Memo
Date: May 12, 2010
To: FHWA Office of Transportation Operations, MUTCD team
From: Shauna Hallmark, Neal Hawkins, and Omar Smadi, Center for Transportation, Research, and Education, Iowa State University, 2711 S. Loop Drive, Suite 4700, Ames, Iowa 50010-8664, Office: (515) 294-8103. Email: shallmar@iastate.edu
Subject: Request for permission to experiment with on-pavement advance curve marking

This memo is an update to a request for experimentation with on-pavement curve markings at two sites in Iowa. The following items are contained in this memo:
Appendix A: original request dated February 4, 2010
Appendix B: follow-up responses dated May 5, 2001
Appendix C: email of approval from Harrison County
Appendix D: material provided to Harrison County when request was made. We included the information that was sent to Harrison County so that the MUTCD committee is able to see what the county was agreeing to.
Appendix E: email of approval from Des Moines County
Appendix F: material provided to Des Moines County when request was made. We included the information that was sent to Des Moines County so that the MUTCD committee is able to see what the county was agreeing to.

APPENDIX A: ORIGINAL REQUEST TO MUTCD

Date: February 4, 2010

Background

A team from the Center for Transportation, Research, and Education (CTRE) at Iowa State University is conducting a research project which is investigating the effectiveness of various low cost treatments in reducing speeds on curves in Iowa. Several sites in Iowa were selected which were both high crash locations and had a demonstrated speed problem. A speeding problem was defined as the mean or 85th percentile speed at the site exceeding the posted or advisory speed by 5 more mph. Initial speed studies were conducted using a radar gun. This memo describes at treatments which will be applied if approval is granted on curves at two locations.

Location of experiment and a statement indicating the nature of the problem.

The first site is Loess Hills Trail (L-20) in Harrison County, Iowa as shown in Figure 1. The posted speed limit is 55 mph with a curve advisory speed of 35 mph. There are no chevrons at the curve. The site was identified as a high crash site (22 crashes in 5 years). As indicated a speeding problem was also identified at the location. Annual average daily traffic (AADT) is 1,880 vehicles per day.

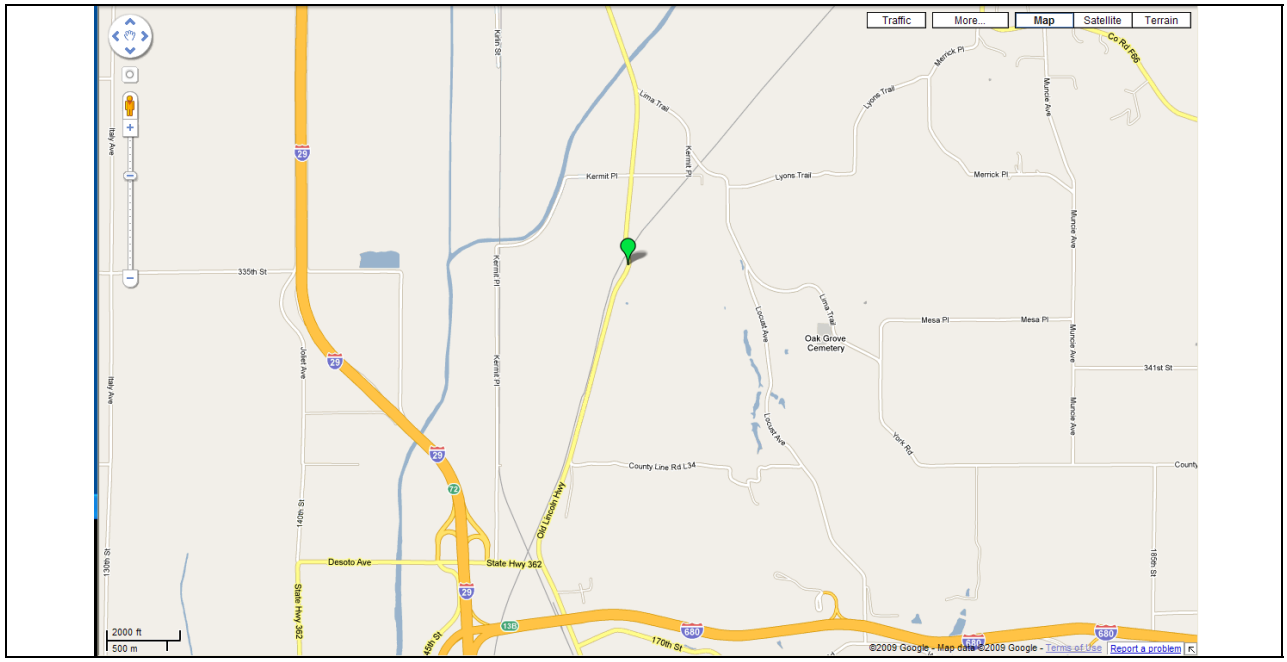

Figure 1: Location for treatment at site 1 (image source: GOOGLE)

The second site is DMC 99 in Des Moines County and is shown in Figure 2. The posted speed limit is 55 mph and no advisory speed is present. No chevrons are present at the curve. The curve has experienced 12 crashes in a five year period. AADT is 1,430 vehicles per day.

