Law Enforcement, Pedestrian Safety, and Driver Compliance with Crosswalk Laws: Evaluation of a Four-Year Campaign in Seattle

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Enforcement of pedestrian right-of-way laws at uncontrolled crosswalk locations and its effect on driver compliance were evaluated from 1991 to 1994 through the cooperative efforts of the Harborview Injury Prevention and Research Center and the Seattle Police Department. Citywide, neighborhood and intersection-specific enforcement was evaluated by using a standardized crossing technique to provide drivers with opportunities to stop for a pedestrian. The rates of driver compliance before and after the programs were calculated by an independent observer. The evaluation suggests that targeting small areas may be as effective as citywide campaigns, that brief efforts may be as effective as longer programs, and that benefits to pedestrians from such enforcement in high-volume commuter corridors may be minimal. In light of the often contradictory results, expectations of traffic enforcement to improve pedestrian safety should remain modest. Behavioral and environmental factors that are more salient to the driver than even rather intensive enforcement efforts make it difficult to achieve a consistent positive effect. Continued research is recommended to identify the optimal use of limited traffic enforcement resources in the service of pedestrian safety.

Injuries from pedestrian-motor vehicle collisions were responsible for 5,500 deaths and thousands more injuries in the United States in 1993 (*1*). Elementary school children, older adults over age 65, and those impaired by alcohol are especially vulnerable (*2–9*). The role of law enforcement is one of the least studied of all potential mechanisms for reducing such injuries, yet law enforcement is routinely recommended as one of the essential strategies for prevention (*6,10,11*). Limited traffic enforcement resources, competing departmental priorities, and a lack of awareness of the problem's significance are three common barriers to the enforcement of pedestrian laws. The presence of a strong pedestrian safety program within the Seattle Police Department and its willingness to collaborate with the Harborview Injury prevention and Research Center provided a unique opportunity to investigate the potential safety benefit of one type of enforcement.

WHY CROSSWALKS?

Crosswalks at uncontrolled intersections were chosen as the focal point for the program because they provide a specific target location for law enforcement efforts aimed at increasing the compliance of drivers with pedestrian laws. They were also chosen because drivers' responses to the enforcement effort could be easily measured. In 1992 more than 800 of the 1,900 pedestrian injuries in Washington State occurred at intersections. Although drivers' willingness to stop for pedestrians is certainly not the only factor in collisions, it is a reasonable focus for law enforcement activities.

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INTERVENTION

The First Step: Strengthening Crosswalk Law

In 1990 a coalition of safety groups, health professionals, citizen activists, and law enforcement representatives worked together to pass a stronger state crosswalk law. The law focused the attention of the public on pedestrian safety by changing the obligation of the driver from yield to stop when pedestrians were attempting to cross at legal crosswalk locations. The new law set the stage for a change in Seattle Police Department policy with respect to pedestrian law enforcement as well as the initiation of a public information campaign.

Changing Focus from Walkers to Drivers

Where pedestrian enforcement programs exist they often target the pedestrian violator, not the driver. For years Seattle had a well-deserved reputation for strict enforcement of jaywalking laws. A significant problem with such a focus is that the people who are most likely to receive citations, working-age adults, have the lowest risk of injury. It was believed that changing drivers' behaviors, if possible, would afford better protection to all walkers, especially those at higher risk.

In 1990 the Seattle Police Department policy toward pedestrian violations was changed to reflect a new emphasis on increasing the compliance of drivers with the legal rights of pedestrians, especially at intersections. The new policy encouraged traffic officers to issue at least two citations to driver violators for every ticket issued to a jaywalker. This policy led to a sharp reduction in jaywalking citations and a commensurate increase in citations to drivers. Approximately 300 to 500 citations related to pedestrian law enforcement are now written each month. The vast majority of these go to drivers. A jaywalking fine is $38, and a driver citation is $66.

Public Information Campaign

With the passage of the new law came a renewed opportunity to focus attention on pedestrian safety through the media. Several pertinent articles appeared in the major Seattle newspapers, and a request was made for citizens to submit nominations for dangerous intersections. Hundreds of letters came in from residents throughout the city. The Engineering Department installed new warning signs and posters, and signs were distributed on buses throughout the city. Customized pamphlets and posters were produced and distributed. These pamphlets and posters informed the public about the seriousness of pedestrian injuries, the specifics of the new law, and the presence of the enforcement campaign.

