# State of Iowa Highway-Rail Grade Crossing Safety Action Plan

## Program for Implementation in Calendar Years 2012 -2016

IOWA DEPARTMENT OF TRANSPORTATION;OFFICE OF RAIL TRANSPORTATION

Revised **8/31/2012**

It is the purpose of this action plan through analysis, discussion, and partnership, to lay a framework for continued reductions in collisions at Iowa's highway-rail grade crossings.

# State of Iowa

# Highway-Rail Grade Crossing Safety

# Action Plan

# Executive Summary

Because Iowa's collision experience ranked in the top ten states for the years 2006 through 2008, the state was mandated by 49 CFR Part 234, "State Highway-Rail Grade Crossing Action Plans," to submit an action plan to the Federal Railroad Administration promoting safety at highway-rail grade crossings. The task was undertaken by the Iowa Department of Transportation's Office of Rail Transportation in cooperation with the Office of Traffic and Safety, the Office of Local Systems, the Research Bureau, Iowa Operation Lifesaver, and the railroads operating within the state. It is planned for implementation in the calendar years 2012 through 2016.

This document describes the current practices of programs relating to crossing safety. Most of these programs determine priority, in whole or in part, based on Iowa's "Benefit-Cost" ratio, which is a state specific adaptation of the GradeDec calculations. A synopsis is presented for Iowa's programmed use of 23 U.S.C § 130 funds for the Iowa Highway Grade Crossing Safety Fund as well as Iowa Code § 312.2 allocations for the Highway Railroad Crossing Surface Repair Fund. Also presented are state allocations for the Iowa Highway Grade Crossing Safety Fund to be used for signal maintenance, State Highway funds used for surface repairs at crossings on state-owned roads, and a background on Iowa Operation Lifesaver.

An analysis was conducted for highway-rail grade crossing collisions for the calendar years 2005 through 2009. Although many analytical queries and cross tabulations were performed, this report only illustrates those that either represent areas with significant findings or those that have been assumed to be significant but have little variation from what would be expected when compared to other data. The analytical graphs are organized into *demographic*, *temporal*, *modal*, and *location* groups.

It was found that the primary target for safety considerations was males under the age of 25, but males in general constitute 78% of all drivers in collisions. When compared with the percentage of traffic on the road, the time period between 10 p.m. and 3 a.m. is over-represented. The type of vehicle being driven was proportionate to the vehicles in the traffic stream. However, crossings on local municipal streets and secondary roads experienced 95% of all collisions. Many of these had vehicle speeds below 25 mph and train speeds below 15 mph.

A study of the number of collisions from 1980 through 2009 is displayed with a best-fit exponential curve and upper and lower control limits. This 30 year history demonstrates a trend line annual reduction of 4.2% with a 71.2% reduction, overall. However, it has also been noted that the utility of the current programs appears to have leveled off over the past decade.

The scale of the remaining number of annual collisions, with the speculation that results of the actions introduced may not show measureable effects within the five-year implementation period, lead to a short-term goal of maintaining the current downward trend. At the end of the period a new trendline will be calculated to quantify measureable effects.

The specific action items are:

Education

- ACTION A: College and High School Education Campaign
- ACTION B: Family Education Partnerships

Enforcement

- ACTION C: Enforcement/Judicial Awareness Campaign

Engineering

- ACTION D: Rumble strips on paved secondary roads
- ACTION E: Verify Engineering for pre-emption signal timing
- ACTION F: Crossing Signal Light LED Conversion Study
- ACTION G: Develop Closure rating criteria

Funding Programs

- ACTION H: Closure as part of the Grade Crossing Surface Repair Program
- ACTION I: Closure incentives for Section 130 program
- ACTION J: Decrease reallocation of Section 130 funds
- ACTION K: Passenger Rail
- ACTION L: Advocate continuation of 23 U.S.C §130 and increased railroad safety funding

Preliminary roles and responsibilities of partners have been presented to guide implementation. Although no formal agreements are in place, representatives from coordinating partners have had opportunity to review this document and provide input and comments.

Finally, types of measurements for individual actions have been defined, as well as methodology for an overall evaluation of the combined actions and the action plan itself.

As directed by the 49 CFR Part 234, "State Highway-Rail Grade Crossing Action Plans," these actions and current practices address:

(i) "specific solutions for improving safety" through new or expanded educational, enforcement, and engineering programs (Action Items A – F, J, and L), as well as new incentives for crossing closures (Action Items G, H, I, and K). At present, federal and state funds cannot sustain any type of standardized highway-rail grade separation program.

(ii) a "focus on crossings that have experienced multiple accidents" through our current and continuing approach of aggressively confronting locations with multiple accidents.

(iii) a plan that will cover "a five-year time period.

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# SCOPE

## Introduction

The State of Iowa has shown a longstanding commitment to improving safety for all modes of transportation. Despite increases in train and vehicle traffic, this has been demonstrated at Iowa's public railroad crossings by an annual 4.2% trendline decrease in collisions from 1980 through 2009. It is the purpose of this action plan through analysis, discussion, and partnership, to lay a framework for continued reductions in collisions at Iowa's highway-rail grade crossings.

Although the impetus for this action plan may be the 49 CFR Part 234, "State Highway-Rail Grade Crossing Action Plans," the State of Iowa accepts this not only as a mandate, but as an opportunity. By direction of this final rule, we will instigate discussions with old and new partners to build safer interaction between Iowa's highway and railroad networks.

Through new action steps or by explanation of current programs, as stated in the §234.11(c)(2) of the CFR this action plan will:

(i) Identify specific solutions for improving safety at crossings, including highway-rail grade crossing closures or grade separations
(ii) Focus on crossing that have experienced multiple accidents or are at high risk for such accidents, and
(iii) Cover a five-year time period

The focus of this action plan is a system-wide approach to reduce *ALL* collisions. The number of fatalities per year at highway-rail grade crossings has become low enough that it may be considered merely an anomaly of collisions in general. Therefore, the aim is to reduce fatal, injury, and property-only collisions by analyzing trends system-wide and instituting or modifying programs and practices to more precisely target state and private resources throughout Iowa's rail network.

This action plan will provide a synopsis of the Iowa Department of Transportation's current programs and activities, an historical analysis of collisions, and an overview of the input provided by other offices within the Iowa DOT and entities outside the department. From these, a set of specific goals and responsibilities will be defined, as well as metrics to measure achievements.

## Background

Highway-Rail grade crossings continue to be a major national issue concerning public safety, capital and maintenance costs, and liability for both railroads and public jurisdictions. Due to increasing highway and rail traffic, and increasing vehicle speeds made possible by industry improvements, the highway-rail grade crossing safety issue will continue to be a focal point for the department.

By Iowa code, final decisions concerning crossing protection on roads not owned by the state are made by the local highway jurisdiction or owner. The Iowa Department of Transportation has no authority to "require" installation of any active protection on these roads. Also, the agricultural nature of the state necessitates many private crossings for field accesses and the movement of livestock and produce.

Many programs have been initiated to encourage and help finance crossing closures and improved protection at public crossings. The track record of these programs can be seen in the facts listed below.

- There are 3,947 miles of track in Iowa, serving 90 of Iowa's 99 counties
- There are 4411 public and 2844 private highway-rail grade crossings in Iowa
- The Vehicle Miles of Travel (VMT) has risen from 18.3 billion in 1980 to almost 31.3 billion in 2009
- Railroads in Iowa moved approximately 125 million tons of freight by rail in 1985 compared to over 350 million tons in 2008
- In 2009, an average of nearly 5.4 million vehicles traversed a highway-rail grade crossing every day in Iowa
- In Iowa, there were 52 vehicle train collisions in 2009, which calculates to one collision for every 37,616,421 vehicles using an at-grade crossing.
- From 1980 through 2009, the exponential trendline demonstrates a 71.2% reduction in collisions at highway-rail grade crossings.

## Current Practice

Iowa's current practices are based on a four-point strategy summarized as:

- **Education:** The state maintains a working relationship with Iowa Operation Lifesaver. This organization exists to increase public awareness of grade crossing traffic laws and hazards.
- **Enforcement:** Laws pertaining to highway-railroad grade crossings and trespassing are a key component of discouraging unsafe behavior. Educational programs for the public,

as well as enforcement officers and the courts, regarding the possible consequences of breaking these laws help reduce the number of violators.

- **Engineering:** Maintenance and physical improvements to the crossings and highways are vital to the safety of the traveling public.
- **Funding Programs:** Programs in place to provide the grants to implement physical and system improvements along the rail network. The state identifies and prioritizes most highway crossing safety grant applications based on portions of the Iowa Benefit-Cost ratio.

**Iowa Benefit-Cost calculation**

To maintain a level of fiscal responsibility for taxpayer dollars it is understood that it isn't cost-effective to install lights and gates at every crossing. Statistics support that full active protection will not prevent every collision. To optimize resources the Iowa Department of Transportation has developed the *Use of a Benefit-Cost Ratio to Prioritize Projects for Funding* (January 2006).

This "Benefit-Cost (B-C) ratio", based primarily on the Federal Railroad Administration's (FRA) GradeDec, goes through a seven-step process to index exposure, predict the number of collisions, breakdown the number of predicted collisions by expected severity, estimate the societal cost of those collisions, extract the benefit in dollars for the proposed protection upgrades, total the cost of that upgrade, and divide the extracted benefit by the total cost. By doing this, the state can identify which projects provide the most protection in relation to the cost.

