A Comparison of Gateway In-Street Sign Treatment to other Driver Prompts to Increase Yielding to Pedestrians at Crosswalks

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Abstract

An important goal to reduce the number of collisions between motorists and pedestrians is to increase motorist’s yielding right-of-way to pedestrians in crosswalks. A Gateway installation of in-street signs (one in-street sign installed between the two travel lanes in each direction, and one on both edges of the roadway in each direction) was evaluated on multilane roads. The first experiment compared the efficacy of adding multiple in-street signs used in a gateway configuration with a single sign between the two travel lanes in each direction. The second experiment compared the in-street sign gateway treatment with a more expensive Pedestrian Hybrid Beacon. The third experiment compared the in-street sign gateway with the more expensive Rectangular Rapid Flashing Beacon (RRFB). The results demonstrated that the Gateway in-street sign treatment produced very high levels of drivers yielding behavior, and that the Gateway treatment was as effective as the two more expensive treatments.
A Comparison of Gateway In-Street Sign Treatment to other Driver Prompts to Increase Yielding to Pedestrians at Crosswalks

In large cities, pedestrians account for 40% to 50% of traffic fatalities. In 2010, there were 4,280 pedestrian fatalities and over 70,000 injuries in the U.S. (NHTSA, 2012) and in 2009; 1,468 were killed in Michigan and 799 of these deaths occurred in the Detroit-Warren-Livonia Area (Transportation for America, 2011). Past research (e.g., Hunter, Stutts, Pein, & Cox, 1996) indicates that a lack of driver compliance to pedestrian crossing laws is associated with pedestrian motor vehicle crashes. Millions of Americans walk every day to get to school, work, grocery stores, bus stops, etc. Pedestrians have to share the road with cars, buses, bicycles, motorcycles, and the many other forms of motorized transportation. Pedestrians along with bicyclists are the most vulnerable road users. Nationally, 67% of all pedestrian fatalities occurred on roads eligible to receive federal funding for construction or improvement, with federal guidelines or oversight for their design (Transportation for America, 2011).

The Surface Transportation Policy Partnership developed a measure of average yearly pedestrian fatalities per capita adjusted for the number of walkers by using NHTSA Fatality Accident Reporting System (FARS) and Census 2000 Journey-to-Work data (Transportation for America, 2011). According to the Partnerships findings, the reoccurring characteristic among high pedestrian crash sites corrected for exposure was a failure to make smart infrastructure investments to make roads safer. With a limited budget, the numbers of dollars that can be invested into solutions that address pedestrian-vehicle collisions are limited. This problem has been exacerbated by reduced spending due to a decreasing level of economic resources available to many municipalities. This
puts increased pressure on communities to create solutions to increase traffic safety that require fewer financial resources.

The problem of pedestrian safety has been approached in a variety of ways. Historically, there has been legal action taken to try and ensure the safety of pedestrians. Despite the legislation of pedestrian right-of-way laws, motorists often fail to yield right-of-way to pedestrians. Some studies have examined ways to increase the occurrence and efficacy of driver compliance with pedestrian right-of-way laws (Van Houten, Malenfant, Blomberg & Huitema, in press; Van Houten and Malenfant, 2004; Malenfant & Van Houten, 1989). Several inexpensive engineering approaches have been designed to increase safety at crosswalks. Several studies have shown that signs and markings can reduce the occurrence of evasive conflicts between motorists and pedestrians (the driver swerving or braking hard, the pedestrian running or jumping to avoid a crash trajectory between vehicle and a pedestrian). For example, signs and pavement markings to encourage drivers to yield further in advance of the crosswalk, and beacons to alert drivers that a pedestrian is crossing have been shown to reduce conflicts between motorists and pedestrians and increase yielding behavior (Huybers, Van Houten, Malenfant, 2004; Malenfant, & Van Houten, 1990; Van Houten, 1988; Van Houten, & Malenfant, 1992; Van Houten, et. al., 2003).

