

US 36/SR 4 & Milford Avenue/Payne Road Signal Warrant Study

Marysville, Ohio

January 6, 2012



ms consultants, inc.
engineers, architects, planners
2221 Schrock Road
Columbus, Ohio 43229-1547

Traffic Signal Warrant Analysis – US36/SR 4 @ Milford Avenue/Payne Road

ms consultants has conducted a traffic signal warrant analysis for the US36/SR 4 and Milford Avenue/Payne Road intersection in Marysville, Ohio per the criteria of the Ohio Manual of Uniform Traffic Control Devices (OMUTCD). This intersection is stop controlled for the Milford Avenue/Payne Road approaches.

Below is a summary of data used in the analysis:

Roadway Geometrics:

	Classification	Speed Limit	No. Lanes
US 36/SR 4	Major Arterial	55 mph	2 lanes
Milford Avenue	Minor Arterial	35 mph	2 lanes
Payne Road	Collector	45 mph	2 lanes

Traffic Counts:

Turning movement traffic count data was collected by **ms consultants** on December 7th, 2011 for a twelve hour period from 6 am to 6 pm. This twelve hour period was chosen based on the 24 hour traffic counts collected in 2008 and contained in the US 36/SR 4 & Milford Avenue Traffic Study dated January 23, 2009. Traffic volumes drop before the 6 am and after the 6 pm hour such that signal warrants are more likely to be met in the higher volumes hours between 6 am and 6 pm. The count data was adjusted with the appropriate seasonal adjustment factors. The traffic count data is contained in Exhibit A.

Crash Data:

Crash data for the most recent past three years was provided by the City of Marysville and included data from the Ohio State Highway Patrol, Union County and City of Marysville law enforcement agencies. OH-1 reports were analyzed to determine the actual date and type of crashes. The crash information is shown in Exhibit B

Analysis and Results:

The above data was utilized to determine if the intersection of US 36/SR 4 & Milford Avenue/Payne Road meets any of the nine OMUTCD warrants. As the speed limit on US 36/SR 4 is 55 mph, the intersection is eligible for the high speed condition (>40 mph) and thus the 70% reduction in traffic volume warrant criteria was used for all the signal warrants. The detailed warrant calculations are shown in Figure 1. The Four Hour Vehicular Volume Graphs for Warrant 2 are shown in Figure 2. The Peak Hour Graphs for Warrant 3 are shown in Figure 3.

The intersection does not at this time meet any of the nine traffic signal warrant criteria outlined in the OMUTCD. Warrant 2, the Four Hour Vehicular Volume Warrant, meets the criteria shown in Table 2 for one hour and is near to meeting the criteria for the three remaining hours. Increases in traffic on the major or minor road or both could cause all four hours to be met.

Warrant 7, Crash Experience, did not meet the requirement for minimum of 5 correctable crashes in a 12 month period. There were 5 crashes in one 12 month period but only two of the five were correctable by installing signal control. In addition, traffic volumes would need to increase in the area to meet the additional Warrant 7 criteria.

The crash history and traffic volumes at this intersection should be monitored periodically to determine if traffic volume increases or crash history indicate a change to signal control. Details of each warrant follows:

Warrant 1 – Eight Hour Vehicular Volume – Not Met

Seventy percent of the total volume criteria for either Warrant 1A or Warrant 1B must be met for any eight hours during the day. This warrant also allows for an additional reduction to 80% of the criteria for Warrant 1A and Warrant 1B for an overall 56% volume reduction if the intersection can meet the *same* 8 hour period for a combination of Warrant 1A *and* 1B. Please see Figure 1 which highlights in green the hours that are met for this 8 hour warrant.

The US 36/SR 4 & Milford/Payne intersection does not meet the full 8 hour criteria but does meet the following as shown in Figure 1:

- 3 hours of the required 8 hours met the criteria for Warrant 1A
- 0 hours met the criteria for Warrant 1 B
- 4 hours of the required 8 hours met the criteria for the combination Warrant 1A & 1B

Warrant 2 – Four Hour Vehicular Volume – Not Met

- 1 hour of the required 4 hours meet the criteria for Warrant 2 as shown in Figure 2. The second highest hour is very close to meeting the Warrant levels; however, the third and fourth highest hours would need about a 20% increase in intersection traffic.

