IOWA STATE UNIVERSITY
Institute for Transportation

Evaluation of Mitigation for Safety Concerns on Low-Volume, Unpaved Rural Roads

tech transfer summary

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RESEARCH PROJECT TITLE
Evaluation of Mitigation for Safety Concerns on Low-Volume, Unpaved Rural Roads

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

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An examination of low-cost safety options can help identify potentially-beneficial mitigation for common crashes on unpaved rural roads and provide multidisciplinary tools for local agencies to use to reduce crashes.

Background

The Institute for Transportation (InTrans) at Iowa State University completed work on an in-depth study of crash history on low-volume, rural roads in Iowa in December 2010. Results of that research indicated that a certain class of rural roadway—unpaved roads with traffic volumes greater than 100 vehicles per day (vpd)—exhibit significantly higher crash frequencies, rates, and densities than any other class of low-volume road examined, paved or unpaved (Souleyrette et al. 2010).

For all classes reviewed, the highest crash frequencies, rates, and densities were found for unpaved, rural roads with traffic volumes between 100 and 400 vpd. While having a higher crash history, this class of secondary road involves only about 4,400 total miles of roadway among Iowa's 99 counties, averaging fewer than 45 miles of roads per county on which to focus enhanced crash mitigation efforts.

Among the major contributing factors to crashes on these roads were higher speeds and younger driver involvement. The final 2010 report included recommendations for crash mitigation, such as enhanced law enforcement, younger driver education, and several low-cost engineering improvements, including upgraded signing, particularly at horizontal curves, and roadside delineation.

Portion of 530th (Grant) Avenue between Ames and Gilbert, Iowa

The recommendations also included additional study of the possible effectiveness of reduced legal speed limits (currently 55 mph in Iowa for daylight hours and 50 mph at night) and development of a crash prediction model for this class of roadway.

Project Objectives

The purpose of this study was to identify and examine several unpaved, local road segments with higher than average crash frequencies, select and undertake potentially-beneficial mitigation, and evaluate the results as time allowed. A variety of low-cost options were considered, including engineering improvements, enhanced efforts by law enforcement, and educational initiatives.

Methodology

InTrans researchers identified several low-volume, local, unpaved road segments in central Iowa (to reduce time and travel costs for the study) and contacted local agencies for interest in cooperating in this low-cost safety improvement effort. InTrans staff then worked with those local agencies to identify possible causations and to select possible crash-reducing, multidisciplinary mitigation strategies.

Engineering strategies included such low-cost improvements as signing upgrades and chevron and/or delineator installation.

County law enforcement agencies were also invited to participate, initially by attending meetings and field reviews to identify problems and later by applying increased patrols and enforcement efforts during time periods identified by the crash data and/or speed studies.

In some counties, local news media were advised of the program and meetings with school officials and driving instructors were sought where significant younger driver crash involvement had been determined. These efforts helped focus attention on safety improvements for these selected roadways while soliciting additional input, including perceived concerns with mitigation strategies, as well as multidisciplinary local involvement.

Key Findings

Commonly-held assumptions regarding major crash contributors did not appear to be completely valid for the segments studied. For example, many of the high-crash study segments exhibited greater roadway widths than other similar roads; granular surfaces were uniform, well-maintained, and without excessive loose aggregate; and segments had very little horizontal curvature and were flat or slightly rolling in vertical alignment.

In addition, as shown in the discussion of comparison between traffic volume and crash frequency in the report, little correlation was shown here either. Other possible crash contributors need to be identified in additional studies.

Most drivers on these roads were presumed to be local, so familiarity with the terrain and roadway features may negate the potential safety impacts of road design deficiencies, such as narrow width, topography, and unpaved surface characteristics.

When located near high schools, younger driver involvement in crashes appeared higher. A revision in younger driver education programs would undoubtedly benefit by including instruction and practice driving on unpaved, rural road surfaces in the curriculum.

From experience in polling drivers, it could be concluded that many are not aware of the statutory speed limit for unpaved roads in Iowa (55 mph daytime and 50 mph nighttime). Posting of these regulations in key locations may yield positive results in raising driver awareness for proper vehicle operation.

Some segments indicated speed as a probable crash contributor. Although not evident uniformly among all study segments, a reduced regulatory speed limit might prove beneficial in modifying driver behavior, if supported by adequate signage and enforcement.

The project did afford an opportunity to implement a variety of low-cost, multidisciplinary mitigation to address safety on lower-volume, unpaved roads.

The relatively small sample of study sites from a concentrated area in Iowa may have contributed to potentially misleading results. An expanded evaluation that would examine a wider scope of rural areas across the entire state may yield different findings.

A longer evaluation period would be needed to more completely and fully assess the potential beneficial impacts on crash reductions that the selected mitigations might have.

Local law enforcement agencies would need additional funding support to apply enhanced enforcement on these low-volume, unpaved roadways.

Public education through local news media and presentations at high schools and service clubs describing crash history and safety concerns on low-volume, unpaved, rural roads should also prove worthwhile.

Due to the existence of extensive crash and roadway databases, Iowa is in a unique position to study potential safety concerns on low-volume, unpaved, rural roads and to develop useful mitigation.