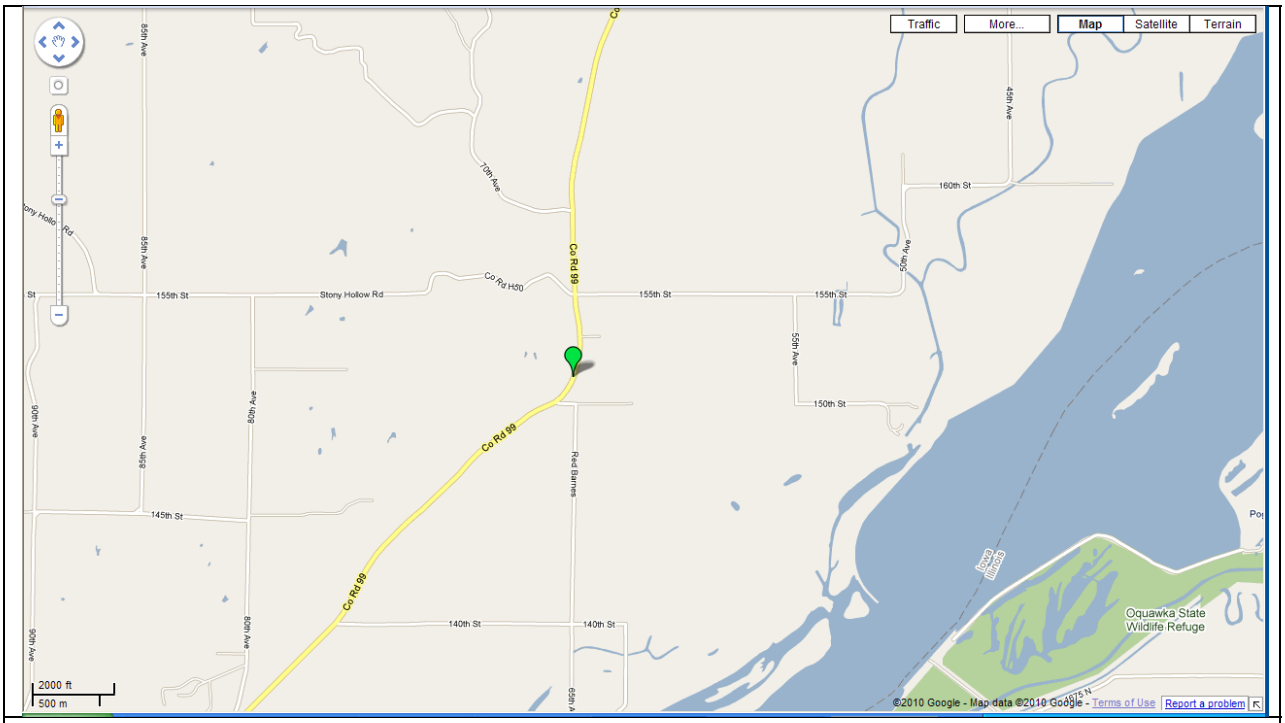

Figure 2: Location for treatment at site 2 (image source: GOOGLE)

A description of the proposed change to the traffic control device or application of the traffic control device, how it was developed, the manner in which it deviates from the standard, and how it is expected to be an improvement over existing standards.
Any illustration that would be helpful to understand the traffic control device or use of the traffic control device.

The device is an on-pavement curve arrow with the wording "SLOW" as shown in Figure 3. All markings are white. This treatment was developed by the Pennsylvania DOT. The treatment consists of two transverse bars, a "SLOW" legend, and arrow indicating the direction of the upcoming curve as shown in Figure 4. The treatment has been used in Ohio and other locations. The treatment is listed as a strategy in "Low-Cost Treatments for Horizontal Curve Safety (2006). The treatment will be placed as indicated by the Penn DOT guidelines shown in Figure 5.

