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NATIONAL COOPERATIVE
HIGHWAY RESEARCH PROGRAM REPORT

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**PLANNING AND IMPLEMENTING
PEDESTRIAN FACILITIES IN
SUBURBAN AND DEVELOPING RURAL AREAS
RESEARCH REPORT**

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NATIONAL COOPERATIVE HIGHWAY RESEARCH PROGRAM
REPORT

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**PLANNING AND IMPLEMENTING PEDESTRIAN
FACILITIES IN
SUBURBAN AND DEVELOPING RURAL AREAS
RESEARCH REPORT**

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RESEARCH SPONSORED BY THE AMERICAN
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AREAS OF INTEREST:

PLANNING
FACILITIES DESIGN
OPERATIONS AND TRAFFIC CONTROL
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TRANSPORTATION RESEARCH BOARD
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JUNE 1987

NATIONAL COOPERATIVE HIGHWAY RESEARCH PROGRAM

Systematic, well-designed research provides the most effective approach to the solution of many problems facing highway administrators and engineers. Often, highway problems are of local interest and can best be studied by highway departments individually or in cooperation with their state universities and others. However, the accelerating growth of highway transportation develops increasingly complex problems of wide interest to highway authorities. These problems are best studied through a coordinated program of cooperative research.

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The Transportation Research Board of the National Research Council was requested by the Association to administer the research program because of the Board's recognized objectivity and understanding of modern research practices. The Board is uniquely suited for this purpose as it maintains an extensive committee structure from which authorities on any highway transportation subject may be drawn; it possesses avenues of communications and cooperation with federal, state, and local governmental agencies, universities, and industry; its relationship to the National Research Council is an insurance of objectivity; it maintains a full-time research correlation staff of specialists in highway transportation matters to bring the findings of research directly to those who are in a position to use them.

The program is developed on the basis of research needs identified by chief administrators of the highway and transportation departments and by committees of AASHTO. Each year, specific areas of research needs to be included in the program are proposed to the National Research Council and the Board by the American Association of State Highway and Transportation Officials. Research projects to fulfill these needs are defined by the Board, and qualified research agencies are selected from those that have submitted proposals. Administration and surveillance of research contracts are the responsibilities of the National Research Council and the Transportation Research Board.

The needs for highway research are many, and the National Cooperative Highway Research Program can make significant contributions to the solution of highway transportation problems of mutual concern to many responsible groups. The program, however, is intended to complement rather than to substitute for or duplicate other highway research programs.

NCHRP REPORT 294A

Project 20-19 FY '85

ISSN 0077-5614

ISBN 0-309-04417-0

L. C. Catalog Card No. 87-50558

Price \$10.40

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The members of the technical committee selected to monitor this project and to review this report were chosen for recognized scholarly competence and with due consideration for the balance of disciplines appropriate to the project. The opinions and conclusions expressed or implied are those of the research agency that performed the research, and, while they have been accepted as appropriate by the technical committee, they are not necessarily those of the Transportation Research Board, the National Research Council, the American Association of State Highway and Transportation officials, or the Federal Highway Administration, U.S. Department of Transportation.

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Published reports of the

NATIONAL COOPERATIVE HIGHWAY RESEARCH PROGRAM

are available from:

Transportation Research Board
National Research Council
2101 Constitution Avenue, N.W.
Washington, D.C. 20418

Printed in the United States of America

FOREWORD

*By Staff
Transportation
Research Board*

Highway engineers, urban designers, decision-makers, and the general public will be interested in the research findings of this two-part report. A wealth of information has been drawn from interviews and discussions with planning and design practitioners, recent research, and 28 case studies of pedestrian facilities from around the United States. The first part of the report presents guidelines and principles that can be used by practitioners in planning, designing, and implementing pedestrian facilities, with emphasis on planning and implementation. The second part of the report presents detailed supporting information and examples of both good and bad planning and design practice. Together, the reports (*NCHRP Report 294A* and *NCHRP Report 294B*) present a methodology for providing convenient and safe pedestrian movement for suburban and developing rural areas.

As the American population shifted from urban centers to more dispersed settings in suburban and rural areas, traffic volumes on highways increased substantially. The population shift, combined with changing land-use patterns and a renewed interest in physical fitness, has also resulted in increased pedestrian demand in these areas. Highway planners and designers have been cognizant of increased traffic volumes, but have not always given adequate consideration to the convenience and safety of those walking in suburban and rural areas.

Pedestrian circulation systems in suburban and urbanizing rural areas are often incomplete and ineffective. These situations have resulted in a rising level of pedestrian-vehicle conflicts on high-speed, high-volume highways. In the past, solutions to pedestrian vehicular conflicts in these areas have favored vehicular traffic. Convenient, yet safe, pedestrian access to and from magnets, such as redeveloping and changing strip commercial areas, shopping centers, office complexes, and mixed-use areas, is needed. Pedestrians need facilities that will not force them either to be dependent on automobiles or to take the risk of walking in unsafe circumstances. They need convenient and low-risk linkages between magnets.

Current trends in suburban revitalization (2nd phase growth) fostered by governmental policy and responded to by private development initiatives suggest that there will be many opportunities to modify and improve pedestrian facilities in the near future while remaining cognizant of the need for safe and efficient traffic flow. There is a need for cost-effective solutions for pedestrian circulation that take into account the physical and demographic characteristics of an area. Furthermore, there is a need for a methodology for such solutions to assist decision-makers, planners, and the public in understanding and evaluating available options.

NCHRP Project 20-19, "Pedestrian Convenience and Safety on Suburban and Rural Highways," was initiated to provide a methodology responsive to the needs outlined above. The general objective of this research was to develop a planning and implementation methodology to assist planners, designers, decision-makers, and the public in providing convenient and safe pedestrian movement for suburban areas having a heavy traffic corridor with adjacent pedestrian magnets, and in rural areas that are in, or likely to be in, transition to suburban areas. The methodology is not an isolated stand-alone process, but requires the integration of pedestrian needs into processes that already exist at the state and local level—processes such as comprehensive planning and site planning. Application of the principles and guidelines in the report should result in the creation of coherent (usable, understandable, continuous) pedestrian circulation for high activity subareas with the potential for connection to community-wide systems.

The results of Project 20-19 are presented in two reports:

1. *NCHRP Report 294A*, "Planning and Implementing Pedestrian Facilities in Suburban and Developing Rural Areas—Research Report."
2. *NCHRP Report 294B*, "Planning and Implementing Pedestrian Facilities in Suburban and Developing Rural Areas—State-of-the-Art Report."

Report 294A presents basic principles and guidelines and covers the general topics of pedestrian travel behavior and accident characteristics, commonly occurring problems with suburban pedestrian facilities, pedestrian planning within the context of the overall planning and development process, pedestrian-sensitive site planning, planning for pedestrian facilities within the highway right-of-way, and implementation of pedestrian facilities.

Report 294B presents detailed supporting information on all aspects of the research. The information is presented as Appendixes A through F. The areas covered include study procedures (Appen. A); case studies (Appen. B); walk trip characteristics and pedestrian accident statistics (Appen. C.); and pedestrian-related development guidelines (Appen. D). Appendix E is a collection of photographs illustrating planning and design treatments. Appendix F is an annotated bibliography of selected references.

Together *Reports 294A* and *294B* present comprehensive information and guidelines on the provision of facilities for the pedestrian. Implementation of the principles and practices presented should result in a significantly improved environment for the pedestrian in and around the many new developments in the growing suburbs and the urbanizing rural areas of America.

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ACKNOWLEDGMENTS

The research reported herein was performed under NCHRP Project 20-19 by JHK & Associates (JHK), Alexandria, Virginia. The Center for Applied Research, Inc., and RTKL Associates, Inc., were subcontractors to JHK.

Steven A. Smith, Senior Associate with JHK, was the principal investigator. The other authors of this report are: Kenneth S. Opiela and Laurel L. Impett of JHK & Associates; Martin T. Pietrucha and Richard L. Knoblauch of the Center for Applied Research, Inc., and Chuck Kubat of RTKL Associates, Inc.

The authors would like to express their appreciation to the many

agencies and individuals that provided input to this project. Many individuals, too numerous to specifically acknowledge here, provided information on pedestrian planning and design practices within their own agencies and organizations. Other individuals volunteered their time to participate in the focus group interviews held on the east and west coasts in the early stages of the project.

