



## **About the Institute for Transportation**

The mission of the Institute for Transportation (InTrans) at Iowa State University is to develop and implement innovative methods, materials, and technologies for improving transportation efficiency, safety, reliability, and sustainability while improving the learning environment of students, faculty, and staff in transportation-related fields.

## **Iowa State University Disclaimer Notice**

The contents of this report reflect the views of the authors, who are responsible for the facts and the accuracy of the information presented herein. The opinions, findings and conclusions expressed in this publication are those of the authors and not necessarily those of the sponsors.

The sponsors assume no liability for the contents or use of the information contained in this document. This report does not constitute a standard, specification, or regulation.

The sponsors do not endorse products or manufacturers. Trademarks or manufacturers' names appear in this report only because they are considered essential to the objective of the document.

## **Iowa State University Non-discrimination Statement**

Iowa State University does not discriminate on the basis of race, color, age, religion, national origin, sexual orientation, gender identity, sex, marital status, disability, or status as a U.S. veteran. Inquiries can be directed to the Director of Equal Opportunity and Diversity, (515) 294-7612.

## **Iowa Department of Transportation Statements**

Federal and state laws prohibit employment and/or public accommodation discrimination on the basis of age, color, creed, disability, gender identity, national origin, pregnancy, race, religion, sex, sexual orientation or veteran's status. If you believe you have been discriminated against, please contact the Iowa Civil Rights Commission at 800-457-4416 or Iowa Department of Transportation's affirmative action officer. If you need accommodations because of a disability to access the Iowa Department of Transportation's services, contact the agency's affirmative action officer at 800-262-0003.

The preparation of this (report, document, etc.) was financed in part through funds provided by the Iowa Department of Transportation through its "Agreement for the Management of Research Conducted by Iowa State University for the Iowa Department of Transportation," and its amendments.

The opinions, findings, and conclusions expressed in this publication are those of the authors and not necessarily those of the Iowa Department of Transportation.

**Technical Report Documentation Page**

<b>1. Report No.</b>		<b>2. Government Accession No.</b>		<b>3. Recipient's Catalog No.</b>	
<b>4. Title and Subtitle</b> Road Safety Audits for County Road X-23 from IA 2 to the South Corporate Limits of West Point and for County Road W-62 from US 218 to IA 27 in Lee County, Iowa				<b>5. Report Date</b> January 2010	
				<b>6. Performing Organization Code</b>	
<b>7. Author(s)</b> Thomas J. McDonald				<b>8. Performing Organization Report No.</b>	
<b>9. Performing Organization Name and Address</b> Institute for Transportation Iowa State University 2711 South Loop Drive, Suite 4700 Ames, IA 50010-8664				<b>10. Work Unit No. (TRAIS)</b>	
				<b>11. Contract or Grant No.</b>	
<b>12. Sponsoring Organization Name and Address</b> Iowa Department of Transportation 800 Lincoln Way Ames, IA 50010				<b>13. Type of Report and Period Covered</b> Final Report	
				<b>14. Sponsoring Agency Code</b>	
<b>15. Supplementary Notes</b> Visit <a href="http://www.intrans.iastate.edu">www.intrans.iastate.edu</a> for color PDF files of this and other research reports.					
<b>16. Abstract</b>  On October 20–21, 2009, two road safety audits were conducted in Lee County, Iowa: one for a 6 mile section of County Road X-23 from IA 2 to the south corporate limits of West Point and one for a 9.7 mile section of County Road W-62 from US 218 to IA 27. Both roads have high severe crash histories for the years of 2001 through 2008. Using these crash data, the Iowa Department of Transportation (Iowa DOT) has identified County Road X-23 as being in the top 5 percent of similar roads for run-off-road crashes. The Iowa DOT lists County Road W-62 as a high-risk rural road that has above-average crash numbers and is eligible for funding under the Federal High-Risk Rural Road Program. Considering these issues, the Lee County Engineer and Iowa DOT requested that road safety audits be conducted to address the safety concerns and to suggest possible mitigation strategies.					
<b>17. Key Words</b> County Road W-62—County Road X-23—Iowa DOT—road safety audit				<b>18. Distribution Statement</b> No restrictions.	
<b>19. Security Classification (of this report)</b> Unclassified.		<b>20. Security Classification (of this page)</b> Unclassified.		<b>21. No. of Pages</b> 39	<b>22. Price</b> NA



**ROAD SAFETY AUDITS FOR COUNTY ROAD X-23  
FROM IA 2 TO THE SOUTH CORPORATE LIMITS  
OF WEST POINT AND FOR COUNTY ROAD W-62  
FROM US 218 TO IA 27 IN LEE COUNTY, IOWA**

**Final Report  
January 2010**

**Principal Investigator**

Thomas J. McDonald  
Safety Circuit Rider  
Institute for Transportation, Iowa State University

**Author**

Thomas J. McDonald

Preparation of this report was financed in part  
through funds provided by the Iowa Department of Transportation  
through its research management agreement with the  
Institute for Transportation.

A report from  
**Institute for Transportation**  
**Iowa State University**  
2711 South Loop Drive, Suite 4700  
Ames, IA 50010-8664  
Phone: 515-294-8103  
Fax: 515-294-0467  
[www.intrans.iastate.edu](http://www.intrans.iastate.edu)



## TABLE OF CONTENTS

ACKNOWLEDGMENTS .....	IX
INTRODUCTION .....	1
INITIAL MEETING.....	1
County Road X-23 .....	2
County Road W-62 .....	2
DAYTIME FIELD REVIEWS .....	2
County Road X-23 .....	2
County Road W-62 .....	3
NIGHTTIME FIELD REVIEWS .....	4
County Road X-23 .....	4
County Road W-62 .....	4
CRASH DATA .....	5
County Road X-23 .....	5
County Road W-62 .....	5
WRAP-UP MEETING AND RECOMMENDATIONS .....	6
Recommendations for County Road X-23.....	6
Recommendations for County Road W-62.....	7
Recommendations for Both Roads .....	7
APPENDIX A. IMAGES FROM FIELD REVIEWS .....	A-1
APPENDIX B. CRASH DATA.....	B-1





