Road Safety Audit for US 151 from Amana to US 30 in Cedar Rapids in Benton, Iowa and Linn Counties, Iowa

Final Report October 2010



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16. Abstract

US 151 was originally constructed as IA 149 in 1931-1934 and has been rehabilitated several times. The most recent major improvements, which were completed in 2005-2006, consisted of hot mix asphalt resurfacing and partial shoulder paving. Major widening and resurfacing improvements were also completed in 2007 between Fairfax and US 30 in Cedar Rapids.

According to a preliminary 2009 estimate, traffic volumes range from about 5,900 vehicles per day (vpd) north of Amana to about 14,400 vpd at the US 30 interchange in Cedar Rapids. In response to high crash densities and medium to medium-high crash rates along the route, the 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 state government met to review crash data and discuss potential safety improvements to this segment of US 151.

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 US 151 FROM AMANA TO US 30 IN CEDAR RAPIDS IN BENTON, IOWA, AND LINN COUNTIES, IOWA

Final Report October 2010

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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:

Jerry Roche
 Tom Welch
 Chris Poole
 Federal Highway Administration
 Safety Engineer, Iowa DOT
 Office of Design, Iowa DOT

• Jack Latterell Safety Consultant

• Randy Hunefeld Governor's Traffic Safety Bureau

• Tom McDonald Safety Circuit Rider, Institute for Transportation

Crash data for this road safety audit were developed by the Iowa Traffic Safety Data Service (ITSDS) at the Institute for Transportation.

INTRODUCTION

US 151 was originally constructed as IA 149 in 1931-1934 and has been rehabilitated several times. The most recent major improvements, which were completed in 2005-2006, consisted of hot mix asphalt resurfacing and partial shoulder paving. Major widening and resurfacing improvements were also completed in 2007 between Fairfax and US 30 in Cedar Rapids.

According to a preliminary 2009 estimate, traffic volumes range from approximately 5,900 vehicles per day (vpd) north of Amana to about 14,400 vpd at the US 30 interchange in Cedar Rapids. A complete record of traffic volume estimates is included later in this report.

In response to high crash densities and medium to medium-high crash rates along the route, this section was recommended for a road safety audit by the Office of Traffic and Safety at the Iowa Department of Transportation (Iowa DOT).

The audit team consisted of the following professionals:

Jerry Roche
 Tom Welch
 Chris Poole
 Federal Highway Administration
 Safety Engineer, Iowa DOT
 Office of Design, Iowa DOT

• Jack Latterell Safety Consultant

• Randy Hunefeld Governor's Traffic Safety Bureau

• Tom McDonald Safety Circuit Rider, Institute for Transportation

INITIAL MEETING

The initial meeting for the audit was conducted at the Iowa DOT District 6 Kirkwood facilities in Cedar Rapids on the morning of May 12.

The audit team met with Iowa DOT District 6 representatives, Newman Abuissa and Steve Wilson, for an initial discussion of safety concerns, review of crash and traffic data, and plans for conducting the audit. Following comments about the purpose for the audit and review of recent improvements by District 6 staff, Tom McDonald distributed and reviewed crash data recorded from 2001 through 2009 on a county by county basis. Of particular concern was the fact that many fatal and major injury crashes had occurred in the urban areas of Walford and Fairfax, despite reduced speed limits. This observation was examined in more detail during the field reviews. A detailed discussion of the crash data is presented later in this report.

DAYLIGHT REVIEW

The daylight review commenced in Iowa County at the intersection of IA 220 and US 151 in Amana and proceeded northerly. The conventional four-leg intersection is controlled with an all-

way-stop configuration, accentuated with overhead flashing red beacons. According to Steve Wilson, all signing in the intersection will be updated under an on-going bridge replacement project just to the north on US 151. A right turn lane was constructed for south to west turning traffic from US 151 in a 2005-2006 rehabilitation project. This location may be recommended for a roundabout in the future by District 6.

Just northerly from the intersection, a Deer Crossing warning sign with a next 2 miles plaque has been installed. Pavement surface conditions on US 151 have a good appearance. Shoulders consist of approximate 4 ft wide paved and 5-6 ft wide granular construction. Milled rumble strips have been installed in the paved shoulders. Even with the paved shoulder, an approximate 2-3 in. edge drop-off, along with occasional severe edge raveling and deterioration, was observed, quite consistently throughout the entire reviewed section. Pavement markings appeared satisfactory in daylight conditions. Right-of-way width is satisfactory and clear of potential hazards within the clear zone. Foreslopes are 6:1, with barn-roof sections at higher fill locations.

A T- intersection at 38th Avenue from the west is paved. An S-curve section is marked at each curve with 30 in. standard yellow curve signs with no advisory speed plaques.

Just south from the paved intersection with 120th Street is an area with numerous animal crashes. Northerly from this intersection is a vertical curve, which has been the site of two head-on, cross-centerline, fatal crashes. Shoulders in this area are approximately 10-12 ft wide.

Just north of milepost 14 is the intersection with County Road F-12, paved to the east toward Swisher and granular to the west. A right turn lane is in place for north to east turning traffic. Several crashes have occurred at this intersection, two of which resulted in major injuries.

At the Iowa-Benton county-line intersection, the road is paved to the east and granular to the west.

From the Iowa county line northerly, US 151 remains in good condition. Northerly from the county line is a long horizontal curve with a paved county road, intersecting US 151 from the west, to connect with the town of Norway. The intersection features roadway lighting and the intersection is marked with a double-arrow sign across from the T. A stop sign is located in an island and painted left turn lanes exist on US 151.

Easterly from this intersection to the town of Walford, the US 151 pavement surface is much rougher than other areas with many distressed transverse joints. The 33rd Avenue intersection is granular from both approaches.

Entering Walford, a curve sign, intersection-ahead sign, and 45 mph regulatory sign were observed, all in satisfactory condition. No rumble strips have been placed through the urban area. The intersection with 1st Street North has been the site of numerous crashes. This is also the Benton-Linn county line.

In Linn County, north from the intersection, a railroad parallels US 151 on the easterly side and an industrial area with several commercial buildings is located there. This area generates a significant number of commercial vehicles and "Watch for Truck Traffic" warning signs have been installed on each side of the area. One fatal crash was also recorded in this area.

The Wright Brothers Boulevard intersection is paved to the east toward the Cedar Rapids airport. To the west is a granular local road approach. A right turn lane exists for north to east turning traffic and the intersection is lighted. Flashing lights are in place at the near proximity rail crossing. Northerly from the intersection, a Portland Cement Concrete (PCC) roadway section in good condition exists.

In the town of Fairfax, horizontal curves were encountered, marked with curve warning signs. The roadway features mountable curbs on both sides in the southerly section of town. Posted speed limits through Fairfax, south to north, vary from 55 mph to 45 mph to 50 mph and finally back to 55 mph.

An overpass bridge carries US 151 over the railroad in Fairfax and intersections on either side of the bridge have been the site of numerous crashes, one of which was a fatal crash. Sight distance restrictions for side road traffic may have been a contributing cause of some of these crashes. A painted left turn lane has been installed on US 151 south of the overpass.

Just north from the overpass is a 28 ft wide bridge over a small stream, followed by a horizontal curve. A T-intersection from the west in this curve has been the site of numerous property damage crashes.

At the paved 80th Street intersection, the posted speed limit reverts to 55 mph and the roadway surface widens to accommodate left turn lanes at many high-volume intersections. Right turn lanes also have been installed at several intersections where housing developments have been constructed. Many crashes, some with serious consequences, have been recorded in this section from Fairfax to the US 30 intersection. At the Beverly Road/Stoney Point intersection, traffic signals have been installed, along with right turn lanes. The US 30 intersection features roadway lighting at the conflict points.

CITIZEN COMMENTS

Following dinner, the audit team visited with a restaurant worker, Tammi Frimmel, to determine her opinions of US 151 traffic and roadway conditions. Frimmel works in Amana, lives in Cedar Rapids, and is a daily commuter on US 151. She opined that truck traffic was not a problem for her during daily trips, but workers at the Amana refrigerator plant, who also commute along this route, do not drive safety, with frequent speeding and risky passing maneuvers. Frimmel said this is particularly a problem at the 3:30 p.m. and 11:00 p.m. shift changes. She also felt that the ride on US 151 was not satisfactory in some locations and that pavement markings are not visible during periods of rain.

NIGHTTIME REVIEW

Following dinner, the audit team conducted a review of the roadway. Traffic volumes were low during this time. Pavement marking conspicuity varied considerably throughout the section, with the yellow centerline consistently less visible than the white edge lines. Pavement markings in the PCC pavement section appeared in better condition than in the hot mix asphalt sections. Signs appeared mostly satisfactory, but could be enhanced for better visibility. The truck turning signs in Walcott were not satisfactory and one sign face appeared to have been vandalized with a paint gun. In addition the legend font size is too small, in the opinion of the audit team. The painted median in Fairfax is badly worn and not satisfactorily visible at night.

CRASH DATA

The most recent nine years of crash data were obtained and summarized for study as part of this safety audit. The results are discussed on a county by county basis.

Iowa County

Beginning in Iowa County, at the intersection of IA 220 in Amana, an intersection crash diagram for this location had been prepared and distributed to the review team. The diagram indicated a total of 10 crashes over the nine-year review period, all of minimal severity. No particular pattern of crashes could be noted here.

The crash data summary for Iowa County revealed a total of 86 crashes, 44 of which were animal related. 2 fatal crashes and 7 major injury events were noted among the data. Several crashes indicated poor driver performance, such as ran stop sign, failed to yield right of way, following too close, and swerving/evasive action. The highest collision types were non-collision with 37, indicating numerous single vehicle incidents. Rear-end collisions were next, with 12, followed by broadside collisions, with 6. These latter types are more common in urban areas and less so in rural locations.

Hour of the day for crashes showed highest numbers during morning and evening commuting times, although 6 crashes were recorded during the midnight to 1:00 a.m. hour. Saturday was the highest day of the week for crashes with 19. Slightly higher crash numbers were recorded during the winter months of November and February. Neither hour of day nor day of week seemed to show a trend for severe result crashes, although 3 of the major injury crashes in Iowa County occurred on Saturday.

31 of the crashes occurred during daylight hours and 13 were noted in dark conditions at unlighted locations. For the 86 crashes, 20 occurred in clear weather conditions and 20 more in cloudy or partly cloudy situations. 6 happened during snow or blowing snow conditions. Road surface conditions were dry for 37 of the recorded crashes and not reported for another 32, the latter of which is common for animal crashes.

124 drivers were involved in the 86 Iowa County crashes, with 10 were reported as losing control and 6 as following too close. However, 43 were found to have performed no improper action. 76 of the drivers were judged to be apparently normal at the time of the crashes, and only 1 was found to be under the influence of alcohol or drugs.

