Iowa Highway Research Board Proposal

Low Cost Strategies to Reduce Speed and Crashes on Curves

Submitted by
Shauna Hallmark, Transportation Engineer and Tom McDonald, Safety Circuit Rider
Center for Transportation Research and Education (CTRE)
Iowa State University (ISU)
2711 South Loop Drive, Suite 4700
Ames, Iowa 50010
shallmar@iastate.edu
Phone: 515-294-5249
Fax: 515-294-0467

Submitted to
Research Engineer, Office of Materials
Iowa Highway Research Board (IHRB)
Iowa Department of Transportation (Iowa DOT)
800 Lincoln Way
Ames, Iowa 50010

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Problem Statement

The objective of this project is to evaluate low cost measures to reduce speeds and crashes on high crash horizontal curves. The research team recently won a competitive FHWA project to evaluate dynamic speed feed back signs on rural roadway curves to determine how effective they are in reducing speeds and crashes. The FHWA project is funded at $300,000 and requires a 100% match. As presented to the IHRB board at the June 2007, this proposal to IHRB will provide partial match. Other sources of match include the Iowa DOT Office of Traffic and Safety, the Midwest Transportation Consortium (MTC), and the Texas Department of Transportation.

The goal of the FHWA project is to conduct a national field evaluation of low-cost dynamic speed signs on rural roadways. The objective is to provide traffic safety and county engineers and other professionals with additional tools to more effectively manage speeds and decrease crashes on rural horizontal curves. The FHWA portion will focus exclusively on dynamic speed feed back signs and will fund installation and evaluation of at least 4 speed feed back signs on curves in Iowa. The IHRB portion of the project will be used to evaluate the signs as well as to evaluate several other low cost treatments to reduce speeds and subsequently crashes on curves. The focus is on rural roadways.

Background Summary

Crash rates on horizontal curves are often higher than those on tangent sections. Frequency and severity are related to factors including radius, degree of curve, length of curve, type of curve transition, lane and shoulder widths, preceding tangent length, and require speed reduction. Luediger et al (1988) and Council (1998) found that crash rates increase as degree of curve increases, even when traffic warning devices are used to warn drivers of the curve. Miaou and Lum (1993) found that that truck crash involvement increases as horizontal curvature increases, depending on the length of curve. Mohamedshah et al (1993) found a negative correlation between crashes and degree of curve for two-lane roadways. Council (1998) also found that the presence of spirals on horizontal curves reduced crash probability on level terrain, but did not find the same effect for hilly or mountainous terrain. Vogt and Bared (1998) evaluated two-lane rural road segments in Minnesota and Washington State using HSIS data, and found a positive correlation between injury crashes and degree of horizontal curve. Shankar et al (1998) evaluated divided state highways without median barriers in Washington and found a relationship between the number of horizontal curves per kilometer and median cross-over crashes. Zegeer et al (1992) evaluated 10,900 horizontal curves on two-lane roads in Washington State using a weighted linear regression model. They found that crash likelihood increases as the degree and length of curve increases. Alternatively, Deng et al (2006) evaluated head-on crashes on two-lane roads in Connecticut for 720 segments, using an ordered probit model. They included geometric characteristics in the analysis, but did not find that presence of horizontal or vertical curves were significant.

The vehicle speed reduction required for traversing a curve has an impact on frequency and severity of crashes on curves. Abrupt changes in operating speed resulting from changes in horizontal alignment are suggested to be a major cause of crashes on rural two-lane roadways (Luediger et al, 1988). Higher crash rates are experienced on horizontal curves that require greater speed reductions (Anderson et al, 1999). This finding is also supported by Fink and Krammes (1995) who indicate that curves requiring no speed reduction did not have significantly different mean crash rates from their preceding roadway tangents. The roadway tangent length influences driver behavior. The effect of a long tangent preceding a curve becomes more of a factor on sharp curves. Roadway tangent lengths also impact crash rates on steep downgrade curves. Crash rates on curves with long tangent lengths are more pronounced when the curve is located on a downgrade of 5% or more, with tangent lengths more than 200 meters.

