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July 2, 2019

Mr. Mark Kehrli
Director of Office Transportation Operations
Federal Highway Administration
1200 New Jersey Avenue, S.E., HOTO-1
Washington, DC 20590

By Email to: MUTCDofficialrequest@dot.gov

Subject: Interim Semi-Annual Progress Report- Use of In-Street Crossing Signs (R1-6a) to Create "Gateway Effect" in Florida – A Request to Experiment

Dear Mr. Kehrli,

Attached is our interim semi-annual progress report. We have collected the baseline and initial temporary sign data for half of the sites. These initial observations are documented within the report. Seven sites have been removed from the study and FDOT is requesting approval for seven replacement sites. These sites are reported in Section 2.0 Introduction and Background, Table 1 of the report.

Our scheduled Semi-Annual Progress Report will be sent out in August 2019.

Sincerely,

V.Y. "Trey" Tillander III, P.E.
State Traffic Operations Engineer
Director, Traffic Engineering and Operations Office

TT:AE:jp

Attachment: "Interim Semi-Annual Progress Report- Use of In-Street Crossing Signs (R1-6a) to Create "Gateway Effect" in Florida – A Request to Experiment report".

cc: District Traffic Operations Engineers
Alan El-Urfali
Javier Ponce
Khoa Nguyen (FHWA)

INTERIM SEMI-ANNUAL PROGRESS REPORT
JULY 2, 2019

USE OF INSTREET CROSSING SIGNS (R1-6a) TO CREATE "GATEWAY EFFECTS IN FLORIDA

A REQUEST TO EXPERIMENT
FLORIDA DEPARTMENT OF TRANSPORTATION
TRAFFIC OPERATION OFFICE

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1.O EXECUTIVE SUMMARY

This report summarizes the work completed to date on the FDOT, FHWA Gateway Effect request to experiment (Ref. No. 2(09)-142(E)). In 2015, one out of every 5 traffic fatalities involving a pedestrian. Unsignalized crosswalks or crosswalks at locations without traffic control devices (uncontrolled crosswalks) can be difficult for pedestrians to navigate and pose significant risks for pedestrians, bicyclists and motorists, alike. Drivers often fail to stop or yield to pedestrians in uncontrolled marked crosswalks. The In-Street Pedestrian Crossing Sign (R1-6a) is a standard regulatory sign available nationwide, but allowable only for placement on the center line, lane line or median island/refuge area under the current MUTCD language. There is national research from other states, including as recently as 2016 (Van Houten/MDOT), that suggests using In-Street Pedestrian Crossing Signs (R1-6a) on the right edge line in combination with standard placement as part of a Gateway Effect produces substantially more efficient benefit to reducing vehicle speeds and increasing vehicle yield/stop rates, which contribute directly towards pedestrian-related crash frequency and severity reductions. While supporting data is available through these previous efforts, this RTE seeks to expand upon these research findings by testing a wider variety of crosswalk sites and conditions throughout Florida in hopes of demonstrating greater efficacy and robustness of the Gateway approach.

Site Locations

Seven sites have been removed from the list in the original application because of designs changes at these sites, or a very high levels of baseline yielding. FDOT has located seven replacement sites.

Data Collection on Site Variables for the "Before" Condition

Qualitative site review to document crosswalk conditions and establish preferred installation method for each location (i.e. edge line, top of curb, gutter pan and materials), and the review of Adopted Work Program to verify upcoming conflicts with proposed projects which may impact the location during the testing phase has been completed. Speed data is currently being collected for each site. We have also collected data for driver yielding right-of-way to pedestrians for the baseline (before) condition at 15 of the sites along with conflict data and yielding distance data using temporary R1-6 signs. This has been done to provide a short-term evaluation of how well each configuration works at each site. The hard installation for each site will follow the collection of baseline speed data.

The evaluation at each site included measuring driver yielding right-of-way to pedestrians and evasive conflicts between drivers and pedestrians during the following conditions using temporary R1-6 signs: 1. Baseline condition with no R1-6 signs installed at the crosswalk; 2. Treatment conditions with R1-6 signs installed in all locations currently permitted in the MUTCD. 3. A gateway constructed with R1-6 signs at all permitted locations plus all edge sign locations.

The number of signs that could be installed in compliance with the current MUTCD varied across sites based on the type or roadway. At some locations only one sign could be installed in compliance with the manual, but at most sites multiple signs could be installed in compliance with the manual forming a partial gateway. Locations permitted by the current MUTCD include centerline placement, lane line placement, and placement at the edge of a pedestrian refuge island or median.

Initial Data Collection with Temporary Signs

Three data sheets were collected during the baseline condition with no R1-6 signs in place, three additional data sheets were collected with as many R1-6 signs in place as is permitted in the current MUTCD, and three data sheets were collected with the full gateway including the edge signs. Therefore, there were a total of 180 staged crossing and as many natural pedestrian crossings as occurred during that period at each of the sites.

We have completed collecting initial comparison of baseline, R1-6 use in compliance with present MUTCD, and the full gateway including edge signs at 15 sites and we have partial data at 1 site and need to collect all data from 7 additional sites. We should finish up with all of these sites as well as the proposed additional sites once we have approval to add 7 additional sites.

Driver Yielding Data. At all 15 sites more drivers yielding to pedestrians when R1-6 signs were installed as prescribed in the MUTCD than during baseline condition with no R1-6 signs. In 14 of the 15 cases more drivers yielded to pedestrians when the full gateway was installed than during the condition when only signs permitted by the manual were installed. These data replicate the MDOT data. It should be noted that these effects are consistent with the data from each set of 20 crossings during each condition.

Vehicle-Pedestrian Conflict Data. Data on multiple threat conflicts included passing a vehicle in the next pedestrian travel lane when the pedestrian was crossing a multilane road, and hard brakes by the person in the next pedestrian travel lane. During the baseline condition, there were 48 instances of this type of conflict, when R1-6 signs were installed in all permitted locations there were 11 such conflicts, and when the full gateway was installed there were 8 such conflicts. It should be noted that all of the conflicts occurred on the multilane roads.

Stopping Distance Data. How far in advance of the crosswalk a driver stops is a critical variable at multilane crosswalks. At one site with an advance stop bar the gateway was installed at the stop bar location 40 ft. in advance of the crosswalk. At this site drivers yielded further in advance of the crosswalk after the temporary gateway was installed. At the remaining multilane sites the R1-6 signs were placed within 2 ft. of the crosswalk. Yielding distances were similar during each condition across these sites.