Very few younger drivers were involved in these crashes, and none for the ages of 14-16. The highest concentration of crashes was found in the age groups between 21 and 59. Severity of crashes by age, again, showed higher numbers for middle-aged drivers, with the age group of 50-54 the highest contribution at 17.

Benton County

The section of US 151 in Benton County recorded a total of 33 crashes during the nine-year review period, 4 of which were animal related. For non-animal related crashes the top major causes included too fast for conditions with 3 and following too close with 6. During this period, 1 fatal crash occurred and 4 with major injuries.

Manner of collision indicated 10 as non-collision events and 11 rear-end incidents. Other intersection-type crashes, such as broadside and angle left turn, were also higher, indicating the many crashes in the city of Walford.

Highest hours of the day for crashes were the afternoon commuting times. Very few crashes were recorded during nighttime hours. Saturday and Sunday recorded the most crashes for day of week. Months for highest crashes were fairly well distributed throughout the year, with no patterns observed.

The highest number of severe crashes occurred during the afternoon commuting time. Of the 33 crashes, 20 were noted during daylight conditions, 7 on a dark, unlighted roadway. Weather conditions were clear, cloudy, or partly cloudy for 22 of 33 crashes, but 6 were recorded during rain. The road surface was dry for 18 crashes and wet for 8 others.

Driver performance played a significant role in many crashes with 7 noted as lost control, 6 followed too close, and 4 failed to yield from a stop sign. However 23 of the total 59 drivers were found to have committed no improper action.

Driver condition was judged to be apparently normal for 54 of 59 drivers. Only 3 were found to be under the influence of drugs or alcohol.

Again few teenage drivers were involved in Benton County crashes, and none from ages 14-16. Higher crash numbers were recorded for middle-aged drivers, but drivers in the 70-79 age group were involved in 6 crashes.

Severity of crashes by driver age showed the same results as described above for total crash involvement. As was noted earlier, most of the severe crashes in Benton County occurred in the

urban area of Walford, including 1 fatal crash and 4 with major injuries. High severity crashes are not common in urban locations and more study of these crashes will be undertaken and the results discussed in the final report.

Linn County

Higher traffic volumes contributed to significantly higher crash numbers in Linn County, where a total of 241 were recorded, with 3 fatal crashes, 15 major injury events, and 147 which resulted in property damage only.

Major causes for Linn County crashes included animal with 25, failed to yield from a stop sign with 32, too fast for conditions with 18, following too close with 30, and swerving/evasive action with 17.

Manner of collision for these crashes indicated higher occurrences for non-collision (single-vehicle) crashes with 61, rear-end collisions with 67, and broadside with 51. The latter two crash types are generally indicative of intersection incidents.

Again, as in the other two counties, most common hours for crashes are the commuting time in morning and evening, but more nighttime crashes are also indicated in Linn County. Days of week with most recorded crashes were Tuesdays and Fridays, with 40 crashes and 42 crashes, respectively. The winter months of November through February showed somewhat higher crash numbers than other months.

All fatal crashes occurred during the early afternoon hours, but other injury crashes were scattered throughout the day, and very few occurred at night. 2 of the fatal crashes were recorded on Friday and 5 of 15 major injury crashes occurred on Thursday. For the 241 crashes, 151 happened during daylight conditions; 28 during darkness, but on a lighted roadway; and 25 were recorded during darkness on an unlighted roadway.

The majority of crashes, 177 of 241, occurred during clear, cloudy, or partly cloudy weather conditions. A total of 10 were reported during rain, and 21 during snow or blowing snow weather conditions. The road surface was reported as dry for 154 crashes, wet for 27 incidents, and ice or snow for 33 crashes.

A total of 437 drivers were involved in the 241 Linn County crashes. For driver-contributing circumstances, the most common types noted were too fast for conditions with 23, lost control with 29, following too close with 32, and failed to yield from a stop sign with 32. However, a total of 172 drivers were judged to have committed no improper action.

A total of 359 of 437 drivers were judged to be apparently normal at the time of the crash, and 11 were found to be under the influence of drugs or alcohol. Crashes by driver age, again, indicated most involvement by middle-aged drivers from ages 21 through 54. However, drivers between the ages of 70 to 79 were involved in a total of 23 crashes.

Crashes by severity did not indicate any significant trends, although 5 of 29 major injuries were suffered by teenage drivers. 1 fatality involved a driver between the age of 80-84.

A higher concentration of crashes was noted at the ramp terminals in the US 30 interchange. Intersection crash maps were prepared for these two locations.

At the southeast entrance ramp, a total of 19 crashes were recorded during the nine-year study period, almost all of which were property damage crashes, although 1 major injury crash and 2 minor injury incidents did occur in the interchange overpass area. A total of 5 of the 19 crashes at the southeast terminal occurred at night, despite the existence of roadway lights in this area.

At the northeast ramp terminal, a total of 8 crashes were noted during the study period, with 3 at night and 1 resulting in an injury.

As was noted earlier (for crashes in the city of Walford), most injury crashes on US 151 in Linn County were recorded within the urban area of Fairfax, with 2 fatal crashes, 8 resulting in major injuries, and 8 with minor injuries. Many of these injury crashes occurred within a 55 mph speed limit area and a study to reduce the posted speed limit in this location, as suggested by Sergeant Gales, might be advisable.

Driver-Contributing Circumstances

When driver-contributing circumstances related to severity of crash were examined, some interesting information can be gleaned. For the 12 total fatalities, 2 were attributable to crossing the centerline, 2 listed exceeded authorized speed, and 2 others occurred when a vehicle was traveling in the wrong lane. However, 4 fatal crashes showed no improper action on the part of a driver, indicating a multi-vehicle crash.

For the 46 crashes with major injuries, 4 were crossed centerline events, 9 showed loss of control, 4 listed failure to yield from a stop sign, and 17 indicated no improper action on the part of the driver, again indicating a multi-vehicle crash.

Crashes Before and After Major Route Improvement

Since a major improvement was completed on this route during the crash analysis period, it is interesting to compare data before and following this improvement.

Table 1. Crash comparison before and after major US 151 route improvement

County	Total crashes	Years*	Avg. no. before	Avg. no. after
Iowa	40	2001-2004	10.00	
	25	2007-2009		8.33
Benton	19	2001-2004	4.75	
	8	2007-2009		2.67
Linn	101	2001-2004	25.25	
	84	2007-2009		28.00
Linn	53	2008-2009		26.50
Total	160	2001-2004	40.00	
	117	2007-2009		39.00

^{*} Omits improvement years 2005-2006

As can be seen in the table above, although total crashes were reduced in the years following the major improvements in Iowa and Benton Counties, the number increased in Linn County, even following the major widening improvements in 2007

For the entire route, however, crashes per year were slightly less following the improvements. This might be partially explained by the fact that even though known positive safety enhancements, such as partially-paved shoulders with milled rumble strips were installed in 2005-2006, the major crash type for this route was not run-off-road right, which would be the type generally most impacted by this particular feature. In addition, as has been stated earlier, many crashes on this route occurred in the urban areas, where the safety benefits from paved shoulders and rumble strips are not necessarily experienced.

Crash Rates

For the nine-year review period, the following crash rates were calculated.

Table 2. 2001-2009 Crash rates by county and road type/location

Road type/ location	Total crash rate	Injury crash rate
Rural	108.14	17.60
Rural	66.46	14.24
Urban	86.68	17.34
2-lane rural	66.03	16.17
4-lane rural	200.27	30.69
Urban	131.87	27.15
	Rural Rural Urban 2-lane rural 4-lane rural	location crash rate Rural 108.14 Rural 66.46 Urban 86.68 2-lane rural 66.03 4-lane rural 200.27

These rates compare to the Iowa DOT statewide average rates for similar roadways.

Table 3. Statewide crash rates for US highways by road type/location

Road type/ location	Total crash rate	Injury crash rate
Rural	96	27
Urban	306	99

Note that these statewide data group 2-lane and 4-lane roadways together.

Complete crash data are contained in Appendix B.

FRICTION DATA

The Materials Department of the Iowa DOT provided the latest available friction data for US 151 in the reviewed area, obtained in 2006.

Table 4. 2006 US 151 friction data by county and direction

County	Milepost	North- bound	South- bound
Iowa	10.85-13.03	53	51
	13.03-15.06	55	55
Benton	15.06-16.26	54	54
	16.26-18.03	53*	53*
Linn	18.03-21.56	50	53
	21.56-24.94	48	50

^{*}Average both directions

TRAFFIC VOLUME DATA

The Office of Transportation Data at the Iowa DOT furnished recently-obtained traffic volume data for several sections of the reviewed route.

Table 5. 2006 US 151 traffic volume data by county

Route section	Data year	vpd	Trucks per day
Iowa County	2006	5,400-5,900	330
Benton County	2009	5,000-5,500	310
Walford	2009	5,600	n/a
Linn County, south of Fairfax	2009	6,300-7,600	n/a
Fairfax	2009	7,000-9,600	n/a
Linn County, north of Fairfax	2009	14,400	470

Preliminary traffic data from several selected intersections are contained in Appendix C.

WRAP-UP MEETING

On May 13, a wrap-up meeting was conducted in the District 6 Kirkwood facilities in Cedar Rapids. Participating in this meeting were audit team members Jack Latterell, Jerry Roche, Randy Hunefeld, Chris Poole, and Tom McDonald, along with District 6 representative, Newman Abuissa, and Linn County Deputy Sheriff Sergeant, Jim Gales.

Deputy Gales reported that the Linn County Sheriff provides county-wide protection for the city of Fairfax, investing approximately 65 hours per month to that effort. The Benton County Sheriff provides similar services for the city of Walford. According to Deputy Gales, high traffic volumes are observed on US 151 in approximate 8-hour intervals, throughout the day and early evening, coinciding primarily with commuting times. It may be beneficial to undertake special enforcement activities along this route using the Iowa State Patrol and County Sheriff offices in the future.

During the meeting, members of the audit team described observations made during the field reviews on the previous day and described possible improvements that could be included as recommendations in the final report, such as signing upgrades, improved pavement markings, centerline rumble strips in selected locations, enhanced maintenance of the granular shoulders, possible addition of chevrons and/or delineators in selected curve locations, discussion of mitigation of animal crashes with the Department of Natural Resources (DNR), and conversion of existing shoulder rumble strips to rumble stripes during the next application of edge line pavement markings.

Deputy Gales also suggested that the speed limit between Fairfax and US 30 be studied for possible reduction to a uniform 45 mph in consideration of the extensive development that has taken place along this corridor in recent years.

It was noted that significant edge drop-off had developed along the outside of the paved shoulders throughout the section, some up to 4 in. (magnitude). This elevation differential has probably also contributed to edge raveling along the outside of the paved shoulders. Additional maintenance effort to address this issue will be recommended.

Current pavement friction data will be requested from the Iowa DOT Office of Materials to ascertain if the roadway surface might be contributing to loss of control crashes.

