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Research Problem Statements: Pedestrians

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RESEARCH PROBLEM STATEMENTS:
Pedestrians

OPERATION, SAFETY AND MAINTENANCE OF TRANSPORTATION FACILITIES

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INTRODUCTION

The following procedure was used by the Subcommittee on Research Needs in developing these research problem statements. An initial list of topics requiring research attention was drawn from a review of research conducted for the Federal Highway Administration in 1985. The expanded discussions of each of these topics were circulated to the members of the entire Pedestrian Committee early in 1986. Committee members were asked to review these topics and to submit additional topics they felt should be considered. Based upon the result of these submissions a list of thirty-four research problem statement topics were prepared and sent to each committee member for ranking as being of high, medium, or low priority.

As a result of these rankings, 17 research problem statements were selected for inclusion in this Circular. Three were considered to be high priority. Five were judged to be of medium priority, and nine were felt to be of low priority.

The members of the Subcommittee on Research Needs drafted these statements in the proper format. They were presented to the full Pedestrian Committee at their Annual Meeting in January 1986. The full Committee recommended that the research problem statements be submitted to Group 3 for publication.

Members of the Subcommittee on Research Needs are:

John C. Fegan, Chairman
Federal Highway Administration

Gregory Benz
Kay Colpitts
Pat Ehrlich
Dave Fielder

Title: Safety and Operational Treatments of Pedestrians in Work Zones

Problem: Pedestrians in work zones experience at least two broad classes of problems. First, the pedestrian passing by the work zone must be able to find and execute a safe path through the construction. Second, workers in the zone, particularly in highway work zones, must be protected from being struck by vehicles or by objects propelled by impact with a vehicle. Previous research on both aspects of this problem has helped provide specifications for establishing urban construction zones and suggested conspicuity treatments for workers, particularly flagmen. Despite these remedial actions, recent studies have shown that flagmen are still being frequently struck. A recent NHTSA study examined a sample of accidents involving road workers (Ulmer, et. al., 1982). The sample was drawn from the States of Florida and New York over a period of several years. This study showed that about 18% of all accidents involving road workers occurred to flagmen. Overall, accidents to people working on or near the roadway are estimated by the same study to represent approximately one-quarter of the percent of all pedestrian accidents. No similar data for non-working pedestrians injured because they were forced into the street by a construction area which impeded their safe passage are known to exist. There also has been no systematic follow-up research to see if the suggested guidelines for channeling pedestrians through urban work zones have solved the problems.

Objectives: To examine the safety of pedestrians, both workers and passers-by, in work zones on the roadway and those which impede pedestrian passage; to determine if further research is needed; and to suggest promising approaches.

Two parallel activities are envisioned. The first will undertake behavioral observations of pedestrians traversing construction sites to determine the nature and extent of difficulties they are encountering. Simultaneously, the extent of compliance with established guidelines and ways to improve compliance should be assessed. If problems are uncovered, guideline revisions will be suggested for setting up construction sites and for designing and executing pedestrian detours. An examination of urban accident data (both vehicle accidents and falls and other related problems, e.g., from emergency room records) should also be undertaken to determine if there is any accident experience associated with walking through construction sites. Diagrams of typical installations should be prepared and published.

The second part of the study should undertake a detailed look at accidents involving workers at highway construction sites. A specific focus of this examination should be the determination of whether existing high visibility materials used by workers are inadequate. This examination will lead to the development of additional or revised guidelines or training for protecting workers, particularly flagmen, at construction sites.

Key Words: Pedestrian accidents, safety guidelines, construction zone safety.

Related Work: See discussion of related research in "Problem" discussion.

Urgency/Priority: The problem statement is rated the highest priority of all the research need statements presented by the committee.

Cost: A cost of $100,000 for a 12 month study should provide for a thorough assessment of any problems and the suggestion of new or revised guidelines.

User Community: The audience for this research need statement is FHWA and AASHTO. The primary users of the research will be state DOT and highway authorities and local public work agencies responsible for roadway and utility construction and maintenance.

Implementation: The findings would be presented in the form of new or revised guidelines and training for protecting workers at construction sites...Distribution would be through association and government agencies.

Effectiveness: Improving and developing new guidelines for pedestrian safety in work zones will reduce injuries and fatalities in construction zones.

Title: Pedestrian Accident Characteristics

Problem: While not growing at the rate of some other accident-types, pedestrian accidents continue to constitute a significant proportion of all traffic accidents. In 1982, 16.6 percent of all fatalities (7,274) were pedestrians. Also in 1982, it was estimated that 125,000 pedestrians were involved in accidents with motor vehicles in which only 6 percent escaped injury.