Law Enforcement Efforts, 1990 to 1994

Four separate traffic enforcement campaigns were conducted by the Seattle Police Department over the course of the 4 years. Although there were differences between each campaign, they all shared the following design features:

1. A specific area of the city was identified to receive emphasized enforcement by traffic officers. The enforcement consisted of increased officer presence in the designated area, with the purpose of citing drivers who violated the crosswalk law.
2. A time line for the campaign was identified. The shortest campaign lasted 3 weeks; the longest lasted longer than 1 year.
3. Sentinel intersections were identified within the area. These intersections were used to measure the compliance of drivers with stopping for crossing pedestrians. Data on historic traffic volumes and posted speed limits were also available for each location.
4. Baseline measures of driver compliance were conducted before the initiation of the law enforcement efforts.
5. Follow-up measures of driver compliance were obtained after the law enforcement effort stopped.

EVALUATION METHODOLOGY

Compliance as Proxy Measure

Although the expected outcome of a successful safety campaign is injury reduction, direct links of program efforts to changes in injury rates are often difficult. Fluctuations in pedestrian-motor vehicle collisions (Figure 1) may be the result of many factors. Changes in the distributions of vulnerable walking groups, weather that leads to more or less walking, a downturn in the economy resulting in fewer vehicles on the roads, school closures, or increased busing of students may all affect walking, traffic exposure, and pedestrian collisions. For a specific community the actual numbers of collisions may be small and collisions may occur relatively infrequently. As a result other measures that are assumed to be related to injury are often used as proxy measures for a reduction in injuries. There is ample precedent for such observational measures with respect to the use of, for example, seat belts, child car seats, and bicycle helmets (*12,13*). In this case the willingness of drivers to stop for pedestrians in crosswalks was used to evaluate the enforcement effort.

Measuring Driver Compliance

A procedure was adapted from previous research (*14*) to measure driver compliance at crosswalks before the enforcement efforts of the traffic officers. A mock pedestrian approached and entered a crosswalk, attempting to make eye contact with the oncoming drivers. An accomplice stood back from the intersection, out of sight of the drivers, and used a handheld counter to tabulate the number of drivers who stopped so that the pedestrian could cross. To allow for those drivers who were too close to the intersection to safely come to a stop when the pedestrian stepped into the crosswalk, a braking "window" was measured in both directions from the crosswalk [46.6 m (153 ft) for a posted speed limit of 48.3 km/hr 30 (mph)]. This braking distance was calculated assuming no grade, dry pavement, and good tire tread (*15*). Only vehicles outside of this window when the pedestrian entered the crosswalk were considered to have had an adequate opportunity to stop; those vehicles outside of the window were not counted. Because a traffic engineer had screened potential intersections and excluded those with poor sight distances, the vast majority of vehicles had much more than this minimum distance in which to stop. Once able to cross, the pedestrian proceeded to the other side of the street and then repeated the procedure, coming back across the intersection in the same fashion as before. As the pedestrian approached the midpoint of the roadway, the compliance of drivers during the second half of the crossing (far side) could also be measured One hundred such pedestrian

FIGURE 1 Seattle pedestrian—motor vehicle collisions.

motor vehicle conflicts were elicited at each sentinel intersection identified in the campaigns. To account for variability in compliance from other factors that might influence the drivers' willingness to stop, compliance was measured only during clear weather. The same pedestrian, time of day, and crossing technique were used each time. Because of known variations in traffic volumes around the weekend, compliance was measured only on Tuesdays, Wednesdays, and Thursdays.

Methodological Considerations

Pedestrian

A white, male, adult pedestrian was used for all studies. It is assumed that drivers who see pedestrians waiting to cross are likely to respond differently to women, joggers, older adults, children, the disabled, bicyclists, and so forth and the use of the same individual was intended to minimize variability from that effect.

Crossing Technique

A clear and consistent but nonaggressive crossing technique was used. The pedestrian was required to be in the crosswalk and not on the curb, required to attempt to make eye contact with oncoming drivers, and prohibited from taking additional steps into the first traffic lane until the vehicle slowed, indicating that the walker had been seen and would be allowed to pass. Observations of typical crossing techniques used by the public indicate a wide range of crossing behaviors, from waiting on the curb until cars came to a complete stop to very aggressive behaviors in which the pedestrian virtually walked into the paths of oncoming vehicles.