A particularly effective way to prompt motorist’s to yield right-of-way is to place narrow prompting signs in the middle of the street where they are highly visible to the motorist and the pedestrian (Kannel, Souleyrette, & Tenges, 2003). A “LOCAL LAW YIELD FOR PEDESTRIANS” sign placed in the roadway is referred to in the Manual on Traffic Control Devices (MUTCD) as an in-street sign (R1-6 sign) (MUTCD, 2009; page
Researchers suggest that the signs may be effective in part because it reminds road users of laws regarding right-of-way at uncontrolled crosswalk locations. This sign has been shown to be effective at increasing motorist yielding right-of-way to pedestrians in crosswalks on roads with one lane in each direction (Ellis, Van Houten, & Kim, 2007). However many roads have more than one lane in each direction (multi-lane roads). When used on multi-lane roads the in-street sign is typically placed on the lane line separating the two travel lanes in each direction. These signs have only proven to be moderately effective on multilane roads (Turner, Fitzpatrick, Brewer, & Park, 2004).

Previous research suggested that there is no advantage gained by installing multiple signs (Ellis, Van Houten, & Kim, 2007). However these signs were installed sequentially in the same location, all of them on the centerline (one 40 ft in advance of the crosswalk, one 20 ft. in advance of the crosswalk, and one at the crosswalk). An alternative way to install multiple in-street signs would is to install them in different locations across the road rather than all in the same location. For example, on a multilane road with two travel lanes in each direction an in-street sign could be installed between the two travel lanes in each direction, and on the right side of the right travel lane and the left side of the left travel lane. Such a gateway configuration should be more visible to all motorists and would produce an apparent narrowing of the travel-way. The purpose of the first study is to compare the efficacy of adding multiple in-street signs used in a gateway configuration with a single sign used between the two travel lanes in each direction on two multilane roads.
General Method

Dependent Variables

Researchers measured the number of motorists who did and did not yield to pedestrians in crosswalks. Driver yielding behavior was measured in reference to an objective dilemma zone (a location beyond which a driver can easily yield if a pedestrian enters the crosswalk). The research team employed 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 that a motorist driving the within the speed limit can stop if the traffic signal changes to yellow. Traffic engineers use the signal-timing formula (Institute of Traffic Engineers, 1984), 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 was used to determine the distance to the dilemma zone boundary by multiplying the time \( y \) by the posted speed limit in feet per second.

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

1

To aide observers in discriminating the location of the dilemma zone, the location

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1 Where \( t \) = the perception/reaction time in seconds (1 second), \( v \) = the speed of approaching vehicles in ft/s (we substitute the posted speed limit in ft/s), \( a \) the deceleration rate, recommended at 10ft/s², \( G \) = acceleration due to gravity (32ft/s²), and \( g \) = the grade of the approach in percent divided by 100.
of the zone was marked by either a sprinkler flag located on the raised concrete adjacent to the road or with bright tape that extended from the raised concrete into the road.

Motorists who had not passed the outer boundary of the dilemma zone when a pedestrian entered the crosswalk were scored as yielding or not yielding because they had sufficient time and space to stop safely for the pedestrian. Motorists who entered the dilemma zone before the pedestrian or researcher placed a foot in the crosswalk could be scored as yielding but could not be scored as failing to yield because the motorist was not legally required to yield at this distance. However the signal timing formula is relatively lenient and hence many vehicles that passed the dilemma zone are able to safely yield, particularly those traveling below the speed limit.

**Data Collection Procedures**

A trial, or staged crossing, began when a researcher displayed an intention to cross the street by placing one foot within the crosswalk with his or her head turned in the direction of the approaching vehicle(s). A research assistant recorded the results of the trial on the clipboard. Data during all three experiments were collected using staged crossings.

Each session consisted of 20 trials (pedestrian crossings). The percentage of drivers yielding right-of-way to pedestrians was calculated for each session by dividing the number of drivers that yielded right-of-way that session by the number of drivers that yielded plus the number of drivers that failed to yield right-of-way. Data were collected during day light hours between the hours of 10:00 am and 8:00 pm on Mondays through Saturday between the months of May through October. Data were not collected when it was raining.
Scoring. Only drivers in the first two travel lanes were scored for yielding right-of-way after the pedestrian has entered the crosswalk. This procedure was employed because it conforms to the obligations of motorists specified in most motor vehicle statutes on who has the right of way at what time. Drivers in the second half of the roadway were scored as a separate trial if there was a pedestrian refuge or median island separating the travel way. If there was no island, drivers in the second half the road were scored when the pedestrian approached the middle of the last lane before the yellow centerline of the road and were scored in the same trial as the crossing of the first half of the roadway.

Data Collector Training. Researchers were trained to use the operational definition of yielding behavior. Researchers practiced recording together until they obtained inter-observer agreement (IOA) of 90% or better for two consecutive data sheets. Researchers were also be trained on how use a walking wheel to measure the distance to the dilemma zone, and how to install the flags or lay the tape.