## LIST OF FIGURES

Figure A.1. County Road X-23, curve sign just northerly from IA 2 intersection .....	A-1
Figure A.2. County Road X-23, curvilinear alignment and pavement markings .....	A-1
Figure A.3. County Road X-23, guardrail and delineation at newer bridge .....	A-2
Figure A.4. County Road X-23, reverse curvature alignment .....	A-2
Figure A.5. County Road X-23, chevron installation along horizontal curve .....	A-3
Figure A.6. County Road X-23, closer view of chevrons .....	A-3
Figure A.7. County Road X-23, pavement markings and bridge delineation at night .....	A-4
Figure A.8. County Road W-62, alignment and pavement markings .....	A-4
Figure A.9. County Road W-62, guardrail and delineation at newer bridge .....	A-5
Figure A.10. County Road W-62, close proximity of vegetation along horizontal curve .....	A-5
Figure A.11. County Road W-62, curve sign and pavement markings .....	A-6
Figure A.12. County Road W-62, reverse curve sign and advisory speed plaque .....	A-6
Figure A.13. County Road W-62, stop sign and double-arrow warning sign at side road intersection approach .....	A-7
Figure A.14. County Road W-62, chevrons along horizontal curve at night .....	A-7
Figure B.1. X-23 crash map for 2001 to 2008 .....	B-1
Figure B.2. W-62 crash map for 2001 to 2008 .....	B-2

## LIST OF TABLES

Table B.1. Crashes by major cause, County Road X-23 .....	B-3
Table B.2. Crashes by manner of collision, County Road X-23 .....	B-3
Table B.3. Crashes by day of week and month, County Road X-23 .....	B-4
Table B.4. Crashes by hour of day, County Road X-23 .....	B-4
Table B.5. Crashes by severity and day of week, County Road X-23 .....	B-4
Table B.6. Crashes by severity and hour of day, County Road X-23 .....	B-5
Table B.7. Crashes by light conditions, County Road X-23 .....	B-5
Table B.8. Crashes by weather conditions, County Road X-23 .....	B-5
Table B.9. Crashes by road surface conditions, County Road X-23 .....	B-6
Table B.10. Crashes by driver contributing circumstances, County Road X-23 .....	B-6
Table B.11. Crashes by driver condition, County Road X-23 .....	B-7
Table B.12. Crashes by driver age, County Road X-23 .....	B-7
Table B.13. Crashes by major cause, County Road W-62 .....	B-8
Table B.14. Crashes by manor of collision, County Road W-62 .....	B-8
Table B.15. Crashes by hour of day, County Road W-62 .....	B-9
Table B.16. Crashes by day of week and month, County Road W-62 .....	B-9
Table B.17. Crashes by severity and hour of day, County Road W-62 .....	B-9
Table B.18. Crashes by severity and day of week, County Road W-62 .....	B-10
Table B.19. Crashes by light conditions, County Road W-62 .....	B-10
Table B.20. Crashes by weather conditions, County Road W-62 .....	B-11
Table B.21. Crashes by road surface conditions, County Road W-62 .....	B-11
Table B.22. Crashes by driver contributing circumstances, County Road W-62 .....	B-12
Table B.23. Crashes by driver condition, County Road W-62 .....	B-12
Table B.24. Crashes by driver age, County Road W-62 .....	B-13



## ACKNOWLEDGMENTS

The author would like to thank the Lee County Engineer's and Sheriff's Offices as well as the Iowa State Patrol for their support and participation in this review. The author would also like to thank the Iowa Department of Transportation (Iowa DOT) for requesting and participating in these road safety audits 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

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

In addition, the participation and contributions of the following individuals during the initial and wrap-up meetings were invaluable and appreciated.

- Ernie Steffensmeier   Lee County Engineer
- Ben Hull                Assistant to the Lee County Engineer
- Lt. Dean Jalas         Iowa State Patrol
- Chad Donaldson       Lee County Deputy Sheriff
- Kevin Korth            Federal Highway Administration
- Jim Armstrong        Local Systems Engineer, Iowa DOT District 5
- Bob Sperry            Safety Liaison, Institute for Transportation
- Tom McDonald        Safety Circuit Rider, Institute for Transportation



## **INTRODUCTION**

On October 20–21, 2009, safety audits were conducted for two roadway sections in Lee County, Iowa: a 6 mile section of County Road X-23 from IA 2 to the south corporate limits of West Point and a 9.7 mile section of County Road W-62 from US 218 to IA 27. Both roads have high severe crash histories for the years of 2001 through 2008. Using these crash data, the Iowa Department of Transportation (Iowa DOT) has identified County Road X-23 as being in the top 5 percent of similar roads for run-off-road crashes. The Iowa DOT lists County Road W-62 as a high-risk rural road that has above average crash numbers and is eligible for funding under the Federal High-Risk Rural Road Program. Considering these issues, the Lee County Engineer and Iowa DOT requested that road safety audits be conducted to address the safety concerns and to suggest possible mitigation strategies.

County Road X-23 was rebuilt in the 1960s and was last resurfaced in 2005. The road was constructed with 3:1 foreslopes and an asphaltic concrete pavement that is 24 feet wide with 3- to 5-foot-wide granular shoulders. The alignment is mostly curvilinear. In 2006, the Iowa DOT estimated that 1,460 vehicles use the road per day.

County Road W-62 is also an asphaltic concrete pavement that is 24 feet wide. The granular shoulders are approximately 4 to 5 feet wide. For the 9.7 miles of road being analyzed, the east end was constructed later than the west section and has wider granular shoulders and foreslopes that are 3:1. On the west end of the section, the shoulders are narrower and have 2:1 foreslopes.

The audits for County Roads X-23 and W-62 were conducted concurrently. The following professionals comprised the audit team:

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

## **INITIAL MEETING**

The initial meeting for these audits took place on October 20 at the Lee County Supervisor's Room. The following individuals participated in the meeting:

- Ernie Steffensmeier    Lee County Engineer
- Ben Hull                         Assistant to the Lee County Engineer
- Lt. Dean Jalas                Iowa State Patrol
- Chad Donaldson            Lee County Deputy Sheriff
- Kevin Korth                    Federal Highway Administration
- Jim Armstrong                Local Systems Engineer, Iowa DOT District 5
- Bob Sperry                     Local Roads Safety Liaison, Institute for Transportation
- Tom McDonald                Safety Circuit Rider, Institute for Transportation

Following introductions, Tom McDonald described the safety audit process and distributed crash data maps and summaries for these two roads. A total of 68 crashes were recorded on County Road X-23 during the 2001 to 2008 review period, with 1 fatal, 4 major injury, 9 minor injury, and 12 possible injury crashes and 42 crashes that resulted in property damage only. County Road W-62 recorded a total of 70 crashes during the 2001 to 2008 review period, with 2 fatal, 4 major injury, 6 minor injury, and 15 possible injury crashes and 43 crashes that resulted in property damage only. A complete discussion of the crash data is presented later in this report.