Warrant 3 – Peak Hour – Not Met

- The peak hour volume is lower than the required volume for meeting Warrant 3 as shown in Figure 3. In the US 36/SR 4 & Milford Avenue Traffic Study dated January 23, 2009, the traffic projections for the middle school combined with the existing traffic volumes appeared that this peak hour volume warrant may be met. However, the current counts are lower than were anticipated in the 2009 study. Based on our 2011 counts, there are approximately 100 fewer school entering trips today than predicted by the ITE Trip Generation Manual. This would indicate that either more students take the bus or more parents carpool than at a typical middle school per the ITE Trip Generation Manual.

Warrant 4 – Pedestrian Volume – Not Met

- No pedestrians were observed during the count. Therefore Warrant 4 is not met.

Warrant 5 – School Crossing – Not Met

- This warrant is not applicable at this location

Warrant 6 – Coordinated Signal System – Not Met

- The nearest signal is 1.2 miles away. Therefore Warrant 6 is not met.

Warrant 7 – Crash Experience – Not Met

- Five or more crashes in a 12 month timeframe correctable by a signal are required to meet this warrant along with meeting 80% of the volumes required for either Warrant 1A or Warrant 1B for an 8 hour period. This calculates to meeting 56% of the total Warrant criteria as Warrant 1A and 1B are already reduced by 70% as this intersection qualifies for the high speed reduction. Correctable crashes include Angle, Left Turn, Right Turn and Sideswipe crashes.
- The crash data does show one 12 month period where five crashes do occur at this intersection. As shown in Exhibit B, five crashes occur from July 2007 to July 2008. However, three of those crashes involved single vehicles cited with failure to control or unsafe speed which would not be correctable by installing signal control.
- The traffic volumes do not satisfy the requirement for meeting 56% of the volumes for Warrant 1A or Warrant 1B (80% Volumes) as only 5 of the required 8 hours meet the criteria.

Warrant 8 – Roadway Network – Not Met

- This warrant is not applicable at this location

Warrant 9 – Intersection near a Grade Crossing (Railroad) – Not Met

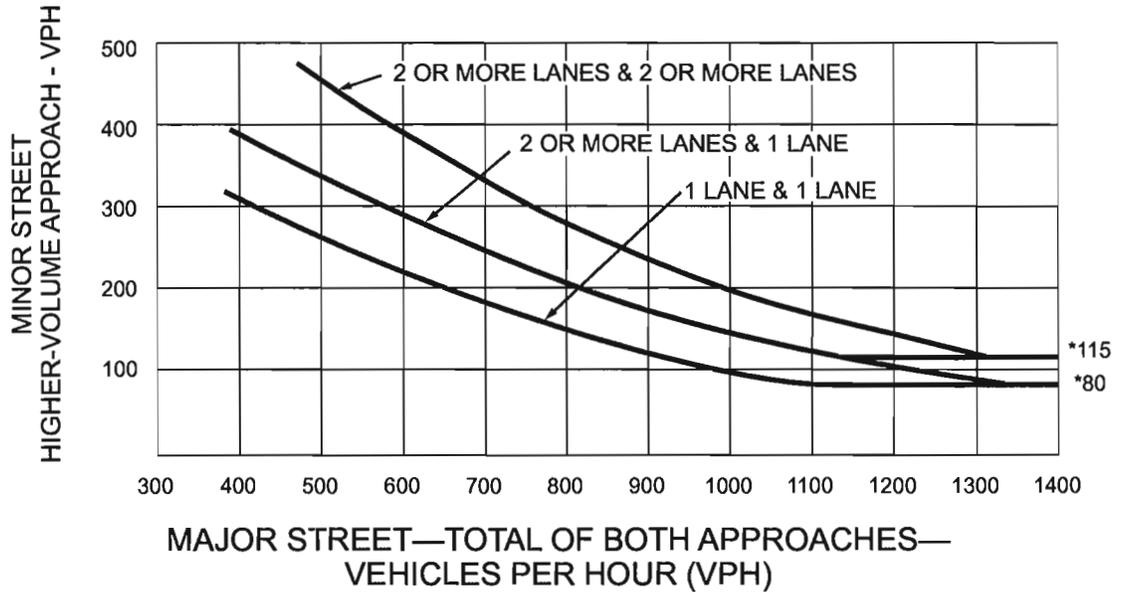
- This warrant is not applicable at this location