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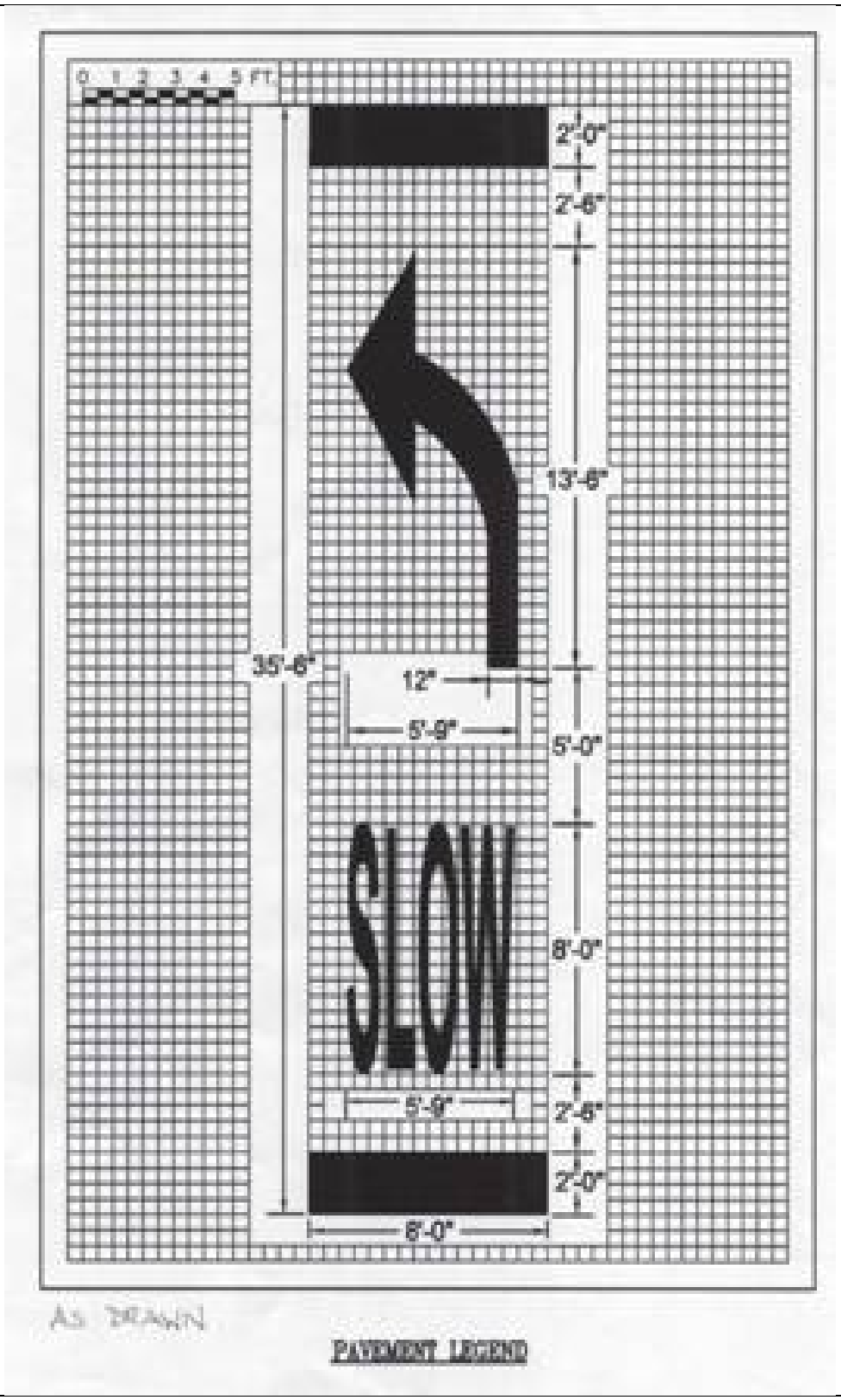
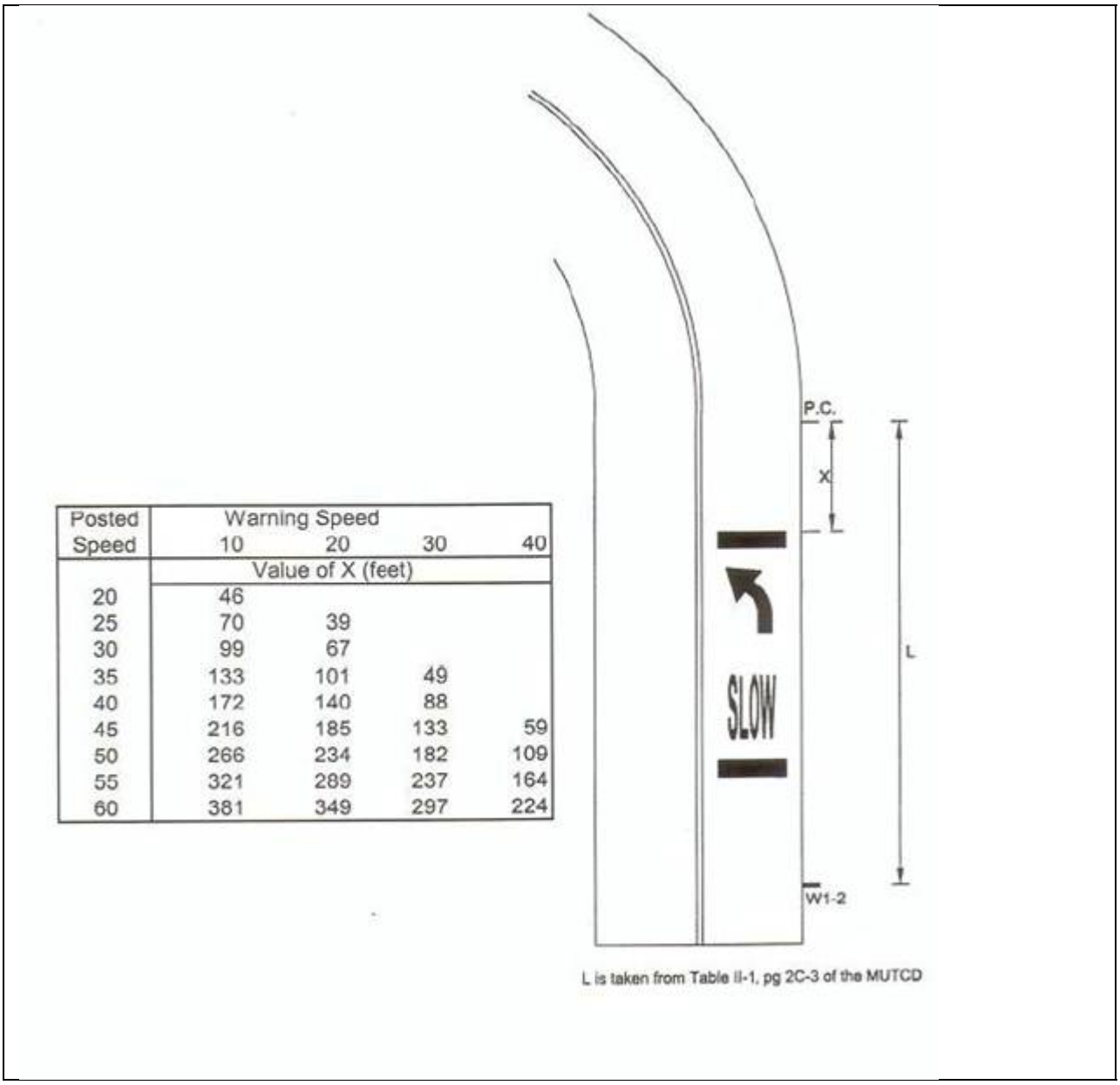