Data Collection Setup Procedure. The researchers set up the dilemma zone before beginning trials. A walking wheel was used to measure the distance from the nearest crosswalk line to the dilemma zone. During the marking process one of the researchers served as a spotter to ensure that the person using the walking wheel was clear of traffic. Both persons wore orange vests during the marking process to make them more visible to drivers. The researchers then marked the location with the necessary flags and/or tape. After the data were collected, the assistants collected the flags using the same spotter safety procedures.

Inter-Observer Agreement
IOA was calculated for 20% of the sheets collected and data were collected during each condition of the experiment. Each event that was scored the same by both observers was counted as an agreement and each event that was scored differently by each observer was scored as a disagreement. IOA was then 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 was then be multiplied by 100 to obtain an IOA percentage score.

During sessions in which agreement data were collected, the two observers would stand several meters apart at a location with an unobstructed view of the crosswalk. When more than one pedestrian crossed at a particular crosswalk, the primary observer identified the pedestrian for whom yielding behavior was to be scored by describing a distinctive feature like such as whether it was a male or female, the color of clothing.

**Participants**

The participants were motorists using the road when pedestrians were crossing in the crosswalk.

**Experiment 1**

**Description of Settings**

The first site was crosswalk near 4 East Holden Hall Trowbridge Road in East Lansing, MI on the Michigan State University campus. Trowbridge Road had two travel lanes in each direction separated by a median island. Vehicles on the two lanes on the north side of the crosswalk were travelling east to west and motorist on the south side of the crosswalk were travelling from west to east. The area around the sidewalk had trees on either side of the road approaching the crosswalk, but not near the crosswalk itself.
The median island separating both half of the roads was approximately 25 feet in length. The posted speed limit was 30 mph.

The second site was a crosswalk near 33199 Grand River Avenue in Farmington, MI. The road here consisted of 3 lanes. There were two lanes in one direction and one in the opposite direction. A double yellow line separated the two directions of travel and there was no island separating the travel lane in each direction. The two lanes of traffic moved from east to west and the one lane of traffic moved from west to east. The posted speed limit was 25 mph. At this site data were only collected in the direction that carried two lanes of traffic. Data collection took place over 3 months at the site located in Farmington, MI and 2 months at the East Lansing, MI site.

**Experimental Design**

A reversal design was be used in this experiment. Baseline was collected in the absence of the in-street signs. During the first condition one in-street sign was installed on the lane line separating two lanes carrying vehicles in one direction. During the gateway treatment two additional in-street signs were installed on each side of the road, one on the gutter pan on the right side of the road and the other on the gutter pan on the left side of the road) on Trowbridge, and one on each side of the road carrying two lanes of traffic and one between the two lanes at the Farmington site.

**Baseline.** During the baseline condition there were no in-street signs in the road.

**Standard in-street sign placement.** During the standard in-street sign condition only one in-street sign was installed separating the two travel lanes in each direction on both half of the road. This configuration is illustrated in the two examples on the left side of Figure 1.
**Gateway in-street sign placement.** An in-street sign was installed to separate travel lanes in each direction as in the previous condition and signs were also installed on the gutter pans on the side of the road and next to the median island. This configuration of signs in the center and both sides will be referred to as the Gateway treatment and is illustrated in the two examples on the right side of Figure 1.

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Insert Figure 1

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**Results**

The results of this study for the Trowbridge Road site in East Lansing, MI site are presented in the top frame of Figure 2. Yielding at this site averaged 25% during the baseline condition when no signs were present, 57% with one in-street sign present, and 79% with the Gateway treatment present. These results generally indicated that the single in-street sign treatment produced more yielding than the baseline condition and that Gateway treatment was more effective than the single in-street sign condition. However a number of instances of overlap between conditions related to the high level of variability at this site.

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Insert Figure 2 about here

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Data from the Grand River Avenue Site in Farmington, MI are presented in the bottom frame of Figure 2. During the baseline condition when no signs were present 25%
of motorists yielded to pedestrians. Yielding increased to 57% during the one sign condition and to 82% during the Gateway condition. These results indicated that the Gateway treatment was more effective than the single sign condition at this site, as well, and that it produced similar yielding to that obtained at the East Lansing, MI site.