2.0 INTRODUCTION AND BACKGROUND

According to the National Highway Traffic Safety Administration (NHTSA), in 2015 Florida ranked 2nd nationally in both number of pedestrian fatalities (628) and in pedestrian fatality rate, with 3.1 fatalities per 100,000 population (NHTSA Traffic Safety Facts, 2015). Additionally, in 2015, pedestrian fatalities represented 21.4% of all traffic fatalities in Florida, leading to one out of every 5 traffic fatalities involving a pedestrian.

Unsignalized crosswalks or crosswalks at locations without traffic control devices (uncontrolled crosswalks) can be difficult for pedestrians to navigate and pose significant risks for pedestrians, bicyclists and motorists, alike. Drivers may often fail to stop or yield to pedestrians in uncontrolled marked crosswalks, although Florida law requires all vehicles to stop (Section 316.130(7)(b), F.S.). Many factors account for this, but lack of crosswalk recognition and failure to recognize or abide by traffic laws are major contributors to crossing point issues and crashes involving pedestrians at uncontrolled crosswalks.

Mitigating vulnerable road user hazards at uncontrolled crosswalks is a serious issue in Florida, where pedestrian fatalities and serious injuries are among the nation's highest. Recognition of this issue has led to pedestrian and bicycle-related crashes being included as a statewide emphasis area within the 2017 Florida Strategic Highway Safety Plan (SHSP). This trend in pedestrian fatalities for Florida is projected to continue if additional steps are not taken to innovate or otherwise experiment statewide with new techniques and/or traffic control devices aimed at reducing pedestrian-related crashes.

This experiment seeks to expand upon results of the Van Houten (WMU)/Michigan DOT studies (2014-2016) to determine if the desired results of greater driver yield/stop rates and lower pedestrian crash frequencies through use of In-Street Pedestrian Crossing Signs (R1-6a) along edge lines and lane lines to create a Gateway Effect, can be induced at a wide variety of locations and roadway types across Florida with the same benefits.

Results from the experiment will help determine the robustness of this experimental low-cost approach in encouraging greater yield rates in areas of pedestrian activities. Test sites will include an evaluation of before and after operational and safety (crash) data as well as monitoring the effects on efficacy through Gateway Effect placement options (on curb or in gutter) maintenance issues and long-term return on investment.

Supporting Data

The In-Street Pedestrian Crossing Sign (R1-6a) is a standard regulatory-related sign available nationwide, but allowable only for placement on the center line, lane line or median island/refuge area under the current MUTCD language. There is national research from other states, including as recently as 2016 (Van Houten/MDOT), that suggests using In-Street Pedestrian Crossing Signs (R1-6a) on the right edge line in combination with standard

placement as part of a Gateway Effect has a substantially more efficient benefit to reducing vehicle speeds and increasing vehicle yield/stop rates, which are factors that contribute directly towards pedestrian-related crash frequency and severity reductions.

In April of 2016, the City of St. Petersburg, Florida, applied for FHWA RTE for In-Street Pedestrian Crossing Signs (R1-6a) using the Gateway Effect to test motorist yielding rates, conflicts and sign survival. A majority of the locations in St. Petersburg have the Gateway Effect installed in advance of the crosswalk in heavily urbanized areas that are in relatively close proximity to each other.

Site Locations

Table 1 shows a list of sites submitted for evaluation under permission to experiment under original sites. Seven sites have been removed from the list in the original application. Site number 9 was removed because a traffic signal is being installed by the district office. One site was lost because of construction (site 15). Two other sites were removed because baseline data collection showed they already had high levels of compliance (sites 1 and 7). Another site was removed as unsuitable because it was a 6-lane segment with a posted speed of 50 mph (site 29). Site 3 was removed because it was the identical pair of site 4 and was had turning movements that made it less suitable for a gateway treatment. Site 2 was removed because it did not have a complete crosswalk. FDOT requests permission to add seven replacement sites highlighted in yellow in Table 1.

Table 1. Crosswalk Locations Selected for the In-Street Pedestrian Crossing (R1-6a) Gateway Effect Treatment including roadway configuration and posted speed. Sites in Yellow are replacement sites to the sites in Red.

