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DEVELOPMENT AND TEST OF SELECTED MODEL PEDESTRIAN SAFETY REGULATIONS

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16. Abstract

Two model regulations to remove parking--one from suburban streets in daylight hours and one on the last 50 feet of the approach to crosswalks--were designed in previous work to prevent pedestrian "dart and dash" accidents by removing screening vehicles, thereby allowing pedestrians and motorists to more easily see each other and react as needed. To evaluate the safety benefits of the regulations, a study was conducted in New York City. The residential areas of Manhattan have one-side-only parking for three hours per day according to a scheme balanced by time of day and affected side of street. Accident data from 1974-1977 were screened and reports were reviewed. Based on 835 pedestrian accidents, no changes in accident distributions were found when the alternate-side parking regulation was in effect. Supplementary observations in the test areas showed good but imperfect compliance with the parking bans and virtually no changes in pedestrian frequency of appearance and gross behaviors as a function of parking changes. The pattern of results plus discrepancies between the New York study situation and the model regulations meant that little could be concluded with respect to the effectiveness or non-effectiveness of the regulations. Guidelines for further research were presented, stressing the need for direct comparability to the model regulations.

In a related activity, support materials were prepared for a third model regulation, one requiring motorists to stop prior to proceeding past another vehicle stopped before a crosswalk. Although its effectiveness was not examined in this study, this regulation promises to reduce accidents between the overtaking vehicle and pedestrians passing the stopped vehicle. Materials to help pass and publicize the regulation were drafted for two western States with a confirmed accident problem of this type. Arizona shows interest in possibly implementing the model law, with contingent evaluation assistance from NHTSA. Suggestions are offered for a follow-up schedule for the State and for NHTSA.

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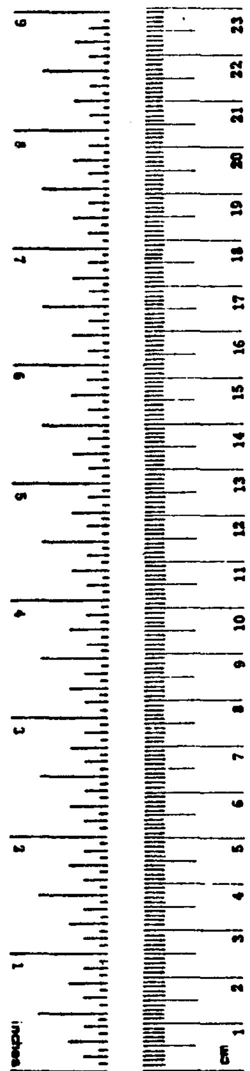
METRIC CONVERSION FACTORS

Approximate Conversions to Metric Measures

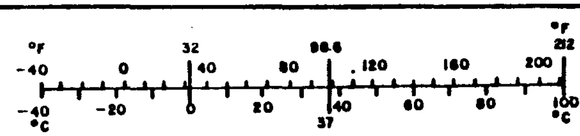
Symbol	When You Know	Multiply by	To Find	Symbol
		LENGTH		
in	inches	*2.5	centimeters	cm
ft	feet	30	centimeters	cm
yd	yards	0.9	meters	m
mi	miles	1.6	kilometers	km
		AREA		
in^2	square inches	6.5	square centimeters	cm^2
ft^2	square feet	0.09	square meters	m^2
yd^2	square yards	0.8	square meters	m^2
mi^2	square miles	2.6	square kilometers	km^2
	acres	0.4	hectares	ha
		MASS (weight)		
oz	ounces	28	grams	g
lb	pounds	0.45	kilograms	kg
	short tons (2000 lb)	0.9	tonnes	t
		VOLUME		
tsp	teaspoons	5	milliliters	ml
Tbsp	tablespoons	15	milliliters	ml
fl oz	fluid ounces	30	milliliters	ml
c	cups	0.24	liters	l
pt	pints	0.47	liters	l
qt	quarts	0.95	liters	l
gal	gallons	3.8	liters	l
ft^3	cubic feet	0.03	cubic meters	m^3
yd^3	cubic yards	0.76	cubic meters	m^3
		TEMPERATURE (exact)		
°F	Fahrenheit temperature	5/9 (after subtracting 32)	Celsius temperature	°C

*1 in = 2.54 (exactly). For other exact conversions and more detailed tables, see NBS Misc. Publ. 286, Units of Weights and Measures, Price $2.25, SD Catalog No. C13.10:286.



Approximate Conversions from Metric Measures

Symbol	When You Know	Multiply by	To Find	Symbol
		LENGTH		
mm	millimeters	0.04	inches	in
cm	centimeters	0.4	inches	in
m	meters	3.3	feet	ft
m	meters	1.1	yards	yd
km	kilometers	0.6	miles	mi
		AREA		
cm^2	square centimeters	0.16	square inches	in^2
m^2	square meters	1.2	square yards	yd^2
km^2	square kilometers	0.4	square miles	mi^2
ha	hectares (10,000 m^2)	2.5	acres	
		MASS (weight)		
g	grams	0.035	ounces	oz
kg	kilograms	2.2	pounds	lb
t	tonnes (1000 kg)	1.1	short tons	
		VOLUME		
ml	milliliters	0.03	fluid ounces	fl oz
l	liters	2.1	pints	pt
l	liters	1.06	quarts	qt
l	liters	0.26	gallons	gal
m^3	cubic meters	35	cubic feet	ft^3
m^3	cubic meters	1.3	cubic yards	yd^3
		TEMPERATURE (exact)		
°C	Celsius temperature	9/5 (then add 32)	Fahrenheit temperature	°F



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I. INTRODUCTION

Over the past decade, NHTSA-sponsored pedestrian accident research has sought to increase pedestrian safety through a three-pronged approach. First, accidents were carefully analyzed into distinct causal types (e.g., Snyder and Knoblauch, 1971). Each type was described in the framework of a model which identified the precipitating events, which immediately preceeded and led to the accident, and predisposing factors, characteristics of the people and the environment which contributed to the development of the accidents. Second, based on these findings, countermeasures were or are being developed which were intended to prevent specific types of accidents through interruptions of the situational and behavioral chains leading to those accident types (e.g., Blomberg, Hale and Kearney, 1974). Third, studies are being conducted to field test the more promising countermeasures to show their effectiveness in reducing accidents and to develop the countermeasures and supportive materials to the point where they can be adopted and successfully implemented by state or local authorities (e.g., Dunlap and Associates, Inc., April 1977, and May 1977).

This contract looked at three proposed model regulations, developed by Blomberg et al. (1974) to reduce pedestrian accidents. Two of the model regulations seek to prevent accidents characterized by pedestrians darting into the street and being struck by motorists who are screened by parked vehicles and have inadequate time to react. The regulations prohibit on-street parking in certain circumstances, in order to remove the parked vehicles which screen pedestrians and motorists from each other. They are:

- Model On-Street Parking Ordinance—as written, prohibits on-street parking in new or rebuilt residential areas during daylight hours, but allows the traffic engineer to exempt areas in which parking removal would yield no benefit or would cause undue hardship.

- Model Ordinance on Parking Near Intersections and Crosswalks--prohibits parking or standing within 50 feet of crosswalks on the approach side (or 60 feet of intersections without marked crosswalks) except for momentary stops to pick up or discharge passengers.

Under this contract, these two regulations were examined vis-a-vis a safety benefits study of an existing situation that reflected conditions similar to those specified in the two model regulations. Although the same setting was used to study both regulations, different data were analyzed for each. The results of this study are described in the second section of this report.

Also examined under this contract was a third regulation proposed by Blomberg et al. (1974) one designed to change driver behaviors in "multiple threat" situations. The multiple threat situation involves two (or more) motorists and a pedestrian. At a crosswalk, a pedestrian begins crossing in front of one motorist who stops (or remains stopped) to allow the pedestrian to cross. This stopped vehicle screens the pedestrian and any other vehicles overtaking the stopped vehicle from seeing each other. Accidents often occur when the pedestrian steps from behind the stopped vehicle just as another vehicle overtakes. To break this behavioral chain, Blomberg et al. (1974) developed the following:

- Model Vehicle Overtaking Law--its major point is to require every driver about to overtake another vehicle stopped at a marked or unmarked crosswalk to stop and to proceed only if there is no crossing pedestrian.

At the start of this contract, a test of essentially this behavior, as nearly as it could be elicited by public information messages, was being conducted under a separate NHTSA contract. Based on those findings, this project developed materials and procedures for implementing this law at the state level in Arizona and California, to support a subsequent field test with accident measures. The results of this activity are described in the third section of this report.

Information on all three model regulations--their development rationale and their annotated forms as produced by Blomberg et al. (1974)--is given in Appendix A.

II. ON-STREET PARKING REDEPLOYMENT

A. Background

As part of an effort to improve pedestrian safety, Blomberg, Hale and Kearney (1974) proposed two model regulations dealing specifically with on-street parking. The motivation for both model regulations emanated from the general finding by Snyder and Knoblauch (1971) that, in many pedestrian accidents, parked cars were cited as contributing to the crashes by preventing motorists and pedestrians from detecting each other until too late to react effectively.

One solution could have been recommending complete barring of on-street parking. This would have been impossible to implement in any real situation, however. After careful study of the patterns of accident occurrence, Blomberg et al. (1974) developed two different regulations which preserve most on-street parking while eliminating the parking most highly associated with accidents. The two regulations are presented below, together with a discussion of their key features, evidence for their likely benefits and the mechanisms through which they may be effective.

1. Model On-Street Parking Ordinance

Midblock "darts and dashes" are accident types which typically involve child pedestrians dashing into the street from curbside while looking straight ahead. While the drivers may be going too fast or may be distracted, most often they are proceeding properly; they are driving straight. Crucial to the causation of the accidents is the fact that the pedestrians first appear in the street, through quick or abrupt motion and/or behind parked vehicles, too close to the drivers for the latter to react safely. In NHTSA studies, three subtypes of these accidents have been identified:

- Midblock Dart-Out, First Half. The pedestrian is almost always a young child and is struck in the first half of his crossing. A key factor is short-time exposure; because of rapid movement and/or blocking, the pedestrian is not seen until he is in the roadway.

- Midblock Dart-Out, Second Half. This type is similar to the preceding type, except that the pedestrian is struck in the second half of his crossing and the contribution of parked cars is less obvious. The pedestrians are still young, but include more young adults than Dart-Out First Half.

- Midblock Dash. These accidents are similar to either of the preceding types, except that short-time exposure is not documented. That is, the degree of pedestrian visibility to the driver is unknown, but the pedestrian ran or darted into the street and was struck.

In recent NHTSA projects done by Dunlap and others, pedestrian accident reports have been coded by experienced traffic safety researchers. For seven cities virtually all pedestrian accident reports were coded for one to six years. Table 1 shows the percentages for the three accident types by city, along with the total numbers of pedestrian accidents. The cities represent a wide cross section of urban areas throughout the country. On average, 31% of all pedestrian accidents for this sample were midblock darts and dashes. Over half of these were Dart-Out First Half.

Table 1. Midblock Dart and Dash Accident Percentages

Accident Type	Los Angeles (73-75)	New Orleans (73-75)	Washington D.C. (1976)	San Diego (73-78)	Columbus (73-76)	Akron[1] (73-78)	Toledo[1] (73-78)
Dart-Out First Half	16.2%	15.1%	22.9%	19.2%	14.8%	12.2%	16.0%
Dart-Out Second Half	7.6%	8.1%	8.0%	8.3%	8.6%	6.3%	6.7%
Midblock Dash	4.2%	7.3%	6.5%	4.4%	11.0%	8.6%	9.4%
N	7922	2655	1316	3263	2511	1332	1878

[1]Data for these cities are only about 90% complete. It is not believed, however, that there are any sampling errors which would materially affect the discussions which follow.

Because these accidents were typed through reading police accident reports, it was impossible to calculate directly how frequently parked vehicles were involved. The reports are simply not detailed enough to conclude that the absence of the mention of parked vehicles meant that parked vehicles were not present. The pioneering study of Snyder and Knoblauch (1971), however, investigated accidents with supplemental site visits and participant interviews. According to re-analyses of those data, 73% of Dart-Out First Half accidents involved parked cars which interfered with driver and/or pedestrian detection. For Dart-Out Second Half, the figure was 34%. (Midblock Dash was not part of their coding scheme.) Projecting this distribution onto the relative accident frequencies shown in Table 1 yields the estimate that at least 59% of all midblock dart and dash accidents and at least 18% of all urban pedestrian accidents involve the visual screening of parked cars.

The blanket countermeasure of banning all on-street parking is impractical in our society: Blomberg et al. (1974) conducted further analyses of the Snyder and Knoblauch (1971) data to identify more specific situations in which midblock dart and dash accidents occur. Their goal was to recommend a selective parking ban which would maximally reduce accidents with minimal disruption of parking. The result was their Model On-Street Parking Ordinance (MOSPO), reproduced in Figure 1.

In their initial report of the MOSPO and its evaluation by traffic engineers, legislative and police representatives, traffic safety groups, and representatives of the general public, Blomberg et al. (1974) pointed to guarded acceptance and expectations of success. There was particular concern that adequate alternative (off-street) parking be available when and where the MOSPO was in effect. Accordingly, the form of the MOSPO should be considered subject to change as long as it satisfies four criteria originally specified by Blomberg et al. (1974):

- Remove on-street parking in the areas and at the times of the most serious dart and dash problems. In general, since young children are the most frequent victims, this means emphasis on residential areas and daylight and early evening hours excluding the times schools are in session.

- Educate the public to the connection between parking and pedestrian accidents to achieve understanding of and support for the regulation.

- Ensure, possibly through a linked zoning code stipulation, that adequate alternative parking exist whenever and wherever the MOSPO is active.

- Allow a mechanism, e.g., traffic engineer discretion, for exceptions to the law to be made whenever limited safety benefits in certain areas would not justify the general inconvenience caused by the law.

2. Model Ordinance or Law on Parking Near Intersections and Crosswalks

Intersection Dash accidents, originally identified by Snyder and Knoblauch (1971), occur to pedestrians of all ages although children are the most frequent victims. Half occurred in commercial areas and about two-fifths occurred in residentail areas. In the Snyder and Knoblauch data, parked vehicles were cited in ten percent of Intersection Dash accidents. In addition, a significant number of Dart-Out First Half and Dart-Out Second Half accidents were coded at intersection locations by Snyder and Knoblauch (1971). Of the former, 60% involved parked vehicles, of the latter, 20% did. Combined by relative frequency, these three accident types had parked cars cited in 25% of their cases. In the coding scheme employed for all accident typing since that original study, all three types at intersections would be coded as "Intersection Dash."

As a result of additional analyses of the accident experience for cities listed in Table 1, Intersection Dashes were found to account for an average of 14% of all accidents, ranging from a low of 7.3% for Washington, D.C. to a high of 20.4% in Toledo, Ohio. Conservatively, then, over three percent of all urban pedestrian accidents occur at intersections and involve the screening of parked vehicles. While this is a small fraction, it represents about 3,000 to 6,000

MODEL ON STREET PARKING ORDINANCE

§ 1 -- Parking to be prohibited in new or redeveloped areas

(a) The (city traffic engineer) shall place official traffic-control devices prohibiting standing and parking from sunrise to sunset on streets in new residential subdivisions built after (January 1, 1981) and in other residential areas where a significant part of an existing block is reconstructed after (January 1, 1981).

(b) When traffic-control devices are in place, a driver shall not park or stand in violation of such devices.

§ 2 -- Exceptions

The (city traffic engineer) may exempt streets or parts of streets subject to section 1 whenever he finds that prohibiting standing or parking will not significantly contribute to pedestrian safety (or whenever he finds that such prohibition imposes burdens disproportionate to benefits to be derived therefrom).

Figure 1. Model On-Street Parking Ordinance

pedestrian accidents per year across the country. Thus, the number is significant. Moreover, a recent study into model ordinance effectiveness has shown a cost-beneficial result even though it dealt with a pedestrian accident problem which was of a small magnitude--the problem of children being struck around ice cream vendor vehicles (Hale and Blomberg, 1978).

To counter the considerable problem of Intersection Dash accidents, Blomberg et al. (1974) proposed the Model Ordinance or Law on Parking Near Intersections and Crosswalks (MOPNIC), reproduced in Figure 2. This regulation prohibits parking within 50 feet of crosswalks--midblock or intersection--or 60 feet of intersections without marked crosswalks. The regulation applies only to the sides of streets which carry traffic into the intersection. The regulation specifically prohibits use of the no-parking area for loading zones (except for passengers), so that the freed areas will remain empty.

The purpose of the regulation is to allow a clear space before intersections and crosswalks so that pedestrians and drivers will have a greater opportunity to see each other. The choice of distance--50 feet or 60 feet--was based on modeling and pilot tests which determined the setback distance needed to permit detection with adequate time and distance available for safe reaction. The actual distance was determined adequate for vehicles approaching at 25-30 mph. A longer distance was rejected for reasons of retaining as much on-street parking as possible, consistent with increased safety. The option of varying the length of the setback according to the speed limits on the streets was also rejected in favor of keeping the regulation simple enough for clear understanding and accurate implementation.

The intended results of both parking regulations are shown in Figure 3 (for the MOSPO) and Figure 4 (for the MOPNIC). In both cases, a pedestrian entering the street--even if darting--should be visible to a driver approaching from at least 75 feet away from the point of possible impact. This is more than two seconds away at a constant speed of 25 mph, a common speed for such accidents. It is enough distance for a driver to react and stop from that speed, and to react and slow or swerve successfully at higher speeds.

In terms of pedestrian accidents and the accident types discussed above, both regulations should lead to reduced rates of accidents. Without the screen of parked vehicles, pedestrians may be more aware of the traffic scene and dart into the street less frequently. However, even if they continue to dart into the street, drivers should have more time to react and avoid a collision or, at least, to lessen its severity through a reduction in impact speed. Thus, darting events, per se, should be less likely to result in accidents. In particular:

- Banning on-street parking (the MOSPO) should dramatically reduce Dart-Out First Half accidents. Dart-Out Second Half and, possibly, Midblock Dash accidents could also decline in frequency. Regardless of subtype, midblock accidents in general should be reduced.

MODEL ORDINANCE OR LAW ON PARKING NEAR INTERSECTIONS AND CROSSWALKS

§ 1 -- Parking near crosswalks regulated

(a) A person shall not stand a vehicle, whether occupied or not:

(1) Within 50 feet of the nearest border of any marked crosswalk on the approach side of the crosswalk

(2) Within 60 feet of an intersection without a marked crosswalk on the approach side of the intersection

(b) Subsection (a) shall not apply to the driver of a vehicle which is stopped:

(1) To avoid conflict with other traffic;
(2) To comply with a law;
(3) To comply with directions of a police officer or official traffic control device;
(4) Momentarily to receive or discharge passengers;
(5) Because it is disabled in such manner and to such extent that it is impossible to avoid stopping and temporarily leaving the vehicle in the area described in subsection (a).

§ 2 -- Traffic-control devices required at certain crosswalks

(a) Traffic-control devices notifying drivers of the restrictions in section 1(a) shall be installed in advance of all marked crosswalks not located at an intersection and in advance of all crosswalks located at any intersection where there is no traffic-control signal or stop sign.

(b) The absence of any such traffic-control device shall not affect a driver's duty to comply with section 1.

Figure 2. Model Ordinance or Law on Parking Near Intersections and Crosswalks

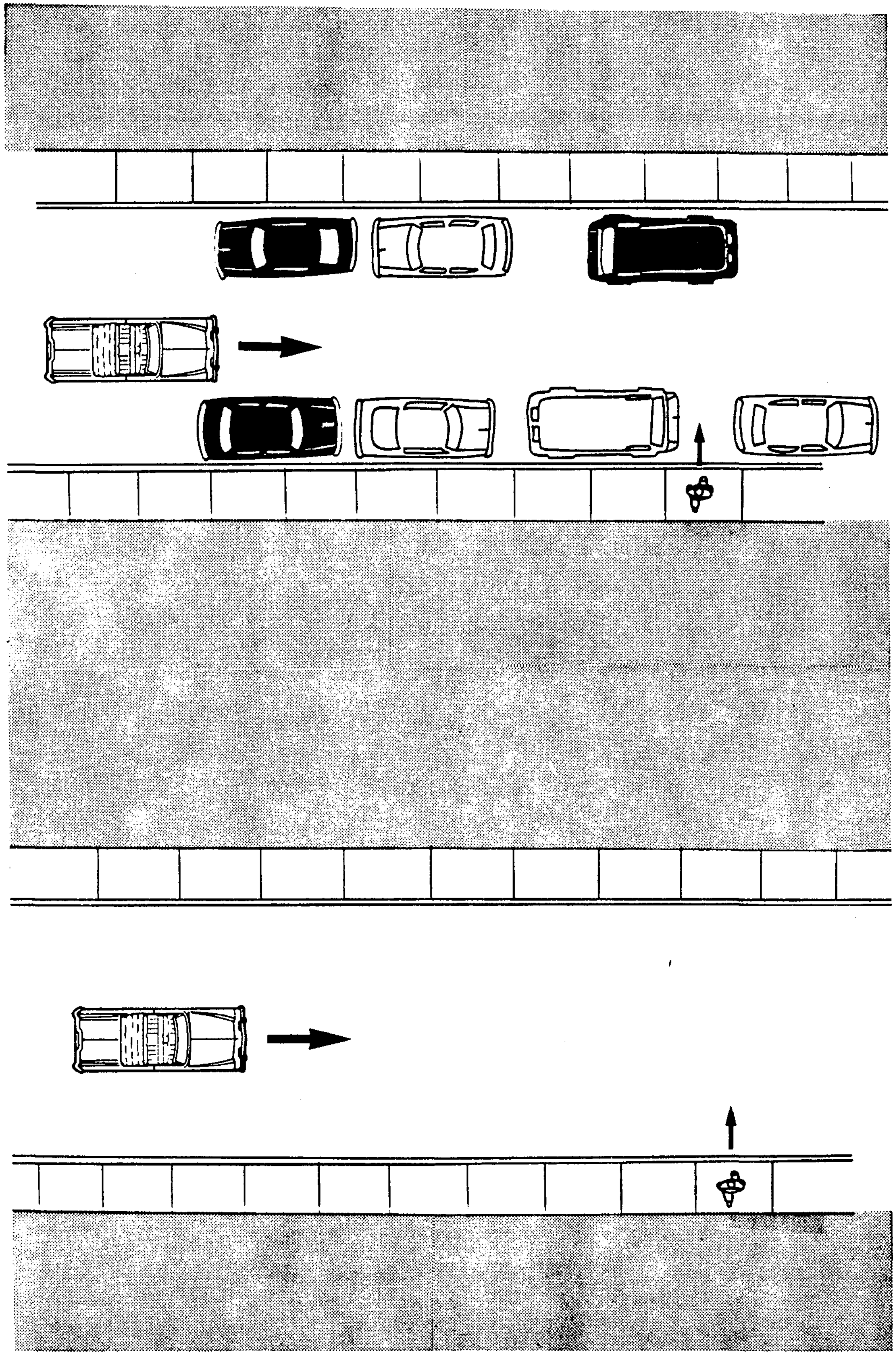


Figure 3. Midblock Crossings With and Without Interference from Parked Vehicles

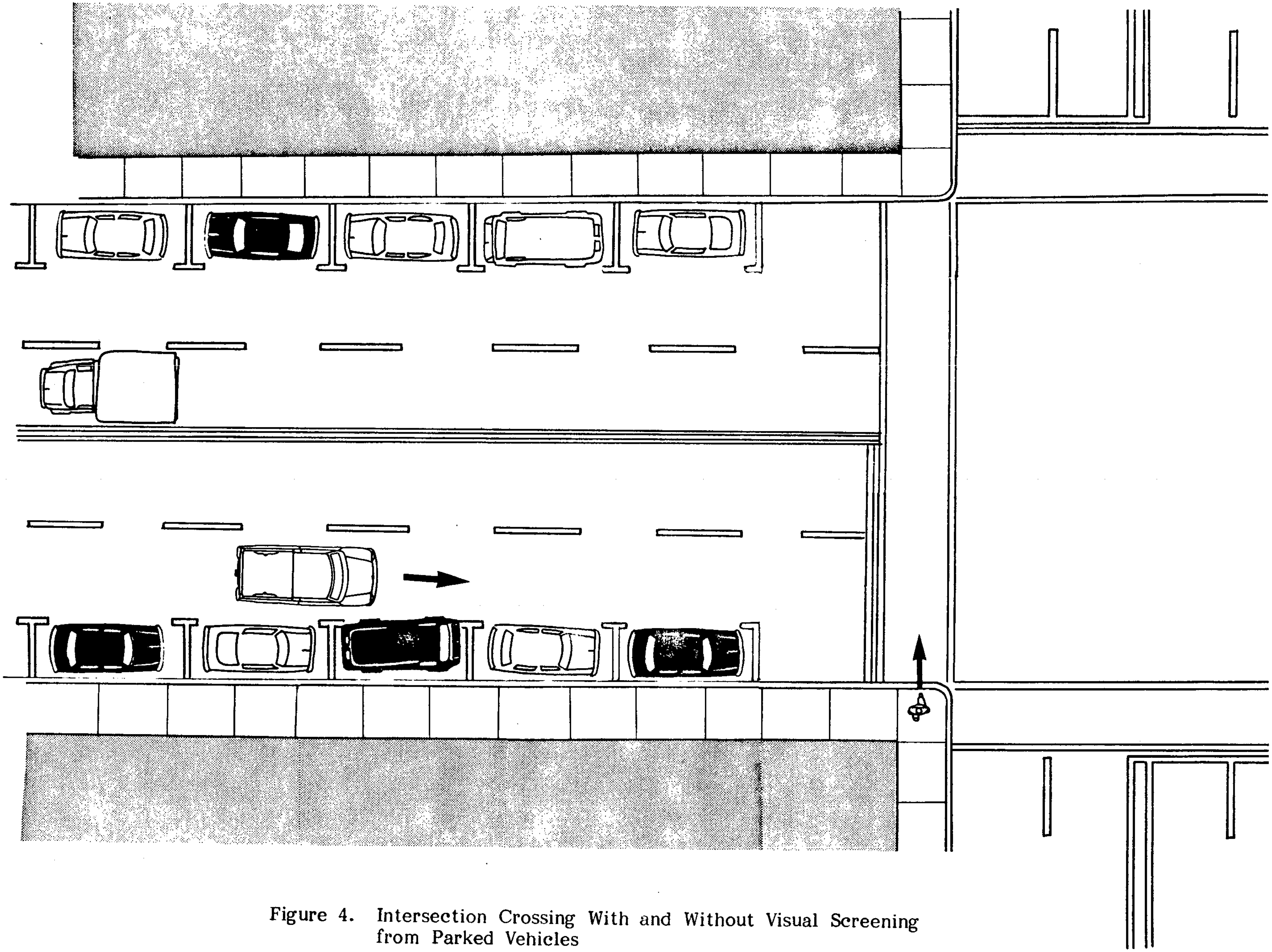


Figure 4. Intersection Crossing With and Without Visual Screening from Parked Vehicles

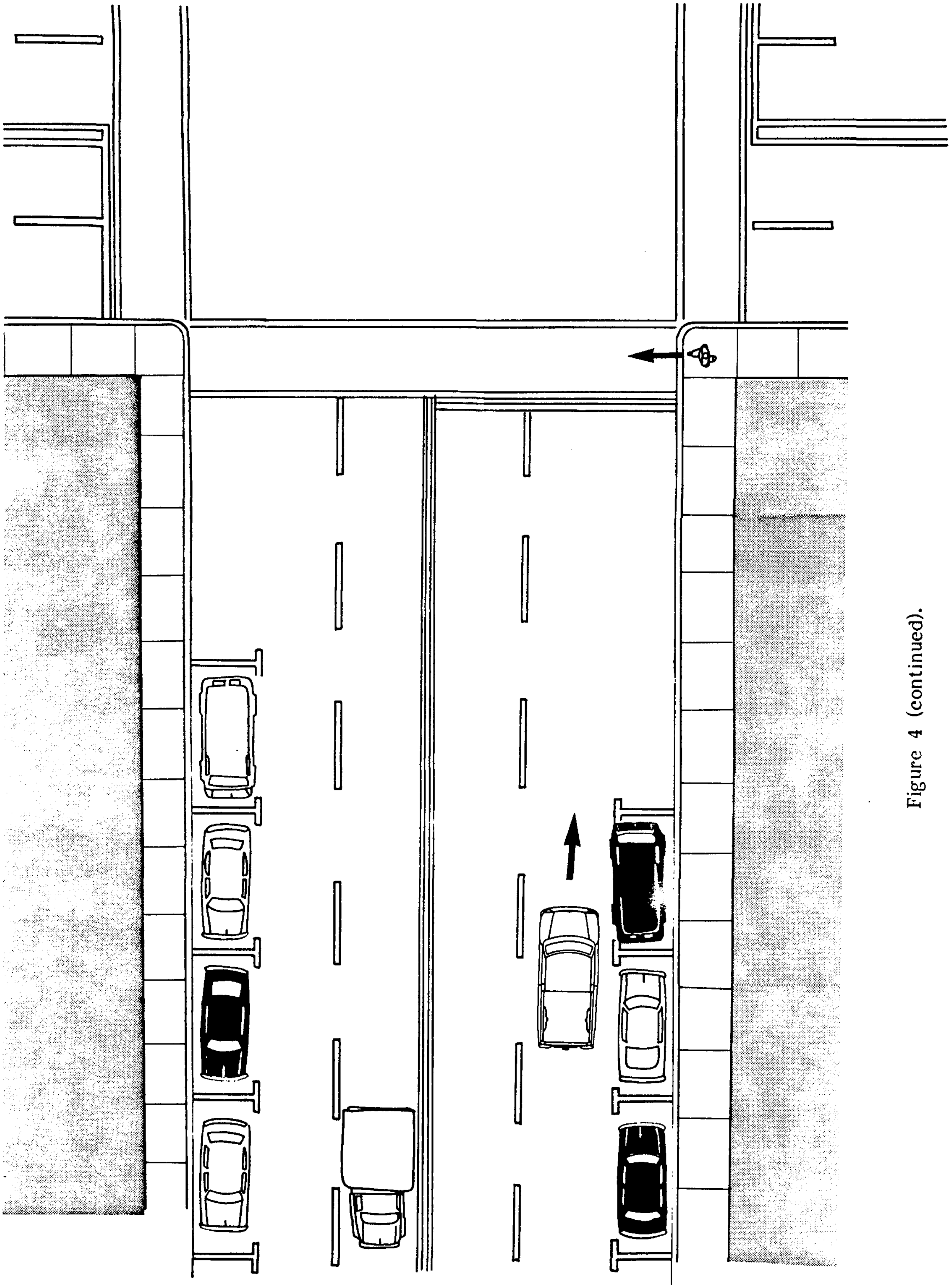


Figure 4 (continued).

- Intersection accidents, particularly Intersection Dashes, should also be reduced by the MOSPO. Since the MOSPO eliminates parking on the entire block, not just the 50 to 60 foot setback, its accident reduction potential should be similar to that of the MOPNIC.

- Removing parked and standing vehicles from the 60 foot area preceding intersections (and midblock crosswalks--the MOPNIC) should reduce Intersection Dashes through the mechanisms cited above. Other intersection accidents may also decrease, due to the increased sight distance and subtle changes in intersection traffic flows and the likely reduction in congestion.

Thus, theoretically both regulations have the potential to reduce pedestrian accidents. In developing the model regulations, Blomberg et al. (1974) used expert testimony to critique the general thrust of the models, to examine the details of the proposals, and to estimate the practical considerations as the basis to determining whether or not the model regulations could succeed in application.

Both regulations were judged to have potential for safety benefits by the broad spectrum of experts consulted by Blomberg et al. (1974), an evaluation reflected in the discussion above (see Appendix A for a more complete discussion). Both regulations would achieve any accident reduction at a cost however--i.e., loss of on-street parking which is highly valued in our society. For the regulations to be implemented effectively, urban officials would have to be convinced of the value of the regulations with evidence more powerful than expert opinion. Simply, a more tangible level of proof in terms of the ultimate measure--accidents--was needed before widespread promotion of the model regulations could be justified or, indeed, undertaken successfully.

The research described in the next sections highlights the study of the safety benefits of an existing parking removal regulation, in order to estimate whether the two model regulations would really yield safety improvements. If safety benefits were shown, the argument for adopting the model regulations would be strengthened and the formerly theoretical safety benefits would become more concrete.

B. Potential Research Approaches

Three alternative procedures were considered in the design of this study. These procedures, each discussed below, were: 1) behavioral assessment, 2) comparing accident rates associated with the model regulations, and 3) comparing accident rates associated with situations similar to the model regulations. The final approach was ultimately chosen. It is described generally in this section and the specific application is developed in detail in subsequent sections.

1. Behavioral Assessment

Often, the only difference between an accident and a near accident is the actual collision. Behaviors, situations, etc. leading to both events can be virtually identical. Therefore, it seems reasonable that pedestrian street crossing events can be ordered by their safety, with crossings characterized by alert, purposive, conservative drivers and pedestrians at one extreme and crossings resulting in crashes at the other extreme. If so, then there are certain crossings which do not end in crashes but otherwise are very similar to crossings which result in accidents. Those "near-accident" crossings are assumed to be more frequent than actual accidents and to be related to accidents in simple ways: The more accidents in a particular situation, the more near-accidents; and the same factors which increase or decrease the rate of accidents increase or decrease the rate of near-accidents.

Further, near-accident crossings are postulated to have certain (unspecified) behavioral components which also occur in crossings leading to accidents but which do not occur in safer crossings. If these behaviors can be identified and reliably detected in crossings, then a study of the MOSPO and the MOPNIC could center around measuring crossing behaviors. If the conditions set by the regulations reduced the rate of accident-related behaviors, then it could be concluded that the regulations were safer for pedestrians.

Although the full rationale forms an elaborate chain, measures developed through the same reasoning have been used successfully in traffic safety (e.g., the measurement of vehicle-vehicle conflicts; for a review see Glauz and Migletz, 1979). The conflicts technique has not been as fully developed in pedestrian situations, however. Nevertheless, it (or a variation) was considered seriously for use in this study. It was rejected for several reasons:

- There was no consensus on what behaviors or what situations reliably identified near-accidents. While "conflicts" is a clear choice, there is no precedent on a satisfactory definition of pedestrian-vehicle conflict or a demonstration of a positive relationship between conflict rates and accident rates (Güttinger and Kraay, 1976). Other behaviors, such as pedestrian pre-crossing search, have been described in detail by Dueker (1978). They have only been weakly linked to accident occurrence by logical association, however. To identify behavior measures for use in testing these model parking regulations and to validate them would have been a massive experimental undertaking, far beyond the resources of this study.

- Pedestrians gear their mode of crossing to the requirements of the immediate setting. For narrow crossings, an "informed dart"--i.e., stepping into the edge of the crossing prepared to dart across if an adequate gap is detected--may be appropriate and quite safe while for wider crossings, with more distance to cover and a potentially more complex traffic pattern to evaluate, the same procedure could be quite dangerous. Adults can visually evaluate crossings several seconds before they reach the curb or in the last fraction of a second before they enter the street. They select search timing based on factors such as visual screens. What may be the safest and most appropriate search process in one setting (e.g., waiting until the last second to search if a visual screen is present) may be an indication of an inattentive and unsafe pedestrian in another (e.g., the same last minute search when a clear view was available long in advance). Thus, comparing behaviors from one condition to another would not have been a simple tabulation and would have had to involve a subjective interpretation of the safety value of each behavior in context.

- Although pedestrian-vehicle near-accidents may be much more frequently occurring than accidents, thousands of observation hours would have been required to obtain adequate samples, projected from any reasonable estimate of near-accident rates.

- The complexity of this test paradigm and the indirectness of the behavioral measures of accident potential would have limited the practical value of the evidence of the regulations' effectiveness. Although the results might have been scientifically valid, they would have been in a form unlikely to persuade city officials, traffic engineers and public groups to implement the regulations in their communities.

A more elaborate description of the complexity of the problem of behavioral measurement of crossing safety, and one possible theoretical framework within which the problem may be resolved, is presented in Appendix E.

2. Accident Rate Tests of the Model Regulations

This would represent the preferred test scenario. It could have evolved in one of two ways. Both were pursued and both failed to bear fruit. First, an "existing situation" might have been found: A jurisdiction might have existed which had in effect one or both of the model regulations. An extensive search of state and municipal traffic codes in this country failed to reveal any such situation. Second, a jurisdiction might have been persuaded to implement one or both of the regulations on a pilot basis, subject to experimental design considerations. For such a test to have yielded accident rate changes which would have been statistically reliable, parking for a very large number of streets and intersections would have had to have been altered for one or more years. This possibility was approached with a few cities without success. The major stumbling block was circularity: Typically, in order for a city to be willing to mount a massive test of these regulations, the test would have had to have been already conducted with positive results. Parking was too precious to remove without evidence that its removal would significantly reduce accidents.

3. Accident Rate Tests of Situations Similar to the Model Regulations

The model regulations represent two specific ways of removing on-street parking, but they are not the only ways. Many cities, for example, have existing regulations which ban parking for brief periods to allow street cleaning.

If a situation could be found which covered a large area and prohibited parking for an adequate time period, then an accident rate study similar to that described above could be undertaken. The results would provide direct evidence on whether the existing situation led to safety benefits or not. To the extent that the existing situation was like the model regulations, the results could be generalized to support the safety effectiveness of the model regulations.

An existing situation study might have other benefits as well, depending on its details. For example, it might represent a more powerful statistical design than a full implementation of the model regulations would provide. The situation might involve some but not all features of the model regulations, and the safety results could be used to separately examine the effectiveness of those aspects of the model regulations. Major differences between the existing situation could, however, make more difficult the generalization of test results to results expected with the model regulations in force.

This procedure was selected for use in this study. The specific situation and the resulting research design are described below.

C. Research Overview

1. Site Characteristics

In support of this approach, the first task was to identify an existing situation suitable for the investigation. It had to have a parking removal situation quite similar to that prescribed under the MOSPO and MOPNIC, it had to be well-documented, and it had to have available an adequate base of accident data for hypothesis testing. After several possible sites were considered, New York City (specifically Manhattan) was selected for the study. Because Manhattan's parking regulations differed in several ways from the model regulations, the situation would provide useful information without being a direct test of the regulations. The Manhattan regulations were particularly well suited to this study, however, because of the orderly way they cycled on and off at any given location.

The areas of Manhattan used in this study were the portion of the island above 59th Street and the part from Houston Street to 59th Street east of Third Avenue. The east-west streets, which formed the bulk of the study sample, were predominately multiple dwelling unit residential. Parking on these streets was unmetered and full-time except as affected by the street cleaning regulations. The north-south avenues, which were mixed commercial and residential, were frequently disqualified from the data analysis because parking was metered or was fully prohibited. The pattern of meters was such that commercial areas tended to be rejected and residential blocks tended to be retained.

In the area of the study, New York City enforces alternate side parking (ASP) regulations for street cleaning. Excluding metered areas, in which the ASP regulations cycle on a different schedule, the regulations operate either four or six days per week, either between 8 and 11 a.m. or between 11 a.m. and 2 p.m. When operative, the regulations prohibit parking on one side of the street, half of the days affecting the north or west sides of the streets and half of the days affecting the south or east sides.

A map of Manhattan with the area of the study lightly shaded and showing the distribution of ASP regulations is produced in Figure 5. There are four basic elaborations of the ASP regulation, varying in the number of days per week affected, according to the severity of the street cleaning problem, and varying in time of day so that street cleaning can be scheduled efficiently. The New York City codes for the four ASP versions indicate their coverage. Two versions (A2X and A3X) affect parking in the morning, between 8 a.m. and 11 a.m.; the other versions (P2X and P3X) affect parking in the period from 11 a.m. to 2 p.m. Two versions (A2X and P2x) remove parking from each side two days per week (Monday and Thursday from one side, Tuesday and Friday from the other). The remaining versions (A3X and P3X) remove parking from each side on three days per week (Monday, Wednesday and Friday from one side and Tuesday, Thursday and Saturday from the other).

These alternate side regulations have been in effect since long before the period relevant to this study (1974 through 1978) and have been essentially unchanged in form for the entire period. Thus, we may expect that compliance has been consistent throughout the period.

An earlier study of the effects of enforcement frequency and strategy on compliance with these regulations (DeBartolo, Preusser and Blomberg, 1978) showed that, in these areas of Manhattan, parking is significantly altered during the times the regulations are in effect. In the middle two hours of the three hour period, the prohibited side of the street was found to be almost always clear of parked cars. During the first part of the period, some cars had not yet moved; during the last half hour or so, cars were moved back into the prohibited area after the street cleaning apparatus had passed. On the opposite side of the street in areas of the city where on-street parking was typically heavy (i.e., most of Manhattan), there was double parking during the periods when the prohibited side was clear of parking.

These observations provided clear evidence that the alternate side parking regulations had major, consistent effects on parking. While these effects were not exactly the same as those to be derived from the model regulations, there are strong similarities. The MOSPO calls for the removal of all parked vehicles from curbs; ASP regulations remove parking from just one side. The MOPNIC would remove parking from within 50 feet of the pedestrian crossing zone; the ASP regulations, on the operative sides of the street, remove parking completely from the approach to the crossing zone.

Also, pedestrian accident data could be made available for the area of Manhattan for a significant time period. Through the cooperation of the State of New York Department of Motor Vehicles, it was possible to obtain computer records of Manhattan pedestrian accidents and to access the physical accident reports as well.

2. Accident Research Design

The ASP-controlled parking pattern permitted a tightly counterbalanced research design. For any given block in the study sample, on some days of the week parking was prohibited on one side of the street and for other days of the week it was prohibited on the other side. Thus each block could serve as its own control.

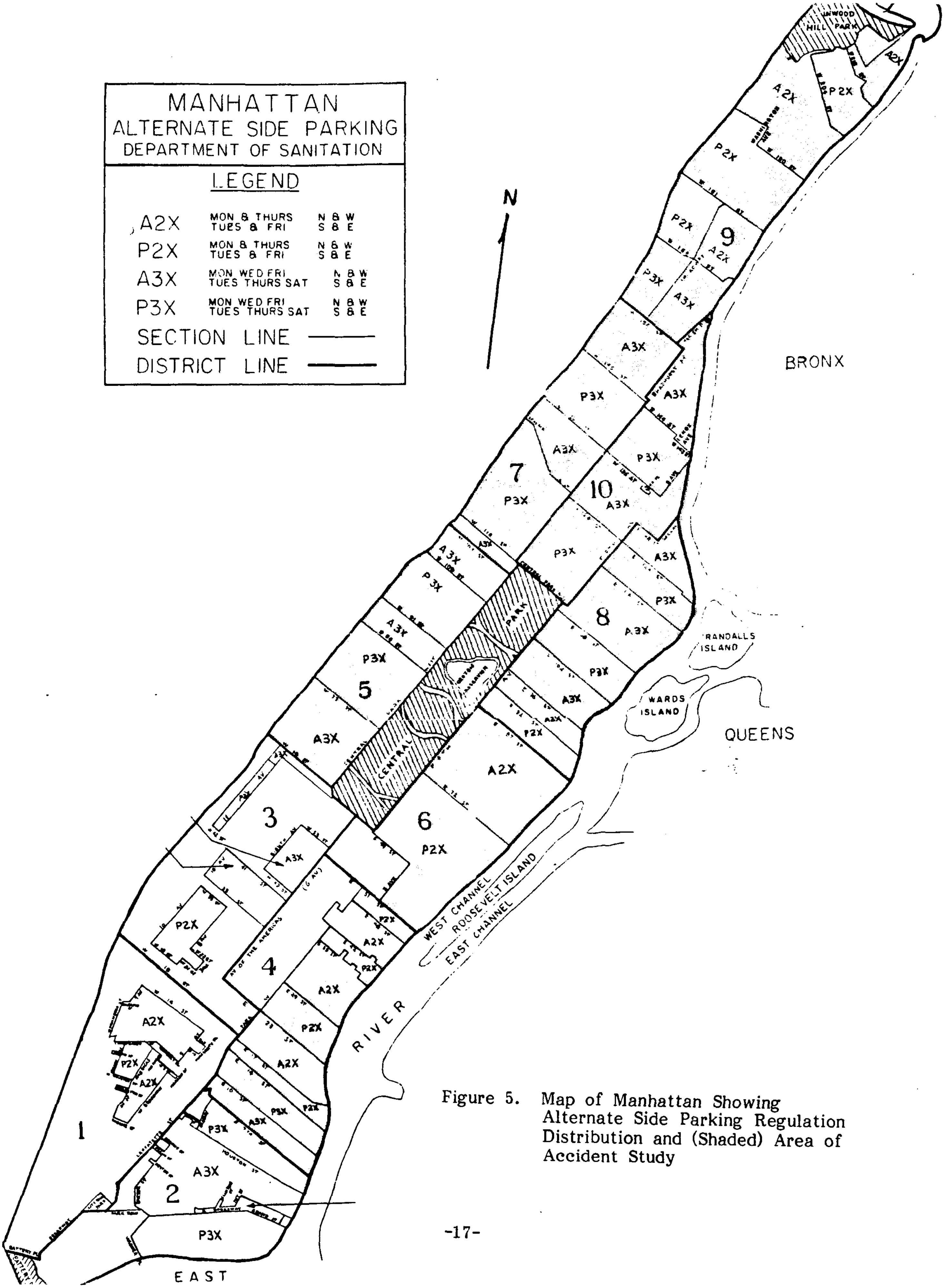


Figure 5. Map of Manhattan Showing Alternate Side Parking Regulation Distribution and (Shaded) Area of Accident Study

For a set of blocks, the hours of ASP activity corresponded to a period of no activity on another set of blocks; ASP activity on the second set was matched in time with normal parking on the first set. Thus, time of day factors could be balanced by the time-location interaction. These factors are illustrated below in Tables 2 and 3.

Table 2. Schedule of Parking Removal Due to Four Versions of ASP Regulations[1]

Alternate Side Parking Regulations	Affected Time of Day	Day of Week						
		Sun	Mon	Tue	Wed	Thu	Fri	Sat
A2X	8 am - 11 am	--	N	S	--	N	S	--
P2X	11 am - 2 pm	--	N	S	--	N	S	--
A3X	8 am - 11 am	--	N	S	N	S	N	S
P3X	11 am - 2 pm	--	N	S	N	S	N	S

[1]Cell entries refer to sides of streets on which parking is prohibited in the affected time periods:

N - North (or West) side prohibition
S - South (or East) side prohibition

Table 3. Time and Location Interaction of ASP Activity

		Time of Day	
		8 am - 11 am	11 am - 2 pm
Areas of the city where ASP regulations apply from ...	8 am - 11 am	ASP in force on alternating sides of the streets	ASP not in force
	11 am - 2 pm	ASP not in force	ASP in force on alternating sides of the street

The dependent variable in the study was accident frequency. All pedestrian accidents occurring in the test area of Manhattan from June 1974 through December 1977 and reported to the City of New York or to the State were examined. For each accident, information was collected on:

- Pedestrian characteristics and actions
- Vehicle and driver characteristics and actions
- Time, day of week and date
- Relationship to intersection of impact location
- ASP condition at time of accident

Intersection and midblock data were analyzed for their separate applicability to the MOSPO and MOPNIC. The data were analyzed through cross-tabulation procedures for the basic distributions of variable categories and for comparisons which tested the relationships between accident types and frequencies and ASP conditions. Two primary hypotheses were tested:

- If parking removal improves safety, then fewer accidents should have been found during the times ASP regulations were in effect than when they were not, when balanced across time of day and geographic area.

