any changes to the signal timing at this intersection to provide additional green time for Washington Street (thus reducing the green time on State Street) would cause larger delays along a stretch of road that has several closely spaced signals with spillback potential into adjacent intersections.
2. While not striped for it, motorists occasionally maneuver around left-turning vehicles on the eastbound approach. This won't occur on the model unless specifically programmed to accommodate for a separate turning bay, which was not done since Washington is only striped as a single lane. Drivers that maneuver around left-turning vehicles further reduce the chance for excessively long delays to occur during actual traffic conditions.
3. There is no additional right of way available for separate turn lanes and the total turning volume is not significant as far as warranting a separate left-turn phase for signal operations.

Intersection Analysis – N Division Street and E Ann Street

E Ann Street and N Division lies immediately north of the project site. This intersection is the intersection of two one-way streets and thus there are limited movements possible. E Ann Street runs eastbound and n Division runs northbound. A stop sign controls access from E Ann Street onto or across N Division Street. There is a slight offset across the intersection along E Ann Street. The following SimTraffic results indicate that current and future traffic operations will be acceptable during both peak hours.



SimTraffic Results - Morning Peak Hour (7:45-8:45 AM)
Intersection of N Division Street and E Ann Street

Existing Conditions	E Ann Street		Division Street	
AM Peak	Eastbound		Northbound	
Movement	Left	Thru	Thru	Right
Volume	76	136	652	77
Delay (sec)	12.2	15.4	0.9	0.6
LOS	B	C	A	A
Queue (ft)	140	140	32	30

Forecast Conditions	E Ann Street		Division Street	
AM Peak	Eastbound		Northbound	
Movement	Left	Thru	Thru	Right
Volume	76	136	659	119
Delay (sec)	11.7	16.8	1.0	0.7
LOS	B	C	A	A
Queue (ft)	138	138	38	38

w/LEFT-TURN	E Ann Street		Division Street	
AM Peak	Eastbound		Northbound	
Movement	Left	Thru	Thru	Right
Volume	76	136	659	119
Delay (sec)	12.7	16.7	1.0	0.7
LOS	B	C	A	A
Queue (ft)	144	144	42	40

SimTraffic Results - Afternoon Peak Hour (4:45-5:45 PM)
Intersection of N Division Street and E Ann Street

Existing Conditions	E Ann Street		Division Street	
PM Peak	Eastbound		Northbound	
Movement	Left	Thru	Thru	Right
Volume	110	68	1193	33
Delay (sec)	16.3	19.4	1.4	0.8
LOS	C	C	A	A
Queue (ft)	140	140	41	41

Forecast Conditions	E Ann Street		Division Street	
PM Peak	Eastbound		Northbound	
Movement	Left	Thru	Thru	Right
Volume	110	68	1198	55
Delay (sec)	12.6	17.3	1.4	1.0
LOS	B	C	A	A
Queue (ft)	112	112	35	34

w/LEFT-TURN	E Ann Street		Division Street	
PM Peak	Eastbound		Northbound	
Movement	Left	Thru	Thru	Right
Volume	110	68	1198	55
Delay (sec)	14.8	19.5	1.4	0.9
LOS	B	C	A	A
Queue (ft)	126	126	38	40

During both peak hours, this intersection will operate at acceptable service levels under all modeled scenarios.

Intersection Analysis – N Division Street and Catherine Street

Catherine Street and N Division is the first signalized intersection lying north of the project site. This intersection is the intersection of two one-way streets and thus there are limited movements possible. Catherine Street runs westbound and N Division runs northbound. A 90-second cycle length two-phase traffic signal with pedestrian signal heads assigns right of way at this intersection. There is a slight offset across the intersection along Catherine Street. The following SimTraffic results indicate that current and future traffic operations will be acceptable during both peak hours.

SimTraffic Results - Morning Peak Hour (7:45-8:45 AM)
Intersection of N Division Street and Catherine Street

Existing Conditions	Catherine Street		Division Street	
AM Peak	Westbound		Northbound	
Movement	Thru	Right	Left	Thru
Volume	90	37	100	666
Delay (sec)	20.0	9.4	1.9	7.0
LOS	C	A	A	A
Queue (ft)	110	110	49	121

Forecast Conditions	Catherine Street		Division Street	
AM Peak	Westbound		Northbound	
Movement	Thru	Right	Left	Thru
Volume	90	37	101	672
Delay (sec)	19.5	9.0	1.8	7.7
LOS	B	A	A	A
Queue (ft)	109	109	130	122

w/LEFT-TURN	Catherine Street		Division Street	
AM Peak	Westbound		Northbound	
Movement	Thru	Right	Left	Thru
Volume	90	37	101	672
Delay (sec)	21.0	9.9	1.8	7.4
LOS	C	A	A	A
Queue (ft)	109	109	126	113

SimTraffic Results - Afternoon Peak Hour (4:45-5:45 PM)
Intersection of N Division Street and Catherine Street

Existing Conditions	Catherine Street		Division Street	
PM Peak	Westbound		Northbound	
Movement	Thru	Right	Left	Thru
Volume	400	55	278	990
Delay (sec)	19.5	18.0	17.4	29.8
LOS	B	B	B	C
Queue (ft)	313	313	288	301

Forecast Conditions	Catherine Street		Division Street	
PM Peak	Westbound		Northbound	
Movement	Thru	Right	Left	Thru
Volume	400	55	279	994
Delay (sec)	19.3	17.3	15.9	29.1
LOS	B	B	B	C
Queue (ft)	298	298	280	312

w/LEFT-TURN	Catherine Street		Division Street	
PM Peak	Westbound		Northbound	
Movement	Thru	Right	Left	Thru
Volume	400	55	279	994
Delay (sec)	19.9	16.5	15.3	29.6
LOS	B	B	B	C
Queue (ft)	302	302	267	296

This intersection operates at acceptable service levels for all movements under all modeled scenarios.