RECOMMENDATIONS

Based on the data available for review, observations made during the field reviews, and discussion among audit team members, the following recommendations are presented for addressing safety concerns in this section of US 151.

- Examine the locations where cross centerline crashes have frequently occurred in the past and consider installing centerline rumble stripes in those areas.
- Upgrade all horizontal curve warning signs to fluorescent yellow background.
- Replace the turning truck warning signs north of Walford with Manual on Uniform Traffic Control Devices (MUTCD)-compliant messaging and fluorescent yellow background signs.
- Perform a speed study between Fairfax and the US 30 interchange to determine the feasibility of reducing the posted speed limit to 45 mph, with the stipulation that law enforcement efforts will be made to monitor driver compliance.
- Consider converting the existing shoulder rumble strips to rumble stripes when the edge line pavement markings are replaced. If this is not feasible, consider utilizing milled-in painted edge lines to enhance wet weather visibility. Another option would be to study the supplemental use of rumble stripes in addition to the existing painted edge lines, although this may require an exception to MUTCD guidelines.
- Perform routine granular shoulder maintenance along the route to eliminate the edge drop-off along the partially-paved shoulder, adding granular material as needed.
- Consider the use of a safety edge along the outside of paved shoulders on future projects.
- The Iowa GTSB should work with the Iowa State Patrol and the three county sheriff's offices to establish an enhanced enforcement effort along this route, especially during higher traffic commuting times.
- The District Office should consult with the DNR regarding the incidence of deer crashes on US 151 and devise potential mitigation efforts.
- Discussion with the railroad company should be undertaken regarding removal of existing trees in the railroad right-of-way.

- Study degree of curvature for various horizontal curves to determine if warrants exist for installing chevron warning signs or delineators for enhanced guidance through the curves.
- Consider modifying the section of US 151 immediately northeasterly of Fairfax to a three-lane section, with a continuous left turn lane, to reduce painted pavement marking requirements in this area.
- The Iowa DOT should make crash diagrams and narratives available for all major crashes for future road safety audits. Accurate assessment of crash causes and, hence, potential mitigation recommendation becomes more difficult if complete data is not available to the team.
- The Iowa Skid Crash Reduction Program should be critically evaluated for effectiveness:
 - Testing appears infrequent and not well understood in the field.
 - Smooth tire testing should be included to evaluate macro-texture adequacy.
- Field training should be developed concerning the critical elements of new guardrail terminals and associated details, including both DOT maintenance and construction staff, as well as local agencies.
- Follow up on these recommendations at future Cedar Rapids multi-disciplinary safety team meetings.

APPENDIX A. IMAGES FROM FIELD REVIEWS



Figure A.1. US 151/IA 220 intersection, southbound



Figure A.2. US 151 northbound, north of Amana



Figure A.3. US 151/IA County Road F-12 (Swisher Road) intersection northbound



Figure A.4. US 151 roadside and clear zone



Figure A.5. Iowa/Benton County Line intersection, northbound



Figure A.6. US 151/Benton County Road E-66 (Norway Road) intersection, northbound



Figure A.7. Shoulder edge deterioration near Norway Road intersection



Figure A.8. US 151/Linn-Benton Road (1st Street North) in Walford, northbound



Figure A.9. Truck Turning Ahead warning sign north of Walford



Figure A.10. Industrial area entrance north of Walford, with shoulder edge deterioration



Figure A.11. Vegetation in railroad right-of-way north of Walford



Figure A.12. Trees in railroad right-of-way south of Fairfax



Figure A.13. US 151/Linn County Road E-70 (Wright Brothers Boulevard) northbound



Figure A.14. Curve warning sign



Figure A.15. US 151 entering Fairfax northbound



Figure A.16. US 151 in Fairfax, southbound



Figure A.17. City intersection north of railroad overpass in Fairfax, southbound



Figure A.18. US 151 railroad overpass bridge in Fairfax, southbound



Figure A.19. City intersection north of railroad overpass in Fairfax, northbound



Figure A.20. Bridge on US 151 in Fairfax



Figure A.21. US 151 Approaching Fairfax, southbound



Figure A.22 US 151/Stoney Point Road (Beverly Road) intersection northbound



Figure A.23. US 151/Stoney Point Road (Beverly Road) intersection, southbound



Figure A.24. US 151/US 30 interchange overhead bridge, southbound



Figure A.25. North ramp terminals in US 151/US 30 interchange



Figure A.26. White edge line in dark conditions



Figure A.27. US 151 pavement conditions with paved shoulder rumble strips



Figure A.28. US 151 pavement conditions with paved shoulder rumble strips

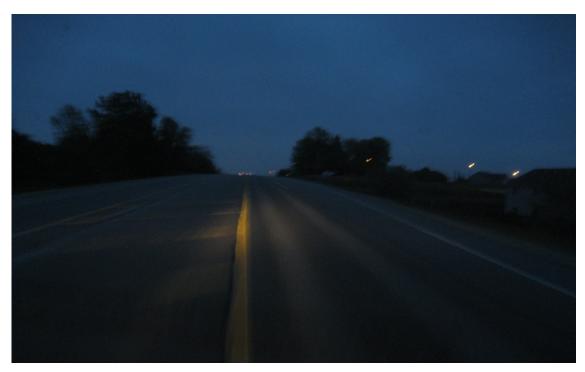


Figure A.29. Yellow centerline in dark conditions

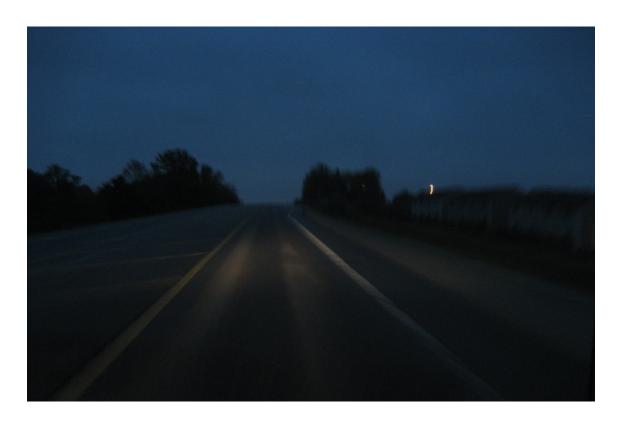


Figure A.30. Edge line and centerline in dark conditions



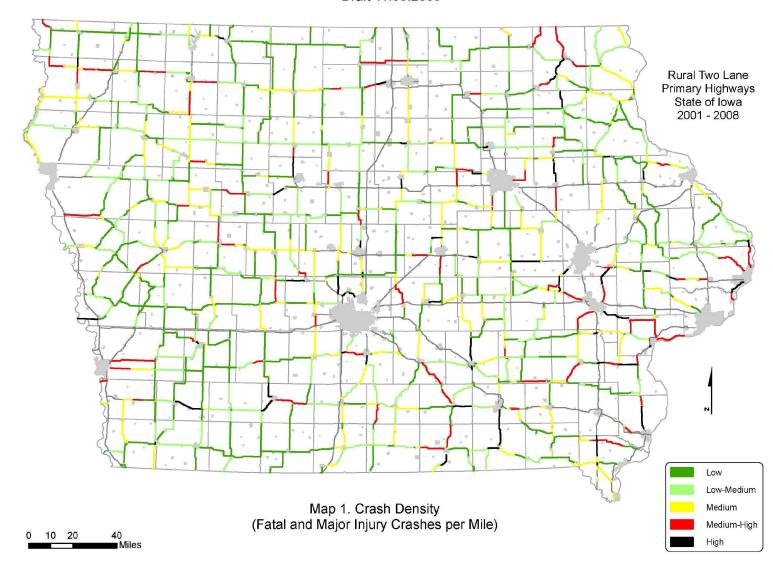
Figure A.31. Warning sign in dark conditions