Original							Revised Sites					
#	Dist.	On Route	At or Near Route	Facility Type	Posted Speed	Reason for Removal	Dist.	On Route	At or Near Route	Facility Type	Posted Speed	Data
1	1	**SR 82**	At Heitman Street	2-Lane	30	High Baseline	6	**SR A1A**	Harding at 89th Street	3-Lane One Way	30	No
2	1	**SR 17**	b/n Verona Ave & Lake Ave	4-Lane	30	Half Crosswalk	2	**Main Street**	at 3rd Avenue	4-Lane Section	30	No
3	1	**SR 600/US 17**	At E Cummings Street	3-Lane One Way	35	Turning Movement	2	**Main Street**	at 9th Avenue	4-Lane Section	30	No
4	1	**SR 600/US 17**	At W Cummings Street	3-Lane One Way	35		1	**SR 600/US 17**	At W Cummings Street	3-Lane One Way	35	Yes
5	2	**SR 211**	West of Barrs Street	2-Lane Refuge	30*		2	**SR 211**	West of Barrs Street	2-Lane Refuge	30*	Yes
6	2	**US 1 Bus/King St**	At Aviles Street	2-Lane One Way	25		2	**US 1 Bus/King St**	At Aviles Street	2-Lane One Way	25	Yes
7	2	**US 1 Bus/King St**	At Grenada Street	2-Lane Refuge	25	High Baseline	CO	**Suwannee Street**	Burns Building	2-Lane Refuge	30	No
8	3	**SR 10/US 90**	D3 District Headquarters	5-Lane Section	45		3	**SR 10/US 90**	D3 District Headquarters	5-Lane Section	45	Yes
9	3	**SR 292**	At Flora Bama Lounge	2-Lane Section	30	Traffic Signal	3	**Front Beach Road**	At Sharkey's Lounge	2-Lane Section	30	No
10	3	**US 98**	Near Cobb Road	2-Lane Section	35		3	**US 98**	Near Cobb Road	2-Lane Section	35	Yes
11	3	**Beck Ave**	At 12th Street	3-Lane Section	30		3	**Beck Ave**	At 12th Street	3-Lane Section	30	Yes
12	4	**SR A1A**	At Alhambra Street	4-Lane Section	30		4	**SR A1A**	At Alhambra Street	4-Lane Section	30	Yes
13	4	**SR A1A**	1 N Fort Lauderdale Beach Blvd	2-Lane Section	30*		4	**SR A1A**	1 N Fort Lauderdale Beach Blvd	2-Lane Section	30*	Yes
14	4	**SR 842/A1A**	At NE 20th Avenue	2-Lane Section	30*		4	**SR 842/A1A**	At NE 20th Avenue	2-Lane Section	30*	Yes
15	5	**SR A1A**	At S 8th Street	2-Lane Section	30	Construction	5	**SR A1A**	At S 4th Street	2-Lane Section	30	No
16	5	**SR A1A**	South of 2nd Avenue	4-Lane Section	40		5	**SR A1A**	South of 2nd Avenue	4-Lane Section	40	Yes
17	5	**SR A1A**	At Hartford Avenue	4-Lane Section	35		5	**SR A1A**	At Hartford Avenue	4-Lane Section	35	Yes
18	6	**SR 5/US 1**	N. of SR 5 (24 North Hotel)	5-lane section	35		6	**SR 5/US 1**	N. of SR 5 (24 North Hotel)	5-lane section	35	No
19	6	**SR 5/US 1**	In front of Capital Bank	5-lane section	35		6	**SR 5/US 1**	In front of Capital Bank	5-lane section	35	No
20	6	**SR 5/US 1**	W. of Kennedy Dr.	5-lane section	35		6	**SR 5/US 1**	W. of Kennedy Dr.	5-lane section	35	No
21	6	**SR 5/US 1**	E. of Hilton Haven Rd.	5-lane section	35		6	**SR 5/US 1**	E. of Hilton Haven Rd.	5-lane section	35	No
22	6	**SR 5/US 1**	West of 3 Street (USCIS Bldg)	5-lane section	35		6	**SR 5/US 1**	West of 3 Street (USCIS Bldg)	5-lane section	35	No
23	6	**SR 860**	West of NW 49th Avenue	6-Lane Section	45		6	**SR 860**	West of NW 49th Avenue	6-Lane Section	45	No
24	6	**SR A1A**	South of 87 Street	3-Lane One Way	30		6	**SR A1A**	South of 87 Street	3-Lane One Way	30	No
25	6	**SR A1A**	500' North of Bal Cross Drive	6-Lane Section	30		6	**SR A1A**	500' North of Bal Cross Drive	6-Lane Section	30	Yes
26	6	**SR 907/Alton Rd**	RT Slip Lane at 43rd Street	Single Lane (RT Slip)	30		6	**SR 907/Alton Rd**	RT Slip Lane at 43rd Street	Single Lane (RT Slip)	30	Yes
27	7	**Oleander Way S**	At Grevilla Avenue	2-Lane Section	25		7	**Oleander Way S**	At Grevilla Avenue	2-Lane Section	25	Yes
28	7	**SR 685**	Near West Horatio Street	4-Lane Section	40		7	**SR 685**	Near West Horatio St.	4-Lane Section	40	Yes
29	7	**SR 52**	At Shadow Ridge Blvd	6-Lane Section	50	High Speed	2	**Main Street**	7th Street	4-Lane Section		No

3.0 RESULTS OBTAINED TO DATE

Data Collection Site Variables (Before Condition)

Qualitative site review to document crosswalk conditions and establish preferred installation method for each location (i.e. edge line, top of curb, gutter pan and materials), and the review of Adopted Work Program to verify upcoming conflicts with proposed projects which may impact the location during the testing phase has been completed. Speed data is currently being collected for each site. We have collected data for driver yielding right-of-way to pedestrians for the baseline (before) condition at many of the sites along with conflict data and yielding distance data using temporary R1-6 signs. This has been done to provide a short-term evaluation of how well each configuration works at each site. The hard installation for each site will follow the collection of baseline speed data.

The evaluation at each site included measuring driver yielding right-of-way to pedestrians and evasive conflicts between drivers and pedestrians during the following conditions using temporary R1-6 signs: 1) Baseline condition with no R1-6 signs installed at the crosswalk; 2) Treatment conditions with R1-6 signs installed in all locations currently permitted in the MUTCD. 3) Gateway constructed with R1-6 signs at all permitted locations plus all edge sign locations not currently permitted in the MUTCD.

The number of signs that could be installed in compliance with the current MUTCD varied across sites based on the type or roadway. At some locations only one sign could be installed in compliance with the manual, but at other sites multiple signs could be installed in compliance with the manual forming a partial gateway. Locations permitted by the current MUTCD include centerline placement, lane line placement, and placement at the edge of a pedestrian refuge island or median.

The number of R1-6 signs that could be installed in compliance with the current MUTCD varied across sites based on roadway configuration. These variations are specified in Table 2.

Configurations Studied

In Table 2 illustrated below NA stands for non-applicable. For example, there would not be a centerline on a one-way street. The last column (Edge of Roadway) is the configuration not presently permitted in the current manual.

Table 2. The number of R1-6 that can be installed at each of the selected roadway configurations.

Road Configuration	Lanes in Each Direction	Centerline if no Island Present	Edge of Island if Island present	Lane Line	Edge of Roadway
Slip Lane	1	NA	1	NA	1
Slip Lane	2	NA	1	1	1
One-way	2	NA	NA	1	2
One-way	3	NA	NA	2	2
One-way	4	NA	NA	3	2
Two-way	1	1	2	NA	2
Two-way	2	1	2	2	2
Two-way	3	1	2	NA	2
Three-lane	1	NA	NA	2	2

Data Collection Methodology

Driver's Yielding right-of-way Behavior. Researchers measured the number of motorists who did and did not yield to pedestrians in crosswalks. Driver yielding 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 ITE signal timing formula 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 (Institute of Transportation Engineers, 1989). This formula takes into account driver reaction time, safe deceleration rate, the posted speed, and the grade of the road to calculate this interval for the yellow traffic light. 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.

$$y = t + \frac{v}{2a + 2Gg}$$ [1]

[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/s^2, G = acceleration due to gravity (32ft/s^2), and g = the grade of the approach in percent divided by 100.

To aide observers in discriminating the location of the dilemma zone, the zone was marked by either a sprinkler flag or with bright tape or spray paint 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 were able to safely yield, particularly those traveling below the speed limit.

