CITY OF MADISON
DEPARTMENT OF TRANSPORTATION
Traffic Engineering Division

Year 2
Field Evaluation of Experimental "In-Street" Yield to Pedestrian Signs
1999

Madison Municipal Building
215 Martin Luther King, Jr. Boulevard
P.O. Box 2986
Madison, Wisconsin, 53701-2986

Submitted to:
Federal Highway Administration

TABLE OF CONTENTS

LIST OF TABLES

LIST OF EXHIBITS

Field Evaluation of Experimental Yield to Pedestrian Signs

EXECUTIVE SUMMARY

The City of Madison Traffic Engineering Division requested and received approval in 1997 from the Federal Highway Administration to experiment with regulatory in-street "Yield to Pedestrians" signs at selected marked crosswalk locations. The experiment began in the spring of 1998. The goal of the experiment was to evaluate the effectiveness of the sign to positively change motorist behavior with respect to yielding to pedestrians at crosswalks. The signs were mounted in the street on flexible post assemblies which were designed to fold down upon impact and then right itself and reorient to traffic afterwards. The desired effect of these signs was to increase driver compliance with Wisconsin's pedestrian rights laws. Three test sites, each having different geometric and pedestrian usage characteristics, were selected for the first year of the experiment. This was expanded to five sites in 1999, the second year of the experiment.

At one site, the sign was placed on the lane line between two approach lanes of a one-way street. At the second site, a double-sided sign was placed on the east-leg of a two way street within a four foot wide painted median. At the third site, a double-sided sign was placed on the west-leg of a two way approach on a raised seven foot wide median. In the second year of the experiment, this sign was replaced with a larger sign (24" w by 30" h), since it was in a protected area. At each of the two sites added in 1999, a double-sided sign was placed on the center line of a two-way street. Long standing pedestrian crossing concerns exist at each of the selected test sites.

Before- and after-studies were done at the two new test locations with a single treatment (addition of yield to pedestrian signs). After-studies were also conducted at two of the original sites. After-studies were not possible at the third original site due to nearby construction that impacted traffic on this street. These after studies were compared to last year's data to evaluate longer term impacts of the sign. The measure of effectiveness used was the occurrence of motorists yielding for pedestrians who were using the crosswalks. The observations collected showed that the occurrence of motorists yielding to pedestrians increased significantly at both of the new sites and at one of the two original sites studied this year. At the other original site studied, there was a substantial increase in the percentage of drivers yielding to pedestrians, but the number of observations was too low to determine if this increase was statistically significant.

INTRODUCTION

Drivers failing to yield right-of-way to pedestrians at marked and unmarked crosswalks is a common problem. One technique being used in several areas of the country is an in-street "Yield to Pedestrian" (YTP) sign to remind drivers of their responsibility to yield to pedestrians at crosswalks. Both warning (black letters on yellow background) and regulatory (black letters on white background) versions of this type of sign have been used. Neither these signs, nor their location in the street, are currently included in the federal *Manual on Uniform Traffic Control*

Devices[1] (MUTCD). The MUTCD does not include any regulatory signs for indicating the requirement that motorists yield to, or stop for, pedestrians at crosswalks. Wisconsin Statutes require that "...all traffic control devices placed and maintained by local authorities *shall* conform to the manual" (emphasis added).

BACKGROUND

In August of 1997, in accordance with procedures provided for in the MUTCD, the City of Madison Traffic Engineering Division requested, and subsequently received, approval from the Federal Highway Administration (FHWA) to experiment with YTP signs at selected marked crosswalk locations. The purpose of the experiment was to evaluate the effectiveness of the YTP sign in increasing driver compliance with Wisconsin's pedestrian rights laws. A regulatory sign (black letters on white background) was selected for the experiment since yielding to pedestrians in crosswalks is a regulatory condition in Wisconsin. The signs (see Exhibits 1a & 1b) were constructed of high impact plastic with high intensity sheeting, mounted on a flexible post assembly. The assembly is constructed so that if impacted it folds down to the roadway. Upon passage of the vehicle, the sign rights itself and reorients the sign(s) in the correct direction. The assembly is secured to the pavement with epoxy and bolts so that the assembly is not launched if struck by an errant vehicle. The research effort consisted of evaluating the effectiveness of the YTP signs at each of the pedestrian crosswalk test sites before and after installation. Field evaluations for 1999 began in May and June, and concluded November 1st.