"A Guide for Reducing Collisions on Horizontal Curves (2004)" reports that the crash rate for horizontal curves is around three times that of tangent sections. They also indicate that about 76% of curve-related fatal crashes involve single vehicle run-off-road crashes and 11% are head-on with an oncoming vehicle. In Iowa (2001-2005), 12% of all fatal crashes and 15% of all major injury crashes occur on curves; 14% of all urban, fatal crashes and 11% of all urban, major injury crashes occur on curves; and 11% of all rural, fatal crashes and 19% of all rural, major injury crashes occur on curves.

Curve related crashes result from a number of causes, including driver workload, driver expectancy, and speeding. Approximately 56% of run-off-road fatal crashes on curves are speed related. Studies have suggested that geometric improvements can reduce crashes. Zegeer et al (1992) suggested that curve flattening could reduce crashes by as much as 80%, while widening lanes and paving shoulders on horizontal curves could reduce crashes by 21% and 33%, respectively. Costs for geometric improvements however, are prohibitive, especially for counties with a large number of rural two-lane roads to maintain. Geometric improvements also require programming and can take some time to implement.

Reducing speed on curves can be done in the short term and at significantly lower costs than making geometric improvements. Dynamic curve warning systems (DCWS) are one method that has been tried in limited applications to reduce vehicle speeds, and subsequently, crashes. A DCWS consists of a speed measuring device, which may include loop detectors or radar, and a variable message sign which provides warnings to speeding drivers to slow down.

Objectives

The main goal is to evaluate the effectiveness of dynamic speed feedback signs and other low cost strategies to reduce speeds and crashes on curves. Research results will provide traffic safety and county engineers and other professionals with additional tools to more effectively manage speeds and decrease crashes on horizontal curves on rural roadways. To accomplish this, the following objectives are proposed:

- Identify low-cost safety treatments which have been used to address speed and safety on rural horizontal curves
- Identify at least 4 to 8 pilot study locations for installation of dynamic speed feedback signs in Iowa
- Identify 4 to 6 pilot study locations for installation of other low cost treatments

- Summarize the resulting information in a format that can be easily communicated and utilized by practioners

Research Plan

The specific tasks to accomplish project objectives are described below.

Research Tasks

Task 1—Summarize existing literature on curve safety and speed displays

Existing information on low-cost safety treatments for horizontal curves on rural roadways will be summarized. The background information will include where they have been used, their effectiveness, and cost. As stated, several dynamic speed feed back signs will be evaluated in Iowa. Several technologies which have been used for an on-going traffic calming in Iowa are shown in Figure 1.

Figure 1: Two different speed signs evaluated for speed reduction in small rural communities in Iowa (image source: CTRE)

Additionally, we will identify and evaluate at least 2 other low cost treatments. Several low cost treatments were identified in a report by FHWA (McGee and Hanscom, 2006). They include:

- Use of wide edgeline (Figure 2)—a New York study found a 17% reduction in fixed object crashes with use of wider edge lines on rural two lanes roads.

- Use of oversize chevrons to delineate curves (Figure 3)—effectiveness has not been established

- Use of delineators (Figure 4)—one study by the Ohio DOT found a reduction of 15% in ROR crashes

Figure 2: Use of wider edgeline on horizontal curve (image source: McGee and Hanscom, 2006)

Figure 3: Larger chevrons and curve signs—US 6, Johnson County (image source: Tom Welch, Iowa DOT)

Figure 4: Post delineators used on a curve (image source: McGee and Hanscom, 2006)

- Flashing beacons (Figure 5)-- effectiveness has not been established

Figure 5: Use of flashing beacon (image source: McGee and Hanscom, 2006)

- Speed limit advisory in lane (Figure 6)—Texas study found some reductions and indicated they were "worthy of further exploration"

Figure 6: Speed limit advisory in lane (image source: McGee and Hanscom, 2006)

- Edgeline rumble strips—this strategy will be evaluated as part of an IHRB project that was recently awarded. Speed reduction information will be included in this project.

The team will also identify and secure any necessary FHWA's Office of Transportation Operations' Manual of Uniform Traffic Control Guidelines (MUTCD) Team as well as state and local approval.

Task 2—Identify initial pilot study locations in Iowa

The main criteria for selection of pilot study locations will be number and type of crashes on the horizontal curve locations in question. Top priority will be given to crash types that are noted as, or appear to be, speed-related. Another main criteria is that no significant changes in geometry or cross-section have occurred over at least the three years prior to the study, and that no reconstruction or rehabilitation is scheduled during the installation and evaluation period. Other criteria include geometry, location, feasibility of installing and maintaining the signs, and ability to collect speed and crash data.