- If parking removal improves safety, then during the times of ASP activity and at the locations where the ASP regulations were in effect, there should have been fewer accidents in which the pedestrians entered the street from the side with parking banned than accidents in which the pedestrians entered from the side with parking permitted.

Analyses were performed across all accidents and across meaningful subsets of accidents, e.g., intersection vs. midblock and children vs. adults.

3. Behavioral Correlates Analysis

The earlier study by DeBartolo et al. (1978) provided detailed information on driver observance of the ASP regulations in the areas of the accident rate evaluation and within the time period covered by the accident reports. No information was collected, however, on whether the parking changes also affected pedestrian travel. Unlike the situation which would be produced by the model on-street parking regulation--i.e., no parking on both sides--the alternate side regulations produced unequal parking on the two sides. Pedestrians may have reacted to this factor by systematically choosing to congregate and travel on the clear side (or on the heavily-parked side).

Such a change, if it were to occur, would have implications for both the analysis of the accident data and the viability of an alternate side regulation as a countermeasure approximation of the MOSPO. If, for example, most pedestrians preferred to be on the unparked side, then even results showing no decrease in accident frequency on the unparked side could be interpreted as showing an accident rate decrease with parking removal (although countered in the alternate side instance by higher pedestrian exposure) and, therefore, as supporting the effectiveness of the model regulations. This same example would show that the alternate side regulation would be a less than ideal safety alternative to the model regulation.

A study to complement the accident rate analysis, then, was designed to provide a measure of the context in which the accidents occurred. It was particularly directed at investigating two factors, as a function of the actual "phase" of the alternate side parking regulation in effect at the time of observation:

- Actual on-street parking density for each side of the street, to confirm the DeBartolo et al. (1978) findings.

- Incidence of pedestrians on each side of the street, subdivided into meaningful age/sex and activity categories.

The collected data were analyzed to provide three kinds of information in the chain of reasoning needed to relate on-street parking restrictions to accident rate improvements, i.e.:

- To verify the pattern of actual parking found in response to the legal prescriptions of the ASP regulations. At the broadest level, if parking were not redeployed during the time periods in which the regulations are active, then all analyses are invalid (this extreme possibility was, of course, ruled out by DeBartolo et al. (1978)). In a more pertinent form, the empirically determined rate and extent of parking redeployment across the ASP regulation cycle provided the best estimate of the parking on the streets at the time of each analyzed accident.

- To relate the incidence of pedestrians on the streets to the ASP regulation cycle phase. Any differences between pedestrian appearance patterns (age groups, location, or activity) related to either: 1) the parked sides of streets vs. the unparked sides during active ASP regulations; or 2) periods of active ASP regulations vs. periods in which ASP regulations are inactive, would be important in relating the rate of pedestrian accidents to pedestrian exposure to traffic conditions. These differences, if documented, would seriously complicate the interpretation of the effects of alternate side parking on pedestrian accident occurrence.

- To relate the incidence of pedestrians on the streets to actual on-street parking patterns. This analysis would have little relevance to the accident rate analysis, but would be very important to recommendations based on the analysis. At best, it could define the parking conditions which would have the optimal effect on pedestrian safety in such urban areas. In particular, it would establish whether a one-side-only parking ban could affect the pedestrian accident rate or whether it would only modify the pattern of accidents but not the overall rate.

D. Procedure

1. Accident Analysis

The main activities in this study prior to data analysis were related to identifying and collecting the data to be analyzed. It was determined through discussions with officials within the New York City Traffic and Sanitation Departments and with the researchers who had conducted the earlier enforcement and compliance study (DeBartolo et al., 1978), that the assignment of ASP regulations had been virtually constant for at least the past five years, probably much longer.

From DeBartolo's earlier work was obtained a 1975 New York City Sanitation Department Map showing distribution of ASP sites in Manhattan (reproduced in Figure 5). With that guide, all of the streets in the ASP areas were inspected in order to:

- Verify the ASP regulations and that they were indeed posted in those areas.
- Identify areas which were not valid samples of the ASP regulation. Based on this investigation, certain ASP areas (shown blank, i.e., not shaded in Figure 5), were rejected. Those areas, below Central Park and from Third Avenue west, had one or more of the following flaws: atypical ASP rules, only a very small portion of the block actually under ASP regulations, or extensive parking which showed little or no correspondence to any parking regulations.
- Cull any blocks within the acceptable ASP areas which did not follow the ASP rules. Two major kinds of exceptions were seen: 1) metered areas, which followed special ASP regulations banning all parking from both sides from 8 to 9 a.m. Monday through Saturday, and 2) areas which had no ASP rules but banned parking or standing during rush hour periods or all day on weekdays.
- Verify that the ASP regulations were generally complied with throughout the areas of Manhattan not otherwise disqualified.

Computer tapes were obtained, through the cooperation of the Office of Research of the New York State Department of Motor Vehicles, which contained the coded records of all reported pedestrian accidents occurring in Manhattan from 1974 through 1977. There were 16,223 such records. These records contained all the objective information on each accident coded on New York City accident report forms (see Figures B-1 and B-2 in Appendix B) except for personal identifiers such as motor vehicle registration number and driver's license number. The records did not contain any diagram or narrative information describing the accident and often did not contain location information. When location information was provided, it consisted of two four-digit numbers referring to the street on which the accident occurred and the cross street nearest to the accident location.

Figures B-3 and B-4 (Appendix B) show the other way in which pedestrian accidents could enter the New York State file--through accident reports filled out by individuals. These report forms allowed for less information than the police forms and, since they were filled out by untrained and involved parties, their information was suspect. Less than five percent of the accidents were reported on these forms alone and, so, represent a minor segment in the data base.

The list of Manhattan street names and corresponding "location code" numbers was obtained from the New York City Police Department. From that, the street code numbers were divided into three subsets: those of streets entirely within the qualified area, those partly within the qualified area, and those entirely outside the qualified area.

This information was used to select a list of accidents possibly relevant to the study, i.e., those which occurred between 7 a.m. and 2:59 p.m. (or time unknown) and did not involve streets entirely outside the desired area. This yielded a list of 4701 accidents. The New York State file code numbers were printed for this list. From the printed file numbers, DMV personnel pulled the report folders, which included the accident report as well as any supplementary interview or follow-up data. Dunlap and Associates coders worked with all available reports in the DMV offices in Albany.

There were four accident coders. Two had extensive prior experience "retrotyping" pedestrian accident reports according to similar schemes. The other two had worked on pedestrian safety projects but had had no direct experience reading and coding accident reports. All coders received several hours of practice on these specific forms and procedures before leaving for Albany. As part of the actual coding procedure, each coder asked the others for aid in resolving ambiguous or obscure coding problems. Thus, the full level of expertise was available for all coding, regardless of who performed the primary coding of the report.

In addition to the accident report files, each coder had a formatted print-out of certain key information from the computer records on the accident. A major coding subtask was to verify that the computer information was correct, based on the written file, and to fill in any information which did not appear on the computer file.

Coding was performed using forms such as that in Figure B-5 of Appendix B. The basic procedure was as follows:

- Determine whether the accident occurred in the area of Manhattan under study; if not, stop coding.
- Determine whether the pedestrian was struck while in the roadway; if not, stop coding.

- Fill in all coding boxes except those which would duplicate information already correct in the computer file. Four kinds of coding were required:

  - Copying information from the accident form which was incorrect or not present in the computer record (Date, Day of Week, Time, Driver, Age and Sex, Pedestrian Age and Sex, Location Codes)

  - Verifying and correcting, where necessary, codes which were transcribed correctly but were judged to describe the accident improperly (Parked Vehicle Involvement, Pedestrian Action, Direction of Travel, Vehicle Action)

  - Describing the objective components of the accident according to categorizations not used in the original reports (Accident Location, Vehicle Position, Pedestrian Location and Pace, Vehicle Type, Pre-impact Direction)

  - Judging culpability for the accident according to which "actors" in the accident (including Environment) directly caused the accident or made the situation so difficult that other actors, behaving with normal safety, were forced into the accident

Although all coders were aware of the hypotheses of the study, they were not aware of the ASP conditions in force for the accidents they were coding. That is, they were not aware of the ASP regulation (e.g., A2X) governing the site of each accident they coded and they certainly did not spend any time comparing time of day and day of week with possible parking patterns.

In Albany, 3,857 reports were reviewed. Reports from the first few months of 1974 were no longer available (DMV destroys reports more than four years old) and occasionally other reports requested could not be located in the files. Of those reports, 2,433 were coded as being both in the critical ASP area and in the roadway. These forms were keypunched and their data were merged with the existing computer information on the accidents. New data were added and corrections were made to the existing codes as indicated.

Earlier, the physical inspection of the test area in Manhattan had yielded a "map" of blocks which met or did not meet the basic ASP provisions. Based on this information, the knowledge of each accident's location, and knowledge of the generally applicable ASP regulation, codes were attached to each accident computer record for the relevant ASP version and for the ASP parking prescription at the time of the accident.

A list of dates was prepared from the New York City records on which the ASP regulations were suspended (usually due to bad weather or holidays) during the study period (1974-1977). About 20 days were affected each year. The computer records for all accidents occurring on those days were altered to show that no ASP regulation applied on the day of the accident.

These further screens isolated 1,422 accidents which occurred on ASP blocks, of which 835 occurred between 8 a.m. and 2 p.m. on days when the ASP regulations were in force.

These data were then analyzed through crosstabulation procedures. The primary goal was to determine whether any significant relationship existed between ASP-induced parking and accident occurrence rates. Other purposes of the analysis were to describe the data, to describe the distribution of accident factors and circumstances, and to explore key interrelationships among these variables.

2. Behavioral Correlates Analysis

Three routes were chosen in Manhattan between 59th Street and 190th Street with either 48 or 49 blocks selected for observation. The blocks had ASP regulations applicable to both sides of the street and were not so busy as to have double parking at all times. The routes, overall, were chosen so as to sample from all the kinds of areas within Manhattan from which accidents were taken.

Each route was driven twice on each of four or five data collection days. As each of the observation blocks was driven through, trained observers coded time of day, average parking on each side of the street, and pedestrian appearance (by age categories, sex and activity category) on each side of the street.

Data collection occurred between 7 a.m. and 3 p.m., the hours surrounding the ASP times of day and the hours for which accident data were analyzed, on Monday through Saturday, the days of week on which ASP regulations could be in effect. Data were collected in June and early July 1978. Over 20,000 pedestrians were observed in all, nearly 7,000 on blocks on which ASP regulations were in effect at the time of observation.

Analyses were performed relating pedestrian activity to whether or not ASP regulations were in effect and, if they were, whether the pedestrians were on the parked or "clear" side.

a. Preliminary Activities and Observer Training

The observation procedures used in this study evolved through several versions until they reached the forms actually employed. The iterative development of procedures and data collection forms benefitted from the participation of the same individuals who performed all the subsequent data collection. Their assistance in testing the early procedures and in developing the modifications served to acquaint them with the routes and the goals of their data collection and to train them in the actual procedures and judgments needed for the study.

By the time actual data collection began, all coders had spent about a week in activities which provided direct training or otherwise familiarized them with their role in the study. They drove the relevant areas of Manhattan and aided the selection of blocks for actual coding, becoming familiar with the general area, the routes, the coded blocks and the design criteria for block selection. They participated in the critique of the data collection procedures and contributed to the forms revision. They spent nearly half this time in practice coding in Manhattan, usually with more than one person coding simultaneously and with discussions of any coding discrepancies. The project director participated in these activities as well, to determine that all coders had full understanding of their tasks and common criteria for making their coding decisions.

b. Data Collection Procedures

On each day of data collection, the coding team (two or three persons) drove from Connecticut so as to be in Manhattan for data collection beginning at about 7 a.m. and ending at about 3 p.m. Three data collection routes, each passing from the upper east side down to the bottom of Central Park and up the west side, and having 48 or 49 blocks designated for data collection, had been laid out previously. On any given day, one of the three routes was used. The route was driven twice, always in the same order, and the data collection blocks were coded as they were encountered.

At the start of each coding day a "Weather Information" sheet was filled out giving day/date/time of recording and estimated temperature, wind and sky conditions. Information was updated at hourly intervals or whenever significant changes occurred (as when rain began or stopped). The sheet is reproduced in Figure B-6 of Appendix B.

As each observation block of the route was passed, the data coder recorded the incidence of pedestrians according to the classification scheme illustrated by the code sheet shown in Figure B-7 and the diagram in Figure B-8 (Appendix B). (Code sheets had been preset for each block in the route, with all information at the top coded in advance except "Observer" and "Time.") The general instructions shown in Figure 6 governed data coding.

The four coders alternated between driving the routes and coding in two or three person teams. During a single coding day, each member of a team typically drove one trip over the route and coded during the other. For five of the route-trips, two persons coded independently. This provided a check as to the continuing correspondence of coding across coders.

One hundred forty-five blocks in Manhattan, between 59th Street and 190th Street, were chosen for study. Collectively, they provided a broad sampling of the area for which accident results were tallied and encompassed wide and narrow roads, quiet and busy roads, north/south and east/west roads, and ones with normally light and normally heavy parking. For each block, ASP regulations were in effect for at least 80% of both sides of the street, with the remainder in bus stops or loading zones. There were no meters on the chosen blocks, since metered areas were subject to other street-cleaning regulations incompatible with the study. For almost all of the blocks, both sides of the street were built up and devoted to similar purposes (e.g., both residential or both small businesses). The exceptions were some blocks bordering parks, with comparable sidewalk provisions on both sides, and blocks with schools. Although special parking prohibitions are posted by schools, the areas were treated as being signed for normal ASP conditions.

DATA CODING INSTRUCTIONS

As you arrive at each block on the route, you are to record descriptive information for all pedestrians or pedestrian groups active on the block at that point in time. Sometimes this can be done while the car is moving, but it may be necessary to stop while you are writing. In such situations, make sure you code only the pedestrians who are around at a single point in time. Two problems: existing pedestrians may disappear (move to the next block, enter a building, enter a vehicle, etc.) before you code them, and new pedestrians may appear while you are writing. Try to avoid losing data on the former and to avoid coding the latter; but in practice it may be necessary to do some of both in order to record the proper number of pedestrians.

Codes: As you reach each block, record the approximate time of arrival and your initials on the prepared code sheet. Also code the observed level of parking in effect on the two sides of the street (N and S or E and W). Code as an estimated fraction of full parking. "1" is full parking, for example; "0" is no parked/standing vehicles along the block side; "1/2" is about half as many parked/standing vehicles as could be held on the block side; "2" is full parking and full double parking. When estimating the parking disregard parking regulations; "1" means the whole block face parked, including all no parking or no standing zones.

Code each person on the target block as an individual regardless of group membership. Use the left side of the coding sheet for pedestrians on the left side of the street; use the right side for those on the right.

Use position in the grid to indicate pedestrian sex (Male in top third, Female in bottom third, sex not certain from visual cues, in middle third) and pedestrian "age" (columns for each side of the street correspond to ages 0-4, 5-14, 15 and older ("adult"), "handicapped," and unknown age category ["?"]).
Make age judgments visually, according to the following criteria:

0-4:
- a. immature physical development - height and body proportion, facial features, gross motor coordination
- b. activity - not self-directed, limited range of play activity, e.g., running, walking, sitting down or playing in a stationary position, usually restricted to sidewalk
- c. dress

5-14:
- a. More advanced physical development, including gross motor control
- b. Activity - greater mobility, more organized
- c. group membership, especially in a peer group, either "hanging out" or engaged in an activity such as stickball, frisbee, etc.

Adult:
- a. mature, has reached or nearly reached full adult stature
- b. activity - controlled, not as random or abrupt
- c. not "Handicapped"

Handicapped:
- a. may be proceeding with assistance of another person or an aid such as a cane, crutches, or wheelchair, or
- b. using aids found only with blind people, such as red-and-white cane or seeing-eye dog, or
- c. noticeably impaired mobility (e.g., severe limp), or
- d. appearance of extreme age with evident severe limitations in perceptual ability and/or movement speed or flexibility

Figure 6. Coding Instructions for Pedestrian and Parking Observations

Use distinctive marks in the grid to indicate pedestrian location and activity categories:

D - pedestrian "darting" into or across the street with sudden, swift and abrupt movement (need not be running)
X - pedestrian crossing at intersection
M - pedestrian crossing midblock (outside the influence of the intersection controls)
P - pedestrian in the parking lane, not crossing or waiting to cross
T - pedestrian standing or moving in lanes devoted to moving traffic, but not crossing or waiting to cross
1 - (hashmark or simple count) - any other person along the block except those clearly unlikely to contribute to pedestrian traffic (e.g., person sleeping in chair on sidewalk)
s - (as subscript to one of the preceding marks indicating a child) shows that child is supervised by adult or older child controlling/directing that child's activities

Include for coding:

- all pedestrians between the ends of the block
- anyone crossing from the corners of the block being coded
- anyone crossing to the corners of the block across a leg of an intersecting street who reaches the curb by the time coding is begun
- anyone standing on a corner of the block, on the near side of an imaginary line bisecting the 90° angle of the corner

(These rules are summarized in Figure B-8 in Appendix B; coded pedestrians are indicated by solid lines or circles, uncoded ones by dotted lines or circles.)

Figure 6 (continued).

The blocks were randomly assigned to three routes with 48, 48 and 49 blocks in each. The distribution of blocks in each ASP condition is shown, by route, in Table 4.

Table 4. Numbers of Blocks in Each ASP Category, by Route

Route Number	A2X	P2X	A3X	P3X	Total
1	4	5	19	20	48
2	9	6	20	13	48
3	7	8	19	15	49
Total	20	19	58	48	145

Each route was coded on four or five days, over the days of the week that ASP regulations could be in effect, according to the schedule in Table 5. The purpose of this sampling plan was to code each block on several days of the week and under different alternate side conditions, so that each block served to some extent as its own control. Block-by-block, this was less than perfect. Altogether, however, blocks in each ASP version were tested across the possible ASP conditions in comparable numbers. These numbers are summarized in Table 6. This provided design counterbalance, such that the final tabulations of pedestrian distributions by side of street during ASP time periods were nearly independent of geographic side of street, day of week, and ASP version.

Table 5. Coding Days, by Day of Week, by Route

Route Number	Day of Week					
	Mon	Tue	Wed	Thu	Fri	Sat
1	1	1	-	1	1	-
2	1	-	1	1	-	2
3	-	2	1	-	1	1

Table 6. Number of Days Blocks Were Coded under Each ASP Parking Condition, by Route and ASP Version

Route Number	ASP Version	Parking Removed from ... North or West	South or East	Neither Side
1	A2X	8	8	0
	P2X	10	10	0
	A3X	38	38	0
	P3X	40	40	0
2	A2X	18	0	27
	P2X	12	0	18
	A3X	40	60	0
	P3X	26	39	0
3	A2X	0	21	14
	P2X	0	24	16
	A3X	38	57	0
	P3X	30	45	0
All	A2X	26	29	41
	P2X	22	34	34
	A3X	116	155	0
	P3X	96	124	0
	Total	260	342	75

Each block was coded to provide the following information for each side of the street.

- Parking density
- Number of pedestrians in these categories:
  - Sex (Male/Female)
  - Age/agility (0-4 unsupervised, 0-4 adult supervision, 5-14 unsupervised, 5-14 supervised, adult and handicapped)
  - Location/action (crossing at intersection, crossing midblock, not crossing but midstreet, not crossing but in parking lane, "darting" into street, and not crossing/not in street)

From knowledge about the ASP regulations applicable on each block and the day and time the data were coded, the following information was attached to the parking/pedestrian data:

- ASP version (A2X, P2X, A3X or P3X)
- Day of week (Monday through Saturday)
- Time of day
- ASP condition at time of data collection (parking prohibited on north or west side, parking prohibited on south or east side, or parking not prohibited)
- Compass direction of each side of street (north/south/east/west)
- ASP proscription for each coded side (parking prohibited this side, parking prohibited other side, or parking not prohibited)

The data were analyzed through crosstabulation procedures. Primary analyses tabulated ASP proscription against the parking/pedestrian variables to determine whether pedestrian activities or concentrations shifted significantly toward or away from the parking patterns induced by the ASP regulations. Other tabulations were made between parking/pedestrian variables and physical variables such as compass direction of side of street, to verify that any observed changes in the parking/pedestrian variables may be clearly attributed to ASP proscription.

E. Results

1. Accident Analysis

From the review of written accident reports, new information was coded and merged with the computer records. Each data record was also coded for the ASP version covering the accident site and the exact ASP conditions in effect at the time of the accident.

All accident data analyses were performed on this data base. It covered 2,433 accidents in all, although many of these were not actually applicable for specific analyses. For example, 173 accidents were from the wrong area of Manhattan or the wrong time of day. The largest number of excluded accidents (838) occurred on blocks with metered or fully prohibited parking. Of the 1,422 accidents on blocks with the desired ASP parking and occurring between 7 a.m. and 3 p.m., 835 occurred on days when ASP parking regulations were in effect during the exact hours (8 a.m. to 2 p.m.) of the ASP regulations and formed the core of most analyses. The remaining accidents served to establish context and allow comparisons.

Table 7 shows the breakdown of accidents by ASP condition, for midblock accidents and for intersection accidents of two subtypes: those with the vehicle entering the intersection and "other" intersection accidents. This split is of particular relevance to the test of the model parking regulations. The MOPNIC, if effective, would reduce accidents from the "intersection: vehicle entering" category because it would improve visibility in that situation (refer to Figure 4 above) but not for vehicles leaving the intersection or for midblock accidents. The MOSPO would primarily affect accidents in the "midblock" category but would also be expected to affect "intersection: vehicle entering" accidents. Neither regulation would be expected to impact the "intersection: other" accidents. Of those "intersection: other" accidents, 74% involved a vehicle which was exiting the intersection but for 26%, the report failed to provide enough detail to determine whether the vehicle was entering or exiting.

Table 7. Pedestrian Accidents by ASP Conditions by Model Regulations Screen[1]

	ASP Area (no meters)	Meters within ASP Areas	Total
Midblock	537 (23.8)	232 (10.3)	769 (34.0)
Intersection: Vehicle Entering	306 (13.5)	216 (9.6)	522 (23.1)
Intersection: Other	579 (25.6)	390 (17.3)	969 (42.9)
Total	1422 (62.9)	838 (37.1)	2260

[1]Cell entries are frequencies and (percentages).

a. Accident Base Description

In this section, the ASP accident base is described through various tabulations of its major variables of interest. Hypotheses are tested which relate to the the effectiveness of the ASP regulations (and, by inference, the MOSPO and MOPNIC) in reducing pedestrian accidents. In each case, the variable being examined is discussed first, followed immediately by a tabular presentation of the data.

- Time of Day--coded in hours and minutes. On the accident reports, minutes tended to have been rounded to the nearest five minutes or quarter, half, or whole hour rather than being evenly distributed across all values. This introduces little or no bias in the time categories used here.

Table 8. Time of Day by Model Regulations Screen: Accident Frequencies and (Percentages)

	7:00 AM - 7:59 AM	8:00 AM - 8:29 AM	8:30 AM - 10:29 AM	10:30 AM - 10:59 AM	11:00 AM - 11:29 AM
Midblock	9 (0.6)	29 (2.1)	91 (6.4)	38 (2.7)	29 (2.1)
Intersection: Vehicle Entering	10 (0.7)	11 (0.8)	76 (5.4)	14 (1.0)	14 (1.0)
Intersection: Other	18 (1.3)	28 (2.0)	138 (9.8)	23 (1.6)	29 (2.1)
Total	37 (2.6)	68 (4.8)	305 (21.6)	75 (5.3)	72 (5.1)

	11:30 AM - 1:29 PM	1:30 PM - 1:59 PM	2:00 PM - 2:59 PM	Total
Midblock	172 (12.2)	58 (4.1)	107 (7.6)	533 (37.7)
Intersection: Vehicle Entering	92 (6.5)	26 (1.8)	62 (4.4)	305 (21.6)
Intersection: Other	165 (11.7)	57 (4.0)	118 (8.3)	576 (40.7)
Total	429 (30.3)	141 (10.0)	287 (20.3)	1414

- Day of Week--all days of the week were coded even though, for example, Sunday is always exempt from ASP regulations. Table 9 can be seen on the following page.

- Traffic Control--In Manhattan, most intersections are signalized. This is reflected in Table 10 below, for which about 82% of the non-midblock accidents were coded as having red-green-amber signal controls present. Only 1.5% of the intersection accidents were cited as having Stop signs. Eleven percent of the non-midblock crashes were shown as having no controls. This may be due partly to

Table 9. Day of Week by Model Regulations Screen: Accident Frequencies and (Percentages)

	Sunday	Monday	Tuesday	Wednesday	Thursday
Midblock	44 (3.1)	83 (5.8)	78 (5.5)	76 (5.3)	77 (5.4)
Intersection: Vehicle Entering	19 (1.3)	49 (3.4)	62 (4.4)	31 (2.2)	52 (3.6)
Intersection: Other	33 (2.3)	95 (6.7)	97 (6.8)	100 (7.0)	102 (7.2)
Total	96 (6.8)	227 (16.0)	237 (16.7)	207 (14.6)	231 (16.2)

	Friday	Saturday	Total
Midblock	98 (6.9)	81 (5.7)	537 (37.8)
Intersection: Vehicle Entering	59 (4.1)	34 (2.4)	306 (21.5)
Intersection: Other	95 (6.7)	57 (4.0)	579 (40.7)
Total	252 (17.7)	172 (12.1)	1422

vehicles at intersections with stop signs on the cross streets, but most of these crashes were probably cases for which the person filling out the accident report simply failed to note the applicable intersection controls. Note that for 24% of the midblock accidents, the nearest intersection was judged close enough for the accident report to list standard intersection controls.

Table 10. Traffic Control by Model Regulations Screen: Accident Frequencies and (Percentages)

	None	Red-Yellow-Green Signal	Stop/Yield Sign	Other	Total
Midblock	365 (25.7)	125 (8.8)	4 (0.3)	43 (3.0)	537 (37.8)
Intersection: Vehicle Entering	40 (2.8)	250 (17.6)	5 (0.3)	11 (0.7)	306 (21.5)
Intersection: Other	59 (4.1)	476 (33.5)	8 (0.6)	36 (2.5)	579 (40.7)
Total	464 (32.6)	851 (59.8)	17 (1.2)	90 (6.3)	1422

- Type of Area--for the first 19 months covered by the data, accident report forms described the type of land use for the area surrounding the accident sites. About half were listed as residential, 28% were business/shopping (the latter compares with 54% in the accidents rejected from this sample because they occurred at sites with parking meters or parking prohibitions). Ten percent of all the accidents occurred near school playgrounds.

Table 11. Land Usage (through December, 1975) by Model Regulations Screen: Accident Frequencies and (Percentages)

	School Playground	1&2 Family Residences	Apartment Residences	Business-Shopping Areas	Industrial Areas
Midblock	45 (7.0)	7 (1.2)	124 (19.4)	39 (6.1)	3 (0.5)
Intersection: Vehicle Entering	1 (0.1)	4 (0.6)	62 (9.7)	49 (7.7)	
Intersection: Other	19 (3.0)	7 (1.1)	110 (17.2)	92 (14.4)	1 (0.1)
Total	65 (10.2)	18 (2.8)	296 (46.3)	180 (28.2)	4 (0.6)

Table 11 (Continued). Land Usage (through December, 1975) by Model Regulations Screen: Accident Frequencies and (Percentages)

	Parks and Camping Areas	Other	Total
Midblock	1 (0.1)	26 (4.1)	245 (38.3)
Intersection: Vehicle Entering		10 (1.6)	126 (19.7)
Intersection: Other	2 (0.3)	37 (5.8)	268 (41.9)
Total	3 (0.5)	73 (11.4)	639

- Weather Conditions. For 86% of the crashes, the weather was clear or cloudy. For only about 10% of the cases was precipitation occurring.

Table 12. Weather by Model Regulations Screen: Accident Frequencies and (Percentages)

	Clear	Cloudy	Rain	Snow	Other	Total
Midblock	396 (27.8)	74 (5.2)	36 (2.5)	9 (0.6)	22 (1.5)	537 (37.8)
Intersection: Vehicle Entering	232 (16.3)	48 (3.4)	19 (1.3)	3 (0.2)	4 (0.3)	306 (21.5)
Intersection: Other	401 (28.2)	73 (5.1)	64 (4.5)	10 (0.7)	31 (2.2)	579 (40.7)
Total	1029 (72.4)	195 (13.7)	119 (8.4)	22 (1.5)	57 (4.0)	1422

- Hit-and-Run Accidents. Hit-and-run occurred in about 7% of the accident sample. They tended to be more frequently intersection than midblock (8.7% vs. 4.7%). Hit-and-run accident data are less reliable because they are based on information from only one party and often include no on-site police investigation. They represent only a minor component of this data base, however.

Table 13. Hit/Skip by Model Regulations Screen: Accident Frequencies and (Percentages)

	Yes	No	Total
Midblock	25 (1.8)	512 (36.0)	537 (37.8)
Intersection: Vehicle Entering	25 (1.8)	281 (19.8)	306 (21.5)
Intersection: Other	52 (3.7)	527 (37.1)	579 (40.7)
Total	102 (7.2)	1320 (92.8)	1422

- Pedestrian Sex. Fifty-seven percent of all involved pedestrians were male. At intersections, males and females were nearly equally represented; for midblock accidents, however, males were 70% of the victims.

Table 14. Pedestrian Sex by Model Regulations Screen: Accident Frequencies and (Percentages)

	Male	Female	Unknown	Total
Midblock	376 (26.4)	154 (10.8)	7 (0.5)	537 (37.8)
Intersection: Vehicle Entering	161 (11.3)	142 (10.0)	3 (0.2)	306 (21.5)
Intersection: Other	275 (19.3)	297 (20.9)	7 (0.5)	579 (40.7)
Total	812 (57.1)	593 (41.7)	17 (1.2)	1422

- Pedestrian Age. About 28.5% of all pedestrians were 14 years of age or younger, with the largest percentage of children in the midblock accidents (43%); the next largest in the "Intersection: Vehicle Entering" accidents (25%), and the smallest representation in the "Intersection: Other" accidents (17%). This is consistent with other research which regularly has shown an overrepresentation of children in the midblock and dart-and-dash types of accidents.

  For older pedestrians, the pattern reverses. Above age 40, relatively few pedestrians are struck midblock (23%) compared with those in accidents with the vehicle entering the intersection (41%) or in other intersection accidents (45%). Nearly 12% of all crash involved pedestrians were more than 70 years old.

  (For the accidents from these sections of Manhattan but rejected because of meters or parking prohibitions, only 14% of the cases involved child pedestrians; 16% involved pedestrians over 70.)

Table 15. Pedestrian Age by Model Regulations Screen: Accident Frequencies and (Percentages)

	1-14	15-24	25-49	50-69	70+
Midblock	229 (16.1)	41 (2.9)	122 (8.6)	60 (4.2)	31 (2.2)
Intersection: Vehicle Entering	76 (5.3)	37 (2.6)	63 (4.4)	53 (3.7)	46 (3.2)
Intersection: Other	100 (7.0)	62 (4.4)	140 (9.8)	117 (8.2)	88 (6.2)
Total	405 (28.5)	140 (9.8)	325 (22.9)	230 (16.2)	165 (11.6)

	Unknown	Total
Midblock	54 (3.8)	537 (37.8)
Intersection: Vehicle Entering	31 (2.2)	306 (21.5)
Intersection: Other	72 (5.1)	579 (40.7)
Total	157 (11.0)	1422

- Pedestrian Age and Sex Interaction. Table 16 below shows the distribution of pedestrian age by sex for all accidents. Males are overrepresented until age 9, underrepresented above age 60, and at a nearly constant value of 55-60% in between those ages, except for a slight increase to 67% between 30 and 39.

  The pedestrian age and sex distribution followed this general pattern for the Model Regulations Screen categories, with some significant variations. For accidents with vehicles entering intersections, males were a nearly constant 60% of the cases up to age 59 and fell sharply to 33% at age 60 and older. For other intersection crashes, males were only about 50% of the distribution up to age 39 and dropped slightly to about 44% of the distribution above age 40. At midblock locations, accident victims were 85% male up to age 4, a relatively stable 75% until age 49, and gradually decreased above that to a low figure of 55% for age 70 and older.

Table 16. Pedestrian Age by Sex: Accident Frequencies and (Percentages)

	1-4	5-14	15-24	25-49	50-69
Male	26 (2.1)	232 (18.6)	80 (6.4)	201 (16.1)	118 (9.5)
Female	9 (0.7)	119 (9.6)	60 (4.8)	124 (10.0)	112 (9.0)
Total	35 (2.8)	351 (28.2)	140 (11.2)	325 (26.1)	230 (18.5)

	70+	Total
Male	71 (5.7)	728 (58.4)
Female	94 (7.5)	518 (41.6)
Total	165 (13.2)	1246

- Pedestrian Action. Almost 19% of all the accidents included mention by the original reporter that the pedestrian stepped from behind a parked vehicle. This is very likely an understatement of the facts; nevertheless, 41% of the midblock accidents referenced parked vehicle involvement. For intersection accidents with vehicle entering, more frequent mention of parked vehicles (6.5%) was noted than in the cases of exiting or uncertain location accident vehicles (4.8%).

Table 17. Pedestrian Action by Model Regulations Screen: Accident Frequencies and (Percentages)

	Crossing with Signal	Crossing against Signal	Crossing, No Signal; Marked Crosswalk	Crossing, No Signal; No Crosswalk	From in Front/Behind Parked Veh.
Midblock	18 (1.3)	23 (1.6)	8 (0.6)	125 (8.8)	222 (15.6)
Intersection: Vehicle Entering	103 (7.2)	100 (7.0)	12 (0.8)	20 (1.4)	20 (1.4)
Intersection: Other	270 (19.0)	140 (9.8)	19 (1.3)	38 (2.7)	28 (2.0)
Total	391 (27.5)	263 (18.5)	39 (2.7)	183 (12.9)	270 (19.0)

	Pushing/ Working on Car	Working in Roadway	Playing in Roadway	Other	Total
Midblock	7 (0.5)	13 (0.9)	21 (1.5)	100 (7.0)	537 (37.8)
Intersection: Vehicle Entering	2 (0.1)	8 (0.6)	2 (0.1)	39 (2.7)	306 (21.5)
Intersection: Other	1 (0.1)	6 (0.4)	8 (0.6)	69 (4.9)	579 (40.7)
Total	10 (0.7)	27 (1.9)	31 (2.2)	208 (14.6)	1422

- Pedestrian Pace. Almost half of the accident reports contained no information on pedestrian pace. Of the remaining cases, 60% of the midblock accidents involved "darting" or running pedestrians; this was true for only 36% of accidents with vehicles entering intersections and 27% of the other intersection accidents.

Table 18. Pedestrian Pace by Model Regulations Screen: Accident Frequencies and (Percentages)

	Stationary	Walking	"Darting"	Running	Pace Unknown or Other	Total
Midblock	53 (3.7)	75 (5.3)	118 (8.3)	90 (6.3)	201 (14.1)	537 (37.8)
Intersection: Vehicle Entering	30 (2.1)	87 (6.1)	20 (1.4)	44 (3.1)	125 (8.8)	306 (21.5)
Intersection: Other	13 (0.9)	148 (10.4)	16 (1.1)	45 (3.2)	357 (25.1)	579 (40.7)
Total	96 (6.8)	310 (21.8)	154 (10.8)	179 (12.6)	683 (48.0)	1422

- Pedestrian Crossing Position. Overall, 91% of the pedestrians for whom this could be determined were judged to be crossing rather than staying in the street. Of those whose half of crossing could be judged, 80% were in the first half of the roadway. The percentage was slightly higher at midblock locations (83%) than elsewhere (79%).

Table 19. Pedestrian Crossing Position by Model Regulations Screen: Accident Frequencies and (Percentages)

	Crossing First Half	Crossing Second Half	Crossing (Not Further Specified)	Staying in Street	Action Unknown or Other	Total
Midblock	268 (18.8)	53 (3.7)	95 (6.7)	76 (5.3)	45 (3.2)	537 (37.8)
Intersection: Vehicle Entering	164 (11.5)	49 (3.4)	56 (3.9)	27 (1.9)	10 (0.7)	306 (21.5)
Intersection: Other	264 (18.6)	67 (4.7)	178 (12.5)	21 (1.5)	49 (3.4)	579 (40.7)
Total	696 (48.9)	169 (11.9)	329 (23.1)	124 (8.7)	104 (7.3)	1422

- Driver Age and Sex. In this accident sample, the vast majority of drivers were male, 88.6% of those whose sex was known. The distribution was stable across age categories. Forty-six percent of drivers were 20 to 39 years of age, while about 3% were 19 or younger. Only 8% were 60 or older.

Table 20. Driver Age and Sex Distribution: Accident Frequencies and (Percentages)

	1-17	18-19	20-29	30-49	50-69
Male	9 (0.7)	27 (2.2)	316 (25.6)	469 (38.0)	247 (20.0)
Female	2 (0.2)	2 (0.2)	41 (3.3)	68 (5.5)	25 (2.0)
Total	11 (0.9)	29 (2.3)	357 (28.9)	537 (43.5)	272 (22.0)

Table 20 (Continued). Driver Age and Sex Distribution: Accident Frequencies and (Percentages)

	70+	Total
Male	26 (2.1)	1094 (88.6)
Female	3 (0.2)	141 (11.4)
Total	29 (2.3)	1235

- Vehicle Type. Most striking vehicles were cars (60%). Taxis (13%) and trucks (12%) were the next most frequent types, followed by station wagons or small vans (6%), buses (2.5%) and motorcycles (1%). Cars were most heavily involved in midblock crashes (67%) and least often in the intersection (other) accidents (52%), although the overall distribution of vehicle types was similar across locations.

Table 21. Vehicle Type by Model Regulations Screen: Accident Frequencies and (Percentages)

	Car	Station Wagon, Small Van	Taxi	Bus	Motor-cycle
Midblock	358 (25.2)	32 (2.2)	61 (4.3)	9 (0.6)	4 (0.3)
Intersection: Vehicle Entering	186 (13.1)	18 (1.3)	28 (2.0)	8 (0.6)	1 (0.1)
Intersection: Other	303 (21.3)	30 (2.1)	95 (6.7)	18 (1.3)	9 (0.6)
Total	847 (59.6)	80 (5.6)	184 (12.9)	35 (2.5)	14 (1.0)

Table 21 (Continued). Vehicle Type by Model Regulations Screen: Accident Frequencies and (Percentages)

	Truck	Other or Unknown	Total
Midblock	53 (3.7)	20 (1.4)	537 (37.8)
Intersection: Vehicle Entering	39 (2.7)	26 (1.8)	306 (21.5)
Intersection: Other	79 (5.6)	45 (3.2)	579 (40.7)
Total	171 (12.0)	91 (6.4)	1422

- Vehicle Action. For the midblock and intersection (vehicle entering) accidents, most of the striking vehicles (75% and 84%, respectively) were going straight ahead, although a significant number (9% and 13%, respectively) were backing. Only 10% of vehicles entering the intersection were coded as turning. For other intersection accidents, however, most of which involved vehicles exiting intersections, 54% were going straight but fully 39% were turning; only 5% were backing.

Table 22. Vehicle Action by Model Regulations Screen: Accident Frequencies and (Percentages)

	Straight	Straight but Busy	Right Turn	Left Turn	Related to Parking
Midblock	435 (30.6)	15 (1.0)	3 (0.2)	5 (0.4)	20 (1.4)
Intersection: Vehicle Entering	205 (14.4)	25 (1.8)	17 (1.2)	15 (1.0)	3 (0.2)
Intersection: Other	287 (20.2)	23 (1.6)	78 (5.5)	149 (10.5)	7 (0.5)
Total	927 (65.2)	63 (4.4)	98 (6.9)	169 (11.9)	30 (2.1)

Table 22 (Continued). Vehicle Action by Model Regulations Screen: Accident Frequencies and (Percentages)

	Backing	Other	Total
Midblock	47 (3.3)	12 (0.8)	537 (37.8)
Intersection: Vehicle Entering	40 (2.8)	1 (0.1)	306 (21.5)
Intersection: Other	31 (2.2)	4 (0.3)	579 (40.7)
Other	118 (8.3)	17 (1.2)	1422

- Parked Vehicle Involvement. Careful attention was paid to the possibility of parked vehicle involvement in the reading of all accident reports. Parked vehicles were cited as relevant to the accidents in 48% of all midlblock cases, but for only 8.5% of the accidents with vehicles entering the intersections and 5.9% of other intersection crashes. Parked vehicle involvement was ruled out, either because of explicit denial on the report or because it was judged that the accident, based on the scenario, could not have been influenced by parked vehicles, in 19%, 49% and 74% of the crashes respectively.

Table 23. Parked Vehicle Involvement by Model Regulations Screen: Accident Frequencies and (Percentages)

	Parked Vehicle Cited	Parked Vehicle Impossible	Other	Total
Midblock	256 (18.0)	102 (7.2)	179 (12.6)	537 (37.8)
Intersection: Vehicle Entering	26 (1.8)	149 (10.5)	131 (9.2)	306 (21.5)
Intersection: Other	34 (2.4)	429 (30.2)	116 (8.1)	579 (40.7)
Total	316 (22.2)	680 (47.8)	426 (30.0)	1422

- ASP Regulation Version. Proportions of intersection (vehicle entering), midblock and other intersection accidents varied significantly by ASP regulation version in force. Overrepresentations of midblock accidents were matched by underrepresented other intersection accidents, and vice versa. No clear explanation for this discrepancy can be advanced, although it may be tied to consistent differences in the pedestrian or vehicular traffic patterns between the areas. Because subsequent analyses collapse across ASP regulation subtypes, this observed variability does not influence later evaluations.

Table 24. ASP Regulation Version by Model Regulations Screen: Accident Frequencies and (Percentages)

	2AX	2PX	3AX	3PX	Total
Midblock	73 (5.1)	79 (5.6)	203 (14.3)	182 (12.8)	537 (37.8)
Intersection: Vehicle Entering	57 (4.0)	62 (4.4)	81 (5.7)	106 (7.4)	306 (21.5)
Intersection: Other	143 (10.0)	133 (9.4)	170 (12.0)	133 (9.4)	579 (40.7)
Total	273 (19.2)	274 (19.3)	454 (31.9)	421 (29.6)	1422

b. Parking and Accident Rates

The basic paradigm of comparison is shown below; time of day and ASP regulation type were cross-tabulated to provide a 2 by 2 Table.

	Time of Day	
Sites	8 am - 11 am	11 am - 2 pm
A_X	a	b
P_X	c	d

Cell entries are accident frequencies. Cells a and d contain accidents occurring when the ASP regulations were in effect at the accident locations. Cells b and c contain accidents in the same set of blocks (b as a, c as d) and during the same hours of the day (c as a, b as d) but when the ASP regulations were not in effect. If parking removal/redeployment as caused by the ASP regulations was associated with lower accident rates, then a x d should be smaller than b x c.

In the full analysis of the accident data, the basic grid shown above was divided into more cells in order to provide for the additional qualifications and complexities of the actual situation and in order to test the various ways in which ASP regulations could possibly influence accident rates. The following distinctions were made:

- Within each period, accidents were separated into test (occurred on an ASP day between 8:00 am and 1:59 pm) and control cases (occurred between 7:00 am and 7:59 am or between 2:00 pm and 2:59 pm or on any not-ASP day). The control cases were only indirectly used in the analyses, to check the context in which other data trends occurred.

- Each ASP period was subdivided into its middle two hours (8:30 am - 10:29 am and 11:30 am - 1:29 pm), in which parking compliance was uniformly good, and its first and last half hours, in which parking compliance was poorer. The most sensitive tests of ASP accident reduction should be those based on the middle hours, although tests based on the full time periods should also be valid.

- On days when ASP regulations were in effect, accidents were divided by the side of the street from which the pedestrian entered to be struck. Pedestrians were coded as entering from the no-parking side, the side opposite the no-parking side, or "unknown side". The last category was inportant to the analyses since it included nearly 41% of the ASP day accidents, a percentage this high because of the vagueness of the original accident reports. Note that, for accidents in which the pedestrian entered from the no-parking side, the side was fully parked during the hours that ASP regulations were not in effect (i.e., 11:00 am - 1:59 pm for the A_X sites and 8:00 am - 10:59 am for the P_X sites).

Data tables based on the full elaboration of these variables, together with a more detailed explanation of the analysis paradigm and procedure, are given in Appendix C. The most important comparisons have been extracted and are shown below.

Before describing specific comparisons, however, a summary point should be made. For the analyses performed, no significant relationship between ASP parking changes and accident rates was observed. (In the analyses shown in Appendix C, 120 Chi-Square tests were performed and it would be expected that, by chance alone, 6 of those values would be "significant" at the $p < .05$ level. This was exactly the case. Since there were no extremely large Chi-Square values and since the "significant" tests followed no easily discernable pattern, the distribution was judged to show no real effects.)

- For all accidents occurring during ASP times on ASP days, there was a slight (7.5%) increase in accidents when the ASP regulations were in effect. This difference was not significant ($\chi^2 = 1.06$, 1 d.f.). The additional ASP period accidents tended to occur in the "unknown side" category, no reasonable explanation can account for this.

Table 25. All ASP-Day Pedestrian Accidents: Frequencies and (Percentages)

	Pedestrian Origin	Time of Day: 8:00 am - 10:59 am	Time of Day: 11:00 am - 1:59 pm	Total
A_X Areas	No-Parking Side	41 (4.9)	69 (8.3)	110 (13.2)
	Opposite Side	53 (6.3)	68 (8.1)	121 (14.5)
	Unknown Side	88 (10.5)	105 (12.6)	193 (23.1)
	All Origins	182 (21.8)	242 (29.0)	424 (50.8)
P_X Areas	No-Parking Side	40 (4.8)	65 (7.8)	105 (12.6)
	Opposite Side	55 (6.6)	57 (6.8)	112 (13.4)
	Unknown Side	67 (8.0)	127 (15.2)	194 (23.2)
	All Origins	162 (19.4)	249 (29.8)	411 (49.2)
Total		344 (41.2)	491 (58.8)	835

- Midblock accidents were those most probably relevant to the MOSPO. These accidents showed no meaningful patterns suggesting a change in accident rates when the ASP parking regulations were in effect. As in the preceding table, a slight (8.1%) overall increase in accidents with ASP in effect occurred and was entirely due to the accidents in which pedestrian direction of crossing could not be determined.

Table 26. Midblock ASP-Day Accidents: Frequencies and (Percentages)

Pedestrian Origin		Time of Day: 8:00 am - 10:59 am	Time of Day: 11:00 am - 1:59 pm	Total
A_X Areas	No-Parking Side	13 (4.0)	23 (7.1)	36 (11.0)
	Opposite Side	17 (5.2)	31 (9.5)	48 (14.7)
	Unknown Side	35 (10.7)	48 (14.7)	83 (25.5)
	All Origins	65 (19.9)	102 (31.3)	167 (51.2)
P_X Areas	No-Parking Side	14 (4.3)	22 (6.7)	36 (11.0)
	Opposite Side	17 (5.2)	24 (7.4)	41 (12.6)
	Unknown Side	25 (7.7)	57 (17.5)	82 (25.2)
	All Origins	56 (17.2)	103 (31.6)	159 (48.8)
Total		121 (37.1)	205 (62.9)	326

- Accidents which occurred when the striking vehicle was approaching the intersection were relevant to both the MOPNIC and the MOSPO. Again, no effects approached significance although there were moderate increases in accident rates when ASP was in effect, over all conditions except the subset of accidents with the pedestrian entering from the fully-parked side of the street.