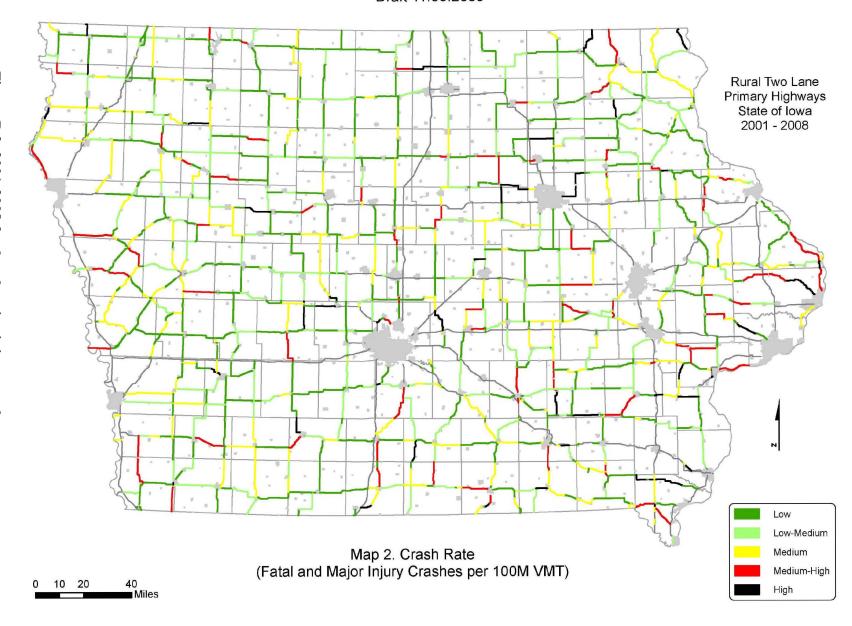
Figure A.32. Audit team

Figure B.1. 2001-2008 fatal and major injury crash density map

Draft 11.09.2009



Draft 11.09.2009



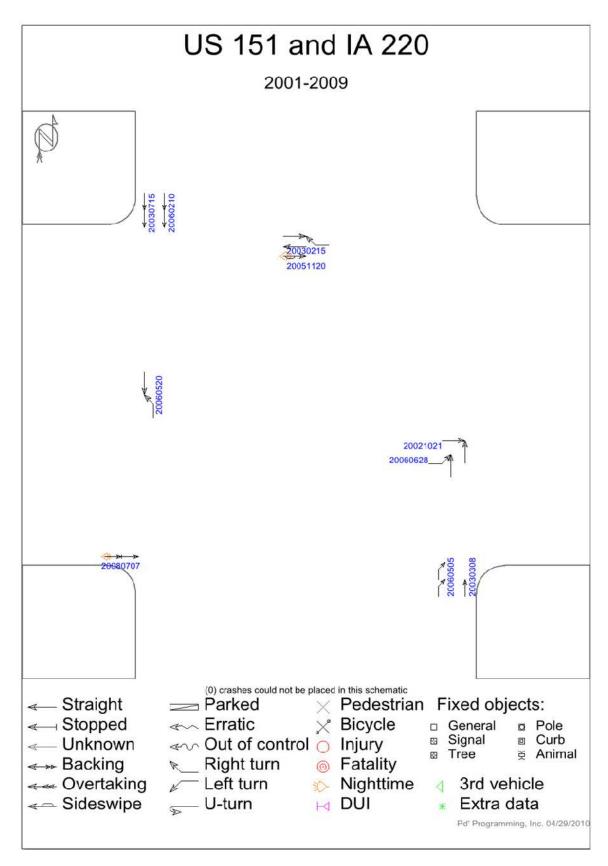


Figure B.3. 2001-2009 US 151 and IA 220 collision diagram

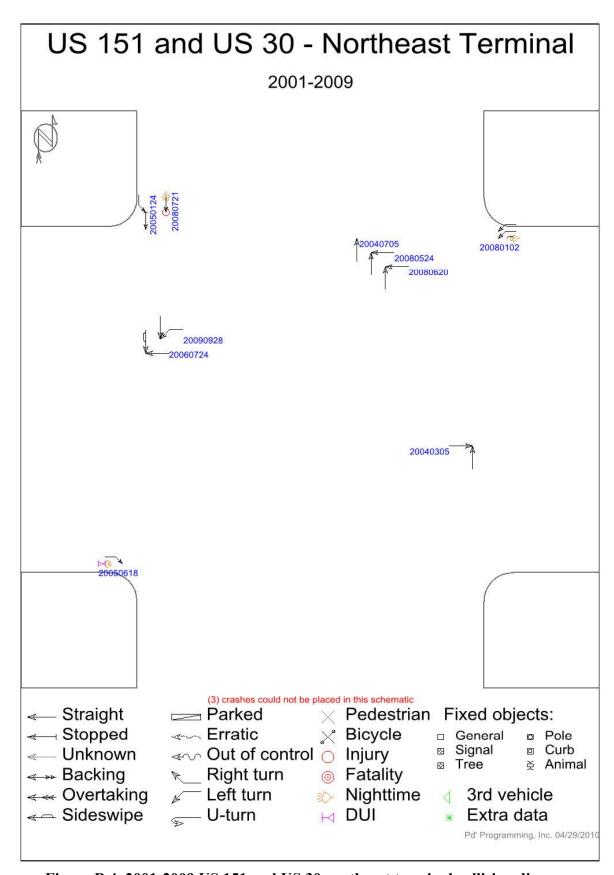


Figure B.4. 2001-2009 US 151 and US 30 northeast terminal collision diagram

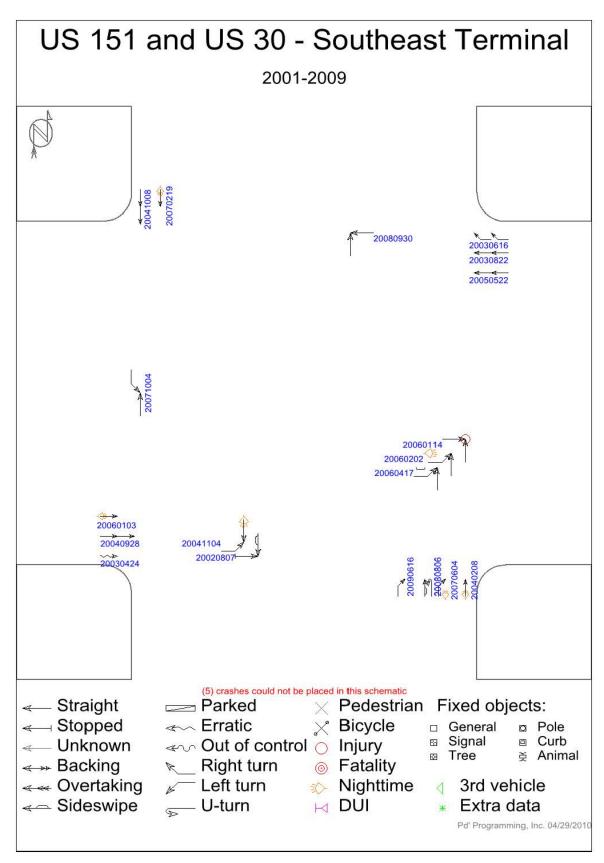


Figure B.3. 2001-2009 US 151 and US 30 southeast terminal collision diagram

BENTON **Crash Severity** Fatal (2) Major Injury (7) Minor Injury (5) Possible/Unknown (7) Property Damage Only (65) US 151 RSA Corridor Paved Roads Unpaved Roads Corporate Boundaries **County Boundaries** * 2009 crash data are considered preliminary Disclaimer: Disciaimer: The information contained in this report was derived from the March 29, 2010, lowa Department of Transportation crash database. If errors or odd cases are found, please communicate the case number or are round, please communicate the case number or send a printed crash report to Michael Pawlovich, lowa DOT, Office of Traffic and Safety, Michael.Pawlovich@dot.iowa.gov, 515.239.1428). Since the database is actively being updated, edited, and reviewed, some of the fatality totals may differ from the Fatality Analysis Reporting System (FARS). If fatal 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). lowa Department of Transportation Produced by: PH, DI Date Produced: April 22, 2010

US 151 RSA lowa County Crashes by Severity ('01-'09*)

Figure B.4. 2001-2009 US 151 Iowa County crash map, by severity

Table B.1. 2001-2009 Iowa County crashes by major cause

								Majo	or Ca	ause								
Year	Animal	Ran Stop Sign	Crossed Centerline	FTYROW: From Stop Sign	FTYROW: From Driveway	FTYROW: Other	Traveling Wrong Way or on Wrong Side of Road	Driving too Fast for Conditions	Followed too Close	Operating vehicle 1	Swerving/Evasive Action	Ran Off Road - Right	Ran Off Road - Left	Lost Control	Inattentive/distracted by: Fallen Object	Unknown	Other: No Improper Action	Total
2001	2							1	1		1							5
2002	6	2	2															10
2003	8			1		1		1	1		1			1				14
2004	5					1	1				3			1				11
2005	2		1	1									1				1	6
2006	6			1	1	2			1	1					1	1	1	15
2007	6										1							7
2008	7	2						1	1		2		1					14
2009	2					1						1						4
Total	44	4	3	3	1	5	1	3	4	1	8	1	2	2	1	1	2	86

¹ Operating vehicle in an erratic/reckless/careless/negligent/aggressive manner

Table B.2. 2001-2009 Iowa County crashes by manner of collision

				Man	ner of Colli	sion				
Year	Non-collision	Head-on	Rear-end	Angle, oncoming left turn	Broadside	Sideswipe, same direction	Sideswipe, opposite direction	Unknown	Not Reported	Total
2001	3		1						1	5
2002	3	2			2				3	10
2003	8	1	1			2	1		1	14
2004	7	1				1	2			11
2005	4				1		1			6
2006	3	1	4	2	2			3		15
2007	2		1						4	7
2008	4		4		1		1		4	14
2009	3		1							4
Total	37	5	12	2	6	3	5	3	13	86

Table B.3. 2001-2009 Iowa County crashes by hour of day

												ŀ	lour	of Da	у										
Year	0	1	2	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	Not Reported	Total
2001					1	1	1			1									1						5
2002				1		1			2							1			3		1		1		10
2003	1				1				1	1		1		2	2		1	1	1	1		1			14
2004	1					1	1	1						1			1		2	1		1		1	11
2005	1													1				1	2	1					6
2006	1					3	1					1	1			3	2			2	1				15
2007					1					1	1	1				1					1	1			7
2008	2					3				1	1	1				1	1	1	1	1	1				14
2009						1				2			1												4
Total	6	0	0	1	3	10	3	1	3	6	2	4	2	4	2	6	5	3	10	6	4	3	1	1	86

Table B.4. 2001-2009 Iowa County crashes by day of week and month

			Day	of W	eek								Мо	nth						
Year	Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	January	February	March	April	May	June	July	August	September	October	November	December	Total
2001				1	2	2			3		1	1								5
2002	4	1			2		3		1	1	1	1	1		1	2	1	1		10
2003	1	1	1		1	1	9	2	1	1		1		1	1	1	1	2	3	14
2004		2	5		1	2	1						2		2	2		2	3	11
2005	2		2	2						1		1					2	2		6
2006	1	1	2	2	2	5	2	1	2		1	3	1	1	1	1	1	1	2	15
2007	3	1	1		1	1					1		1	2	1			2		7
2008		3	3	3		3	2	1	2		2			1	2	1	3	2		14
2009				1		1	2		2			2								4
Total	11	9	14	9	9	15	19	4	11	3	6	9	5	5	8	7	8	12	8	86

Table B.5. 2001-2009 Iowa County crashes by hour of day and crash severity

												Н	lour c	f Day	1										
Crash Severity	0	1	2	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	Not Reported	Total
Fatal							1		1																2
Major Injury	1			1		1				1	1		1	1											7
Minor Injury													1	2				1					1		5
Possible/ Unknown	1						1			1	1					1			1		1				7
PDO	4				3	9	1	1	2	4		4		1	2	5	5	2	9	6	3	3		1	6 5
Total	6	0	0	1	3	10	3	1	3	6	2	4	2	4	2	6	5	3	10	6	4	3	1	1	8

Table B.6. 2001-2009 Iowa County crashes by day of week and crash severity

			Day	of W	eek			
Crash Severity	Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Total
Fatal	1		1					2
Major Injury	1		1	1		1	3	7
Minor Injury				1			4	5
Possible/Unknow n	1		2		1	3		7
PDO	8	9	10	7	8	11	12	65
Total	11	9	14	9	9	15	19	86

Table B.7. 2001-2009 Iowa County crashes by light conditions

			Ligh	nt Conditi	ons			
Year	Daylight	Dawn	Dark - Roadway Lighted	Dark - Roadway Not Lighted	Dark - Unknown Roadway Lighting	Unknown	Not Reported	Total
2001	2	1		1			1	5
2002	4			3			3	10
2003	5			1			8	14
2004	3	1		2			5	11
2005	2		1	2			1	6
2006	7	1		2		4	1	15
2007	1					1	5	7
2008	4			2	1		7	14
2009	3						1	4
Total	31	3	1	13	1	5	32	86

Table B.8. 2001-2009 Iowa County crashes by weather conditions

			V	Veather C	ondition	s			
Year	Clear	Partly Cloudy	Cloudy	Rain	Snow	Blowing Sand/Soil/ Dirt/Snow	Not Reported	Unknown	Total
2001			2			2	1		5
2002	2	1	4				3		10
2003	3	1		2			8		14
2004	4	1			1		5		11
2005	2	1	2				1		6
2006	5	2	2		1		1	4	15
2007		1					5	1	7
2008	3	2		1	1		7		14
2009	1	1				1	1		4
Total	20	10	10	3	3	3	32	5	86

