September 23, 2011

Mr. Hari Kalla
Office of Transportation Operations
Federal Highway Administration
1200 New Jersey Avenue, SE, E84-403 HOTO - I
Washington DC, 20590

Dear Mr. Kalla:

Subject: Request for Permission to Experiment
Gateway Treatment with In-Street Signs on Multilane Roads

In accordance with guidelines set forth in the Manual on Uniform Traffic Control Devices (MUTCD), the Michigan Department of Transportation (MDOT) and the Road Commission for Oakland County formally requests Permission to Experiment for the use of In-Street Signs (R1-6) as a gateway treatment on multilane roads on: 1) yielding to pedestrians in the crosswalk; and 2) the number of pedestrian-motor vehicle conflicts, including attempts to pass stopped vehicles. Dr. Ron Van Houten of Western Michigan University will evaluate the efficacy of the markings and will conduct long-term, follow-up data analysis to determine if any initial results persist over time.

A. NATURE OF PROBLEM
Many drivers fail to stop or yield to pedestrians in marked multilane crosswalks at locations without traffic control devices. Numerous devices have been tested nationwide to help reduce the pedestrian crash problem; many have yielded only marginal results. Some devices that have proven effective are the HAWK and RRFB. Although both of these devices are less expensive than a traffic signal, cost might preclude installation of these devices at all locations.

MDOT would like to evaluate the use of a series of in-street signs (R1-6) including signs placed on lane lines, the median, plus right and left sides of the road. Such a gateway treatment would be more conspicuous and might result in higher levels of yielding than the standard configuration, which is reasonably effective on roads with one travel lane in each direction. We would compare the gateway installation with traditional installation between lanes and on the median island. Long-term data collection (one year follow-up data) can be expected to produce useful information on whether the effects of the treatment persist. If the gateway treatment is significantly effective and the results persist, this option may be a lower cost alternative to the use of the RRFB or Hybrid beacon on four lane roads with speed limits of 30 or 35 mph.

B. PREVIOUS RESEARCH
Previous research conducted by Turner, Fitzpatrick, Brewer and Park has documented the efficacy of in-street signs on two-lane roads but not four-lane roads.1 Dr. Van Houten has demonstrated in-street signs positioned at the crosswalk were more effective than in-street signs placed in advance of the

---

July 18, 2011

Mr. Hari Kalla  
Office of Transportation Operations  
Federal Highway Administration  
1200 New Jersey Avenue, S.E., E84-403 HOTO - I  
Washington DC, 20590  

RE: Request for Permission to Experiment  

Gateway Treatment with In-Street Signs on Multilane Roads  

Dear Mr. Kalla  

Subject: Gateway Treatment with In-Street Signs on Multilane Roads Request for Permission to Experiment  

In accordance with the guidelines set forth in the Manual on Uniform Traffic Control Devices (MUTCD), the Michigan State University concurs with the Michigan Department of Transportation’s (MDOT) Permission to Experiment formal request for the use of in-Street signs as a gateway treatment on multilane roads on: 1) yielding to pedestrians in the crosswalk; and 2) the number of pedestrian motor vehicle conflicts including attempts to pass stopped vehicles. Dr. Ron Van Houten of Western Michigan University will evaluate the efficacy of the markings and will conduct long-term follow-up data analysis to determine if any initial results persist over time in accordance with MDOT’s Permission to Experiment formal Request.  

In the event that data indicate the gateway treatment using in-street signs produce a safety problem, the Michigan State University agrees to remove the signs on the approach side of the crosswalks.  

Sincerely,  

[Signature]  

Thomas Maleck
crosswalk.\textsuperscript{2} Research currently being carried out for MDOT by Dr. Van Houten has also found in-street signs reasonably effective on two-lane roads with one lane in each direction but much less effective on multilane roads. The proposed research will determine whether adding signs to the approach side of the crosswalk will improve this treatment’s effectiveness.

C. DESCRIPTION OF A GATEWAY TREATMENT WITH IN-STREET SIGNS
Currently, in-street signs are only placed on the lane line and/or the center of the road, or on a median island. They are not used on the curbside approach to the crosswalk, the driver’s right. In this study, we will compare the standard method of deploying these signs with a gateway treatment which includes placement of signs on the curbside approaches to the crosswalk on multilane roads.

D. ILLUSTRATION OF IN STREET SIGN GATEWAY TREATMENT:
The diagram below shows a Photoshop deployment of the signs including one deployed in the gutter pan on the driver’s right.

![Gateway Treatment Diagram](image)

E. EXPERIMENTAL DESIGN AND DATA ANALYSIS
We will adopt a replication logic design to compare the traditional use of in-street signs (only placed on lane lines and median or centerline) with the gateway treatment use of these signs on two four-lane, multilane roads. We plan to alternate traditional sign use with the gateway treatment. Each replication of the effect will add to the confidence in the difference between the two conditions. A repeated measure Analysis of Variance will be used to test for significance. If alternation of the two conditions indicates use of the gateway treatment is consistently more effective than traditional placement, we will leave this

treatment in effect to see whether the improved result persists over time. Dr. Van Houten will use definitions of yielding and conflicts that have been used in his past research. This design involves a within comparison and therefore each site becomes its own control (Van Houten, and Hall, 2001). 