Figure 3: Schematic of Treatment (Image source: Penn DOT, http://safety.fhwa.dot.gov/roadway_dept/horicurves/fhwasa07002/ch7.cfm)

Figure 4: Use of the on-pavement advance curve marking in Ohio



Posted Speed	Warning Speed 10	20	30	40
	Value of X (feet)			
20	46			
25	70	39		
30	99	67		
35	133	101	49	
40	172	140	88	
45	216	185	133	59
50	266	234	182	109
55	321	289	237	164
60	381	349	297	224

Figure 5: Placement guidelines from Penn DOT (Image source: Penn DOT, http://safety.fhwa.dot.gov/roadway_dept/horicurves/fhwasa07002/ch7.cfm)

Any supporting data explaining how the traffic control device was developed, if it has been tried, in what ways it was found to be adequate or inadequate, and how this choice of device or application was derived.

As indicated in the previous section, the treatment was developed by Penn DOT. McGee and Hanscom (2006) reported that the treatment has been shown to reduce overall speeds by 6 to 7% with slight reductions in the percentage of high speed vehicles. No other studies were found which report speed or crash impacts.

A legally binding statement certifying that the concept of the traffic control device is not protected by a patent or copyright. (An example of a traffic control device concept would be countdown pedestrian signals in general. Ordinarily an entire general concept would not be patented or copyrighted, but if it were it would not be acceptable for experimentation unless the patent or copyright owner signs a waiver of rights acceptable to the FHWA. An example of a patented or copyrighted specific device within the general concept of countdown pedestrian signals would be a manufacturer's design for its specific brand of countdown signal, including the design details of the housing or electronics that are unique to that manufacturer's product. As long as the general concept is not patented or copyrighted, it is acceptable for experimentation to incorporate the use of one or more patented devices of one or several manufacturers.)

The on-pavement advance curve sign falls under the category of pavement markings. We are not aware of any copyrights or patents for the device.

The time period and location(s) of the experiment.

The treatment will be installed in spring 2010 (sometime between March and May).

A detailed research or evaluation plan that must provide for close monitoring of the experimentation, especially in the early stages of its field implementation. The evaluation plan should include before and after studies as well as quantitative data describing the performance of the experimental device.

The evaluation will consist of measuring speeds before and after installation of the treatment. Speed and volume data will be collected using pneumatic road tubes at the treatment and within the center of the curve. Speed will also be measured at a point ½ mile upstream where the treatment is not expected to have an impact. This data collection site will be used as a control site.

Data will be collected before the treatment is installed and 1-month after the treatment is installed. Data will then be collected at 3-month intervals for 1year after installation (i.e. 3-mon, 6-mon, 9-mon, and 12-mon). The mean and 85^{th} speeds will be compared for the before and after periods. The number of vehicles exceeding the posted or advisory speed limit by 5, 10, 15, or 20 mph will also be compared.

Standard statistical tests such as t-test or test of proportions will be used to determine statistical significance of changes in speed.

There will not be a sufficient after period to evaluate crashes. It is assumed that a reduction in speeds will result in a reduction in crashes.