Table B.9. 2001-2009 Iowa County crashes by road surface conditions

			Road	d Surfac	e Condit	ions			
Year	Dry	Wet	eol	Snow	Sand/Mud/Dirt/ Oil/Gravel	Water (Standing or Moving)	Unknown	Not Reported	Total
2001	1	1	2					1	5
2002	7							3	10
2003	4	2						8	14
2004	4		1	1				5	11
2005	4				1			1	6
2006	9			1			4	1	15
2007	1						1	5	7
2008	5			1		1		7	14
2009	2			1				1	4
Total	37	3	3	4	1	1	5	32	86

Table B.10. 2001-2009 Iowa County crashes by driver contributing circumstances

						Dri	ver Contr	ibuting	Circu	mstand	ces						
Year	Ran stop sign	Driving too fast for conditions	Traveling wrong way or on wrong side of road	Crossed centerline	Lost control	Followed too close	Swerved to avoid: vehicle/object/ non-motorist/animal in roadway	Operating vehicle ¹	FTYROW: From stop sign	FTYROW: From driveway	FTYROW: Other	Inattentive/distracted by: Fallen object	Other: Other improper action	Other: No improper action	Not reported	Unknown	Total
2001		1			1	1	1								2		6
2002	2			3			1							3	5		14
2003		1			1	2			1		1		1	8	7		22
2004			1		4						1			6	4		16
2005				1	1				1					4	1		8
2006						2		1	1	1	1	1		7	8	2	24
2007					1									2	1	4	8
2008	2	1			2	1	1						1	9		3	20
2009											1			4		1	6
Total	4	3	1	4	10	6	3	1	3	1	4	1	2	43	28	10	124

Table B.11. 2001-2009 Iowa County crashes by driver condition

			Dr	iver Con	dition			
Year	Apparently normal	Physical impairment	Asleep/fainted/fatigued/etc.	Under the influence of alcohol/ drugs/medications	Other	Unknown	Not reported	Total
2001	4	1					1	6
2002	7		1	1		2	3	14
2003	15						7	22
2004	11					1	4	16
2005	6					1	1	8
2006	14				1	7	2	24
2007	2				_	1	5	8
2008	12				1		7	20
2009	5						1	6
Total	76	1	1	1	2	12	31	124

Table B.12. 2001-2009 Iowa County crashes by driver age

											Drive	er Age										
Year	14-16	17	18	19	20	21-24	25-29	30-34	35-39	40-44	45-49	50-54	55-59	60-64	69-69	70-74	75-79	80-84	85-89	90-94	Unknown	Total
2001						2					1		1	1			1					6
2002					1	2			1	3	1	1	3		1	1						14
2003			2		1	1		1	2		4	4	1	2	3	1						22
2004		1		2		2	2	1	1	2	1	2	1			1						16
2005		1		1		3			1			1							1			8
2006			1		1	1	1	4	3	3	1	3	2	2							2	24
2007						1			2			2		1		1		1				8
2008			2		2		1	1	1		2	2	3	1	4	1						20
2009									1	2		2					1					6
Total	0	2	5	3	5	12	4	7	12	10	10	17	11	7	8	5	2	1	1	0	2	124

Table B.13. 2001-2009 Iowa County crashes by driver age and crash severity

										Dr	iver A	ge										
Crash Severity	14-16	17	18	19	20	21-24	25-29	30-34	35-39	40-44	45-49	50-54	55-59	60-64	62-69	70-74	75-79	80-84	85-89	90-94	Unknown	Total
Fatal						1	1			3												5
Major Injury			1	1	1	1	1		3		1	1	3									13
Minor Injury		1				1				2	1	1			1		1					8
Possible/ Unknown				1	1	1			1			3					1				2	10
PDO		1	4	1	3	8	2	7	8	5	8	12	8	7	7	5		1	1			88
Total	0	2	5	3	5	12	4	7	12	10	10	17	11	7	8	5	2	1	1	0	2	124

US 151 RSA Benton County Crashes by Severity ('01-'09*) BENTON LINN IOWA Crash Severity lowa Department of Transportation Fatal (1) Major Injury (2) Minor Injury (4) IOWA STATE UNIVERSITY Possible/Unknown (7) Property Damage Only (19) The information contained in this report was derived from the March 29, 2010, Iowa Department of Transportation US 151 RSA Corridor 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). Paved Roads Since the database is actively being updated, edited, and reviewed, some of the fatality totals may differ from the Fatality Analysis Reporting System (FARS). If fatal crash/fatality errors or odd cases are found, please contact Scott Unpaved Roads Corporate Boundaries Falb, Iowa DOT, Office of Driver Services, (Scott.Falb@dot.iowa.gov, 515.237.3154). County Boundaries Produced by: PH, DI Date Produced: April 22, 2010 2009 crash data are considered preliminary

Figure B.5. 2001-2009 US 151 Benton County crash map, by severity

Table B.14. 2001-2009 Benton County crashes by major cause

							Maj	or Caus	е							
Year	Animal	Crossed Centerline	FTYROW: At Uncontrolled Intersection	FTYROW: From Stop Sign	FTYROW: Making Left Turn	FTYROW: Other	Driving too Fast for Conditions	Exceeded Authorized Speed	Made Improper Turn	Followed too Close	Swerving/Evasive Action	Equipment Failure	Ran Off Road - Right	Lost Control	Other: Other Improper Action	Total
2001	1	1		1	1					1						5
2002			1	2						1			1	1		6
2003					1						1			1		3
2004	1						2			1	1					5
2005								1							1	2
2006	2									1	1					4
2007						1										1
2008				1			1			1		1		1		5
2009									1	1						2
Total	4	1	1	4	2	1	3	1	1	6	3	1	1	3	1	33

Table B.15. 2001-2009 Benton County crashes by manner of collision

			Man	ner of Colli	ision			
Year	Non-collision	Rear-end	Angle, oncoming left turn	Broadside	Sideswipe, same direction	Sideswipe, opposite direction	Unknown	Total
2001	1	1		1	1	1		5
2002	1	3	1	1				6
2003		1	1				1	3
2004	1	2				1	1	5
2005	1	1						2
2006	3	1						4
2007			1					1
2008	3	1		1				5
2009		1		1				2
Total	10	11	3	4	1	2	2	33

Table B.16. 2001-2009 Benton County crashes by hour of day

												Ho	ur of	Day										a
Year	0	1	2	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	Total
2001		1					1			1	1	1												5
2002							1									2	2	1						6
2003									1		1		1											3
2004						1											1	2			1			5
2005											1										1			2
2006			1	1													1			1				4
2007																	1							1
2008														1	1		1		2					5
2009													1			1								2
Total	0	1	1	1	0	1	2	0	1	1	3	1	2	1	1	3	6	3	2	1	2	0	0	33

Table B.17. 2001-2009 Benton County crashes by day of week and month

			Day	of W	eek								Мо	nth						
Year	Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	January	February	March	April	May	June	July	August	September	October	November	December	Total
2001				1	2	1	1	1	1			1				1		1		5
2002	2	1	1	1			1	1	1		1	1	1					1		6
2003		1			1		1				1		1						1	3
2004	2	1	2					1				1		2		1				5
2005						1	1		1			1								2
2006	1	1					2						1			1		2		4
2007			1														1			1
2008			1	1	2	1		1	1				2	1						5
2009			1		1						1								1	2
Total	5	4	6	3	6	3	6	4	4	0	3	4	5	3	0	3	1	4	2	33

Table B.18. 2001-2009 Benton County crashes by hour of day and crash severity

Crash												Ho	ur of	Day										al
Severity	0	1	2	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	Total
Fatal																					1			1
Major Injury						1					1													2
Minor Injury		1	1	1												1								4
Possible/ Unknown							1			1	1	1			1	2								7
PDO							1		1		1		2	1			6	3	2	1	1			19
Total	0	1	1	1	0	1	2	0	1	1	3	1	2	1	1	3	6	3	2	1	2	0	0	33

Table B.19. 2001-2009 Benton County crashes by day of week and crash severity

			Day	of W	eek			
Crash Severity	Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Total
Fatal							1	1
Major Injury			1				1	2
Minor Injury	1	1		1			1	4
Possible/Unknow n				1	3	1	2	7
PDO	4	3	5	1	3	2	1	19
Total	5	4	6	3	6	3	6	33

Table B.20. 2001-2009 Benton County crashes by light conditions

		Ligh	t Condi	tions		
Year	Daylight	Dark - Roadway Lighted	Dark - Roadway Not Lighted	Dark - Unknown Roadway Lighting	Unknown	Total
2001	4		1			5
2002	4	1	1			6
2003	3					3
2004	2		2		1	5
2005	1		1			2
2006			2	2		4
2007	1					1
2008	3	1		1		5
2009	2					2
Total	20	2	7	3	1	33

Table B.21. 2001-2009 Benton County crashes by weather conditions

			We	eather C	onditio	ns			
Year	Clear	Partly Cloudy	Cludy	Mist	Rain	Snow	Blowing Sand/Soil/ Dirt/Snow	Unknown	Total
2001	3		1		1				5
2002	3	1			2				6
2003		1	2						3
2004	1	1			1	1		1	5
2005		1	1						2
2006	1	1	1		1				4
2007					1				1
2008	3					1	1		5
2009	1			1					2
Total	12	5	5	1	6	2	1	1	33

Table B.22. 2001-2009 Benton County crashes by road surface conditions

		R	oad Su	rface Co	ondition	ıs		
Year	Dry	Wet	Snow	Slush	Sand/Mud/Dirt/Oil/ Gravel	Unknown	Not Reported	Total
2001	4	1						5
2002	3	3						6
2003	1			1	1			3
2004	2	1	1			1		5
2005	2							2
2006	2	1					1	4
2007		1						1
2008	3	_	2			_	_	5
2009	1	1						2
Total	18	8	3	1	1	1	1	33

Table B.23. 2001-2009 Benton County crashes by driver contributing circumstances

					Drive	er Cor	ntributing	Circu	mstai	nces					
Year	Exceeded authorized speed	Driving too fast for conditions	Made improper turn	Crossed centerline	Lost control	Followed too close	Swerved to avoid: vehicle/ objectnon-motorist/ animal in roadway	FTYROW: From stop sign	FTYROW: Making left turn	FTYROW: At uncontrolled intersection	FTYROW: Other	Other: Other improper action	Other: No improper action	Not reported	Total
2001			1	1	1		1	1	1				3		9
2002					2	1		2		3			4		12
2003					2				1			1	1	1	6
2004		2			1	1							3	1	8
2005	1											1	1		3
2006						1						1	5		7
2007											1		1		2
2008		1			1	2		1					3		8
2009			1			1							2		4
Total	1	3	2	1	7	6	1	4	2	3	1	3	23	2	59

Table B.24. 2001-2009 Benton County crashes by driver condition

	Dr	iver C	onditio	n	
Year	Apparently normal	Asleep/fainted/fatigued/etc.	Under the influence of alcohol/drugs/medications	Unknown	Total
2001	8	1			9
2002	12				12
2003					6
2004	6 7			1	8
2005	2		1		3
2006	5		2		7
2007	2				2
2008	8				8
2009	4				4
Total	54	1	3	1	59

