Comments on LADOT Report
ENHANCED SPEED ENFORCEMENT AND TOOLS TO REDUCE SPEEDING (COUNCIL FILE NO. 15-1006)

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At the Transportation Committee meeting on October 14, 2015, LADOT will present their report ENHANCED SPEED ENFORCEMENT AND TOOLS TO REDUCE SPEEDING (COUNCIL FILE NO. 15-1006) dated October 7, 2015, relative to City Council Motion 15-1006 (Englander-Bonin) requesting the Los Angeles Department of Transportation (LADOT), in consultation with the Los Angeles Police Department (LAPD), to provide a report on the current state of speed enforcement in the City of Los Angeles, and to make recommendations to more effectively enforce safe travel speeds. Additionally, the departments were asked to report on pilot projects that could be implemented quickly to reduce speeding.

The following comments are in response to the LADOT report. Our goal in providing these comments is to provide a broader context for the discussion of improving pedestrian safety. Policies adopted by elected officials can only be successful when they target the correct problems using proper countermeasures. In general, our review of collision data indicates that focusing primarily on speed reduction as a means of protecting pedestrians from harm is unlikely to yield the safety improvements we all wish to see. However, there are numerous policies which can be employed to achieve this goal and which can produce very tangible results. Some suggestions along with a detailed report on improving pedestrian safety appears at the end of these comments.

Within the following comments, text from the LADOT report appears in bold italics. Our response follows.

BACKGROUND
Vision Zero and the High Injury Network

Work on the Vision Zero initiative has led to the identification of the High Injury Network (HIN). The HIN (Attachment A) is the network of streets with the highest incidence of severe and fatal collisions, accounting for 65% of all fatalities and severe injuries involving people walking. The HIN covers 6% of the City's street miles. Therefore, the HIN includes areas where speeds should be more closely scrutinized.

This might be an effective strategy if speed was a significant factor contributing to fatalities and severe injuries involving pedestrians. However, according to the Statewide Integrated Traffic Records System (SWITRS) database (the same database used by LADOT to identify the High Injury Network), violations of the basic speed law account for a small fraction of the fatalities and severe injuries involving pedestrians.

Safer Streets L.A. conducted an analysis of collisions in Los Angeles for calendar year 2013, the most recent complete year of records in the SWITRS database. We looked at the Primary Collision Factors resulting in both fatal and severe injuries involving pedestrians. Tables 1 and 2 below show the results.

Table 1 - Primary Collision Factors Resulting in Fatalities to Pedestrians 2013					
			Impairment	Hit & Run	
21954A	27	30.68%	**17**	8	Pedestrian not in crosswalk failed to yield to vehicle
21950A	15	17.05%	2	7	Failure to yield to pedestrian at crosswalk
21456B	9	10.23%	**3**	2	Pedestrian Crossing against red signal
21955	7	7.95%	**5**	2	J walking
21956	7	7.95%	**4**	3	Pedestrian walking on wrong side of roadway
23152	5	5.68%	5	2	Alcohol Impairment
Unknown	5	5.68%	1	1	
21950B	3	3.41%	**1**		Pedestrian Failed to yield to vehicle when crossing
22350	3	3.41%	1		Basic speed law
21658A	2	2.27%	1	2	unsafe lane change
21453A	1	1.14%			Red light
21453D	1	1.14%			Pedestrian Crossing against red signal
21750	1	1.14%			Failure to pass on left
21954B	1	1.14%		1	Driver failed to exercise due care
22106	1	1.14%			Starting or backing vehicle
Total	88		40	28	
Pedestrian at fault	55	62.50%	56.36%		

As can be seen from the above table, violations of the basic speed law make up less than 3½% of pedestrian fatalities. The vast majority of pedestrian fatalities are caused by pedestrians failing to yield to vehicles that have the right of way, pedestrians J-walking and vehicles failing to yield to pedestrians in either a marked or unmarked crosswalk. It should be noted that over 62% of fatal pedestrian collisions are caused by the actions of the pedestrian and over 56% of those occur while the pedestrian is impaired by drugs or alcohol (mostly alcohol).

It should also be noted that the category which encompasses speed as a factor, violation of California Vehicle Code 22350, the basic speed law, is not necessarily a violation of exceeding the speed limit. This category includes both violations of the speed limit and violations where the driver at fault was deemed to be going too fast for conditions but possibly traveling well under the posted speed limit. Often times, when no other factor can be determined as the cause of a collision, investigators will use this catch-all category as the default collision factor. Therefore, a more detailed analysis of the actual collision report narratives would be necessary to determine the proper countermeasures to employ to reduce these types of collisions as general enforcement of speed limits may not sufficiently target the behavior causing the collisions.

Table 2 below shows similar results for Primary Collision Factors resulting in severe injury to pedestrians. Again violations of the basic speed law (not necessarily exceeding the posted speed limit) make up a relatively small fraction of severe injury collisions involving pedestrians. As with fatalities, pedestrians failing to yield to vehicles that have the right of way, pedestrians J-walking, and vehicles failing to yield to pedestrians in either a marked or unmarked crosswalk make up the vast majority of the Primary Collision Factors. Here too, pedestrians are the cause of almost half of the collisions where they are seriously injured.