US 36/SR 4 @ Milford Avenue/Payne Road

Figure 1: Analysis of 8 Hour Volume Warrants

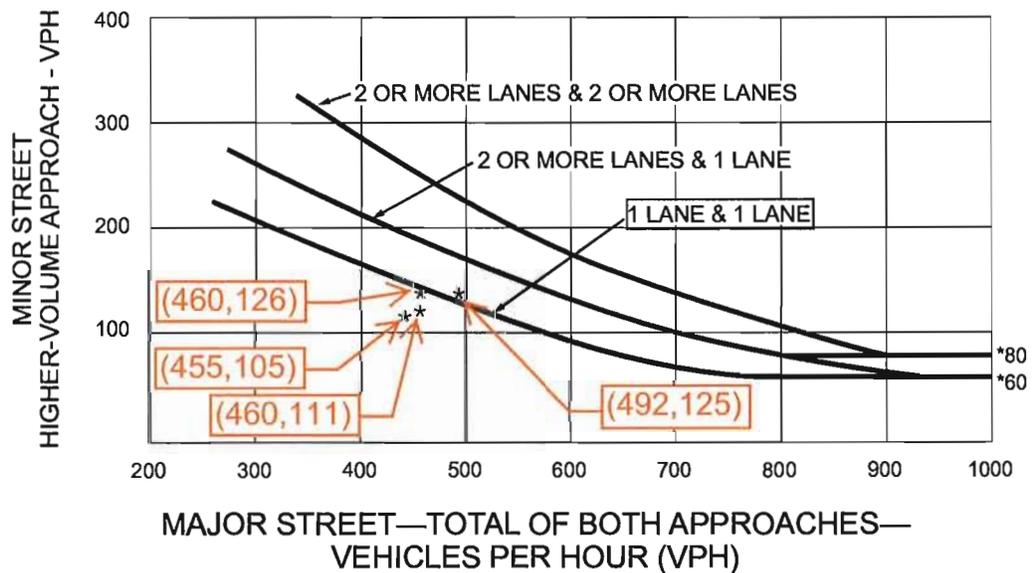
Begin Hour	US 36/SR 4		Milford Av/Payne Rd		70% of Full Warrant Criteria						56% of Full Warrant Criteria (80% of 70% Volumes)					
	Major Street Total	Higher Minor Street Volume	Direction	Warrant 1A			Warrant 1B			Warrant 1A & 1B (Cond A)			Warrant 1A & 1B (Cond B)			
				Major St Criteria	Minor St Criteria	Criteria Met	Major St Criteria	Minor St Criteria	Criteria Met	Major St Criteria	Minor St Criteria	Criteria Met	Major St Criteria	Minor St Criteria	Criteria Met	
6:00 AM	241	86	WB	350 - No	105 - No	---	525 - No	53 - Yes	Minor St	280 - No	84 - Yes	Minor St	420 - No	42 - Yes	Minor St	
7:00 AM	492	125	WB	350 - Yes	105 - Yes	Both	525 - No	53 - Yes	Minor St	280 - Yes	84 - Yes	Both	420 - Yes	42 - Yes	Both	
8:00 AM	232	79	WB	350 - No	105 - No	---	525 - No	53 - Yes	Minor St	280 - No	84 - No	---	420 - No	42 - Yes	Minor St	
9:00 AM	237	40	WB	350 - No	105 - No	---	525 - No	53 - No	---	280 - No	84 - No	---	420 - No	42 - No	---	
10:00 AM	203	49	WB	350 - No	105 - No	---	525 - No	53 - No	---	280 - No	84 - No	---	420 - No	42 - Yes	Minor St	
11:00 AM	155	37	WB	350 - No	105 - No	---	525 - No	53 - No	---	280 - No	84 - No	---	420 - No	42 - No	---	
12:00 PM	245	51	WB	350 - No	105 - No	---	525 - No	53 - No	---	280 - No	84 - No	---	420 - No	42 - Yes	Minor St	
1:00 PM	229	65	WB	350 - No	105 - No	---	525 - No	53 - No	---	280 - No	84 - No	---	420 - No	42 - Yes	Minor St	
2:00 PM	388	89	WB	350 - Yes	105 - No	Major St	525 - No	53 - Yes	Minor St	280 - Yes	84 - Yes	Both	420 - No	42 - Yes	Minor St	
3:00 PM	460	126	WB	350 - Yes	105 - Yes	Both	525 - No	53 - Yes	Minor St	280 - Yes	84 - Yes	Both	420 - Yes	42 - Yes	Both	
4:00 PM	455	105	WB	350 - Yes	105 - No	Major St	525 - No	53 - Yes	Minor St	280 - Yes	84 - Yes	Both	420 - Yes	42 - Yes	Both	
5:00 PM	460	111	WB	350 - Yes	105 - Yes	Both	525 - No	53 - Yes	Minor St	280 - Yes	84 - Yes	Both	420 - Yes	42 - Yes	Both	