Table B.25. 2001-2009 Benton County crashes by driver age

										Dr	iver A	ge										
Year	14-16	17	18	19	20	21-24	25-29	30-34	35-39	40-44	45-49	50-54	55-59	60-64	69-69	70-74	75-79	80-84	85-89	90-94	Unknown	Total
2001							2			1	1	2		1		1	1					9
2002		2	1	1		1		1		1	2		1	1			1					12
2003				1							1		2		1			1				6
2004								2	2	1		1			1	1						8
2005				1			1		1													3
2006						1	1			1	1	1					1				1	7
2007									1								1					2
2008		1		_	1	1	1		1	1	1	1					_		_		_	8
2009			1				1					1	1									4
Total	0	3	2	3	1	3	6	3	5	5	6	6	4	2	2	2	4	1	0	0	1	59

Table B.26. 2001-2009 Benton County crashes by driver age and crash severity

										Dr	iver A	ge										
Crash Severity	14-16	17	18	19	20	21-24	25-29	30-34	35-39	40-44	45-49	50-54	55-59	60-64	69-69	70-74	75-79	80-84	85-89	90-94	Unknown	Total
Fatal									1													1
Major Injury				1						1					1			1				4
Minor Injury		1		1		1				1	2						1					7
Possible/ Unknow n							3		1	2	1	3	1	1			2					14
PDO		2	2	1	1	2	3	3	3	1	3	3	3	1	1	2	1				1	33
Total	0	3	2	3	1	3	6	3	5	5	6	6	4	2	2	2	4	1	0	0	1	59

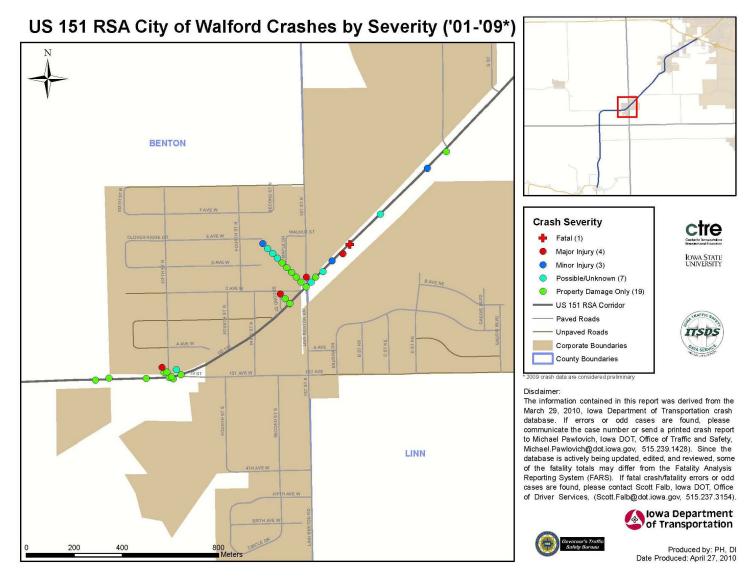


Figure B.6. 2001-2009 US 151 Walford crash map, by severity

US 151 RSA Linn County Crashes by Severity ('01-'09*) Legend ctre + Fatal (3) Major Injury (15) Minor Injury (27) IOWA STATE UNIVERSITY MAIN ST Possible Unknown (49) LINN ST Property Damage Only (147) US 151 RSA Corridor Paved Roads Unpaved Roads ITSDS Corporate Boundaries County Boundaries * 2009 data are considered preliminary lowa Department of Transportation WRIGHT BROTHER S BLVD Disclaimer: The information contained in this report was derived from the March 29, 2010, Iowa Department of Transportation 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). Since the database is actively being updated, edited, and reviewed, some of the fatality totals may differ from the Fatality Analysis Reporting System (FARS). If fatal 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). 3,000 Meters 500 1,000 2,000 Produced by: PH, DI Date Produced: April 27, 2010

Figure B.7. 2001-2009 US 151 Linn County crash map, by severity

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Table B.27. 2001-2009 Linn County crashes by major cause

														Majo	or Ca	use														
Year	Animal	Ran Traffic Signal	Ran Stop Sign	Crossed Centerline	FTYROW: From Stop Sign	FTYROW: From Yield Sign	FTYROW: Making Left Turn	FTYROW: From Driveway	FTYROW: Other	Traveling Wrong Way or on Wrong Side of Road	Driving too Fast for Conditions	Exceeded Authorized Speed	Made Improper Turn	Followed too Close	Operating vehicle*	Swerving/ Evasive Action	Over Correcting/ Over Steering	Equipment Failure	Ran Off Road - Right	Ran Off Road - Straight	Ran Off Road - Left	Lost Control	Inattentive/distracted by: Passenger	Inattentive/distracted by: Fatigued/asleep	Other: Vision Obstructed	Other: Other Improper Action	Unknown	Other: No Improper Action	Not Reported	Total
2001	1		1	1	2		2		1		2			1			1				1	1			1			2		17
2002			1	1	3	1		1	1		2			6	1	1			1			2				1	1			23
2003	2			1	2		3		1		1	1	1	5		1		1	2								2			23
2004	3			3	9		1	1			1	1	1	5		7			1			1				1	1	2		38
2005	3		2	2	1		1		1		4	1	1	3	1	3								1		2	1	1	1	29
2006	2			2	5	1	3	1	1	2	3		1	3					1				1				1			27
2007	3	1		2	3		2					1		6	1	2	1		2		2	1					2	2		31
2008	5			1	3	1	1	1		1	2			1		1					3	3			1	1	4			29
2009	6	1		1	4		1	1			3		1			2			1	1		2								24
Total	25	2	4	14	32	3	14	5	5	3	18	4	5	30	3	17	2	1	8	1	6	10	1	1	2	5	12	7	1	241

^{*}Operating vehicle in an erratic/reckless/careless/negligent/aggressive manner

Table B.28. 2001-2009 Linn County crashes by manner of collision

				Man	ner of (Collisio	n			
Year	Non-collision	Head-on	Rear-end	Angle, oncoming left turn	Broadside	Sideswipe, same direction	Sideswipe, opposite direction	Unknown	Not Reported	Total
2001	5	2	4	1	3		2			17
2002			13	3	4	2	1			23
2003	7		10	4	1			1		23
2004	10	2	14	1	9			1	1	38
2005	5	1	8	2	8	2	1	1	1	29
2006	6		6	4	7	4				27
2007	9	4	6	1	5	5	1			31
2008	11	1	2	1	5	4	2		3	29
2009	8		4		9			1	2	24
Total	61	10	67	17	51	17	7	4	7	241

Table B.29. 2001-2009 Linn County crashes by hour of day

												Hour	of Da	ay										a
Year	0	1	2	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	Total
2001				1			1	1		3	1			1	2	2	2			1	1		1	17
2002	1					1	1	1	1	2		4		2	3	2	5							23
2003	1	1				3	1	1		1		2		3	1	5	1		1	1		1		23
2004	1	1		1		2	2		2	2	1		1	2	8	4	4	3	1	2		1		38
2005	1						2	1				2	1	1	5	2	6	2		2	2	1	1	29
2006	1		1		1	4	1		1	3				2	3	1	5	1	1		1		1	27
2007	2			1	2	1	4	3	2		1	3			2	2	1	1	1	1	2		2	31
2008			1			2	2	5							4	2	4	2	4	2	1			29
2009	1				1	1		1	2	1		1	1	3	2	2	2	3	1			2		24
Total	8	2	2	3	4	14	14	13	8	12	3	12	3	14	30	22	30	12	9	9	7	5	5	241

Table B.30. 2001-2009 Linn County crashes by day of week and month

			Day	of W	eek								Мо	nth						
Year	Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	January	February	March	April	Мау	June	July	August	September	October	November	December	Total
2001	3	2		4	2	5	1	3	3	1	1			2		1	2		4	17
2002	4	3	3	7	2	3	1	2	1	4	3		1	2	2	2	3	2	1	23
2003	4	2	3	3	3	4	4	2			2	2	4		5		1	3	4	23
2004	4	4	5	4	6	10	5	4	6	3	1	2	1	6	1	5	2	3	4	38
2005	4	5	6	3	4	2	5	2	3	4	2	5	1		1	3	1	2	5	29
2006	3	5	5	4	6	2	2	4	4	2	3	2	1	3	1		2	2	3	27
2007	2	5	7	4	4	7	2	2	2	1	2	2	2	1	4	2	4	3	6	31
2008		5	8	5	4	4	3	4	4	3		4	2	2	3	1	2	2	2	29
2009	4	3	3	3	5	5	1		1	1	1	2	4	3		1	1	3	7	24
Total	28	34	40	37	36	42	24	23	24	19	15	19	16	19	17	15	18	20	36	241

Table B.31. 2001-2009 Linn County crashes by hour of day and crash severity

Crash												Hour	of Da	ay										al
Severity	0	1	2	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	Total
Fatal												1	1		1									3
Major Injury			1			2	1		2		1	1			2	1		2	2					15
Minor Injury						2		2	1	3	1	2		2	1	4	3		1	2	1		2	27
Possible/ Unknow n				1	1	2	7	4	1	3	1	2	1	4	10	2	7				2	1		49
PDO	8	2	1	2	3	8	6	7	4	6		6	1	8	16	15	20	10	6	7	4	4	3	147
Total	8	2	2	3	4	14	14	13	8	12	3	12	3	14	30	22	30	12	9	9	7	5	5	241

Table B.32. 2001-2009 Linn County crashes by day of week and crash severity

			Day	of W	eek			
Crash Severity	Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Total
Fatal				1		2		3
Major Injury	2	1	3	3	5	1		15
Minor Injury	3	5	5	2	3	6	3	27
Possible/Unknow n	7	9	7	7	6	8	5	49
PDO	16	19	25	24	22	25	16	147
Total	28	34	40	37	36	42	24	241

Table B.33. 2001-2009 Linn County crashes by light conditions

			Ligh	nt Conditi	ions			
Year	Daylight	Dusk	Dawn	Dark - Roadway Lighted	Dark - Roadway Not Lighted	Unknown	Not Reported	Total
2001	12	1			4			17
2002	20			3				23
2003	15	1	1	4	2			23
2004	25	1	2	3	4		3	38
2005	17	2		2	4	1	3	29
2006	15		2	6	3		1	27
2007	19	1		5	4		2	31
2008	15		1	3	3	1	6	29
2009	13		1	2	1		7	24
Total	151	6	7	28	25	2	22	241