Table 27. Intersection (Vehicle Entering) ASP-Day Accidents: Frequencies and (Percentages)

	Pedestrian Origin	Time of Day: 8:00 am - 10:59 am	Time of Day: 11:00 am - 1:59 pm	Total
A_X Areas	No-Parking Side	11 (5.8)	14 (7.3)	25 (13.1)
	Opposite Side	12 (6.3)	13 (6.8)	25 (13.1)
	Unknown Side	18 (9.4)	16 (8.4)	34 (17.8)
	All Origins	41 (21.5)	43 (22.5)	84 (44.0)
P_X Areas	No-Parking Side	10 (5.2)	17 (8.9)	27 (14.1)
	Opposite Side	18 (9.4)	17 (8.9)	35 (18.3)
	Unknown Side	18 (9.4)	27 (14.1)	45 (23.6)
	All Origins	46 (24.1)	61 (31.9)	107 (56.0)
Total		87 (45.5)	104 (54.5)	191

- Accidents occurring at intersections with striking vehicles exiting the intersection (or with vehicles whose locations could not be determined) are shown below. They would not be expected to show ASP/not-ASP differences because, for vehicles striking pedestrians as they exit intersections, parked vehicles should not be in a position for visual screening. As with the other tables, no overall significant difference was observed. Although accidents with the pedestrian leaving the unparked side decreased when ASP regulations were in effect, the decrease was almost entirely counterbalanced by an increase in accidents during ASP in which the pedestrian's origin was unknown.

Table 28. Intersection (Vehicle Exiting or Position Unknown) ASP-Day Accidents: Frequencies and (Percentages)

	Pedestrian Origin	Time of Day		Total
		8:00 am - 10:59 am	11:00 am - 1:59 pm	
A_X Areas	No-Parking Side	7 (2.3)	32 (10.4)	39 (12.7)
	Opposite Side	24 (7.8)	24 (7.8)	48 (15.6)
	Unknown Side	35 (11.4)	41 (13.3)	76 (24.7)
	All Origins	66 (21.4)	97 (31.5)	163 (52.9)
P_X Areas	No-Parking Side	16 (5.2)	26 (8.4)	42 (13.6)
	Opposite Side	20 (6.5)	16 (5.2)	36 (11.7)
	Unknown Side	24 (7.8)	43 (14.0)	67 (21.8)
	All Origins	60 (19.5)	85 (27.6)	145 (47.1)
Total		126 (40.9)	182 (59.1)	308

- Children are regularly struck in dart and dash accidents and are thought to be the population group most likely to be affected by parking removal. In these data, pedestrian accident rates for children decreased by 4.1% when ASP regulations were active, a minor improvement not approaching statistical significance. Examination of the midblock and vehicle-entering-intersection accidents with children, the subsets most likely to be affected by parking removal, showed no improvement.

Table 29. ASP-Day Accidents with Children through Age 12: Frequencies and (Percentages)

Pedestrian Origin		Time of Day: 8:00 am - 10:59 am	Time of Day: 11:00 am - 1:59 pm	Total
A_X Areas	No-Parking Side	13 (5.7)	21 (9.2)	34 (14.8)
	Opposite Side	16 (7.0)	29 (12.7)	45 (19.7)
	Unknown Side	13 (5.7)	27 (11.8)	40 (17.5)
	All Origins	42 (18.3)	77 (33.6)	119 (52.0)
P_X Areas	No-Parking Side	11 (4.8)	16 (7.0)	27 (11.8)
	Opposite Side	18 (7.9)	19 (8.3)	37 (16.2)
	Unknown Side	12 (5.2)	34 (14.8)	46 (20.1)
	All Origins	41 (17.9)	69 (30.1)	110 (48.0)
Total		83 (36.2)	146 (63.8)	229

- Parked vehicles could be cited as contributory on the accident reports, and they actually were cited on 316 reports, 189 of which occurred on ASP days between 8 am and 2 pm. This was only 22% of all ASP-area accidents, 48% of midblock accidents and only 7% of intersection accidents. Because of the known heavy parking in the accident areas, these figures almost certainly underestimate the number of accidents in which parked vehicles were stationed between the pedestrian and the striking vehicle. One would expect fewer parked vehicle citations for accidents with the pedestrian coming from the side with no parking. The evidence supports this, but only partially; of the parked-vehicle-cited accidents with known pedestrian origin, only 40% (49 of 122) were no-parking-side pedestrian origin, statistically significant ($z = -2.17$, $p < .05$). However, this difference was primarily due to the hours in which the ASP regulations were not in effect. In general, in the table below, there were no credible ASP/not-ASP differences.

Table 30. ASP-Day Accidents with Parked Vehicles Cited: Frequencies and (Percentages)

	Pedestrian Origin	Time of Day		Total
		8:00 am - 10:59 am	11:00 am - 1:59 pm	
A_X Areas	No-Parking Side	7 (3.7)	19 (10.1)	26 (13.8)
	Opposite Side	11 (5.8)	28 (14.8)	39 (20.6)
	Unknown Side	14 (7.4)	17 (9.0)	31 (16.4)
	All Origins	32 (16.9)	64 (33.9)	96 (50.8)
P_X Areas	No-Parking Side	7 (3.7)	16 (8.5)	23 (12.2)
	Opposite Side	18 (9.5)	16 (8.5)	34 (18.0)
	Unknown Side	9 (4.8)	27 (14.3)	36 (19.0)
	All Origins	34 (18.0)	59 (31.2)	93 (49.2)
Total		66 (34.9)	123 (65.1)	189

Further data displays in Appendix C show other splits of the accident data. Although there are some details which appear not to be chance perturbations and which have plausible explanations, the full analysis suggests that there are no real differences in accident rates associated with the parking changes caused by the ASP regulations. The implications of this conclusion will be discussed in Section F below.

2. Behavioral Correlates Analysis

a. Weather

Data were collected in June and July on fourteen days of generally excellent weather. The only precipitation on blocks during data coding was on the first day; it lasted about 10 minutes, during which four blocks were coded. Overall, the sky was characterized as predominantly bright on six days, predominantly hazy on five days and primarily cloudy on the remaining three days.

Winds were characterized as "light" throughout. Temperatures were estimated to range from lows of sixties and seventies (one reading of 54^{o}) to highs of seventies and eighties (one reading of 90^{o}). Subjectively, the data collection days were comfortable or warm, with two or three "hot" days. Temperatures never seemed oppressive, as they often are in Manhattan in the summer.

In general, then, the weather was uniformly supportive of outdoor activities. There is no reason to believe that any data collection days or time periods (except for the one rain shower) were uniquely impacted by weather factors.

b. Coding and Analysis Overview

The results of the observations were keypunched such that each datum was a frequency, the number of people counted, with these descriptors:

- Route, block number and side of street (left or right)
- Date and time
- Observer number
- Day of week
- Parking density on that side of the street
- Pedestrian sex
- Pedestrian age/supervision category
- Pedestrian location/activity category

These data were combined with information about each block (compass equivalents of left and right sides, ASP regulation version) and information about how each ASP version related to time of day and day of week, to add these descriptors for each observed pedestrian:

- Side of street (N/S/E/W)
- ASP regulation version (A2X/P2X/A3X/P3X)
- ASP configuration at time of observation (parking prohibited on pedestrian's side/parking prohibited on other side/day of ASP regulation but not time of parking prohibition/day of no ASP impact [A2X and P2X only])

For two full days of data collection, pairs of coders riding in the same car recorded observations in parallel. The reliability of the independent coding was extremely high. For estimates of parking density, for the four half-days of duplicate coding, inter-observer correlations ranged from .91 to .97 with an average of .93 when data were compared by side of block. For pedestrian counts on each block side, the correlations ranged from .85 to .96; the average was .92.

In coding the data from these days, the observations of the two coders were averaged. This was done based on the smallest data categories available, i.e., sex/age/location category for the same side of the street, on a block-by-block coding time basis. Because many of the numbers were small, the averages were rounded to the nearest odd integer. This prevented the loss of unsupported observations, i.e., a single pedestrian in one category reported by only one coder: The average (.5) rounded to 1 rather than 0. As a general procedure, this would not introduce bias to the data. However, because the frequency of single unsupported entries tended to be larger than that of other kinds of odd observations, this procedure did slightly bias the data toward reporting more pedestrians for the blocks coded by pairs of observers. The bias was extremely small, however, and independent of any of the comparisons to be reported below.

Although the observation procedures allowed coders to mark pedestrians as "unknown" on sex or age, this option was taken extremely infrequently. Approximately 0.2% of all pedestrians were coded with sex unknown, most of whom were young children. None were coded with age unknown. The few cases where sex was unknown were assigned to categories according to the male/female ratio observed among the remaining pedestrians on that block during that observation.

For the primary analyses, a data file was generated with one record per coded pedestrian. Each record was tagged with all of the site information shown above. This data set formed the basic source of data for the analysis described below.

c. Parking, Time of Day and ASP Regulations

These initial tabulations were undertaken to describe the degree to which parking patterns followed the prescriptions of the ASP regulations.

Parking densities tended to be heavy in the areas of Manhattan studied. Therefore the ASP regulations had a significant number of vehicles to displace when they operated. And, to the extent that the vehicles were moved, an excess number of vehicles had to be accommodated elsewhere during those time periods. The results of these dynamics are shown in Table 31.

During ASP times, that is when parking was actually prohibited on one side of the street, parking had shifted. Overall, on the side where parking was prohibited, parked vehicles covered an average of 21% of the curb length. The best compliance was found during the middle of the prohibited period; the poorest in the time interval covering the last 15 minutes of the prohibited period. Then, almost half the curb length was parked as drivers moved their cars back in anticipation of the end of the prohibition. On the side opposite the prohibited side, parking averaged full parking plus about one quarter double parking. The pattern over time was the inverse of the prohibited side; parking was heaviest during the middle of the ASP periods and eased off at the ends of the periods.

These numbers are in close agreement with parking measurements made by DeBartolo et al. (1978) in 1977, a time period covered by the accident data.

On the days when the ASP regulations were in effect but during the times when they did not apply, parking was steady at an average of 84% of full parking capacity, across both sides of the street. This was consistently lighter than the days when ASP regulations were not in effect at all; then parking averaged 98% full. This difference may signify that days of ASP regulations "stir up" the parking even during unaffected hours, thus reducing the parking density slightly. The difference is minor, however, and may be due to the fact that only A2X and P2X sites entered the "not ASP day" category and all sites were involved in "not ASP time of day."

Table 31. Actual Parking Densities by Time of Day and ASP Configuration[1]

	Time of Day							
ASP Configuration	Early 7:00 - 7:45 am	AM Change 7:46 - 8:15 am	AM ASP 8:16 - 10:45 am	Middle Change 10:46 - 11:15 am	PM ASP 11:16 - 1:45 pm	PM Change 1:46 - 2:15 pm	Late 2:16 - 3:00 pm	Mean
ASP On-- No Parking This Side		.28	.16	.42	.15	.55		.21
ASP On-- No Parking Other Side		1.09	1.29	1.01	1.34	1.24		1.27
ASP Off-- Not ASP Time of Day	.66	.88	.78	.83	.87	.88	.90	.84
ASP Off-- Not ASP Day	.87	.94	.99	.99	.99	.95	1.02	.98
Mean	.69	.83	.77	.76	.83	.89	.93	.82

[1]All entries are average parking densities; 0.0 = no parking, 1.0 = full parking, 2.0 = complete double parking.

Table 32 illustrates this point. The different ASP versions are not present in all cells which made up Table 31 and comparisons between cells which draw on different ASP areas must be made cautiously. This imbalance has relatively little impact on the remaining analyses, however, which combine readings across times of the day.

Table 32. ASP Regulation Versions Which Could Enter into Locations of ASP Configuration

ASP Configuration	Time of Day									
	Early	AM Change		AM ASP	Middle Change		PM ASP	PM Change		Late
	7:00 - 7:45 am	7:46 - 7:59 am	8:00 - 8:15 am	8:16 - 10:45 am	10:46 - 10:59 am	11:00 - 11:15 am	11:16 - 1:45 pm	1:46 - 1:59 pm	2:00 - 2:15 pm	2:16 - 3:00 pm
ASP On—No Parking due to ASP	no	no	A2X A3X	A2X A3X	A2X A3X	P2X P3X	P2X P3X	P2X P3X	no	no
ASP Off—Not ASP Time of Day	A2X A3X P2X P3X	A2X A3X P2X P3X	P2X P3X	P2X P3X	P2X P3X	A2X A3X	A2X A3X	A2X A3X	A2X A3X P2X P3X	A2X A3X P2X P3X
ASP Off—Not ASP Day	A2X P2X	A2X P2X	A2X P2X	A2X P2X	A2X P2X	A2X P2X	A2X P2X	A2X P2X	A2X P2X	A2X P2X

d. Pedestrian Characteristics

In the course of the study, slightly more than 20,000 pedestrians were observed and coded. Since approximately 1350 blocks were coded (48 or 49 blocks per route x 4 or 5 days per route x 3 routes x 2 times per block per day), this meant that approximately 15 pedestrians were tallied for each block coded. In all, only 0.8% of pedestrians were judged handicapped by the criteria above, half males and half females.

Table 33 shows the distribution of pedestrians by age and sex. Among the youngest children, about half were male and half female. Within the other two age groups, about 65% were male. There was a tendency within both children's age groups for males to be unsupervised more often than females. The difference was quite large for older children; 80% of the males were unsupervised but only 64% of the females. For the 0-4 year old children, the difference was smaller; 35% of males were unsupervised against 29% of the females. ("Supervised" children were those judged to have an adult or significantly older child controlling or directing their activities.) The percentage of supervised children showed a sharp drop from the younger children (68%) to the older children (26%). Overall, children made up a relatively small fraction, less than 13%, of all the pedestrians coded.

Table 34 shows the same categories as Table 33 broken down by Pedestrian Location/Activity code. About 85% of all pedestrians were on the sidewalk, usually walking along the sidewalk or standing, talking with other pedestrians. Among the youngest children, the percentage was even higher, 93%. (Those on the sidewalk but waiting to cross were coded in one of the "Crossing" categories.) Half of the remaining pedestrians, 7.6% overall, were crossing the street. Most were male (57%; more than half but less than the proportion of males coded).

There was a split by age and sex between those who crossed at the corner and those who crossed midblock. Fifty-four percent of the women crossed at the corner and supervised children also crossed at the corner more than half the time. Adult males and unsupervised children crossed midblock more often, with

65% and 69% choosing midblock crossings. Pedestrians remaining in the street made up more than 6% of all those observed; 81% were adult male and 16% adult female. A very small proportion of children remained in the street, usually playing games or watching adults in the street. The tendency of males to cross midblock and females to cross at intersections relates well to the accident data (Table 14). There, males were involved in 71% of midblock accidents and 50% of all intersection accidents.

Table 33. Pedestrians by Age/Supervision and Sex: Frequencies and (Percentages)

	0 - 4		5 - 14			
	Unsupervised	Supervised	Unsupervised	Supervised	Adult	Total
Male	91 (0.4)	167 (0.8)	1,090 (5.4)	273 (1.3)	11,230 (55.3)	12,851 (63.8)
Female	71 (0.3)	174 (0.9)	462 (2.3)	263 (1.3)	6,309 (31.1)	7,279 (36.2)
Total	162 (0.8)	341 (1.7)	1,552 (7.6)	536 (2.6)	17,539 (86.4)	20,130

Table 34. Pedestrian Location/Activity by Age and Sex: Frequencies and (Percentages)[1,2]

Pedestrian Location/Activity		Sex	0 - 4 Unsupervised	0 - 4 Supervised	5 - 14 Unsupervised	5 - 14 Supervised	Adult	Total
	On Sidewalk	M	86 (0.4)	150 (0.7)	876 (4.4)	235 (1.2)	9,457 (47.0)	10,804 (53.7)
		F	69 (0.3)	163 (0.8)	412 (2.0)	224 (1.1)	5,524 (27.5)	6,392 (31.8)
	Crossing at Intersection	M	1	13	22 (0.1)	14	264 (1.3)	314 (1.6)
		F	0	6	3	15	324 (1.6)	348 (1.7)
	Crossing Mid-block	M	0	3	51 (0.3)	17	484 (2.4)	555 (2.8)
		F	1	4	17	23 (0.1)	253 (1.3)	298 (1.5)
	In Street	M	1	1	29 (0.1)	4	1,006 (5.0)	1,041 (5.2)
		F	0	1	11	1	208 (1.0)	221 (1.1)
	"Darting"	M	3	0	112+ (0.6)	3	19+	137 (0.7)
		F	1	0	19+	0	0	20 (0.1)

[1]Percentages not shown if below 0.1%.

[2]Entries marked + are significantly higher than would be expected.

The final category of "darting" pedestrians--those moving suddenly and swiftly toward the street although they may not have actually entered the traveled lanes--was less than one percent of all observed pedestrians. They were almost all in one category, however--unsupervised male children between the ages of 5 and 14. The remaining darters were either unsupervised females in the same age group or adult males.

This age/sex distribution differed significantly from that for the pedestrian accidents. In the accident data (Table 16), males were significantly overrepresented in the child years, and more so for the youngest category. In terms of appearance along the streets, however, males were less often present as children than as adults. The factor of "darting" behavior may explain the discrepancy. Males who dart were observed much more frequently than females who dart. Although those actions made up only a tiny fraction of all behaviors, it is reasonable to believe that those actions precede most pedestrian accidents. If so, the large number of male children in accidents is consistent with the observational findings.

e. Pedestrians and Parking Regulations

The distribution of male and female pedestrians by ASP condition is shown in Table 35. The total number of people on the no-parking side was virtually identical to the number on the opposite, or fully-parked side. There was a slight tendency in these data for males to be overrepresented on the side with no parking (66.2% of those people and only 63.8% of people on the side opposite the no parking); the effect was statistically significant (χ^2 = 4.16, 1 d.f.; $p < .05$).

Table 35. Pedestrian Distribution across ASP Configurations by Sex: Frequencies and (Percentages)

ASP Configuration	Pedestrian Sex		Total
	Male	Female	
ASP On-- No Parking, Ped. Side	2,274 (11.2)	1,163 (5.7)	3,437 (16.9)
ASP On-- No Parking Other Side	2,212 (10.9)	1,254 (6.2)	3,466 (17.1)
ASP Off-- Not ASP Time of Day	7,249 (35.7)	4,213 (20.8)	11,462 (56.5)
ASP Off-- Not ASP Day	1,195 (5.9)	732 (3.6)	1,927 (9.5)
Total	12,930 (63.7)	7,362 (36.3)	20,292

Table 36 provides the age/supervision breakdown of the information in the prior table. When ASP was on, adults were more frequently present and children less frequently present (the effect was more pronounced on the side opposite the no parking side) than during non-ASP times or on non-ASP days. The effect was relatively small, however (children were 10.3% of all observations when ASP regulations were in effect, 14.1% of observations at other times). Other than this minor effect, there were no instances of specific age/sex interactions with ASP configurations.

Table 37 shows the relationship between pedestrian location/activity and ASP configuration at the time of data collection. Several statistically significant differences existed between the "no parking, this side" and the "no parking, other side" rows. The largest difference was that less than half as many people were in the street when parking was banned on their side. Also, on that same side, proportionately more pedestrians were on the sidewalk. These two factors may reflect an underlying "no difference" situation; the sum of the two categories was almost identical across the two ASP configurations (3209 vs. 3183), and may reflect the reluctance of people to stand and converse in the streets when there were no parked cars to shield them.

Table 36. Pedestrian Distribution across ASP Configuration by Age and Sex: Frequencies and (Percentages)[1]

		Sex	0 - 4 Unsupervised	0 - 4 Supervised	5 - 14 Unsupervised	5 - 14 Supervised	Adult	Total
ASP Configuration	ASP On--No Parking Ped. Side	M	7	26 (0.1)	195 (1.0)	37 (0.2)	1,990 (9.9)	2,255 (11.2)
		F	4	24 (0.1)	59 (0.3)	29 (0.1)	1,030 (5.1)	1,146 (5.7)
	ASP On--No Parking, Other Side	M	14	14	151 (0.8)	34 (0.2)	1,985 (9.9)	2,198 (10.9)
		F	8	10	62 (0.3)	34 (0.2)	1,126 (5.6)	1,240 (6.2)
	ASP Off--Not ASP Time of Day	M	56 (0.3)	113 (0.6)	619 (3.1)	168 (0.8)	6,252 (31.1)	7,208 (35.8)
		F	45 (0.2)	124 (0.6)	284 (1.4)	186 (0.9)	3,532 (17.5)	4,171 (20.7)
	ASP Off--Not ASP Day	M	14	14	125 (0.6)	34 (0.2)	1,003 (5.0)	1,190 (5.9)
		F	14	16	57 (0.3)	14	621 (3.1)	722 (3.6)

[1]Percentages not shown if below 0.1%.

Table 37. Distribution of Pedestrian Location/Activity Codes across ASP Configuration: Frequencies and (Percentages)[1]

ASP Configuration	On the Sidewalk	Crossing at Intersection	Crossing Midblock	In the Roadway	"Darting"	Total
ASP On—No Parking Ped. Side	3,077+ (15.2)	87- (0.4)	121- (0.6)	132- (0.7)	20 (0.1)	3,437 (16.9)
ASP On—No Parking, Other Side	2,903 (14.3)	130 (0.6)	143 (0.7)	280+ (1.4)	10- (0.05)	3,466 (17.1)
ASP Off—Not ASP Time of Day	9,734 (48.0)	398 (2.0)	537+ (2.6)	688 (3.4)	105 (0.5)	11,462 (56.5)
ASP Off—Not ASP Day	1,618 (8.0)	62 (0.3)	61- (0.3)	164+ (0.8)	22 (0.1)	1,927 (9.5)
Total	17,332 (85.4)	677 (4.2)	862 (3.3)	1,264 (6.2)	157 (0.8)	20,292

[1]Entries marked + or - are significantly higher or lower than would be expected by chance.

There were also more people crossing at intersections from the side opposite the no parking, and marginally more crossing midblock from the same side. "Darting" behavior was reduced on the side opposite the no parking, perhaps due to the double parking and the corresponding increase in difficulty of darting into the street. "Darting" showed no increase in frequency from the no parking side when compared to the non-ASP conditions.

Two conditions showed increased frequencies in the non-ASP conditions. First, midblock crossings were up during non-ASP times of the day (7 am to 2:59 pm but while the ASP regulations were off). Also, on non-ASP day, more pedestrians were in the roadway.

Overall, conditions with ASP regulations active led to less rather than more crossing or in-street activity than seen in the non-ASP conditions. Crossing and in-street activity with ASP regulations active was below the level predicted by the other observed frequencies ($\chi^2 = 12.42$, 1 d.f.; $p < .001$).

For only those observations taken when ASP regulations were active, pedestrian location/activity was broken down by pedestrian age and sex (Table 38). The general finding that more adults were in the street on the side opposite the parking ban than on the side with parking banned, held for both men and women. The finding of more people on the sidewalk on the side where parking was banned held only for males, however, for adults and for unsupervised boys ages 5-14 ($\chi^2 = 21.82$, 1 d.f.; $p < .001$).

Both males and females crossing at intersections did so more often from the parked side, though the effect reached significance only for adult females ($\chi^2 = 6.18$, 1 d.f.; $p < .025$). Boys ages 5-14 "darted" to the street significantly more often from the side on which parking was banned. This finding is based on a small number of observations, however, and is countered by the fact that girls of the same age "darted" entirely from the side opposite the ban--although the number here was even smaller.

For all children 0-4 years old, most of those on the side with parking removed were supervised while those on the other side were as often supervised as unsupervised ($\chi^2 = 11.80$, 1 d.f.; $p < .001$). For children 5-14 years old, the pattern had reversed although not significantly. An explanation for these data may be that adults are regularly present for the youngest children and perceive a need for special supervision when there is no parked vehicle screen, but are not as often present and do not see a special need for older children.

Table 38. Distribution of Pedestrians by Side of Street with ASP Regulations in Effect, by Ped Age/Sex/Activity: Frequencies and (Percentages)[1,2]

Ped Location/ Activity Code	Sex	Side of Parking Ban	Age/Supervision					Total
			0 - 4		5 - 14			
			Unsupervised	Supervised	Unsupervised	Supervised	Adult	
On Sidewalk	M	Ped	7- (0.1)	24+ (0.3)	163+ (2.4)	34 (0.5)	1,754+ (25.4)	1,982 (29.0)
		Other	13 (0.2)	11 (0.2)	121 (1.8)	33 (0.5)	1,638- (23.7)	1,828 (26.5)
	F	Ped	4-	24+ (0.3)	58 (0.8)	28 (0.4)	950 (13.8)	1,064 (15.6)
		Other	8 (0.1)	9 (0.1)	49 (0.7)	31 (0.4)	966 (14.0)	1,075 (15.6)
Crossing at Inter-section	M	Ped	0	2	1	2	44 (0.6)	49 (0.7)
		Other	1	1	8 (0.1)	1	56 (0.8)	68 (1.0)
	F	Ped	0	0	1	1	33- (0.5)	35 (0.6)
		Other	0	1	0	0	60+ (0.9)	61 (0.9)
Crossing Midblock	M	Ped	0	0	7 (0.1)	1	82 (1.2)	90 (1.3)
		Other	0	2	13 (0.2)	0	83 (1.2)	98 (1.4)
	F	Ped	0	0	0	0	30 (0.4)	30 (0.4)
		Other	0	0	1	3	40 (0.6)	44 (0.7)
Staying in Street	M	Ped	0	0	4	0	110- (1.6)	114 (1.7)
		Other	0	0	7 (0.1)	0	208+ (3.0)	215 (3.1)
	F	Ped	0	0	0	0	17- (0.2)	17 (0.2)
		Other	0	0	4	0	60+ (0.9)	64 (0.9)
"Darting"	M	Ped	0	0	20+ (0.3)	0	0	20 (0.3)
		Other	0	0	2	0	0	2
	F	Ped	0	0	0	0	0	0
		Other	0	0	8 (0.1)	0	0	8 (0.1)
Total			33 (0.5)	74 (1.1)	467 (6.8)	134 (1.9)	6,131 (88.8)	6,839

[1]Percentages less than 0.1% are omitted.

[2]Entries marked + or - are significantly higher or lower than would be expected by chance.

3. Accident/Behavior Comparisons

Although there were no significant changes in accident rates between ASP conditions, there are several relationships between accident rates and behavior rates. These may be interpreted as a kind of accident frequency/exposure measure, showing which classes of pedestrians and which of their activities are more at risk than others. While the observation data and the accident data do not come from perfectly comparable conditions, general comparisons can be validly made which are useful within the broad framework of pedestrian safety.

- Midblock crashes showed nearly 3/4 male victims, with progressively higher male involvement with decreasing age. This followed the pattern of midblock crossings by age and sex, although male children were not as overrepresented in midblock crossings as in accidents. At intersections, the distributions shifted dramatically; females made up almost 51% of intersection accident pedestrians and made about 53% of all intersection crossings.

Table 39. Pedestrian Age and Sex by Location: Accident Frequencies and (Percentages)

		1 - 4	5 - 14	Adult	Total
Midblock	Male	23 (4.7)	147 (29.8)	186 (37.7)	356 (72.1)
	Female	4 (0.8)	52 (10.5)	82 (16.6)	138 (27.9)
Intersection	Male	3 (0.4)	93 (11.4)	307 (37.7)	403 (49.4)
	Female	5 (0.6)	71 (8.7)	336 (41.2)	412 (50.6)
Total	Male	26 (2.0)	240 (18.3)	493 (37.7)	759 (58.0)
	Female	9 (0.7)	123 (9.4)	418 (31.9)	550 (42.0)

- Darting pedestrians were almost entirely young males and may constitute a population at extreme risk. If so, for example, they make up for the lack of fit noted in the preceding point. Three other factors support such a conclusion: Darting behavior was coded very infrequently, but is often cited as contributory when it appears on accident reports, and it fits logically and prominently into most explanations of accident causation.

- Children (5-14) seem to be shown significantly less capable of dealing successfully with traffic. They accounted for 27.7% of all accidents—20.1% of intersection crashes and 40.3% of the midblock accidents. By contrast, they made up just 10.4% of all observations, just 8.2% of intersection crossings and 12.7% of midblock crossings (but 85.4% of all "darting" observations, most of which were midblock). It is not clear whether they are worse crossing at intersections or in midblock areas; while they were more than twice the percentage of midblock accidents, they attempted more midblock crossings--twice as many numerically, with an even greater discrepancy if "darts" are considered crossings which were mostly midblock.

- The youngest children showed a similar overrepresentation in the accident data, although the numbers of accidents and observations were very small. The numbers of unsupervised crossings observed for such children were almost zero. Since these--rather than supervised crossings in which an adult is providing the judgment and guidance--are likely the best estimates of the danger of traffic to very young children, this limited evidence suggests that children up through age 4 are incapable of dealing effectively with traffic.

- For adults, males seem about as likely to be involved in a pedestrian crash as females, with exposure adjusted.

- For the youngest children, males are struck much more often than females regardless of adjustments for exposure. Although crossing observations were very sparse for these children, males must cross proportionately more often to offer sufficient opportunities for the accident rate discrepancy to build up.

Table 40. Pedestrian Occurrence Frequencies: Age and Sex for Selected Activities: Frequencies and (Activity Percentages)

	Ped Sex	Pedestrian Age/Supervision					Total
		0 - 4		5 - 14			
		Unsupervised	Supervised	Unsupervised	Supervised	Adult	
"Darting"	M	3 (1.9)	0	112 (71.3)	3 (1.9)	19 (12.1)	137 (87.3)
	F	1 (0.6)	0	19 (12.1)	0	0	20 (12.7)
Crossing Midblock	M	0	3 (0.4)	51 (6.0)	17 (2.0)	484 (56.7)	555 (65.1)
	F	1 (0.1)	4 (0.5)	17 (2.0)	23 (2.7)	253 (29.7)	298 (34.9)
Crossing at Intersection	M	1 (0.2)	13 (2.0)	22 (3.3)	14 (2.1)	264 (39.9)	314 (47.4)
	F	0	6 (0.9)	3 (0.5)	15 (2.3)	324 (48.9)	348 (52.6)
All Activities	M	91 (0.5)	167 (0.8)	1,090 (5.4)	273 (1.4)	11,230 (55.8)	12,851 (63.8)
	F	71 (0.4)	174 (0.9)	462 (2.3)	263 (1.3)	6,309 (31.3)	7,279 (36.2)

F. Discussion

More than being just a test of the model regulations, the combined accident and behavioral studies are a general advance in pedestrian safety information. The accident data themselves extend existing databases in an intensive, selective way.

Of particular theoretical interest is the distinction made in coding based on vehicle position vis-a-vis the intersection. Of intersection accidents, those with the vehicle entering the intersection have a distinctly different flavor than those with the vehicle exiting the intersection. In the latter case, for example, a much larger number of vehicles were turning. Also for vehicles exiting, the pedestrians were more often crossing with the signal and less often crossing against the signal. Pedestrians were slightly older in the exiting accidents, and more often female. The distinction between vehicle entering and exiting has not explicitly been made in prior NHTSA accident typing research, although it enters implicitly into the accident types and the kinds of countermeasure approaches taken. Vehicle Turn/Merge accidents (other than the Right Turn on Red subcategory) almost always involve vehicles exiting intersections, for example, and Multiple Threat accidents involve vehicles entering intersections. The distinction is important, for the task for drivers and pedestrians differs significantly based on where the drivers are in their task of negotiating the intersection.

The behavioral data provide some useful benchmarks for pedestrian incidence in urban residential areas. For the locations studied, for example, about 0.75% of pedestrians were "darting" into the street when observed. Fully three fourths of the darting pedestrians were boys ages 5-14, even though they were only 6.7% of all observed pedestrians. Comparisons of accident rates and darting distributions support the hypothesized causal relationship between darting and accidents. Other behavioral and accident data comparisons were described in the preceding pages.

With respect to the model regulations, whose test was the major purpose for this research, the results were less informative. Briefly, the accident rate data, based on nearly four years of reported pedestrian accidents in Manhattan, showed no variations which could credibly be linked to parking changes brought on by the ASP regulations. Although there were some slight variations in pedestrian position and activity associated with ASP parking changes, the patterns did not relate to the accident rates in any meaningful way.

While one interpretation of these findings is that parking indeed does not affect pedestrian accident rates, it is not the only possible conclusion nor the most plausible one. The hypothesis that parking does contribute to accidents is too firmly established by prior research to reject on the basis of a single study. The visual screen of parked vehicles was cited as a frequent precipitating or predisposing factor by Snyder and Knoblauch (1971). In all subsequent studies involving NHTSA typing schemes, parked vehicles have been coded as important in a large number of the dart and dash accident types. Even in these data, parked vehicles were cited frequently. While it is possible that those accidents would all have occurred anyway and that the parked vehicles were irrelevant parts of the environment, it is unlikely. It is more probable that these parking changes, as evoked by the ASP regulations, were neither complete enough nor free enough of counterproductive elements to improve pedestrian safety. Several features of the ASP parking realization departed from the MOSPO and MOPNIC prescriptions in ways which may have compromised safety potential. They were:

- ASP parking removal was one-side-only. For drivers, it may be that their driving environment remains cluttered and distracting when one street side retains parked cars. That is, although they may have line-of-sight to pedestrians darting into the street from the unparked side, they may fail to detect such actions in time to avert accidents because they concentrate on the other, fully parked, side.

- Because ASP parking removal was one-side-only, drivers drove closer to the unparked curb. This removed a "buffer zone" between the curb and the normal path of vehicles into which pedestrians could safely move. The buffer zone allows pedestrians more time and space to search for oncoming cars and more room to signal their intent to cross to oncoming motorists. This mechanism may be critical to the functioning of the MOPNIC, which would channel traffic away from the buffer zone by permitting parking to within 50 feet of the crosswalk.

- The ASP parking ban produced major relocation of parked vehicles but resulted in less than perfect compliance. Not only were some parked vehicles left on the unparked side, which provided some opportunity for visual screening, but when combined with frequent double parking the non-compliance required motorists often to concentrate on driving through a narrowed and irregular channel.

Added together, these discrepancies between the ASP situation and the model regulations prescriptions and the lack of safety change under the ASP regulations prevented any judgments of the net safety effectiveness of the MOSPO and MOPNIC.

In particular, the results do not disprove the model regulations in any way. Both regulations were developed by traffic safety experts, after careful study of accident causation and with consultation from experts in fields related to traffic safety. The regulations remain plausible, suggesting face-valid changes in the traffic environment which should alter the pattern of accident causation and thus reduce accidents. They remain worthy of experimental evaluation.

For future research to evaluate the MOSPO and the MOPNIC, several recommendations can be drawn from the current effort, i.e.:

- The test situation should duplicate as closely as possible the features of the tested model regulation(s). The current study showed that parking redeployment in itself does not guarantee pedestrian safety improvements. Because the model regulations were developed very carefully, their features probably offer the best chance of significant safety benefits.

- The test situation should insure compliance with the parking intended. The kinds and degrees of activity—e.g., on-site signing, public information announcements, police enforcement--needed to insure compliance are valid study topics themselves. However, those questions should be resolved in advance and appropriate measures taken during the safety benefit test so that compliance is virtually complete.

- Accident reductions are the most persuasive and credible evidence of safety benefits, and may be the most cost-effective to develop. Behavior changes on the part of drivers and/or of pedestrians may offer the potential for valid evidence. However, because the model regulations change the setting in which the behaviors would occur, the process and safety implications of the behaviors must be carefully quantified for valid results. This would be a protracted and costly undertaking, and its results would still be less persuasive to legislators and others than would accident reductions.

  Accordingly, the test situation should be of a large enough scale to provide adequate accident data. The obvious procedures for this include altering a large physical area for a long time. Other factors involve concentrating on the situations in which the model regulations are expected to be most effective. For the MOSPO, these include daytime hours, especially afternoon and evening, and dense residential areas with many people using the sidewalks, heavy on-street parking, relatively heavy traffic, and few alternate areas for children's activities. The MOPNIC is most appropriate for commercial or residential areas with heavy on-street parking.

In an actual future test, of course, it may not be possible to faithfully reproduce all the details of the MOSPO and/or the MOPNIC. If the discrepancies are chosen (or accepted) carefully, the test can still be valid and informative. For the MOSPO in particular, some of its provisions were established as compromises between the ideal and what was felt might actually be implemented. Compromises in the details for either regulation may be acceptable, as long as they do not interfere with the primary mechanisms by which the model regulations are felt to improve pedestrian safety.

III. MODEL VEHICLE OVERTAKING LAW

A. Background

Multiple Threat accidents are ones which typically occur at crosswalks of multi-lane roads; usually the pedestrian is crossing at a moderate pace. The accident is characterized by the documented presence of a screening vehicle, but one which is stopped rather than parked. It is illustrated in Figure 7.

The accident situation develops when a pedestrian initiates his crossing in front of an occupied vehicle which waits for him. This vehicle may have been stopped or it may stop for the pedestrian; the driver may invite the pedestrian to cross or the latter may force the driver to wait for him. Regardless of how the situation arose, as the pedestrian crosses in front of the waiting vehicle, he is screened from overtaking traffic by the stopped vehicle. If the pedestrian steps from behind the stopped vehicle just as a moving vehicle passes the stopped vehicle, a crash is likely to result.

The problem is serious, though variable among cities. Snyder and Knoblauch (1971) found 3.2% of their accident sample was of the Multiple Threat type. The average was approximately the same for the data from seven cities referenced in Table 1, but the range was from only 0.4% in Toledo to 7.7% in Los Angeles.

In fact, there are four subtypes of accidents which get typed as Multiple Threat. First is the "classic" case, much as described above. This appears to be a "western state" accident, although the evidence supporting this generalization is not exhaustive. In eastern cities, these accidents do not occur because the situations do not occur: Drivers will not stop (on a multi-lane road) to invite pedestrians to cross in front of them, and pedestrians will not accept such an invitation if offered. These made up, by contrast, the vast majority of Multiple Threat accidents coded in Los Angeles and San Diego, the west coast cities whose accidents have been extensively studied in other NHTSA research. The second subtype is similar, except that the pedestrian began crossing on a green traffic signal in front of a car stopped for the light. The light changes just as the pedestrian clears the stopped vehicle, and the "trapped" pedestrian is hit by an overtaking motorist who timed his approach so as to enter the intersection just as his light became green. Because the first vehicle stopped for a signal, if the pedestrian is screened from view there is no other clue for the overtaking driver that a pedestrian is in jeopardy. This subtype is relatively rare though not geographically limited. The third and fourth subtypes are pseudo multiple threats, also rare and not geographically limited. In the third subtype, the pedestrian darts across in front of a moving vehicle which never stops to set up the standard multiple threat situation, but is forced to yield and does briefly screen the pedestrian from the overtaking striking vehicle. In the fourth, the pedestrian dodges through a line of vehicles stopped for a signal ahead and is struck--not in the crosswalk--by a vehicle in another lane pulling up to stop for the signal. (This discussion is based on accident coding experience gained in conjunction with research for NHTSA Contract No. DOT-HS-4-00952 [Hale, 1980].)

Only the first, or classic Multiple Threat, is susceptible to the countermeasures developed and discussed below.

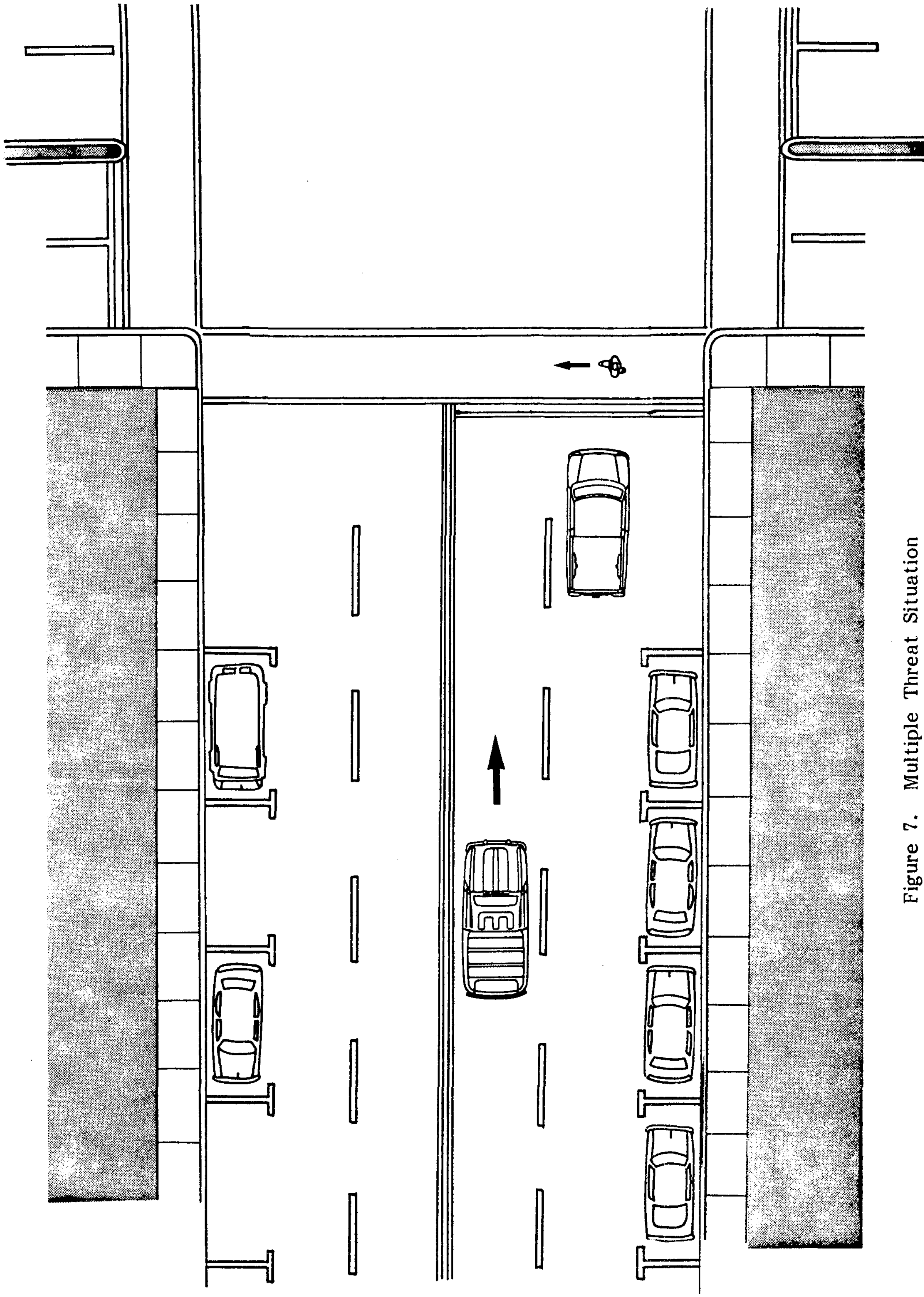


Figure 7. Multiple Threat Situation at Intersection Crosswalk

There currently exists a section of the Uniform Vehicle Code (UVC) which should prevent the occurrence of the classic Multiple Threat accident (UVC section 11-502[d]) which states that "whenever any vehicle is stopped at a marked crosswalk or at any unmarked crosswalk at an intersection to permit a pedestrian to cross the roadway,the driver of any other vehicle approaching from the rear shall not overtake and pass such stopped vehicle." There is a key weakness in the law, however; the overtaking vehicle is required to stop only if the driver detects the presence of a crossing pedestrian. Because the pedestrian may be hidden by the already-stopped vehicle at the driver's moment for decision, the driver may not have the cues he needs to know to stop. If the pedestrian steps out without himself searching for overtaking vehicles, an accident will occur.

Blomberg et al. (1974) argue that the intent of UVC section 11-502(d) was not to allow unseen pedestrians to be hit but to have drivers stop for every pedestrian regardless of his visibility when passing the stopped vehicle. The resulting Model Vehicle Overtaking Law (MVOL) is shown in Figure 8. The key change to UVC section 11-502 is §3 of the MVOL, which requires that overtaking motorists stop for all vehicles stopped before marked or unmarked crosswalks and proceed only if it is determined that it is safe. If followed, the MVOL would defuse the multiple threat situation by having all overtaking vehicles stop just at the time the pedestrian steps into their path. The MVOL would no longer require the overtaking driver to detect the crossing pedestrian, but to respond to the general situation by stopping to anticipate the danger.

Other provisions of the MVOL attempt to shape pedestrian use of crosswalks and vehicle stopping locations so that it is optimally possible for crossing pedestrians and overtaking motorists to detect each other.

In the initial development of the MVOL, survey results were positive except for the mobility factor. For traffic engineers and legal representatives, the MVOL was felt to possibly impede traffic flow. Several reviewers commented that they felt rear-end collisions would be caused by the stopping vehicles (Blomberg et al., 1974).

In fact, the MVOL would affect traffic in a very small set of instances. Two conditions would lead to additional stops under the MVOL. First is a false multiple threat situation—a screening car stops but there is no pedestrian. Data are not available for the number of times this happens, but it is probably rare; drivers stopping for reasons other than crossing pedestrians would be likely to do so to pick up or discharge passengers (who then might become multiple threat targets) and would have no specific reason to do so just before a crosswalk. Second is the multiple threat situation in which overtaking drivers currently drive right through. This situation is also rare, but its frequency has been documented in Los Angeles as part of the research for NHTSA Contract No. DOT-HS-4-00952. Of the 6,829 multiple threat situations coded in that study, overtaking drivers stopped or slowed enough to stop 90.5% of the time. In only that remaining 9.5% of multiple threat situations would the MVOL (ideally) cause drivers to stop where they do not currently do so. Presently, that 9.5% leads to over 200 Multiple Threat accidents per year in Los Angeles. Any increase in vehicle-vehicle rear end crashes caused by these additional stops, probably minor, would have to be weighed against the eliminated Multiple Threat accidents (Preusser, 1981).

MODEL VEHICLE OVERTAKING LAW

§ 1 -- Driver must yield to pedestrian in crosswalk

(a) 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 so 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.

(b) No pedestrian shall suddenly leave a curb or other place of safety and walk or run into the path of a vehicle which is so close as to constitute an immediate hazard.

§ 2 -- Where required stop must be made

When stopping for a pedestrian as required by section 1, a driver shall stop at a clearly marked stop line or at a point indicated by a sign. If there is no line or sign, a driver shall stop before entering the crosswalk.

§ 3 -- Passing stopped vehicle prohibited

Whenever any vehicle is stopped in a lane for moving traffic at a crosswalk or at any stop line in advance of a crosswalk, the driver of any other vehicle approaching from the rear in an adjacent lane shall not overtake and pass such stopped vehicle until he has brought his vehicle to a stop and determined that it is safe to proceed.

§ 4 -- Placement of traffic-control devices

When traffic-control signals are not in place or not in operation at a pedestrian crosswalk, provision shall be made through signing, painting of stop lines or alteration of crosswalk geometry to insure that motorists stopping to yield to pedestrians in a crosswalk will stop at least 20 feet from the crosswalk line farthest from the motorist.

§ 5 -- Movement of pedestrians in crosswalks

Pedestrians shall move, whenever practicable, upon the right half of crosswalks.

Figure 8. Model Vehicle Overtaking Law.

Overall, then, the MVOL was received positively when it was originally developed, it has no identified drawbacks which can not be refuted, and it is a logically compelling countermeasure for Multiple Threat accidents. At the time this contract was issued, a test of some of the provisions of the MVOL was being undertaken as part of another NHTSA research effort. Rather than duplicate some of that effort in a direct test of the MVOL, it was the goal of this contract to build on the results of that research and, if the evidence was favorable, to prepare materials to advance the MVOL for adoption in the real world.

