

2002-2004 Green Bay Metropolitan Area Intersection Crash Study



Brown County Planning Commission
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I. Introduction

The Green Bay metropolitan area experiences hundreds of vehicle crashes every year that are caused by a variety of factors, and many of these crashes occur at intersections because these are the main conflict points in the street system. This study begins by comparing the crash statistics for the 30 intersections that were profiled in the planning commission's 1997-1999 intersection crash study to the statistics for the three-year period between 2002 and 2004. Following this comparison, the study examines the 30 metropolitan area intersections that experienced at least 15 reportable crashes and had the highest average annual crash rates between 2002 and 2004 to determine the primary causes for the incidents and methods of correcting many of the major problems that appear to exist at the intersections. The study does not include the metropolitan area freeway interchanges because reliable crash rates could not be calculated using the available information.

The information for this study was obtained from the Wisconsin Department of Transportation (WisDOT) Bureau of Highway Operations in Madison and through reviews of each intersection in the report. Despite being difficult to sort by intersection, the WisDOT records are very extensive and provide a detailed summary of the information provided on the forms completed by law enforcement officers at the scene of every reportable crash. The summary information, field visits, and the experience of observing and using many of the intersections on a daily basis enabled staff to develop observations and recommendations for the study.

II. Explanation of Terms Used in the Study

Crash Rate

The crash rates that were calculated for the intersections using WisDOT's most recent traffic counts (2003) and counts from other sources represent the number of crashes that occurred for every million vehicles that entered each intersection in a year. The intersections were ranked by crash rate because this was assumed to be the most appropriate indication of safety problems, but many intersections with relatively low rates experienced many property damage and injury crashes throughout the three-year study period and should not be disregarded merely because of their lower rates. The average annual number of crashes experienced at the intersections in the study and the intersections' annual crash rates are shown in Maps 1 and 2.

Reportable Crashes Per Year

This study only considers crashes that are considered to be reportable by the law enforcement officer who was at the scene because these are believed to be the most severe and are the incidents that are submitted to the crash records division of the Wisconsin Department of Transportation in Madison. For a crash to be reportable, an officer has to believe that a vehicle has sustained a minimum of \$2,000 damage.

Crashes where less damage has occurred are typically noted by officers but are not filed with the WisDOT crash records division.

Estimated Property Damage Cost Per Year

To estimate the average annual property damage costs associated with crashes at each intersection in the 1997-1999 study, planning commission staff used a per-crash estimate of \$6,400 that was developed by the National Safety Council (NSC) in 1997. To estimate the average annual property damage costs at each intersection for the period between 2002 and 2004, staff used the NSC's 2002 per-crash estimate of \$6,200.

Injuries Per Year

This statistic identifies the average number of people who were injured at each intersection per year over the three-year study period.

Estimated Injury Cost Per Year

To estimate the average annual injury costs associated with crashes at each intersection in the 1997-1999 study, planning commission staff used a per-injury estimate of \$34,100 that was developed by the NSC in 1997. To estimate the average annual injury costs at each intersection for the period between 2002 and 2004, staff used the NSC's 2002 per-injury estimate of \$39,875.

Crash Type

The crash reports provided by WisDOT identify several types of crashes, but this study concentrates on angle, rear end, head on, and side swipe crashes because these were usually the most common and severe types of crashes at each intersection. The study also notes the percentage of crashes that involved pedestrians and bicycles to determine if the intersections are relatively unsafe for these transportation modes.

Driver Factor

The WisDOT reports also identify several factors that caused the intersection-related crashes, but this study concentrates on crashes that involved drivers disregarding traffic controls, failing to yield, driving inattentively, and traveling too fast for conditions. The study also notes the percentage of crashes that were caused by the condition of the drivers, which typically meant that one or more of the drivers was under the influence of alcohol or another substance.

Comments

The comments for the intersections are based on an extensive review of the crash data and visits to the intersections to identify problems and confirm the existence of hazards.

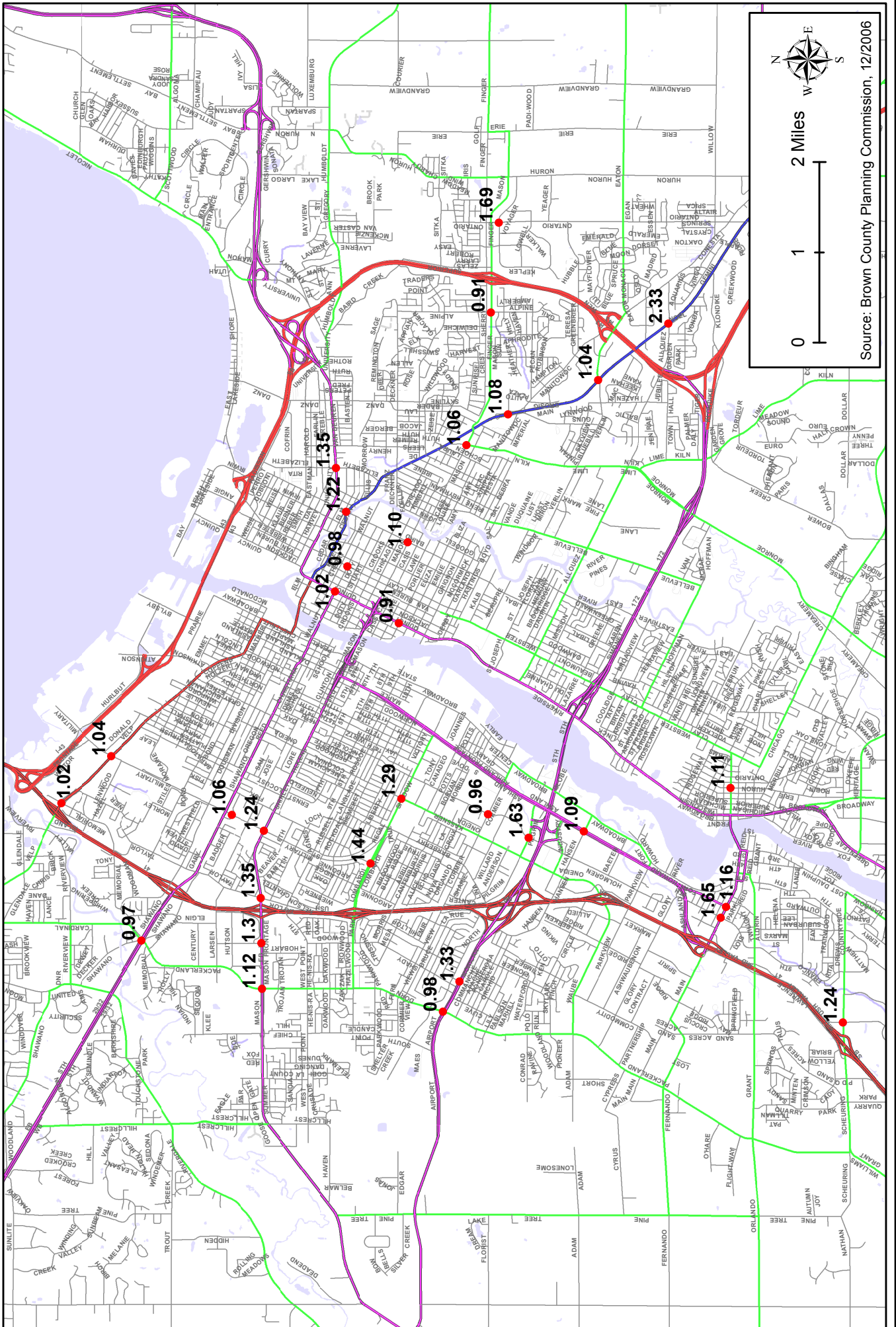
Recommendations

The report recommends remedies to the problems that are believed to exist at the study's 30 intersections. Since these recommendations often involve changes in the intersections' physical characteristics, the recommendations should be reviewed by a certified engineer before the corrections are made.



Map 1: Top 30 Metropolitan Area Annual Intersection Crash Rates, 2002-2004

(At Least Fifteen Crashes Over a Three-Year Period Needed to be Included in Study)



Source: Brown County Planning Commission, 12/2006

III. Comparison of 1997-1999 and 2002-2004 Crash Statistics

1. Madison Street/Cherry Street (Green Bay)

	<u>1997-1999</u>	<u>2002-2004</u>	<u>Difference</u>	<u>% Difference</u>
Crash Rate	2.42	0.56	-1.86	-76.9%
Reportable Crashes Per Year	5.3	1	-4.3	-81.1%
Est. Property Damage Cost/Year	\$33,920	\$6,200	-\$27,720	-81.7%
Injuries Per Year	2.7	0.7	-2.04	-75.6%
Est. Injury Cost/Year	\$92,070	\$26,318	-\$65,753	-71.4%
Crash Type				
Right Angle	14	2	-12	-85.7%
Rear End	0	0	0	0.0%
Side Swipe	1	1	0	0.0%
Head On	0	0	0	0.0%
Bicycle/Pedestrian	0	0	0	0.0%
Other	1	0	-1	-100.0%
Driver Factor				
Disregard Traffic Control	10	1	-9	-90.0%
Failure To Yield	1	1	0	0.0%
Inattentive Driving	2	1	-1	-50.0%
Too Fast For Conditions	0	0	0	0.0%
Driver Condition	0	0	0	0.0%
Other	3	0	-3	-100.0%

2. University Avenue/Elizabeth Street (Green Bay)

	<u>1997-1999</u>	<u>2002-2004</u>	<u>Difference</u>	<u>% Difference</u>
Crash Rate	2.11	1.35	-0.76	-36.0%
Reportable Crashes Per Year	14.3	9.3	-5	-35.0%
Est. Property Damage Cost/Year	\$91,520	\$57,660	-\$33,860	-37.0%
Injuries Per Year	9.7	4.3	-5.4	-55.7%
Est. Injury Cost/Year	\$330,770	\$171,463	-\$159,308	-48.2%
Crash Type				
Right Angle	19	18	-1	-5.3%
Rear End	13	7	-6	-46.2%
Side Swipe	6	1	-5	-83.3%
Head On	2	0	-2	-100.0%
Bicycle/Pedestrian	0	0	0	0.0%
Other	3	2	-1	-33.3%
Driver Factor				
Disregard Traffic Control	2	6	4	200.0%
Failure To Yield	22	10	-12	-54.5%
Inattentive Driving	8	5	-3	-37.5%
Too Fast For Conditions	5	2	-3	-60.0%
Driver Condition	1	2	1	100.0%
Other	5	3	-2	-40.0%

3. Walnut Street/Roosevelt Street (Green Bay)

	<u>1997-1999</u>	<u>2002-2004</u>	<u>Difference</u>	<u>% Difference</u>
Crash Rate	1.99	1.26	-0.73	-36.7%
Reportable Crashes Per Year	6	4.3	-1.7	-28.3%
Est. Property Damage Cost/Year	\$38,400	\$26,660	-\$11,740	-30.6%
Injuries Per Year	6.7	4.3	-2.4	-35.8%
Est. Injury Cost/Year	\$228,470	\$171,463	-\$57,008	-25.0%
Crash Type				
Right Angle	12	9	-3	-25.0%
Rear End	2	1	-1	-50.0%
Side Swipe	1	1	0	0.0%
Head On	1	0	-1	-100.0%
Bicycle/Pedestrian	1	2	1	100.0%
Other	1	0	-1	-100.0%
Driver Factor				
Disregard Traffic Control	2	3	1	50.0%
Failure To Yield	6	7	1	16.7%
Inattentive Driving	4	1	-3	-75.0%
Too Fast For Conditions	0	1	1	---
Driver Condition	3	0	-3	-100.0%
Other	3	1	-2	-66.7%