Table 2 - Primary Collision Factors Resulting in Severe Injury to Pedestrians 2013			
21950A	83	25.70%	Failure to yield to pedestrian at crosswalk
21954A	75	23.22%	Pedestrian not in crosswalk failed to yield to vehicle
21955	29	8.98%	J walking
Unknown	27	8.36%	
22350	17	5.26%	Basic speed law
21801A	14	4.33%	Turn or U-turn
21956	13	4.02%	Pedestrian walking on wrong side of roadway
21456B	11	3.41%	Pedestrian Crossing against red signal
23152	9	2.79%	Alcohol Impairment
21453A	8	2.48%	Red light
22106	6	1.86%	Starting or backing vehicle
21453D	4	1.24%	Pedestrian Crossing against red signal
21950B	4	1.24%	Pedestrian Failed to yield to vehicle when crossing
21953	4	1.24%	Ped failed to yield
21950C	3	0.93%	Driver failed to exercise due care
21106B	2	0.62%	Unlawful pedestrian crossing
21650	2	0.62%	Vehicle on wrong side of roadway
21954B	2	0.62%	Driver failed to exercise due care
22107	2	0.62%	Unsafe lane change
21456A	1	0.31%	Pedestrian Failed to yield to vehicle lawfully in intersection
21654A	1	0.31%	Failure to stay to right
21658A	1	0.31%	unsafe lane change
21802A	1	0.31%	Stop sign
21951	1	0.31%	Overtaking other vehicle stopped for pedestrian
21952	1	0.31%	Vehicle crossing sidewalk
22450	1	0.31%	Stop sign
22515A	1	0.31%	Unattended vehicle left on roadway
Total Severe Injury	323		
Ped at fault	144	44.58%	

Tools to Reduce Speed

Speed and speeding are complex issues. Regardless of how the speed limit is determined, there are tools that can be used to reduce the critical speeds. These tools can reduce the prevailing speeds over a period of time and can have permanent lasting effects, while others only provide short-term speed reduction. These can include:

- ***Speed trailers and speed feedback signs***
- ***Increased police presence***
- ***Road diets (removal of traffic lanes)***
- ***Lane narrowing***
- ***Physical improvements (bump outs, roundabouts, median islands, roadway narrowing)***
- ***Speed humps and speed tables (on residential streets)***
- ***Signal timing techniques***

- ***School slow zones***
- ***Automated red light cameras***
- ***New vehicle technologies***
- ***Automated speed enforcement (ASE)***

While some of the above countermeasures are effective in reducing travel speeds where necessary, others can have unintended consequences and could serve to decrease safety overall. For example, when traffic lanes are removed and traffic backs up, drivers seek alternative routes, often through otherwise quiet residential streets. These streets are often not built to handle the additional traffic and increasing motor traffic can put residents, especially children, at greater risk.

With regard to signal timing techniques, we assume that DOT is referring to the practice of timing signals so drivers are caught at more red lights. This practice is also counterproductive as it increases driver frustration, causes drivers to speed up between signals, and exposes cross traffic to potential red light running as motorists experience more red signals. Proper engineering protocols to reduce the incidence of red light running dictates that drivers be presented with fewer red lights, not more.

Regarding Automated Speed Enforcement, LADOT correctly notes that this type of enforcement is disallowed in California, and with good reason. These types of excessive ticketing programs have not been shown to improve safety and are most often deployed where the posted speed limit is less than the design speed of the roadway. As the LADOT report makes clear, artificially lowered speed limits have little effect on actual speeds. Therefore, ticketing programs, whether automated or using live officers, which ensnare large numbers of violators indicate that the posted speed limit which is being enforced is out of line with the design of the roadway. In effect, the government is providing a roadway design which encourages a higher speed, and then ticketing drivers who travel at that speed. This has serious negative consequences on the public including economic hardship resulting in higher poverty rates and the erosion of public support for elected officials and the police.

One of the most effective countermeasures to reducing speed is to change the nature of the roadway so that motorists naturally drive at lower speeds. Unfortunately, in some cases this is impractical due to cost constraints and the unintended consequences of traffic moving to other roadways less able to handle the increase in traffic and speeds. On such roadways, which are generally arterial roads, alternative countermeasures can be employed to improve safety for other roadway users including enhanced crossings, speed feedback signs, and design features which give visual cues that pedestrians may be present and greater caution by motorists is warranted.

For these reasons, our organization, along with a broad coalition of partners across the political spectrum has worked, and will continue to work, to ensure that automated speed enforcement remains illegal in the State of California. The City of Los Angeles has already experienced the significant public backlash from the failed red light camera program and would be ill-advised to head down a similar path by advocating for speed cameras.

A brief discussion of the red light camera program is in order here since the LADOT report inexplicably mentions red light ticketing cameras as a means of speed control. First, red light cameras actually have the opposite effect as some drivers speed up as they approach the intersection to ensure they are not entrapped. Further, these cameras have been shown to decrease safety as other drivers slam on their brakes, causing rear end collisions. Through our work at the state level, we have changed the protocols for yellow signal timing which have been incorporated into the most recent edition of the California MUTCD. We have shown how a sufficient yellow interval substantially improves safety by

significantly reducing red light running. The chart below shows the kinds of safety improvements that can be attained with proper signal timing.