Many studies have been made of pedestrian accidents. However, the data collected on most of those accidents studied were sparse and usually confined to very general characteristics. The analyses of these general characteristics have proven useful in the development of some very effective accident countermeasures, but there remains a critical need for greater details which can lead to a better understanding of the cause of accidents and the development of even more effective countermeasures.

In recent years, limited research budgets have precluded large-scale pedestrian accident data collection efforts. However, at least one (and possibly other) large continuous accident data collection systems, the National Accident Sampling System (NASS), includes pedestrian accidents. To date, no known in-depth analyses have been performed on this data. The opportunity to analyze a wealth of pedestrian accident data without incurring the cost to collect it should not be ignored. Such an analysis could lead to significant improvement in accident scene. In addition,

there are scene photographs, diagrams and other uncoded data in the hard copy file. There are presently about 1800 cases in the data base. An analysis of the data might begin by first obtaining a distribution of all univariates. The next level would consist of looking at bivariate distributions, and finally at selected multivariate distributions. Other tasks would include examining other existing data bases, such as FARS, AAA, and the National Safety Council, to see if additional analyses were appropriate. Ways could also be explored to incorporate existing exposure data into the analyses.

Objective: To explore recent accident data bases in an effort to better define the characteristics of pedestrian accidents, and to identify specific pedestrian safety problems.

Key Words: Pedestrian safety, accident data analysis.

Related Work: See discussion in Problem discussion.

Urgency/Priority: This research problem was given the second rank under the highest priority category.

Cost: The study would require mostly analyst time plus some computer time. The estimated cost would be $75,000 for a 12-month study.

User Community: The audiences for this research need statement are FHWA and AASHTO. The primary users will be state and local highway and safety organizations.

Implementation: The findings would be published as a report and as articles for technical journals.

Effectiveness: The results of this research may identify significant factors in pedestrian-vehicle accidents, and measures can be taken to reduce accident fatalities and injuries.

Title: Guidelines for Improved Usage of Pedestrian Safety Measures

Problem: Some pedestrian safety measures (e.g., bus stop relocations, street closures and curb parking arrangements) do not require involvement of the pedestrian to achieve their potential effectiveness. Others (e.g., barriers, pedestrian signals and crossing guards) require an active, positive, use by the pedestrian. A large proportion of pedestrians are not obedient to pedestrian signal controls, their crossing behavior being affected more by vehicular speed and gap size. Pedestrian barriers are often scaled or destroyed, rather than the pedestrian using the desired crossing point. Pedestrian grade separations are often shunned and go virtually unused, while people continue to cross a hazardous roadway

at-grade.

Some limited research has been done on pedestrian behavior where these types of devices have been employed. Some rules of thumb have been derived and some insights into pedestrian behavior have been gained. However, the state of knowledge has not been synthesized in this respect. Furthermore, large gaps exist in understanding of the motivation which drives pedestrian behavior with respect to these countermeasures. More knowledge is needed which can be translated into practical guidelines. The planners and designers in the U.S. need a set of guidelines for selection, design and placement of pedestrian safety devices for their most effective use. These must reflect pedestrian behavior characteristics derived from other research.

Objective: A set of practical guidelines useable by local agencies to enhance their ability to effectively choose, design and apply pedestrian safety measures.

- Acquire and synthesize current knowledge on pedestrian use of countermeasures requiring their active participation. Pedestrian behavioral research should be referenced along with field studies of installations.

- Document current designs and warrants employed for pedestrian safety measures. Document current guidelines for their application and available data on their effectiveness. Document examples of desirable and undesirable behaviors associated with specific measures.

- Assess candidate measures and behaviors and select a set for further study. Conduct additional laboratory and field research to determine pedestrian motivational and behavioral characteristics which affect usage of the selected measure and how to effectively deal with those attributes to achieve the objective of the measure.

- Develop a set of guidelines of selection, design and placement of the selected measures.

Key Words: Pedestrian behavior.

Related Work: See discussion of Problem.

Urgency/Priority: The problem statement was given the third rank under the highest priority category.

Cost: The research study is estimated to cost $250,000 and require a period of 20 to 24 months.

User Community: The audience for this research need statement is FHWA, AASHTO and ITE. The primary users will be state and local highway and safety organization and planning and design disciplines responsible for pedestrian safety.

Implementation: A set of guidelines for selection, design and placement of the selected measures will be developed and issued as a manual; articles for professional technical journals will also be prepared.

Effectiveness: This research will lead to improved effective measures to enhance pedestrian safety which will reduce pedestrian fatalities and injuries.