### **County Road X-23**

For County Road X-23, Deputy Donaldson stated that many run-off-road crashes might be alcohol-related but not recorded as such due to lack of evidence. Numerous operating while intoxicated (OWI) citations are issued to drivers on this section, particularly during the August Sweet Corn Festival in West Point and the September rodeo in Ft. Madison.

County Engineer Steffensmeier reported that X-23 does not have destination lighting and that the maintenance garage that serves this area is located in West Point, Iowa. Since 1988, Lee County checks the nighttime visibility of signs on a two-year cycle. Centerline pavement markings are repainted every two years, and edge lines on all paved roads are repainted every three years. Additionally, the county mows all rights-of-way on an annual basis. For installing advance curve warning signs, the county uses the minimum criteria of a 3-degree curve radius.

### **County Road W-62**

For County Road W-62, Deputy Donaldson stated that he frequently concentrates on OWI enforcement because there are bars located in nearby Summitville and Argyle and numerous drinking establishments in Keokuk. Lt. Jalas reported that the Iowa State Patrol only visits these roads occasionally due to lower traffic volumes than on state roads in the area. Narrow shoulders also make it difficult to stop vehicles for citations.

County Road W-62 was utilized as a detour during the 2008 flooding, dramatically increasing traffic and possibly crashes as well.

## **DAYTIME FIELD REVIEWS**

Daylight reviews of both routes were conducted following the initial meeting. County Road X-23 was reviewed first. Images of each road section are included in Appendix A.

### **County Road X-23**

The asphalt pavement was in excellent condition. The centerline pavement markings were placed in 2009 and appeared quite satisfactory. However, the edge line markings, which were placed in 2007, appeared worn. Some edge rutting was observed along the pavement.

A Stop sign island is in place at the IA 2 intersection. A horizontal curve south of the 218th Street intersection is the location of several crashes. Large chevrons are in place but are not mounted on brackets. Curve warning signs also include 45 mph advisory speed plaques. A foreslope slide area exists on the eastern side of the roadway south of this curve.

Several crashes, including two major injury incidents and several animal crashes, were concentrated north of 218th Street.

North of the 235th Avenue intersection is a bridge constructed in the mid-1980s. The guardrail appeared satisfactory. Numerous animal crashes have been recorded in this area.

A fatal crash occurred near the Burt Road intersection just south of 175th Street in West Point. Law enforcement advised that this was an alcohol-related run-off-road incident.

When traveling into West Point, the audit team noted several poor-quality signs belonging to the community.

Most, but not all, curves along the route have standard advance yellow warning signs. All T-intersections appeared to have double-arrow warning signs across from the T, but safety dikes were not in place. Some down guys at utility poles were observed in the right-of-way.

## **County Road W-62**

On County Road W-62, the asphalt pavement was in good condition. The centerline pavement markings appeared good, but the edge lines were worn. Some ruts along the pavement edge were also observed.

In 2002, a fatal crash was recorded at the US 218 intersection when a vehicle left the road and struck a utility pole. Law enforcement indicated that this crash involved excessive speed and alcohol.

A rural fire station is located near the Lake Road intersection.

The 235th Avenue intersection has been the site of several crashes, some caused by failing to stop at the side road intersection. No rumble strips exist on the side road approach. Some edge rutting was noticed along W-62 in this location. A trailer park is located on the south side of W-62 in this area.

Most curves have advance warning signs of standard size and yellow sheeting, and many have advisory speed plaques with 45 and 50 mph speeds.

Numerous animal crashes have occurred between the 357th Street and 350th Street intersections. An alcohol-related run-off-road fatal crash occurred just beyond the 350th Street intersection,

but officers thought that the location shown on the crash map in Appendix B was too far west. Numerous animal crashes have occurred in this area, and trees in the right-of-way are located at the bottom of the foreslope. A bridge is located between these intersections; the guardrail was updated recently and a three-beam rail extends through the structure.

A rural church, with appropriate warning signs, is located just beyond the Johnson Street Road intersection. At this point, the W-62 roadway changes to narrower shoulders and steeper foreslopes.

Crashes are widely scattered along the remainder of the route, with most crashes located near the east end. However, one major injury crash occurred at the 310th Street intersection, where a four wheeler left the road at the T-intersection in an alcohol-related incident, according to Deputy Donaldson.

## **NIGHTTIME FIELD REVIEWS**

A nighttime review of these two routes was conducted on the evening of October 20. County Road X-23 was reviewed first.

### **County Road X-23**

The centerline pavement marking appeared good, but visibility of the edge lines was less satisfactory. Most curve warning signs and chevrons appeared to have good visibility. Some dull No Passing signs were observed. Vertical panels and some delineators at the bridge did not exhibit good retroreflectivity. In addition, retroreflective tape was missing from some guardrail terminal ends. For X-23 traffic proceeding southbound toward this bridge, some roadway edge delineation would be beneficial.

### **County Road W-62**

On W-62, the centerline pavement markings were replaced in 2008 and the edge lines were replaced in 2007. The markings appeared dull during the review, but all markings are due for replacement in 2010.

Most curve warning signs appeared to exhibit adequate visibility, but advisory speed plaques and No Passing signs were dull. However, some of these observations may have been due to moisture condensation.

Vertical panels and guardrail markings at the bridge exhibited satisfactory visibility.



## **CRASH DATA**

Crash data for County Road X-23 and County Road W-62 are reviewed below. Crash summary maps and tables are included in Appendix B.

### **County Road X-23**

For County Road X-23, the summarized crash data listed a total of 68 crashes, with major causes being animal collisions (28 crashes) and swerving or evasive action, which might also be associated with animal encounters, (16 crashes). Analyzing the manner of collision indicated that 47 of 68 crashes were non-collision, which indicates a majority of single-vehicle incidents.

The most common hours of the day for these crashes were primarily clustered around commuting times between the hours of 5:00 a.m. to 9:00 a.m. and 3:00 p.m. to 8:00 p.m. However, serious crashes were scattered throughout all hours of the day. The number of crashes per day was consistent throughout the week, although Mondays only listed 5 crashes. The months with the highest numbers of crashes were the winter months of November through February.

Light conditions for crashes indicated that 28 of 68 occurred in daylight, but 22 occurred during nighttime hours. Weather conditions were clear, cloudy, or partly cloudy for 40 of the 68 crashes. Snow or freezing rain was listed for 7 crashes. Road surface conditions were reported as dry for 34 crashes and snow or ice conditions for 10 crashes.

Analysis of driver contributing circumstances indicated that 25 of 78 drivers lost control of their vehicles, but 20 drivers made no improper action. Driver condition was judged as normal for 49 of 78 drivers; 3 were found to be under the influence of a controlled substance. Driver ages were unevenly distributed: 15 teenagers, including 8 drivers of age 17, 33 drivers ages 35 to 55, but only 5 drivers ages 65 and older were involved in these crashes.