Figure 4C-1. Warrant 2, Four-Hour Vehicular Volume



*Note: 115 vph applies as the lower threshold volume for a minor-street approach with two or more lanes and 80 vph applies as the lower threshold volume for a minor-street approach with one lane.

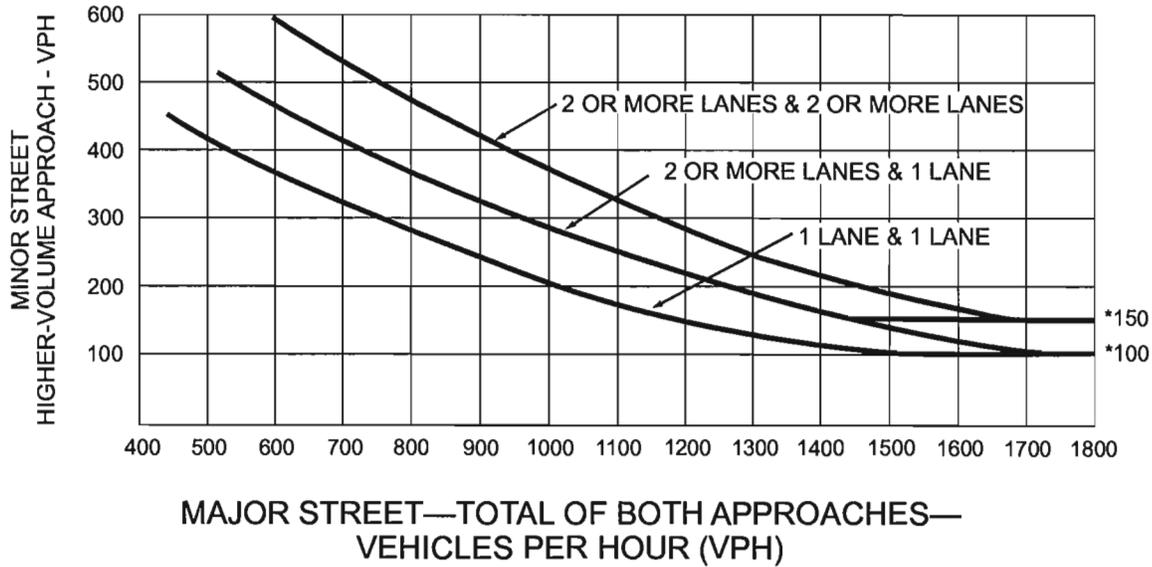
Figure 4C-2. Warrant 2, Four-Hour Vehicular Volume (70% Factor)
(COMMUNITY LESS THAN 10,000 POPULATION OR ABOVE 70 km/h OR ABOVE 40 mph ON MAJOR STREET)



*Note: 80 vph applies as the lower threshold volume for a minor-street approach with two or more lanes and 60 vph applies as the lower threshold volume for a minor-street approach with one lane.

Conclusion: Warrant 2, Four Hour Vehicular Volume - Not Met

Figure 4C-3. Warrant 3, Peak Hour



*Note: 150 vph applies as the lower threshold volume for a minor-street approach with two or more lanes and 100 vph applies as the lower threshold volume for a minor-street approach with one lane.

Figure 4C-4. Warrant 3, Peak Hour (70% Factor)

(COMMUNITY LESS THAN 10,000 POPULATION OR ABOVE 70 km/h OR ABOVE 40 mph ON MAJOR STREET)



*Note: 100 vph applies as the lower threshold volume for a minor-street approach with two or more lanes and 75 vph applies as the lower threshold volume for a minor-street approach with one lane.

