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16. Abstract Jefferson County Road H-46 from Redwood Avenue to the southeast corporate limits (SCL) of Fairfield, Iowa, is a paved roadway approximately 6.5 miles long made of asphaltic concrete pavement with curvilinear alignment. The roadway consists of a 22 ft wide pavement, last overlaid in 2002, with 3 to 4 ft wide earth shoulders. Traffic estimates indicated volumes ranging from 500 to 1,590 vehicles per day, with numbers increasing as the route nears Fairfield. This roadway was found to be among the highest 5 percent of similar Iowa roadways in terms of severity of run-off-road crashes. In response, Iowa Department of Transportation (Iowa DOT) requested a road safety audit to examine the roadway and suggest possible mitigation. Representatives from the Iowa DOT, Federal Highway Administration, Institute for Transportation, local law enforcement, and local government met to review crash data and discuss potential safety improvements to this segment H-46. This report outlines the findings and recommendations of the road safety audit team for addressing the safety concerns on this roadway.			
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ROAD SAFETY AUDIT FOR COUNTY ROAD H-46 FROM REDWOOD AVENUE TO THE SOUTHERLY CORPORATE LIMITS OF FAIRFIELD IN JEFFERSON COUNTY, IOWA

**Final Report
January 2010**

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The author would like to thank the Jefferson County Engineer's and Sheriff's Offices, Iowa State Patrol, and the Iowa Department of Transportation (Iowa DOT) District 5 Office for their support and participation in this review. The author would also like to thank the Iowa DOT for requesting and participating in this road safety audit and for sponsoring the effort.

The participation and contributions of the members of the road safety audit team were invaluable in the successful completion of this activity. The audit team included the following people:

- Kevin Korth Federal Highway Administration
- Bob Sperry Local Roads Safety Liaison, Institute for Transportation
- Tom McDonald Safety Circuit Rider, Institute for Transportation

Crash data for this road safety audit were developed by Dan Cook, Institute for Transportation.

INTRODUCTION

This report documents the findings and recommendations of a road safety audit for a section of County Road H-46 from Redwood Avenue to the south corporate limits (SCL) of Fairfield in Jefferson County, Iowa. County Road H-46 is a paved roadway of asphaltic concrete pavement with curvilinear alignment, approximately 6.5 miles in length. The roadway consists of a 22 ft wide pavement, last overlaid in 2002, with 3 to 4 ft wide earth shoulders and steep foreslopes. The pavement surface was treated in 2009 with a Gilsonite spray application, and new pavement markings were applied. Traffic volume as determined by a 2006 Iowa Department of Transportation (Iowa DOT) estimate indicated volumes ranging from 500 to 1,590 vehicles per day, with numbers increasing as the route nears Fairfield. This roadway was found to be among the highest 5 percent of similar Iowa roadways in terms of severity of run-off-road crashes.

In response, a road safety audit was scheduled to examine the roadway and suggest possible mitigation. The audit was conducted on October 21, 2009, by a team formed by Kevin Korth, Federal Highway Administration (FHWA), Iowa Division; Bob Sperry, Local Roads Safety Liaison, Institute for Transportation (InTrans) at Iowa State University; and Tom McDonald, Safety Circuit Rider, InTrans.

INITIAL MEETING

The initial meeting for the audit was conducted in the Jefferson County Engineer's Office in Fairfield. The following people participated in the meeting:

- Tom Goff Jefferson County Engineer
- Brian Messer Assistant to the Jefferson County Engineer
- Russ Morey Iowa State Patrol
- Mark Miller Jefferson County Deputy
- Pete Tollenaere District 5 Assistant District Engineer, Iowa DOT
- Jim Armstrong District 5 Local Systems Engineer, Iowa DOT
- Kevin Korth FHWA
- Bob Sperry InTrans
- Tom McDonald InTrans

Following introductions, Tom McDonald briefly described the purpose of road safety audits and distributed crash data for review and discussion. The data consisted of a crash location map by severity and summaries of selected crash data for the most recent eight years, 2001 through 2008. These data indicated a total of 52 crashes during the review period, with 1 fatal crash, 5 major injury crashes, 8 minor injury incidents, 5 possible injury crashes, and 33 property damage only crashes. Included in the total were 22 animal crashes. The easterly end of this section had experienced mostly widely spaced animal crashes with property damage only severity. As the roadway alignment becomes more curvilinear toward Fairfield, both crash numbers and severity increase. It should be noted that the original data for this review did not include the rural location between the US 34 bypass and the City of Fairfield, as pointed out by County Engineer Goff.