### **County Road W-62**

For County Road W-62, a total of 70 crashes were recorded during the 2001 to 2008 study period. Major causes included animal crashes (28 crashes) and possibly related swerving and evasive action (12 crashes). Analysis of the manner of collision showed that 42 of 70 crashes were non-collision, indicating a high number of single-vehicle crashes.

Crashes clustered around morning and evening commuting times, but high crash numbers were also listed between 7:00 p.m. and 10:00 p.m. Severe crashes were more frequent during these hours. In addition, 7 crashes were recorded between midnight and 2:00 a.m. Weekends were the most frequent days for crashes, particularly Friday and Saturday, with a total of 32 crashes. The months with the highest number of crashes were May and October with 11 crashes each.

Although 17 of 70 crashes occurred in daylight, 25 crashes occurred during dark roadway conditions. A total of 39 crashes occurred during clear, cloudy, or partly cloudy conditions.

Snow or ice conditions were recorded for 3 crashes. Road surface conditions were reported as dry for 31 crashes and snow or ice for 5 crashes.

Analysis of driver contributing circumstances indicated that 16 of 83 drivers lost control and 6 swerved to avoid a collision. A total of 19 drivers were listed as committing no improper action. Driver condition was recorded as apparently normal for 41 drivers, but 10 were found to be under the influence of a controlled substance. Of the 83 drivers involved in these crashes, 13 were teenagers and 43 were between the ages of 30 and 60. Only 7 drivers were ages 65 and older.

## **WRAP-UP MEETING AND RECOMMENDATIONS**

The audit team met with local representatives for a wrap-up meeting conducted on October 21 in the Lee County Supervisor's Room. Participating in the meeting were Ernie Steffensmeier, Ben Hull, Jim Armstrong, Kevin Korth, Bob Sperry, and Tom McDonald.

Results and observations from the daylight and nighttime field reviews of the two routes were discussed, and preliminary suggestions for improvement were presented.

### **Recommendations for County Road X-23**

The following suggestions, not listed in any particular order, are possible mitigation strategies for the reviewed section of X-23:

- Improve sign visibility by using fluorescent yellow sheeting and higher grade microprismatic sheeting to enhance nighttime visibility.
- Use brackets for the curve chevrons to improve visibility of these devices. Conduct a study of device placement to assure compliance with new *Manual on Uniform Traffic Control Devices* guidelines.
- Install paved shoulders in selected curves, and consider including rumble strips.
- Upgrade vertical panels, delineators, and guardrail markings at the bridge.
- Study establishing a reliable criterion for curve delineation. Chevrons for all curves with a radius of 6 degrees or more and single white delineators for curves with radii from 3 degrees to 6 degrees could be considered.
- Investigate the Iowa DOT Small Signs Program for improving signing in West Point.
- Discuss removing down guys at utility poles with utility companies.

## **Recommendations for County Road W-62**

The following suggestions address the safety concerns for the reviewed section of W-62. The suggestions are not listed in any particular order.

- Improve warning sign visibility by using fluorescent yellow sheeting and microprismatic sheeting for enhanced nighttime visibility.
- Upgrade advisory speed plaques at curve warning signs.
- Consider paved shoulders in selected locations to address run-off-road crashes.
- Add deer warning signs in selected locations to alert drivers.
- Install rumble strips on the side road at 235th Avenue to warn of the Stop sign ahead. It was noted that none of the other T-intersections appeared to feature safety dikes opposite the T; however, no crashes where the vehicle passed the Stop sign and left the roadway were recorded.
- In light of the crash data, consider W-62 for enhanced enforcement activities, particularly for impaired drivers. The crash data can provide guidance for the hours when focused enforcements would be most beneficial. The Governor's Traffic Safety Bureau may want to provide funding for these activities by law enforcement.
- Inform and alert the public of the road crash history and enhanced enforcement through news releases.

## **Recommendations for Both Roads**

For both routes, Lee County should consider milled-in pavement markings with any future resurfacing projects to enhance visibility throughout the replacement cycle.