Title: Time-Space Analysis of Crosswalks and Corners

Problem: The current draft of the New Highway Capacity Manual contains a new method of analysing the adequacy of corners and crosswalks based on a "time-space" concept. In addition, the new analysis procedure provides a means of evaluating the effect of turning vehicles on pedestrian crosswalk adequacy, and conversely, the effect of heavy pedestrian crossing volumes on the vehicular capacity of the intersection. In the latter application it would identify pedestrian crossings where turn restrictions or special signalization strategies should be employed to increase intersection capacity. The method is adaptable to microcomputer programming.

While for the most part, the time-space method is based on previous pedestrian traffic and walking speed research, there has been no broad-based field validation of the method which compares theoretical value with actual observed traffic conditions at various types of urban intersections. Analyzing the effects of pedestrian crossing time-space is a new analytical technique with the promise of a better understanding of the functioning of complex traffic areas such as intersections where there is a mix of pedestrians and different vehicle types competing for the same "green-time".

Objectives: (a) To validate the time-space method for determining the level-of-service for crosswalks and corners; (b) to determine the effects on intersection vehicular capacity of pedestrian crossing activity; (c) to provide an up-date of the Highway Capacity Manual (HCM) section on time-space analysis; (d) to develop a micro-computer program for analysing crosswalks and corners; and (e) to develop a training program, using the case-study approach to instruct practitioners in the use of the HCM time-space analysis technique.

The approach will include time-lapse photography/video analysis of selected intersections for different conditions in a number of cities to establish:

(a) for corners
pedestrian densities and levels-of service for a range of pedestrian volumes and signal cycles;

(b) crosswalks

pedestrian densities and levels-of-service for a range of crossing volumes, signal cycles, crosswalk length and width, and time-space requirements for turning vehicles of different classifications (autos, buses, trucks).

(c) intersection capacity

the threshold values where heavy pedestrian volumes delay turning vehicles to the extent that the through-put and capacity of the intersection is reduced; curves, formulae and other means of estimating intersection capacity reductions for different types of intersections (1 way-1 way, 1 way-2 way, 2 way-2 way) due to pedestrian crossing activity.

Key Words: Pedestrians, level-of-service, sidewalks, intersections, pedestrian-vehicle conflict, walking.
Related Work: Recently, the New York Department of City Planning completed a study to validate and calibrate the time-space concept for Manhattan conditions. The research found that the time-space concept was able to replicate observed and measured pedestrian conditions, recommend several refinements and calibrate parameters for the procedure as presented in the new HCM. However, this research was only for Manhattan conditions and may not be valid for other applications. Thus a more geographically balanced analysis is needed.

Urgency/Priority: The Pedestrian Committee has ranked this research statement the first one under Medium Priority.

Cost: $250,000 for a 24 month period, including field collection of data in three to five cities, development of necessary curves and formulae, a micro-computer analysis procedure, and a training program to instruct practitioners in the use of the time space analysis technique.

User Community: The audience for this research need statement is FHWA and AASHTO. The primary users of the research will be local agencies responsible for ensuring safe and comfortable conditions at pedestrian facilities.

Implementation: The findings would be presented in the form of addenda to the new HCM; as technical articles in professional journals such as the Transportation Research Record, ITE Journal, and NCHRP publications. Also, a training program could be incorporated as part of a larger program on the new HCM.

Effectiveness: Refining and calibrating the time-space approach will improve the ability of practitioners to provide safe and convenient pedestrian facilities. This will improve the pedestrian environment in areas such as downtown business districts thereby enhancing their economic vitality and viability. The improved safety will reduce pedestrian fatalities and injuries. Reduced pedestrian-vehicle conflicts will improve vehicular traffic flow and reduce traffic congestion and the associated air pollution.

Title: Pedestrian Gap Acceptance

Problem: Although pedestrian gap acceptance has been examined in several studies, a comprehensive examination of the various parameters affecting pedestrian gap acceptance has not been conducted. A wide variety of pedestrian, roadway, and environmental characteristics must be considered when examining gap acceptance. Data on gap acceptance would be useful in determining where various pedestrian safety treatments (signals, overpasses, cross-walks, etc.) should be installed.

Objective: To provide a sound empirical basis for determining the gap in the traffic stream that pedestrians require to cross an uncontrolled roadway.

Key Words: Gap availability, pedestrian crossings, pedestrian warrants, sight distance, pedestrian visibility, gap study.