Compliance: Did They Stop?

Judgment as to whether a vehicle stopped entered into the compliance calculations because many vehicles slowed dramatically, sometimes to a crawl, but did not come to a complete stop. If the pedestrian proceeded and the observer judged that the driver would have stopped for the crossing pedestrian, this behavior was recorded as compliance.

Near-Side Versus Far-Side Compliance

In addition to other factors affecting compliance, it was assumed that drivers would behave differently with respect to pedestrians who were close or far away from them as their vehicles approached the crosswalk. Two obvious factors are the visibility and vulnerability of the pedestrian (a protected pedestrian at curbside versus one in the middle of the roadway). For these reasons near-side, far-side, and overall (near-side and far-side combined) compliance are distinguished. For the purposes of the present study near-side compliance represents the compliance of drivers approaching from the crossing pedestrian's left. For a four-lane (two-way) road there are two near-side lanes. For a two-lane road there is only one near-side lane per crossing. Far-side compliance represents the compliance of drivers approaching from the pedestrian's right as the center line of the roadway is crossed. Although compliance was measured in several ways during the campaigns, the near-side compliance at marked crosswalk locations was always reported. This represents the willingness of drivers to allow crossing pedestrians to get an initial "foothold" in the street at locations where the right-of-way of the pedestrian is the most unambiguous.

Choosing Sentinel Crosswalk Locations

The choice of which areas of the city to enforce driver compliance with crosswalk laws was made jointly by the Seattle Police Department and the Harborview Injury Prevention and Research Center. Harborview contacted community leaders throughout the city to determine their interest in having such a program in their community. The purpose of contacting members of the community was not to have citizens choose the target locations but to make certain that the residents would support an emphasized enforcement program should it occur in their community. The police department identified areas of the city where increased officer presence could be justified on the basis of other concerns, such as crime or speeding, in addition to pedestrian safety. It was easier to justify the use of scarce departmental resources if the targeted areas of the city had other needs for police resources as well. Once the areas of the city were identified, city traffic engineers assisted Harborview with identifying uncontrolled crosswalk locations whose configurations and locations would provide adequate visibility for both pedestrians and drivers and not contain any steep grades or curves that might adversely affect the reaction times or stopping distances of the drivers. Initially, a mix of two-lane and four-lane, marked and unmarked, as well as midblock intersections was identified. It was anticipated that higher-speed, multilane roadways in commuter corridors would elicit different levels of compliance than two-lane roads running through residential areas. It was also assumed that marking of the crosswalks, signs, beacons, visibility, and other factors would have an effect. Although actual pedestrian volumes were not measured, prospective sentinel locations were observed beforehand. Locations with a greater volume of pedestrian traffic were preferred.

RESULTS

Campaign 1: Citywide Focus, Summer 1990 to Fall 1991

Table 1 summarizes the first enforcement campaign to go into effect after the new crosswalk law passed the state legislature in 1990. The area identified for the program was the entire city. Twelve sentinel intersections, representing two-lane, four-lane, marked, unmarked, and midblock crosswalks in different parts of the city were identified by city traffic engineers. Although not every marked crosswalk was marked in the same way, all of the sentinel crosswalks were marked with either painted roadway stripes or an overhead beacon. In most cases both were present, as were advance warning signs to drivers. Law enforcement officers were unaware of the locations of the sentinel intersections. Approximately 3,600 citations were written to violating drivers throughout the city during this time. The overall level of compliance did not change (Table 1).