**APPENDIX A. IMAGES FROM FIELD REVIEWS**



**Figure A.1. County Road X-23, curve sign just northerly from IA 2 intersection**



**Figure A.2. County Road X-23, curvilinear alignment and pavement markings**



**Figure A.3. County Road X-23, guardrail and delineation at newer bridge**



**Figure A.4. County Road X-23, reverse curvature alignment**



**Figure A.5. County Road X-23, chevron installation along horizontal curve**



**Figure A.6. County Road X-23, closer view of chevrons**



**Figure A.7. County Road X-23, pavement markings and bridge delineation at night**



**Figure A.8. County Road W-62, alignment and pavement markings**





**Figure A.9. County Road W-62, guardrail and delineation at newer bridge**



**Figure A.10. County Road W-62, close proximity of vegetation along horizontal curve**



**Figure A.11. County Road W-62, curve sign and pavement markings**



**Figure A.12. County Road W-62, reverse curve sign and advisory speed plaque**



**Figure A.13. County Road W-62, stop sign and double-arrow warning sign at side road intersection approach**



**Figure A.14. County Road W-62, chevrons along horizontal curve at night**



# APPENDIX B. CRASH DATA

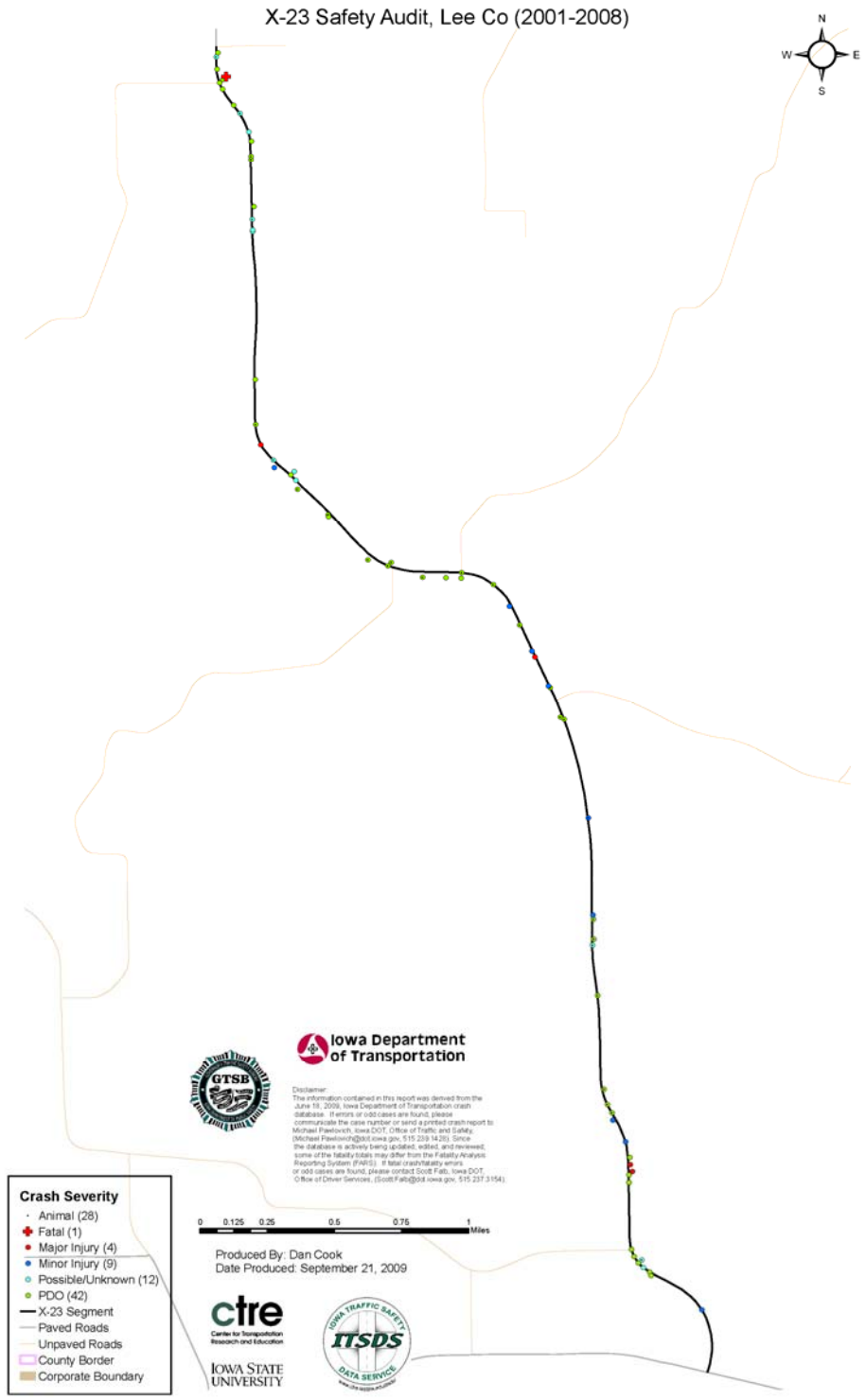


Figure B.1. X-23 crash map for 2001 to 2008

W-62 Safety Audit, Lee Co (2001-2008)

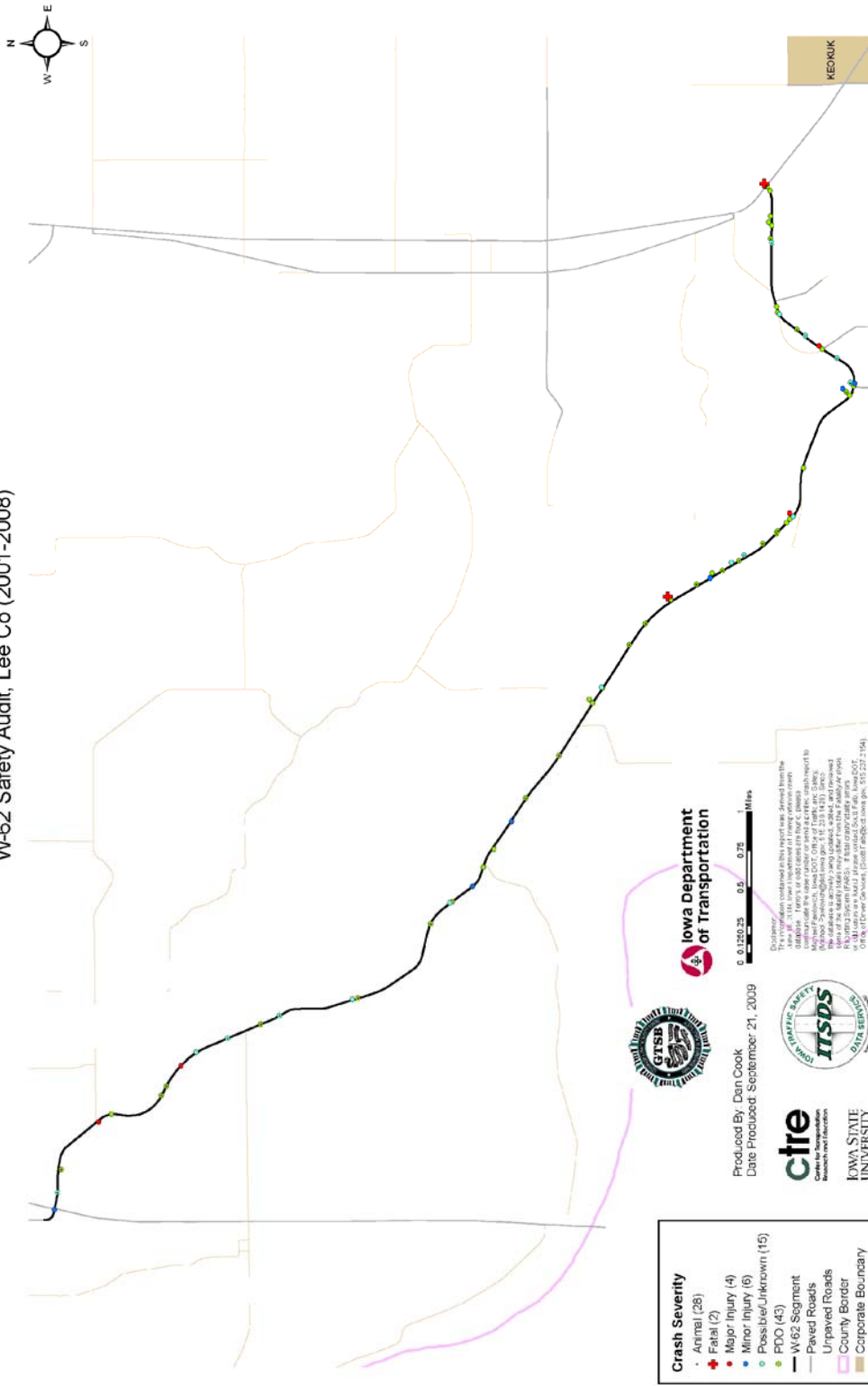


Figure B.2. W-62 crash map for 2001 to 2008

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 those in 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, County Road X-23**