The study, being conducted under NHTSA Contract No. DOT-HS-4-00952, took the approach of using public information radio and television spots to change driver and pedestrian responses in multiple threat situations. The goals of the message campaign were threefold:

- To make motorists and pedestrians clearly aware of the Multiple Threat accident type and the situations in which it occurs.
- To persuade overtaking motorists that pedestrians may be present even if undetected and thus to react to any multiple threat situation by stopping, or slowing enough to be able to stop, when overtaking a stopped vehicle at a crosswalk.
- To alert pedestrians to the danger of crossing in front of stopped vehicles and to persuade them to stop at the edge of every stopped vehicle and look around for oncoming vehicles before proceeding.

As part of the test, telephone interviews were held to assess knowledge of the information presented in the driver and the pedestrian messages and observations were made at selected locations of the behaviors of drivers and pedestrians in multiple threat situations. Interviews and observations were conducted before the messages were broadcast, immediately afterward, and six months after that.

The test of these messages, conducted in Los Angeles, was nearly complete as of this writing. Although the number of television and radio plays of the message was small, the telephone interviews showed a moderate improvement in pedestrian knowledge but no change in driver knowledge. Also, no consistent changes in behavior were seen in observations of pedestrians and drivers in multiple threat situations. Preliminary analysis also showed no change in Multiple Threat accident rates which could be reliably connected to the message presentations (Preusser, 1981).

B. Rationale

In sum, the MVOL is a simple change to existing law and is a compellingly straightforward solution to the accident problem. If it achieved its intended driver behavior change, Multiple Threat accidents would necessarily decrease. A direct test of the MVOL was outside the scope of this contract, however, and the evidence does not warrant an unqualified recommendation. A middle course of action was taken: to encourage a full test of the MVOL through identification of suitable jurisdictions, presentation of the concept to them, and development of prototype materials to support all aspects of MVOL implementation and testing. This approach met three objectives:

- It moved work forward on the MVOL appropriately, based on the current state of knowledge about the regulation's likely effectiveness, its acceptability, and alternative approaches to the same goal.

- It directly satisfied the contract goals, i.e., to develop a total information package for the MVOL suitable to the results of the messages test.

- It brought other parties, ones with a potential long-term interest in the MVOL, into involvement with a structured task leading to full MVOL implementation and testing.

This last point was particularly important. Further developmental work, needed on the MVOL, could not be carried out under this contract. A procedure depending on new research would be subject to procedural delays which would rule out a smooth transition from groundwork accomplished here to the subsequent testing. For this effort to be of value, it was necessary to involve state, regional and local people to the degree that they would take this preparatory work and use it, under their own initiative and on a timetable fitting their needs and constraints.

C. Procedures and Activities

The first step in this was to identify a suitable test site, or sites since this was to be preparation for a test rather than the test itself. Based on meetings with NHTSA, it was determined that it would be possible to evaluate Arizona, California and Nevada for suitability. Eastern sites were excluded from consideration because, as noted above, classic Multiple Threat accidents have been found to be almost nonexistent in those areas. The three identified states were all within NHTSA Region IX, and coordination of any further activities could be handled through those offices. While other western states could be suitable for an MVOL test, no efforts were made to add them to the initial target of three states because the goal was to find one or more test sites rather than all possible ones. (For example, Snyder and Knoblauch (1971) found that 8.7% of 69 Seattle, Washington accidents, and 3.5% of 172 Denver, Colorado, accidents were Multiple Threat types.)

Through prior work, California had been certified to have a large Multiple Threat accident problem. Exhaustive tabulations of Los Angeles and San Diego accident reports for several years had shown 7.7% and 3.5%, respectively; in a sample of 218 San Francisco accidents, Snyder and Knoblauch (1971) found 7.8% Multiple Threats.

In order to confirm a Multiple Threat problem in Arizona and Nevada, samples of pedestrian accident reports were obtained from the two major cities of each State. The samples were coded for accident type according to the NHTSA research typology (see Table 41). Both States showed high rates of Multiple Threat accidents, making them suitable for promotion of the MVOL. Nevada was, however, judged to have relatively low pedestrian accident rates, which would have meant a long study time to acquire enough accident data for an adequate MVOL test. Also, Las Vegas and Reno both have large numbers of people from outside of Nevada who would not be expected to be familiar with the MVOL even if it were the law. Accordingly, Nevada was dropped from further consideration.

Table 41. Multiple Threat Sample Rates in Arizona and Nevada Cities

City	Percent Multiple Threat	Total Sample Number
Phoenix	7%	131
Tucson	13%	99
Las Vegas	5%	44
Reno	10%	49

For Arizona and California, a presentation procedure was devised to make key officials in each State aware of the MVOL and sufficiently prepared, if they subsequently desired, to themselves describe and promote the MVOL within their own States. The initial presentation was conducted by Dunlap and Associates, Inc.

A key element to the presentation was a set of materials for use at that time and suitable for use by State personnel in their subsequent meetings. The materials (described in the next section and presented fully in Appendix D) were designed to accomplish several goals:

- To describe the Multiple Threat problem and the MVOL as a solution to legislators and others who can facilitate a decision to adopt and implement the MVOL.
- To present similar information to the general public, to make them aware of the new law, to understand its purpose, and to induce voluntary compliance.
- To instruct police on the enforcement aspects of the new law so they can encourage compliance in their dealings with the public.

With the assistance of NHTSA Region IX officials, meetings were held in California and in Arizona in late 1980. California officials felt uncomfortable with the MVOL and were not interested in recommending adoption within their State. Arizona officials expressed interest in the MVOL as a reasonable and potentially effective countermeasure. On the basis of its meeting, Arizona planned to go at least one step further in discussing the MVOL with key legislative personnel, to attempt to elicit support for proposing the MVOL as legislation. As of this writing, those contacts have been made. The MVOL is viewed as being attractive legislation but not something meriting immediate action.

D. MVOL Support Materials

The materials are straightforward and suitable for convenient and effective use. They include seven components, tailored as needed for each State:

- Twenty-one slides and an accompanying script for a brief presentation in meetings.

- Brief written descriptive report which covers the same material as the slide presentation in a form suitable for distribution to interested persons.

- Accident data from cities within the State to emphasize the magnitude and relevance of the problem.

- Public information and education materials to assist publicizing the passed law to police and members of the general public--TV and radio scripts and a pamphlet suitable for distribution in DMV mailings to licensed drivers.

- Suggested changes to the State manual for licensed drivers, to bring that document into conformity with the new law.

- Codified version of the MVOL suitable for word-for-word integration to the existing State motor vehicle code.

- The potential for an NHTSA-sponsored evaluation of the effectiveness of the MVOL once adopted. This is a key element, for both the State and for NHTSA. A suitable evaluation of accident reduction and behavioral change brought on by the MVOL is needed to support the model law as a countermeasure for Multiple Threat accidents. Such results will assist NHTSA in developing its ultimate position vis-a-vis the MVOL. Also, such an evaluation is important to the adopting State, to insure to the State that the effects of the regulation will be measured responsibly. This will assist the State, which will have adopted the MVOL as a best judgment decision, to monitor the effects to verify the expected safety benefits or determine the absence of such benefits as a basis for any subsequent actions on the MVOL.

E. MVOL Prospects

Based on the accident data referenced above, it is virtually certain that the majority of the Multiple Threat accident problem is limited to a definable section of this country--in particular, western states. The feature of western driving practices which seems to cause multiple threat situations, which sometimes degenerate into accidents, is the enforced and habitual courtesy of drivers to pedestrians. Paradoxically, the tendency for drivers to stop to allow pedestrians an unimpeded crossing seems to invite accidents, by leading pedestrians into multiple threat situations which are complex and hard for motorists and pedestrians to handle under the best circumstances.

The MVOL offers a certain way to defuse the dangerous situation, by making the overtaking driver stop just before the point at which the accident occurs. Proof of the effectiveness of the MVOL is lacking at this time, although there is evidence that the concept of the MVOL, as presented in public services messages, can make a knowledge improvement for pedestrians.

The effort in this aspect of the project encouraged a State with a known Multiple Threat accident problem to adopt the MVOL as a plausible test and for NHTSA and the State to monitor the results of the test to validate the MVOL concept. In the initial meeting with Dunlap, officials from the Governor's Office, from the State Police and from the cities of Phoenix and Tucson reacted positively to the presentation, and follow-up work was being done to bring the MVOL to the attention of State legislators. Should these activities proceed in a timely and favorable fashion, the MVOL might be adopted in Arizona.

The following events would then be required for the MVOL to become proved, accepted and widely adopted:

- With State initiative and cooperation, an NHTSA-supported evaluation effort for the MVOL assessment in Arizona. Because this should involve behavioral measures as well as accident rate evaluations, this activity should begin some months before the MVOL takes effect. For the evaluation to be adequate, it should cover at least three years of accident data before the MVOL and two or more years after the MVOL.

- With accident reduction evidence for the MVOL, additional states can be approached by NHTSA--first, for a determination from existing accident reports whether a Multiple Threat problem exists; and second, if one does exist, for assistance in implementing the MVOL and monitoring its effectiveness.

- With accident reduction evidence, the support for the MVOL should be completed by showing that it would not bring with it significant negative consequences. Two concerns are likely to be raised. First, the MVOL presents the appearance to many people of hampering mobility or safety through requiring frequent "purposeless" stops. This argument was logically rejected above, and the collection of empirical data to answer the question could be designed into the primary state MVOL test. Second, it is necessary to show that the MVOL will not adversely affect safety if adopted in states without a large Multiple Threat accident problem. This argument seems likely to be groundless, for few multiple threat situations occur in such states, and therefore, the MVOL provisions would be only rarely invoked. To support this, a brief behavioral study in non-Multiple Threat cities might be useful together with a careful examination of the MVOL test situation for any negative consequences.

- With the full complement of evidence for the MVOL, it should be presented to the National Committee on Uniform Traffic Laws and Ordinances for inclusion in the Uniform Vehicle Code. Because the MVOL represents only a minor change to an existing section, with accident reduction proof it may be accepted. If so, the request to states for adopting the MVOL can be made in terms of "coming into compliance with the UVC," a positive argument in its own right.

APPENDIX A

BACKGROUND: DEVELOPMENT OF MODEL REGULATIONS FOR PEDESTRIAN SAFETY

(Blomberg, Hale and Kearney, 1974)

The basic purpose of this study was to produce a set of model rules, regulations, codes and/or ordinances and related procedures which, if adopted, would reduce urban pedestrian accidents. The study addressed nine specific regulatory areas which were based on previous research on the causes of urban pedestrian accidents. Guidelines followed in developing, drafting, pretesting and annotating the resulting regulatory countermeasures were:

- To specify the physical and operational requirements for each countermeasure in significant detail to insure uniform application across jurisdictions; expeditious and complete implementation of the countermeasure; and sensitivity to local needs and special requirements.

- To draft model regulations in a manner most conducive to legislative approval and enactment.

- To insure that all regulations produced were capable of enforcement within the constraints of existing or reasonably contemplated enforcement resources.

- To draft regulations which were maximally acceptable to the public to insure compliance and minimize confusion.

- To draft regulations which were acceptable to the official community including judges, elected officials, traffic engineers and police officers.

The study began with a thorough review of predisposing and precipitating factors associated with the nine accident types/regulatory areas. This review resulted in a threat analysis for each accident type and an initial "group think" attempt at generating countermeasures was made. A search was instituted for any existing municipal ordinances or state laws which addressed the pedestrian accident types under study. Nineteen out of twenty five major cities polled responded with portions of their municipal codes related to the regulatory areas under study. These ordinances were scrutinized for relevant provisions. Computer based literature searches were also conducted.

Brainstorming of countermeasures was conducted throughout the project. Countermeasure ideas were generated and passed through several internal reviews before being converted into approved legal/regulatory content and format. These were evaluated in a nationwide survey among segments of the population concerned with the enactment and enforcement of new regulations (traffic engineers, police, legislators, National Committee on Uniform Traffic Laws and Ordinances [NCUTLO] committee members, special interest groups and members of the general public). The survey instrument was composed of an introduction to the regulations which provided a brief description of the pedestrian accident-producing situation;

the provisions of the regulation; and fifteen rating scales which consisted of evaluative statements concerning the regulation. Respondents were to indicate their degree of agreement or disagreement with each statement. They were also asked if they would make any additions, deletions or modifications to the body of the regulation. Probe type questions were posed about existing or contemplated content items for the regulation. Data analysis consisted of cross tabulation analysis, factor analysis and content analysis on subjective data received. Based on analyzed survey results, the test versions of the regulations were revised as necessary and recommendations were documented for support actions needed to gain widespread implementation of the model regulations.

Three of the regulations developed by Blomberg et al (1974) were the subject of the present contract effort. Excerpted below are the portions of their final report which present, for each of the three model regulations, the accident background, the countermeasure approach, and the annotations to the model regulations.

I. Model On-Street Parking Ordinance

A. Background

Parallel parked cars, particularly in residential areas where children are playing contribute to dart-out type accidents (Snyder and Knoblauch, 1971 ["ORI"]). These are accidents in which the pedestrian, usually a child, appears suddenly from the side of the road and thereby presents only a short time exposure to drivers. Dart-outs, as a class, accounted for 37% of the ORI accident cases. Children in particular, do not realize that the parked cars screen them from the view of oncoming motorists. In addition, children who are playing do not attend to traffic and will often run impulsively into the street to retrieve a ball or other toy.

One way to alleviate part of this problem is to prohibit on-street parking in residential areas where children are likely to dart-out. However, this could represent a significant hardship to motorists in areas where sufficient off-street parking has not been provided. On the other hand, newly developed or redeveloped areas can include provision for sufficient off-street parking so that on-street parking and its attendant hazards can be eliminated. Allowing the city traffic engineer to override the prohibition is necessary to cover the range of situations in which, for some locally existing reasons, a prohibition of on-street parking would not be practical or beneficial, e.g., in a retirement community where children are not at play.

B. Approach

A simplistic approach to this model regulation was adopted for both the survey and final versions. Since parallel parked cars are a predisposing factor to many accidents of this type (21% of all accidents and 62% of dart-out first half accidents in the Snyder and Knoblauch study, 1971), it was considered beneficial to eliminate them entirely when such a prohibition does not represent an undue hardship. This can be accomplished in new or redeveloped areas in which zoning laws and ordinances can require the provision of ample off-street parking. The inclusion of a requirement to provide these off-street parking spaces was considered as part of this Model but rejected because it would not be appropriate for codification with existing vehicle and traffic laws. It is recognized, however, that companion zoning laws or building codes will be needed for this Model to function effectively. These already exist in many jurisdictions but would have to be enacted in others.

The parking prohibition itself has been tempered to reflect the conditions of dart-out accident incidence. Since children are the primary victims and they do not generally play or walk alone at night, the prohibition only covers the time between sunrise and sunset. This will allow residents of affected areas to have evening guests or parties with visitors parking on the street.

The final provision of the survey version allowed the city traffic engineer to request an exception to the prohibition by filing a report with the clerk of the City Council or other appropriate official. This would provide a mechanism for exempting new or redeveloped areas in which children do not reside or in which the prohibition would be unnecessary or unreasonable for special reasons. This was only one of the methods considered for allowing exceptions. Other included exceptions by popular petition with public hearings and allowing the city traffic engineer to grant exemptions on his own.

C. Overview

As mentioned earlier, this model regulation is intended to remove parallel parked cars from streets on which children are likely to be playing. Accident data collected in the ORI study indicate that parked cars are one of the most prominent environmental factors predisposing to a pedestrian accident. Simply, a parked car can block the view a driver has of a pedestrian and vice versa thereby leading to a short time exposure and little opportunity for evasive action by either driver or pedestrian. The situation is exacerbated in areas where children are playing because:

- Children are not fully aware of pedestrian hazards and are therefore more prone to dart-out movements than are adults.
- The small physical size of children makes a parked car an extremely effective visual screen.
- Children at play are generally not paying attention to vehicle threats and, thus, the burden of accident avoidance falls primarily on the driver. Maximizing sight distance is one of the best ways to insure that drivers will detect and avoid pedestrian hazards.

It should be noted that the concept of prohibiting parking to protect child pedestrians is not entirely novel. The city of Fresno, California (and perhaps other jurisdictions although they did not come to the attention of this study) has an ordinance which authorizes the Director of Parks and Recreation to post signs prohibiting double parking near parks, playgrounds or recreational areas or in any place where double parking will present a hazard to pedestrians or motorists. While this ordinance only removes part of the problem—double parking in areas where children might be playing—it reflects an acknowledgment of the problem being addressed by the Model.

The provisions of the final version of the Model On Street Parking Ordinance are shown in Figure A-1 below. An annotation of the two sections follows.

MODEL ON STREET PARKING ORDINANCE

§ 1 -- Parking to be prohibited in new or redeveloped areas

(a) The (city traffic engineer) shall place official traffic-control devices prohibiting standing and parking from sunrise to sunset on streets in new residential subdivisions built after (January 1, 1981) and in other residential areas where a significant part of an existing block is reconstructed after (January 1, 1981).

(b) When traffic-control devices are in place, a driver shall not park or stand in violation of such devices.

§ 2 -- Exceptions

The (city traffic engineer) may exempt streets or parts of streets subject to section 1 whenever he finds that prohibiting standing or parking will not significantly contribute to pedestrian safety (or whenever he finds that such prohibition imposes burdens disproportionate to benefits to be derived therefrom).

Figure A-1. Model On-Street Parking Ordinance

D. Annotation

§ 1—Parking to be Prohibited in New or Redeveloped Areas

(a) If cars are parked, children will almost inevitably dart-out in front of them. In new or redeveloped areas, there is a possibility of providing adequate off-street parking thereby making it realistic to prohibit on street parking between sunrise and sunset when children are likely to be at play. Requiring the placement of official traffic-control devices (signs, signals and/or markings) removes the need for interpretation on the part of the motorist. Only the city traffic engineer need concern himself with the definitions of "new" or "reconstructed." The motorist must simply obey the traffic-control devices when installed as specifically required by subsection (b).

The definitions of "new" and "reconstructed" have purposely been left vague. The intent, however, is clear. Parking is to be prohibited in residential areas where sufficient provision can be made for off-street parking. Thus, "a significant part of an existing block" can be considered to have been reconstructed if sufficient off-street parking is available. This, together with the exemption privilege provided by section 2 of the Model, allows the city traffic engineer to implement the Model effectively even in the absence of companion zoning codes. He can exempt any areas which cannot provide alternate parking facilities and "place official traffic-control devices prohibiting standing and parking" wherever such a prohibition will not represent an undue hardship.

(b) This subsection reiterates a general rule of the road prohibiting standing or parking in violation of signs. UVC sections 11-1003 (a), 1,k and 11-1003 (a), 2,f provide the same rule as do various sections of the MTO including 14-5(b), 14-6(b), 14-7, 14-9(b), 16-1, 16-3, 16-4, 16-5 and 16-6. Thus, if sufficient similiar restrictions have already been enacted, this subsection may be deleted from the Model. However, both the UVC and MTO contain redundant references to a driver's duty to obey official signs and, therefore, inclusion of this subsection in all implementations of the Model would not be inconsistent with current practice.

§ 2—Exceptions

It may not be possible in all cases to provide adequate off-street parking and some new or reconstructed areas may not present a high dart-out threat, e.g., a retirement community. Thus, the city traffic engineer or other appropriate individual or agency (to be specified locally when the Model is adopted) is given the power to grant exceptions when appropriate. Guidance is also provided in the language of the section concerning reasons for granting an exception. These cover the cases in which pedestrian safety will not be enhanced by the prohibition or in which the benefits are far less than the burdens. This latter exlusion has been made optional and is primarily intended to cover implementation in the absence of zoning or building codes to require the provision of off-street parking. Prohibiting on street parking in new or reconstructed areas in which alternate parking arrangements have not been made would likely represent an undue hardship on residents. If appropriate zoning codes are in existence or are to be enacted simutaneously with the Model, this optional clause should be deleted.

II. Model Ordinance or Law on Parking Near Intersections and Crosswalks

A. Background

The threat posed to pedestrian safety by the standing of vehicles near a marked or unmarked crosswalk is fundamental. Namely, if vehicles are allowed to park too close to a marked or unmarked crosswalk at an intersection the closest parked vehicle(s) may screen the view of a crossing pedestrian from oncoming motorists. This, in turn, can lead to a short time exposure to view of the pedestrian thereby significantly reducing the available time for pedestrian or motorist to execute evasive maneuvers and leading to accidents of the intersection dash variety (Snyder and Knoblauch, 1971). These accidents comprised 8.4% of the ORI study cases. Further, a pedestrian problem can arise regardless of the dwell time of the stopped vehicle and this problem becomes particularly acute when a truck or other large vehicle stops near an intersection or crosswalk.

The highway safety community, particularly those drafting traffic laws, have recognized this problem for a long time. The 1926 Uniform Vehicle Code prohibited parking "within twenty-five feet from the intersection of curb lines." Throughout the ensuing years, the UVC has been modified many times but has always retained a prohibition related to stopping, standing or parking near intersections or crosswalks.

Unfortunately, the traditional UVC approach is not fully protective of pedestrians for two reasons. First, as currently constructed, the UVC (§ 11-1003 a, 2, c) only prohibits parking within 20 feet of a crosswalk (marked or unmarked) at an intersection. This 20 foot setback is traditional and does not meet the sight distance needs of the situation. Second, the UVC does not specify any parking setback from crosswalks located at places other than intersections. The UVC (§§ 11-1003 a, 2, f and 11-1003 a, 3, b) does establish the need to avoid standing or parking where prohibited by official signs. The assumption is that the traffic engineer who establishes a midblock crosswalk will simultaneously establish a parking or standing prohibition with signs. There is, however, no guarantee that signs will be erected, and, in their absence, motorists can stand or park right up to the crosswalk line.

B. Approach

The basic approach adopted for the survey version of the Model Ordinance or Law on Parking Near Intersections or Crosswalks preserves the format of the long-standing sections in the UVC. However, the two basic shortcomings of the UVC (§ 11-1003) mentioned above were corrected and the scope of the Model was limited to intersections and crosswalks (UVC § 11-1003 covers situations such as fire hydrants and railroad crossings in addition).

An analysis of the geometry of the situation at intersections and an examination of the speed of vehicles involved in pedestrian accidents at intersections led to a decision that parking should be prohibited within 60 feet of an intersection. Allowing a 10 foot width for a marked crosswalk, this same prohibition can be stated as prohibiting parking within 50 feet of the nearest border of a marked crosswalk. Since the Model forbids standing or parking within 50 feet of a marked crosswalk, regardless of the location of the crosswalk, the problem of midblock crosswalks which arises from the UVC version of the same concept is eliminated.

The absolute prohibition of standing or parking near intersections and crosswalks must be tempered somewhat to account for extraordinary circumstances which may arise. Thus, exceptions are permitted:

- To avoid conflict with other traffic
- To comply with a law or the directions of a police officer or official traffic control device
- Momentarily to receive or discharge passengers
- Due to a disablement.

Finally, a particularly hazardous pedestrian situation arises at midblock crosswalks and at marked or unmarked crosswalks at intersections where there are no traffic-control signals or stop signs. Drivers do not expect to encounter pedestrians midblock and are not normally slowed or stopped at intersections where there are no traffic-control devices. Thus, in these circumstances it becomes even more important to maintain good pedestrian-to-driver sight distances. Therefore it was deemed beneficial to mandate the installation of traffic control devices (signs, signals or stop signs) to insure compliance with the Model's setbacks. While marking all crosswalks would have obvious pedestrian safety and enforcement benefits, it was considered too expensive to implement. Further, the 60 foot setback provides a sufficient margin for error at intersections with signals or stop signs. Hence, the mandatory notification of the parking restriction was limited to the more hazardous special situations.

C. Overview

The final version of the Model Law or Ordinance on Parking Near Intersections and Crosswalks is shown in Figure A-2. It is substantially the same as the survey version with two exceptions:

- The wording of the prohibition has been changed from "A person shall not stand or park" to "A person shall not stand" to emphasize that momentary stopping is allowed only to pick up or discharge passengers and not to pick up or unload property.
- The setbacks of 50 and 60 feet apply only to the approach side of intersections and crosswalks.

The analysis which established the needed setback distances is based on geometrical considerations of sight distance and the average speed of intersection accidents from an analysis of the ORI study data (Snyder and Knoblauch, 1971). Accomplishing these setbacks is the major purpose of the model regulation. Its additional provisions simply provide completeness and help insure compliance in special circumstances when drivers are least likely to expect pedestrian crossings.

MODEL ORDINANCE OR LAW ON PARKING NEAR INTERSECTIONS AND CROSSWALKS

§ 1 -- Parking near crosswalks regulated

(a) A person shall not stand a vehicle, whether occupied or not:

(1) Within 50 feet of the nearest border of any marked crosswalk on the approach side of the crosswalk

(2) Within 60 feet of an intersection without a marked crosswalk on the approach side of the intersection

(b) Subsection (a) shall not apply to the driver of a vehicle which is stopped:

(1) To avoid conflict with other traffic;
(2) To comply with a law;
(3) To comply with directions of a police officer or official traffic control device;
(4) Momentarily to receive or discharge passengers;
(5) Because it is disabled in such manner and to such extent that it is impossible to avoid stopping and temporarily leaving the vehicle in the area described in subsection (a).

§ 2 -- Traffic-control devices required at certain crosswalks

(a) Traffic-control devices notifying drivers of the restrictions in section 1(a) shall be installed in advance of all marked crosswalks not located at an intersection and in advance of all crosswalks located at any intersection where there is no traffic-control signal or stop sign.

(b) The absence of any such traffic-control device shall not affect a driver's duty to comply with section 1.

Figure A-2. Model Ordinance or Law on Parking Near Intersections and Crosswalks

D. Annotation

§ 1 - Parking Near Crosswalks Regulated

Section 1 (a) regulates standing within a specified distance of crosswalks, both marked (intersection or midblock) and unmarked (at intersections). The form of the section is similar to the applicable portions of UVC Section 11-1003 and the laws of many states. The substantial difference, however, is that section 1 (a) specifies a distance of 60 feet from the intersection without a marked crosswalk and 50 feet from all marked crosswalks on the approach side while the UVC only specifies a prohibition of 20 feet from a crosswalk (marked or unmarked) at an intersection. Thus, the Model extends the setback distance to 50 feet from an intersection (assuming a modal value of 10 feet for the width of a marked crosswalk) and extends the provisions of the regulation to cover specifically the situation of midblock crosswalks.

The choice of setback distances was made in accordance with the previously mentioned analyses. Making the Model applicable to only the approach side is consistent with the greatest threat and conserves as much parking space as possible. Existing setback regulations (e.g., UVC § 11-1003, 2, c) would apply to the departure side of intersections and crosswalks thereby establishing a setback of about 20 feet (there is some variation across states and municipalities).

Prohibiting standing rather than parking would limit momentary stopping in the setback zone to the receiving and discharging of passengers but not property. Thus, trucks, which are a significantly larger screen to driver/pedestrian vision, are expressly forbidden to stop in the setback zone to receive or discharge property.

Subsection (b) lists five cases in which the standing prohibitions need not be obeyed. These exceptions are necessary for completeness and to avoid penalizing a motorist who is either directed (by another law, police officer or traffic control device) or forced (by traffic conditions or a disablement) to stand his vehicle in the prohibited zone. In addition, the fourth exclusion reiterates the definition of standing from UVC section 1-168 to emphasize that momentary stops for passengers are permitted.

§ 2 - Traffic-Control Devices Required at Certain Crosswalks

Section 2 of the Model mandates the installation of traffic-control devices (signs, signals or markings) at all midblock crosswalks and at all intersectional crosswalks which are not controlled by a signal or stop sign. Signing or marking of the parking restrictions has been proffered only for uncontrolled intersections as there is a greater need for sight distance to pedestrians where there is not a traffic control device to control the movement of pedestrians and vehicles. Required signing or marking of non-intersectional crosswalks has also been proposed since this is a relatively more novel or unexpected occurrence (from the driver's point of view) than an intersectional crosswalk. Moreover, non-intersectional crosswalks are frequently uncontrolled. Both factors require good sight distance to insure protection of the crossing pedestrian. Finally, it was considered too costly to mark all intersections and crosswalks even though marking would aid enforcement of the regulation by providing an objective frame of reference to support the issuance of a citation or summons. Thus, mandatory marking was limited (in subsection a) to intersections without traffic control signals or stop signs and to midblock crosswalks.

Subsection (b) of section 2 merely reiterates a driver's duty to comply with the setback provisions of section 1 even if the traffic-control devices required by section 2 (a) are not installed or not in place. Thus, a driver's duty to comply is made independent of required marking to insure maintenance of sight distance in all circumstances.

III. Model Vehicle Overtaking Law

A. Background

The situation of concern here is one in which a vehicle on a multiple lane roadway (two or more lanes in one direction) has stopped for a pedestrian crossing in a crosswalk, and another vehicle approaching the stopped vehicle is induced to overtake as his view of the pedestrian is momentarily blocked by the stopped vehicle. As a result, the crossing pedestrian may be struck by the overtaking vehicle. The ORI study (Snyder and Knoblauch, 1971) has stated that this type of pedestrian accident (termed "multiple threat") accounted for 3.2% of the total sample studied.

B. Approach

The focus of the test regulation was directed primarily to pedestrian crosswalks where no traffic control signals are in place. When traffic controls are in place, it is assumed that there is sufficient control over the movements of vehicles and pedestrians at or near crosswalks to obviate this hazard.

The substance of UVC section 11-502(a) was incorporated in the initial provision of the test regulation. In essence, this stated that drivers must yield to pedestrians in crosswalks when traffic control signals are not in place or operating. To insure a margin of safe physical separation between stopping vehicles and crossing pedestrians, a requirement was incorporated which stated that a driver must stop at a stop line, point indicated by a sign, or before entering a crosswalk. In an attempt to obviate the ambiguity and obscured vision inherent in the situation described above, it was deemed necessary to say that a driver must not overtake a vehicle stopped at a crosswalk before first stopping and determining that it is safe to do so. It was also required that traffic control devices must be installed to insure that motorists stop 20 feet from the farthest crosswalk line. The research and rationale in support of this distance are discussed in the Model's annotation in this chapter. A final provision required that pedestrians shall move in the right half of crosswalks. This was intended to minimize the crossing time of any pedestrian and maximize his visibility to motorists approaching a vehicle already stopped at the crosswalk by keeping the vehicle-to-pedestrian distance as great as possible.

It should be noted that UVC section 11-502(d) and the laws of most states prohibit overtaking a vehicle stopped "to permit a pedestrian to cross the roadway." This restriction does not fully counter the multiple threat accident problem because the stopped vehicle usually blocks the overtaking driver's view of the crossing pedestrian. If he cannot see the pedestrian, he does not know the pedestrian is crossing the roadway and therefore is not legally obliged to avoid overtaking the vehicle stopped for the pedestrian. The essence of the approach adopted herein for the

Model is to use the position of the stopped vehicle at a stop line or crosswalk as the determinant of when overtaking is prohibited. The presence of a crossing pedestrian is immaterial. Simply, a driver cannot overtake a car stopped at a crosswalk or stop line without first stopping to determine that it is safe to proceed. This obviates the need to detect a pedestrian behind the screening vehicle in order for the overtaking driver to be duty bound to stop.

C. Overview

The final version of this regulation appears in Figure A-3. The final form of the regulation is basically the same as the test version. The exception to this is the addition of UVC section 11-502(b) as section 1(b) of the Model.

D. Annotation

§ 1 - Driver Must Yield to Pedestrian in Crosswalk

Subsection (a) of this provision obligates drivers to yield to crossing pedestrians and is a direct quotation of UVC section 11-502(a) which has been in effect since 1938. Although the merit of this regulation is apparent and such a provision is desirable, in and of itself it does not provide sufficient controls for the safety of crossing pedestrians. The difficulty with this provision is that it assumes that a driver can always see a pedestrian crossing in a crosswalk. As was pointed out earlier, if a vehicle has already stopped for a crossing pedestrian it can screen the pedestrian from an overtaking vehicle. Section 3 of this regulation addresses and solves this problem.

Subsection (b) of this provision rightfully limits pedestrians' use of crosswalks so as to not place unreasonable demands upon approaching drivers to stop for them. This section is a direct quote of UVC section 11-502(b) as revised in 1971.

§ 2 - Where Required Stop Must Be Made

This section is really self-explanatory and meets a perceived need to define the point at which drivers should stop for pedestrians in crosswalks so that sight distance around the stopped car and the vehicle-to-pedestrian distance itself are maintained at safe values. Besides circumscribing stopping behavior, this section provides objective criteria for enforcing the required stopping behavior.

§ 3 - Passing Stopped Vehicle Prohibited

This section complements section 1 of this regulation and provides the essential restraint of driver behavior to preclude the multiple threat accident type from occurring. Based on UVC section 11-502(d), this section establishes an unambiguous requirement for all vehicles approaching a vehicle stopped at a crosswalk to first stop in the appropriate manner and then determine that it is safe (primarily that no pedestrian is crossing) to do so before overtaking or passing. In holding a driver accountable for section 1 of this regulation without the requirement to stop before overtaking a vehicle already stopped at a crosswalk, an approaching driver is put into a compromising position of not always having adequate information to determine if the stopped vheicle is allowing a pedestrian to cross. Without the "stop and look" element of this provision, the approaching driver could well be playing a guessing game whose outcome would not be in favor of any crossing

MODEL VEHICLE OVERTAKING LAW

§ 1 -- Driver must yield to pedestrian in crosswalk

(a) 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 so 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.

(b) No pedestrian shall suddenly leave a curb or other place of safety and walk or run into the path of a vehicle which is so close as to constitute an immediate hazard.

§ 2 -- Where required stop must be made

When stopping for a pedestrian as required by section 1, a driver shall stop at a clearly marked stop line or at a point indicated by a sign. If there is no line or sign, a driver shall stop before entering the crosswalk.

§ 3 -- Passing stopped vehicle prohibited

Whenever any vehicle is stopped in a lane for moving traffic at a crosswalk or at any stop line in advance of a crosswalk, the driver of any other vehicle approaching from the rear in an adjacent lane shall not overtake and pass such stopped vehicle until he has brought his vehicle to a stop and determined that it is safe to proceed.

§ 4 -- Placement of traffic-control devices

When traffic-control signals are not in place or not in operation at a pedestrian crosswalk, provision shall be made through signing, painting of stop lines or alteration of crosswalk geometry to insure that motorists stopping to yield to pedestrians in a crosswalk will stop at least 20 feet from the crosswalk line farthest from the motorist.

§ 5 -- Movement of pedestrians in crosswalks

Pedestrians shall move, whenever practicable, upon the right half of crosswalks.

Figure A-3. Model Vehicle Overtaking Law pedestrian. The requirement for approaching drivers to stop before proceeding also provides a clearly enforceable element for this law. In effect, a stopped vehicle at a crosswalk or stop line is an unmistakable "traffic control signal" for approaching motorists to stop before passing or overtaking.

§ 4 - Placement of Traffic Control Devices

In support of marking the point where the stop mentioned in section 2 is required, this provision has been provided. Its basic intent, through alternate means, is to insure that the motorists will stop at a safe distance from any pedestrian crossing within either a marked or unmarked crosswalk. The concept of "safe distances" subsumes both adequate physical separation of a stopped vehicle from a pedestrian and the provision of adequate sight distance between stopped and/or approaching vehicles and crossing pedestrians.

The MUTCD in Section 3B-14 stated that "Stop lines, where used, should ordinarily be placed 4 feet in advance of and parallel to the nearest crosswalk line. In the absence of a marked crosswalk, the stop line should be placed at the desired stopping point, in no case more than 30 feet or less than 4 feet from the nearest edge of the intersecting roadway." Snyder and Knoblauch (1971, p 5-27) in developing a countermeasure approach to this pedestrian hazard suggested that:

> In order to reduce the incidents where cars stopped at the stop line obscure the view from the striking car, a wide stop or limit line should be placed a number of feet prior to the crosswalk. Although specific design would depend on a number of factors at the particular location, the objective is to stop the cars far enough back so that a pedestrian in the walk is likely to be noticed by cars other than the ones facing him. The recommendation given by the Manual on Uniform Control Devices for a stop line about 4 feet in front of the nearest crosswalk may not go far enough.

Mortimer, Nagamachi and Carlson (1969, p 1, p #ii) in their study of the effects of roadway markings on vehicles stopping near pedestrian crosswalks concluded that:

> ...the minimum distance of 4 feet between the crosswalk line and the stop line recommended in the Michigan Manual of Uniform Traffic Control Devices, is not adequate to reduce the frequency of vehicles stopping on the crosswalk to 1 percent. To maintain unimpeded pedestrian flow on the crosswalk, the stop line should be located at least 8 feet from the crosswalk line* (assumes a crosswalk line of 12.0 feet from an intersection).
>
> The "...greatest control of stopping position, with minimum vehicle encroachment in the crosswalk was achieved by the use of a stop line across the traffic lane which was not nearer to the intersection than 20 feet."

*underlining and parenthetical expression added

In view of the above findings and recommendations, the Dunlap and Associates, Inc. results of an hourglass crosswalk test (an innovative crosswalk geometry to enhance the sight distance between crossing pedestrians and motorists) and the fact that a modal width for a crosswalk is about 10 feet, the 20 foot stopping distance from the crosswalk line farthest from an approaching motorist was proposed for this provision. As it is worded, this 20 feet setback is amenable to easy implementation for both marked and unmarked crosswalks.

§ 5 - Movement of Pedestrians

In an attempt to minimize the exposure time of pedestrians in crosswalks, (i.e., discourage diagonal crossings) as well as to maximize their visibility to vehicles approaching from their left, this provision to have pedestrians move in the right half of crosswalks has been proffered. It is a verbatim restatement of UVC section 11-505. This required movement of the pedestrian in crosswalks also conforms to the U.S. population stereotype for the movement of traffic units in traffic lanes.

APPENDIX B

DATA COLLECTION FORMS

MV-104AN (9/75)

State of New York – Department of Motor Vehicles

POLICE ACCIDENT REPORT (N.Y.C.)

Page____ of ____ Pages

1 PRECINCT

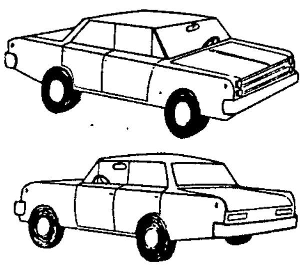
ACCIDENT NO.

2 ACCIDENT DATE MO / DA / YR | DAY OF WEEK | TIME (MILITARY) | NUMBER OF VEHICLES | NO. INJURED | NO. KILLED | NON-HIGHWAY ☐ | NOT INVESTIGATED AT SCENE ☐ | LEFT SCENE ☐ | POLICE PHOTOS YES ☐ NO ☐ 20

VEHICLE 1	VEHICLE 2
LAST NAME DRIVER 1 / FIRST NAME / MIDDLE INITIAL	LAST NAME DRIVER 2 / FIRST NAME / MIDDLE INITIAL
NUMBER AND STREET	NUMBER AND STREET
CITY / STATE / ZIP CODE	CITY / STATE / ZIP CODE
DATE OF BIRTH MO / DA / YR / SEX / UNLICENSED ☐ / NUMBER OF OCCUPANTS / PUBLIC PROPERTY DAMAGED ☐ / DMV USE	DATE OF BIRTH MO / DA / YR / SEX / UNLICENSED ☐ / NUMBER OF OCCUPANTS / PUBLIC PROPERTY DAMAGED ☐ / DMV USE
LAST NAME OWNER 1 / FIRST NAME / MIDDLE INITIAL	LAST NAME OWNER 2 / FIRST NAME / MIDDLE INITIAL
NUMBER AND STREET	NUMBER AND STREET
CITY / STATE / ZIP CODE	CITY / STATE / ZIP CODE
PLATE NUMBER / STATE OF REG. / YEAR & VEHICLE MAKE / VEHICLE TYPE / INS. CODE	PLATE NUMBER / STATE OF REG. / YEAR & VEHICLE MAKE / VEHICLE TYPE / INS. CODE

Margin boxes: 1, 2, 3, 4, 5, 6, 7, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30

VEHICLE 1 DAMAGE



NO DAMAGE ☐ UNDERCARRIAGE ☐

VEHICLE TOWED BY TO

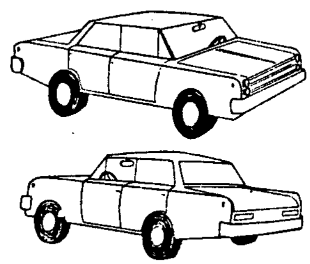
ACCIDENT DIAGRAM

1. REAR END | 3. LEFT TURN | 4. INTERSECTION | 5. RIGHT TURN | 7. HEAD ON

2. OVERTAKING | 0. LEFT TURN | 6. RIGHT TURN | 8. SIDESWIPE

9.

VEHICLE 2 DAMAGE



NO DAMAGE ☐ UNDERCARRIAGE ☐

VEHICLE TOWED BY TO

REFERENCE MARKER | LOCATION CODE | COUNTY | ADDRESS/LANDMARKS AT SCENE

ROUTE NO. OR STREET NAME ON ____ ☐ MILES ☐ FEET ☐ N ☐ S ☐ E ☐ W OF ☐ AT INTERSECTION WITH ROUTE NO. OR STREET NAME

TICKET/ARREST OPR 1 ☐ OPR 2 ☐ PEDESTRIAN ☐ OTHER ☐ | TICKET/ARREST NUMBER(S) | VIOLATION SECTION(S) | COMPLAINT NO.

ACCIDENT DESCRIPTION/OFFICER'S NOTES

USE COVER SHEET **B**

	8	9	10	11	12	13	14	15	16	17	18	NAMES – IF DECEASED GIVE DATE OF DEATH
A												
B												
C												
D												
E												
F												
G												

ALL INVOLVED

SIGN HERE OFFICER'S RANK AND NAME	BADGE NO.	DEPARTMENT	PRECINCT	POST/SECTOR	REVIEWING OFFICER	DATE/TIME REVIEWED
		03030				

Figure B-1. Police Accident Report Form MV-104AN for New York City

MV-1

PEDESTRIAN LOCATION (1)
1. Pedestrian at Intersection
2. Pedestrian Not at Intersection

PEDESTRIAN ACTION (2)
1. Crossing, With Signal
2. Crossing, Against Signal
3. Crossing, No Signal, Marked Crosswalk
4. Crossing, No Signal or Crosswalk
5. Walking Along Highway With Traffic
6. Walking Along Highway Against Traffic
7. Emerging from in Front of/Behind Parked Vehicle
8. Going To/From Stopped School Bus
9. Getting On/Off Vehicle Other Than School Bus
10. Pushing/Working On Car
11. Working in Roadway
12. Playing in Roadway
13. Other Actions in Roadway*
14. Not in Roadway (Indicate)*

TRAFFIC CONTROL (3)
1. None
2. Traffic Signal
3. Stop Sign
4. Flashing Light
5. Yield Sign
6. Officer/Flagman/Guard
7. No Passing Zone
8. RR Crossing Sign
9. RR Crossing Flashing Lt.
10. RR Crossing Gates
11. Stopped School Bus - Red Lights Flashing
20. Other *

APPARENT CONTRIBUTING FACTORS

HUMAN
2. Alcohol Involvement
3. Backing Unsafely
4. Driver Inattention (Indicate)*
5. Driver Inexperience (Indicate)*
6. Drugs (Illegal)
7. Failure to Yield Right-of-Way
8. Fell Asleep
9. Following Too Closely
10. Illness
11. Lost Consciousness
12. Passenger Distraction
13. Passing or Lane Usage Improper
14. Pedestrian's Error/Confusion
15. Physical Disability
16. Prescription Medication
17. Traffic Control Disregarded
18. Turning Improperly
19. Unsafe Speed
40. Other Human *

VEHICULAR
41. Accelerator Defective
42. Brakes Defective
43. Headlights Defective
44. Other Lighting Defects
45. Oversized Vehicle
46. Steering Failure
47. Tire Failure/Inadequate
48. Tow Hitch Defective
49. Windshield Inadequate
60. Other Vehicular *

ENVIRONMENTAL
61. Animal's Action
62. Glare
63. Lane Marking Improper/Inadequate
64. Obstruction/Debris
65. Pavement Defective
66. Pavement Slippery
67. Shoulders Defective/Improper
68. Traffic Control Device Improper/Non-Working
69. View Obstructed/Limited
80. Other Environmental *

Vehicle 1 (19) — Vehicle 1 (20) — Vehicle 2 (21) — Vehicle 2 (22)

LIGHT CONDITIONS (4)
1. Daylight
2. Dawn
3. Dusk
4. Dark-Road Lighted
5. Dark-Road Unlighted

State of New York
Department of Motor Vehicles

POLICE ACCIDENT REPORT (N.Y.C.)

MV-104AN (9/75)

* EXPLAIN IN ACCIDENT DESCRIPTION

IF A QUESTION DOES NOT APPLY, ENTER A DASH (—).