Related Work: Previous work has used a limited number of test subjects in a simulated crossing situation. In order for the results to be most useful to the practitioner, the research should be a field data collection effort and not be conducted in an artificial setting. The risk/consequences of a pedestrian's crossing decision are too difficult to simulate. Also refer to FHWA contract DTFH61-85-C-00079, "Measuring Pedestrian Volumes and Conflicts".

Urgency/Priority: The Pedestrian Committee gives this research a "medium" priority. It ranks fifth out of 34 evaluated by the Committee.

Cost: The estimated cost is $100,000 for a period of 18 months.

User Community: FHWA, NHTSA, and state and local traffic engineers, planners, designers and safety specialists.

Implementation: One important product of the research would be the development of techniques to allow the local practitioner to determine the "gap availability" at various locations. These techniques could be added to the Traffic Control Devices Handbook.

Effectiveness: Gap acceptance should be measured for a variety of pedestrian characteristics (age, sex, accompaniment) and roadway characteristics (width, operating speed, ADT, ratio of ADT to capacity, sight distance restrictions, etc.). In addition, the potential role of vehicle factors (speed, size, color, noise level) and environmental factors (rain, fog, snow, darkness) should be considered. An MOE might be the observed percentage of pedestrian crossings without conflicts of the total attempted crossings.

Title: Nighttime Pedestrian Safety

Problem: A large number of pedestrian accidents occur after dark. The risk is made even more extreme by the lesser exposure; few people walk at night and those who do are in the presumably more competent age group--young and middle-aged adults. Yet walking is necessary for many people, either as a primary mode of transportation at times or as access to other transportation modes. Furthermore, this need may increase in the future because of energy costs. In addition, the recent flood of advice on health matters has emphasized walking as a useful health measure. With the heightened interest in health, people likely will walk more and, for many people, the only block of time available during the winter half of the year occurs during darkness or half-light. Thus, an already-serious problem may be exacerbated in the near future.

Objective: To reduce the excessive risk in walking after dark by educating the public.

Key Words: Pedestrian visibility, retroreflective clothing, nighttime accident countermeasures.

Related Work: Certain countermeasures have been shown to increase pedestrian conspicuity, notably the use of a flashlight and retroreflective material that is contoured to give information that a human being is present, not just a reflector. In this country there has never been a broad promotion of the effective protection techniques presently available.

Urgency/Priority: The Pedestrian Committee gives this problem a "medium" priority. It ranks sixth out of 34 evaluated by the Committee.

Cost: The estimated cost is $180,000 for a period of 12 months.

User Community: AASHTO, FHWA, NHTSA, AAA, National Safety Council.

Implementation: This project should assemble and evaluate the information available from those states that require use of flashlights and/or retroreflective material at night. In addition, a feasibility study should be made of mandating retroreflective treatment of all normal exterior garments by manufacturers. Finally, a campaign should be conducted that is designed to motivate the public to protect those who walk in the dark (either planned or unplanned pedestrian trips) and to publicize the simple, inexpensive means for protection that are readily available. This campaign should be designed with due regard for the knowledge of social scientists about influencing motivation. The effectiveness of the campaign should be rigorously evaluated and a cost-effectiveness evaluation made.

Effectiveness: The ultimate societal impact of this research should be reduced nighttime accidents involving pedestrians. Measures of public acceptance of a public relations campaign might be before-after random nighttime observations of pedestrians in retroreflective versus

non-retroreflective clothing conducted in a managable-size study area.

Title: Safety Effects of Alternative Crosswalk Marking and Signal Systems

Problem: The wide variety of crosswalk marking and signal systems in use constitutes a veritable menagerie of treatments (zebra, pelican, panda, etc.). We need to determine which treatment is the most effective in the various types of highway situations.

Objective: To determine the operational and safety effects associated with various crosswalk marking and signal systems.

Key Words: Pelican crosswalks, zebra crosswalks, panda crosswalks, pedestrian crosswalks, crosswalk markings.

Related Work:

Urgency/Priority: The Pedestrian Committee gives this research a "medium" priority. It ranks seventh out of 34 research problem statements.

Cost: The estimated cost is $100,000 for a period of 24 months.

User Community: AASHTO, FHWA, NCUTCD (Markings and Signals Technical Committees), state and local traffic engineers.

Implementation: Practitioners at the local level could select the type of crosswalk marking and signal system most appropriate for the location type.

Effectiveness: MOEs should include: the number of pedestrian accidents per each type of crossing, the number of accidents per pedestrian using each type of crossing, and the number of accidents per exposure (pedestrian volume times vehicle volume) for each type of crossing. Other MOEs might also be used.

