

MEMO

VIA EMAIL

To: Mr. Mark Clemence
Chief of Police
City of Birmingham

From: Michael J. Labadie, P.E.
Julie M. Kroll, P.E., PTOE
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Date: June 15, 2016

Re: W. Maple Road 4 to 3 Lane Conversion
City of Birmingham, Michigan
Before & After Study

Introduction

This memorandum presents the methodologies, analyses, and results of the Before & After Study for the W. Maple Road 4 to 3 lane conversion between Cranbrook Road and Southfield Road in the City of Birmingham, Michigan.

The scope of this study was developed based on Fleis & VandenBrink's (F&V) knowledge of the study area, information provided by City of Birmingham, accepted traffic engineering practice, and methodologies published by the Institute of Transportation Engineers (ITE).

Data Collection

Data collection was performed September 22-October 1, 2015 to collect the Before conditions of the four-lane roadway. Interim data collection was performed with the three-lane roadway January 5-10, 2016 and the After condition data collection was performed April 11-22, 2016. The following data was collected during the three analysis periods:

- Crash Data
- Average Daily Traffic Volumes
- Peak Period Traffic Volumes (Weekday and Sunday)
- Speed Data
- Cut-Through Traffic
- Travel Time

The results of the data collection analyses are summarized herein.

Crash Analysis

The crash data used in the study was provided by the Traffic Improvement Association of Michigan (TIA). The data includes the three years (January 2012 to December 2014) prior lane reduction and the six months after the three-lane conversion was completed. The crash analysis evaluated the six-month crash average for both the four-lane and three-lane operations. The results showed a reduction for all crash types and an overall 38% reduction in the crashes along the corridor. The results of the analysis are summarized in Table 1.

Table 1: Crash Analysis Summary Table

Crash Type	6-Month Crash Average		
	Before Condition (4-Lanes W. Maple Rd.)	After Condition (3-Lanes W. Maple Rd.)	Percent Change
Angle	2.0	1.0	-50%
Head-On Left	0.5	0.0	-100%
Head-On	0.2	0.0	-100%
Rear-End	12.8	11.0	-14%
Rear-End Left	0.7	0.0	-100%
Rear-End Right	0.3	0.0	-100%
Single Vehicle	1.2	1.0	-15%
Sideswipe Same	2.8	1.0	-65%
Other	3.5	1.0	-71%
Total	24.0	15.0	-38%

Average Daily Traffic

The average daily traffic volumes were collected for a period of 24-hours during a typical weekday for each of the three analysis periods (Before, Interim and After) on the following study roadways:

- **W. Maple Road**, Cranbrook Road to Southfield Road
- **Quarton Road**, Cranbrook Road to Southfield Road
- **Lincoln Street**, Cranbrook Road to Southfield Road
- **Oak Street**, Cranbrook Road to Old Woodward
- **14 Mile Road**, Southfield to Pierce Street

The results of the analysis are summarized in Table 2.

Table 2: Average Daily Traffic Volumes Summary Table

Evaluation Criteria	Before Condition 4-Lanes September 2015	Interim Review 3-Lanes January 2016	After Condition 3-Lanes April 2016	Difference 4-to-3 Lanes January 2016	Difference 4-to-3 Lanes April 2016
Study Roadway	Average Daily Traffic Volume (vehicles per day)				
Maple at Baldwin ¹	27,190	21,212	23,781	-5,978	-3,409
14 Mile Road	17,917	16,717	18,774	-1,200	857
Lincoln Street	6,698	6,269	7,802	-429	1,104
Oak Street	3,047	3,422	4,156	375	1,109
Quarton Road	19,986	19,528	8,933	-458	-11,053
Total Study Network	102,028	89,791	89,701	-12,237	-12,327

¹ Before condition volume is an average of 1999-2002; since these volumes were taken, an overall 20% reduction in traffic volumes occurred, reaching the lowest level in 2008. Volumes are slowly returning to their peak volumes at a growth rate less than 1% annually.

Overall, the average daily traffic volumes decreased throughout the City after the completion of the three-lane conversion. During the interim analysis, Oak Street was marginally higher than the before counts conducted in September 2015. This is attributed to Oak Street having been closed all summer for construction and had recently reopened when the September 2015 data collection was performed. Therefore, counts at this location were determined to be artificially low and the January 2016 condition represents typical traffic volumes along this roadway.