We would also like to thank the agencies and individuals with whom we had contact in conducting the detailed case study investigations. Individuals contacted provided substantial time and copies of maps, site plans and project documentation, enabling us to compile the information presented in the report.

PLANNING AND IMPLEMENTING PEDESTRIAN FACILITIES IN SUBURBAN AND DEVELOPING RURAL AREAS—RESEARCH REPORT

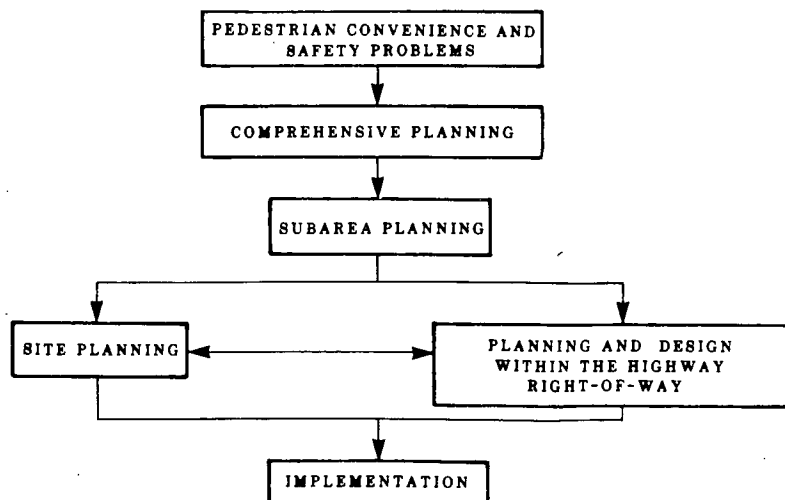
SUMMARY

The research conducted under NCHRP Project 20-19 has resulted in the publication of two reports: *NCHRP Report 294A* and *NCHRP Report 294B*. This report (*Report 294A*) presents information on the planning, design, and implementation of pedestrian facilities in suburban and developing rural areas. Information has been drawn from interviews and discussions with planning and design practitioners, recent research, observation and inventory of many pedestrian facilities, both good and bad, from around the United States, and more detailed case study evaluations at 28 sites. The report presents guidelines and principles that can be used by practitioners in planning, designing, and implementing pedestrian facilities, with emphasis on the planning and implementation elements. The reader having a need for detailed background information is directed to the companion report, *Report 294B*, which bears the main title, "Planning and Implementing Pedestrian Facilities In Suburban and Developing Rural Areas," and is subtitled "State-of-the-Art Report."

The research brought to light many facts and observations regarding both problems with pedestrian facilities as well as creative ways which have been employed by the public and private sectors to solve those problems. The general topics addressed are pedestrian travel behavior and accident characteristics, commonly occurring problems with suburban pedestrian facilities, pedestrian planning within the context of the overall planning and development process, pedestrian-sensitive site planning, planning for pedestrian facilities within the highway right-of-way, and implementation of pedestrian facilities.

One of the overall conclusions from the research is that pedestrian planning cannot be conducted in isolation from other planning elements (i.e., land use and highway design). Rather, planning for the pedestrian must be integrated with the entire process of planning, design, and implementation by the public and private sectors and effectively advocated within that process.

Pedestrian planning, design, and implementation is a joint responsibility of the public and private sectors. The general flow of the pedestrian planning, design, and implementation process is illustrated in the following diagram. This includes an initial



stage in which problems are identified and conditions documented. In this report, the emphasis is on the problems of pedestrian convenience and safety. Most local and state jurisdictions follow a process of comprehensive planning. Subarea planning activities are undertaken for areas of special concern or emphasis. Pedestrian planning is an integral part of both these levels. This is followed by a still more detailed level of site planning—the planning and design of pedestrian networks in conjunction with private land development. Pedestrian planning and design within the highway right-of-way is usually a public responsibility. Implementation is the critical step in making the planned and designed facilities a reality. Institutional issues which inhibit effective pedestrian planning must be addressed head-on if real progress is to be made.

Why is Planning for the Pedestrian Important?

Most people would acknowledge that planning for the pedestrian is necessary in downtown high-density settings. After all, this is where pedestrians are. Certainly, great strides have been made in the planning and design of pedestrian spaces in the downtown, and this emphasis needs to be maintained. But people walk in the suburbs too. Worn footpaths along major highways attest to the fact that pedestrians are there. In some suburban land-use settings they are present in great numbers. Although pedestrian needs cannot be expected to dominate in the consideration of the many suburban transportation and land-use priorities, they need to be thought about in a deliberate, systematic way. The following paragraphs state some of the reasons why it is in the public interest that the pedestrian be an integral part of the planning, design, and implementation process in suburban as well as in downtown areas.

Compact, pedestrian-oriented land-use arrangements make pedestrian travel easier and eliminate some vehicular travel. Although this will not solve the congestion problem, it is a start, and encourages the conservation of energy resources, reduces development costs, reduces public infrastructure requirements and costs, and is more easily served by transit.

Pedestrian-sensitive site planning and design also makes a development more marketable. Planning for the pedestrian and for associated amenities pays off in the long run. Several instances of this were noted in the case studies.

Pedestrian safety remains a national problem. Between 7,000 and 8,000 pedestrians are killed annually and more than 100,000 are injured. Tort liability claims are also steadily increasing. Planning itself and the agencies that conduct planning activities become more credible when an integrated transportation system is achieved. While drivers may not notice the pedestrian elements as much as the pedestrians do, comprehensive planning for all modes instills the public's confidence and makes the job of planning easier.

On-going pedestrian planning and facility maintenance can remove public eyesores and solve spot problems that are the source of citizen complaints or of real safety hazards.

The continued public interest in fitness, recreation, and outdoor exercise calls for well-located and designed recreational walking, jogging, and biking facilities.

Accessibility for all groups continues to be a national objective. The young, the elderly, the visually impaired, the nonambulatory and other less agile individuals present special design considerations. Some of the most glaring deficiencies are in suburban and developing rural areas.

The remaining sections of the summary highlight the nature of the findings from each of the functional areas listed in the previously presented figure. Although it is difficult to capsule the findings into a few succinct statements, the major findings are listed and selected planning, design, and implementation principles are presented.

Pedestrian-Related Problems in Suburban and Developing Rural Areas

This study identified problems experienced by pedestrians in suburban and developing rural areas as well as potential solutions to those problems. Typical problems

addressed include: (1) difficulty of crossing wide, heavily trafficked arterial and collector streets; (2) lack of walkway or other designated walking area along major highways; (3) insufficient lighting at intersections and along highways; (4) indirect or circuitous pathways between pedestrian magnets; (5) security problems on some secluded sections of pathway; (6) difficulty of justifying overpasses and underpasses, and many existing overpasses not well utilized; (7) auto orientation of the suburbs, due to low-density land-use patterns that typically exist; (8) pedestrian system remains incomplete because construction of sidewalks traditionally awaits development or redevelopment of land parcels, and where public agency does not step in, missing links perpetuate; (9) developing pressure, as time goes on, to increase land-use intensity, and locations where pedestrian facilities not originally viewed to be needed gradually generate the need as redevelopment and infill development occurs; (10) general lack of respect of pedestrians by drivers, at least partially brought about by lack of enforcement of laws governing pedestrian right-of-way; (11) overlooking of pedestrian needs by planners and engineers in site planning, highway design, and development review; (12) inflexibility of zoning ordinances, subdivision regulations, and other local codes to allow unique designs that would favor the pedestrian.

Implementation problems were acknowledged to be some of the most serious problems facing pedestrian mobility and safety in the suburbs. Many of the problems observed by the research staff were simply planning and design oversights or victims of an inflexible planning process. The pedestrian is often excluded as a design consideration in development projects and in suburban highway design, and becomes merely an afterthought.

The Pedestrian Planning Process

One of the conclusions of the study was that the process of planning pedestrian facilities must be fully integrated into the other ongoing planning activities (e.g., comprehensive planning, subarea planning, and site plan review—principles and procedures for each of these areas are provided in the report). A completely separate planning process for the pedestrian is not needed and will be counterproductive. Research into local and state planning processes revealed several key elements that appeared to be consistently present in jurisdictions that were adequately treating pedestrian accommodations in their planning process. These elements comprised: (1) policy statements in the comprehensive plan that relate to pedestrian needs and objectives; (2) inclusion of pedestrian facility elements (especially a master plan of walkways) in the comprehensive plan; (3) preparation of subarea or sector plans for areas needing special coordination; and (4) designation of a knowledgeable person or persons on the planning and/or engineering staff to serve as the in-house pedestrian advocate.