Intersection Analysis – Site Driveways

The intersection of E. Huron Street and the site driveway, controlled with a stop sign for the driveway, would operate at an acceptable level of service during both the morning and afternoon peak hours. There will not be any significant traffic queue lengths for the west-to-north ingress movement. The access driveway is modeled as a right-turn in and right-turn out access. The SimTraffic results are shown below.

SimTraffic Results - Morning Peak Hour (7:45-8:45 AM)
Intersection of E. Huron Street and the Site Driveway

Forecast Conditions	Huron Street	Huron Street		Site Driveway
AM Peak	Eastbound	Westbound		Southbound
Movement	Thru	Thru	Right	Right
Volume	1118	557	30	62
Delay (sec)	2.1	2.1	1.9	3.8
LOS	A	A	A	A
Queue (ft)	10	0	0	58

w/LEFT-TURN	Huron Street	Huron Street		Site Driveway
AM Peak	Eastbound	Westbound		Southbound
Movement	Thru	Thru	Right	Right
Volume	1118	557	30	62
Delay (sec)	2.1	2.1	1.9	4.3
LOS	A	A	A	A
Queue (ft)	12	3	3	61

SimTraffic Results - Afternoon Peak Hour (4:45-5:45 PM)
Intersection of E. Huron Street and the Site Driveway

Forecast Conditions	Huron Street	Huron Street		Site Driveway
PM Peak	Eastbound	Westbound		Southbound
Movement	Thru	Thru	Right	Right
Volume	808	875	62	42
Delay (sec)	13.5	3.4	2.6	16.2
LOS	B	A	A	C
Queue (ft)	68	35	32	66

w/LEFT-TURN	Huron Street	Huron Street		Site Driveway
PM Peak	Eastbound	Westbound		Southbound
Movement	Thru	Thru	Right	Right
Volume	808	875	62	42
Delay (sec)	0.9	3.4	2.6	11.9
LOS	A	A	A	B
Queue (ft)	4	38	47	62

SimTraffic Results - Morning Peak Hour (7:45-8:45 AM)
Intersection of N Division Street and the Site Driveway

Forecast Conditions	N Division Street		Site Driveway
AM Peak	Northbound		Westbound
Movement	Thru	Right	Right
Volume	809	2	5
Delay (sec)	0.8	0.5	2.8
LOS	A	A	A
Queue (ft)	3	3	22

w/LEFT-TURN	N Division Street		Site Driveway
AM Peak	Northbound		Westbound
Movement	Thru	Right	Right
Volume	809	2	5
Delay (sec)	0.8	0.6	2.7
LOS	A	A	A
Queue (ft)	4	4	23

SimTraffic Results - Afternoon Peak Hour (4:45-5:45 PM)
Intersection of N Division Street and the Site Driveway

Forecast Conditions	N Division Street		Site Driveway
PM Peak	Northbound		Westbound
Movement	Thru	Right	Right
Volume	1126	5	3
Delay (sec)	1.2	0.7	4.3
LOS	A	A	A
Queue (ft)	5	5	20

Forecast Conditions	N Division Street		Site Driveway
PM Peak	Northbound		Westbound
Movement	Thru	Right	Right
Volume	1126	5	3
Delay (sec)	1.2	0.9	4.3
LOS	A	A	A
Queue (ft)	2	2	17

Similarly, the site driveway along N Division Street is projected to operate at an acceptable level of service with no adverse impacts on the N Division Street traffic stream. Since there are only 10 parking spaces provided at the site that are accessible via this access driveway, its anticipated use is minor and will not require mitigation should adverse traffic impacts occur.

Summary of Findings

The 413 E Huron development will have no significant adverse impact on the levels of service for the traffic in this area. While there are intersections which currently exhibit undesirable service levels, these are not appreciably degraded by adding new traffic directly associated with the 413 E Huron proposed development. The eastbound left-turn at the intersection of Washington Street and State Street currently operates at a level of service E. No mitigation is recommended at that location due to the reasons discussed on page 22.

Almost all of the changes to the delays from the existing conditions to the forecast conditions are minor, typically only one or two seconds of delay difference from existing to forecast. The variance experienced in the 10 distinct SimTraffic runs provides more of a factor in the difference in delays than the actual increase in traffic. Several forecasted turning movements are projected to operate at a better level of service than existing conditions due to these variances.

The additional modeling of a left-turn phase at the intersection of 5th Avenue and E Huron Street appears to hold promise for improving existing service levels to acceptable levels during the pm peak hour. There appear to be benefits to traffic operations at adjacent intersection should this change be pursued.

Recommendations

This study did not identify any adverse traffic impacts occasioned by the full development of 413 E Huron as proposed. Thus, it is recommended that no traffic mitigation strategies are required of the developer at any of the intersections included in the study area.