The overall number of vehicles in the study roadway network remained essentially unchanged from January to April 2016, and were significantly less than the before condition traffic volumes. The significant changes in the traffic volumes and distributions is due to the closure of Big Beaver Road (Quarton Road) east of Woodward Avenue. As a result of this closure, daily traffic volumes on Quarton Road showed a significant decrease, with traffic diverted to alternate parallel routes including W. Maple Road, 14 Mile Road, Lincoln Street, and Oak Street.

Speed Data Summary

The daily speed data was collected concurrently with the 24-hour traffic volumes data as summarized above. The results of the analysis show that the 85th percentile speeds on W. Maple Road have decreased and now more closely correspond with the posted speed limits on W. Maple Road. In addition, 4-to-3 lane conversion did not significantly change the 85th percentile speeds on the parallel routes as summarized in Table 3 below. The speeds on eastbound Quarton Road did marginally increase; however, this is due to the significant decrease in traffic volumes on Quarton Road (summarized in Table 2) resulting in less congestion.

Table 3: Speed Data Summary Table

Evaluation Criteria	Before Condition 4-Lanes September 2015	Interim Review 3-Lanes January 2016	After Condition 3-Lanes April 2016	Difference 4-to-3 Lanes January 2016	Difference 4-to-3 Lanes April 2016
Study Roadway	Eastbound 85th Percentile Speed (mph)				
Maple at Baldwin	41	39	37	-2	-4
Maple at Suffield	41	37	36	-4	-5
14 Mile Road	38	40	39	2	-1
Lincoln Street	31	31	31	0	0
Oak Street	31	31	31	0	0
Quarton Road	42	44	46	2	4
Study Roadway	Westbound 85th Percentile Speed (mph)				
Maple at Baldwin	45	38	39	-7	-6
Maple at Suffield	45	37	37	-8	-8
14 Mile Road	39	39	39	0	0
Lincoln Street	30	31	31	1	1
Oak Street	30	31	31	1	1
Quarton Road	45	43	47	-2	2

Cut-Through Traffic

The Cut-Through traffic volumes were collected during the PM peak period (4-6PM) during a typical weekday for each of the three analysis periods (Before, Interim and After). The Cut-Through traffic was determined by recording the license plate information on both north and south end of each of the following roadway segments. A vehicle was identified to be a "cut-through" when it traveled the study roadway in 5 minutes or less.

- Arlington Street, W. Maple Road to Lincoln Street
- Shirley Road, W. Maple Road to Lincoln Street
- Chesterfield Avenue, W. Maple Road to Quarton Road
- Glenhurst Drive, W. Maple Road to Lincoln Street
- Lake Park Drive, W. Maple Road to Oak Street
- Larchlea Drive, W. Maple Road to Lincoln Street
- Pilgrim Avenue, W. Maple Road to Quarton Road
- Pleasant Avenue, W. Maple Road to Lincoln Street

Table 4: Cut-Through Traffic Summary Table

Evaluation Criteria		Before Condition 4-Lanes September 2015	Interim Review 3-Lanes January 2016	After Condition 3-Lanes April 2016	Difference 4-to-3 Lanes January 2016	Difference 4-to-3 Lanes April 2016
Study Roadway	Direction	PM Peak Period Vehicles (4-6PM)				
Arlington Street/ Shirley Road	Northbound	36	29	25	-7	-11
	Southbound	66	32	60	-34	-6
	Total	102	61	85	-41	-17
Chesterfield Avenue	Northbound	27	13	8	-14	-19
	Southbound	43	21	17	-22	-26
	Total	70	34	25	-36	-45
Glenhurst Drive	Northbound	7	9	8	2	1
	Southbound	9	7	8	-2	-1
	Total	16	16	16	0	0
Lake Park Drive	Northbound	44	43	49	-1	5
	Southbound	45	51	56	6	11
	Total	89	94	105	5	16
Larchlea Drive	Northbound	5	0	5	-5	0
	Southbound	7	3	4	-4	-3
	Total	12	3	9	-9	-3
Pilgrim Avenue	Northbound	3	1	4	-2	1
	Southbound	10	4	0	-6	-10
	Total	13	5	4	-8	-9
Pleasant Avenue	Northbound	35	41	35	6	0
	Southbound	52	54	75	2	23
	Total	87	95	110	8	23
Total	Northbound	157	136	134	-21	-23
	Southbound	232	172	220	-60	-12
	Total	389	308	354	-81	-35

The results of the analysis show a significant reduction in cut-through traffic, most notably on Arlington Street/Shirley Road and Chesterfield Avenue from the Before conditions to Interim analysis. There was an increase in cut-through traffic from the Interim analysis in January 2016 to the Before analysis in April 2016. This increase is attributed to the closure of Big Beaver Road (Quarton Road) east of Woodward Avenue which has diverted traffic to the alternate parallel routes, including Lincoln Street and Oak Street. It should be noted that even with the redistribution from the Big Beaver closure, the cut-through traffic volumes are overall less than what was experienced during the Before condition with the four-lanes on W. Maple Road.