SITE SELECTION

Three sites were selected for testing the in-street "Yield to Pedestrians" sign in 1998. These sites were retained, and two sites were added, in 1999. These sites all had long standing pedestrian crossing concerns. It was also desired to select sites having different geometric and pedestrian usage characteristics so as to evaluate what effect, if any, such differences might have on the sign's effectiveness.

The following is a brief description of the two new locations selected for testing the YTP sign. Sites 1 - 3 were described in the 1998 report.

Test Site 4: Williamson Street at Dickinson Street is a four-legged intersection of an arterial street (Williamson) and a local street (Dickinson) in a neighborhood business district (see Exhibit 2). This site is two blocks from site #2, Williamson Street at Few Street, at the other end of the business district. The intersection between Few and Dickinson Streets (Baldwin Street) is signalized. Dickinson Street is stop sign controlled. One double-sided YTP sign was placed on the center-line adjacent to the crosswalk on the east leg of this intersection. Williamson Street has a posted speed limit of 25 mph and serves approximately 16,250 vehicles per day. There are traffic signals at the intersections of Williamson Street one block east and one block west of Dickinson Street. These signals are part of a progressively timed signal system.

Williamson Street is 48 feet wide with two traffic lanes, one in each direction, with parking permitted on both sides. During morning and evening rush hours (7:00 am - 8:30 am and 4:00 pm to 5:30 pm, respectively) parking is prohibited in the peak direction only, and that curb lane is used as a third travel lane. Pedestrian crossings for the before and after studies were observed

only during non-peak hours.

Test site 5: Monroe Street at Harrison Street is a four-legged intersection of an arterial street (Monroe) and a local street (Harrison) in a neighborhood business district (see Exhibit 3). Harrison Street is stop sign controlled. One double-sided YTP sign was placed on the center-line adjacent to the crosswalk on the east leg of this intersection. Monroe Street has a posted speed limit of 25 mph and serves approximately 18,700 vehicles per day in this area. There is a traffic signal one block to the east.

Monroe Street is 46 feet wide with two traffic lanes, one in each direction, with parking permitted on both sides. During morning and evening rush hours (7:00 am - 8:30 am and 4:00 pm to 5:30 pm, respectively) parking is prohibited in the peak direction only and that curb lane is used as a third travel lane. Pedestrian crossings for the before- and after-studies were observed only during non-peak hours.

Comments on other sites:
Test Site 1: Wilson Street at Martin Luther King, Jr. Boulevard was not studied this year due to construction of a hotel adjacent to this site. The construction affect traffic conditions at this site. The in-street YTP sign was used at this site in 1999.

Test Site 2: Williamson Street at Few Street Conditions at this site were essentially the same in 1999 as they were in 1998.

Test site 3: Regent Street at Vista Road The YTP signs at this location was left up all winter due to its location on a protected raised median. In 1999, these signs were replaced with a larger (24" w by 30" h) aluminum sign mounted on a metal pole with the same message.

EVALUATION METHODOLOGY

Measures of effectiveness
The goal of this experiment was to evaluate the effectiveness of the experimental in-street YTP sign in reminding motorists of their responsibility to yield to pedestrians in crosswalks, thus positively changing motorist's behavior. Therefore, the measure of effectiveness selected to survey was the occurrence of motorists yielding to pedestrians.

Experiment design
The "before-and-after" experimental method was used at each test site with the installation of the YTP sign as the primary treatment. To overcome any novelty effects the new sign might have, the "after" data was collected no sooner than 30-days following installation of the YTP signs.
Neither a large scale education nor an enforcement campaign, which could bias the results of the sign test, was conducted.

After-studies were conducted at 2 of the 3 sites continued from 1998. This data was compared to the after data from 1998 to evaluate longer term changes in motorist behavior. Data was not collected at Test Site 1, Wilson Street/Martin Luther King Jr. Blvd. site due to construction near the site that impacted traffic flow and pedestrian crossings.

