

Memo

To: MUTCD Experimentation Approval Team

From: Shauna Hallmark and Neal Hawkins

Project: Evaluation of Traffic Calming Treatments for Rural Communities Phase II

Subject: Description of Traffic Calming Plan for Jesup, Iowa

Date: August 20, 2011

1. Background

This memo is to request MUTCD approval for a traffic calming treatment which will be implemented in Jesup, Iowa. The traffic calming is being implemented as part of an Iowa Highway Research Board (IHRB) and Iowa DOT project which is evaluating the effectiveness of low-cost traffic calming strategies on reducing speeds along major roads through small communities. This project is being conducted by the Center for Transportation Research and Education (CTRE) at Iowa State University (ISU). This project is the second phase of a project which also evaluated a number of rural traffic calming treatments.

In the first phase, the research team evaluated several traffic calming treatments that were appropriate for small rural communities. That research was funded by the Iowa DOT, the Iowa Highway Research Board, and Federal Highway Administration (<http://www.intrans.iastate.edu/research/detail.cfm?projectID=-226410767>). Several types of treatments were shown to be effective while a few of the others were not. However, each treatment was only applied in one location. As a result, firm conclusions could not be drawn about whether the effectiveness or lack of effectiveness was due to the treatment itself or was related to other factors. Additionally, since traffic calming in rural communities is relatively unknown in the US, there are a several other treatments which may have been effective but could not be evaluated under the scope of that project. There have also been subsequent requests from Iowa agencies and other communities nationally for additional guidance in selecting and applying traffic calming in small communities.

In the current project (Phase II), CTRE is evaluating the effectiveness of additional low cost treatments at the entrance to small rural communities. The focus is on the main road within a small community which also serves as the major state or county highway outside the community. As a result, drivers frequently enter the community at high speeds which poses a safety problem within the community. The objective of rural community traffic calming is to remind drivers traveling along major state or county highways that they are entering a community and need to adjust their speed accordingly.

The treatment described in this request was selected by carefully considering traffic calming treatments that have been effectively used in other countries for small rural communities, as well as using the information gained from the first phase of the project.

2. Description of Community

The traffic calming treatment will be installed in Jesup, Iowa (Figure 1 and 2). The population is 2,212. Traffic calming is proposed along the main road through community 220th Street (State Highway 939 outside of Jesup).