These calculations take into account the number of daily highway vehicles and trains that use the crossing broken down by time of day. They also incorporate whether the crossing is rural or urban, the number of highway lanes, pavement type, the number of tracks, train speed, the number of switching movements, and the number of collisions over the previous five years. The sensitivity of the formula to historical collisions is great enough to increase the adjusted predicted accidents result by a set amount approximately equal to the value assigned to a crossing if it had zero collisions (IE: 0 historical collisions = .4 predicted collisions, 1 historical collisions ≈ .8 predicted collisions, 2 historical collisions ≈ 1.2 predicted collisions, etc.). This automatically puts emphasis on locations where collisions have occurred in the recent past.

**23 U.S.C. § 130 Funds - Highway Grade Crossing Safety Fund**

Current Transportation Authorization through SAFETEA-LU includes funding for highway-rail grade crossing safety and is subject to future federal appropriations. Through this

appropriation the Iowa DOT receives approximately $4.5M each year that are intended to be used for eliminating hazards at highway-rail grade crossing. From this, one million dollars is directed each year to the Grade Crossing Surface Repair Program (as explained in a following section). The remaining funds are distributed by an application process for the specific purpose of upgrading crossing protection.

To award the grants, the Iowa DOT constantly maintains a list of the B-C ratio for every public crossing in the state. Once per year, all cities, counties and railroads are informed of the ratios for each crossing within their jurisdiction. They are advised to make note of any crossing with a B-C ratio greater than 1.0 and to consider submitting an application for upgrade.

The applications, which can be submitted by the railroad or the highway authority, are sorted according to the most current B-C ratio. Beginning from the highest ranking, projects are selected for examination until all funds are expended. The grants provide 90% of the project cost with 10% being paid by the applicant as negotiated between the highway authority and the railroad.

The examination may determine the protection upgrade, but the possibility of closure, as well as monetary compensation for that option, are a standard part of that discussion. By this U.S. Code, the program can match up to $7500 of any amount the railroad will pay for such compensation. However, the railroad is not limited to this amount.

If the examination determines the upgrade is not warranted, or if the highway authority and railroad cannot pay the 10% grant match for the project, those funds are returned to the grant pool. In an iterative process, selections and examinations continue until the funds are fully disbursed.

**Iowa Highway Grade Crossing Safety Fund for Maintenance**

In addition to the Section 130 funds, *Iowa Code §312.2* allocates $700,000 from the Road Use Tax Fund each year for the Highway Grade Crossing Safety Fund. The purpose of this program is to reimburse railroads for a portion of the annual maintenance costs associated with “active warning devices”. Examples of annual maintenance are costs incurred by a railroad for the repair or replacement of obsolete, worn out, damaged, vandalized, or missing component parts of an approved active warning device.

This money is allocated to all railroads operating in Iowa weighted by the number of crossings where protection upgrades have been funded by the state and the type of maintenance required. The total eligible maintenance costs in 2010 exceeded $2.2 million. The $700,000 reimburses approximately 32% of these costs.

**Iowa Highway Railroad Grade Crossing Surface Repair Fund**

Although it's the railroads' obligation to keep the crossings in adequate condition, finances prevent them from maintaining all of them to this level. By 1980 the crossing conditions had fallen into a state of disrepair. As a matter of public interest, a state program was initiated to ensure adequate surface conditions at public crossings. Currently, $900,000 is allocated each year by *Iowa Code §312.2* to aid in the rebuild costs for crossings on county and municipal roads.

On a continuing basis, public road jurisdictions or railroads can apply for these grants to rebuild deteriorating crossing surfaces, which includes the approaches. By Iowa Code, these grants are awarded with 60% of the total project cost being paid by the state's grant funds, 20% by the railroad, and 20% by the public road jurisdiction.

These state funds are then awarded according to state code on a "first come, first served" basis. As each grant comes to the top of the list an evaluation of the needs, known as an "Exhibit A," is conducted to outline the best approach to rebuild the crossing and define responsibilities for the award agreement.

Despite this program, by the year 2000 there was a 10-year backlog of grant applications remaining. It was determined that poor crossing surfaces could play a role in the safety of a crossing. Therefore since 2002, one million dollars in Section 130 funds have been directed on an annual basis to help support this program.

However, Iowa Code requires these funds to be awarded based on priority of needs. To achieve this, after the current state funds are expended, the exposure index from step 1 of the benefit-cost calculations is applied to the revised list of applications. The list is then sorted by highest exposure and the federal funds are awarded starting with the greatest result and continuing down the list until the one million dollars in section 130 funds are committed.

The State of Iowa is the responsible highway authority for primary road crossings. 174 public grade crossings on primary roads are not eligible for the surface program grants. It has been the current practice of the Iowa Department of Transportation's Highway Division to allocate $500,000 each year to maintain these crossing surfaces and approaches. The Iowa D.O.T. works cooperatively with the railroads to build primary road crossings. For a complete rebuild, this contracts with the railroad to pay for railroad ties, surface, etc., at a rate of $400 per lineal foot measuring along the tracks and including the traveled-way, as well as shoulders, sidewalks, and recreational trails where applicable.

**Iowa Operation Lifesaver**

Iowa Operation Lifesaver is a nonprofit education and awareness program dedicated to ending tragic collisions, fatalities and injuries at highway-rail grade crossings and on railroad rights-of-way. It began in Iowa under the auspices of the National Safety Council in 1978 with program management conducted by the Iowa DOT.

Since 2001, it has operated as a non-profit organization separate from the Department. The railroads operating in Iowa, state and local law enforcement organizations, Federal Railroad Administration, and the department provide volunteer staffing for the Iowa committee focusing on education concerning railroad safety, engineering improvements of crossings, and enforcement of current laws.

Although the program is funded in part by a national organization as well as the Iowa Association of Railroad Passengers, most of the financial support comes from the railroads. Each year, a request is made of all partnering entities with railways that cross any public road in the amount of $7 per crossing. The Department also provides in-kind funding through specific services. This combination of funding provided operating capital of approximately $30,000 in 2010.

Because the presentation and training staff are certified volunteers, the operating capital is spent mainly on administration, advertising, and educational materials. This has positioned Iowa Operation Lifesaver as the “public face” for railroad crossing safety and an integral part of the efforts in Iowa.

# RESEARCH

## Collision Statistics

The collision data used for these analyses were downloaded from the FRA for the years 2005 through 2009. The comparisons with existing traffic and crossing conditions are from the Iowa DOT Geographic Information Management System (GIMS) downloads for 2009. Both are freely available on the Internet.

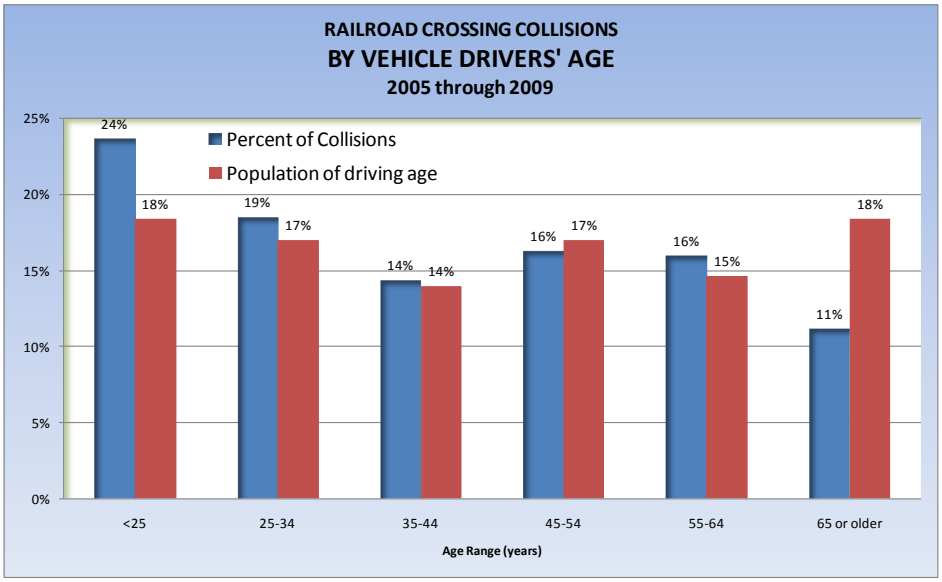
The examination of the data was conducted by joining the datasets in a Geographic Information System (GIS) environment. This data includes information on 352 accidents over the five-year period. Some sample sizes may not match due to blank fields in the accident reports or rounding error.