4. Madison Street/Crooks Street (Green Bay)

	<u>1997-1999</u>	<u>2002-2004</u>	<u>Difference</u>	<u>% Difference</u>
Crash Rate	1.93	0.48	-1.45	-75.1%
Reportable Crashes Per Year	5	1	-4	-80.0%
Est. Property Damage Cost/Year	\$32,000	\$6,200	-\$25,800	-80.6%
Injuries Per Year	3.7	1	-2.7	-73.0%
Est. Injury Cost/Year	\$126,170	\$39,875	-\$86,295	-68.4%
Crash Type				
Right Angle	13	2	-11	-84.6%
Rear End	0	0	0	0.0%
Side Swipe	2	1	-1	-50.0%
Head On	0	0	0	0.0%
Bicycle/Pedestrian	0	0	0	0.0%
Other	0	0	0	0.0%
Driver Factor				
Disregard Traffic Control	5	0	-5	-100.0%
Failure To Yield	8	1	-7	-87.5%
Inattentive Driving	0	0	0	0.0%
Too Fast For Conditions	0	0	0	0.0%
Driver Condition	0	0	0	0.0%
Other	2	2	0	0.0%

5. West Mason Street/Taylor Street (Green Bay)

	<u>1997-1999</u>	<u>2002-2004</u>	<u>Difference</u>	<u>% Difference</u>
Crash Rate	1.87	1.35	-0.52	-27.8%
Reportable Crashes Per Year	24	22.3	-1.7	-7.1%
Est. Property Damage Cost/Year	\$153,600	\$138,260	-\$15,340	-10.0%
Injuries Per Year	21.7	20	-1.7	-7.8%
Est. Injury Cost/Year	\$739,970	\$797,500	\$57,530	7.8%
Crash Type				
Right Angle	48	45	-3	-6.3%
Rear End	18	16	-2	-11.1%
Side Swipe	2	3	1	50.0%
Head On	1	2	1	100.0%
Bicycle/Pedestrian	1	0	-1	-100.0%
Other	2	1	-1	-50.0%
Driver Factor				
Disregard Traffic Control	24	23	-1	-4.2%
Failure To Yield	23	24	1	4.3%
Inattentive Driving	11	8	-3	-27.3%
Too Fast For Conditions	6	1	-5	-83.3%
Driver Condition	0	1	1	-----
Other	8	10	2	25.0%

6. Lombardi Avenue/Marlee Lane (Ashwaubenon & Green Bay)

	<u>1997-1999</u>	<u>2002-2004</u>	<u>Difference</u>	<u>% Difference</u>
Crash Rate	1.82	1.44	-0.38	-20.9%
Reportable Crashes Per Year	18.7	14	-4.7	-25.1%
Est. Property Damage Cost/Year	\$119,680	\$86,800	-\$32,880	-27.5%
Injuries Per Year	18	6.3	-11.7	-65.0%
Est. Injury Cost/Year	\$613,800	\$251,213	-\$362,588	-59.1%
Fatalities Per Year	0	0.33	0.33	-----
Est. Fatality Cost/Year	\$0	?	\$?	-----
Crash Type				
Right Angle	26	23	-3	-11.5%
Rear End	27	12	-15	-55.6%
Side Swipe	2	1	-1	-50.0%
Head On	0	0	0	0.0%
Bicycle/Pedestrian	0	0	0	0.0%
Other	1	6	5	500.0%
Driver Factor				
Disregard Traffic Control	3	2	-1	-33.3%
Failure To Yield	21	21	0	0.0%
Inattentive Driving	9	8	-1	-11.1%
Too Fast For Conditions	6	1	-5	-83.3%
Other	16	10	-6	-37.5%

7. STH 172/Babcock Road (Ashwaubenon)

	<u>1997-1999</u>	<u>2002-2004</u>	<u>Difference</u>	<u>% Difference</u>
Crash Rate	1.65	1.33	-0.32	-19.4%
Reportable Crashes Per Year	15.7	13.7	-2	-12.7%
Est. Property Damage Cost/Year	\$100,480	\$84,940	-\$15,540	-15.5%
Injuries Per Year	8	11	3	37.5%
Est. Injury Cost/Year	\$272,800	\$438,625	\$165,825	60.8%
Crash Type				
Right Angle	26	22	-4	-15.4%
Rear End	11	15	4	36.4%
Side Swipe	3	3	0	0.0%
Head On	1	0	-1	-100.0%
Bicycle/Pedestrian	0	1	1	-----
Other	6	0	-6	-100.0%
Driver Factor				
Disregard Traffic Control	8	2	-6	-75.0%
Failure To Yield	21	16	-5	-23.8%
Inattentive Driving	7	13	6	85.7%
Too Fast For Conditions	2	5	3	150.0%
Driver Condition	0	0	0	0.0%
Other	9	5	-4	-44.4%

8. Irwin Avenue/Radisson Street (Green Bay)

	<u>1997-1999</u>	<u>2002-2004</u>	<u>Difference</u>	<u>% Difference</u>
Crash Rate	1.6	1.24	-0.36	-22.5%
Reportable Crashes Per Year	5.3	3.3	-2	-37.7%
Est. Property Damage Cost/Year	\$33,920	\$20,460	-\$13,460	-39.7%
Injuries Per Year	4.3	2.3	-2	-46.5%
Est. Injury Cost/Year	\$146,630	\$91,713	-\$54,918	-37.5%
Crash Type				
Right Angle	12	5	-7	-58.3%
Rear End	3	2	-1	-33.3%
Side Swipe	1	2	1	100.0%
Head On	0	1	1	-----
Bicycle/Pedestrian	0	0	0	0.0%
Other	0	0	0	0.0%
Driver Factor				
Disregard Traffic Control	0	6	6	-----
Failure To Yield	10	1	-9	-90.0%
Inattentive Driving	4	1	-3	-75.0%
Too Fast For Conditions	0	0	0	0.0%
Driver Condition	0	1	1	-----
Other	2	1	-1	-50.0%

9. Ashland Avenue/Cormier Road (Ashwaubenon)

	<u>1997-1999</u>	<u>2002-2004</u>	<u>Difference</u>	<u>% Difference</u>
Crash Rate	1.59	0.63	-0.96	-60.4%
Reportable Crashes Per Year	16.3	6.3	-10	-61.3%
Est. Property Damage Cost/Year	\$104,320	\$39,060	-\$65,260	-62.6%
Injuries Per Year	12	4	-8	-66.7%
Est. Injury Cost/Year	\$409,200	\$159,500	-\$249,700	-61.0%
Crash Type				
Right Angle	23	8	-15	-65.2%
Rear End	12	4	-8	-66.7%
Side Swipe	2	1	-1	-50.0%
Head On	0	1	1	-----
Bicycle/Pedestrian	1	1	0	0.0%
Other	11	4	-7	-63.6%
Driver Factor				
Disregard Traffic Control	9	2	-7	-77.8%
Failure To Yield	5	8	3	60.0%
Inattentive Driving	17	1	-16	-94.1%
Too Fast For Conditions	8	0	-8	-100.0%
Driver Condition	9	0	-9	-100.0%
Other	1	8	7	700.0%

10. Main Street/Auto Plaza Way (Green Bay)

	<u>1997-1999</u>	<u>2002-2004</u>	<u>Difference</u>	<u>% Difference</u>
Crash Rate	1.55	1.08	-0.47	-30.3%
Reportable Crashes Per Year	13	11.7	-1.3	-10.0%
Est. Property Damage Cost/Year	\$83,200	\$72,540	-\$10,660	-12.8%
Injuries Per Year	8.3	6.7	-1.6	-19.3%
Est. Injury Cost/Year	\$283,030	\$267,163	-\$15,868	-5.6%
Crash Type				
Right Angle	29	30	1	3.4%
Rear End	4	3	-1	-25.0%
Side Swipe	2	1	-1	-50.0%
Head On	0	0	0	0.0%
Bicycle/Pedestrian	1	0	-1	-100.0%
Other	3	1	-2	-66.7%
Driver Factor				
Disregard Traffic Control	9	4	-5	-55.6%
Failure To Yield	19	25	6	31.6%
Inattentive Driving	6	3	-3	-50.0%
Too Fast For Conditions	2	2	0	0.0%
Driver Condition	0	0	0	0.0%
Other	3	1	-2	-66.7%

11. Monroe Avenue/Cherry Street (Green Bay)

	<u>1997-1999</u>	<u>2002-2004</u>	<u>Difference</u>	<u>% Difference</u>
Crash Rate	1.51	0.89	-0.62	-41.1%
Reportable Crashes Per Year	8	4.7	-3.3	-41.3%
Est. Property Damage Cost/Year	\$51,200	\$29,140	-\$22,060	-43.1%
Injuries Per Year	6.3	4	-2.3	-36.5%
Est. Injury Cost/Year	\$214,830	\$159,500	-\$55,330	-25.8%
Crash Type				
Right Angle	21	12	-9	-42.9%
Rear End	2	1	-1	-50.0%
Side Swipe	0	0	0	0.0%
Head On	0	1	1	-----
Bicycle/Pedestrian	1	0	-1	-100.0%
Other	0	1	1	-----
Driver Factor				
Disregard Traffic Control	14	7	-7	-50.0%
Failure To Yield	1	5	4	400.0%
Inattentive Driving	6	4	-2	-33.3%
Too Fast For Conditions	0	0	0	0.0%
Driver Condition	0	1	1	-----
Other	3	0	-3	-100.0%

12. West Mason Street/Packerland Drive (Green Bay)

	<u>1997-1999</u>	<u>2002-2004</u>	<u>Difference</u>	<u>% Difference</u>
Crash Rate	1.49	1.12	-0.37	-24.8%
Reportable Crashes Per Year	18.3	14.7	-3.6	-19.7%
Est. Property Damage Cost/Year	\$117,120	\$91,140	-\$25,980	-22.2%
Injuries Per Year	9.7	7.7	-2	-20.6%
Est. Injury Cost/Year	\$330,770	\$307,038	-\$23,733	-7.2%
Crash Type				
Right Angle	35	25	-10	-28.6%
Rear End	10	14	4	40.0%
Side Swipe	4	3	-1	-25.0%
Head On	1	1	0	0.0%
Bicycle/Pedestrian	2	0	-2	-100.0%
Other	3	1	-2	-66.7%
Driver Factor				
Disregard Traffic Control	1	2	1	100.0%
Failure To Yield	35	22	-13	-37.1%
Inattentive Driving	7	2	-5	-71.4%
Too Fast For Conditions	1	2	1	100.0%
Driver Condition	1	0	-1	-100.0%
Other	10	16	6	60.0%

13. East Mason Street/Lime Kiln Road (Green Bay)

	<u>1997-1999</u>	<u>2002-2004</u>	<u>Difference</u>	<u>% Difference</u>
Crash Rate	1.46	1.06	-0.4	-27.4%
Reportable Crashes Per Year	12.7	10.3	-2.4	-18.9%
Est. Property Damage Cost/Year	\$81,280	\$63,860	-\$17,420	-21.4%
Injuries Per Year	9	8.7	-0.3	-3.3%
Est. Injury Cost/Year	\$306,900	\$346,913	\$40,013	13.0%
Crash Type				
Right Angle	20	15	-5	-25.0%
Rear End	12	10	-2	-16.7%
Side Swipe	2	0	-2	-100.0%
Head On	1	1	0	0.0%
Bicycle/Pedestrian	0	3	3	-----
Other	3	2	-1	-33.3%
Driver Factor				
Disregard Traffic Control	6	8	2	33.3%
Failure To Yield	10	6	-4	-40.0%
Inattentive Driving	8	6	-2	-25.0%
Too Fast For Conditions	3	0	-3	-100.0%
Driver Condition	4	3	-1	-25.0%
Other	7	8	1	14.3%

14. West Mason Street/Military Avenue (Green Bay)

	<u>1997-1999</u>	<u>2002-2004</u>	<u>Difference</u>	<u>% Difference</u>
Crash Rate	1.37	1.24	-0.13	-9.5%
Reportable Crashes Per Year	20.3	20	-0.3	-1.5%
Est. Property Damage Cost/Year	\$129,920	\$124,000	-\$5,920	-4.6%
Injuries Per Year	18.3	12.7	-5.6	-30.6%
Est. Injury Cost/Year	\$624,030	\$506,413	-\$117,618	-18.8%
Crash Type				
Right Angle	24	34	10	41.7%
Rear End	30	21	-9	-30.0%
Side Swipe	3	1	-2	-66.7%
Head On	1	2	1	100.0%
Bicycle/Pedestrian	0	0	0	0.0%
Other	3	2	-1	-33.3%
Driver Factor				
Disregard Traffic Control	10	9	-1	-10.0%
Failure To Yield	15	23	8	53.3%
Inattentive Driving	15	10	-5	-33.3%
Too Fast For Conditions	5	5	0	0.0%
Driver Condition	1	2	1	100.0%
Other*	15	11	-4	-26.7%

*The predominant other factor during both study periods was following too close.