Year	Major Cause													Total	
	Animal	Crossed Centerline	FTYROW: Making left turn	Driving too Fast for Conditions	Exceeded authorized speed	Swerving/ Evasive Action	Over correcting/over steering	Ran off Road - right	Ran off Road - straight	Ran off Road - left	Lost Control	Other Improper Action	No improper action		Not Reported
2001	4	1											2		7
2002			1				1							1	3
2003	2			1				1		1	1	1			7
2004					1	1		1		1					4
2005	2	1				2		2							7
2006	8	1				2			1	1					13
2007	8			2		8		1							19
2008	4					3		1							8
<b>Total</b>	<b>28</b>	<b>3</b>	<b>1</b>	<b>3</b>	<b>1</b>	<b>16</b>	<b>1</b>	<b>6</b>	<b>1</b>	<b>3</b>	<b>1</b>	<b>1</b>	<b>2</b>	<b>1</b>	<b>68</b>

**Table B.2. Crashes by manner of collision, County Road X-23**

Year	Manner of Collision								Total
	Non-collision	Rear-end	Angle, oncoming left turn	Broadside	Sideswipe, Same Direction	Sideswipe, Opposite Direction	Unknown	Not Reported	
2001	5				1			1	7
2002	1	1	1						3
2003	4	2				1			7
2004	4								4
2005	5						2		7
2006	8					1	4		13
2007	14			1			2	2	19
2008	6				1			1	8
<b>Total</b>	<b>47</b>	<b>3</b>	<b>1</b>	<b>1</b>	<b>2</b>	<b>2</b>	<b>8</b>	<b>4</b>	<b>68</b>

**Table B.3. Crashes by day of week and month, County Road X-23**

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	2	1		3		1				2				2	1			1	1	7
2002	2			1						1	1		1							3
2003	1		2		1		3		2						1			1	3	7
2004	1		1	1	1			1				1							2	4
2005	1	1	1		1	1	2				2	1		1				2	1	7
2006	2	1	2	2	1	4	1	2					2		2		2	3	2	13
2007	2		3	3	1	6	4	5	4			1	2	1			1	4	1	19
2008		2			5		1	2	1	1			1	1	1		1			8
<b>Total</b>	<b>11</b>	<b>5</b>	<b>9</b>	<b>10</b>	<b>10</b>	<b>12</b>	<b>11</b>	<b>10</b>	<b>7</b>	<b>4</b>	<b>3</b>	<b>3</b>	<b>6</b>	<b>5</b>	<b>5</b>	<b>0</b>	<b>4</b>	<b>11</b>	<b>10</b>	<b>68</b>

**Table B.4. Crashes by hour of day, County Road X-23**

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			2	1				7
2002					1											1	1									3
2003				1			1	1			1	1									1	1				7
2004				1				1								1		1								4
2005					1			1				1	1							1			1	1		7
2006						1	2	1								1	2	1	2	1			1	1		13
2007	1		1			1	1	1	1		2		1		2		2	2	2		2					19
2008		1			1	1			1							2			1	1						8
<b>Total</b>	<b>1</b>	<b>1</b>	<b>1</b>	<b>3</b>	<b>2</b>	<b>4</b>	<b>4</b>	<b>4</b>	<b>4</b>	<b>0</b>	<b>2</b>	<b>1</b>	<b>2</b>	<b>1</b>	<b>1</b>	<b>4</b>	<b>6</b>	<b>5</b>	<b>6</b>	<b>5</b>	<b>3</b>	<b>4</b>	<b>2</b>	<b>2</b>	<b>0</b>	<b>68</b>

**Table B.5. Crashes by severity and day of week, County Road X-23**

Crash Severity	Day of Week							Total
	Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	
Fatal	1							1
Major Inj	1			1	1		1	4
Minor Inj	4					3	2	9
Poss/Unk	1	2	1		2	3	3	12
PDO	4	3	8	9	7	6	5	42
<b>Total</b>	<b>11</b>	<b>5</b>	<b>9</b>	<b>10</b>	<b>10</b>	<b>12</b>	<b>11</b>	<b>68</b>



**Table B.6. Crashes by severity and hour of day, County Road X-23**

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							4
Minor Inj					1	1			2			1		1	1			1		1						9
Poss/Unk	1	1			1	1		1	1		1							1		2		1	1			12
PDO				3	2	4	2	1		1	1		1		3	5	3	5	2	3	3	1	2			42
<b>Total</b>	<b>1</b>	<b>1</b>	<b>1</b>	<b>3</b>	<b>2</b>	<b>4</b>	<b>4</b>	<b>4</b>	<b>4</b>	<b>0</b>	<b>2</b>	<b>1</b>	<b>2</b>	<b>1</b>	<b>1</b>	<b>4</b>	<b>6</b>	<b>5</b>	<b>6</b>	<b>5</b>	<b>3</b>	<b>4</b>	<b>2</b>	<b>2</b>	<b>0</b>	<b>68</b>

**Table B.7. Crashes by light conditions, County Road X-23**

Year	Light Conditions						Total
	Daylight	Dawn	Dark - Roadway lighted	Dark - roadway not lighted	Unknown	Not Reported	
2001	2		1	3		1	7
2002	2					1	3
2003	3			4			7
2004	3		1				4
2005	3		1	1	2		7
2006	3	1		3	6		13
2007	8			6	3	2	19
2008	4			2		2	8
<b>Total</b>	<b>28</b>	<b>1</b>	<b>3</b>	<b>19</b>	<b>11</b>	<b>6</b>	<b>68</b>

**Table B.8. Crashes by weather conditions, County Road X-23**

Year	Weather Conditions										Total
	Clear	Partly Cloudy	Cloudy	Fog/smoke	Rain	Sleet/ hail/ freezing rain	Snow	Not Reported	Other	Unknown	
2001	4	2						1			7
2002	2							1			3
2003	3	1			1	1	1				7
2004	1	3									4
2005	3		1						1	2	7
2006	4	3								6	13
2007	7		3			3	1	2		3	19
2008	3			1	1		1	2			8
<b>Total</b>	<b>27</b>	<b>9</b>	<b>4</b>	<b>1</b>	<b>2</b>	<b>4</b>	<b>3</b>	<b>6</b>	<b>1</b>	<b>11</b>	<b>68</b>