Table B.34. 2001-2009 Linn County crashes by weather conditions

					Weat	her Cond	itions					
Year	Clear	Partly Cloudy	Cloudy	Fog/Smoke	Mist	Rain	Sleet/Hail/Freezing Rain	Snow	Blowing Sand/Soil/ Dirt/Snow	Not Reported	Unknown	Total
2001	6	5				1	1	3	1			17
2002	10	5	4			3		1				23
2003	9	5	6		1			2				23
2004	17	11	4		2	1				3		38
2005	7	6	4	1		1	1	5		3	1	29
2006	13	4	4	1		3	1			1		27
2007	16	2	5					5		3		31
2008	11	3	5			1		1	1	6	1	29
2009	8	3	4	1				2		6		24
Total	97	44	36	3	3	10	3	19	2	22	2	241

Table B.35. 2001-2009 Linn County crashes by road surface conditions

			Road Su	ırface Co	onditions	S		
Year	Dry	Wet	eo]	Snow	Slush	Unknown	Not Reported	Total
2001	10	1	5		1			17
2002	17	5	1					23
2003	19	2	1	1				23
2004	28	7					3	38
2005	16	1	3	4	1	1	3	29
2006	20	4	1				2	27
2007	20	2	3	3			3	31
2008	13	2	4	3		1	6	29
2009	11	3	3	1			6	24
Total	154	27	21	12	2	2	23	241

Table B.36. 2001-2009 Linn County crashes by driver contributing circumstances

										Driver C	ontril	outing	Circu	mstan	ces									
Year	Ran traffic signal	Ran stop sign	Exceeded authorized speed	Driving too fast for conditions	Made improper turn	Traveling wrong way or on wrong side of road	Crossed centerline	Lost control	Followed too close	Swerved to avoid: vehicle/object/ non-motorist/animal in roadway	Over correcting/over steering	FTYROW: From stop sign	FTYROW: From yield sign	FTYROW: Making left turn	FTYROW: From driveway	FTYROW: Other	Inattentive/distracted by: Passenger	Inattentive/ distracted by: Fatigued/asleep	Other: Vision obstructed	Other: Other improper action	Other: No improper action	Not reported	Unknown	Total
2001		1		2			1	1	2		1	2		1		1			2	1	9	6		30
2002		1		3			1	3	7			3	2		1	1				2	20	4		48
2003			1	1	2		1	5	4			2		2		1					15	4	1	39
2004			2	2	1	1	1	5	5	4		9		1	1		1	1		4	25	7		70
2005		2	1	5	1		1	1	3	2		1		1		1		1		3	20	11		54
2006				5	1	2	2	1	3	1		5	1	3	1	2	1				21	3	1	53
2007	1		1				2	5	6	1	1	3		2			·			1	26	2	5	56
2008				2		1	1	6	2	2		3	1	1	1				1	1	16		10	48
2009	1			3	1		1	2			,	4		1	1			1		2	20		2	39
Total	2	4	5	23	6	4	11	29	32	10	2	32	4	12	5	6	2	3	3	14	172	37	19	437

Table B.37. 2001-2009 Linn County crashes by driver condition

			Driv	ver Cond	lition			
Year	Apparently normal	Emotional	Asleep/fainted/fatigued/etc.	Under the influence of alcohol/ drugs/medications	Other	Unknown	Not reported	Total
2001	25		1				4	30
2002	44						4	48
2003	31	1		3		2	2	39
2004	58	1	2	1		1	7	70
2005	43		1	2	1	1	6	54
2006	47			3	1		2	53
2007	44	2		1	1	2	6	56
2008	36					1	11	48
2009	31		1	1			6	39
Total	359	4	5	11	3	7	48	437

Table B.38. 2001-2009 Linn County crashes by driver age

											Dr	iver A	ge											
Year	14	15	16	17	18	19	20	21-24	25-29	30-34	35-39	40-44	45-49	50-54	55-59	60-64	62-69	70-74	75-79	80-84	85-89	90-94	Unknown	Total
2001	1		2	2	1			2	3	1	3	2	3	2	4	2				2				30
2002			2		1	2	1	6	5	4	6	6	3	4	2			2	3				1	48
2003			2		1		1	5	6		3	4	6	2	2	1	1		4			1		39
2004			3	1	4	3	2	6	8	4	12	4	8	4	2	2	1	1			3		2	70
2005		1	2	1	5	3	2	8	2	3	2	6	4	5	2	4	3			1				54
2006		1	2	2		1	1	6	7	5	7	5	2	2	4	2	4	2						53
2007		1	1			2	3	6	7	4	6	8	3	7	2	1		2	2				1	56
2008				3	3	2	1	5	5	6	3	3	3	4	3	2	1	3					1	48
2009			4	2	2			2	2	2	4	4	4	6		1	1	1	3		1			39
Total	1	3	18	11	17	13	11	46	45	29	46	42	36	36	21	15	11	11	12	3	4	1	5	437

Table B.39. 2001-2009 Linn County crashes by driver age and crash severity

											Dr	iver A	ge											
Crash Severity	14	15	16	17	18	19	20	21-24	25-29	30-34	35-39	40-44	45-49	50-54	55-59	60-64	69-69	70-74	75-79	80-84	85-89	90-94	Unknown	Total
Fatal								1				1	1	1		1				1				6
Major Injury			3	1	1		1	2	1	1	3	2	5	3	3		1		1	1				29
Minor Injury			2	1	2	2	1	1	5	4	7	8	6	3		4		1			1		1	49
Possible/ Unknown	1	1	5	2	5	6	2	9	16	4	10	5	6	9	5	1	2	4	4				1	98
PDO		2	8	7	9	5	7	33	23	20	26	26	18	20	13	9	8	6	7	1	3	1	3	255
Total	1	3	18	11	17	13	11	46	45	29	46	42	36	36	21	15	11	11	12	3	4	1	5	437

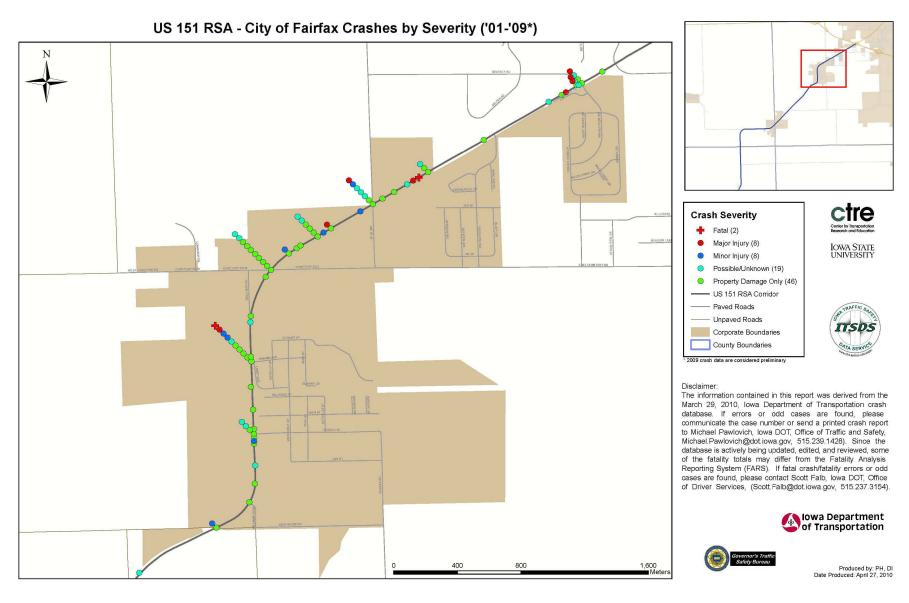


Figure B.6. 2001-2009 US 151 Fairfax crash map, by severity

Table B.40. First driver contributing circumstances by crash severity for all three counties

											First	Driver C	ontri	butin	g Circ	cumst	ance										
Crash Severity	Ran traffic signal	Ran stop sign	Exceeded authorized speed	Driving too fast for conditions	Made improper turn	Traveling wrong way/on wrong side of road	Crossed centerline	Lost control	Followed too close	Swerved to avoid: vehicle/object/non- motorist/animal in roadway	Over correcting/over steering	Operating vehicle in an erratic/reckless/ careless/ negligent/aggressive manner	FTYROW: From stop sign	FTYROW: From yield sign	FTYROW: Making left turn	FTYROW: From driveway	FTYROW: At uncontrolled intersection	FTYROW: Other	Inattentive/distracted by: Passenger	Inattentive/distracted by: Fallen object	Inattentive/distracted by: Fatigued/asleep	Other: Vision obstructed	Other: Other improper action	Other: No improper action	Not Reported	Unknown	Total
Fatal			2			2	2			1						1								4			12
Major Injury		1	2				4	9		1			4		1	1		2						17	2	2	46
Minor Injury		2		5	1		1	5	4	1			4		1	1			1				5	26	6	1	64
Possible/Unknown	1	1		5	2	1	5	7	14	3			8	1	5	1		1		1			1	52	10	3	122
PDO	1	4	2	19	5	2	4	25	26	8	2	1	23	3	7	2	3	8	1		3	3	13	139	49	23	376
Total	2	8	6	29	8	5	16	46	44	14	2	1	39	4	14	6	3	11	2	1	3	3	19	238	67	29	620

Table B.41. Second driver contributing circumstances by crash severity for all three counties

					S	econd D	river	Cont	ributi	ng Circu	ımstanc	e				
Crash Severity	Crossed centerline	Lost control	Followed too close	Swerved to avoid: vehicle/objecthon-motorist/animal in roadway	Over correcting/0ver steering	Operating vehicle in an erratic/reckless/ careless/negligent/aggressive manner	FTYROW: From stop sign	FTYROW: Making left turn	FTYROW: Other	Inattentive/distracted by: Use of phone Of other device	Inattentive/distracted by: Fatigued/asleep	Other: Vision obstructed	Other: Other improper action	Not Reported	Unknown	Total
Fatal	1	1		1										9		12
Major Injury		2	1	2						1		1		36	3	46
Minor Injury		2	2	1	1	1				1	1			53	2	64
Possible/ Unknown		4	1		1	2					1		1	98	14	122
PDO		11	3	7	2	2	1	4	3	2		1	3	324	13	376
Total	1	20	7	11	4	5	1	4	3	4	2	2	4	520	32	620

Table B.42. Iowa County first driver contributing circumstances by crash severity

					F	irst C	river Co	ontributing	Circu	ımsta	nce						
Crash Severity	Ran Stop Sign	Driving too Fast for Conditions	Traveling Wrong Way/on Wrong Side of Road	Crossed Centerline	Lost Control	Followed too Close	Swerved to avoid: vehicle/object'non- motorist'animal in roadway	Operating Vehicle in an erratic/reckless/ careless/negligent/aggressive manner	FTYROW: From Stop Sign	FTYROW: From Driveway	FTYROW: Other	Inattentive/distracted by: Fallen Object	Other: Other Improper Action	Other: No Improper Action	Not Reported	Unknown	Grand Total
Fatal			1	1			1							2			5
Major Injury	1			2	3		1		1		1			3		1	13
Minor Injury	1				1								1	4	1		8
Possible/Unknown		1			1							1		3	3	1	10
PDO	2	2		1	5	6	1	1	2	1	3		1	31	24	8	88
Total	4	3	1	4	10	6	3	1	3	1	4	1	2	43	28	10	124

