APPENDIX

APPENDIX A: ADDITIONAL SITE VISIT

ADDITIONAL M-41 AT M-28 ROUNDABOUT SITE VISIT

The result of the site visit is detailed as followed:

M-41 at M-28 in Marquette, MI

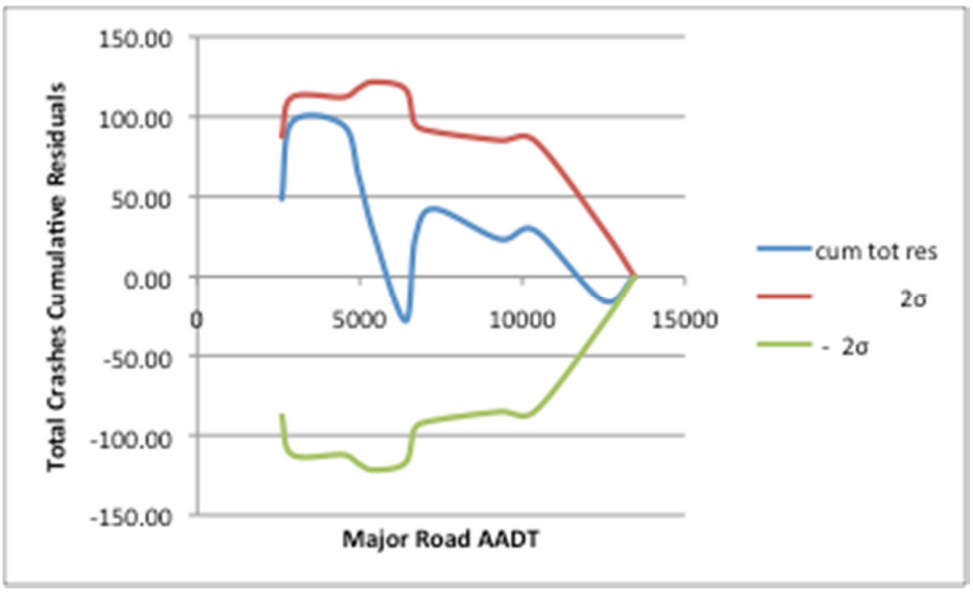
- Overall good yielding behavior, very little conflicts observed
- No pedestrians noted
- As shown in the photo below, the lane assignment sign along the north leg of the roundabout has both lanes as through only lanes, instead of one through lane and one shared through/right turn lane. The lane assignment sign also may block motorists sight of the other two signs.

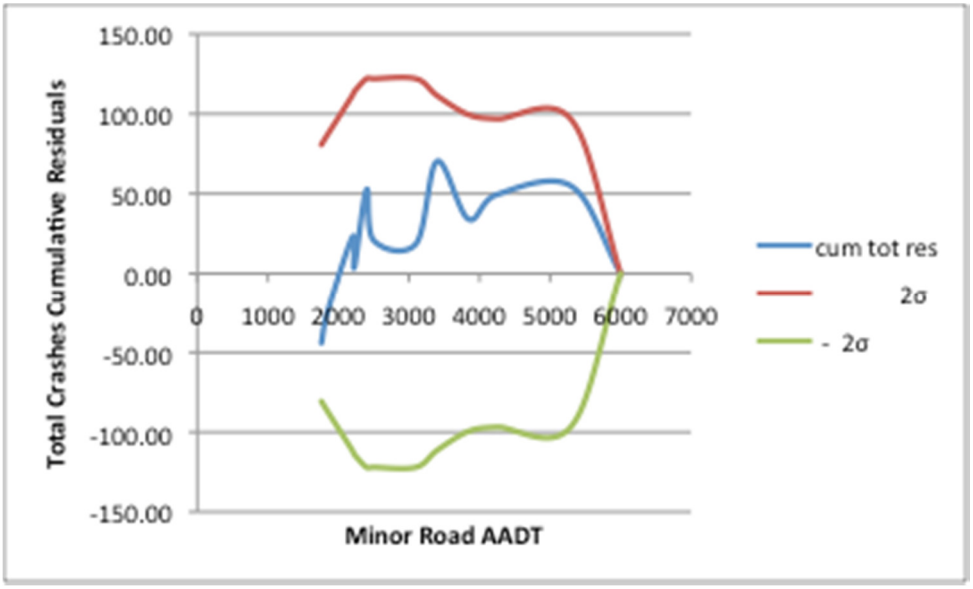
APPENDIX B: CURE PLOTS

CURE PLOTS OF RECALIBRATED SPFS

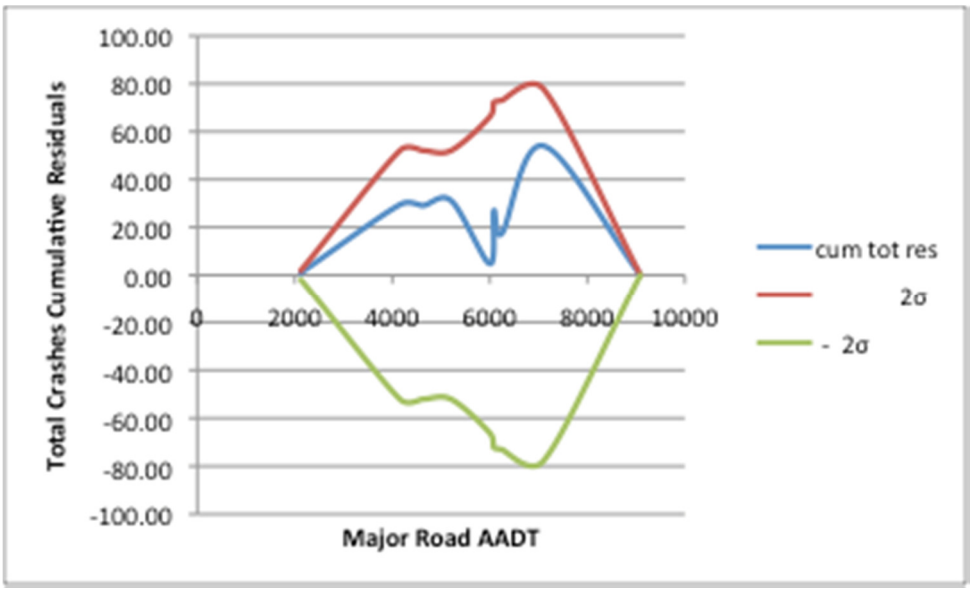
Total Crashes

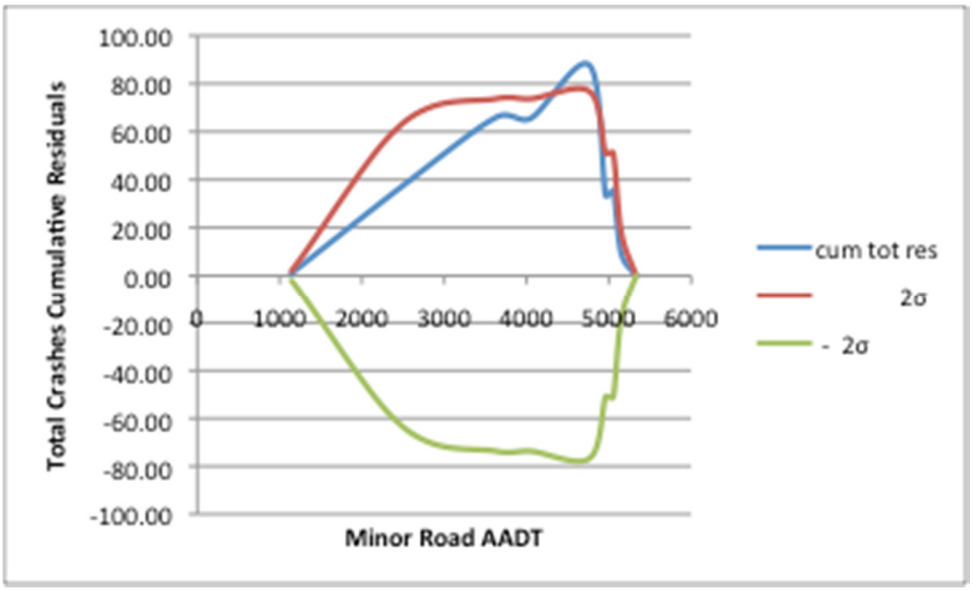
3-legged stop-controlled (urban)



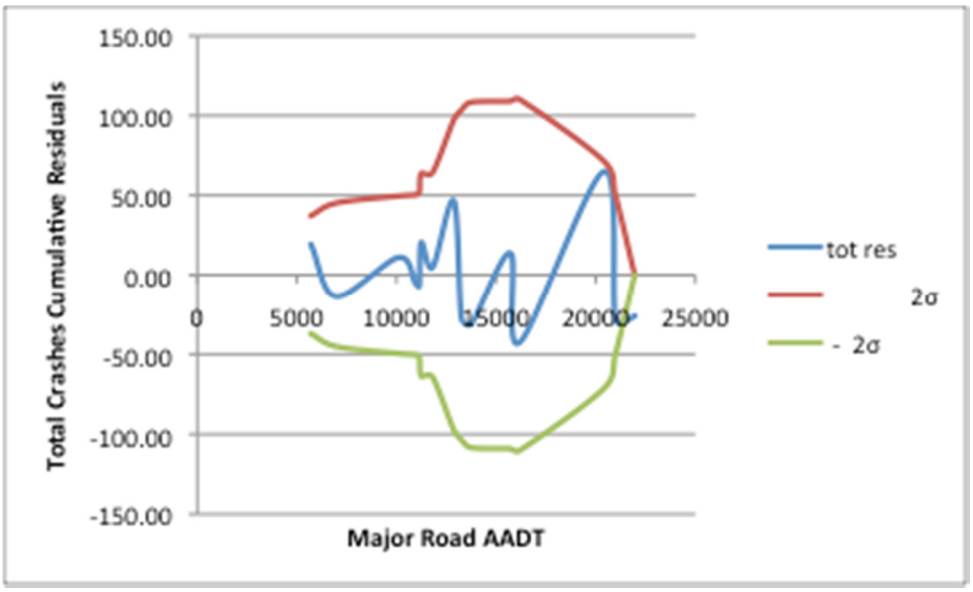


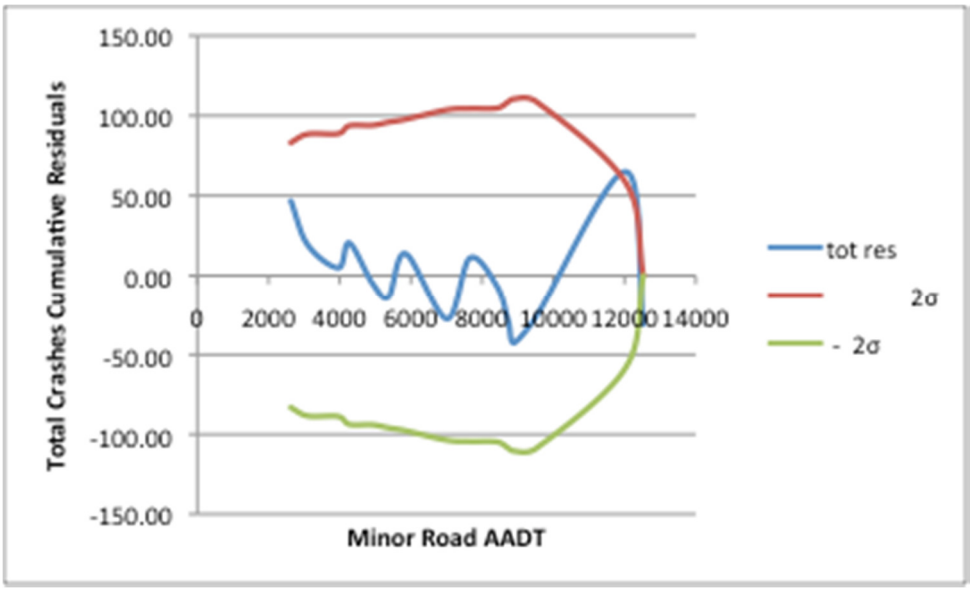
3-legged all-way stop-controlled (rural)



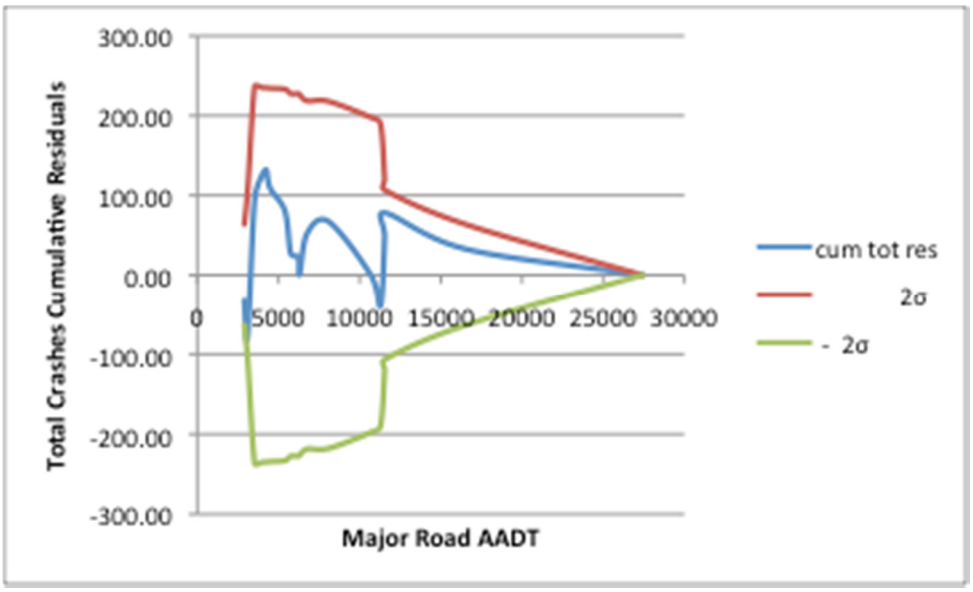


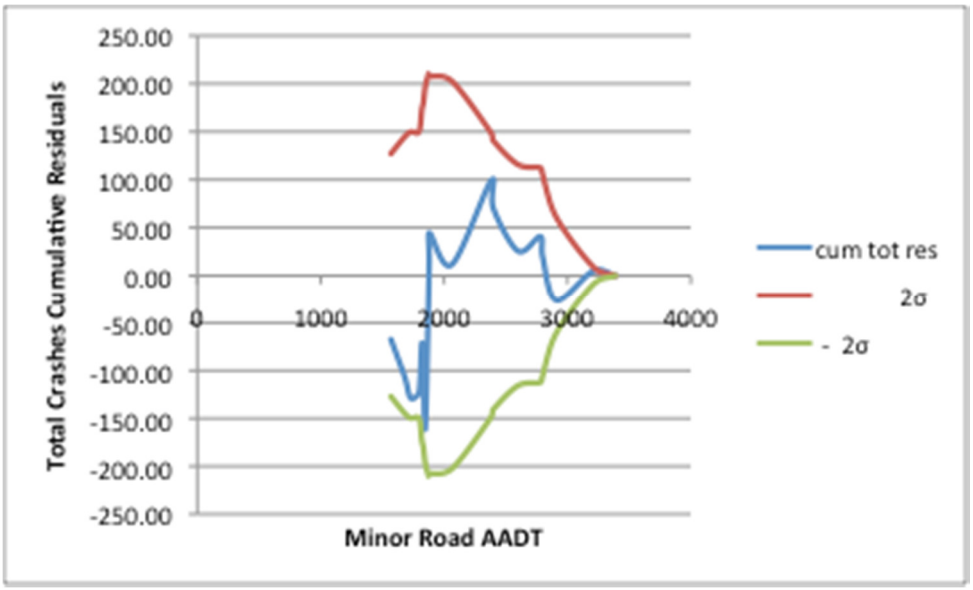
3-legged signalized (rural)



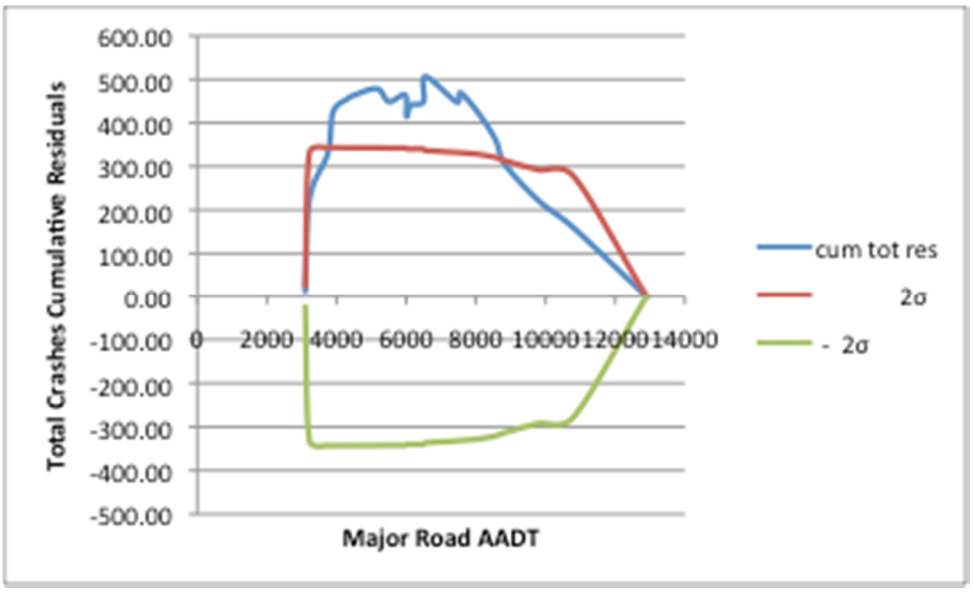


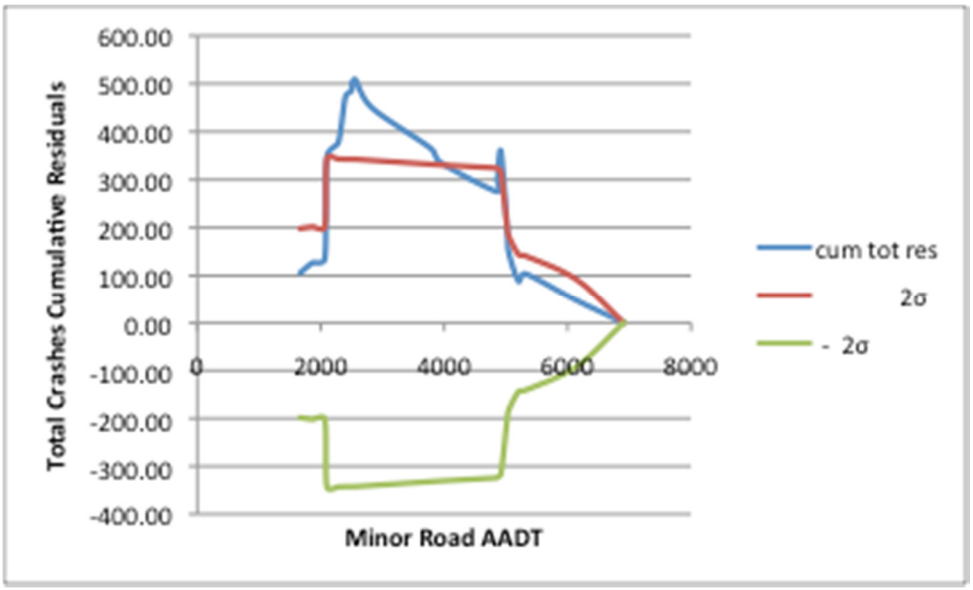
4-legged stop-controlled (urban)



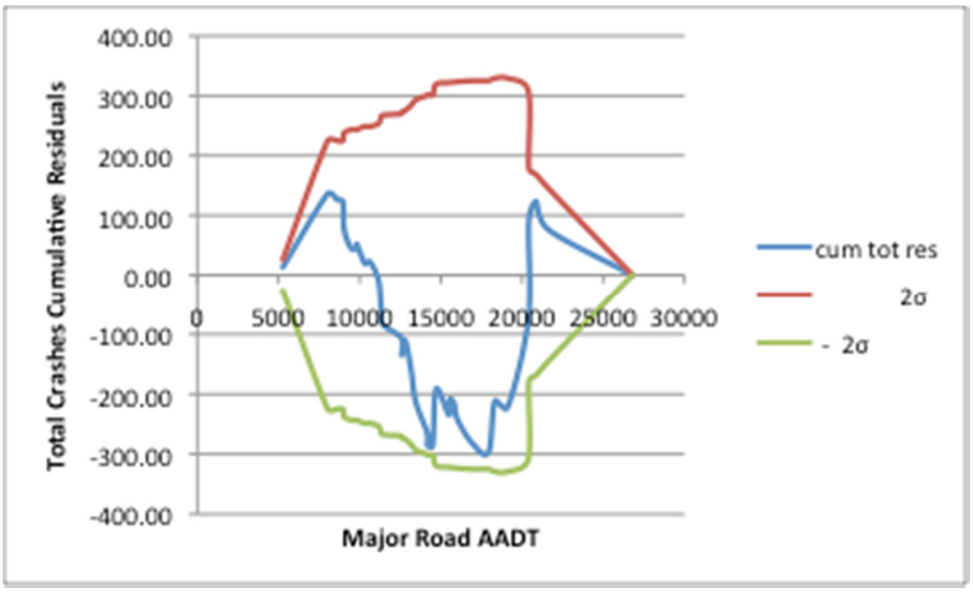


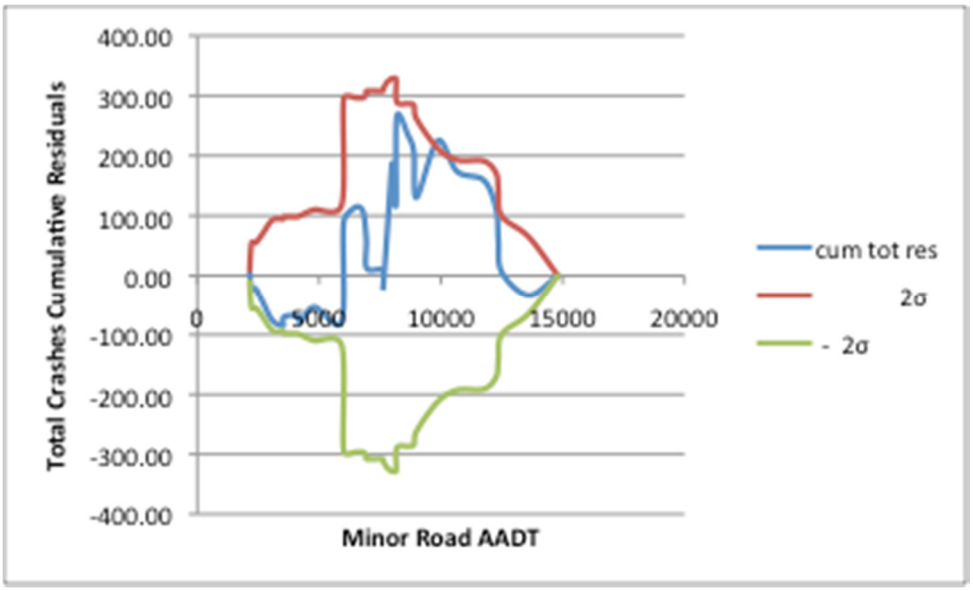
4-legged all-way stop-controlled (rural)





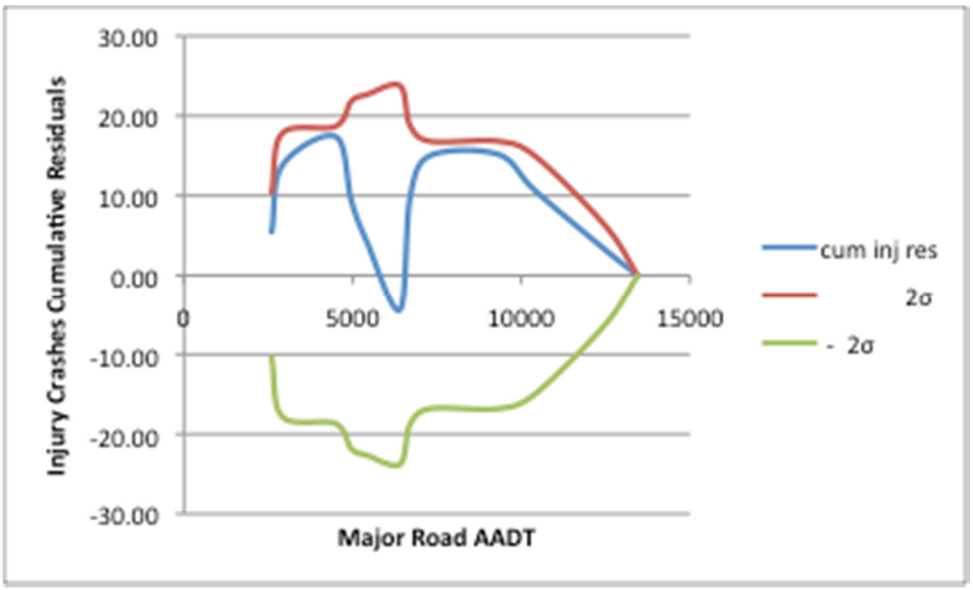
4-legged signalized (rural)

