

First Avenue Lane Reconfiguration

Iowa City, Iowa

Prepared By:



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Prepared For:

City of Iowa City


July 6, 2016

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Snyder & Associates, Inc.

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	<p>I hereby certify that this Engineering Document was prepared by me or under my direct personal supervision and that I am a duly Licensed Professional Engineer under the Laws of the State of Iowa.</p> <p><u><i>Justin C. Jackson</i></u> <u><i>7/06/16</i></u> Justin C. Jackson, P.E. Date License Number 20538 My License Renewal Date is December 31, 2016 <u><i>All</i></u> _____ _____ _____</p>
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Background

Iowa City submitted and was successful in applying for the Iowa DOT Traffic Safety Improvement Program (TSIP) funding in 2014 for First Avenue 3-lane conversion from US 6 to north of Mall Drive. The following report summarizes the findings of a detailed capacity analysis of converting First Avenue from a 4-lane to a 3-lane roadway (with continuous center left turn lane) based on current and future forecasted traffic conditions. Iowa City's DOT Traffic Safety Funds application was used for existing conditions, historic traffic data, and project concept for the corridor.

Traffic History

Iowa Department of Transportation (DOT) historic counts were compiled from similar locations within the corridor to estimate a traffic growth rate and identify traffic pattern trends. The annual average daily traffic (AADT) volumes from the DOT counts for years 2002, 2006, 2010, and 2014 are shown in Table 1 for locations within the corridor. As is illustrated in Table 1, most of the segments experienced steady traffic volumes or traffic volume decline. The City collected peak hour counts at intersections in the corridor as part of the TSIP application. The total peak hour traffic volumes on First Avenue at intersection approaches are listed in Table 2. Since peak hour counts at Mall Drive and Lower Muscatine Road were conducted a week apart in 2013, the actual peak hour traffic volume counted was used for analysis although the exiting volumes from one intersection do not equal the entering volume at the next intersection. However, since the peak hour count at the intersection of US Hwy 6 was conducted in 2009 and there are no accesses between this intersection and Lower Muscatine Road intersection, the peak hour volume at US Hwy 6 was adjusted so that the exiting volumes from one intersection equaled the entering volume from the other intersection. The percentage change of the adjusted turning traffic volume at US Hwy 6 was also applied to the through traffic volumes at the intersection.

Table 1: Historic Annual Average Daily Traffic

Roadway Segment (First Avenue)	Historic Daily Traffic			
	2002	2006	2010	2014
Mall Drive, south of	12,800	-	13,000	-
US Hwy 6, north of	11,100	10,900	11,000	9,500

- DOT did not count location during count year

Table 2: Existing Total Peak Hour Traffic Volumes

Roadway Segment (First Avenue)	AM	PM
Mall Drive, north of	1,216	1,725
Mall Drive, south of	944	1,343
Lower Muscatine, north of	930	1,202
US Hwy 6, north of	685	931

Traffic Volume Forecasts

Metropolitan Planning Organization of Johnson County (MPOJC) provided traffic volumes from their regional travel demand model for base year 2010 and the 2040 horizon year as the source of information for annual rates of traffic change for the corridor. The traffic demand model addresses

future changes in the region and/or corridor development trends that are different from the historical trend. In addition, the model has the capability of taking into account street network changes that may result in First Avenue becoming a more attractive or less attractive route relative to alternative corridors. Thus, there is the potential for observing substantial changes from historical traffic trends if there are forecasted employment, residential development, or roadway network changes from the current conditions or historical trends.

MPOJC base year traffic volumes, future year traffic volumes, and annual change rate are listed in Table 3. Table 4 lists the future year 2040 total peak hour traffic volumes. The annual rate of traffic volume change was applied to existing peak hour traffic volumes to calculate future 2040 peak hour traffic volumes. At the intersection of Mall Drive, only the through traffic volumes on First Avenue had a growth factor applied in the analysis of future conditions since one approach of the intersection is a business access and Mall Drive only connects to fully developed parcels. The growth rate applied to turning traffic from Lower Muscatine Road corresponded to the growth rate of the segment the vehicles were turning on to. The through traffic volumes on Lower Muscatine Road had a growth rate of 0.32% applied for future analysis.