Reduction in Red Light Running After Increase in Yellow Interval	
Fremont, CA	77% reduction after 0.7 sec increase
Loma Linda, CA	93% reduction after 1.0 sec increase
Santa Clarita, CA (Left Turn Lanes)	58% reduction after 0.5 sec increase 70% reduction after 1.0 sec increase
Oakland, CA	87% reduction after 1.0 sec increase
Redlands, CA	88% reduction after 0.9 sec increase
West Hollywood, CA	47% - 70% reduction after 0.3 sec increase
Fairfax Co., VA	71% reduction after 0.5 sec increase

Finally, we reviewed the statistics for red light running collisions in the City of Los Angeles since the red light cameras were removed. Comparing the final full year of the program, 2010, to calendar year 2013 shows a greater than 10% reduction in red light running collisions since the cameras were eliminated. This further shows the folly of employing massive ticketing campaigns rather than using proven engineering countermeasures to improve roadway safety.

Conclusion

There are numerous ways to improve safety on our roadways through proper engineering, education and enforcement countermeasures. In choosing the proper approach, it is important to remember that preventing collisions or improper behavior from happening in the first place through engineering and educational countermeasures can often be more effective than enforcement which occurs "after the fact". Certainly, enforcement has its place, but it is not a substitute for proper engineering and educational programs.

In 2011, we authored a report on pedestrian safety for the Sherman Oaks Neighborhood Council which was widely praised by Councilmember Paul Krekorian (who represented the area at that time) and representatives of LAPD Valley Traffic Division. We have attached this report to assist in the discussion of how, together, we can improve pedestrian safety in Los Angeles. The following are a few of our recommendations offered at that time.

1. With the assistance of LAPD and LADOT, compile an inventory of at-risk crosswalks ranked by priority for engineering or educational countermeasure implementation.

2. Engage with local and state representatives to explore possible changes to the California Vehicle Code that would clarify the exact and realistic expectations of motorists and pedestrians to avoid unnecessary confusion.

3. Engage with local and state representatives to explore ways to enhance the driver education manual with well-written, well-illustrated information on possible pedestrian conflicts concentrating equally on driver and pedestrian responsibility for avoiding crashes.

4. Reach out to private driving schools in a partnership to enhance the pedestrian safety component of their curriculum.

5. Partner with local schools to create a Safe Routes to School program and in-school assembly programs to educate students about pedestrian right-of-way laws, potential traffic hazards, and safety measures they must consider both as pedestrians and newly licensed drivers. Discuss the possibility of employing in-roadway "Yield to Pedestrians" signs to assist crossing guards in ensuring drivers recognize the presence of children in the crosswalk.

6. Engage with the proper authorities to ensure that the beginning and end of school zones are clearly marked with appropriate signage, perhaps incorporating the use of flashing warning signals and speed feedback signs at schools adjacent to high volume roadways.

7. Create educational programs for citizens of all ages (including seniors) that encourage pedestrians to make eye contact with motorists to ensure they are being seen. Educate pedestrians of the added risk of the multiple-threat scenario that exists on multiple lane crossings, emphasizing that although pedestrians may have the right-of-way, they may be shielded from the view of drivers of vehicles in adjacent lanes of travel.

8. Encourage the LADOT to amend their policy regarding the removal of marked crosswalks and instead consider enhancing these locations with other traffic engineering measures to increase the conspicuity of the crosswalks and any pedestrians within them.
These include:

a. The installation of advance stop lines and "Yield Here for Pedestrian" signs located in advance of the crosswalk.
b. The installation of "State Law - Yield to Pedestrian" type signs.
c. The installation of Rectangular Rapid-Flash Beacons at marked crosswalks where vehicle-pedestrian collisions are most common or severe.
d. On smaller, lower-speed roads, the installation of in-roadway "Yield to Pedestrians" signs.

9. Engage with local law enforcement to encourage a greater emphasis on education during pedestrian sting operations and clarify the agency's policy on what exactly constitutes a violation of pedestrian right-of-way laws.

10. Engage with media representatives who cover pedestrian sting operations to ensure that their reports include specific educational information about exactly what constitutes a violation and what errors in judgment drivers made.

In reviewing the attached report, we ask that you pay particular attention to the section regarding the use of Rectangular Rapid Flashing Beacons as a countermeasure to improve the safety for those wishing to cross the street between signalized intersections (where most fatalities and injuries to pedestrians occur). In numerous studies these devices have been proven extremely effective, often gaining yielding compliance in the 90% range.

We thank you for your time in reviewing our comments and look forward to working with all parties to bring about safer streets in Los Angeles.

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POTENTIAL COUNTERMEASURES FOR IMPROVED PEDESTRIAN SAFETY

A Report for the Sherman Oaks Neighborhood Council
Public Safety Committee

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A Report for the Sherman Oaks Neighborhood Council Public Safety Committee

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The Sherman Oaks Neighborhood Council has expressed concern regarding the number of pedestrian injuries and fatalities involving motor vehicles in the City of Los Angeles and specifically in the Eastern San Fernando Valley. Although the L.A. Daily News reported in June 2010 that, valley wide, the number of pedestrians injured in traffic accidents decreased by 2% over the previous year, in North Hollywood, pedestrian-related traffic collisions increased by 40% over the same period. This overview is intended to identify some possible causes and solutions to this problem.