T15. Main Street/Monroe Avenue (Green Bay)

	<u>1997-1999</u>	<u>2002-2004</u>	<u>Difference</u>	<u>% Difference</u>
Crash Rate	1.3	0.72	-0.58	-44.6%
Reportable Crashes Per Year	6.7	7.7	1	14.9%
Est. Property Damage Cost/Year	\$42,880	\$47,740	\$4,860	11.3%
Injuries Per Year	2.3	7.3	5	217.4%
Est. Injury Cost/Year	\$78,430	\$291,088	\$212,658	271.1%
Crash Type				
Right Angle	14	11	-3	-21.4%
Rear End	3	8	5	166.7%
Side Swipe	1	1	0	0.0%
Head On	0	1	1	-----
Bicycle/Pedestrian	0	2	2	-----
Other	2	0	-2	-100.0%
Driver Factor				
Disregard Traffic Control	6	4	-2	-33.3%
Failure To Yield	7	8	1	14.3%
Inattentive Driving	2	6	4	200.0%
Too Fast For Conditions	1	1	0	0.0%
Driver Condition	0	1	1	-----
Other	4	3	-1	-25.0%

T15. Walnut Street/Jefferson Street (Green Bay)

	<u>1997-1999</u>	<u>2002-2004</u>	<u>Difference</u>	<u>% Difference</u>
Crash Rate	1.3	0.69	-0.61	-46.9%
Reportable Crashes Per Year	8	3.3	-4.7	-58.8%
Est. Property Damage Cost/Year	\$51,200	\$20,460	-\$30,740	-60.0%
Injuries Per Year	8.7	0.67	-8.03	-92.3%
Est. Injury Cost/Year	\$296,670	\$26,716	-\$269,954	-91.0%
Crash Type				
Right Angle	16	7	-9	-56.3%
Rear End	4	1	-3	-75.0%
Side Swipe	1	2	1	100.0%
Head On	0	0	0	0.0%
Bicycle/Pedestrian	3	0	-3	-100.0%
Other	0	0	0	0.0%
Driver Factor				
Disregard Traffic Control	12	5	-7	-58.3%
Failure To Yield	5	2	-3	-60.0%
Inattentive Driving	2	1	-1	-50.0%
Too Fast For Conditions	1	0	-1	-100.0%
Driver Condition	0	0	0	0.0%
Other	4	2	-2	-50.0%

T17. Military Avenue/Leo Street (Green Bay)

	<u>1997-1999</u>	<u>2002-2004</u>	<u>Difference</u>	<u>% Difference</u>
Crash Rate	1.25	1.06	-0.19	-15.2%
Reportable Crashes Per Year	10	10.7	0.7	7.0%
Est. Property Damage Cost/Year	\$64,000	\$66,340	\$2,340	3.7%
Injuries Per Year	9	7.7	-1.3	-14.4%
Est. Injury Cost/Year	\$306,900	\$307,038	\$138	0.0%
Crash Type				
Right Angle	22	25	3	13.6%
Rear End	3	6	3	100.0%
Side Swipe	1	1	0	0.0%
Head On	0	0	0	0.0%
Bicycle/Pedestrian	3	0	-3	-100.0%
Other	1	0	-1	-100.0%
Driver Factor				
Disregard Traffic Control	15	13	-2	-13.3%
Failure To Yield	3	8	5	166.7%
Inattentive Driving	8	3	-5	-62.5%
Too Fast For Conditions	0	3	3	-----
Driver Condition	0	0	0	0.0%
Other	4	5	1	25.0%

T17. Walnut Street/Madison Street (Green Bay)

	<u>1997-1999</u>	<u>2002-2004</u>	<u>Difference</u>	<u>% Difference</u>
Crash Rate	1.25	0.95	-0.3	-24.0%
Reportable Crashes Per Year	7.7	4.7	-3	-39.0%
Est. Property Damage Cost/Year	\$49,280	\$29,140	-\$20,140	-40.9%
Injuries Per Year	8.7	2.3	-6.4	-73.6%
Est. Injury Cost/Year	\$296,670	\$91,713	-\$204,958	-69.1%
Crash Type				
Right Angle	16	11	-5	-31.3%
Rear End	4	1	-3	-75.0%
Side Swipe	1	0	-1	-100.0%
Head On	0	0	0	0.0%
Bicycle/Pedestrian	0	1	1	-----
Other	2	1	-1	-50.0%
Driver Factor				
Disregard Traffic Control	10	10	0	0.0%
Failure To Yield	3	0	-3	-100.0%
Inattentive Driving	6	0	-6	-100.0%
Too Fast For Conditions	0	1	1	-----
Driver Condition	0	0	0	0.0%
Other	4	3	-1	-25.0%

19. Cormier Road/Holmgren Way (Ashwaubenon)

	<u>1997-1999</u>	<u>2002-2004</u>	<u>Difference</u>	<u>% Difference</u>
Crash Rate	1.23	0.96	-0.27	-22.0%
Reportable Crashes Per Year	7	5.3	-1.7	-24.3%
Est. Property Damage Cost/Year	\$44,800	\$32,860	-\$11,940	-26.7%
Injuries Per Year	4	5	1	25.0%
Est. Injury Cost/Year	\$136,400	\$199,375	\$62,975	46.2%
Crash Type				
Right Angle	16	14	-2	-12.5%
Rear End	3	1	-2	-66.7%
Side Swipe	1	1	0	0.0%
Head On	1	0	-1	-100.0%
Bicycle/Pedestrian	0	0	0	0.0%
Other	0	0	0	0.0%
Driver Factor				
Disregard Traffic Control	2	5	3	150.0%
Failure To Yield	13	6	-7	-53.8%
Inattentive Driving	2	2	0	0.0%
Too Fast For Conditions	0	0	0	0.0%
Driver Condition	0	0	0	0.0%
Other	4	3	-1	-25.0%

T20. Monroe Avenue/Porlier Street (Green Bay)

	<u>1997-1999</u>	<u>2002-2004</u>	<u>Difference</u>	<u>% Difference</u>
Crash Rate	1.19	0.91	-0.28	-23.5%
Reportable Crashes Per Year	9.3	7	-2.3	-24.7%
Est. Property Damage Cost/Year	\$59,520	\$43,400	-\$16,120	-27.1%
Injuries Per Year	6	5.7	-0.3	-5.0%
Est. Injury Cost/Year	\$204,600	\$227,288	\$22,688	11.1%
Crash Type				
Right Angle	22	19	-3	-13.6%
Rear End	3	2	-1	-33.3%
Side Swipe	2	0	-2	-100.0%
Head On	0	0	0	0.0%
Bicycle/Pedestrian	0	0	0	0.0%
Other	1	0	-1	-100.0%
Driver Factor				
Disregard Traffic Control	0	3	3	-----
Failure To Yield	22	16	-6	-27.3%
Inattentive Driving	1	2	1	100.0%
Too Fast For Conditions	1	0	-1	-100.0%
Driver Condition	0	0	0	0.0%
Other	4	0	-4	-100.0%

T20. Ashland Avenue/Hansen Road (Ashwaubenon)

	<u>1997-1999</u>	<u>2002-2004</u>	<u>Difference</u>	<u>% Difference</u>
Crash Rate	1.19	1.09	-0.1	-8.4%
Reportable Crashes Per Year	11.7	9.3	-2.4	-20.5%
Est. Property Damage Cost/Year	\$74,880	\$57,660	-\$17,220	-23.0%
Injuries Per Year	8.3	2.7	-5.6	-67.5%
Est. Injury Cost/Year	\$283,030	\$107,663	-\$175,368	-62.0%
Crash Type				
Right Angle	20	17	-3	-15.0%
Rear End	12	6	-6	-50.0%
Side Swipe	1	3	2	200.0%
Head On	0	2	2	-----
Bicycle/Pedestrian	0	0	0	0.0%
Other	2	0	-2	-100.0%
Driver Factor				
Disregard Traffic Control	2	4	2	100.0%
Failure To Yield	18	11	-7	-38.9%
Inattentive Driving	7	2	-5	-71.4%
Too Fast For Conditions	2	1	-1	-50.0%
Driver Condition	1	0	-1	-100.0%
Other	5	10	5	100.0%

22. East Mason Street/Bellevue Street (Green Bay)

	<u>1997-1999</u>	<u>2002-2004</u>	<u>Difference</u>	<u>% Difference</u>
Crash Rate	1.18	0.71	-0.47	-39.8%
Reportable Crashes Per Year	13.7	8.7	-5	-36.5%
Est. Property Damage Cost/Year	\$87,680	\$53,940	-\$33,740	-38.5%
Injuries Per Year	12.3	6.7	-5.6	-45.5%
Est. Injury Cost/Year	\$419,430	\$267,163	-\$152,268	-36.3%
Crash Type				
Right Angle	21	13	-8	-38.1%
Rear End	12	9	-3	-25.0%
Side Swipe	1	2	1	100.0%
Head On	4	0	-4	-100.0%
Bicycle/Pedestrian	2	0	-2	-100.0%
Other	1	2	1	100.0%
Driver Factor				
Disregard Traffic Control	8	2	-6	-75.0%
Failure To Yield	18	8	-10	-55.6%
Inattentive Driving	6	5	-1	-16.7%
Too Fast For Conditions	0	0	0	0.0%
Driver Condition	3	2	-1	-33.3%
Other	6	9	3	50.0%

23. Walnut Street/Washington Street (Green Bay)

	<u>1997-1999</u>	<u>2002-2004</u>	<u>Difference</u>	<u>% Difference</u>
Crash Rate	1.17	0.44	-0.73	-62.4%
Reportable Crashes Per Year	8	2.7	-5.3	-66.3%
Est. Property Damage Cost/Year	\$51,200	\$16,740	-\$34,460	-67.3%
Injuries Per Year	6.3	2	-4.3	-68.3%
Est. Injury Cost/Year	\$214,830	\$79,750	-\$135,080	-62.9%
Crash Type				
Right Angle	8	3	-5	-62.5%
Rear End	10	3	-7	-70.0%
Side Swipe	3	0	-3	-100.0%
Head On	2	2	0	0.0%
Bicycle/Pedestrian	0	0	0	0.0%
Other	1	0	-1	-100.0%
Driver Factor				
Disregard Traffic Control	6	3	-3	-50.0%
Failure To Yield	1	2	1	100.0%
Inattentive Driving	8	1	-7	-87.5%
Too Fast For Conditions	8	0	-8	-100.0%
Driver Condition	0	0	0	0.0%
Other	1	2	1	100.0%

T24. University Avenue/Baird Street (Green Bay)