An agreement to restore the site of the experiment to a condition that complies with the provisions of this Manual within 3 months following the end of the time period of the

experiment. This agreement must also provide that the agency sponsoring the experimentation will terminate the experimentation at any time that it determines significant safety concerns are directly or indirectly attributable to the experimentation. The FHWA's Office of Transportation Operations has the right to terminate approval of the experimentation at any time if there is an indication of safety concerns. If, as a result of the experimentation, a request is made that this Manual be changed to include the device or application being experimented with, the device or application will be permitted to remain in place until an official rulemaking action has occurred.

The pavement marking treatment will be installed and evaluated for 1-year without being repainted. Since the treatment consists of pavement markings, normal wear will obliterate the markings within 1-year of ending the evaluation of the treatment.

If any safety concerns are brought to the attention of the research team, the markings will be removed as soon as possible.

An agreement to provide semi-annual progress reports for the duration of the experimentation, and an agreement to provide a copy of the final results of the experimentation to the FHWA's Office of Transportation Operations within 3 months following completion of the experimentation. The FHWA's Office of Transportation Operations has the right to terminate approval of the experimentation if reports are not provided in accordance with this schedule.

The team will provide a semi-annual progress reports during the duration of the testing. The team will also submit a copy of the final report and tech brief to the FHWA's Office of Transportation Operations.

References

McGee, Hugh and Fred R. Hanscom. Low-Cost Treatments for Horizontal Curve Safety. FHWA-SA-08-002. Dec 2006.

APPENDIX B: FOLLOW-UP RESPONSES FROM ISU TO MUTCD COMMITTEE

Date: May 5, 2010
To: FHWA Office of Transportation Operations, MUTCD team; Jerry Roche, FHWA
From: Shauna Hallmark, Neal Hawkins, and Omar Smadi, Center for Transportation, Research, and Education, Iowa State University, 2711 S. Loop Drive, Suite 4700, Ames, Iowa 50010-8664, Office: (515) 294-8103. Email: shallmar@iastate.edu
Subject: Request for permission to experiment with on-pavement advance curve marking

This memo is in response to concerns by the MUTCD committee concerning use of advance curve markings on 2 Iowa curves.

We would like to clarify that this is not part of the FHWA "Evaluation of Low Cost Safety Improvements Pooled Fund Study." We will be providing data to that team. This project however, is funded by the Iowa Highway Research Board and Iowa Department of Transportation.

1. I am concerned that the 2 curve locations, both of which have been identified as being high crash locations with excessive speed, have not been first treated with MUTCD-compliant devices. The Harrison County location has no chevrons. The Des Moines County location not only has no chevrons but doesn't even have an Advisory Speed posted. It doesn't say whether delineators, edge lines, and other remedial measures have been tried at these locations. Ordinarily we would see experimental devices proposed for use at locations where traditional devices have not solved the problem.

Both sites have edgelines.

Harrison County does have an advisory speed of 35 mph. There are no chevrons at the location which we believe is due to the fact that there is a railroad overpass (which has a rather narrow configuration) within the curve that has a number of hazard markers as shown in Figure 1. Use of chevrons at this location may result in visual clutter. Additionally, at this location, it is important to slow traffic so they can negotiate the overpass without encroaching on the adjacent lane which will not necessarily be achieved by addition of chevrons.

Figure 1: Railroad Overpass at Loess Hills Trail

At the DMC 99 location in Des Moines County, there are no chevrons or advisory speed as highlighted by the MUTCD committee. The intent of the project was to select a number of high crash curve locations which had not received any treatment for the last several years and then to apply one of three treatments as shown in Figure 2.

Since two of the treatments required that existing chevrons be present, the on-pavement treatment seemed most appropriate for the site with no chevrons. Since this is a research project, we would also like to try the on-pavement marking at a site where it is the only treatment since this makes it easier to test the effect of just that treatment.

	
On-pavement curve sign	larger chevron replacing regular chevrons

reflectorized strips on existing chevrons

Figure 2: Low Cost Curve Treatments

However if this is not acceptable to the MUTCD committee we can use one of the sites which is slated for the other treatments.

2. They cite the PA experimentation and research with the advance curve pavement marking but, to my knowledge, all of the PA locations already had chevrons (or large arrows) and advisory speeds. In ISU's Figure 5, they have reproduced PA's placement guidelines, and you can see that the advance placement distance is based on differential between speed limit and advisory speed. I don't see the use of testing this marking at curves that are not sharp enough to need an advisory speed, or at locations where other traditional remedial measures have not yet been tried.

Pennsylvania's placement guidelines will work at the Loess Hills Trail site (Harrison County) since it has an advisory speed.

The sign would be placed at the Des Moines County site using the difference between 50^{th} or 85^{th} percentile speed and the speed limit. For example, if the 85^{th} percentile speed was 65 mph and the speed limit was 55 mph, we would use a 10 mph differential.

Even though the curve does not appear to be sharp, it is a high crash location. We feel that treatments to slow vehicles on curves should not be limited to just sharp curves.