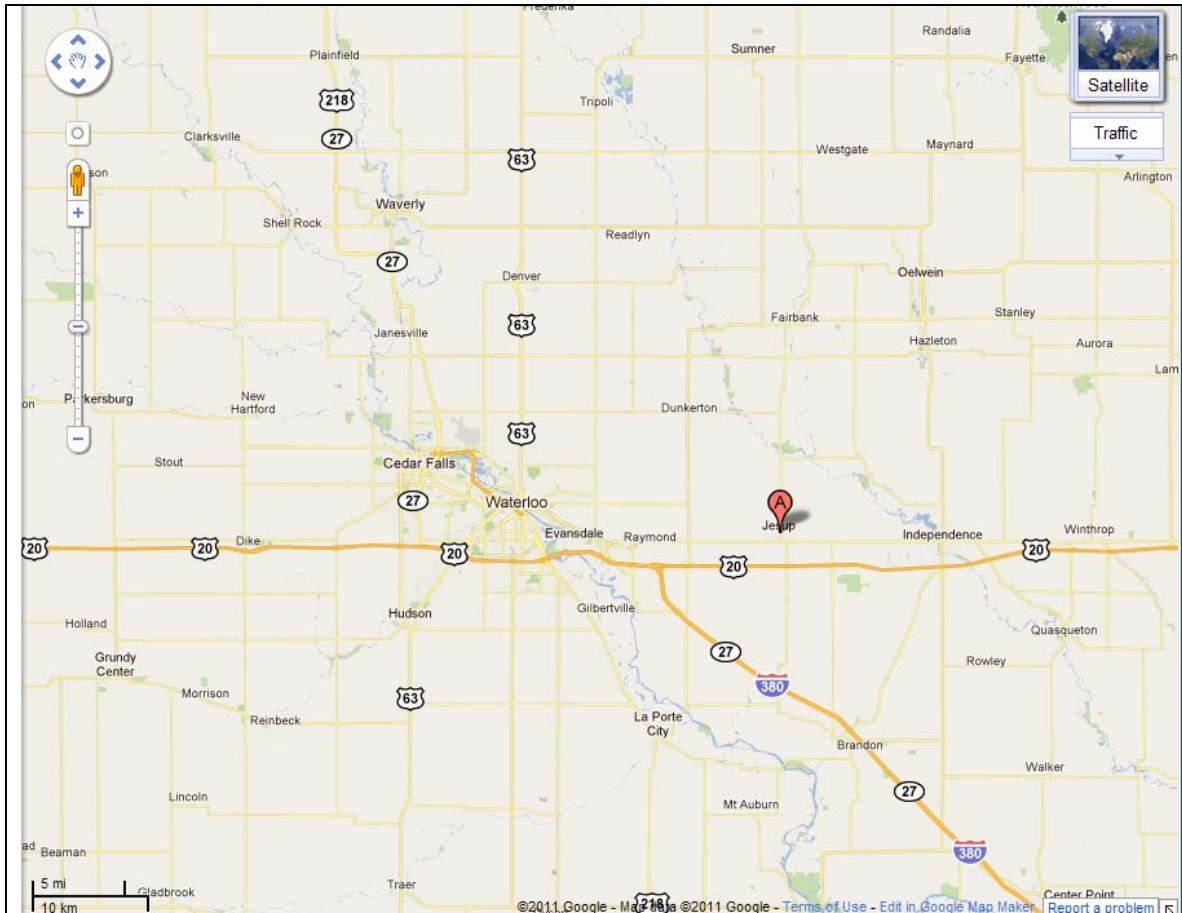


Figure 1: Location of Jesup, Iowa

3. Nature of the Problem (Step 1 of the Experimentation Request)

As noted, 220th Street serves as the main route through Jesup. A number of business and residential areas are located long both sides of the roadway as shown in Figure 2. The speed limit is 55 mph outside of the community and drops to 35 mph at 1st Street on the west and east of 12th Street on the east. An initial speed study was conducted and the 85th percentile speeds for both entrances were 5 to 9 mph over the posted speed limit of 35 mph. Relative to the community, these sites have high volumes with 3,070 vehicles per day (vpd) at the west entrance and 2,850 vpd at the east entrance. The site was recommended by the Buchanan County engineer who was concerned about speeding and safety.

The proposed treatment is requested since few strategies are available for rural traffic calming.