	<u>1997-1999</u>	<u>2002-2004</u>	<u>Difference</u>	<u>% Difference</u>
Crash Rate	1.1	0.95	-0.15	-13.6%
Reportable Crashes Per Year	5.3	4	-1.3	-24.5%
Est. Property Damage Cost/Year	\$33,920	\$24,800	-\$9,120	-26.9%
Injuries Per Year	5.7	3.3	-2.4	-42.1%
Est. Injury Cost/Year	\$194,370	\$131,588	-\$62,783	-32.3%
Crash Type				
Right Angle	10	8	-2	-20.0%
Rear End	4	1	-3	-75.0%
Side Swipe	1	1	0	0.0%
Head On	1	0	-1	-100.0%
Bicycle/Pedestrian	0	1	1	-----
Other	0	1	1	-----
Driver Factor				
Disregard Traffic Control	4	3	-1	-25.0%
Failure To Yield	7	5	-2	-28.6%
Inattentive Driving	2	1	-1	-50.0%
Too Fast For Conditions	3	0	-3	-100.0%
Driver Condition	0	0	0	0.0%
Other	0	3	3	-----

T24. Webster Avenue/Walnut Street (Green Bay)

	<u>1997-1999</u>	<u>2002-2004</u>	<u>Difference</u>	<u>% Difference</u>
Crash Rate	1.1	0.98	-0.12	-10.9%
Reportable Crashes Per Year	8.7	7.7	-1	-11.5%
Est. Property Damage Cost/Year	\$55,680	\$47,740	-\$7,940	-14.3%
Injuries Per Year	9.7	6.7	-3	-30.9%
Est. Injury Cost/Year	\$330,770	\$267,163	-\$63,608	-19.2%
Crash Type				
Right Angle	15	15	0	0.0%
Rear End	6	1	-5	-83.3%
Side Swipe	2	2	0	0.0%
Head On	0	1	1	-----
Bicycle/Pedestrian	1	2	1	100.0%
Other	2	2	0	0.0%
Driver Factor				
Disregard Traffic Control	9	11	2	22.2%
Failure To Yield	2	8	6	300.0%
Inattentive Driving	8	2	-6	-75.0%
Too Fast For Conditions	1	1	0	0.0%
Driver Condition	0	1	1	-----
Other	6	0	-6	-100.0%

26. Lombardi Access/Marlee Lane (Ashwaubenon)

	<u>1997-1999</u>	<u>2002-2004</u>	<u>Difference</u>	<u>% Difference</u>
Crash Rate	1.06	Unknown	Unknown	Unknown
Reportable Crashes Per Year	5.3	3.3	-2	-37.7%
Est. Property Damage Cost/Year	\$33,920	\$20,460	-\$13,460	-39.7%
Injuries Per Year	2.3	2.3	0	0.0%
Est. Injury Cost/Year	\$78,430	\$91,713	\$13,283	16.9%
Crash Type				
Right Angle	12	8	-4	-33.3%
Rear End	1	0	-1	-100.0%
Side Swipe	2	1	-1	-50.0%
Head On	1	0	-1	-100.0%
Bicycle/Pedestrian	0	0	0	0.0%
Other	0	1	1	-----
Driver Factor				
Disregard Traffic Control	1	1	0	0.0%
Failure To Yield	12	7	-5	-41.7%
Inattentive Driving	1	1	0	0.0%
Too Fast For Conditions	1	0	-1	-100.0%
Driver Condition	0	0	0	0.0%
Other	1	1	0	0.0%

27. West Mason Street/Hinkle Street (Green Bay)

	<u>1997-1999</u>	<u>2002-2004</u>	<u>Difference</u>	<u>% Difference</u>
Crash Rate	1.03	1.3	0.27	26.2%
Reportable Crashes Per Year	14.3	17	2.7	18.9%
Est. Property Damage Cost/Year	\$91,520	\$105,400	\$13,880	15.2%
Injuries Per Year	8.7	11	2.3	26.4%
Est. Injury Cost/Year	\$296,670	\$438,625	\$141,955	47.8%
Crash Type				
Right Angle	14	19	5	35.7%
Rear End	20	26	6	30.0%
Side Swipe	6	4	-2	-33.3%
Head On	1	1	0	0.0%
Bicycle/Pedestrian	0	0	0	0.0%
Other	2	1	-1	-50.0%
Driver Factor				
Disregard Traffic Control	2	5	3	150.0%
Failure To Yield	11	10	-1	-9.1%
Inattentive Driving	10	14	4	40.0%
Too Fast For Conditions	4	9	5	125.0%
Driver Condition	2	2	0	0.0%
Other	14	11	-3	-21.4%

28. Main Street/Baird Street (Green Bay)

	<u>1997-1999</u>	<u>2002-2004</u>	<u>Difference</u>	<u>% Difference</u>
Crash Rate	1.01	1.22	0.21	20.8%
Reportable Crashes Per Year	9	11.7	2.7	30.0%
Est. Property Damage Cost/Year	\$57,600	\$72,540	\$14,940	25.9%
Injuries Per Year	5	10	5	100.0%
Est. Injury Cost/Year	\$170,500	\$398,750	\$228,250	133.9%
Crash Type				
Right Angle	18	25	7	38.9%
Rear End	3	6	3	100.0%
Side Swipe	2	2	0	0.0%
Head On	2	1	-1	-50.0%
Bicycle/Pedestrian	0	0	0	0.0%
Other	2	1	-1	-50.0%
Driver Factor				
Disregard Traffic Control	7	6	-1	-14.3%
Failure To Yield	10	22	12	120.0%
Inattentive Driving	2	2	0	0.0%
Too Fast For Conditions	2	2	0	0.0%
Driver Condition	2	1	-1	-50.0%
Other	4	2	-2	-50.0%

T29. Main Street/Elizabeth Street (Green Bay)

	<u>1997-1999</u>	<u>2002-2004</u>	<u>Difference</u>	<u>% Difference</u>
Crash Rate	0.99	0.20	-0.79	-79.8%
Reportable Crashes Per Year	6.7	1.7	-5	-74.6%
Est. Property Damage Cost/Year	\$42,880	\$10,540	-\$32,340	-75.4%
Injuries Per Year	3	1	-2	-66.7%
Est. Injury Cost/Year	\$102,300	\$39,875	-\$62,425	-61.0%
Crash Type				
Right Angle	9	0	-9	-100.0%
Rear End	6	2	-4	-66.7%
Side Swipe	1	0	-1	-100.0%
Head On	0	0	0	0.0%
Bicycle/Pedestrian	0	0	0	0.0%
Other	4	3	-1	-25.0%
Driver Factor				
Disregard Traffic Control	3	0	-3	-100.0%
Failure To Yield	4	0	-4	-100.0%
Inattentive Driving	1	1	0	0.0%
Too Fast For Conditions	4	0	-4	-100.0%
Driver Condition	1	0	-1	-100.0%
Other	7	5	-2	-28.6%

T29. Monroe Avenue/Walnut Street (Green Bay)

	<u>1997-1999</u>	<u>2002-2004</u>	<u>Difference</u>	<u>% Difference</u>
Crash Rate	0.99	1.02	0.03	3.0%
Reportable Crashes Per Year	8.3	8	-0.3	-3.6%
Est. Property Damage Cost/Year	\$53,120	\$49,600	-\$3,520	-6.6%
Injuries Per Year	4.3	5.7	1.4	32.6%
Est. Injury Cost/Year	\$146,630	\$227,288	\$80,658	55.0%
Crash Type				
Right Angle	8	13	5	62.5%
Rear End	9	4	-5	-55.6%
Side Swipe	4	2	-2	-50.0%
Head On	0	0	0	0.0%
Bicycle/Pedestrian	2	2	0	0.0%
Other	2	3	1	50.0%
Driver Factor				
Disregard Traffic Control	3	7	4	133.3%
Failure To Yield	5	5	0	0.0%
Inattentive Driving	6	2	-4	-66.7%
Too Fast For Conditions	1	2	1	100.0%
Driver Condition	0	0	0	0.0%
Other	10	8	-2	-20.0%

IV. Metropolitan Area Intersections with the Highest Crash Rates Between 2002 and 2004

1. Main Street/Allouez Avenue (Bellevue)

Crash Rate	2.33
Reportable Crashes Per Year	9
Est. Property Damage Cost/Year	\$55,800
Injuries Per Year	8
Est. Injury Cost/Year	\$319,000
Crash Type	
Right Angle	19 (70%)
Rear End	5 (18%)
Side Swipe	0 (0%)
Head On	1 (4%)
Bicycle/Pedestrian	1 (4%)
Other	1 (4%)
Driver Factor	
Disregard Traffic Control	1 (4%)
Failure To Yield	18 (67%)
Inattentive Driving	5 (18%)
Too Fast For Conditions	1 (4%)
Driver Condition	0 (0%)
Other	2 (7%)

Comments: Many of the reportable crashes at this intersection during the three-year study period were right angle incidents where drivers pulled into the intersection from Allouez Avenue and were hit by vehicles traveling on Main Street at relatively high speeds. The statistics from this three-year period also indicate that five of the angle crashes occurred after the intersection was converted from a two-way stop to a four-way stop and that six of the angle crashes resulted in two or more injuries.

Recommendations: WisDOT intends to construct a roundabout at this intersection in 2007 to address these safety problems.

2. Ontario Road/Voyager Drive (Green Bay)

Crash Rate	1.69
Reportable Crashes Per Year	5.3
Est. Property Damage Cost/Year	\$32,860
Injuries Per Year	4
Est. Injury Cost/Year	\$159,500
Crash Type	
Right Angle	14 (88%)
Rear End	1 (6%)
Side Swipe	0 (0%)
Head On	0 (0%)
Bicycle/Pedestrian	1 (6%)
Other	0 (0%)
Driver Factor	
Disregard Traffic Control	7 (44%)
Failure To Yield	7 (44%)
Inattentive Driving	0 (0%)
Too Fast For Conditions	2 (12%)
Driver Condition	0 (0%)
Other	0 (0%)

Comments: Nearly all of the incidents that occurred at this intersection during the three-year study period were right angle crashes that involved Voyager Drive motorists being hit after running the stop signs or proceeding into the intersection when vehicles were approaching from the north or south. The problems at this intersection appear to be similar to the problems that have been experienced at West Mason and Packerland, Main and Auto Plaza Way, and other relatively wide frontage road intersections that are close to major intersections. As traffic levels increase in this area, it is likely that the number of crashes will also increase even if the East Mason/Ontario intersection is signalized because vehicle movements and speeds will continue to be difficult to predict and visibility will be restricted by vehicle queues.

Recommendations: The city should consider allowing motorists to make only right turns onto Ontario Road during peak traffic periods to minimize the risk of crashes at the intersection. The city should also monitor the intersection to determine if the numbers of crashes and injuries increase in the future.

3. Main Avenue/Ninth Street (De Pere)

Crash Rate	1.65
Reportable Crashes Per Year	14
Est. Property Damage Cost/Year	\$86,800
Injuries Per Year	5.3
Est. Injury Cost/Year	\$211,338
Crash Type	
Right Angle	20 (48%)
Rear End	11 (26%)
Side Swipe	3 (7%)
Head On	1 (2%)
Bicycle/Pedestrian	0 (0%)
Other	7 (17%)
Driver Factor	
Disregard Traffic Control	4 (10%)
Failure To Yield	14 (33%)
Inattentive Driving	12 (29%)
Too Fast For Conditions	2 (4%)
Driver Condition	0 (0%)
Other	10 (24%)

Comments: The most common incidents at this intersection during the three-year study period were right angle crashes that occurred when left-turning motorists pulled in front of motorists going straight on Main Avenue. These crashes caused some of the injuries experienced at the intersection, but injuries also happened as a result of rear end crashes.

Recommendations: In 2005, the City of De Pere used a Hazard Elimination and Safety (HES) grant to install left turn lanes on Main Avenue at the intersection. In the future, this intersection should be monitored to determine if the turn lanes reduce the intersection's safety problems.