Each session consisted of 20 staged pedestrian crossings, and as many natural pedestrian crossings that occurred during the staged 20 trials. Staged crossings were not made when a natural pedestrian was crossing. The percentage of drivers who yielded the right of way to pedestrians was calculated for each session by dividing the number of drivers that yielded the right of way that session by the number of drivers that yielded plus the number of drivers that failed to yield. Data were collected during daylight hours between 10:00 a.m. and 8:00 p.m. Monday through Saturday. Three data sheets were collected at each site during for each condition. Data were not collected when it was raining. See Appendix A for a the data sheet used for scoring pedestrians.

Scoring. At one-way streets, all drivers were scored as yielding once the pedestrian entered the crosswalk. On two-way streets, only drivers in the first half of the roadway were scored for yielding after the pedestrian had entered the crosswalk. This procedure was used because it conforms to the obligations of motorists specified in most motor vehicle statutes regarding who has the right of way at what time. At locations with a median or pedestrian refuge island, drivers in the second half of the roadway were scored as a separate trial. If there was no island, drivers in the second half of the road were scored when the pedestrian approached the middle of the last lane before the yellow centerline and were scored in the same trial as the crossing for the first half of the roadway.

Distance Driver's Yielded in Advance of the Crosswalk. Coders observed the staged crosser and oncoming vehicles to denote where yielding occurred (see Appendix B for a more detailed explanation). Vehicles beyond the "dilemma zone" were coded if they failed to yield or where they yielded by distance from the crosswalk (i.e., less than 10 ft., greater than 30 ft., or greater than 50 ft. based on final stopping locations near spray painted neon orange dots placed by the research team in the middle of each lane of travel.

Conflicts. Multiple vehicle threats were coded as a "pass" where one vehicle would yield and another vehicle would continue past the stopped vehicle in the next lane of the pedestrian's travel. A hard brake by a vehicle that would otherwise pass a stopped vehicle in the next lane of travel was also recorded as a near multiple threat pass. Multiple vehicle threats or "passing" is

most likely to occur on multi-lane (e.g., 4 or more lanes) roadways, but is also possible on 2-lane roads with wide lanes or parking lanes with sufficient space for passing on the right.

Training data collectors. Researchers were trained to use the operational definition of yielding behavior. They practiced recording together until they obtained inter-observer agreement of 90% or better for two consecutive sessions (a total of 40 observations). Researchers were also trained on how to 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. 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, tape, or both.

Inter-observer Agreement. Inter-observer agreement was calculated for at least 20% of all observations, 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. Inter-observer agreement 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 converted to a percentage by multiplying by 100.

During sessions in which agreement data were collected, the two observers stood 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 such as whether the person was a male or female or the color of his or her clothing.

Initial Data Collection with Temporary Signs

Three data sheets were collected during the baseline condition with no R1-6 signs in place, three additional data sheets were collected with as many R1-6 signs in place as is permitted in the current MUTCD, and three data sheets were collected with the full gateway including the edge signs. Therefore, there were a total of 60 staged crossing during each of the three conditions and as many natural pedestrian crossings as occurred during that period at each site.

We have completed collecting initial comparison of baseline, R1-6 use in compliance with present MUTCD, and the full gateway with edge signs at 15 sites and we have partial data at 1 site and need to collect data at 7 additional sites and 7 new sites we propose to add to replace sites lost for various reasons. Data collections was recently slowed when FEDEX lost the R1-6

signs and bases that we were using. We should finish up with all of the previously approved sites as well as the proposed additional sites once we have approval to add 7 additional sites.

Driver Yielding Data. Figure 1 shows data from 15 sites where initial data collection with the temporary signs has been completed. The blue bar shows the percentage of drivers that yielded to pedestrians during baseline, the gray bar shows the percentage of drivers that yielded to pedestrians with as many R1-6 signs installed as is permitted by the manual, and the orange bar shows the percentage of drivers that yielded to pedestrians with a full gateway including edge signs. In all cases more drivers yielded to pedestrians when R1-6 signs were installed as prescribed in the MUTCD than during baseline condition with no R1-6 signs. In 14 of the 15 cases more drivers yielded to pedestrians when the full gateway was installed than during the condition when only signs permitted by the manual were installed. A bar graph showing the average across all 15 sites is presented in Figure 2.

Figure 1. The percentage of drivers yielding to pedestrians during each of the three conditions.