3. The research method is a simple "before-and-after" comparison of speeds. They do not plan to maintain the markings in place for long enough to obtain before and after crash data. Do you think this is an adequate evaluation of the device?

There will only be 2 sites. We do plan to track crashes but conducting a before and after crash analysis on two sites will not provide enough information to draw conclusions with any statistical significance.

In addition, we will be sharing results with Craig Lyon who is conducting the FHWA "Evaluation of Low Cost Safety Improvements Pooled Fund Study." That research team plans to conduct a crash analysis over several states which have incorporated the on-pavement curve marking.

4. The request says ISU is doing the research for Iowa DOT, but the 2 locations they have chosen are both on county-maintained roads, one in Harrison County and one in Des Moines County. If we end up deciding to further consider approval of this experiment, we would need to have letters from the county highway departments concurring with the experiment and agreeing to the terms of Section 1A.10.

We have approval from each county and can forward that. We currently have an email from each county. Please let us know if that will suffice.

APPENDIX C: EMAIL OF APPROVAL FROM HARRISON COUNTY

Contact info for Harrison County Engineer

Engineering & Secondary Roads

Location
Harrison County
Engineer's Building
301 N 6th Ave.
Logan, IA 51546

Hours of Operation
Mon. - Fri.
7:00 a.m. to 3:30 p.m.

Phone:
(712) 644-3140
Fax:
(712) 644-3412

Other Websites of Interest

Iowa Department of Transportation

Need Adobe Reader?
Then download it here.

Get ADOBE READER

Home

IOWA

The Official Website of

Harrison County, Iowa

General Information

A Guide to Country Living

Harrison County maintains 144 miles of paved roads and 792 miles of gravel road. In addition, there are over 160 miles of earth roads in the county. The Code of Iowa requires all counties to employ a licensed engineer to be in charge of the construction and maintenance of all roads under the county's jurisdiction. The County Board of Supervisors fixes the terms of employment of the engineer. All employees of the Secondary Road Department are hired by the County Engineer, at the direction of the Board, to carry out the duties of the Department.

Tom Stoner
County Engineer

Tom Robbins
Road Foreman

Kathy Lundergard
Office Manager

Ron Bell
Field Assistant to the Engineer

John Shelton
Office Assistant to the Engineer

Dennis Hall,
Engineering Technician

Email from Harrison County Engineer

-----Original Message-----
From: mail.loganet.net [mailto:jtstoner@harrisoncountyia.org]
Sent: Tuesday, February 09, 2010 7:52 AM
To: Hawkins, Neal R [ITRNS]
Subject: Re: Iowa DOT Study - Safety Treatments on Rural Curves

Neal:

Would very much like to participate, and much prefer the additional pavement marking concept.

Tom Stoner

> Original Message -----
> From: Hawkins, Neal R [ITRNS] <mailto:hawkins@iastate.edu>
> To: 'jtstoner@harrisoncountyia.org'

Cc: Hallmark, Shauna L [CCE E] <mailto:shallmar@mail.iastate.edu> ; 'smadi@iastate.edu'
Sent: Monday, February 08, 2010 2:01 PM
Subject: FW: Iowa DOT Study - Safety Treatments on Rural Curves

Tom, will you be able to participate in this study?

Thanks,

Neal

_____

From: Hawkins, Neal R [ITRNS]
Sent: Friday, January 22, 2010 2:22 PM
To: 'jtstoner@harrisoncountyia.org'
Cc: Hallmark, Shauna L [CCE E]; 'smadi@iastate.edu'
Subject: Iowa DOT Study - Safety Treatments on Rural Curves

Tom, CTRE is leading an Iowa DOT research project on the effectiveness of low cost safety treatments on rural curves. We have identified a number of curve locations throughout the state where we would like to install and evaluate various curve identification/speed reduction treatments. One of the proposed study locations falls within your county (see attached document) and we are writing you to request permission to install and evaluate the traffic control device. We are considering several curve treatment options as noted below and our initial thoughts for your curve site is depicted on the attached document. Only one option will be installed.

* Add reflective sheeting material on the face of the chevron sign supports.

* Increase the size of the existing curve chevron signs.
* Add a pavement marking message to alert motorists of the curve.

The treatment will become the property of the County at no charge and we are asking that you assist the research team through providing traffic control and, if appropriate, help install the new signs. We expect to install the treatment in the Spring of this year (2010).

Please let me know if you are willing to participate in the study effort. Feel free to email or call me, my information is noted below.