Effective pedestrian-oriented land-use planning will have the most significant impact on pedestrian travel of any pedestrian strategy. Compact, higher density land use is recommended where environmentally compatible with surrounding uses. The “urban village concept” is set forth as a desirable development form in which access to the area may be predominately by auto, but circulation within the area would be largely on foot.

Pedestrian-Sensitive Site Planning

Substantial attention was given in this project to principles and procedures for pedestrian-sensitive site planning on private development sites. The principles were based on findings from the case studies, the literature, and experience of the research team. Eight land-use types were covered, including: residential developments, shopping centers, office and industrial parks, mixed use development, commercial strip development, suburban activity centers (new and redeveloping), main streets in small towns and older suburban areas, and freestanding single use sites.

The report presents findings from the research in each of the foregoing areas, as well as a set of planning and design principles applicable to each site type. Procedural steps for planning a walkway system were also developed, and implementation issues were addressed for each use.

Pedestrian Planning Within the Highway Right-of-Way

The crossing of heavily trafficked arterial streets is widely regarded by users as one of the most significant pedestrian problems in suburban areas, if not the most significant problem. Areas investigated in this research included highway cross section design, design of intersections and interchanges, and other related elements.

The importance of medians to the convenience of pedestrian travel in suburban and developing rural areas is one of the most significant findings of this study. When traffic signals are infrequent, as they are on many miles of suburban highway, ways need to be found to make it easier for pedestrians to cross these high-volume arteries, while maintaining traffic flow. Medians or strategically placed refuge islands make a dramatic difference in facilitating the pedestrian's task of crossing the street. Islands for pedestrian refuge should be considered much more frequently than they currently are. European countries make considerably better use of refuge islands than has the United States.

Two other significant observations are: (1) There should be more emphasis on requiring walkways or shoulders on arterial and collector streets. Some subdivision regulations are more specific than others in requiring these adequate walking areas. The State of Florida now requires at least a 4-ft paved shoulder on highways within 5 miles of urban areas to accommodate pedestrians and bicyclists. (2) sidewalk flares (extensions of the sidewalk into the parking lane) have potential for wider application as a benefit to pedestrians, with minimal impact on vehicles.

Implementation

Implementation represents those actions taken by public agencies, the community, or the private sector to bring pedestrian facilities into being. Information collected in this project pointed toward a number of implementation-related actions that can be taken by each of these groups to foster the provision of effective suburban pedestrian systems.

The most significant of the implementation strategies is simply stated: **THINK PEDESTRIAN**. There are so many other necessary details to be covered in a development project or transportation plan that it is not uncommon to simply forget about the pedestrian facilities in the shuffle. *Think Pedestrian* means including the pedestrian as a factor in site planning, highway design and operations not as an afterthought, but at each stage of the planning, design, and implementation process from beginning to end. This need not take a great deal of time or expense. Most of the pedestrian considerations can be treated easily and simply. But observations in this project suggest that pedestrians are often left out of the process until the last minute, when it may be too late to influence site designs or planning strategies. Obviously this is not always the case, but the simple remembering to think about the pedestrian will solve many of the oversights that occur.

Some of the tools investigated in this research that can be applied to the implementation of pedestrian facilities include zoning ordinance provisions; subdivision regulations; flexibility and discretion within the site plan review process; advocates for the pedestrian, both within public agencies and within the community; obtaining easements for pedestrian facilities; financing pedestrian facilities through capital budgeting, revolving funds, special assessment districts, and other techniques; maintenance management; and changes in state to encourage the provision of pedestrian facilities.

The case studies provided a wealth of material on which to draw experience and principles that can be applied to other situations. Lessons learned from both the

physical design and implementation elements are documented to provide examples of both effective and ineffective strategies.

It is instructive to remember that *everyone is a pedestrian sometime*. We all benefit from the implementation of pedestrian facilities. Greater attention to the needs of pedestrians in the planning and implementation stage is the key to creating suburban environments more conducive to pedestrian travel.

CHAPTER ONE

INTRODUCTION AND RESEARCH APPROACH

THE PROBLEM

As the American population has shifted from urban centers to more dispersed settings in suburban and rural areas, traffic volumes on highways have increased substantially. At the same time, renewed interest in physical fitness and greater appreciation of the environment and aesthetics have resulted in more walking, jogging, and cycling throughout the United States. Highway planners and designers have been cognizant of increased traffic volumes, but many have been remiss in not adequately considering the convenience and safety of those walking in suburban and rural areas.

While walking is not likely to become the predominant mode for suburban and rural trip-making, it must be recognized that some people want to walk, others must walk, and the future promises to find more people walking. Surveys conducted by the National Park Service in 1982–1983 indicate that over one-half of the U.S. population, age 12 and over, walks for pleasure at least occasionally. Surveys conducted in a number of suburban residential areas in the United States, for this NCHRP project, indicated that up to 90 percent of the residents engage in recreational walking. In addition, jogging has maintained a steady level of involvement by a broad cross section of the population, and there is little likelihood of a major decline in jogging activity in the near future. Walking not only is a recreational activity, but it is also employed as a utilitarian mode of travel for the shorter trips, even in suburban areas. This is particularly true in suburban and developing rural areas with commercial development.

Pedestrian circulation systems in suburban and urbanizing rural areas are incomplete and ineffective. These situations have resulted in a rising level of pedestrian-vehicle conflicts on high-speed, high-volume highways. In the past, solutions to pedestrian-vehicular conflicts in these areas have favored vehicular traffic. Convenient, yet safe, pedestrian access to and from magnets, such as redeveloping and changing strip commercial areas, shopping centers, office complexes, and mixed-use areas, is needed. Pedestrians need facilities that will not force them either to be dependent on automobiles or to take the risk of walking in unsafe circumstances. They need convenient and low-risk linkages between magnets.

Current trends in suburban revitalization (2nd phase growth),

fostered by governmental policy and responded to by private development initiatives, suggest that there will be many opportunities to modify and improve pedestrian facilities in the near future while remaining cognizant of the need for safe and efficient traffic flow. There is a need for cost-effective solutions for pedestrian circulation which take into account the physical and demographic characteristics of an area. Furthermore, there is a need for a methodology for such solutions to assist decision-makers, planners, and the public in understanding and evaluating available options.

Pedestrian accommodations in suburban and rural areas need not be elaborate; however, providing those accommodations requires that pedestrians be recognized as legitimate users of suburban and rural streets and highways and that their needs be addressed in a deliberate, systematic way. This is not to say that the movement of vehicles is unimportant. The need to solve increasingly severe traffic congestion problems is one of the greatest transportation issues of our day. However, the pedestrian can easily become a planning and design casualty in the midst of the major changes taking place in land development and highway transportation. It is incumbent upon those involved in land use planning, transportation planning, highway design, and traffic operations to prevent this from occurring. The planning, design, and implementation process needs to reflect a balance in the facilities provided for all modes of travel, including driving, walking, and other modes as well.

PROJECT OBJECTIVES AND SCOPE

The general objective of this research was to develop a planning and implementation methodology to assist planners, designers, decision-makers, and the public in providing convenient and safe pedestrian movement for suburban areas having a heavy traffic corridor with adjacent pedestrian magnets, and in rural areas that are in, or likely to be in, transition to suburban areas. The research was conducted in five tasks, as follows:

- Task 1—A literature review was conducted of solutions that provide convenient and safe movement of pedestrians in suburban and developing rural areas.

- Task 2—Examples of effective and ineffective pedestrian systems were identified and documented in a series of case studies. Documentation included site-specific conditions, including institutional arrangements (public and private sector roles and responsibilities, and citizen participation).

- Task 3—Possible solutions were identified that either had not been discovered in the literature or had not been emphasized adequately in research or practice, but in the current context may be feasible.

- Task 4—The state of the art and state of the practice were synthesized and evaluated from the knowledge gained in Tasks 1, 2, 3, and a synthesis report was prepared.

- Task 5—Guiding principles and design considerations were developed to assist planning and design professionals to provide coherent pedestrian circulation. These principles and considerations were developed into a planning and implementation methodology, designed to be integrated into accepted methodologies for land use and transportation planning being practiced within local and state governments in the United States.