Discussion

The results of Experiment 1 demonstrated that a Gateway treatment of the in-street signs produced a level of yielding similar to those reported for more expensive traffic control devices (Van Houten, Ellis, & Marmolejo, 2008; Fitzpatrick, & Park, 2009). One reason why the Gateway treatment was so effective may have been the perceived narrowing of the roadway produced by adding signs in the gutter pan area or the edge of the road outside the travel way. It is also likely that three signs likely were more visible than one sign particularly if vehicles ahead of a motorist approaching the crossing screens one or more of the signs. Gutter pan placement also may be less prone to being struck by vehicles thereby contributing to a longer life of the signs.

Because the data were collected over months, these data also capture the effectiveness of the intervention over time. Some of the highest yielding behavior was recorded on the last day of the last Gateway phase. The Gateway treatment is hypothesized to decrease the perceived width of the roadway. Because of the location of the signs, the road itself is not actually narrowed. These signs may also provide better delineation of the edge of the roadway when they are present. Specifically the boundaries of the road are extended vertically via the signs. A driver may ignore the boundaries of the road while driving. However, when the visual approximations are made more salient,
it may cause the driver slow down. However, no data were collected on vehicle speed in this series of studies.

**Experiment 2**

Another successful intervention for increasing yielding right-of-way for pedestrians in crosswalks is the Pedestrian Hybrid Beacon (PHB) (Fitzpatrick et. al, 2009). An evaluation of the PHB at 21 sites and an additional 102 reference sites found a 13% and 29% reduction in all crashes and approximately 50% reduction in pedestrian-vehicle crashes (Fitzpatrick & Park, 2009). Like the in-street signs the PHB is not accessible to blind travelers,

Although the PHB has been shown to be highly effective, it is relatively expensive to install. The installed cost of the PHB varies between $60,000 and $100,000. This cost is subject to a variety of factors including existing infrastructure in place and the geometry of the crossing location. Therefore, costs in some cases are sometimes higher. In contrast the installed cost of in-street signs is currently $300 a piece. The purpose of Experiment 2 is to compare the in-street sign gateway treatment with the PHB and the effects of combining a single in-street sign with the PHB.

**Setting**

Two sites with a PHB installed were evaluated in this experiment. The first sets of data were collected from a crosswalk located near 19139 Livernois Avenue in Detroit, MI. This site has an island of separating the two travel lanes in each direction. Traffic on the two east lanes moved from south to north and traffic on the west two lanes move from north to south. There was parking located on both sides of the road and trees dotting the sidewalks. The posted speed limit is 30 mph at this site.
The second PHB was a midblock crosswalk located at 5474 Cass Road in Detroit, MI. This crosswalk had four lanes of traffic, two lanes in each direction and did not have an island or median. Traffic moved from north to south in the two westbound lanes and from south to north in the two eastbound lanes. There were some trees near the sidewalk and but less than all the other sites. The posted speed limit was 25 mph. Because both sites are located in the same city, they will be referred to as Livernois Avenue site and the Cass Road site.

**Experimental Design**

A reversal design was used in this experiment. The baseline condition consists of crossings when there were no in signs in the road and the PHB is not activated. The one sign condition had one sign separating travel lanes in each direction and the PHB was not activated. During the PHB alone condition there were no in-street signs in the road and the PHB was activated for each crossing. The sign plus PHB condition had one in-street sign separating the travel lanes in each direction and the PHB was activated for each crossing. The Gateway treatment condition had three in-street signs in each direction and the PHB was not activated. The Gateway treatment was not evaluated at the Cass site because the single sign plus PHB yielded very high levels at this site.

**Results**

The results of the Livernois Avenue site are presented in the top frame of Figure 3. Yielding at this site averaged 1% during baseline (crosswalk markings alone) condition, 37% during the one in-street sign alone condition, 62% during the PHB alone condition, 85% during the in-street sign plus PHB treatment condition, and 72% during the Gateway alone treatment. These results indicated that the PHB alone was more
effective than the in-street sign alone, but the Gateway treatment was equal to or more effective than the PHB alone condition. The PHB plus the in-street sign was the most effective of the treatments producing 13% more yielding than the Gateway treatment alone.