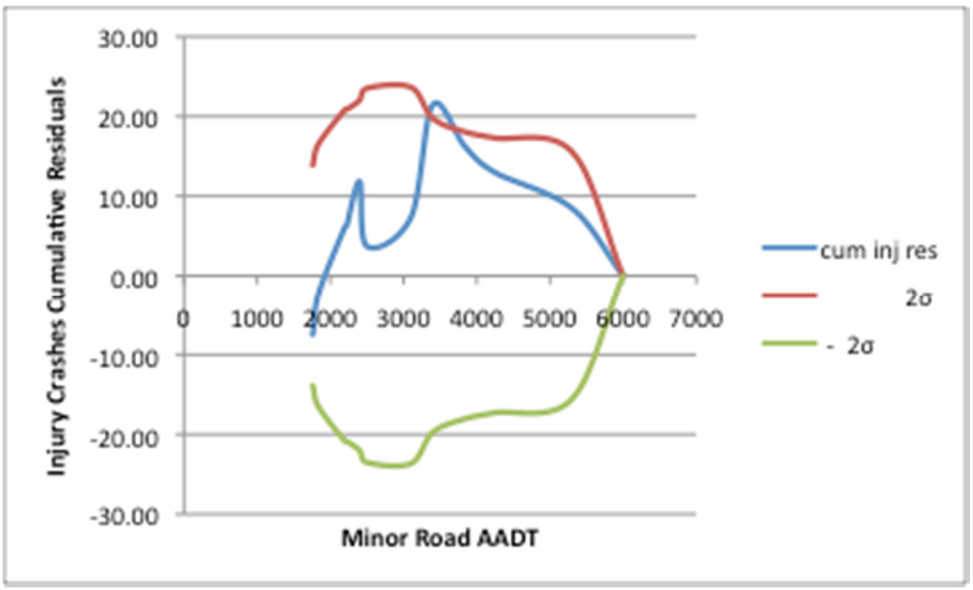




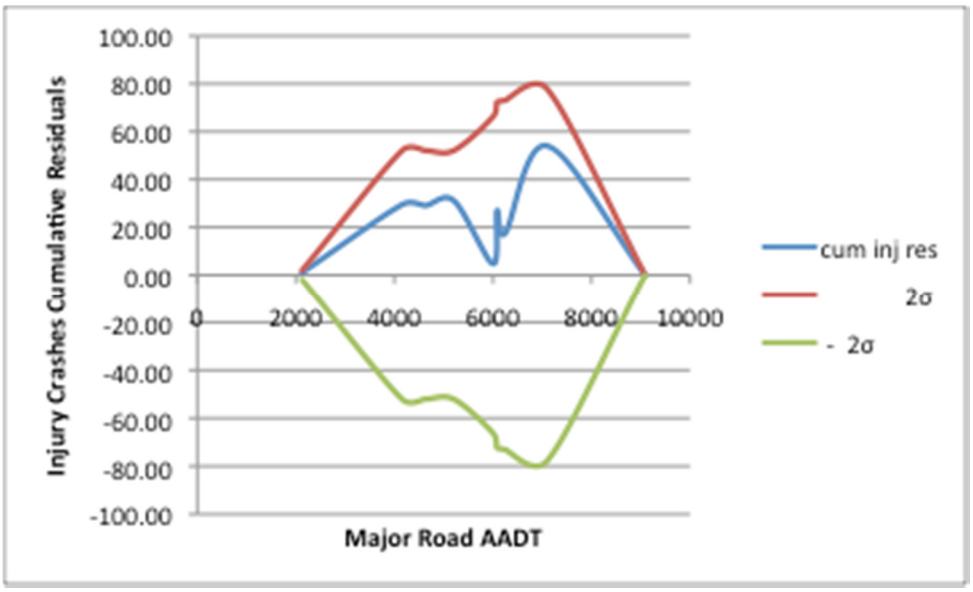
Injury Crashes

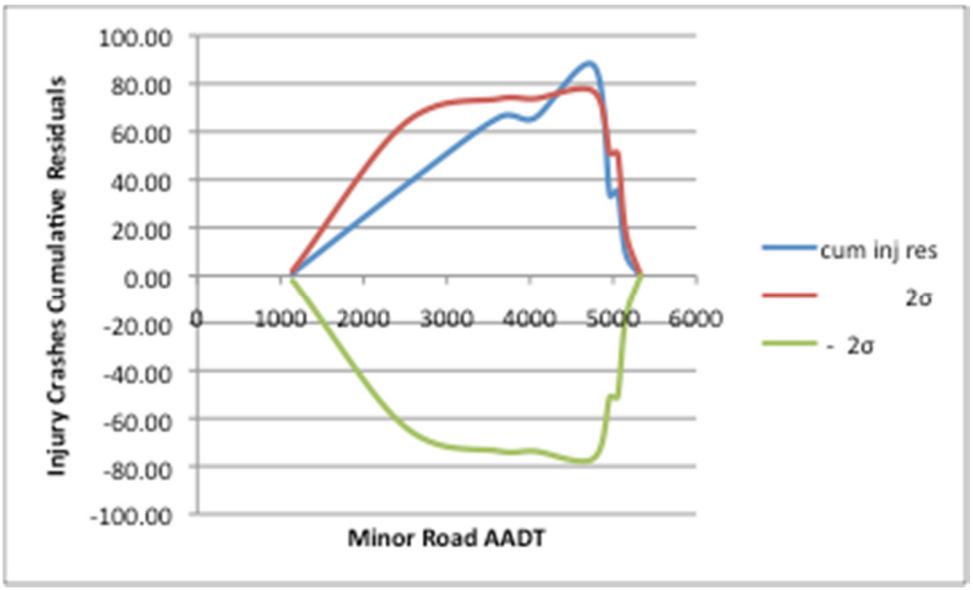
3-legged stop-controlled (urban)



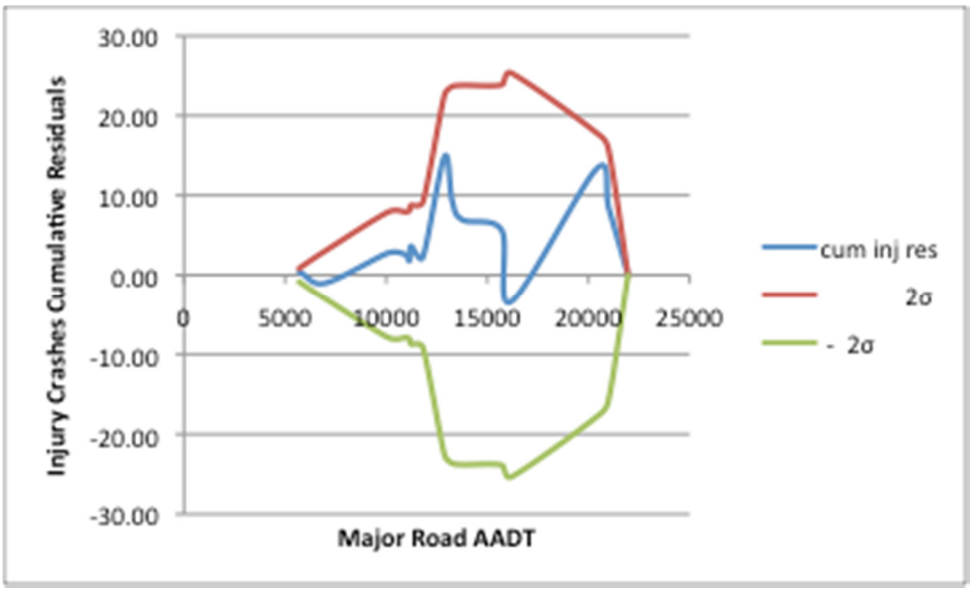


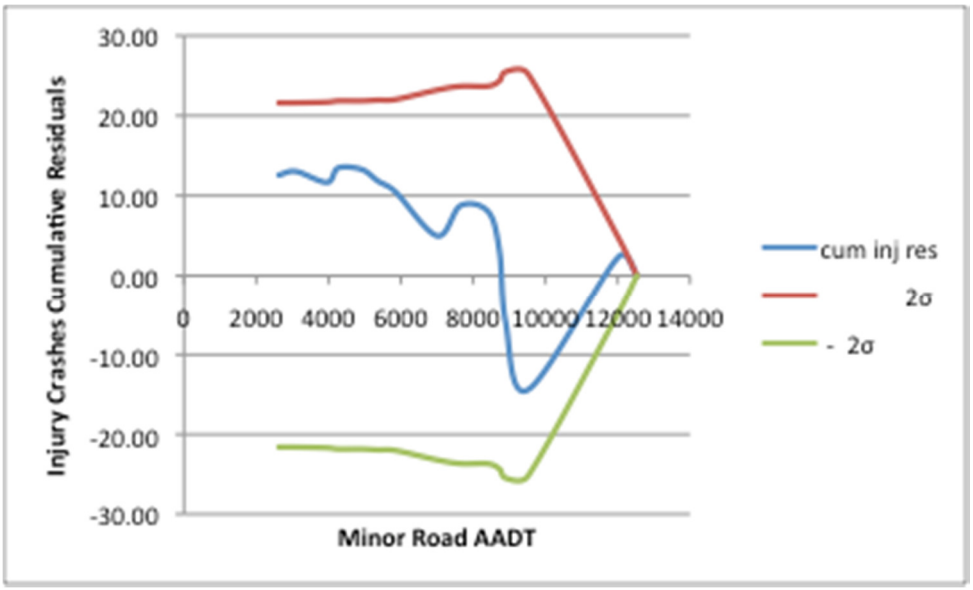
3-legged all-way stop-controlled (rural)



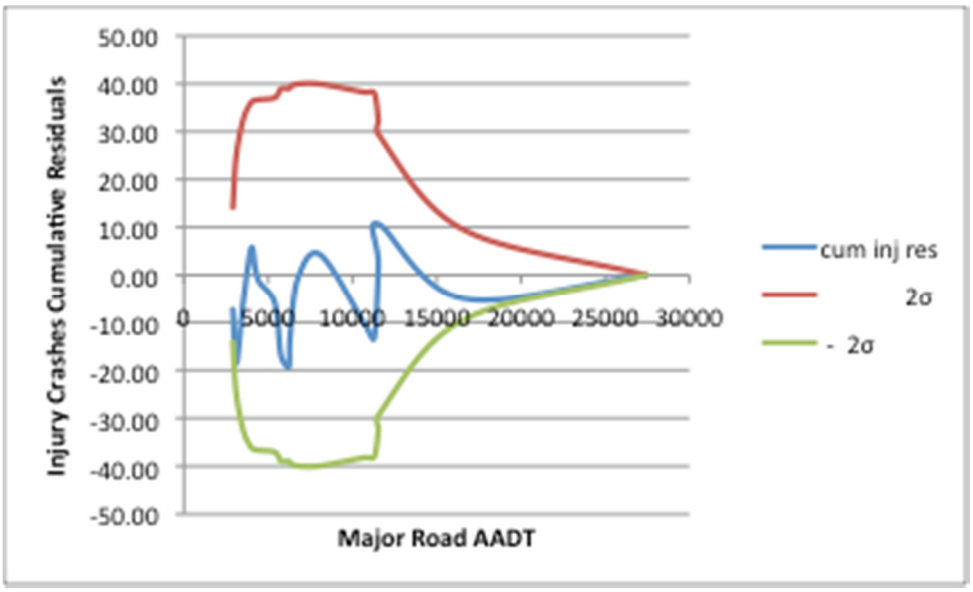


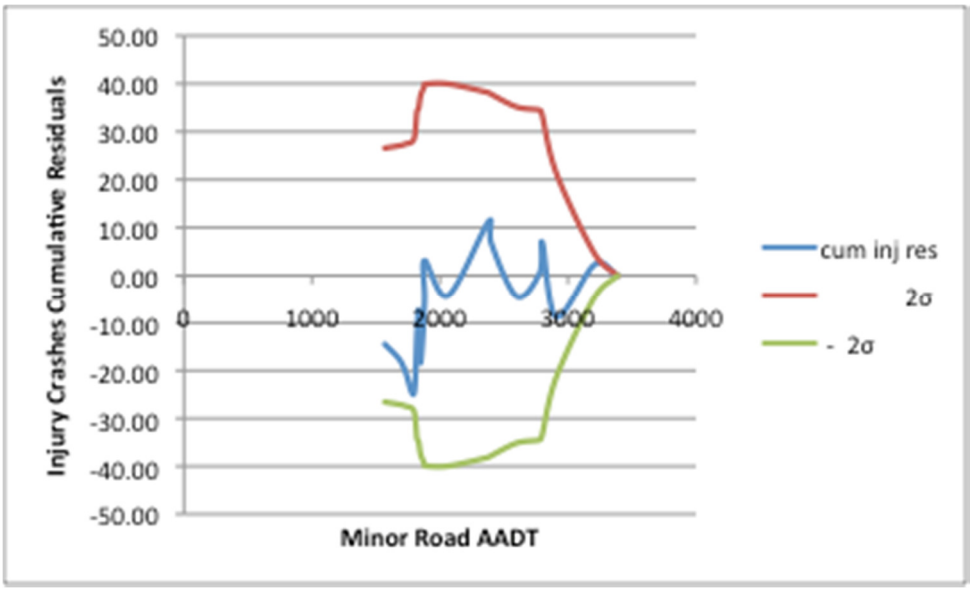
3-legged signalized (rural)



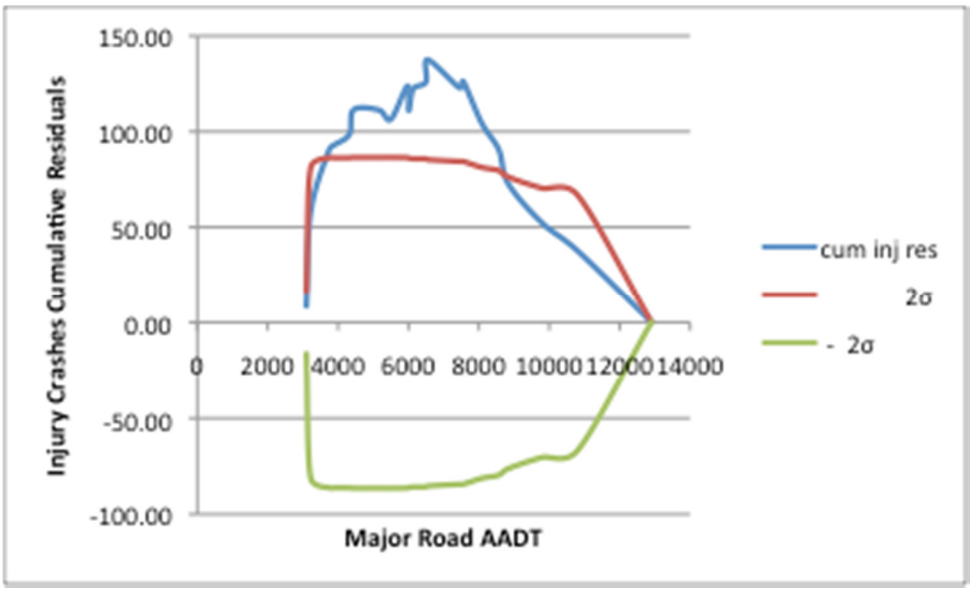


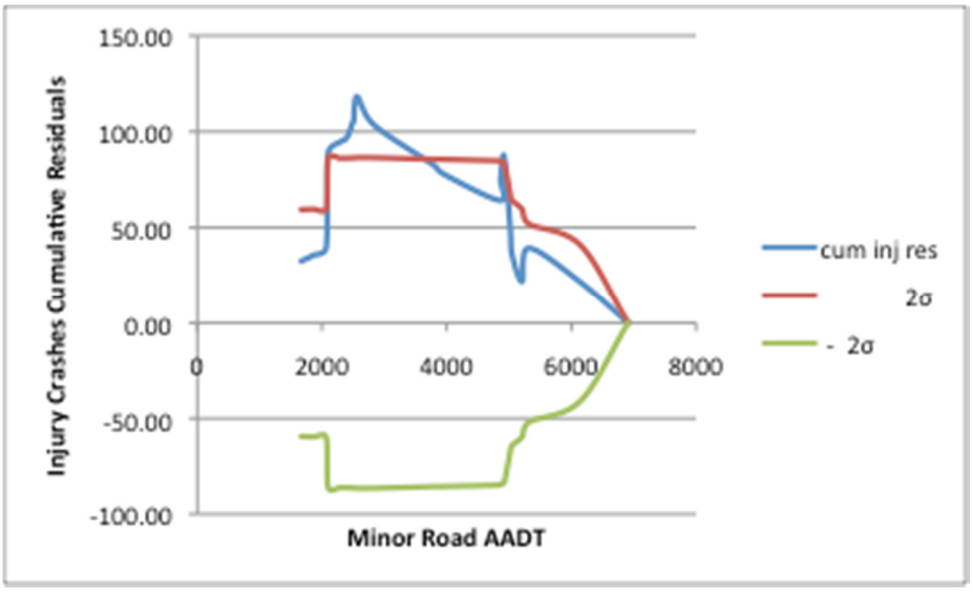
4-legged stop-controlled (urban)



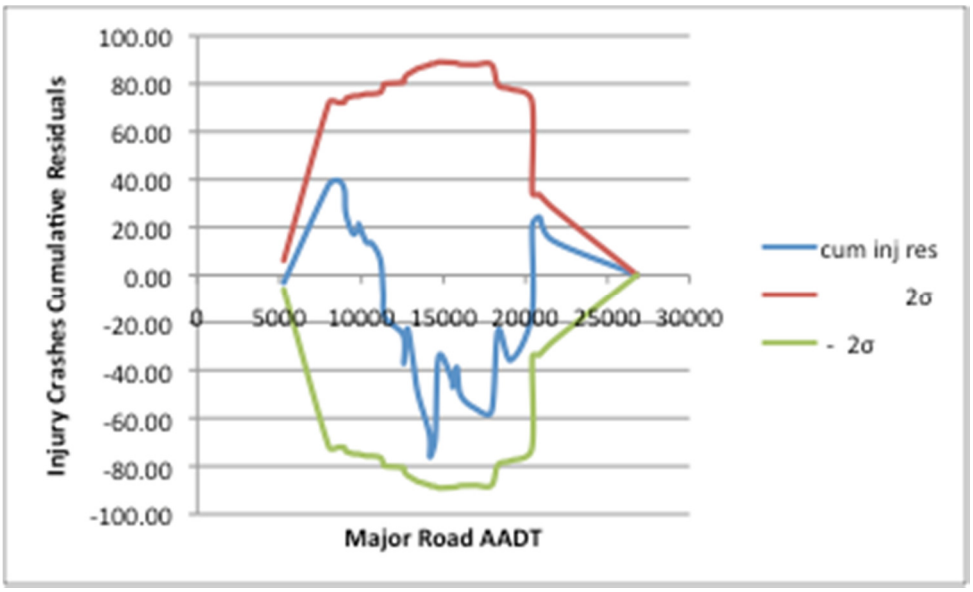


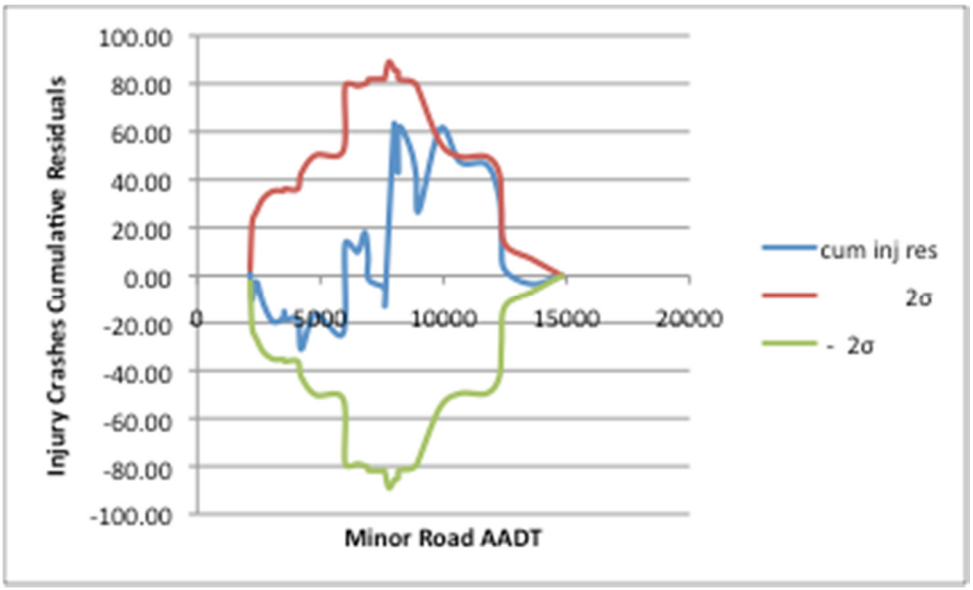
4-legged all-way stop-controlled (rural)





4-legged signalized (rural)