Observation Methodology
To avoid bias, the same observation method, observation points, and observation times were used during both the "before" and "after" observation periods. Likewise, the "before" and "after" observation periods at Regent-Vista were scheduled during the school year. Data was only collected during good weather, and in the absence of atypical traffic conditions. All observation periods were video recorded. For consistency, the same team collected and scored all before and after data and followed established data-collection procedures[2].

Behavioral Observations
The measure of effectiveness surveyed for this test was the occurrence of drivers yielding to pedestrians at the crosswalks being observed. Therefore the survey crew recorded the number of motorists yielding to pedestrians attempting to cross the intersections as well as the number of motorists voluntarily yielding, or failing to yield, to these pedestrians. Neither the occurrence of pedestrians crossing in the absence of opposing vehicular traffic nor vehicles passing in the absence of pedestrians was recorded. Yielding events were recorded when motorists voluntarily yielded to allow a pedestrian to initiate a roadway crossing. For a yielding event to be recorded, the following criteria were required:

1. The motorist slowed down for a pedestrian initiating a roadway crossing, not for a pedestrian already within the vehicle's lane of travel.
2. The motorist initiated braking in advance of the crossing and gradually slowed before stopping.
3. The gradual slowing and stopping did not involve evasive action by the motorist or the pedestrian.
4. The motorist approached the intersection within a free-flow traffic condition, i.e. the motorist had not been required to slow down due to stopped or slowed traffic ahead.
5. Neither yielding nor non-yielding events by turning vehicles were recorded.

The playback feature of the video recording equipment was a valuable tool enabling the two member survey crew to accurately and consistently evaluate whether or not the above criteria were met.

Data Collection
Table 1 shows the dates and times that data was collected at each of the five sites where the in-street Yield to Pedestrians sign was used in 1999. It was attempted to collect the before and after data at similar times of the day, and under similar traffic and pedestrian activity levels. A summary of the recorded observations is provided in Table 2. All tables are presented at the end of this report.

ANALYSIS OF COLLECTED DATA

As shown in Table 3, the YTP sign increased the percentage of motorists yielding to pedestrians at all locations where the sign was used. To test if the changes between the before and after periods were statistically significant, a Z-test for proportions was employed as recommended by

the FHWA *Guidelines for Evaluation Fluorescent Strong Yellow Green Crossing Signs*[3]. As shown in Table 3, applying the Z-test to the before and after proportions shows a significant change at the 95 percent confidence level (Z=1.645, two-tailed test) at all locations studied except site 2. Note that at site 2 there was a small number of observations during the after-study. The change at site 3 was not significant for the individual legs evaluated alone (again, note the small number of observations for the after-studies), but was significant when both legs were evaluated together. The change at site 5 was significant for the leg with the sign, but not at the leg without the sign.

DURABILITY OF IN-STREET YIELD TO PEDESTRIAN SIGNS

At the Williamson–Few, Williamson–Dickinson and Monroe–Harrison test sites, where the signs were placed in the street without the protection of a raised median, the signs were subjected to vehicular hits resulting in degradation of the sign's surface. Six signs were replaced overall during the 1999 test, including one that was reportedly hit at 80 mph. No claims have been made against the City for damages. The cost of routine sign replacement is a greater concern with in-street YTP signs than with other methods of conventional signage.

DISCUSSION

From the data collected, it is clear that the effectiveness of the sign differed somewhat at each test site. The test sites had different physical geometric characteristics as well as differences in motorist and pedestrian crossing characteristics. Due to the limited number of test sites selected for this experiment, it was not possible to conclusively determine what specific intersection characteristic(s) contributed to the differing success rates of the YTP signs. If the YTP sign is eventually approved for use by the FHWA for inclusion in the MUTCD, it would be useful to identify at what types of intersections the sign's placement could be expected to most benefit pedestrians. Further research on this topic will be needed.

The geographic setting as well as the extent of pedestrian crossings of each site are characteristics which may have influenced the relative effectiveness of the YTP signs. The Wilson-MLK site located in the heart of a high-volume central business district with frequent pedestrian crossing throughout the day and year. The Williamson–Few, Williamson–Dickinson and Monroe–Harrison test sites are located in neighborhood business districts with similar motor vehicle traffic volumes, but differing levels of pedestrian activity. The Regent-Vista site is in front of a High School with existing advance school warning signs and school speed limit signs, overhead flashers and a pedestrian refuge island which permitted the use of a larger YTP sign than at the other sites, and which has intense pedestrian crossings during only a few periods per day with infrequent crossings the rest of the day.

