

Milford Avenue & Maple Street Intersection Study

City of Marysville, Ohio

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Milford Avenue & Maple Street Intersection Study

City of Marysville, Ohio

Introduction

ms consultants has prepared a study for the Milford Avenue and Maple Street intersection in Marysville, Ohio. This document serves as an update to the “Maple Street & Milford Avenue Intersection Study” performed by R. D. Zande & Associates in December, 2000 and the “Corridor Study – Collins Avenue, Milford Avenue & Ninth Street” prepared by Jones-Stuckey in 2003. This intersection is located just southwest of the downtown area, as shown on **Figure 1**. The purpose of this report is to develop a low-cost alternative that improves traffic operations while requiring little, if any, construction of new roadway.

Study Area

Milford Avenue and Maple Street intersect at a skewed intersection located in close proximity of the Milford Avenue/Stocksdale Drive intersection. Milford Avenue and Maple Street both have a speed limit of 35 miles per hour within the study area. Southbound Milford Avenue is currently signed to stop for traffic to and from Maple Street. Because of the skewed angle of this intersection, a short connector roadway was built to allow southbound vehicles on either Maple Street or Milford Avenue to turn northbound onto the other street more safely and efficiently. However, this connector road does result in an additional intersection on both Maple Street and Milford Avenue. Just north of the Milford Avenue/Maple Street intersection, Stocksdale Drive intersects Milford Avenue. Stocksdale Drive is a short street connecting Milford Avenue and Main Street, with a 25-mph speed limit.

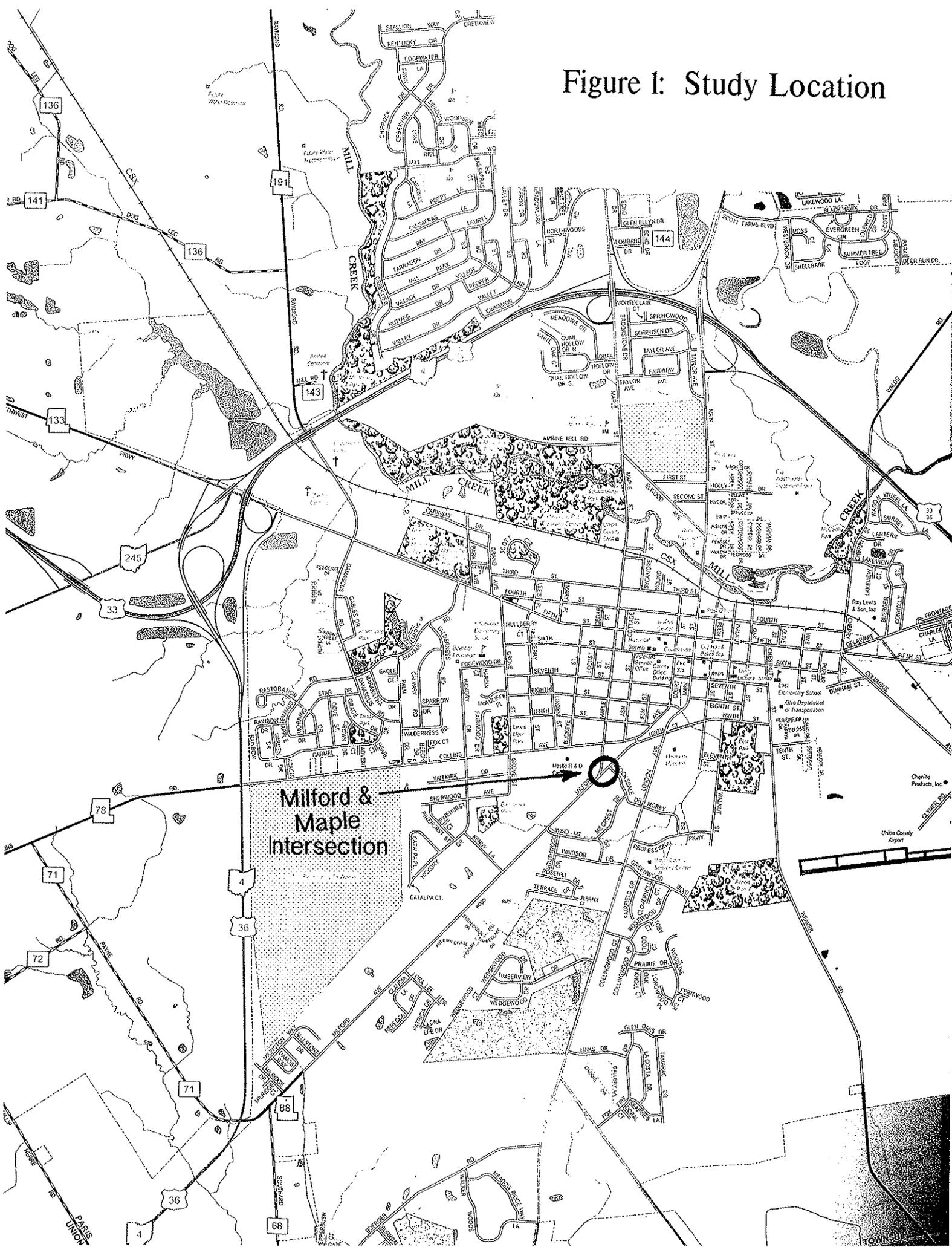
Crash data was provided by the City of Marysville for the Milford Avenue/Maple Street intersection study area. In the three-year period from 2005-2007, a total of 7 crashes were reported in the vicinity of this intersection. Three of these crashes involved angle collisions at the Milford Avenue/Maple Street intersection. Two of the crashes occurred in the parking lot of the IGA supermarket. No crashes were reported at the Milford Avenue/Stocksdale Drive intersection. None of the crashes involved injuries. **Figure 2** illustrates all of the crashes that occurred in the three-year analysis period. Based on this crash data, no discernable pattern of crashes exists in this study area.

