

Road Safety Audit for Union County IA 25 from the WCL of Creston to North H-24 Intersection

**Final Report
July 2008**

Sponsored by
the Iowa Department of Transportation



**IOWA STATE
UNIVERSITY**

Iowa State University's Center for Transportation Research and Education is the umbrella organization for the following centers and programs: Bridge Engineering Center • Center for Weather Impacts on Mobility and Safety • Construction Management & Technology • Iowa Local Technical Assistance Program • Iowa Traffic Safety Data Service • Midwest Transportation Consortium • National Concrete Pavement Technology Center • Partnership for Geotechnical Advancement • Roadway Infrastructure Management and Operations Systems • Statewide Urban Design and Specifications • Traffic Safety and Operations

About CTRE/ISU

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

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.

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.

Technical Report Documentation Page

1. Report No.	2. Government Accession No.	3. Recipient's Catalog No.	
4. Title and Subtitle Road Safety Audit for Union County IA 25 from the WCL of Creston to North H-24 Intersection		5. Report Date July 2008	
		6. Performing Organization Code	
7. Author(s) Thomas H. Maze, Thomas J. McDonald		8. Performing Organization Report No.	
9. Performing Organization Name and Address Center for Transportation Research and Education Iowa State University 2711 South Loop Drive, Suite 4700 Ames, IA 50010-8664		10. Work Unit No(TRAIS)	
		11. Contract or Grant No.	
12. Sponsoring Organization Name and Address Iowa Department of Transportation 800 Lincoln Way Ames, IA 50010		13. Type of Report and Period Covered Final Report	
		14. Sponsoring Agency Code	
15. Supplementary Notes Visit www.ctre.iastate.edu for color PDF files of this and other research reports.			
16. Abstract <p>In April 2008 a preliminary investigation of fatal and major injury crashes on Iowa's primary road system from 2001 through 2007 was conducted by the Iowa Department of Transportation, Office of Traffic and Safety. A mapping of these data revealed an apparent concentration of these serious crashes on a section of Iowa 25 north of Creston. Based on this information, a road safety audit of this roadway section was requested by the Office of Traffic and Safety.</p> <p>Iowa 25 is a two-lane asphaltic concrete pavement roadway, 22 ft in width with approximately 6 ft wide granular shoulders. Originally constructed in 1939, the roadway was last rehabilitated in 1996 with a 4-in. asphalt overlay. Except for shoulder paving through a curve area, no additional work beyond routine maintenance has been accomplished in the section. The 2004 traffic map indicates that IA 25 has a traffic volume of approximately 2070 vehicles per day with 160 commercial vehicles. The posted speed is 55 mph.</p> <p>This report contains a discussion of audit team findings, crash and roadway data, and recommendations for possible mitigation of safety concerns for this roadway section.</p>			
17. Key Words pavement markings—surface friction		18. Distribution Statement No restrictions.	
19. Security Classification (of this report) Unclassified.	20. Security Classification (of this page) Unclassified.	21. No. of Pages 46	22. Price NA

ROAD SAFETY AUDIT FOR UNION COUNTY IA 25 FROM THE WCL OF CRESTON TO NORTH H-24 INTERSECTION

**Final Report
July 2008**

Principal Investigator

Thomas H. Maze

Professor, Department of Civil, Construction, and Environmental Engineering
Center for Transportation Research and Education, Iowa State University

Co-Principal Investigator

Thomas J. McDonald

Safety Circuit Rider

Center for Transportation Research and Education, Iowa State University

Preparation of this report was financed
through funds provided by the Iowa Department of Transportation
through its research management agreement with the
Center for Transportation Research and Education.

A report from
Center for Transportation Research and Education

Iowa State University

2711 South Loop Drive, Suite 4700

Ames, IA 50010-8664

Phone: 515-294-8103

Fax: 515-294-0467

www.ctre.iastate.edu

TABLE OF CONTENTS

1. INTRODUCTION	1
2. INITIAL MEETING	2
3. DAYTIME FIELD REVIEW	4
4. NIGHTTIME REVIEW	5
5. WRAP-UP MEETING.....	6
6. DISCUSSION OF PERTINENT DATA.....	7
6.1 Traffic Speed Investigation.....	7
6.2 Friction Data	7
6.3 Crash Data.....	7
7. CONCLUSIONS AND RECOMMENDATIONS	10
APPENDIX A. OBSERVATIONS FROM IA 25 FIELD REVIEW	A-1
APPENDIX B. SPEED AND VOLUME DATA	B-1
APPENDIX C. CRASH DATA.....	C-1

LIST OF FIGURES

Figure A.1. Audit team	A-1
Figure A.2. IA 25 westbound just west of Creston City Limits	A-1
Figure A.3. Entering curve westbound	A-2
Figure A.4. Northbound view just north of curve.....	A-2
Figure A.5. Agricultural equipment.....	A-3
Figure A.6. Large culvert under IA 25	A-3
Figure A.7. Mailbox support and guard posts	A-4
Figure B.1. Mile post 35.5 northbound.....	B-1
Figure B.2. Mile post 41.2 northbound.....	B-2
Figure B.3. Mile post 41.3 southbound	B-3
Figure C.1. Crash severity locations	C-2
Figure C.2. Injury severity locations	C-3
Figure C.3. Crash data details (Color coded by severity).....	C-4
Figure C.4. Crash data details	C-5
Figure C.5. Crash data details	C-6
Figure C.6. Crash data details	C-7
Figure C.7. Crash data details	C-8
Figure C.8. Crash data details	C-9
Figure C.9. Crash data details	C-10
Figure C.10. Crash data details	C-11
Figure C.11. Crashes by driver age.....	C-18
Figure C.12. Crashes by light conditions.....	C-18
Figure C.13. Crashes by surface conditions	C-18

LIST OF TABLES

Table C.1. Summary of crash history, 2001–2007	C-1
Table C.2. Crash type by severity	C-12
Table C.3. Major cause by severity	C-13
Table C.4. Major cause by severity, continued.....	C-14
Table C.5. Occupant protection summary	C-14
Table C.6. Vehicle classification	C-15
Table C.7. Vehicle action	C-15
Table C.8. Driver condition	C-15
Table C.9. Driver contributing circumstances	C-16
Table C.10. Driver county of residence	C-17
Table C.11. Weather conditions	C-17

1. INTRODUCTION

In April 2008 a preliminary investigation of fatal and major injury crashes on Iowa's primary road system from 2003 through 2007 was conducted by the Iowa Department of Transportation (Iowa DOT), Office of Traffic and Safety. A mapping of these data revealed an apparent concentration of these serious crashes on a section of Iowa 25 north of Creston. Based on this information, a road safety audit of this roadway section was requested by the Office of Traffic and Safety.

Iowa 25 is a two-lane asphaltic concrete pavement roadway, 22 ft in width with approximately 6 ft wide granular shoulders. Originally constructed in 1939, the roadway was last rehabilitated in 1996 with a 4-in. asphalt overlay. Except for shoulder paving through a curve area, no additional work beyond routine maintenance has been accomplished in the section. The 2004 traffic map indicates that IA 25 has a traffic volume of approximately 2070 vehicles per day with 160 commercial vehicles. The posted speed is 55 mph.

The audit team consisted of the following:

- Jerry Roche, Federal Highway Administration
- Adam Larsen, Federal Highway Administration
- Jack Latterell, Consultant
- Randy Hunefeld, Governor's Traffic Safety Bureau
- Don Stevens, Assistant District 4 Engineer, Iowa DOT
- Jim Bane, District 4 Maintenance Manager, Iowa DOT
- Scott Nixon, Resident Construction Engineer, Iowa DOT
- Rex Allen, District 4 Traffic Technician, Iowa DOT
- Todd Frank, Maintenance Supervisor, Iowa DOT
- Sergeant Jim Eyberg, Iowa State Patrol
- Rick Piel, Union County Sheriff
- Tom McDonald, Center for Transportation Research and Education

2. INITIAL MEETING

On July 23, 2008, a preliminary meeting was conducted in the Iowa DOT resident engineer's office in Creston for a road safety audit on this section of roadway. Participating in the meeting were Sgt. James Eyberg, Iowa State Patrol; Randy Hunefeld, Governor's Traffic Safety Bureau (GTSB); Rick Piel, Union County Sheriff; Jack Latterell, safety consultant; Jerry Roche and Adam Larsen, Federal Highway Administration (FHWA); Don Stevens, assistant district engineer, Scott Nixon, resident construction engineer, Jim Bane, maintenance manager, Todd Frank, maintenance supervisor, and Rex Allen, district traffic technician, all from the Iowa DOT; and Tom McDonald from the Center for Transportation Research and Education.

Following introductions, Tom McDonald and Jack Latterell explained the general background and purpose of road safety audits. Communication between the DOT offices and law enforcement was recommended to address safety needs in this road section.

Summaries of the most recent seven years of crash data were distributed to the group. Adam Larsen and Tom McDonald explained the information shown in these handouts, which included a total of 31 crashes including three fatal crashes and five major injuries. These data would be referenced later during the field reviews. Other data that will be obtained and studied for this area are driver residence, unbelted crash rate, speed-related crashes, and weather conditions for crashes. In addition a route crash map will be included with the final report depicting the crash locations and major causes by severity.