IF AN ANSWER IS UNKNOWN, ENTER AN "X"

DIRECTION OF TRAVEL

N, S, E, W — 1, 2, 3, 4, 5, 6, 7, 8

Vehicle 1 (23) — Vehicle 2 (24)

ROADWAY CHARACTER (5)
1. Straight and Level
2. Straight and Grade
3. Straight at Hillcrest
4. Curve and Level
5. Curve and Grade
6. Curve at Hillcrest

ROADWAY SURFACE CONDITION (6)
1. Dry
2. Wet
3. Muddy
4. Snow/Ice
5. Slush
10. Other*

WEATHER (7)
1. Clear
2. Cloudy
3. Rain
4. Snow
5. Sleet/Hail/Freezing Rain
6. Fog/Smog/Smoke
10. Other*

LOCATION OF MOST SEVERE PHYSICAL COMPLAINT (14)
1. Head
2. Face
3. Eye
4. Neck
5. Chest
6. Back
7. Shoulder-Upper Arm
8. Elbow-Lower Arm-Hand
9. Abdomen - Pelvis
10. Hip-Upper Leg
11. Knee-Lower Leg-Foot
12. Entire Body

PRE-ACCIDENT VEHICLE ACTION
1. Going Straight Ahead
2. Making Right Turn
3. Making Left Turn
4. Making U Turn
5. Starting from Parking
6. Starting in Traffic
7. Slowing or Stopping
8. Stopped in Traffic
9. Entering Parked Position
10. Parked
11. Avoiding Object in Roadway
12. Changing Lanes
13. Overtaking
14. Merging
15. Backing
20. Other*

Vehicle 1 (25) — Vehicle 2 (26)

LOCATION OF FIRST EVENT (27)
1. On Roadway
2. Off Roadway

WHICH VEHICLE OCCUPIED (8)
1. Vehicle No. 1
2. Vehicle No. 2
B. Bicyclist
P. Pedestrian
O. Other*

POSITION IN/ON VEHICLE (9)
1. Driver
2–7. Passengers
8. Riding/Hanging On Outside

SAFETY EQUIPMENT USED (10)
1. No Restraint Used
2. Lap Belt
3. Harness
4. Lap Belt and Harness
5. Child Restraint
10. Other*

EJECTION FROM VEHICLE (11)
1. Not Ejected
2. Partially Ejected
3. Ejected

AGE (12) — SEX (13)

TYPE OF PHYSICAL COMPLAINT (15)
1. Amputation
2. Concussion
3. Internal
4. Minor Bleeding
5. Severe Bleeding
6. Minor Burn
7. Moderate Burn
8. Severe Burn
9. Fracture - Dislocation
10. Contusion - Bruise
11. Abrasion
12. Complaint of Pain
13. None Visible

VICTIM'S PHYSICAL AND EMOTIONAL STATUS (16)
1. Apparent Death
2. Unconscious
3. Semiconscious
4. Incoherent
5. Shock
6. Conscious

INJURED TAKEN
17 BY | TO 18

TYPE OF ACCIDENT

COLLISION WITH
1. Other Motor Vehicle
2. Pedestrian
3. Bicyclist
4. Animal
5. Railroad Train
10. Other Object (Not Fixed)*

COLLISION WITH FIXED OBJECT
11. Light Support/Utility Pole
12. Guide Rail
13. Crash Cushion
14. Sign Post
15. Tree
16. Building/Wall
17. Curbing
18. Fence
19. Bridge Structure
20. Culvert/Head Wall
21. Median/Barrier
22. Snow Embankment
23. Earth Embankment/Rock Cut/Ditch
24. Fire Hydrant
30. Other Fixed Object*

NON-COLLISION
31. Overturned
32. Fire/Explosion
33. Submersion
34. Ran Off Roadway Only
40. Other*

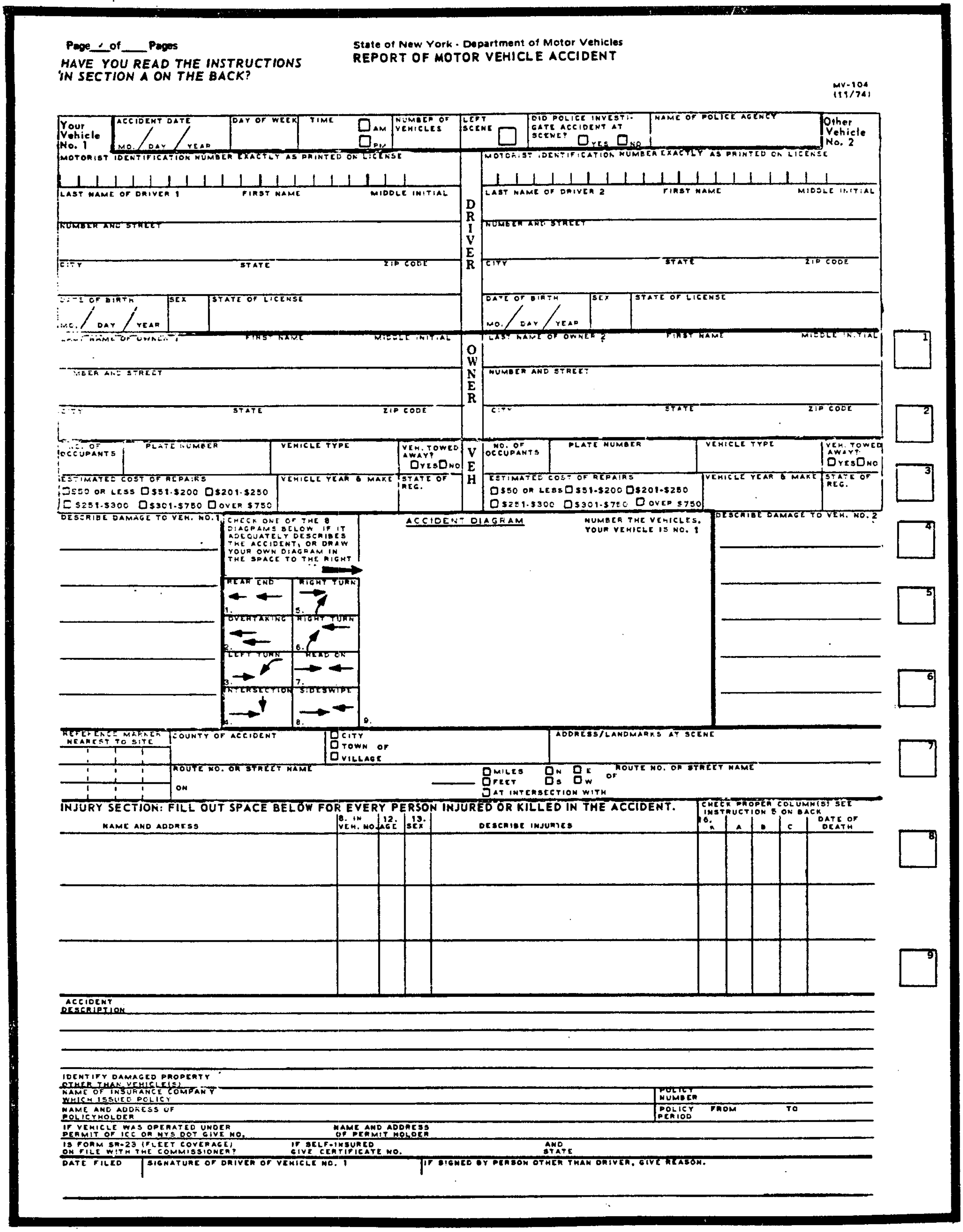
First Event (28) — SECOND EVENT: Vehicle 1 (29), Vehicle 2 (30)

COVER SHEET **B** — USE COVER SHEET **B**

ALL INVOLVED: A, B, C, D, E, F, G

OFFICER'S RANK AND NAME	BADGE NO.	DEPARTMENT	PRECINCT	POST/SECTOR	REVIEWING OFFICER	DATE/TIME REVIEWED
		03030				

Figure B-2. Coding Instructions and Categories For MV-104AN (shown superimposed on MV-104AN such that instructions line up with code boxes)


Page 1 of ___ Pages

HAVE YOU READ THE INSTRUCTIONS IN SECTION A ON THE BACK?

State of New York - Department of Motor Vehicles

REPORT OF MOTOR VEHICLE ACCIDENT

MV-104 (11/74)

Your Vehicle No. 1 | ACCIDENT DATE MO. DAY YEAR | DAY OF WEEK | TIME AM PM | NUMBER OF VEHICLES | LEFT SCENE | DID POLICE INVESTIGATE ACCIDENT AT SCENE? YES NO | NAME OF POLICE AGENCY | Other Vehicle No. 2

DRIVER

MOTORIST IDENTIFICATION NUMBER EXACTLY AS PRINTED ON LICENSE

LAST NAME OF DRIVER 1 | FIRST NAME | MIDDLE INITIAL

NUMBER AND STREET

CITY | STATE | ZIP CODE

DATE OF BIRTH MO. DAY YEAR | SEX | STATE OF LICENSE

MOTORIST IDENTIFICATION NUMBER EXACTLY AS PRINTED ON LICENSE

LAST NAME OF DRIVER 2 | FIRST NAME | MIDDLE INITIAL

NUMBER AND STREET

CITY | STATE | ZIP CODE

DATE OF BIRTH MO. DAY YEAR | SEX | STATE OF LICENSE

OWNER

LAST NAME OF OWNER 1 | FIRST NAME | MIDDLE INITIAL

NUMBER AND STREET

CITY | STATE | ZIP CODE

LAST NAME OF OWNER 2 | FIRST NAME | MIDDLE INITIAL

NUMBER AND STREET

CITY | STATE | ZIP CODE

VEH

NO. OF OCCUPANTS | PLATE NUMBER | VEHICLE TYPE | VEH. TOWED AWAY? YES NO

ESTIMATED COST OF REPAIRS: $50 OR LESS, $51-$200, $201-$250, $251-$300, $301-$750, OVER $750 | VEHICLE YEAR & MAKE | STATE OF REG.

NO. OF OCCUPANTS | PLATE NUMBER | VEHICLE TYPE | VEH. TOWED AWAY? YES NO

ESTIMATED COST OF REPAIRS: $50 OR LESS, $51-$200, $201-$250, $251-$300, $301-$750, OVER $750 | VEHICLE YEAR & MAKE | STATE OF REG.

DESCRIBE DAMAGE TO VEH. NO. 1

CHECK ONE OF THE 8 DIAGRAMS BELOW IF IT ADEQUATELY DESCRIBES THE ACCIDENT, OR DRAW YOUR OWN DIAGRAM IN THE SPACE TO THE RIGHT

1. REAR END
2. OVERTAKING
3. LEFT TURN
4. INTERSECTION
5. RIGHT TURN
6. RIGHT TURN
7. HEAD ON
8. SIDESWIPE
9.

ACCIDENT DIAGRAM — NUMBER THE VEHICLES, YOUR VEHICLE IS NO. 1

DESCRIBE DAMAGE TO VEH. NO. 2

1 2 3 4 5 6 7 8 9

REFERENCE MARKER NEAREST TO SITE | COUNTY OF ACCIDENT | CITY / TOWN OF / VILLAGE | ADDRESS/LANDMARKS AT SCENE

ROUTE NO. OR STREET NAME ON | MILES / FEET / AT INTERSECTION WITH | N S E W OF | ROUTE NO. OR STREET NAME

INJURY SECTION: FILL OUT SPACE BELOW FOR EVERY PERSON INJURED OR KILLED IN THE ACCIDENT.

NAME AND ADDRESS	8. IN VEH. NO.	12. AGE	13. SEX	DESCRIBE INJURIES	CHECK PROPER COLUMN(S) SEE INSTRUCTION 5 ON BACK 6. K	A	B	C	DATE OF DEATH

ACCIDENT DESCRIPTION

IDENTIFY DAMAGED PROPERTY OTHER THAN VEHICLE(S)

NAME OF INSURANCE COMPANY WHICH ISSUED POLICY | POLICY NUMBER

NAME AND ADDRESS OF POLICYHOLDER | POLICY PERIOD FROM TO

IF VEHICLE WAS OPERATED UNDER PERMIT OF ICC OR NYS DOT GIVE NO. | NAME AND ADDRESS OF PERMIT HOLDER

IS FORM SR-23 (FLEET COVERAGE) ON FILE WITH THE COMMISSIONER? | IF SELF-INSURED GIVE CERTIFICATE NO. | AND STATE

DATE FILED | SIGNATURE OF DRIVER OF VEHICLE NO. 1 | IF SIGNED BY PERSON OTHER THAN DRIVER, GIVE REASON.

Figure B-3. Individual Accident Report Form MV-104

SECTION A

An accident in New York State causing death, personal injury or damage over $200 to the property of any one person must be reported within 10 days. Failure to report within 10 days is a misdemeanor and subjects License and/or Registration to suspension until report is filed.

INSTRUCTIONS

PLEASE PRINT OR TYPE ALL INFORMATION
USE BLACK OR DARK BLUE INK

Begin by folding along this line ➤
and follow the instructions at the top of Section B.

1. If you were involved in an accident with a pedestrian, enter the pedestrian information in the DRIVER block of the space provided for other Vehicle No. 2, and print "PEDESTRIAN" in the OWNER block.

   If you were involved in an accident with a vehicle other than a motor vehicle, e.g., snowmobile, mini-bike, aircycle, all-terrain vehicle, trail bike or other non-motor vehicle, enter the driver, owner and vehicle information as you would normally for Other Vehicle No. 2.

   If a vehicle is unoccupied, enter all available information. Be sure to enter the correct vehicle plate number and vehicle type in the appropriate VEHICLE block.

2. Driver information must be entered exactly as it appears on each driver's license.

   Owner information must be entered exactly as it appears on the Registration of each vehicle involved in the accident.

3. If you were involved in an accident in which there were more than two vehicles, an additional one of these report forms must be filled out. On that form, place the information for the third vehicle in the space marked "Your Vehicle No. 1" and mark it No. 3. Use the space marked "Other Vehicle No. 2" for the fourth vehicle, and mark it No. 4 and so on.

4. The location of the accident is very important and you should describe it as accurately as possible in the space provided. In addition, if the accident occurred on a State highway, you will find a small green sign, called a Reference Marker, somewhere near the crash site. They are posted each 10th of a mile along the highway. The reference marker section should include the number exactly as it appears on the sign.

5. For each person injured in the accident, describe his injuries and check the injury code K, A, B, or C, that applies. When a Pedestrian is injured, place a "P" in the box labeled "In Vehicle Number". Injuries are defined as follows:

K	A
Any injury that results in death.	Severe lacerations, broken or distorted limbs, skull fracture, crushed chest, internal injuries, unconscious when taken from the accident scene, unable to leave accident scene without assistance.
B	**C**
Lump on head, abrasions, minor lacerations.	Momentary unconsciousness, limping, nausea, hysteria, complaint of pain (no visible injury).

   If there are more than three persons injured, another one of these report forms is needed. In the injury section of that report, record the required information for all additional injured persons.

6. Attach any additional report forms to page one. Each page of the report must be numbered in the upper left corner, dated and signed on the bottom line and submitted to:

   COMMISSIONER OF MOTOR VEHICLES
   EMPIRE STATE PLAZA
   ALBANY, NEW YORK 12228

SECTION B

State of New York - Department of Motor Vehicles — MV-104 (11/74)

REPORT OF MOTOR VEHICLE ACCIDENT

BE SURE FORM IS FOLDED ALONG THIS LINE BEFORE ANSWERING THE QUESTIONS BELOW.

FILL IN THE 9 BOXES TO THE RIGHT BY ENTERING THE NUMBER OF THE ITEM WHICH BEST DESCRIBES THE CIRCUMSTANCES OF THE ACCIDENT.

IF A QUESTION DOES NOT APPLY ENTER A DASH (–)

IF AN ANSWER IS UNKNOWN ENTER AN "X"

TRAFFIC CONTROL (1)

1. None
2. Traffic Signal
3. Stop Sign
4. Flashing Light
5. Yield Sign
6. Officer/Flagman/Guard
7. No Passing Zone
8. RR Crossing Sign
9. RR Crossing Flashing Light
10. RR Crossing Gates
20. Other

ROADWAY CHARACTER (2)

1. Straight and Level
2. Straight and Grade
3. Straight at Hillcrest
4. Curve and Level
5. Curve and Grade
6. Curve at Hillcrest

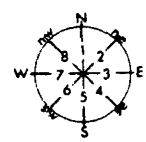
ROADWAY SURFACE CONDITION (3)

1. Dry
2. Wet
3. Muddy
4. Snow/Ice
5. Slush
10. Other

WEATHER (4)

1. Clear
2. Cloudy
3. Rain
4. Snow
5. Sleet/Hail/Freezing Rain
6. Fog/Smog/Smoke
10. Other

DIRECTION OF TRAVEL (Your Vehicle No. 1 — 5; Vehicle No. 2 — 6)



1. North
2. Northeast
3. East
4. Southeast
5. South
6. Southwest
7. West
8. Northwest

ACTION OF VEHICLES BEFORE ACCIDENT (7, 8)

1. Going Straight Ahead
2. Making Right Turn
3. Making Left Turn
4. Making U Turn
5. Starting from Parking
6. Starting in Traffic
7. Slowing or Stopping
8. Stopped in Traffic
9. Entering Parked Position
10. Parked
11. Avoiding Object in Roadway
12. Changing Lanes
13. Overtaking
14. Merging
15. Backing
20. Other

TYPE OF ACCIDENT (9)

COLLISION WITH

1. Other Motor Vehicle
2. Pedestrian
3. Bicyclist
4. Animal
5. Railroad Train
10. Other Object (Not Fixed)

COLLISION WITH FIXED OBJECT

11. Light Support/Utility Pole
12. Guide Rail
13. Crash Cushion
14. Sign Post
15. Tree
16. Building/Wall
17. Curbing
18. Fence
19. Bridge Structure
20. Culvert/Head Wall
21. Median/Barrier
22. Snow Embankment
23. Earth Embankment/Rock Cut/Ditch
24. Fire hydrant
30. Other Fixed Object

NON—COLLISION

31. Overturned
32. Fire/Explosion
33. Submersion
34. Ran Off Roadway Only
40. Other

PLEASE READ INSTRUCTIONS 1 THROUGH 6 ON OTHER SIDE OF FOLD BEFORE COMPLETING THE INSIDE OF REPORT.

Figure B-4. Coding Instructions and Categories for MV-104 (appears on back of MV-104 and intended to be folded so that instructions line up with code boxes)

CASE NUMBER...................................... ☐–☐☐☐☐☐☐ 1-7

ASP AREA?.......1. Yes; 2. No (skip rest of form)........................ ☐ 8

ACCIDENT LOCATION....1. Not in Rdway (skip rest of form); 2. Midblock;
3. Near Intersection; 4. Intersection (NFS); 5. Ped in Crosswalk;
6. Ped in Middle of Int.. ☐ 9

VEHICLE POSITION (For Intersection Accidents): 1. Entering Intersection;
2. Exiting Intersection; 3. Unknown...................................... ☐ 10

PEDESTRIAN......1. Crossing, first half; 2. Crossing, second half;
3. Crossing (NSF); 4. Staying in street; 5. In street, action unknown......... ☐ 11

PEDESTRIAN PACE........1. Stationary; 2. Slow walk; 3. Walk;
4. "Darting"; 5. Running; 6. Pace Unknown.............................. ☐ 12

INTERPOSED PARKED VEHICLES.....1. Yes; 2. No; 3. Unknown;
4. Irrelevant... ☐ 13

CULPABILITY....0. None; 1. Ped; 2. Driver; 3. Ped & Driver;
4. Environment; 5. Ped & Env; 6. Driver & Env; 7. All three; 8. Other
specific; 9. Unknown... ☐ 14

ACCIDENT DATE...................................... ☐☐/☐☐/☐☐ 15-20

DAY OF WEEK...1. Su; 2. M; 3. Tu; 4. W; 5. Th; 6. F; 7. Sa............... ☐ 21

TIME OF DAY (MILITARY)..................................... ☐☐:☐☐ 22-25

(2) PEDESTRIAN ACTION ☐☐ 26-27

1. Crossing, With Signal
2. Crossing, Against Signal
3. Crossing, No Signal, Marked Crosswalk
4. Crossing, No Signal or Crosswalk
5. Walking Along Highway With Traffic
6. Walking Along Highway Against Traffic
7. Emerging from in Front of/Behind Parked Vehicle
8. Child Getting On/Off School Bus
9. Getting On/Off Vehicle Other Than School Bus
10. Pushing/Working On Car
11. Working in Roadway
12. Playing in Roadway
13. Other Actions in Roadway
14. Not in Roadway

DRIVER AGE (IF KNOWN).. ☐☐ 28-29

DRIVER SEX...1. M; 2. F; 3. H&R; 4. H&R-M; 5. H&R-F; 6. Unknown........... ☐ 30

VEHICLE TYPE...1. Car; 2. Small van; 3. Taxi; 4. Bus; 5. Motorcycle;
6. Straight truck; 7. Articulated truck; 8. Other; 9. Unknown .... ☐ 31

LOCATION CODES

ACCIDENT STREET.. ☐☐☐☐ 32-35

........................Feet (99 if 99 or more)..................... ☐☐ 36-37

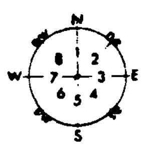
1. N; 2. E; 3. S; 4. W; 5. Mid-intersection................................ ☐ 38

of SECONDARY STREET .... ☐☐☐☐ 39-42

PEDESTRIAN AGE.........(97 = Unknown child; 98 = Unknown adult; .... ☐☐ 43-44
99 = Completely Unknown)

PEDESTRIAN SEX........1. M; 2. F; 3. Unknown.......................... ☐ 45

DIRECTION OF TRAVEL:



9. None, Unknown

(23) VEHICLES: AT IMPACT... ☐ 46
: PRE-IMPACT (If different).............................. ☐ 47

(24) PEDESTRIAN: AT IMPACT.. ☐ 48
: PRE-IMPACT (If different)............................ ☐ 49

(25) VEHICLE ACTION. ☐☐ 50-51

1. Going Straight Ahead
2. Making Right Turn
3. Making Left Turn
4. Making U Turn
5. Starting from Parking
6. Starting in Traffic
7. Slowing or Stopping
8. Stopped in Traffic
9. Entering Parked Position
10. Parked
11. Avoiding Object in Roadway
12. Changing Lanes
13. Overtaking
14. Merging
15. Backing
20. Other

CODED BY: 1. WAL; 2. MLF; 3. JJH; 4. CAG .... ☐ 80

Figure B-5. Form Used to Code Information About Manhattan Pedestrian Accidents

Weather Information. Date: ___/___/ 78

Day of Week: ____________ Study: 1 2 3

Time	Temperature	Wind	Sky
		l m h g	b h c s r
		l m h g	b h c s r
		l m h g	b h c s r
		l m h g	b h c s r
		l m h g	b h c s r
		l m h g	b h c s r
		l m h g	b h c s r
		l m h g	b h c s r
		l m h g	b h c s r
		l m h g	b h c s r

Weather Information: Record data at each hour of the data collection period and at any time the weather conditions significantly changes (e.g., the onset or cessation of precipitation).

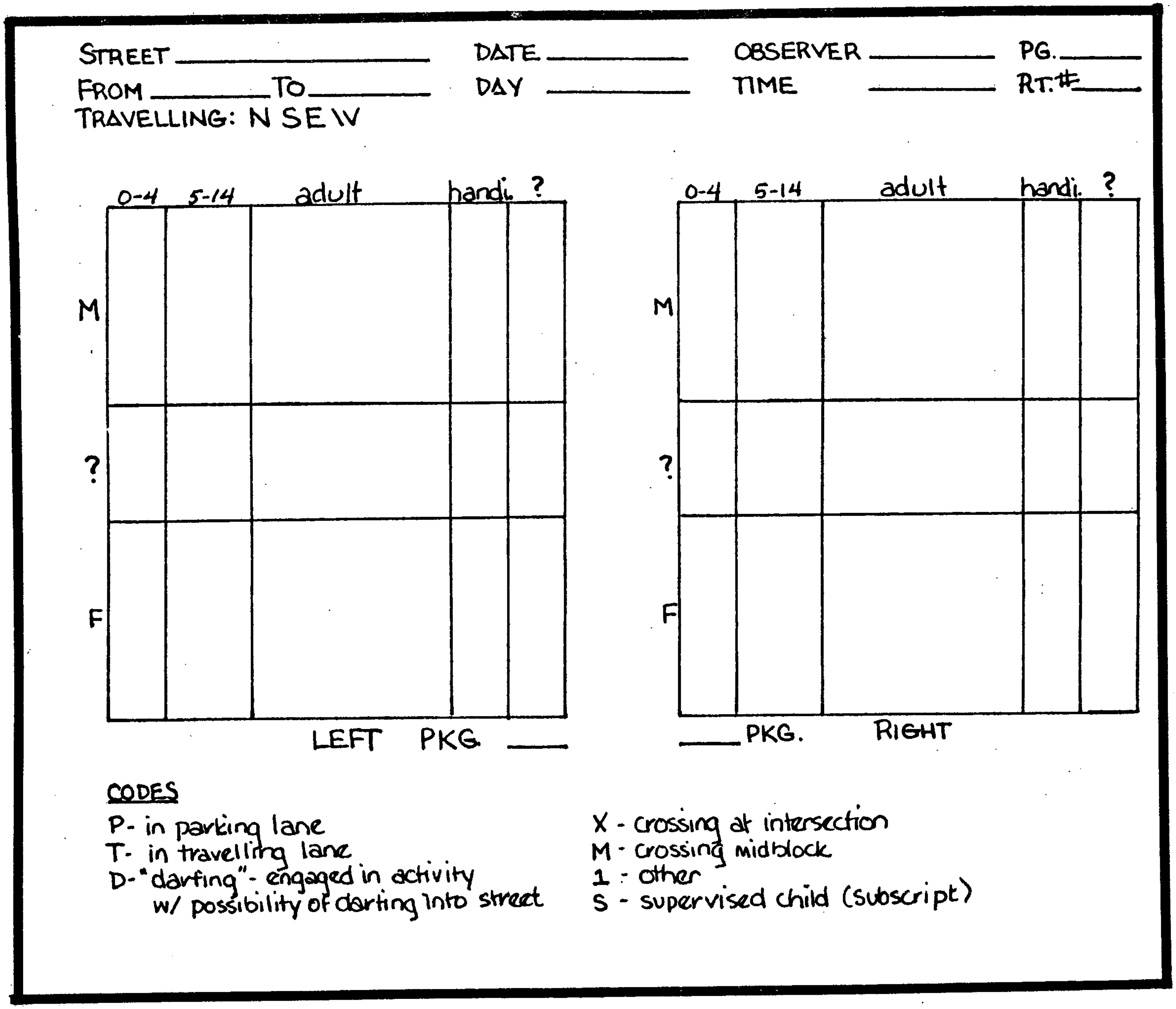
Codes and Explanations:

Temperature: Estimate to nearest five (5) degrees the temperature affecting pedestrians not in direct sunlight.

Wind: l=light; a mild or nonexistent breeze which would not affect people
- m=medium; a wind offering some cooling and perhaps a little interference to some activities.
- h =heavy; a stronger wind causing many people to avert their heads or otherwise adjust to the wind's presence.
- g =gusty; irregular wind sometimes heavy or even stronger (but not just light or medium). If extremely windy, code both h and g.

Sky: b=bright sun with crisp shadows.
- h=hazy sun with visible but softer shadows.
- c=cloudy; no visible shadows.
- s=sprinkling; mild, perhaps intermittent, showers which offer minimal interference to normal pedestrian activity.
- r=rain; heavy and/or steady rain which keeps some pedestrians inside, causes others to protect themselves from rain to point of interference with freedom of motion and/or vision.

Figure B-6. Weather Information Form



STREET ______ DATE ______ OBSERVER ______ PG. ______
FROM ______ TO ______ DAY ______ TIME ______ RT.# ______
TRAVELLING: N S E W

	0-4	5-14	adult	handi.	?
M					
?					
F					

LEFT PKG. ______

	0-4	5-14	adult	handi.	?
M					
?					
F					

______ PKG. RIGHT

CODES

P- in parking lane
T- in travelling lane
D- "darting"- engaged in activity w/ possibility of darting into street
X - crossing at intersection
M - crossing midblock
1 - other
S - supervised child (subscript)

Figure B-7. Code Sheet for Pedestrian Activity and Parking for One Block

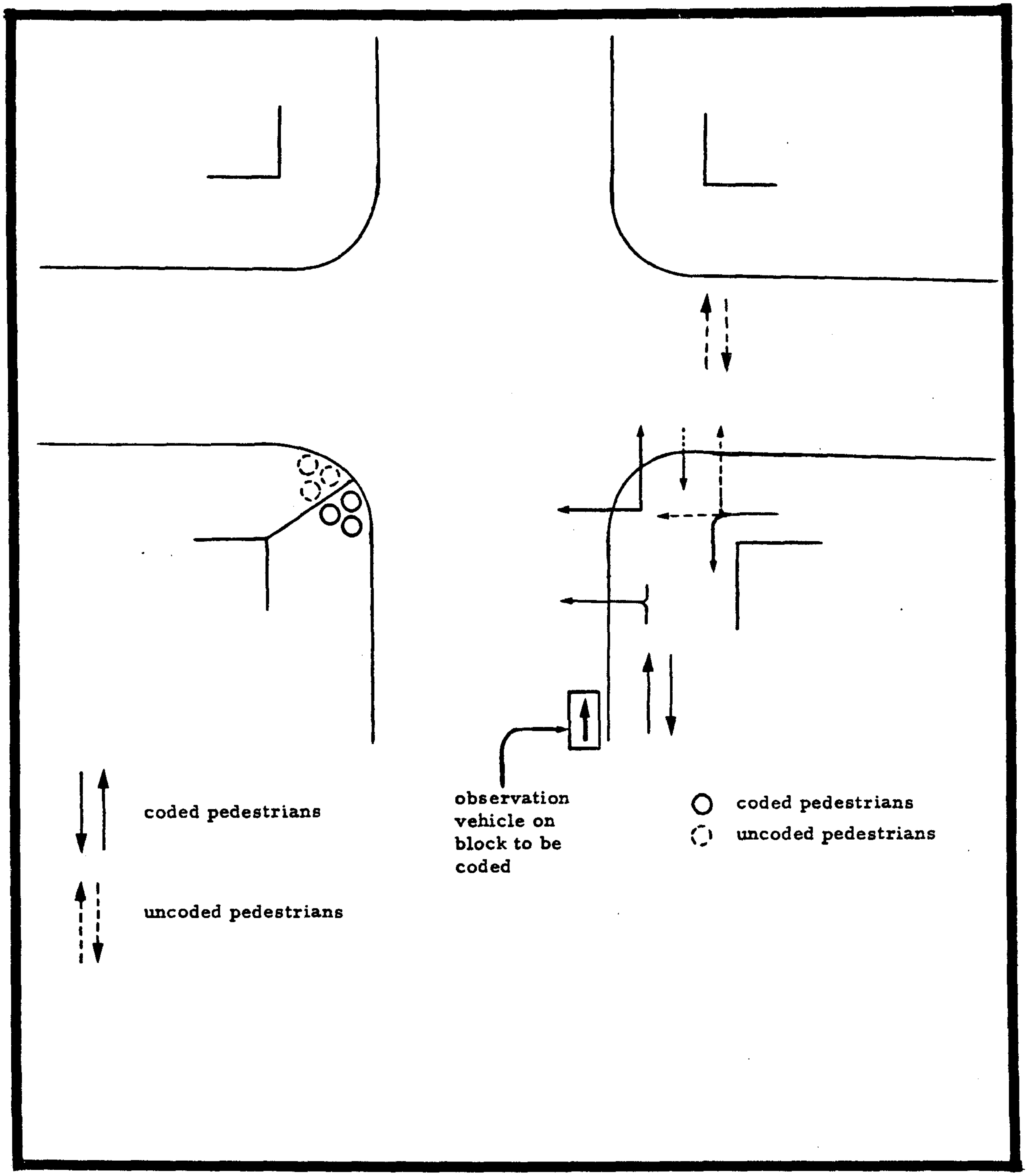


Figure B-8. Diagram for Observers Showing Which Pedestrians Were to be Counted and Which Ignored

APPENDIX C

ACCIDENT DATA ANALYSES: DETAILED TABULATIONS

The detailed analysis paradigm is shown below in Table C-1. In addition to the basic A_X/P_X time and location interactions, the table was expanded to include more time-of-day categories, ASP day/not-ASP day distinctions, and pedestrian origins.

Tested comparisons follow the general (a and d) vs. (b and c) pattern used in the body of this report. For any subset of cells within each quadrant, the comparison is valid (although specific subsets don't necessarily test ASP accident reduction). The following details were examined in the expanded paradigm of Table C-1.

- The time of greatest expected compliance with ASP regulations was tested in isolation as well as compared with the "transition" periods (2, 5, 8 comparisons alone or with 1, 4, 7 and 3, 6, 9).

- The effect of ASP regulations on accidents from the side with no parking, the major expected benefit from the MOSPO, was assessed (1, 2, and 3).

- The effect of ASP regulations on accidents from the opposite sides (i.e., fully parked and possibly double parked) was tested, with particular concern for accident enhancement during ASP periods (4, 5, and 6).

- The overall effect of ASP regulations was assessed even for accidents in which our coders could not determine from which side of the street the pedestrians came (7, 8 and 9).

- Similar "control" tests were made for sites on days for which ASP regulations were not in effect. These should, of course, show no interaction between ASP condition and time of day since full parking was permitted on all of the days included here (10, 11, and 12). Care should be taken in comparing these "control" tests with the actual ASP-effectiveness tests, since the days are not strictly comparable: In this category are all Sunday accidents, Wednesday and Saturday accidents for A2X and P2X sites, and accidents on days when ASP regulations were suspended.

Overall, the ASP regulations should have reduced pedestrian accidents in general when they were active—according to the rationale underlying the development of the model parking regulations. Also, there are subsets of accidents for which the parking removal has the potential for very large accident rate reductions. In order to cover all reasonable accident rate expectations for the model regulations, the data are presented below for all accidents and for relevant subsets.

Each table below contains two sections. At the top are tabulated accident frequencies, by time of day and ASP/pedestrian movement, in the format of Table C-1.

Table C-1. Accident Frequency Comparison Paradigm

		Time of Day							
		Before ASP	A.M. ASP			P.M. ASP			After ASP
			Start	Middle	End	Start	Middle	End	
		7:00 - 7:59 am	8:00 - 8:29 am	8:30 - 10:29 am	10:30 - 10:59 am	11:00 - 11:29 am	11:30 - 1:29 pm	1:30 - 1:59 pm	2:00 - 2:59 pm
A_X on this day, Ped came from	No-Parking No-Parking Side	13a	1a	2a	3a	1b	2b	3b	17b
	Opposite Side	14a	4a	5a	6a	4b	5b	6b	18b
	Unknown Side	15a	7a	8a	9a	7b	8b	9b	19b
A_X but not on this day		16a	10a	11a	12a	10b	11b	12b	20b
P_X on this day, Ped came from	No-Parking Side	13c	1c	2c	3c	1d	2d	3d	17d
	Opposite Side	14c	4c	5c	6c	4d	5d	6d	18d
	Unknown Side	15c	7c	8c	9c	7d	8d	9d	19d
P_X but not on this day		16c	10c	11c	12c	10d	11d	12d	20d

At the bottom are descriptive summaries for each of the six forms of accident change under ASP regulations listed above. (The last of the six is a pseudo-test; it is the equivalent numerical exercise as the "Overall" test, but for data on the days when no ASP regulations were in force.)

There are three components to each descriptive summary line. First, the a, b, c and d tallies of the relevant cells in the top tabulation. (The letters refer to the four quadrants of Table C-1). Second, a Chi-Square test of the significance of the ad vs. bc interaction—i.e., the statistical test of whether there was a significant difference in accident frequency between the periods when the ASP regulations were in force and the time-and-location control periods when the ASP regulations were not in force. The formula was

$$\chi^2 = \frac{N\,(ad - bc)^2}{(a+b)\,(c+d)\,(a+c)\,(b+d)}$$

where N = a+b+c+d. (The Yates correction was not used; see Camilli and Hopkins, 1978, for a discussion.) The statistic has one degree of freedom; values for the .05 and .01 levels of confidence are 3.84 and 6.63, respectively. Third, a Percent Change in accident frequency with ASP regulations in effect. This is, essentially, the observed change in the a and d values from the values which would have been predicted from b and c—i.e., the percent change in the baseline (b and c) accident rate actually observed in the parking redeployment test (a and d) conditions. Positive percentages indicate a worsening accident picture when the ASP regulations were in effect, negative percentages show an improvement.

The formula for this was

$$\%\ \text{Change} = 100\ \left(\frac{a-E(a)+d-E(d)}{(b+c)/2}\right),$$

where E(a), the expected value of a, = $\sqrt{(abc/d)}$ and E(d) = $\sqrt{(bcd/a)}$. Because of relatively small sample sizes, some of the Percent Change values are numerically large but unreliable. The best index of the importance of each Percent Change value, i.e., the likelihood that it represents a change truly different from "no change", is the statistical significance of the associated Chi-Square number.

Tables C-2 through C-21 present the results of the accident rate analyses for all accidents and for subsets. Throughout these tables, there are no differences reported which can be judged to be statistically significant.[1] For the analyses performed, no relationship between ASP regulations and accident rates was observed.

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[1]There are 120 Chi-Square values reported in the Tables. By chance, assuming no truly significant effects, 12 values would be 2.71 or above, 6 of which would be 3.84 or above, the nominal 5% level. Of the 120 values, 11 were 2.71 or above and 6 of those were 3.84 or above. Thus there is no reason to believe that any of those values represent "real" effects.

Table C-2. Time of Day by ASP Condition and Pedestrian Origin: All Accidents

	7-7:59	8-8:29	8:30-10:29	10:30-10:59	11 AM-11:29	11:30-1:29 PM	1:30-1:59	2 PM-2:59	SUM	
AX, ON	2	10	24	7	7	47	15	27	139	RAW
TODAY ON	1.439	7.194	17.266	5.036	5.036	33.813	10.791	19.424	100.000	RPR
PED SIDE	5.405	14.706	7.869	9.333	9.722	10.956	10.638	9.408	9.830	RPC
	3.637	6.685	29.982	7.373	7.078	42.172	13.861	28.213	139.000	ERF
AX, ON	8	10	37	6	6	49	13	30	159	RAW
TODAY ON	5.031	6.289	23.270	3.774	3.774	30.818	8.176	18.868	100.000	RPR
OTHR SIDE	21.622	14.706	12.131	8.000	8.333	11.422	9.220	10.453	11.245	RPC
	4.161	7.646	34.296	8.434	8.096	48.240	15.855	32.272	159.000	ERF
AX ON,	10	14	58	16	13	66	26	45	248	RAW
PED SIDE	4.032	5.645	23.387	6.452	5.242	26.613	10.484	18.145	100.000	RPR
UNKNOWN	27.027	20.588	19.016	21.333	18.056	15.385	18.440	15.679	17.539	RPC
	6.489	11.926	53.494	13.154	12.628	75.242	24.730	50.337	248.000	ERF
AX AREA	2	5	39	12	9	52	18	41	178	RAW
BUT NOT	1.124	2.809	21.910	6.742	5.056	29.213	10.112	23.034	100.000	RPR
ON TODAY	5.405	7.353	12.787	16.000	12.500	12.121	12.766	14.286	12.588	RPC
	4.658	8.560	38.395	9.441	9.064	54.004	17.750	36.129	178.000	ERF
PX, ON	2	6	25	9	5	48	12	38	145	RAW
TODAY ON	1.379	4.138	17.241	6.207	3.448	33.103	8.276	26.207	100.000	RPR
PED SIDE	5.405	8.824	8.197	12.000	6.944	11.189	8.511	13.240	10.255	RPC
	3.794	6.973	31.277	7.691	7.383	43.992	14.459	29.431	145.000	ERF
PX, ON		12	39	4	9	39	9	30	142	RAW
TODAY ON		8.451	27.465	2.817	6.338	27.465	6.338	21.127	100.000	RPR
OTHR SIDE		17.647	12.787	5.333	12.500	9.091	6.383	10.453	10.042	RPC
	3.716	6.829	30.629	7.532	7.231	43.082	14.160	28.822	142.000	ERF
PX ON,	6	7	47	13	11	85	31	49	249	RAW
PED SIDE	2.410	2.811	18.876	5.221	4.418	34.137	12.450	19.679	100.000	RPR
UNKNOWN	16.216	10.294	15.410	17.333	15.278	19.814	21.986	17.073	17.610	RPC
	6.516	11.975	53.709	13.207	12.679	75.545	24.830	50.540	249.000	ERF
PX AREA	7	4	36	8	12	43	17	27	154	RAW
BUT NOT	4.545	2.597	23.377	5.195	7.792	27.922	11.039	17.532	100.000	RPR
ON TODAY	18.919	5.882	11.803	10.667	16.667	10.023	12.057	9.408	10.891	RPC
	4.030	7.406	33.218	8.168	7.842	46.723	15.356	31.257	154.000	ERF
SUM	37	68	305	75	72	429	141	287	1414	RAW
	2.617	4.809	21.570	5.304	5.092	30.339	9.972	20.297	100.000	RPR
	100.000	100.000	100.000	100.000	100.000	100.000	100.000	100.000	100.000	RPC
	37.000	68.000	305.000	75.000	72.000	429.000	141.000	287.000	1414.000	ERF

Tests[1]	a[2]	b	c	d[2]	Chi-Square[3]	% Change with ASP[4]
Overall (1-9)	182	242	162	249	1.06	7.5%
Middle hours (2,5,8)	119	162	111	172	.57	6.7%
No-Parking side (1,2,3)	41	69	40	65	.02	-1.7%
Opposite side (4,5,6)	53	68	55	57	.66	-10.1%
Side unknown (7,8,9)	88	105	67	127	4.93	25.8%
Control days (10,11,12)[5]	56	79	48	72	.06	3.0%

1. Numbers, letters refer to Table C-1
2. Frequencies expected to be lower if ASP parking is associated with fewer accidents.
3. One degree of freedom, not Yates corrected. Interpret with caution.
4. Negative values show an accident improvement under the ASP regulations.
5. Should show only random fluctuations.

Table C-3. Time of Day by ASP Condition and Pedestrian Origin: All Accidents with Vehicle Going Straight Ahead

	7-7:59	8-8:29	8:30-10:29	10:30-10:59	11 AM-11:29	11:30-1:29 PM	1:30-1:59	2 PM-2:59	SUM	
AX, ON TODAY ON PED SIDE	1	5	16	4	5	37	6	17	91	RAW
	1.099	5.495	17.582	4.396	5.495	40.659	6.593	18.681	100.000	RPR
	4.167	11.905	8.556	9.302	11.364	12.628	6.897	8.458	9.881	RPC
	2.371	4.150	18.477	4.249	4.347	28.950	8.596	19.860	91.000	ERF
AX, ON TODAY ON OTHR SIDE	5	3	20	5	5	39	7	20	104	RAW
	4.808	2.885	19.231	4.808	4.808	37.500	6.731	19.231	100.000	RPR
	20.833	7.143	10.695	11.628	11.364	13.311	8.046	9.950	11.292	RPC
	2.710	4.743	21.116	4.856	4.969	33.086	9.824	22.697	104.000	ERF
AX ON, PED SIDE UNKNOWN	7	9	38	8	8	45	14	30	159	RAW
	4.403	5.660	23.899	5.031	5.031	28.302	8.805	18.868	100.000	RPR
	29.167	21.429	20.321	18.605	18.182	15.358	16.092	14.925	17.264	RPC
	4.143	7.251	32.283	7.423	7.596	50.583	15.020	34.700	159.000	ERF
AX AREA BUT NOT ON TODAY	1	1	18	11	7	30	11	28	107	RAW
	0.935	0.935	16.822	10.280	6.542	28.037	10.280	26.168	100.000	RPR
	4.167	2.381	9.626	25.581	15.909	10.239	12.644	13.930	11.618	RPC
	2.788	4.879	21.725	4.996	5.112	34.040	10.107	23.352	107.000	ERF
PX, ON TODAY ON PED SIDE	2	4	17	5	2	30	8	32	100	RAW
	2.000	4.000	17.000	5.000	2.000	30.000	8.000	32.000	100.000	RPR
	8.333	9.524	9.091	11.628	4.545	10.239	9.195	15.920	10.858	RPC
	2.606	4.560	20.304	4.669	4.777	31.813	9.446	21.824	100.000	ERF
PX, ON TODAY ON OTHR SIDE		10	29	1	6	32	8	24	110	RAW
		9.091	26.364	0.909	5.455	29.091	7.273	21.818	100.000	RPR
		23.810	15.508	2.326	13.636	10.922	9.195	11.940	11.944	RPC
	2.866	5.016	22.334	5.136	5.255	34.995	10.391	24.007	110.000	ERF
PX ON, PED SIDE UNKNOWN	3	7	29	5	7	52	26	35	164	RAW
	1.829	4.268	17.683	3.049	4.268	31.707	15.854	21.341	100.000	RPR
	12.500	16.667	15.508	11.628	15.909	17.747	29.885	17.413	17.807	RPC
	4.274	7.479	33.299	7.657	7.835	52.174	15.492	35.792	164.000	ERF
PX AREA BUT NOT ON TODAY	5	3	20	4	4	28	7	15	86	RAW
	5.814	3.488	23.256	4.651	4.651	32.558	8.140	17.442	100.000	RPR
	20.833	7.143	10.695	9.302	9.091	9.556	8.046	7.463	9.338	RPC
	2.241	3.922	17.461	4.015	4.109	27.359	8.124	18.769	86.000	ERF
SUM	24	42	187	43	44	293	87	201	921	RAW
	2.606	4.560	20.304	4.669	4.777	31.813	9.446	21.824	100.000	RPR
	100.000	100.000	100.000	100.000	100.000	100.000	100.000	100.000	100.000	RPC
	24.000	42.000	187.000	43.000	44.000	293.000	87.000	201.000	921.000	ERF

Tests[1]	a[2]	b	c	d[2]	Chi-Square[3]	% Change with ASP[4]
Overall (1-9)	108	166	107	171	.05	2.0%
Middle hours (2,5,8)	74	121	75	114	.12	-3.6%
No-Parking side (1,2,3)	25	48	26	40	.40	-10.3%
Opposite side (4,5,6)	28	51	40	46	2.08	-21.0%
Side unknown (7,8,9)	55	67	41	85	4.11	30.3%
Control days (10,11,12)[5]	30	48	27	39	.09	-4.8%

1. Numbers, letters refer to Table C-1
2. Frequencies expected to be lower if ASP parking is associated with fewer accidents.
3. One degree of freedom, not Yates corrected. Interpret with caution.
4. Negative values show an accident improvement under the ASP regulations.
5. Should show only random fluctuations.

Table C-4. Time of Day by ASP Condition and Pedestrian Origin: All Midblock Accidents

	7-7:59	8-8:29	8:30-10:29	10:30-10:59	11 AM-11:29	11:30-1:29 PM	1:30-1:59	2 PM-2:59	SUM	
AX, ON		2	7	4	2	16	5	7	43	RAW
TODAY ON		4.651	16.279	9.302	4.651	37.209	11.628	16.279	100.000	RPR
PED SIDE		6.897	7.692	10.526	6.897	9.302	8.621	6.542	8.068	RPC
	0.726	2.340	7.341	3.066	2.340	13.876	4.679	8.632	43.000	ERF
AX, ON	2	2	12	3	2	23	6	16	66	RAW
TODAY ON	3.030	3.030	18.182	4.545	3.030	34.848	9.091	24.242	100.000	RPR
OTHR SIDE	22.222	6.897	13.187	7.895	6.897	13.372	10.345	14.953	12.383	RPC
	1.114	3.591	11.268	4.705	3.591	21.298	7.182	13.250	66.000	ERF
AX ON,	3	8	17	10	6	31	11	18	104	RAW
PED SIDE	2.885	7.692	16.346	9.615	5.769	29.808	10.577	17.308	100.000	RPR
UNKNOWN	33.333	27.586	18.681	26.316	20.690	18.023	18.966	16.822	19.512	RPC
	1.756	5.659	17.756	7.415	5.659	33.561	11.317	20.878	104.000	ERF
AX AREA	1	3	14	6	6	15	7	10	62	RAW
BUT NOT	1.613	4.839	22.581	9.677	9.677	24.194	11.290	16.129	100.000	RPR
ON TODAY	11.111	10.345	15.385	15.789	20.690	8.721	12.069	9.346	11.632	RPC
	1.047	3.373	10.585	4.420	3.373	20.008	6.747	12.447	62.000	ERF
PX, ON	1	2	7	5		16	6	14	51	RAW
TODAY ON	1.961	3.922	13.725	9.804		31.373	11.765	27.451	100.000	RPR
PED SIDE	11.111	6.897	7.692	13.158		9.302	10.345	13.084	9.568	RPC
	0.861	2.775	8.707	3.636	2.775	16.458	5.550	10.238	51.000	ERF
PX, ON		6	11		2	20	2	15	56	RAW
TODAY ON		10.714	19.643		3.571	35.714	3.571	26.786	100.000	RPR
OTHR SIDE		20.690	12.088		6.897	11.628	3.448	14.019	10.507	RPC
	0.946	3.047	9.561	3.992	3.047	18.071	6.094	11.242	56.000	ERF
PX ON,		3	15	7	6	35	16	19	101	RAW
PED SIDE		2.970	14.851	6.931	5.941	34.653	15.842	18.812	100.000	RPR
UNKNOWN		10.345	16.484	18.421	20.690	20.349	27.586	17.757	18.949	RPC
	1.705	5.495	17.244	7.201	5.495	32.593	10.991	20.276	101.000	ERF
PX AREA	2	3	8	3	5	16	5	8	50	RAW
BUT NOT	4.000	6.000	16.000	6.000	10.000	32.000	10.000	16.000	100.000	RPR
ON TODAY	22.222	10.345	8.791	7.895	17.241	9.302	8.621	7.477	9.381	RPC
	0.844	2.720	8.537	3.565	2.720	16.135	5.441	10.038	50.000	ERF
SUM	9	29	91	38	29	172	58	107	533	RAW
	1.689	5.441	17.073	7.129	5.441	32.270	10.882	20.075	100.000	RPR
	100.000	100.000	100.000	100.000	100.000	100.000	100.000	100.000	100.000	RPC
	9.000	29.000	91.000	38.000	29.000	172.000	58.000	107.000	533.000	ERF

Tests[1]	a[2]	b	c	d[2]	Chi-Square[3]	% Change with ASP[4]
Overall (1-9)	65	102	56	103	.48	8.1%
Middle hours (2,5,8)	36	70	33	71	.12	5.1%
No-Parking side (1,2,3)	13	23	14	22	.06	-5.8%
Opposite side (4,5,6)	17	31	17	24	.34	-11.7%
Side unknown (7,8,9)	35	48	25	57	2.43	28.3%
Control days (10,11,12)[5]	23	28	14	26	.95	22.2%

1. Numbers, letters refer to Table C-1
2. Frequencies expected to be lower if ASP parking is associated with fewer accidents.
3. One degree of freedom, not Yates corrected. Interpret with caution.
4. Negative values show an accident improvement under the ASP regulations.
5. Should show only random fluctuations.