**Table B.9. Crashes by road surface conditions, County Road X-23**

Year	Road Surface Conditions								Total
	Dry	Wet	Ice	Snow	Slush	Other	Unknown	Not Reported	
2001	6							1	7
2002	2							1	3
2003	4	1	1	1					7
2004	2					2			4
2005	4			1			2		7
2006	6	1					6		13
2007	7		4	2			4	2	19
2008	3	1		1	1			2	8
<b>Total</b>	<b>34</b>	<b>3</b>	<b>5</b>	<b>5</b>	<b>1</b>	<b>2</b>	<b>12</b>	<b>6</b>	<b>68</b>

**Table B.10. Crashes by driver contributing circumstances, County Road X-23**

Year	Driver Contributing Circumstances										Total
	Exceeded authorized speed	Driving too fast for conditions	Crossed Centerline	Lost Control	Swerved to avoid	FTYROW: Making left turn	Other improper action	No improper action	Not Reported	Unknown	
2001	1							3	3	1	8
2002				1		1			3		5
2003		1		3			1	5	1		11
2004	1			2				1			4
2005			1	3	1				2		7
2006			1	3				4	6		14
2007		2		9	1			4	2	2	20
2008				4	1			3		1	9
<b>Total</b>	<b>2</b>	<b>3</b>	<b>2</b>	<b>25</b>	<b>3</b>	<b>1</b>	<b>1</b>	<b>20</b>	<b>17</b>	<b>4</b>	<b>78</b>

**Table B.11. Crashes by driver condition, County Road X-23**

Year	Driver Condition						Total
	Apparently Normal	Asleep/ fainted/ fatigued/ etc.	Under the influence of alcohol/ drugs/ medications	Other	Unknown	Not Reported	
2001	6					2	8
2002	3					2	5
2003	10	1					11
2004	4						4
2005	3		1		3		7
2006	4	3		1	6		14
2007	12		2		4	2	20
2008	7					2	9
<b>Total</b>	<b>49</b>	<b>4</b>	<b>3</b>	<b>1</b>	<b>13</b>	<b>8</b>	<b>78</b>

**Table B.12. Crashes by driver age, County Road X-23**

Year	Driver Age																	Total		
	16	17	18	19	20	21-24	25-29	30-34	35-39	40-44	45-49	50-54	55-59	60-64	65-69	75-79	80-84		85-89	Unknown
2001		1	1			1		1		1	1			1					1	8
2002		1				1					1	2								5
2003		1				2		1	2	1		2	1				1			11
2004				1			1			1						1				4
2005	1	1			2		1				1		1							7
2006		2				1	1	1	2	1	3	1	1		1					14
2007		1	2	2		2	2	1	2	3	1	2		1				1		20
2008		1						1	1	4	1		1							9
<b>Total</b>	<b>1</b>	<b>8</b>	<b>3</b>	<b>3</b>	<b>2</b>	<b>7</b>	<b>5</b>	<b>5</b>	<b>7</b>	<b>11</b>	<b>8</b>	<b>7</b>	<b>4</b>	<b>1</b>	<b>2</b>	<b>1</b>	<b>1</b>	<b>1</b>	<b>1</b>	<b>78</b>

**Table B.13. Crashes by major cause, County Road W-62**

Year	Major Cause																		Total	
	Animal	Ran Stop Sign	Crossed Centerline	FTYROW: From Stop Sign	Driving too Fast for Conditions	Exceeded authorized speed	Made Improper Turn	Followed too close	Operating vehicle in an erratic manner	Swerving/ Evasive Action	Over correcting/over steering	Ran off Road – right	Ran off Road – straight	Ran off Road – left	Lost Control	Inattentive/distracted by: Use of Phone or other device	Other Improper Action	Unknown		Not Reported
2001	1																	4		5
2002	4					1				3		1			1					10
2003										2		1								3
2004	2	2									1								1	6
2005	2								1	1		2								6
2006	6		1	1						3	1	1		1			3			17
2007	5				2				1	2										10
2008	8						1	1		1			1		1					13
<b>Total</b>	<b>28</b>	<b>2</b>	<b>1</b>	<b>1</b>	<b>2</b>	<b>1</b>	<b>1</b>	<b>1</b>	<b>2</b>	<b>12</b>	<b>2</b>	<b>5</b>	<b>1</b>	<b>1</b>	<b>1</b>	<b>1</b>	<b>3</b>	<b>4</b>	<b>1</b>	<b>70</b>

**Table B.14. Crashes by manor of collision, County Road W-62**

Year	Manner of Collision								Total
	Non-collision	Head-On	Rear-end	Broadside	Sideswipe, Same Direction	Sideswipe, Opposite Direction	Unknown	Not Reported	
2001	3							2	5
2002	5	1			1	1		2	10
2003	2		1						3
2004	6								6
2005	5						1		6
2006	11			1		2	3		17
2007	5		1				1	3	10
2008	5		1		2			5	13
<b>Total</b>	<b>42</b>	<b>1</b>	<b>3</b>	<b>1</b>	<b>3</b>	<b>3</b>	<b>5</b>	<b>12</b>	<b>70</b>

**Table B.15. Crashes by hour of day, County Road W-62**

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								2	1				1							5
2002	1			1		1										1	1		1		1	2	1			10
2003												1	1				1									3
2004				1		1	1														1	1	1			6
2005	2					1											1					1	1			6
2006		1				1	1	1	1	1						1		1	1	2	4	1		1		17
2007		1	1								1						2	1		2		1	1			10
2008	1	1				1	2	1							2	1				2		2				13
<b>Total</b>	<b>4</b>	<b>3</b>	<b>1</b>	<b>2</b>	<b>0</b>	<b>3</b>	<b>5</b>	<b>3</b>	<b>1</b>	<b>1</b>	<b>2</b>	<b>1</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>3</b>	<b>5</b>	<b>2</b>	<b>3</b>	<b>6</b>	<b>6</b>	<b>8</b>	<b>4</b>	<b>1</b>	<b>0</b>	<b>70</b>

**Table B.16. Crashes by day of week and month, County Road W-62**

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			2	2					2	1					1	1								5
2002		3		2	2	1	2		1		2	1		2	1	2		1								10
2003		1			1		1					1				1							1			3
2004	1		1	1			3			1		3					1	1								6
2005	2			1	2	1		1		1		1		1		1							1			6
2006	4	3	2	1	1	2	4	1		2	1	3	2	1			3	1	3							17
2007	1	2	1	1			5	2	2			1	1			1	1			1	1		2			10
2008	1			1		8	3		1	2			1	1	2		5	1								13
<b>Total</b>	<b>9</b>	<b>10</b>	<b>4</b>	<b>7</b>	<b>8</b>	<b>14</b>	<b>18</b>	<b>4</b>	<b>4</b>	<b>6</b>	<b>5</b>	<b>11</b>	<b>4</b>	<b>5</b>	<b>3</b>	<b>5</b>	<b>11</b>	<b>5</b>	<b>7</b>	<b>7</b>	<b>7</b>	<b>7</b>	<b>7</b>	<b>7</b>	<b>70</b>	