Two CTRE team members are currently assisting the Iowa DOT in identifying their top 5% of hazardous curve locations. Part of this effort is identifying which curves are high crash locations. They will use their expertise in this area to finalize the methodology to select final curve locations.

All pilot study locations will be in rural areas. Final sites will be selected to represent a range of roadway types and situations so the treatments can be evaluated across a range of conditions. Mr. Tom Welch of the Iowa DOT suggested that we include at least one curve on a rural gravel road since local road safety is a concern in Iowa, as well as in other states. Other common situations in Iowa are locations with long tangents between curves. They are of concern because drivers may become complacent by lack of change in the roadway geometry, then encounter a curve unexpectedly at a high speed. As a result, even large-radius curves can present a hazard when a driver's attention is focused away from the roadway. Another situation to consider is locations where a curve both is preceded and followed in fairly short succession by other curves. We will also want to consider speed differentials between the tangent section and the curve. Locations with large differences may be better candidates. Consideration will also be given to traffic characteristics. A location with a larger percentage of trucks might be impacted differently than a location with fewer trucks. A treatment on a commuter route or one that carries mostly local traffic might lose its effectiveness sooner than a route with fewer regular users, since regular drivers may get used to the technology and pay less attention.

It should be noted that we do not anticipate conducting a large-scale test to evaluate speeds at numerous locations in order to use this in the initial selection criteria, due to time and resource constraints. However, when a curve location is selected, we will conduct a "before" speed study, and may decide not to pursue a pilot study if a demonstrated speed problem does not exist.

A control location will be selected for each pilot study location. The control location will be selected in the same geographical location and will have similar geometric and traffic conditions, along with a similar crash history.

Task 3—Collect Before Data
Once the final pilot study and control locations are selected, baseline roadway, traffic, and crash data will be collected for each location. It is anticipated that the following information will be collected for each site:

Roadway Data: Roadway geometry and other pertinent information to be collected for each pilot study and control site is expected to include the following:

- Number of lanes
- Lane width
- Shoulder width and type
- Speed limit
- Pavement type and condition
- Presence and location of street lighting
- Grade
- Horizontal curve radius
- Degree of curvature
- Super elevation
- Sight distance
- Presence and characteristics of spirals
- Density of curves upstream in terms of number of curves per mile or some similar metric
- Length of the connecting tangent sections
- Any other features that might influence driver expectation and curve approach speed
- Location and type of signing before and within the curve, including location of speed reduction zones, chevrons, etc.

Aerial images and as-built plans will be obtained for each study location, if possible. Information will also be sought from other sources such as geographic information databases (i.e., the Iowa DOT's GIMS road characteristics database or a county database). A site visit will be made in all cases to collect data not available from other sources and to document collected information.

Traffic Data: Speed and volume data will be collected at each pilot study location where the activated speed displays will be installed. We propose collecting data at three locations, similar to what is shown in Figure 7. The upstream data collection location will serve as a control speed location. In the rural traffic calming project that is currently underway for FHWA and the Iowa Highway Research Board, we found that in some cases, speeds actually went up slightly after installation of the traffic calming devices. Fortunately, the data collection protocol called for measuring speeds at locations well away from the traffic calming devices, where speeds would not have been affected by installation of the treatments. As a result, we determined that the speed increases were independent of the installation of traffic calming treatments. We suggest placing a data collection location ½ to 1 mile upstream of the beginning of the curve, at a location well away from spiral sections. The control data collection location will be far enough away from the dynamic display device that neither the presence of the curve nor the display should affect traffic behavior. This will provide us with the ability to evaluate speed trends that may influence study results.

The second data collection location will be at the beginning of curve, to measure how effective the devices are at this point as shown in Figure 7. The third data collection location will be within the curve to determine whether reduced speeds are maintained throughout the curve.