Table C-5. Time of Day by ASP Condition and Pedestrian Origin: Midblock Accidents, Vehicle Going Straight Ahead

	7-7:59	8-8:29	8:30-10:29	10:30-10:59	11 AM-11:29	11:30-1:29 PM	1:30-1:59	2 PM-2:59	SUM	
AX, ON		2	7	3	2	15	2	7	38	RAW
TODAY ON		5.263	18.421	7.895	5.263	39.474	5.263	18.421	100.000	RPR
PED SIDE		8.696	9.859	11.538	8.333	10.204	4.651	7.778	8.796	RPC
	0.704	2.023	6.245	2.287	2.111	12.931	3.782	7.917	38.000	ERP
AX, ON	2	1	10	3	2	23	3	15	59	RAW
TODAY ON	3.390	1.695	16.949	5.085	3.390	38.983	5.085	25.424	100.000	RPR
OTHR SIDE	25.000	4.348	14.085	11.538	8.333	15.646	6.977	16.667	13.657	RPC
	1.093	3.141	9.697	3.551	3.278	20.076	5.873	12.292	59.000	ERP
AX ON,	2	5	10	7	5	26	5	11	71	RAW
PED SIDE	2.817	7.042	14.085	9.859	7.042	36.620	7.042	15.493	100.000	RPR
UNKNOWN	25.000	21.739	14.085	26.923	20.833	17.687	11.628	12.222	16.435	RPC
	1.315	3.780	11.669	4.273	3.944	24.160	7.067	14.792	71.000	ERP
AX AREA	1	1	9	5	6	14	6	10	52	RAW
BUT NOT	1.923	1.923	17.308	9.615	11.538	26.923	11.538	19.231	100.000	RPR
ON TODAY	12.500	4.348	12.676	19.231	25.000	9.524	13.953	11.111	12.037	RPC
	0.963	2.769	8.546	3.130	2.889	17.694	5.176	10.833	52.000	ERP
PX, ON	1	2	5	4		13	5	14	44	RAW
TODAY ON	2.273	4.545	11.364	9.091		29.545	11.364	31.818	100.000	RPR
PED SIDE	12.500	8.696	7.042	15.385		8.844	11.628	15.556	10.185	RPC
	0.815	2.343	7.231	2.648	2.444	14.972	4.380	9.167	44.000	ERP
PX, ON		6	11		2	18	2	14	53	RAW
TODAY ON		11.321	20.755		3.774	33.962	3.774	26.415	100.000	RPR
OTHR SIDE		26.087	15.493		8.333	12.245	4.651	15.556	12.269	RPC
	0.981	2.822	8.711	3.190	2.944	18.035	5.275	11.042	53.000	ERP
PX ON,		3	11	2	5	25	16	13	75	RAW
PED SIDE		4.000	14.667	2.667	6.667	33.333	21.333	17.333	100.000	RPR
UNKNOWN		13.043	15.493	7.692	20.833	17.007	37.209	14.444	17.361	RPC
	1.389	3.993	12.326	4.514	4.167	25.521	7.465	15.625	75.000	ERP
PX AREA	2	3	8	2	2	13	4	6	40	RAW
BUT NOT	5.000	7.500	20.000	5.000	5.000	32.500	10.000	15.000	100.000	RPR
ON TODAY	25.000	13.043	11.268	7.692	8.333	8.844	9.302	6.667	9.259	RPC
	0.741	2.130	6.574	2.407	2.222	13.611	3.981	8.333	40.000	ERP
SUM	8	23	71	26	24	147	43	90	432	RAW
	1.852	5.324	16.435	6.019	5.556	34.028	9.954	20.833	100.000	RPR
	100.000	100.000	100.000	100.000	100.000	100.000	100.000	100.000	100.000	RPC
	8.000	23.000	71.000	26.000	24.000	147.000	43.000	90.000	432.000	ERP

Tests[1]	a[2]	b	c	d[2]	Chi-Square[3]	% Change with ASP[4]
Overall (1-9)	48	83	44	86	.22	6.3%
Middle hours (2,5,8)	27	64	27	56	.17	-6.3%
No-Parking side (1,2,3)	12	19	11	18	.00	1.6%
Opposite side (4,5,6)	14	28	17	22	.90	-19.5%
Side unknown (7,8,9)	22	36	16	46	2.04	32.1%
Control days (10,11,12)[5]	15	26	13	19	.12	-7.8%

1. Numbers, letters refer to Table C-1
2. Frequencies expected to be lower if ASP parking is associated with fewer accidents.
3. One degree of freedom, not Yates corrected. Interpret with caution.
4. Negative values show an accident improvement under the ASP regulations.
5. Should show only random fluctuations.

Table C-6. Time of Day by ASP Condition and Pedestrian Origin: All Accidents with Vehicle Entering Intersection

	7-7:59	8-8:29	8:30-10:29	10:30-10:59	11 AM-11:29	11:30-1:29 PM	1:30-1:59	2 PM-2:59	SUM	
AX, ON TODAY ON PED SIDE		3	6	2	2	10	2	5	30	RAW
		10.000	20.000	6.667	6.667	33.333	6.667	16.667	100.000	RPR
		27.273	7.895	14.286	14.286	10.870	7.692	8.065	9.836	RPC
	0.984	1.082	7.475	1.377	1.377	9.049	2.557	6.098	30.000	ERF
AX, ON TODAY ON OTHR SIDE	4	1	9	2	2	10	1	6	35	RAW
	11.429	2.857	25.714	5.714	5.714	28.571	2.857	17.143	100.000	RPR
	40.000	9.091	11.842	14.286	14.286	10,870	3,846	9.677	11.475	RPC
	1.148	1.262	8.721	1.607	1.607	10.557	2.984	7.115	35.000	ERF
AX ON, PED SIDE UNKNOWN	1		15	3	1	8	7	6	41	RAW
	2.439		36.585	7.317	2.439	19.512	17.073	14.634	100.000	RPR
	10.000		19.737	21.429	7.143	8.696	26.923	9.677	13.443	RPC
	1.344	1.479	10.216	1.882	1.882	12.367	3.495	8.334	41.000	ERF
AX AREA BUT NOT ON TODAY		1	4	1	1	12	3	9	31	RAW
		3.226	12.903	3.226	3.226	38.710	9.677	29.032	100.000	RPR
		9.091	5.263	7.143	7.143	13.043	11.538	14.516	10.164	RPC
	1.016	1.118	7.725	1.423	1.423	9.351	2.643	6.302	31.000	ERF
PX, ON TODAY ON PED SIDE	1	2	7	1	2	13	2	14	42	RAW
	2.381	4.762	16.667	2.381	4.762	30.952	4.762	33.333	100.000	RPR
	10.000	18.182	9.211	7.143	14.286	14.130	7.692	22,581	13,770	RPC
	1.377	1.515	10.466	1.928	1.928	12.669	3.580	8.538	42.000	ERF
PX, ON TODAY ON OTHR SIDE		4	12	2	2	12	3	4	39	RAW
		10.256	30.769	5.128	5.128	30.769	7.692	10.256	100.000	RPR
		36.364	15.789	14.286	14.286	13.043	11.538	6.452	12.787	RPC
	1.279	1.407	9.718	1.790	1.790	11.764	3,325	7,928	39.000	ERF
PX ON, PED SIDE UNKNOWN	1		17	1	2	20	5	10	56	RAW
	1.786		30.357	1.786	3.571	35,714	8.929	17.857	100.000	RPR
	10.000		22.368	7.143	14.286	21.739	19.231	16.129	18.361	RPC
	1.836	2.020	13.954	2.570	2.570	16.892	4.774	11.384	56.000	ERF
PX AREA BUT NOT ON TODAY	3		6	2	2	7	3	8	31	RAW
	9.677		19.355	6.452	6.452	22.581	9.677	25.806	100.000	RPR
	30.000		7.895	14.286	14,286	7,609	11.538	12.903	10.164	RPC
	1.016	1.118	7.725	1.423	1.423	9.351	2.643	6.302	31.000	ERF
SUM	10	11	76	14	14	92	26	62	305	RAW
	3.279	3.607	24.918	4.590	4.590	30.164	8.525	20.328	100.000	RPR
	100.000	100.000	100.000	100.000	100.000	100.000	100.000	100.000	100.000	RPC
	10.000	11.000	76.000	14.000	14.000	92.000	26.000	62.000	305.000	ERF

Tests[1]	a[2]	b	c	d[2]	Chi-Square[3]	% Change with ASP[4]
Overall (1-9)	41	43	46	61	.64	12.7%
Middle hours (2,5,8)	30	28	36	45	.72	15.9%
No-Parking side (1,2,3)	11	14	10	17	.26	15.7%
Opposite side (4,5,6)	12	13	18	17	.07	-6.6%
Side unknown (7,8,9)	18	16	18	27	1.31	30.5%
Control days (10,11,12)[5]	6	16	8	12	.76	-25.0%

1. Numbers, letters refer to Table C-1
2. Frequencies expected to be lower if ASP parking is associated with fewer accidents.
3. One degree of freedom, not Yates corrected. Interpret with caution.
4. Negative values show an accident improvement under the ASP regulations.
5. Should show only random fluctuations.

Table C-7. Time of Day by ASP Condition and Pedestrian Origin: Vehicle Proceeding Straight and Entering Intersection

	7-7:59	8-8:29	8:30-10:29	10:30-10:59	11 AM-11:29	11:30-1:29 PM	1:30-1:59	2 PM-2:59	SUM	
AX, ON			4	1	2	8	1	3	19	RAW
TODAY ON			21.053	5.263	10.526	42.105	5.263	15.789	100.000	RPR
PED SIDE			7.273	16.667	20.000	13.333	5.556	6.977	9.314	RPC
	0.745	0.373	5.123	0.559	0.931	5.588	1.676	4.005	19.000	ERP
AX, ON	3		4	1	2	7	1	3	21	RAW
TODAY ON	14.286		19.048	4.762	9.524	33.333	4.762	14.286	100.000	RPR
OTHR SIDE	37.500		7.273	16.667	20.000	11.667	5.556	6.977	10.294	RPC
	0.824	0.412	5.662	0.618	1.029	6.176	1.853	4.426	21.000	ERP
AX ON,			11		1	5	3	4	24	RAW
PED SIDE			45.833		4.167	20.833	12.500	16.667	100.000	RPR
UNKNOWN			20.000		10.000	8.333	16.667	9.302	11.765	RPC
	0.941	0.471	6.471	0.706	1.176	7.059	2.118	5.059	24.000	ERP
AX AREA			4	1	1	7	1	7	21	RAW
BUT NOT			19.048	4.762	4.762	33.333	4.762	33.333	100.000	RPR
ON TODAY			7.273	16.667	10.000	11.667	5.556	16.279	10.294	RPC
	0.824	0.412	5.662	0.618	1.029	6.176	1.853	4.426	21.000	ERP
PX, ON	1	1	5	1	1	8	2	13	32	RAW
TODAY ON	3.125	3.125	15.625	3.125	3.125	25.000	6.250	40.625	100.000	RPR
PED SIDE	12.500	25.000	9.091	16.667	10.000	13.333	11.111	30.233	15.686	RPC
	1.255	0.627	8.627	0.941	1.569	9.412	2.824	6.745	32.000	ERP
PX, ON		3	10		2	10	3	3	31	RAW
TODAY ON		9.677	32.258		6.452	32.258	9.677	9.677	100.000	RPR
OTHR SIDE		75.000	18.182		20.000	16.667	16.667	6.977	15.196	RPC
	1.216	0.608	8.358	0.912	1.520	9.118	2.735	6.534	31.000	ERP
PX ON,	1		12	1	1	10	5	5	35	RAW
PED SIDE	2.857		34.286	2.857	2.857	28.571	14.286	14.286	100.000	RPR
UNKNOWN	12.500		21.818	16.667	10.000	16.667	27.778	11.628	17.157	RPC
	1.373	0.686	9.436	1.029	1.716	10.294	3.088	7.377	35.000	ERP
PX AREA	3		5	1		5	2	5	21	RAW
BUT NOT	14.286		23.810	4.762		23.810	9.524	23.810	100.000	RPR
ON TODAY	37.500		9.091	16.667		8.333	11.111	11.628	10.294	RPC
	0.824	0.412	5.662	0.618	1.029	6.176	1.853	4.426	21.000	ERP
SUM	8	4	55	6	10	60	18	43	204	RAW
	3.922	1.961	26.961	2.941	4.902	29.412	8.824	21.078	100.000	RPR
	100.000	100.000	100.000	100.000	100.000	100.000	100.000	100.000	100.000	RPC
	8.000	4.000	55.000	6.000	10.000	60.000	18.000	43.000	204.000	ERP

Tests[1]	a[2]	b	c	d[2]	Chi-Square[3]	% Change with ASP[4]
Overall (1-9)	21	30	33	42	.10	-5.9%
Middle hours (2,5,8)	19	20	27	28	.00	-0.7%
No-Parking side (1,2,3)	5	11	7	11	.22	-16.3%
Opposite side (4,5,6)	5	10	13	15	.69	-27.5%
Side unknown (7,8,9)	11	9	13	16	.49	22.7%
Control days (10,11,12)[5]	5	9	6	7	.30	-19.4%

1. Numbers, letters refer to Table C-1
2. Frequencies expected to be lower if ASP parking is associated with fewer accidents.
3. One degree of freedom, not Yates corrected. Interpret with caution.
4. Negative values show an accident improvement under the ASP regulations.
5. Should show only random fluctuations.

Table C-8. Time of Day by ASP Condition and Pedestrian Origin: Other (i.e., Vehicle Not Clearly Entering) Intersection

	7-7:59	8-8:29	8:30-10:29	10:30-10:59	11 AM-11:29	11:30-1:29 PM	1:30-1:59	2 PM-2:59	SUM	
AX, ON TODAY ON PED SIDE	2	5	11	1	3	21	8	15	66	RAW
	3.030	7.576	16.667	1.515	4.545	31.818	12.121	22.727	100.000	RPR
	11.111	17.857	7.971	4.348	10.345	12.727	14.035	12.712	11.458	RPC
	2.063	3.208	15.813	2.635	3.323	18.906	6.531	13.521	66.000	ERF
AX, ON TODAY ON OTHR SIDE	2	7	16	1	2	16	6	8	58	RAW
	3.448	12.069	27.586	1.724	3.448	27.586	10.345	13.793	100.000	RPR
	11.111	25.000	11.594	4.348	6.897	9.697	10.526	6.780	10.069	RPC
	1.813	2.819	13.896	2.316	2.920	16.615	5.740	11.882	58.000	ERF
AX ON, PED SIDE UNKNOWN	6	6	26	3	6	27	8	21	103	RAW
	5.825	5.825	25.243	2.913	5.825	26.214	7.767	20.388	100.000	RPR
	33.333	21.429	18.841	13.043	20.690	16.364	14.035	17.797	17.882	RPC
	3.219	5.007	24.677	4.113	5.186	29.505	10.193	21.101	103.000	ERF
AX AREA BUT NOT ON TODAY	1	1	21	5	2	25	8	22	85	RAW
	1.176	1.176	24.706	5.882	2.353	29.412	9.412	25.882	100.000	RPR
	5.556	3.571	15.217	21.739	6.897	15.152	14.035	18.644	14.757	RPC
	2.656	4.132	20.365	3.394	4.280	24.349	8.411	17.413	85.000	ERF
PX, ON TODAY ON PED SIDE		2	11	3	3	19	4	10	52	RAW
		3.846	21.154	5.769	5.769	36.538	7.692	19.231	100.000	RPR
		7.143	7.971	13.043	10.345	11.515	7.018	8.475	9.028	RPC
	1.625	2.528	12.458	2.076	2.618	14.896	5.146	10.653	52.000	ERF
PX, ON TODAY ON OTHR SIDE		2	16	2	5	7	4	11	47	RAW
		4.255	34.043	4.255	10.638	14.894	8.511	23.404	100.000	RPR
		7.143	11.594	8.696	17.241	4.242	7.018	9.322	8.160	RPC
	1.469	2.285	11.260	1.877	2.366	13.464	4.651	9.628	47.000	ERF
PX ON, PED SIDE UNKNOWN	5	4	15	5	3	30	10	20	92	RAW
	5.435	4.348	16.304	5.435	3.261	32.609	10.870	21.739	100.000	RPR
	27.778	14.286	10.870	21.739	10.345	18.182	17.544	16.949	15.972	RPC
	2.875	4.472	22.042	3.674	4.632	26.354	9.104	18.847	92.000	ERF
PX AREA BUT NOT ON TODAY	2	1	22	3	5	20	9	11	73	RAW
	2.740	1.370	30.137	4.110	6.849	27.397	12.329	15.068	100.000	RPR
	11.111	3.571	15.942	13.043	17.241	12.121	15.789	9.322	12.674	RPC
	2.281	3.549	17.490	2.915	3.675	20.911	7.224	14.955	73.000	ERF
SUM	18	28	138	23	29	165	57	118	576	RAW
	3.125	4.861	23.958	3.993	5.035	28.646	9.896	20.486	100.000	RPR
	100.000	100.000	100.000	100.000	100.000	100.000	100.000	100.000	100.000	RPC
	18.000	28.000	138.000	23.000	29.000	165.000	57.000	118.000	576.000	ERF

Tests[1]	a[2]	b	c	d[2]	Chi-Square[3]	% Change with ASP[4]
Overall (1-9)	66	97	60	85	.03	-1.8%
Middle hours (2,5,8)	53	64	42	56	.13	5.0%
No-Parking side (1,2,3)	7	32	16	26	4.04	-46.6%
Opposite side (4,5,6)	24	24	20	16	.25	-10.7%
Side unknown (7,8,9)	35	41	24	43	1.54	23.0%
Control days (10,11,12)[5]	27	35	26	34	.00	0.4%

1. Numbers, letters refer to Table C-1
2. Frequencies expected to be lower if ASP parking is associated with fewer accidents.
3. One degree of freedom, not Yates corrected. Interpret with caution.
4. Negative values show an accident improvement under the ASP regulations.
5. Should show only random fluctuations.

Table C-9. Time of Day by ASP Condition and Pedestrian Origin: Other Intersection Accidents, Vehicle Going Straight Ahead

	7-7:59	8-8:29	8:30-10:29	10:30-10:59	11 AM-11:29	11:30-1:29 PM	1:30-1:59	2 PM-2:59	SUM	
AX, ON	1	3	5		1	14	3	7	34	RAW
TODAY ON	2.941	8.824	14.706		2.941	41.176	8.824	20.588	100.000	RPR
PED SIDE	12.500	20.000	8.197		10.000	16.279	11.538	10.294	11.930	RPC
	0.954	1.789	7.277	1.312	1.193	10.260	3.102	8.112	34.000	ERF
AX, ON		2	6	1	1	9	3	2	24	RAW
TODAY ON		8.333	25.000	4.167	4.167	37.500	12.500	8.333	100.000	RPR
OTHR SIDE		13.333	9.836	9.091	10.000	10.465	11.538	2.941	8.421	RPC
	0.674	1.263	5.137	0.926	0.842	7.242	2.189	5.726	24.000	ERF
AX ON,	5	4	17	1	2	14	6	15	64	RAW
PED SIDE	7.813	6.250	26.563	1.563	3.125	21.875	9.375	23.438	100.000	RPR
UNKNOWN	62.500	26.667	27.869	9.091	20.000	16.279	23.077	22.059	22.456	RPC
	1.796	3.368	13.698	2.470	2.246	19.312	5.839	15.270	64.000	ERF
AX AREA			5	5		9	4	11	34	RAW
BUT NOT			14.706	14.706		26.471	11.765	32.353	100.000	RPR
ON TODAY			8.197	45.455		10.465	15.385	16.176	11.930	RPC
	0.954	1.789	7.277	1.312	1.193	10.260	3.102	8.112	34.000	ERF
PX, ON		1	7		1	9	1	5	24	RAW
TODAY ON		4.167	29.167		4.167	37.500	4.167	20.833	100.000	RPR
PED SIDE		6.667	11.475		10.000	10.465	3.846	7.353	8.421	RPC
	0.674	1.263	5.137	0.926	0.842	7.242	2.189	5.726	24.000	ERF
PX, ON		1	8	1	2	4	3	7	26	RAW
TODAY ON		3.846	30.769	3.846	7.692	15.385	11.538	26.923	100.000	RPR
OTHR SIDE		6.667	13.115	9.091	20.000	4.651	11.538	10.294	9.123	RPC
	0.730	1.368	5.565	1.004	0.912	7.846	2.372	6.204	26.000	ERF
PX ON,	2	4	6	2	1	17	5	17	54	RAW
PED SIDE	3.704	7.407	11.111	3.704	1.852	31.481	9.259	31.481	100.000	RPR
UNKNOWN	25.000	26.667	9.836	18.182	10.000	19.767	19.231	25.000	18.947	RPC
	1.516	2.842	11.558	2.084	1.895	16.295	4.926	12.884	54.000	ERF
PX AREA			7	1	2	10	1	4	25	RAW
BUT NOT			28.000	4.000	8.000	40.000	4.000	16.000	100.000	RPR
ON TODAY			11.475	9.091	20.000	11.628	3.846	5.882	8.772	RPC
	0.702	1.316	5.351	0.965	0.877	7.544	2.281	5.965	25.000	ERF
SUM	8	15	61	11	10	86	26	68	285	RAW
	2.807	5.263	21.404	3.860	3.509	30.175	9.123	23.860	100.000	RPR
	100.000	100.000	100.000	100.000	100.000	100.000	100.000	100.000	100.000	RPC
	8.000	15.000	61.000	11.000	10.000	86.000	26.000	68.000	285.000	ERF

Tests[1]	a[2]	b	c	d[2]	Chi-Square[3]	% Change with ASP[4]
Overall (1-9)	39	53	30	43	.03	2.6%
Middle hours (2,5,8)	28	37	21	30	.04	3.8%
No-Parking side (1,2,3)	8	18	8	11	.62	-20.4%
Opposite side (4,5,6)	9	13	10	9	.56	-20.9%
Side unknown (7,8,9)	22	22	12	23	1.96	36.8%
Control days (10,11,12)[5]	10	13	8	13	.13	11.6%

1. Numbers, letters refer to Table C-1
2. Frequencies expected to be lower if ASP parking is associated with fewer accidents.
3. One degree of freedom, not Yates corrected. Interpret with caution.
4. Negative values show an accident improvement under the ASP regulations.
5. Should show only random fluctuations.

Table C-10. Time of Day by ASP Condition and Pedestrian Origin: Children Through Age 12

	7-7:59	8-8:29	8:30-10:29	10:30-10:59	11 AM-11:29	11:30-1:29 PM	1:30-1:59	2 PM-2:59	SUM	
AX, ON TODAY ON PED SIDE		4	7	2	1	16	4	8	42	RAW
		9.524	16.667	4.762	2.381	38.095	9.524	19.048	100.000	RPR
		15.385	12.963	18.182	7.143	13.008	11.429	9.195	11.798	RPC
	0.708	3.067	6.371	1.298	1.652	14.511	4.129	10.264	42.000	ERP
AX, ON TODAY ON OTHR SIDE	2	5	9	2	2	24	3	7	54	RAW
	3.704	9.259	16.667	3.704	3.704	44.444	5.556	12.963	100.000	RPR
	33.333	19.231	16.667	18.182	14.286	19.512	8.571	8.046	15.169	RPC
	0.910	3.944	8.191	1.669	2.124	18.657	5.309	13.197	54.000	ERP
AX ON, PED SIDE UNKNOWN	1	3	8	2	2	20	5	14	55	RAW
	1.818	5.455	14.545	3.636	3.636	36.364	9.091	25.455	100.000	RPR
	16.667	11.538	14.815	18.182	14.286	16.260	14.286	16.092	15.449	RPC
	0.927	4.017	8.343	1.699	2.163	19.003	5.407	13.441	55.000	ERP
AX AREA BUT NOT ON TODAY			2	1	3	9	3	9	27	RAW
			7.407	3.704	11.111	33.333	11.111	33.333	100.000	RPR
			3.704	9.091	21.429	7.317	8.571	10.345	7.584	RPC
	0.455	1.972	4.096	0.834	1.062	9.329	2.654	6.598	27.000	ERP
PX, ON TODAY ON PED SIDE	1	4	5	2		12	4	16	44	RAW
	2.273	9.091	11.364	4.545		27.273	9.091	36.364	100.000	RPR
	16.667	15.385	9.259	18.182		9.756	11.429	18.391	12.360	RPC
	0.742	3.213	6.674	1.360	1.730	15.202	4.326	10.753	44.000	ERP
PX, ON TODAY ON OTHR SIDE		7	11		2	14	3	10	47	RAW
		14.894	23.404		4.255	29.787	6.383	21.277	100.000	RPR
		26.923	20.370		14.286	11.382	8.571	11.494	13.202	RPC
	0.792	3.433	7.129	1.452	1.848	16.239	4.621	11.486	47.000	ERP
PX ON, PED SIDE UNKNOWN	1	2	9	1	1	23	10	14	61	RAW
	1.639	3.279	14.754	1.639	1.639	37.705	16.393	22.951	100.000	RPR
	16.667	7.692	16.667	9.091	7.143	18.699	28.571	16.092	17.135	RPC
	1.028	4.455	9.253	1.885	2.399	21.076	5.997	14.907	61.000	ERP
PX AREA BUT NOT ON TODAY	1	1	3	1	3	5	3	9	26	RAW
	3.846	3.846	11.538	3.846	11.538	19.231	11.538	34.615	100.000	RPR
	16.667	3.846	5.556	9.091	21.429	4.065	8.571	10.345	7.303	RPC
	0.438	1.899	3.944	0.803	1.022	8.983	2.556	6.354	26.000	ERP
SUM	6	26	54	11	14	123	35	87	356	RAW
	1.685	7.303	15.169	3.090	3.933	34.551	9.831	24.438	100.000	RPR
	100.000	100.000	100.000	100.000	100.000	100.000	100.000	100.000	100.000	RPC
	6.000	26.000	54.000	11.000	14.000	123.000	35.000	87.000	356.000	ERP

Tests[1]	a[2]	b	c	d[2]	Chi-Square[3]	% Change with ASP[4]
Overall (1-9)	42	77	41	69	.10	-4.1%
Middle hours (2,5,8)	24	60	25	49	.50	-11.1%
No-Parking side (1,2,3)	13	21	11	16	.04	-4.9%
Opposite side (4,5,6)	16	29	18	19	1.43	-23.1%
Side unknown (7,8,9)	13	27	12	34	.43	17.3%
Control days (10,11,12)[5]	3	15	5	11	1.00	-35.5%

1. Numbers, letters refer to Table C-1
2. Frequencies expected to be lower if ASP parking is associated with fewer accidents.
3. One degree of freedom, not Yates corrected. Interpret with caution.
4. Negative values show an accident improvement under the ASP regulations.
5. Should show only random fluctuations.

Table C-11. Time of Day by ASP Condition and Pedestrian Origin: Children (0-12) in Midblock Accidents

	7-7:59	8-8:29	8:30-10:29	10:30-10:59	11 AM-11:29	11:30-1:29 PM	1:30-1:59	2 PM-2:59	SUM	
AX, ON		2	4	2	1	9	2	5	25	RAW
TODAY ON		8.000	16.000	8.000	4.000	36.000	8.000	20.000	100.000	RPR
PED SIDE		20.000	16.667	20.000	8.333	12.500	9.091	10.204	12.438	RPC
	0.249	1.244	2.985	1.244	1.493	8.955	2.736	6.095	25.000	ERF
AX, ON	1	1	5	2	2	18	3	5	37	RAW
TODAY ON	2.703	2.703	13.514	5.405	5.405	48.649	8.108	13.514	100.000	RPR
OTHR SIDE	50.000	10.000	20.833	20.000	16.667	25.000	13.636	10.204	18.408	RPC
	0.368	1.841	4.418	1.841	2.209	13.254	4.050	9.020	37.000	ERF
AX ON,		2	2	2	2	12	2	7	29	RAW
PED SIDE		6.897	6.897	6.897	6.897	41.379	6.897	24.138	100.000	RPR
UNKNOWN		20.000	8.333	20.000	16.667	16.667	9.091	14.286	14.428	RPC
	0.289	1.443	3.463	1.443	1.731	10.388	3.174	7.070	29.000	ERF
AX AREA			2		3	3	2	4	14	RAW
BUT NOT			14.286		21.429	21.429	14.286	28.571	100.000	RPR
ON TODAY			8.333		25.000	4.167	9.091	8.163	6.965	RPC
	0.139	0.697	1.672	0.697	0.836	5.015	1.532	3.413	14.000	ERF
PX, ON	1	1	3	2		5	3	9	24	RAW
TODAY ON	4.167	4.167	12.500	8.333		20.833	12.500	37.500	100.000	RPR
PED SIDE	50.000	10.000	12.500	20.000		6.944	13.636	18.367	11.940	RPC
	0.239	1.194	2.866	1.194	1.433	8.597	2.627	5.851	24.000	ERF
PX, ON		3	5		1	8	2	8	27	RAW
TODAY ON		11.111	18.519		3.704	29.630	7.407	29.630	100.000	RPR
OTHR SIDE		30.000	20.833		8.333	11.111	9.091	16.327	13.433	RPC
	0.269	1.343	3.224	1.343	1.612	9.672	2.955	6.582	27.000	ERF
PX ON,			3	1	1	15	7	7	34	RAW
PED SIDE			8.824	2.941	2.941	44.118	20.588	20.588	100.000	RPR
UNKNOWN			12.500	10.000	8.333	20.833	31.818	14.286	16.915	RPC
	0.338	1.692	4.060	1.692	2.030	12.179	3.721	8.289	34.000	ERF
PX AREA		1		1	2	2	1	4	11	RAW
BUT NOT		9.091		9.091	18.182	18.182	9.091	36.364	100.000	RPR
ON TODAY		10.000		10.000	16.667	2.778	4.545	8.163	5.473	RPC
	0.109	0.547	1.313	0.547	0.657	3.940	1.204	2.682	11.000	ERF
SUM	2	10	24	10	12	72	22	49	201	RAW
	0.995	4.975	11.940	4.975	5.970	35.821	10.945	24.378	100.000	RPR
	100.000	100.000	100.000	100.000	100.000	100.000	100.000	100.000	100.000	RPC
	2.000	10.000	24.000	10.000	12.000	72.000	22.000	49.000	201.000	ERF

Tests[1]	a[2]	b	c	d[2]	Chi-Square[3]	% Change with ASP[4]
Overall (1-9)	22	51	18	42	.00	0.3%
Middle hours (2,5,8)	11	39	11	28	.45	-14.1%
No-Parking side (1,2,3)	8	12	6	8	.03	-5.4%
Opposite side (4,5,6)	8	23	8	11	1.44	-27.3%
Side unknown (7,8,9)	6	16	4	23	1.16	46.3%
Control days (10,11,12)[5]	2	8	2	5	.17	-18.5%

1. Numbers, letters refer to Table C-1
2. Frequencies expected to be lower if ASP parking is associated with fewer accidents.
3. One degree of freedom, not Yates corrected. Interpret with caution.
4. Negative values show an accident improvement under the ASP regulations.
5. Should show only random fluctuations.

Table C-12. Time of Day by ASP Condition and Pedestrian Origin: Children (0-12) with Vehicle Entering Intersection

	7-7:59	8-8:29	8:30-10:29	10:30-10:59	11 AM-11:29	11:30-1:29 PM	1:30-1:59	2 PM-2:59	SUM	
AX, ON TODAY ON PED SIDE		1	1			1		2	5	RAW
		20.000	20.000			20.000		40.000	100.000	RPR
		16.667	6.667			5.000		9.524	7.246	RPC
	0.145	0.435	1.087	0.072	0.072	1.449	0.217	1.522	5.000	ERF
AX, ON TODAY ON OTHR SIDE	1	1				2		2	6	RAW
	16.667	16.667				33.333		33.333	100.000	RPR
	50.000	16.667				10.000		9.524	8.696	RPC
	0.174	0.522	1.304	0.087	0.087	1.739	0.261	1.826	6.000	ERF
AX ON, PED SIDE UNKNOWN			4			3	1	1	9	RAW
			44.444			33.333	11.111	11.111	100.000	RPR
			26.667			15.000	33.333	4.762	13.043	RPC
	0.261	0.783	1.957	0.130	0.130	2.609	0.391	2.739	9.000	ERF
AX AREA BUT NOT ON TODAY				1		2		2	5	RAW
				20.000		40.000		40.000	100.000	RPR
				100.000		10.000		9.524	7.246	RPC
	0.145	0.435	1.087	0.072	0.072	1.449	0.217	1.522	5.000	ERF
PX, ON TODAY ON PED SIDE		1	1			3		5	10	RAW
		10.000	10.000			30.000		50.000	100.000	RPR
		16.667	6.667			15.000		23.810	14.493	RPC
	0.290	0.870	2.174	0.145	0.145	2.899	0.435	3.043	10.000	ERF
PX, ON TODAY ON OTHR SIDE		3	4		1	4		2	14	RAW
		21.429	28.571		7.143	28.571		14.286	100.000	RPR
		50.000	26.667		100.000	20.000		9.524	20.290	RPC
	0.406	1.217	3.043	0.203	0.203	4.058	0.609	4.261	14.000	ERF
PX ON, PED SIDE UNKNOWN			4			4	1	4	13	RAW
			30.769			30.769	7.692	30.769	100.000	RPR
			26.667			20.000	33.333	19.048	18.841	RPC
	0.377	1.130	2.826	0.188	0.188	3.768	0.565	3.957	13.000	ERF
PX AREA BUT NOT ON TODAY	1		1			1	1	3	7	RAW
	14.286		14.286			14.286	14.286	42.857	100.000	RPR
	50.000		6.667			5.000	33.333	14.286	10.145	RPC
	0.203	0.609	1.522	0.101	0.101	2.029	0.304	2.130	7.000	ERF
SUM	2	6	15	1	1	20	3	21	69	RAW
	2.899	8.696	21.739	1.449	1.449	28.986	4.348	30.435	100.000	RPR
	100.000	100.000	100.000	100.000	100.000	100.000	100.000	100.000	100.000	RPC
	2.000	6.000	15.000	1.000	1.000	20.000	3.000	21.000	69.000	ERF

Tests[1]	a[2]	b	c	d[2]	Chi-Square[3]	% Change with ASP[4]
Overall (1-9)	7	7	13	13	0.00	0.0%
Middle hours (2,5,8)	5	6	9	11	.00	1.0%
No-Parking side (1,2,3)	2	1	2	3	.53	70.4%
Opposite side (4,5,6)	1	2	7	5	.60	-44.9%
Side unknown (7,8,9)	4	4	4	5	.05	11.9%
Control days (10,11,12)[5]	1	2	1	2	0.00	0.0%

1. Numbers, letters refer to Table C-1
2. Frequencies expected to be lower if ASP parking is associated with fewer accidents.
3. One degree of freedom, not Yates corrected. Interpret with caution.
4. Negative values show an accident improvement under the ASP regulations.
5. Should show only random fluctuations.

Table C-13. Time of Day by ASP Condition and Pedestrian Origin: Children (0-12) in Other Intersection Accidents

	7-7:59	8-8:29	8:30-10:29	11 AM-11:29	11:30-1:29 PM	1:30-1:59	2 PM-2:59	SUM	
AX, ON TODAY ON PED SIDE		1	2		6	2	1	12	RAW
		8.333	16.667		50.000	16.667	8.333	100.000	RPR
		10.000	13.333		19.355	20.000	5.882	13.953	RPC
	0.279	1.395	2.093	0.140	4.326	1.395	2.372	12.000	ERF
AX, ON TODAY ON OTHR SIDE		3	4		4			11	RAW
		27.273	36.364		36.364			100.000	RPR
		30.000	26.667		12.903			12.791	RPC
	0.256	1.279	1.919	0.128	3.965	1.279	2.174	11.000	ERF
AX ON, PED SIDE UNKNOWN	1	1	2		5	2	6	17	RAW
	5.882	5.882	11.765		29.412	11.765	35.294	100.000	RPR
	50.000	10.000	13.333		16.129	20.000	35.294	19.767	RPC
	0.395	1.977	2.965	0.198	6.128	1.977	3.360	17.000	ERF
AX AREA BUT NOT ON TODAY					4	1	3	8	RAW
					50.000	12.500	37.500	100.000	RPR
					12.903	10.000	17.647	9.302	RPC
	0.186	0.930	1.395	0.093	2.884	0.930	1.581	8.000	ERF
PX, ON TODAY ON PED SIDE		2	1		4	1	2	10	RAW
		20.000	10.000		40.000	10.000	20.000	100.000	RPR
		20.000	6.667		12.903	10.000	11.765	11.628	RPC
	0.233	1.163	1.744	0.116	3.605	1.163	1.977	10.000	ERF
PX, ON TODAY ON OTHR SIDE		1	2		2	1		6	RAW
		16.667	33.333		33.333	16.667		100.000	RPR
		10.000	13.333		6.452	10.000		6.977	RPC
	0.140	0.698	1.047	0.070	2.163	0.698	1.186	6.000	ERF
PX ON, PED SIDE UNKNOWN	1	2	2		4	2	3	14	RAW
	7.143	14.286	14.286		28.571	14.286	21.429	100.000	RPR
	50.000	20.000	13.333		12.903	20.000	17.647	16.279	RPC
	0.326	1.628	2.442	0.163	5.047	1.628	2.767	14.000	ERF
PX AREA BUT NOT ON TODAY			2	1	2	1	2	8	RAW
			25.000	12.500	25.000	12.500	25.000	100.000	RPR
			13.333	100.000	6.452	10.000	11.765	9.302	RPC
	0.186	0.930	1.395	0.093	2.884	0.930	1.581	8.000	ERF
SUM	2	10	15	1	31	10	17	86	RAW
	2.326	11.628	17.442	1.163	36.047	11.628	19.767	100.000	RPR
	100.000	100.000	100.000	100.000	100.000	100.000	100.000	100.000	RPC
	2.000	10.000	15.000	1.000	31.000	10.000	17.000	86.000	ERF

Tests[1]	a[2]	b	c	d[2]	Chi-Square[3]	% Change with ASP[4]
Overall (1-9)	13	19	10	14	.01	-2.0%
Middle hours (2,5,8)	8	15	5	10	.01	2.9%
No-Parking side (1,2,3)	3	8	3	5	.22	-19.3%
Opposite side (4,5,6)	7	4	3	3	.30	34.9%
Side unknown (7,8,9)	3	7	4	6	.22	-20.2%
Control days (10,11,12)[5]	0	5	2	4	2.04	-51.9%

1. Numbers, letters refer to Table C-1
2. Frequencies expected to be lower if ASP parking is associated with fewer accidents.
3. One degree of freedom, not Yates corrected. Interpret with caution.
4. Negative values show an accident improvement under the ASP regulations.
5. Should show only random fluctuations.

Table C-14. Time of Day by ASP Condition and Pedestrian Origin: All Accidents with Parked Vehicles Cited

	7-7:59	8-8:29	8:30-10:29	10:30-10:59	11 AM-11:29	11:30-1:29 PM	1:30-1:59	2 PM-2:59	SUM	
AX, ON		1	4	2	2	13	4	10	36	RAW
TODAY ON		2.778	11.111	5.556	5.556	36.111	11.111	27.778	100.000	RPR
PED SIDE		6.250	9.524	11.111	11.765	11.927	14.286	12.346	11.392	RPC
	0.570	1.823	4.785	2.051	1.937	12.418	3.190	9.228	36.000	ERF
AX, ON	3	1	8	2	3	20	5	14	56	RAW
TODAY ON	5.357	1.786	14.286	3.571	5.357	35.714	8.929	25.000	100.000	RPR
OTHR SIDE	60.000	6.250	19.048	11.111	17.647	18.349	17.857	17.284	17.722	RPC
	0.886	2.835	7.443	3.190	3.013	19.316	4.962	14.354	56.000	ERF
AX ON,	1	5	5	4	2	11	4	8	40	RAW
PED SIDE	2.500	12.500	12.500	10.000	5.000	27.500	10.000	20.000	100.000	RPR
UNKNOWN	20.000	31.250	11.905	22.222	11.765	10.092	14.286	9.877	12.658	RPC
	0.633	2.025	5.316	2.278	2.152	13.797	3.544	10.253	40.000	ERF
AX AREA		1	2	1	4	10	3	8	29	RAW
BUT NOT		3.448	6.897	3.448	13.793	34.483	10.345	27.586	100.000	RPR
ON TODAY		6.250	4.762	5.556	23.529	9.174	10.714	9.877	9.177	RPC
	0.459	1.468	3.854	1.652	1.560	10.003	2.570	7.434	29.000	ERF
PX, ON	1	2	2	3		13	3	13	37	RAW
TODAY ON	2.703	5.405	5.405	8.108		35.135	8.108	35.135	100.000	RPR
PED SIDE	20.000	12.500	4.762	16.667		11.927	10.714	16.049	11.709	RPC
	0.585	1.873	4.918	2.108	1.991	12.763	3.278	9.484	37.000	ERF
PX, ON		4	13	1	2	13	1	11	45	RAW
TODAY ON		8.889	28.889	2.222	4.444	28.889	2.222	24.444	100.000	RPR
OTHR SIDE		25.000	30.952	5.556	11.765	11.927	3.571	13.580	14.241	RPC
	0.712	2.278	5.981	2.563	2.421	15.522	3.987	11.535	45.000	ERF
PX ON,			6	3	1	21	5	8	44	RAW
PED SIDE			13.636	6.818	2.273	47.727	11.364	18.182	100.000	RPR
UNKNOWN			14.286	16.667	5.882	19.266	17.857	9.877	13.924	RPC
	0.696	2.228	5.848	2.506	2.367	15.177	3.899	11.278	44.000	ERF
PX AREA		2	2	2	3	8	3	9	29	RAW
BUT NOT		6.897	6.897	6.897	10.345	27.586	10.345	31.034	100.000	RPR
ON TODAY		12.500	4.762	11.111	17.647	7.339	10.714	11.111	9.177	RPC
	0.459	1.468	3.854	1.652	1.560	10.003	2.570	7.434	29.000	ERF
SUM	5	16	42	18	17	109	28	81	316	RAW
	1.582	5.063	13.291	5.696	5.380	34.494	8.861	25.633	100.000	RPR
	100.000	100.000	100.000	100.000	100.000	100.000	100.000	100.000	100.000	RPC
	5.000	16.000	42.000	18.000	17.000	109.000	28.000	81.000	316.000	ERF

Tests[1]	a[2]	b	c	d[2]	Chi-Square[3]	% Change with ASP[4]
Overall (1-9)	32	64	34	59	.22	-6.8%
Middle hours (2,5,8)	17	44	21	47	.14	-7.4%
No-Parking side (1,2,3)	7	19	7	16	.07	-7.9%
Opposite side (4,5,6)	11	28	18	16	4.64	-40.6%
Side unknown (7,8,9)	14	17	9	27	3.00	57.4%
Control days (10,11,12)[5]	4	17	6	14	.67	-27.4%

1. Numbers, letters refer to Table C-1
2. Frequencies expected to be lower if ASP parking is associated with fewer accidents.
3. One degree of freedom, not Yates corrected. Interpret with caution.
4. Negative values show an accident improvement under the ASP regulations.
5. Should show only random fluctuations.

Table C-15. Time of Day by ASP Condition and Pedestrian Origin: Midblock Accidents and Parked Vehicles Cited

	7-7:59	8-8:29	8:30-10:29	10:30-10:59	11 AM-11:29	11:30-1:29 PM	1:30-1:59	2 PM-2:59	SUM	
AX, ON		1	4	2	1	10	2	6	26	RAW
TODAY ON		3.846	15.385	7.692	3.846	38.462	7.692	23.077	100.000	RPR
PED SIDE		6.667	12.500	12.500	9.091	10.638	8.696	9.836	10.156	RPC
	0.406	1.523	3.250	1.625	1.117	9.547	2.336	6.195	26.000	ERP
AX, ON	2	1	7	2	2	18	4	12	48	RAW
TODAY ON	4.167	2.083	14.583	4.167	4.167	37.500	8.333	25.000	100.000	RPR
OTHR SIDE	50.000	6.667	21.875	12.500	18.182	19.149	17.391	19.672	18.750	RPC
	0.750	2.813	6.000	3.000	2.063	17.625	4.313	11.438	48.000	ERP
AX ON,	1	4	3	4	1	11	4	6	34	RAW
PED SIDE	2.941	11.765	8.824	11.765	2.941	32.353	11.765	17.647	100.000	RPR
UNKNOWN	25.000	26.667	9.375	25.000	9.091	11.702	17.391	9.836	13.281	RPC
	0.531	1.992	4.250	2.125	1.461	12.484	3.055	8.102	34.000	ERP
AX AREA		1	2	1	3	8	3	5	23	RAW
BUT NOT		4.348	8.696	4.348	13.043	34.783	13.043	21.739	100.000	RPR
ON TODAY		6.667	6.250	6.250	27.273	8.511	13.043	8.197	8.984	RPC
	0.359	1.348	2.875	1.438	0.988	8.445	2.066	5.480	23.000	ERP
PX, ON	1	2	2	2		11	3	9	30	RAW
TODAY ON	3.333	6.667	6.667	6.667		36.667	10.000	30.000	100.000	RPR
PED SIDE	25.000	13.333	6.250	12.500		11.702	13.043	14.754	11.719	RPC
	0.469	1.758	3.750	1.875	1.289	11.016	2.695	7.148	30.000	ERP
PX, ON		4	9		1	11	1	11	37	RAW
TODAY ON		10.811	24.324		2.703	29.730	2.703	29.730	100.000	RPR
OTHR SIDE		26.667	28.125		9.091	11.702	4.348	18.033	14.453	RPC
	0.578	2.168	4.625	2.313	1.590	13.586	3.324	8.816	37.000	ERP
PX ON,			3	3	1	19	4	6	36	RAW
PED SIDE			8.333	8.333	2.778	52.778	11.111	16.667	100.000	RPR
UNKNOWN			9.375	18.750	9.091	20.213	17.391	9.836	14.063	RPC
	0.563	2.109	4.500	2.250	1.547	13.219	3.234	8.578	36.000	ERP
PX AREA		2	2	2	2	6	2	6	22	RAW
BUT NOT		9.091	9.091	9.091	9.091	27.273	9.091	27.273	100.000	RPR
ON TODAY		13.333	6.250	12.500	18.182	6.383	8.696	9.836	8.594	RPC
	0.344	1.289	2.750	1.375	0.945	8.078	1.977	5.242	22.000	ERP
SUM	4	15	32	16	11	94	23	61	256	RAW
	1.563	5.859	12.500	6.250	4.297	36.719	8.984	23.828	100.000	RPR
	100.000	100.000	100.000	100.000	100.000	100.000	100.000	100.000	100.000	RPC
	4.000	15.000	32.000	16.000	11.000	94.000	23.000	61.000	256.000	ERP

Tests[1]	a[2]	b	c	d[2]	Chi-Square[3]	% Change with ASP[4]
Overall (1-9)	28	53	25	51	.05	3.7%
Middle hours (2,5,8)	14	39	14	41	.01	2.6%
No-Parking side (1,2,3)	7	13	6	14	.11	11.9%
Opposite side (4,5,6)	10	24	13	13	2.64	-34.1%
Side unknown (7,8,9)	11	16	6	24	2.92	63.2%
Control days (10,11,12)[5]	4	14	6	10	.95	-31.4%

1. Numbers, letters refer to Table C-1
2. Frequencies expected to be lower if ASP parking is associated with fewer accidents.
3. One degree of freedom, not Yates corrected. Interpret with caution.
4. Negative values show an accident improvement under the ASP regulations.
5. Should show only random fluctuations.