**Table B.17. Crashes by severity and hour of day, County Road W-62**

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			2
Major Inj								1									1				1		1			4
Minor Inj	2					1	1								1	1										6
Poss/Unk	1	2				1	1								1		1		1	1	1	4	1			15
PDO	1	1	1	2		2	3	1	1	1	2	1	1	2	1	2	3	2	2	5	3	4	1	1		43
<b>Total</b>	<b>4</b>	<b>3</b>	<b>1</b>	<b>2</b>	<b>0</b>	<b>3</b>	<b>5</b>	<b>3</b>	<b>1</b>	<b>1</b>	<b>2</b>	<b>1</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>3</b>	<b>5</b>	<b>2</b>	<b>3</b>	<b>6</b>	<b>6</b>	<b>8</b>	<b>4</b>	<b>1</b>	<b>0</b>	<b>70</b>

**Table B.18. Crashes by severity and day of week, County Road W-62**

Crash Severity	Day of Week							Total
	Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	
Fatal	1				1			2
Major Inj	1	1		1			1	4
Minor Inj				2	2		2	6
Poss/Unk	3	3		1	2	3	3	15
PDO	4	6	4	3	3	11	12	43
<b>Total</b>	<b>9</b>	<b>10</b>	<b>4</b>	<b>7</b>	<b>8</b>	<b>14</b>	<b>18</b>	<b>70</b>

**Table B.19. Crashes by light conditions, County Road W-62**

Year	Light Conditions							Total	
	Daylight	Dusk	Dawn	Dark - Roadway lighted	Dark - roadway not lighted	Dark - unknown roadway lighting	Unknown		Not Reported
2001					1		2	2	5
2002	3				5			2	10
2003	3								3
2004	1			1	4				6
2005					5		1		6
2006	3	1	1		6		4	2	17
2007	3	1				1	2	3	10
2008	4		2		2			5	13
<b>Total</b>	<b>17</b>	<b>2</b>	<b>3</b>	<b>1</b>	<b>23</b>	<b>1</b>	<b>9</b>	<b>14</b>	<b>70</b>

**Table B.20. Crashes by weather conditions, County Road W-62**

Year	Weather Conditions									Total
	Clear	Partly Cloudy	Cloudy	Mist	Rain	Sleet/ hail/ freezing rain	Snow	Not Reported	Unknown	
2001	1							2	2	5
2002	5	2	1					2		10
2003	2				1					3
2004	1		4					1		6
2005	2	1	2						1	6
2006	6	1	1	1	2			2	4	17
2007	1		1			2	1	3	2	10
2008	8							5		13
<b>Total</b>	<b>26</b>	<b>4</b>	<b>9</b>	<b>1</b>	<b>3</b>	<b>2</b>	<b>1</b>	<b>15</b>	<b>9</b>	<b>70</b>

**Table B.21. Crashes by road surface conditions, County Road W-62**

Year	Road Surface Conditions								Total
	Dry	Wet	Ice	Snow	Slush	Sand/ mud/ dirt/ oil/ gravel	Unkonwn	Not Reported	
2001		1					2	2	5
2002	8							2	10
2003	2	1							3
2004	3	2						1	6
2005	3			1		1	1		6
2006	6	3	2				4	2	17
2007	1	1	1	1	1		2	3	10
2008	8							5	13
<b>Total</b>	<b>31</b>	<b>8</b>	<b>3</b>	<b>2</b>	<b>1</b>	<b>1</b>	<b>9</b>	<b>15</b>	<b>70</b>

**Table B.22. Crashes by driver contributing circumstances, County Road W-62**

Year	Driver Contributing Circumstances															Total	
	Ran Stop Sign	Exceeded authorized speed	Driving too fast for conditions	Made improper turn	Crossed Centerline	Lost Control	Followed too close	Swerved to avoid	Over correcting/ over steering	Operating vehicle in an erratic manner	FTYROW: From stop sign	Inattentive/ distracted by: Use of phone or other device	Other improper action	No improper action	Not Reported		Unknown
2001														1	2	2	5
2002		1				2		5						4	2		14
2003						2		1						1			4
2004	2					1								2	1		6
2005						3								2	1		6
2006					1	5			1		1		3		7	2	20
2007			2			1				1			1	2	2	3	12
2008				1		2	1					1		7		4	16
<b>Total</b>	<b>2</b>	<b>1</b>	<b>2</b>	<b>1</b>	<b>1</b>	<b>16</b>	<b>1</b>	<b>6</b>	<b>1</b>	<b>1</b>	<b>1</b>	<b>1</b>	<b>4</b>	<b>19</b>	<b>15</b>	<b>11</b>	<b>83</b>

**Table B.23. Crashes by driver condition, County Road W-62**

Year	Driver Condition								Total
	Apparently Normal	Emotional	Illness	Asleep/ fainted/ fatigued/ etc.	Under the influence of alcohol/ drugs/ medications	Other	Unknown	Not Reported	
2001	1						2	2	5
2002	9	1		1	1			2	14
2003	2		1				1		4
2004	2				2		1	1	6
2005	3				1		2		6
2006	9				3	1	5	2	20
2007	6				1		2	3	12
2008	9				2			5	16
<b>Total</b>	<b>41</b>	<b>1</b>	<b>1</b>	<b>1</b>	<b>10</b>	<b>1</b>	<b>13</b>	<b>15</b>	<b>83</b>



**Table B.24. Crashes by driver age, County Road W-62**

Year	Driver Age															Total				
	16	17	18	19	20	21-24	25-29	30-34	35-39	40-44	45-49	50-54	55-59	60-64	65-69		70-74	75-79	Unknown	
2001								1				2	1			1				5
2002	1		1	1	2		1		1	1		1	3						2	14
2003										2							1	1		4
2004			1			1		2			1			1						6
2005	1			1				1					1		1				1	6
2006		2	1			2	2	2	2	4	2	1	1	1						20
2007				3		1	1	1	1	1		1	1	2						12
2008				1			1	1	1		3	3	1	1	3	1				16
<b>Total</b>	<b>2</b>	<b>2</b>	<b>3</b>	<b>6</b>	<b>2</b>	<b>4</b>	<b>5</b>	<b>8</b>	<b>5</b>	<b>8</b>	<b>6</b>	<b>8</b>	<b>8</b>	<b>5</b>	<b>4</b>	<b>2</b>	<b>1</b>	<b>4</b>	<b>83</b>	