Pedestrians really like the in-street Yield to Pedestrians sign. Madison Traffic Engineering staff received many compliments for installing these signs. People always called when a sign needed maintenance. Some got quite upset when the signs are taken out for winter. Exhibit 4, page 14 is a poster that was put up in several businesses near Test Site 5 after that sign was removed for the winter. Exhibit 5, page 15 was our response, put up in the same locations.

CONCLUSIONS

The data collected at the test sites clearly demonstrates the YTP sign's potential to substantially increase the percentage of motorists yielding to pedestrians at crosswalks adjacent to the sign. It is also clear that more research needs to be done. Further testing at additional sites will be required in order to ascertain the characteristics which contribute to the YTP signs effectiveness or lack there of.

RECOMMENDATIONS

Staff recommends securing approval from the FHWA to continue further testing of the YTP signs at the five current test sites in Madison. FHWA should also consider soliciting other communities for testing this sign.

REFERENCES

1. Manual on Uniform Traffic Control Devices, FHWA, U.S. Department of Transportation, 1988

2. Parker, M.R., and C.V. Zegeer, *Traffic Conflict Techniques for Safety and Operations-Engineers Guide*. Report FHWA-IP-88-026, FHWA, U.S. Department of Transportation, 1988.

3. Parker, M. R., Guidelines for Evaluating Fluorescent Strong Yellow Green Crossing Signs. Report FHWA-SA-93-035, FHWA, U.S. Department of Transportation, 1993.

Table 1
Data Collection Dates and Times - 1999

Site	Location	Before Study		After Study	
		Date	**Time**	**Date**	**Time**
1	Wilson – MLK	Not studied 1999 due to construction			
2	Williamson – Few	Compared to 1998 After 8/21/1998	12:10 - 13:30	10/28/1999	12:00 - 13:00
3	Regent – Vista	Compared to 1998 After 9/22/1998	15:00 - 15:45	9/9/1999	12:00 - 13:00
4	Williamson – Dickinson	6/3/1999	12:00 - 13:00	8/11/1999 8/31/1999	12:00 - 13:00 12:00 - 13:00
5	Monroe – Harrison	6/10/1999	12:00 - 13:00	8/31/1999	11:57 - 12:53

Table 2

1999 Summary of "Before" and "After" observational data

Site	Period	Crossings Initiated While Motorists Approached Crosswalk	Crossing in Which First Approaching Motorist Yielded to Pedestrians	Crossings in Which Other Than First Approaching Motorist Yielded to Pedestrians	Crossings in Which no Approaching Motorist Yielded to Pedestrians	Approaching Motorists Yielding to Pedestrians	Approaching Motorists Failing to Yield to Pedestrians	Total Number of Approaching Motorists	Percent of Motorists Yielding to Pedestrians
		(1)	(2)	(3)	(4)	(5) = (2) + (3)	(6)	(7) = (5) + (6)	(8) = (5)/(7)
1) Wilson - MLK		Not studied 1999 due to construction							
2) Williamson-Few									
E-Leg (with sign)	1998 After	29	1	12	16	13	110	123	10.6%
	1999 After	9	1	4	4	5	24	29	17.2%
3) Regent-Vista									
W-Leg (with sign)	1998 After	30	5	1	24	6	65	71	8.5%
	1999 After	18	3	3	12	6	28	34	17.6%
E-Leg (w/o sign)	1998 After	23	3	1	19	4	37	41	9.8%
	1999 After	16	3	2	11	5	18	23	21.7%
Total (W + E legs)	1998 After	53	8	2	43	10	102	112	8.9%
	1999 After	34	6	5	23	11	46	57	19.3%
4) Williamson-Dickinson									
W-Leg (with sign)	Before	31	1	1	29	2	179	181	1.1%
	After	13	1	4	8	5	64	69	7.2%
E-Leg (w/o sign)	Before	13	0	0	13	0	65	65	0.0%
	After	5	1	1	3	2	11	13	15.4%
Total (W + E legs)	Before	44	1	1	0	2	244	246	0.8%
	After	18	2	5	2	7	75	82	8.5%
5) Monroe-Harrison									
N-Leg (with sign)	Before	27	2	0	25	2	67	69	2.9%
	After	28	3	11	14	14	64	78	17.9%
S-Leg (w/o sign)	Before	10	0	0	10	0	25	25	0.0%
	After	9	0	1	8	1	29	30	3.3%
Total (N + S legs)	Before	37	2	0	35	2	92	94	2.1%
	After	37	3	12	22	15	93	108	13.9%