**Examination**

Demographics Analysis

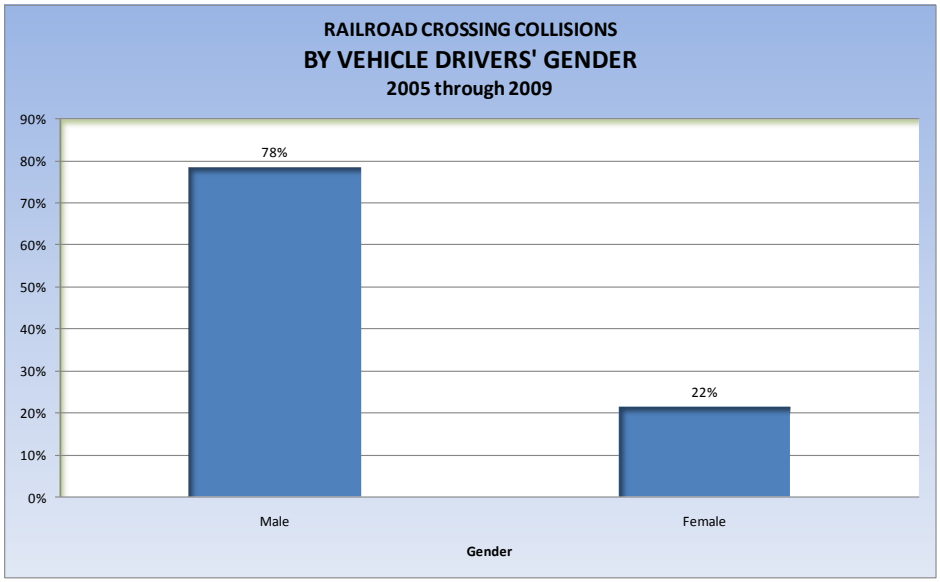
The first two graphs represent driver demographics and have significant findings. On the first graph (Figure 1) the age group "less than 25" is over-represented. This is the only age group that has an accident variance compared to Iowa's general population of people of driving age that is greater by more than 5%. It should also be noted that the "greater than 65" group makes up over 18 percent of the same population but is the driver in only 11 percent of the accidents. All other categories were within 2 percent of their population distribution.

Figure 1: Drivers' Age



The gender split of the second graph (Figure 2) says 78 percent of all drivers involved in grade crossing accidents are male. Yet less than 49 percent of the population of driving age is male. These two graphs would indicate that the major target audience for crossing safety education should be males under the age of 25. In fact, records show that almost one of every five accidents has a male driver that is 25 years of age or younger. Females in the same age group have less than half that amount.

Figure 2: Drivers' Gender




## Temporal Analysis

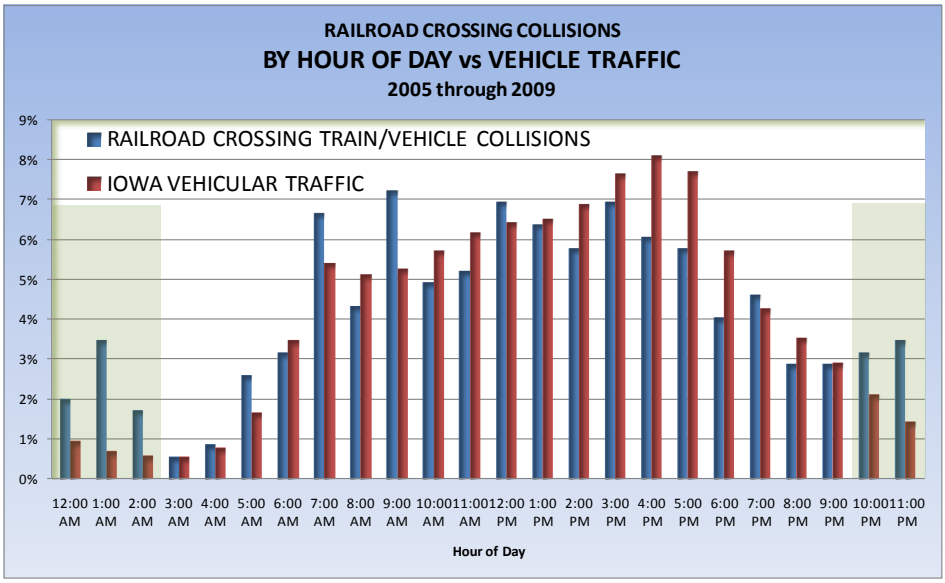
The next three graphs show trends of when the collisions occur. The first (Figure 3) shows a percentage of accidents during the morning rush slightly higher than the percentage of traffic that drives during that time of day. Conversely, accidents tend to be lower than traffic during the evening rush. However, the most striking difference is from 11:00 p.m. to 3:00 a.m..

During these late night hours the age of the drivers was distributed normally. However, 26 of the 27 drivers in the accidents that occurred between midnight and 3:00 a.m. were males. Of the 12 accidents between 11:00 p.m. and midnight, four were driven by females. Three of the females were 18 years old or under.

Some differences are expected when viewing comparisons by hour. This makes it prudent to investigate areas that show trends over time. The late night hours show a growth and recession of accidents over a five-hour period. Similarly, the variance of accidents below traffic levels during the afternoon rush hours develops for four hours. The morning rush hours, although appearing significant in variation from the hourly percentage of traffic, alternate over

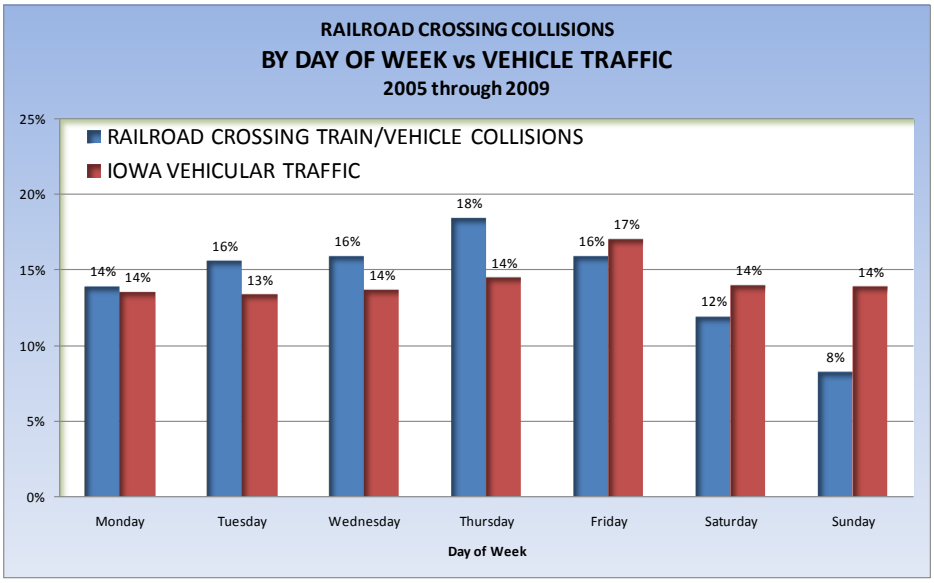
and under traffic levels. During these hours gender and age are similar to what appears on average for the rest of the day, which may exclude this time period as significant.

Figure 3: Hour of Day




Although accidents seem to be slightly higher than traffic comparisons on Tuesdays through Thursdays (Figure 4), the day of the week doesn't appear to be a significant finding. However, looking at the trends over time, weekday accidents may warrant further scrutiny. If the trend increases, we should ask, "What are the cultural and sociological differences that make Iowans

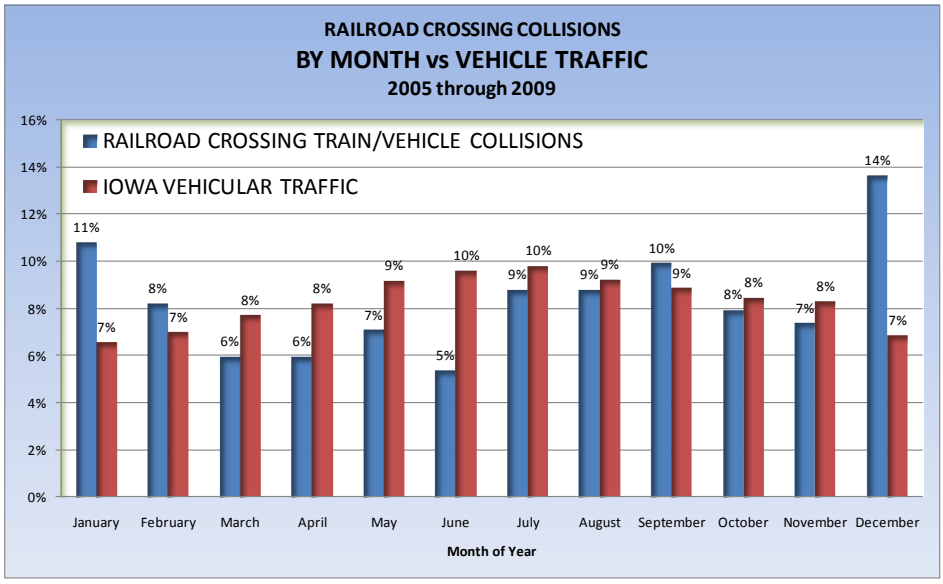
Figure 4: Day of Week



less prone to accidents on the weekends?"

The graph of accidents by month (Figure 5) demonstrates a high number of collisions that occur in December and January and a low number of collisions from March through June, when compared to traffic. Even looking only at the raw numbers, the collisions in these two winter months are 25% to 30% higher than the monthly average. For those accident reports that supplied the information, examination of the accident weather conditions and narratives suggests that icy roads may have contributed, but not enough to make up the difference.

Figure 5: Month of Year




## Modal Analysis

The next two graphs provide interesting information regarding vehicle and train speed. A majority of the collisions occur when both the vehicle and the train are traveling at low speeds (Figures 6 and 7). In the narratives for these collisions, references to "shoving" and "switching" appear frequently.