Title: Innovative Solutions to Pedestrian Accident Types

Problem: There is a tendency for pedestrian safety efforts to become inbred because experts from a limited number of disciplines typically are included in countermeasure research efforts. Creative idea generation procedures using participants from related fields (e.g., aviation safety,

crowd control) have been used to "unchain" the process and begin focusing on ideas that are somewhat less conventional. The generation of ideas without regard to implementation constraints often can uncover the kernal of an effective solution. New idea generation can consider recent technological developments. Recently developed information on the causes and nature of pedestrian problems can be a powerful catalyst to the creative process.

Recent evidence appears to implicate the driver in many pedestrian accidents. Even where the pedestrian has committed the critical behavioral error, lack of alertness to the possibility of pedestrian presence and/or driving at an excessive speed can contribute to accident occurrence. Further, two categories of victims--young children and the alcohol-impaired pedestrian--cannot always be expected to act reliably in their own behalf. Exhortations to the driver have not proved to be sufficiently effective. Although use of traffic controls can help, they cannot be universally deployed and many accidents are occurring at controlled locations. Pedestrian signals do not appear to improve safety and are not even relevant to the many non-intersection (midblock) crossings where accidents occur. Therefore, it appears to be extremely beneficial to find innovative ways to alert the driver to pedestrian threats and promote an appropriate behavioral response (e.g., reduction in speed).

Objective: To obtain creative input from disciplines in addition to psychology and traffic engineering in an effort to identify new countermeasure approaches. Specific emphasis should be placed on finding ways to alert the driver to pedestrian activity and/or to modify the driver's behavior by manipulation of the environment, particularly where pedestrian risk is high. In addition, an attempt should be made to identify design or other techniques that encourage more cautious crossing behavior at intersections, reduce pedestrian exposure to vehicles, and encourage better recognition by motorists of pedestrian crossing rights and problems at intersections.

Key Words: Pedestrian accident countermeasures, defensible space, brainstorming, technology transfer, technology sharing, pedestrian innovations.

Urgency/Priority: The Pedestrian Committee gives this research a "medium" priority. It ranks eight out of 34 research problem statements.

Cost: The estimated cost is $100,000 for a period of 12 months.

User Community: FHWA, NHTSA, IACP, AAA, NSC, AIA, ITE, NAS, ASCE, Human Factors Society, other non-engineering organizations.
Implementation: The final product will be a list of innovative problem solution approaches considered worthy of further research, together with appropriate implementation, evaluation, and feasibility information, a priority value, and a recommended timing for addressing the area.

Effectiveness: Ultimately, reduced pedestrian accidents.

Title: School Trip Safety
Problem: The school trip is regarded by the local community as a great concern. Generally, a youngster's trip to and from school is perceived by the public as a "problem" -- real or otherwise. Frequently, the school trip is a highly emotional issue that involves many groups -- parents, local officials, teachers, school officials, police and school organizations such as the PTA. A "perceived problem" most often results in action of some sort -- sometimes without much real basis for that action. With a better understanding of school trip accidents and their alternative countermeasures, local communities would be prepared to effectively deal with school trip safety issues.

Previous research of school trip accidents is not only outdated, but limited in its scope and inconsistent in its findings. Because school age children continue to be overrepresented in pedestrian accidents when compared to their proportion of the population, and because there has been a shift in the percentage of all pedestrian accidents within the school age group, there is a need for more current research with regard to school trip accidents.

Objective: Utilizing data from cities of various population sizes, geographic area and general characteristics, determine the extent of the involvement of school age children (elementary through junior high school) in pedestrian accidents occurring during the trip to and from school; identify characteristics of that involvement, such as age, time of day, urban or rural, pedestrian action, vehicle action and speed, type of roadway/number of lanes, length of school trip, sight distance, availability of sidewalks/paths and precipitating factors; compare characteristics of school trip accidents to non-school trip accidents; and identify countermeasures in effect at the time of the accidents, such as presence of safety patrols, presence of traffic control devices, safe route to school programs or sight distance improvements.

Key Words: Pedestrians, accidents, countermeasures, accident characteristics.

Related Work: School Trip Safety and Urban Play Areas (1975) and Pedestrian Trip Making Characteristics and Exposure (1985).

Urgency/Priority: Low

Cost: $150,000

User Community: FHWA, NHTSA, State and local transportation agencies.

Implementation: Current information on school trip accidents, their characteristics, and the countermeasures in effect at the time of those accidents will assist officials in better defining the problem with school age children in order to develop countermeasures to reduce these accidents.

Effectiveness: This study would foster a better understanding of the accidents experienced during the school trip which would lead to the

development of a safer environment for these trips.