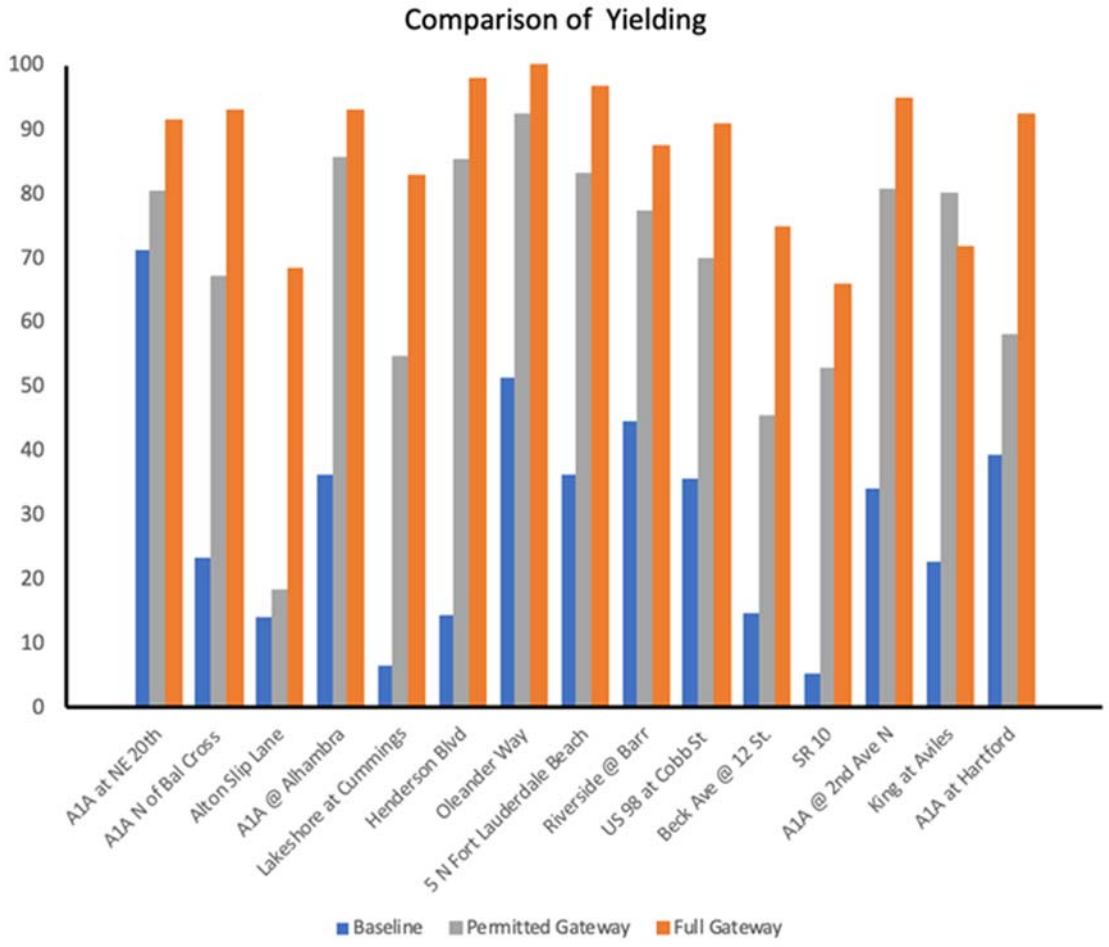
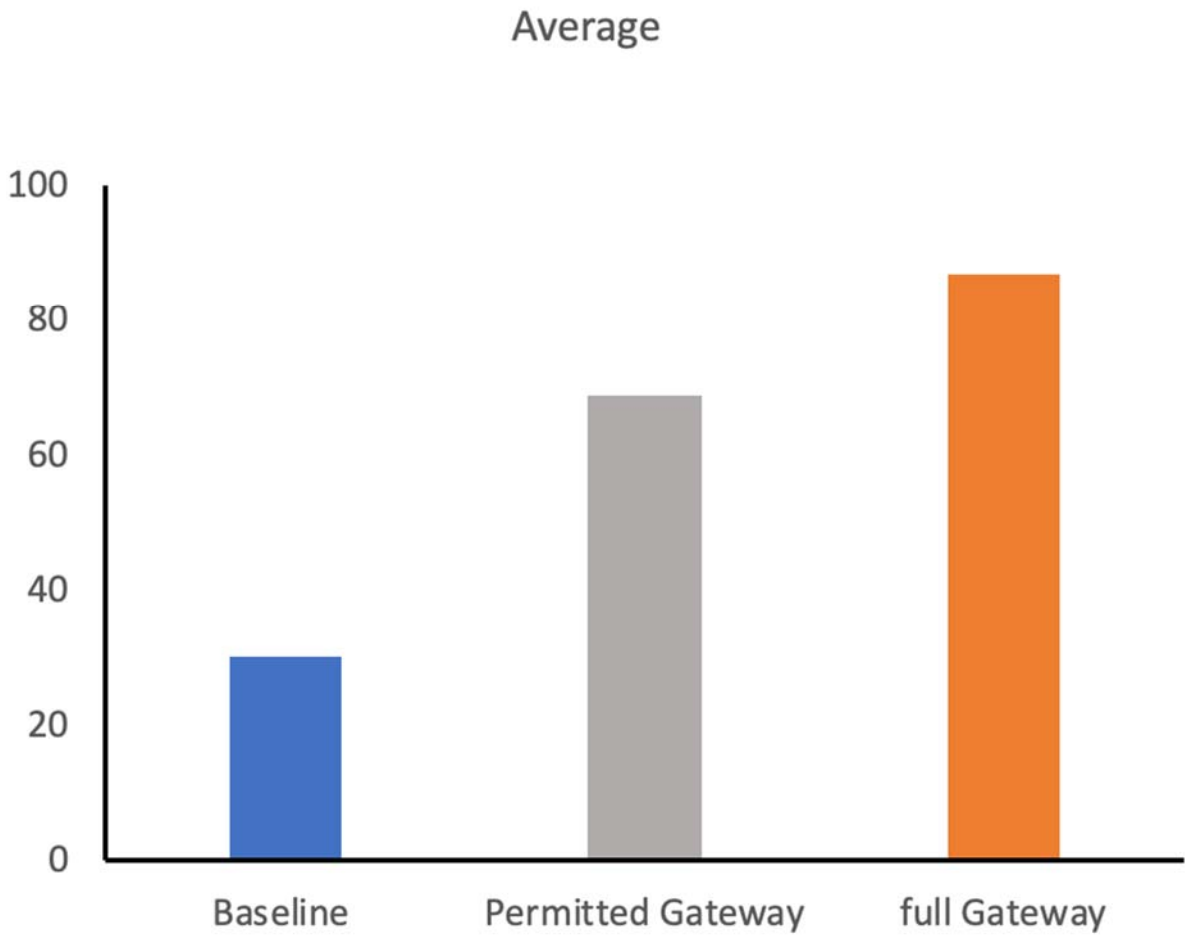


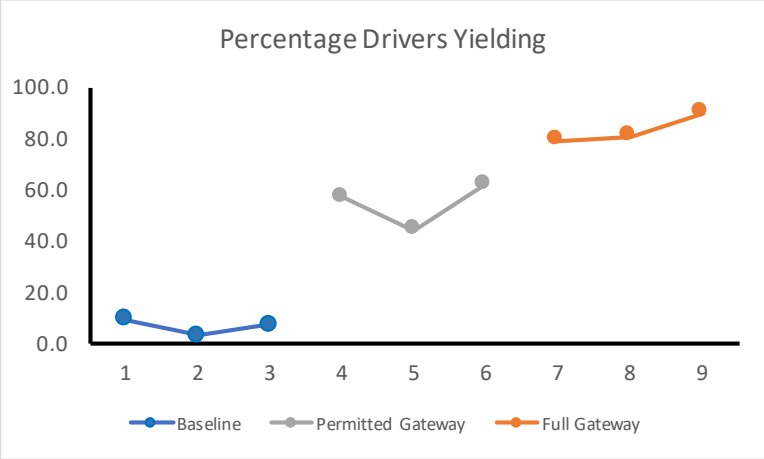
Figure 2. The average percentage of drivers yielding to pedestrians during Baseline, the Permitted Gateway treatment and the Full Gateway treatment conditions.