APPENDIX C: ROUNDABOUT DETAILED CRASH DATA

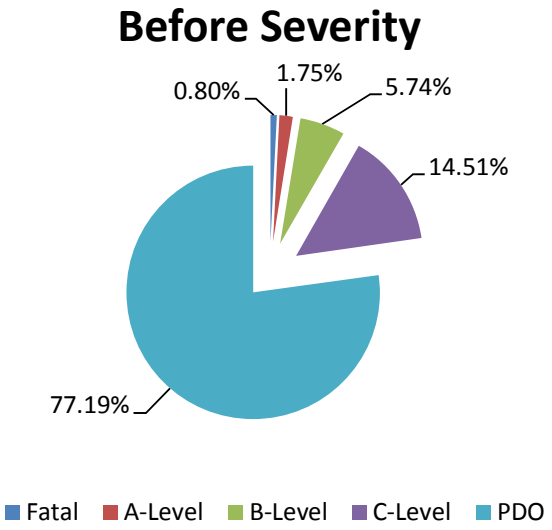
All Roundabouts

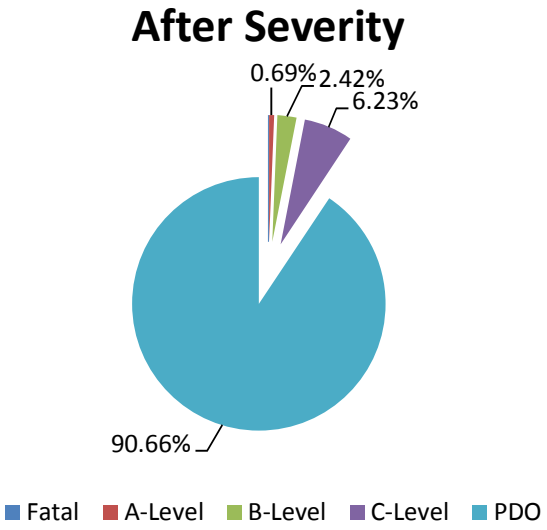
Intersection	Total Crashes	Environment	Before Control Type	Roundabout Type	Construction Year	Before Crashes	After Crashes	Before Years	After Years	Average Annual Total Before	Average Annual Total After	Average Annual Injury Before	Average Annual Injury After	Before ADT	Before Crash Rate	After ADT	After Crash Rate
3rd St & Western Ave	17	Urban	Stop Controlled	single lane	2006	8	8	5	4	1.60	2.00	0.00	0.25	2385	1.84	2000	2.74
68th Ave & Randall St/ State	83	Rural	awsc	double lane	2007	48	27	6	3	8.00	9.00	1.50	1.00	16787	1.31	14100	1.75
7 Mile Rd & Brewer Ave	18	Rural	Stop Controlled	single lane	2007	13	3	6	3	2.17	1.00	0.50	0.00	3615	1.64	2831	0.97
Baldwin Rd/Indianwood Rd & S. Coats Rd	114	Rural	Stop Controlled	double lane	2004	35	64	3	6	11.67	10.67	2.00	1.17	18255	1.75	12160	2.40
Bennett Rd & Hulett Rd	59	Rural	Stop Controlled	single lane	2004	25	27	3	6	8.33	4.50	3.67	0.50	8619	2.65	7536	1.64
Cedar St & Holbrook Dr	28	Rural	Stop Controlled	double lane	2009	19	4	8	1	2.38	4.00	0.13	1.00	10894	0.60	9662	1.13
Cherry St & Jefferson Ave	27	Urban	Signalized	single lane	2007	22	4	6	3	3.67	1.33	1.33	0.00	10705	0.94	10417	0.35
Cooley Lake Rd & Bogie Lake Rd	146	Rural	Signalized	single lane	2007	94	38	6	3	15.67	12.67	5.00	1.33	25040	1.71	21720	1.60
Cooley Lake Rd & Oxbow Lake Rd	35	Rural	Stop Controlled	single lane	2007	17	13	6	3	2.83	4.33	0.50	0.67	11710	0.66	11980	0.99
Geddes Rd & Superior Rd	2	Rural	awsc	double lane	2008	1	1	7	2	0.14	0.50	0.00	0.00	17071	0.02	17140	0.08
Hamburg Rd & Winans Lake Rd	55	Rural	Stop Controlled	single lane	2009	49	3	8	1	6.13	3.00	0.88	0.00	16390	1.02	15155	0.54
Hayes Rd & 25 Mile Rd	63	Rural	Stop Controlled	single lane	2005	23	36	4	5	5.75	7.20	1.25	0.40	12400	1.27	15825	1.25
I-94 Business (Main St) & 5th St	20	Urban	Stop Controlled	single lane	2009	17	0	8	1	2.13	0.00	0.00	0.00	14756	0.39	14615	0.00
I-94 Business (Main St) & Riverview Dr	46	Urban	Signalized	single lane	2009	42	1	8	1	5.25	1.00	0.00	0.00	16478	0.87	16321	0.17
Lake Lansing Rd & Chamberlain Dr	52	Urban	Stop Controlled	double lane	2007	25	20	6	3	4.17	6.67	0.83	1.33	15856	0.72	16641	1.10
M-46/Apple Ave & M-37/Newaygo Rd	59	Rural	awsc	single lane	2009	46	2	8	1	5.75	2.00	1.75	0.00	16301	0.97	15964	0.34
Main St & 3rd St	37	Urban	Stop Controlled	single lane	2003	9	25	2	7	4.50	3.57	0.50	0.29	19656	0.63	14930	0.66
Michigan Ave & Rankin St	74	Urban	Stop Controlled	double lane	2004	34	28	3	6	11.33	4.67	1.67	0.50	2000	15.53	2000	6.39
Michigan Ave & Washington Square	73	Urban	awsc	single lane	2007	44	15	6	3	7.33	5.00	0.33	0.33	8950	2.24	9093	1.51
Nixon Rd & Huron Pkwy	28	Urban	awsc	single lane	2009	26	1	8	1	3.25	1.00	0.75	0.00	13665	0.65	12376	0.22
Old US-27/North Hwy & Livingston Blvd	21	Rural	Stop Controlled	single lane	2006	9	7	5	4	1.80	1.75	0.20	0.25	1500	3.29	1500	3.20
Romeo Plank Rd & 19 Mile Rd	52	Rural	Signalized	double lane	2008	33	17	7	2	4.71	8.50	0.86	0.50	36910	0.35	31100	0.75
Romeo Plank Rd & Cass Ave	89	Rural	Signalized	double lane	2008	52	31	7	2	7.43	15.50	1.71	1.00	27730	0.73	28190	1.51
US-127 BR & Mission St	5	Rural	Stop Controlled	single lane	2009	4	0	8	1	0.50	0.00	0.00	0.00	18250	0.08	16400	0.00
Utica Rd & Dodge Park Rd	122	Urban	Signalized	double lane	2009	109	5	8	1	13.63	5.00	1.38	0.00	31000	1.20	27630	0.50
Wealthy St & Jefferson Ave	9	Urban	Signalized	single lane	2008	130	17	7	2	18.57	8.50	4.86	1.00	28285	1.80	21875	1.06
Wealthy St & Lafayette Ave	158	Urban	Signalized	single lane	2008	8	0	7	2	1.14	0.00	0.00	0.00	30168	0.10	21444	0.00
Willow Hwy & Canal Rd	29	Rural	awsc	single lane	2008	20	7	7	2	2.86	3.50	0.00	0.50	9371	0.84	9784	0.98
Wood St & Sam's Way	23	Urban	Stop Controlled	double lane	2007	7	13	6	3	1.17	4.33	0.17	1.00	7263	0.44	9842	1.21
M-53 SB off ramp & 26-Mile	109	Rural	Stop Controlled	double lane	2009	92	4	8	1	11.50	4.00	2.63	0.00	35986	0.88	36493	0.30
M-53 NB off ramp & 26-Mile	22	Rural	Stop Controlled	double lane	2009	16	3	8	1	2.00	3.00	0.50	0.00	22863	0.24	23494	0.35
I-75 SB off ramp & M-81/Washington Road	7	Rural	Signalized	single lane	2006	5	0	5	4	1.00	0.00	0.00	0.00	19268	0.14	15359	0.00
I-75 NB off ramp & M-81/Washington Road	32	Rural	Signalized	single lane	2006	26	2	5	4	5.20	0.50	0.80	0.00	19320	0.74	13570	0.10
Maple Rd & M-14 EB off ramp	39	Urban	Stop Controlled	double lane	2007	17	20	6	3	2.83	6.67	1.50	0.67	13546	0.57	12953	1.41
Maple Rd & M-14WB off ramp	66	Urban	Stop Controlled	double lane	2007	42	16	6	3	7.00	5.33	1.67	0.67	10241	1.87	9276	1.58
Maple Rd & Drake Rd	454	Urban	Signalized	triple lane	2007	194	202	6	3	32.33	67.33	6.33	4.67	36510	2.43	37200	4.96
Maple Rd & Farmington Rd	466	Urban	Signalized	triple lane	2007	244	181	6	3	40.67	60.33	6.67	4.33	36380	3.06	36640	4.51
Whitmore Lake Rd & Lee Rd	191	Urban	Stop Controlled	triple lane	2006	29	159	5	4	5.80	39.75	1.40	2.50	29493	0.54	28056	3.88
US-23 SB off ramp & Lee Rd	152	Urban	Stop Controlled	triple lane	2006	57	71	5	4	11.40	17.75	1.80	0.00	21434	1.46	25785	1.89
US-23 NB off ramp & Lee Rd	57	Urban	Stop Controlled	triple lane	2006	14	34	5	4	2.80	8.50	0.80	0.00	22565	0.34	26571	0.88
14 Mile Rd & Farmington Rd	393	Urban	Signalized	triple lane	2008	255	115	7	2	36.43	57.50	8.57	3.00	35460	2.81	32960	4.78

Rural Roundabouts

In the "before" period, 22.81% of the crashes resulted in an injury or a fatality. In the "after" period only 9.34% of the crashes resulted in an injury or a fatality. There were also five fatalities (0.80%) observed in the "before" period and in the "after" period there were no observed fatal crashes.

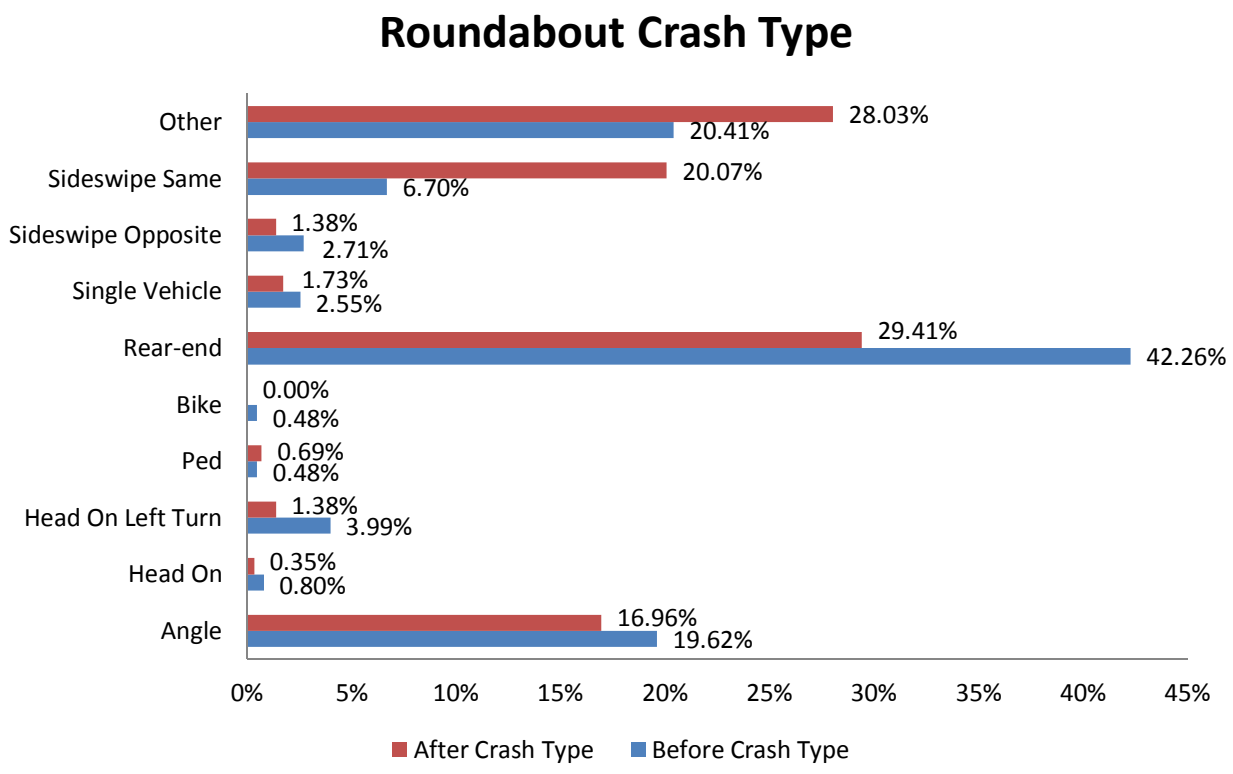
Severity Type	"Before" Severity		"After" Severity	
Fatal	5	0.80%	0	0.00%
A-Level	11	1.75%	2	0.69%
B-Level	36	5.74%	7	2.42%
C-Level	91	14.51%	18	6.23%
PDO	484	77.19%	262	90.66%
Total	627	100.00%	289	100.00%





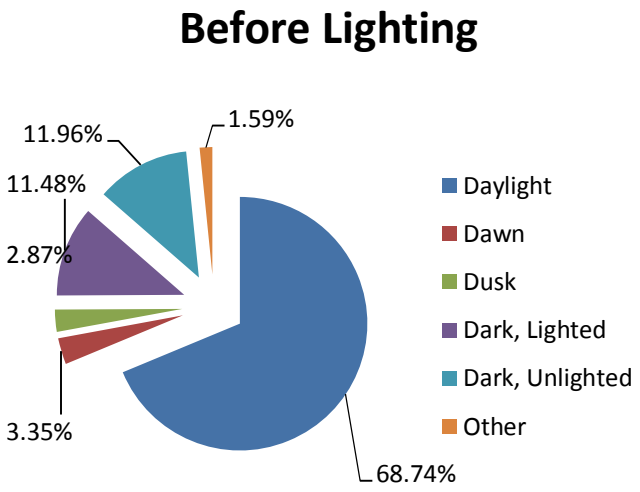
The largest change in the crash types came from the crash types that often result in the greatest severity of crashes (angle, head-on, head-on left turn, pedestrian, and bike). Most notably, the percent of angle crashes was reduced by over 2.66%. This number may also be greater than 2.66%, because a common error in recording crash types is mistaking sideswipe crashes as angle crashes especially since an angle crash cannot occur in a roundabout.

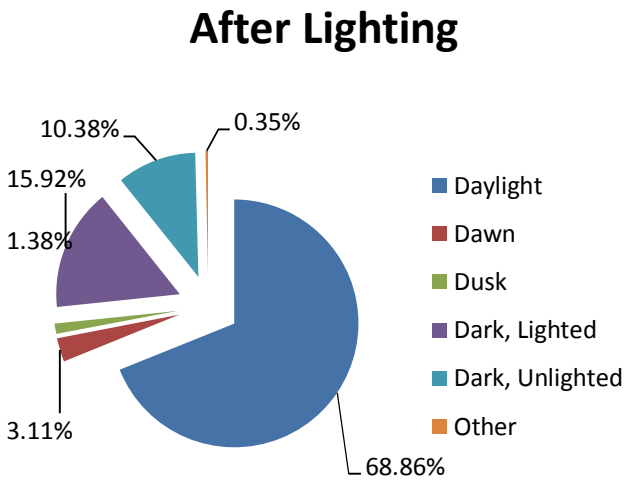
Crash Type	"Before" Type		"After" Type	
Angle	123	19.62%	49	16.96%
Head On	5	0.80%	1	0.35%
Head On Left turn	25	3.99%	4	1.38%
Pedestrian	3	0.48%	2	0.69%
Bike	3	0.48%	0	0.00%
Rear-end	265	42.26%	85	29.41%
Single Vehicle	16	2.55%	5	1.73%
Sideswipe Opposite	17	2.71%	4	1.38%
Sideswipe Same	42	6.70%	58	20.07%
Other	128	20.41%	81	28.03%
Total	627	100.00%	289	100.00%



The results of the analysis show that the percent of crashes that occurred during the daytime remained almost the same in the "before" and "after" conditions (68.74% "before" versus 68.86% "after"). A larger percent of crashes occurred during "dark, lighted" conditions in the "after" period (15.92%) than in the "before" period (11.48%). Despite the lighting requirements at roundabout intersections, almost the same percent of crashes occur during the nighttime conditions in the "before" condition as they do in the "after" condition (31.26% "before" versus 31.14% "after").

Lighting	"Before"		"After"	
Daylight	431	68.74%	199	68.86%
Dawn	21	3.35%	9	3.11%
Dusk	18	2.87%	4	1.38%
Dark, Lighted	72	11.48%	46	15.92%
Dark, Unlighted	75	11.96%	30	10.38%
Other	10	1.59%	1	0.35%
Total	627	100.00%	289	100.00%

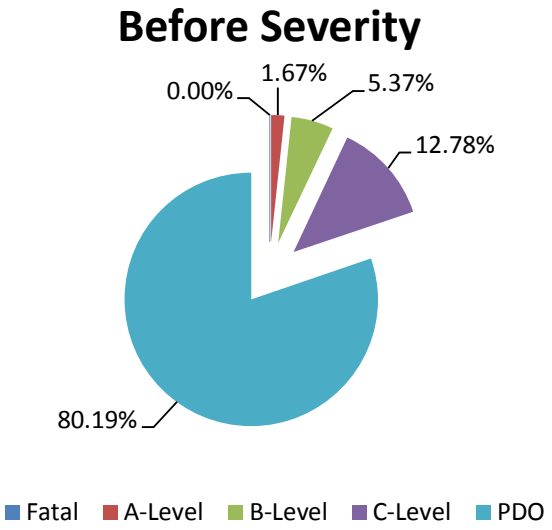


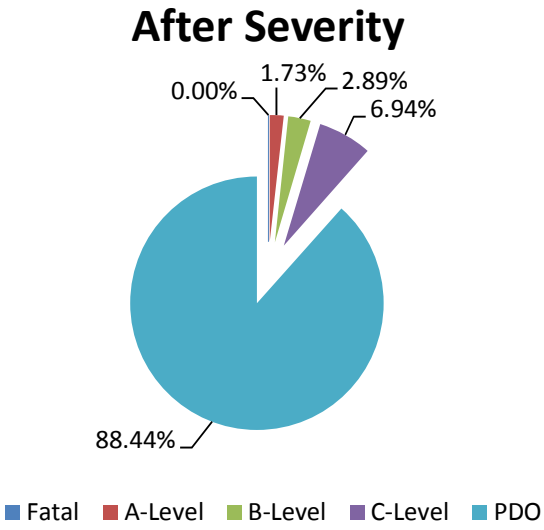


Urban Roundabouts

In the "before" period, 19.81% of the crashes resulted in an injury or a fatality. In the "after" period only 11.56% of the crashes resulted in an injury or a fatality. There were no observed fatalities in either the "before" or "after" time periods.

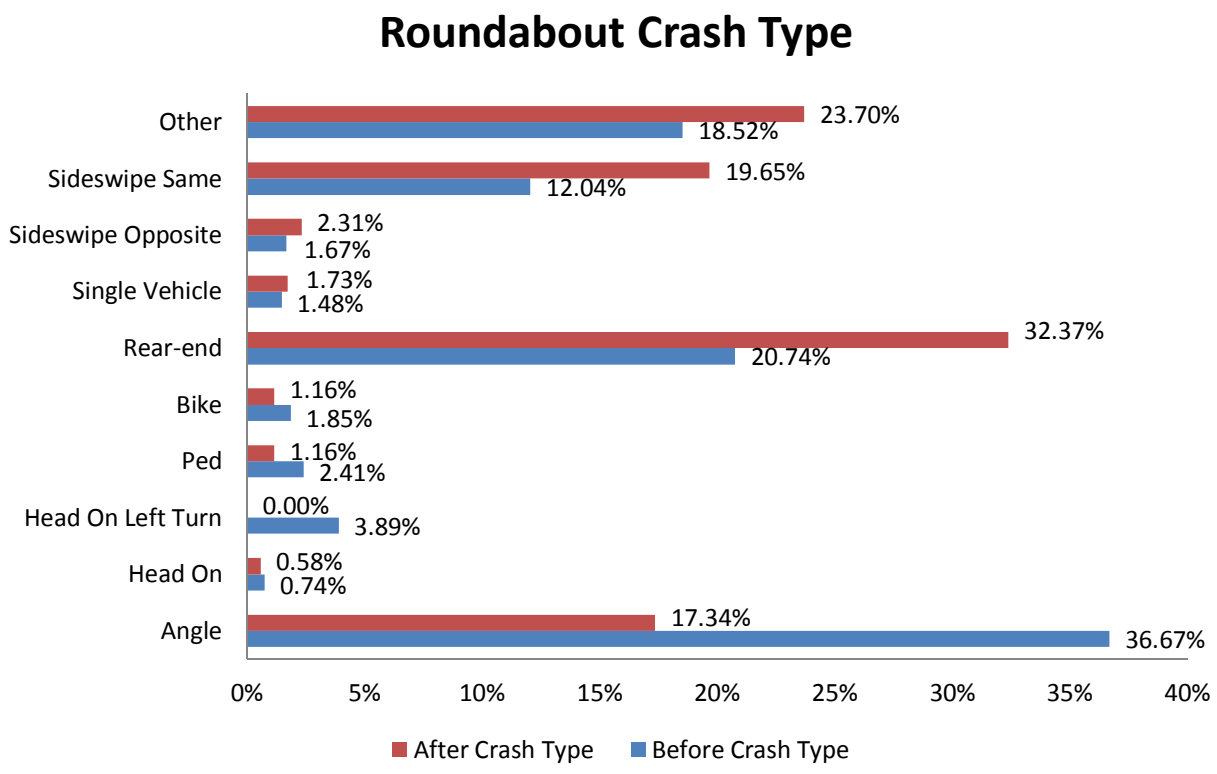
Severity Type	"Before" Severity		"After" Severity	
Fatal	0	0.00%	0	0.00%
A-Level	9	1.67%	3	1.73%
B-Level	29	5.37%	5	2.89%
C-Level	69	12.78%	12	6.94%
PDO	433	80.19%	153	88.44%
Total	540	100.00%	173	100.00%





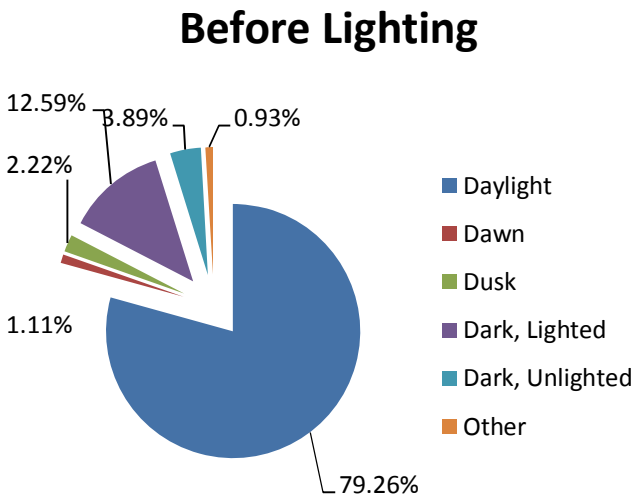
The largest change in the crash types came from the crash types that often result in the greatest severity of crashes (angle, head-on, head-on left turn, pedestrian, and bike). Most notably, the percent of angle crashes was reduced by 19.33%. This number may also be greater than 19.33%, because a common error in recording crash types is mistaking sideswipe crashes as angle crashes especially since an angle crash cannot occur in a roundabout.

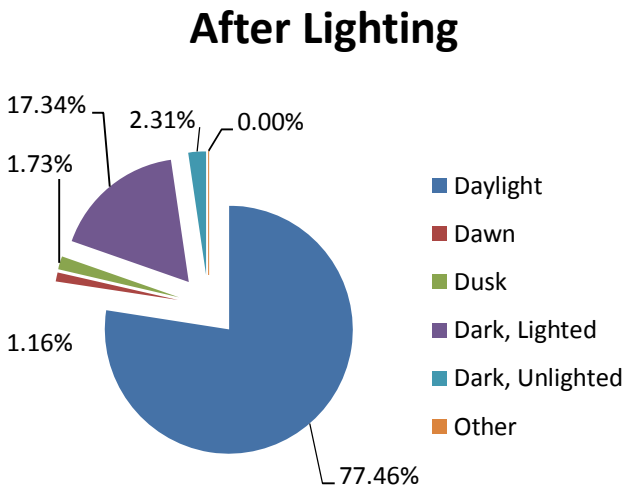
Crash Type	"Before" Type		"After" Type	
Angle	198	36.67%	30	17.34%
Head On	4	0.74%	1	0.58%
Head On Left turn	21	3.89%	0	0.00%
Pedestrian	13	2.41%	2	1.16%
Bike	10	1.85%	2	1.16%
Rear-end	112	20.74%	56	32.37%
Single Vehicle	8	1.48%	3	1.73%
Sideswipe Opposite	9	1.67%	4	2.31%
Sideswipe Same	65	12.04%	34	19.65%
Other	100	18.52%	41	23.70%
Total	540	100.00%	173	100.00%



The results of the analysis show that the percent of crashes that occurred during the daytime remained almost the same in the "before" and "after" conditions (79.26% "before" versus 77.46% "after"). A larger percent of crashes occurred during "dark, lighted" conditions in the "after" period (17.34%) than in the "before" period (12.59%). Despite the lighting requirements at roundabout intersections, almost the same percent of crashes occur during the nighttime conditions in the "before" condition as they do in the "after" condition (20.74% "before" versus 22.54% "after").

Lighting	"Before"		"After"	
Daylight	428	79.26%	134	77.46%
Dawn	6	1.11%	2	1.16%
Dusk	12	2.22%	3	1.73%
Dark, Lighted	68	12.59%	30	17.34%
Dark, Unlighted	21	3.89%	4	2.31%
Other	5	0.93%	0	0.00%
Total	540	100.00%	173	100.00%

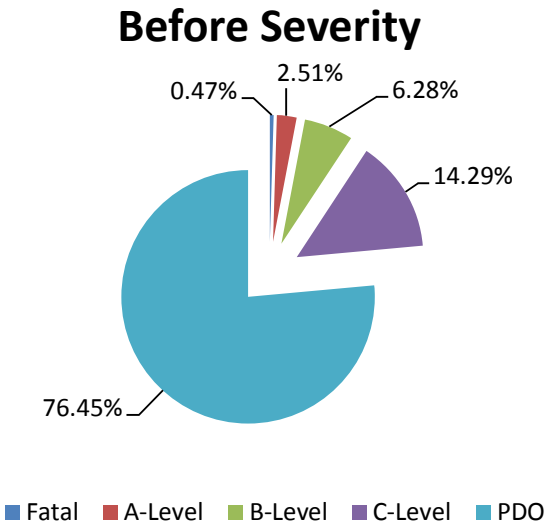


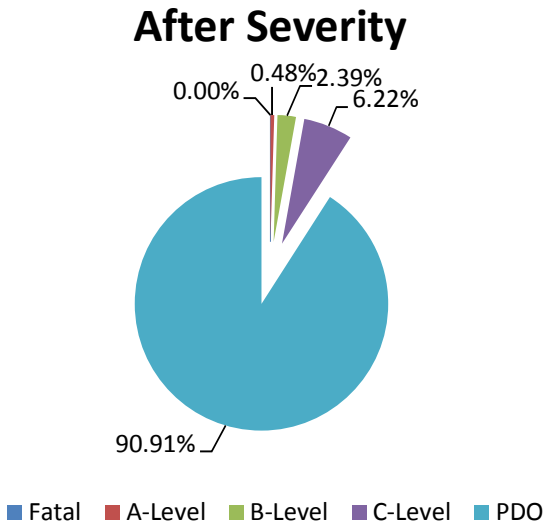


Single Lane Roundabouts

In the "before" period, 23.55% of the crashes resulted in an injury or a fatality. In the "after" period only 9.09% of the crashes resulted in an injury or a fatality. There were also three fatalities (0.47%) observed in the "before" period and in the "after" period there were no observed fatal crashes.