Title: Methods for Determining Sidewalk Adequacy

Problem: A method for determining the adequacy of sidewalks based on actual sidewalk conditions is not available. The Highway Capacity Manual method for evaluating the adequacy of sidewalks is based on previous pedestrian traffic research in buildings. The impact of traffic signals, street furniture and other flow conditions which differ from those occuring in buildings are not considered.

Objective: To establish a method for evaluating the adequacy of sidewalks under existing conditions and under the impacts of new developments, e.g., for different signal cycles and locations of street furniture. To develop a training program using the case study approach to instruct practitioners in analyzing sidewalks.

Key Words: Sidewalk width, trip conditions, pedestrian volume, training.

Related Work: The 1986 NY HPR Study, "Pedestrian Movement Analysis".

Urgency/Priority: Low

Cost: $100,000

User Community: FHWA, AASHTO, TRB, State and local transportation agencies.

Implementation: The information obtained from this research could be used to update the Highway Capacity Manual to make it more applicable to actual sidewalk conditions. A training program would assist practitioners in being able to analyze sidewalk adequacy.

Effectiveness: Adequate sidewalks would enhance the walking trip and improve pedestrian flow particularly in congested areas.

Title: Parking Facility Design for Pedestrian Safety

Problem: While accidents occurring in off-street parking facilities are not often documented in municipal records systems, there is experience which indicates that these occur with sufficient frequency to be of concern. It has been recognized that the design standards for off-street

parking are often dictated by architectural and economic factors. Pedestrian safety and convenience are often forgotten.

There are features of circulation, parking stall design and walkway treatment which currently result in maximizing, rather than minimizing, the exposure of pedestrians to moving vehicles. Other problems, such as visibility and sight distance are also matters of safety concern. Designers currently are without guides and criteria on which to base improved designs.

Objective: To arrive at design criteria and guidelines which will enhance pedestrian safety in off-street surface or structure parking.

Key Words: Off-street parking, parking structure, sight distance.

Related Work: Pedestrian Convenience and Safety on Suburban and Rural Highways.

Urgency/Priority: Low

Cost: $75,000

User Community: Local planning agencies, developers, A/E firms, and land use designers.

Implementation: The design criteria and guidelines could be used by developers and designers in designing off-street surface or structure parking which is safer and more convenient for pedestrians. Planning agencies could use the information during reviews for approving developments which include parking facilities.

Effectiveness: The exposure of pedestrians to moving vehicles could be reduced which would enhance their safety in parking facilities.

Title: Improved Pedestrian Accident Reporting

Problem: Analysts of pedestrian accidents require as complete and detailed a picture of what occurred as is feasible.
In some cases data are not collected because accidents go unreported. Spot studies of emergency room files show that pedestrian-automobile injuries are treated which do not appear in the local jurisdiction accident record files. Often these are cases resulting from crashes in off-street locations, such as privately owned parking lots, which are not required to be reported. In other cases an injury may be so slight that the bruised pedestrian walks away and the incident is forgotten. Other unreported cases of pedestrian injury do not involve motor vehicles, but are within the realm of traffic accidents. Additionally the

representation of the pedestrian accident on the report form and in fields of the automated records has been inadequate, and the information is often inaccurate. There is a need to capture these accidents so that as complete a picture as possible may be formed, within a time frame that is not unreasonably long, thereby gaining sufficient sample size to support statistical analysis.

Objective: To identify means for maximizing the percentage of pedestrian accidents reported and for acquiring sufficient information to meet the needs of the variety of data users.

Key Words: Pedestrian injuries, pedestrian accidents, accident reporting.

Related Work: Unknown

Urgency/Priority: Low

Cost: $100,000

User Community: FHWA, NHTSA, State and local highway safety offices

Implementation: An improved pedestrian accident data base and reporting system which can relate to data in other data bases, will allow the user to do more refined analyses of the pedestrian problem and apply appropriate countermeasures to reduce the problem.

Effectiveness: The implementation of appropriate countermeasures to address the pedestrian accident problem will result in fewer pedestrian accidents.

Title: Driver Countermeasures of Pedestrian Crossing Accidents

Problem: Recent evidence appears to implicate the driver in many pedestrian accidents. Even where the pedestrian is said to be "at fault", lack of alertness to the possibility of pedestrian presence and/or speed in excess of that which is prudent frequently contributed. There are a number of ways of alerting the driver to possible conflicts. Police presence is one but is temporary and very expensive. Environmental changes would include rumble strips, yellow warning flashers, "scramble" signal operation, increasing crosswalk visibility, more parking removal near crosswalks to provide unobstructed view of the corner where pedestrians gather to cross. Other possibilities include traffic diversion from neighborhoods, redesign of streets for speed reduction and speed bumps, etc.