Figure 6: Vehicle Speed

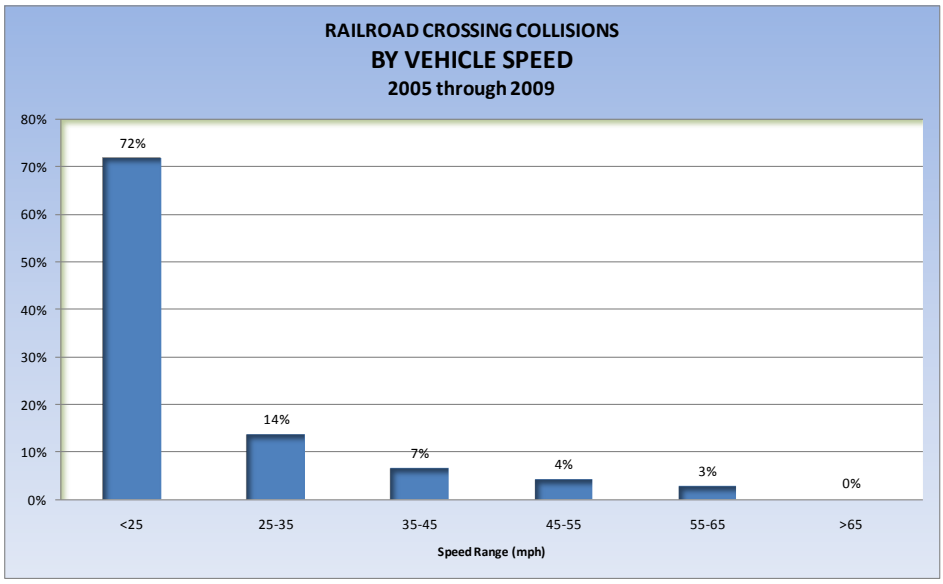
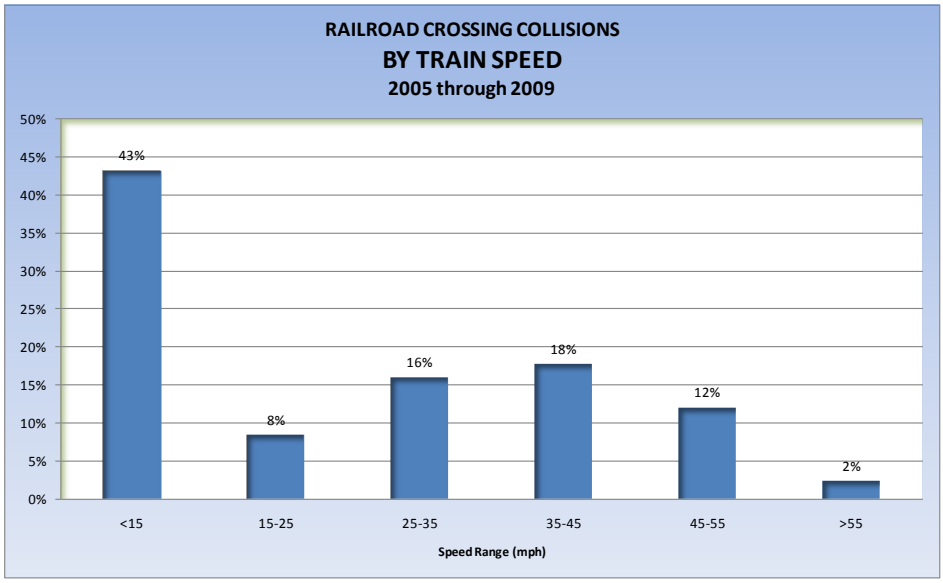


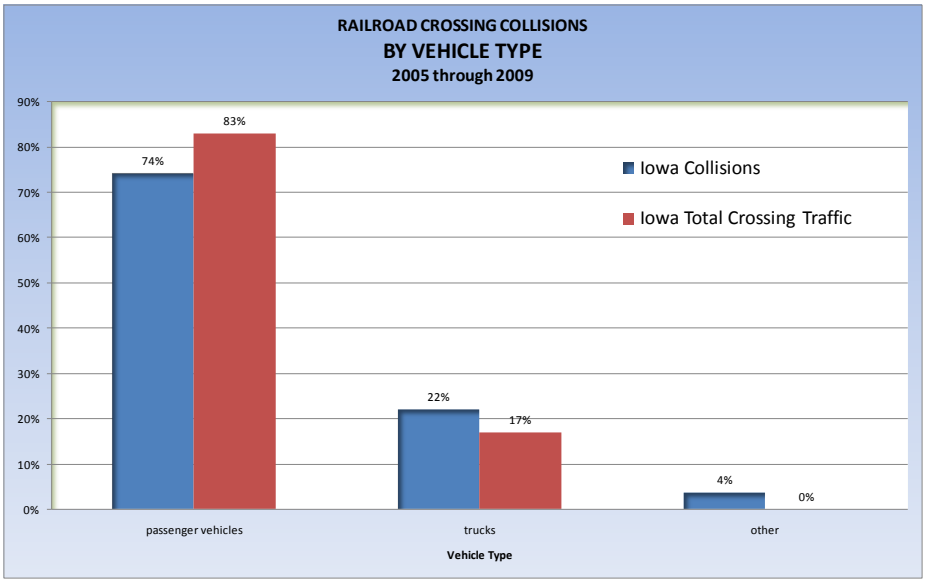

Figure 7: Train Speed




In looking at the accident report narratives, there are some collisions where tractor-trailers become stranded while fouling the crossing. But, when passenger vehicles are added together, the percentage of vehicle types involved in collisions comes relatively close to what is in the traffic stream (Figure 8). It should be noted that the crossing percentages are somewhat skewed due to a lack of pedestrian and "Other" data.

This does not negate the issue of stranded trucks. Future examination of accidents and engineering of grade crossings should continue to consider and seek to accommodate this storage issue.

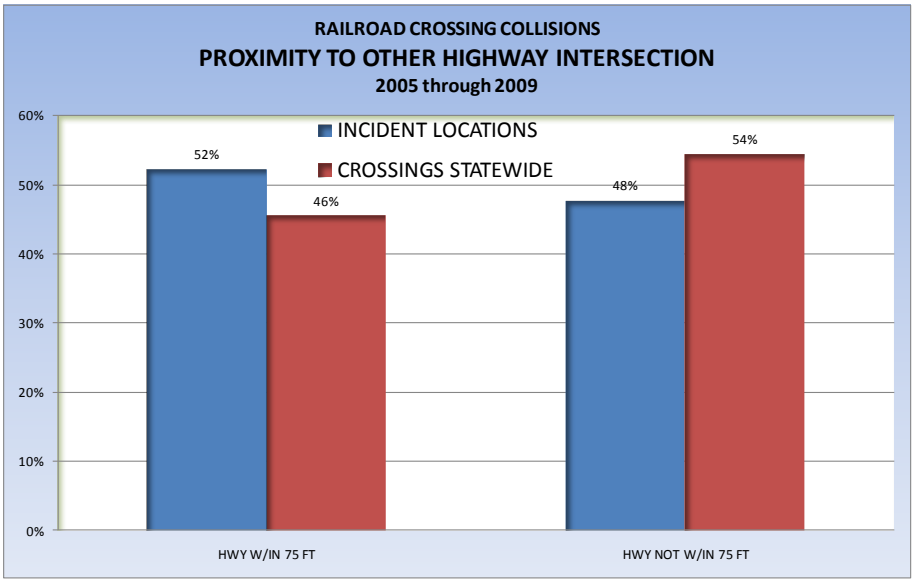
Figure 8: Vehicle Type




## Location Analysis

In particular, some states have noted a significant increase in incidents when the crossing is within 75 feet of a highway intersection. Because of Iowa's roadway grid network, 46% of highway-rail grade crossings are within 75 feet of a roadway intersection (Figure 9). Yet, only 52% of the vehicle-train collisions occurred at these crossings. If this were a significant issue, the expectation would be that Iowa would experience a far greater number of collisions with concentrations at these crossings.

Figure 9: Intersection Proximity




Even though Private crossings account for mare than one third of the total crossings in the state of Iowa (Figure 10), only about 11% of the collisions happen there. This would support a concentration of efforts at public crossings. The nature of Iowa's relationship with the railroads and other highway authorities also guide this inclination.