Note : - Only crossings initiated when opposing motorists were present were recorded and only motorists approaching in free flow traffic conditions were recorded as either yielding or non-yielding. See "Behavioral Observations" paragraph in the "Evaluation Methodology" section.

- Pedestrian crossings between sidewalk curb and median were counted as one crossing at the Williamson-Few and Regent-Vista locations, i.e. a pedestrian crossing the entire street, of Regent or Williamson Street would have made two crossings.

TABLE 3

RESULTS OF Z-TEST SIGNIFICANT ANALYSIS - 1999

Site	Percent Vehicles Yielding Before	Percent Vehicles Yielding After	Z-Value for Before[1] vs. After	Significant at 95% Level (Z=1.645)
1) Wilson–MLK	Not studied 1999 due to construction			
2) Few-Williamson				
E-Leg (with sign)	10.6%	17.2%	-1.000	No
3) Regent-Vista				
W-Leg (with sign)	8.5%	17.6%	-1.386	No
E-Leg (w/o sign)	9.8%	21.7%	-1.323	No
W-Leg plus E-Leg	8.9%	19.3%	-1.932	Yes
4) Williamson-Dickinson				
W-Leg (with sign)	1.1%	7.2%	-2.631	Yes
E-Leg (w/o sign)	0.0%	15.4%	-3.204	Yes
Total (W + E legs)	0.8%	8.5%	-3.708	Yes
5) Monroe-Harrison				
N-Leg (with sign)	2.9%	17.9%	-2.924	Yes
S-Leg (w/o sign)	0.0%	3.3%	-0.921	No
Total (N + S legs)	2.1%	13.9%	-3.003	Yes

1. Before data for Regent at Vista and for Williamson at Few used 1998 after data to compare 1998 results with 1999 results.