The existing network features several undesirable roadway feature, which this report will address. A summary of the roadway features is provided below:

- **Skewed Intersection Angle**
The Milford Avenue and Maple Street intersection features a skew angle of approximately 15 degrees, which is much smaller than design standards. This gives Southbound Milford Avenue drivers a poor view of southbound Maple Street vehicles that they must yield to.



Figure 1: Study Location



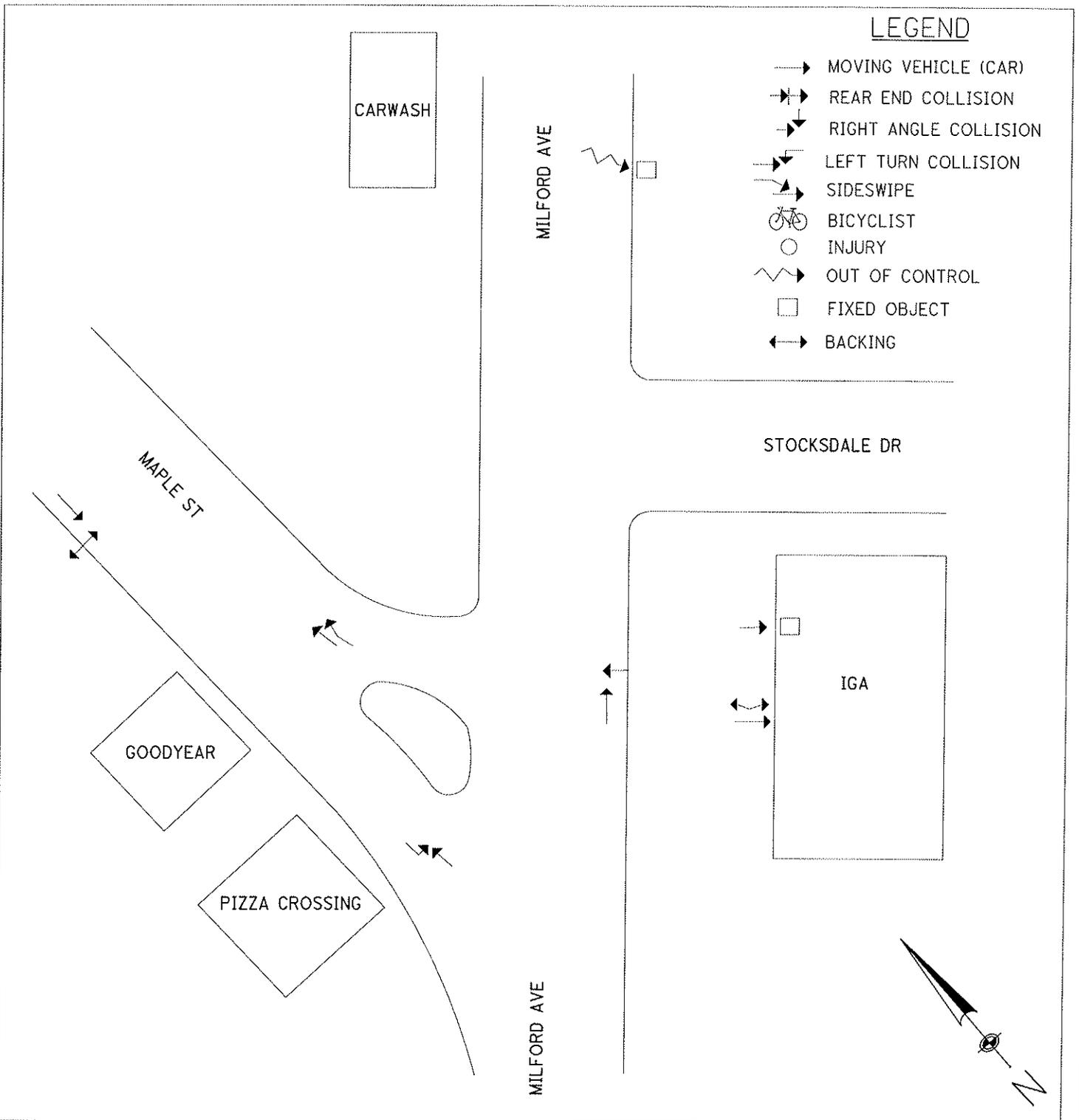
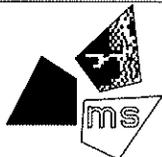