Conclusion: Warrant 3, Peak Hour - Not Met



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Exhibit A
Traffic Counts

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 2221 Schrock Road
 Columbus, OH 43229

SR 4 AND MILFORD RD STUDY
 MARYSVILLE, OHIO

File Name : SR 4 AND MILFORD
 Site Code : 10589
 Start Date : 12/7/2011
 Page No : 1

Start Time	MILFORD												ROUTE 4											
	Eastbound						Westbound						Northbound						Southbound					
	Left	Thru	Right	Peds	App. Total		Left	Thru	Right	Peds	App. Total		Left	Thru	Right	Peds	App. Total		Left	Thru	Right	Peds	App. Total	
06:00 AM	2	0	0	0	2	4	1	9	0	0	14	0	27	0	0	0	27	1	14	0	0	0	15	58
06:15 AM	3	1	0	0	4	4	0	9	0	13	18	0	18	0	0	0	18	0	14	1	0	0	15	50
06:30 AM	1	3	1	0	5	5	0	13	0	18	26	0	26	0	0	0	26	5	20	1	0	0	26	75
06:45 AM	2	0	1	0	3	21	2	16	0	39	33	0	33	0	0	0	33	2	73	0	0	0	75	150
Total	8	4	2	0	14	34	3	47	0	84	104	0	104	0	0	0	104	8	121	2	0	0	131	333
07:00 AM	2	0	9	0	11	23	2	24	0	49	69	1	69	1	0	0	75	4	155	0	0	0	159	294
07:15 AM	0	1	3	0	4	15	0	15	0	30	92	0	92	0	0	0	93	6	45	0	0	0	51	178
07:30 AM	1	2	2	0	5	7	0	14	0	21	13	0	13	0	0	0	13	3	24	0	0	0	27	66
07:45 AM	0	3	0	0	3	5	2	15	0	22	38	0	38	0	0	0	39	4	19	0	0	0	23	87
Total	3	6	14	0	23	50	4	68	0	122	212	1	212	1	0	0	220	17	243	0	0	0	260	625
08:00 AM	1	2	0	0	3	6	1	15	0	22	28	0	28	0	0	0	28	5	21	0	0	0	26	79
08:15 AM	0	1	0	0	1	6	0	13	0	19	24	0	24	0	0	0	24	0	28	0	0	0	28	72
08:30 AM	0	3	0	0	3	3	0	12	0	15	36	1	36	1	0	0	37	2	26	0	0	0	28	83
08:45 AM	0	1	0	0	1	9	1	11	0	21	24	0	24	0	0	0	25	5	25	0	0	0	30	77
Total	1	7	0	0	8	24	2	51	0	77	112	1	112	1	0	0	114	12	100	0	0	0	112	311
09:00 AM	0	2	0	0	2	12	0	2	0	14	26	0	26	0	0	0	26	0	21	0	0	0	21	63
09:15 AM	0	2	0	0	2	2	1	4	0	7	25	0	25	0	0	0	25	2	31	0	0	0	33	67
09:30 AM	0	0	0	0	0	8	0	3	0	11	22	0	22	0	0	0	22	5	31	0	0	0	36	69
09:45 AM	0	1	1	0	2	4	0	3	0	7	34	0	34	0	0	0	34	5	29	0	0	0	34	77
Total	0	5	1	0	6	26	1	12	0	39	107	0	107	0	0	0	107	12	112	0	0	0	124	276
10:00 AM	0	1	1	0	2	11	0	4	0	15	32	0	32	0	0	0	32	2	17	0	0	0	19	68
10:15 AM	0	0	0	0	0	6	1	3	0	10	36	0	36	0	0	0	36	6	24	0	0	0	30	76
10:30 AM	0	2	0	0	2	6	2	6	0	14	17	0	17	0	0	0	17	2	24	0	0	0	26	59
10:45 AM	0	1	0	0	1	4	1	4	0	9	22	0	22	0	0	0	22	1	15	0	0	0	16	48
Total	0	4	1	0	5	27	4	17	0	48	107	0	107	0	0	0	107	11	80	0	0	0	91	251
11:00 AM	0	1	0	0	1	2	1	3	0	6	23	0	23	0	0	0	23	3	15	0	0	0	18	48
11:15 AM	0	0	0	0	0	3	1	5	0	9	12	0	12	0	0	0	12	1	12	0	0	0	13	34
11:30 AM	0	0	0	0	0	6	0	4	0	10	19	0	19	0	0	0	19	2	14	0	0	0	16	45
11:45 AM	0	1	0	0	1	5	0	6	0	11	21	0	21	0	0	0	21	3	26	0	0	0	29	62
Total	0	2	0	0	2	16	2	18	0	36	75	0	75	0	0	0	75	9	67	0	0	0	76	189
12:00 PM	0	1	0	0	1	8	2	4	0	14	21	0	21	0	0	0	21	7	28	0	0	0	35	71
12:15 PM	0	0	0	0	0	11	0	2	0	13	29	0	29	0	0	0	30	4	30	0	0	0	34	77
12:30 PM	0	1	0	0	1	6	1	4	0	11	32	0	32	0	0	0	32	5	34	0	0	0	39	83
12:45 PM	0	0	0	0	0	6	1	5	0	12	20	0	20	0	0	0	20	3	25	0	0	0	28	60
Total	0	2	0	0	2	31	4	15	0	50	102	0	102	0	0	0	103	19	117	0	0	0	136	291

