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RESEARCH PROBLEM STATEMENTS: PEDESTRIANS

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OPERATION AND MAINTENANCE OF TRANSPORTATION FACILITIES

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INTRODUCTION

Pedestrian deaths have numbered approximately 8,000 annually for the last decade, accounting for 17 to 19 percent of all motor vehicle deaths. Additionally, more than 100,000 pedestrians are injured each year. In addressing this serious problem, the Committee on Pedestrians believes that the preparation and dissemination of research needs is a major committee function. The committee has identified seven problem areas requiring further research attention. This Circular is intended to communicate these research problem statements to the transportation research community.

PRIORITY

Although each of the seven problem statements was considered to be deserving of research support, a priority ranking system was devised to inform others of which problems the committee considers to be of high, medium, and low priority. The problem statements were solicited from committee members and ranked by them during 1981. The ranking represents the committee's judgments as to the relative importance of each of the seven problem statements.

RESEARCH PROBLEM STATEMENTSPROBLEM NO. 1

1. TITLE: Signal/Signing for Intersection Pedestrian-Vehicle Conflicts
2. PROBLEM: At certain intersections, vehicular volumes and geometrics are such that insufficient green time is available for pedestrians to cross the entire intersection without undue delay to vehicles. At some of these locations the pedestrian "WALK" time is extended into what would otherwise be protected turning phases. However, the Manual on Uniform Traffic Control Devices (MUTCD) only allows use of GREEN ARROW indications where the vehicular movements are totally conflict-free -- i.e., do not conflict with either vehicles or pedestrians. In this situation, the GREEN ARROW cannot technically be used, but motorists can turn, free from vehicular conflicts. No sign or signal indication currently exists in the MUTCD to transmit this information to the motorist.
This problem also occurs at intersections where other types of signal overlap or split phasing is used and where roadways are too wide for pedestrians to cross in one signal cycle. Often the "solution" is not to install crosswalks or pedestrian signals, thereby ignoring the problem. (See MUTCD, Section 4B-5, paragraph 1(b) and 1(c); Section 4B-6, paragraph 5(e), and Section 4B-16).
3. OBJECTIVE: The following activities should be conducted:
 - (1) a survey of the frequency of such situations and of the various ways ~~state, county, and localities are~~ dealing with such signalized intersections
 - (2) information needs analysis
 - (3) development of various countermeasures/treatments/devices
 - (4) lab test of candidate countermeasures/treatments/devices
 - (5) field test of same
 - (6) analysis of results of field test
 - (7) recommendations.
4. KEY WORDS: GREEN ARROW Indication, vehicle-pedestrian conflict
5. RELATED WORK: On-going FHWA contract with Goodell-Grivas, Inc.
6. URGENCY/PRIORITY: High
7. COST: \$100,000
8. USER COMMUNITY: American Association of State Highway and Transportation Officials, Federal Highway Administration, National Highway Traffic Safety

Administration, National Cooperative Highway Research Program (TRD), State and Local Governments.

9. IMPLEMENTATION: Included as MUTCD standard.
10. EFFECTIVENESS: Would clarify to both motorists and pedestrians precisely when there are vehicle-vehicle conflicts vs. vehicle-pedestrian and when there are not; this would increase safety by providing information that is not currently available. Also, it would reduce delay to both pedestrians and motorists caused by confusion and hesitation.