Figure 2
COLLISION DIAGRAM

MILFORD AVENUE & MAPLE STREET INTERSECTION STUDY
Marysville, Ohio



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ms consultants, inc.
Columbus, Ohio

Milford Avenue & Maple Street Intersection Study

City of Marysville, Ohio

- **Three Intersections Within 300 Feet on Milford Avenue**

The presence of three intersections on Milford Avenue in close proximity to each other creates a confusing situation for drivers. Vehicles are entering and exiting Milford Avenue at numerous locations.
- **Driveway Accesses**

The study area contains a number of properties that have excessively wide or continuous curb cuts on public streets. Both the IGA supermarket and the carwash property have long curb cuts on Milford Avenue. The IGA parking aisles and several parking spaces in front of the store directly connect to the street. This can create a situation where vehicles are turning on and off the roadway at unexpected places. Two properties on Maple Street, the Goodyear service center and the Pizza Crossing restaurant, also have large curb cuts that can be detrimental to the operation and safety of the roadway.
- **Pedestrian Issues**

Sidewalks exist on Maple Street and Milford Avenue in the areas surrounding this intersection, but do not exist in the intersection vicinity. This is likely due to the presence of the wide curb cuts that exist. Also, the large skew angle and non-standard design of the Milford Avenue/Maple Street intersection make for a less friendly environment for pedestrians to cross the street.

Evaluation of Alternatives

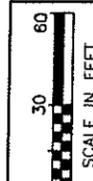
This section documents several alternatives for the Milford Avenue/Maple Street/Stocksdale Drive intersection area. The first three alternatives were developed in the previous study and are presented here for comparative purposes.

Alternative 1

Alternative 1 involves realigning the north leg of Milford Avenue so that it intersects with Maple Street at nearly a 90-degree angle. Stocksdale Drive would intersect Milford Avenue on the newly-created curve, approximately 100 feet east of Maple Street. A diagram of Alternative 1 is shown on **Figure 3**.

Alternative 2

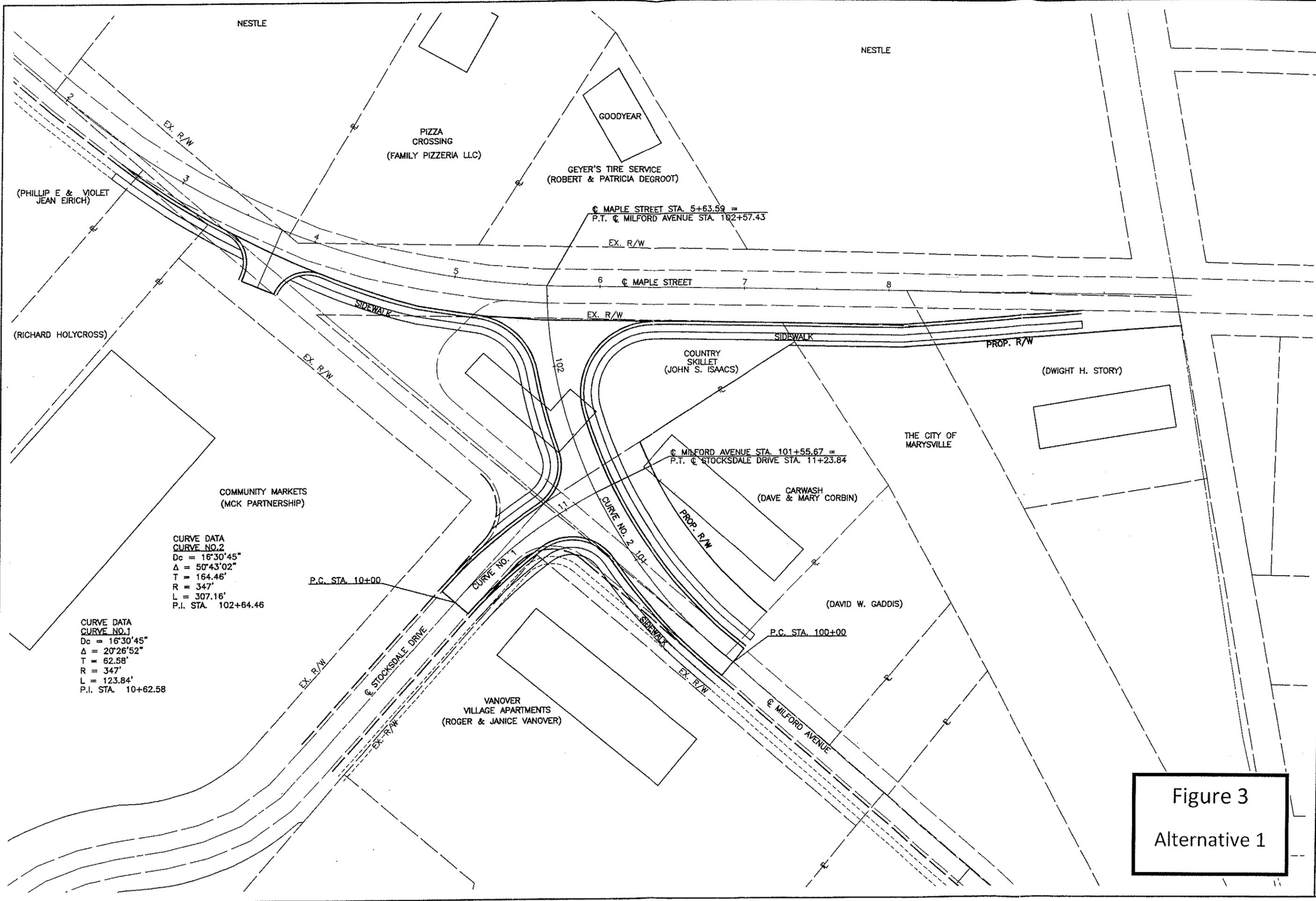
Alternative 2 would extend Stocksdale Drive west to Maple Street. The north leg of Milford Avenue would begin at Stocksdale Drive. **Figure 4** contains an illustration of