ms consultants, inc.
 2221 Schrock Road
 Columbus, OH 43229

SR 4 AND MILFORD RD STUDY
 MARYSVILLE, OHIO

File Name : SR 4 AND MILFORD
 Site Code : 10589
 Start Date : 12/7/2011
 Page No : 2

Groups Printed- ALL VEHICLES

Start Time	MILFORD Eastbound						MILFORD Westbound						ROUTE 4 Northbound						ROUTE 4 Southbound											
	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total
	01:00 PM	0	0	0	0	0	17	2	5	0	24	0	24	0	0	0	24	0	24	0	0	0	24	3	22	0	0	25	73	
01:15 PM	0	0	0	0	0	8	1	4	0	13	0	23	0	0	0	23	4	16	0	0	0	20	4	16	0	0	20	56		
01:30 PM	0	0	0	0	0	7	1	4	0	12	0	24	0	0	0	24	5	41	0	0	0	47	5	41	0	0	47	83		
01:45 PM	0	1	2	0	3	10	1	3	0	14	0	23	0	0	0	23	5	32	0	0	0	37	5	32	0	0	37	77		
Total	0	1	2	0	3	42	5	16	0	63	0	94	0	0	0	94	17	111	1	0	0	129	17	111	1	0	129	289		
02:00 PM	0	1	0	0	1	19	3	6	0	28	0	27	0	0	0	27	0	42	0	0	0	42	0	42	0	0	42	98		
02:15 PM	0	0	2	0	2	12	2	6	0	20	2	41	0	0	0	43	3	41	0	0	0	44	3	41	0	0	44	109		
02:30 PM	0	1	0	0	1	12	2	7	0	21	4	72	0	0	0	76	2	38	1	0	0	41	2	38	1	0	41	139		
02:45 PM	2	3	3	0	8	11	1	6	0	18	1	49	1	0	0	51	6	47	1	0	0	54	6	47	1	0	54	131		
Total	2	5	5	0	12	54	8	25	0	87	7	189	1	0	0	197	11	168	2	0	0	181	11	168	2	0	181	477		
03:00 PM	0	2	0	0	2	7	4	6	0	17	0	45	0	0	0	45	8	36	0	0	0	44	8	36	0	0	44	108		
03:15 PM	0	3	0	0	3	14	1	15	0	30	1	42	0	0	0	43	15	46	0	0	0	61	15	46	0	0	61	137		
03:30 PM	0	1	1	0	2	23	3	16	0	42	0	48	0	0	0	48	18	49	1	0	0	68	18	49	1	0	68	160		
03:45 PM	1	0	2	0	3	24	1	9	0	34	0	55	0	0	0	55	21	61	2	0	0	84	21	61	2	0	84	176		
Total	1	6	3	0	10	68	9	46	0	123	1	190	0	0	0	191	62	192	3	0	0	257	62	192	3	0	257	581		
04:00 PM	2	2	0	0	4	13	2	12	0	27	3	59	0	0	0	62	12	56	0	0	0	68	12	56	0	0	68	161		
04:15 PM	2	2	1	0	5	15	1	8	0	24	0	47	0	0	0	47	14	45	1	0	0	60	14	45	1	0	60	136		
04:30 PM	2	3	3	0	8	19	1	6	0	26	4	33	0	0	0	37	15	39	0	0	0	54	15	39	0	0	54	125		
04:45 PM	0	1	0	0	1	13	2	10	0	25	0	46	0	0	0	46	10	58	1	0	0	69	10	58	1	0	69	141		
Total	6	8	4	0	18	60	6	36	0	102	7	185	0	0	0	192	51	198	2	0	0	251	51	198	2	0	251	563		
05:00 PM	0	1	0	0	1	22	3	5	0	30	2	40	0	0	0	42	13	54	2	0	0	69	13	54	2	0	69	142		
05:15 PM	0	1	2	0	3	14	2	13	0	29	0	49	0	0	0	49	15	72	2	0	0	89	15	72	2	0	89	170		
05:30 PM	1	1	0	0	2	21	1	5	0	27	1	38	0	0	0	39	9	43	2	0	0	54	9	43	2	0	54	122		
05:45 PM	0	1	0	0	1	12	3	7	0	22	1	29	0	0	0	30	26	50	0	0	0	76	26	50	0	0	76	129		
Total	1	4	2	0	7	69	9	30	0	108	4	156	0	0	0	160	63	219	6	0	0	288	63	219	6	0	288	563		
Grand Total	22	54	34	0	110	501	57	381	0	939	28	1633	3	0	0	1664	292	1728	16	0	0	2036	292	1728	16	0	2036	4749		
Approch %	20	49.1	30.9	0		53.4	6.1	40.6	0		1.7	98.1	0.2	0		14.3	84.9	0.8	0	0		6.1	36.4	0.3	0		42.9			
Total %	0.5	1.1	0.7	0		10.5	1.2	8	0		0.6	34.4	0.1	0		35	6.1	36.4	0.3	0	0		6.1	36.4	0.3	0		42.9		