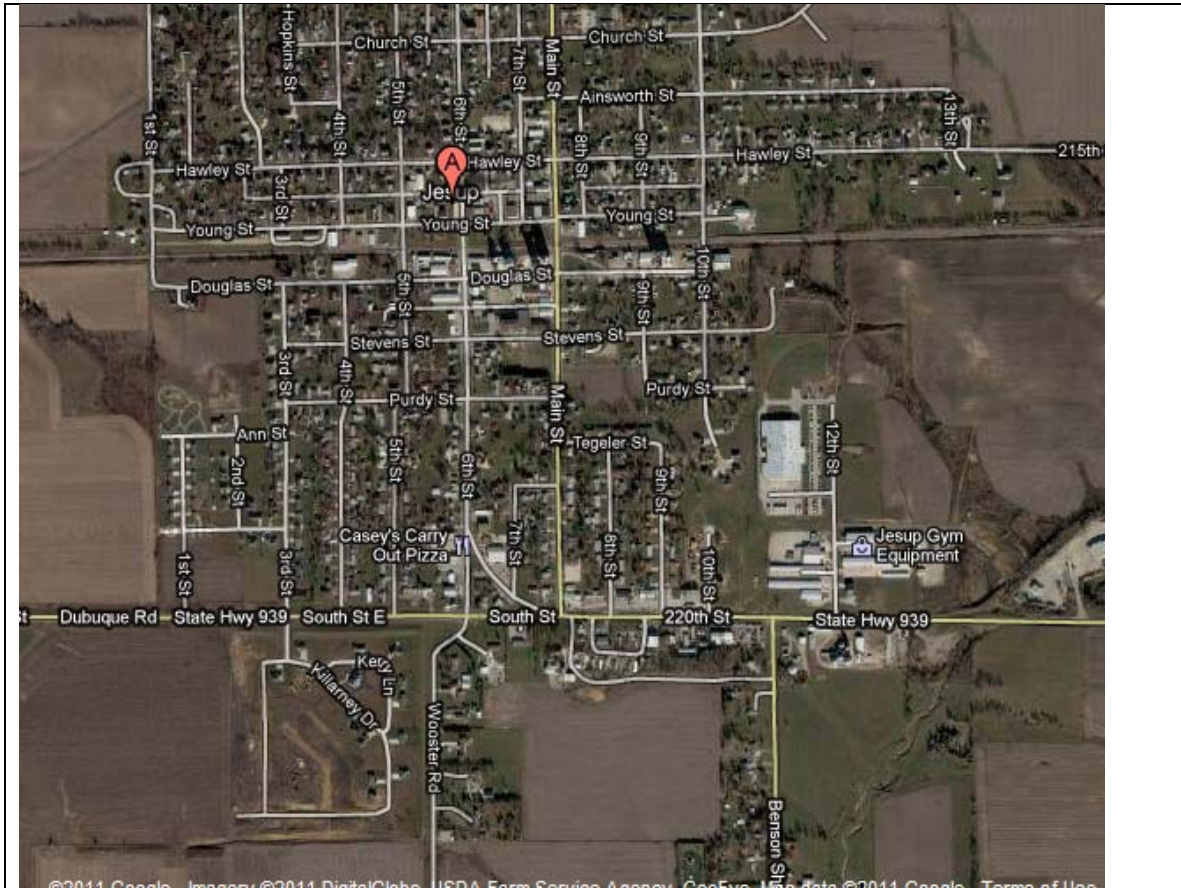


Figure 2: Schematic of Jesup, Iowa

4. Description of the Treatment (Step 2 of the Experimentation Request)

The following describes how the treatment was selected, describes the treatment, and outlines how it deviates from the MUTCD.

4.1 Development of Treatment

As noted in the background section, treatments in general were selected based on a review of what has been successfully implemented in Europe or was evaluated in the first phase of a rural traffic calming project. Consideration was also given to cost since rural communities have constrained resources for traffic management.

Colored surface dressing or textured surfaces are common traffic calming treatments in the UK and are often used in conjunction with gateways or other traffic calming measures to emphasize the presence of traffic calming features. Surface treatments are typically done in different colors or textures. They draw attention to the fact that something about the roadway is changing and provide visual clues to the driver that they have entered a

different area. A common European entrance treatment using lane narrowing's and red surface markings is shown in Figure 3.

Figure 4 shows a modified treatment tested in Dexter, Iowa as part of Phase I of this project. This treatment was found to be very effective as described in Section 6. The proposed treatment is based on the Dexter treatment but was modified to more closely reflect treatments used in Europe.



Figure 3: Red Markings with Posted Speed Limit Signs Used in European Gateways (image source: Sustrans, 2004)



Figure 4: European Style Traffic Calming Treatment Used in Dexter, Iowa

4.2 Design and Placement

The full final treatment design to be tested is shown in Figures 5b. Figure 6 shows design details. The proposed treatment consists of “dragon’s teeth for approximately 100 feet followed by two colored boxes which reinforce the speed limit. An entrance treatment will be used at the east and west entrances to the community on 220 St. The treatment will be set to terminate at the beginning of the 35 mph speed limit since this is where it is desirable to slow people down as shown in Figure 7.