PROBLEM NO. 2

1. TITLE: Modeling of Pedestrian Volumes for Pedestrian Safety and Operational Analysis
2. PROBLEM: The collection of pedestrian volume data is necessary for the planning of pedestrian facilities, application of pedestrian signal warrants, determination of the need for signing prohibition of Right Turn on Red (RTOR), selection of proper signal timing, selection of the type of pedestrian signals (pushbutton, scramble timing, standard timing, protected phases, etc.), research purposes, and other purposes related to the safety and operation of pedestrian travel. For many of these uses, as much as eight to twelve hours of volume counts are needed or are highly desirable.
The collection of pedestrian volume data generally requires the use of manual volume counts by traffic engineering technicians. Such data collection can become quite expensive in terms of manpower costs alone. Moderate and large cities commonly have from a few hundred to several thousands of intersections where pedestrian volume data are needed. Adequate manpower often is not available for collecting pedestrian volumes, except a few locations per year (school zone locations, etc.). Adjustment factors for vehicle volumes have been developed and used for many years for converting short-term vehicle counts to Average Daily Traffic (ADT) counts. To date, no known adjustment factors have been used to estimate pedestrian ADT's from short-term counts. Based on this situation, many State and local engineers and planners have expressed a strong need for some type of predictive model to be developed for use in estimating pedestrian crossing volumes, particularly at urban area intersections.
3. OBJECTIVE: To develop a set of factors which can be used to estimate pedestrian ADT's from short-term counts. Further, it is desirable to develop a mathematical or graphical model to allow local and state highway agencies to estimate daily pedestrian volume of a large number of intersections at a minimum expenditure. The model(s) would allow for inputting jurisdictional characteristics

(city population, density, etc.), near-
by land use (residential, commercial,
recreational, etc.), area type (Central
Business District, fringe, etc.), and
possibly a short-term (peak hour, etc.)
pedestrian ADT level or other desired
time period (12-hours, 8-hours, 16-hours,
etc.).

4. KEY WORDS: Pedestrian volumes, modeling, data projections
5. RELATED WORK: Preliminary analyses of data in Seattle, Toledo, and Detroit in a current FHWA study have revealed that the use of pedestrian volume data for AM and PM peak hours alone can be used to accurately estimate the 12-hour or 24-hour pedestrian volumes, particularly in the CBD areas. (Also BioTechnology, Inc. pedestrian exposure study and work by RTKL and Associates of Baltimore, MD).
The predictive models developed in this proposed study should account for seasonal factors, time variations, day of week, weather conditions during the count, and other factors that could have an effect on pedestrian volumes. The model could be updated as more data become available.
Existing or newly collected pedestrian volume data (i.e., FHWA pedestrian exposure study) would be used to develop the model(s), which then would be validated in field tests.
6. URGENCY/PRIORITY: High - According to numerous city traffic engineers nationwide, there is a vital need to develop such models for estimating pedestrian volumes in order to allow for the proper handling of pedestrian safety and operational needs.
7. COST: \$100,000 to \$150,000
8. USER COMMUNITY: FHWA, NHTSA, NCHRP, Department of Housing and Urban Development (HUD)
9. IMPLEMENTATION: The results of the research could be implemented immediately by cities throughout the country and conserve on data collection efforts and allow for more comprehensive analyses of city-wide pedestrian needs.
10. EFFECTIVENESS: The development of such a model would aid engineers and planners designing pedestrian facilities and selecting safety countermeasures.

PROBLEM NO. 3

1. TITLE: The Relationship of Sight Distance and Visibility to Pedestrian Accidents
2. PROBLEM: Visibility and sight distance are well-recognized as important safety factors in vehicular accident causation and prevention. But most attention is given to the sight distance and visibility aspects of a hazard from the perspective of the motorist. Formulas

for highway design and for placement of traffic control devices are all based upon the ability of motorists to detect and respond to hazards and of their vehicles to decelerate. Little is known about the roles that pedestrian sight distance and visibility play in pedestrian accidents--both visibility of the pedestrian by the motorist and sight distance to the vehicle for the pedestrian. Many pedestrian accidents involve some measure of a sight distance problem--either on the part of the driver and/or the pedestrian.

3. OBJECTIVES: Determine the relationship of visibility and sight distance to pedestrian accidents. This research should
 - (1) Estimate the frequency of accidents where sight distance or the lack of pedestrian visibility is a problem.
 - (2) Determine effect of various illumination levels and luminaire types on pedestrian safety.
 - (3) Identify factors preventing the motor vehicle from seeing pedestrians and vice-versa.
 - (4) Identify potential solutions (e.g., appropriate parking set-back distances for various operating speeds).
 - (5) Estimate magnitude of accident reduction for most promising solutions.
4. KEY WORDS: Visibility, sight distance, pedestrian accidents, decision sight distance, safe stopping sight distance
5. RELATED WORK: Dunlap/NHTSA Study now underway--is examining pedestrian conspicuity but is not specifically concerned with sight distance as it relates to parked vehicles.
6. URGENCY/PRIORITY: Medium
7. COST: \$200,000
8. USER COMMUNITY: AASHTO, FHWA, NHTSA, NCHRP, Human Factors Specialists
9. IMPLEMENTATION: A wide range of actions primarily of a low-cost nature could be taken to address the problem once the needs are quantified. For example, the distance from a crosswalk in which parking should be prohibited according to the various vehicle operating speeds could be incorporated into the similar guidelines presently used to enhance motorist sight distance.
10. EFFECTIVENESS: Since the scope of the problem is unknown, an estimation of the benefits of this research cannot be made. However, many of the implementation techniques should be relatively cost effective.