Complete crash data, including data for this area, will be described in more detail later in this report.

County Engineer Goff indicated that a Gilsonite surface treatment had been applied in 2009 with satisfactory results and that pavement markings are replaced annually by local crews.

The Iowa DOT recently completed a US 34 bypass around the City of Fairfield and opened the bypass to traffic. Since opening, it was reported that traffic on Osage Avenue connecting the bypass to H-46 has increased significantly.

Deputy Miller reported that nighttime traffic on H-46 is relatively high, possibly due to commuter traffic from industries in Fairfield or due to travelers to a restaurant in Bonaparte. This high traffic may be reflected in higher nighttime crash numbers.

State Trooper Morey suggested that drivers who want to avoid detection on US 34 may use H-46 as an alternate travel route between Mt. Pleasant and Fairfield. This usage could also contribute to higher nighttime traffic volumes.

Safety audit participants thought the fatal crash listed in the data may have been weather related and that a second fatal crash may have occurred near the Palm Boulevard intersection. These observations will be reviewed in more depth later in this report.

Pete Tollenaere, who resides in the rural area off H-46, reported that bicycle traffic on this route is also quite common.

FIELD REVIEWS

This section summarizes the findings from the daylight and nighttime field reviews. Images from both field reviews are provided in Appendix A.

Daylight Field Review

Following the initial office meeting, the audit team and local meeting participants reviewed roadway conditions on H-46, beginning at the south corporate limits of Fairfield and proceeding southeasterly. Because the crash map provided for this review terminated some distance from the corporate limits of Fairfield, this additional area past the Greenbrier Circle entrances was examined for crash history and is included in the discussion below.

Some crashes have occurred on H-46 in the area of an overpass bridge for the US 34 bypass. Reconstruction of H-46 in this area had been undertaken as part of the bypass project, and roadway alignment has been improved since the time of some of the crashes.

A vertical panel marked a culvert end and steep slope slide area just southerly from the US 34 bypass. Several crashes have been recorded between the bypass and the Osage Avenue intersection, including one major injury crash. For southbound traffic at this intersection, visibility to the southeast is hampered by a vertical curve on H-46 and a large maple tree near the right-of-way. Several crashes, including one minor injury incident, have been recorded at this intersection.

Warning signs are in place in advance of most curves along the curvilinear roadway, and deer warning signs with “Next 2 Miles” plaques advise of frequent deer crossings in this area.

At the Pine Avenue intersection, no double-arrow sign was in place across from this T-intersection. However, Pine Avenue is very narrow and carries little traffic.

Southeasterly from Pine Avenue, a newer bridge with a current guard rail exists. Vertical panels marking the bridge ends are in good condition. Beyond the bridge, H-46 features a long vertical rise with numerous private entrances and roads. One private road serves seven to eight residences. Advance sight distance to this private road connection for northbound drivers is hampered by the vertical geometry of H-46.

Palm Boulevard intersects H-46 from the south near a horizontal curve. One fatal crash, possibly weather related, was recorded in this area during the review period. Widely spaced, larger size chevron warning signs mounted on brackets are in place through this curve. For northbound traffic approaching this area, a curve warning sign with a 45 mph advisory speed is in place. A School Bus Stop Ahead warning sign is also located in advance of the curve.

Between Palm Blvd. and Queenscup Road, a close clustering of animal crashes is shown on the crash map. The H-46 roadway in this area to the Redwood Avenue intersection is a tangent alignment with few crashes noted.

Signing throughout this section appeared satisfactory during the daylight review; however visibility could be enhanced by replacing the high-intensity warning signs, including chevrons with fluorescent yellow, microprismatic sheeting devices.

Some down guys at utility poles were observed within the right of way along the route.

Nighttime Field Review

On the evening of November 11, 2009, the following team members reviewed conditions on County Road H-46: Jack Latterell, Roger Larson, Bob Sperry, and Tom McDonald. The initial drive-through began at the south corporate limits of Fairfield and proceeded southerly. A second visual observation was conducted in the northerly direction of travel.

The pavement markings on the newly applied Gilsonite surface treatment were quite visible, with good retroreflection. In addition, the markings beyond the Gilsonite section also appeared very satisfactory.