CALCULATED	JES
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ALTERNATIVE 1

MILFORD AVENUE & MAPLE STREET STUDY



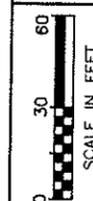
CURVE DATA
 CURVE NO. 2
 Dc = 16°30'45"
 Δ = 50°43'02"
 T = 164.46'
 R = 347'
 L = 307.16'
 P.I. STA. 102+64.46

CURVE DATA
 CURVE NO. 1
 Dc = 16°30'45"
 Δ = 20°26'52"
 T = 62.58'
 R = 347'
 L = 123.84'
 P.I. STA. 10+62.58

Figure 3
 Alternative 1

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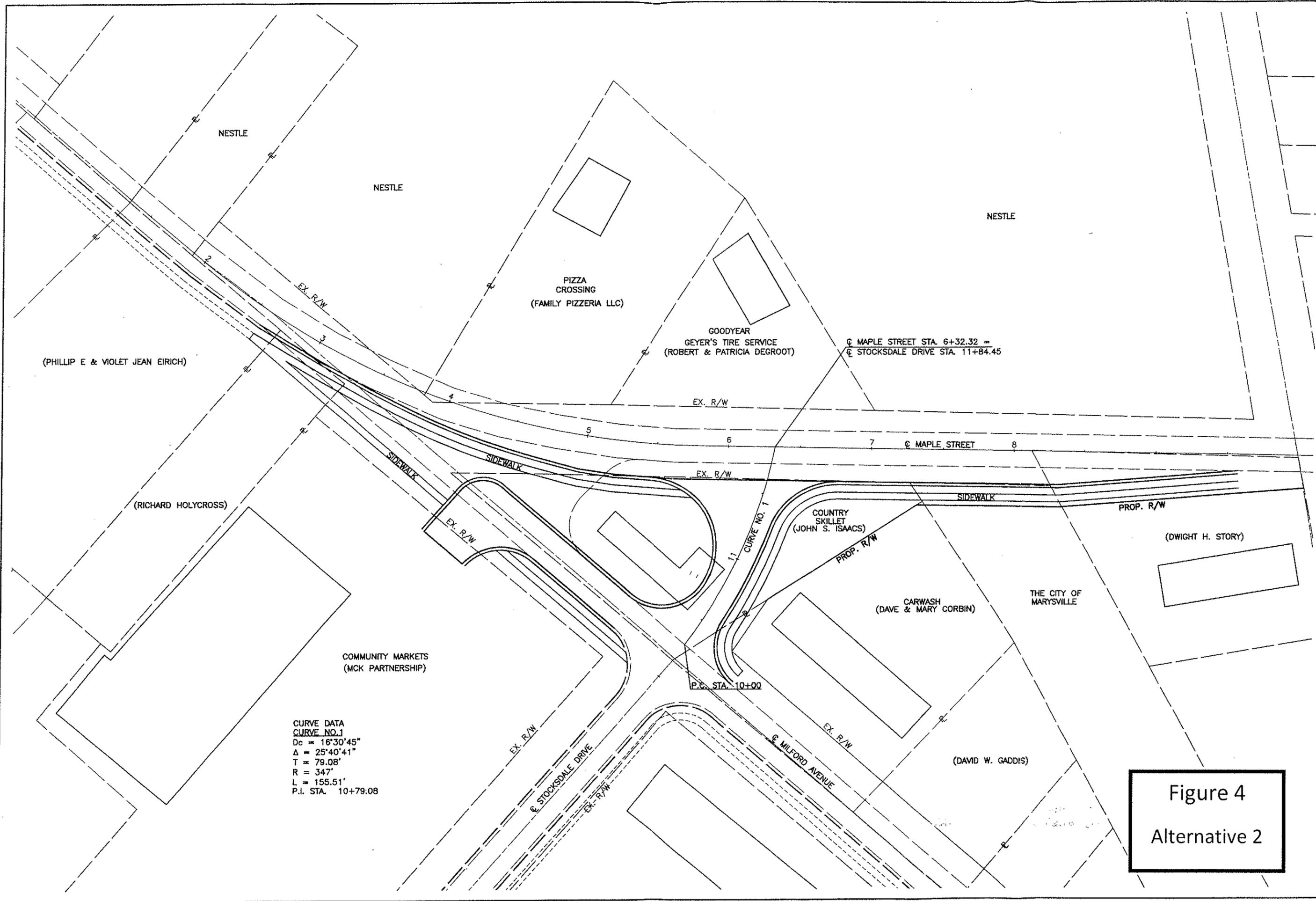
08/02 P:\08047\TRAFFIC\ACAD\6014412.DWG - LAYOUT1 - LAYOUT1 - NOV 30, 2009 3:05 PM