Rex Allen had obtained traffic speed and volume data during the previous week and a summary of this data was also distributed and explained. A speed check in the northbound lane at mile post 35.5 in a long horizontal curve area west of Creston indicated fairly good compliance with the 55 mph posted speed, but over half of all drivers were exceeding the 45 mph advisory speed. However, in a tangent section at mile post 41.2, the 85% speed in both directions of travel was approximately 10 mph above the posted speed limit of 55 mph. A complete discussion of this speed sampling is included later in this report.

Both Sgt. Eyberg and Sheriff Piel indicated that IA 25 had not been a high priority area for enforcement. Pavement edge drop-off was not noted as a major problem in this section, probably because the Iowa DOT maintenance staff stated that shoulder maintenance was a priority in this area due to the narrow, 22 ft wide pavement and granular shoulders. Iowa DOT maintenance also reported that pavement edge markings are generally replaced on a two-year cycle when the need is indicated by retro-reflectometer measurements. The officers advised that they routinely report roadway defects such as pavement blow-ups or severe edge rutting to the Iowa DOT for needed action.

Sgt. Eyberg suggested consideration of a four-way stop at the southerly H-24 intersection and/or travel lane rumble strips as speed reduction measures.

Randy Hunefeld advised that special funding might be available to purchase needed enforcement equipment for use on this corridor, such as speed trailers and/or LIDAR speed detectors.

Sheriff Piel and/or the GTSB staff could provide news releases for local media to raise

awareness of safety concerns on this section of IA 25 and to alert the public that focused enforcement may be applied in the area. Schools should also be contacted, and the Creston Police Department could be involved in enforcement efforts. Contact with major employers in the Creston area might also be beneficial in raising awareness of safety concerns. Randy Hunefeld could assist in contacting the Iowa-Illinois Safety Council for providing this information.

Sgt. Eyberg suggested that special signing be erected advising the public that this road corridor is a safety focus section, and double fines would be a good deterrent for speeding. Both officers indicated that enforcement efforts could be enhanced in this area.

3. DAYTIME FIELD REVIEW

Following lunch, a field review of the IA 25 corridor was conducted by the road safety audit team. Images from the field review are included in Appendix A. The following conditions were noted and suggestions offered.

IA 25 in the study area is a 22 ft wide asphalt pavement with approximately 6 ft wide granular shoulders. Some steep foreslopes were noted, but much of IA 25 has approximately 4:1 slopes. Several feet of shoulder erosion was noted just west of Creston adjacent to the eastbound lane. A conventional cable guardrail is in place on either side of a shoulder-width bridge that spans an arm of Summit Lake, and w-beam guardrails are attached to the bridge. Both systems appeared to have current end treatments and were in good condition.

Sgt. Eyberg suggested that the existing 45 mph speed limit and the four-lane pavement section be extended down a hill and possibly even through the Summit Lake crossing.

Pavement edge lines appeared quite worn west of Creston. Non-breakaway steel mailbox supports were noted in two locations with one mailbox protected with concrete-filled bollards.

Standard curve warning signs with 45 mph advisory speed plaques are in place in advance of a curve west of Creston, and standard chevrons are in place through the super-elevated curve. Approximately 4 ft wide paved shoulders were placed through the curve as part of a 1996 pavement surface improvement project. However, no rumble strips were milled into the shoulders. Members of the audit team felt the addition of rumble strips would be beneficial.

A “Y” configuration intersection exists in this curve with granular surfaced approaches at each end of the curve. Foreslopes in the curve area appeared steeper than many other locations. Reconstruction to a “T” configuration might be beneficial for the intersecting side road traffic.

Northerly from the curve area, the granular shoulders appeared slightly narrower than along the previous section west of Creston, and several sections of steeper foreslopes were noted. In addition, two large, approximately 8 ft by 8 ft, reinforced box culverts were noted, both marked with triple amber delineators. Both culverts have ends immediately at the shoulder edge, and several feet of very steep foreslopes exist on either side of the culverts.

Some small trees were noted on of the foreslopes in several locations.

Sgt. Eyberg suggested that intersection warning signs be installed in advance of the southerly H-24 intersection and that possibly a flashing warning beacon should be considered.

The southerly H-24 intersection is paved to the west. The opposite approach is granular surfaced with an approximate 10 ft wide paved approach apron. The northerly H-24 intersection (140th Street) is paved to the east toward Green Valley Park; the opposite approach is granular surfaced with an approximate 10 ft wide paved approach apron.

4. NIGHTTIME REVIEW

Following dinner, several members of the team conducted a nighttime review of the IA 25 corridor. Participating in the review were Sgt. Eyberg, Sheriff Piel, Rex Allen, Jerry Roche, Adam Larsen, Randy Hunefeld, Jack Latterell, and Tom McDonald.

The team noted that the pavement markings, which had appeared quite worn during daylight hours, appeared more visible at night, indicating that much of the retro-reflective qualities remained. Warning signs and chevrons, while quite visible, especially under high-beam headlights, could be beneficially enhanced with larger sizes and fluorescent sheeting. Guide signing appeared satisfactory for visibility. The paved side road approaches of H-24 appeared satisfactory, but the visibility of the stop sign at the southerly approach might be improved by shifting the location closer to the travel lane or by increasing the size. Pavement rumble strips had been installed by Union County in advance of this stop sign location.

5. WRAP-UP MEETING

On July 24, a wrap-up meeting for the road safety audit on IA 25 was conducted in the resident construction engineer's office in Creston. Participating in the meeting were Sgt. Eyberg, Don Stevens, Rex Allen, Jack Latterell, Adam Larsen, Randy Hunefeld, Jerry Roche, Sheriff Piel, Scott Nixon, and Tom McDonald.

Jack Latterell and Tom McDonald opened the meeting by reviewing notes that Tom Welch had prepared following a previous field review in early July. In addition to observations of roadway conditions, several recommendations for safety improvements were included in those notes. Also, notes taken by the road safety audit team during both the daytime and nighttime field reviews were discussed.

Other items discussed by the team included the following:

It was noted that approximately 30% of the crashes along this section were weather related. Consideration should be given to modifying the Iowa DOT winter maintenance responsibilities for IA 25, at least for the section from Creston to Orient, transferring from the Greenfield garage to the Creston garage. This reassignment of responsibilities may reduce response times somewhat for snow and ice removal from this section of IA 25. The District Office will have more experience and insight regarding this suggestion.

It was suggested that current friction numbers for the pavement surface be investigated. This will be done and the information included in the final audit report.

Continued communication between law enforcement agencies and the Iowa DOT offices was again recommended. Prompt response to concerns from each agency was encouraged.

Sgt. Eyberg suggested that farm equipment warning signs and "Share the Road" plaques be considered for the IA 25 section, especially in light of the crashes involving farm machinery in the crash history. Crash history, existing conditions, and the *Manual on Uniform Traffic Control Devices* (MUTCD) guidance should be studied in more detail before erecting this signage. Sgt. Eyberg also suggested that "School Bus Stop Ahead" signs be considered where appropriate.

It was suggested that pavement markings for aerial speed enforcement be installed along the road section. The Iowa State Patrol should be consulted for possible periodic aerial surveillance to aid with enforcement efforts.

Jack Latterell mentioned the existence of utility down guys along the roadway. These should be checked to ascertain that they are outside the clear zone and, if not, the utility company should be contacted to discuss relocation.

Investigation into acquiring TracS equipment for the Union County Sheriff will be undertaken.

The wrap-up meeting adjourned at 9:30 a.m., and all participants were thanked for their valuable input.

6. DISCUSSION OF PERTINENT DATA

6.1 Traffic Speed Investigation

On July 16–17, 2008, Iowa DOT District Traffic Technicians Rex Allen and Frank Redeker conducted a 24-hour traffic speed, volume, and classification sampling at three locations on IA 25 using Nu-Metric Traffic Analyzers. The following were the recorded results:

- Mile post 35.5 northbound lane (curve area)
1074 total vehicles, 88% passenger cars, 6% tractor-trailer units
Average speed: 49 mph, 85 percentile speed: 57.3 mph,
Approximately 6.5 % exceeding 55 mph
(Over 57% were exceeding the posted advisory speed of 45 mph)
- Mile post 41.2 northbound lane
856 total vehicles, 89% passenger cars, 6% tractor-trailer units
Average speed 59 mph, 85 percentile speed 64.8 mph,
Approximately 32.3% were exceeding 55 mph
- Mile post 41.2 southbound lane
774 passenger cars, 6% tractor-trailer units
Average speed 60 mph, 85% speed 66 mph,
Approximately 42.8 % exceeding 55 mph

Complete reports of these data are included in Appendix B.

Although this sample only represents one 24-hour period of data, it would appear that excessive speed may be a factor influencing traffic safety on this section, and increased enforcement could be beneficial.

6.2 Friction Data

Surface friction data was gathered by the Materials Department of the Iowa DOT in 2007 for this section of IA 25. The results were reported as follows:

Northbound lanes composite of readings, average friction 53.8, low reading 44.6
Southbound lanes composite of readings, average friction 51.4, low reading 45.5

These results would not indicate any major friction concerns for this roadway section.

6.3 Crash Data

A complete crash history investigation was conducted to provide data for the road safety audit by Khyle Clute of the Iowa DOT and Adam Larsen of the FHWA. A time period from 2001 through 2007 was examined. Summaries of these crash data are included in Appendix C of this report.

It should be noted that the data are presented in this report in differing manners. One summary method can be termed “crash level,” and these data represent crash events as singular occurrences. The other method of presentation could be termed “driver/vehicle level” and/or “injury level.” Under this latter method, the information describes the numbers of actual vehicles and drivers/occupants involved in these crashes. The numbers shown for the “driver/vehicle” and/or “injury” levels will always be at least equal to and generally higher than the “crash level” data.