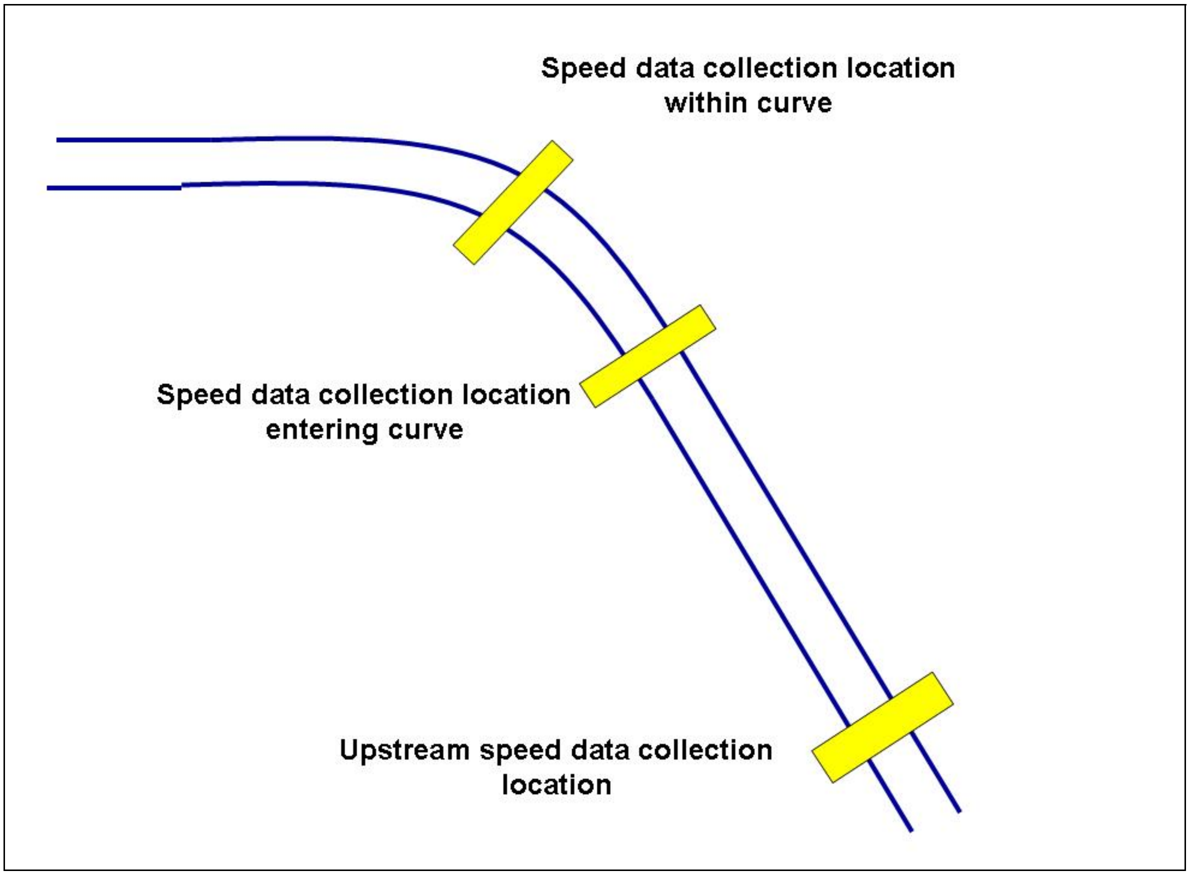

Figure 7: Schematic of proposed data collection locations

Pneumatic road tubes are usually placed across all lanes of an undivided road, so traffic data will be collected in both directions. However, the dynamic devices are only expected to affect speeds in the direction facing the signs. As a result, this will be the main direction of analysis.

We have found, during other speeds studies, that it is best to monitor speeds over 48 to 72 hours, since it is not always possible to note unusual weather or traffic conditions at a data collection location. While every effort will be made to avoid unusual events, it is possible that they will occur, and with several days of data, there is less chance for atypical conditions to overwhelm the final data metrics. Additionally, under lower-volume conditions, a longer study period allows for collection of a larger sample size, which helps to ensure that the data are normally distributed so that appropriate statistical tests, such as the t-test, can be applied.