CALCULATED
JES
CHECKED
PJM

ALTERNATIVE 2

MILFORD AVENUE & MAPLE
STREET STUDY



CURVE DATA
CURVE NO. 1
Dc = 16°30'45"
Δ = 25°40'41"
T = 79.08'
R = 347'
L = 155.51'
P.I. STA. 10+79.08

Figure 4
Alternative 2

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this alternative. The previous study recommended Alternative 2 as the best solution for the intersection area.

Alternative 3

Alternative 3 is similar to Alternative 1, but it would realign less of Milford Avenue. This would create a sharper intersection angle with Maple Street, but would require less right-of-way. A depiction of Alternative 3 is provided on **Figure 5**.

Alternative 4

While the purpose of this study is to identify a low-cost alternative with limited or no roadway work, there is an additional long-term option that appears more desirable than Alternatives 1, 2, or 3. This solution, Alternative 4, would realign the south end Maple Street so that it intersects Milford Street at a 90-degree angle directly across from Stocksdale Drive. An illustration of Alternative 4 is shown on **Figure 6**. Aligning of Maple Street across from Stocksdale Drive would reduce the number of public street intersections in the study area to one. The previous alternatives all contain two public street intersections that are closely spaced. This configuration would allow for continuity of Milford Avenue, instead of requiring drivers to turn in order to remain on Milford Avenue. In addition to the road realignment, curb would be installed along Milford Avenue and Maple Street in order to implement access management. Two properties that currently access Maple Street would have their access diverted to Milford Avenue directly across from the main IGA parking aisle.

Capacity analyses were performed for Alternative 4 using the Highway Capacity Software (HCS+) Unsignalized module. Design year traffic volumes for the intersection were derived from the previous study and are shown in **Figure 7**. The analysis showed that the proposed Milford Avenue/Maple Street/Stocksdale Drive intersection would operate at level-of-service (LOS) B in the design year if under 4-way stop control. The intersection would operate at LOS C if operated under two-way stop control with Milford Avenue being free-flow. In an urban environment like this, LOS D or better is generally considered to be acceptable. Copies of these and all other HCS reports can be found in the **Appendix**.

If sidewalks were installed as part of this project, pedestrian access would be greatly improved in the study area. Pedestrians could more easily walk between Stocksdale Drive and Maple Street, giving residents along Maple Street better access to the IGA store. Right-of-way requirements for Alternative 4 would be no greater than Alternative 2, which was recommended in the previous study.

Milford Avenue & Maple Street Intersection Study

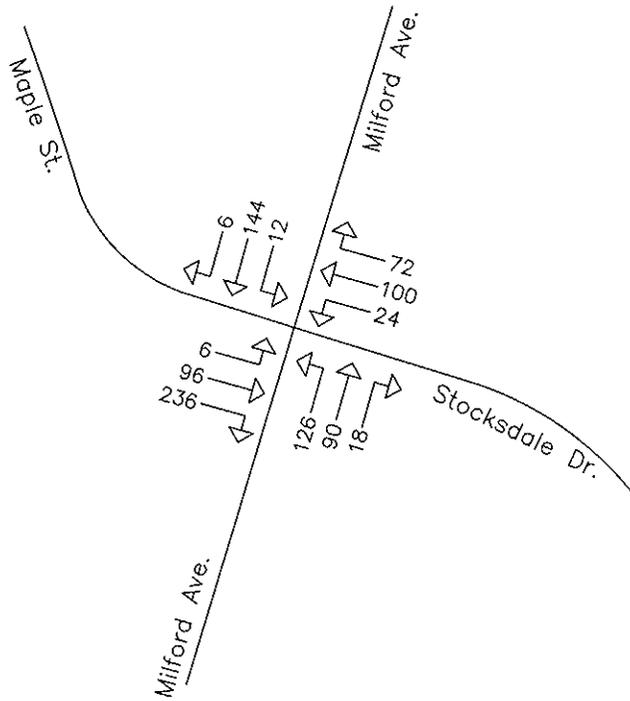


Figure 6
Alternative 4

ALTERNATIVE 4

Because this is proposed as a long-term improvement, the traffic volumes shown are for a 20-year horizon.