Campaign 2: Neighborhood Focus, September 1992 to January 1993

Table 2 summarizes the second enforcement campaign. As with the first campaign, 12 sentinel crosswalks were identified. No midblock

TABLE 1 Citywide Enforcement Campaign 1, Summer 1990 to Fall 1991

Location	Compliance Before [a]	Compliance After
Near-side (marked)	15%	19%
Near-side overall	15 %	13 %
Far-side overall	52 %	55%
Avg. overall	34%	34 %

[a] Percent is based on 100 opportunities for drivers to stop at each sentinel crosswalk.

crosswalks were included in this second effort. In the second campaign traffic officers were asked to focus their efforts in only five city neighborhoods. Although the boundaries of these neighborhoods are not legally defined, their locations are generally recognized, and street boundaries were set by the police department for the enforcement. It was hoped that this would result in a more concentrated enforcement effort than that during the previous citywide campaign. As in the first campaign traffic officers were unaware of the location of the sentinel intersections. The second campaign was significantly shorter than the first one lasting about 3 months. The largest increases in compliance were seen in the near-side lanes, with the greatest effect at marked intersections. Although there was noticeable improvement with respect to the baseline observation, the majority of vehicles were still not stopping for the pedestrian.

Campaign 3: Neighborhood Focus, July to October 1993

Table 3 summarizes the results of the third enforcement effort. This campaign also identified 12 intersections in five neighborhoods and lasted 3 months, but in contrast to previous efforts, it used only marked sentinel intersections to measure the effect. Only the compliances of drivers approaching the pedestrian's left side (near side) were measured. Getting a foothold in the crosswalk appeared to be the most difficult part of the crossing process, as evidenced from the previous campaign results. In contrast to previous efforts, citation information that allowed an assessment of the strength and distribution of the enforcement effort was available. The citation data indicated that 90 percent of the citations (436 of 487) had been written in only two of the five neighborhoods. Follow-up compliance observations were not performed at the other three locations because they were not considered to have received a significant intervention. The reasons for the skewed distribution of the enforcement effort are not clear but may have been the result of low pedestrian volumes in those neighborhoods.

The results are contradictory, with a dramatic decrease in compliance in Neighborhood 1 and an equally dramatic increase in compliance in Neighborhood 2. Neighborhood characteristics and enforcement patterns may have contributed to the results.

The first neighborhood was actually a portion of the downtown business corridor used heavily by commuters. Traffic volumes are high during afternoon peak volumes, pedestrian traffic at the sentinel crosswalk was sporadic, and none of the 286 citations issued during the campaign were issued at the sentinel intersection where compliance was measured. All citations were issued at surrounding intersections.

The second neighborhood largely comprised multifamily dwellings, such as apartment buildings or condominiums, mixed with small retail businesses. Pedestrian traffic was frequent, vehicular traffic volumes were less, and 78 percent of the citations (117 of 150) issued in the neighborhood were written at the sentinel intersection where compliance was measured. The focus on this crosswalk by traffic officers was unintended but not surprising, since pedestrian activity is known to be frequent here.

Campaign 4: Intersection-Specific Enforcement, May to June 1994

Table 4 summarizes the most recent campaign, which identified two specific intersections for enforcement. Both intersections were on four-lane arterials with the same posted speed limit of 47 km/hr (30 mph) and had similar afternoon peak traffic volumes. Both intersections were marked with painted crosswalks, advance warning

TABLE 2 Neighborhood Enforcement Campaign 2, September 1992 to January 1993

Location	Before	After
Near-side marked	23 %	36 %
Near-side unmarked	3 %	4 %
Near-side overall	11 %	18 %
Far-side overall	47 %	47 %
Compliance Overall	28 %	32 %

TABLE 3 Neighborhood Enforcement Campaign 3, July to October 1993

Neighborhood [a]	Before	# Citations [b]	After
1	19 %	286	7 %
2	9 %	150	30 %

[a] Two neighborhoods accounted for 90% of all citations.
[b] Citations written in the neighborhood, not necessarily at the sentinel crosswalk.

TABLE 4 Intersection Enforcement Campaign 4, April to June 1994

Intersection	Dates	Before	During [a]	After	# Citations
1	4/19-5/9	24%	19%	15%	74
2	5/23-6/10	30%	54%	45%	50

[a] Traffic officers were asked to stop enforcement for one day so mid-program compliance could be measured.

signs to drivers, and an overhead flashing beacon. Near-side lane compliance was used to measure the effect of the 3-week program. Traffic officers were assigned to the intersections each of the 5 weekdays during the hours when traffic volumes were highest (4 to 6 p.m.). Traffic officers were asked to temporarily stop enforcement at the intersection during one afternoon of the 15-day program so that midprogram compliance could be determined.

The results from Intersection 1 suggest that enforcement made no difference in compliance, whereas the results from Intersection 2 seem to suggest the opposite.