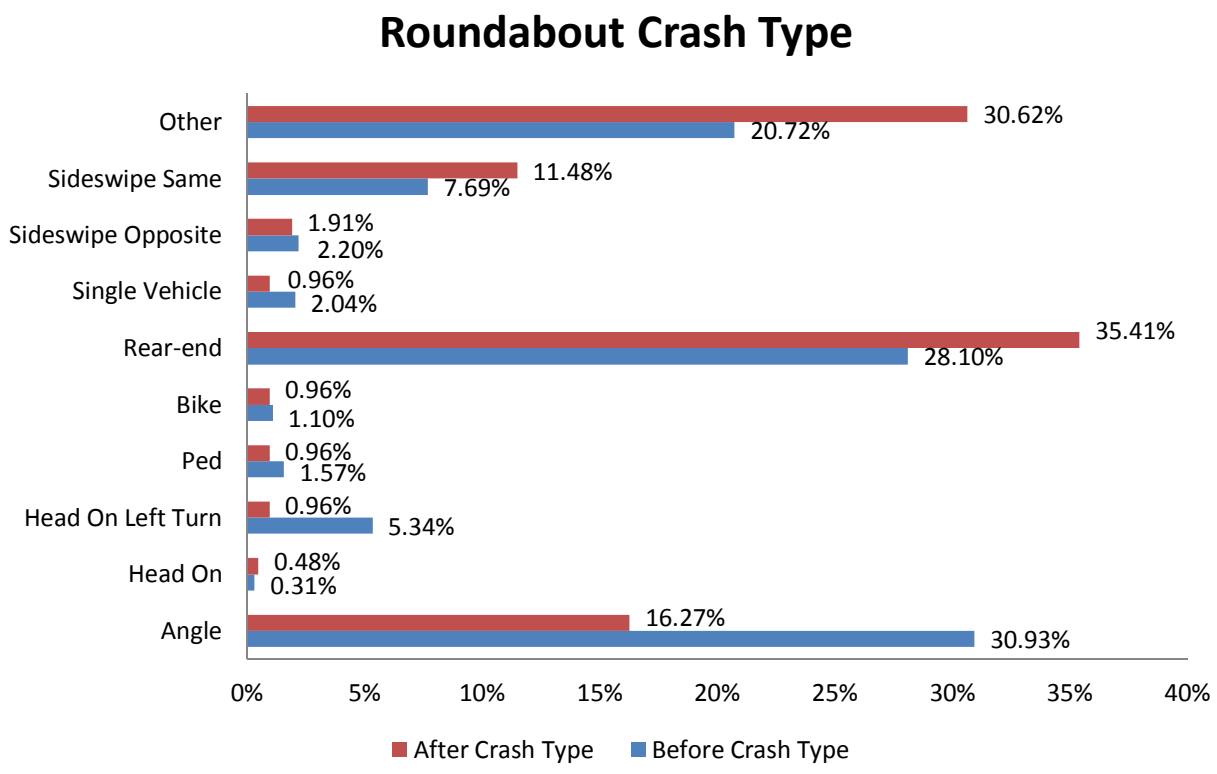
Severity Type	"Before" Severity		"After" Severity	
Fatal	3	0.47%	0	0.00%
A-Level	16	2.51%	1	0.48%
B-Level	40	6.28%	5	2.39%
C-Level	91	14.29%	13	6.22%
PDO	487	76.45%	190	90.91%
Total	637	100.00%	209	100.00%





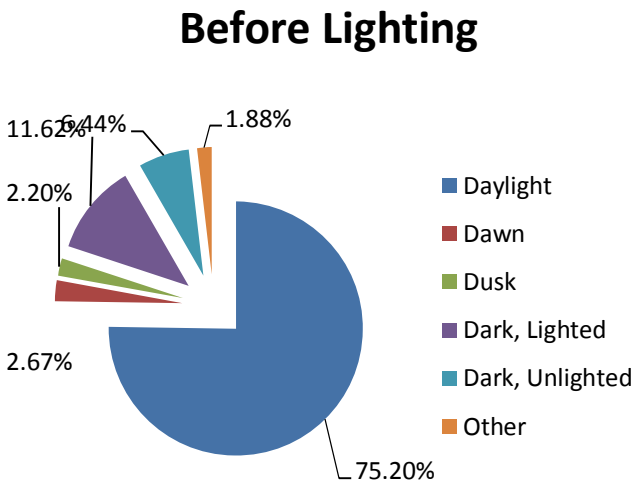
The largest change in the crash types came from the crash types that often result in the greatest severity of crashes (angle, head-on, head-on left turn, pedestrian, and bike). Most notably, the percent of angle crashes was reduced by 14.66%. This number may also be greater than 14.66%, because a common error in recording crash types is mistaking sideswipe crashes as angle crashes especially since an angle crash cannot occur in a roundabout.

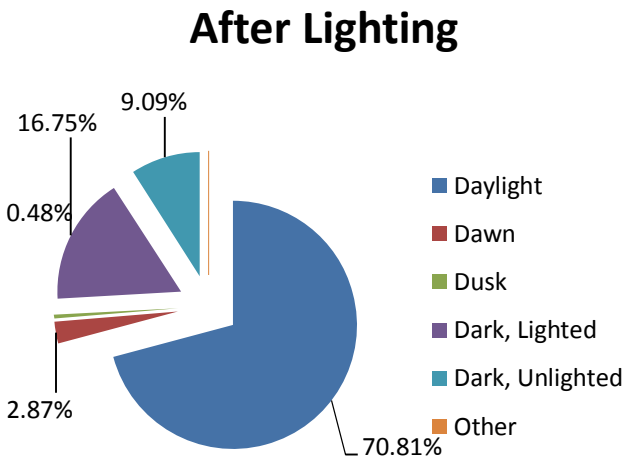
Crash Type	"Before" Type		"After" Type	
Angle	197	30.93%	34	16.27%
Head On	2	0.31%	1	0.48%
Head On Left turn	34	5.34%	2	0.96%
Pedestrian	10	1.57%	2	0.96%
Bike	7	1.10%	2	0.96%
Rear-end	179	28.10%	74	35.41%
Single Vehicle	13	2.04%	2	0.96%
Sideswipe Opposite	14	2.20%	4	1.91%
Sideswipe Same	49	7.69%	24	11.48%
Other	132	20.72%	64	30.62%
Total	637	100.00%	209	100.00%



The results of the analysis show that the percent of crashes that occurred during the daytime remained almost the same in the "before" and "after" conditions (75.20% "before" versus 70.81% "after"). A larger percent of crashes occurred during "dark, lighted" conditions in the "after" period (16.75%) than in the "before" period (11.62%). Despite the lighting requirements at roundabout intersections, almost the same percent of crashes occur during the nighttime conditions in the "before" condition as they do in the "after" condition (24.80% "before" versus 29.19% "after").

Lighting	"Before"		"After"	
Daylight	479	75.20%	148	70.81%
Dawn	17	2.67%	6	2.87%
Dusk	14	2.20%	1	0.48%
Dark, Lighted	74	11.62%	35	16.75%
Dark, Unlighted	41	6.44%	19	9.09%
Other	12	1.88%	0	0.00%
Total	637	100.00%	209	100.00%

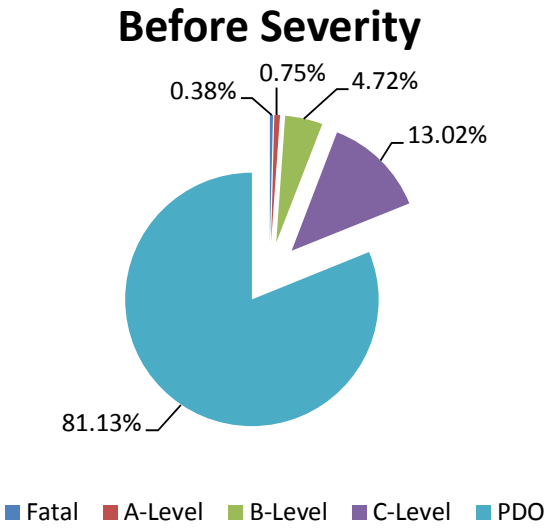


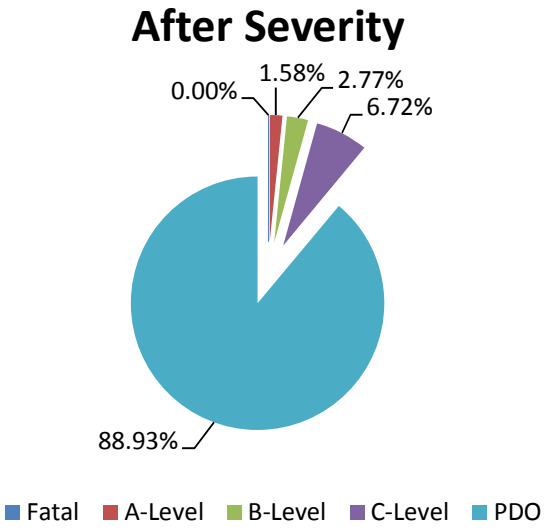


Double Lane Roundabouts

In the "before" period, 18.87% of the crashes resulted in an injury or a fatality. In the "after" period only 11.07% of the crashes resulted in an injury or a fatality. There were also two fatalities (0.38%) observed in the "before" period and in the "after" period there were no observed fatal crashes.

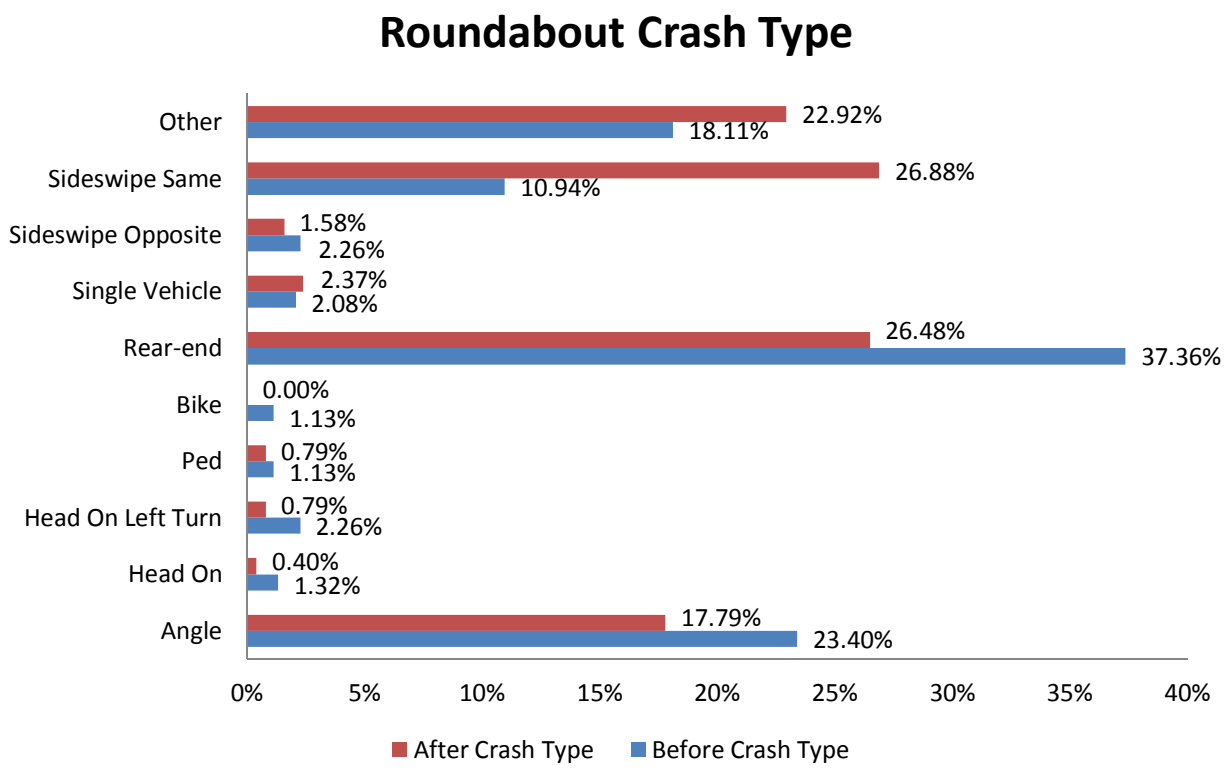
Severity Type	"Before" Severity		"After" Severity	
Fatal	2	0.38%	0	0.00%
A-Level	4	0.75%	4	1.58%
B-Level	25	4.72%	7	2.77%
C-Level	69	13.02%	17	6.72%
PDO	430	81.13%	225	88.93%
Total	530	100.00%	253	100.00%





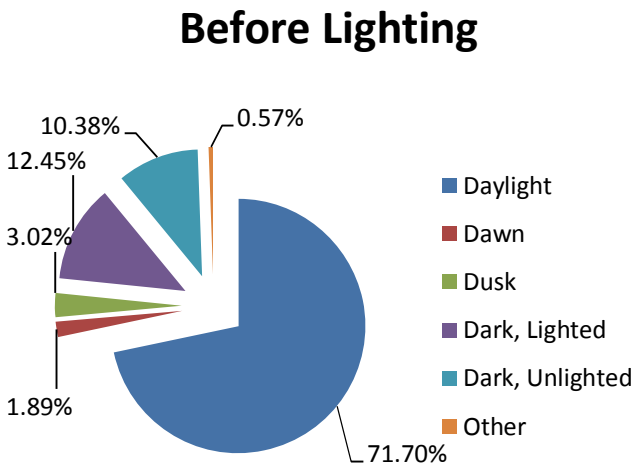
The largest change in the crash types came from the crash types that often result in the greatest severity of crashes (angle, head-on, head-on left turn, pedestrian, and bike). Most notably, the percent of angle crashes was reduced by 5.61%. This number may also be greater than 5.61%, because a common error in recording crash types is mistaking sideswipe crashes as angle crashes especially since an angle crash cannot occur in a roundabout.

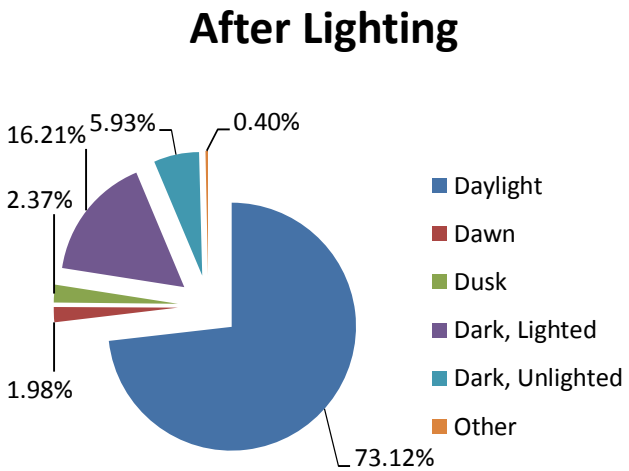
Crash Type	"Before" Type		"After" Type	
Angle	124	23.40%	45	17.79%
Head On	7	1.32%	1	0.40%
Head On Left turn	12	2.26%	2	0.79%
Pedestrian	6	1.13%	2	0.79%
Bike	6	1.13%	0	0.00%
Rear-end	198	37.36%	67	26.48%
Single Vehicle	11	2.08%	6	2.37%
Sideswipe Opposite	12	2.26%	4	1.58%
Sideswipe Same	58	10.94%	68	26.88%
Other	96	18.11%	58	22.92%
Total	530	100.00%	253	100.00%



The results of the analysis show that the percent of crashes that occurred during the daytime remained almost the same in the "before" and "after" conditions (71.70% "before" versus 73.12% "after"). A larger percent of crashes occurred during "dark, lighted" conditions in the "after" period (16.21%) than in the "before" period (12.45%). Despite the lighting requirements at roundabout intersections, almost the same percent of crashes occur during the nighttime conditions in the "before" condition as they do in the "after" condition (28.30% "before" versus 26.88% "after").

Lighting	"Before"		"After"	
Daylight	380	71.70%	185	73.12%
Dawn	10	1.89%	5	1.98%
Dusk	16	3.02%	6	2.37%
Dark, Lighted	66	12.45%	41	16.21%
Dark, Unlighted	55	10.38%	15	5.93%
Other	3	0.57%	1	0.40%
Total	530	100.00%	253	100.00%

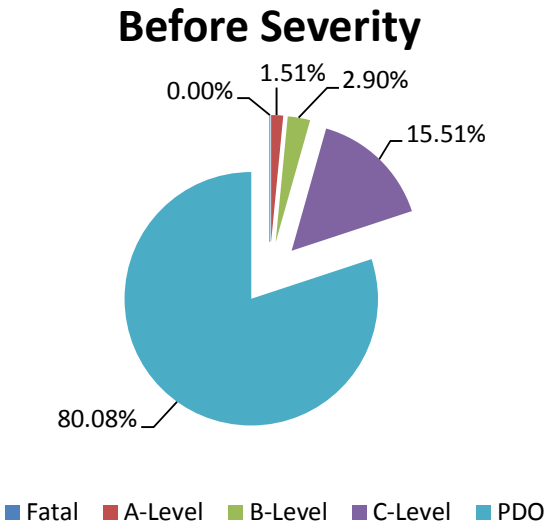


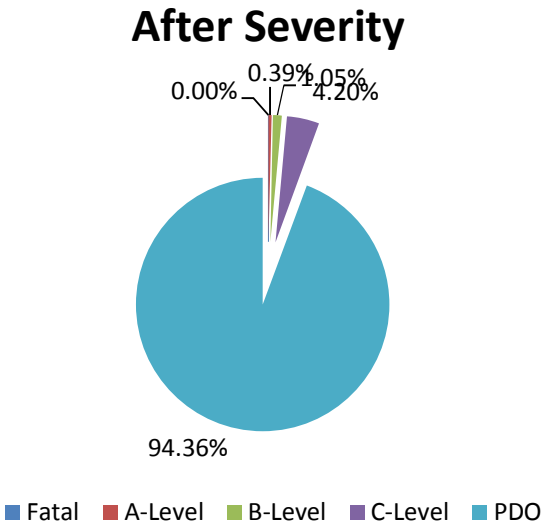


Triple Lane Roundabouts

In the "before" period, 19.92% of the crashes resulted in an injury or a fatality. In the "after" period only 5.64% of the crashes resulted in an injury or a fatality. There were no observed fatalities in either the "before" or "after" time periods.

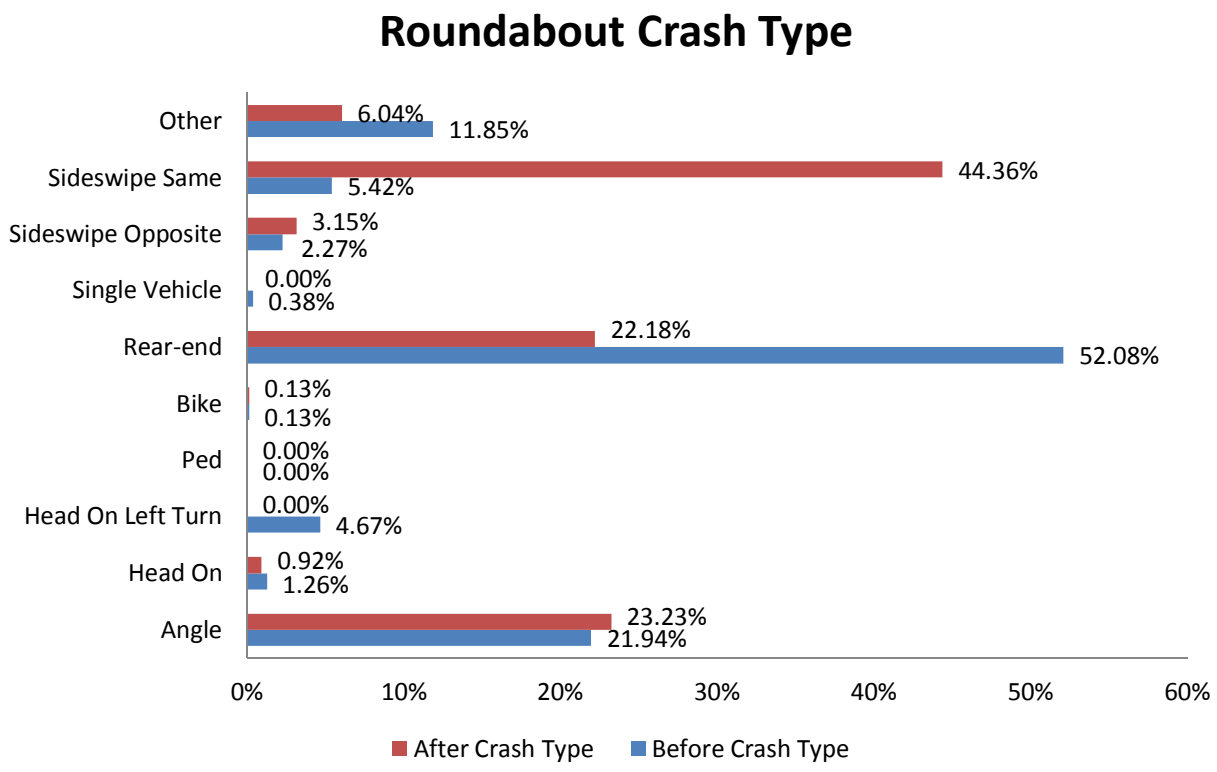
Severity Type	"Before" Severity		"After" Severity	
Fatal	0	0.00%	0	0.00%
A-Level	12	1.51%	3	0.39%
B-Level	23	2.90%	8	1.05%
C-Level	123	15.51%	32	4.20%
PDO	635	80.08%	719	94.36%
Total	793	100.00%	762	100.00%





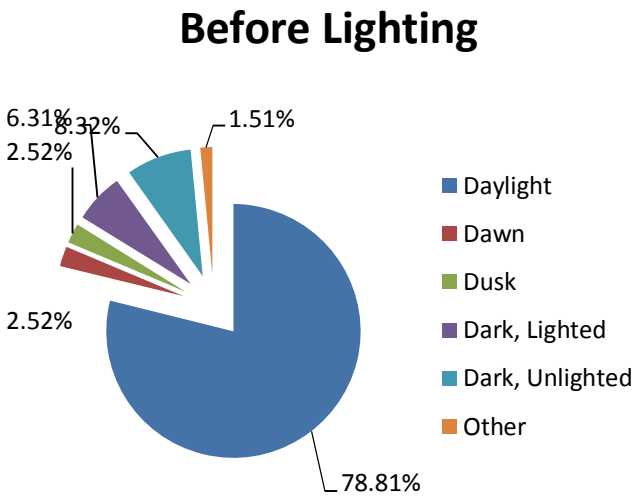
The largest change in the crash types came from the rear-end crash types. 52.08% of the crashes in the "before" period were rear-end type crashes and 22.18% of the crashes in the "after" period were rear-end type crashes. It is also important to note that the Sideswipe Same crashes increased from only 5.42% in the "before" period to 44.36% in the "after" period.

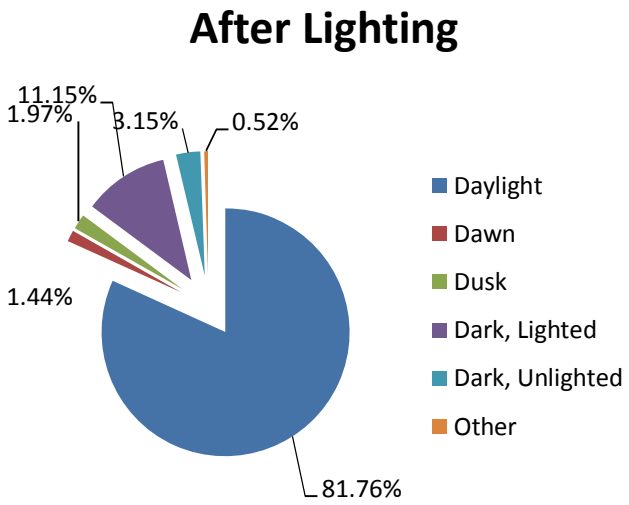
Crash Type	"Before" Type		"After" Type	
Angle	174	21.94%	177	23.23%
Head On	10	1.26%	7	0.92%
Head On Left turn	37	4.67%	0	0.00%
Pedestrian	0	0.00%	0	0.00%
Bike	1	0.13%	1	0.13%
Rear-end	413	52.08%	169	22.18%
Single Vehicle	3	0.38%	0	0.00%
Sideswipe Opposite	18	2.27%	24	3.15%
Sideswipe Same	43	5.42%	338	44.36%
Other	94	11.85%	46	6.04%
Total	793	100.00%	762	100.00%



The results of the analysis show that the percent of crashes that occurred during the daytime remained almost the same in the "before" and "after" conditions (78.81% "before" versus 81.76% "after"). A larger percent of crashes occurred during "dark, lighted" conditions in the "after" period (11.15%) than in the "before" period (6.31%). Despite the lighting requirements at roundabout intersections, almost the same percent of crashes occur during the nighttime conditions in the "before" condition as they do in the "after" condition (21.19% "before" versus 18.24% "after").