Table 3: MPOJC Traffic Model Volumes

Roadway Segment (First Avenue)	Daily Traffic		
	2010	2040	Annual Rate
Mall Dr to Lower Muscatine Rd	13,000	14,300	0.32%
Lower Muscatine Rd to US Hwy 6	11,000	12,800	0.51%

Table 4: 2040 Total Peak Hour Traffic Volumes

Roadway Segment (First Avenue)	AM	PM
Mall Drive, north of	1,312	1,830
Mall Drive, south of	1,018	1,448
Lower Muscatine, north of	1,034	1,336
US Hwy 6, north of	773	1,052

Proposed Corridor Improvements

The current and forecasted traffic volumes for the corridor are within the limits of what a 3-lane roadway can typically accommodate with acceptable user delay. The 3-lane corridor was evaluated with every signalized intersection providing protected/permissive left turn phasing on First Avenue along with the traffic signals operating in coordination. The existing and future 3-lane traffic conditions were analyzed with the following improvements:

- 3-lane cross section from Mall Drive (connecting to the proposed 3-lane cross section from the railroad grade separation project) to US 6
 - 1 NB Shared through/right turn-lane
 - 1 Southbound through/right turn-lane
 - 1 Continuous center left turn-lane
 - Designated bike lanes from Mall Drive to Lower Muscatine Road
- Protected/permissive left turn phasing at all signalized intersections
- Traffic signals operating in coordination

- Dedicated left turn lanes at signalized intersection with 100' of storage

Capacity and Intersection Analysis

Traffic operations were evaluated at each key intersection using the existing conditions, existing traffic volumes with 3-lane configuration, and year 2040 forecasted traffic volumes with 3-lane configuration for AM and PM peak period traffic volumes. The measures of effectiveness (MOE's) for the corridor were characterized by quantifying the following:

- The level-of-service (LOS) at each intersection for either STOP controlled or traffic signalized intersection resulted from applying *Highway Capacity Manual, 2010* (HCM) methodology incorporated into traffic analysis and modeling software, *Synchro 8*.
- Corridor travel time and delays of the corridor were modeled utilizing *SimTraffic 8* traffic signal coordination software.

At signalized intersections, the LOS is based on the weighted average of all approach delays and is expressed as a letter grade from A through F, with each grade representing a range of vehicle delay. Analysis of 3-lane configurations includes the proposed improvements previously described. Tables 5 and 6 list HCM computed vehicle delay and LOS of each intersection by approach for existing conditions, existing traffic volume with 3-lane configuration, and forecasted traffic volumes with 3-lane configurations for AM and PM peak periods. The current delay and LOS per each intersection approach and movement is acceptable (LOS D or better). Reconfiguring First Avenue to a 3-lane cross section will increase the intersection vehicle delay by 10 to 20 seconds and decrease the LOS during the peak periods. However the LOS will still stay acceptable with the lane reconfiguration with current traffic volumes and forecasted traffic volumes. The directional travel times along the corridor during the peak analysis periods are listed in Table 7.

Table 7: Travel Time in Seconds

Peak Hour	Direction of Travel	2016 Model 4-lane	2016 Model 3-Lane	2040 Model 4-Lane	2040 Model 3-Lane
AM Peak	Northbound	56	57	58	58
	Southbound	99	104	111	110
PM Peak	Northbound	68	68	65	65
	Southbound	109	117	112	125

Table 5: AM PEAK HOUR HCM 2010 ANALYSIS RESULTS

Intersection of 1st Avenue w/	App	2016 -Existing							2040 - Future						
		Peak Volume	4-Lane			3-Lane			Peak Volume	4-Lane			3-Lane		
			Delay (secs/ veh)	LOS	Max Queue (ft/lane)	Delay (secs/ veh)	LOS	Max Queue (ft/lane)		Delay (secs/ veh)	LOS	Max Queue (ft/lane)	Delay (secs/ veh)	LOS	Max Queue (ft/lane)
Mall Dr	NB	519	4	A	130	6	A	180 / Th	522	4	A	160	6	A	190 / Th
	SB	613	4	A	110	8	A	300 / Th	695	4	A	190	9	A	300 / Th
	EB	113	14	B	60	41	D	130	114	15	B	60	41	D	150
	WB	3	12	B	30	36	D	30	3	13	B	30	36	D	30
	All	1248	5	A		11	B		1334	5	A		11	B	
Lower Muscatine Rd	NB	376	12	B	180	18	B	160 / Th	452	13	B	200	21	C	310 / Th
	SB	413	12	B	140	19	B	260 / Th	416	13	B	200	21	C	250 / Th
	EB	197	12	B	160 / Lt	27	C	160 / Lt	222	13	B	140 / Th	27	C	140 / Th
	WB	241	18	B	160 / Th	46	D	280 / Th	268	20	B	200 / Th	39	D	290 / Th
	All	1227	13	B		26	C		1358	14	B		26	C	
US Hwy 6	SB	311	22	C	130 / Rt	52	D	70 / Lt	323	23	C	130 / Lt	40	D	90 / Lt
	EB	716	10	A	250 / Lt	25	C	360 / Lt	767	11	B	350 / Lt	24	C	350 / Lt
	WB	433	13	B	140 / Th	39	D	250 / Th	422	15	B	160 / Th	42	D	180 / Th
	All	1460	12	B		30	C		1512	13	B		31	C	