A total of 31 crashes were recorded during this period, resulting in 3 fatalities, 9 major injuries, 12 minor injuries, 14 possible injuries, and 10 crashes resulting in property damage only.

The serious crashes (fatal and major injury) occurred in a curve area or within one mile of that location. Other crash locations are scattered throughout the section. All three fatal crashes and two of the major injury crashes were head-on incidents. Other major injury crashes were attributable to broadside or non-collision causes. Non-collision, which generally involves run-off-road or animal crashes, were noted for 12 of the 31 total crashes in the corridor. Swerving/evasive action was noted as a major crash cause in eight crashes, and animal collisions occurred three times. Driving too fast for conditions was only noted for a single property damage crash.

Occupant protection crash review found that 21 of 39 injured persons were wearing both shoulder and lap belt restraints; four uninjured occupants were using these safety devices. Only one uninjured and seven injured persons were not using any occupant protection.

Most of the 49 vehicles involved in these crashes were passenger cars (20), and a smaller number of vehicles were light trucks (10). A total of six sport utility vehicles were involved in crashes.

Movement of vehicles preceding crashes was predominantly straight, though four involved left-turning movements.

Of the 49 drivers involved in crashes, 37 were judged to be apparently normal, and only four were found to be under the influence of alcohol or drugs.

Driver residence was recorded as mostly Union County (27) or adjacent Adair County (11); therefore, the crash-involved drivers were presumably familiar with this roadway.

No significantly consistent driver-contributing circumstances were noted. Of the 47 drivers, 4 were noted as having lost control, but 16 were recorded as taking no improper action, and contributing circumstances were not reported for 6 drivers.

Drivers in the 20–29 age group were most represented in the crashes (13 of 47); teenage drivers followed as the second most represented group, with 10 crashes.

Approximately 48% of the crashes occurred in daylight conditions, and 39% in the dark.

Roadway surface conditions were dry for 56% of the total crashes; wet surface, snow, and ice were noted for 28% of the crashes. Adverse weather conditions were noted in approximately

15% of the crashes, but clear or cloudy conditions were noted in approximately 30% of the reports.

7. CONCLUSIONS AND RECOMMENDATIONS

Although the crash data did not indicate any prominent contributing factors for the reported crashes, most of the serious incidents were located in an approximately one-mile long segment, and this area should be examined in depth for possible low-cost improvements to improve safety conditions. In addition, the speed sampling indicated considerable posted speed violations during the sampling period, and focused enforcement could be beneficial to improve driver compliance.

The audit team offers the following recommendations for consideration by the District 4 staff of the Iowa DOT.

Recommended engineering improvements include the following:

- Install rumble strips or rumble stripes along the widened pavement section through the curve west of Creston. If adequate lane width can be maintained, consider installing centerline rumble strips through the curve to discourage centerline crossovers. Narrower (6 in. wide) rumbles could be used to minimize travel lane reduction. Rumble strips may help reduce speeds through this curve by restricting available travel to a 12 ft wide path. Consider extending the partially paved shoulders beyond this area to provide a wider travel surface. To accomplish these improvements, District 4 staff should plan to submit a FY 2011 Traffic Safety Fund application next June if other funding cannot be identified.
- Review the number and spacing of existing chevron signs in the curve area for compliance with Iowa DOT and MUTCD guidelines. Consider updating these devices and the current curve warning signs with fluorescent yellow sheeting and larger sizes.
- Consider a future resurfacing, restoration, and rehabilitation (3R) project to widen the 22 ft pavement when surface conditions indicate a need for restoration. Include extension or shielding of large reinforced box culverts as part of the project.
- Discuss replacement of heavy steel mailbox supports with the property owners.
- Several crashes, including one fatal, involved slow moving farm equipment. If that type of vehicle is a frequent road user, consider installation of Vehicular Traffic signs, W11-5 or W11-5a, possibly accompanied by Share the Road, W16-1, plaques.
- Study the need for intersection warning signs in advance of the south H-24 intersection.
- Remove vegetation within the clear zone before size becomes a crash hazard (4 in. diameter).
- Examine existing down guys for utility poles and, if within clear zone limits, discuss relocation with utility company.
- Consider shifting winter maintenance responsibilities for this section of IA 25 from Greenfield to Creston to improve response time during storm events.

Recommended enforcement enhancements include the following:

- The Iowa State Patrol and Union County Sheriff's office should consider increasing enforcement surveillance on this section of IA 25, especially concentrating on speed

- The Iowa DOT field offices and law enforcement agencies should establish and maintain a strong communication network as a safety enhancement. Sharing information about observed roadway defects, sign conditions, and other safety-related issues would be beneficial.
- The GTSB and Iowa DOT should assist the law enforcement agencies with funding assistance to acquire such equipment as speed trailers, LIDAR speed detectors, etc., if these can be shown to enhance safety and improve driver performance on IA 25 and nearby US 34.

Recommended public information and education efforts include the following:

- The Iowa DOT and Union County Sheriff should contact the local news media to raise public awareness of safety concerns on this section of IA 25 and share crash data. Notice of increased traffic surveillance should be provided.
- Contact should also be made with local schools to provide this same information for younger drivers and teachers.
- Large employers in the area should be made aware of the IA 25 crash history and of planned efforts to address those concerns, with the anticipation that this information would be provided to employees.
- Randy Hunefeld at the GTSB and Iowa DOT Media and Marketing Services could assist in these efforts.

With a focused multi-disciplinary approach using a variety of initiatives and options, as listed above, public awareness should be enhanced, driver performance improved, and crashes reduced on this section of IA 25.

APPENDIX A. OBSERVATIONS FROM IA 25 FIELD REVIEW



Figure A.1. Audit team



Figure A.2. IA 25 westbound just west of Creston City Limits



Figure A.3. Entering curve westbound



Figure A.4. Northbound view just north of curve



Figure A.5. Agricultural equipment



Figure A.6. Large culvert under IA 25



Figure A.7. Mailbox support and guard posts

APPENDIX B. SPEED AND VOLUME DATA

**Nu-Metrics Traffic Analyzer Study
Computer Generated Summary Report
City:
Street: Hwy 25**

A study of vehicle traffic was conducted with HI-STAR unit number 2247. The study was done in the NB MP 35.5 lane at Hwy 25 in , Ia in Union county. The study began on Jul/16/2008 at 12:00:00 PM and concluded on Jul/17/2008 at 12:00:00 PM, lasting a total of 24.00 hours. Traffic statistics were recorded in 60 minute time periods. The total recorded volume showed 1074 vehicles passed through the location with a peak volume of 114 on Jul/16/2008 at [16:00-17:00] and a minimum volume of 3 on Jul/17/2008 at [03:00-04:00]. The AADT count for this study was 1,074.

SPEED

Chart 1 lists the values of the speed bins and the total traffic volume for each bin. At least half the vehicles were traveling in the 46 - 51 MPH range or lower. The average speed for all classified vehicles was 49 MPH with 6.51% vehicles exceeding the posted speed of 55 MPH. The HI-STAR found 6.51 percent of the total vehicles were traveling in excess of 55 MPH. The mode speed for this traffic study was 46MPH and the 85th percentile was 57.33 MPH.

< to 10	11 to 15	16 to 20	21 to 25	26 to 30	31 to 35	36 to 40	41 to 45	46 to 50	51 to 55	56 to 60	61 to 65	66 to 70	71 to 75	76 to >					
0	11	7	18	18	28	61	166	268	216	113	36	15	10	2					

CHART 1

CLASSIFICATION

Chart 2 lists the values of the classification bins and the total traffic volume accumulated for each bin. Most of the vehicles classified during the study were Passenger Vehicles. The number of Passenger Vehicles in the study was 852 which represents 88 percent of the total classified vehicles. The number of Vans & Pickups in the study was 29 which represents 3 percent of the total classified vehicles. The number of Busses & Trucks in the study was 25 which represents 3 percent of the total classified vehicles. The number of Tractor Trailers in the study was 61 which represents 6 percent of the total classified vehicles.

< to 16	17 to 23	24 to 29	30 to 39	40 to 49	50 to 59	60 to 69	70 to >												
731	121	29	25	26	24	5	6												

CHART 2

HEADWAY

During the peak traffic period, on Jul/16/2008 at [16:00-17:00] the average headway between vehicles was 31.304 seconds. During the slowest traffic period, on Jul/17/2008 at [03:00-04:00] the average headway between vehicles was 900 seconds.

WEATHER

The roadway surface temperature over the period of the study varied between 72.00 and 111.00 degrees F. The HI-STAR determined that the roadway surface was Dry 100.00% of the time.

Figure B.1. Mile post 35.5 northbound

Nu-Metrics Traffic Analyzer Study
Computer Generated Summary Report
City:
Street: Hwy 25

A study of vehicle traffic was conducted with HI-STAR unit number 7576. The study was done in the NB MP 41.2 lane at Hwy 25 in , Ia in Union county. The study began on Jul/16/2008 at 12:00:00 PM and concluded on Jul/17/2008 at 12:00:00 PM, lasting a total of 24.00 hours. Traffic statistics were recorded in 60 minute time periods. The total recorded volume showed 856 vehicles passed through the location with a peak volume of 93 on Jul/16/2008 at [15:00-16:00] and a minimum volume of 3 on Jul/17/2008 at [03:00-04:00]. The AADT count for this study was 856.