Figure 10: Public vs. Private

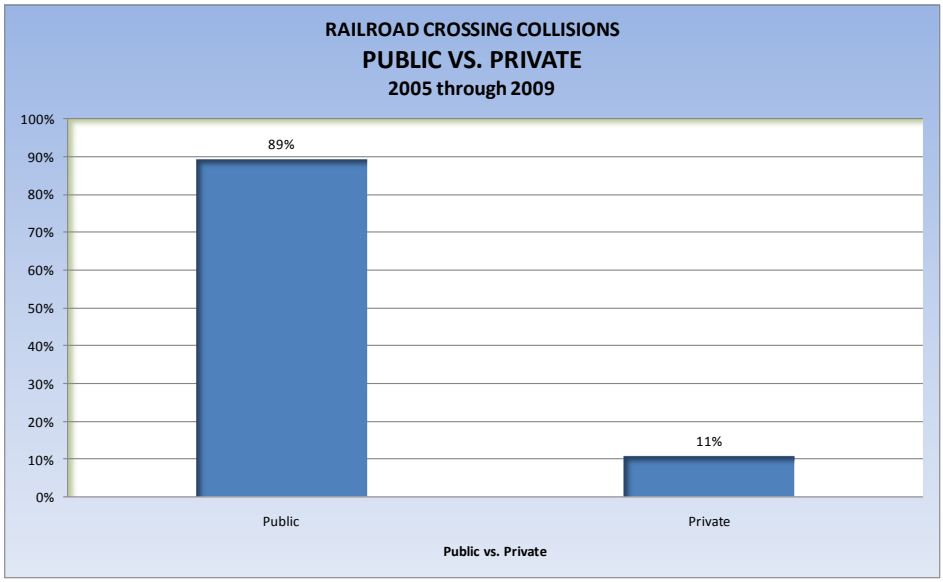
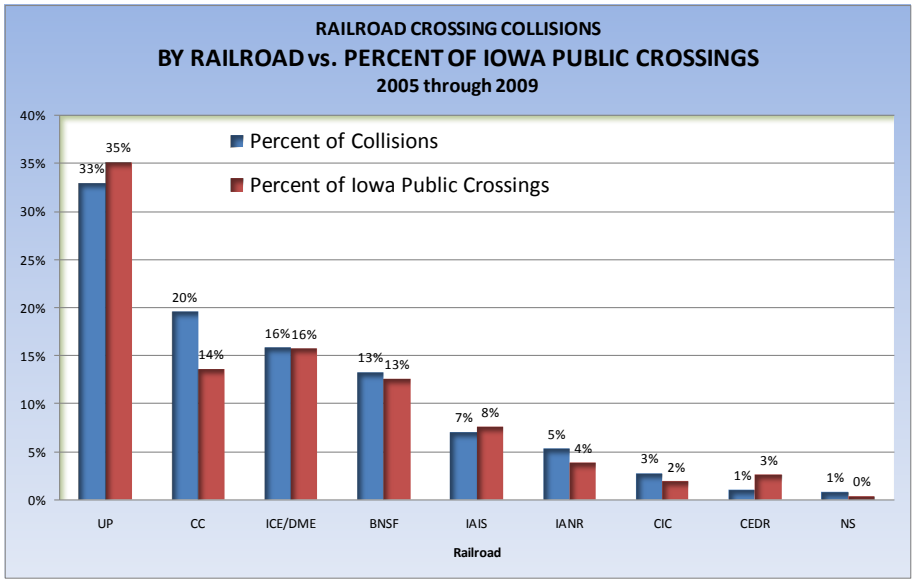


Figure 11: Railroad Ownership

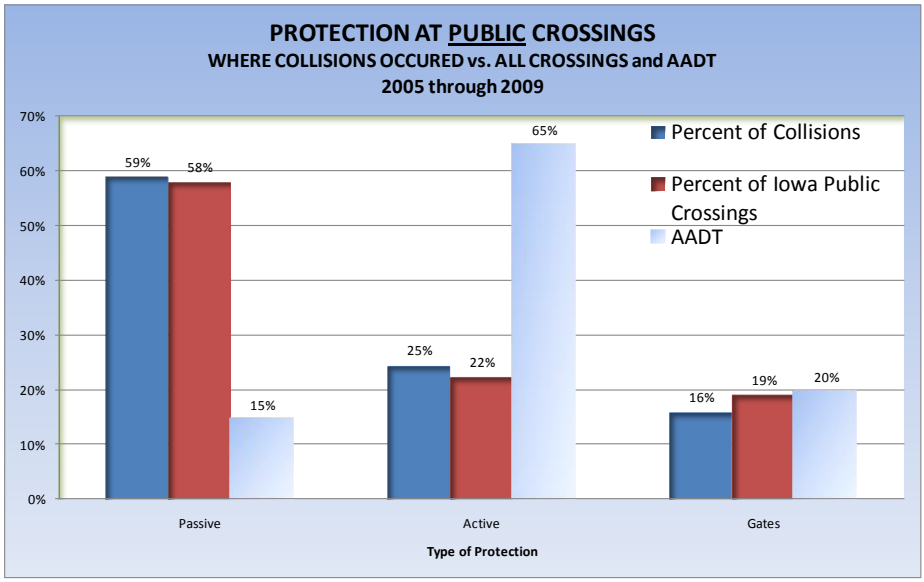



The railroads appear to be reasonably distributed for the number of collisions (Figure 11) compared to the number of crossings where they own track.

When comparing the percentage of collision locations to all public crossings in Iowa, this graph (Figure 12) would seem to show that the type of protection does not make a difference in preventing collisions. However, when the exposure of the number of vehicles using the crossing is added, the use of active protection is strongly supported. Passive protection, on the other hand has a percentage of risk four times greater than its exposure. Also, nearly three out of every five collisions are at passively protected crossings.

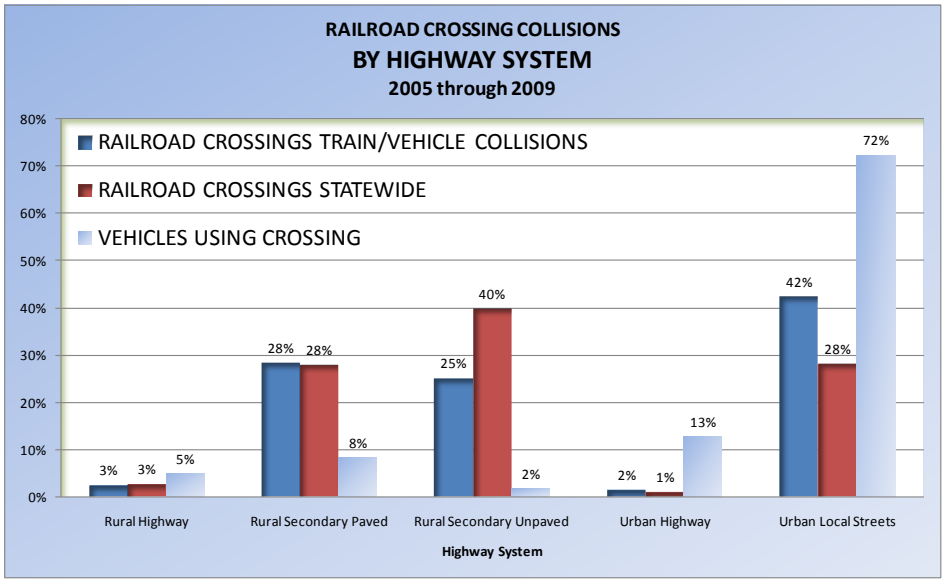
It may be expected that crossings with gates would experience better statistical results. But, the comparison does show a lower percentage than the total crossings and the exposure. It can also be argued that crossings with this level of protection tend to be at locations that would score highest from the B-C Accident Prediction Formula.

Figure 12: Protection




The final graph (Figure 13) demonstrates a disproportion number of collisions on rural secondary roads when compared to Annual Average Daily Traffic (AADT). In addition, even though the comparison of collisions to AADT appears small, there is a need to look at the crossing on urban local streets where 42% of all collisions occur. When this is combined with the previous graph and the understanding that urban local streets and rural secondary roads are where the majority of passively protected crossings are located, another target is identified.

Figure 13: Highway System



**Significant Findings**

Although many analytical queries and cross tabulations were performed, this report only illustrates those that either represent areas with significant findings or those that have been assumed to be significant but have little variation from what would be expected when compared to other data. These comparisons are looking for significant variations in:

- Exposure – differences in the percentage of collisions compared to the percentage using a crossing
- Population - differences in the percentage of collision compared to the state's total dataset
- Size – any independent variable that experiences an overwhelming percentage of collisions

The most typical driver of a vehicle that collides with a train is a male 25 years of age or younger. Male drivers in particular need to be educated on driving habits between midnight and 3:00 a.m.. This time period only addresses about 7% of the total accidents, but targets the most disparate amount of crashes compared to relative traffic.

The typical "at-risk" crossing has multiple issues to manage. As is expected, passively protected at-grade crossings are a significant contributor to total collisions. But the highway system has two separate distinctions. When compared to the number of vehicles using a crossing, rural secondary roads are significantly out of range. However, even though urban local streets have less than two-thirds of the rate when compared to the same type of exposure, they still make up 42% of the total collisions. Therefore, passively protected rural secondary roads AND urban local streets should both be addressed.

While even one accident is too many, there are two areas that require no added attention. Private crossing comprise a large portion of the total grade crossings in the state but contribute to only 11% of the collisions. This, as well as the lack of authority, excludes them from specific action in this plan.

Likewise, state-owned highways represent a small percentage of total crossings and total collisions. And when compared to the total traffic utilizing these crossings, the current relative safety at these locations excludes them from specific action in this plan.

## Collaboration

For any solution in this plan to be effective, collaboration with other entities is necessary. To this end, conversations have been initiated with organizations outside the Iowa DOT's Office of

Rail Transportation. Although all of them have been beneficial, the most productive have provided input into what needs to be studied, possible resolutions, and gainful cooperation as to implementation. As part of the approval process of the final product, this plan will be sent to the entities described below for further input.

**Office of Traffic and Safety**

The Iowa DOT's Office of Traffic and Safety has a long and distinguished reputation for innovative and effective traffic safety solutions. Their past experience has guided us to look strongly at simple solutions with a system-wide view rather than targeting specific crossings.

As per their guidance, the examination of current programs highlights the strong focus and prioritization already given to grade crossings with a history of collisions. This allows a broader view and more cost-effective use of available resources targeting "at-risk" crossings.