The difficulty of linking these inconsistent results with the enforcement effort is compounded by the following: at Intersection 1 drivers received more tickets (74 versus 50), there were more average tickets per day of enforcement (7.4 versus 6.25), and there were more days with traffic officers present (10 versus 8) than at Intersection 2, yet compliance at Intersection 2 increased, whereas compliance at Intersection 1 clearly decreased. During the enforcement of both intersections traffic officers were occasionally called away from their assignments for other competing departmental priorities, leading to these differences in the actual numbers of days that officers were present.

Even more surprising was that Intersection 2, which showed a decrease in driver compliance in this campaign, was the same sentinel intersection for Neighborhood 2 in Campaign 3, which demonstrated a dramatic increase in driver compliance after drivers received 117 citations.

A synthesis of all four enforcement campaigns is provided in Table 5. Near-side compliance measurements are displayed since this measure was obtained for every campaign. Exact citation information became available only for the two most recent campaigns, but this information is included when it is available. Although the programs differed with respect to their duration, location, and concentration of enforcement, all used the same method to measure driver compliance.

DISCUSSION OF RESULTS

First Campaign

The results of the first citywide campaign suggested that although enforcement and other public information efforts may have increased the awareness of drivers about pedestrian safety issues, there is no reason to believe that this campaign improved the safety of people trying to cross the street. Eighty-one of every 100 cars failed to stop for a pedestrian in the near-side lanes of the marked sentinel locations.

Second Campaign

The second campaign suggested that a more focused effort in discrete neighborhoods might be as useful as the initial citywide approach, even though it was conducted for only 3 months. Modest improvements in compliance were seen, especially in the near-side lanes of marked crosswalks. Although legal obligations on the part

TABLE 5 Summary of Crosswalk Enforcement Efforts, 1990 to 1994[a]

Campaign & Focus		Duration	# Citations	Before [b]	Mid-Prog	After
#1	City-wide	1 yr+	3600+ (est)	15%	—[c]	19%
#2	Neighborhood	3 Months	—	11%	—	18%
#3	Neighborhood (1)	3 Months	286	19%	—	7%
	Neighborhood (2)	3 Months	150	9%	—	30%
#4	Intersection (1)	3 Weeks	74	24%	—	15%
	Intersection (2)	3 Weeks	50	30%	—	45%

[a] Size of area enforced and sentinel intersections enforced varied with individual campaigns.
[b] Near-side compliance of marked crosswalks was measured in all campaigns. Compliance for Campaigns 1 & 2 represent averages of 12 sentinel crosswalks. Compliance for Campaigns 3 & 4 represent observations at single sentinel marked crosswalks.
[c] Signifies that the information was not collected for this campaign.

of the driver are the same for unmarked as well as marked crosswalks, unmarked intersections continue to elicit very poor compliance responses from drivers. After the enforcement campaign, drivers were still 9 times more likely to stop for a pedestrian in the near side of a marked intersection than the near side of an unmarked one (36 versus 4 percent).

Third Campaign

The third campaign raised issues about the characteristics of neighborhoods that are likely to benefit from enforcement as well as the practical limitations for conducting such a program from the point of view of traffic enforcement resources. The two sites analyzed varied markedly in their responses to enforcement. This campaign suggests that even intense enforcement conducted in downtown commuter corridors may not result in a safety benefit for the pedestrian. A location where more people live or where people walk frequently appears to predict better results. If drivers routinely encounter pedestrians, perhaps they will be more susceptible to law enforcement reminders.

The skewed distribution of enforcement suggests that extended programs covering several sites may find it difficult to achieve and maintain a high level of enforcement activity because of competing demands for law enforcement resources. Providing a consistent level of enforcement to intervention sites must be an ongoing and important aspect of future evaluations.

Fourth Campaign

The contradictory results of Campaign 4 indicate that success may vary markedly from intersection to intersection and suggest that, despite heavy ticketing, other environmental and perhaps behavioral factors are more salient to drivers than enforcement concerns. This is supported by the fact that the very same intersection where drivers received 117 citations over a 3 month period and that demonstrated a dramatic increase in driver compliance in one campaign (Campaign 3) showed a decrease in driver compliance with enforcement in Campaign 4. The results also suggest that the threshold level of ticketing necessary to achieve even transient changes in driver behavior is quite high.