SPEED

Chart 1 lists the values of the speed bins and the total traffic volume for each bin. At least half the vehicles were traveling in the 56 - 61 MPH range or lower. The average speed for all classified vehicles was 59 MPH with 32.34% vehicles exceeding the posted speed of 55 MPH. The HI-STAR found 32.34 percent of the total vehicles were traveling in excess of 55 MPH. The mode speed for this traffic study was 56MPH and the 85th percentile was 64.79 MPH.

< to 10	11 to 15	16 to 20	21 to 25	26 to 30	31 to 35	36 to 40	41 to 45	46 to 50	51 to 55	56 to 60	61 to 65	66 to 70	71 to 75	76 to >					
0	2	0	1	1	1	4	11	42	156	347	190	57	21	2					

CHART 1

CLASSIFICATION

Chart 2 lists the values of the classification bins and the total traffic volume accumulated for each bin. Most of the vehicles classified during the study were Passenger Vehicles. The number of Passenger Vehicles in the study was 747 which represents 89 percent of the total classified vehicles. The number of Vans & Pickups in the study was 23 which represents 3 percent of the total classified vehicles. The number of Busses & Trucks in the study was 19 which represents 2 percent of the total classified vehicles. The number of Tractor Trailers in the study was 46 which represents 6 percent of the total classified vehicles.

< to 16	17 to 23	24 to 29	30 to 39	40 to 49	50 to 59	60 to 69	70 to >												
671	76	23	19	19	19	7	1												

CHART 2

HEADWAY

During the peak traffic period, on Jul/16/2008 at [15:00-16:00] the average headway between vehicles was 38.298 seconds. During the slowest traffic period, on Jul/17/2008 at [03:00-04:00] the average headway between vehicles was 900 seconds.

WEATHER

The roadway surface temperature over the period of the study varied between 72.00 and 111.00 degrees F. The HI-STAR determined that the roadway surface was Dry 100.00% of the time.

Figure B.2. Mile post 41.2 northbound

**Nu-Metrics Traffic Analyzer Study
Computer Generated Summary Report**

City:
Street: Hwy 25

A study of vehicle traffic was conducted with HI-STAR unit number 2248. The study was done in the SB MP 41.2 lane at Hwy 25 in , la in Union county. The study began on Jul/16/2008 at 12:00:00 PM and concluded on Jul/17/2008 at 12:00:00 PM, lasting a total of 24.00 hours. Traffic statistics were recorded in 60 minute time periods. The total recorded volume showed 889 vehicles passed through the location with a peak volume of 78 on Jul/17/2008 at [07:00-08:00] and a minimum volume of 2 on Jul/17/2008 at [03:00-04:00]. The AADT count for this study was 889.

SPEED

Chart 1 lists the values of the speed bins and the total traffic volume for each bin. At least half the vehicles were traveling in the 56 - 61 MPH range or lower. The average speed for all classified vehicles was 60 MPH with 42.82% vehicles exceeding the posted speed of 55 MPH. The HI-STAR found 42.82 percent of the total vehicles were traveling in excess of 55 MPH. The mode speed for this traffic study was 56MPH and the 85th percentile was 65.58 MPH.

< to 10	11 to 15	16 to 20	21 to 25	26 to 30	31 to 35	36 to 40	41 to 45	46 to 50	51 to 55	56 to 60	61 to 65	66 to 70	71 to 75	76 to >					
0	0	0	2	1	1	1	6	20	129	338	264	89	14	6					

CHART 1

CLASSIFICATION

Chart 2 lists the values of the classification bins and the total traffic volume accumulated for each bin. Most of the vehicles classified during the study were Passenger Vehicles. The number of Passenger Vehicles in the study was 774 which represents 89 percent of the total classified vehicles. The number of Vans & Pickups in the study was 24 which represents 3 percent of the total classified vehicles. The number of Busses & Trucks in the study was 20 which represents 2 percent of the total classified vehicles. The number of Tractor Trailers in the study was 53 which represents 6 percent of the total classified vehicles.

< to 16	17 to 23	24 to 29	30 to 39	40 to 49	50 to 59	60 to 69	70 to >												
585	189	24	20	13	25	13	2												

CHART 2

HEADWAY

During the peak traffic period, on Jul/17/2008 at [07:00-08:00] the average headway between vehicles was 45.57 seconds. During the slowest traffic period, on Jul/17/2008 at [03:00-04:00] the average headway between vehicles was 1200 seconds.

WEATHER

The roadway surface temperature over the period of the study varied between 72.00 and 107.00 degrees F. The HI-STAR determined that the roadway surface was Dry 100.00% of the time.

Figure B.3. Mile post 41.3 southbound

APPENDIX C. CRASH DATA

Table C.1. Summary of crash history, 2001–2007, for IA 25 from WCL of Creston to 130th St. in Union County, Iowa

		Fatal	Major injury	Minor injury	Possible/unknown	PDO	Total
2001	Crashes	1	0	2	0	1	4
	Injuries	1	0	3	1/0		5
2002	Crashes	0	0	0	1	3	4
	Injuries	0	0	0	1/0		1
2003	Crashes	0	2	1	2	1	6
	Injuries	0	2	1	3/0		6
2004	Crashes	1	0	0	0	0	1
	Injuries	1	0	5	0/0		6
2005	Crashes	0	2	0	2	0	4
	Injuries	0	4	0	5/0		9
2006	Crashes	1	1	2	1	0	5
	Injuries	1	3	3	3/0		10
2007	Crashes	0	0	0	2	5	7
	Injuries	0	0	0	1/0		1
Seven-year summary, 2001–2007							
	Crashes	3	5	5	8	10	31
	Injuries	3	9	12	14		38