Lighting	"Before"		"After"	
Daylight	625	78.81%	623	81.76%
Dawn	20	2.52%	11	1.44%
Dusk	20	2.52%	15	1.97%
Dark, Lighted	50	6.31%	85	11.15%
Dark, Unlighted	66	8.32%	24	3.15%
Other	12	1.51%	4	0.52%
Total	793	100.00%	762	100.00%

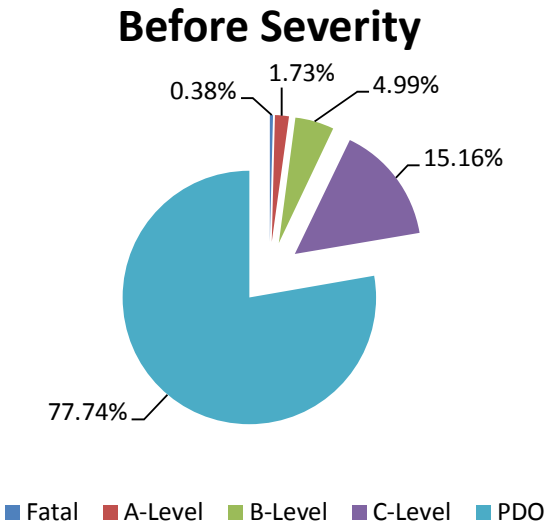


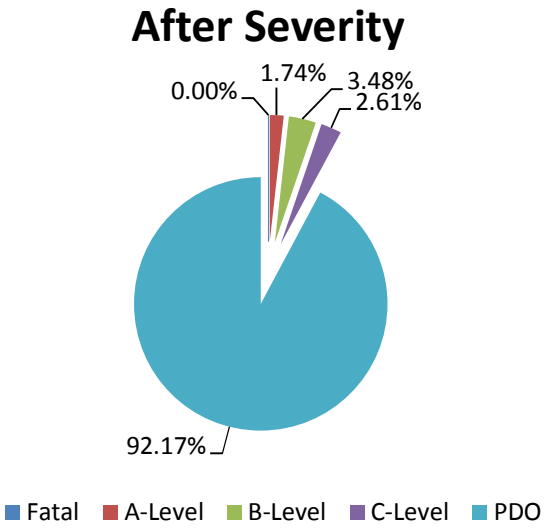


Signalized Intersections Conversion to Roundabouts

In the "before" period, 22.26% of the crashes resulted in an injury or a fatality. In the "after" period only 7.83% of the crashes resulted in an injury or a fatality. There were also two fatalities (0.38%) observed in the "before" period and in the "after" period there were no observed fatal crashes.

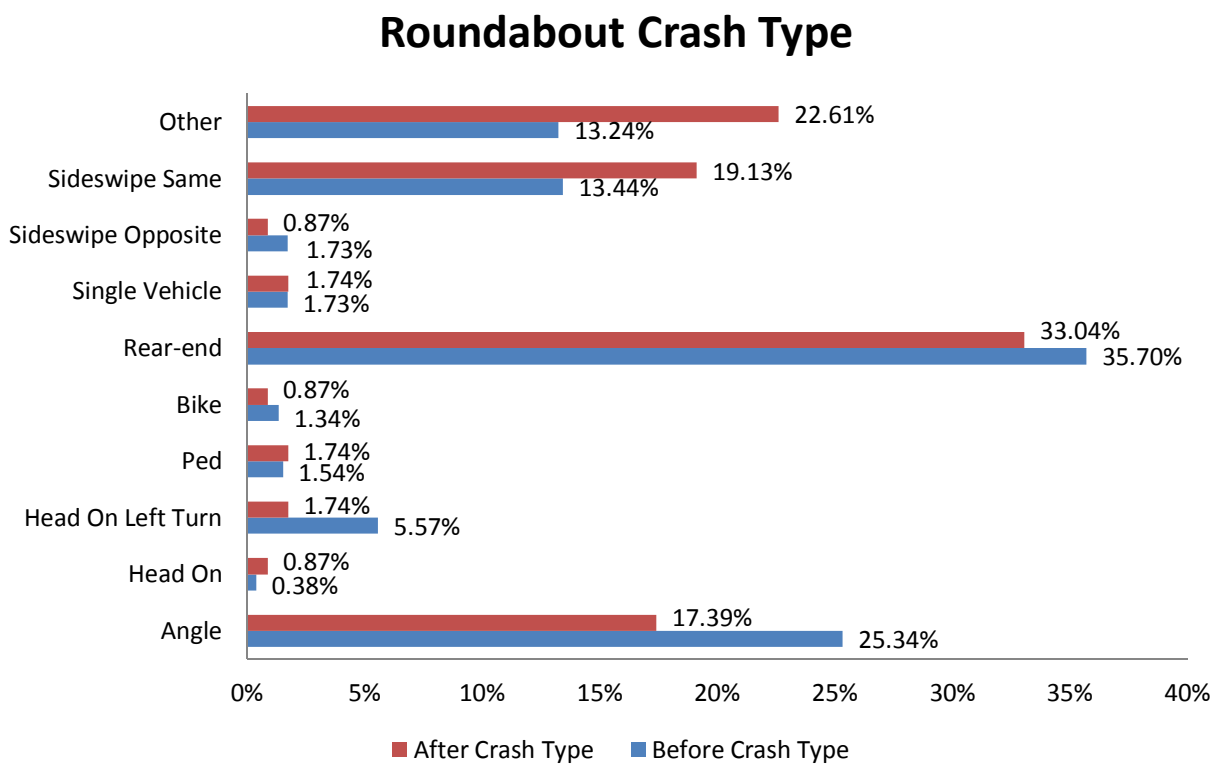
Severity Type	"Before" Severity		"After" Severity	
Fatal	2	0.38%	0	0.00%
A-Level	9	1.73%	2	1.74%
B-Level	26	4.99%	4	3.48%
C-Level	79	15.16%	3	2.61%
PDO	405	77.74%	106	92.17%
Total	521	100.00%	115	100.00%





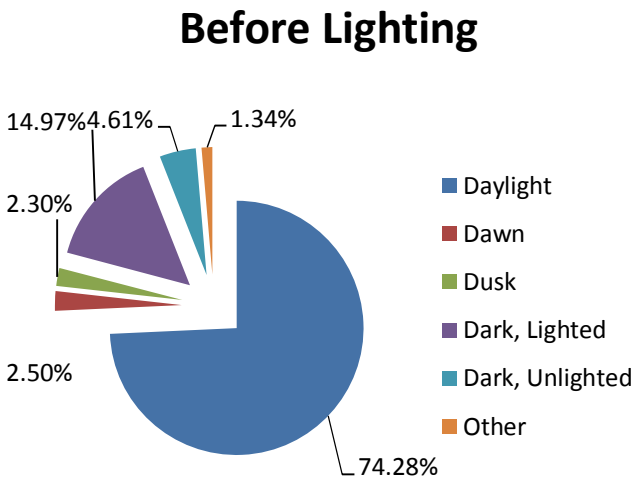
The largest change in the crash types came from the crash types that often result in the greatest severity of crashes (angle, head-on, head-on left turn, pedestrian, and bike). Most notably, the percent of angle crashes was reduced by 7.95%. This number may also be greater than 7.95%, because a common error in recording crash types is mistaking sideswipe crashes as angle crashes especially since an angle crash cannot occur in a roundabout.

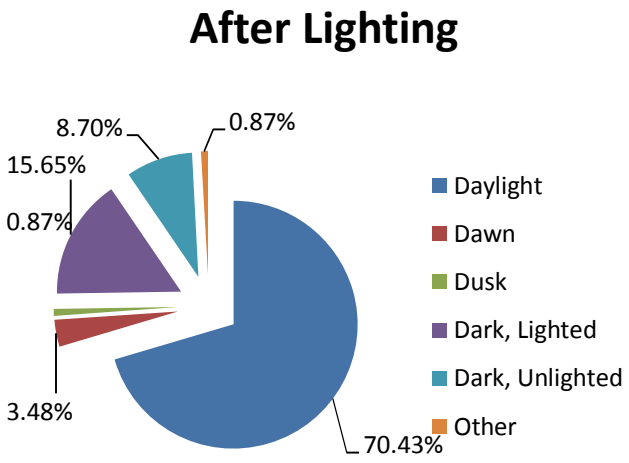
Crash Type	"Before" Type		"After" Type	
Angle	132	25.34%	20	17.39%
Head On	2	0.38%	1	0.87%
Head On Left turn	29	5.57%	2	1.74%
Pedestrian	8	1.54%	2	1.74%
Bike	7	1.34%	1	0.87%
Rear-end	186	35.70%	38	33.04%
Single Vehicle	9	1.73%	2	1.74%
Sideswipe Opposite	9	1.73%	1	0.87%
Sideswipe Same	70	13.44%	22	19.13%
Other	69	13.24%	26	22.61%
Total	521	100.00%	115	100.00%



The results of the analysis show that the percent of crashes that occurred during the daytime remained almost the same in the "before" and "after" conditions (74.28% "before" versus 70.43% "after"). A larger percent of crashes occurred during "dark, lighted" conditions in the "after" period (15.65%) than in the "before" period (14.97%). Despite the lighting requirements at roundabout intersections, almost the same percent of crashes occur during the nighttime conditions in the "before" condition as they do in the "after" condition (25.72% "before" versus 29.57% "after").

Lighting	"Before"		"After"	
Daylight	387	74.28%	81	70.43%
Dawn	13	2.50%	4	3.48%
Dusk	12	2.30%	1	0.87%
Dark, Lighted	78	14.97%	18	15.65%
Dark, Unlighted	24	4.61%	10	8.70%
Other	7	1.34%	1	0.87%
Total	521	100.00%	115	100.00%

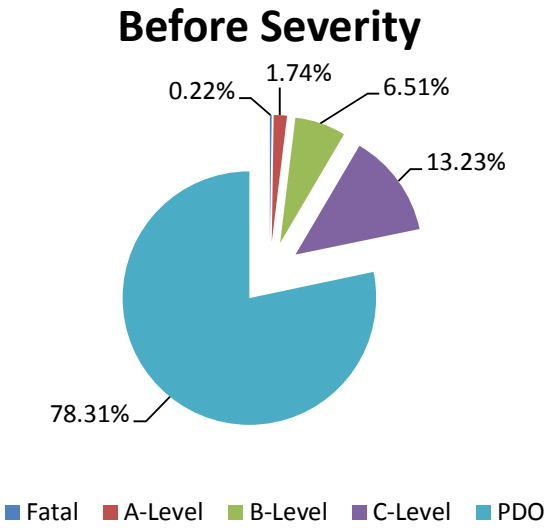


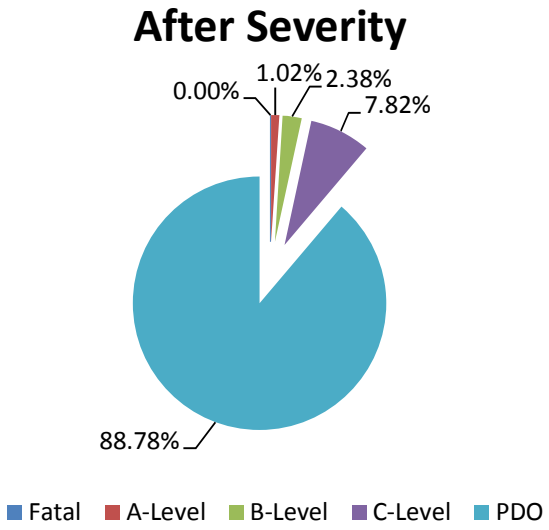


Stop Controlled Intersection Conversions to Roundabouts

In the "before" period, 21.69% of the crashes resulted in an injury or a fatality. In the "after" period only 11.22% of the crashes resulted in an injury or a fatality. There was also one fatality (0.22%) observed in the "before" period and in the "after" period there were no observed fatal crashes.

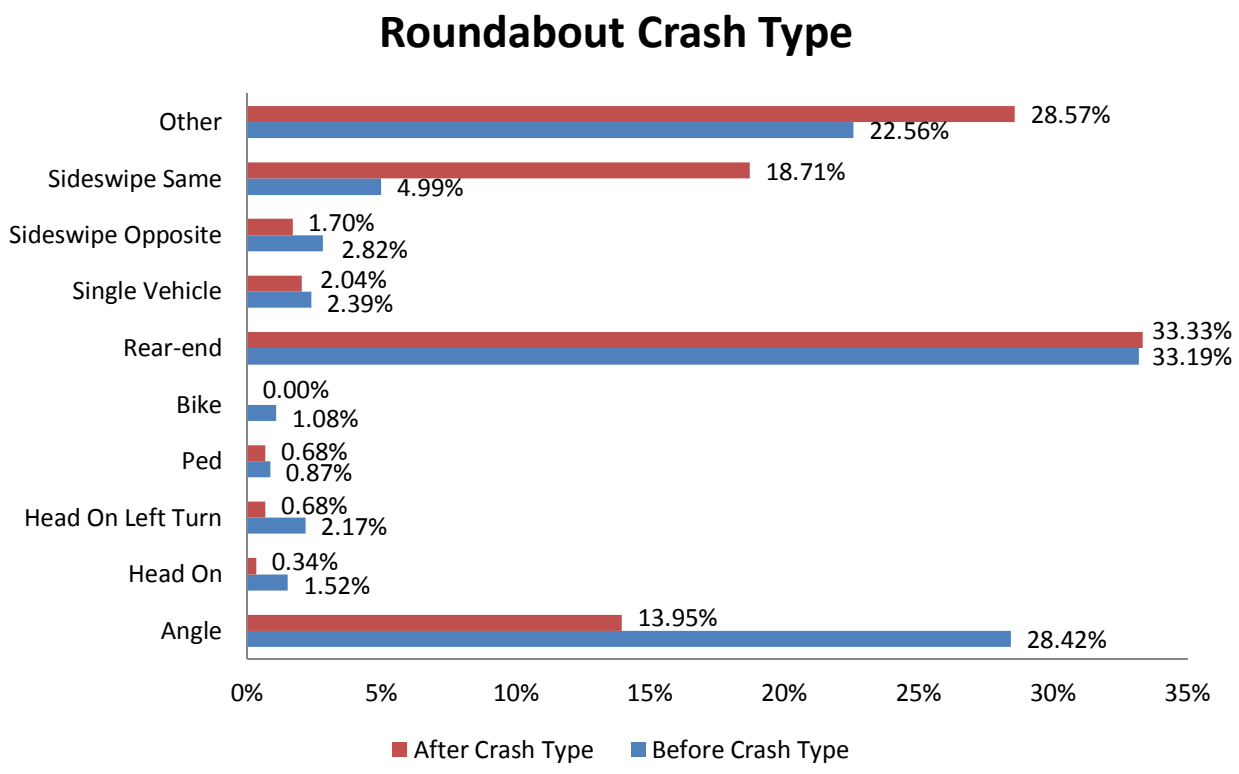
Severity Type	"Before" Severity		"After" Severity	
Fatal	1	0.22%	0	0.00%
A-Level	8	1.74%	3	1.02%
B-Level	30	6.51%	7	2.38%
C-Level	61	13.23%	23	7.82%
PDO	361	78.31%	261	88.78%
Total	461	100.00%	294	100.00%





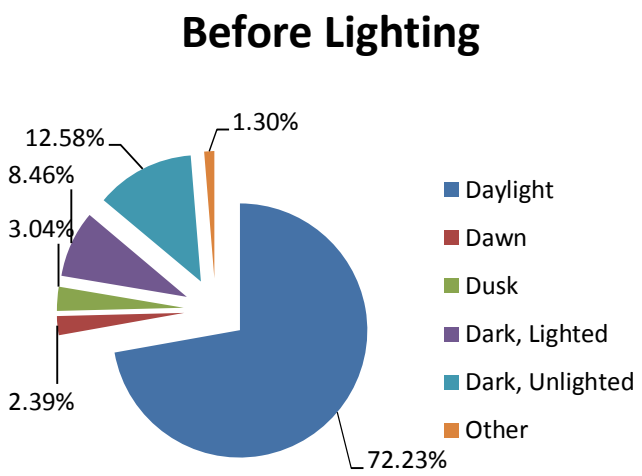
The largest change in the crash types came from the crash types that often result in the greatest severity of crashes (angle, head-on, head-on left turn, pedestrian, and bike). Most notably, the percent of angle crashes was reduced by 14.47%. This number may also be greater than 14.47%, because a common error in recording crash types is mistaking sideswipe crashes as angle crashes especially since an angle crash cannot occur in a roundabout.

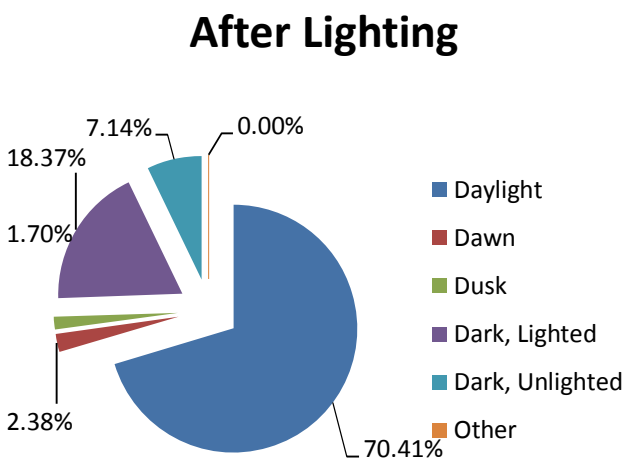
Crash Type	"Before" Type		"After" Type	
Angle	131	28.42%	41	13.95%
Head On	7	1.52%	1	0.34%
Head On Left turn	10	2.17%	2	0.68%
Pedestrian	4	0.87%	2	0.68%
Bike	5	1.08%	0	0.00%
Rear-end	153	33.19%	98	33.33%
Single Vehicle	11	2.39%	6	2.04%
Sideswipe Opposite	13	2.82%	5	1.70%
Sideswipe Same	23	4.99%	55	18.71%
Other	104	22.56%	84	28.57%
Total	461	100.00%	294	100.00%



The results of the analysis show that the percent of crashes that occurred during the daytime remained almost the same in the "before" and "after" conditions (72.23% "before" versus 70.41% "after"). A larger percent of crashes occurred during "dark, lighted" conditions in the "after" period (18.37%) than in the "before" period (8.46%). Despite the lighting requirements at roundabout intersections, almost the same percent of crashes occur during the nighttime conditions in the "before" condition as they do in the "after" condition (27.77% "before" versus 29.59% "after").

Lighting	"Before"		"After"	
Daylight	333	72.23%	207	70.41%
Dawn	11	2.39%	7	2.38%
Dusk	14	3.04%	5	1.70%
Dark, Lighted	39	8.46%	54	18.37%
Dark, Unlighted	58	12.58%	21	7.14%
Other	6	1.30%	0	0.00%
Total	461	100.00%	294	100.00%

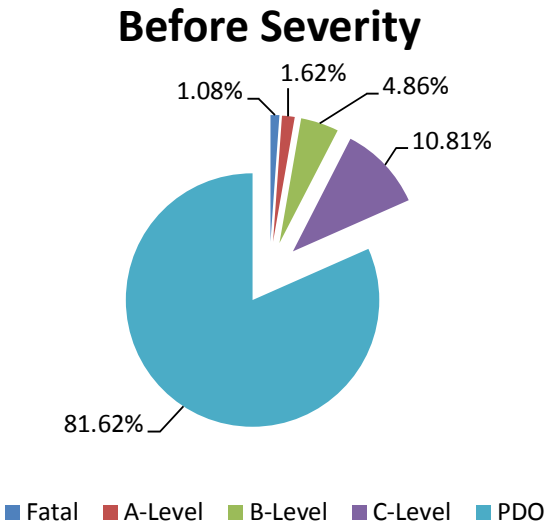


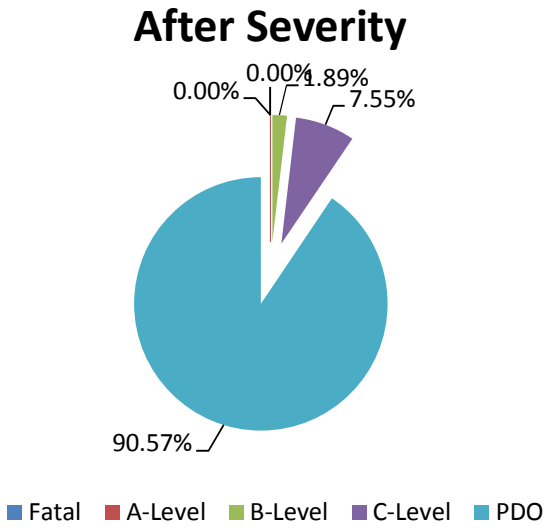


All Way Stop Controlled Intersection Conversions to Roundabouts

In the "before" period, 18.38% of the crashes resulted in an injury or a fatality. In the "after" period only 9.43% of the crashes resulted in an injury or a fatality. There were also two fatalities (1.08%) observed in the "before" period and in the "after" period there were no observed fatal crashes.

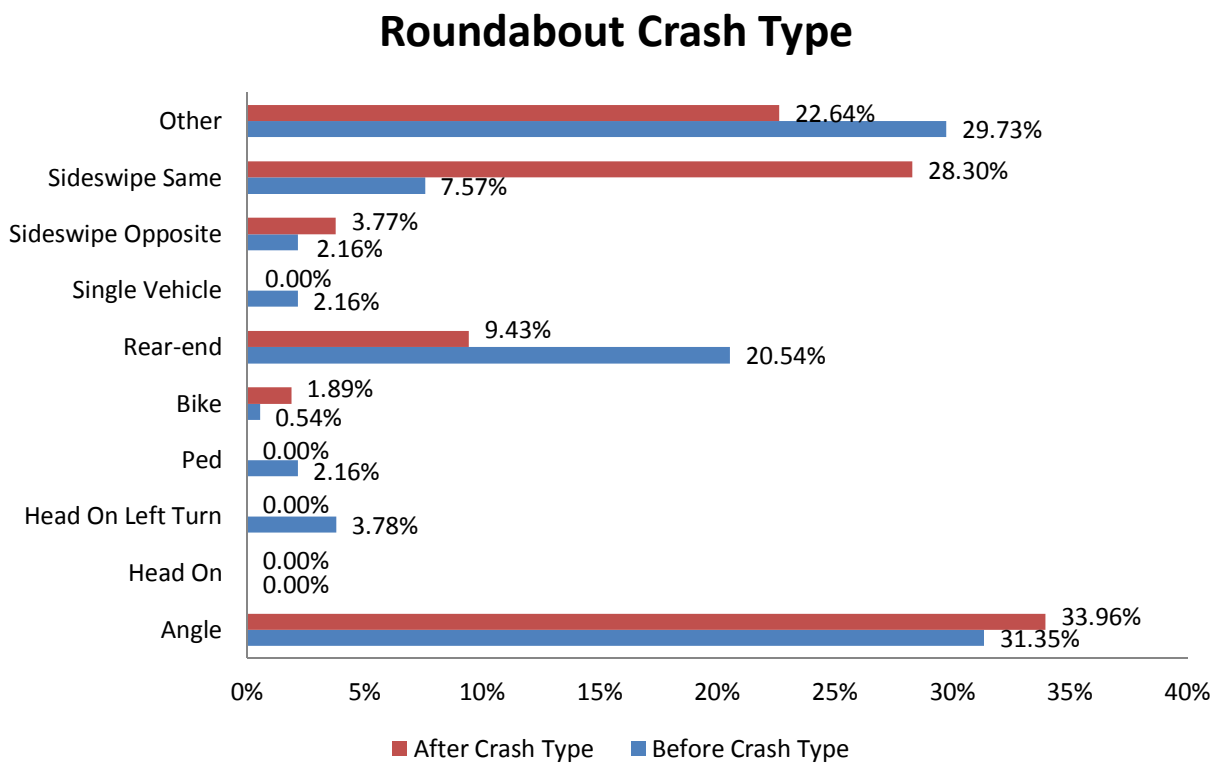
Severity Type	"Before" Severity		"After" Severity	
Fatal	2	1.08%	0	0.00%
A-Level	3	1.62%	0	0.00%
B-Level	9	4.86%	1	1.89%
C-Level	20	10.81%	4	7.55%
PDO	151	81.62%	48	90.57%
Total	185	100.00%	53	100.00%





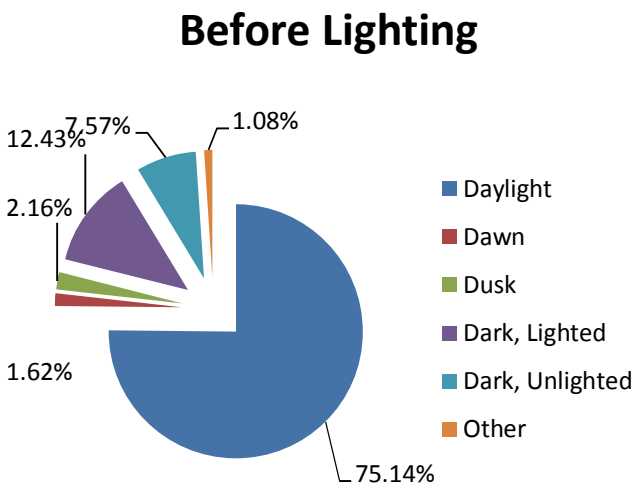
The largest change in the crash types came from the rear-end crash types. 20.54% of the crashes in the "before" period were rear-end type crashes and 9.43% of the crashes in the "after" period were rear-end type crashes. It is also important to note that the Sideswipe Same crashes increased from 7.57% in the "before" period to 28.30% in the "after" period.