Travel Times

The travel time data was collected during the AM (7-9 AM), Midday (11 AM-1 PM) and PM (4-6 PM) peak hours on W. Maple Road between Cranbrook Road and Chester Street. The travel times were conducted by driving a data collection vehicle equipped with a GPS location device that collects time and location data. A minimum of 10 travel time runs were conducted for each direction during peak periods and then averaged to calculate the peak period travel time for each direction of travel. The results of the analysis are summarized in Table 5.

Table 5: Travel Time Summary Table

Evaluation Criteria		Before Condition 4-Lanes September 2015	Interim Review 3-Lanes January 2016	After Condition 3-Lanes April 2016	Difference 4-to-3 Lanes January 2016	Difference 4-to-3 Lanes April 2016
Peak Period	Direction	Average Travel Time (min)				
AM Peak Hour	Eastbound	3.5	2.9	4.4	-0.6	0.9
	Westbound	3.2	3.1	2.7	-0.1	-0.5
Midday Peak Hour	Eastbound	3.5	3.4	3.7	-0.1	0.2
	Westbound	2.6	2.7	3.3	0.1	0.7
PM Peak Hour	Eastbound	3.4	3.4	4.7	0.0	1.3
	Westbound	3.1	3.3	4.1	0.2	1.0
Average	Eastbound	3.5	3.2	4.3	-0.2	0.8
	Westbound	3.0	3.0	3.4	0.1	0.4

The results of the analysis show that overall the travel time has increased on W. Maple Road; however, the increases are generally less than 1 minute. This is consistent with the decrease in speeds on W. Maple Road as summarized in Table 3.

Weekday Level of Service

Peak hour vehicle delays and Levels of Service (LOS) were calculated at the signalized intersections along the W. Maple Road corridor using Synchro (Version 9) traffic analysis software. This analysis was based on the methodologies presented in the *Highway Capacity Manual 2010* (HCM). The weekday LOS was evaluated the Before, Interim, and After conditions. There was generally no change in the Level of Service (LOS) at intersections along the corridor. All intersections continue to operate acceptably at LOS C or better and a LOS D is generally considered the lowest acceptable grade. The intersections with the greatest delay are summarized in Table 6.

Table 6: Intersection LOS Summary Table

Evaluation Criteria	Before Condition 4-Lanes September 2015	Interim Review 3-Lanes January 2016	After Condition 3-Lanes April 2016	Difference 4-to-3 Lanes January 2016	Difference 4-to-3 Lanes April 2016
Peak Period	W. Maple Rd. & Chester Street				
AM Peak Hour	B	B	B	n/c	n/c
PM Peak Hour	C	C	C	n/c	n/c
Peak Period	W. Maple Rd. & Southfield Road				
AM Peak Hour	B	B	C	n/c	B to C ¹
PM Peak Hour	B	C	C	B to C ¹	B to C

The results of the analysis show that no change in operational delay is experienced at W. Maple Road & Chester Street. During the PM peak period the increase in traffic volumes on W. Maple Road caused an additional delay of 13 seconds, decreasing the overall LOS from B to C.

¹ Delay increased by <5 seconds, which changed the LOS letter grade, however this increase in delay would be indiscernible.

Sunday Level of Service

Peak hour vehicle delays and LOS were calculated at the unsignalized intersections and driveways directly impacted by church operations on Sunday. The following intersections were included in the analysis:

- Lutheran Church of the Redeemer-West Site Drive
- First Presbyterian Church-W. Maple Road Site Drive
- First United Methodist Church-Pleasant Avenue

Sunday peak period (9-11AM) data collection was performed at each of the study intersections for the Before, Interim, and After conditions. The Sunday peak hour volumes on W. Maple Road in April 2016 were determined to be higher than the data collected in both September 2015 and January 2016. The traffic volumes are summarized in Table 7.