Pattern of Enforcement

Although it was not a focus of the initial program the citation data available from the two most recent campaigns suggest that the intensity and distribution of the enforcement effort varied dramatically. In Campaign 3 the pattern of citations indicated two significant trends. First, 90 percent of the citations had been written in only two of the five neighborhoods originally identified for enforcement. The second trend that surfaced was that of the distribution of citations over time. As can be seen in Figure 2 the initial enforcement effort in campaign 3 was more intense, tapered off over time, and then increased again near the end of the campaign. Because

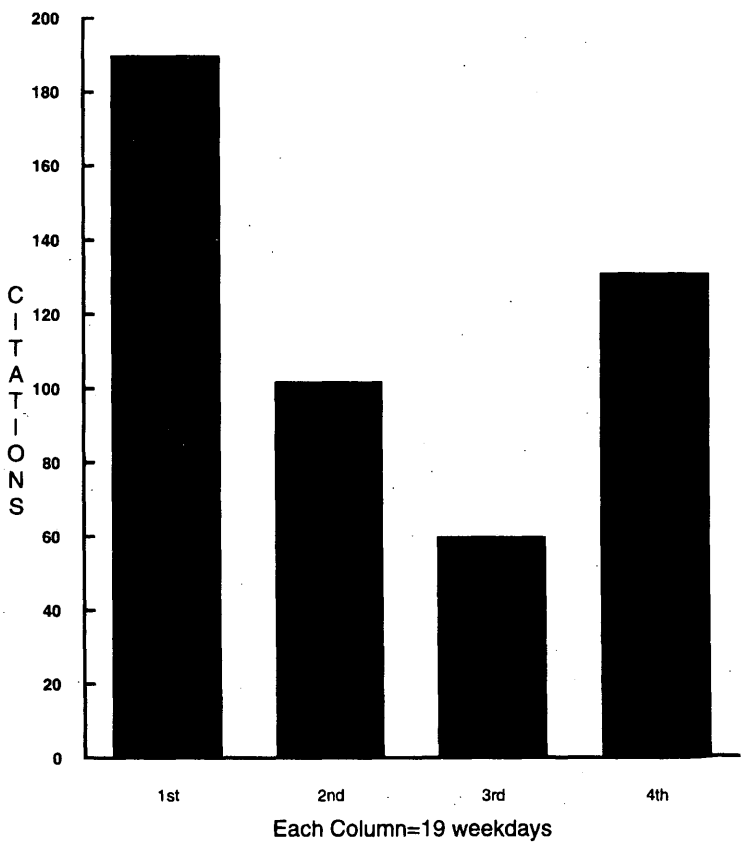

FIGURE 2 Enforcement pattern campaign 3.

Campaign 3 began and ended in the middle of a month, the timeline of Campaign 3 was divided into four equal 19-day periods for ease of comparison. The number of citations issued during each period is displayed.

In the fourth campaign, in which the focus was on daily enforcement at specific intersections, officers were also occasionally unable to be at their assigned locations. For Intersection 2 enforcement occurred on 8 of 14 program days (57 percent), and at Intersection 1 enforcement occurred on 10 of 14 days (71 percent).

Actual citations for the earlier campaigns were not available, but it is likely that such variation in enforcement with respect to location and time occurred in those programs as well. Although they are an expected part of the daily activity of law enforcement agencies, these fluctuations in the intensity and distribution of enforcement must be considered when implementing and evaluating future programs.

LIMITATIONS

Although efforts were made to control as many variables as possible that might affect driver compliance, the following factors may have added to the variability in the results.

- The braking window used to define an adequate braking distance for vehicles and for defining the pedestrian-motor vehicle conflicts assumed average driver reaction time, adequate brake and tire equipment, the posted speed limit, and dry, flat pavement.
- No actual counts of pedestrian volumes were made at the intersections. The regular presence of crossing pedestrians may lead to increased compliance.
- The compliance rates of grouped and single vehicles were not distinguished.
- The intensity of enforcement as well as its distribution varied.
- Streets with posted speed limits of 30 or 35 mph were used for the campaigns. The actual approach speeds of the vehicles were not measured.