The Iowa Traffic Engineering Assistance Program (TEAP) offers funds each year for community traffic safety issues. This, as well as their advice and assistance throughout the plan period, may prove to be an invaluable resource for the success of this plan.

**Iowa Operation Lifesaver**

As the most visible entity promoting crossing safety, Operation Lifesaver (OL) has the resources to directly present the message of railroad crossing and right-of-way safety to targeted audiences. At the 2011 Iowa OL annual meeting, members of the board, executive director, and the certified volunteers were made aware of the statistical examination of this plan.

While Iowa OL has the capacity to educate and advertise, the Iowa DOT's Office of Rail Transportation has the ability to perform in-depth statistical analysis. With closer coordination, Iowa OL may be able to concentrate efforts on demographic groups that account for the largest percentage of collision for any given timeframe. With cooperation and current statistics, the successful reduction of collisions may be realized.

**Railroads**

Many of the proposed actions would be difficult, if not impossible without the understanding and cooperation of the railroads. In an effort to understand each other, issues derived from the preliminary "Collision Statistics-Examination" of this plan were provided to the railroads at a Rail Advisory Committee (RAC) in October 2010.

After a discussion regarding other possible research needs, a matrix of possible solutions with rows defining who the responsible party should be was presented to the group (Figure 14). Columns were also provided for their input for other possible solutions.

Figure 14: Railroad Priorities

## CROSSING SAFETY ACTION PLAN PRIORITIES

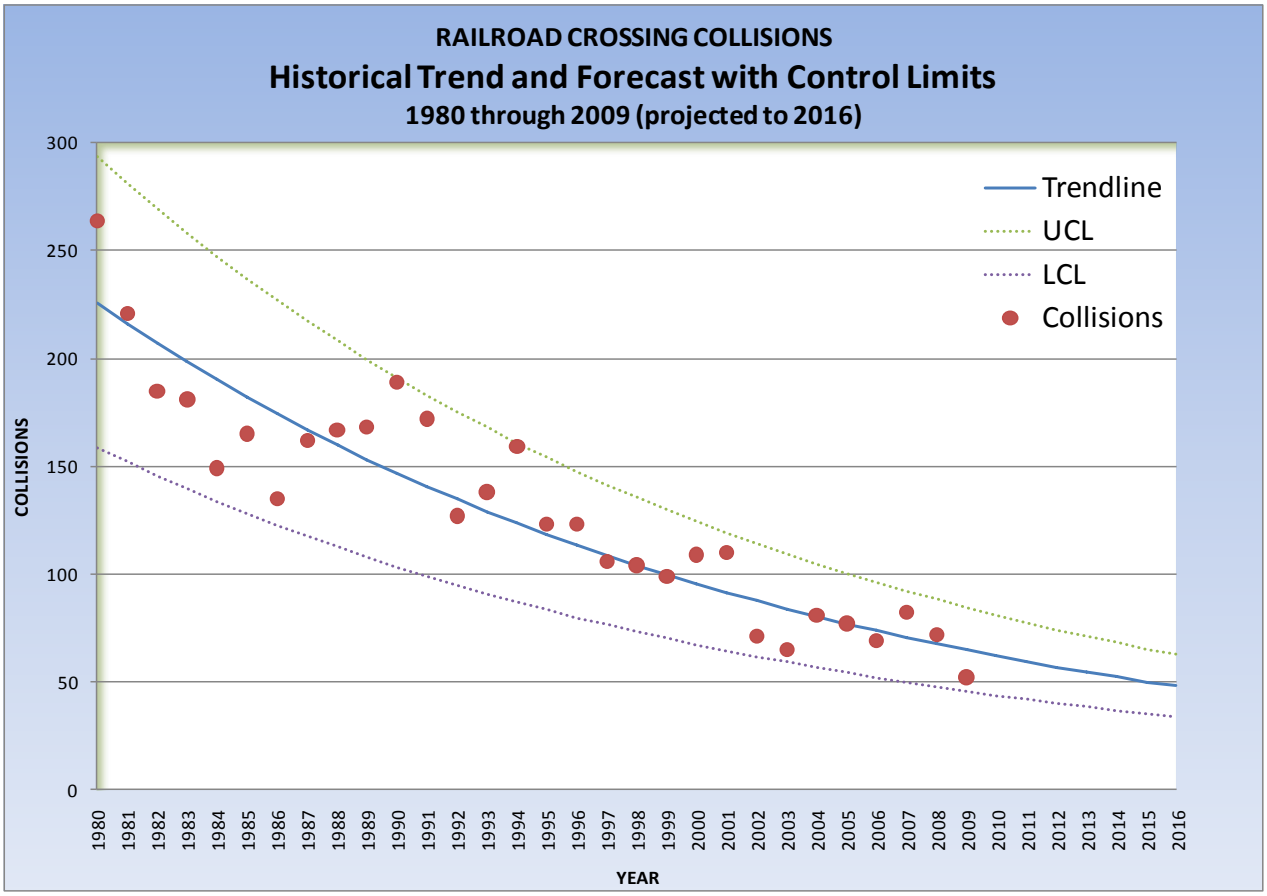
| | Education | | Closure and/or Consolidation | Upgraded controls | Roadway Geometry Improvements | Visibility Improvements | Raised Medians | Lighting | Legislation | Judicial and/or Enforcement coordination | Interconnects | Grade Separation | Section 130 funds |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Public | Railroad Staff | | | | | | | | | | | |
| **FRA** | | | 1 | | | | | | | | | | |
| **Iowa DOT** | 2,2<br>**4** | | 4,4,4,4,4,<br>3,3,1,1,1<br>**29** | | | 3,3<br>**6** | 2,1<br>**3** | | | 4,4,3,3,<br>2,2,1<br>**19** | | 3,2,2,2,1<br>**10** | 3,2<br>**5** |
| **Railroads** | 2 | | 4,4,4<br>**12** | | 1 | 3 | | | | 3 | | | |
| **OL** | | | | | | | | | | | | | |
| | 6 | 0 | 42 | 0 | 1 | 9 | 3 | 0 | 0 | 22 | 0 | 10 | 5 |

# STRATEGIES

## Goals

It can be difficult to set goals when you consider variables that can change from year to year. A forecast is merely an *average* of what the future is expected to be. Half of the actual future occurrences will probably be above the anticipated level. However, we can statistically define the range in which each years' number of collisions can be expected to fall.

Figure 15: Historical Trend & Forecast




An analysis of collisions from 1980 to 2009 was conducted with a best fit exponential trendline, which had the best correlation ($R^2$=.8707) with the historical data (Figure 15). Upper and lower control limits were defined to show the bounds of the expected range. This was done by calculating the -4.2% annualized change of the trendline, and using it to normalize all historical data points to a 1980 equivalency. The standard deviation was then computed on the adjusted data points. The range of the upper and lower control limits are then represented by lines that begin two standard deviations upward and downward from the 1980 trendline point, and

converge towards the trendline at the -4.2% rate. This is done to maintain the generally decreasing size of the numbers.

Statistical probability supports control limits that extend three standard deviations in both directions from the trendline. That is to say, it can be expected that any single data point should fall within these parameters 99.7% of the time. Anything outside these limits is considered an "outlier" and may warrant investigation as to what new variable caused the departure.

Although some come close, examination of the data shows that no single data point falls outside the two standard deviation control limits (statistically inclusive of 95.5% of the population). This may be a demonstration of the control with which the implementation of the present programs has been executed. But further assessment shows that the benefit of these programs may be leveling off, making it more probable that individual years may occur in the future that fall outside these control limits.

A 30-year history of decreasing trends will be difficult to maintain in the future. Therefore, it is the goal of the selected actions defined in this plan to continue the downward trend for the five-year plan period. Because the expected improvements from these actions may not be realized until the end of the implementation period, this can still be considered an aggressive goal. A long-range goal is to recalculate the curve at the end of the five-year period and show a greater decrease in the annualized trend.

## Possible Solutions

With input from staff of the Iowa DOT's Office of Rail Transportation the following list of possible solutions were proposed for study:

- Crossing closure
- Upgraded controls
- Roadway geometry improvements
- Visibility improvements
- Raised medians
- Lighting improvements
- Innovative solutions (traffic calming, speed zones, channeling guard rail, etc.)
- Rule or policy changes
- Legislation for additional authority, enforcement, or funding

With input from the Office of Traffic and Safety, as well as the railroads, the following items were added to the list:

- Judicial and enforcement education and coordination
- Verification of the engineering for signal interconnects and pre-emptions
- Grade separations
- Study of the present use of Section 130 funds

Research and analysis was conducted with these strategies in mind. Consideration was given to probable effectiveness, cost-efficiency, funding availability, implementation timeline, and overall responsibility to the taxpayers and their safety. Those showing promise and feasibility carried through to actions.

## Selected Actions

The selected items are not an exhaustive list of all actions that may be taken over the five-year period. The programs in place are systematically reviewed and slight adjustments may be made to increase their effectiveness.

It is the objective of the selected actions to change physical characteristics of grade crossings AND public behaviors that lead to collisions. After full consideration of the statistics, personal knowledge and history of the study partners, and continued emphasis on Education, Enforcement, and Engineering; the following actions will be pursued.