Causes of Vehicle-Pedestrian Accidents

Numerous causes of vehicle-pedestrian collisions have been identified in the literature. However, when a vehicle-pedestrian collision occurs, it is often assumed by the public that the motor vehicle operator was at fault. Generally this is due to the fact that in these situations, the pedestrian is the party much more likely to be injured. However, vehicle-pedestrian collisions may be caused by motorists or pedestrians as well as faulty engineering practices. Therefore motorists, pedestrians, and government officials have a shared responsibility for pedestrian safety.

Inadequate Understanding of Right-of-Way Laws

One factor in vehicle-pedestrian collisions may be whether the driver, the pedestrian, or both understand the motor vehicle code, which demarcates the right-of-way in pedestrian-vehicle interactions. Inappropriate or unlawful behavior may occur because the law is not understood or is misunderstood. Numerous studies (1) have shown that drivers and pedestrians have a limited knowledge of pedestrian right-of-way laws. Complicating this issue is that motor vehicle laws may be inconsistent across state jurisdictions or use unnecessarily vague or ambiguous language, leading to further confusion on the part of motorists and pedestrians.

A 2007 study of driver and pedestrian knowledge conducted in the San Francisco Bay Area confirmed that a substantial level of confusion about pedestrian right-of-way laws exists. This confusion was exacerbated by intersections that had unstriped, or unmarked, crosswalks. (1) The results of this study demonstrated that road users tend to understand the pedestrian right-of-way laws when the message is clear and simple such as when pedestrians are in a marked crosswalk at an intersection. Sixty four percent of drivers and 90% of pedestrians correctly understood that pedestrians have the right-of-way in this situation. However, for other scenarios of increasing complexity, both pedestrians and drivers exhibited a lower level of understanding of the vehicle code. For example, only 41% of drivers and 43% of pedestrians correctly understood that, in California, pedestrians have the right-of-way at intersections without a marked crosswalk. Also noteworthy is that more than 35% of the driver respondents did not believe that pedestrians have the right-of-way even at marked crosswalks. This widespread lack of accurate knowledge regarding right-of-way laws is potentially a significant contributing factor in pedestrian-vehicle collisions. Therefore, in addition to engineering and enforcement countermeasures for enhancing safety in marked crosswalks, behavioral countermeasures may be needed including educational campaigns designed to increase

driver and pedestrian understanding and compliance with right-of-way laws as well as increased education of the dangers citizens may encounter as pedestrians on city streets.

Vague or Confusing Right-of-Way Laws

A further useful approach may be to petition government officials to adjust the wording in the Vehicle Code to clarify the exact and realistic expectations of motorists and pedestrians to avoid unnecessary confusion.

The California Vehicle Code regarding pedestrian and driver responsibility states:

(a) The driver of a vehicle shall yield the right-of-way to a pedestrian crossing the roadway within any marked crosswalk or within any unmarked crosswalk at an intersection, except as otherwise provided. . . .

(b) This . . . does not relieve a pedestrian from the duty of using due care for his or her safety. No pedestrian may suddenly leave a curb or other place of safety and walk or run into the path of a vehicle that is so close as to constitute an immediate hazard. No pedestrian may unnecessarily stop or delay traffic while in a marked or unmarked crosswalk.

(c) The driver of a vehicle approaching a pedestrian within any marked or unmarked crosswalk shall exercise all due care and shall reduce the speed of the vehicle or take any other action relating to the operation of the vehicle as necessary to safeguard the safety of the pedestrian.

(d) Subdivision (b) does not relieve a driver of a vehicle from the duty of exercising due care for the safety of any pedestrian within any marked crosswalk or within any unmarked crosswalk at an intersection.

In contrast, the Uniform Vehicle Code published by the National Committee on Uniform Traffic Laws and Ordinances whose members include the National Highway Traffic Safety Administration and the Federal Highway Administration states in part:

UVC § 11- 502(a) Pedestrians' right of way in crosswalks [Yield to pedestrian in crosswalk]
When traffic-control signals are not in place or not in operation, the driver of a vehicle shall yield the right of way, slowing down or stopping if need be to yield to a pedestrian crossing the roadway within a crosswalk when the pedestrian is upon the half of the roadway upon which the vehicle is traveling, or when the pedestrian is approaching so closely from the opposite half of the roadway as to be in danger.

UVC § 11- 503(a) Crossing at other than crosswalks
Every pedestrian crossing a roadway at any point other than within a marked crosswalk or within an unmarked crosswalk at an intersection *shall yield the right of way to all vehicles* upon the roadway. (emphasis added)

As can be seen, California's right-of-way laws are less specific than the UVC and give the right-of-way at unmarked crosswalks to pedestrians as opposed to vehicles. In addition, the UVC's specific requirement that drivers must yield to pedestrians in crosswalks "when the pedestrian is upon the half of the roadway upon which the vehicle is traveling…" makes clear what a driver's responsibility is in this area. California's lack of specific language can lead to confusion on the part of both motorists and pedestrians.