The results for the Cass Road site are presented in the bottom frame of Figure 3. Yielding at this site averaged 10% during the baseline (crosswalk markings alone) condition, 84% during the PHB condition alone condition, and 94.5% during the PHB plus one in-street sign condition. Even though yielding for the PHB was far better at this site than the Livernois Avenue site, the addition of a single the in-street sign in each direction separating the lane lines still increased yielding to higher levels. This site was on the Wayne State University campus where the posted speed limit was 25 mph. At the Livernois Avenue site the posted speed limit was 30 mph, and less yielding was obtained during both the marked crosswalk alone condition and the PHB activation conditions.
Discussion

These results show the addition of an in-street sign at both sites increased yielding behavior to higher levels than the PHB alone, and that the Gateway treatment was as effective as more expensive PHB alone at the Livernois site. The Gateway treatment was not needed at the Cass Site because the PHB plus one in-street sign produced near perfect yielding behavior. This is likely because of the lower posted speed limit at this site. However, it is likely that the Gateway treatment alone would have also produced excellent results at this site. One limitation of the data set collected at the Cass Road site was the failure to return to baseline. However, the consistency and ease of recovering baseline at all other sites minimizes these concerns.

Experiment 3

Another intervention that has been used to increase motorist yielding right-of-way to pedestrians in crosswalks is the Rectangular Rapid Flashing Beacon (RRFB) (Shurbutt & Van Houten, 2009; Van Houten, Ellis, & Marmolejo 2008). The RRFB is located at the roadside below pedestrian crosswalk signs and can be activated by a pedestrian pushing a button. Van Houten et. al. (2008) found that the RRFB increased of yielding behavior of 58.3%, 63.5%, at two sites to 91%. This treatment was also evaluated at 22 locations and produced an increase in yielding from a baseline of 2% to 84% at these sites, and these changes persisted during a 2-year follow-up (Shurbutt & Van Houten, 2009). The RRFB is not accessible to blind travelers.

The cost of installing the RRFB treatment is approximately $20,000. The purpose of Experiment 3 was to compare the in-street sign gateway treatment with the RRFB
treatments and examine the effects of combining a single in-street sign and the gateway in-street sign treatment with the RRFB.

**Participants and Setting**

Like the other experiments, the participants were motorists traveling across the crosswalk. Data were collected at an RRFB site located on Grand River Avenue in South Lyon Township at a bike/walking trail crossing. The crosswalk on Grand River Avenue crosses one lane in the westbound direction and one lane in the eastbound direction, as well as a turning lane in the center. Due to a sharp curve on both the eastbound and westbound sides of Grand River Avenue, the posted speed was 25 mph for both sides of the road. The township posted an advance pedestrian crossing warning sign 30 feet in advance of the crosswalk on both sides of the street.

**Experimental Design**

A reversal design was also used for this experiment. During the baseline condition, the in-street sign was not used and the pedestrian crossed without activating the RRFB. The advance pedestrian crossing warning signs installed by the township remained in place. For the first condition the pedestrian pressed the button to activate the RRFB, but the Gateway treatment was not installed. The second condition was a return to baseline (crosswalk alone). During the third condition the Gateway treatment was in place with in-street signs were installed on the lane line on both sides of the turn lane immediately beyond the crosswalk and the RRFB was not activated. The fourth condition was the RRFB activated alone. The fifth condition was a brief return to baseline and the sixth condition was the gateway treatment alone. After another brief return to baseline
the RRFB condition was introduced followed by another return to baseline. The final condition was the RRFB plus Gateway in-street sign condition.

**Inter-observer Agreement**

IOA on yielding occurrence averaged 99% (range 98% to 100%) during baseline, 100% during the Gateway treatment phases, and 100% during the combination of the RRFB and Gateway treatment phases.

**Results**

Figure 4 shows the percentage of motorists yielding during each of the conditions. During baseline when the signs were absent and the RRFB was not activated, yielding averaged 20% at this site. The RRFB alone produced an average yielding level of 69%. The Gateway treatment produced 80% yielding, and the combination of the Gateway and RRFB produced 85% yielding. These data show that the Gateway treatment produces effects that are similar to the RRFB and the Gateway and RRFB together may produce effects similar to the Gateway treatment alone.

General Discussion

The results of this study show that pedestrian improvements, such as the PHB and RRFB, produce large increases in yielding, which can be further enhanced by the presence of a single in-street sign in each direction. These data also show that the use of
the in-street sign as a Gateway treatment can produce effects on multilane roads that are similar to those produced by the PHB and the RRFB alone.

The Gateway treatment offers several advantages over the PHB and the RRFB. First, the Gateway treatment is less expensive than the PHB and RRFB. Second, it does not require special outreach efforts to educate the public on how to respond to it. Third, it does not require a push button or pedestrian detector to activate, which makes it effective during all crossings.