Data will be collected on the weekdays, Tuesday to Thursday. The equipment will be installed a day prior to when data collection is desired and picked up the day following the final day of data collection. Holidays and the weekdays following holidays in the same week will be avoided. Every attempt will be made to collect speed data during dry pavement conditions. The following data will be collected:

- Individual vehicle speeds
- Individual vehicle headway or arrival time
- Measurement location
- Volume data
- Weather
- Time of day
- Day of week
- Vehicle classification (passenger car vs. heavy truck)

Crash Data: Crashes for a three- to five- year period before installation of the dynamic speed displays will be collected for each pilot study and control curve location. Crash attributes to be collected will include the following:

- Crash type
- Major cause
- Contributing factors
- Sequence of events
- Vehicle types
- Driver age
- Driver contributing circumstance
- Vehicle contributing circumstance
- First harmful event
- Roadway surface condition
- Time, day, and month
- Direction
- Citations issued
- Drug/alcohol use

Average daily traffic volume will also be collected for both the pilot study and control locations for each year as the crash data. Vehicle fleet mix will also be collected. The team will collect AADT corresponding to years for crash data as well as AADT by vehicle class, if available.

Task 4—Install Treatments

The treatments will be installed as soon as possible after sites are selected and any approvals obtained.

Task 5—Collect After-Installation Data

The same speed and volume data collected in the pre-installation period will be collected in the post-installation period. Data collection will mirror pre-installation data collection at each location as much as possible. For instance, traffic data will be collected for the same day of the week. Speed sample sizes will be determined in the final work plan.

Speed data will be collected after-installation, similar to the method described in Task 6 for pre-installation. We propose to collect speed data at one-, three-, six-, nine-, 12-, 18-, and 24-month intervals after installation of the treatments. The treatments are expected to be effective initially. There is some thought that they might lose effectiveness over time once regular drivers get used to them.

Crash data will be collected at the end of the third analysis year for each pilot study and control site. AADT for that three-year "after" period will also be collected. The same crash data will be collected as for the pre-installation

Task 6—Speed Analysis
Speed will be collected for each of the study periods using pneumatic road tubes. Data from the pneumatic road tubes will be inspected as soon as possible after removal of the units for each data collection period to ensure that no problems occurred. If equipment malfunctions or other problems occur, data will be rescheduled the following week or as soon thereafter as possible. Speed data will be checked for normality.

The reduction in speed that occurs will be compared for the "before" and "after" periods for each of the activated speed display signs. Reductions in average spot speed or 85^{th} percentile speeds are the most common measures of effectiveness used in evaluating traffic calming techniques. However, average speed reduction may not be the most appropriate measure of effectiveness. One measure often used in traffic calming studies is to compare the reduction in the percent of vehicles that are traveling at or above a certain threshold above the speed limit (for instance, number of vehicles traveling 15 mph or more above the posted speed limit). Reducing the high speeds of drivers may provide a safer roadway environment than slight reductions in average speeds.

Data from pre- and post-installation will be processed, and reductions in speeds for the following measures of effectiveness will be calculated and compared for statistical significance:

- Mean speed and standard deviation of mean
- 85^{th} percentile
- 10 mph pace
- Percent of vehicles 5, 10, 15, 20, etc. mph over the posted speed limit or over the design speed for the curve
- Mean speed of the fastest 10%
- Headway
- Volume
- Percent heavy trucks

Heavy truck and passenger vehicles will be evaluated separately to determine whether speed reductions differ between vehicle classes. If no significant differences are noted, results will be presented together. Since data will be downloaded after each data collection period, interim results can be provided. Speed will only be monitored at pilot study locations; control locations will not be included in the speed analysis.

Task 7—Crash Analysis
A before and after crash analysis will be conducted for a three- to five-year "before" period, and approximately three-year "after" period. The crash analysis will include both the pilot study and control locations. The specific analysis methodology will be specified in the work plan; however, we anticipate using a Bayesian or generalized linear model analysis. The team has a strong relationship with the Department of Statistics at ISU and currently employs one graduate student from the Department of Statistics who will be used to assist with the analysis, as necessary.

Task 8—Prepare Final Report
An interim report will be submitted after the first year of data collection. A final report will be prepared at the conclusion of the study.

Technical Basis of the Research

This project will provide an opportunity to evaluate low cost treatments that may reduce speeds and crashes on curves on rural roadways.

Facilities and Equipment

The research team has access to the facilities and equipment necessary to complete this project. Task 1 (review of current literature) will be accomplished through a combination of electronic and library resources available to CTRE. Crash analysis will be conducted using Iowa's crash database.