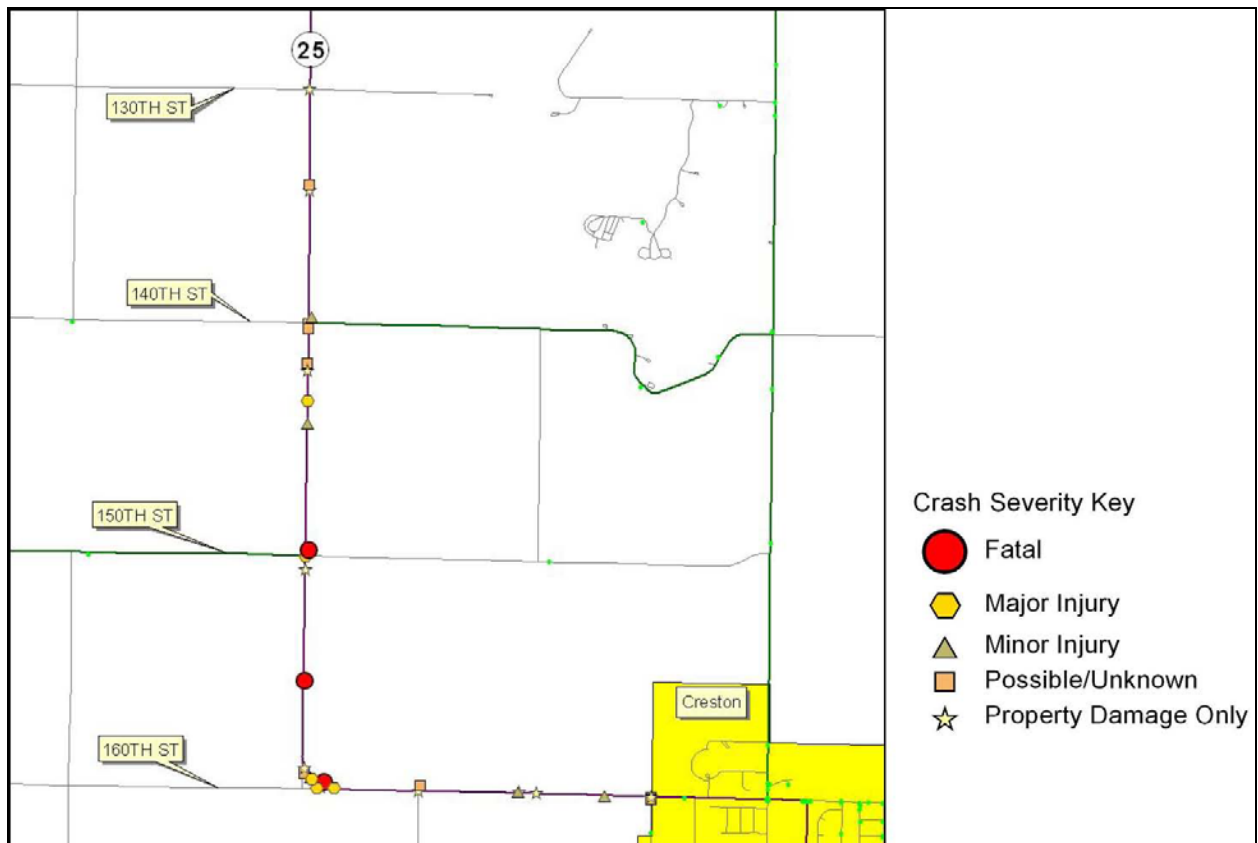


Figure C.1. Crash severity locations

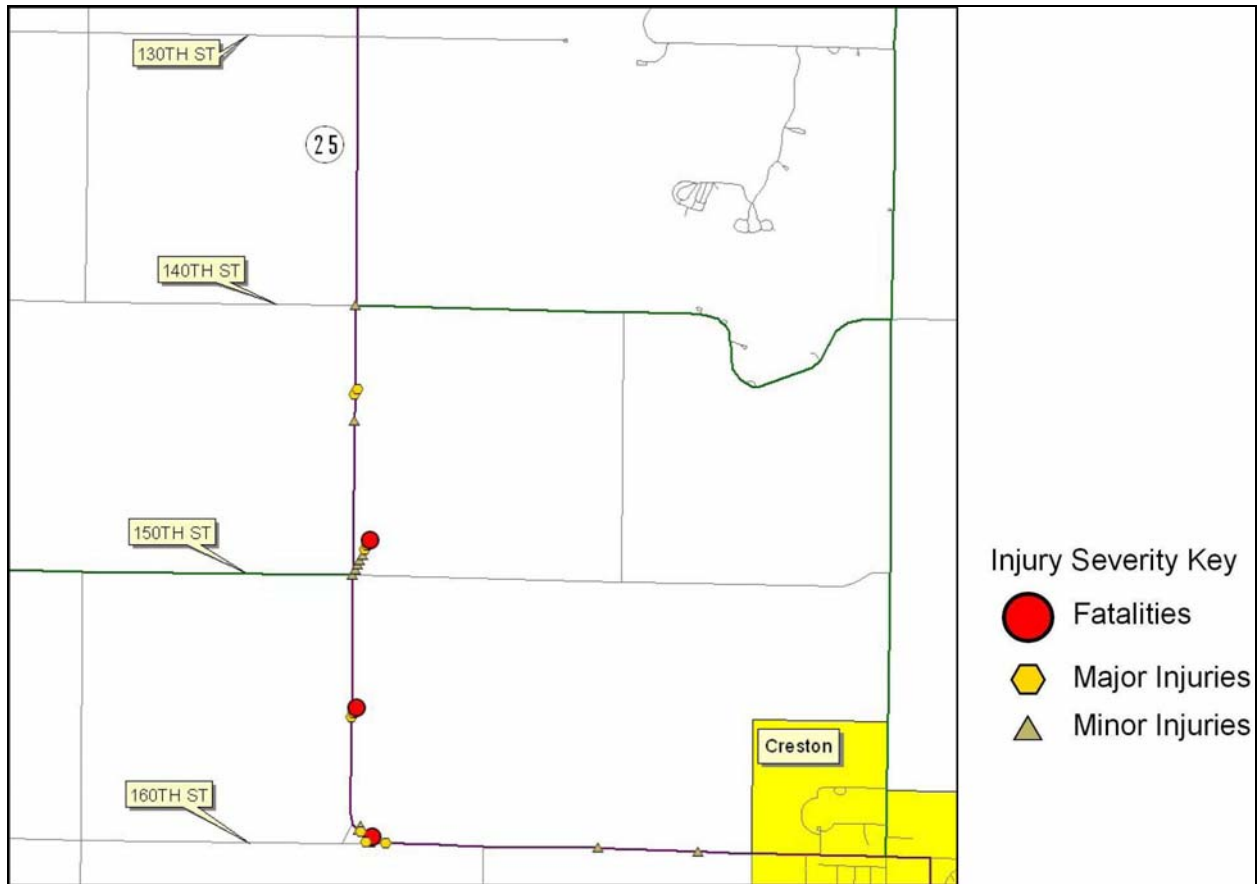


Figure C.2. Injury severity locations

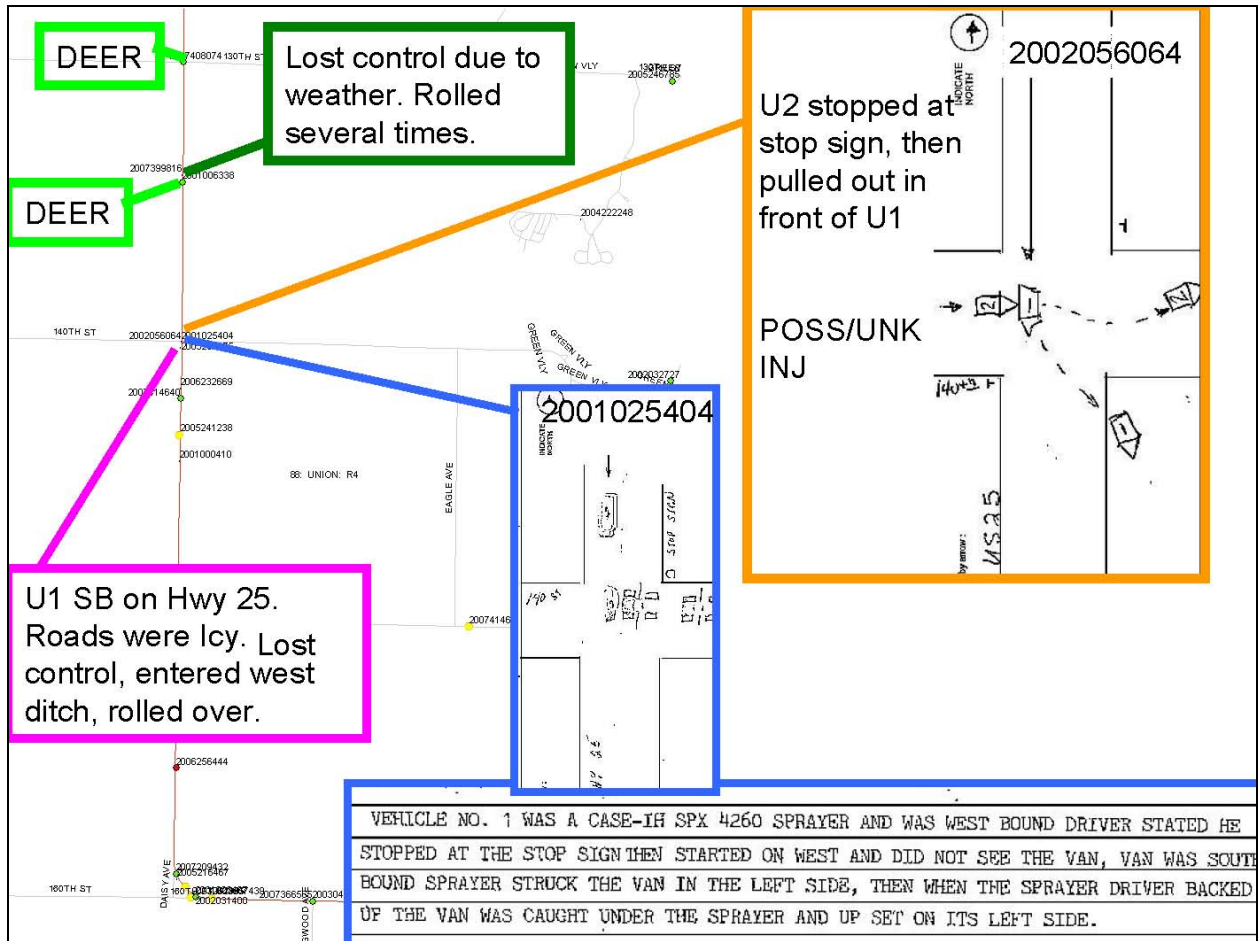


Figure C.3. Crash data details (Color coded by severity)