Table C-16. Time of Day by ASP Condition and Pedestrian Origin: All Accidents, Parked Vehicles Not Cited but Possible

	7-7:59	8-8:29	8:30-10:29	10:30-10:59	11 AM-11:29	11:30-1:29 PM	1:30-1:59	2 PM-2:59	SUM	
AX, ON TODAY ON PED SIDE		2	4	2	3	10	2	1	24	RAW
		8.333	16.667	8.333	12.500	41.667	8.333	4.167	100.000	RPR
		10.000	4.444	10.526	15.000	7.634	4.651	1.220	5.742	RPC
	0.746	1.148	5.167	1.091	1.148	7.522	2.469	4.708	24.000	ERF
AX, ON TODAY ON OTHR SIDE	2	1	7	2		9	2	4	27	RAW
	7.407	3.704	25.926	7.407		33.333	7.407	14.815	100.000	RPR
	15.385	5.000	7.778	10.526		6.870	4.651	4.878	6.459	RPC
	0.840	1.292	5.813	1.227	1.292	8.462	2.778	5.297	27.000	ERF
AX ON, PED SIDE UNKNOWN	3	5	22	5	6	30	11	19	101	RAW
	2.970	4.950	21.782	4.950	5.941	29.703	10.891	18.812	100.000	RPR
	23.077	25.000	24.444	26.316	30.000	22.901	25.581	23.171	24.163	RPC
	3.141	4.833	21.746	4.591	4.833	31.653	10.390	19.813	101.000	ERF
AX AREA BUT NOT ON TODAY	1	1	12	4	4	20	3	15	60	RAW
	1.667	1.667	20.000	6.667	6.667	33.333	5.000	25.000	100.000	RPR
	7.692	5.000	13.333	21.053	20.000	15.267	6.977	18.293	14.354	RPC
	1.866	2.871	12.919	2.727	2.871	18.804	6.172	11.770	60.000	ERF
PX, ON TODAY ON PED SIDE		1	8	1	1	9	4	12	36	RAW
		2.778	22.222	2.778	2.778	25.000	11.111	33.333	100.000	RPR
		5.000	8.889	5.263	5.000	6.870	9.302	14.634	8.612	RPC
	1.120	1.722	7.751	1.636	1.722	11.282	3.703	7.062	36.000	ERF
PX, ON TODAY ON OTHR SIDE		4	11	1	1	13	3	8	41	RAW
		9.756	26.829	2.439	2.439	31.707	7.317	19.512	100.000	RPR
		20.000	12.222	5.263	5.000	9.924	6.977	9.756	9.809	RPC
	1.275	1.962	8.828	1.864	1.962	12.849	4.218	8.043	41.000	ERF
PX ON, PED SIDE UNKNOWN	2	5	15	1	1	29	14	21	88	RAW
	2.273	5.682	17.045	1.136	1.136	32.955	15.909	23.864	100.000	RPR
	15.385	25.000	16.667	5.263	5.000	22.137	32.558	25.610	21.053	RPC
	2.737	4.211	18.947	4.000	4.211	27.579	9.053	17.263	88.000	ERF
PX AREA BUT NOT ON TODAY	5	1	11	3	4	11	4	2	41	RAW
	12.195	2.439	26.829	7.317	9.756	26.829	9.756	4.878	100.000	RPR
	38.462	5.000	12.222	15.789	20.000	8.397	9.302	2.439	9.809	RPC
	1.275	1.962	8.828	1.864	1.962	12.849	4.218	8.043	41.000	ERF
SUM	13	20	90	19	20	131	43	82	418	RAW
	3.110	4.785	21.531	4.545	4.785	31.340	10.287	19.617	100.000	RPR
	100.000	100.000	100.000	100.000	100.000	100.000	100.000	100.000	100.000	RPC
	13.000	20.000	90.000	19.000	20.000	131.000	43.000	82.000	418.000	ERF

Tests[1]	a[2]	b	c	d[2]	Chi-Square[3]	% Change with ASP[4]
Overall (1-9)	50	73	47	75	.12	4.5%
Middle hours (2,5,8)	33	49	34	51	.00	0.5%
No-Parking side (1,2,3)	8	15	10	14	.24	-13.8%
Opposite side (4,5,6)	10	11	16	17	.00	-1.7%
Side unknown (7,8,9)	32	47	21	44	1.03	18.2%
Control days (10,11,12)[5]	17	27	15	19	.24	-10.3%

1. Numbers, letters refer to Table C-1
2. Frequencies expected to be lower if ASP parking is associated with fewer accidents.
3. One degree of freedom, not Yates corrected. Interpret with caution.
4. Negative values show an accident improvement under the ASP regulations.
5. Should show only random fluctuations.

Table C-17. Time of Day by ASP Condition and Pedestrian Origin: Midblock Accidents, Parked Vehicles Not Cited but Possible

	7-7:59	8-8:29	8:30-10:29	10:30-10:59	11 AM-11:29	11:30-1:29 PM	1:30-1:59	2 PM-2:59	SUM	
AX, ON			3	1	1	4	1	1	11	RAW
TODAY ON			27.273	9.091	9.091	36.364	9.091	9.091	100.000	RPR
PED SIDE			8.333	12.500	9.091	7.692	4.545	2.857	6.286	RPC
	0.189	0.503	2.263	0.503	0.691	3.269	1.383	2.200	11.000	ERF
AX, ON		1	4			3	2	4	14	RAW
TODAY ON		7.143	28.571			21.429	14.286	28.571	100.000	RPR
OTHR SIDE		12.500	11.111			5.769	9.091	11.429	8.000	RPC
	0.240	0.640	2.880	0.640	0.880	4.160	1.760	2.800	14.000	ERF
AX ON,	1	2	5	3	4	10	4	8	37	RAW
PED SIDE	2.703	5.405	13.514	8.108	10.811	27.027	10.811	21.622	100.000	RPR
UNKNOWN	33.333	25.000	13.889	37.500	36.364	19.231	18.182	22.857	21.143	RPC
	0.634	1.691	7.611	1.691	2.326	10.994	4.651	7.400	37.000	ERF
AX AREA	1		9	2	3	6	2	5	28	RAW
BUT NOT	3.571		32.143	7.143	10.714	21.429	7.143	17.857	100.000	RPR
ON TODAY	33.333		25.000	25.000	27.273	11.538	9.091	14.286	16.000	RPC
	0.480	1.280	5.760	1.280	1.760	8.320	3.520	5.600	28.000	ERF
PX, ON			4	1		4	3	4	16	RAW
TODAY ON			25.000	6.250		25.000	18.750	25.000	100.000	RPR
PED SIDE			11.111	12.500		7.692	13.636	11.429	9.143	RPC
	0.274	0.731	3.291	0.731	1.006	4.754	2.011	3.200	16.000	ERF
PX, ON		2	2			7	1	4	16	RAW
TODAY ON		12.500	12.500			43.750	6.250	25.000	100.000	RPR
OTHR SIDE		25.000	5.556			13.462	4.545	11.429	9.143	RPC
	0.274	0.731	3.291	0.731	1.006	4.754	2.011	3.200	16.000	ERF
PX ON,		2	6			12	8	9	37	RAW
PED SIDE		5.405	16.216			32.432	21.622	24.324	100.000	RPR
UNKNOWN		25.000	16.667			23.077	36.364	25.714	21.143	RPC
	0.634	1.691	7.611	1.691	2.326	10.994	4.651	7.400	37.000	ERF
PX AREA	1	1	3	1	3	6	1		16	RAW
BUT NOT	6.250	6.250	18.750	6.250	18.750	37.500	6.250		100.000	RPR
ON TODAY	33.333	12.500	8.333	12.500	27.273	11.538	4.545		9.143	RPC
	0.274	0.731	3.291	0.731	1.006	4.754	2.011	3.200	16.000	ERF
SUM	3	8	36	8	11	52	22	35	175	RAW
	1.714	4.571	20.571	4.571	6.286	29.714	12.571	20.000	100.000	RPR
	100.000	100.000	100.000	100.000	100.000	100.000	100.000	100.000	100.000	RPC
	3.000	8.000	36.000	8.000	11.000	52.000	22.000	35.000	175.000	ERF

Tests[1]	a[2]	b	c	d[2]	Chi-Square[3]	% Change with ASP[4]
Overall (1-9)	19	29	17	35	.51	16.3%
Middle hours (2,5,8)	12	17	12	23	.34	16.9%
No-Parking side (1,2,3)	4	6	5	7	.01	-3.5%
Opposite side (4,5,6)	5	5	4	8	.63	42.3%
Side unknown (7,8,9)	10	18	8	20	.33	17.5%
Control days (10,11,12)[5]	11	11	5	8	.44	24.9%

1. Numbers, letters refer to Table C-1
2. Frequencies expected to be lower if ASP parking is associated with fewer accidents.
3. One degree of freedom, not Yates corrected. Interpret with caution.
4. Negative values show an accident improvement under the ASP regulations.
5. Should show only random fluctuations.

Table C-18. Time of Day by ASP Condition and Pedestrian Origin: Vehicle Entering Intersection and Parked Vehicles Not Cited but Possible

	7-7:59	8-8:29	8:30-10:29	10:30-10:59	11 AM-11:29	11:30-1:29 PM	1:30-1:59	2 PM-2:59	SUM	
AX, ON		2	1	1	2	6	1		13	RAW
TODAY ON		15.385	7.692	7.692	15.385	46.154	7.692		100.000	RPR
PED SIDE		40.000	3.125	11.111	50.000	13.636	9.091		10.000	RPC
	0.600	0.500	3.200	0.900	0.400	4.400	1.100	1.900	13.000	ERF
AX, ON	2		3	2		5			12	RAW
TODAY ON	16.667		25.000	16.667		41.667			100.000	RPR
OTHR SIDE	33.333		9.375	22.222		11.364			9.231	RPC
	0.554	0.462	2.954	0.831	0.369	4.062	1.015	1.754	12.000	ERF
AX ON,			6	1		6	2	1	16	RAW
PED SIDE			37.500	6.250		37.500	12.500	6.250	100.000	RPR
UNKNOWN			18.750	11.111		13.636	18.182	5.263	12.308	RPC
	0.738	0.615	3.938	1.108	0.492	5.415	1.354	2.338	16.000	ERF
AX AREA			1	1		8	1	4	15	RAW
BUT NOT			6.667	6.667		53.333	6.667	26.667	100.000	RPR
ON TODAY			3.125	11.111		18.182	9.091	21.053	11.538	RPC
	0.692	0.577	3.692	1.038	0.462	5.077	1.269	2.192	15.000	ERF
PX, ON		1	3		1	5	1	8	19	RAW
TODAY ON		5.263	15.789		5.263	26.316	5.263	42.105	100.000	RPR
PED SIDE		20.000	9.375		25.000	11.364	9.091	42.105	14.615	RPC
	0.877	0.731	4.677	1.315	0.585	6.431	1.608	2.777	19.000	ERF
PX, ON		2	9	1	1	6	2	2	23	RAW
TODAY ON		8.696	39.130	4.348	4.348	26.087	8.696	8.696	100.000	RPR
OTHR SIDE		40.000	28.125	11.111	25.000	13.636	18.182	10.526	17.692	RPC
	1.062	0.885	5.662	1.592	0.708	7.785	1.946	3.362	23.000	ERF
PX ON,	1		4	1		5	3	3	17	RAW
PED SIDE	5.882		23.529	5.882		29.412	17.647	17.647	100.000	RPR
UNKNOWN	16.667		12.500	11.111		11.364	27.273	15.789	13.077	RPC
	0.785	0.654	4.185	1.177	0.523	5.754	1.438	2.485	17.000	ERF
PX AREA	3		5	2		3	1	1	15	RAW
BUT NOT	20.000		33.333	13.333		20.000	6.667	6.667	100.000	RPR
ON TODAY	50.000		15.625	22.222		6.818	9.091	5.263	11.538	RPC
	0.692	0.577	3.692	1.038	0.462	5.077	1.269	2.192	15.000	ERF
SUM	6	5	32	9	4	44	11	19	130	RAW
	4.615	3.846	24.615	6.923	3.077	33.846	8.462	14.615	100.000	RPR
	100.000	100.000	100.000	100.000	100.000	100.000	100.000	100.000	100.000	RPC
	6.000	5.000	32.000	9.000	4.000	44.000	11.000	19.000	130.000	ERF

Tests[1]	a[2]	b	c	d[2]	Chi-Square[3]	% Change with ASP[4]
Overall (1-9)	16	22	21	24	.17	-9.0%
Middle hours (2,5,8)	10	17	16	16	1.00	-23.9%
No-Parking side (1,2,3)	4	9	4	7	.08	-11.3%
Opposite side (4,5,6)	5	5	12	9	.14	-12.7%
Side unknown (7,8,9)	7	8	5	8	.19	17.9%
Control days (10,11,12)[5]	2	9	7	4	4.70	-67.7%

1. Numbers, letters refer to Table C-1
2. Frequencies expected to be lower if ASP parking is associated with fewer accidents.
3. One degree of freedom, not Yates corrected. Interpret with caution.
4. Negative values show an accident improvement under the ASP regulations.
5. Should show only random fluctuations.

Table C-19. Time of Day by ASP Condition and Pedestrian Origin: Midblock Accidents, Parked Vehicles Ruled Out

	7-7:59	8-8:29	8:30-10:29	10:30-10:59	11 AM-11:29	11:30-1:29 PM	1:30-1:59	2 PM-2:59	SUM	
AX, ON TODAY ON PED SIDE		1		1		2	2		6	RAW
		16.667		16.667		33.333	33.333		100.000	RPR
		16.667		7.143		7.692	15.385		5.882	RPC
	0.118	0.353	1.353	0.824	0.412	1.529	0.765	0.647	6.000	ERF
AX, ON TODAY ON OTHR SIDE			1	1		2			4	RAW
			25.000	25.000		50.000			100.000	RPR
			4.348	7.143		7.692			3.922	RPC
	0.078	0.235	0.902	0.549	0.275	1.020	0.510	0.431	4.000	ERF
AX ON, PED SIDE UNKNOWN	1	2	9	3	1	10	3	4	33	RAW
	3.030	6.061	27.273	9.091	3.030	30.303	9.091	12.121	100.000	RPR
	50.000	33.333	39.130	21.429	14.286	38.462	23.077	36.364	32.353	RPC
	0.647	1.941	7.441	4.529	2.265	8.412	4.206	3.559	33.000	ERF
AX AREA BUT NOT ON TODAY		2	3	3		1	2		11	RAW
		18.182	27.273	27.273		9.091	18.182		100.000	RPR
		33.333	13.043	21.429		3.846	15.385		10.784	RPC
	0.216	0.647	2.480	1.510	0.755	2.804	1.402	1.186	11.000	ERF
PX, ON TODAY ON PED SIDE			1	2		1		1	5	RAW
			20.000	40.000		20.000		20.000	100.000	RPR
			4.348	14.286		3.846		9.091	4.902	RPC
	0.098	0.294	1.127	0.686	0.343	1.275	0.637	0.539	5.000	ERF
PX, ON TODAY ON OTHR SIDE					1	2			3	RAW
					33.333	66.667			100.000	RPR
					14.286	7.692			2.941	RPC
	0.059	0.176	0.676	0.412	0.206	0.765	0.382	0.324	3.000	ERF
PX ON, PED SIDE UNKNOWN		1	6	4	5	4	4	4	28	RAW
		3.571	21.429	14.286	17.857	14.286	14.286	14.286	100.000	RPR
		16.667	26.087	28.571	71.429	15.385	30.769	36.364	27.451	RPC
	0.549	1.647	6.314	3.843	1.922	7.137	3.569	3.020	28.000	ERF
PX AREA BUT NOT ON TODAY	1		3			4	2	2	12	RAW
	8.333		25.000			33.333	16.667	16.667	100.000	RPR
	50.000		13.043			15.385	15.385	18.182	11.765	RPC
	0.235	0.706	2.706	1.647	0.824	3.059	1.529	1.294	12.000	ERF
SUM	2	6	23	14	7	26	13	11	102	RAW
	1.961	5.882	22.549	13.725	6.863	25.490	12.745	10.784	100.000	RPR
	100.000	100.000	100.000	100.000	100.000	100.000	100.000	100.000	100.000	RPC
	2.000	6.000	23.000	14.000	7.000	26.000	13.000	11.000	102.000	ERF

Tests[1]	a[2]	b	c	d[2]	Chi-Square[3]	% Change with ASP[4]
Overall (1-9)	18	20	14	17	.03	4.5%
Middle hours (2,5,8)	10	14	7	7	.25	-14.8%
No-Parking side (1,2,3)	2	4	3	1	1.67	-62.1%
Opposite side (4,5,6)	2	2	0	3	2.10	250.0%
Side unknown (7,8,9)	14	14	11	13	.09	8.7%
Control days (10,11,12)[5]	8	3	3	6	3.10	132.3%

1. Numbers, letters refer to Table C-1
2. Frequencies expected to be lower if ASP parking is associated with fewer accidents.
3. One degree of freedom, not Yates corrected. Interpret with caution.
4. Negative values show an accident improvement under the ASP regulations.
5. Should show only random fluctuations.

Table C-20. Time of Day by ASP Condition and Pedestrian Origin: Vehicle Entering Intersection, Parked Vehicles Ruled Out

	7-7:59	8-8:29	8:30-10:29	10:30-10:59	11 AM-11:29	11:30-1:29 PM	1:30-1:59	2 PM-2:59	SUM	
AX, ON		1	5	1		3	1	2	13	RAW
TODAY ON		7.692	38.462	7.692		23.077	7.692	15.385	100.000	RPR
PED SIDE		16.667	12.500	25.000		7.143	6.667	6.250	8.725	RPC
	0.262	0.523	3.490	0.349	0.611	3.664	1.309	2.792	13.000	ERF
AX, ON	1	1	6		1	4	1	4	18	RAW
TODAY ON	5.556	5.556	33.333		5.556	22.222	5.556	22.222	100.000	RPR
OTHR SIDE	33.333	16.667	15.000		14.286	9.524	6.667	12.500	12.081	RPC
	0.362	0.725	4.832	0.483	0.846	5.074	1.812	3.866	18.000	ERF
AX ON,	1		8	2	1	2	5	4	23	RAW
PED SIDE	4.348		34.783	8.696	4.348	8.696	21.739	17.391	100.000	RPR
UNKNOWN	33.333		20.000	50.000	14.286	4.762	33.333	12.500	15.436	RPC
	0.463	0.926	6.174	0.617	1.081	6.483	2.315	4.940	23.000	ERF
AX AREA		1	3			4	2	4	14	RAW
BUT NOT		7.143	21.429			28.571	14.286	28.571	100.000	RPR
ON TODAY		16.667	7.500			9.524	13.333	12.500	9.396	RPC
	0.282	0.564	3.758	0.376	0.658	3.946	1.409	3.007	14.000	ERF
PX, ON	1	1	4		1	8	1	4	20	RAW
TODAY ON	5.000	5.000	20.000		5.000	40.000	5.000	20.000	100.000	RPR
PED SIDE	33.333	16.667	10.000		14.286	19.048	6.667	12.500	13.423	RPC
	0.403	0.805	5.369	0.537	0.940	5.638	2.013	4.295	20.000	ERF
PX, ON		2		1		4	1	2	10	RAW
TODAY ON		20.000		10.000		40.000	10.000	20.000	100.000	RPR
OTHR SIDE		33.333		25.000		9.524	6.667	6.250	6.711	RPC
	0.201	0.403	2.685	0.268	0.470	2.819	1.007	2.148	10.000	ERF
PX ON,			13		2	13	2	7	37	RAW
PED SIDE			35.135		5.405	35.135	5.405	18.919	100.000	RPR
UNKNOWN			32.500		28.571	30.952	13.333	21.875	24.832	RPC
	0.745	1.490	9.933	0.993	1.738	10.430	3.725	7.946	37.000	ERF
PX AREA			1		2	4	2	5	14	RAW
BUT NOT			7.143		14.286	28.571	14.286	35.714	100.000	RPR
ON TODAY			2.500		28.571	9.524	13.333	15.625	9.396	RPC
	0.282	0.564	3.758	0.376	0.658	3.946	1.409	3.007	14.000	ERF
SUM	3	6	40	4	7	42	15	32	149	RAW
	2.013	4.027	26.846	2.685	4.698	28.188	10.067	21.477	100.000	RPR
	100.000	100.000	100.000	100.000	100.000	100.000	100.000	100.000	100.000	RPC
	3.000	6.000	40.000	4.000	7.000	42.000	15.000	32.000	149.000	ERF

Tests[1]	a[2]	b	c	d[2]	Chi-Square[3]	% Change with ASP[4]
Overall (1-9)	24	18	21	32	2.88	42.9%
Middle hours (2,5,8)	19	9	17	25	5.04	73.2%
No-Parking side (1,2,3)	7	4	5	10	2.34	87.9%
Opposite side (4,5,6)	7	6	3	5	.53	37.7%
Side unknown (7,8,9)	10	8	13	17	.67	28.0%
Control days (10,11,12)[5]	4	6	1	8	2.04	97.2%

1. Numbers, letters refer to Table C-1
2. Frequencies expected to be lower if ASP parking is associated with fewer accidents.
3. One degree of freedom, not Yates corrected. Interpret with caution.
4. Negative values show an accident improvement under the ASP regulations.
5. Should show only random fluctuations.

Table C-21. Time of Day by ASP Condition and Pedestrian Origin: All Accidents with Vehicles Backing Up

	7-7:59	8-8:29	8:30-10:29	10:30-10:59	11 AM-11:29	11:30-1:29 PM	1:30-1:59	2 PM-2:59	SUM	
AX, ON			1	2		2	5	3	13	RAW
TODAY ON			7.692	15.385		15.385	38.462	23.077	100.000	RPR
PED SIDE			4.348	20.000		5.000	33.333	15.000	11.111	RPC
	0.111	0.556	2.556	1.111	0.333	4.444	1.667	2.222	13.000	ERF
AX, ON		1	3			1	2	4	11	RAW
TODAY ON		9.091	27.273			9.091	18.182	36.364	100.000	RPR
OTHR SIDE		20.000	13.043			2.500	13.333	20.000	9.402	RPC
	0.094	0.470	2.162	0.940	0.282	3.761	1.410	1.880	11.000	ERF
AX ON,		3	7	3	2	8	3	5	31	RAW
PED SIDE		9.677	22.581	9.677	6.452	25.806	9.677	16.129	100.000	RPR
UNKNOWN		60.000	30.435	30.000	66.667	20.000	20.000	25.000	26.496	RPC
	0.265	1.325	6.094	2.650	0.795	10.598	3.974	5.299	31.000	ERF
AX AREA		1	3	1		3	3	1	12	RAW
BUT NOT		8.333	25.000	8.333		25.000	25.000	8.333	100.000	RPR
ON TODAY		20.000	13.043	10.000		7.500	20.000	5.000	10.256	RPC
	0.103	0.513	2.359	1.026	0.308	4.103	1.538	2.051	12.000	ERF
PX, ON			2	1		4		2	9	RAW
TODAY ON			22.222	11.111		44.444		22.222	100.000	RPR
PED SIDE			8.696	10.000		10.000		10.000	7.692	RPC
	0.077	0.385	1.769	0.769	0.231	3.077	1.154	1.538	9.000	ERF
PX, ON				1		1		1	3	RAW
TODAY ON				33.333		33.333		33.333	100.000	RPR
OTHR SIDE				10.000		2.500		5.000	2.564	RPC
	0.026	0.128	0.590	0.256	0.077	1.026	0.385	0.513	3.000	ERF
PX ON,			6	2	1	16		4	29	RAW
PED SIDE			20.690	6.897	3.448	55.172		13.793	100.000	RPR
UNKNOWN			26.087	20.000	33.333	40.000		20.000	24.786	RPC
	0.248	1.239	5.701	2.479	0.744	9.915	3.718	4.957	29.000	ERF
PX AREA	1		1			5	2		9	RAW
BUT NOT	11.111		11.111			55.556	22.222		100.000	RPR
ON TODAY	100.000		4.348			12.500	13.333		7.692	RPC
	0.077	0.385	1.769	0.769	0.231	3.077	1.154	1.538	9.000	ERF
SUM	1	5	23	10	3	40	15	20	117	RAW
	0.855	4.274	19.658	8.547	2.564	34.188	12.821	17.094	100.000	RPR
	100.000	100.000	100.000	100.000	100.000	100.000	100.000	100.000	100.000	RPC
	1.000	5.000	23.000	10.000	3.000	40.000	15.000	20.000	117.000	ERF

Tests[1]	a[2]	b	c	d[2]	Chi-Square[3]	% Change with ASP[4]
Overall (1-9)	20	23	12	22	.98	25.0%
Middle hours (2,5,8)	11	11	7	21	3.34	75.1%
No-Parking side (1,2,3)	3	7	3	4	.30	-22.6%
Opposite side (4,5,6)	4	3	1	1	.03	16.7%
Side unknown (7,8,9)	13	13	8	17	1.70	44.9%
Control days (10,11,12)[5]	5	6	1	7	2.33	100.5%

1. Numbers, letters refer to Table C-1
2. Frequencies expected to be lower if ASP parking is associated with fewer accidents.
3. One degree of freedom, not Yates corrected. Interpret with caution.
4. Negative values show an accident improvement under the ASP regulations.
5. Should show only random fluctuations.

APPENDIX D

MODEL VEHICLE OVERTAKING LAW: TOTAL INFORMATION PACKAGE MATERIALS

Written materials were developed to support MVOL passage in Arizona and California. The materials were virtually identical between States, except for specific reference to the data or laws of one State or the other. The written materials are presented below, essentially as developed for Arizona. Where significant changes exist between the two versions (other than the substitution of the word "California" for the word "Arizona"), the text that was modified is marked with a vertical bar in the margin and the replacement California text is given immediately below in brackets. The components of the package in this Appendix are:

- Slide Discussion Script (for presenting the initial briefing to small groups of officials)

- Brief Report Handout (suitable as a take-along document for the same audiences). This includes, as attachments, codified versions of the MVOL for each State, suggested modifications to each State's driver's manual, and draft materials for a TV spot, a radio spot and a pamphlet to introduce the MVOL to the driving public.

I. Slide Discussion Script (Arizona)

[MVOL in Arizona - Topics for Slide Presentation]

SLIDE 1 - MODEL VEHICLE OVERTAKING LAW IN ARIZONA

THIS PRESENTATION WILL DESCRIBE ONE UNIQUE TYPE OF PEDESTRIAN ACCIDENT, THE MULTIPLE THREAT, IDENTIFIED BY NHTSA RESEARCH. IT IS A PARTICULARLY PREVALENT TYPE IN ARIZONA. RESEARCH HAS ALSO SUGGESTED A SIMPLE CHANGE TO THE VEHICLE AND TRAFFIC LAW, TERMED THE MODEL VEHICLE OVERTAKING LAW, WHICH IF ADOPTED AND MADE OPERATIVE THROUGH PUBLIC INFORMATION AND EDUCATION AND ENFORCEMENT, SHOULD REDUCE THE INCIDENCE OF MULTIPLE THREAT ACCIDENTS.

SLIDE 2 - THE ACCIDENT TYPE

A PEDESTRIAN PREPARES TO CROSS A MULTILANED STREET WHERE TRAFFIC WOULD FLOW UNIMPEDED EXCEPT FOR HIS/HER PRESENCE. WHEN HE/SHE STARTS TO CROSS, AT LEAST ONE VEHICLE STOPS FOR HIM/HER, SETTING UP A "SCREEN." THE PEDESTRIAN CROSSES IN FRONT OF THE STOPPED VEHICLE AND IS HIT BY A SECOND VEHICLE OVERTAKING THE FIRST. THE PEDESTRIAN IS HIDDEN BY THE YIELDING VEHICLE(S) FROM THE VIEW OF THE DRIVER OF THE COLLISION VEHICLE.

IN MANY WESTERN CITIES, THIS ACCIDENT TYPE IS A SERIOUS PROBLEM, PROBABLY BECAUSE SO MANY DRIVERS OBEY THE BASIC RIGHT-OF-WAY LAWS AND STOP FOR PEDESTRIANS IN CROSS WALKS. IN ORDER TO ESTIMATE THE MAGNITUDE OF THE PROBLEM IN ARIZONA, RANDOM SAMPLES OF RECENT PEDESTRIAN ACCIDENT REPORTS FROM PHOENIX AND TUCSON WERE REQUESTED. THEY SHOWED CONVINCINGLY THE MAGNITUDE OF THE PROBLEM. IN TUCSON, 13 OF 100 (13%) REPORTS WERE MULTIPLE THREAT. IN PHOENIX, 9 OF 133 (6.8%) WERE MULTIPLE THREATS. BOTH FIGURES ARE INDICATIVE OF THE RATES OF OCCURENCE IN OTHER WESTERN CITIES (E.G., LOS ANGELES--7.1%, SAN FRANCISCO--7.8%, SEATTLE--8.7%)

OF-WAY LAWS AND STOP FOR PEDESTRIANS IN CROSSWALKS. IN LOS ANGELES, A COMPREHENSIVE STUDY OF ALL PEDESTRIAN ACCIDENT REPORTS FOR A SIX YEAR PERIOD (1973-1978) SHOWED 7.1 PERCENT OF ALL ACCIDENTS WERE MULTIPLE THREATS--NEARLY 230 ACCIDENTS PER YEAR. IN SAN FRANCISCO, THE AVERAGE FIGURE BASED ON SAMPLES OF ACCIDENTS MAY BE AS HIGH AS 8 PERCENT. IN SAN DIEGO, 3.5 PERCENT OF ALL PEDESTRIAN ACCIDENTS WERE MULTIPLE THREATS FROM 1973 THROUGH 1978. IN THOSE CITIES, THE ACCIDENTS TYPICALLY OCCURRED IN CROSSWALKS OF WIDE STREETS AT UNSIGNALIZED INTERSECTIONS, IN COMMERCIAL AREAS IN DAYLIGHT. ALL AGES OF PEDESTRIANS WERE INVOLVED, AND ALL DAYS OF THE WEEK BUT WITH EMPHASIS ON MONDAY THROUGH FRIDAY.

SLIDE 3 - EXISTING LAW

ARIZONA VEHICLE AND TRAFFIC LAW PROVIDES IN §28-792,B:

> WHEN ANY VEHICLE IS STOPPED AT A MARKED CROSS WALK OR AT ANY UNMARKED CROSS WALK AT AN INTERSECTION TO PERMIT A PEDESTRIAN TO CROSS THE ROADWAY, THE DRIVER OF ANY OTHER VEHICLE APPROACHING FROM THE REAR SHALL NOT OVERTAKE AND PASS THE STOPPED VEHICLE.

CALIFORNIA VEHICLE AND TRAFFIC LAW PROVIDES IN §21951:

> WHENEVER ANY VEHICLE HAS STOPPED AT A MARKED CROSSWALK OR AT ANY UNMARKED CROSSWALK AT AN INTERSECTION TO PERMIT A PEDESTRIAN TO CROSS THE ROADWAY, THE DRIVER OF ANY OTHER VEHICLE APPROACHING FROM THE REAR SHALL NOT OVERTAKE AND PASS THE STOPPED VEHICLE.

THE INTENT OF THE LAW IS EXCELLENT. IT WOULD PREVENT MULTIPLE THREAT ACCIDENTS, EXCEPT THAT IT OCCASIONALLY PLACES AN IMPOSSIBLE BURDEN ON THE OVERTAKING MOTORIST. SINCE HE MAY PASS A VEHICLE STOPPED OTHER THAN TO LET A PEDESTRIAN CROSS, AND SINCE PEDESTRIANS ARE OFTEN OBSCURED BY THE STOPPED VEHICLE, THE OVERTAKING DRIVER MAY NOT BE ABLE TO DETECT THE NEED TO STOP UNTIL IT IS TOO LATE.

SLIDE 4 - THE PROBLEM

OVERTAKING DRIVERS OFTEN CANNOT DETERMINE THAT THERE IS A NEED TO STOP SINCE THEY CANNOT SEE THE PEDESTRIAN UNTIL IT IS TOO LATE.

SLIDES 5 - 19

IT MAY SEEM AS THOUGH AN AVERAGE ADULT PEDESTRIAN WOULD BE CLEARLY VISIBLE IN FRONT OF A STOPPED CAR. THESE SLIDES SHOW THAT IS NOT THE CASE. EVEN WHEN BITS OF THE PEDESTRIAN ARE VISIBLE, THEY ARE DIFFICULT TO PICK OUT, PARTICULARLY WHEN A DRIVER IS OCCUPIED WITH TRAFFIC AND MAY NOT BE EXPECTING A PEDESTRIAN.

SLIDE 20 - THE SOLUTION

THE MODEL VEHICLE OVERTAKING LAW PRESENTS A SIMPLE, STRAIGHTFORWARD SOLUTION TO THIS PROBLEM. IF A VEHICLE IS STOPPED IN A LANE FOR MOVING TRAFFIC AT A POINT WHERE A PEDESTRIAN MIGHT BE CROSSING (I.E., AT ANY MARKED CROSSWALK, AT ANY STOP LINE IN ADVANCE OF A CROSSWALK OR AT ANY UNMARKED CROSSWALK) AN OVERTAKING DRIVER MUST STOP AND DETERMINE THAT IT IS SAFE BEFORE PROCEEDING. FEW VEHICLES WOULD BE STOPPED IN A LANE FOR MOVING TRAFFIC FOR ANY REASON OTHER THAN TO LET A PEDESTRIAN CROSS THE ROAD. THUS, THE MVOL SHOULD ACTUALLY ACCOMPLISH WHAT THE EXISTING LAW DOES NOT BECASE IT DEPENDS ON THE ALWAYS VISIBLE STOPPED CAR AND ITS POSITION AS THE CUE TO THE OVERTAKING MOTORIST AND NOT THE OFTEN INVISIBLE CROSSING PEDESTRIAN.

SLIDE 21 - MVOL IMPLEMENTATION PACKAGE

AS PART OF A NHTSA CONTRACT TO DEVELOP THE MVOL, THE FOLLOWING MATERIALS ARE AVAILABLE TO ASSIST THE PASSAGE OF THE MVOL:

- THESE SLIDES AND A BRIEF SCRIPT TO AID THEIR USE
- A BRIEF REPORT PROVIDING THE DETAILS OF THE ACCIDENT TYPE AND THE MVOL
- EXTENSIVE ACCIDENT DATA TO FURTHER DEFINE THE PROBLEM (E.G., VICTIM AGE AND SEX, TIME OF DAY)
- PUBLIC INFORMATION AND EDUCATION (PI&E) MATERIALS TO INFORM THE PUBLIC ABOUT THE NEW LAW AFTER ITS ADOPTION. THESE INCLUDE SCRIPTS FOR 60 AND 30 SECOND TV SPOTS, A SCRIPT FOR A RADIO SPOT AND A REPRODUCIBLE OF A PAMPHLET WHICH HAS ROOM FOR A LOCAL SPONSORSHIP
- SUGGEST CHANGES TO THE STATE'S DRIVER'S MANUAL TO ADD REFERENCE TO THE MVOL
- A DRAFT OF A CODIFIED BILL PREPARED BY EDWARD F. KEARNEY, EXECUTIVE DIRECTOR OF THE NATIONAL COMMITTEE ON UNIFORM TRAFFIC LAWS AND ORDINANCES AND CHIEF DRAFTSMAN OF THE UNIFORM VEHICLE CODE
- AN EVALUATION STUDY TO BE FUNDED BY NHTSA AFTER THE LAW IS ADOPTED.

II. Brief Report Handout (Arizona)

["Multiple Threat" Accidents and the MVOL in Arizona]

Background

Pedestrian deaths and injuries are a major highway safety problem in the United States. For 1978, the National Safety Council's Accident Facts (1979) reported 9,300 pedestrian deaths (18% of the total motor vehicle deaths) nationwide and 110,000 pedestrian injuries (9.2% of the total motor vehicle injuries). The problem is even worse in urban areas in which the same National Safety Council report shows that 32.2% of all motor vehicle accident fatalities were pedestrians.

For more than ten years, the National Highway Traffic Safety Administration (NHTSA) has been conducting a comprehensive program of research and development in an effort to reduce pedestrian accidents. The first step in this process was to separate pedestrian accidents into recurring "types" which could then become the focus of individual countermeasures efforts. It was theorized that by addressing individual accident types or clusters of accident types with similar causative elements, a productive accident reduction program could be initiated.

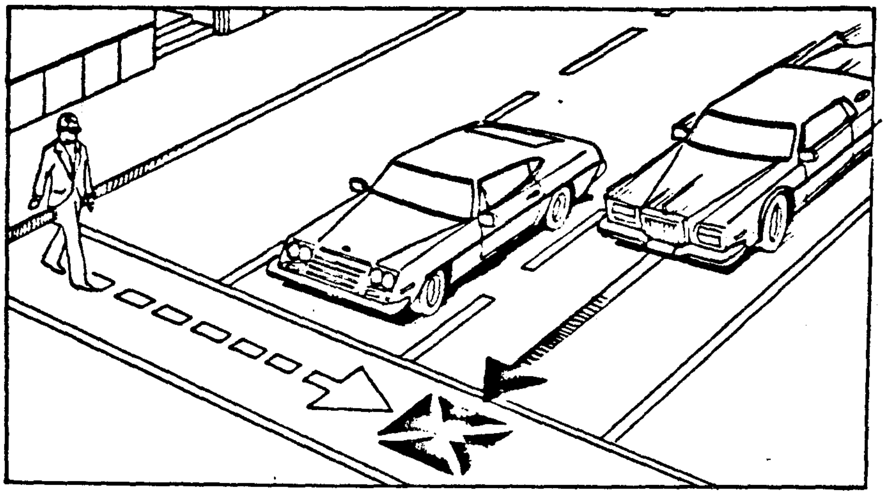
One of the countermeasure approaches considered was the vehicle and traffic law. Certain accident types appeared susceptible to reduction through a regulatory approach. Hence, nine model laws and ordinances were developed in a previous research effort (Blomberg, Hale and Kearney, 1974). Some of these regulations have already been tested. Most notably, the Model Ice Cream Truck Ordinance (MICTO), which mandates flashing lights and a stop/swing arm on ice cream trucks and requires motorists to stop before passing an ice cream truck displaying the safety equipment, was passed by the City of Detroit. An evaluation study of the MICTO in Detroit (Hale, Blomberg and Preusser, 1978) showed that the ordinance reduced accidents of the "Vendor" type (children going to/from an ice cream truck) by 77% in the two years following its passage.

The tremendous success of the MICTO indicates that changes in the vehicle and traffic law are a viable pedestrian accident countermeasure approach. It also suggests that other model regulations produced by the same 1974 study may be a rich source of ideas for pedestrian accident reduction. One of these regulations, The Model Vehicle Overtaking Law (MVOL) and the "Multiple Threat" (MT) accident type it is intended to combat, are the topics of this report. The information herein is designed to provide an overview of the accident type and the model law. More comprehensive information is contained in the original report (Blomberg, Hale and Kearney, 1974) and is also available from the NHTSA Regional Office (see below).

The Multiple Threat Accident Type

A pedestrian prepares to cross a multi-laned street on which traffic would flow unimpeded except for his presence. When he starts to cross, at least one vehicle stops for him, setting up a "screen." The pedestrian crosses in front of the stopped vehicle and is hit by a second vehicle overtaking the first. (The accident is more fully described in Figure 1 on the next page.)

The Multiple Threat Accident appears to be quite prevalent in Arizona. Recently, random samples of pedestrian accident reports were drawn from Phoenix



MULTIPLE THREAT

WHAT: The pedestrian, crossing a multilaned street, is permitted to cross by one or more vehicles that stop, remain stopped or slow to yield to the pedestrian. He is hit by another vehicle which passes the yielding vehicle(s), traveling in the same direction. The pedestrian is hidden by the yielding vehicle(s) from the view of the driver of the collision vehicle.

WHO: This accident occurs to all age groups of pedestrians.

WHERE: Mostly at intersections, in marked crosswalks, in commercial areas and in daytime.

WHY: The key element is that the driver and the pedestrian are hidden from each other by the yielding vehicle(s). The most significant driver error is a failure to detect the pedestrian or to recognize that a pedestrian may be crossing in front of the yielding vehicle. The most significant pedestrian error is a failure to search for an additional vehicle passing the yielding vehicle. Most of the pedestrians are watching traffic but not the collision vehicle. Few of either the drivers or the pedestrians recognized the need for evasive action until just prior to impact.

Figure 1.

and Tucson. Each of these reports was carefully read and assigned an accident type. Fully 13% of Tucson's accidents and 6.8% of those from Phoenix were Multiple Threats. This made the type the third and eighth most prevalent types, respectively, in the two cities. Clearly, even allowing for sampling error, the Multiple Threat type is a major component of the pedestrian accident problem in Arizona.

The high incidence of Multiple Threats in Arizona appears to be, in part, a by-product of extremely high compliance with the basic law on pedestrian's right-of-way in crosswalks. The Arizona vehicle and traffic law in section 28-792A, requires that drivers yield to pedestrians in all crosswalks when traffic signals are not in place or in operation. Compliance with this provision in Arizona is typically much higher than in most other states. However, by stopping at a crosswalk to yield to a pedestrian, a driver may screen the pedestrian from the view of an overtaking motorist thereby establishing the conditions for the Multiple Threat Accident.

[The Multiple Threat Accident is quite prevalent in California. In fact, NHTSA research indicates that it is the fifth most frequently occurring type in Los Angeles and the eighth most frequent type in San Diego. As part of NHTSA's research, every pedestrian crash in these two cities was read and assigned a type for the years 1973-1978. In Los Angeles, 7.1% of these (1,377 crashes out of 19,388) were Multiple Threats. In San Diego, 3.5% (113 of 3,263 crashes) were assigned this type. In addition, the original study (Snyder and Knoblauch, 1971) which defined the accident types included a sample of crashes from San Francisco of which 7.8% were Multiple Threats. Clearly, this type of pedestrian accident is a significant problem in California.

The high incidence of Multiple Threats in California appears to be, in part, a by-product of extremely high compliance with the basic law on pedestrian's right-of-way in crosswalks. The California vehicle and traffic law in section 21950 requires that drivers yield to pedestrians in all crosswalks. Compliance with this provision in California is typically much higher than in most other states. However, by stopping at a crosswalk to yield to a pedestrian, a driver may secreen the pedestrian from the view of an overtaking motorist thereby establishing the conditions for the Multiple Threat Accident.]

The potential for this problem was obviously realized by those who drafted the vehicle and traffic law. For example, the Uniform Vehicle Code (UVC) §11-502(d) states that:

> Whenever any vehicle is stopped at a marked crosswalk or at any unmarked crosswalk at an intersection to permit a pedestrian to cross the roadway, the driver of any other vehicle approaching from the rear shall not overtake and pass such stopped vehicle.

Verbatim, this is the law in Arizona. The intent of the law is excellent.

[Almost verbatim, this is the law in California. The intent of the law is excellent.]

It would prevent Multiple Threat accidents, except that it occasionally places an impossible burden on the overtaking motorist. Since he may pass a vehicle stopped other than to let a pedestrian cross, and since pedestrians are often obscured by the stopped vehicle, the overtaking driver may not be able to detect the need to stop until it is too late.

The Model Vehicle Overtaking Law

Analysis of many accident reports describing Multiple Threat events led to the conclusion that the accident might be successfully avoided if the required stops by overtaking motorists were prompted by a more reliable cue in the environment than the often obscured presence of a pedestrian. It became apparent that the screening vehicle's position was likely a reliable indicator of the reason for its stop. Simply, vehicles stopped in a lane for moving traffic at a marked crosswalk (intersection or midblock) or at any unmarked crosswalk at an intersection were probably stopped either for a red traffic signal or to allow a pedestrian to cross, or both. If the screening vehicle is stopped for a red light, the duty of an overtaking vehicle to stop also is clear. If the first vehicle stops for a pedestrian, its very position in the roadway should be sufficient to require a stop by any overtaking motorist. Once a stop has been made, the driver has time to determine that it is safe to proceed. Thus, it is reasonable to permit overtaking after a stop has been made.

This revised requirement to stop only necessitates a simple modification to the UVC section cited above. The basic MVOL provision to replace it (as suggested by Blomberg, Hale and Kearney, 1974) is:

> Whenever any vehicle is stopped in a lane for moving traffic at a crosswalk or at any stop line in advance of a crosswalk, the driver of any other vehicle approaching from the rear in an adjacent lane shall not overtake and pass such stopped vehicle until he has brought his vehicle to a stop and determined that it is safe to proceed.

That is, the overtaking driver must first stop; then, from his position of rest, he may proceed if it is safe—in this context, if there is no danger of striking a crossing pedestrian. This is an easily performed sequence of behaviors and perceptions. Also, by increasing the total time needed for the overtaking vehicle to approach and pass the crossing pedestrian's path, the model law would allow the pedestrian much longer to detect and react as necessary to the overtaking vehicle.

The full text of the proposed model law codified for Arizona is included as Attachment 1.

Implementation Steps

Although the actual changes to the existing law as shown in Attachment 1 are minor, they still require legislative action. Moreover, they will not have the desired effect on Multiple Threat accidents unless they are made operative through public information to inform drivers of their duties and enforcement of the new law to promote a high degree of compliance. Hence, each of the steps outlined below must be given attention if the MVOL's full potential is to be realized.

(1) Passage

The first step in securing passage will be to attempt to secure legislative support for the changes. Attachment 1 provides initial thoughts on how the MVOL might be codified within the existing vehicle and traffic law. It should provide a basis for understanding how the law itself will fit into the code, and the truly minor nature of the changes.

In considering any new law, legislators are rightly concerned with potential reaction from their constituents. As part of the study which developed the MVOL, a nationwide survey of the general public and various special interest groups, e.g., police, judges, was conducted to ascertain their thoughts on the MVOL concept. As reported by Blomberg, Hale and Kearney (1974), there was generally a favorable response to the law, although many thought that significant public education would be required to make it work. Thus, there is reason to believe that the public would support adoption of the law.