**EDUCATION-ACTION A: College and High School Education Campaign**

*This is a targeted education campaign directed at the drivers that contribute the most to our collision statistics. Although both genders in this age group contribute to the nearly 1 out of 4 collisions, males were more than twice as likely in this age group to be the driver.*

*Due to limited gatherings and educational opportunities, as well as staff and budgetary constraints, this is an action that could take the full five years to plan and implement. Results may not be fully realized until the end of the plan period. However, if even one out of ten of the potential future statistics in this demographic can be prevented, the historical 4.2% reduction may be changed by another 2.5%.*

*Expected Timeline for Implementation:* *4 years*

**EDUCATION-ACTION B: Family Education Partnerships**

*The purpose of this action is to perform a statewide inventory of other safety programs and advocacy groups throughout the state that can be dovetailed with Operation Lifesaver and the Office of Rail Transportation. Through partnership with these groups the intention is to bring railroad safety discussions into the home.*

*Groups such as the Iowa Center for Ag Safety and Health (I-CASH) and the Blank Children's Hospital Advocacy Group already conduct training courses in rural roadway safety and teen driver safety. By partnering with groups such as these to include railroad crossing and trespassing education, participation by targeted drivers may be greatly improved.*

*Expected Timeline for Implementation: 5 years*

**ENFORCEMENT-ACTION C: Enforcement/Judicial Awareness Campaign**

*The railroads chose this as their second most important action. It was felt that, because of the low number of traffic violations that occur at highway-rail crossings compared to other moving violations, they may be easy to overlook. By emphasizing the serious nature and catastrophic consequences of train/vehicle collisions, enforcement officials may increase vigilance toward offenders. Potentially, an enforcement campaign may alter public perception and awareness.*

*However, the effectiveness of enforcement alone may be counteracted without the full support of the County and District Attorneys, the Iowa Attorney General, and the judicial system. Raising awareness of all groups will maximize the value of this campaign.*

*This action will pursue and promote a working relationship with Iowa Operation Lifesaver and the State Attorney General's Office to initiate this campaign. A study of reported "near misses" may provide a starting point for implementation.*

*Expected Timeline for Implementation: 4 years*

**ENGINEERING-ACTION D: Rumble strips on paved secondary roads**

*The State of Iowa contains 211 rural paved at-grade crossings, of which, approximately 50 have stop signs. A stop sign cannot be placed on a public roadway without an engineering study. Likewise, it is standard practice in Iowa to only use rumble strips in conjunction with stop signs.*

*Rumble strips that coincide with other crossing signage are a relatively inexpensive solution to alert drivers to an upcoming railroad crossing and stop sign. To improve*

*safety on secondary crossings, this action will work with the counties to identify locations where rumble strips can be installed. Each crossing will have to be evaluated in regards to clear approach distances, need for noise abatement, and other considerations. As future engineering studies for stop signs are executed at rural railroad crossings, consideration should be given to making a rumble strip evaluation standard practice.*

*Expected Timeline for Implementation:* *5 years*

**ENGINEERING-ACTION E: Verify engineering for pre-emption signal timing**

*Although this was not identified by the railroads as a priority during the group input, during individual meetings it was often commented that the engineering and timing calculations for the signal preemptions and interconnections occasionally don't appear to be optimized. Without monitoring, input variables can drift over time due to changes in vehicle and train operations or physical changes to the tracks or roads.*

*Through the Iowa Traffic Engineering Assistance Program (TEAP), staff will work with the cities and the railroads to verify calculations at all interconnect and pre-emptions in the state. Engineering will follow guidelines established by the FHWA in the "Railroad-Highway Grade Crossing Handbook – Revised Second Edition, August 2007; Appendix I, Pre-emption Calculation Procedures."*

*Expected Timeline for Implementation:* *3 years*

**ENGINEERING-ACTION F: Crossing Signal Light LED Conversion Study**

*Approximately 40% of the at-grade crossings in the state of Iowa have active protection. For the past decade it has been a requirement of all active protection funded with state or federal dollars to include LED lighting as part of the specifications. In addition, many of the railroads operating in the state have often replaced incandescent lights with the more visible LEDs as part of their own maintenance and upgrades. What has not been determined is how many incandescent installations remain.*

*Although it is the opinion of many of the railroad maintenance staff and track inspectors that this technology can improve protection visibility and safety, not much research has been conducted to support this assumption. One such study, conducted for Transport Canada, provides empirical evidence of the advantages of LED signal lighting. This study, "LED Technology for Improved Conspicuity of Signal Lights at Highway-Railway Grade Crossings," can be found online at:*

http://www.tc.gc.ca/eng/innovation/tdc-summary-14000-14043e-701.htm

*Accepting the advantages of this upgrade, the specific action is to study the possibility for a statewide conversion program.*

- *How many incandescent systems remain in use?*
- *What levels of requirements are needed for conversion*
  - *8" to 12"*
  - *wiring upgrades*
  - *direct replacement*
- *What is the total cost of the conversion?*
- *What current programs could further incorporate this action?*
- *What rationale can be used to prioritize which conversions are most immediately funded?*
- *What other funding is available?*

*Expected Timeline for Implementation:* *2 years*

**ENGINEERING-ACTION G: Develop closure rating criteria**

*With the understanding that we have no authority to mandate closure of any crossing off the state-owned primary road system, the intent of this action is to develop a standardized formula to rate a low-volume, at-grade crossing's potential for closure. Although this cannot directly cause a closure, by establishing categorical thresholds it could provide a valuable tool for analysis and negotiation.*

*For the tool to be effective and unbiased, it must include empirical data wherever practicable. However, it cannot exclude economic and engineering judgment. These elements will need to be incorporated on a case-by-case basis.*

*The empirical elements may include: population, current protection, needed protection upgrades, crossing angle, train and roadway traffic volume, speed of trains and vehicles, type and number of tracks, material being carried, crossing location, sight distance, distance to traffic signals, and number of crashes. Economic and engineering considerations may include: emergency service needs, anticipated upgrade costs, and crossing alternatives.*

*Once developed, a program should be introduced to educate affected parties on the tool's background and programs in which it may be incorporated. Emphasis should be given to local streets and secondary roads. Initial audiences should include: the railroads, the Iowa League of Cities, the Iowa County Engineers association, and the Iowa Chapter of the American Public Works Association.*

*Expected Timeline for Implementation:* *1 year*

**FUNDING PROGRAMS-ACTION H: Closure as part of the Grade Crossing Surface Repair Program**

*The purpose of the Grade Crossing Surface Repair Program is to promote the safety, rideability, and convenience of the traveling public by keeping the crossing surfaces in a safe and suitable condition.*

*This action will emphasize the "Closure" checklist item in the "Exhibit A" to highlight this discussion as part of the negotiations. The safety benefits for the closure of passively protected local streets and secondary roads should be prominent. Use of the "Closure Rating" (Action G) can make this decision more quantifiable. By instituting this action item, the state, local governments, and railroads can more effectively direct their resources.*

*Expected Timeline for Implementation:* *1 year*

**FUNDING PROGRAMS-ACTION I: Closure incentives for Section 130 program**

*The current Section 130 crossing protection program already includes discussions regarding closure as an alternative to system upgrades. In some cases system upgrades to an adjacent crossing are offered as an incentive for closure. What this action proposes is a factoring process that promotes nearby closures of sites being upgraded.*

*As described in the "SCOPE – Current Practice" section of this plan, applications for section 130 funds are prioritized by the B-C ratio. Using this "factoring" process, a local highway authority's application score could be increased by offering to close a nearby (within identified parameters) crossing. The goal of this incentive is to allow local highway authorities to promote the likelihood of their application to be awarded more immediate funding. This also may not disqualify them from applying for and receiving the monetary compensation for a crossing closure, which may offset the local/railroad 10% cost-share and emphasize the safety benefits for the closure of local streets and secondary roads.*

*Expected Timeline for Implementation:* *2 years*

**FUNDING PROGRAMS-ACTION J: Decrease reallocation of Section 130 funds**

*As explained in this document's "SCOPE - Current Practices" section, as a matter of public safety, one million dollars of Section 130 funds are being directed each year to the Grade*

*Crossing Surface Repair Program. Over the past decade, this has substantially reduced a 10-year backlog.*

*The course of this action is to study and implement a reduction process to retain a substantial portion of these funds for use in upgrading crossing protection. This process must be sensitive to the safety value of a good crossing surface while providing the most funds possible for protection upgrades.*

*Expected Timeline for Implementation:* *1 year*

**FUNDING PROGRAMS-ACTION K: Passenger Rail**

*The State of Iowa is currently in the process of establishing High-Speed Intercity Passenger Rail service from Chicago to Iowa City. As part of this development, approximately 70 crossings will be improved. The 10-year Rail Plan discusses the expansion of this service to Omaha and other possible routes. This action step will be the active pursuit of these corridors, which would necessitate the improvement of many of the crossings across the state.*

*Expected Timeline for Implementation:* *10 years*

**FUNDING PROGRAMS-ACTION L: Advocate continuation of 23 U.S.C §130 and increased railroad safety funding**

*Many of the Funding Programs, and the actions pertaining to them, are predicated by the continuation of* 23 U.S.C §130 *funds. This action documents a commitment to vigorously advocate the continuation of railroad safety funding at increased and sustained levels.*

*Expected Timeline for Implementation:* *On-going*

# RESPONSIBILITIES

By identifying the parties responsible and gaining acceptance for their implementation, progress toward the actions can be expedited. Consequently, this plan will list (but not limit) the expectations conferred upon partnering entities.