The average data show that installing R1-6 signs has a large effect and that a complete gateway is more effective than a partial gateway. These data replicate the MDOT data.

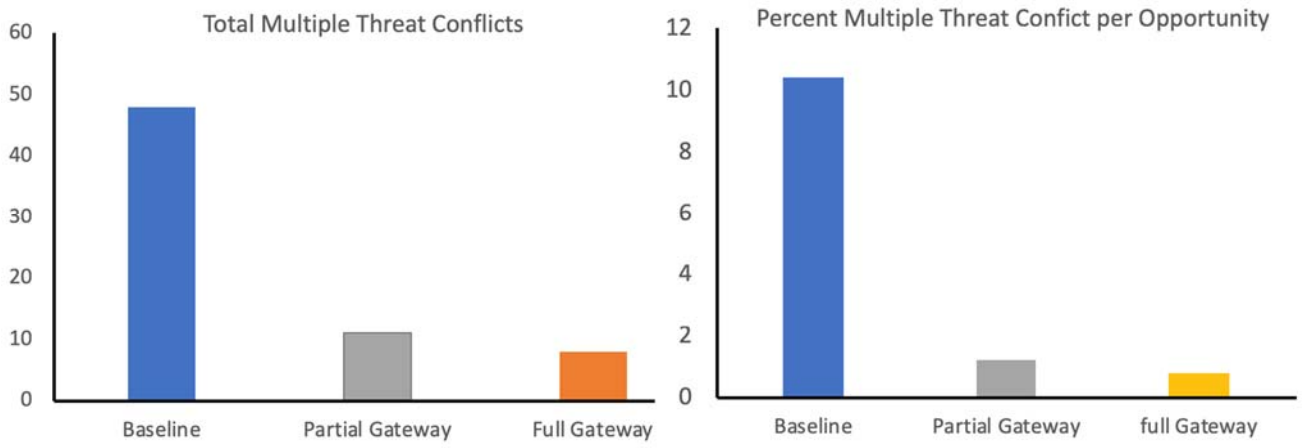
Figure 3 shows the data for each of the three data sets 60 crossing for each condition at one of the sites (Lakeshore Dr. West. at Cummings). It should be noted that all the data from each of the sheets collected from the permitted gateway condition are higher than each of the sheet in the baseline condition and all of the sheet collected during the full gateway condition are higher than all the sheet collected during the permitted gateway condition. These data are typical of the data collected at most of the sites.

Figure 3. The average percentage of drivers yielding to pedestrians for each 20 crossing data sheet during each of the three conditions at Lakeshore Dr. West at Cummings.



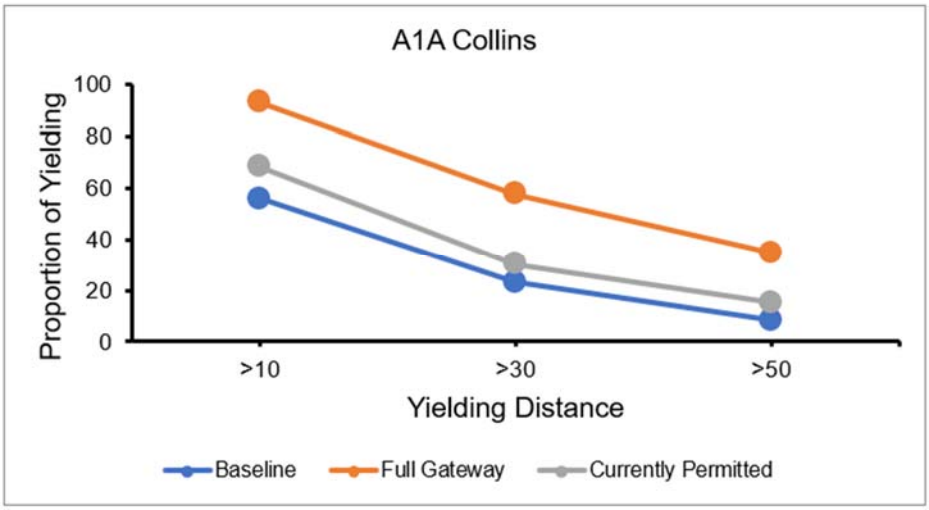
Vehicle-Pedestrian Conflict Data. Data on multiple threat conflicts included passing a vehicle in the next pedestrian travel lane when the pedestrian was crossing a multilane road, and hard braking by the person in the next pedestrian travel lane. During the baseline condition, there were 48 instances of this type of conflict, when R1-6 signs were installed in all permitted locations there were 11 such conflicts, and when the full gateway was installed there were 8 such conflicts. It should be noted that all of the conflicts occurred on the multilane roads. The graph shown on the left side of Figure 4 shows the absolute number of conflicts during each condition. Note that very few people yielded during the baseline condition. Because a conflict with a passing vehicle could only occur if a driver yielded the percentage of conflicts per opportunity looks much worse. The number of conflicts per opportunity is presented in the graph on the right side of Figure 4.

Figure 4. The graph on the left shows the total number of conflicts observed during each of the three conditions. The graph on the right shows the percentage of conflicts for crossings under each of the three conditions.



Stopping Distance Data. How far in advance a driver stops is a critical variable at multilane crosswalks. Ten studies indicated that advance yield or stop markings and signs reduced pedestrian-vehicle conflicts and a national NCHRP study found a crash modification factor for advance yield or stop markings on multilane roads. Another study conducted at two sites without advance yield or stop markings showed that placement of a gateway 50 ft. in advance of a crosswalk increased yielding in advance of the crosswalk at two multilane sites. At one sites completed so far in this study the gateway treatment was installed 40 ft. in advance of the crosswalk at the advance stop line.