(2) Implementation Support

Clearly, the driving public would have to be informed of the passage of the MVOL and their duties under it. The two most readily available avenues for reaching drivers are mass media and the State Driver's Manual. Inclusion of the MVOL in the latter, would require minor revisions. These are suggested in Attachment 2, which highlights places in the Manual at which this information could be included and proposes modified language to convey the MVOL concept.

Appropriate mass media to reach drivers include television and radio spot announcements ("spots") and a pamphlet suitable for distribution at motor vehicle offices or for mailing with license and registration renewals. A storyboard for a TV spot, a script for a radio spot and camera-ready copy for such a brochure have been prepared under contract to NHTSA. These are all capable of carrying a local identification. Copies of these materials are presented in Attachment 3. The camera-ready copy of the pamphlet is available from the source listed below.

The training of police officers to enforce a new law is handled in various ways depending on the particular jurisdiction involved. A simple printed bulletin is issued by some departments. Others use role call training sessions to convey this type of information. The provisions of the MVOL are straightforward and easy to understand. The major offense a driver could commit under it is failing to stop before overtaking a vehicle stopped in a lane for moving traffic at a marked or unmarked crosswalk or at a stop line in advance of a crosswalk. Hence, the information contained herein should be sufficient background to prepare any police training materials needed.

(3) Evaluation

It is good practice to evaluate the impact of any new highway safety countermeasure. Evaluation will not only indicate the extent to which the countermeasure achieves its objectives, but may also highlight areas in which improvement can be achieved. Hence, it would be desirable to evaluate the implementation of the MVOL, including consideration of Multiple Threat accident rates before and after its implementation.

As part of its continuing pedestrian safety program, NHTSA is keenly interested in the impact the MVOL might have in Arizona. It is, therefore, planning to support a rigorous evaluation study if the law is passed.

<u>For Further Information</u>

Obviously, this document could not contain everything that is known about Multiple Threat accidents and the Model Vehicle Overtaking Law. Much statistical data exist on the accident type. These might be helpful in understanding the magnitude and nature of the problem. A slide presentation about the MVOL is also available.

To obtain more information, a copy of the slide show, the TV and radio scripts, the pamphlet copy or further information on any of the references contained herein, please contact:

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U.S. Department of Transportation
National Highway Traffic Safety Administration
Two Embarcadero Center, Suite 610
San Francisco, California 94111
(415)-556-6415

References

Blomberg, R.D., Hale, A., & Kearney, E. The Development of Model Regulations for Pedestrian Safety. Final Report to the National Highway Traffic Safety Administration, July 31, 1974, Dunlap and Associates, Inc., Darien, Connecticut, ED 74-6.

Hale, A., Blomberg, R.D., & Preusser, D.F. Experimental Field Test of the Model Ice Cream Truck Ordinance in Detroit. Final Report to the U.S. Department of Transportation, National Highway Traffic Safety Administration, April 1978, Dunlap and Associates, Inc., Darien, Connecticut. Contract No. DOT-HS-5-01144. Available NTIS.

Attachment I

CODIFIED LAW

Suggested changes to the Arizona Vehicle and Traffic Law to incorporate the basic concept of the Model Vehicle Overtaking Law have been drafted by Edward F. Kearney, Executive Director of the National Committee on Uniform Traffic Laws and Ordinances. The suggested revisions to §28-792 are shown below. In these texts, [bracketed material] currently exists and would be deleted and <u>underlined language</u> would be added.

§ 28-792. Pedestrians' right of way in cross walks

A. 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 so yield, to a pedestrian crossing the roadway within a cross walk 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, but no pedestrian shall suddenly leave a curb or other place of safety and walk or run into the path of a vehicle which is so close that it is impossible for the driver to yield. This provision shall not apply under the conditions stated in subsection B of § 28-793.

B. When any vehicle is stopped <u>in a lane for moving traffic at a cross walk or at any stop line in advance of a cross walk</u> [at a marked cross walk or at any unmarked cross walk at an intersection to permit a pedestrian to cross the roadway], the driver of any other vehicle approaching from the rear <u>in an adjacent lane</u> shall not overtake and pass the stopped vehicle <u>until he has brought his vehicle to a stop and determined that it is safe to proceed</u>.

Suggested changes to the California Vehicle and Traffic Law to incorporate the basic concept of the Model Vehicle Overtaking Law have been drafted by Edward F. Kearney, Executive Director of the National Committee on Uniform Traffic Laws and Ordinances. The suggested revisions to §21951 are shown below. In these texts, [bracketed material] currently exists and would be deleted and <u>underlined language</u> would be added.

§ 21951. Vehicles Stopped for Pedestrians

Whenever any vehicle has stopped <u>in a lane for moving traffic at a crosswalk or at any stop line in advance of a crosswalk</u> [at a marked crosswalk or at any unmarked crosswalk at an intersection to permit a pedestrian to cross the roadway], the driver of any other vehicle approaching from the rear <u>in an adjacent lane</u> shall not overtake and pass the stopped vehicle <u>until he has brought his vehicle to a stop and determined that it is safe to proceed</u>.

The research which led to the Model Vehicle Overtaking Law also revealed two additional provisions which might optionally be added to enhance the Law's effectiveness. These might be included as additional subsections to the sections cited above.

The first of these is:

> Where required stop must be made - When stopping for a pedestrian as required by section 1, a driver shall stop at a clearly marked stop line or at a point indicated by a sign. If there is no line or sign, a driver shall stop before entering the cross walk.

This provision would insure that drivers stopping to yield to pedestrians do so in a position which is far enough away to permit a view of the cross walk or intersection, i.e., the cues which must be used to determine the necessity of a stop. It also provides objective criteria for enforcing the required stopping behavior.

The second optional section is:

> Placement of traffic-control devices - When traffic-control signals are not in place or not in operation at a pedestrian cross walk, provision shall be made through signing, painting of stop lines or alteration of cross walk geometry to insure that motorists stopping to yield to pedestrians in a cross walk will stop at least 20 feet from the cross walk line farthest from the motorist.

In support of marking the point where the stop mentioned in the section cited above is required, this optional provision has been provided. Its basic intent, through alternate means, is to insure that the motorists will stop at a safe distance from any pedestrian crossing within either a marked or unmarked cross walk. The concept of "safe distances" subsumes both adequate physical separation of a stopped vehicle from a pedestrian and the provision of adequate sight distance between stopped and/or approaching vehicles and crossing pedestrians.

In view of the numerous research findings and recommendations (see Blomberg, Hale and Kearney, 1974, pp. 124-125), and the fact that a modal width for a cross walk is about 10 feet, the 20 foot stopping distance from the cross walk line farthest from an approaching motorist is proposed for this provision. As it is worded, this 20 foot setback is amenable to easy implementation for both marked and unmarked cross walks.

Attachment 2

Suggested Changes to Arizona's
Driver's Manual

The Model Vehicle Overtaking Law (MVOL), with its added emphasis on driver responsibility to pedestrians and its caveat against overtaking and passing a vehicle stopped at a cross walk in an adjacent lane, can be covered with only minimal modification of existing wording in the Arizona Driver License Manual. In all cases, revision can be smoothly incorporated into current wording without disrupting the continuity and message impact of the Manual.

An effort has been made to identify all logical insertion points in the Manual. It is probably best to make changes to each section mentioned below, as they are obviously interrelated and cumulative in their impact.

The following sections of the Manual are key targets for change:

I. Introductory Page: The section entitled "Review Questions Likely to be Included in the Written Test" contains a question on pedestrians which reads as follows:

> 1. "When Pedestrians (Persons Walking) Have the Right of Way Over Motor Vehicles (see page 18)"

We recommend that this be followed by a second item which reads as follows:

> 2. You are approaching an intersection and the car in the adjacent lane ahead of you is stopped at a cross walk; you should (see page 18)

II. Page Seven: The section labeled "EVERY CHILD IS A HUMAN CAUTION SIGN" represents a logical and necessary place for modification. The current wording is as follows:

> "Where school crossings are established, all vehicles are restricted to a speed of 15 mph when approaching the cross walk, provided signs are in place in the roadway.
>
> "Passing is not permitted in these areas, which includes overtaking and passing another car traveling or stopped in the same direction but in another lane.
>
> "The law requires all vehicles to come to a complete stop at the school crossing when the cross walk is occupied by any Person."

Since the third sentence of this section requires the motorist to stop only if a pedestrian is visible, it is recommended that the third sentence be deleted and the following substitution made:

In fact, if you are overtaking a vehicle that is stopped at any marked or unmarked cross walk, the law requires that you come to a complete stop at that cross walk, whether it is marked or unmarked. Only when you have determined that it is safe to do so may you proceed. Remember, a pedestrian hidden from your view may be crossing.

III. Page Fifteen: The section here labeled "Overtaking and Passing On the Right" may in fact weaken the MVOL message. The last paragraph of this section reads as follows:

"The driver of a vehicle may overtake and pass another vehicle upon the right only under conditions permitting such movement in safety. In no event shall such movement be made by driving off the pavement or main-traveled portion of the roadway."

We simply recommend the addition of the following sentence, to immediately follow the last:

Neither shall any driver overtake and pass another vehicle stopped at a marked or unmarked cross walk in an adjacent lane, without first stopping yourself: a pedestrian hidden from view may be crossing.

IV. Page Eighteen: The "Right of Way for Pedestrians" section, in its entirety, reads as follows:

"Persons who are walking across streets have the right of way over motor vehicles if they are walking lawfully within the cross walks WHETHER THE CROSS WALKS ARE MARKED OR NOT. Pedestrians do not have the right-of-way when crossing the street at other points, or "Jay Walking." Two wrongs do not make a right—so do not run over a pedestrian even though he is in violation.

"When traffic is controlled by police officers or by traffic signals, pedestrians must obey the directions of such officers or signals.

"Where sidewalks are not provided any pedestrian walking along shall, when practicable; walk only on the left side of the roadway or its shoulder facing traffic which may approach from the opposite direction."

While preserving this section verbatim, we recommend the insertion of a distinct paragraph which should follow the first; this would read:

> Where a vehicle in an adjacent lane is stopped at a marked or unmarked cross walk, you may not overtake and pass that vehicle without first stopping at the cross walk. Only when you have determined that it is safe to do so may you proceed; remember, a pedestrian hidden from your view may be crossing.

V. Page Twenty-six: Finally, the back cover of the Manual tells the the reader to "Look Out For...", inter alia, pedestrians, and is accompanied by a pictorial representation of potentially hazardous situations. In order to reinforce the MVOL message, we recommend an addition to one of the current sentences, which reads:

> When approaching and entering an intersection, look carefully in all directions.

The recommended addition would follow this sentence and read:

> Do not overtake and pass a vehicle stopped at a marked or unmarked cross walk in an adjacent lane, without first stopping your own vehicle at that cross walk.

We believe that incorporation of these five modifications in the Arizona Drivers License Manual will have maximum message impact, with a minimal amount of revision. Furthermore, care has been taken that none of the revisions conflict with other related sections of the Manual, either directly or indirectly.

Attachment 2

Suggested Changes to California's
Driver's Manual

The Model Vehicle Overtaking Law (MVOL), with its orientation toward driver responsibilities for pedestrians, may be incorporated smoothly into parts of the California Driver's Handbook and would require only minor modifications of same. The impact of the MVOL would supplement existing passages that emphasize pedestrian right-of-way in crosswalks, by adding the provision that drivers may not overtake and pass a car in the adjacent lane which is stopped at a crosswalk (marked or unmarked), without themselves coming to a full stop.

Since the adoption of the MVOL will require specific changes in the Driver's Handbook, an examination of existing regulations and suggested revisions is warranted.

On page 18 of the Handbook, "crosswalks" and "limit lines" are discussed: since these sections identify and describe crosswalks, while mandating that motorists stop at "limit lines" to allow safe pedestrian crossing, these sections are logical locations for the insertion of the MVOL message.

The "Crosswalk" section currently reads as follows:

> "Every intersection where streets with sidewalks meet (at about right angles) has a crosswalk for pedestrians to cross the street. The crosswalk is that part of the pavement where the sidewalk lines would extend across the street.
>
> "Many pedestrian crosswalks are marked by solid white lines. Some crosswalks, especially in residential areas, are not marked. Yellow crosswalks may be painted at school intersections."

A suggested addition to this section might read as follows:

> You may not overtake and pass another vehicle from behind that is stopped at a crosswalk in an adjacent lane, without coming to a complete stop at a marked or unmarked crosswalk or intersection. You may proceed only after you have determined that it is safe to do so. Remember, the other vehicle may be stopped for a pedestrian that you cannot see.

Pedestrian crosswalks are explicitly treated on page 38 of the Handbook - this is also a logical place for inclusion of the MVOL message. Under the "Responsibilities of Drivers" subsection on this page, the current wording states the following:

> "Pedestrians have the right-of-way at intersections.... whether or not the crosswalks are marked by painted white lines.
>
> "Stop for the safety of anybody crossing the street on foot. Do not pass a vehicle from behind that has stopped at a crosswalk. A pedestrian hidden from your view may be crossing."

This section of the Handbook may be amended to read:

> Pedestrians have the right-of-way at intersections... whether or not the crosswalks are marked by painted white lines. Stop for the safety of anybody crossing the street on foot.
>
> Whenever any vehicle is stopped in a lane for moving traffic at any marked or unmarked crosswalk or at any stop line in advance of a crosswalk, you are required to stop before you may overtake and pass the stopped vehicle in the adjacent lane. Only after you have stopped and determined the situation is safe, may you proceed. A pedestrian hidden from your view may be crossing and stopping is the only sure way to avoid an accident.

In this way, the wording emphasizes both the driver's responsibility to the pedestrian, and the driver's responsibility to stop at any crosswalk or intersection regardless of a pedestrian's presence.

Attachment 3

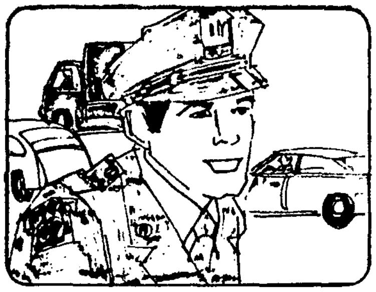
Public Information and Education
Materials

1. Storyboard for 60 second TV spot

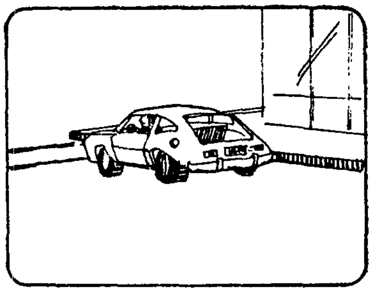
2. Script for 60 second Radio spot

3. Copy of front and back sides [actual size] of a pamphlet (reproducible available)

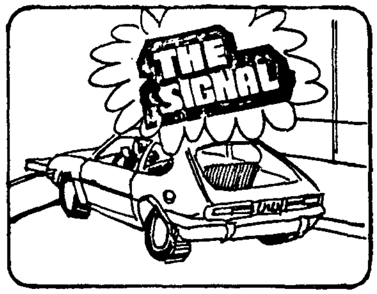
Model Vehicle Overtaking TV :60 Spot



POLICEMAN:
Nobody driving a car wants to hurt a pedestrian. So now there's a new law in (name of state) to prevent hitting pedestrians in crosswalks.

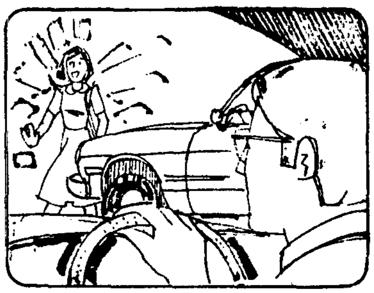


POLICEMAN V.O.:
Now when you see a car stopped at a crosswalk or intersection...or a car, truck or bus slowing down at a crosswalk...



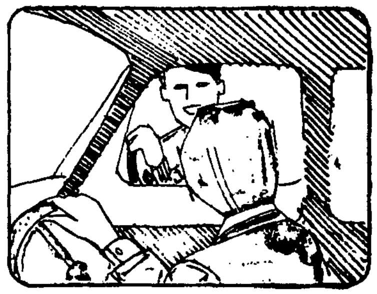
...GET THE SIGNAL to stop. It's the new law to help you avoid hitting a pedestrian.. someone you can't see crossing.

Because, if you don't stop, you're breaking the law...

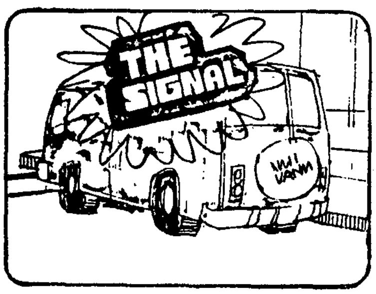


(Driver comes to screeching halt almost hitting pedestrian)

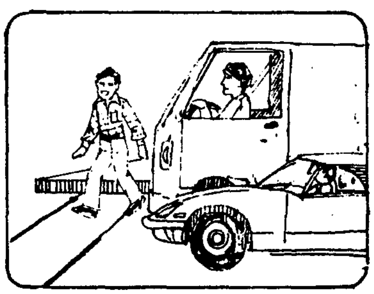
...and...



STOPPED DRIVER:
That's why you're supposed to stop. Pedestrians are sometimes careless...and you never know when.
DRIVER:
Yeah, I see what you mean.



POLICEMAN V.O.:
So when you see a car, truck or bus slowing down or stopped at a crosswalk... GET THE SIGNAL...



...to stop...to avoid hitting a hidden pedestrian. After you're sure it's safe, it's O.K. to go ahead...carefully.

GET THE SIGNAL...and stop. It's the new law.

SAXE MITCHELL INC.

Crossways Park North/Woodbury, L.I., New York 11797 (516) 364-9595

RADIO COPY

CLIENT/PRODUCT Dunlap and Associates/NHTSA

START ______ STOP ______

LENGTH :60 COMM'L NO. ______

DATE TYPED ______ APPROVAL ______ JOB NO. DOT-HS-6-01444

INSTRUCTIONS ______

(Traffic noises)

POLICEMAN: Nobody driving a car wants to hurt a pedestrian. So, now there's a new law in (name of state) to help you prevent hitting pedestrians in crosswalks or at intersections. I'm officer Jackson of the (name of city) police reminding you when you see a car, truck or bus stopped at a crosswalk or intersection in a lane for moving traffic...like this driver here...

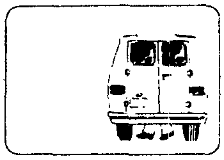
DRIVER IN STOPPED CAR: Good morning officer.

POLICEMAN: Good morning. As I was saying, when you see a car, truck or bus stopped at a crosswalk or intersection... that's your signal to stop. Because that vehicle may be hiding a crossing pedestrian. You see, sometimes pedestrians are careless...and don't stop to look around the edge of a vehicle that stops to let them cross.

DRIVER IN STOPPED CAR: You're right officer. My car blocks the view of a vehicle passing me...and the driver can't see a pedestrian crossing in front of me.

POLICEMAN: Exactly. So, you drivers out there remember...when you see a vehicle slowing down or stopped at a crosswalk or intersection...that's your signal to stop...then check for a hidden pedestrian. After you're sure it's safe...it's O.K. to go ahead... carefully. Get the signal and stop. It's the new law in (name of state).

YOU THE DRIVER... IT'S THE LAW TO STOP



It's the law to stop when approaching a stopped or slowing vehicle at a crosswalk or intersection... because it may be hiding a crossing pedestrian.

You have to avoid hitting pedestrians, even the ones you can't see. Like those crossing in front of a stopped bus. Or, a pedestrian crossing in front of cars stopped at a light. Or someone crossing in front of a slowing vehicle. In each of these situations you may not see or expect a pedestrian, but one could be there ready to step right out into your path.

How do you avoid hitting a hidden pedestrian? When you see a car, truck or bus stopped at a crosswalk or intersection, **you have to stop.** It's the new law to help you avoid accidents.

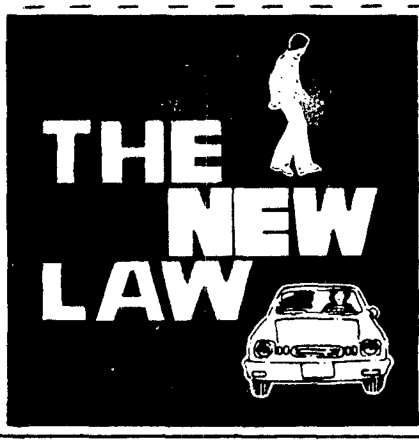
YOU THE PEDESTRIAN... STOP AND LOOK AROUND IT

When crossing in front of a stopped vehicle, look around it to see if a car is coming.

You'd never knowingly walk right out into the path of an oncoming vehicle whose driver coundn't see you. But sometimes you forget that a driver overtaking a stopped car, truck or bus can't see people crossing in front of it. Sure it seems safe when cars stop for you at a crosswalk or when cars stay stopped at a light to let you cross. The problem is that these vehicles hide you from overtaking motorists. What's the answer?

Simple. Whenever you cross in front of or between stopped vehicles, stop at their outside edge and **look around them.** Look around them to be sure there are no cars coming that could hit you as you step in front of the vehicle which is hiding you. Remember, when you cross in front of a stopped vehicle, look around it. It's one good way to avoid accidents.

(STATE SYMBOL GOES HERE)



PREVENTS ACCIDENTS LIKE THIS.

APPENDIX E

CROSSING DANGER: CONSIDERATIONS AND CODING

Very few pedestrian street crossings result in accidents. For the vast majority of crossings, one is tempted to say "a miss is as good as a mile" and lump them all together, "safe." Yet if one has crossed many streets, he probably has the feeling that almost all of the crossings were completely safe, that some were "risky" but safe, and that at least one--perhaps--was not an accident only by luck.

In this Appendix we will propose a set of criteria by which an observer can judge how close a crossing was to being an accident. The need for such criteria is based on two points:

1. Crossings follow a safety continuum. Most crossings are very safe, with margin for large error in several dimensions; some have room for some error; a few have little room for error; a very few have no room for error; and a very, very few have less than no room for error--i.e., are accidents. "Near accidents" are postulated to be very similar to actual accidents, with almost all behavioral and positional characteristics the same (with the certain exception of no physical contact).

2. Because there are very, very few actual accidents, studies which observe pedestrian crossings to evaluate safe and dangerous actions for countermeasure development and application must study non-accidents, i.e., normal crossings and near accidents, and extrapolate from the observed behaviors to conclusions about behaviors in actual accidents.

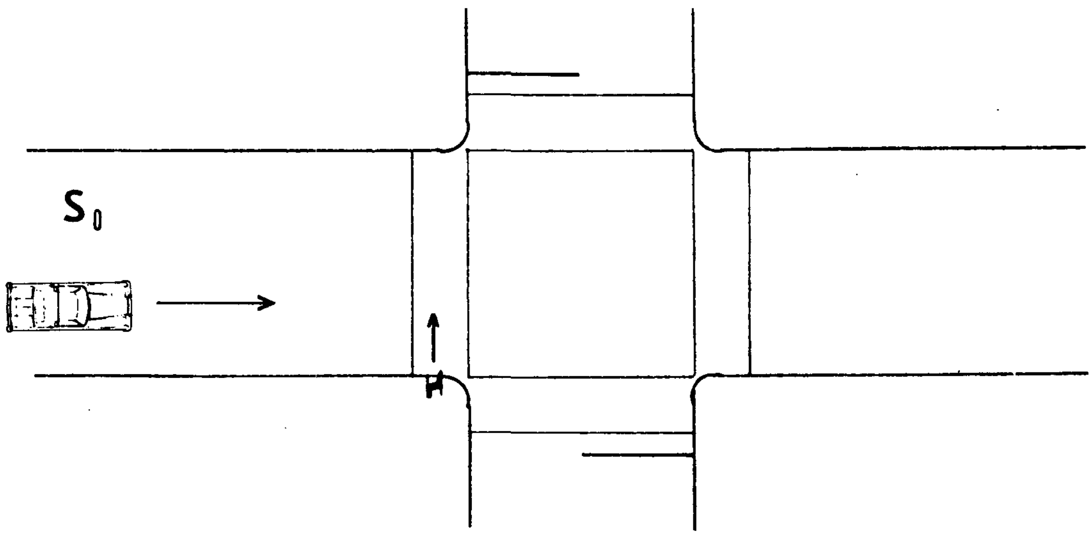
Before continuing, we will outline some definitions, or conventional meanings, which will apply to terms used here:

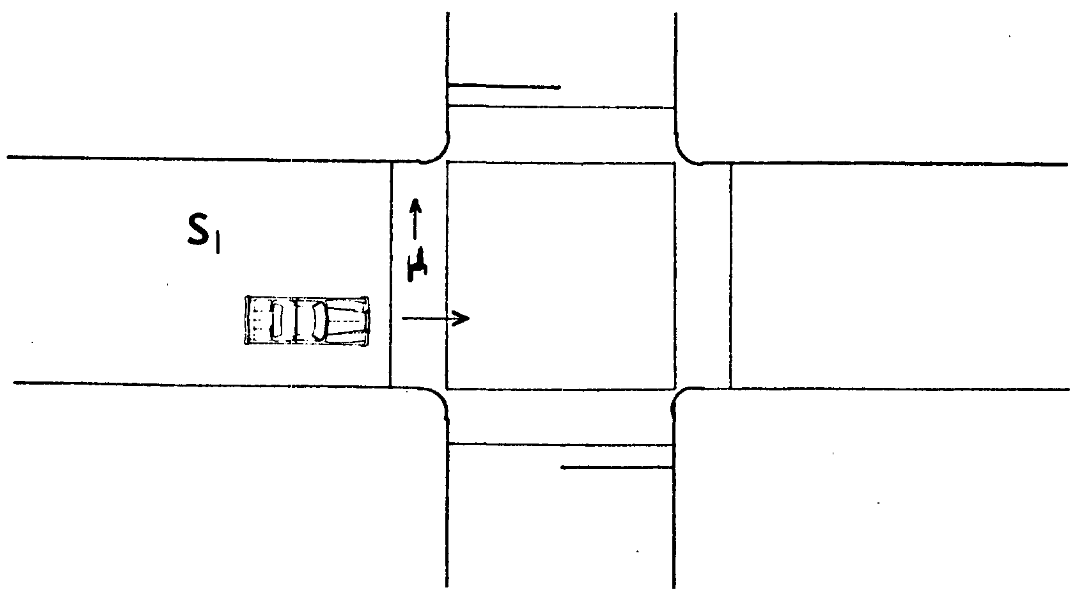
Accident: Unintentional physical contact of a pedestrian and a vehicle, possibly leading to injury and/or property damage. A crossing event either results in an accident or does not.

Near Accident: Of those crossing events which are not accidents, ones most like accidents in all characteristics (except for contact) causally or otherwise related to accident occurrence. This is a general label for crossing events which are most "dangerous" by the criteria developed below.

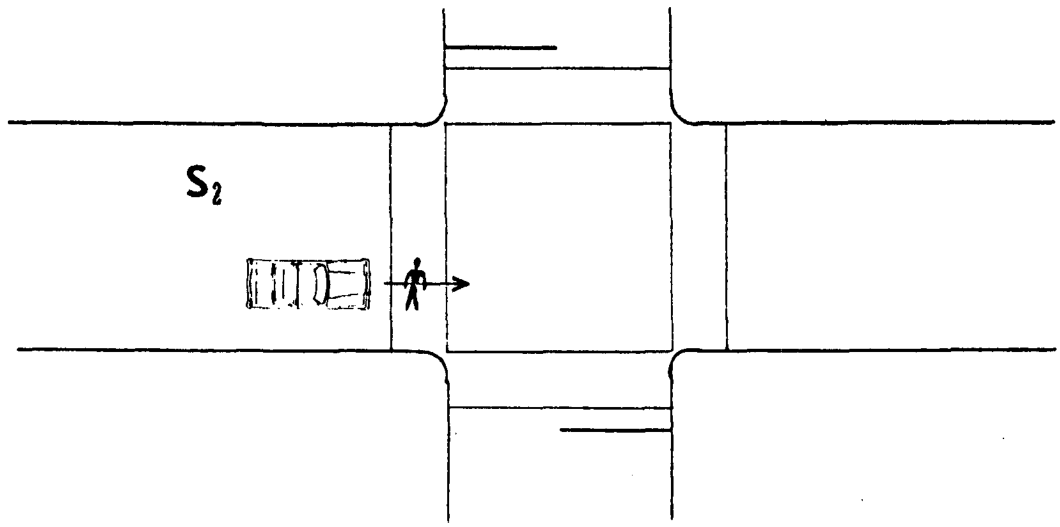
Dangerous: A crossing event is "dangerous as a function of its nearness to being an accident and the severity of injury that would result to the pedestrian. (More generally, the severity of all the negative consequences, including vehicle secondary impact damage, driver injury, etc.)

One may think in terms of a state model; as illustrated below, the current situation is S_0 which in fact translates into S_1, a non-accident, after a few

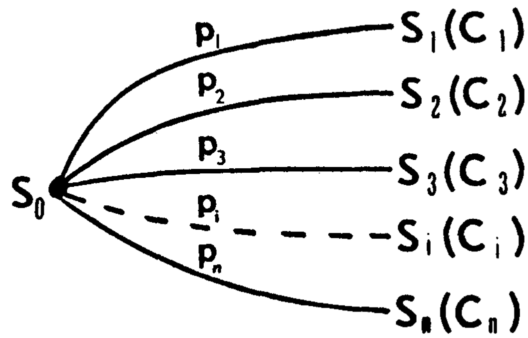




seconds. It is possible, however, that the pedestrian could have tripped and that S_2, an accident would have developed.



Let us say that there are n ways in which S_0 could have been resolved (including the one which actually occurred) each with $p_i > 0$ ($\sum_{i=1}^{n} p_i \equiv 1$) and each with injury consequences C_i (such that $C_i = \emptyset$ if no negative consequences exist in S_i and that, if S_j has "more" negative consequences than S_k, $C_j > C_k$):



Then the dangerousness of S_0 is some function of P_i and C_i (for i = 1 to n), e.g., $D_{S_0} = \sum_{i=1}^{n} f(p_i, C_i)$.

The simplest function, which produces higher values of D for higher dangers, is $D_{S_0} = \sum_{i=1}^{n} P_i C_i$ (Note that C_i is only generally defined. If one were to try to explicity obtain numerical values for D, which we are not, one would have to scale C_i in such a way that the orderings of situations by their D values corresponded to subjective orderings of the situations by "danger.")

Note also that "Dangerousness" is grounded in a criterion of subjective judgment. The judgment must be made by an informed judge, however, and must be based on combined evaluations of the nearness of the crossing to being an accident (the subject of this Appendix) and the seriousness of the consequences of the accident (not discussed further).

Practically speaking, the subjective application of any complex formula such as those above is impossible. To actually rate crossing events, it will usually be sufficient to estimate the probability of the single most likely accident and weigh its consequences.

A final practical consideration: accidents are extremely unlikely events. Street crossings end in accidents once in 10^4 - 10^5 times; the likelihood that the "typical" safely executed crossing would have degenerated into an accident is much smaller than that, perhaps on the order of magnitude of 10^{-7}. Probabilities so small may be impossible for judges to deal with reasonably, and a conversion to verbal descriptions of probability may be necessary. This can be a sloppy process; but if done effectively it can lead to much more reliable and valid "Danger" judgments.

Risky: A crossing is "risky" if the pedestrian, intentionally and with awareness, challenges vehicles or places himself in close proximity to moving vehicles. An example of this is the pedestrian who dodges through several lanes of heavy moving traffic. He may judge and execute quite well and cross safely, but he has left himself little margin for error in terms of time and space. "Risky" crossings might be characterized as "aggressive;" such crossings are not necessarily near accidents.

Safe: "Safe" is approximately the inverse of "dangerous." It includes components of likelihood of accident and of consequence severity.

Characterization of Crossing Events

Snyder et. al. (1971) describe crossing events as function/event sequences, with each pedestrian (and involved driver, if any) performing sequentially stages of Search the field, Detect features of the field such as signal phase and approaching vehicles and pedestrians, Evaluate their relevance to the safety of continuing, Decide what course of action is appropriate (included is "no action" or "no change"), and implement Action intended to carry out the decision.

According to the model, failure to successfully complete one stage means failure to successfully complete subsequent stages. Such failure does not always imply an accident; but an accident implies that both parties experienced a function/event failure. (Such "failure" does not imply "fault" of the party, but sometimes impossibility of not failing. For example, if a pedestrian is hit by a vehicle which slows as if to stop at its red light, then suddenly accelerates when ten feet from the pedestrian, the pedestrian's "failure" is an inability to perceive, detect, evaluate, decide and react within the fraction of a second available.)

The model retains some recycling possibilities. For example, if a decision was to return to the curb, then the model requires the pedestrian to resume searching from his new vantage point.

The model tends to be rigid, however, in prescribing certain activities and sequences of activities for safe crossings and in viewing deviations as degrading safety. It is unwieldy, too, in trying to characterize a wide variety of crossing styles. Consider, for example:

- Pedestrian approaches corner, waits at curb while monitoring traffic and signal, and walks briskly across after verifying he can complete the crossing well before any approaching traffic reaches him.

- Pedestrian approaches a signalized intersection, notes he will get the light as he crosses the curb and that traffic is either missing or stopped so as to present no threat. He walks across without breaking stride.

- Pedestrian, stopped at curb, starts walking normally exactly when he perceives the light turning green for him. Traffic can also move, but he does not monitor for it.

- Pedestrian crosses very low volume street without looking.

- Pedestrian approaches curb to cross, withdraws because of adverse conditions, and walks to next corner before attempting another crossing.

- Pedestrian crosses high volume street midblock by crossing one lane at a time, stopping at lane boundaries to wait for room to cross the next lane while traffic passes immediately behind him.

- Pedestrian sees approaching traffic and runs to cross before it reaches him.

- While crossing in crosswalk, pedestrian notices vehicle turning toward him, makes eye contact with driver and continues walking.

- Pedestrian enters crosswalk with a parked delivery van blocking his view of left-approaching traffic. As he clears the van at the edge of the traffic lane, he detects a car approaching very close from his left. He breaks into a run to pass in front of the car.

- Old pedestrian arrives at crosswalk with green light and no traffic. He waits through a red cycle and starts walking as soon as his light turns green again. As he steps out, a right-turning car making the maneuver just after the light turned red passes within two feet of the walking man.

All except perhaps the first and fifth examples have function/event failures, yet describing the crossings only in terms of their departures from the model loses much positive which can be said about each crossing.

We prefer to look at individual crossing events as problem-solving activities by complex and usually time-sharing organisms. That is, pedestrians set for themselves the problem of reaching the other side of the street and attempt to solve that problem successfully. Pedestrians can go about solving the problem in various ways. The way chosen varies according to the conditions, traffic volume, crossing breadth, pedestrian's capabilities and preferences (young adult in good physical condition, nearsighted person without glasses, arthritic pedestrian who can only walk very slowly). The way may change mid-crossing (e.g., the pedestrian may try to cross a busy street against the light, then give up and wait off the curb for the light to change).

Children, when crossing attentively, concentrate exclusively on crossing. Children may not be attending at all, if they are running to join friends or are distracted in a game. In that case, speaking of their crossing activity as problem-solving may be completely misleading.

Adults crossing streets usually concentrate on other things while they cross: like driving, street-crossing is so overlearned that people can perform it competently while conversing, thinking about work or home, planning shopping strategies, or doing many other things. Thus their behavior is determined by more factors than just street-crossing.

Finally, while researchers' criteria for judging crossings are all safety-related, pedestrians' and drivers' criteria are multiple: safety, minimizing effort and time spent, not interrupting an ongoing conversation, keeping the legally-deserved right of way, getting to the appointment on time, etc. In this situation, people <u>satisfice</u>: they choose a course of action which, on the basis of a limited choice effort, seems likely to do best toward meeting their multiple goals (or well enough to justify not spending the effort to search for a better solution).

This "problem-solving" model is, in fact, not so much a model as a recognition that people cross streets in different ways.

This Appendix is concerned with defining unsafety, or dangerousness. Since we recognize a variety of crossing styles, which we can't delimit <u>a priori</u>, the criteria for unsafety must be based on features of the crossing event which are unrelated to style. They must be stated in the general terms of <u>results</u> of the application of crossing style.

The list below is a partial enumeration of factors which are related to crossing danger. They are based on two general principles: that safety is defensive and the pedestrian (or driver) must be aware of his position and environment as the first step in behaving defensively; and that physical closeness to a collision situation increases the chance of such a collision in spite of perfect awareness. Factors are stated from the pedestrian's perspective, partly from convenience and partly from the view that pedestrians initiate crossing events by venturing into a stream of traffic and that each crossing event consists of one pedestrian interacting with no, one, or many vehicles.

1. The closer the initial paths of pedestrian and vehicle will cross in time and space, the more danger.

2. The higher the vehicle's speed, the more danger to both because of higher impact consequences and greater difficulty for each actor to track each other because of greater distance and closing speed.

3. The fewer or less effective the alternative environmental factors requiring the vehicle to stop (e.g. red light, stop sign, marked cross walk), the more danger.

4. The more factors which can keep one actor from detecting the other, the more danger. Factors may be direct interference, such as visual obstructions between the actors (e.g. parked or standing vehicles, moving traffic, posts, bushes, buildings) or loud auditory signals, or factors may interfere by drawing attention away from the other actor (e.g. the actor's destination, friends, other relevant traffic cues, traffic-irrelevant distractors, loud auditory signals).

5. The wider the attempted crossing, the greater the pedestrian's exposure time and the greater the possible number and directions of threats, and the greater the danger.

6. The less the driver is aware of, and searching for, possible pedestrians, the more danger.

7. The less the driver's flexibility to detect, respond to, and compensate for the pedestrian's presence and actions, the more danger. Factors which reduce flexibility are:

   a. Unalertness

   b. Distraction

   c. High speed

   d. The remainder of the driving task may be already taxing the driver's capabilities, due to: complex maneuvers; heavy pedestrian and/or vehicle traffic; reduced capabilities due to inexperience, temporary fatigue or illness (including drug-induced incapacity), or permanent decline of old age or illness; motivational factors such as haste, anger; preoccupation.

e. Inability to visualize the range of possible pedestrian actions.

8. The more the driver's (vehicle's) actions fail to conform to the pedestrian's expectations by being faster, by being in an unusual place (e.g. wrong side of road, wrong way, out of lane toward pedestrian's projected position), or by failing to yield as would be customary, the more danger.

9. The less the pedestrian is aware of and searching for possible approaching vehicles, or aware of his own position in the crossing, or even aware that he is entering a street, the more danger.

10. The less the pedestrian's flexibility to detect, respond to, and compensate for the presence, path, and reactions of vehicles, the more danger. Factors which reduce flexibility include:

   a. Unalertness

   b. Distraction

   c. Maneuverability problems, such as those related to extreme youth, reduced capabilities of old age, physical handicaps, or impediments such as packages, heavy clothing, pets or small children walking/being carried, etc.

   d. Poor or inaccurate understanding of drivers' perceptual, behavioral, and attitudinal limitations and of vehicles' stopping or maneuvering capabilities.

   e. Reduced responsiveness due to state of mind: limited response set due to emotional factors such as anger; haste; preoccupation; fatigue or drug-related diminution of capabilities; mental incompetence of extreme youth or age-related mental decline.

11. The more the pedestrian's location and actions fail to conform to drivers' expectations, the less likely the driver will compensate appropriately and the more danger. For example, the pedestrian may cross at an unusual location (midblock, expressway, unmarked or unused crosswalk), he may be less visible than expected (by being very small), his actions may be quick (e.g. running) or abrupt (darting into street with no prior behavioral warning clues), he may challenge a driver in a crosswalk whose history suggests the pedestrian will defer, or he may fail to move as quickly as normal pedestrians to avoid an approaching vehicle.

12. The more the environment interferes with normal pedestrian or vehicle progress (e.g. rain, snow, ice, high wind, darkness), the more danger.

The factors described above are an incomplete list of things which influence the safety of crossings. While, as described, they all work to lower safety, the relative or absolute effect on safety is not indicated because it is a highly interdependent network. For example, driver vigilance has no effect if the pedestrian is highly vigilant but a tremendous effect if the pedestrian is inattentive. Driver vigilance is also unimportant if the pedestrian enters the travelled roadway with no perceptible warning.

The factors are, in many cases, internal factors affecting the safety-related success of the problem-solving process as applied to street-crossing and driving, and affecting the extent to which the pedestrian or driver even invokes the problem-solving process. The process factors ultimately influence the dangerousness of the crossing, but they are not directly on view to the observer who must code crossing danger.

The definition of crossing danger offered below attempts to capture the physical elements in the crossing interaction as well as to capture aspects of driver and pedestrian awareness and general capability which can be observed and/or inferred by an observer. The factors listed above have been considered and incorporated where possible. They offer an elaboration of the context in which the coding definition, which is also based on practical limitations, has been developed. The definition is presented in the context of a trained observer viewing the crossing event.

Observable Crossing Danger

Pedestrian awareness. Regardless of the proximity of a vehicle, if the pedestrian is unaware of his own location or of the actual vehicular situation around him, he is unsafe. A car could be ready to strike the pedestrian, and he would fail to detect and therefore be unable to react. (This is a simple, straightforward example of Snyder's function/event sequence model.)

To the extent, then, that the pedestrian is perceptually distracted (e.g., newspaper, other pedestrians, window display) or unaware ("in a daze"), or that he is physically unprepared to react to danger (e.g., sauntering loosely or carelessly), he is unsafe.

Qualification: if there are no relevant vehicles, it may be impossible to judge whether the pedestrian is "unaware" through lack of search and attention or whether he has already searched, judged the crossing to be unchallenged, and relaxed.

Driver awareness. Obviously, the concerns about pedestrian awareness apply to driver awareness equally. The data are not directly available, however; much less of the driver is visible to trained observers, that which is visible is behind reflecting glass, and signs of awareness may be as small as a brief eye movement--or nothing at all, if the awareness is accomplished through peripheral vision. Worse, many or most drivers continually move their eyes over the field of view, whether attending to driving or not. Thus driver awareness and attentiveness is important but simply not measureable through non-intrusive observation.

Physical proximity and reactions to it. If pedestrian and vehicle are on a collision course before either reacts, then one index of the nearness of the event to being an actual collision (we assume it doesn't) is the distance to the collision point at which the first actor reacts.* That distance may be thought of as a buffer zone whose purpose is to be large enough to allow effective accident prevention. The adequacy of the buffer zone depends on its size plus actor stopping or maneuvering distance requirements.

Let us say, then, that the raw measure of physical proximity is distance to collision at which (each) actor reacts to prevent the collision. The interpretation of distance is discussed below. As a general rule, there is a "minimum adequate distance" such that reactions made at less than that distance can not by themselves prevent an accident. Beyond that point, additional distance allows the reaction to be deliberately chosen and more gradually and

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*Other distance-to-collision points are perhaps more important. The points at which each actor can first detect the other are of central importance to this project, for example. Modifying parking patterns is intended to increase visibility, such that pedestrian and driver can detect each other safely in advance of reaching the collision point. Also important are the points at which each does detect the other, evaluates the positions and courses to determine the possibility of the collision, and decides on a course of corrective action. The first point is an independent experimental variable (in the context of this project) which can be measured objectively. The other points (detection, evaluation, and decision) are critically important but the processes are not observable. The point of actual reaction is far down the behavioral chain, but it can be reliably observed. Particularly in "close call" events, there is likely to be little arbitrary delay between detection and reaction, and the reaction point will be a good index of the adequacy of the detection point in preventing a collision even if it is not a clear indication of the exact detection point.

deliberately applied. It is expected that there is a "preferred interval," perhaps 1-1/2 to 2 times the minimum adequate distance, at which actors choose to begin to react even if they have recognized the need for reaction well before that. Practically, if the actor has more than enough time to react, the point at which he actually reacts depends on the types of reactions available to him, their relative attractiveness, and their likely effects on the other actor.

Minimum adequate distance:

- Pedestrian: pedestrians move comparatively slowly and, once they have decided to stop, they can do so in very short distances. As a rough estimate, let us say that the minimum distance needed to stop by a pedestrian is equal to, or less than, the distance he would have travelled in one second at his initial rate. For a normal walk, this can be as short as three feet--most of which is taken up by feet, arms, and a small space cushion between the stopped pedestrian and the passing vehicle. For a full run, this distance is more than 20 feet.

  If the pedestrian was stopped and his reaction consists of not starting (with some behavioral cues that he had intended to start moving), we will arbitrarily consider the minimum adequate distance to be three feet.

- Vehicle: a vehicle with very good brakes on good pavement (stopping force = .75g) requires about ten feet to stop from 15 m.p.h. after the brakes have taken hold. At 60 m.p.h., the stopping distance is nearly 160 feet. Stopping with moderate braking force requires about twice as far at any speed than the "panic" stopping distance illustrated above. Tables of stopping distance are available (i.e., "Charts and Tables for Stopping Distances of Motor Vehicles," Northwestern University Traffic Institute, 1971) for almost all road conditions and approach speeds, and should be consulted for actual determination of minimum adequate distances for each observation location.

- Roadway conditions: for both pedestrians and drivers, distances to stop increase if the road surface is not firm, textured, and dry. Loose sand or gravel, rain, snow, and ice all make stopping (or swerving) more difficult. The corrections for vehicles is simple: refer to the tables for the effect of the adverse conditions on stopping forces and determine the correct figures. For pedestrians, the rule described above is not easy to modify directly. We suggest determining the factor by which the adverse conditions degrade vehicle stopping distance ($= \frac{\text{adverse stopping distance}}{\text{ideal stopping distance}}$) and multiplying the ideal pedestrian stopping distance by that factor.

Non-collision courses. The assumption so far has been that pedestrian and vehicle were on a collision course which required some form of avoidance reaction. Situations in which the pedestrian and vehicle will pass close together without colliding also inspire avoidance reactions if the paths are very nearly intersecting (in time and space). Information from such crossings is useful not only in describing all pedestrian and driver behavior in potential accident situations but to determine how close the approaches must be before actors treat them as situations requiring avoidance reactions.

It is useful in such situations to obtain the distance to the point the original paths would cross for both pedestrian and vehicle for both pedestrian reaction and driver reaction (that is, two distances measured at two different times). The interpretation of the distance will vary depending on the actual resolution of the crossing event and, for example, whether the pedestrian reacted before reaching the vehicle's path or after entering it.

Injury severity. Based on the speed of the vehicle and whether the pedestrian hits the vehicle or is hit by it, the pedestrian may be injured, bruised, battered, or killed. A miscalculation while dodging between creeping cars may yield a bruise; the same error with cars going 50 m.p.h. may be fatal. It is important in assessing the safety or danger of a crossing event not only to judge how close the crossing was to being a collision, but how much damage would have been done if the collision had occurred. Aware pedestrians, for example, behave more cautiously if traffic is moving fast than if it is moving slowly. Whether it is because they can't judge as well with fast-moving traffic as with slow, or whether it is because they would suffer more serious injury, is unimportant. People react differently in these situations, and any assessment of crossing event danger should include such information.

Summary

Within the realm of pedestrian-vehicle conflicts, a multitude of measures of crossing event safety exist. The difficulty in defining crossing danger is to select from them those which can be measured simply and accurately, which do not overlap in scope, and which cover all significant contributors to danger. We suggest the following factors as measurable, relevant, and adequately comprehensive.

A crossing event shows increased danger to the extent that:

1. The pedestrian is unaware of his situation before he is in the travelled way.

2. The pedestrian and vehicle are on a collision or near collision course and:

   a. The pedestrian's avoidance reaction is close to or within his "minimum adequate distance."

   b. The driver's avoidance reaction is close to or within his "minimum adequate distance."

   c. Injury would be severe if an accident actually occurred.

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