Table 7: Two-Way Traffic Volumes on W. Maple Road West of Pleasant Avenue

Evaluation Criteria	Before Condition 4-Lanes <i>September 2015</i>	Interim Review 3-Lanes <i>January 2016</i>	After Condition 3-Lanes <i>April 2016</i>
Sunday Peak Hour	1,154	762	1,340

Therefore, to evaluate the Sunday LOS operations the April traffic volumes were used with both the Before (4-Lanes) and After (3-Lanes) conditions. This evaluation shows the impact of converting back to the 4-lane operation with the existing (April 2016) traffic volumes on W. Maple Road. The results of the analysis are summarized in Table 8.

Table 8: Sunday Peak Period LOS Summary Table

Evaluation Criteria	Before Condition 4-Lanes <i>April 2016 (adj)</i>	After Condition 3-Lanes <i>April 2016</i>	Difference 4-to-3 Lanes <i>April 2016</i>
Movement	W. Maple Rd. & Lutheran Church Driveway		
EB LT	B	B	n/c
WB LT	A	A	n/c
NB	F	F	n/c
SB	F	F	n/c
Movement	W. Maple Rd. & First Presbyterian Church Driveway		
WB LT	B	B	n/c
NB	E	C	E to C
Movement	W. Maple Rd. & Pleasant Avenue		
EB LT	A	A	n/c
WB LT	B	B	n/c
NB	F	F	n/c
SB	D	D	n/c

Overall, the church driveways will operate in a manner similar manner to the Before conditions. The operations at the First Presbyterian Church Driveway were improved to an acceptable LOS C over the Before conditions operations which operate at a LOS E.

Conclusions

The results of the analysis conclude that the test conversion of W. Maple Road to a three lane section improved the safety and reduced speeds along the corridor. There was negligible impact to the adjacent roadways and neighborhoods generally saw a reduction in cut-through traffic.

It is recommended that the proposed W. Maple Road reconstruction provide a three-lane cross-section between Cranbrook Road and Southfield Road.

END

Evaluation Criteria	Before Condition 4-Lanes Sep-2015	Interim Review 3-Lanes Jan-2016	After Condition 3-Lanes Apr-2016	Difference 4-to-3 Lanes Jan-2016	Difference 4-to-3 Lanes Apr-2016
Crash Analysis					
Crash Average					
6-Month Average	24.0		15.0		-38%
Traffic Volumes					
Average Daily Traffic Volume (vehicles per day)					
Maple @ Baldwin ¹	27,190	21,212	23,781	-5,978	-3,409
14 Mile Road	17,917	16,717	18,774	-1,200	857
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Quarton Road	19,986	19,528	8,933	-458	-11,053
Total Study Network	102,028	89,791	89,701	-12,237	-12,327
Average Speeds²					
Eastbound 85th Percentile Speed (mph)					
Maple at Baldwin	41	39	37	-2	-4
Maple at Suffield	41	37	36	-4	-5
14 Mile Road	38	40	39	2	1
Lincoln Street	31	31	31	0	0
Oak Street	31	31	31	0	0
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Westbound 85th Percentile Speed (mph)					
Maple at Baldwin	45	38	39	-7	-6
Maple at Suffield	45	37	37	-8	-8
14 Mile Road	39	39	39	0	0
Lincoln Street	30	31	31	1	1
Oak Street	30	31	31	1	1
Quarton Road	45	43	47	-2	2
Cut-Through Traffic					
Vehicles Per Hour					
Northbound	157	136	134	-21	-23
Southbound	232	172	220	-60	-12
Total	389	308	354	-81	-35
Travel Time					
Average Travel Time (min)					
Eastbound W. Maple Rd.	3.5	3.2	4.3	-0.3	0.8
Westbound W. Maple Rd.	3.0	3.0	3.4	n/c	0.4
Weekday Level of Service					
W. Maple Rd. & Chester Street					
AM Peak Hour	B	B	B	n/c	n/c
PM Peak Hour	C	C	C	n/c	n/c
W. Maple Rd. & Southfield Road					
AM Peak Hour	B	B	C	n/c	B to C ³
PM Peak Hour	B	C	C	B to C ³	B to C ⁴

Key: Decrease No change/Indiscernible Increase

¹ Changes in speed of ± 2 mph are indiscernible.

² Before condition volume is an average of 1999-2002; since these volumes were taken, an overall 20% reduction in traffic volumes occurred, reaching the lowest level in 2008. Volumes are slowly returning to their peak volumes at a growth rate less than 1% annually.

³ Delay increased by <5 seconds, which changed the LOS letter grade, however this increase in delay would be indiscernible.

⁴ During the PM peak period the increase in traffic volumes on W. Maple Road caused an additional delay of 13 seconds