Often, police officers are inconsistent in their enforcement of right-of-way laws as well. As explained by the Senior Lead Officer for the Sherman Oaks area after a recent crosswalk sting operation, each officer "uses their own judgment" when choosing how to enforce the law. Some officers only cited motorists who failed to yield to approaching pedestrians in their half of the roadway, while other officers cited all drivers who failed to yield to pedestrians anywhere within the crosswalk. This "mixed message" again leads to confusion regarding the law. Although knowledge of and consistent application of the

law does not necessarily translate into full compliance, a clearer message as to exactly what is expected of both drivers and pedestrians is likely to result in improved yielding behavior.

Educational Countermeasures

One avenue to increasing driver and pedestrian understanding of right-of-way laws is to enhance driver education manuals with "well-written, well-illustrated information on pedestrian conflicts associated with different traffic regulations" (2). Sarkar and colleagues reviewed the drivers' manuals from 32 states on the basis of the premise that "along with enforcement and engineering, quality education can be very important in improving driver behavior and providing a better understanding of the vulnerability of pedestrians". They concluded that although state driver's licensing manuals can play a key role in education, the manuals needed significant improvements in the area of pedestrian safety (1). Given the gradual phasing out of driver education in schools, it may also be advantageous to reach out to private driving schools in a partnership to enhance the pedestrian safety component of their curriculum.

As there is no analogous licensing manual or training for non-driver pedestrians, parents, teachers, concerned citizens and the media must work together to convey pedestrian right-of-way laws and safety measures to nondrivers, especially school-aged children. "Some efforts, such as Safe Routes to School programs (http://www.saferoutesinfo.org), have demonstrated considerable success with pedestrian safety education of children. Holtz et al. evaluated the effectiveness of the WalkSafe program for elementary school children in Miami, Florida. The study concluded, "The WalkSafe program implemented in a single high-risk district was shown to improve the pedestrian safety knowledge of elementary school children. The observational data demonstrated improved crossing behaviors from pre-test to post-testing conditions" (1).

In Phoenix, AZ, "The School Safety Program" was developed by a school safety task force which was created at the request of the city council. A 2005 report by the Institute of Transportation Engineers indicates that the program "is building a stronger relationship between schools and community and has been extremely beneficial for approximately 400 Phoenix schools and thousands of schoolchildren" (3). The recommendations implemented through the program included both educational and engineering countermeasures including:

1. Develop "Safest Route to School" walking plans for parents and students, and conduct school crossing safety audits to evaluate major crossings;
2. Conduct more in-school safety training for students;
3. Use two adult crossing guards at wide street crossings;
4. Provide school crossing guards brighter fluorescent yellow-green (FYG) vests with more reflective material, as well as bright orange hats;
5. Create wider paved student queuing areas at major school crossings;
6. Paint stand-back lines on the sidewalk to show children where to stand while waiting to cross;
7. Build buffers and/or wider sidewalks along new schools and build more sidewalks;
8. Paint SCHOOL pavement stencils on each high speed approach to a school crossing;
9. Experiment with active driver feedback speed signs that flash to speeders; and
10. Experiment with in-pavement flashing crosswalks;

Likewise, a Pedestrian and Traffic Safety Project in San Francisco produced educational materials for parents of preschool children about pedestrian injuries, potential traffic hazards and safe behaviors to avoid pedestrian injuries to young children as well as producing a video to document the dangers children and other pedestrians face when crossing the streets. The sample handout reproduced here encourages pedestrians to make eye contact with motorists and was found to be effective in promoting pedestrian safety (3).

Pedestrian crosswalk stings are also often looked upon as an opportunity to further educate drivers as to their responsibility to yield to pedestrians in crosswalks. While these types of enforcement efforts can serve as valuable educational campaigns, to be effective they must be designed, executed and reported on properly. By incorporating warnings, informational pamphlets, media coverage, and community involvement activities, the educational message can be maximized, not only to the drivers involved but to the citywide population as a whole (1). Critical in this regard is how the media covers the story. Often, media reports focus on the number of motorists cited and neglect the larger message as to the exact nature of the violations and how compliance relates to improved safety. As future sting operations are enacted, it may be necessary to engage with media representatives to ensure that specific educational information is included in their reports about exactly what constitutes a violation and what errors in judgment the drivers made.

Engineering Factors in Vehicle-Pedestrian Accidents

The appropriate use of engineering countermeasures can actively communicate the right-of-way to drivers and pedestrians, whether or not they know their legal responsibilities. These include highly visible warning signs and signals as well as pedestrian refuge islands located in the roadway median to protect pedestrians as they transition between opposing lanes of traffic. An examination of some potential engineering countermeasures follows.