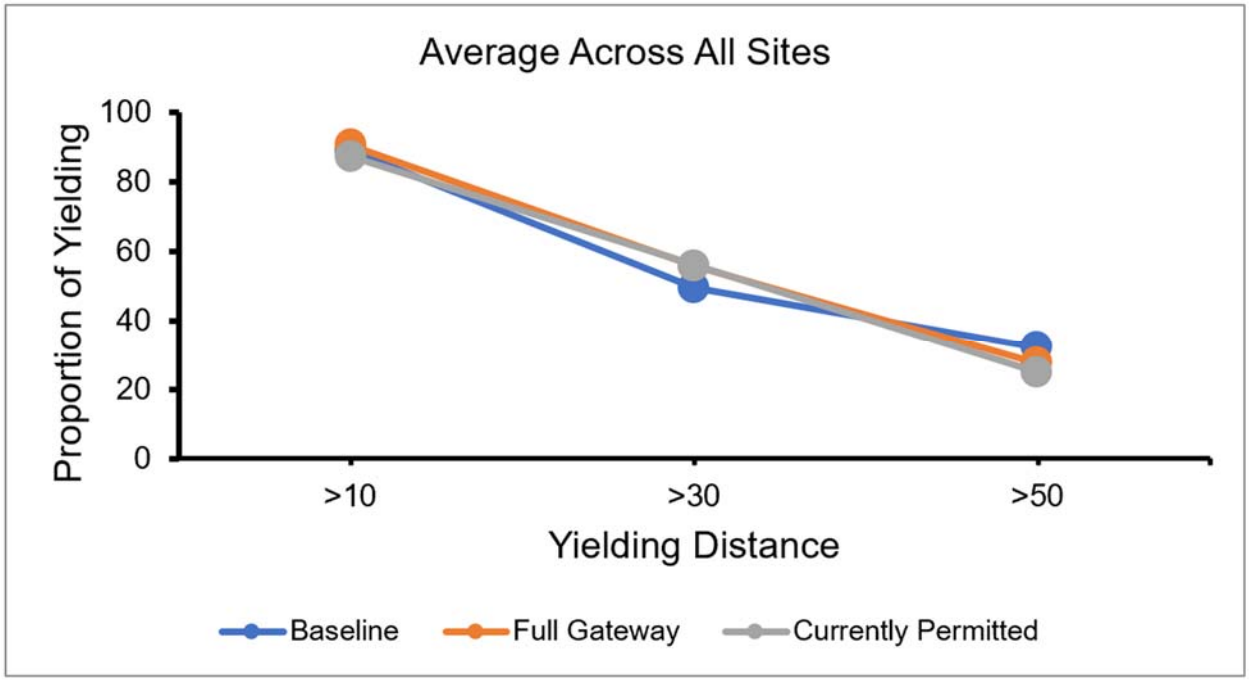
Figure 5. The percentage of drivers yielding more than 10 ft., 30ft. and 50 ft. in advance of the crosswalk at two multilane sites during baseline, the currently permitted condition and the full gateway conditions.



At the A1A site on Collins Ave midblock crosswalk, a six-lane road with three lanes in each direction, signs were placed 40 ft. in advance of the crosswalk. Drivers yielded further back during the full gateway treatment than during baseline at this site but the partial gateway had little influence on yielding distance.

At the remaining multilane sites the R1-6 signs were placed within 2 ft. of the crosswalk. The average yielding distances across all sites is shown in Figure 6. Yielding distances were similar during each condition across these sites. As mentioned earlier in the progress report, motor vehicle pedestrian conflicts were very high at all of these sites during baseline and rarely occurred once the R1-6 signs were introduced. Although more data are required before a final conclusion can be drawn, it appears that the full gateway is associated with fewer conflicts than the partial gateway.

Figure 6. The average percentage of drivers yielding more than 10 ft., 30ft. and 50 ft. in advance of the crosswalk when signs were placed with 2 ft. of the crosswalk.



4.0 CONCLUSIONS

Data collected to date show that the use of the R1-6 signs increases yielding at each of the crosswalks, and that the use of a full gateway produces greater yielding than a gateway that only involves the locations currently permitted by the manual. Even though a partial gateway is effective it heavily relies on the use of the most vulnerable sign locations (signs placed on lane lines). Once hard installations are completed it is anticipated that more of the lane line signs will be lost than edge and centerline signs. Data also show there is a large reduction in conflicts with passing vehicles on multilane roads after R1-6 signs are installed. Data collected on how far drivers yield in advance of the crosswalk, replicates an earlier study that showed vehicles stop further in advance of the crosswalk when the gateway is installed at locations where advance yield and stop markings can be installed on multilane roads.

Because we have lost access to 7 of the original sites, we need permission to add 7 additional sites. We also need to collect baseline speed data at each site. Although speed data were not collected while collecting data on temporary installations of the R1-6 signs it was the impression of data collectors that there was a marked reduction in vehicle speed associated with the gateway treatment. This impression is in accord with data collected in the MDOT study. Speed data collections will be necessary before and after gateways are installed at each of these sites to confirm these impressions.

Appendix A: A sample data sheet.

Location: _____ _____

Discribe conditions: _____

Date:_____ Start Time:_____ Stop Time:_____

Staged Crossings	Drivers Not Yielding	Drivers Yielding	Distance Drivers yielded from crosswalk				Multiple Threat Conflict		Evasive Action		Trap	Failure in Protocol
			< 10 ft	10ft-30ft	30ft-50ft	>50 ft	Pass	Hard Brake	Ped	Veh		
1												
2												
3												
4												
5												
6												
7												
8												
9												
10												
11												
12												
13												
14												
15												
16												
17												
18												
19												
20												
Sum												
%												

Natural Crossings	Drivers Non Yielding	Drivers Yielding	Distance Cars yielded from crosswalk				Multiple Threat Conflict		Evasive Action		Trap	Failure in Protocol
			Less than	Betwee n 10 ft -		More than	Pass	Hard Brake	Ped	Veh		
1												
2												
3												
4												
5												
6												
7												
8												
9												
10												
Sum												
%												

Appendix B: Observational Protocol.

Introduction

Pedestrian safety is important for livable communities and relies on the cooperation of drivers to look for and legally stop for pedestrians at crosswalks. This study will measure driver yielding rates on FDOT roads to evaluate the effectiveness of the Gateway Treatment under FHWA permission to experiment. The safety of the research team is of the utmost importance. Following this protocol is the best way to ensure that our team remains safe and our data quality meets the highest standards.

Staffing Requirements

- Research coding teams must consist of two trained coders who will both alternatively serve as either the staged pedestrian or the recorders. The staged pedestrian will initiate the yield request to on-coming vehicles and cross the street once vehicles yield and the recorder will code the driver behaviors on the coding sheet.
- Both team members should wear solid, weather appropriate clothing (no visible patterns or logos) with jeans and comfortable shoes with little-to-no retroreflective clothing.
- Each member should have a clipboard holding safety protocol and multiple coding sheets and a pencil to take notes and easily correct entry errors.