REPORT OVERVIEW

This report presents information on the planning, design, and implementation of pedestrian facilities in suburban and developing rural areas. Its scope includes both walking and jogging, addressing the needs of both utilitarian and recreational pedestrian travel. Information has been drawn from planning and design practitioners, recent research, and case studies of pedestrian facilities conducted as part of this project. It is organized to present guidelines and principles that can be used by others in planning, designing, and implementing pedestrian facilities, with emphasis on the planning and implementation elements.

Report Objectives

Specific objectives of this report are to: (1) heighten the awareness of problems encountered by pedestrians in suburban and developing rural areas; (2) provide guidelines for pedestrian-oriented land use and site planning; (3) suggest ways of making the consideration of pedestrian needs a more integral part of the total planning and design process, so that oversights do not occur; (4) provide ideas for consideration by federal, state, and local agencies to foster the implementation and funding of pedestrian facilities; (5) direct readers to additional sources of information for more detailed aspects of pedestrian planning and design that cannot be adequately covered here; and (6) encourage the integration of pedestrian planning, design, and implementation concepts into future updates of standard reference texts in the fields of highway design, traffic operations, land use planning, and site planning for suburban and rural areas.

The underlying goal of this report is to present ways in which pedestrian facilities can be planned, designed, implemented, and maintained in concert with other facilities within the existing framework of land development and transportation planning processes. Thus, there is not a need for a separate planning process for the pedestrian, but rather, a more effective integration of pedestrian considerations into ongoing planning and design processes at the state and local levels. The cost of pedestrian planning need not be large. However, it will require an

additional dimension of thinking as planners, designers, and engineers come to grips with how to treat such subjects as site planning, highway cross-section design, and traffic signalization from the pedestrian point of view.

The report is situation-oriented. It takes a set of commonly occurring problems or situations and addresses how the pedestrian can be more effectively accommodated within that context. Many illustrations are provided of how actual situations have been treated in the hope that these will provide guidance to others facing similar circumstances.

The report devotes significant attention to the problems associated with implementing pedestrian improvements. Some of the deficiencies in pedestrian facilities observed over the course of this project are so obvious that one must wonder how they could ever occur. Yet, they do occur, and ways must be found to overcome the implementation barriers responsible for them. The implementation process is fraught with problems of lack of interagency communication, red tape, inflexibility, legal barriers, funding problems, and a host of other pitfalls that inhibit the provision of effective pedestrian facilities, even though intentions may be good. To address only the planning and design problems leaves the job only partially done. The implementation processes used by public agencies and the associated laws, regulations, and ordinances must be addressed if real progress is to be made in improving the suburban and rural pedestrian environment.

Report Organization

Chapter One of this report presents an overview of the project and the study methodology. Chapters Two through Six summarize the findings from the project and draw from those findings principles of planning, design, and implementation that can be applied by others. These chapters are organized in accordance with the general flow of the local planning process, illustrated in Figure 1. This includes an initial stage in which problems are identified and conditions documented (summarized in Chapter Two). In this report, the emphasis is on the problems of pedestrian convenience and safety. This is followed by the process of planning on a broad scale (comprehensive planning) and planning at a more detailed subarea level. These topics are covered in Chapter Three. Planning and design at a still more detailed level are discussed in Chapters Four and Five. Chapter Four addresses site planning—the planning and design of the pedestrian networks in conjunction with private land development. Chapter Five addresses pedestrian planning and design within the highway right-of-way, usually a public responsibility. Chapter Six summarizes information on the implementation of pedestrian networks and facilities. Chapter Seven describes the implications of the findings on future planning, design and implementation of pedestrian facilities in suburban and developing rural areas. Finally, Chapter Eight summarizes the study conclusions and assesses the need for additional investigation and testing of potential solutions to pedestrian-related problems.

The appendixes (reproduced in *NCHRP Report 294B*, as submitted by the research agency) provide more complete detail on all aspects of the research effort. The areas covered include study procedures (Appen. A), case studies (Appen. B), walk trip characteristics and pedestrian accident statistics (Appen. C), and pedestrian-related development guidelines (Appen. D). Appendix E introduces a collection of photographs illustrating

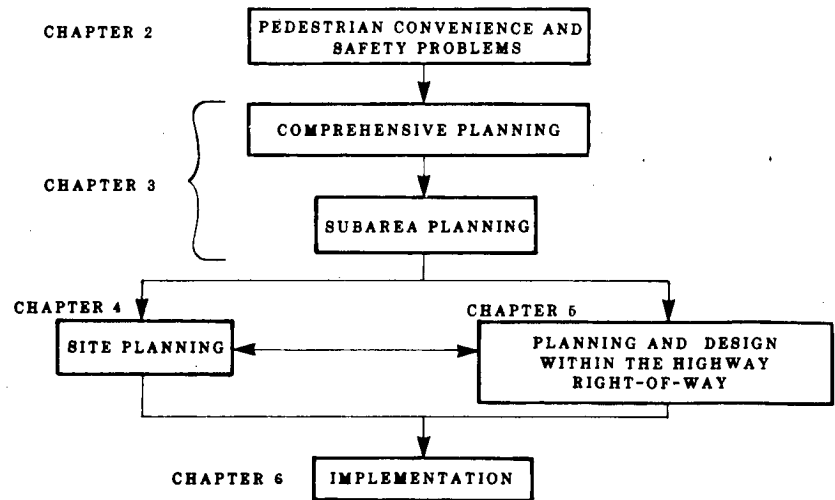


Figure 1. Flow of the pedestrian planning, design, and implementation process.

planning and design treatments. The annotated bibliography of selected references, in Appendix F, provides additional authoritative sources of information on particular subjects including general planning texts, pedestrian facility planning, site planning, walk trip characteristics, pedestrian facility design, implementation and funding, pedestrian safety, and highway design and traffic operations. The remainder of this chapter reviews some basic definitions pertinent to the study and discusses the methodologies employed.

BASIC DEFINITIONS

This project was specifically oriented toward suburban and *developing* rural areas. There is, however, no clear cut way of distinguishing when urban ends and suburban begins. In fact, many of the pedestrian-related problems in suburban and urban areas are quite similar. However, *suburban*, as defined in this study, represents areas outside of densely developed downtown areas. Suburban areas are normally not within the realm for consideration of extensive second-level pedestrian walkway systems and major pedestrian malls. Another distinguishing feature of suburban areas is heavy orientation to the automobile. This implies more area devoted to parking facilities, resulting in greater distances between pedestrian magnets. However, suburban activity centers (areas of mixed residential, office, and other commercial uses) are an important emerging suburban land development pattern and are included in the definition of suburban, even though their densities may approach those of some downtown areas. Small towns are also within the scope of this project.

It is also not always possible to draw a clear distinction between planning and design. In essence though, *planning* refers to the location and arrangement of buildings, road networks, and other facilities, while *design* refers to the determination of the physical and dimensional aspects of such facilities. Some of the key terms used throughout this report are defined as follows:

- *Comprehensive planning* (or master planning)—development of an overall plan for a local jurisdiction, encompassing

land use, transportation facilities and other public facilities. It is usually a legally required function of most local governments.

- *Subarea planning*—planning conducted at a smaller geographic scale, adding detail to the comprehensive plan.
- *Land use planning*—the determination of preferred arrangements and intensities of land uses.
- *Site planning*—the arrangement of buildings, roads, walkways, parking, and other facilities on a specific site.
- *Transportation planning*—the process of conceiving, evaluating, and programming new or improved transportation facilities including roadways, transit, and pedestrian facilities and other facilities for the movement of people and goals.
- *Highway and pedestrian facility design*—specification of the physical characteristics of streets, highways, and walkways to be constructed (e.g., cross-section, alignment, etc.).
- *Facility operations* (e.g., traffic operations)—ways in which the people and vehicles moving about the transportation network are controlled and provided with information.
- *Maintenance*—procedures dealing with keeping the existing facilities in good working order.

All of the foregoing play fundamental roles in producing and maintaining an environment conducive to both vehicular and pedestrian movement. Processes have been developed over the years to deal with each of these areas. Most of them are legally controlled through local and state ordinances and regulations. Others are a function of local policy and practice. The processes of financing, budgeting and programming improvements are an integral part of seeing that planned and designed facilities are installed and managed.

STUDY METHODOLOGY

The information in this report has been drawn from numerous sources, including both the assimilation of existing data and collection of new data. Study procedures are listed, as follows. They are more fully documented in Appendix A.