Marked vs. Unmarked Crosswalks

A landmark study conducted by Zegeer et al. in 2001 for FHWA analyzed 5 years of pedestrian collisions at 1,000 marked crosswalks and 1,000 matched unmarked comparison sites in 30 U.S. cities. The study concluded that no meaningful differences in crash risk exist between marked and unmarked crosswalks on two-lane roads or low-volume multilane roads. However, the researchers found that on multilane roads with traffic volumes greater than about 12,000 vehicles per day, marked crosswalks without

other substantial roadway treatments were associated with a somewhat higher pedestrian crash rate than unmarked crosswalks. While it is possible that crashes increase at these locations because crashes migrate along with pedestrians to these sites, the study concluded that, particularly on high-speed, high-volume, and multilane roads, *painted white lines are not enough to improve pedestrian safety* (4). (emphasis added)

Primarily in response to such safety studies, the LADOT has elected to remove marked crosswalks at uncontrolled intersections and has shown resistance to installing them where they do not currently exist. This policy may be shortsighted.

One of the central debates regarding pedestrian behavior in crosswalks is whether pedestrians are less cautious in marked crosswalks than in unmarked crosswalks or in non-crosswalk locations. Herms's 1972 analysis hypothesized that this lack of caution may lead to the higher rate of crashes observed in marked crosswalks compared with unmarked crosswalks (4).

In a 2008 study, Mitman et al. noted that pedestrians did exhibit a greater level of caution (looking both ways, waiting for gaps in traffic, and hurrying across the street) when crossing in unmarked crosswalks than in marked crosswalks. Results from this study also suggest that drivers do yield more frequently to pedestrians in marked crosswalks compared with unmarked crosswalks. Additionally, as previous studies suggested, the researchers found that drivers were more likely to be confused regarding right-of-way laws at unmarked crosswalks and theorized that a lower driver yielding rate at unmarked crosswalks may be at least partially the result of a lack of knowledge of the pedestrian's right-of-way at these locations (4).

The researchers therefore hypothesize that "pedestrians exhibit extraordinary caution in unmarked crosswalks because (a) they do not know that motorists must legally yield the right-of-way when they are crossing in unmarked and marked crosswalks, and (b) experience has taught them that drivers are not likely to yield, or a combination of both reasons. It is then also plausible that pedestrians exhibit ordinary (as opposed to extraordinary) caution when crossing in marked crosswalks for similar reasons: they are more likely to know that drivers must yield the right-of-way to them or experience has taught them that drivers are more likely to yield, or a combination of both" (4). This is one explanation for the higher rates of pedestrian accidents at marked crosswalks vs. unmarked crosswalks.

Perhaps more importantly, the study uncovered the paradox that the higher rate of yielding in marked crosswalks can result in an increased incidence of what is known as multiple-threat crashes. This is an all too common occurrence in which a driver in one lane yields to a pedestrian in a marked crosswalk whereas a driver in the adjacent lane of the same direction of travel does not yield and strikes the pedestrian emerging from in front of the first yielding vehicle. The recent fatality at Laurel Canyon and Archwood St. in North Hollywood is a tragic example of this type of accident. While it may initially appear that all that is necessary to reduce multiple-threat crashes is to simply get more drivers to yield at intersections, the situation is more complicated.

In research studying multiple-threat crashes, Van Houten et al. explained, "A major factor contributing to this kind of crash is vehicles yielding too close to the crosswalk and thus screening the view of motorists approaching in the pedestrian's next lane of travel. Although buses and trucks have always been able to completely screen the pedestrian, the popularity of sport utility vehicles and minivans has increased the percentage of vehicles on the road that can screen the view of pedestrians crossing the street, and children and persons of short stature can be completely screened by relatively small passenger vehicles" (5).

Due to this screening effect and other factors that may reduce a motorist's awareness of the presence of a pedestrian attempting to cross the street, many traffic engineers have recommended that marked crosswalks not be installed alone on multilane roads with a high average daily traffic volume such as those that exist in many areas of Los Angeles. However, rather than removing or failing to install crosswalks at these locations, marked crosswalks may be enhanced with other traffic engineering measures to increase the conspicuity of the crosswalks and any pedestrians within them.

Advance Stop Lines and Signage

One possible enhancement is the use of signs and markings that encourage motorists to yield in advance of the crosswalk. The underlying principle behind advance stop lines and "Yield Here for Pedestrian" signs located prior to the crosswalk is that they reduce the screening effect of vehicles yielding to pedestrians and serve as a supplemental cue to drivers of the crosswalk location (5). Additionally, drivers who do fail to initially see the pedestrian and attempt to overtake the yielding vehicle will have additional time and distance to react and yield once the presence of the pedestrian becomes known. An example of these types of signs and pavement markings appears below.

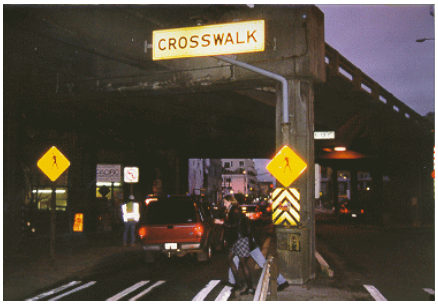
State Law Signing

Another effective tool to make the crosswalks more conspicuous, improve compliance, and help educate drivers of the law is the recently approved "State Law - Yield to Pedestrian" type signs. The city of Boulder, CO has installed these devices mounted curbside and in the median at unsignalized intersections and midblock locations where a less aggressive/less costly treatment is desired. The city reports significant improvements in driver yielding behavior at locations where this type of signage has been installed (3).