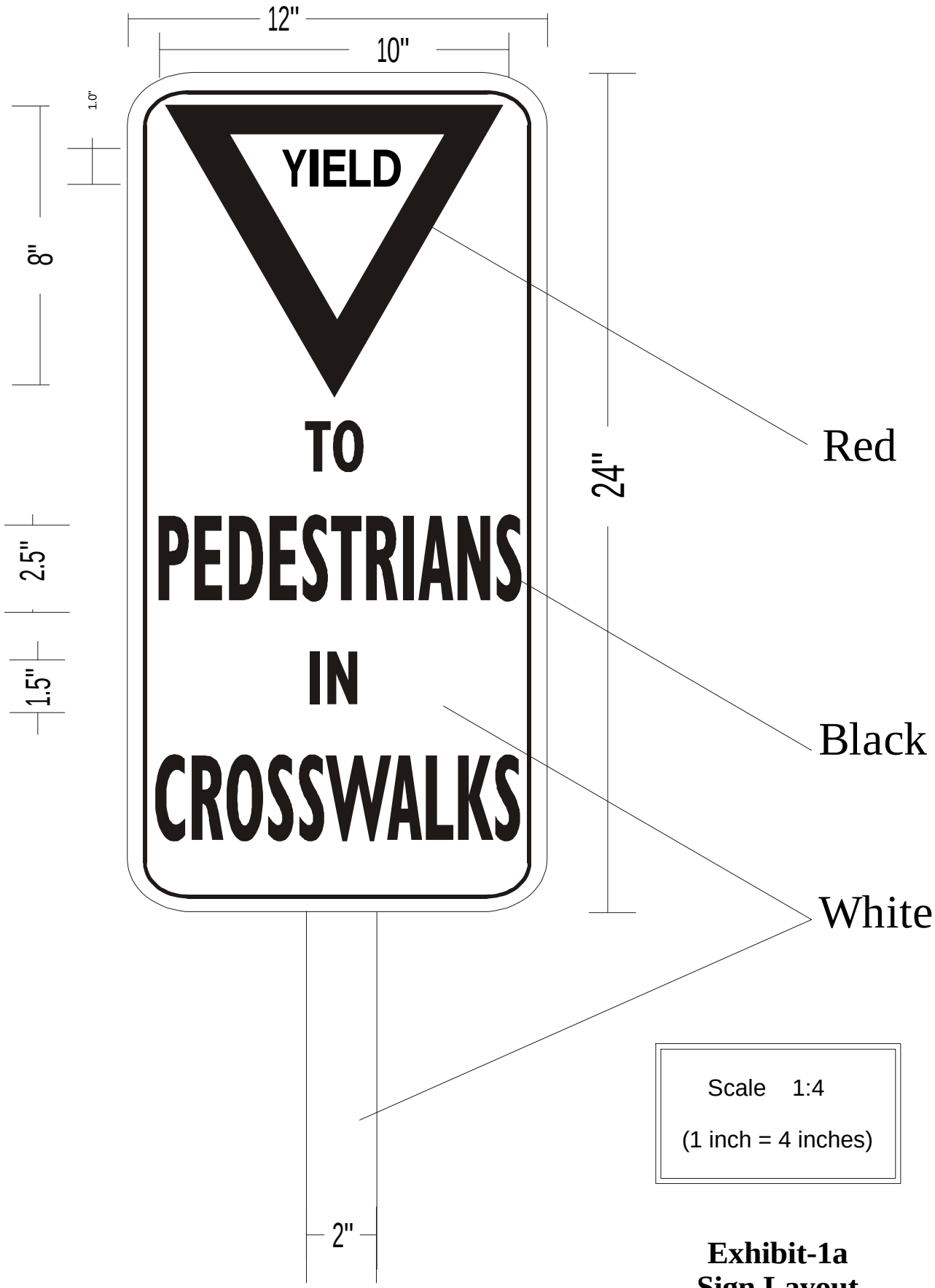

Exhibit-1a
Sign Layout

Exhibit 1b
In-Street Yield to Pedestrians in Crosswalks Sign

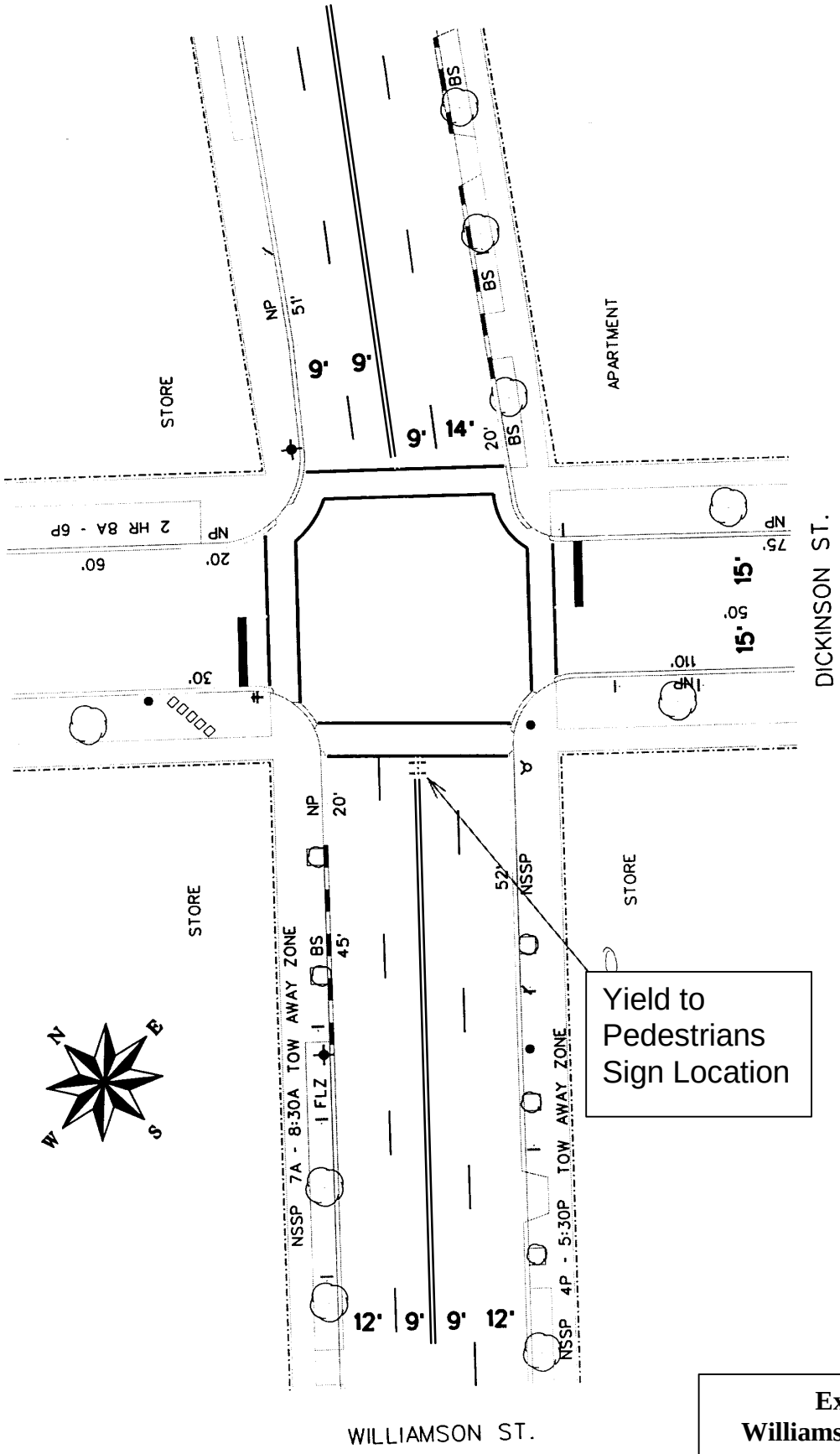

Exhibit 2
Williamson-Dickinson
Condition Diagram

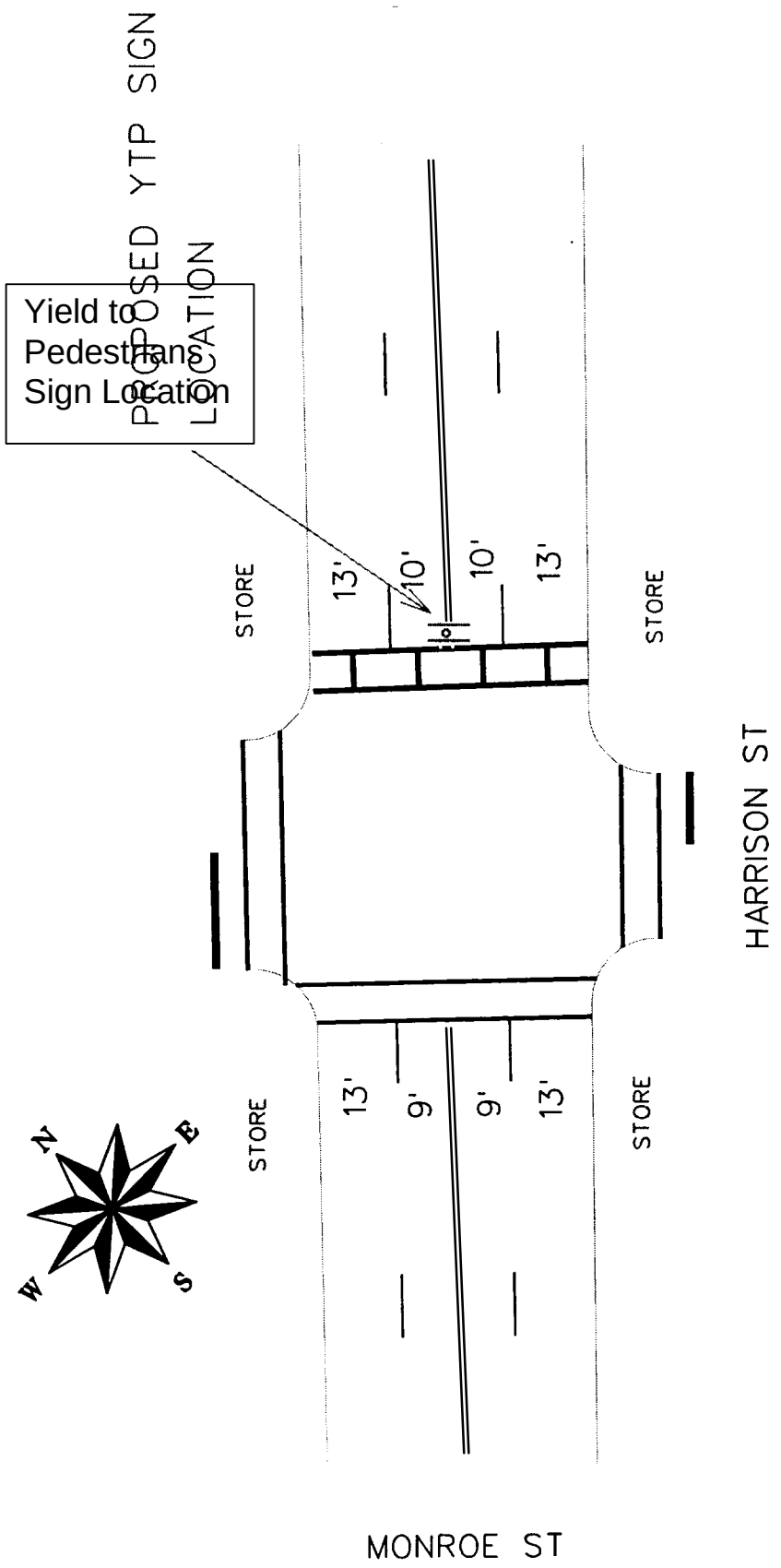

Exhibit 3
Monroe-Harrison
Condition Diagram

November 12, 1999

MEMO

To: Those of You Who Do Not Want to Be Hit by a Car

From: The Powers That Be

If you would like our "PEDESTRIAN CROSSING" sign returned to the Monroe Street / Harrison Street intersection, please call Arthur Ross at 266-6225 and beg for a second coming!

Thank you for your concern for human life.

ARTHUR ROSS PEDESTRIAN CROSSING 266-6225

ARTHUR ROSS PEDESTRIAN CROSSING 266-6225
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Department of Transportation
Traffic/Parking/Transit

David C. Dryer, City Traffic Engineer

Madison Municipal Building
215 Martin Luther King, Jr. Boulevard
P.O. Box 2986
Madison, Wisconsin 53701-2986