Measures of Effectiveness

Data collectors will use a standard recording sheet to record data at the two experimental crosswalks. A sample data sheet is presented in Appendix A. Data collectors will be trained to use an operational definition of yielding behavior which increases the objectivity of data collection. This method included the definition of the dilemma zone. Drivers need to be behind the dilemma zone when the pedestrian enters the crosswalk in order to be scored. This procedure ensures motorists traveling at the speed limit have adequate time to yield to a pedestrian.

4.1 Defining the Dilemma Zone

A walking wheel will be used to measure the distance from the nearest crosswalk edge to the dilemma zones prior to the crosswalks. A cone or a solid no pass line will be used to mark each dilemma zone. We will employ the formula used by traffic engineers to determine whether a driver could have safely stopped at a traffic signal to determine whether the driver could have stopped for a pedestrian standing with one foot in the crosswalk. Calculating the distance beyond which a motorist can safely stop for a pedestrian is the same as calculating the distance in advance of a traffic signal a motorist driving the speed limit can stop if the traffic signal changes to yellow. Traffic engineers use the signal-timing formula (Institute of Transportation Engineers, 1985), which takes into account driver reaction time, safe deceleration rate, the posted speed, and the grade of the road to calculate this interval for the amber indication. This formula:

\[ y = t + \frac{v}{2a + 2Gg} \]

will be used to determine the distance to the dilemma zone boundary by multiplying the time by the speed limit in feet per second. A marker will be placed at this distance on each side of each crosswalk with a cone or the end of a solid no pass line. Motorists who pass this landmark when a pedestrian enters the crosswalk can be scored as yielding to pedestrians but not as failing to yield, because they passed the point at which there is sufficient time to easily yield right-of-way to pedestrians. Motorists who have not yet crossed the dilemma zone boundary when the pedestrian enters the crosswalk will be scored as yielding or not yielding because they will have sufficient distance to safely stop.

4.2 Scoring Driver Yielding Right-of-Way to Pedestrians

Once a pedestrian indicates an intention to cross the street (by standing at the curb between the crosswalk lines facing the roadway or oncoming traffic with one foot in the roadway between the crosswalk lines and the other foot on the curb), the behavior of drivers who have not yet crossed the dilemma zone boundary will be scored as not yielding to pedestrians if they fail to yield.

When the pedestrian first starts to cross, only drivers in the first half of the roadway will be scored for yielding. Once the pedestrian approaches within a half lane of the center of the road, the yielding

---


4 Where \( t \) stands for a reaction time of 1 second, \( v \) stands for the speed limit, \( a \) stands for a safe deceleration speed (3.05 m/sec^2), \( G \) stands for acceleration due to gravity (9.8 m/sec^2) and \( g \) stands for grade of the approach road in percent divided by 100.
behaviors of motorists in the remaining lane(s) will be scored. This procedure will be followed because it conforms to the obligation of motorists specified in most motor vehicle statutes. The observers will use a clipboard and data sheets or an iPad to observe the research assistants who served as decoy pedestrians.

Observers will score motorist-yielding behavior for both staged crossings and any naturally occurring, or unstaged, crossings that take place during each data collection period. These data will be disaggregated for analysis purposes. Data will be recorded in sets of 20 staged crossings when vehicles are present that could yield or fail to yield right-of-way during each observation session.

A conflict between a motorist and pedestrian will be scored whenever a motorist has to suddenly stop or swerve to avoid striking a pedestrian or a pedestrian has to jump, run, or suddenly step or lunge backward to avoid being struck by a vehicle. A pedestrian will be scored as stranded in the center whenever he or she has to wait at the centerline for 10 seconds or more because cars in the final lanes of travel do not yield right-of-way.

Data Integrity
Occasional measures of crossing procedure integrity will be employed as a control for procedural drift (the tendency of decoys to change their crossing behavior over time). Crossing integrity will be assessed by video taping crossings and having an observer score the decoy’s crossing behavior from the videotape using a checklist based on the safe crossing procedure.

Inter-observer agreement (IOA)

IOA is a method of determining whether the observers are measuring the conditions reliably. IOA will be calculated for 20 percent of the sheets collected. Each event which is scored the same by two independent observers will be counted as an agreement and each event scored differently by each observer will be scored as a disagreement. IOA will be calculated by dividing the number of agreements during each session by the number of agreements during that session plus the number of disagreements for that session. The result of this calculation will then be multiplied to obtain a percentage. During sessions in which agreement data will be collected, the two observers will stand several meters apart at a location with an unobstructed view of the crosswalk. When more than one pedestrian is crossing at a particular crosswalk, the primary observer will identify the pedestrian for whom yielding behavior will be scored. An agreement on yielding will be scored only if both observers scored all vehicles the same for each pedestrian. An agreement on the occurrence of conflicts will be scored if both observers score an event as a conflict, and an agreement for a pedestrian being trapped at the centerline will be scored if both observers score the pedestrian as trapped.