The colored box portion of the treatment will be constructed from a high friction material so that the area is skid resistant. The colored box portion of the treatment reminds drivers that the roadway is changing and reinforces the change in posted speed limit. A study of just on-pavement speed limit markings indicated that the markings alone were not effective. The box provides significant visual contrast. The box is approximately 12 feet tall with 8 foot lettering with standard font and spacing. The boxes are spaced 28 feet apart so that drivers are able to read the message sequentially.

The “dragon’s teeth” are used to lengthen the area of the treatment so it is more visible to the drivers. The red treatment was very effective in a previous study conducted in Dexter, Iowa (information on the effectiveness is provided in Section 6). The red treatment is not that large and is somewhat unusual. The white “dragon’s teeth” provides some transition which may be effective in getting driver’s attention in advance of the red treatments. The white portion also provides some visual narrowing of the lanes well in advance of the treatment. The “dragon’s teeth” pattern is used instead of the speed reduction markings covered in Section 3B.22 of the MUTCD since a study in Union, Iowa using the speed reduction markings showed them as only being moderately effective. The dragon’s teeth are larger and more unusual so it was felt that the pattern would get drivers’ attention. It also reflects some of the zig-zag edge line styles used in Europe.

The original design was to use both the red marking and “dragon’s teeth” together. The MUTCD experimentation team requested that the red markings be tested first and then one year later the white “dragon’s teeth” be added so that the effect of just the red treatment compared to the entire design could be assessed. As a result, the treatment will be applied in two phases. The treatment for Phase I is shown in Figure 5a. A speed evaluation will be conducted at 1-month and then 12-months. After the 12-month data collection, the dragon’s teeth will be added and the Phase II design will be that shown in Figure 5b. Speed data will then be collected at 13-months and 24-months.