- Existing research and literature were reviewed. Approxi-

mately 2,000 abstracts from pedestrian-related references were reviewed, both foreign and domestic. From these, documents relevant to those areas discussed in the previous section were identified and reviewed. Emphasis was placed more on references dealing with pedestrian systems and networks, but safety-related literature was also included.

- Questionnaires were sent to some 200 local planning agencies, state highway departments, and selected individuals with private companies and universities. The questionnaires asked about pedestrian-related planning and design practices. Details on the distribution and format of the questionnaires are provided in Appendix A.

- Two focus group interviews were held, one on the east coast and one on the west coast. The purpose of the interviews was to obtain the perspective on the pedestrian problem and potential solutions from a variety of viewpoints of both individual users and public agency practitioners.

- Inventories of pedestrian-related features and problems were conducted for more than 160 sites throughout the United States. The purpose of the inventories was to document the types of problems that tend to occur, and to identify how pedestrian-related problems were solved or could have been solved. A listing of site locations is presented in Appendix A. Photography was extensively used to document conditions.

- More detailed case study evaluations were performed for 28 of the 160 sites. The sites were classified in one of eight land-use categories, and interviews were conducted with individuals involved with the planning, design, and implementation of the pedestrian facilities. Sites included both those that had proved to be effective and those that had not. A listing of sites is contained in Appendix B.

- A set of criteria was developed for evaluating the pedestrian-related features of the case study sites. Candidate criteria were derived from prior research, and the final criteria were tailored to the suburban and developing rural setting. Most of the criteria were qualitative in nature.

- Supplementary quantitative data were obtained from a number of sites, some of which were case study sites and others

that were not. The type of data collected varied, depending on the need. Residential surveys were conducted at eight sites, including five of the case study sites. Sidewalk interviews were conducted at five locations. Data on walk trip characteristics were obtained at five employment sites and special pedestrian counts were conducted at several additional sites to evaluate pedestrian usage characteristics.

- The experience of project staff in the areas of land-use planning, site planning, pedestrian safety, highway and project design, traffic operations, and facility implementation was also drawn upon in the project.

Many of the issues addressed in this study were qualitative in nature. This was particularly true of those issues related to institutional concerns or to the planning process. The answers to many of the questions about pedestrian planning and design must be derived from experience, by determining the general characteristics that the effective systems have in common and drawing on lessons learned in a variety of contexts. However, some of the questions can be answered by past research data, particularly those that concern pedestrian safety. Another technique applied in this study to draw conclusions on various aspects of pedestrian planning and design was the functional analysis of certain pedestrian facility features. For example, this was applied to the evaluation of medians and refuge islands, in determining their benefits to pedestrian movement in the suburbs.

As stated earlier, this report is situation-oriented. Chapters Four and Five discuss findings and pedestrian planning principles for each situation type. Chapter Four addresses site planning for eight suburban site types: (1) residential development, (2) shopping centers, (3) office and industrial parks, (4) mixed-use development, (5) suburban activity centers, (6) development along commercial strips, (7) "main streets" in older suburban areas and small towns, and (8) smaller single use developments.

Chapter Five addresses the situations encountered in providing pedestrian facilities in the highway right-of-way. These situations include the cross-sectional designs for new and existing roadways, intersections, and interchanges.

CHAPTER TWO

NATURE OF THE SUBURBAN AND RURAL PEDESTRIAN PROBLEM

This chapter describes the nature of the suburban and rural pedestrian problem from several points of view. It first addresses characteristics of suburban and rural pedestrian trip-making, followed by a discussion of pedestrian accident characteristics and an overview of the range of problems with pedestrian facilities in suburban and rural areas. The data on walking and jogging characteristics and on pedestrian accident characteristics are presented in brief overview form. Additional information is provided in Appendix C.

WALK TRIP CHARACTERISTICS

Walk trips can be classified into four basic trip purposes: work trips, school trips, trips for personal business (shopping, doctor, etc.), and recreational trips. Data from the Nationwide Personal Transportation Study, 1983-1984 (1) indicate that approximately one-third of the pedestrian miles traveled in the United States are for school-related purposes. Because the sample was limited to all persons 14 years and older, this percentage

is probably underestimated. The large amount of walking between home and school points out the importance of paying careful attention to the home-to-school link in pedestrian facility planning. Much of the emphasis of pedestrian safety programs has been in this direction.

Data from the 1977 Nationwide Personal Transportation Study (2) indicate that between 2.5 and 6 percent of the work trips in the United States are made via the walking mode. The percentage varies by city size, with medium-sized cities having the lowest walk trip percentage. Average trip length for those who walk from home to work is approximately one-half mile. However, the number of walking trips to work is somewhat greater when one considers that walking is a vital component of both ends of a transit trip. In some of the larger metropolitan areas, up to 20 percent of the commuting trips are by public transit. In the New York metropolitan area, 30 percent of the commuting trips are transit-related, some of which entail substantial walks to and from the transit stops.

The extent to which people walk for shopping and personal business depends largely on land use characteristics. For typical suburban shopping centers, walk trips typically comprise approximately 3 percent of all person trips to the center. In more densely developed mixed-used settings, this percentage increases dramatically. Data reviewed in this project show that some

convenience-oriented retail stores (e.g., drug stores) in suburban activity centers can generate up to 90 percent of their patronage from foot traffic.

Data were obtained in this study concerning characteristics of utilitarian walking trips from suburban office buildings in Fairfax County, Virginia. Figure 2 represents a cumulative distribution, by distance, of midday walking and driving trips from office buildings in suburban activity centers of the County. It indicates that although walk trips for personal business tend to be short (70 percent are 0.1 mile or less), a significant number of short trips are also made by car. In the areas surveyed, approximately 15 percent of the auto trips were less than one-half mile in length. The fact that many short trips are still made by car reflects the importance placed on travel time by the trip maker. Whatever can be done to increase the compactness of land use will encourage greater pedestrian travel for personal business trips and for other trip purposes as well.

Recreational walking and jogging have become increasingly popular as the American public's interest in good health and physical fitness continues. Nearly 90 percent of the residents surveyed in suburban areas as part of this project indicated that they walk for exercise or recreation. Up to a third of these do so at least 5 days a week, weather permitting. Approximately one-third indicated that they run or jog for exercise. Most of