This list is not intended to be "all inclusive" nor does it indemnify any entity from supplemental action required for the successful accomplishment of the actions contained herein. It merely attempts to advise them of future possible needs. This document in no way constitutes a contract or legal obligation and representation from each of the coordinating partners has been given draft copies of this plan for review and input.

## Iowa Department of Transportation

**Office of Rail Transportation**

The Office of Rail Transportation is accountable for the overall implementation of this plan. As the lead partner, it is responsible for initiating and maintaining contact with all partners, monitoring progress, and supplying the required data analysis. At the conclusion of the plan period it is also responsible for producing the final report.

Pertaining to individual actions, this office is responsible for:

College and High School Education, Family education, and Enforcement/Judicial Awareness (ACTIONS A, B, and C) – Annual analysis of collision demographics and providing new targets to Operation Lifesaver. Assist Operation Lifesaver in seeking new groups and opportunities to present to the specified targets. Develop a trendline analysis of the effectiveness in these actions.

Rumble Strips and Pre-emption Timing (ACTIONS D and E) – Parameters, specific outcomes, and monitoring of progress will be established with the assistance of the Office of Traffic and Safety.

LED Crossing Signals and Closure Consolidation Criteria (ACTIONS F and G) – Collaboration with the Research Bureau will pursue research funding and conduct or contract research projects to define and implement these actions.

Grade Crossing Surface Repair Program Crossing/Consolidation, 23 U.S.C. § 130 Closure Incentives, Decreased reallocation of 23 U.S.C. § 130 Funds (ACTIONS H, I, and J) – Further analysis of programs to refine the parameters of these actions will be conducted. Final results will be used to pursue changes to funding allocations and program design.

Passenger Rail (ACTION K) – Continued emphasis will be placed upon the introduction of new passenger rail corridors as defined in the department's 10-year plan. This will include planning research and applications for grants as they become available. A separate accounting will be

maintained for the number and type of crossing improvements instigated by these developments.

Advocation of 23 U.S.C. § 130 and other railroad safety funding (ACTION L) – Seek opportunities to increase railroad safety funding. Increased and sustained funding is necessary to aggressively address crossing safety needs.

**Office of Traffic and Safety**

The Office of Traffic and Safety is responsible for the execution of a programmed engineering study of the pre-emption timing where it currently exists (ACTION E). Assistance will be provided as needed from the Office of Local Systems and the Office of Rail Transportation.

In addition, as the department experts on traffic safety, advice has been, and will continue to be, periodically sought on the cost-effectiveness and success of Rumble Strips (ACTION D) and other individual actions.

**Office of Local Systems**

The Office of Local Systems will be responsible, as needed, to provide assistance as a liaison with the counties and cities that may be specifically affected by given actions.

**Research Bureau**

The Research Bureau will be responsible for working with the Office of Rail Transportation in seeking research contracts and conducting research projects in-house for the LED Conversion Study, Closure/ Consolidation Criteria development (ACTIONS F and G), and where feasible elsewhere. Also, assistance may be necessary for training development.

## Iowa Operation Lifesaver

Iowa Operation Lifesaver focuses efforts and educational materials to targeted groups. The Office of Rail Transportation will provide statistical analysis to define targets, currently Identified as College and High School Education, Family education, and Enforcement/Judicial Awareness (ACTIONS A, B, and C), that the organization may use in planning efforts. This is in no way intended to work as a detriment to other programs and groups with which they work, but to aid them in directing their resources.

In addition, the organization will provide the Office of Rail Transportation with the annual report that breaks down the number of presentations given with the number of participants categorized by the specified demographic groups.

## Railroads

The department has enjoyed a strong working relationship with the railroads in the state of Iowa and many current programs have benefitted from that rapport. The department, and by extension this action plan, cannot hold the railroads accountable for inaction. It is also understood that, as a private business, each railroad's primary responsibility is to its own business. However, many, if not all, of these actions cannot be successful without support and action from the railroads.

With that understanding, it is the responsibility of the railroads to work in partnership with the Office of Rail Transportation to learn and use the tools and programs developed or modified by this plan to the best benefit of the traveling public.

# PROGRAM EVALUATION

## Measurements

With the relatively large number of action items all having the same objective of reducing grade crossing collisions, discernment of the effectiveness of any individual item may be difficult. In addition, many of the changes won't show a measurable effect until the end of the five-year period or beyond. Unfortunately, this is inherent in a system-wide approach.

Because of this perspective, it may be better to account for the practical implementation of each action only to ensure that none of them become counter-productive. Some of the measurements may be easily quantifiable, while others may remain subjective. Ultimately, the final judgment will be the overall trend of highway-rail grade crossing collisions.

With the understanding that early results will be limited, the following information will be reviewed for individual actions:

The College and High School Education, Family Education, and Enforcement/Judicial Awareness programs (ACTIONS A, B and C) will annually track the number of people within the prescribed demographics that have attended educational presentations or received mailed materials. Throughout the plan period annual analysis will be shared to determine the most appropriate audience.

The Rumble Strips and Pre-emption Timing (Action D and E) will annually track both the percentage of relevant locations where studies have been performed as well as the percentage where changes have been made.

The LED Conversion Study (Action F) will end in a determination of feasibility at the end of two years. If a structured program can be developed through this study, each subsequent year will track the percentage of incandescent lights remaining.

The Closure Criteria, Grade Crossing Surface Repair Program Crossing/Consolidation, and 23 U.S.C. § 130 Closure Incentives (Actions G, H, and I) will annually track the number of crossing closures by railroad to evaluate the trend. Each winter, the Office of Rail Transportation meets with the railroads in small groups or individually. During these annual meetings, a subjective review will be conducted to determine the effectiveness of these programs and make adjustments if necessary.

The Decreased reallocation of 23 U.S.C. § 130 Funds (Action J) will be measured by an annual trendline analysis of the number of crossing with stipulated improvement or upgrade.

Passenger Rail (Action K) will report the number of crossings upgraded or eliminated as part of the passenger rail development in the state of Iowa at the end of the plan period.

As an overall measurement, the "Best Fit" exponential curve will be recalculated at the end of the five-year plan period to determine the new annual percentage of decrease. It should be expected that the difference may be very small due to scalar issues of using 7 years to alter the previous 30. However, as described in the *Strategies – Goals* section of this plan, any percentage of decrease equal to or greater than -4.2% should be considered a success.

As a secondary ambition, the annual number of crashes will be assessed to see if the incident rate falls at or below the original 30-year trendline projection. Because statistically each years' data point can be expected to fall above the trendline generally 50% of the time, there may be no scientific basis for this analysis. However, the narrow band of limits over a 30-year period substantiates the control within which previous efforts have operated. All data points occurring on one side of the trendline may be an indication that the variables have substantially changed.

## Re-Evaluation

The measurements prescribed in this document call for intermittent reviews and adjustments. However, to maintain a constant improvement, new plans must be part of a programmed approach to overall railroad crossing safety. With continued funding, this undertaking can sustain a systematic improvement in perpetuity.

To that end, at the conclusion of the plan period an overall examination of the success of this action plan will be completed. A report on the effectiveness of the individual actions, needs for implementation, and the plan period will be put on record to finalize this plan. Using this information and another full analysis of the new collision data, an appropriate new plan will be prepared.

## CONCLUSIONS

By studying the data and the nature of the problem, it can be concluded that a goal of achieving zero accidents on a continuous basis is impractical. Alternatively, the FHWA's national strategy, "Toward zero deaths" is ambiguous and provides no real incentive without statistical parameters.

Furthermore, it can be concluded that, since a negative number of collisions is impossible, an exponential curve is the best analytical metric to evaluate the degree of success for this action plan. This will maintain the, "toward zero" initiative while providing the needed parameters.

So, the objective of this action plan is to seek innovations in existing programs and a redirection of resources to maintain and or improve the historical trend of accident reductions. While a change in the rate of -4.2% to -5.25% makes a difference of only eight total collisions by the end of the five-year plan period, this is in actuality an improvement of 25% of the historical change.

Finally, no action plan can be considered successful if the methodology and actions are not performed on a continuing basis. But, it can be concluded that through this programmed analysis, goal-setting, and intentional actions, measurable improvements to the trend are possible.

By these actions, the State of Iowa will continue its longstanding commitment to improving safety. As directed by the 49 CFR Part 234, "State Highway-Rail Grade Crossing Action Plans," we have addressed:

(iv) "specific solutions for improving safety" through new or expanded educational, enforcement, and engineering programs (Action Items A – F, J, and L), as well as new incentives for crossing closures (Action Items G, H, I, and K). While grade separations are always a consideration, mandating set standards that will require grade separation without considering immediate costs would be infeasible for local agencies without a supporting funding source. At present, federal and state funds cannot sustain any type of standardized highway-rail grade separation program.

(v) a "focus on crossings that have experienced multiple accidents" as addressed in the "Iowa Benefit – Cost Calculation" section of the chapter, *CURRENT PRACTICE*. This section demonstrates our current and continuing approach of aggressively confronting locations with multiple accidents.

(vi) a plan that will cover "a five-year time period. Although the expected timelines for implementation range from 1 to 10 years with a programmed approach for

monitoring and re-evaluation, a final report at the end of the five-year plan period can serve as a baseline for the next highway-rail grade crossing safety action plan.