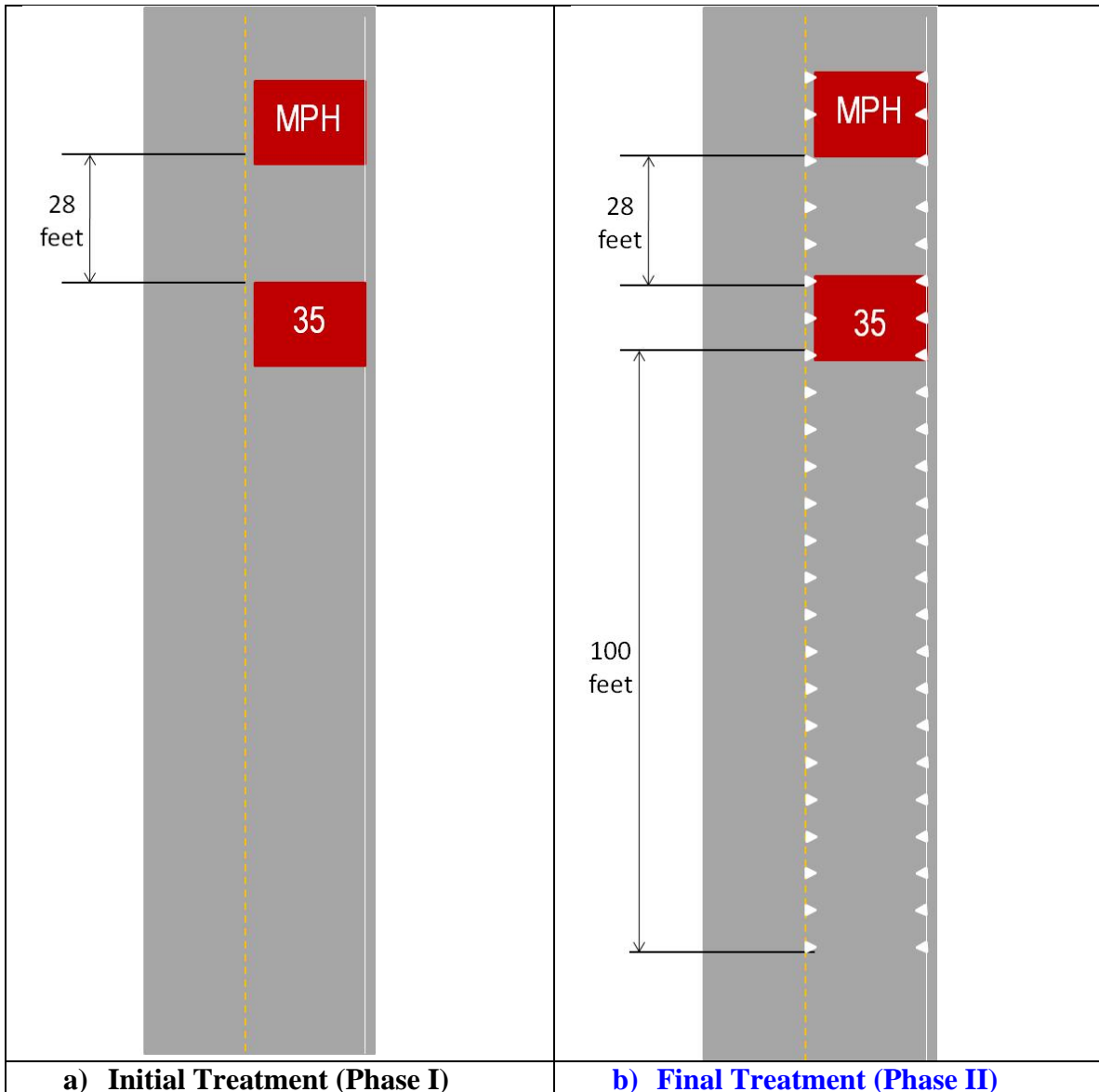


Figure 5: Schematic of Treatment

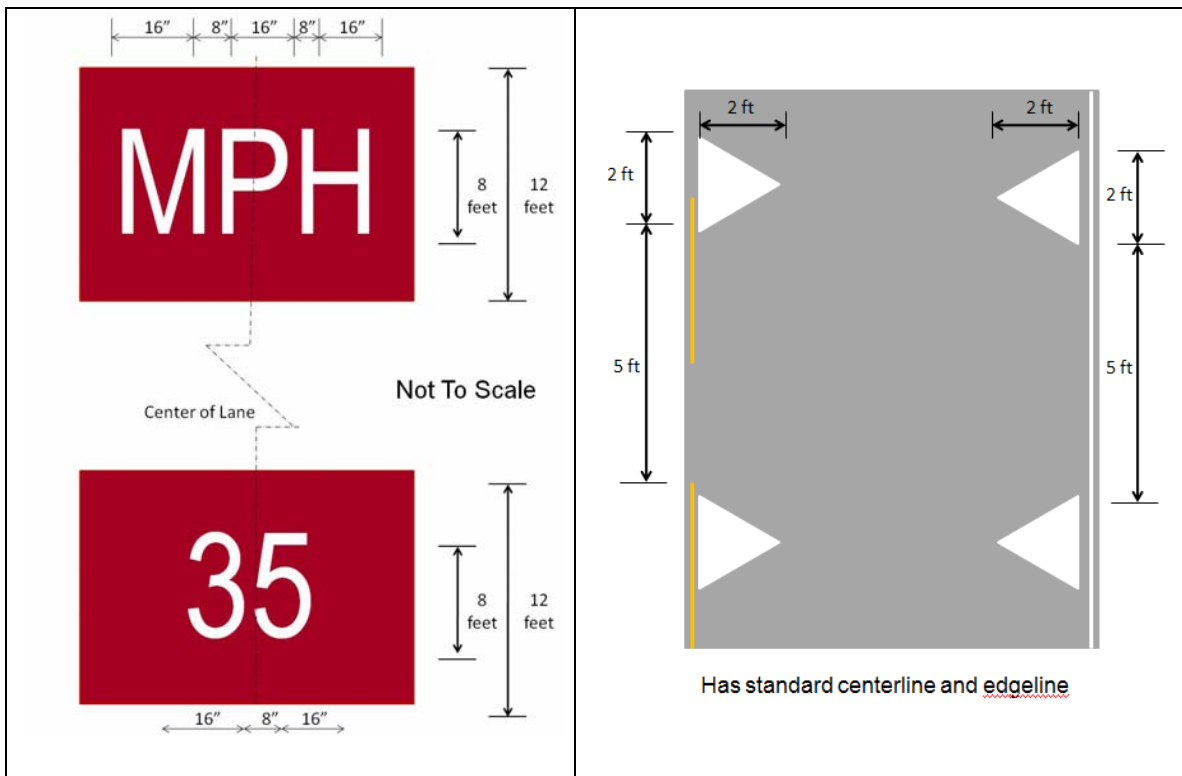


Figure 6: Details of Treatment

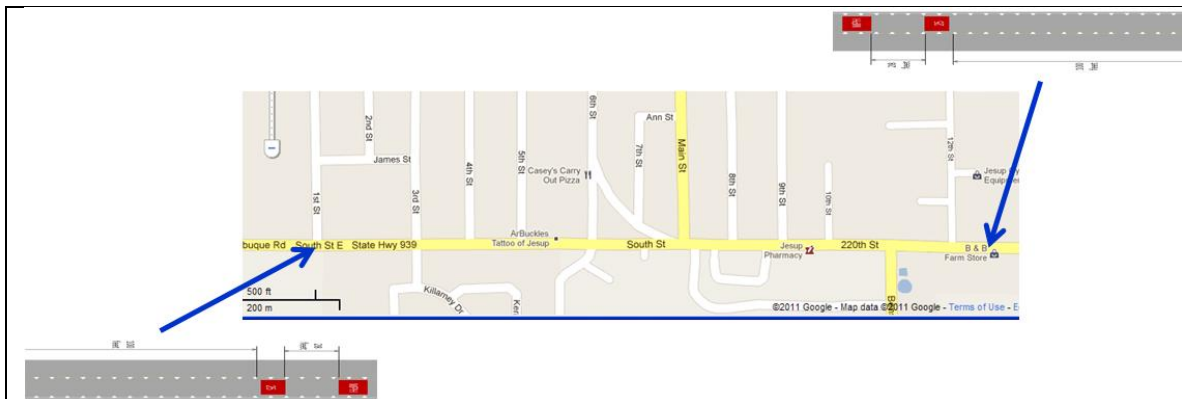


Figure 7: Location for Treatment

4.3 Deviation from the MUTCD

The use of on-pavement speed limit markings (35 mph) are allowed as described in Section 3B.20 (2009 version) of the MUTCD. Use of the colored box is not covered in the MUTCD although Section 3A.05 states that pavement markings shall be yellow, white, red or blue.

The “Dragon’s teeth” are similar to speed reduction markings (Section 3B.22) but are not specifically covered in the MUTCD. Orientation and size of the triangle used in the design was selected so that they would not be confused with yield lines (Section 3B.16), advance speed hump markings (3B.26), or any other type of marking covered in the MUTCD. The markings are white for both sides in compliance with Section 3B.15 which states that transverse markings should be white.

5. Illustration of the Traffic Control Device (Step 3 of the Experimentation Request)

See section B.

6. Effectiveness (Step 4 of the Experimentation Request)

A study in Shropshire, UK reported on the use of colored surface treatments in conjunctions with speed limit signs (DETR, 2005). They used red patches 8 meters long across full width of roadway along with speed limit signs placed for each direction. This configuration was repeated at 10 locations throughout the city and was used along with other traffic calming measures. The study indicated that reductions in both mean and 85th percentile speeds occurred although actual values were not provided.