4. Holmgren Way/Pilgrim Way (Ashwaubenon)

Crash Rate	1.63
Reportable Crashes Per Year	12
Est. Property Damage Cost/Year	\$74,400
Injuries Per Year	10.3
Est. Injury Cost/Year	\$410,713
Crash Type	
Right Angle	10 (28%)
Rear End	19 (53%)
Side Swipe	3 (9%)
Head On	1 (2%)
Bicycle/Pedestrian	1 (2%)
Other	2 (6%)
Driver Factor	
Disregard Traffic Control	2 (6%)
Failure To Yield	7 (19%)
Inattentive Driving	11 (31%)
Too Fast For Conditions	0 (0%)
Driver Condition	0 (0%)
Other	16 (44%)

Comments: The most common property damage and injury incidents at this intersection were rear end crashes on Pilgrim Way where westbound motorists hit other motorists who were stopped at the signal or in a vehicle queue. In most of these situations, the offending drivers were cited for inattentive driving or for following other vehicles too closely.

It is possible that a typical rear end crash at this intersection involved either a motorist who had just exited STH 172 and made a left turn at Pilgrim Way encountering a vehicle backup at the Holmgren Way intersection or a turning motorist following another turning motorist too closely as they both approached the intersection. It is also possible that motorists have to stop suddenly because they do not realize the speeds at which they are traveling after exiting the freeway.

Recommendations: If vehicle queues at the Pilgrim/Holmgren intersection are the cause of many of the crashes, the best crash reduction strategy would be to minimize the queue. To do this, the Brown County Highway Department and Village of Ashwaubenon should consider constructing a roundabout at the intersection. In addition to improving safety at the intersection by making the intersection more efficient and minimizing vehicle conflicts, a roundabout would improve the intersection's appearance and create an attractive entry point to the village's retail area from the freeway.

5. Lombardi Avenue/Marlee Lane (Green Bay/Ashwaubenon)

Crash Rate	1.44
Reportable Crashes Per Year	14
Est. Property Damage Cost/Year	\$86,800
Injuries Per Year	6.3
Est. Injury Cost/Year	\$251,213
Fatalities Per Year	0.33
Est. Fatality Cost/Year	?
Crash Type	
Right Angle	23 (55%)
Rear End	12 (29%)
Side Swipe	1 (2%)
Head On	0 (0%)
Bicycle/Pedestrian	0 (0%)
Other	6 (14%)
Driver Factor	
Disregard Traffic Control	2 (5%)
Failure To Yield	21 (50%)
Inattentive Driving	8 (19%)
Too Fast For Conditions	1 (2%)

Comments: The most common incidents at this intersection were angle crashes that occurred when motorists traveling in all four directions turned left in front of oncoming vehicles. Like at many of the other intersections in this study, it is likely that the left turn crashes at Lombardi/Marlee were caused by the inability of left turning motorists to see oncoming vehicles before making their turns.

Recommendations: A relatively low cost method of making left turns safer on Lombardi Avenue would be to construct positive-offset left turn lanes in the Lombardi medians to enable motorists to easily see oncoming vehicles (see Figure 1 at the end of the study). It is also possible that some of the rear end crashes could be eliminated by encouraging eastbound Lombardi motorists to drive slower by narrowing each of the street's four lanes to 11 feet and curbing the outside of the street to make it feel less like a highway and more like a city street.

Another option that would significantly reduce conflicts at the Lombardi/Marlee and Lombardi Access/Marlee intersections would be to construct a six leg roundabout that includes both Lombardi approaches, both Marlee approaches, and both Lombardi Access approaches. Bringing all of these streets into one roundabout would address all of the safety problems at both intersections, increase traffic flow and capacity, make the intersections more pedestrian and bicycle friendly, and improve the area's appearance.

T6. West Mason Street/Taylor Street (Green Bay)

Crash Rate	1.35
Reportable Crashes Per Year	22.3
Est. Property Damage Cost/Year	\$138,260
Injuries Per Year	20
Est. Injury Cost/Year	\$797,500
Crash Type	
Right Angle	45 (67%)
Rear End	16 (24%)
Side Swipe	3 (5%)
Head On	2 (3%)
Bicycle/Pedestrian	0 (0%)
Other	1 (1%)
Driver Factor	
Disregard Traffic Control	23 (34%)
Failure To Yield	24 (36%)
Inattentive Driving	8 (12%)
Too Fast For Conditions	1 (1%)
Driver Condition	1 (1%)
Other	10 (16%)

Comments: The most common (and severe) incidents at this intersection were angle crashes that occurred on Mason Street when eastbound and westbound motorists turned left in front of oncoming vehicles and when Mason motorists disregarded the traffic signal and hit northbound and southbound Taylor motorists.

It is difficult to determine why motorists disregard the signals so frequently, but it is likely that many drivers try to avoid being stopped at the intersection but fail to beat the red light and that some westbound motorists are ignoring the Taylor lights as they concentrate on positioning themselves to enter US 41. The crashes caused by left turning vehicles pulling in front of vehicles traveling straight are probably due to the inability of left turners to see traffic approaching from the opposite direction because their view is obstructed by opposing left turners. This situation appears to be common at many of the intersections in this study and, in this case, should be relatively easy to correct.

The crash statistics between the 97-99 and 02-04 study periods are very similar, which suggests that the problems that existed during the first study period continued to exist during the second period. The crash rate reduction that occurred between the two periods is likely due to an increase in the number of vehicles that entered the intersection on an average day.

Recommendations: The problems addressed above could be corrected with a roundabout at the Mason/Taylor intersection, and this roundabout would be even more effective if roundabouts were built at the two Mason/US 41 ramp intersections to the west. A roundabout at Mason and Taylor would also make the intersection much safer for pedestrians and bicyclists, improve the attractiveness of the area, and would quickly pay for itself by significantly reducing property damage and injuries. However, if a roundabout is not feasible, a more immediate method of solving the left turning problems would be to construct positive-offset left turn lanes in the Mason Street medians to enable motorists to easily see oncoming vehicles (see Figure 1 at the end of the study).

T6. University Avenue/Elizabeth Street (Green Bay)

Crash Rate	1.35
Reportable Crashes Per Year	9.3
Est. Property Damage Cost/Year	\$57,660
Injuries Per Year	4.3
Est. Injury Cost/Year	\$171,463
Crash Type	
Right Angle	18 (64%)
Rear End	7 (25%)
Side Swipe	1 (4%)
Head On	0 (0%)
Bicycle/Pedestrian	0 (0%)
Other	2 (7%)
Driver Factor	
Disregard Traffic Control	6 (21%)
Failure To Yield	10 (36%)
Inattentive Driving	5 (18%)
Too Fast For Conditions	2 (7%)
Driver Condition	2 (7%)
Other	3 (11%)

Comments: The most common incidents at this intersection were angle crashes that occurred on University Avenue when eastbound and westbound motorists turned left in front of oncoming vehicles, but the number of crashes where a driver was cited for failing to yield decreased by more than half between the 1997-1999 and 2002-2004 study periods. The intersection also experienced fewer rear end and side swipe crashes during the '02 to '04 study period, and the reduction in rear end crashes could explain the 55 percent reduction of injuries.

Recommendations: The city's plan to remove the Day Street connection will make the intersection more efficient and could improve safety, but the visibility problem that likely causes many of the right angle crashes will still exist on University Avenue.

8. STH 172/Babcock Road (Ashwaubenon)

Crash Rate	1.33
Reportable Crashes Per Year	13.7
Est. Property Damage Cost/Year	\$84,940
Injuries Per Year	11
Est. Injury Cost/Year	\$438,625
Crash Type	
Right Angle	22 (54%)
Rear End	15 (37%)
Side Swipe	3 (7%)
Head On	0 (0%)
Bicycle/Pedestrian	1 (2%)
Other	0 (0%)
Driver Factor	
Disregard Traffic Control	2 (5%)
Failure To Yield	16 (39%)
Inattentive Driving	13 (32%)
Too Fast For Conditions	5 (12%)
Driver Condition	0 (0%)
Other	5 (12%)

Comments: This intersection was reconstructed in the fall of 2003, and positive-offset left turn lanes were added during the project. Since this study includes only one year of data following the addition of the turn lanes, their safety impacts will need to be evaluated over a longer period to determine if they have improved safety. However, the data collected during 2004 suggest that the offset turn lanes have had a positive impact.

In addition to adding the offset turn lanes, WisDOT completed a study of STH 172 in 2005 that recommends the eventual conversion of the Babcock intersection to a grade-separated overpass. When this occurs, the conflicts at the intersection will be eliminated.

Recommendations: Continue to monitor the intersection to determine the impacts of the offset turn lanes.

9. West Mason Street/Hinkle Street (Green Bay)

Crash Rate	1.3
Reportable Crashes Per Year	17
Est. Property Damage Cost/Year	\$105,400
Injuries Per Year	11
Est. Injury Cost/Year	\$438,625
Crash Type	
Right Angle	19 (37%)
Rear End	26 (51%)
Side Swipe	4 (8%)
Head On	1 (2%)
Bicycle/Pedestrian	0 (0%)
Other	1 (2%)
Driver Factor	
Disregard Traffic Control	5 (10%)
Failure To Yield	10 (20%)
Inattentive Driving	14 (28%)
Too Fast For Conditions	9 (18%)
Driver Condition	1 (2%)
Other	11 (22%)

Comments: The most common incidents at this intersection were rear end crashes on Mason Street that occurred when motorists were driving inattentively or were following other motorists too closely. The intersection also experienced several left turning angle and side swipe crashes.

The left turning angle and side swipe crashes on Mason Street would likely be eliminated by installing offset left turn lanes in the Mason medians, but the rear end crashes will likely continue unless traffic levels decrease or vehicle speeds are reduced. However, reducing speeds on this segment of Mason Street will be very difficult because it is very wide and invites motorists to drive fast. The roundabouts recommended for the Mason/Taylor intersection earlier in the study combined with roundabouts at the Mason/US 41 interchange could reduce speeds east of the Mason/Hinkle intersection, but many of the rear end crashes on Mason Street were caused by eastbound drivers as they approached the intersection from the west.

Recommendations: Offset left turn lanes should be constructed in the Mason medians to enable left turning motorists to clearly see oncoming traffic (see Figure 1 at the end of the study). Roundabouts at the US 41/Mason Street interchange should also be considered to slow traffic in the area and hopefully reduce the number of rear end crashes. It is also possible that Mason's outside lanes could be eliminated if roundabouts are built at the interchange, which would increase side friction and reduce speeds.

10. Oneida Street/Lombardi Avenue (Green Bay & Ashwaubenon)

Crash Rate	1.29
Reportable Crashes Per Year	11.7
Est. Property Damage Cost/Year	\$72,540
Injuries Per Year	8
Est. Injury Cost/Year	\$319,000
Crash Type	
Right Angle	26 (74%)
Rear End	7 (20%)
Side Swipe	0 (0%)
Head On	2 (6%)
Bicycle/Pedestrian	0 (0%)
Other	0 (0%)
Driver Factor	
Disregard Traffic Control	5 (14%)
Failure To Yield	21 (60%)
Inattentive Driving	2 (6%)
Too Fast For Conditions	0 (0%)
Driver Condition	0 (0%)
Other	7 (20%)

Comments: The most common incidents at this intersection were right angle crashes that occurred when drivers made left turns in front of oncoming vehicles, and these crashes were often associated with northbound left turning movements. Although the proportion of angle crashes was relatively high at this intersection, only 36 percent of these crashes resulted in injuries (while 71 percent of the rear end crashes resulted in injuries).

Recommendations: Since it is difficult for northbound drivers who intend to make left turns to see oncoming vehicles if an opposing vehicle is also waiting to make a left turn, it is possible that the number of angle crashes could be reduced if the northbound and southbound left turn lanes were offset to allow people to see around the waiting vehicles. A roundabout at this intersection would also likely reduce crashes and injuries, but it might be difficult to accommodate the variety of lane configurations at the intersection's approaches.