In-Roadway "Yield to Pedestrians" Signs

Several studies have demonstrated that the use of in-roadway signs can significantly increase the percentage of motorists yielding to pedestrians at uncontrolled marked crosswalks. A 2007 investigation by Ellis et al. revealed that without treatment, only 32% of drivers at study sites yielded to pedestrians. When the "Yield to Pedestrians" sign was placed at the crosswalk line, the rate of yielding increased to an average of 78% (6). Likewise, Huang et al. noted that in New York, when pedestrian safety cones were placed in-roadway, it resulted in motorists yielding to 81.2 percent of pedestrians compared with 69.8 percent without this treatment, an 11.4% increase. In contrast, an overhead crosswalk sign in Seattle resulted in a lesser 6.6% increase in yielding and a pedestrian regulatory sign in Tucson showed limited effectiveness (7).

NY Pedestrian Safety Cone



Seattle Overhead Crosswalk Sign

Tucson Regulatory Sign

It is possible that the higher effectiveness of the in-roadway signs may be the result of the types of locations where the devices were installed. In-roadway signs are more often used at lower speed (under 35 mph) roadways with 2 or fewer lanes. In contrast, overhead lighted and flashing signs are usually deployed at high speed locations with multiple lanes of traffic.

In-roadway pedestrian safety signs, which can be permanently affixed or portable, are a low-cost (about $150 each), easily-implemented, and effective treatment, especially on lower speed roadways or where there is a reduced speed limit such as active school or business zones. School crossings, in particular, may be prime locations for use of these devices due to the presence of crossing guards who can place and remove the signs at the beginning and end of the periods when students are present. Street frontage shopping or business districts with significant pedestrian activity may also benefit from the use of this countermeasure.

HAWK Signal Beacons

A relatively expensive but highly effective countermeasure for busy roadways is the High Intensity Activated Crosswalk (HAWK) signal beacon. This device resembles an emergency vehicle beacon and only provides yellow and red indications. The pedestrian phase is typically activated by a pushbutton and provides a sequence of flashing yellow, steady yellow, steady red, and flashing red indications. The advantage to this device over installation of a full traffic signal is a somewhat reduced cost and the fact that when no pedestrians are present, the HAWK dwells in a dark mode and does not impede the flow of traffic. Red signal or beacon treatments such as the HAWK consistently perform well, with compliance rates greater than 94% (8). The research team concluded that these treatments are effective because they send a clear regulatory message (a red signal) to motorists that they must stop for pedestrians. This is an experimental traffic control device and has not been approved for use in all areas.

Rectangular Rapid-Flash Beacons

Rectangular Rapid-Flash Beacons (RRFB), also known as Stutter-Flash Light-Emitting-Diode Beacons are a relatively new and promising addition to the traffic engineer's toolbox for increasing pedestrian safety.

These devices, similar in operation to emergency flashers on police vehicles, attach to curb and median mounted "yield-to-pedestrian" signage and use amber LED flashers with an irregular flash pattern to warn motorists of the presence of pedestrians attempting to cross the street.

Sherbutt et al. conducted three experiments of the effects of RRFBs on motorists yielding behavior at uncontrolled marked crosswalks (9). The first experiment evaluated two and four beacon RRFB systems. The results showed that the RRFB could produce a large increase in yielding behavior at multilane uncontrolled crosswalk locations and that installing additional beacons on the median island (four-beacon system) further improves the efficacy of the system. Motorist yielding at baseline without the system initially averaged 18.2%. Upon installation of the two-beacon system, yielding increased to 81.2%. Yielding with the four-beacon system averaged 87.8%. When the system was removed, yielding reverted to 25.1%. Reinstallation of the systems showed similar results. In a 14 month follow-up study, the two-beacon system was producing yielding at the 95.5% level and at the 99.1% level for the four-beacon system, suggesting that the effects of the system's implementation increases as drivers become accustomed to the warning signal that pedestrians are present and yielding is needed. In addition, it may be that the four-beacon system was superior to the two-beacon system due to the visibility of the median island RRFBs to motorists occupying the inside lanes, that is, the lanes in which the motorists are more likely to see devices on the median rather than those placed near the curb.

The study also found that drivers passing or attempting to pass a stopped vehicle (multiple-threat scenario) significantly decreased with the RRFB systems. During the baseline period across all four sites, there were a total of 48 passes or attempted passes. During all treatment phases with both two- and four-beacon systems there were only eight of these occurrences, a reduction of 83.3%. This decrease in the multiple-threat scenario could have a significant positive impact on pedestrian safety.

The second experiment compared the efficiency of the RRFB systems to a standard overhead yellow flashing beacon and a standard side-mounted yellow beacon. Again, the RRFB showed significant increases in driver compliance. Baseline yielding (with no system) was 2.15%. Standard overhead beacons produced 15.5% yielding and standard side-mounted beacons produced 11.48% yielding. With the two-beacon system activated drivers yielded at the 76.6% level and with the four-beacon system, yielding occurred at the 86.49% level.

The third experiment showed that the RRFB was highly effective at a large number of sites located in three different parts of the country and that these effects were maintained over time at each location.