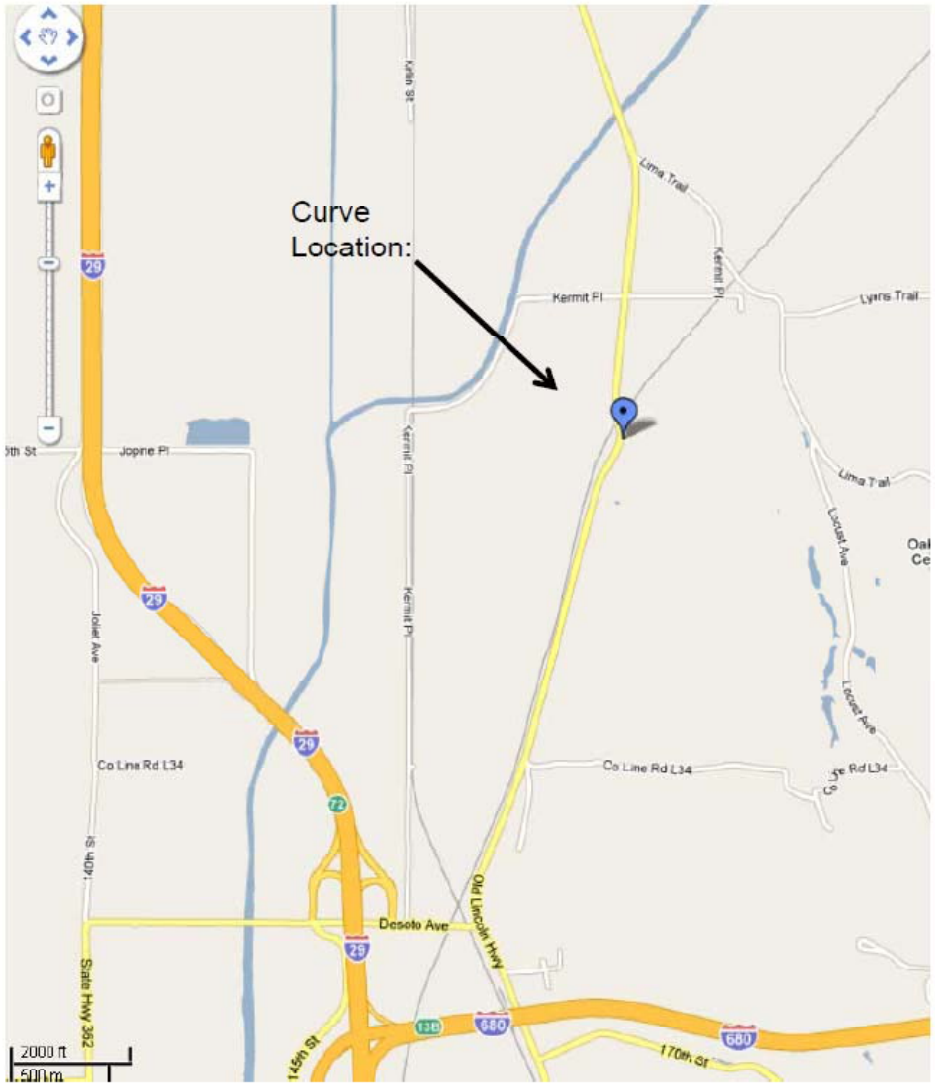
Thank You!

Neal

Neal Hawkins, P.E.
hawkins@iastate.edu <mailto:hawkins@iastate.edu>
Associate Director of Traffic Operations - CTRE (Center for Transportation Research and Education)
Director - CWIMS (Center for Weather Impacts on Mobility and Safety)
Iowa State University
ISU Research Park
2711 S. Loop Drive, Suite 4700
Ames, Iowa 50010-8664
Phone: 515.294.8103
Fax: 515.294.0467