T11. West Mason Street/Military Avenue (Green Bay)

Crash Rate	1.24
Reportable Crashes Per Year	20
Est. Property Damage Cost/Year	\$124,000
Injuries Per Year	12.7
Est. Injury Cost/Year	\$506,413
Crash Type	
Right Angle	34 (57%)
Rear End	21 (35%)
Side Swipe	1 (2%)
Head On	2 (3%)
Bicycle/Pedestrian	0 (0%)
Other	2 (3%)
Driver Factor	
Disregard Traffic Control	9 (15%)
Failure To Yield	23 (38%)
Inattentive Driving	10 (17%)
Too Fast For Conditions	5 (9%)
Driver Condition	2 (3%)
Other*	11 (18%)

*The predominant other factor between 2002 and 2004 was following too close.

Comments: The most common incidents at the West Mason/Military intersection were right angle crashes where drivers made left turns in front of oncoming vehicles, but rear end crashes continued to be a problem as well. Many of the left turning motorists were traveling westbound prior to their turns, and only a handful of northbound left turning vehicles were hit during the three-year period.

Recommendations: To slow motorists down, reduce weaving, and minimize driver confusion on Military, the city should consider narrowing the street to four lanes between 9th Street and Dousman Street. The 2003 counts for this segment of Military indicated that daily traffic volumes did not exceed 21,000 at any count station, and four lanes can handle this amount of traffic. The extra space at the Mason intersection could then be used to create positive-offset left turn lanes that would enable left turning motorists to see oncoming vehicles and offer pedestrians a refuge when crossing the wide intersection. This narrowing project would improve safety and accessibility at other Military intersections as well.

To improve safety on Mason Street, the city should consider constructing positive-offset left turn lanes like the ones recommended for Military and other intersections in the study. The city should also attempt to reduce the number of conflicts along Mason Street by working with the merchants along Mason between Fisk Street and Mitchell Street to develop shared driveways.

T11. Scheuring Road/Lawrence Drive (De Pere)

Crash Rate	1.24
Reportable Crashes Per Year	6.3
Est. Property Damage Cost/Year	\$39,060
Injuries Per Year	1.7
Est. Injury Cost/Year	\$67,788
Crash Type	
Right Angle	10 (53%)
Rear End	5 (26%)
Side Swipe	2 (11%)
Head On	1 (5%)
Bicycle/Pedestrian	0 (0%)
Other	1 (5%)
Driver Factor	
Disregard Traffic Control	2 (11%)
Failure To Yield	9 (47%)
Inattentive Driving	3 (16%)
Too Fast For Conditions	1 (5%)
Driver Condition	1 (5%)
Other/Blank	3 (16%)

Comments: The most common incidents at this intersection were right angle crashes that occurred when westbound drivers made left turns in front of eastbound drivers on Scheuring Road. Like many of the intersections cited in this and the previous crash studies, these crashes were likely the results of drivers being unable to see oncoming vehicles because their views were obstructed by opposing vehicles.

Recommendations: Since it is difficult for westbound and eastbound drivers who intend to make left turns to see oncoming vehicles if an opposing vehicle is also waiting to make a left turn, it is possible that angle crashes could be reduced if the westbound and eastbound left turn lanes were offset to allow people to see around the waiting vehicles.

13. Main Street/Baird Street (Green Bay)

Crash Rate	1.22
Reportable Crashes Per Year	11.7
Est. Property Damage Cost/Year	\$72,540
Injuries Per Year	10
Est. Injury Cost/Year	\$398,750
Crash Type	
Right Angle	25 (71%)
Rear End	6 (17%)
Side Swipe	2 (6%)
Head On	1 (3%)
Bicycle/Pedestrian	0 (0%)
Other	1 (3%)
Driver Factor	
Disregard Traffic Control	6 (17%)
Failure To Yield	22 (62%)
Inattentive Driving	2 (6%)
Too Fast For Conditions	2 (6%)
Driver Condition	1 (3%)
Other	2 (6%)

Comments: The most common incidents at this intersection during the three-year period were angle crashes that happened when vehicles traveling straight hit vehicles making left turns, and nearly all of the left turners were traveling westbound or southbound when they were hit. Also, most of the motorists who were cited for disregarding the traffic signal on Main were traveling eastbound prior to the crashes.

Recommendations: An effective method of reducing (or possibly eliminating) the left turn crashes at the intersection would be to construct positive-offset left turn lanes at the two Main Street intersection approaches, and the space necessary to add these offset lanes appears to be available at the Main approaches and possibly at the Baird approaches. This intersection could also be made more safe, accessible, and attractive with a roundabout, but it is possible that existing traffic volumes would strain the capacity of a single-lane facility.

14. Main Avenue/Eighth Street (De Pere)

Crash Rate	1.16
Reportable Crashes Per Year	9.3
Est. Property Damage Cost/Year	\$57,660
Injuries Per Year	6.3
Est. Injury Cost/Year	\$251,213
Crash Type	
Right Angle	15 (54%)
Rear End	7 (25%)
Side Swipe	1 (3%)
Head On	0 (0%)
Bicycle/Pedestrian	0 (0%)
Other	5 (18%)
Driver Factor	
Disregard Traffic Control	2 (7%)
Failure To Yield	13 (46%)
Inattentive Driving	6 (22%)
Too Fast For Conditions	1 (3%)
Driver Condition	0 (0%)
Other	6 (22%)

Comments: The most common incidents at this intersection during the three-year study period were right angle crashes that occurred when left-turning motorists pulled in front of motorists going straight on Main Avenue. These crashes caused some of the injuries experienced at the intersection, but injuries also happened as a result of rear end crashes.

Recommendations: This intersection is only one block from the Main/Ninth intersection that was recently reconstructed to address many of the same problems. If the new left turn lanes at the Main/Ninth intersection prove to be effective, the same treatments should be considered for the Main/Eighth intersection as well.

15. West Mason Street/Packerland Drive (Green Bay)

Crash Rate	1.12
Reportable Crashes Per Year	14.7
Est. Property Damage Cost/Year	\$91,140
Injuries Per Year	7.7
Est. Injury Cost/Year	\$307,038
Crash Type	
Right Angle	25 (57%)
Rear End	14 (32%)
Side Swipe	3 (7%)
Head On	1 (2%)
Bicycle/Pedestrian	0 (0%)
Other	1 (2%)
Driver Factor	
Disregard Traffic Control	2 (5%)
Failure To Yield	22 (50%)
Inattentive Driving	2 (5%)
Too Fast For Conditions	2 (5%)
Driver Condition	0 (0%)
Other	16 (35%)

Comments: Once again, the most common incidents at this intersection were angle crashes that occurred when vehicles on the West Mason frontage roads pulled in front of vehicles traveling north or south on Packerland Drive. In almost every instance, the West Mason frontage road vehicle was attempting to make a left turn onto Packerland or was trying to cross Packerland to reach the opposing frontage road. These crashes were likely the result of the frontage road motorists trying to cross several lanes of fast moving traffic on Packerland by quickly accelerating into what were believed to be adequate gaps and getting hit before entering the flow or reaching the other side of the street.

Recommendations: The data suggest that many of the crashes at the West Mason/Packerland intersection could be eliminated if motorists entering Packerland Drive from the frontage roads were only allowed to make right turns (at least during peak traffic periods). Left turns onto the frontage roads from Packerland could still be allowed since they do not appear to cause many crashes, but frontage road motorists that want to turn left or go straight should be forced to use the other streets to the east and west. A possible negative impact of this action, however, is that motorists on the east frontage road might cut through the Grand Central Station parking lot to reach Packerland Drive. This temptation could possibly be lessened by reducing the size of the gas station's driveways, but some cutting through would still likely occur.

16. George Street/Erie Street (De Pere)

Crash Rate	1.11
Reportable Crashes Per Year	5
Est. Property Damage Cost/Year	\$31,000
Injuries Per Year	3
Est. Injury Cost/Year	\$119,625
Crash Type	
Right Angle	9 (60%)
Rear End	3 (20%)
Side Swipe	1 (7%)
Head On	1 (7%)
Bicycle/Pedestrian	0 (0%)
Other	1 (7%)
Driver Factor	
Disregard Traffic Control	5 (33%)
Failure To Yield	4 (27%)
Inattentive Driving	4 (27%)
Too Fast For Conditions	1 (7%)
Driver Condition	0 (0%)
Other	1 (7%)

Comments: The most common incidents at this intersection during the three-year study period were right angle crashes that occurred when people either disregarded the George Street traffic signals or made left turns in front of drivers traveling straight on George Street.

This intersection was rebuilt in 2006 as a part of a complete reconstruction of George Street, and the project included the addition of well-defined pedestrian crosswalks, bump-outs at many intersections, and other treatments that are designed to slow traffic, improve pedestrian accessibility, and enhance the corridor's appearance. Although bump-outs were not added to the Erie Street intersection, it is possible that the other treatments at and near this intersection will reduce speeds, increase driver awareness, and, as a result, reduce crashes.

Recommendations: Monitor the intersection to see if the improvements reduce crashes.

17. East Mason Street/Baird Street (Green Bay)

Crash Rate	1.1
Reportable Crashes Per Year	8.3
Est. Property Damage Cost/Year	\$51,460
Injuries Per Year	4.7
Est. Injury Cost/Year	\$187,413
Crash Type	
Right Angle	7 (28%)
Rear End	15 (60%)
Side Swipe	0 (0%)
Head On	0 (0%)
Bicycle/Pedestrian	1 (4%)
Other	2 (8%)
Driver Factor	
Disregard Traffic Control	4 (16%)
Failure To Yield	3 (12%)
Inattentive Driving	7 (28%)
Too Fast For Conditions	1 (4%)
Driver Condition	1 (4%)
Other*	9 (36%)

*The predominant other factor between 2002 and 2004 was following too close.

Comments: The most common incidents at this intersection during the three-year study period were westbound and southbound rear end crashes where the offending drivers were driving inattentively or following vehicles too closely. It is difficult to determine the reasons for these crashes, but many of the crashes could be attributable to mistakes prompted by Mason Street's relatively high traffic volume, the presence of many commercial and residential driveways, the inability of some people to stop in time after speeding between the Bellevue Street and Baird Street traffic signals, and possibly other factors.

Recommendations: Monitor the intersection to see if crash levels increase.

18. Ashland Avenue/Hansen Road (Ashwaubenon)

Crash Rate	1.09
Reportable Crashes Per Year	9.3
Est. Property Damage Cost/Year	\$57,660
Injuries Per Year	2.7
Est. Injury Cost/Year	\$107,663
Crash Type	
Right Angle	17 (61%)
Rear End	6 (21%)
Side Swipe	3 (11%)
Head On	2 (7%)
Bicycle/Pedestrian	0 (0%)
Other	0 (0%)
Driver Factor	
Disregard Traffic Control	4 (14%)
Failure To Yield	11 (39%)
Inattentive Driving	2 (7%)
Too Fast For Conditions	0 (0%)
Driver Condition	1 (4%)
Other	10 (36%)

Comments: This intersection was reconstructed in the fall of 2003, and positive-offset left turn lanes were added during the project. Since this study includes only one year of data following the addition of the turn lanes, their safety impacts will need to be evaluated over a longer period to determine if they have improved safety. However, the data collected during 2004 suggest that the offset turn lanes have had a positive impact, and no reportable crashes occurred during the last six months of 2004.

Recommendations: Continue to monitor the intersection to determine the impacts of the offset turn lanes.