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Exhibit B
Crash Data



OHIO STATE HIGHWAY PATROL

OFFICE OF OPERATIONS - STATISTICAL ANALYSIS UNIT

2006-2011 Union County Crashes In Vicinity US36/SR 4 & Milford Ave/Payne Rd

Date*	Year	Month	Day_of_Week	Hour	Severity	Document #	Report	Agency	Cause	Crash Type*
02-28-2006	2006	February	Tuesday	1100	Injury	20068051462	80-0262-80	OSHP	Following Too Closely	Rear End
08-02-2006	2006	August	Wednesday	1525	Property	20068178440	80-0881-80	OSHP	Failure To Yield	Angle
08-18-2006	2006	August	Friday	1840	Property	20068194098	80-0952-80	OSHP	Failure To Yield	Angle
02-17-2007	2007	February	Saturday	1744	Property	20078035296	07C00087	Marysville PD	Improper Lane Change	Sideswipe-same
07-28-2007	2007	July	Saturday	1804	Injury	20078148624	07C00244	Marysville PD	Failure To Yield	Angle
11-06-2007	2007	November	Tuesday	0635	Injury	20078212069	07C00383	Marysville PD	Failure To Control	Single Vehicle
11-29-2007	2007	November	Thursday	1735	Injury	20076143998	80-1219-80	OSHP	Failure To Yield	Angle
02-22-2008	2008	February	Friday	1740	Property	20086220883	80-0182-80	OSHP	Unsafe Speed	Single Vehicle
07-06-2008	2008	July	Sunday	1212	Injury	20086246881	80-0556-80	OSHP	Failure To Control	Single Vehicle
10-30-2008	2008	October	Thursday	1209	Injury	20088183697	08C00370	Marysville PD	Failure To Yield	Angle
02-25-2009	2009	February	Wednesday	0759	Injury	20098038770	09C00068	Marysville PD	Following Too Closely	Rear End
10-06-2009	2009	October	Tuesday	1850	Property	20096393697	80-0812-80	OSHP	Failure To Yield	Angle
11-20-2009	2009	November	Friday	1421	Property	20098176281	09C00341	Marysville PD	Failure To Yield	Angle
01-24-2010	2010	January	Sunday	1240	Injury	20108008521	10C00034	Marysville PD	Improper Lane Change	Sideswipe-same
01-15-2011	2011	January	Saturday	1442	Property	20118010969	11C00025	Marysville PD	Following Too Closely	Rear End
03-14-2011	2011	March	Monday	1551	Injury	20118057508	80-11-086	Sheriff	Failure To Yield	Angle
09-25-2011	2011	September	Sunday	1540	Injury	20118132452	11C00313	Marysville PD	Ran Stop Sign	Angle
09-19-2011	2011	September	Monday	1630	Property	20118143319	80-11-224	Sheriff	Following Too Closely	Rear End

N = 18

Note: 2011 data is provisional.

* - Data added by ms consultants