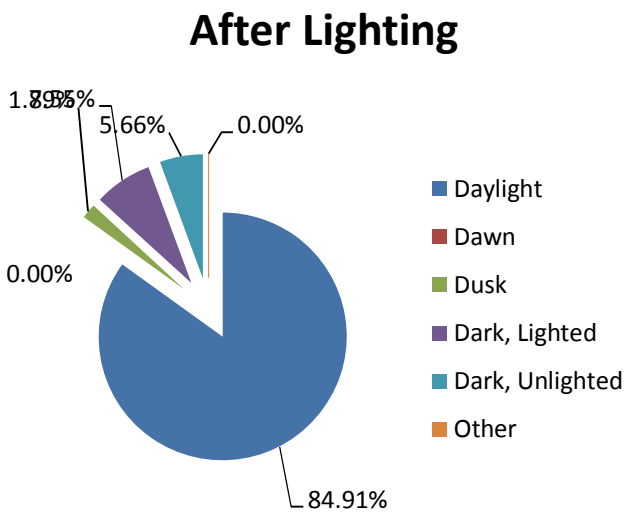
Crash Type	"Before" Type		"After" Type	
Angle	58	31.35%	18	33.96%
Head On	0	0.00%	0	0.00%
Head On Left turn	7	3.78%	0	0.00%
Pedestrian	4	2.16%	0	0.00%
Bike	1	0.54%	1	1.89%
Rear-end	38	20.54%	5	9.43%
Single Vehicle	4	2.16%	0	0.00%
Sideswipe Opposite	4	2.16%	2	3.77%
Sideswipe Same	14	7.57%	15	28.30%
Other	55	29.73%	12	22.64%
Total	185	100.00%	53	100.00%



The results of the analysis show that the percent of crashes that occurred during the increased from 75.14% in the “before” period to 84.91% in the “after period.

Lighting	“Before”		“After”	
Daylight	139	75.14%	45	84.91%
Dawn	3	1.62%	0	0.00%
Dusk	4	2.16%	1	1.89%
Dark, Lighted	23	12.43%	4	7.55%
Dark, Unlighted	14	7.57%	3	5.66%
Other	2	1.08%	0	0.00%
Total	185	100.00%	53	100.00%

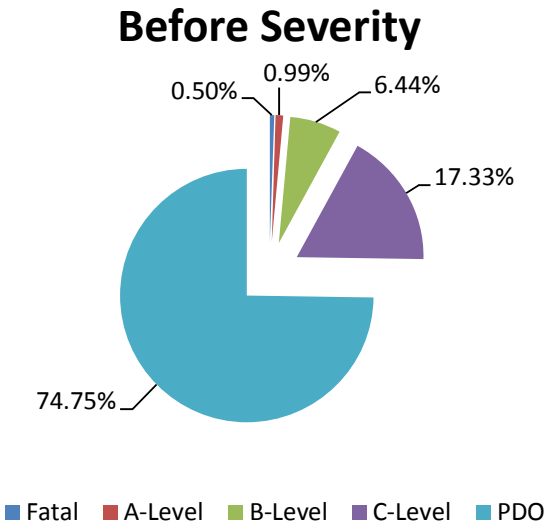


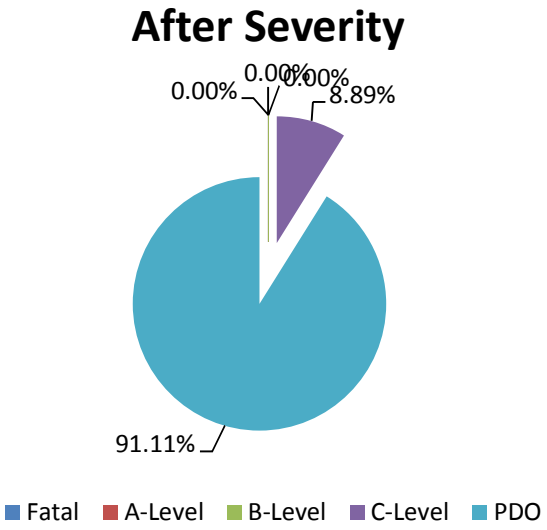


Interchange Roundabout

In the "before" period, 25.25% of the crashes resulted in an injury or a fatality. In the "after" period only 8.89% of the crashes resulted in an injury or a fatality. There was also one fatality (0.50%) observed in the "before" period and in the "after" period there were no observed fatal crashes.

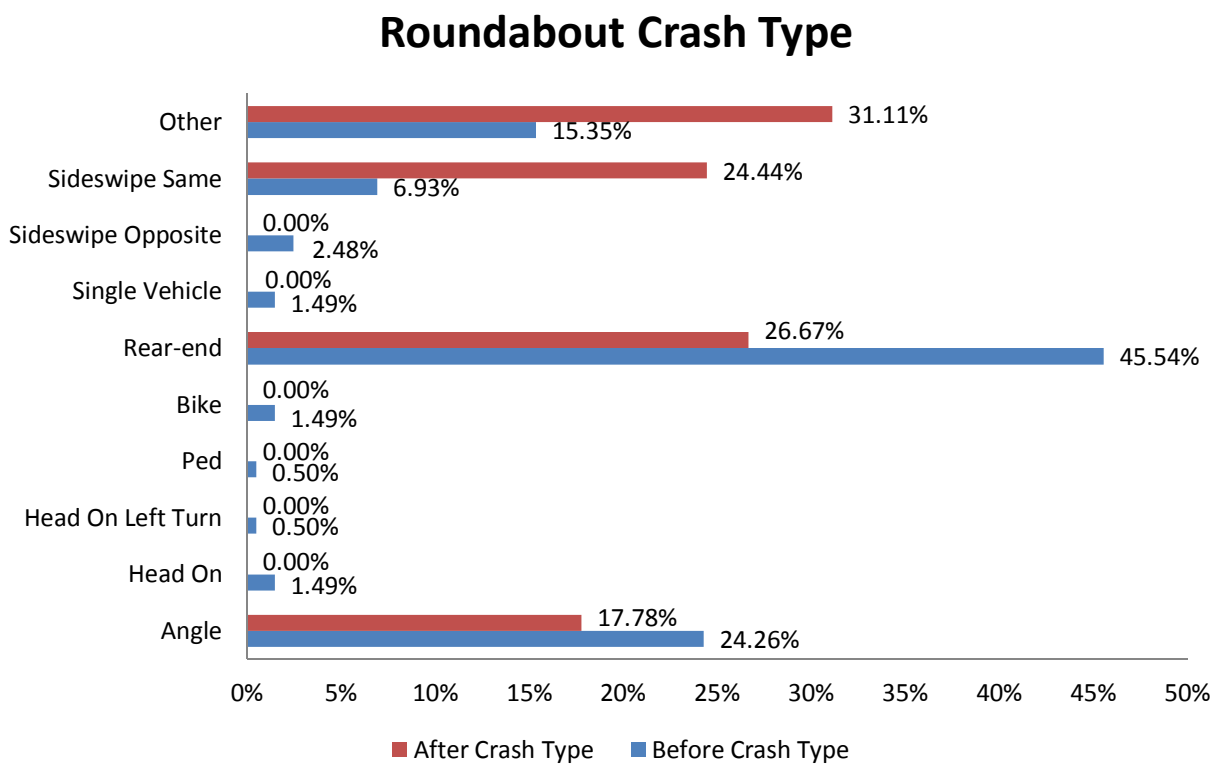
Severity Type	"Before" Severity		"After" Severity	
Fatal	1	0.50%	0	0.00%
A-Level	2	0.99%	0	0.00%
B-Level	13	6.44%	0	0.00%
C-Level	35	17.33%	4	8.89%
PDO	151	74.75%	41	91.11%
Total	202	100.00%	45	100.00%





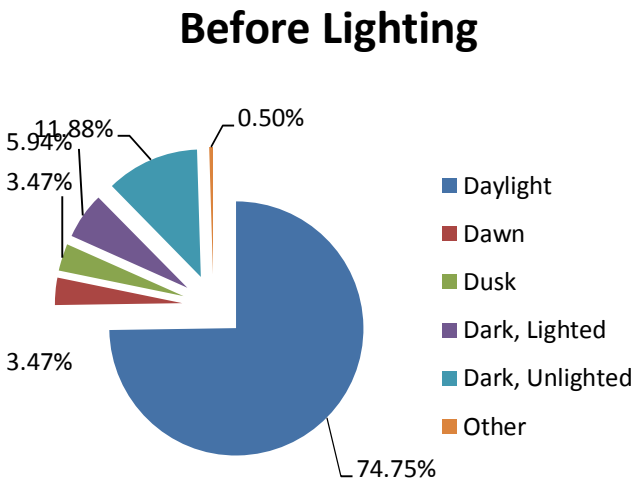
The largest change in the crash types came from the crash types that often result in the greatest severity of crashes (angle, head-on, head-on left turn, pedestrian, and bike). Most notably, the percent of angle crashes was reduced by 6.48%. This number may also be greater than 6.48%, because a common error in recording crash types is mistaking sideswipe crashes as angle crashes especially since an angle crash cannot occur in a roundabout.

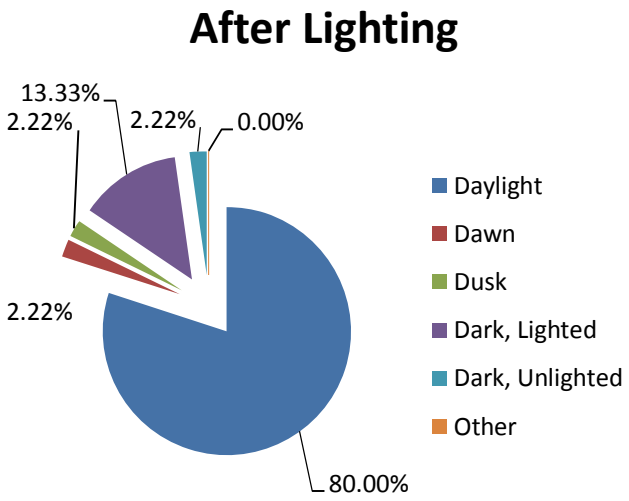
Crash Type	"Before" Type		"After" Type	
Angle	49	24.26%	8	17.78%
Head On	3	1.49%	0	0.00%
Head On Left turn	1	0.50%	0	0.00%
Pedestrian	1	0.50%	0	0.00%
Bike	3	1.49%	0	0.00%
Rear-end	92	45.54%	12	26.67%
Single Vehicle	3	1.49%	0	0.00%
Sideswipe Opposite	5	2.48%	0	0.00%
Sideswipe Same	14	6.93%	11	24.44%
Other	31	15.35%	14	31.11%
Total	202	100.00%	45	100.00%



The results of the analysis show that the percent of crashes that occurred during the daytime remained almost the same in the "before" and "after" conditions (74.75% "before" versus 80.00% "after"). A larger percent of crashes occurred during "dark, lighted" conditions in the "after" period (13.33%) than in the "before" period (5.94%). Despite the lighting requirements at roundabout intersections, almost the same percent of crashes occur during the nighttime conditions in the "before" condition as they do in the "after" condition (25.25% "before" versus 20.00% "after").

Lighting	"Before"		"After"	
Daylight	151	74.75%	36	80.00%
Dawn	7	3.47%	1	2.22%
Dusk	7	3.47%	1	2.22%
Dark, Lighted	12	5.94%	6	13.33%
Dark, Unlighted	24	11.88%	1	2.22%
Other	1	0.50%	0	0.00%
Total	202	100.00%	45	100.00%





APPENDIX D: BENEFIT/COST ANALYSIS

SINGLE LANE ROUNDABOUTS

Intersection	Roundabout Type	Delta PDO/year	Delta injury/year	Point Estimate $ benefit			Construction Cost	Delay Benefit	Time of Return (years)
				PDO/year	Injury/year	ALL/year			
I-94 Business (Main St) & Riverview Dr	single lane	3.013	1.186	$24,704	$127,784	$152,488	$464,137	$510,318	0.70
I-94 Business (Main St) & 5th St	single lane	1.451	0.536	$11,897	$57,751	$69,649	$464,137	$510,318	0.80
US-127 BR & Mission St	single lane	0.239	0.382	$1,959	$41,202	$43,162	$464,137	$510,318	0.84
Willow Hwy & Canal Rd	single lane	-0.885	-0.118	-$7,259	-$12,770	-$20,029	$464,137	$510,318	0.95
Bennett Rd & Hulett Rd	single lane	0.080	1.822	$659	$196,429	$197,088	$339,844	$510,318	0.48
Michigan Ave & Washington Square	single lane	1.231	0.026	$10,092	$2,794	$12,886	$464,137	$510,318	0.89
Mosher St & Main St	single lane	0.092	0.344	$753	$37,128	$37,881	$464,137	$510,318	0.85
Cherry St & Jefferson Ave	single lane	0.930	0.969	$7,627	$104,432	$112,059	$464,137	$510,318	0.75
Wealthy St & Lafayette Ave	single lane	3.038	0.162	$24,914	$17,454	$42,368	$464,137	$510,318	0.84
Wealthy St & Jefferson Ave	single lane	3.651	2.596	$29,939	$279,835	$309,776	$464,137	$510,318	0.57
7 Mile Rd & Brewer Ave	single lane	0.230	0.534	$1,889	$57,580	$59,469	$464,137	$510,318	0.81
Hamburg Rd & Winans Lake Rd	single lane	1.464	0.695	$12,006	$74,954	$86,959	$524,136	$510,318	0.88
Main St & 3rd St	single lane	-0.597	0.624	-$4,896	$67,299	$62,403	$464,137	$510,318	0.81
Hayes Rd & 25 Mile Rd	single lane	-2.992	0.939	-$24,532	$101,160	$76,629	$528,430	$510,318	0.90
M-46/Apple Ave & M-37/Newaygo Rd	single lane	1.657	1.228	$13,588	$132,371	$145,960	$464,137	$510,318	0.71
3rd St & Western Ave	single lane	-0.723	0.016	-$5,929	$1,763	-$4,166	$464,137	$510,318	0.92
Cooley Lake Rd & Bogie Lake Rd	single lane	-1.505	1.880	-$12,344	$202,650	$190,306	$464,137	$510,318	0.66
Cooley Lake Rd & Oxbow Lake Rd	single lane	-1.801	-0.035	-$14,770	-$3,764	-$18,534	$464,137	$510,318	0.94
Old US-27/North Hwy & Livingston Blvd	single lane	-0.237	-0.069	-$1,945	-$7,451	-$9,397	$464,137	$510,318	0.93
Nixon Rd & Huron Pkwy	single lane	1.061	0.582	$8,698	$62,716	$71,414	$464,137	$510,318	0.80
	Average	0.470	0.715	$3,852	$77,066	$80,919			
	TOTAL	9.396	14.300	$77,049	$1,541,317	$1,618,372			

DOUBLE LANE ROUNDABOUTS

Intersection	Roundabout Type	Delta PDO/year	Delta injury/year	Point Estimate $ benefit			Construction Cost	Delay Benefit	Time of Return (years)
				PDO/year	Injury/year	ALL/year			
Lake Lansing Rd & Chamberlain Dr	double lane	-2.689	-0.615	-$22,047	-$66,322	-$88,369	$750,000	$1,668,896	0.47
Wood St & Sam's Way	double lane	-2.455	-0.658	-$20,134	-$70,910	-$91,044	$750,000	$1,668,896	0.48
Cedar St & Holbrook Dr	double lane	-1.162	-0.719	-$9,532	-$77,503	-$87,035	$750,000	$1,668,896	0.47
Michigan Ave & Rankin St	double lane	2.767	0.045	$22,691	$4,809	$27,500	$1,977,270	$1,668,896	1.17
Romeo Plank Rd & 19 Mile Rd	double lane	-4.343	0.268	-$35,609	$28,882	-$6,727	$3,110,094	$1,668,896	1.87
Romeo Plank Rd & Cass Ave	double lane	-9.082	0.252	-$74,473	$27,141	-$47,332	$3,110,094	$1,668,896	1.92
Utica Rd & Dodge Park Rd	double lane	6.937	1.156	$56,880	$124,618	$181,498	$3,393,431	$1,668,896	1.83
M-53 ramp & 26-Mile	double lane	4.188	1.977	$34,345	$213,073	$247,419	$1,977,270	$1,668,896	1.03
M-53 ramp & 26-Mile	double lane	-1.646	0.466	-$13,499	$50,242	$36,743	$1,977,270	$1,668,896	1.16
Baldwin Rd/Indianwood Rd & S. Coats Rd	double lane	-3.180	0.246	-$26,080	$26,503	$423	$1,977,270	$1,668,896	1.18
68th Ave & Randall St/ State	double lane	-2.746	0.199	-$22,521	$21,416	-$1,105	$1,977,270	$1,668,896	1.19
I-75 & M-81/Washington Road	double lane	0.890	0.156	$7,299	$16,762	$24,061	$1,977,270	$1,668,896	1.17
I-75 & M-81/Washington Road	double lane	3.206	0.591	$26,293	$63,671	$89,965	$1,977,270	$1,668,896	1.12
Geddes Rd & Superior Rd	double lane	-0.355	0.177	-$2,911	$19,118	$16,207	$1,977,270	$1,668,896	1.17
Maple Rd & M-14	double lane	-4.858	0.441	-$39,838	$47,560	$7,721	$1,977,270	$1,668,896	1.18
Maple Rd & M-14	double lane	-0.688	0.517	-$5,641	$55,695	$50,055	$1,977,270	$1,668,896	1.15
	Average	-0.951	0.281	-$7,799	$30,297	$22,499			
	TOTAL	-15.217	4.497	-$124,777	$484,755	$359,980			

TRIPLE LANE ROUNDABOUTS

Intersection	Roundabout Type	Delta PDO/year	Delta injury/year	Point Estimate $ benefit			Construction Cost	Delay Benefit	Time of Return (years)
				PDO/year	Injury/year	ALL/year			
Maple Rd & Drake Rd	Triple Lane	-39.692	-0.080	-$325,474	-$8,612	-$334,086	$1,777,546	$2,331,446	0.89
Maple Rd & Farmington Rd	Triple Lane	-26.219	0.485	-$214,998	$52,274	-$162,724	$2,138,162	$2,331,446	0.99
14 Mile Rd & Farmington Rd	Triple Lane	-28.162	3.335	-$230,931	$359,405	$128,474	$1,957,854	$2,331,446	0.80
	Average	-31.358	1.247	-$257,134	$134,356	-$122,778			
	TOTAL	-94.074	3.740	-$771,403	$403,067	-$368,336			

ALL WAY STOP CONTROLLED INTERSECTION CONVERSIONS TO ROUNDABOUTS

Intersection	Before Control	Delta PDO/year	Delta injury/year	Point Estimate $ benefit			Construction Cost	Delay Benefit	Time of Return (years)
				PDO/year	Injury/year	ALL/year			
Willow Hwy & Canal Rd	awsc	-0.885	-0.118	-$7,259	-$12,770	-$20,029	$464,137	$510,318	0.95
Michigan Ave & Washington Square	awsc	1.231	0.026	$10,092	$2,794	$12,886	$464,137	$510,318	0.89
M-46/Apple Ave & M-37/Newaygo Rd	awsc	1.657	1.228	$13,588	$132,371	$145,960	$464,137	$510,318	0.71
68th Ave & Randall St/ State	awsc	-2.746	0.199	-$22,521	$21,416	-$1,105	$1,977,270	$1,668,896	1.19
Nixon Rd & Huron Pkwy	awsc	1.061	0.582	$8,698	$62,716	$71,414	$464,137	$510,318	0.80
Geddes Rd & Superior Rd	awsc	-0.355	0.177	-$2,911	$19,118	$16,207	$1,977,270	$1,668,896	1.17
	Average	-0.006	0.349	-$52	$37,608	$37,555			
	TOTAL	-0.038	2.093	-$313	$225,645	$225,333			

SIGNALIZED INTERSECTION CONVERSIONS TO ROUNDABOUTS

Intersection	Before Control	Delta PDO/year	Delta injury/year	Point Estimate $ benefit			Construction Cost	Delay Benefit	Time of Return (years)
				PDO/year	Injury/year	ALL/year			
I-94 Business (Main St) & Riverview Dr	Signalized	3.013	1.186	$24,704	$127,784	$152,488	$464,137	$510,318	0.70
Mosher St & Main St	Signalized	0.092	0.344	$753	$37,128	$37,881	$464,137	$510,318	0.85
Cherry St & Jefferson Ave	Signalized	0.930	0.969	$7,627	$104,432	$112,059	$464,137	$510,318	0.75
Wealthy St & Lafayette Ave	Signalized	3.038	0.162	$24,914	$17,454	$42,368	$464,137	$510,318	0.84
Wealthy St & Jefferson Ave	Signalized	3.651	2.596	$29,939	$279,835	$309,776	$464,137	$510,318	0.57
Romeo Plank Rd & 19 Mile Rd	Signalized	-4.343	0.268	-$35,609	$28,882	-$6,727	$3,110,094	$1,668,896	1.87
Romeo Plank Rd & Cass Ave	Signalized	-9.082	0.252	-$74,473	$27,141	-$47,332	$3,110,094	$1,668,896	1.92
Utica Rd & Dodge Park Rd	Signalized	6.937	1.156	$56,880	$124,618	$181,498	$3,393,431	$1,668,896	1.83
Cooley Lake Rd & Bogie Lake Rd	Signalized	-1.505	1.880	-$12,344	$202,650	$190,306	$464,137	$510,318	0.66
I-75 & M-81/Washington Road	Signalized	0.890	0.156	$7,299	$16,762	$24,061	$1,977,270	$1,668,896	1.17
I-75 & M-81/Washington Road	Signalized	3.206	0.591	$26,293	$63,671	$89,965	$1,977,270	$1,668,896	1.12
	Average	0.621	0.869	$5,089	$93,669	$98,759			
	TOTAL	6.827	9.559	$55,983	$1,030,357	$1,086,344			