CONCLUSION

The authors have been unable to demonstrate that law enforcement efforts directed at motorist violators of crosswalk laws significantly or consistently increase drivers' willingness to stop for pedestrians. It appears that even with a high degree of commitment on the part of law enforcement, the expectations from such programs should remain modest. If intense enforcement efforts aimed at drivers do not elicit a positive effect at marked crosswalks, it is difficult to imagine that they will be effective in locations where the pedestrian right-of-way is more ambiguous. Although there are few standards by which to judge the relative enforcement intensities of these campaigns, the authors are unaware of any law enforcement agency that has conducted and evaluated a more focused effort.

It appears that other uncontrolled factors were responsible for the wide fluctuations in compliance. Day-to-day speed and volume fluctuations and their behavioral effects on drivers may have a greater effect on compliance than even the most aggressive enforcement campaign. Further evaluations should be encouraged. Such evaluations may be able to account for some of this variability and determine whether and to what extent there is a positive effect.

These results, although discouraging, are by no means conclusive and should not be construed as relieving law enforcement agencies from playing an active role in pedestrian safety programs. Rather, they should focus attention on finding the most effective way to make use of such resources as part of a communitywide approach. Communities have legitimate concerns about increasing the safety of the walking public, and all stakeholders must consider carefully what can and cannot be done to provide an increased margin of safety for pedestrians.

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DISCUSSION

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Although the study focused on law enforcement and its effectiveness in attaining driver compliance with crosswalk laws, it would be legitimate to ask whether the law is designed to give adequate protection to the pedestrian?

When crossing a road at an unsignalized location, either in midblock or at a marked or unmarked crosswalk, pedestrians face one of three situations. They can wait until conflicting vehicles have passed and a safe, adequate gap is available. When vehicles are at a safe distance or when none is approaching, the issue of right-of-way between driver and pedestrian does not arise.

The crossing less safe is when pedestrians try to pass through a gap that is not entirely adequate. They can walk faster to avoid the conflict, and the driver can slow down without coming to a complete stop.

The most dangerous time to cross is the moment when a vehicle is near and pedestrians exercise their right-of-way and force drivers to stop at the crosswalk. Drivers may be inattentive, they may fail to stop for fear of getting rear-ended, or they may hit a pedestrian who was hidden from view by a vehicle that slowed down or stopped in an adjoining lane (multiple threat).

The study was directed at unsignalized intersection crosswalks where vehicles on side streets are controlled by stop signs. Major roads, like the downtown commuter corridors in the study, have the purpose of carrying relatively large volumes of vehicles at a steady speed, often through a series of coordinated traffic signals. Unsignalized intersections located between signalized ones on a commuter corridor are controlled by stop signs to prevent side-street drivers from interfering with the steady progress of vehicles on the major road. To the pedestrian, however, the law gives the opposite instructions. Subject only to the requirement that they do not suddenly walk or run into the path of a vehicle so close that it constitutes an immediate hazard, pedestrians are not only allowed but encouraged to do what is forbidden to the motorist: interfere with fast-moving vehicles on a major road.

The crosswalk law and the major road concept are incompatible in terms of safety and efficient vehicle movement. To give a pedestrian instructions different from those given to the side-street driver is difficult to justify on operational or safety grounds. A more economical way to get pedestrians safely across a busy street would be to construct a refuge that allows them to cross in two stages.

AUTHORS' CLOSURE

The purpose of the study was not to investigate the "compatibility" of the crosswalk law with other laws designed to regulate motor vehicle traffic, but to determine whether increased enforcement of the crosswalk law would have an effect. If drivers consistently slow or stop their vehicles in response to the presence of pedestrians, it is likely that both the frequency and severity of pedestrian and motor vehicle collisions would decline. The study attempted to determine how effective enforcement might be at eliciting this response under a variety of conditions.

A larger question is whether the cause of pedestrian safety is best served by expending resources in enforcement or in another manner altogether. Our biases, both before and since the study, are that altering the design features of the roadway through traffic calming and other strategies, such as the refuge suggested by discussant, are likely to be a more effective, albeit more expensive way to address the problem. Still, the enforcement community is often called on to reduce pedestrian injuries. Research that will shed light on which enforcement strategies are effective and provide guidance as to the best use of limited traffic enforcement resources should continue to be performed.