The 0.6% per year linear growth factor developed for the Downtown One-Way Pair Study was applied to existing volumes.



ALTERNATIVE 5

Because this is a low-cost, short-term improvement, the traffic volumes shown are for existing year.

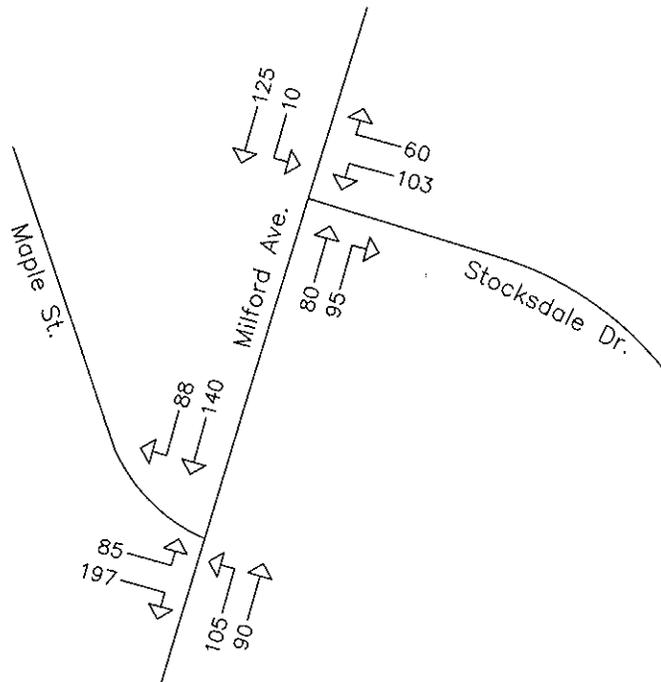


Figure 7
MILFORD AVENUE & MAPLE STREET
INTERSECTION STUDY
DESIGN HOUR TRAFFIC VOLUMES



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ms consultants, inc.
Columbus, Ohio

Milford Avenue & Maple Street Intersection Study

City of Marysville, Ohio

Alternative 5 – Low-Cost Solution

Alternative 5 is a low-cost solution that does not involve the construction of any new roadway. Through the use of striping and temporary barriers, improved traffic operations and geometry can be achieved. Alternative 5 would utilize the existing short connector road between Milford Avenue and Maple Street. Maple Street would be striped to curve onto this connector road and intersect Milford Avenue. Reboundable tubular pylons would be recommended to define the south edge of this new curve and keep drivers on the roadway. The intersection control would be changed so that Maple Street would stop for Milford Avenue. This alternative would eliminate the existing skewed intersection between the two streets and give southbound Maple Street drivers a good view of cross traffic. Currently, southbound Milford Avenue drivers must look almost behind them in order to see conflicting southbound Maple Street vehicles. A depiction of Alternative 5 is provided on **Figure 8**. Because this is a short-term solution, existing year traffic volumes were used to conduct HCS analyses at both public street intersections. The capacity analyses showed that the Milford Avenue/Maple Street intersection and the Milford Avenue/Stocksdale Drive intersection would both operate at LOS B.

In addition to the road restriping, this alternative contains low-cost or temporary access management in the study area. It is important to help control traffic flow in the study area by restricting the number and width of access points to streets in the study area. It is doubtful that striping alone would adequately control access, particularly on the locations that current have continuous curb cuts. These locations, such as the IGA supermarket on Milford Avenue, should have standard width driveways. Physical barriers are needed at these locations in order to implement the access management. Portable concrete barrier (PCB), concrete wheelblocks, or asphalt curb are recommended to help control access and define the driveways. If PCB or asphalt curb were installed, drainage issues should be examined to ensure that this alternative would not cause undesirable ponding of water. PCB would also likely be the least aesthetically pleasing choice for access control. However, PCB would be the most visible barrier for drivers, particularly during nighttime hours. If it is desired to implement Alternative 5 as a long-term solution, permanent concrete curbing should be considered in order to increase the design life of the project. In the “island” created south of the proposed Maple Street curve, it would also be possible to install grass or landscaping as a buffer between Maple Street and the Pizza Crossing restaurant driveway as part of a short-term or long-term scenario.

Conclusion

A short-term solution can be implemented at the Milford Avenue/Maple Street intersection that would help to reduce the number of vehicle conflict points and provide a more efficient roadway network. Using pavement that is already in existence, the southern end of Maple Street can be restriped to provide a 90-degree intersection with Milford Avenue. Through the use of temporary or low-cost materials, barriers can be



Milford Avenue & Maple Street Intersection Study



Figure 8
Alternative 5
Low-Cost Solution

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installed in the study area to limit the number and width of access points on the public street network. The concept shown in Figure 7 (Alternative 5) outlines a strategy for these low-cost improvements. If funding becomes available in the future, Alternative 4 would be recommended as the best long-term configuration for this intersection.