A study of a modification of the European treatment was evaluated at the entrances to Dexter, Iowa along 350th Street (State Highway 925), see Figure 4. The treatment resulted in a reduction in mean speeds of 5.4 mph and reductions in 85th percentile speeds of 8 mph. The percentage of vehicles traveling 5 or more mph over the posted speed limit was reduced by up to 32% and the percentage of vehicles traveling 10 or more mph over the posted speed limit was reduced by 14.5% (Hallmark et al, 2007).

7. Copyright (Step 5 of the Experimentation Request)

CTRE developed the design. Consequently the device is not protected by patent or copyright.

8. Proposed Time and Location of Experiment (Step 6 of the Experimentation Request)

The treatments will be installed by fall of 2011. The duration of the test study will be approximately 12 months. Location of the experiment is described in Section 4.2.

9. Evaluation Plan (Step 7 of the Experimentation Request)

We plan to install the treatments in the fall 2011. An initial speed study was conducted to make a preliminary determination as to whether a speeding problem existed. However, only 25 vehicles were collected with a radar gun which is not a representative sample. A full scale speed study will be implemented before implementation of the traffic calming devices to establish a baseline “before” case. “Before” data will be collected no more than one month before implementation of the gateway treatments. Phase I of the treatment will be installed and data will be collected within one month after the devices are installed and at one year. Phase II of the treatment will be installed after the 12-month after data collection and data will be collected at 13-months and then again at 24-months. “After” data will be compared with “before” data and across time to determine effectiveness over time. Data will be collected for at least 24-hours using pneumatic road tubes (JAMAR brand counters).

Data will be compared for the before period to Phase I at 1-month and 12-month, before period to Phase II at 13-months and 24-months, Phase I at 1-month to Phase II at 13-months, and Phase I at 12-months to Phase II at 24-months. This will allow us to determine if just the Phase I treatment was effective or if “dragon’s teeth” added for Phase II are more effective in getting driver’s attention.

We expect to use the t-test, F-test, or tests of proportionality to compare speed data. A 95% level of confidence will be used for statistical tests. If data are not normally distributed (which we expect is unlikely given the large sample sizes), the appropriate non-parametric test, such as the Wilcoxon signed rank test will be used.

We anticipate comparing the following data in order to determine whether the treatments were effective:

- average speed
- 85th percentile speed
- % vehicles 5, 10, 15, and 20 mph over speed limit
- volume

The after period will only be two years. This is not sufficient time to conduct a crash analysis so study results will be based on the assumption that reducing speeds will have a safety impact in the community.

10. Removal of Treatment (Step 8 of the Experimentation Request)

Without refreshing the pavement markings during the study we expect, given Iowa’s harsh winter climate and use of snow plows and de-icing agents, the pavement markings will have faded or been removed within 36 months.

If the team, Iowa DOT, Buchanan County, or FHWA determines that the treatment constitutes a safety hazard, the treatment will be removed before the end of the study.

11. Agreement to provide semiannual progress reports (Step 9 of the Experimentation Request)

A final project report and tech brief will be provided to the Office of Transportation Operations at the conclusion of the project.

12. References

DETR (2005). Department of the Environment, Transport and the Regions. *Traffic Calming on Major Roads*. England.

Hallmark, Shauna L., Eric Peterson, Eric Fitzsimmons, Neal Hawkins, Jon Resler, and Tom Welch. Evaluation of Gateway and Low-Cost Traffic-Calming Treatments for Major Routes in Small Rural Communities. Nov. 2007.

<http://www.intrans.iastate.edu/research/detail.cfm?projectID=-226410767>

Sustrans, 2005. Rural Minor Road Traffic Calming. Sustains. National Cycle Network, College Green, Briton, UK. www.sustrans.org.uk. Accessed February 2005

Sustrans, 2004. Rural Minor Road Traffic Calming. Information Fact Sheet FF38. www.sustrans.org.uk. September 2004.