Products

The following deliverables will be produced by this research project:

- Working with technical advisory committee
- Progress reports as requested by the Iowa Highway Research Board
- Interim final report to the Iowa Highway Research Board including results of initial evaluation one year following installation
- Final report for the project will be made at the end of the project

Implementation/Technology Transfer

The research findings will be contained in final report and a 1-2 page tech brief.

Printed copies of the report will be distributed to counties, cities, interested Iowa DOT offices, and national transportation research libraries. PDF files of the report will also be made available to any interested individuals or organizations through the IHRB and CTRE websites.

The interim and final reports will be publicized through news releases and articles in such publications as CTRE's *Technology News*. Evaluation results will also be presented in workshops and conferences such as those conducted by the Iowa County Engineers Association and Local Technical Assistance Program.

Benefits

Iowa counties in particular will benefit from this research by obtaining another tool for improving safety on rural curves. A number of treatments have been used but their effectiveness is not known.

Additionally, use of the project as matching funds to the FHWA project allows us to leverage federal funding to evaluate treatments in Iowa and to be able to compare those results to other sites nationally.

Time Schedule

Project duration is 48 months once the project commences. Table 1 shows a time table for completion of tasks. The timeline presented in Table 1 matches the timeline for the FHWA project.

Table 1: Project Timeline

Task	Activity Description	Milestone/Deliverable	Due Date After Award
1	Identification of displays and curve locations	List of available technologies and specifications	6 weeks
2	Identify initial pilot study locations in Iowa	List of final sites	3 months
3	Collect additional baseline data	Summary of each pilot study and control location	Within 6 months
4	Install treatments	Photo log of pilot study locations after installation	Within 9 months
5	Collect post-installation data		As stated in work plan
6	Speed analysis	Chapter for final report	Within initial results, within 14 months after installation of signs
7	Crash analysis	Chapter for final report	With draft final report
8	Prepare first year evaluation report	First year interim report	Within 12 months
	Prepare draft final report	Draft final report	48 months
9	Prepare quarterly progress reports	Quarterly progress reports	quarterly

Staffing

Bios are presented for the main researchers.

Shauna Hallmark, Principal Investigator

As principal investigator, Shauna Hallmark will provide direction and management for the overall proposed project.

Experience

Shauna is an associate professor in the Department of Civil, Construction, and Environmental Engineering and a research engineer at CTRE. She has significant experience in road departure, traffic calming, and other traffic safety engineering topics. She recently completed a project that evaluated the safety impacts of pavement edge drop-off by developing a relationship between amount of drop-off and run-off-road crashes. The project also included evaluation of crash forms to quantify the number and severity of potential pavement edge crashes in Iowa and Missouri. She is also currently involved with a project to evaluate the effectiveness of adding paved shoulders in reconstruction, restoration, and rehabilitation projects in reducing the number and severity of run-off-road crashes. She participated in the Iowa CHSIP lane departure focus group.

Education

Ph.D., Civil Engineering, Georgia Institute of Technology, 1999; S., Civil Engineering, Utah State University, 1996; B.S., Civil Engineering, Brigham Young University, 1991

Neal Hawkins, co-PI

Experience

Mr. Hawkins has expertise in understanding safety issues related to lighting, pavement markings, and signing. He has led the traffic operations research at CTRE for the last three years. Prior to working at CTRE, Neal led the transportation team at the Howard R. Green Company office in Des Moines. While at Howard R. Green, he supervised and participated in the design of numerous urban streets. Prior to joining Howard R. Green Company, he worked in the Office of Traffic and Transportation for the City of Des Moines. Through his experience as a designer with a consultant, and through his experience with the City of Des Moines, he understands the issues and trade-offs made while making urban roadway designs, and has many first-hand experiences in making safety improvements where trade-offs had to be made between devoting resources to clearing fixed objects or to making other safety and operational improvements. Mr. Hawkins will add practicality to issues faced by municipal engineers and help to interpret the results so the information is useful to practitioners.