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Appendix A

HCS Reports



ALL-WAY STOP CONTROL ANALYSIS

General Information

Analyst *REB*
 Agency/Co. *ms consultants*
 Date Performed *9/3/2008*
 Analysis Time Period *Design Hour*

Site Information

Intersection *Milford & Maple*
 Jurisdiction *Marysville, OH*
 Analysis Year *Design Year*

Project ID *Alternative 4*

East/West Street: *Maple/Stocksdale*

North/South Street: *Milford Ave.*

Volume Adjustments and Site Characteristics

Approach	Eastbound			Westbound		
	L	T	R	L	T	R
Movement						
Volume (veh/h)	6	96	236	24	100	72
%Thrus Left Lane						

Approach	Northbound			Southbound		
	L	T	R	L	T	R
Movement						
Volume (veh/h)	126	90	18	12	144	6
%Thrus Left Lane						

	Eastbound		Westbound		Northbound		Southbound	
	L1	L2	L1	L2	L1	L2	L1	L2
Configuration	<i>LTR</i>		<i>LTR</i>		<i>LTR</i>		<i>LTR</i>	
PHF	<i>0.90</i>		<i>0.90</i>		<i>0.90</i>		<i>0.90</i>	
Flow Rate (veh/h)	<i>374</i>		<i>217</i>		<i>260</i>		<i>179</i>	
% Heavy Vehicles	<i>2</i>		<i>2</i>		<i>2</i>		<i>2</i>	
No. Lanes	<i>1</i>		<i>1</i>		<i>1</i>		<i>1</i>	
Geometry Group	<i>1</i>		<i>1</i>		<i>1</i>		<i>1</i>	
Duration, T	<i>0.25</i>							

Saturation Headway Adjustment Worksheet

Prop. Left-Turns	<i>0.0</i>		<i>0.1</i>		<i>0.5</i>		<i>0.1</i>	
Prop. Right-Turns	<i>0.7</i>		<i>0.4</i>		<i>0.1</i>		<i>0.0</i>	
Prop. Heavy Vehicle	<i>0.0</i>		<i>0.0</i>		<i>0.0</i>		<i>0.0</i>	
hLT-adj	<i>0.2</i>							
hRT-adj	<i>-0.6</i>							
hHV-adj	<i>1.7</i>							
hadj, computed	<i>-0.4</i>		<i>-0.2</i>		<i>0.1</i>		<i>0.0</i>	

Departure Headway and Service Time

hd, initial value (s)	<i>3.20</i>		<i>3.20</i>		<i>3.20</i>		<i>3.20</i>	
x, initial	<i>0.33</i>		<i>0.19</i>		<i>0.23</i>		<i>0.16</i>	
hd, final value (s)	<i>5.31</i>		<i>5.80</i>		<i>6.05</i>		<i>6.17</i>	
x, final value	<i>0.55</i>		<i>0.35</i>		<i>0.44</i>		<i>0.31</i>	
Move-up time, m (s)	<i>2.0</i>		<i>2.0</i>		<i>2.0</i>		<i>2.0</i>	
Service Time, t_s (s)	<i>3.3</i>		<i>3.8</i>		<i>4.1</i>		<i>4.2</i>	

Capacity and Level of Service

	Eastbound		Westbound		Northbound		Southbound	
	L1	L2	L1	L2	L1	L2	L1	L2
Capacity (veh/h)	<i>624</i>		<i>467</i>		<i>510</i>		<i>429</i>	
Delay (s/veh)	<i>14.66</i>		<i>11.88</i>		<i>13.67</i>		<i>11.87</i>	
LOS	<i>B</i>		<i>B</i>		<i>B</i>		<i>B</i>	
Approach: Delay (s/veh)	<i>14.66</i>		<i>11.88</i>		<i>13.67</i>		<i>11.87</i>	
LOS	<i>B</i>		<i>B</i>		<i>B</i>		<i>B</i>	
Intersection Delay (s/veh)	<i>13.34</i>							
Intersection LOS	<i>B</i>							

TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	<i>REB</i>	Intersection	<i>Milford & Maple</i>
Agency/Co.	<i>ms consultants</i>	Jurisdiction	<i>Marysville, OH</i>
Date Performed	<i>9/3/2008</i>	Analysis Year	<i>Design Year</i>
Analysis Time Period	<i>Design Hour</i>		

Project Description <i>Alternative 4</i>	
East/West Street: <i>Maple St/Stocksdale Dr</i>	North/South Street: <i>Milford Ave</i>
Intersection Orientation: <i>North-South</i>	Study Period (hrs): <i>0.25</i>

Vehicle Volumes and Adjustments						
Major Street	Northbound			Southbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)	126	90	18	12	144	6
Peak-Hour Factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90
Hourly Flow Rate, HFR (veh/h)	140	100	20	13	160	6
Percent Heavy Vehicles	2	--	--	2	--	--
Median Type	<i>Undivided</i>					
RT Channelized			0			0
Lanes	0	1	0	0	1	0
Configuration	<i>LTR</i>			<i>LTR</i>		
Upstream Signal		0			0	