The relatively new bridge over the US 34 bypass did not appear to feature delineation in the guardrail. Nighttime visibility of this structure could be improved with guardrail reflectors and perhaps newer vertical panel object markers.

A vertical panel object marker along a slide area just southerly from the US 34 bypass did not exhibit good visibility. Several No Passing signs also did not appear to have good conspicuity. The supports for some of these signs may be tipped, which would hamper retroreflectivity at night.

Street name signs throughout the road safety audit section were visible and legible. However, some curve warning signs did not exhibit good visibility, although moisture on the signs' surface may have contributed to this assessment.

Visibility of the bridge and guardrail southerly from Pine Avenue could be improved by replacing the vertical panel object markers and delineators. Additional delineation along the face of the guardrail would also be very effective.

The existing chevrons along the curve near the Palm Boulevard intersection would be more effective if these devices were repositioned to more closely comply with 2009 Edition of the *Manual on Uniform Traffic Control Devices* (MUTCD) guidelines. In addition, at least one more chevron should be added to enhance visibility of the curve for southbound drivers approaching the area from the north.

A route marker guide sign just westbound from the Redwood Avenue intersection should be replaced.

Only one curve in the reviewed section has been delineated beyond standard pavement markings. Enhanced guidance along several curves with higher degrees of radius would be effective, perhaps using single white delineators spaced according to 2009 MUTCD guidelines or using devices similar to the Carsonite product to provide flexible supports.

CRASH DATA

Summaries of selected crash data were distributed and reviewed as part of this safety audit, with the observations described below.

When the initial examination of this roadway section was examined for crash data, it was assumed that the corporate limits of Fairfield extended to south of the US 34 bypass. During the safety audit review it was pointed out that county jurisdiction actually extended some distance northerly from the new bypass. When the audit team returned to the office, this additional area

was reviewed using the Crash Mapping and Analysis Tool, CMAT. A summary of data from this added area is included in Appendix B.

When the section of rural roadway between the US 34 bypass and the southern corporate limits of Fairfield are included in the crash data, a total of 65 crashes were recorded during the review period, 2001 through 2008. For 30 of these incidents, the major cause was listed as animal involvement, and 15 incidents were listed as ran-off-road crashes, right or left. Other crash causes were quite consistent, although crossed centerline was evident for four of the crashes.

The most common manner of collision type was non-collision, with 56 crashes out of 65 listing this collision type. These data indicate that most crashes only involved a single vehicle.

The hours of the day with the most frequent crashes were during the morning commuting time, 5:00 a.m. to 9:00 a.m. A total of five crashes were recorded at approximately 5:00 p.m., and relatively higher numbers of crashes were also shown for most hours up to midnight. Morning hours also experienced the highest number of serious crashes, with four of the six serious crashes occurring between 5:00 a.m. and 9:00 a.m. Crashes by day of week varied somewhat, with Tuesdays, Saturdays, and Mondays experiencing the highest crash numbers. Sunday crashes were the least frequent, with only three incidents. The highest month for crashes was October, with nine crashes. Crashes during the winter months were not higher than for other months.

Twenty crashes were recorded during daylight conditions. However, 25 crashes were listed as happening on a dark roadway. The majority of crashes, 43 of 65, occurred during clear, cloudy, or partly cloudy weather conditions. None were shown for winter weather conditions.

Road surface conditions were listed as dry for 40 of 65 crashes, but ice was listed for 6 crashes.

For the 72 drivers involved in these 65 crashes, the most common contributing circumstance was lost control, for 10 drivers. A total of 45 drivers were found to have made no improper action leading to the crash. For 58 of the 72 drivers, the driver condition was concluded to be apparently normal, and 3 were found to be under the influence of a controlled substance.

Driver ages were well distributed, with 9 teenage drivers and only 3 drivers over the age of 60 involved in the crashes. For drivers between the ages of 21 and 59, distribution was quite uniform.

A complete summary of the crash data is included in Appendix B.