Mr. Hawkins' research focus has included a variety of topics, including asset management (serving as the Principal Investigator for two Iowa DOT management system projects involving statewide pavement markings and signs), roadway lighting (serving as Principal Investigator on the Iowa Highway Research Board's "Developing a Rural and Urban Roadway Lighting Practical Design Guide"), traffic signal operations (various projects), urban traffic flow and one-way streets (City of Des Moines "Court Avenue Study"), urban trail safety and pedestrian flow (Corps of Engineers "Des Moines Riverwalk"), dealing with growth and the impacts of large scale development (City of West Des Moines "Western Growth Area Analysis" and City of Johnston "Western Area Analysis"), recreational area safety (Marion County and Corps of Engineers "Red Rock Lake Study"), traffic calming (co-PI on Iowa Highway Research Board "Small Town Traffic Calming" study), road safety audits (FHWA), and developing innovative tools for public agencies to plan and manage infrastructure and daily operations. These projects have been completed for a variety of clients, including the FHWA, Iowa DOT, US Army Corps of Engineers, and numerous municipalities, counties, and consultant teams.

Education: BS, Civil Engineering, University of Oklahoma, 1988; MS, Transportation Engineering, Iowa State University, 1990

Omar Smadi, co-PI
Experience: Dr. Smadi has more than 15 years of experience in the areas of infrastructure and asset management data, and research ranging among pavements, bridges, signs, and other infrastructure assets. He has expertise in pavement performance, pavement markings and signing. He is a research scientist with CTRE and serves as an adjunct professor with the department of Civil, Construction, and Environmental Engineering at Iowa State University. He teaches graduate and undergraduate civil engineering courses on transportation engineering, pavement management, and asset management, and supervises staff, graduate, and undergraduate students. He is currently serving as PI for several research projects for the Iowa Department of Transportation, the Iowa Highway Research Board, and the federally-funded Midwest Transportation Consortium (MTC) and Wisconsin MRUTC. He also serves as a program of study committee member for several graduate students.

Dr. Smadi is a member of the TRB Pavement Management Committee and the committee on Pavement Monitoring, Evaluation, and Data Storage. He is also a member of the ASCE committee on Infrastructure Management Systems and the committee on Advanced Transportation systems. He is serving as a member of Task Force 45, a committee of AASHTO, FHWA, and ARTBA to look at data needs for asset management. He is also listed as a friend of the AASHTO Asset Management Sub Committee and TRB Asset Management Committee. Dr Smadi serves on multiple NCHRP research panels on projects dealing with infrastructure management and data requirements.

Education: Ph.D., Transportation Engineering, Iowa State University, M.S., Transportation Engineering, Iowa State University, B.Sc., Civil Engineering, Yarmouk University

Thomas J. McDonald, P.E.

Tom McDonald brings years of engineering experience and expertise to his role as co-principal investigator on the proposed project. McDonald will assist in the effort on research Tasks 1 (review of literature), 2 (selection of sites, discussion with counties), will provide guidance for Task 3 (installation), and review and comments for the final interim report.

Experience

- Safety Circuit Rider, Center for Transportation Research and Education, Iowa State University, 1998 to present
- Development Engineer, Iowa DOT, 1994–1998
- District Engineer, Iowa DOT, 1988–1994
- Portland Cement Concrete Engineer/Field Exam Engineer, Iowa DOT, 1984–1988
- Resident Construction Engineer, Iowa DOT, 1970–1984
- Engineer in Training/Assistant Resident Construction Engineer, Iowa DOT, 1966–1970

Education and Licensure

- Licensed Professional Engineer, Iowa
- B.S., Civil Engineering, Iowa State University

Qualifications and Accomplishments

As safety circuit rider, Tom McDonald provides technical training to local and state agencies as well as utility companies and contractors, specializing in transportation safety. He has over 30 years of experience in various positions with the Iowa DOT; as district engineer and development engineer, he managed numerous transportation construction and maintenance projects and developed extensive relationships with cities and counties in 20-county region. Experience as a resident engineer and in design provided many opportunities to deal with drainage issues.

McDonald has served as co-principal investigator on many relevant projects, including Red Light Running in Iowa (Iowa DOT); Iowa Flagger Handbook and Training Video (Iowa DOT); Iowa Traffic Control Devices and Pavement Markings: A Manual for Cities and Counties (IHRB TR-441); Iowa Tribal Consultation Process: State of Iowa Tribal Summit and Field Workshop (FHWA and Iowa DOT); Low Water Stream Crossings in Iowa: Report and Guide (IHRB TR-453); Paved Shoulders on Primary Highways in Iowa (Iowa DOT); Synthesis of Best Practices for Increasing Protection and Visibility of Highway Maintenance Vehicles and Workers (IHRB TR-475); Traffic Control Strategies in Work Zones with Edge Drop-Offs (Iowa DOT).