Table B.43. Iowa County second driver contributing circumstances by crash severity

	Sec	cond Dr	iver C	ontri	butin	g Circ	cumsta	nce
Crash Severity	Lost Control	Swerved to avoid: vehicle/object non-motorist/animal in roadway	Over correcting/over steering	FTYROW: From Stop Sign	FTYROW: Other	Other: Other Improper Action	Not Reported	Total
Fatal		1					4	5
Major Injury		2					11	13
Minor Injury			1				7	8
Possible/Unknown	1						9	10
PDO	1			1	1	1	84	88
Total	2	3	1	1	1	1	115	124

Table B.44. Benton County first driver contributing circumstances by crash severity

					First	Drive	r Contri	butin	g Circ	cums	tance				
Crash Severity	Exceeded authorized speed	Driving too Fast for Conditions	Made Improper Tum	Crossed Centerline	Lost Control	Followed too Close	Swerved to avoid: vehicle/object/non-motorist/animal in roadway	FTYROW: From Stop Sign	FTYROW: Making Left Turn	FTYROW: At Uncontrolled Intersection	FTYROW: Other	Other: Other Improper Action	Other: No Improper Action	Not Reported	Total
Fatal	1														1
Major Injury					2								1	1	4
Minor Injury						2						1	4		7
Possible/Unknown			1	1	2	2	1	2					5		14
PDO		3	1		3	2		2	2	3	1	2	13	1	33
Total	1	3	2	1	7	6	1	4	2	3	1	3	23	2	59

Table B.45. Benton County second driver contributing circumstances by crash severity

	Seco	nd Dri	ver Co	ntribut	ting Ci	rcumst	ance
Crash Severity	Lost Control	Followed too Close	FTYROW: Making Left Turn	Inattentive/distracted by: Fatigued/asleep	Not Reported	Unknown	Total
Fatal	1						1
Major Injury					3	1	4
Minor Injury				1	6		7
Possible/Unknown		1			5	8	14
PDO	2		1		26	4	33
Total	3	1	1	1	40	13	59

Table B.46. Linn County first driver contributing circumstances by crash severity

									Fir	st Drive	r Con	tribut	tina C	ircun	nstan	Ce								
Crash Severity	Ran Traffic Signal	Ran Stop Sign	Exceeded Authorized Speed	Driving too Fast for Conditions	Made Improper Turn	Traveling Wrong Way/on Wrong Side of Road	Crossed Centerline	Lost Control	Followed too Close	Swerved to avoid: vehicle/object/non- motorist/animal in roadway	Over correcting/over steering	FTYROW: From Stop Sign	FTYROW: From Yield Sign	FTYROW: Making Left Turn	FTYROW: From Driveway	FTYROW: Other	Inattentive/distracted by: Passenger	Inattentive/distracted by: Fatigued/asleep	Other: Vision Obstructed	Other: Other Improper Action	Other: No Improper Action	Not Reported	Unknown	Total
Fatal			1			1	1								1						2			6
Major Injury			2				2	4				3		1	1	1					13	1	1	29
Minor Injury		1		5	1		1	4	2	1		4		1	1		1			3	18	5	1	49
Possible/Unknown	1	1		4	1	1	4	4	12	2		6	1	5	1	1				1	44	7	2	98
PDO	1	2	2	14	4	2	3	17	18	7	2	19	3	5	1	4	1	3	3	10	95	24	15	255
Total	2	4	5	23	6	4	11	29	32	10	2	32	4	12	5	6	2	3	3	14	172	37	19	437

Table B.47. Linn County second driver contributing circumstances by crash severity

					Sec	ond Driver	Contr	ributii	ng Circu	ımsta	nce				
Crash Severity	Crossed Centerline	Lost Control	Followed too Close	Swerved to avoid: vehicle/object/non- motorist/animal in roadway	Over correcting/over steering	Operating Vehicle in an erratic/reckless/ careless/negligent/aggressive manner	FTYROW: Making Left Turn	FTYROW: Other	Inattentive/distracted by: Use of Phone or Other Device	Inattentive/distracted by: Fatigued/asleep	Other: Vision Obstructed	Other: Other Improper Action	Not Reported	Unknown	Total
Fatal	1												5		6
Major Injury		2	1						1		1		22	2	29
Minor Injury		2	2	1		1			1				40	2	49
Possible/Unknown		3			1	2				1		1	84	6	98
PDO		8	3	7	2	2	3	2	2		1	2	214	9	255
Total	1	15	6	8	3	5	3	2	4	1	2	3	365	19	437

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Table B.48. 2001-2009 County crash rates

County	Total Length (Miles)	Total VMT (Daily)	Location	Total Crash Count	Crash Rate Based on Total Crashes	Injury Crashes (Including Fatal)	Crash Rate Based on Injury Crashes	Injury Crashes (Not including Fatal)	Crash Rate Based on Non-Fatal Injury Crashes
Benton	2.62	12,825	RURAL	28	66.46	6	14.24	5	11.87
Benton	0.32	1,756	URBAN	5	86.68	1	17.34	1	17.34
lowa	4.19	24,210	RURAL	86	108.14	14	17.60	12	15.09
Linn	1.71	18,848	RURAL NORTH	124	200.27	19	30.69	19	30.69
Linn	3.28	22,589	RURAL SOUTH	49	66.03	12	16.17	11	14.82
Linn	2.09	15,697	URBAN	68	131.87	14	27.15	12	23.27

Crash Rate = Number of Crashes x 100,000,000 / VMT x Analysis Period (years) x 365

Disclaimer: The information contained in this report was derived from the March 29, 2010 Iowa Department of Transportation crash database. 2009 data are preliminary and continually being updated. Data may not contain all 2009 crashes. 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). Since the database is actively being updated, edited, and reviewed, some of the fatality totals may differ from the Fatality Analysis Reporting System (FARS). If fatal 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).

APPENDIX C. TRAFFIC VOLUME DATA

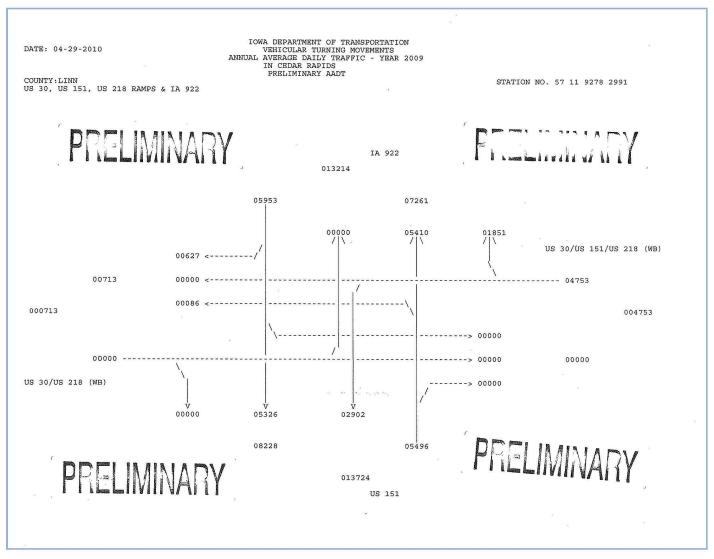


Figure C.1. 2009 US 151, IA 922, and US 30/US 218 westbound ramps average daily traffic

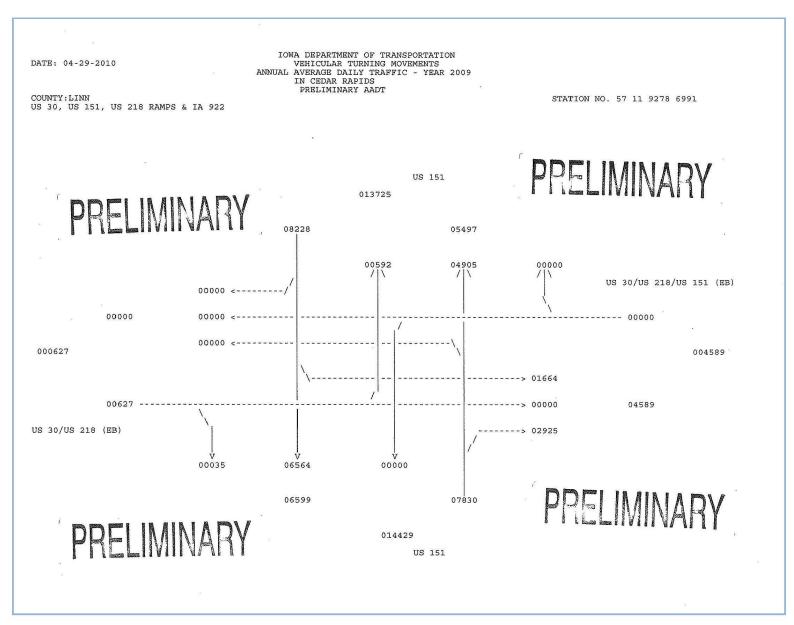


Figure C.2. 2009 US 151, IA 922, and US 30/US 218 eastbound ramps average daily traffic

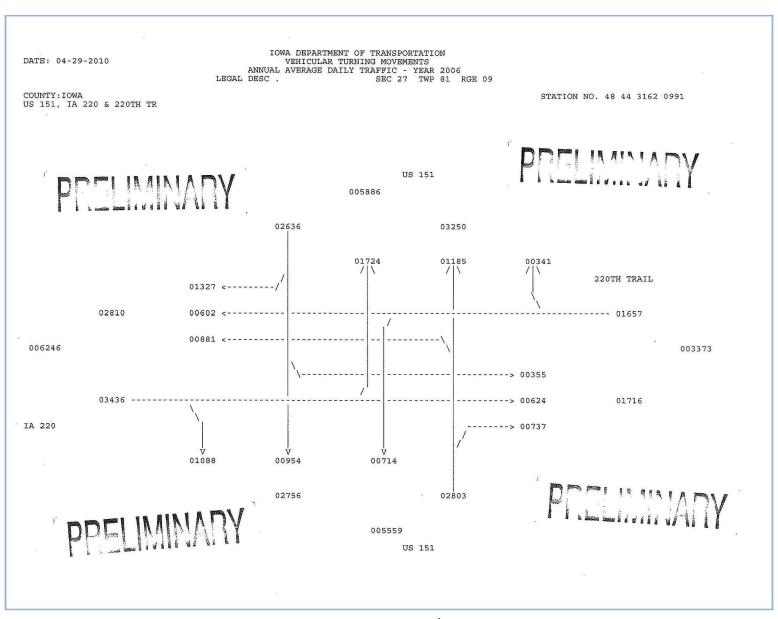


Figure C.3. 2006 US 151, IA 220, and 220th Trail average daily traffic