19. Main Avenue/Auto Plaza Way (Green Bay)

Crash Rate	1.08
Reportable Crashes Per Year	11.7
Est. Property Damage Cost/Year	\$72,540
Injuries Per Year	6.7
Est. Injury Cost/Year	\$267,163
Crash Type	
Right Angle	30 (86%)
Rear End	3 (8%)
Side Swipe	1 (3%)
Head On	0 (0%)
Bicycle/Pedestrian	0 (0%)
Other	1 (3%)
Driver Factor	
Disregard Traffic Control	4 (11%)
Failure To Yield	25 (71%)
Inattentive Driving	3 (8%)
Too Fast For Conditions	2 (7%)
Driver Condition	0 (0%)
Other	1 (3%)

Comments: The most common incidents at this intersection continued to be angle crashes that occurred when vehicles on the east Main Street frontage road pulled in front of vehicles traveling east or west on Auto Plaza Way. In almost every instance, the Main frontage road vehicles appeared to have been trying to cross Auto Plaza Way to reach the opposing frontage road. These crashes were likely a result of the frontage road motorists trying to cross traffic on Auto Plaza Way by quickly accelerating into what were believed to be adequate gaps and getting hit before reaching the other side of the street.

Recommendations: The data suggest that more than a third of the crashes at the Main/Auto Plaza Way intersection could be eliminated if motorists approaching Auto Plaza Way on the east frontage road were only allowed to make right turns (at least during peak traffic periods). Left turns onto the frontage road from Auto Plaza Way could still be allowed since they do not appear to cause many crashes, but frontage road motorists that want to turn left or go straight would be forced to use the other streets to the north and south.

T20. East Mason Street/Lime Kiln Road (Green Bay)

Crash Rate	1.06
Reportable Crashes Per Year	10.3
Est. Property Damage Cost/Year	\$63,860
Injuries Per Year	8.7
Est. Injury Cost/Year	\$346,913
Crash Type	
Right Angle	15 (48%)
Rear End	10 (32%)
Side Swipe	0 (0%)
Head On	1 (4%)
Bicycle/Pedestrian	3 (10%)
Other	2 (6%)
Driver Factor	
Disregard Traffic Control	8 (26%)
Failure To Yield	6 (19%)
Inattentive Driving	6 (19%)
Too Fast For Conditions	0 (0%)
Driver Condition	3 (10%)
Other	8 (26%)

Comments: The most common incidents at this intersection were angle crashes that occurred when motorists on Mason Street disregarded the traffic lights. Rear end crashes were also common, and these were fairly evenly distributed among the intersection approaches. Alcohol was a factor in some of the crashes, but the percentage of property damage and injury crashes that involved alcohol was lower than during the 1997-1999 study period.

Many of the motorists who ran the red lights during the study period were traveling east on Mason Street, so it is possible that they did not see the Lime Kiln signal because they were looking ahead to the intersection of Mason and Main. The proximity of the traffic signals along this segment of Mason Street (along with the traffic volumes, weaving movements, and driveways) might also confuse some drivers and cause them to run the Lime Kiln signals.

Recommendations: Perhaps the city could make the traffic lights more visible by installing new signal heads at the intersection, but the proximity of the surrounding intersections and other factors might make improving safety at the Lime Kiln intersection difficult.

T20. Military Avenue/Leo Street (Green Bay)

Crash Rate	1.06
Reportable Crashes Per Year	10.7
Est. Property Damage Cost/Year	\$66,340
Injuries Per Year	7.7
Est. Injury Cost/Year	\$307,038
Crash Type	
Right Angle	25 (78%)
Rear End	6 (19%)
Side Swipe	1 (3%)
Head On	0 (0%)
Bicycle/Pedestrian	0 (0%)
Other	0 (0%)
Driver Factor	
Disregard Traffic Control	13 (41%)
Failure To Yield	8 (25%)
Inattentive Driving	3 (9%)
Too Fast For Conditions	3 (9%)
Driver Condition	0 (0%)
Other	5 (16%)

Comments: The most common incidents at this intersection were angle crashes that occurred when northbound and southbound motorists on Military Avenue disregarded the traffic signals and hit eastbound and westbound Leo motorists, and most of the Military violators were traveling north prior to the crashes. These crashes likely occurred because the traffic signals at the Leo intersection are dim, the signals are difficult to identify (the mast arms barely extend over Military Avenue's outside lanes), speeds on Military are relatively high, and many motorists on Military do not expect to encounter a set of signals so close to the Shawano Avenue intersection.

Recommendations: The city should increase the visibility of the Leo Street signals by extending the mast arms farther over the northbound and southbound Military Avenue lanes and replacing the dim signals with new ones that are easily seen. The city should also narrow Military Avenue between 9th and Dousman for the reasons identified in the West Mason/Military intersection recommendations.

T22. Main Street/Verlin Road (Bellevue)

Crash Rate	1.04
Reportable Crashes Per Year	7.7
Est. Property Damage Cost/Year	\$47,740
Injuries Per Year	4.7
Est. Injury Cost/Year	\$187,413
Crash Type	
Right Angle	11 (48%)
Rear End	8 (35%)
Side Swipe	2 (9%)
Head On	1 (4%)
Bicycle/Pedestrian	0 (0%)
Other	1 (4%)
Driver Factor	
Disregard Traffic Control	2 (9%)
Failure To Yield	10 (43%)
Inattentive Driving	4 (17%)
Too Fast For Conditions	2 (9%)
Driver Condition	0 (0%)
Other	5 (22%)

Comments: The most common incidents at this intersection during the three-year study period were crashes that occurred when drivers making left turns from Main Street to Verlin Road were hit by vehicles going straight on Main.

Recommendations: WisDOT is currently planning to construct a roundabout at this intersection in 2010, and this should correct many of the problems that have existed here for many years.

T22. Military Avenue/Velp Avenue (Green Bay & Howard)

Crash Rate	1.04
Reportable Crashes Per Year	9
Est. Property Damage Cost/Year	\$55,800
Injuries Per Year	4.3
Est. Injury Cost/Year	\$171,463
Crash Type	
Right Angle	11 (41%)
Rear End	11 (41%)
Side Swipe	2 (7%)
Head On	2 (7%)
Bicycle/Pedestrian	0 (0%)
Other	1 (4%)
Driver Factor	
Disregard Traffic Control	3 (11%)
Failure To Yield	11 (41%)
Inattentive Driving	6 (22%)
Too Fast For Conditions	1 (4%)
Driver Condition	0 (0%)
Other	6 (22%)

Comments: The most common incidents at this intersection during the three-year study period were right angle and rear end crashes, and the crash summary suggests that these two types of crashes happened with the same frequency at the intersection. However, a closer look at the statistics shows that most of the angle crashes occurred at the Velp Avenue approaches and that most of the rear end crashes happened at Military Avenue's northbound approach. The statistics also show that most of the angle crashes occurred when westbound drivers tried to make left turns and were hit by eastbound drivers.

Recommendations: The intersection should be converted to a roundabout to accommodate the intersection's average daily traffic volumes, significantly reduce the number of reportable intersection-related crashes, and minimize (or eliminate) intersection-related injuries. A roundabout will also be easier and safer for pedestrians and bicyclists to negotiate than the current intersection and will allow the slip lane between eastbound Velp and southbound Military to be removed.

T24. Monroe Avenue/Walnut Street (Green Bay)

Crash Rate	1.02
Reportable Crashes Per Year	8
Est. Property Damage Cost/Year	\$49,600
Injuries Per Year	5.7
Est. Injury Cost/Year	\$227,288
Crash Type	
Right Angle	13 (54%)
Rear End	4 (17%)
Side Swipe	2 (8%)
Head On	0 (0%)
Bicycle/Pedestrian	2 (8%)
Other	3 (13%)
Driver Factor	
Disregard Traffic Control	7 (29%)
Failure To Yield	5 (21%)
Inattentive Driving	2 (8%)
Too Fast For Conditions	2 (8%)
Driver Condition	0 (0%)
Other	8 (34%)

Comments: This intersection experienced a variety of crashes that were caused by a variety of factors between 2002 and 2004, but the most common incidents were angle and rear end crashes caused primarily by southbound and eastbound motorists who had disregarded the traffic controls or failed to yield. The crashes were also fairly evenly distributed throughout the week and occurred at all times of the day, and six of the 24 crashes (25%) during the three-year period involved alcohol.

Recommendations: Perhaps the signals could be timed to allow the southbound and eastbound vehicles to clear the Walnut and Monroe corridors without trying to beat the lights, but this would be difficult since both streets are arterials.

T24. Velp Avenue/Memorial Drive (Howard)

Crash Rate	1.02
Reportable Crashes Per Year	7
Est. Property Damage Cost/Year	\$43,400
Injuries Per Year	5.3
Est. Injury Cost/Year	\$211,338
Crash Type	
Right Angle	17 (81%)
Rear End	0 (0%)
Side Swipe	1 (5%)
Head On	0 (0%)
Bicycle/Pedestrian	0 (0%)
Other	3 (14%)
Driver Factor	
Disregard Traffic Control	0 (0%)
Failure To Yield	16 (76%)
Inattentive Driving	4 (19%)
Too Fast For Conditions	0 (0%)
Driver Condition	0 (0%)
Other	1 (5%)

Comments: Almost every incident at this intersection during the three-year study period was a right angle crash that occurred when motorists on Memorial Drive pulled out in front of people traveling straight on Velp Avenue. The statistics for this period also indicate that 5 of the 21 crashes involved alcohol, and that 9 of the period's 16 injuries resulted from these alcohol-related crashes.

Recommendations: The intersection should be converted to a roundabout to accommodate the intersection's average daily traffic volumes, significantly reduce the number of reportable intersection-related crashes, and minimize (or eliminate) intersection-related injuries.

T26. STH 172/Packerland Drive (Ashwaubenon)

Crash Rate	0.98
Reportable Crashes Per Year	12.3
Est. Property Damage Cost/Year	\$76,260
Injuries Per Year	7.3
Est. Injury Cost/Year	\$291,088
Crash Type	
Right Angle	15 (41%)
Rear End	11 (30%)
Side Swipe	3 (8%)
Head On	2 (5%)
Bicycle/Pedestrian	0 (0%)
Other	6 (16%)
Driver Factor	
Disregard Traffic Control	5 (13%)
Failure To Yield	14 (38%)
Inattentive Driving	8 (22%)
Too Fast For Conditions	3 (8%)
Driver Condition	0 (0%)
Other	7 (19%)

Comments: This intersection was reconstructed in the fall of 2003, and positive-offset left turn lanes were added during the project. Since this study includes only one year of data following the addition of the turn lanes, their safety impacts will need to be evaluated over a longer period to determine if they have improved safety. However, the data collected during 2004 suggest that the offset turn lanes have had a positive impact.

In addition to adding the offset turn lanes, WisDOT completed a study of STH 172 in 2005 that recommends the eventual conversion of the Packerland intersection to a grade-separated interchange. When this occurs, the conflicts at the intersection will be eliminated.

Recommendations: Continue to monitor the intersection to determine the impacts of the offset turn lanes.

T26. Webster Avenue/Walnut Street (Green Bay)

Crash Rate	0.98
Reportable Crashes Per Year	7.7
Est. Property Damage Cost/Year	\$47,740
Injuries Per Year	6.7
Est. Injury Cost/Year	\$267,163
Crash Type	
Right Angle	15 (65%)
Rear End	1 (4%)
Side Swipe	2 (9%)
Head On	1 (4%)
Bicycle/Pedestrian	2 (9%)
Other	2 (9%)
Driver Factor	
Disregard Traffic Control	11 (48%)
Failure To Yield	8 (35%)
Inattentive Driving	2 (9%)
Too Fast For Conditions	1 (4%)
Driver Condition	1 (4%)
Other	0 (0%)

Comments: This intersection experienced a variety of crashes that were caused by a variety of factors between 2002 and 2004, but the most common (and severe) incidents were angle crashes caused by motorists disregarding the traffic signals and making left turns in front of oncoming vehicles.

Recommendations: Visibility for left-turning motorists could be improved by modifying the approaches and installing positive-offset left turn lanes, but space might not be available to make the improvements at the intersection.