Minor Street	Eastbound			Westbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)	6	96	236	24	100	72
Peak-Hour Factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90
Hourly Flow Rate, HFR (veh/h)	6	106	262	26	111	80
Percent Heavy Vehicles	2	2	2	2	2	2
Percent Grade (%)	0			0		
Flared Approach		<i>N</i>			<i>N</i>	
Storage		0			0	
RT Channelized			0			0
Lanes	0	1	0	0	1	0
Configuration		<i>LTR</i>			<i>LTR</i>	

Delay, Queue Length, and Level of Service								
Approach	Northbound	Southbound	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	<i>LTR</i>	<i>LTR</i>		<i>LTR</i>			<i>LTR</i>	
v (veh/h)	140	13		217			374	
C (m) (veh/h)	1412	1468		401			616	
v/c	0.10	0.01		0.54			0.61	
95% queue length	0.33	0.03		3.12			4.08	
Control Delay (s/veh)	7.8	7.5		24.1			19.5	
LOS	<i>A</i>	<i>A</i>		<i>C</i>			<i>C</i>	
Approach Delay (s/veh)	--	--		24.1			19.5	
Approach LOS	--	--		<i>C</i>			<i>C</i>	

TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	<i>REB</i>	Intersection	<i>Milford & Stocksdale</i>
Agency/Co.	<i>ms consultants</i>	Jurisdiction	<i>Marysville, OH</i>
Date Performed	<i>9/3/2008</i>	Analysis Year	<i>Existing Year</i>
Analysis Time Period	<i>Design Hour</i>		

Project Description <i>Alternative 5</i>	
East/West Street: <i>Stocksdale Drive</i>	North/South Street: <i>Milford Avenue</i>
Intersection Orientation: <i>North-South</i>	Study Period (hrs): <i>0.25</i>

Vehicle Volumes and Adjustments						
Major Street	Northbound			Southbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)		80	95	10	125	
Peak-Hour Factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90
Hourly Flow Rate, HFR (veh/h)	0	88	105	11	138	0
Percent Heavy Vehicles	2	--	--	2	--	--
Median Type	<i>Undivided</i>					
RT Channelized			0			0
Lanes	0	1	0	0	1	0
Configuration			<i>TR</i>	<i>LT</i>		
Upstream Signal		0			0	

Minor Street	Eastbound			Westbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)				103		60
Peak-Hour Factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90
Hourly Flow Rate, HFR (veh/h)	0	0	0	114	0	66
Percent Heavy Vehicles	2	2	2	2	2	2
Percent Grade (%)		0			0	
Flared Approach		<i>N</i>			<i>N</i>	
Storage		0			0	
RT Channelized			0			0
Lanes	0	0	0	0	0	0
Configuration					<i>LR</i>	

Delay, Queue Length, and Level of Service								
Approach	Northbound	Southbound	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration		<i>LT</i>		<i>LR</i>				
v (veh/h)		11		180				
C (m) (veh/h)		1380		753				
v/c		0.01		0.24				
95% queue length		0.02		0.93				
Control Delay (s/veh)		7.6		11.3				
LOS		<i>A</i>		<i>B</i>				
Approach Delay (s/veh)	--	--	11.3					
Approach LOS	--	--	<i>B</i>					

TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	<i>REB</i>	Intersection	<i>Milford & Maple</i>
Agency/Co.	<i>ms consultants</i>	Jurisdiction	<i>Marysville, OH</i>
Date Performed	<i>9/3/2008</i>	Analysis Year	<i>Existing Year</i>
Analysis Time Period	<i>Design Hour</i>		

Project Description <i>Alternative 5</i>	
East/West Street: <i>Maple Street</i>	North/South Street: <i>Milford Avenue</i>
Intersection Orientation: <i>North-South</i>	Study Period (hrs): <i>0.25</i>

Vehicle Volumes and Adjustments						
Major Street	Northbound			Southbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)	105	90			140	88
Peak-Hour Factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90
Hourly Flow Rate, HFR (veh/h)	116	100	0	0	155	97
Percent Heavy Vehicles	2	--	--	2	--	--
Median Type	<i>Undivided</i>					
RT Channelized			0			0
Lanes	0	1	0	0	1	0
Configuration	<i>LT</i>					<i>TR</i>
Upstream Signal		0			0	

Minor Street	Eastbound			Westbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)	85		197			
Peak-Hour Factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90
Hourly Flow Rate, HFR (veh/h)	94	0	218	0	0	0
Percent Heavy Vehicles	2	2	2	2	2	2
Percent Grade (%)		0			0	
Flared Approach		<i>N</i>			<i>N</i>	
Storage		0			0	
RT Channelized			0			0
Lanes	0	0	0	0	0	0
Configuration		<i>LR</i>				

Delay, Queue Length, and Level of Service								
Approach	Northbound	Southbound	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	<i>LT</i>						<i>LR</i>	
v (veh/h)	116						312	
C (m) (veh/h)	1313						671	
v/c	0.09						0.46	
95% queue length	0.29						2.47	
Control Delay (s/veh)	8.0						14.9	
LOS	<i>A</i>						<i>B</i>	
Approach Delay (s/veh)	--	--					14.9	
Approach LOS	--	--					<i>B</i>	