Table 6: PM PEAK HOUR HCM 2010 ANALYSIS RESULTS

Intersection of 1st Avenue w/	App	2016 -Existing							2040 - Future						
		Peak Volume	4-Lane			3-Lane			Peak Volume	4-Lane			3-Lane		
			Delay (secs/ veh)	LOS	Max Queue (ft/lane)	Delay (secs/ veh)	LOS	Max Queue (ft/lane)		Delay (secs/ veh)	LOS	Max Queue (ft/lane)	Delay (secs/ veh)	LOS	Max Queue (ft/lane)
Mall Dr	NB	609	6	A	110	9	A	290 / Th	675	6	A	140	10	B	210 / Th
	SB	828	6	A	280	19	B	620 / Th	941	7	A	240	19	B	620 / Th
	EB	229	18	B	190	34	C	150	230	37	D	230	42	D	340
	WB	6	14	B	30	23	C	30	6	29	C	30	69	E	30
	All	1672	8	A		17	B		1852	11	B		19	B	
Lower Muscatine Rd	NB	402	11	B	160	16	B	120 / Th	445	12	B	200	19	B	140 / Th
	SB	659	13	B	320	20	B	360 / Th	680	13	B	440	27	C	630 / Th
	EB	343	15	B	160 / Lt	33	C	160 / Th	370	28	C	190 / Th	29	C	370 / Th
	WB	283	19	B	200 / Th	37	D	230 / Th	304	39	D	180 / Th	36	D	330 / Th
	All	1687	14	B		24	C		1799	20	C		27	C	
US Hwy 6	SB	571	20	B	150 / Rt	34	C	130 / Rt	608	37	D	220 / Rt	36	D	170 / Rt
	EB	1035	9	A	310 / Lt	21	C	290 / Lt	991	24	C	320 / Lt	20	C	330 / Lt
	WB	460	13	B	120 / Th	37	D	170 / Th	402	37	D	160 / Th	40	D	210 / Th
	All	2066	10	B		26	C		2001	29	C		26	C	

Summary

Given the existing traffic volumes and the number of accesses on First Avenue from Lower Muscatine Road to Mall Drive, converting the 4-lane roadway to a 3-lane roadway with a continuous center left turn will increase intersection vehicle delay by 10 to 20 seconds during the peak periods. However the vehicle delay and LOS will remain acceptable while providing a beneficial left turn lane for vehicles utilizing the accesses between intersections. Reconfiguring First Avenue from 4-lane to 3-lane cross section will increase the projected travel time by 10 seconds in the PM peak period upon implementation of the lane reconfiguration. This portion of Iowa City is developed therefore future forecasted traffic volumes along the corridor are projected to have a minimal increase since there are no undeveloped areas adjacent to the corridor.

The existing business accesses along First Avenue do not all align opposite from one another except the north access of Eastdale Plaza on the east side of First Avenue and Java House on the west side of First Avenue. An unaligned access can cause the potential of left turning vehicle conflicts if they are not directly across from one another, or offset downstream from one another (for example, if an access to the east is south of an access to the west, the left turning vehicle paths may overlap). A left turn conflict was identified as a left turning vehicle having the potential to block the continuous left turn lane for an opposite direction of travel left turning vehicle. However, since all the accesses are offset upstream from one another, a left turn conflict does not exist except for one location. One location that does have the potential of left turning vehicle conflict is the southern access of Eastdale Plaza on the east side of First Avenue and Java House on the west side of First Avenue. To eliminate left turning vehicle conflict, either the southern access to Eastdale Plaza should be eliminated or access to Java House should be eliminated. Additional analysis of internal site circulation should be conducted to determine the feasibility of closing either of the two accesses. If the sites were to be redeveloped, the number and locations of the accesses should be reviewed as it relates to corridor access management and adjacent property accesses.

The future 3-lane traffic conditions should mimic existing 3-lane traffic conditions as tabulated with acceptable vehicle delay with the following recommended improvements to the corridor:

- 3-lane cross section from Mall Drive (connecting to the proposed 3-lane cross section from the railroad grade separation project) to US 6
 - 1 NB Shared through/right turn-lane
 - 1 Southbound through/right turn-lane
 - 1 Continuous center left turn-lane
 - Designated bike lanes from Mall Drive to Lower Muscatine Road
- Protected/permissive left turn phasing at all signalized intersections
- Traffic signals operating in coordination
- Dedicated left turn lanes at signalized intersection with 100' of storage