28. Shawano Avenue/Packerland Drive (Howard)

Crash Rate	0.97
Reportable Crashes Per Year	17.7
Est. Property Damage Cost/Year	\$109,740
Injuries Per Year	12.3
Est. Injury Cost/Year	\$490,463
Crash Type	
Right Angle	18 (34%)
Rear End	29 (55%)
Side Swipe	3 (6%)
Head On	1 (1%)
Bicycle/Pedestrian	0 (0%)
Other	2 (4%)
Driver Factor	
Disregard Traffic Control	3 (6%)
Failure To Yield	9 (17%)
Inattentive Driving	18 (34%)
Too Fast For Conditions	8 (15%)
Driver Condition	3 (6%)
Other	12 (22%)

Comments: This intersection was reconstructed in the fall of 2003, and slotted left turn lanes were added during the project. Since this study includes only one year of data following the addition of the turn lanes, their safety impacts will need to be evaluated over a longer period to determine if they have improved safety. However, the data collected during 2004 suggest that the turn lanes have had a positive impact.

Within the next ten years, WisDOT plans to replace this intersection with a grade-separated interchange that will to separate regional traffic from local traffic. When this project is completed, many of the right angle and rear end conflicts at the intersection should be eliminated.

Recommendations: WisDOT should proceed with its planned project.

29. Holmgren Way/Cormier Road (Ashwaubenon)

Crash Rate	0.96
Reportable Crashes Per Year	5.3
Est. Property Damage Cost/Year	\$32,860
Injuries Per Year	5
Est. Injury Cost/Year	\$199,375
Crash Type	
Right Angle	14 (88%)
Rear End	1 (6%)
Side Swipe	1 (6%)
Head On	0 (0%)
Bicycle/Pedestrian	0 (0%)
Other	0 (0%)
Driver Factor	
Disregard Traffic Control	5 (31%)
Failure To Yield	6 (38%)
Inattentive Driving	2 (12%)
Too Fast For Conditions	0 (0%)
Driver Condition	0 (0%)
Other	3 (19%)

Comments: The most common incidents at this intersection during the three-year study period were right angle crashes that occurred when people disregarded the traffic signals or failed to yield when making left turns. Although the numbers of crashes on Holmgren and Cormier were nearly even, the Holmgren crashes tended to involve more injuries.

Recommendations: The intersection should be converted to a roundabout to accommodate the intersection's average daily traffic volumes, significantly reduce the number of reportable intersection-related crashes, and minimize (or eliminate) intersection-related injuries. A roundabout at this intersection would also complement the roundabout recommended for the intersection of Holmgren Way and Pilgrim Way.

T30. Monroe Avenue/Porlier Street (Green Bay)

Crash Rate	0.91
Reportable Crashes Per Year	7
Est. Property Damage Cost/Year	\$43,400
Injuries Per Year	5.7
Est. Injury Cost/Year	\$227,288
Crash Type	
Right Angle	19 (90%)
Rear End	2 (10%)
Side Swipe	0 (0%)
Head On	0 (0%)
Bicycle/Pedestrian	0 (0%)
Other	0 (0%)
Driver Factor	
Disregard Traffic Control	3 (14%)
Failure To Yield	16 (76%)
Inattentive Driving	2 (10%)
Too Fast For Conditions	0 (0%)
Driver Condition	0 (0%)
Other	0 (0%)

Comments: Most of the crashes at this intersection occurred when a northbound or southbound vehicle hit another vehicle as it was turning left onto Porlier. These crashes were likely the result of left turners not being able to see vehicles approaching the intersection in the outside lanes because an opposing vehicle was also waiting to make a left turn.

Recommendations: Assuming that vehicle visibility is the primary problem, the ideal solution would be to offset the left turning vehicles so approaching vehicles can be seen well before reaching the intersection. However, this could only be accomplished by restricting the two inside lanes of Monroe to left turns and forcing all through and right movements to occur in the two outside lanes. If this is not possible or desirable, the city should consider adding a protected left turn signal phase for southbound drivers that would complement the existing northbound protected left turn phase. Although this additional protected left turn phase would make the intersection less efficient and would not likely *eliminate* crashes, the new phase could reduce the risk of making left turns onto eastbound Porlier from southbound Monroe since 11 of the 21 reportable crashes during the study period involved this movement.

T30. East Mason Street/Alpine Drive (Green Bay)

Crash Rate	0.91
Reportable Crashes Per Year	8.7
Est. Property Damage Cost/Year	\$53,940
Injuries Per Year	3.7
Est. Injury Cost/Year	\$147,538
Crash Type	
Right Angle	17 (65%)
Rear End	5 (19%)
Side Swipe	1 (4%)
Head On	0 (0%)
Bicycle/Pedestrian	1 (4%)
Other	2 (8%)
Driver Factor	
Disregard Traffic Control	6 (23%)
Failure To Yield	7 (27%)
Inattentive Driving	2 (8%)
Too Fast For Conditions	8 (30%)
Driver Condition	1 (4%)
Other/Blank	2 (8%)

Comments: The most common incidents at this intersection during the three-year study period were right angle crashes that occurred when people disregarded the traffic signals or failed to yield when making left turns. The statistics also indicate that many crashes occurred as a result of westbound motorists traveling too fast when the street was covered by rain, snow, or ice. This suggests that people might be having a hard time making the transition from freeway speeds to city street speeds, and Mason Street's shoulders and ditches between I-43 and Alpine Drive could lead people to believe that they are still on a highway before encountering the Alpine signals.

Recommendations: One method of encouraging westbound drivers to approach the intersection at lower speeds could be to add outside curbs and other features to Mason Street that will clearly inform people that they are now on a city street.

V. Conclusions

The statistics for the 30 intersections in this study suggest that many of the crashes that occurred between 2002 and 2004 were the result of only a handful of problems. For example, every intersection experienced at least a few crashes that were likely caused by the inability of turning motorists to see oncoming motorists, and this was probably the primary cause of the majority of crashes at several of the intersections. All of the intersections in the study also experienced crashes attributable to drivers disregarding traffic signals or stop signs, and most of these incidents were probably the result of people failing to beat red lights or simply not seeing the signal or sign until it was too late. Rear end crashes were common, and in most cases these crashes appeared to have been caused by drivers not paying attention, following the vehicles in front of them too closely, and driving too fast in all types of weather. There were several crashes that did not fit into these categories, but these seemed to be the most common crashes at the 30 metropolitan area intersections during the three-year study period.

Since most of the crashes appear to fit into one of the categories listed above, it should be reasonably easy to correct the problems and significantly reduce the number of crashes in the area. The intersection summaries presented in Section IV of the study recommended several methods of improving safety, but the more frequent recommendations are also discussed below.

Roundabouts

Roundabouts are recommended at several intersections in the study because they can significantly reduce the number and severity of the types of crashes that were common at these intersections (e.g. right angle crashes and crashes caused by people disregarding traffic controls), enhance traffic capacity, maximize safety and accessibility for pedestrians and bicyclists, and improve the attractiveness of an area. In many cases, roundabouts are less expensive to build than new or expanded signalized intersections and allow streets that would ordinarily be expanded for vehicle storage to remain narrow because traffic is able to flow virtually uninterrupted. The reduction in property damage and injury costs at many of the intersections in the study would likely cover the cost of the roundabouts in very little time.

Single lane roundabouts have proven to be very safe, efficient, and attractive throughout the world. The roundabouts in Brown County have improved flow, safety, and accessibility, and many people who initially opposed their installation have become roundabout supporters. Roundabouts with more than one lane, however, are still untested locally and are encountering some of the same opposition that the single lane roundabouts faced in 1998 and 1999. Even though the safety benefits have not been as significant as those attributable to single lane facilities, two lane roundabouts have still reduced crash frequency and substantially reduced crash severity after they replaced large signalized intersections, and they are much more pedestrian-friendly than many multi-lane signalized crossings.

The benefits of two lane roundabouts are mentioned here because these larger facilities will likely be necessary if roundabouts are chosen at the intersections of Lombardi Avenue and Marlee Lane, West Mason Street and Taylor Street, and other high volume arterial intersections in the area. Roundabouts were recommended at these heavily traveled intersections because they experienced several severe crashes during the three-year study period that could be eliminated by roundabouts. Larger roundabouts are also a logical method of reducing the dangers associated with frontage roads that connect to major streets very close to large intersections, for they significantly reduce conflicts and speeds and make the intersection much less confusing. The large roundabouts would not eliminate crashes at the large intersections, but the number of crashes would decrease and the severity of the crashes that occur would be low.

Positive-Offset Left Turn Lanes

The positive-offset left turn lanes that are recommended for many intersections in the study would significantly improve the ability of left turning motorists to see oncoming vehicles and, as a result, likely reduce crashes at many of the intersections included in this study. These relatively low cost methods of improving safety were installed at intersections along Ashland Avenue and STH 172 at the end of 2003, and they appear to have reduced the number and severity of left-turning crashes at these intersections.

Frontage Roads

Some of the intersections in the study contain frontage roads on one or both sides of arterial streets that connect very close to the main intersections. The crash data and field reviews suggest that vehicle movements to and from the frontage roads make the intersections very dangerous at peak travel times and moderately dangerous during off-peak times. Unfortunately, the problems posed by the existing frontage roads are very difficult to fix because existing buildings make it nearly impossible to move the connection points farther away from the intersections. Since the connection points cannot be moved, the only way to reduce crashes at the frontage roads would be to restrict vehicle movements to and from the roads or make the existing movements safer.

The study recommends that frontage road movements at the West Mason Street/Packerland Drive and Main Street/Auto Plaza Way intersections be restricted to improve safety, which theoretically would reduce the number of crashes at the intersections. However, this would likely prompt drivers to cut through parking lots, make U-turns in traffic, and take other illegal and dangerous actions to minimize the "inconvenience" created by the frontage road restrictions. This probable reaction to the restrictions is one of the reasons the study recommends a six leg roundabout at the Lombardi Avenue/Marlee Lane intersection that would include both Lombardi approaches, both Marlee approaches, and both Lombardi Access approaches. In addition to maximizing convenience, the roundabout would likely be the most efficient and safe means of correcting many of the problems that exist at the two closely spaced intersections. The Mason/Packerland and Main/Auto Plaza Way intersections could also be converted to eight leg roundabouts (which do exist), but this would likely be very confusing for local drivers and should not be attempted until people become familiar with two lane roundabouts with fewer approaches. As complicated as a six (or more) leg roundabout sounds, its ability to accommodate several street approaches at one

intersection makes it the safest and most efficient method of correcting the problems created by frontage roads that connect too close to major intersections.

If frontage roads are considered for other streets in the future, they should be constructed as far away from the main intersections as possible. If, however, frontage roads absolutely have to be connected close to intersections, multi-leg roundabouts should also be considered to maximize safety and efficiency.

VI. Implementation

This study identifies safety problems at several intersections, identifies the estimated property damage and injury costs associated with these problems, and recommends remedies to the problems that would likely be paid for by the cost savings associated with the resulting crash and injury reductions. For instance, a 30 percent crash and injury reduction at the intersection of West Mason Street and Taylor Street could reduce the intersection's property damage and injury costs by more than \$280,000 per year, and this savings could be even greater if the most severe crashes are reduced or eliminated. If each of the intersections in this study were to realize similar crash reductions, property damage and injury costs would decline by several millions of dollars every year.

The financial impact of improving safety at these and other intersections in the area would be very significant, but the most important reason to make intersections as hazard-free as possible is to protect the drivers, pedestrians, bicyclists, and other users of the transportation system from injury. After all, a dented fender can be fixed, but many injuries never completely heal. To provide everyone safer access to a variety of destinations, the study should be used by the affected communities, Brown County Highway Department, and Wisconsin Department of Transportation as a means of identifying the existence of hazards, determining why the hazards exist, and financially justifying corrections that will reduce or eliminate the hazards.

Figure 1: Positive-Offset Left Turn Lanes (Four Lane Street Example)