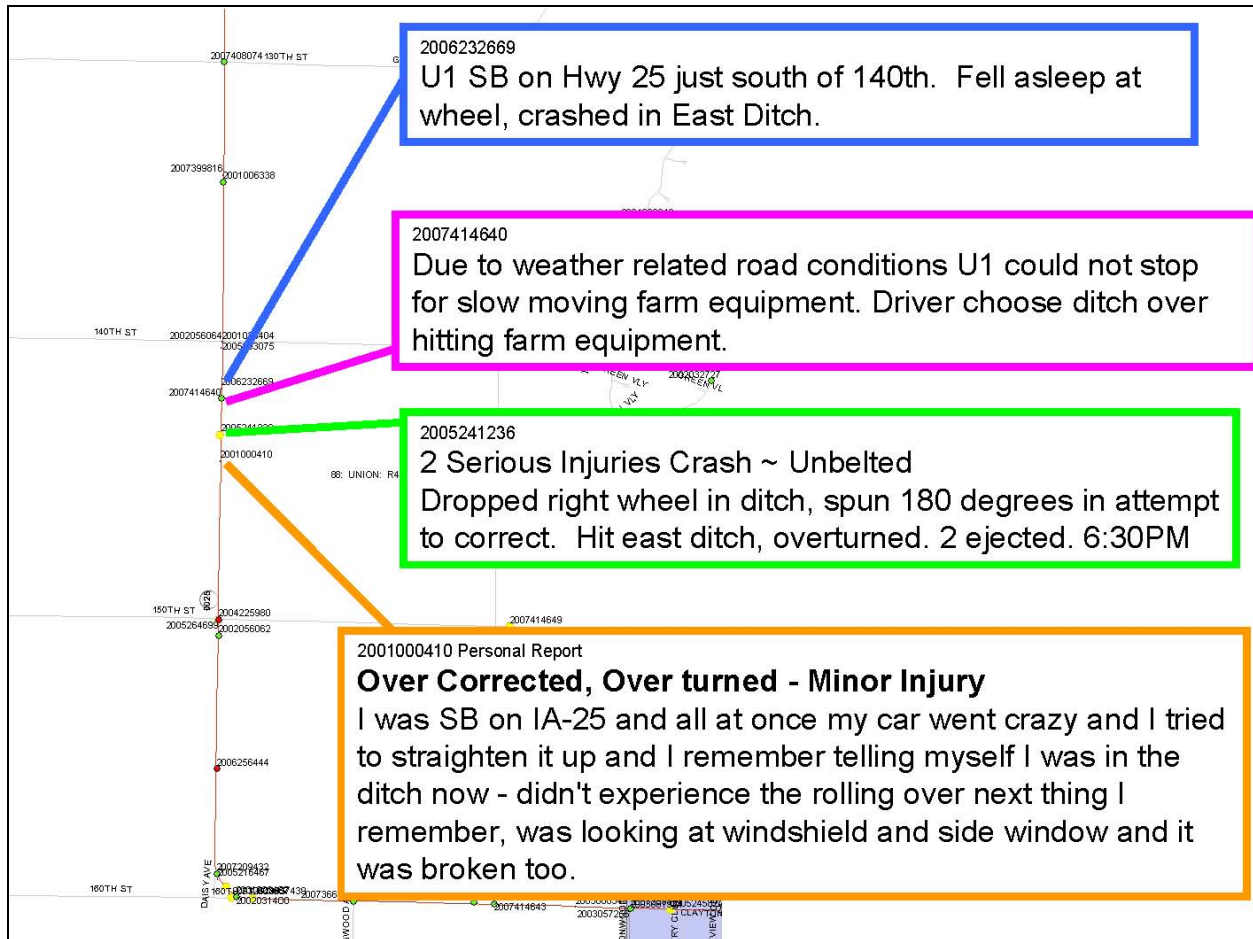


Figure C.4. Crash data details

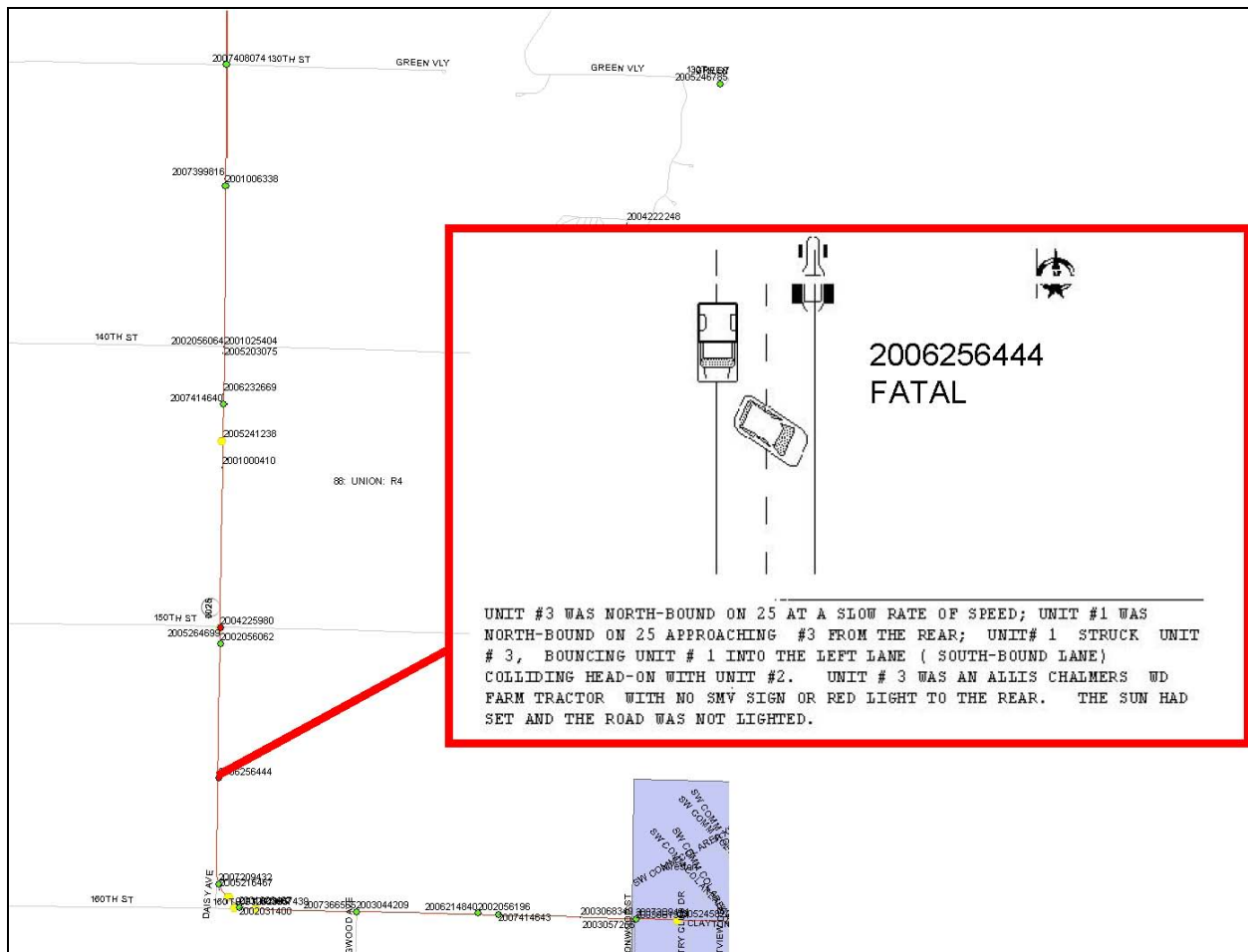


Figure C.6. Crash data details

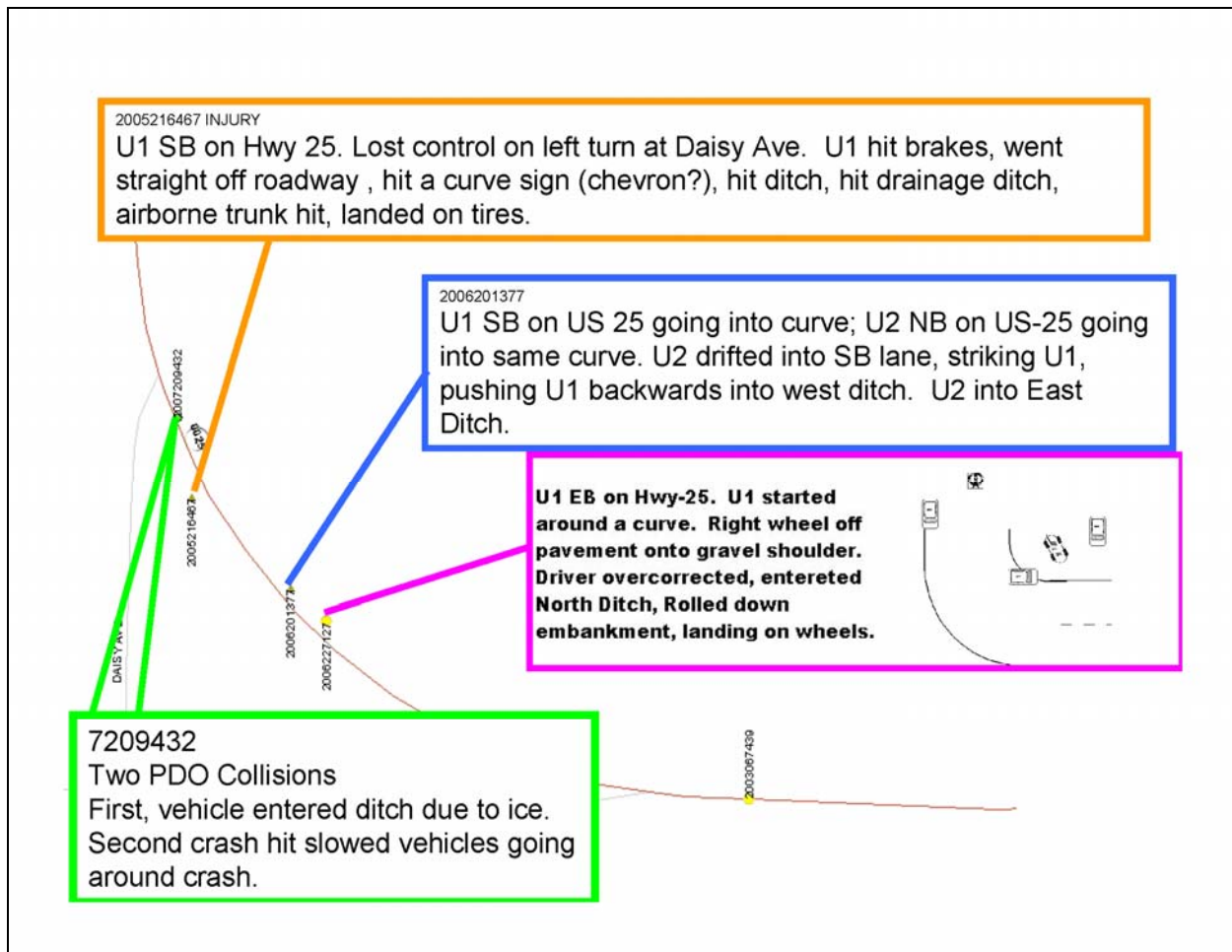


Figure C.7. Crash data details

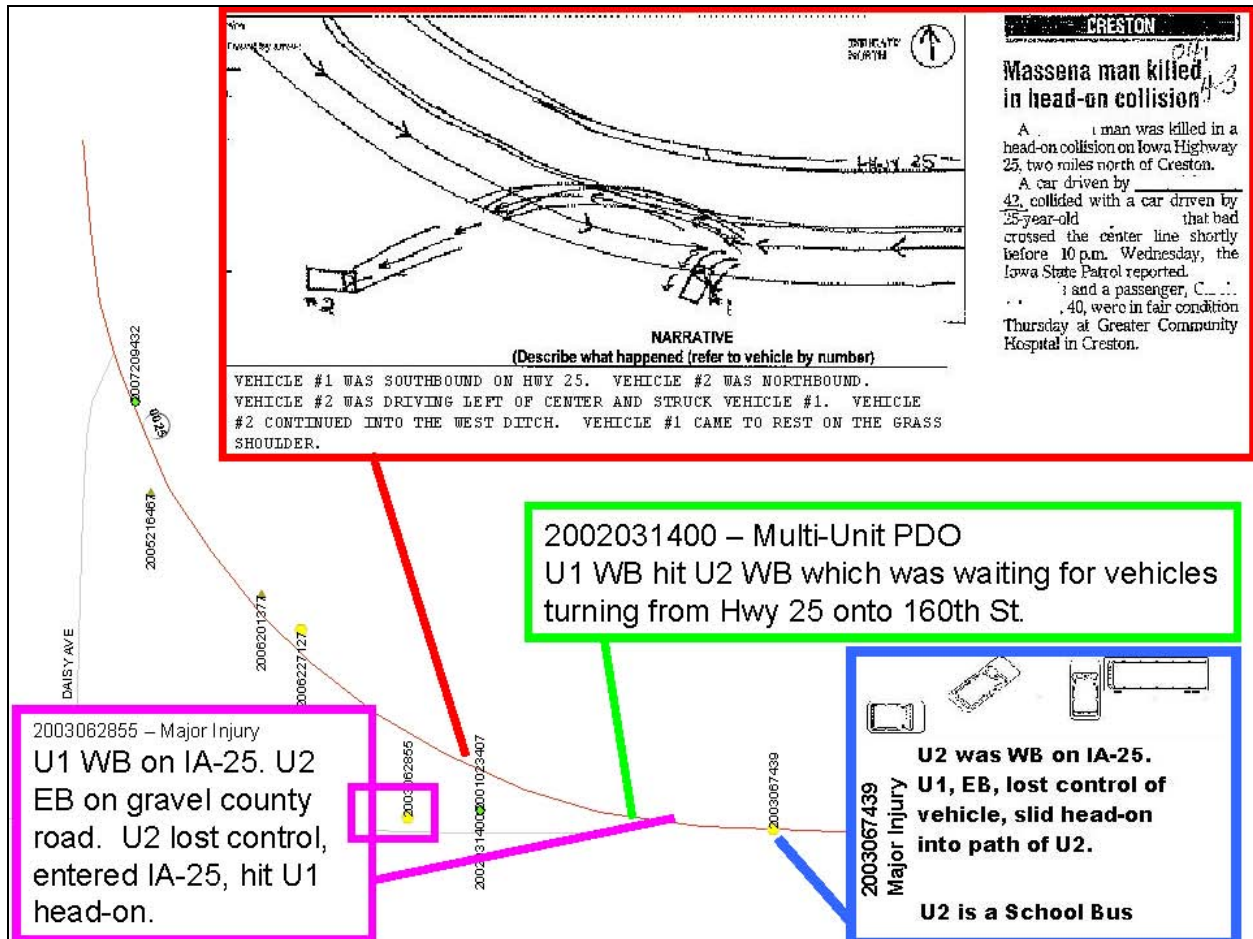


Figure C.8. Crash data details

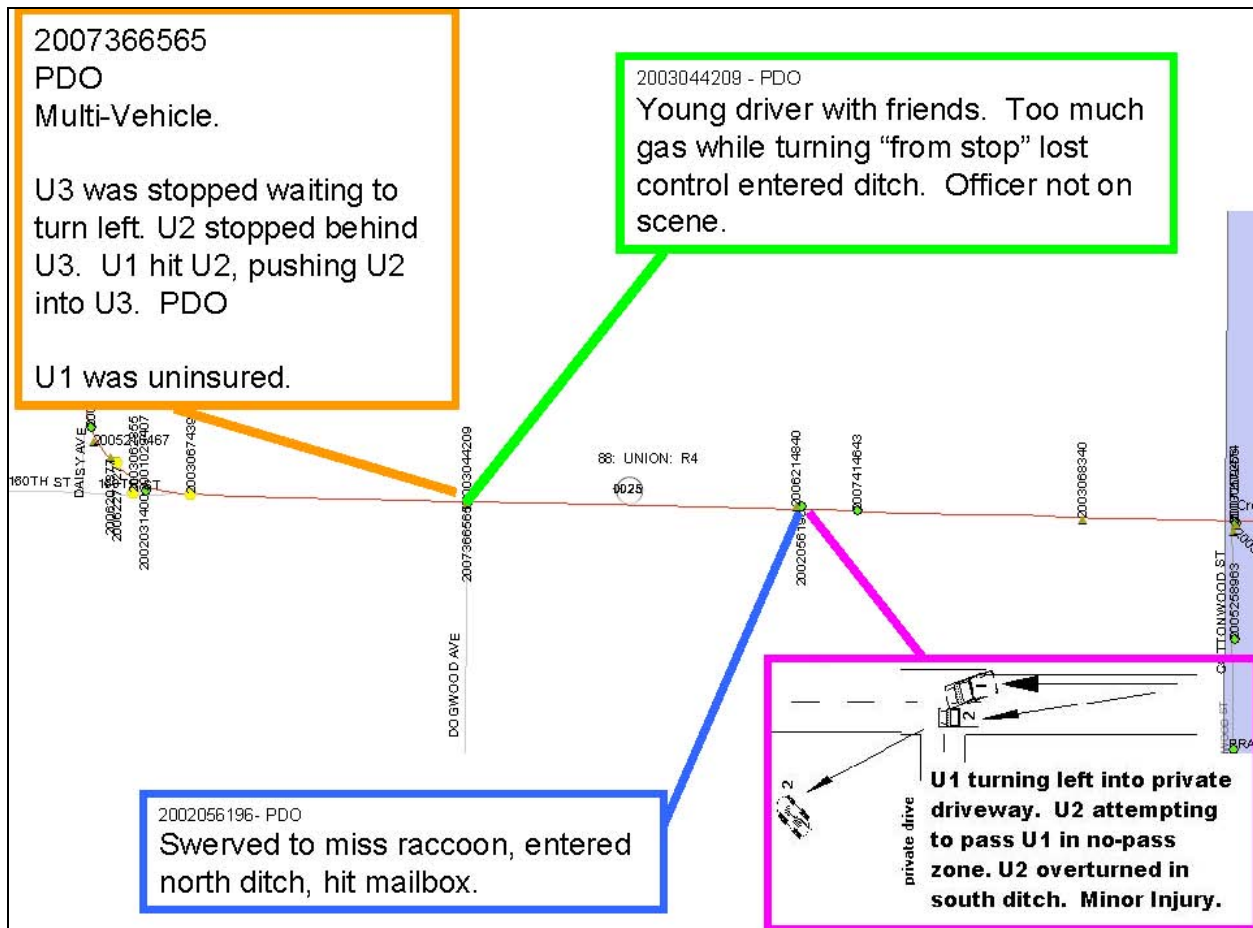


Figure C.9. Crash data details

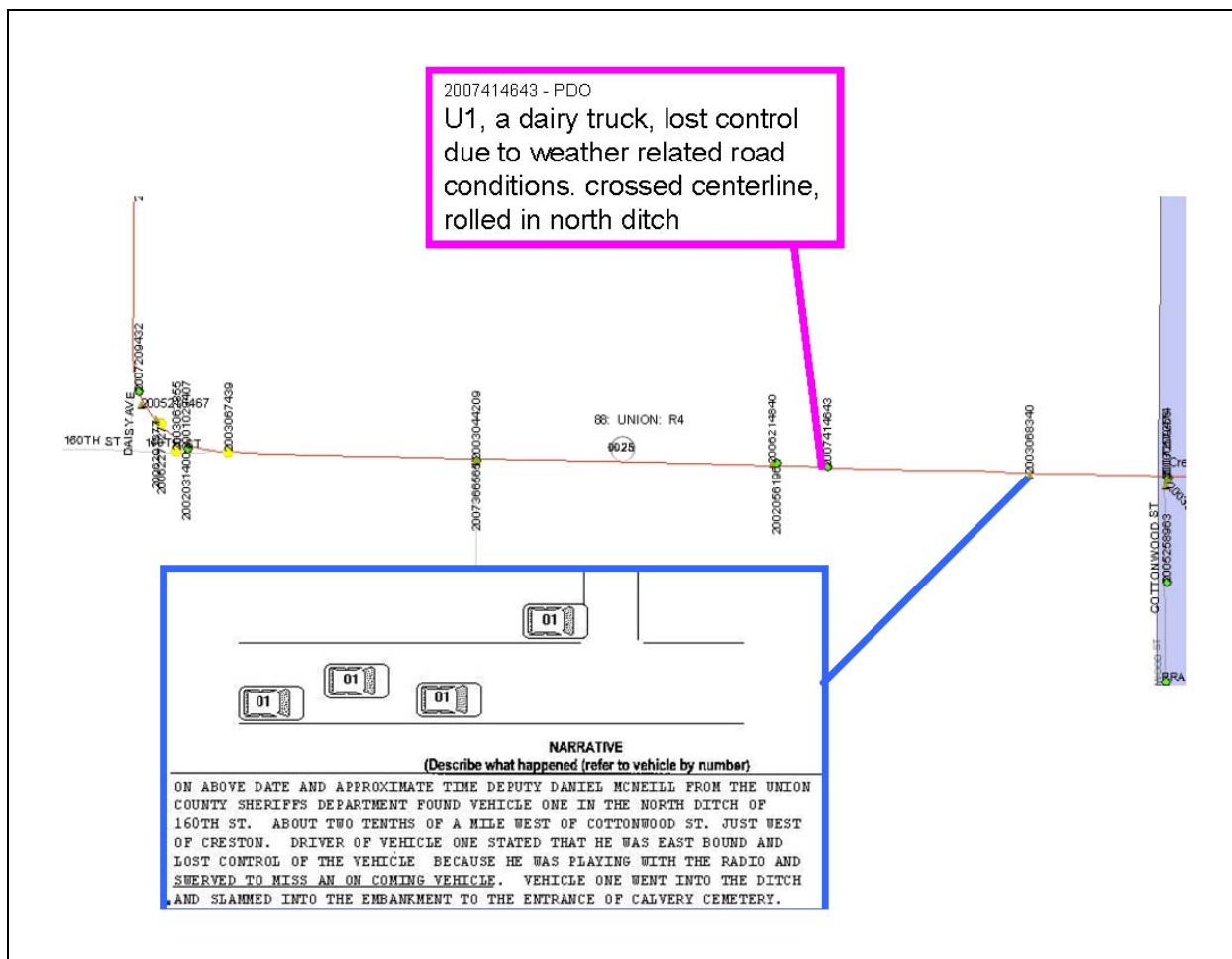


Figure C.10. Crash data details

Table C.2. Crash type by severity

Crash severity	Manner of crash	Total
Fatal	Head-on	3
Fatal total		3
Major injury	Broadside	1
	Head-on	2
	Non-collision	2
Major injury total		5
Minor injury	Broadside	1
	Head-on	1
	Non-collision	1
	Not reported	1
	Sideswipe-same direction	1
Minor injury total		5
Possible/unknown	Angle-oncoming left turn	1
	Broadside	1
	Non-collision	3
	Not reported	1
	Rear end	2
Possible/unknown total		8
Property damage only	Non-collision	6
	Not reported	1
	Rear-end	2
	Sideswipe -same direction	1
Property damage only total		10

Table C.3. Major cause by severity

Crash severity	Major cause	Total
Fatal	FTYROW: Making left turn	1
	Operating vehicle in an erratic/reckless/ careless/negligent/aggressive manner	1
	Traveling wrong way or on wrong side of road	1
Fatal total		3
Major injury	Driving too fast for conditions	1
	Other (explain in narrative): no improper action	1
	Ran stop sign	1
	Swerving/evasive action	2
Major injury total		5
Minor injury	Crossed centerline	1
	FTYROW: from stop sign	1
	Other (explain in narrative): other improper action	1
	Swerving/evasive action	1
	Unknown	1
Minor injury total		5

Table C.4. Major cause by severity, continued