STOP CONTROLLED INTERSECTION CONVERSIONS TO ROUNDABOUTS

Intersection	Before Control	Delta PDO/year	Delta injury/year	Point Estimate $ benefit			Construction Cost	Delay Benefit	Time of Return (years)
				PDO/year	Injury/year	ALL/year			
I-94 Business (Main St) & 5th St	Stop Controlled	1.451	0.536	$11,897	$57,751	$69,649	$464,137	$510,318	0.80
US-127 BR & Mission St	Stop Controlled	0.239	0.382	$1,959	$41,202	$43,162	$464,137	$510,318	0.84
Bennett Rd & Hulett Rd	Stop Controlled	0.080	1.822	$659	$196,429	$197,088	$339,844	$510,318	0.48
Lake Lansing Rd & Chamberlain Dr	Stop Controlled	-2.689	-0.615	-$22,047	-$66,322	-$88,369	$750,000	$1,668,896	0.47
Wood St & Sam's Way	Stop Controlled	-2.455	-0.658	-$20,134	-$70,910	-$91,044	$750,000	$1,668,896	0.48
Cedar St & Holbrook Dr	Stop Controlled	-1.162	-0.719	-$9,532	-$77,503	-$87,035	$750,000	$1,668,896	0.47
Michigan Ave & Rankin St	Stop Controlled	2.767	0.045	$22,691	$4,809	$27,500	$1,977,270	$1,668,896	1.17
7 Mile Rd & Brewer Ave	Stop Controlled	0.230	0.534	$1,889	$57,580	$59,469	$464,137	$510,318	0.81
Hamburg Rd & Winans Lake Rd	Stop Controlled	1.464	0.695	$12,006	$74,954	$86,959	$524,136	$510,318	0.88
Main St & 3rd St	Stop Controlled	-0.597	0.624	-$4,896	$67,299	$62,403	$464,137	$510,318	0.81
Hayes Rd & 25 Mile Rd	Stop Controlled	-2.992	0.939	-$24,532	$101,160	$76,629	$528,430	$510,318	0.90
M-53 ramp & 26-Mile	Stop Controlled	4.188	1.977	$34,345	$213,073	$247,419	$1,977,270	$1,668,896	1.03
M-53 ramp & 26-Mile	Stop Controlled	-1.646	0.466	-$13,499	$50,242	$36,743	$1,977,270	$1,668,896	1.16
3rd St & Western Ave	Stop Controlled	-0.723	0.016	-$5,929	$1,763	-$4,166	$464,137	$510,318	0.92
Cooley Lake Rd & Oxbow Lake Rd	Stop Controlled	-1.801	-0.035	-$14,770	-$3,764	-$18,534	$464,137	$510,318	0.94
Baldwin Rd/Indianwood Rd & S. Coats Rd	Stop Controlled	-3.180	0.246	-$26,080	$26,503	$423	$1,977,270	$1,668,896	1.18
Old US-27/North Hwy & Livingston Blvd	Stop Controlled	-0.237	-0.069	-$1,945	-$7,451	-$9,397	$464,137	$510,318	0.93
Maple Rd & M-14	Stop Controlled	-4.858	0.441	-$39,838	$47,560	$7,721	$1,977,270	$1,668,896	1.18
Maple Rd & M-14	Stop Controlled	-0.688	0.517	-$5,641	$55,695	$50,055	$1,977,270	$1,668,896	1.15
	Average	-0.664	0.376	-$5,442	$40,530	$35,088			
	TOTAL	-12.609	7.145	-$103,397	$770,070	$666,676			

RURAL ROUNDABOUTS

Intersection	Environment	Delta PDO/year	Delta injury/year	Point Estimate $ benefit			Construction Cost	Delay Benefit	Time of Return (years)
				PDO/year	Injury/year	ALL/year			
US-127 BR & Mission St	Rural	0.239	0.382	$1,959	$41,202	$43,162	$464,137	$510,318	0.84
Willow Hwy & Canal Rd	Rural	-0.885	-0.118	-$7,259	-$12,770	-$20,029	$464,137	$510,318	0.95
Bennett Rd & Hulett Rd	Rural	0.080	1.822	$659	$196,429	$197,088	$339,844	$510,318	0.48
Cedar St & Holbrook Dr	Rural	-1.162	-0.719	-$9,532	-$77,503	-$87,035	$750,000	$1,668,896	0.47
7 Mile Rd & Brewer Ave	Rural	0.230	0.534	$1,889	$57,580	$59,469	$464,137	$510,318	0.81
Hamburg Rd & Winans Lake Rd	Rural	1.464	0.695	$12,006	$74,954	$86,959	$524,136	$510,318	0.88
Hayes Rd & 25 Mile Rd	Rural	-2.992	0.939	-$24,532	$101,160	$76,629	$528,430	$510,318	0.90
Romeo Plank Rd & 19 Mile Rd	Rural	-4.343	0.268	-$35,609	$28,882	-$6,727	$3,110,094	$1,668,896	1.87
Romeo Plank Rd & Cass Ave	Rural	-9.082	0.252	-$74,473	$27,141	-$47,332	$3,110,094	$1,668,896	1.92
M-53 ramp & 26-Mile	Rural	4.188	1.977	$34,345	$213,073	$247,419	$1,977,270	$1,668,896	1.03
M-53 ramp & 26-Mile	Rural	-1.646	0.466	-$13,499	$50,242	$36,743	$1,977,270	$1,668,896	1.16
M-46/Apple Ave & M-37/Newaygo Rd	Rural	1.657	1.228	$13,588	$132,371	$145,960	$464,137	$510,318	0.71
Cooley Lake Rd & Bogie Lake Rd	Rural	-1.505	1.880	-$12,344	$202,650	$190,306	$464,137	$510,318	0.66
Cooley Lake Rd & Oxbow Lake Rd	Rural	-1.801	-0.035	-$14,770	-$3,764	-$18,534	$464,137	$510,318	0.94
Baldwin Rd/Indianwood Rd & S. Coats Rd	Rural	-3.180	0.246	-$26,080	$26,503	$423	$1,977,270	$1,668,896	1.18
Old US-27/North Hwy & Livingston Blvd	Rural	-0.237	-0.069	-$1,945	-$7,451	-$9,397	$464,137	$510,318	0.93
68th Ave & Randall St/ State	Rural	-2.746	0.199	-$22,521	$21,416	-$1,105	$1,977,270	$1,668,896	1.19
I-75 & M-81/Washington Road	Rural	0.890	0.156	$7,299	$16,762	$24,061	$1,977,270	$1,668,896	1.17
I-75 & M-81/Washington Road	Rural	3.206	0.591	$26,293	$63,671	$89,965	$1,977,270	$1,668,896	1.12
Geddes Rd & Superior Rd	Rural	-0.355	0.177	-$2,911	$19,118	$16,207	$1,977,270	$1,668,896	1.17
	Average	-0.899	0.544	-$7,372	$58,584	$51,212			
	TOTAL	-17.980	10.871	-$147,437	$1,171,666	$1,024,233			

URBAN ROUNDABOUTS

Intersection	Environment	Delta PDO/year	Delta injury/year	Point Estimate $ benefit			Construction Cost	Delay Benefit	Time of Return (years)
				PDO/year	Injury/year	ALL/year			
I-94 Business (Main St) & Riverview Dr	Urban	3.013	1.186	$24,704	$127,784	$152,488	$464,137	$510,318	0.70
I-94 Business (Main St) & 5th St	Urban	1.451	0.536	$11,897	$57,751	$69,649	$464,137	$510,318	0.80
Lake Lansing Rd & Chamberlain Dr	Urban	-2.689	-0.615	-$22,047	-$66,322	-$88,369	$750,000	$1,668,896	0.47
Wood St & Sam's Way	Urban	-2.455	-0.658	-$20,134	-$70,910	-$91,044	$750,000	$1,668,896	0.48
Michigan Ave & Washington Square	Urban	1.231	0.026	$10,092	$2,794	$12,886	$464,137	$510,318	0.89
Mosher St & Main St	Urban	0.092	0.344	$753	$37,128	$37,881	$464,137	$510,318	0.85
Michigan Ave & Rankin St	Urban	2.767	0.045	$22,691	$4,809	$27,500	$1,977,270	$1,668,896	1.17
Cherry St & Jefferson Ave	Urban	0.930	0.969	$7,627	$104,432	$112,059	$464,137	$510,318	0.75
Wealthy St & Lafayette Ave	Urban	3.038	0.162	$24,914	$17,454	$42,368	$464,137	$510,318	0.84
Wealthy St & Jefferson Ave	Urban	3.651	2.596	$29,939	$279,835	$309,776	$464,137	$510,318	0.57
Main St & 3rd St	Urban	-0.597	0.624	-$4,896	$67,299	$62,403	$464,137	$510,318	0.81
Utica Rd & Dodge Park Rd	Urban	6.937	1.156	$56,880	$124,618	$181,498	$3,393,431	$1,668,896	1.83
3rd St & Western Ave	Urban	-0.723	0.016	-$5,929	$1,763	-$4,166	$464,137	$510,318	0.92
Nixon Rd & Huron Pkwy	Urban	1.061	0.582	$8,698	$62,716	$71,414	$464,137	$510,318	0.80
Maple Rd & M-14	Urban	-4.858	0.441	-$39,838	$47,560	$7,721	$1,977,270	$1,668,896	1.18
Maple Rd & M-14	Urban	-0.688	0.517	-$5,641	$55,695	$50,055	$1,977,270	$1,668,896	1.15
	Average	0.760	0.495	$6,232	$53,401	$59,632			
	TOTAL	12.160	7.927	$99,710	$854,406	$954,119			

INTERCHANGE ROUNDABOUTS

Intersection	Roundabout Type	Delta PDO/year	Delta injury/year	Point Estimate $ benefit			Construction Cost	Delay Benefit	Time of Return (years)
				PDO/year	Injury/year	ALL/year			
I-94 Business (Main St) & Riverview Dr	Single Lane	3.013	1.186	$24,704	$127,784	$152,488	$464,137	$510,318	0.70
I-94 Business (Main St) & 5th St	Single Lane	1.451	0.536	$11,897	$57,751	$69,649	$464,137	$510,318	0.80
US-127 BR & Mission St	Single Lane	0.239	0.382	$1,959	$41,202	$43,161	$464,137	$510,318	0.84
M-53 ramp & 26-Mile	double lane	4.188	1.977	$34,345	$213,073	$247,418	$1,977,270	$1,668,896	1.03
M-53 ramp & 26-Mile	double lane	-1.646	0.466	-$13,499	$50,242	$36,743	$1,977,270	$1,668,896	1.16
I-75 & M-81/Washington Road	double lane	0.890	0.156	$7,299	$16,762	$24,061	$1,977,270	$1,668,896	1.17
I-75 & M-81/Washington Road	double lane	3.206	0.591	$26,293	$63,671	$89,965	$1,977,270	$1,668,896	1.12
Maple Rd & M-14	double lane	-4.858	0.441	-$39,838	$47,560	$7,721	$1,977,270	$1,668,896	1.18
Maple Rd & M-14	double lane	-0.688	0.517	-$5,641	$55,695	$50,054	$1,977,270	$1,668,896	1.15
	Average	0.644	0.695	$5,280	$74,860	$80,140			
	TOTAL	5.795	6.251	$47,519	$673,742	$721,261			

BENEFIT/COST ANALYSIS EB M-14 Ramps at Maple Road

PEAK HOUR SUMMARY STATISTICS

		Stop Delay (hr)
8:00 AM - 9:00 AM		
Total Network		
	Before	105.5
	After	6.5
	Change	-99.0
5:00 PM - 6:00 PM		
Total Network		
	Before	37.1
	After	6.5
	Change	-30.6

PEAK PERIOD SUMMARY STATISTICS

		Stop Delay (veh*hr)
AM Period (6:00 AM - 11:00 AM)		
Total Network		
	Before	562.2
	After	34.6
	Change	-527.6
PM Period (11:00 AM - 10:00 PM)		
Total Network		
	Before	186.1
	After	32.6
	Change	-153.5

DAILY SUMMARY STATISTICS

	Stop Delay (veh*hr)
Before	748.32
After	67.25
Change	-681.08
% Change	-91.0%

BENEFIT/COST EVALUATION

	Stop Delay Savings	
	veh*hrs	Person - $
Daily Savings	681.08	$10,301
Yearly Savings	170,270	$2,575,331

Total Project Cost:	$100,000
Benefit/Cost:	**25.75**

Assumptions

Avg. # of Workdays/Year	250
Avg. Vehicle Occupancy	1.1
Avg. Value of Time/Individual ($/hr)	$13.75

BENEFIT/COST ANALYSIS Huron Pkwy at Nixon Road

PEAK HOUR SUMMARY STATISTICS

		Stop Delay (hr)
7:00 AM - 8:00 AM		
Total Network		
	Before	22.3
	After	5.7
	Change	-16.6
5:00 PM - 6:00 PM		
Total Network		
	Before	19.5
	After	6.8
	Change	-12.7

PEAK PERIOD SUMMARY STATISTICS

		Stop Delay (veh*hr)
AM Period (6:00 AM - 11:00 AM)		
Total Network		
	Before	108.6
	After	27.8
	Change	-80.9
PM Period (11:00 AM - 10:00 PM)		
Total Network		
	Before	83.1
	After	29.0
	Change	-54.1

DAILY SUMMARY STATISTICS

	Stop Delay (veh*hr)
Before	191.69
After	56.73
Change	-134.96
% Change	-70.4%

BENEFIT/COST EVALUATION

	Stop Delay Savings	
	veh*hrs	Person - $
Daily Savings	134.96	$2,041
Yearly Savings	33,740	$510,318

Total Project Cost:	$660,000
Benefit/Cost:	**0.77**

Assumptions

Avg. # of Workdays/Year	250
Avg. Vehicle Occupancy	1.1
Avg. Value of Time/Individual ($/hr)	$13.75

BENEFIT/COST ANALYSIS Maple and Drake

PEAK HOUR SUMMARY STATISTICS

		Stop Delay (hr)
8:00 AM - 9:00 AM		
Total Network		
	Before	35.0
	After	5.7
	Change	-29.3
5:00 PM - 6:00 PM		
Total Network		
	Before	55.0
	After	6.4
	Change	-48.6

PEAK PERIOD SUMMARY STATISTICS

		Stop Delay (veh*hr)
AM Period (6:00 AM - 11:00 AM)		
Total Network		
	Before	232.4
	After	37.8
	Change	-194.6
PM Period (11:00 AM - 10:00 PM)		
Total Network		
	Before	341.5
	After	39.7
	Change	-301.7

DAILY SUMMARY STATISTICS

	Stop Delay (veh*hr)
Before	573.87
After	77.58
Change	-496.29
% Change	-86.5%

BENEFIT/COST EVALUATION

	Stop Delay Savings	
	veh*hrs	Person - $
Daily Savings	496.29	$7,506
Yearly Savings	124,072	$1,876,588

Total Project Cost:	$1,777,546
Benefit/Cost:	**1.06**

Assumptions

Avg. # of Workdays/Year	250
Avg. Vehicle Occupancy	1.1
Avg. Value of Time/Individual ($/hr)	$13.75

BENEFIT/COST ANALYSIS WB M-14 Ramps at Maple Road

PEAK HOUR SUMMARY STATISTICS

		Stop Delay (hr)
8:00 AM - 9:00 AM		
Total Network		
	Before	80.0
	After	7.7
	Change	-72.3
5:00 PM - 6:00 PM		
Total Network		
	Before	55.0
	After	9.5
	Change	-45.5

PEAK PERIOD SUMMARY STATISTICS

		Stop Delay (veh*hr)
AM Period (6:00 AM - 11:00 AM)		
Total Network		
	Before	499.0
	After	48.0
	Change	-450.9
PM Period (11:00 AM - 10:00 PM)		
Total Network		
	Before	345.6
	After	59.7
	Change	-285.9

DAILY SUMMARY STATISTICS

	Stop Delay (veh*hr)
Before	844.60
After	107.72
Change	-736.87
% Change	-87.2%

BENEFIT/COST EVALUATION

	Stop Delay Savings	
	veh*hrs	Person - $
Daily Savings	736.87	$11,145
Yearly Savings	184,218	$2,786,297

Total Project Cost:	$2,138,162
Benefit/Cost:	**1.30**

Assumptions

Avg. # of Workdays/Year	250
Avg. Vehicle Occupancy	1.1
Avg. Value of Time/Individual ($/hr)	$13.75

BENEFIT/COST ANALYSIS WB M-14 Ramps at Maple Road

PEAK HOUR SUMMARY STATISTICS

		Stop Delay (hr)
8:00 AM - 9:00 AM		
Total Network		
	Before	34.2
	After	5.1
	Change	-29.1
5:00 PM - 6:00 PM		
Total Network		
	Before	16.0
	After	3.7
	Change	-12.3

PEAK PERIOD SUMMARY STATISTICS

		Stop Delay (veh*hr)
AM Period (6:00 AM - 11:00 AM)		
Total Network		
	Before	166.5
	After	24.8
	Change	-141.7
PM Period (11:00 AM - 10:00 PM)		
Total Network		
	Before	78.0
	After	18.0
	Change	-60.0

DAILY SUMMARY STATISTICS

	Stop Delay (veh*hr)
Before	244.51
After	42.87
Change	-201.64
% Change	-82.5%

BENEFIT/COST EVALUATION

	Stop Delay Savings	
	veh*hrs	Person - $
Daily Savings	201.64	$3,050
Yearly Savings	50,411	$762,460

Total Project Cost:	$100,000
Benefit/Cost:	**7.62**

Assumptions

Avg. # of Workdays/Year	250
Avg. Vehicle Occupancy	1.1
Avg. Value of Time/Individual ($/hr)	$13.75

APPENDIX E: DETAILED ROUNDABOUT DATA

Study Roundabouts

Intersection	County	City	Jurisdiction	New Build / Converted	Year of Construction	Num Legs	Environment	Before					After				
								Before Control	ADT Major	ADT Major Year	ADT Minor	ADT Minor Year	Roundabout Type	ADT Major	ADT Major Year	ADT Minor	ADT Minor Year
I-94 Business (Main St) & Riverview Dr	Berrien	Benton Harbor	MDOT	Converted	2009	4	Urban	Signalized	10,500	2008	5,978	2003	single lane	10,400	2009	**5,921**	**2009**
I-94 Business (Main St) & 5th St	Berrien	Benton Harbor	MDOT	Converted	2009	4	Urban	2-way Stop	10,500	2008	4,256	2003	single lane	10,400	2009	**4,215**	**2009**
US-127 BR & Mission St	Clare	Clare	MDOT	Converted	2009	3	Rural	1-way stop	17,250	2007	**1,000**	**2007**	single lane	15,400	2009	**1,000**	**2009**
Willow Hwy & Canal Rd	Eaton	Meridian Township	Eaton County Road Commission	Converted	2008	4	Rural	awsc	4,997	2004	4,374	2004	single lane	5,217	2010	**4,567**	**2010**
Bennett Rd & Hulett Rd	Ingham	Lansing	Ingham County Road Commission	Converted	2004	4	Rural	2-way Stop	6,878	2000	1,741	2000	single lane	5,347	2008	2,189	2006
Lake Lansing Rd & Chamberlain Dr	Ingham	Lansing	Ingham County Road Commission	Converted	2007	3	Urban	1-way stop	15,356	2006	**500**	**2006**	double lane	**16,141**	**2,008**	**500**	**2008**
Wood St & Sam's Way	Ingham	Lansing	Ingham County Road Commission	Converted	2007	4	Urban	1-way stop	6,763	2005	**500**	**2007**	double lane	9,342	2008	**500**	**2008**
Michigan Ave & Washington Square	Ingham	Lansing	City of Lansing	Converted	2007	4	Urban	awsc	6,325	2003	2,625	2003	single lane	**6,119**	**2008**	**2,973**	**2008**
Cedar St & Holbrook Dr	Ingham	Holt	Ingham County Road Commission	Converted	2009	4	Rural	1-way stop	9,894	2007	**1,000**	**2007**	single/double lane	**8,662**	**2010**	**1,000**	**2010**
Beal Ave & Barnes Ave	Ingham	Lansing	City of Lansing	Converted	2004	4	Urban	2-way Stop	**1,000**	**2003**	**1,000**	**2003**	single lane	**1,000**	**2005**	**1,000**	**2005**
Harding Ave & Pershing Ave	Ingham	Lansing	City of Lansing	Converted	2006	4	Urban	2-way Stop	**1,000**	**2005**	**1,000**	**2005**	single lane	**1,000**	**2007**	**1,000**	**2007**
Moores River Dr & Boston Blvd/Pattengill Ave	Ingham	Lansing	City of Lansing	Converted	1998 to 2005	4	Urban	2-way Stop	**1,000**	**2004**	**1,000**	**2004**	single lane	**1,000**	**2006**	**1,000**	**2006**
Mosher St & Main St	Isabella	Mt Pleasant		Converted	2009	4	Urban	Signalized	**1,000**	**2008**	**1,000**	**2008**	single lane	**1,000**	**2010**	**1,000**	**2010**
Michigan Ave & Rankin St	Kalamazoo	Kalamazoo	City of Kalamazoo	Converted	2004	3	Urban	Stop Controlled	**1,000**	**2003**	**1,000**	**2003**	double lane	**1,000**	**2010**	**1,000**	**2010**
Cherry St & Jefferson Ave	Kent	Grand Rapids	City of Grand Rapids	Converted	2007	4	Urban	Signalized	5,412	2005	5,293	2005	single lane	6,185	2009	4,232	2009
Wealthy St & Lafayette Ave	Kent	Grand Rapids	City of Grand Rapids	Converted	2008	4	Urban	Signalized	21,678	2006	6,607	2007	single lane	16,765	2009	**5,110**	**2009**
Wealthy St & Jefferson Ave	Kent	Grand Rapids	City of Grand Rapids	Converted	2008	4	Urban	Signalized	21,678	2006	8,490	2005	single lane	16,765	2009	4,679	2009
7 Mile Rd & Brewer Ave	Kent	Plainfield	Kent County Road Commission	Converted	2007	4	Rural	2-way Stop	2,222	2005	1,393	2005	single lane	1,571	2008	1,260	2008
Hamburg Rd & Winans Lake Rd	Livingston	Brighton	Livingston County Road Commission	Converted	2009	3	Rural	1-way stop	6,970	2005	9,420	2006	single lane	6,455	2010	8,700	2010
Kensington Rd & Jacoby Rd	Livingston	Milford	Livingston County Road Commission	Converted	2006	3	Rural	Yield	5,845	2003	2,130	2003	single lane	4,710	2010	2,140	2010
US-23/Whitmore Lake Rd & Lee Rd	Livingston	Brighton	MDOT	Converted	2006	4	Urban	Signalized	16,642	2005	12,851	2005	interchange	13,457	2008	14,599	2008
US-23/Whitmore Lake Rd & Lee Rd	Livingston	Brighton	MDOT	Converted	2006	4	Urban	1-way stop	6,281	2005	15,153	2005	interchange	4,365	2008	21,420	2008
US-23/Whitmore Lake Rd & Lee Rd	Livingston	Brighton	MDOT	Converted	2006	4	Urban	1-way stop	**7,412**	**2005**	15,153	2005	interchange	5,151	2008	21,420	2008
Green Oak Village Place & Green Oak Ave	Livingston	Brighton	Private	New Build	2006	4	Urban	-	-	-	-	-	double lane	**1,000**	**2010**	**1,000**	**2010**
Green Oak Village Place & Lee Rd	Livingston	Brighton	Private	New Build	2006	4	Urban	-	-	-	-	-	double lane	**1,000**	**2010**	**1,000**	**2010**
Main St & 3rd St	Livingston	Brighton	City of Brighton	Converted	2003	4	Urban	2-way Stop	13,600	2002	**6,056**	**2002**	single lane	10,330	2009	4,600	2009
Hayes Rd & 25 Mile Rd	Macomb	Shelby Township	Road Commission of Macomb County	Converted	2005	4	Rural	Stop Controlled	5,435	2004	6,965	2004	single lane	5,270	2008	10,555	2008
Romeo Plank Rd & 19 Mile Rd	Macomb	Macomb Township	Road Commission of Macomb County	Converted	2008	4	Rural	Signalized	18,220	2006	18,690	2006	double lane	13,750	2008	17,350	2008
Romeo Plank Rd & Cass Ave	Macomb	Clinton Township	Road Commission of Macomb County	Converted	2008	3	Rural	Signalized	6,210	2006	21,520	2006	double lane	6,140	2008	22,050	2008
Van Dyke & 18.5 Mile	Macomb	Sterling Heights	MDOT	New Build	2005	4	Urban	1-way stop	24,740	2004	5,450	2004	triple/double lane	23,630	2010	23,425	2008
Utica Rd & Dodge Park Rd	Macomb	Sterling Heights	Road Commission of Macomb County	Converted	2009	3	Urban	Signalized	22,670	2007	8,330	2007	double lane	18,420	2010	9,210	2010
Stratford Blvd and Charleston Dr/Plantation	Macomb	Washington		New Build	2002 to 2005	4	Urban	-	-	-	-	-	single lane	**1,000**	**2010**	**1,000**	**2010**
Waterside Dr & W. Vergote Dr	Macomb	New Baltimore		New Build	2007	3	Urban	-	-	-	-	-	single lane	**1,000**	**2010**	**1,000**	**2010**
M-53 ramp & 26-Mile	Macomb	Utica	MDOT	Converted	2009	4	Rural	Ramp stop controlled	9,975	2003	26,011	2003	interchange	10,127	2007	26,366	2007
M-53 ramp & 26-Mile	Macomb	Utica	MDOT	Converted	2009	4	Rural	Ramp stop controlled	1,499	2001	21,364	2003	interchange	1,188	2007	22,306	2007
M-46/Apple Ave & M-37/Newaygo Rd	Muskegon	Casnovia	MDOT	Converted	2009	4	Rural	awsc	6,683	2007	9,618	2006	**single lane**	6,285	2009	9,679	2009
3rd St & Western Ave	Muskegon	Muskegon	City of Muskegon	Converted	2006	4	Urban	2-way Stop	**1,000**	**2005**	1,385	2005	single lane	**1,000**	**2007**	**1,000**	**2007**
Chesapeake Dr & Walker Rd	Muskegon	Muskegon	Muskegon County Road Commission	New Build	2002	4	Rural	-	-	-	-	-	single lane	**1,000**	**2010**	**1,000**	**2010**
Maple Rd & Drake Rd	Oakland	West Bloomfield Twsp	Road Commission for Oakland County	Converted	2007	4	Urban	Signalized	23,680	2005	12,830	2005	triple/double lane	24,500	2009	12,700	2009
Maple Rd & Farmington Rd	Oakland	West Bloomfield Twsp	Road Commission for Oakland County	Converted	2007	4	Urban	Signalized	23,810	2005	12,570	2005	triple/double lane	24,860	2009	11,780	2009
14 Mile Rd & Farmington Rd	Oakland	Farmington Hills	Road Commission for Oakland County	Converted	2008	4	Urban	Signalized	22,420	2005	13,040	2005	triple/double lane	21,130	2010	11,830	2010
Cooley Lake Rd & Bogie Lake Rd	Oakland	White Lake	Road Commission for Oakland County	Converted	2007	3	Rural	Signalized	11,940	2003	13,100	2003	single lane	9,400	2009	12,320	2009
Cooley Lake Rd & Oxbow Lake Rd	Oakland	White Lake	Road Commission for Oakland County	Converted	2007	3	Rural	1-way stop	8,460	2006	3,250	2004	single lane	7,440	2009	4,540	2010
Commerce Crossing & Loop Rd	Oakland	Walled Lake	Road Commission for Oakland County	New Build	2003	3	Rural	-	-	-	-	-	single lane	**1,000**	**2010**	**1,000**	**2010**
Baldwin Rd/Indianwood Rd & S. Coats Rd	Oakland	Orion	Road Commission for Oakland County	Converted	2004	4	Rural	Stop Controlled	10,140	2005	8,115	2005	double lane	6,365	2010	5,795	2010
Taft Rd & Morgan Blvd	Oakland	Northville	City of Northville	Converted	2008	4	Rural	2-way Stop	7,860	2006	**500**	**2006**	single lane	5,740	2010	**500**	**2010**
Chambers/Renton & Johanna Ware	Oakland	Wixom		New Build	2005	4	Urban	-	-	-	-	-	single lane	**1,000**	**2010**	**1,000**	**2010**
Old US-27/North Hwy & Livingston Blvd	Otsego	Gaylord	Otsego County Road Commission	Converted	2006	3	Rural	1-way stop	**1,000**	**2005**	**500**	**2005**	single lane	**1,000**	**2007**	**500**	**2007**
68th Ave & Randall St/ State	Ottawa	Coopersville	City of Coopersville	Converted	2007	4	Rural	awsc	9,032	2006	7,755	2006	double lane	7,922	2010	6,178	2010
I-75 & M-81/Washington Road	Saginaw	Saginaw	MDOT	Converted	2006	4	Rural	Signalized	5,868	2005	13,400	2005	interchange	5,609	2009	9,750	2009
I-75 & M-81/Washington Road	Saginaw	Saginaw	MDOT	Converted	2006	4	Rural	Signalized	5,920	2005	13,400	2005	interchange	3,820	2009	9,750	2009
Nixon Rd & Huron Pkwy	Washtenaw	Ann Arbor	City of Ann Arbor	Converted	2009	4	Urban	awsc	9,382	2006	4,283	2006	single lane	**9,327**	**2010**	**3,049**	**2010**
Geddes Rd & Superior Rd	Washtenaw	Ypsilanti	Washtenaw County Road Commission	Converted	2008	3	Rural	awsc	9,680	2003	7,391	2000	double lane	11,360	2009	5,780	2008
Maple Rd & M-14	Washtenaw	Ann Arbor	MDOT	Converted	2007	4	Urban	2-way Stop	11,532	2006	2,014	2005	interchange	**11,233**	**2008**	**1,720**	**2008**
Maple Rd & M-14	Washtenaw	Ann Arbor	MDOT	Converted	2007	4	Urban	2-way Stop	3,866	2006	6,375	2005	interchange	**3,832**	**2008**	**5,445**	**2008**
Maple & Skyline High School	Washtenaw	Ann Arbor	Washtenaw County Road Commission	New Build	2007	3	Urban	-	-	-	-	-	single lane	2,862	2010	**500**	**2010**
Campus Parkway & Community Dr	Washtenaw	Saline	Washtenaw County Road Commission	New Build	2004	4	Urban	-	-	-	-	-	single lane	2,230	2005	1,267	2007
Campus Parkway & Suncrest Dr	Washtenaw	Saline	Washtenaw County Road Commission	New Build	2004	4	Urban	-	-	-	-	-	single lane	2,230	2005	340	2010