WRAP-UP MEETING AND SUGGESTIONS

A brief summary of observations and possible mitigation options were discussed following the daylight review. The suggestions are as follows:

- Review the existing chevrons on the curve near Palm Boulevard for needed upgrades, such as adding of mounting brackets, re-spacing to match 2009 MUTCD guidelines, and possibly using fluorescent yellow, microprismatic sheeting. Consider similar sheeting for the curve warning signs at this location.
- Consider installing a hidden driveway warning sign easterly of Palm Boulevard for northbound traffic.
- Discuss with the affected property owner the removal of a large tree that hampers visibility at the Osage Avenue intersection.
- Study the feasibility of deer fencing along the right-of-way between Palm Boulevard and Queenscup Road, where there has been a high concentration of deer crashes.
- Monitor the pavement surface for friction quality.
- With a future resurfacing project, consider installing milled-in pavement markings for better longevity and performance.

APPENDIX A. IMAGES FROM FIELD REVIEWS



Figure A.1. School bus warning sign and chevron along horizontal curve at Palm Boulevard intersection



Figure A.2. Pavement markings on County Road H-46



Figure A.3. Large tree obstructing view from side road at Sage Avenue intersection



Figure A.4. Curve sign and mail box



Figure A.5. Chevron installation along horizontal curve



Figure A.6. Guardrail and delineation at newer bridge



Figure A.7. Nighttime view of pavement markings

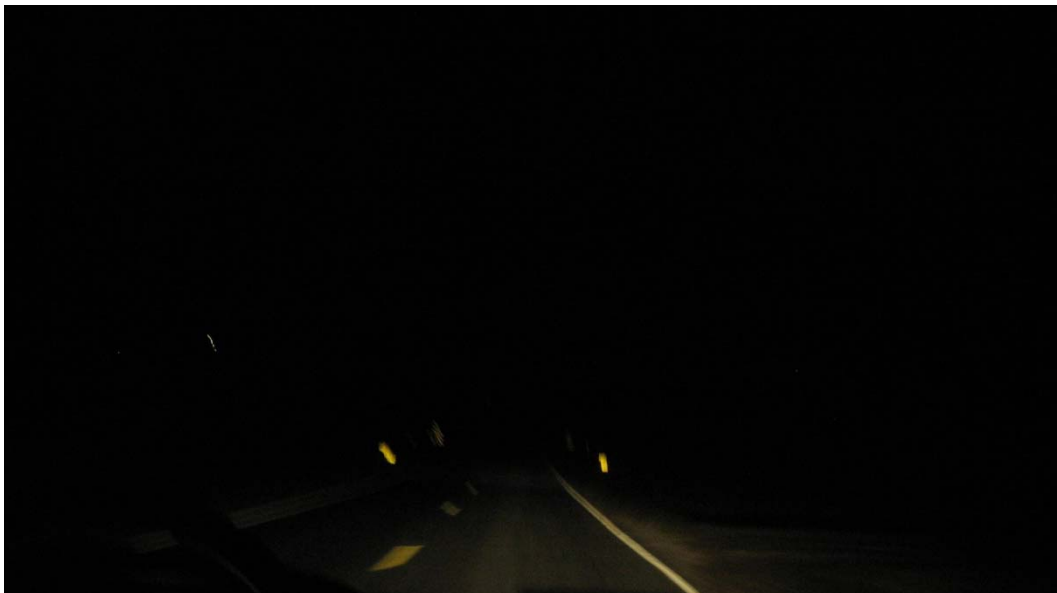


Figure A.8. Nighttime view of pavement markings and guardrail delineation at bridge