F. PATENT
There are no patent issues with this treatment. The use of in-street signs is in the public domain.

G. TIME PERIOD and LOCATIONS
Gateway in-street sign treatment will be placed at two crosswalks with a history of poor performance with just the use of the in-street sign in the center lane median centerline/median locations. Follow-up data will be collected for a minimum of one-year to assess whether the effects produced by the markings diminish over time.
The table below shows the proposed treated and control locations.

<table>
<thead>
<tr>
<th>Site</th>
<th>Baseline</th>
<th>Treatment 1</th>
<th>Baseline 2</th>
<th>Treatment 2</th>
<th>1 yr Follow-up</th>
</tr>
</thead>
<tbody>
<tr>
<td>Farmington Rd at State</td>
<td>1 week</td>
<td>1 week</td>
<td>1 week</td>
<td>1 week</td>
<td>1 week</td>
</tr>
<tr>
<td>M-43 (Grand River) east of Farmington</td>
<td>1 week</td>
<td>1 week</td>
<td>1 week</td>
<td>1 week</td>
<td>1 week</td>
</tr>
<tr>
<td>Midblock Trowbridge at MSU</td>
<td>1 week</td>
<td>1 week</td>
<td>1 week</td>
<td>1 week</td>
<td>1 week</td>
</tr>
</tbody>
</table>

H. RESEARCH RESULTS
Research on the effectiveness of in-street signs is part of a larger MDOT study which is currently awarded to Western Michigan University to evaluate the efficacy of Pedestrian Treatments. Results of this experiment will be reported in the MDOT Final Report.

I AGREEMENT TO RESTORE
In the event data indicate the gateway treatment using in-street signs produces a safety problem, MDOT agrees to remove the signs on the approach side of the crosswalks.

J. SEMI-ANNUAL PROGRESS REPORTS
MDOT will keep FHWA apprised of the results with a report at six months and one year after installation. We look forward to receiving FHWA approval to experiment with the use of a gateway treatment with in-street signs. If you have any questions please feel free to contact.

Sincerely,

Mark W. Bott, P.E., Manager
Traffic Operations Section

Enclosures

MWB:nw

cc: M. Townley
    A. Uzcategui
    J. Morena
    D. Thompson
    G. Piotrowicz, RCOC
    T. Maleck, MSU
    Dr. R. Van Houten, WMU
August 22, 2011

Mr. Hari Kalla
Office of Transportation Operations
Federal Highway Administration
1200 New Jersey Avenue, S.E., E84-403 HOTO - I
Washington DC, 20590

RE: Request for Permission to Experiment
Gateway Treatment with In-Street Signs on Multilane Roads

Dear Mr. Kalla

In accordance with the guidelines set forth in the Manual on Uniform Traffic Control Devices (MUTCD), the Road Commission for Oakland County concurs with the Michigan Department of Transportation’s (MDOT) Permission to Experiment formal request for the use of in-Street signs as a gateway treatment on multilane roads on: 1) yielding to pedestrians in the crosswalk; and 2) the number of pedestrian motor vehicle conflicts including attempts to pass stopped vehicles. Dr. Ron Van Houten of Western Michigan University will evaluate the efficacy of the markings and will conduct long-term follow-up data analysis to determine if any initial results persist over time in accordance with MDOT’s Permission to Experiment formal Request.

In the event that data indicate the gateway treatment using in-street signs produce a safety problem, the Road Commission for Oakland County agrees to remove the signs on the approach side of the crosswalks.

If you have any questions, please feel free to contact me at 248-858-4832 or gpjotrowicz@rcoc.org.

Sincerely,

Gary Piotrowicz, PE, PTOE
Director of Traffic-Safety
Road Commission for Oakland County
July 18, 2011

Mr. Hari Kalla
Office of Transportation Operations
Federal Highway Administration
1200 New Jersey Avenue, S.E., E84-403 HOTO - I
Washington DC, 20590

RE: Request for Permission to Experiment

Gateway Treatment with In-Street Signs on Multilane Roads

Dear Mr. Kalla

Subject: Gateway Treatment with In-Street Signs on Multilane Roads Request for Permission to Experiment

In accordance with the guidelines set forth in the Manual on Uniform Traffic Control Devices (MUTCD), the Michigan State University concurs with the Michigan Department of Transportation’s (MDOT) Permission to Experiment formal request for the use of in-Street signs as a gateway treatment on multilane roads on: 1) yielding to pedestrians in the crosswalk; and 2) the number of pedestrian motor vehicle conflicts including attempts to pass stopped vehicles. Dr. Ron Van Houten of Western Michigan University will evaluate the efficacy of the markings and will conduct long-term follow-up data analysis to determine if any initial results persist over time in accordance with MDOT’s Permission to Experiment formal Request.

In the event that data indicate the gateway treatment using in-street signs produce a safety problem, the Michigan State University agrees to remove the signs on the approach side of the crosswalks.

Sincerely,

[Signature]

Thomas Maleck