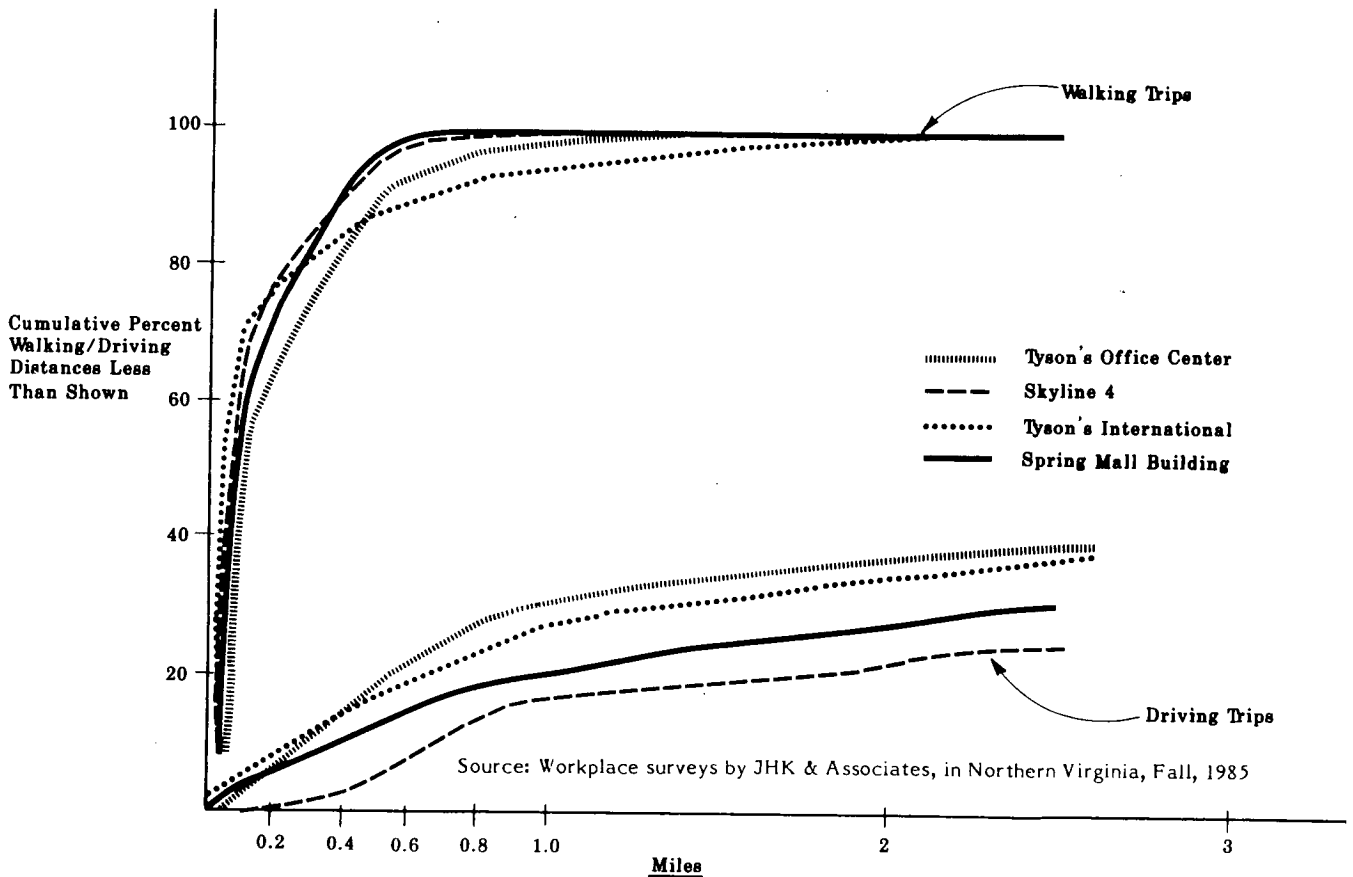


Figure 2. Cumulative distribution of trip distance for midday walking and driving trips from office buildings in suburban activity centers.

these do so 1 to 4 days per week. Appendix C presents more detailed results.

SUBURBAN AND RURAL PEDESTRIAN ACCIDENT CHARACTERISTICS

Each year pedestrian accidents account for about one out of every six motor vehicle fatalities in the United States, and about one out of every 30 injuries (3). Of the approximately 7,000 to 8,000 pedestrian fatalities each year, about one-third occur in rural areas. Although the number of suburban fatalities and injuries cannot be determined specifically, many of the some 4,600 pedestrians killed and 120,000 injured each year in areas classified as urban actually could be considered as suburban pedestrian casualties. Slightly over half of the rural and suburban pedestrian accidents occur in residential areas and approximately one-fourth occur in commercial areas (4). Appendix C provides additional information on the characteristics of the suburban and rural pedestrian accident problem. Nighttime pedestrian accidents are still a major component of the accident problem, and must be considered a factor in planning and design. Almost two-thirds of U.S. pedestrian fatalities occur at night.

PROBLEMS WITH THE PLANNING, DESIGN AND IMPLEMENTATION OF PEDESTRIAN FACILITIES IN SUBURBAN AREAS

Overview

One of the important initial parts of this research was the identification of the most significant problems in the planning, design, and implementation of pedestrian facilities. This section identifies the most prevalent types of problems identified in the study and illustrates the nature and significance of the problems through research data and photographic examples from around the United States.

A comprehensive listing of pedestrian-related problems in suburban and developing rural areas was developed from a number of sources, including:

- Prior research on pedestrian safety.
- Prior surveys and data collection on the travel habits and perceptions of walkers and joggers.
- Inventories conducted in this project of pedestrian-related problems at more than 160 sites throughout the United States.
 - Surveys of residents from nine selected communities around the country, administered through a home-based mailback questionnaire.
 - Sidewalk interviews with approximately 150 pedestrians, also conducted during the course of this project.
 - Two group interviews, one in Washington, D.C., and one in San Francisco, with representatives of public agencies (both planners and engineers), walking and jogging groups, senior citizen organizations, architects, urban designers and other individuals with an interest in pedestrian issues. The primary purpose of the interviews was to identify problems with both the physical pedestrian environment and with the process of planning, designing and implementing pedestrian facilities.
 - Surveys of state and local planning and engineering agencies and of planners, engineers, and architects in private practice.

- Experience of the research staff with planning, designing, and implementing pedestrian facilities.

The sections that follow present a discussion of the problem areas viewed to be most significant in the context of suburban and developing rural areas. The problems are classified as: highway design and operational problems, sidewalk and pathway location and design problems, land use and site planning problems, and institutional and legal problems.

For each problem identified, the specific nature of the problem is first presented, followed by background data and/or photographs illustrating the problem. The problems discussed below are actually a subset of all the problems identified over the course of the project, but represent the most significant ones by virtue of either the magnitude of the hazard, level of inconvenience caused, or the number of pedestrians affected. Some of the problems are discussed more in depth than others, but all have a basis in either empirical or observational data. Chapter Seven provides a summary table showing the nature of the problems and identifying potential solutions.

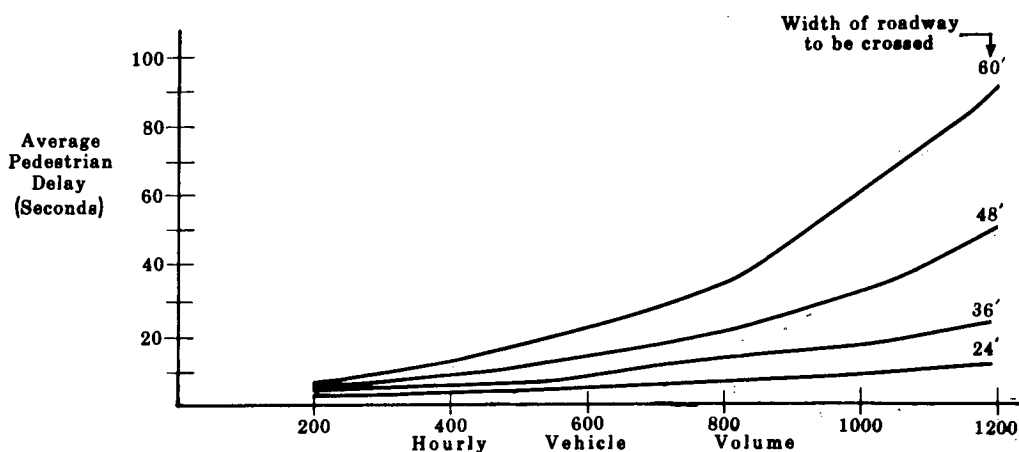
Highway Design and Operational Problems

Problem: Difficulty of crossing wide, heavily trafficked arterial and collector streets. This is perhaps the most common problem perceived with pedestrian travel in suburban areas. Traffic signals are less frequent than in downtown areas, requiring pedestrians to fend for themselves in crossing the street. Additional signals are only rarely warranted because of the low pedestrian volumes in most places. Undivided highways, including those with two-way left-turn lanes pose particularly difficult crossing problems.

Traffic signals provide two major benefits to pedestrian travel. At intersections, they stop traffic on the street to be crossed (except for right-turns-on-red and turns from the cross street). Away from intersections, they create gaps in traffic, providing more opportunities for the pedestrian to find gaps of adequate size for crossing. Signal spacing in downtown areas is often as low as 500 ft (one every block). Spacing in suburban and developing rural areas is much greater (usually more than half a mile), affording fewer opportunities to cross at signalized intersections. It is not realistic to expect that pedestrians will go far out of their way to cross at a signal when their destination is right across the street. One local feasibility study of a potential pedestrian overpass across a major suburban arterial indicated that about 90 percent of the pedestrian crossings were being made mid-block (5). This is not atypical of the crossing patterns in suburban areas. The extent to which crossings are made mid-block depends largely on intersection spacing and on land use on either side of the roadway.

Figure 3, derived from data in Ref. 6, shows the delays typically incurred by pedestrians in crossing streets of different width and traffic volume. The problem is particularly acute at wide, undivided arterial streets and at those with two-way left-turn lanes. The problem is less severe where there is a median for pedestrian refuge.

Safety research also points to the significance of the street crossing problem. A major study of accidents occurring in suburban and rural areas (4) indicated that almost all vehicle-pedestrian accidents occur on the roadway and that over half involve pedestrians specifically engaged in crossing the roadway.



Note: Delay Curves Derived From Data In A Pedestrian Planning Procedures Manual (Ref. 6)
 Delay = no. of seconds waiting for gap in traffic

Figure 3. Impact of traffic volume and street width on delay to pedestrians crossing a street.