APPENDIX B. CRASH DATA

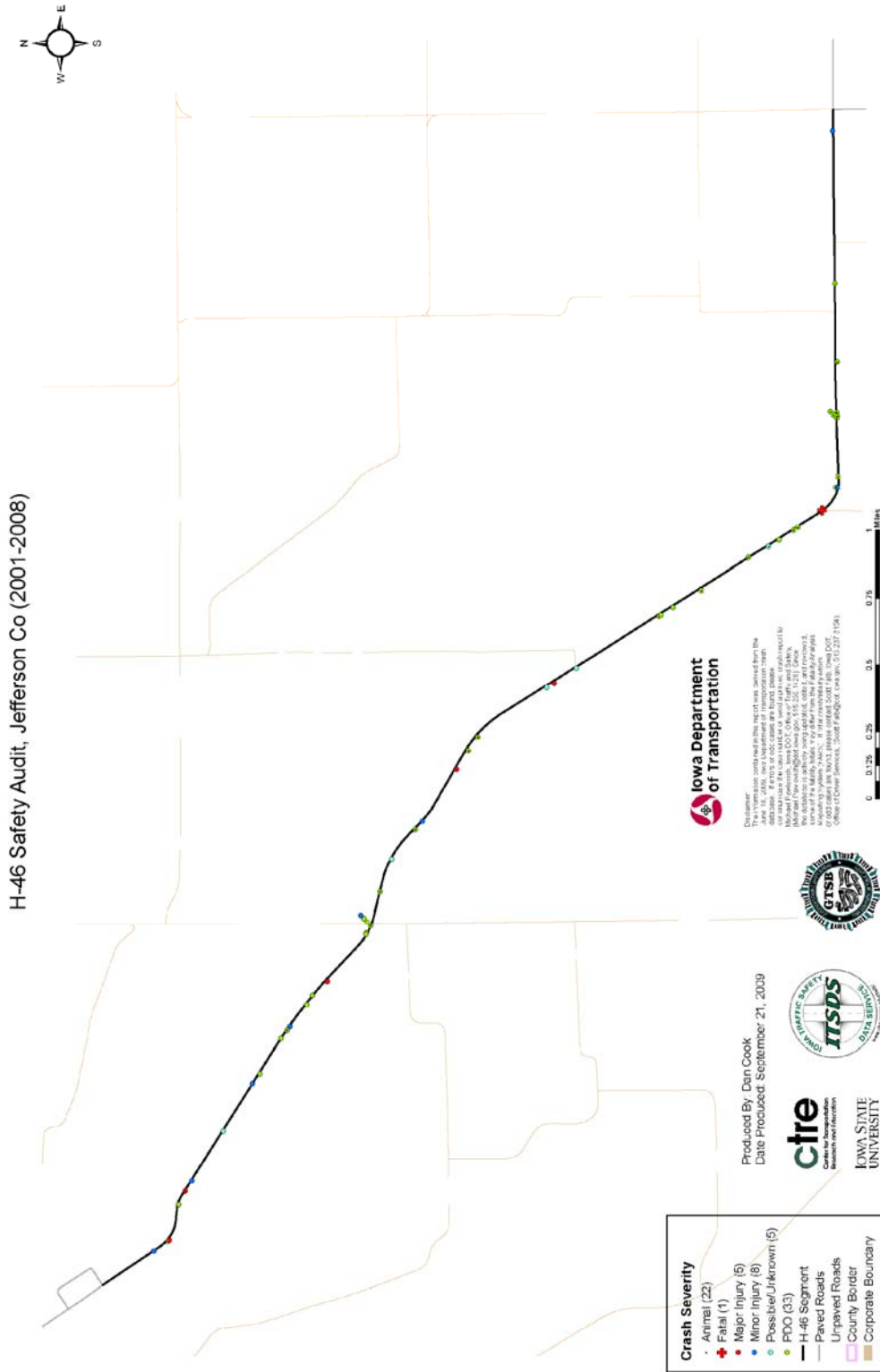


Figure B.1. Crash map for 2001 to 2008



Major Cause Summary

Jefferson County H46 Extension

Report Version 1.1 Jan 2005

Analysis Years: 2002 [3], 2003 [2], 2004 [3], 2005 [1], 2006 [1], 2007 [1], 2008 [2]

Crash Summary:

Fatal	-
Major Injury	-
Minor Injury	-
Possible/Unknown	-
PDO	13
Total Crashes	13

Injury Summary:

Fatal	-
Major Injury	-
Minor Injury	-
Possible	-
Unknown	-
Total Injuries	0

Surface Condition Summary:

Dry	10
Wet	1
Ice	-
Snow	1
Slush	1
Sand/Dirt/Oil/Gravel	-
Water	-
Other	-
Unknown	-
Not Reported	-
Total Crashes	13

TOT Property Damage: \$25,146

AVG Property Damage: \$1,934

Major Cause Summary:

- | | |
|---|---|
| <ul style="list-style-type: none"> 8 Animal <ul style="list-style-type: none"> Ran Traffic Signal Ran Stop Sign 1 Crossed Centerline <ul style="list-style-type: none"> FTYROW: At Uncontrolled Intersection FTYROW: Making Right Turn on Red Signal FTYROW: From Stop Sign FTYROW: From Yield Sign FTYROW: Making Left Turn FTYROW: From Driveway FTYROW: From Parked Position FTYROW: To Pedestrian FTYROW: Other (explain in narrative) Traveling Wrong Way or on Wrong Side of Rd Driving Too Fast for Conditions Exceeded Authorized Speed Made Improper Turn Improper Lane Change 1 Followed Too Close <ul style="list-style-type: none"> Disregarded Railroad Signal Disregarded Warning Sign Operating Vehicle in Reckless/Aggressive Manner | <ul style="list-style-type: none"> Improper Backing Illegally Parked/Unattended Swerving/Evasive Action Over-Correcting/Over-Steering Downhill Runaway Equipment Failure Separation of Units 1 Ran Off Road - Right <ul style="list-style-type: none"> Ran Off Road - Straight 2 Ran Off Road - Left <ul style="list-style-type: none"> Lost Control Inattentive/Distracted By: Passenger Inattentive/Distracted By: Use of Phone or Other Inattentive/Distracted By: Fallen Object Inattentive/Distracted By: Fatigued/Asleep Other: Vision Obstructed Oversized Load/ Oversized Vehicle Cargo/Equipment Loss or Shift Other: Other Improper Action Unknown Other: No Improper Action None Indicated |
|---|---|

Selection Filter:

((YEAR <> 2009))

Analyst: RBS

Notes: All crashes 2001-2008

Figure B.2. CMAT major cause summary

Disclaimer: The information contained in this report was derived from the June 18, 2009, Iowa Department of Transportation (Iowa DOT) crash database. If errors or odd cases are found, please communicate the case number or send a printed crash report to Michael Pawlovich, Iowa DOT, Office of Traffic and Safety (Michael.Pawlovich@dot.iowa.gov, 515.239.1428). Because the database is actively being updated, edited, and reviewed, some of the fatality totals may differ from the Fatality Analysis Reporting System (FARS). If crash/fatality errors or odd cases are found, please contact Scott Falb, Iowa DOT, Office of Driver Services (Scott.Falb@dot.iowa.gov, 515.237.3154).

Table B.1. Crashes by major cause

Year	Major Cause													Total		
	Animal	Ran Traffic Signal	Crossed Centerline	FTYROW: From stop sign	FTYROW: Making left turn	Traveling on wrong side of road	Driving too Fast for Conditions	Followed too Close	Operating vehicle in an erratic manner	Swerving/Evasive Action	Equipment Failure	Ran off Road - right	Ran off Road - left		Vision obstructed	Other Improper Action
2001	3	1										1		1		6
2002	4								1	1					1	7
2003	2			1												3
2004	4		2						1				1			8
2005	2					1					2	1				6
2006	5				1	1		1	1		5					15
2007	1		1			1					1					4
2008	1					1					1					3
Total	22	1	3	1	1	2	2	1	1	3	1	10	2	1	1	52

Table B.2. Crashes by manner of collision

Year	Manner of Collision						Total
	Non-collision	Head-on	Rear-end	Angle, oncoming left turn	Broadside	Sideswipe, same Direction	
2001	6						6
2002	6					1	7
2003	2				1		3
2004	8						8
2005	6						6
2006	12		1	1		1	15
2007	3	1					4
2008	2	1					3
Total	45	2	1	1	1	2	52

Table B.3. Crashes by hour of day

Year	Hour of Day																							Total		
	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22		23	Unknown
2001			1			1	2															1		1		6
2002								1								1				1	2	2				7
2003																	2	1								3
2004					1	2		1									2		1				1			8
2005						2		1	1						1				1							6
2006	1	1			1	2	2		1			1		1	1			1			1			2		15
2007							1	1											1					1		4
2008				1													1				1					3
Total	1	1	1	1	2	5	6	2	4	1	0	1	0	1	1	2	1	5	2	3	4	3	1	4	0	52

Table B.4. Crashes by day of week and month

Year	Day of Week							Month												Total						
	Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	January	February	March	April	May	June	July	August	September	October	November	December							
2001			1	1		1	3	2		1			1				2									6
2002		1	2	1	1	1	1							2	1	2	2									7
2003		2		1									1					2								3
2004		2	2	1	1		2	1		1	2		1		1	1	1									8
2005	1	1	1		3				2				1					1					2			6
2006	1	2	2	2	2	1	5	1	2	1	2	3		1	1	1	1	1	1	1	1	1	1	1	1	15
2007			2			2		2					1					1								4
2008	1	1	1							1		1						1								3
Total	3	9	11	6	7	5	11	6	4	4	4	4	5	3	4	5	9	1	3	3	3	3	3	3	3	52