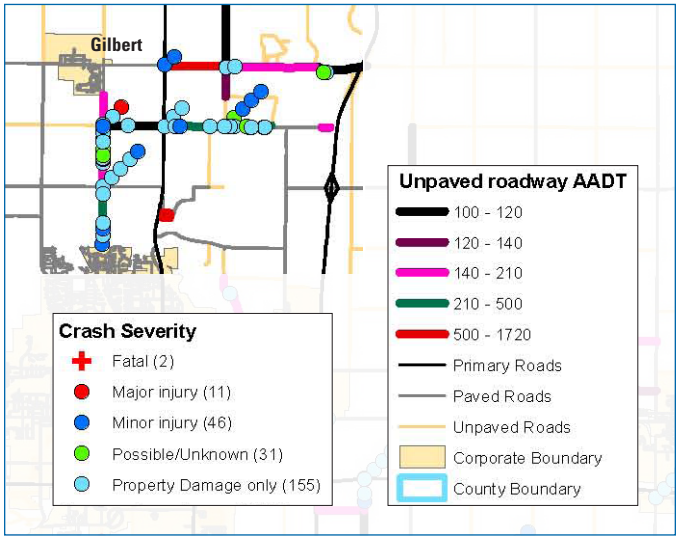
Implementation Readiness

Considering the relatively low mileage (averaging fewer than 45 miles per county statewide) of unpaved rural roads with traffic volumes exceeding 100 vpd, local agency engineers should consider identifying these segments and examining crash data for application of low-cost improvements where it is concluded to be potentially beneficial.

Local agencies can follow the methodology used for this project within their own counties/jurisdictions and InTrans staff are available to assist in these efforts:

1. Using Iowa Department of Transportation (DOT) traffic estimates and county maps, which are available at www.iowadot.gov/maps/, identify rural, unpaved road segments with more than 100 vpd.

2. Analyze crashes for the last 10 years on those roads using the Iowa DOT Crash Mapping Analysis Tool (CMAT) to determine if there appear to be high crash frequencies, rates, or densities on any segments. The Iowa DOT Crash analysis website at www.iowadot.gov/crashanalysis/ is a good reference that can be used to compare crash frequencies with similar secondary roads statewide.



Sample Data: Crash clusters by severity for 530th (Grant) Avenue (shown vertically from south to north) from the north corporate limits of Ames to the south limits of Gilbert 2001 through 2010

3. Review and assess the road segments further with engineering staff, local law enforcement, and others who are familiar with these roads using InTrans for assistance if needed. Conduct meetings and field reviews of the segment(s). (Notes from field reviews and meetings conducted during the course of this study are included in the final project report, along with samples of the crash data and speed study results shared at meetings, as well as a list of young driver education resources.)

4. Identify and implement potential multidisciplinary safety awareness and crash mitigation strategies.

5. Follow up with an analysis of benefits in the future and document those results.

2.45 miles, 10 year period

29 total crashes, 21 injuries, no fatalities, including
1 animal
1 ran Stop sign
3 FTYROR (from Stop sign and from uncontrolled intersection)
15 speed related
4 ROR

No adverse surface conditions reported

40 total drivers, including
22 teenaged (55%)
1 +65
1 impaired driver

Objects struck include
12 ditch/embankment

Major hours of day for crashes
5 from 6:00 a.m. to 8:00 a.m. (17%)
18 from 2 p.m. to 8:00 p.m. (62%)

Sample Data: Crash history for 530th (Grant) Avenue from the north corporate limits of Ames to the south limits of Gilbert 2001 through 2010

Sample Mitigation: New, highly-reflective delineators and signs installed in Dallas and Story counties

Examples of options that can be used in this process are included in the final project report appendices, including a sample press release about enhanced enforcement efforts and an enhanced enforcement reporting spreadsheet to track those results. In addition, an InTrans guide, *Traffic Safety Analysis for Local Agencies*, details crash data analysis steps, Iowa crash analysis data resources and tools, and potential countermeasures that can be employed, as well as possible funding for improvements (McDonald 2012).

Future Research Recommendations

To supplement the methods employed with this project, future research should consider and evaluate other methods of data collection and crash mitigation.

Given that a high percentage of serious-result crashes are recorded on two-lane, rural roads, and many of those are on unpaved roads, additional research should be undertaken to consider a statewide examination of this road type and more in-depth analysis of the contribution of younger drivers and speed to higher crash frequencies.

One aspect for additional research might include intermittent posting of statutory regulatory speed limits, day and night, on unpaved roads, along with an assessment of benefits as ascertained by speed studies.

Origin of drivers involved in crashes may prove beneficial in determining safety mitigation steps. An additional study could also include a crash reduction analysis of the mitigation applied under this and previous research projects.

A broader-scoped study may permit the development of a crash prediction model for this class of rural roadway, which would be quite valuable for local agencies.

References and Resources

Iowa DOT. Welcome to the Office of Transportation Data. (See for County Road Maps). www.iowadot.gov/maps/

Iowa DOT. City and County Annual Average Daily Traffic (AADT) Maps. www.iowadot.gov/maps//msp/traffic/index.html

Iowa DOT. Crash analysis website. Office of Traffic and Safety. www.iowadot.gov/crashanalysis/

McDonald, Tom. *Traffic Safety Analysis for Local Agencies*. Institute for Transportation, Iowa State University, Ames, IA. April 2012. www.intrans.iastate.edu/research/projects/detail/?projectID=-1711250359

Souleyrette, R. R., M. Caputcu, T. J. McDonald, R. B. Sperry, Z. Hans, D. Cook. *Safety Analysis of Low-Volume Rural Roads in Iowa*. Institute for Transportation, Iowa State University, Ames, IA. December 2010. www.ctre.iastate.edu/research/detail.cfm?projectID=-1080103903