Objective: To find ways to alert the driver to pedestrian activity and/or modify the driver's behavior by manipulation of the environment where

pedestrian risk is high.

Key Words: Crosswalks, pedestrian flashers, speed reduction.

Urgency/Priority: Low

Cost: It is estimated that $200,000 would be needed over a 24 month span.

User Community: AASHTO, NHTSA, FHWA, state and local traffic engineers and safety specialists.

Implementation: Primary users would be city and county areas of dense population, as well as concentrated housing and commerical areas.

Title: Evaluation of Alternative Pedestrian Actuated Warning Beacons

Problem: A true need for additional emphasis at non-signalized pedestrian crosswalks exists. The National Safety Council reports that 88,000 pedestrians were killed or injured in motor-vehicle collisions in 1983. 63.7% or 56,056 occurred when the pedestrian was crossing the street; 26.4% at intersections, 37.3% between intersections. They did not differentiate between signalized and non-signalized locations. They do indicate, however, that 23.7% of all motor vehicle accidents involved drivers failure to yield the right-of-way. At non-signalized intersections the only protection for pedestrians crossing the street is the requirement that drivers yield the right-of-way to pedestrians.

Pedestrian crossing warning signs, marking and beacons are utilized at non-signalized crosswalks to improve driver compliance to yielding to pedestrians. None require drivers to stop unless the pedestrian is in danger of being run over by the vehicle. They exist at all times, whether a pedestrian is there to cross or not, and are, therefore, easily ignored by drivers.

The view of a pedestrian walking across a street is what alerts a driver to the presence of the person and provides the input for the driver to decide whether to stop or yield. Multiple threat and dart-out pedestrian collisions often occur because the pedestrian is not seen by the driver in time for the decision to stop to be made. An alternative dynamic device is needed to alert the driver to the presence of a pedestrian.

For example, Seattle, Washington has created a dynamic device to supplement the movement of the pedestrian and alert drivers to the fact that a pedestrian is crossing. Push buttons have been installed for a pedestrian to actuate overhead flashing lights at various crosswalks. The beacon remains static until actuated by a pedestrian. The pedestrian crosses the street while the lights flash, then the device reverts to its

static position.

There exists a need to determine the effectiveness of this type of device under varying conditions of land use, street width, traffic volume, flash duration, color of lights, etc., and to develop guidelines for its application to hazardous crossings where warrants for full signalization are not met.

It is anticipated that seven device configurations might be field tested and evaluated. An overhead crosswalk sign alone could be the basis for comparison. Six flashing light configurations could be compared to the basic sign: 1) sign with continuously flashing yellow beacon, 2) sign with pedestrian push-button (ppb) flashing yellow beacon, 3) sign with ppb flashing read beacon, 4) continuous flashing yellow beacon alone, 5) ppb yellow flashing beacon alone, 6) ppb flashing read beacon alone.

Objective: To test the safety effectiveness of pedestrian push-button, flashing crosswalk beacons and develop design criteria and installation guidelines for their use.

Key Words: Crosswalks, pedestrian signs

Urgency/Priority: Low

Cost: $150,000 to $200,000

User Community: AASHTO, FHWA, NHTSA

Implementation: The device could be used by cities and other areas of pedestrian concentration (county, school, etc.).

Title: Guidelines for Use of Pedestrian Actuated Devices

Problem: There are many unanswered questions on the subject of pedestrian indications and pedestrian actuation of traffic signals. Some of these are:

1. Under what circumstances of vehicle/pedestrian volume, land use, visibility of vehicle indications, signal timing, etc. do WALK/DON'T WALK indications need to be installed at traffic signalized locations.

2. What are the circumstances which require the installation of pedestrian actuation equipment at actuated traffic signals.

3. Are WALK/DON'T WALK indications required at actuated traffic signals or can a pedestrian use the vehicle indications.

4. At what level of side street vehicular volume is it necessary to provide pedestrian actuation at actuated traffic signals.

5. What is the accident experience at locations where WALK/DON'T WALK indications exist as compared to where they don't.

6. Are there any other users, such as bicyclists, who need traffic signal actuation equipment.

7. Is there a consistency and user expection in the application of WALK/DON'T WALK indications and use of pedestrian actuation equipment.

Objective: To develop a user's guide for determining under what circumstances pedestrian WALK/DON'T WALK indications should be installed and when pedestrian actuation of traffic signals and devices is warranted.