Two-thirds of the crossing accidents involved mid-block crossings. Other pedestrian actions with significant accident involvement include standing or playing in the roadway and walking along the roadway (not on the sidewalk, if it exists). Approximately two-thirds of the suburban and rural pedestrian accidents occur on arterial and collector streets.

Surveys of individuals conducted during this study indicated that "traffic" was high on the list of perceived problems. The residential surveys asked residents to indicate what they most liked and most disliked about walking in their area, and what they thought could be done to improve walking conditions. Table 1 presents a tabulation of these open-ended responses, indicating the percentage of respondents with this concern. Some respondents specifically listed the problem of trying to cross the roadway, while others simply mentioned traffic in general. Because this part of the survey was designed for open-ended responses, it is clear that the respondents were highly sensitive to the problems listed and were not merely checking off an answer. Figures 4 and 5 illustrate typical high-volume arterial streets in commercial areas posing difficulties for pedestrian crossing.

Problem: Lack of sidewalk or other designated walking area along many major highways. Sidewalks are still missing in many suburban and developing rural areas, the need for which is evidenced by well-worn dirt footpaths (Fig. 6). Sidewalks can end abruptly (Fig. 7) or be blocked by obstacles (Fig. 8). The causes vary, but may include physical constraints, lack of local requirements or standards, or simply oversight and lack of coordination.

The problem of missing sidewalk links came through consistently in the site inventories. In inventories along major suburban highways, the lack of sidewalk or pathway was often noted, more so in the outskirts of the city. Obviously, this varies geographically based on local policy. Some of the reasons for the absence of sidewalk could include local and state policies on replacement-in-kind only; lack of ordinances requiring the

provision of sidewalk; oversights in the site plan review process; lack of recognition by both the public and private sector that sidewalks are important; and lack of development of certain land parcels and no initiative taken by the public agency to bridge the gap. The lack of sidewalks was also consistently mentioned as a problem in the pedestrian surveys, as indicated in Table 1.

Problem: Insufficient lighting at intersections and along highways. Insufficient lighting was also one of the major complaints of respondents to the residential surveys. As can be seen from Table 1, residents suggested improved lighting fairly consistently as a possible improvement to walking conditions. When one considers that over half of the pedestrian fatalities occur at night, it is apparent that this is a significant problem. The study of suburban and rural pedestrian accidents (4) reported that 33 percent of the pedestrian accidents occur after dark. In contrast, approximately 20 percent of the walking is done at night (7). A study of the relative hazard of various types of pedestrian activity indicated a hazard score for locations with no lighting of 6 to 12 times the hazard score for locations with lighting (7). Although this does not necessarily translate into six times the accident rate, it suggests a significantly higher accident threat.

Problem: Difficulty in crossing certain intersections and interchanges. Many suburban intersections are difficult or inconvenient to cross because of their configuration, signal phasing and timing problems, or lack of appropriate sidewalk connections. The site inventories pointed out the problems in numerous locations. Most of these problems could be attributed either to a simple failure to think about how the pedestrian would cross the intersection or interchange or to other priorities in design. Most problems would have cost little to remedy if they had been recognized earlier and corrected prior to construction.

Problem: Inadequate signal timing to enable slower walkers to cross the street. The *Manual on Uniform Traffic Control*

Table 1. Pedestrian perceptions and expectations.

| | Percent of All Respondents Commenting | | | | | | |
|-------------------------------------|---------------------------------------|---------------------|---------------------|----------------------|------------------|------------------------|--------------------|
| | Burke Residents | Arlington Residents | Claremont Residents | Costa Mesa Residents | Boston Residents | Chesterbrook Residents | Columbia Residents |
| Specific likes: | | | | | | | |
| friendly neighbors | 0 | 6 | 45 | - | 3 | - | 2 |
| stores nearby | 2 | 6 | 2 | 24 | 5 | - | 3 |
| nice scenery | 84 | 3 | 48 | 28 | 24 | 56 | 33 |
| exercise/fresh air | 7 | 15 | 8 | 3 | 3 | 15 | - |
| safe, pleasant area | 7 | 3 | 6 | 17 | 24 | 6 | - |
| space for recreation | 3 | 6 | - | 3 | - | 26 | - |
| local paths/side-walk, parks | - | 24 | 6 | - | - | - | 27 |
| Specific dislikes: | | | | | | | |
| litter/graffiti/dogs | 5 | 18 | 4 | - | 3 | - | 8 |
| traffic | 67 | 30 | 11 | 41 | 24 | 15 | 5 |
| lacking sidewalks | 5 | 6 | 12 | 21 | 11 | 50 | 19 |
| not enough crosswalks | - | - | - | 7 | 5 | - | - |
| not enough trees/scenery | - | 9 | - | 3 | - | - | - |
| lacking street lights | 16 | - | 18 | - | 3 | - | 18 |
| air pollution | - | 3 | - | - | - | - | - |
| security problems | 6 | 27 | 4 | 17 | 2 | 8 | 40 |
| Suggestions for improvement: | | | | | | | |
| snow plowing | - | - | - | - | 3 | - | - |
| more/fix sidewalks | 47 | 3 | 21 | 21 | 16 | 56 | 6 |
| traffic enforcement/police patrol | - | 30 | 3 | 24 | 3 | 6 | 5 |
| more crosswalks | - | - | - | - | 14 | - | - |
| more one-way streets | - | - | - | 3 | - | - | - |
| pave roads | - | - | - | - | 3 | - | - |
| better lighting | 16 | 21 | 22 | 7 | 5 | - | 24 |
| longer time for walk signals | 11 | - | 7 | 7 | - | 6 | - |

NOTE: Numbers will not sum to 100 percent. Source: Residential surveys, Fall, 1985. Average of 50 responses each site.



Figure 4. Typical cross section of a major arterial highway.



Figure 5. Arterial highway with a two-way left-turn lane.

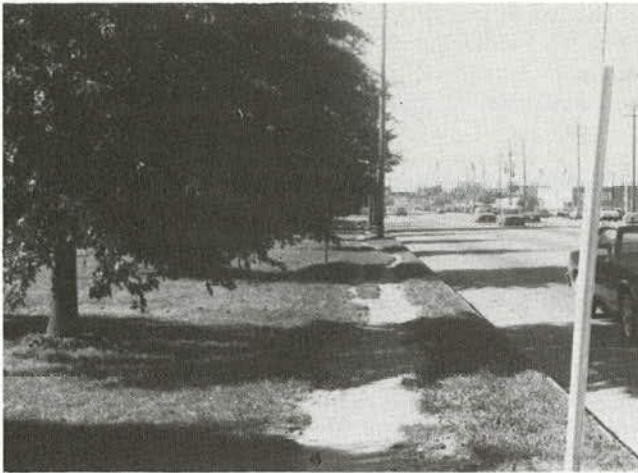


Figure 6. Need for sidewalk evidenced by a well-worn dirt path.



Figure 7. Abruptly ending sidewalk.

Devices (8) requires that the clearance time for pedestrian signals use 4.0 ft per sec as the assumed pedestrian walking speed. A speed of 3.5 ft per sec is recommended where there is a significant proportion of slower walkers. Distributions of walking speeds indicate that the timing of the clearance interval at 4.0 ft per sec designs for about 75 percent of the pedestrians (i.e., 25 percent will walk slower than 4 ft per sec). However, a study of pedestrian walking speeds indicated that speeds are slower for women and older men, and that almost three quarters of the older women walk slower than 4 ft per sec (9). This is not generally a problem for pedestrian signals on the minor street crossing, but a significant conflict and tradeoff can occur on the crossing of the major street at intersections that are at or near their vehicular capacity. An additional concern is the handling of pedestrians at actuated signals. Reference 8 provides guidelines on the installation of pedestrian push buttons at actuated signals.

Sidewalk and Pathway Location and Design

Problem: Sidewalks too close to high-speed traffic, discouraging pedestrian travel because of traffic noise and perception of hazard. The site inventories indicated that sidewalks or walkways in some areas are immediately adjacent to high-volume, high-speed arterial streets (see example in Fig. 9). Although having a sidewalk at the very edge of the road is better than none at all, wider sidewalk setbacks would add to the convenience and perceived safety of pedestrian travel. Untermann (10) discusses this problem in detail.