It is possible that the efficacy of the Gateway treatment alone in Studies 2 and 3 may have been impacted by the presence of the other devices (PHB and RRFB) even though they were not activated. We do not consider this to be very likely for two reasons. First, the PHB and RRFB were also present (and inactivated) in the baselines of those studies. Second, the efficacy of gateway treatment in Experiment 1 at sites that did not have the PHB and RRFB was similar to the efficacy of the gateway treatment in Experiments 2 and 3.

However, two disadvantages of the in-street sign were noted. First, it cannot be left in place during the winter at locations that receive snowfall that requires plowing, and second, the sign needs to be replaced if repeatedly struck by vehicles (this did not occur in our study). The in-street sign is an impactable sign that is designed to be struck. However, in-street signs are subject to damage when repeatedly struck, the replacement of these signs could still be more cost effective than installing a PHB or RRFB because of their low cost. Further research is needed to determine the durability of the Gateway treatment. Vehicles may be less likely to strike in-street signs that are placed at the edge.
of the roadway. The signs on the lane line are most vulnerable and may limit the application of this device on higher speed roads.

The in-street sign is likely effective because it serves as a salient prompt to drivers to yield to pedestrians in the crosswalk. Research indicates that two factors that influence the efficacy of prompts are timing and location (Van Houten, 1998). Location is critical because it affects timing and the salience of the prompt. If a parent wants to prompt a child to hang up their coat when they get home from school rather than throwing it on a chair, the place to place the prompt is on the chair. Similarly, if you want to prompt drivers to yield to a pedestrian in a crosswalk, the prompt should be placed in the roadway because this is where drivers are most likely to be looking. There are several reasons why the three in-street sign gateway treatment should be more effective than the use of a single in-street sign. First, three signs increases the likelihood the driver will be looking at a sign when a pedestrian is crossing. Attending to the sign and crosswalk rather than to distracting private behavior (day dreaming) or public behavior such as use of a cell phone, the driver may be more likely to notice the presence of pedestrian.

Second and perhaps more important, the gateway treatment provides a perceived narrowing of the roadway which might be expected to reduce driver speed and increase drive attention to the driving task. Reducing speed can increase yielding behavior because it is less effort to stop a slow moving vehicle than a faster moving vehicle. A number of studies have shown that response effort can affect driving behavior. For example, Van Houten, Hilton, Schulman, & Reagan (2011) showed that decreasing accelerator pedal resistance contingent on seatbelt use can increase seatbelt use, and Shulman (2005) found that increasing accelerator pedal resistance contingent upon
speeding behavior can reduce speeding. Studies have also shown that driver yielding behavior is inversely related to driver speed. Future research should examine the relationship between in-street sign placement and driver speed.

Another application for the Gateway treatment could be at crosswalks at intersections with corner turning islands. If the slip lane is a single lane, signs could be placed on the each side of the lane. A similar application could be tested at crosswalks at freeway off ramp locations.
Reference


USE OF GATEWAY TREATMENT TO INCREASE YIELDING


Van Houten, R. & Malenfant, L. (1992). The Influence of signs prompting motorists to yield 50 feet (15.5 m) before marked crosswalks on motor vehicle-pedestrian conflicts at crosswalks with pedestrian activated flashing lights. Accident Analysis and Prevention, 24, 217-225.


Figure 1. The two pictures on the left side show two examples of the standard one sign installations of the in-street sign and the two pictures on the right side show gateway installations of the in-street sign.
Figure 2. The top frame shows the percentage of drivers yielding to pedestrians on Trowbridge Rd. without the sign (BL), with one sign, and with the Gateway treatment while the bottom frame shows the percentage of drivers yielding to pedestrians on Farmington Rd. without the sign (BL), with one sign, and with the Gateway treatment.
Figure 3. The top frame shows the percentage of drivers yielding to pedestrians without the sign (BL), with one sign, with the PHB alone, with one sign plus the PHB, and with the Gateway in-street sign treatment at the Livernois at 7 Mile Rd site, while the bottom frame shows the percentage of drivers yielding to pedestrians with no treatment (BL), with the PHB alone, and with the PHB plus an in-street sign at the Cass Rd site.
Figure 4. The percentage of drivers yielding to pedestrians during with no treatment (BL), with the RRFB alone, with the Gateway alone, and with the RRFB plus the Gateway treatment.