* = assumed value

bold = assumed values

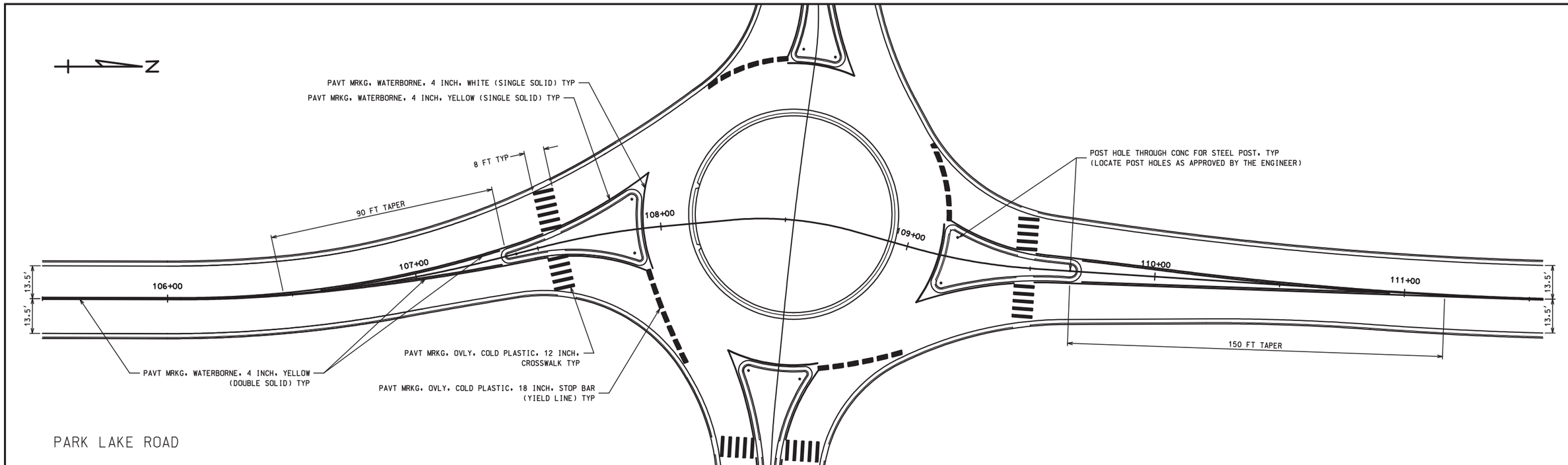
500 used for small developments
1000 used for local and rural roads

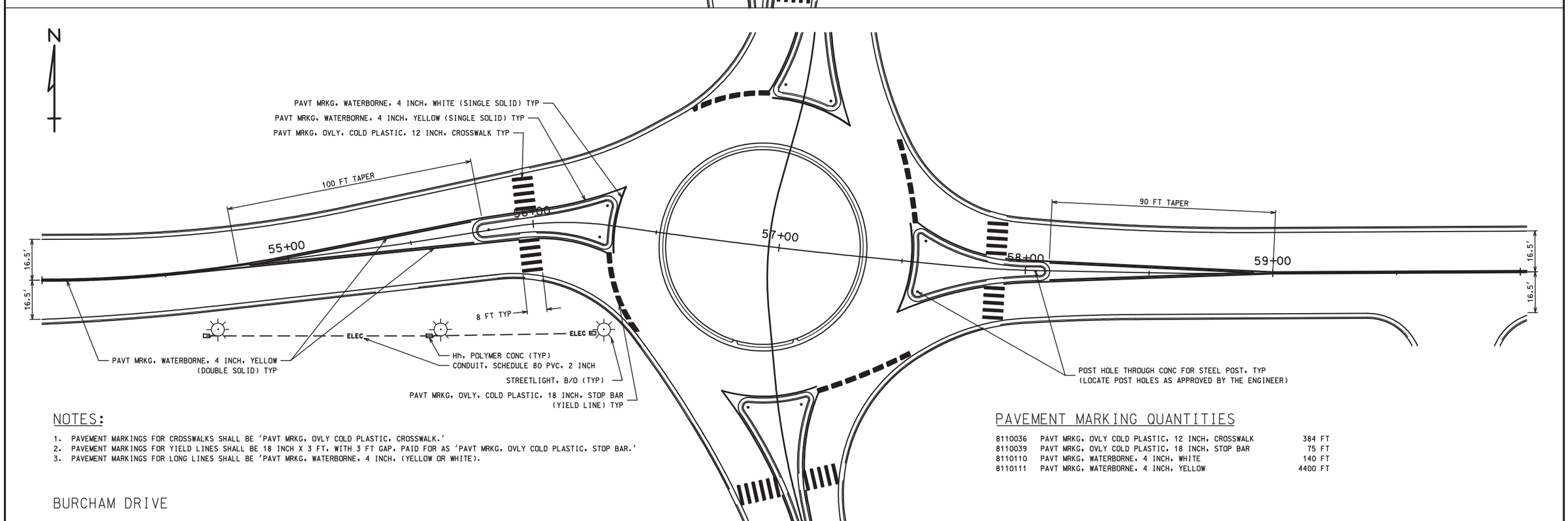
Road	Annual Growth Rate	Source
M-14 EB Ramp	-1.30%	Obtained from SEMCOG (traffic counts)
M-14 WB Ramp	-0.44%	
Maple	-5.12%	
Huron	-8.14%	
Nixon	-0.15%	
Michigan	-0.66%	Obtained from City of Lansing traffic count database
Washington	1.66%	
Cedar St	-4.33%	
Lake Lansing	2.52%	

Eliminated Roundabouts

Intersection	County	City	Jurisdiction	New Build / Converted	Year of Construction	Num Legs	Environment	Before					After				
								Before Control	ADT Major	ADT Major Year	ADT Minor	ADT Minor Year	Roundabout Type	ADT Major	ADT Major Year	ADT Minor	ADT Minor Year
S. Hillsdale St & W. Main St	Calhoun	Homer		New Build	Before 1999								Single Lane				
Tienken Rd & Sheldon Rd/Cemetery	Oakland	Roachester Hills	Road Commission for Oakland County	Converted	2000*	4	rural		17,270	2003	2,000	2003	single lane	17,560	2009	3,610	2008
Tienken Rd/Runyon Rd & Washington Rd	Oakland	Roachester Hills	Road Commission for Oakland County	Converted	2000*	4	rural	1-way stop	17,270	2003	1,090	2005	single lane	17,560	2009	1,300	2010
Utica Park Blvd & Utica Park Dr	Macomb	Utica	Road Commission of Macomb County	New Build	Before 2000	4	Urban	-	-	-	-	-	double lane	N/A	N/A	N/A	N/A
Greenville W Dr & Meijer Dr	Montcalm	Greenville	City of Greenville	New Build	2000	4	rural		N/A	N/A	N/A	N/A	single lane	N/A	N/A	N/A	N/A
Bogue St & Shaw Ln	Ingham	East Lansing	Michigan State University	Converted	2000	4	Urban	Traffic Circle					Single Lane				
4th St & S West Ave	Jackson	Jackson	City of Jackson	Converted	2000	3	Rural	1-way stop	10,863	2006	6,189	2006	Single Lane	10,640	2009	6,362	2009
Blue Star Hwy & North Shore Dr	Allegan	South Haven	Allegan County Road Commission	Converted	2010	4	Rural	2-way Stop					Single	3,448	2010	1,017	2010
N. Kalamazoo Ave/17 Mile Rd & W Michigan Ave	Calhoun	Marshall		Converted	Before 1999	4	Urban						Single Lane				
East Rd & Creyts Rd	Eaton	Dimondale	Eaton County Road Commission	Converted		3	Rural		2,634	2008	3,331	2003	Painted Single Lane			3,660	2010
Glen Dr. & Birch Tree Ln	Grand Traverse	Traverse City		New Build	2006	3	Urban	-	-	-	-	-					
Center St & Main St 4th St	Iron	Alpha		New Build	Before 1992								Single Lane				
Emajean St. & Arboretum Circle	Kalamazoo	Kalamazoo		New Build			Urban						Single Lane				
Trillium Blvd & Lotus Lily Ave	Kalamazoo	Kalamazoo		New Build			Rural	-					Single Lane				
Pfeiffer Woods & ???	Kent	Kentwood	City of Kentwood	New Build	2005	3	Rural	-					Single Lane				
Sunset Ridge Dr & Saddle Ridge Dr	Kent	Rockford		New Build	2005	4	Rural	-	-	-	-	-	Single Lane				
Hartland Rd & Town Square	Livingston	Hartland	Livingston County Road Commission	New Build	2009	4	Rural	-	6,230	2001	-	-	single lane	6,960	2008	-	-
Patridge Creek Blvd & Hawk Ln	Macomb	Clinton Township	Road Commission of Macomb County	New Build	2006	3	Urban	-	N/A	N/A	N/A	N/A	double lane	5,780	2010		
Patridge Creek Blvd & Scoter Ln	Macomb	Clinton Township	Road Commission of Macomb County	New Build	2006	3	Urban	-	N/A	N/A	N/A	N/A	double lane	5,780	2010		
Romeo Plank Rd & Canal Rd	Macomb	Clinton Township	Road Commission of Macomb County	Converted	2011	4	Rural	awsc	6,210	2006	8,815	2004	Single Lane	6,140	2008	7,605	2006
Lakeshore Drive and Cottage/Monroe Stree	Manistee	Manistee	City of Manistee	New Build	1992	3	rural	-	N/A	N/A	N/A	N/A	single lane	N/A	N/A	N/A	N/A
US-41/M-28 & Front St	Marquette	Marquette	MDOT	Converted	2010	3	rural	Stop Controlled	15,400	2007	23,600	2007	Double Lane	16,700	2009	22,600	2009
Grand River Ave & Travis Ln	Oakland	New Hudson	Road Commission for Oakland County	Converted	2009	3	rural	1-way stop	14,260	2006			double lane	10,300	2010		
Grand River Ave & Lyon Center Dr	Oakland	New Hudson	Road Commission for Oakland County	Converted	2008	4	rural	2-way Stop	4,360	2008	4,740	2006	double lane	4,580	2010	4,470	2007
Lyon Center & Pontiac Trail	Oakland	New Hudson	Road Commission for Oakland County	Converted	2010	4	rural	1-way stop					Single Lane				
Martin Rd & Library	Oakland	Walled Lake	Road Commission for Oakland County	Converted	2009	4	rural	-					single lane				
Martin Rd & Pga Dr	Oakland	Walled Lake	Road Commission for Oakland County	Converted	2009	3	rural						double lane				
Oakley Park Rd & Martin Rd	Oakland	Walled Lake	Road Commission for Oakland County	Converted	2009	4	rural	signal	8,610	2008	6,550	2003	double lane	7,330	2010	6,880	2006
Livernois Rd & Hamlin Rd	Oakland	Rochester Hills	City of Rochester Hills	Converted	2010	4	rural	signal	17,645	2006	12,250	2005		17,015	2009	12,480	2008
Livernois Rd & Tienken Rd	Oakland	Rochester Hills	City of Rochester Hills	Converted		4	rural	signal	7,985	2007	20,470	2007		8,265	2009	19,850	2009
M-43 and 72nd St and 12th Ave/CR 689	Van Buren	South Haven	MDOT	Converted	2008	6	rural	signal					single lane				
I-94 & Main St	Van Buren	Mattawan	MDOT	Converted	2011	4	rural	ramp stop					interchange				
I-94 & Main St	Van Buren	Mattawan	MDOT	Converted	2011	4	rural	signal					interchange				
Whittaker Rd & Stony Creek Rd	Washtenaw	Ypsilanti	Washtenaw County Road Commission	Converted	2010	4	Urban	signal	14,070	2006	7,960	2006	double lane	13,280	2008	7,290	2008
US-23 & Geddes Rd	Washtenaw	Ann Arbor	MDOT	Converted	2010	4	Urban	signal	4,907	2007	19,680	2006	interchange			20,290	2008
US-23 & Geddes Rd	Washtenaw	Ann Arbor	MDOT	Converted	2011	4	Urban	signal	6,402	2001	16,540	1997	interchange	6,292	2007	18,770	2005
Geddes Rd/Concordia Campus Dr & Earhart Rd	Washtenaw	Ann Arbor	City of Ann Arbor	Converted	2010	4	Urban	signal	16,540	1997	5,110	1998		18,770	2005	4,740	2005
Lakeview Rd & Island Lake	Wayne	Rockwood		New Build	Before 1993	3	Rural	-					single lane				
Hamilton Rd & Marsh Rd	Ingham	Okemos	Ingham County Road Commission	Converted	2000	3	Urban	Signal	11,205	2004	5,188	2001	Single/Double Lane	12,015	2007	4,300	2005

APPENDIX F: ROUNDABOUT DETAILED PLANS





NOTES:

1. PAVEMENT MARKINGS FOR CROSSWALKS SHALL BE 'PAVT MRKG, OVLY COLD PLASTIC, CROSSWALK.'
2. PAVEMENT MARKINGS FOR YIELD LINES SHALL BE 18 INCH X 3 FT, WITH 3 FT GAP, PAID FOR AS 'PAVT MRKG, OVLY COLD PLASTIC, STOP BAR.'
3. PAVEMENT MARKINGS FOR LONG LINES SHALL BE 'PAVT MRKG, WATERBORNE, 4 INCH, (YELLOW OR WHITE).

PAVEMENT MARKING QUANTITIES

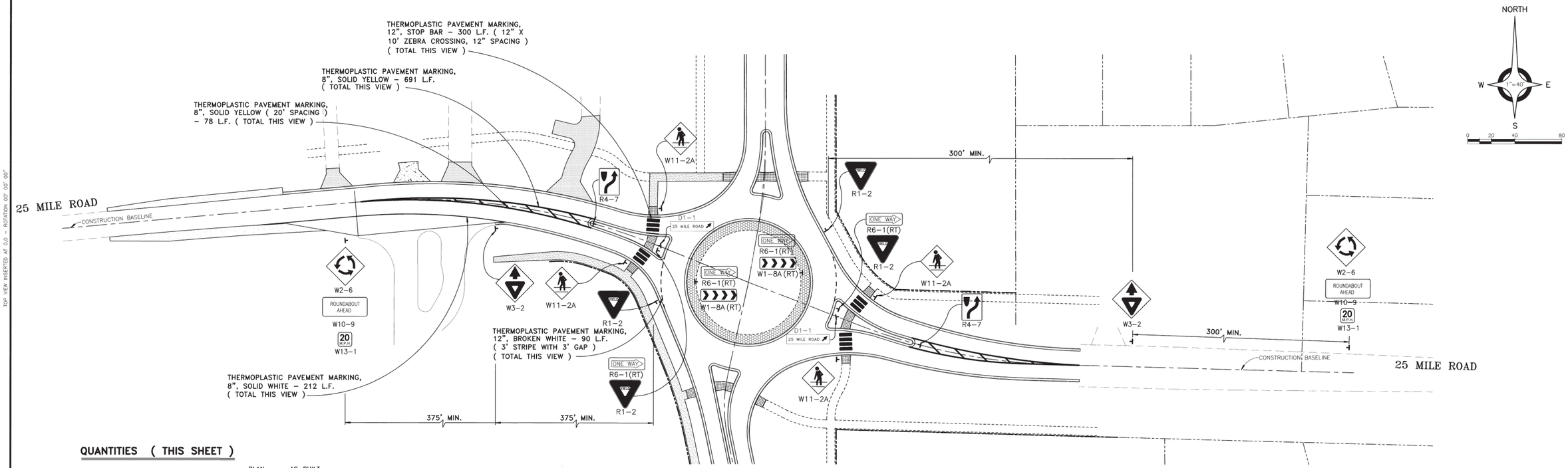
8110036	PAVT MRKG, OVLY COLD PLASTIC, 12 INCH, CROSSWALK	384 FT
8110039	PAVT MRKG, OVLY COLD PLASTIC, 18 INCH, STOP BAR	75 FT
8110110	PAVT MRKG, WATERBORNE, 4 INCH, WHITE	140 FT
8110111	PAVT MRKG, WATERBORNE, 4 INCH, YELLOW	4400 FT

PAVEMENT MARKING/ELECTRIC PLAN

INGHAM COUNTY ROAD COMMISSION

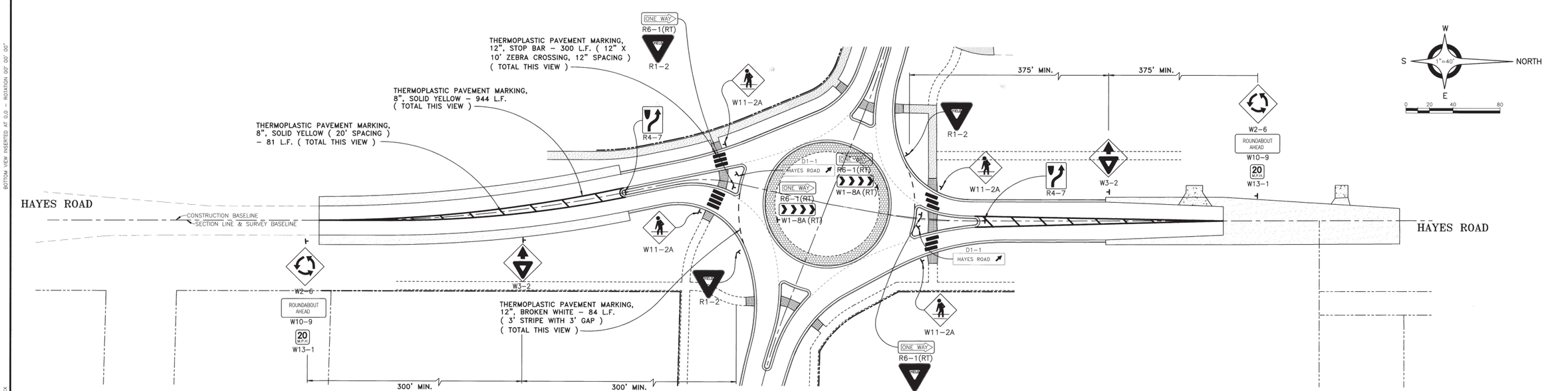
PARK LAKE ROAD & BURCHAM DRIVE

DATE	SCALE	CONT. SEC.	JOB NO.	DESIGN UNIT	SHEET NO. R.O.W.
09/10/11	1"= 20'	33400	112874	TROIA	22/24



QUANTITIES (THIS SHEET)

NO.	ITEM	PLAN QUANTITY	AS-BUILT QUANTITY
1.	PAVT MRKG, THERMOPL, 12 INCH, STOP BAR	600 FT	
2.	PAVT MRKG, THERMOPL, 8 INCH, YELLOW	1794 FT	
3.	PAVT MRKG, THERMOPL, 8 INCH, WHITE	212 FT	
4.	PAVT MRKG, THERMOPL, 12 INCH, WHITE	174 FT	
5.	SIGN, TYPE III A	8 SFT	
4.	SIGN, TYPE III B	186 SFT	



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TOP VIEW INSERTED AT 0,0 – ROTATION 00° 00' 00"

BOTTOM VIEW INSERTED AT 0,0 – ROTATION 00° 00' 00"

PLOT SCALE: X=XX

REVISIONS	DATE	REMARKS	DATE	REMARKS
	5-09-05	MRP PER RCMC		
	05-17-05	SMH SHORTEN ISLAND PER RCMC		

3 WORKING DAYS BEFORE YOU DIG CALL MISS DIG 1-800-482-7171 (TOLL FREE)

ROAD COMMISSION OF MACOMB COUNTY, CHARTER TOWNSHIP OF SHELBY AND MACOMB TOWNSHIP

ANDERSON, ECKSTEIN AND WESTRICK, INC.
Civil Engineers • Surveyors • Architects
51301 Schoenherr Road, Shelby Township, Michigan 48315
Phone 586•726•1234 Fax 586•726•8780

25 MILE–HAYES INTERSECTION SIGNAGE & STRIPING PLANS

☐ PRELIMINARY
■ CONSTRUCTION
☐ AS-BUILT

CLIENT: CHARTER TOWNSHIP OF SHELBY
DRAWING SCALE: NOT TO SCALE
PROJECT NO. 132-421
DATE: NOVEMBER, 2004
DRAWN BY: SMH
CHECK BY:

SHEET NO. 13

W.O. 5045