Crash severity	Major cause	Total
Possible/unknown	Animal	1
	Followed too close	1
	FTYROW: from stop sign	1
	Made improper turn	1
	Other (explain in narrative): vision obstructed	1
	Ran off road-left	1
	Swerving/evasive action	2
Possible/unknown total		8
Property damage only	Animal	2
	Driving too fast for conditions	1
	Followed too close	1
	None indicated	1
	Ran off road-left	2
	Swerving/evasive action	3
Property damage only total		10

Table C.5. Occupant protection summary

Occupant Protection	Injured Persons								Uninjured Persons							
	2001	2002	2003	2004	2005	2006	2007	Total	2001	2002	2003	2004	2005	2006	2007	Total
None used	0	1	4	0	2	0	0	7	0	0	0	0	0	0	1	1
Shoulder and lap belt used	1	0	1	5	7	6	1	21	0	0	1	0	0	1	2	4
Lap belt only used	0	0	1	0	0	0	0	1	0	0	1	0	0	0	0	1
Shoulder belt only used	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Child safety seat used	0	0	0	1	0	1	0	2	0	0	0	0	0	0	0	0
Helmet used	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other (explain in narrative)	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0
Unknown	0	0	0	0	0	2	0	2	0	0	1	0	0	0	5	6
Not reported	4	0	0	0	0	0	1	5	1	0	3	0	0	0	1	5
							Total	39							Total	17

Table C.6. Vehicle classification

Vehicle	Total
Farm vehicle/equipment	2
Four-tire light truck (pick-up/panel)	10
Not reported	2
Passenger car	20
School bus (seats > 15)	2
Single-unit truck (2-axle/6-tire)	3
Sport utility vehicle	6
Van or mini-van	4
Total	49

Table C.7. Vehicle action

Vehicle action	Total
Movement essentially straight	33
Not reported	4
Overtaking/passing	1
Slowing/stopping	3
Turning left	4
Turning right	1
Unknown	1