Key Words: Walk signals, pedestrian accidents at signals, bicycle actuation.

Urgency/Priority: Low

Cost: $50,000 for a questionnaire and survey, and develop guidelines.

User Community: AASHTO, ITE, NHTSA, FHWA, local and state traffic engineers

Implementation: Via the Manual on Uniform Traffic Control Devices(MUTCD), professional associations and technical publications.

Title: Assessing Economic Impacts of Pedestrian Improvements

Problem: There are a variety of reasons for implementing pedestrian improvements: increase safety at high hazard locations (reduce pedestrian accidents), to improve pedestrian access, enhance pedestrian mobility, provide increased pedestrian capacity, and increase urban (pedestrian) activity. Unfortunately, pedestrians as a transportation modal user group are relatively incohesive and inarticulate. There are few groups or organizations championing the cause of pedestrians. As a result, providing pedestrian improvements is essentially a reactive process, and having the softest voice, pedestrians are usually the last served. Among the reasons (though seldom articulated) for carrying out pedestrian improvements is that certain ones can ultimately have economically beneficial consequences to the specific locale in which the improvement is carried out; the community, the city, and so on. Such benefits might include: improved business climate; increased retail sales; increased commercial activity; increased attendance at cultural or sporting events;

enhanced access to employment and increases in employment; generation of increased taxes; economic benefits due to the construction activity itself; increased property values; and reduced pollution, congestion and delay time.

It would be desirable if the economic consequences of pedestrian improvements were better understood. This would better enable transportation professionals to include these benefits as a further reason for considering and/or implementing improvements which would enhance the pedestrian environment. It would provide a positive or affirmative rationale for providing such improvements rather than a negative or reactive one (e.g., as a result of deaths or injuries).

Approach:

Task 1: identify an array of improvements which, it is postulated, might lead to enhanced economic activites, e.g., pedestrian malls, auto-free zones, new/reconstructed/refurbished sidewalks or paths, Woonerfs, pedestrian walkways on bridges, improved pedestrian crossing (signals at crosswalks, overpasses), or other improvements which result in improved pedestrian access or mobility.

Task 2: identify study locations where such improvements are comtemplated, proposed, or have recently been undertaken. An "impact zone" would be selected for each study location.

A "before and after" study would then be carried out to identify the economic consequences (benefits and dis-benefits) attributable to these specific improvements.

Objectives: To determine the extent to which various types of pedestrian improvements result in measurable/economic benefits or dis-benefits.

Key Words: Pedestrian cost-benefits, pedestrian improvements.

Related Work: NCHRP Project 20-19 "Pedestrian Convenience and Safety on Suburban and Rural Highways" is complete. (See NCHRP Reports 294 A and B.) It covers current and proposed pedestrian facilities in outlying commercial areas and how to encourage consideration of their safety and convenience during design and long term planning.

Urgency/Priority: Low

Cost: $200,000 (18 month contract period).

User Community: AASHTO, Land Planners, Urban Land Institute, FHWA, state and local traffic engineers.

Implementation: Through TRB and ITE publication and the Urban Land Institute.

Title: Pedestrian Accomodations at Ramps, Jughandles and other Turning Roadways

Pedestrian needs are largely ignored at many ramps, jughandles, and for some channelized roadways. The reconstruction of roadways employing the "Jersey Barrier", for example, restricts pedestrian cross flows to widely spaced channelized intersections. At such locations, the primary intent of the traffic engineer in many instances is to increase vehicle capacity, maintain smooth vehicle flow, and minimize multi-vehicle accidents. If pedestrian volumes are low, pedestrians may be totally ignored in terms of providing for safe crossings both parallel to and across the main roadway. This may create a hazardous or near impossible crossing situation for the pedestrians. In situations where pedestrian accommodations are made, they may be insufficient or inappropriate to provide safe passage by pedestrians without adversely affecting vehicle safety or operations.

There is a need to define the various types of ramps, jughandles, and channelization where pedestrian accommodations are needed and then recommend the types of treatment which are most effective for pedestrians and traffic. Finally a users manual should be developed to provide for easy implementation of recommended procedures.

Objectives: To identify conditions at ramps, jughandles and channelized roadways where pedestrian accommodations are needed and recommend the types of treatments which are appropriate for various situations.

Key Words: Interchange design, pedestrian safety.

Urgency/Priority: Low

Cost: The estimated cost of this project is approximately $150,000 for a 24-month period.

User Community: AASHTO, ITE, NHTSA, FHWA, local and state traffic and maintenance engineers.

Implementation: User's manual which could be made available to state highway departments and designers.