PROBLEM NO. 4

1. TITLE: Pedestrian Traffic Enforcement
 2. PROBLEM: Many citizens and traffic safety officials suggest "enforcement" as a means to correct a pedestrian accident "problem" discovered in their jurisdiction. Although some enforcement campaigns have documented short term effects, there is little research to support that enforcement is effective over the long term and, therefore, little information on procedures for implementing a successful program.
 3. OBJECTIVE: Document the types of enforcement efforts which have been undertaken relating to pedestrian safety. Determine which, if any, pedestrian traffic enforcement efforts, techniques, and procedures are effective over a long term--specifically, for more than one or two years. The range of enforcement activities should be identified, evaluations made of the more widely used or promising techniques and information disseminated to enforcement agencies. Ineffective programs should also be documented so that these efforts are not unnecessarily repeated. Elements of vehicle enforcement related to pedestrian safety should also be investigated.
 4. KEY WORDS: Enforcement, pedestrian enforcement, jaywalking, pedestrian safety programs
 5. RELATED WORK: Unknown
 6. URGENCY/PRIORITY: Medium
 7. COST: \$150,000
 8. USER COMMUNITY: NHTSA, FHWA, NCHRP, AASHTO, IACP (International Association of Chiefs of Police), American Automobile Association (AAA)
 9. IMPLEMENTATION: This research would enable police departments, traffic engineering agencies, and others responsible for pedestrian safety to select the most effective enforcement countermeasures for implementation at state and local levels.
 10. EFFECTIVENESS: This research should identify the measures of effectiveness that are most valid for determining long-term effects of various enforcement techniques. This in turn should save money and time spent on less-effective techniques and increase meaningful (long-term) benefits of the more successful techniques.
- tion given to pedestrian access and safety. Such a location is usually thought to be a completely auto-oriented environment, but some pedestrian trip making occurs or would occur more frequently if proper planning were performed. Examples of such problems include lack of sidewalks between major origins and destinations, inadequate pedestrian signalization at intersections, frequent and/or wide curb-cuts and indirect routings for pedestrian access. "Strip developments" create particular safety and access problems for pedestrians. Moderate to high speeds along some of these arterial streets pose a greater threat to pedestrian safety than more urban locations.
3. OBJECTIVES: Quantify the level of pedestrian activity for different land use settings along suburban arterial streets. Identify, through several case studies, the barriers to pedestrian access and typical hazards posed to pedestrians which are potentially correctible through good planning and design. Recommend corrective measures and methods for their implementation, including zoning and site plan review for obtaining cooperation from the private sector.
 4. KEY WORDS: Pedestrian access, pedestrian safety, suburban arterials
 5. RELATED WORK: Unknown
 6. URGENCY/PRIORITY: Medium
 7. COST: \$100,000
 8. USER COMMUNITY: Municipal planning/traffic departments, FHWA, State governments
 9. IMPLEMENTATION: Guidelines could be used by local planning department in working with private developers, with certain provisions explicitly stated in local ordinances or national manuals, where necessary.
 10. EFFECTIVENESS: This study would foster better planning for pedestrians in suburban areas which would hopefully lead to replacement of some auto trips with walking and to a safer environment for pedestrians.