608/266-4761
FAX # 608/267-1158

TO: Monroe/Harrison Area Residents and Shoppers

FROM: Arthur Ross, Pedestrian-Bicycle Coordinator

DATE: 04/13/00

SUBJ: Yield To Pedestrians Sign

I have received numerous phone calls from concerned citizens regarding the recent removal of the "Yield to Pedestrians in Crosswalks" sign that was located in Monroe Street at the crosswalk between Ken Kopp's and Neuhauser's. Apparently, these calls were the result of a flyer posted in area businesses by "The Powers that Be" dated November 12.

The use of this sign, located in the street, is experimental. This year was the second year of the experiment, which is sanctioned by the Federal Highway Administration. in 1998 we used this sign at three locations: Williamson Street at Few Street (in front of the Willy Street Coop); Wilson Street at Martin Luther King, Jr. Blvd. (Monona Terrace Convention Center); and Regent Street at Vista Road (West High School). This year we expanded the experiment to also include Williamson Street at Dickinson Street and Monroe Street at Harrison Street. Each year we need to study these sites, report our findings to the Federal Highway Administration, and request their permission to continue the experiment in the following year. Locally, we have had to work with various city agencies, and it was agreed that the signs would be removed before it snowed to facilitate winter snow plowing.

We are in the process of evaluating the data we have collected and preparing our report to the Federal Highway Administration. Our report will include a request to continue the experiment in 2000. If they approve our request, the sign will be re-installed on Monroe at Harrison in the spring.

Preliminary review of data for Monroe at Harrison shows that motorist's voluntarily yielding to pedestrians at the crosswalk between Ken Kopp's and Neuhauser's increased from 2.9% before the sign was installed to 17.9% afterwards.