Table B.5. Crashes by severity and hour of day

Crash Severity	Hour of Day																							Total			
	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22		23	Unknown	
Fatal									1																		1
Major Inj						1		1	1						1								1				5
Minor Inj					1					1						1	1				1	1				2	8
Poss/Unk	1	1			1													1		1							5
PDO			1	1		4	6	1	2			1		1		1		4	2	1	3	3		2			33
Total	1	1	1	1	2	5	6	2	4	1	0	1	0	1	1	2	1	5	2	3	4	3	1	4	0	52	

Table B.6. Crashes by severity and day of week

Crash Severity	Day of Week							Total
	Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	
Fatal			1					1
Major Inj		1	1		1		2	5
Minor Inj	1	2		1	2	2		8
Poss/Unk				1			4	5
PDO	2	6	9	4	4	3	5	33
Total	3	9	11	6	7	5	11	52

Table B.7. Crashes by light conditions

Year	Light Conditions							Total
	Daylight	Dusk	Dawn	Dark - Roadway lighted	Dark - roadway not lighted	Dark - unknown roadway lighting	Unknown	
2001	1				5			6
2002	3				3		1	7
2003	1				2			3
2004	2	2			2	1		8
2005	4		2					6
2006	5			2	8			15
2007	3				1			4
2008	1				2			3
Total	20	2	2	2	23	1	1	52

Table B.8. Crashes by weather conditions

Year	Weather Conditions								Total
	Clear	Partly Cloudy	Cloudy	Mist	Rain	Severe Winds	Not Reported	Unknown	
2001	4		1					1	6
2002	5		1					1	7
2003	2		1						3
2004	3	3				1	1		8
2005	4	1	1						6
2006	3	4	4	1	3				15
2007		2	1					1	4
2008	1		2						3
Total	22	10	11	1	3	1	1	3	52

Table B.9. Crashes by road surface conditions

Year	Road Surface Conditions						Total
	Dry	Wet	Ice	Sand/ mud/ dirt/ oil/ gravel	Unkonwn	Not Reported	
2001	4		1		1		6
2002	5			1	1		7
2003	3						3
2004	7					1	8
2005	3		3				6
2006	10	4		1			15
2007	2		2				4
2008	3						3
Total	37	4	6	2	2	1	52

Table B.10. Crashes by driver contributing circumstances

Year	Driver Contributing Circumstances															Total	
	Ran traffic signal	Driving too fast for conditions	Traveling on wrong side of road	Crossed Centerline	Lost Control	Followed too close	Swerved to avoid	Operating vehicle in an erratic manner	FTYROW: From stop sign	FTYROW: Making left turn	FTYROW: At uncontrolled intersection	Vision obstructed	Other improper action	No improper action	Not Reported		Unknown
2001	1										1	1		2		1	6
2002					1		1						1	4		1	8
2003									1					3			4
2004				2	1		1							2	1	1	8
2005		1			2									2	1		6
2006			1		5	1		1		1				8		1	18
2007		1		1										2		1	5
2008			1		1									2			4
Total	1	2	2	3	10	1	2	1	1	1	1	1	1	25	2	5	59

Table B.11. Crashes by driver condition

Year	Driver Condition					Total
	Apparently Normal	Asleep/ fainted/ fatigued/ etc.	Under the influence of alcohol/ drugs/ medications	Unknown	Not Reported	
2001	4			1	1	6
2002	7			1		8
2003	4					4
2004	5	1	1		1	8
2005	6					6
2006	14		2	2		18
2007	5					5
2008	3			1		4
Total	48	1	3	5	2	59

Table B.12. Crashes by driver age

Driver Age																		
Year	15	16	17	18	20	21-24	25-29	30-34	35-39	40-44	45-49	50-54	55-59	60-64	70-74	80-84	Unknown	Total
2001		1				1	1	1		1		1						6
2002		1			1	1	1	1	1					1		1		8
2003	1							1		1			1					4
2004			1	1				1			3	1	1					8
2005				2					2	1		1						6
2006			1			2	3	1	3	3	2	2					1	18
2007				1				1					2		1			5
2008						1					1		2					4
Total	1	2	2	4	1	5	5	6	6	6	6	5	6	1	1	1	1	59