Total	47

Table C.8. Driver condition

Driver condition	Total
Apparently normal	37
Asleep/fainted/fatigued/etc.	1
Emotional (e.g., depressed/angry/disturbed)	1
Not reported	4
Under the influence of alcohol/drugs/medications	4
Unknown	2
Total	49

Table C.9. Driver contributing circumstances

Driver contributing circumstances	Total
Crossed centerline	1
Driving too fast for conditions	2
Followed too close	2
FTYROW: from stop sign	2
FTYROW: making left turn	1
Inattentive/distracted by: fatigued/asleep	1
Lost control	4
Made improper turn	1
Operating vehicle in an erratic/reckless/careless/ negligent/aggressive manner	1
Over correcting/over steering	1
Ran stop sign	1
Swerved to avoid: vehicle/object/non-motorist/or animal in roadway	2
Traveling wrong way or on wrong side of road	1
Other (explain in narrative): no improper action	16
Other (explain in narrative): other improper action	2
Other (explain in narrative): vision obstructed	1
Unknown	2
Not reported	6
Total	47

Table C.10. Driver county of residence

Driver county of residence	Total
Adair	11
Adams	2
Cass	1
Clarke	1
Guthrie	1
Lucas	1
Madison	1
Taylor	2
Union	27
Unknown	1

Table C.11. Weather conditions

Weather Condition	Total	Percent
Clear	11	23.4%
Cloudy	3	6.4%
Fog/smoke	2	4.3%
Partly cloudy	1	2.1%
Rain	1	2.1%
Sleet/hail/freezing rain	1	2.1%
Snow	6	12.8%
Unknown	1	2.1%
Not Reported	21	44.7%
Total	47	100.0%

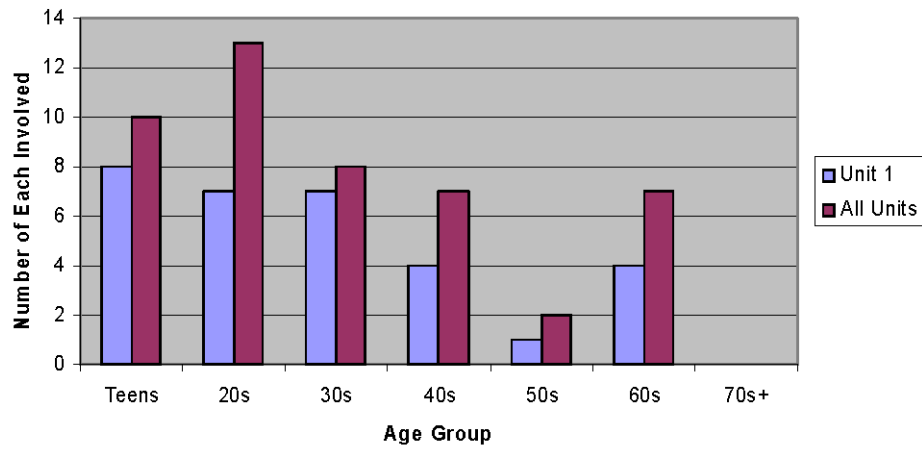


Figure C.11. Crashes by driver age

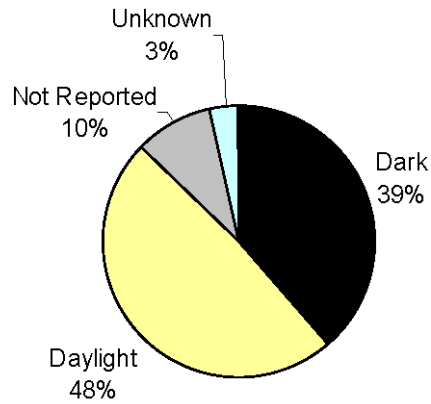


Figure C.12. Crashes by light conditions

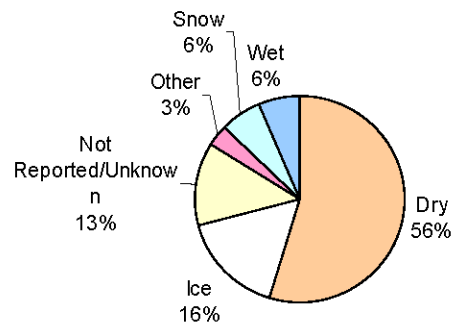


Figure C.13. Crashes by surface conditions