Commitments of the Research Team

Members of the research team are committed to fulfilling the requirements of this project within the proposed schedule. The current commitments of the team leave sufficient and ample time available for conducting the proposed research. CTRE will invite experienced and knowledgeable professionals to serve on the guidance committee, including county engineers, Federal Highway Administration staff, and representatives from the Iowa Department of Transportation.

Iowa DOT or Local Jurisdiction Involvement

The Iowa DOT and local jurisdictions will be solicited for input to selection of strategies and locations for the pilot studies and will also be involved as potential study participants. The IHRB will review the draft interim report before finalization. The IHRB member and DOT led technical person on the project TAC will also review.

Budget

The amount requested from IHRB is $80,000 as indicated at the June 2007 IHRB meeting. The budget is shown in Table 2. Funds for travel are requested to collect data within Iowa. Funds for equipment and equipment are for purchase and installation of the low cost treatments, purchase of data collection equipment, and minor supplies. As indicated this project provides match to a project funded by FHWA. The FHWA match is $300,000 and requires a match of $300,000. The funds from this project along with funding from the Iowa DOT, Midwest Transportation Consortium, and Texas Department of Transportation will be used towards match.

Table 2: Budget

Low Cost Strategies to Reduce Speed and Crashes on Curves

Iowa Highway Research Board

November 1, 2007 to April 30, 2011

Staff Detail	#			Rate*	# of hrs	IHRB Total Project Amount
Faculty						
Shauna Hallmark, PI			$	55.05	220	$12,112
Fringe benefits						$3,198
Reg Souleyrette			$	78.56	10	$786
Fringe benefits						$207
Professional & Scientific Staff						
Neal Hawkins, co-PI			$	51.34	75	$3,851
Fringe benefits						$1,251
Omar Smadi, co-PI			$	52.49	70	$3,674
Fringe benefits						$1,194
Tom McDonald			$	34.96	60	$2,097
Fringe benefits						$682
Dennis Kroeger			$	30.14	50	$1,507
Fringe benefits						$490
Merit (Support) Staff						
Project assistant			$	21.72	37.75	$820
Fringe benefits						$344
Student Research Assistants	#					
R.A. Student (MS candidate)	1	@	$	17.88	520	$9,300
Fringe benefits						$1,070
Hourly						
Other hourly (including unregistered students)	1	@	$	10.00	125	$1,250
Fringe benefits						$150
Total Personnel						$43,983

Budget Summary by Category			
Salaries/Hourly			$33,300
Payroll Benefits			$8,586
Equipment >$5,000			$15,000
Travel-Domestic			$2,000
Supplies/Materials			$7,000
Other Direct Costs			
Communications Services editing, web, publications)			$502
Other (software licenses, leases, etc.			$200
			$0
TOTAL DIRECT COSTS			$66,588
Indirect Costs	@	26.0%	$13,413
TOTAL ALL COSTS			$80,000

1. ISU employees are salaried. Estimate is based on the FY2007 base rates. Annual increases (July 1) and/or midyear promotions or rate changes may affect the level of effort possible under this budget. Hourly rates can be estimated by dividing annual salary by 2080.

2. Fringe rates are *estimated* as follows: Faculty - 26.4%; P&S - 32.5%; Merit - 42%; Research Asnts - 11.5%; non student hourly - 12%; student hourly - 4.6%. Actual fringe will be charged.

3. This project is administered by CTRE (Center for Transportation Research and Education), an ISU non-academic research center.

4. ISU charges indirect on ALL direct costs *except* equipment items over $5000, sponsor paid tuition, and each subcontract's cost over $25,000. Indirect rate is determined by a negotiated agreement between Iowa State University and the Department of Health and Human Services. A copy can be found at http://www.ospa.iastate.edu/Business/docs/FAndARateAgreement.pdf . Basic institutional information can be found at http://ospa.iastate.edu/instinfo.htm

References

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