Evaluation of Driver Yielding Compliance at Uncontrolled Midblock Crosswalks on Divided Low-Speed Roadways

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Background

Pedestrian fatalities are increasing at a rate faster than total road fatalities nationwide (NHTSA 2016)

- Most pedestrian crashes in Michigan occur midblock, rather than at controlled intersections (MSP 2016)
- Various crosswalk enhancements have been devised, such as in-street signage (R1-6)
- As crashes involving pedestrians are particularly rare, an alternative to crashes is needed as a measure of effectiveness for safety (yielding compliance)

Figure 1. Three crosswalk types studied: from left, unmarked, continental markings, in-street R1-6 (images from Google Maps)

Methods

Background

- Cross-sectional study conducted to compare the relative effectiveness of various existing traffic control devices at uncontrolled crossing areas on low speed divided streets
- 11 sites selected on low speed streets on or near large public universities in Detroit and East Lansing (Table 1)

Measure of Effectiveness

- Driver yielding compliance utilizing the staged pedestrian protocol developed by Van Houten and Fitzpatrick was used as MOE
- Events were recorded by elevated video camera, and behavior and volume data were extracted by manual video review

Table 1. Summary Statistics

Categorical Factors			
Factor	**Level or Unit**	**Proportion of Observations**	**Number of Sites**
Driver action	Yield	0.62	
	Did not yield	0.38	
Vehicle lane position	Near (curb) lane	0.70	
	Center or far lanes	0.30	
Position of vehicle in queue	Unqueued vehicle	0.72	
	Queue leader	0.20	
	Queue follower	0.08	
Crosswalk treatment	Unmarked	0.14	1
	Continental only	0.70	8
	In-street R1-6 sign	0.17	2

Continuous Factors					
Factor	**Level or Unit**	**Mean**	**SD**	**Min**	**Max**
Crossing width	ft	31.64	10.01	22	49
Vehicle volume at crosswalk	vehicles/h	367.10	129.43	220.7	614.5
Pedestrian crossing volume	pedestrians/h	97.15	122.49	14.33	371

Statistical Analysis

- Binary logistic regression was used, whereby each event was scored as either "yielded" or "did not yield"

$$p_i = \frac{\exp(\alpha_i + \beta' X_i)}{1 + \exp(\alpha_i + \beta' X_i)}$$

- Site-specific random effect included

Table 2. Binary logistic regression results

Variable	Level or Unit	Coefficient Estimate	Std Error	p-value	Odds Ratio
Constant		-6.5675	2.6109	0.0119	N/A
Crosswalk treatment	Unmarked	*baseline*			
	Continental only	1.0557	0.5101	0.0385	2.9
	In-street R1-6 sign	3.6715	0.6926	<0.0001	39.3
Vehicle volume	ln(veh/h)	0.9504	0.4629	0.0401	2.6
Vehicle lane position	Near (curb) lane	*baseline*			
	Other lane	0.8714	0.2481	0.0004	2.4
Vehicle position in queue	Unqueued vehicle	*baseline*			
	Queue leader	0.9059	0.2622	0.0006	2.5
	Queue follower	-1.026	0.4466	0.0216	0.4

Results

- Probability of driver yielding increases with additional treatment (Table 2)
- While sites without R1-6 showed large differences in yielding depending on whether the subject vehicle was in the near (curb) lane or other lane, this difference was small with in-street sign (Figure 2)

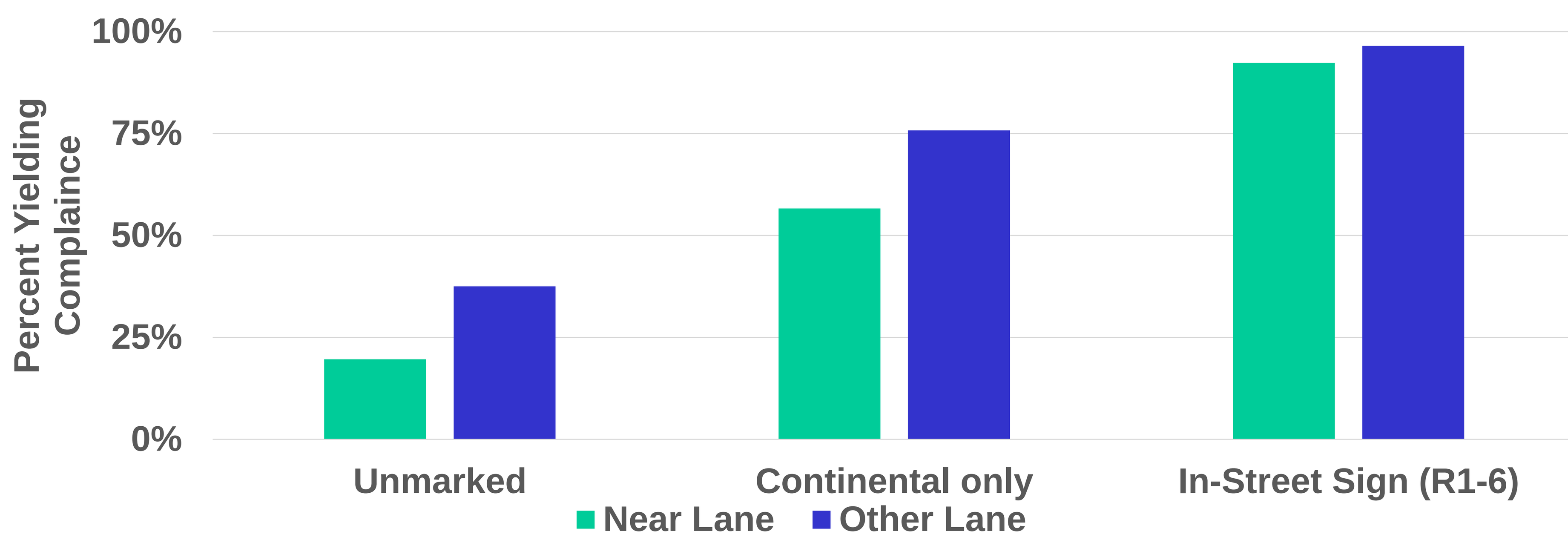

Figure 2. Yielding compliance by lane position and cross-section or treatment

Conclusions

- Type of crosswalk treatment has a strong influence on driver yielding compliance
  - In-street signs are an improvement over markings only, which are an improvement over unmarked crosswalks
  - Crosswalk enhancement devices showed improvements over prior Michigan studies
- Yielding compliance showed little sensitivity to lane position at sites with R1-6
  - Crosswalks without enhancement devices were highly affected by driver lane position
    - This could be due to the vulnerability of pedestrians already in the crosswalk, or increased conspicuity