Coding Session Requirements

- Coding sessions should occur only under clear weather conditions (i.e., not during rain, or wet surface conditions) and during daylight hours (i.e., not during dawn, dusk, or dark conditions).
- Coding sessions should occur between the hours of 8:30 am and 4:00pm to avoid rush hour traffic conditions.
- Pavement markings should be visible from recorder coding position. Notify supervisors if markings are no longer fully visible so that they can be re-touched. Markings should be on the curbside to mark “dilemma zone” for both directions of traffic and in-street (in the center of each lane) to mark 10 and 40 feet yielding distances.

General Instructions

- The team member first serving as staged pedestrian will read the ***Safe Crossing Protocol*** aloud to the recorder then proceed with 10 staged crossings.
- The second team member will then assume the role of staged pedestrian by first reading the ***Safe Crossing Protocol*** aloud to the newly assigned recorder before proceeding with the final 10 staged crossings.
- Recorders will follow ***Coding Instructions*** as they observe the staged pedestrian crossings
- The coding team will step back to observe and score the vehicle behavior in the presence of any natural pedestrians who initiate a yielding request (i.e., step off of the curb) of oncoming traffic. Each code-able natural pedestrian crossings will take the place of a planned staged crossing.

Safe Crossing Protocol

All crossing should follow the standard safe crossing protocol. The safety crossing protocol involves the following procedure:

Step 1: Place one foot into the crosswalk when an approaching vehicle is just beyond the marked "dilemma zone" distance to ensure a safe stopping distance for vehicles traveling at the posted speed. Do not take additional steps until the vehicle begins to slow in order to yield or until all approaching vehicles have traveled through the crosswalk and a sufficient gap presents itself. If there is on street parking you will need to step out to the edge of parked cars but no further until the approaching vehicle begins to slow whenever cars are parked close to the crosswalk.

Step 2: If the vehicle makes no attempt to stop, do not proceed to cross. If the vehicle is traveling at excessive speeds or is traveling close to the curb face or parking lane, step back as the vehicle approaches.

Step 3: If the vehicle clearly begins to yield and the next lane is free, begin initial lane crossing and wave to the first yielding vehicle to give indication of your intention to cross and thank them for stopping. **NOTE:** ***If you see a vehicle rapidly approaching the stopped vehicle in the same lane ensure it comes to a safe stop before proceeding into the lane of the stopped vehicle.***

Step 4: On multilane roads, ***always stop at the lane line, search and make sure the next lane is clear.***

This step is essential to prevent the possibility of being involved in a Multiple Threat crash. ***Looking is not enough because you have a limited reaction time and if crossing at a normal speed, you will not be able to react in time unless you stop. Get into the habit of making a brief stop even if the car yields further back.***

Step 5: If the vehicle yields in the next lane of multilane roads, wave to the vehicle and proceed to the centerline or median.

Step 6: At roads with a median or pedestrian refuge island treat the second half of the crossing the same as the first half. That is place a foot in the crosswalk and wait for any oncoming cars to yield before entering the lane. At four lane roads without a median or pedestrian refuge island, stop at the lane edge and wait for any oncoming traffic to yield before crossing the centerline.

Step 7: If a large gap appears in traffic, proceed through the crosswalk and do not wait for the vehicles to move closer within range.

Coding Instructions (for staged and natural crossings)

Step 1: Place yourself according to your training in a position away from the crosswalk, as to not give false indication of an intention to cross, but where you are able to view the movements of the staged pedestrian and "dilemma zone" markings for both direction of travel. You should be able to see in-street markings from this position as well.

Step 2: Observe vehicles approaching from the lanes of travel on the pedestrian's side of the street.

- Any vehicle approaching which is on the outside of the "dilemma zone" marking once the staged pedestrian steps off the curb should be coded. If the vehicle makes no attempt to

stop, score it as "**Cars Not Yielding**". Any subsequent vehicles which do not stop should also be scored as "**Cars Not Yielding**".

- Any vehicles that are inside the "dilemma zone" when the staged pedestrian steps off the curb should not be scored if they do not stop, but can be scored if they chose to yield (see Step 3).

Step 3: Once a vehicle stops at the crosswalk, score them as "yielding" in one of the *Distance Cars Yielded* from Crosswalk bins:

- If no in-street dots are visible (i.e., they are stopped very close to the crosswalk), score them in the "**Less than 10ft**" yielding bin.
- If one in-street dot is visible (i.e., stopped slightly further back from the crosswalk), score them in the "**10-40ft**" yielding bin.
- If two in-street dots are visible (i.e., stopped at a distance back from the crosswalk), score them in the "**More than 40ft**" yielding bin.

Step 4: On multilane roads, if a vehicle yields in one lane and other vehicles in the same direction of travel do not stop, score them as "**Cars Not Yielding**" and make note of each one in the "**Pass**" bin under the Multiple Threat Conflicts.

Step 5: On multilane roads, if a vehicle yields in one lane and other vehicles in the same direction of travel brakes hard (e.g., audible tires screech or visible downward vehicle nose), score it as "**Hard Brake**" under the Multiple Threat Conflicts section.

Step 6: Score vehicles in the opposing lane of travel in the same manner as the first direction. Begin scoring vehicles outside of "dilemma zone" once the staged pedestrian has either been yielded to in all lanes in the first direction of the roadway or has a large gap and is proceeding to walk across the opposite lanes of travel. If the vehicles in the opposite lane of travel do not yield so that the pedestrian is forced to stand on the centerline with vehicles moving in both lanes of travel, code this event as "**Trapped**"

Step 7: If the pedestrian must move themselves out of harm's way to avoid a vehicle (e.g., step back out of the road, or move quickly forward to avoid the vehicle), then code it as an "**Evasive Action: Ped**", if a vehicle must quickly swerve to avoid the pedestrian or another yielding vehicle, then code it as an "**Evasive Action:** This will apply to naturally crossing pedestrians, if you follow the safe crossing protocol, it should not happen at all.

Step 8: Importantly, you serve as a second set of eyes to help keep your partner safe. If the staged pedestrian fails to follow protocol (e.g., does not stop at lane's edge or check for Multiple Threat Conflicts), code the crossing under "**Failure in Protocol**". Give real-time feedback to your partner and review protocol with them. Alert supervisors for any safety concerns you have about safety training of you or your partners or of specific crosswalks.