APPENDIX D: MATERIAL PROVIDED TO HARRISON COUNTY WHEN REQUEST WAS MADE

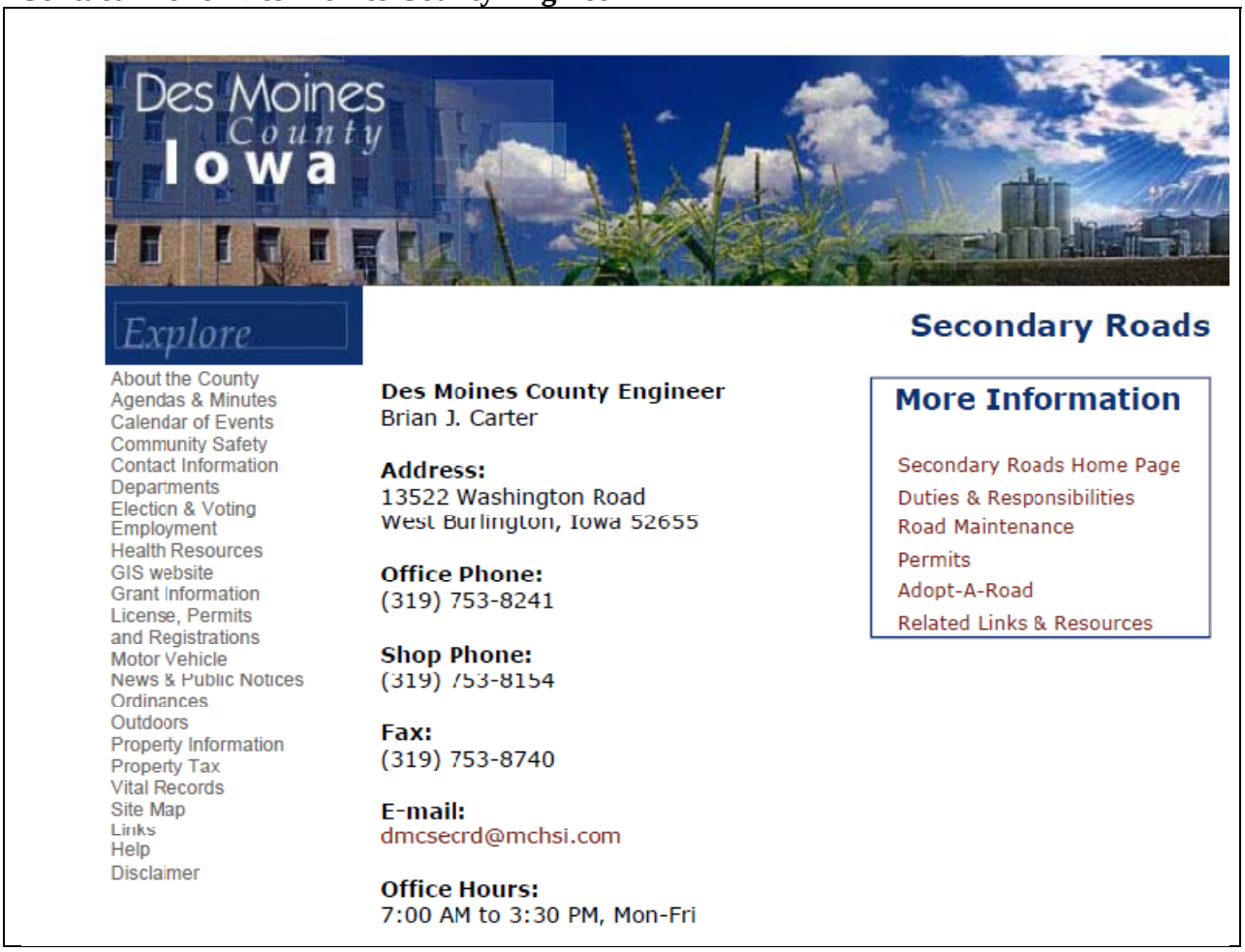
Loess Hills Trail – Harrison County



Expected Treatment:
Pavement marking message in advance of the curve (for both directions). See example below:

APPENDIX E: EMAIL OF APPROVAL FROM DES MOINES COUNTY

Contact info for Des Moines County Engineer



Emails from Des County Engineer

From: Brian Carter [mailto:dmccoeng@mcfshsi.com]
Sent: Thursday, April 15, 2010 1:46 PM
To: shallmar@iastate.edu
Subject: Iowa DOT Study - Safety Treatments on Rural Curves

Shauna,

I'd be happy to work with you on this project. Let me know when you get closer to painting and if you have a specific layout, please provide it. Thanks.

Brian J. Carter, P.E.
Des Moines County Engineer
Phone: 319-753-8241
Fax: 319-753-8740

-----Original Message-----
From: Hallmark, Shauna L [CCE E] [mailto:shallmar@iastate.edu]
Sent: Tuesday, March 23, 2010 8:09 AM
To: 'dmcsecrd@mchsi.com'
Subject: RE: Iowa DOT Study - Safety Treatments on Rural Curves

Brian,

I just realized I should have provided the curve information in case you didn't have it from the previous email from my colleague Neal Hawkins. The attached shows the curve location we are interested in Des Moines County as well as the treatment.

Shauna

Center for Transportation, Research, and Education
Iowa State University
2711 S. Loop Drive, Suite 4700
Ames, Iowa 50010-8664

Office: (515) 294-5249
Fax: (515) 294-0467

From: Hawkins, Neal R [ITRNS]
Sent: Wednesday, February 10, 2010 11:05 AM
To: 'dmcsecrd@mchsi.com'
Cc: Hallmark, Shauna L [CCE E]; 'smadi@iastate.edu'
Subject: Iowa DOT Study - Safety Treatments on Rural Curves

Brian, CTRE is leading an Iowa DOT research project on the effectiveness of low cost safety treatments on rural curves. We have identified a number of curve locations throughout the state where we would like to install and evaluate various curve identification/speed reduction treatments. One of the proposed study locations falls within your county (see attached document) and we are writing you to request permission to install and evaluate the traffic control device. We are considering several curve treatment options as noted below and our initial thoughts for your curve site is depicted on the attached document. Only one option will be installed.

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Please let me know if you are willing to participate in the study effort. Feel free to email or call me, my information is noted below.

Thank You!
Neal

Neal Hawkins, P.E.
hawkins@iastate.edu

APPENDIX F: MATERIAL PROVIDED TO DES MOINES COUNTY WHEN REQUEST WAS MADE

Curve 60

1,430 vpd
DMC 99 --
Des Moines
County

On-pavement curve sign