A previous study of RRFBs by Van Houten et al. also showed that the LED flashers installed on pedestrian signs produced a marked increase in yielding behavior. In addition, the data indicated that the use of the device produced a reduction in evasive conflicts between drivers and pedestrians and a reduction in the percentage of pedestrians trapped in the crosswalk at the center of a road without a median island (10).

While the price of Rectangular Rapid-Flash Beacon systems is not insignificant, costing approximately $6000 - $12,000 per installation, they are substantially more economical that installing overhead beacons on mast arms or a HAWK signal beacon type system. Considering the significant increase in motorist yielding that may be achieved with the RRFB system, serious thought should be given to employing these devices at uncontrolled marked crosswalks in Los Angeles where vehicle-pedestrian collisions are most common or severe.

School Speed Zoning

One recommendation that has been made to increase the safety of school children traveling to and from school has been to increase the size of the reduced speed school zone to incorporate a larger area. The research suggests that this countermeasure is likely to be ineffective and could be counterproductive. A recent Texas DOT project, *Comprehensive Guide to Traffic Control Near Schools*, examined traffic control treatments used near schools, especially those associated with reduced speed school zones located on higher-speed roadways. Notable among the findings was that vehicle speeds increase as the relative distance in the school zone increases, approximately 0.9 mph for every 500 ft in school zone length. Thus, longer school zones do not result in lower speeds for a longer distance. In fact, arbitrarily long school zones may have the unintended consequence of increased vehicle speeds as motorists approach the critical areas of the school zone, that is, the area closest to the school where children are most likely to be present. The authors recommend lengths for school speed zones and school buffer zones of 1000 ft and 500 ft, respectively with school speed zone lengths in urban areas as short as 400 ft. (11).

However, what may be of benefit is to ensure that the beginning and end of each school zone is clearly marked with appropriate signage, perhaps incorporating the use of flashing warning signals. This clearly indicates to motorists that they are entering an active school zone and should reduce their speed accordingly.

Also, a comprehensive Safe Routes to School program can help ensure that children cross major roadways in the most appropriate and safest locations.

Funding

Recognizing that limited funds are available for pedestrian safety improvements, stakeholders must explore alternative avenues to accomplish the goal of reducing vehicle-pedestrian collisions. One avenue to explore is grant funding provided by the California Office of of Traffic Safety. OTS makes available grants to local and state public agencies for programs that help them enforce traffic laws, educate the public in traffic safety, and provide varied and effective means of reducing fatalities, injuries and economic losses from collisions. In order to access these grants, stakeholders must partner with a local or state agency such as the LAPD or LADOT. The current funding cycle began on January 4, 2011. Other Federal or State grants may be available and research into this possibility is ongoing.

Recommendations

While not comprehensive, this report has attempted to explain some of the reasons for vehicle-pedestrian conflicts as well as some possible solutions for consideration. The following are recommendations for further discussion:

1. With the assistance of LAPD and LADOT, compile an inventory of at-risk crosswalks ranked by priority for engineering or educational countermeasure implementation.

2. Engage with local and state representatives to explore possible changes to the California Vehicle Code that would clarify the exact and realistic expectations of motorists and pedestrians to avoid unnecessary confusion.

3. Engage with local and state representatives to explore ways to enhance the driver education manual with well-written, well-illustrated information on possible pedestrian conflicts concentrating equally on driver and pedestrian responsibility for avoiding crashes.

4. Reach out to private driving schools in a partnership to enhance the pedestrian safety component of their curriculum.

5. Partner with local schools to create a Safe Routes to School program and in-school assembly programs to educate students about pedestrian right-of-way laws, potential traffic hazards, and safety measures they must consider both as pedestrians and newly licensed drivers. Discuss the possibility of employing in-roadway “Yield to Pedestrians” signs to assist crossing guards in ensuring drivers recognize the presence of children in the crosswalk.

6. Engage with the proper authorities to ensure that the beginning and end of school zones are clearly marked with appropriate signage, perhaps incorporating the use of flashing warning signals at schools adjacent to high volume roadways.

7. Create educational programs for citizens of all ages (including seniors) that encourage pedestrians to make eye contact with motorists to ensure they are being seen. Educate

pedestrians of the added risk of the multiple-threat scenario that exists on multiple lane crossings, emphasizing that although pedestrians may have the right-of-way, they may be shielded from the view of drivers of vehicles in adjacent lanes of travel.

8. Encourage the LADOT to amend their policy regarding the removal of marked crosswalks and instead consider enhancing these locations with other traffic engineering measures to increase the conspicuity of the crosswalks and any pedestrians within them. These include:

a. The installation of advance stop lines and “Yield Here for Pedestrian” signs located in advance of the crosswalk.
b. The installation of "State Law - Yield to Pedestrian" type signs.
c. The installation of Rectangular Rapid-Flash Beacons at marked crosswalks where vehicle-pedestrian collisions are most common or severe.
d. On smaller, lower-speed roads, the installation of in-roadway “Yield to Pedestrians” signs.

9. Engage with local law enforcement to encourage a greater emphasis on education during pedestrian sting operations and clarify the agency’s policy on what exactly constitutes a violation of pedestrian right-of-way laws.

10. Engage with media representatives who cover pedestrian sting operations to ensure that their reports include specific educational information about exactly what constitutes a violation and what errors in judgment drivers made.

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