PROBLEM NO. 5

1. TITLE: Pedestrian Access and Safety Improvements on Arterial Streets
2. PROBLEM: Arterial streets, particularly those in suburban areas, have often been designed with only secondary considera-

PROBLEM NO. 6

1. TITLE: Relationship of Pedestrian Travel to Land Use and Energy Consumption
2. PROBLEM: A major objective of the United States since the oil embargo of 1973-74 has been to reduce the consumption of petroleum-based products, particularly in the transportation sector. However, the ability of pedestrian travel, as either a primary or supplemental tripmaking mode, to reduce energy consumption has not been assessed. This problem is directly related to future land use and transportation planning

since the propensity for pedestrian trips largely depends on the distance between origin and destination. The role of other low-energy-use personal modes of travel such as bicycles and mopeds should also be assessed.

3. OBJECTIVES: Assess the potential of pedestrian, bicycle, and moped travel to reduce the consumption of future energy resources. This assessment should include
 - (1) The percentage of trips and miles of travel captured by these modes for several scenarios of land use
 - (2) The elasticity of demand for these modes given variables of fuel availability and cost, weather, temperature, availability of other modes, and other factors determined to be important
 - (3) Innovative options for the replacement of auto travel with these modes (e.g., TSM-type preferential treatment strategies for pedestrians, tax incentives for living close to work, etc.).

The need is to structure alternatives, and weigh their potential payoff so that promising options can be devised and further evaluated. Existing data sources are to be used, where available, although the last objective listed above may require more subjective analysis.
4. KEY WORDS: Pedestrian, bicycle, moped, land use, energy consumption
5. RELATED WORK: Unknown
6. URGENCY/PRIORITY: Low - This initial study is important to determine potential impact of such strategies. Depending on findings, subsequent studies may or may not be important.
7. COST: \$50,000 (first phase; additional phases if promising)
8. USER COMMUNITY: FHWA, HUD, Department of Energy (DOE)
9. IMPLEMENTATION: This research could conceivably affect land use policy and the development of additional strategies to conserve energy resources.
10. EFFECTIVENESS: The societal impacts of this research would be more knowledge about how much energy could be saved by various land use and transportation options taken to encourage pedestrian travel as a replacement mode for more energy-intensive modes.

PROBLEM NO. 7

1. TITLE: The Impact of Highway Center Barriers and Jughandles on Pedestrian Access and Safety

2. PROBLEM: A typical urban arterial improvement to increase capacity and safety is to dualize or widen the road, often accompanied by the placement of a median barrier, such as concrete "Jersey" barrier or dual-face guide beam, and the addition of jughandles for left and "U" turns.

A thorough evaluation could undoubtedly attest to the safety of such features for motorists; however, as currently implemented, they appear to take a severe toll on pedestrian access and pedestrian safety. The barrier with crossings spaced at intervals convenient for motor vehicles but not for pedestrians is an obvious barrier to pedestrian access, and it is also a safety problem when pedestrians attempt to cross "mid-block" despite the presence of the barrier.

Jughandles may also present access and safety problems to pedestrian traffic along the highway as pedestrians must contend with decelerating vehicles approaching from the rear and crossing into the pedestrian line of travel as they enter the jughandle. This problem is similar to what would happen if pedestrians were permitted on limited access facilities and had to cross on-ramp or off-ramp at the gore area.

3. OBJECTIVES:
 - (1) Determine the level of access denial (and how to measure it) and extent of risk to pedestrians that results from these design features.
 - (2) Develop and test appropriate countermeasures to overcome these problems (e.g., breaks in barrier, pedestrian-actuated signals, stiles, safe cross walks at jughandle locations)
4. KEY WORDS: Pedestrian access, arterial design, median breaks, median barriers, urban arterial improvements
5. RELATED WORK: "Planning for Pedestrian Movement at Interchanges," FHWA, "Freeway Pedestrian Accidents," NHTSA and FHWA
6. URGENCY/PRIORITY: Low
7. COST: \$100,000
8. USER COMMUNITY: FHWA, AASHTO, NHTSA, State and Local Transportation Agencies
9. IMPLEMENTATION: Adoption of standards or recommendations by AASHTO, or FHWA, incorporating effective guidelines for pedestrian access and safety into arterial improvement projects.
10. EFFECTIVENESS: Increased mobility and safety for pedestrians. Possible increase in safety (reduction of deaths and injuries to pedestrians) if effective guidelines are devised and implemented. Possible minor reduction of vehicle miles of travel.