Problem: Security problems on some pathways, primarily in secluded areas. This was also a concern of respondents to the residential questionnaire (see Table 1), particularly those that lived near special pathway systems. This problem was especially evident from planners and police in the Fremont, California, case study (see Appen. B). Newspaper reports of attacks of pedestrians on other planned pathway systems were also noted, but it cannot be absolutely concluded whether these pathway systems are any more or less safe than any other walking area. However, interviews with a jogging association confirmed con-



Figure 8. Major obstacles unnecessarily placed in sidewalk.

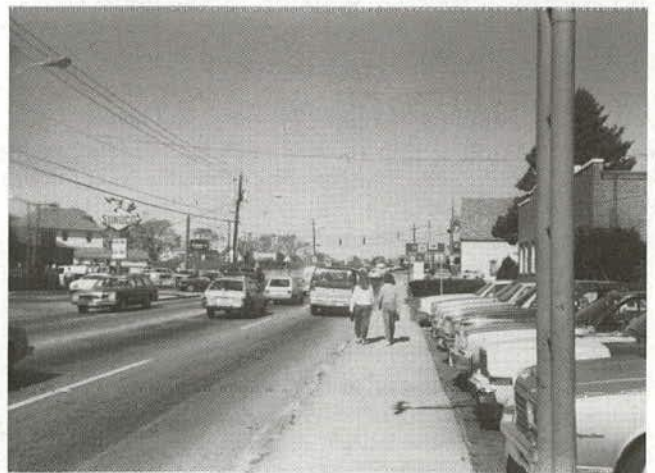


Figure 9. Sidewalk lacking separation from high-volume arterial highway.

cern about the problem. Members had suggested more visible routes, more lighting, and more telephones along the pathways as a possible help.

Problem: Lack of curb ramps or improper design of curb ramps. There has been slow, but steady, progress in ramping curbs at intersections. However, many ramps observed in this study were deficient in their design and some locations were still without ramps. Improper ramp design can, in fact, pose tripping hazards or slipping hazards when covered with snow or ice. Reference 11 provides guidelines on proper ramp design.

Problem: Overpasses and underpasses are infrequently justified and, without proper planning, are underutilized. Pedestrian overpasses and underpasses have been widely studied, and many of those installed have unfortunately become monuments to well-intentioned but inadequate planning. The Tramway Boulevard case study pointed out again the classic problem of pedestrians choosing to cross at street level rather than using the intended facility. However, some pedestrian bridges and underpasses do work, and the conditions under which they work need to be recognized. Reference 12 provides some suggested warrants for overpasses and underpasses.

Problem: Information provided to the pedestrian is often lacking, confusing or misleading. There are many guidelines and standards for signing for vehicular traffic, but few for pedestrian traffic. The ability of a pedestrian to find his or her way is often assumed and not necessarily thought through. This problem also occurs at some signalized intersections, particularly the more complex, multilevel ones.

Land Use, Site Planning, and Development-Related Problems

Problem: The auto-orientation of the suburbs is almost completely due to low density land-use patterns that typically exist. Low density development in suburban settings results in greater spatial separation between origin and destination, causing trip distances to fall into the range usually not considered feasible for walking. Thus, not enough pedestrian traffic is generated to justify the provision of better facilities to accommodate pedestrian needs. Sprawling low-density development with large parking lots and lack of focussed activity makes utilitarian walking generally impractical in these areas. A study by the Office of the Secretary of the U.S. Department of Transportation (13) indicated that developing in a more compact land-use form would have by far the most significant influence on increasing pedestrian travel. The study compared land-use strategies with other incentives for pedestrian travel, including the more generous provision of aesthetic pedestrian facilities and road pricing schemes. More details from this interesting study are documented in Appendix C. Chapter Three discusses the land-use problem further and suggests a variety of solutions.

Problem: Pedestrian needs are often not foreseen in the initial stages of development. Development takes place over time, and the final land-use arrangements and densities cannot easily be foreseen. In typical suburban development, there are initially few pedestrian trips, because there are few closely located pedestrian magnets. When pedestrian demand increases with additional development, it is more difficult or more costly to go back and install pedestrian facilities if they were not initially planned. It is quite apparent that many of the deficiencies in the pedestrian system can be traced to the inability to predict future devel-

opment patterns or to the lack of foresight in planning for future needs. One of the staging problems brought on by incremental development is that of having missing pedestrian system links on parcels awaiting development.

Institutional and Legal Problems

Problem: General lack of respect of pedestrians by drivers, at least partially brought about by lack of enforcement of laws governing pedestrian right-of-way. The Uniform Vehicle Code (14) indicates that pedestrians are to have the right-of-way in crosswalks. It states:

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. . . .

Most state laws generally follow these guidelines. However, observation indicates that the above priorities are seldom recognized or enforced. Although some areas of the country are reportedly better than others in this regard, there is general recognition that motorist compliance is declining, including motorists yielding to pedestrians.

Problem: Lack of pedestrian advocates at the community level and in public agencies. Proper planning, design, and implementation require the same personal attention that the building of highways does. Oversights in the pedestrian system can sometimes be traced to there being no individual within the public agency that is paying attention to the needs of the pedestrian in site plan reviews, capital programming, or maintenance. Where there is also no vocal community group to bring these needs before local officials, the deficiencies continue to persist. The importance of addressing this problem is discussed in Chapter Six.

Problem: Neighborhoods and merchants sometimes oppose changes that would actually benefit the pedestrian. Pedestrians are not the only user group which competes for priority in planning and design. Residents become concerned about increasing development density (many times for legitimate reasons). Merchants place a high premium on parking, and proposals to reduce or remove it to widen the sidewalk are not generally looked upon with favor. Because of these competing objectives, pedestrian facilities cannot always be ideal; but neither can their presence be neglected.

Problem: Zoning ordinances, subdivision regulations and other local codes are often too inflexible to allow unique designs that would favor the pedestrian. Although local and state regulatory devices have been beneficial to planning and design in the long run, they can also be so restrictive as to inhibit creative solutions. This can be particularly true of pedestrian design. Overly zealous "by-the-book" interpretations can be detrimental to pedestrian design. Several examples of this were cited by practicing planners and engineers in the national survey.

Summary

The pedestrian-related problems discussed in this chapter are a sample of those identified in this project. Chapter Seven lists additional problems and relates them to potential solutions, discussed in Chapters Three through Six. Perhaps one of the

reasons for many of the problems is that responsibility for the pedestrian is not as clearcut as with other land use and transportation issues. The pedestrian is traditionally handled on the border of public and private property, and both parties would often rather avoid as much of their responsibility as possible. Solutions to some of the physical planning and design problems are simple. Solutions to the institutional problems are quite another story. Improvements to problems of coordination communication, funding, and legal matters are usually slow in coming, and difficult to resolve in a multipath decision-making framework. But these are the problems that must be most directly addressed if continued progress is to be made in improving the pedestrian environment. Information on the implementation aspects of pedestrian facility planning and design is presented in Chapter Six.

IDENTIFICATION OF PEDESTRIAN-RELATED PROBLEMS AT THE LOCAL LEVEL

Although many of the problems discussed in the preceding section are common to all communities, there are often unique problems, and their magnitude may vary. Thus, an important element of local planning must involve problem identification. Although the first box in Figure 1 (the planning, design, and implementation process) showed the problem identification phase at the top, it is really an on-going process that takes place at all levels. It includes the identification of the major deficiencies that have become pervasive over the years (e.g., failing to require sidewalks along major highways), as well as the day-to-day isolated problems that occur (e.g., signs down, ice patches on the sidewalk, malfunctioning signals, etc.).

Both public agencies and private citizens are an integral part of the problem identification process. Chapter Six provides additional information on the role of each group in the planning, design, and implementation of pedestrian facilities. In the problem identification stage, the following activities are appropriate. Examples of each have been documented in the literature or were found in local practices reviewed in this study.

Public Agencies

- Periodic reviews of their own practices in light of new information, resources or evolving national practices. This should include a review of legal instruments (e.g., zoning and subdivision regulations) to ensure that they adequately address pedestrian requirements.

- Appointing citizen task forces or commissions to advise the public agency on matters dealing with pedestrian facilities. This group can serve as a significant source for identifying the highest priority problems that need to be addressed.

- Keeping adequate records of pedestrian accident occurrences. Reference 15 provides guidelines that will help in the organization of this, if an adequate system does not already exist. Because pedestrian accidents occur much less frequently than auto accidents, a spot map of accidents over several years sometimes helps to pinpoint potential problem areas.

- Maintaining inventories of roadway characteristics and traffic control devices. Where time and resources permit, special inventories (such as of the sidewalk system) can be conducted and updated so that the status of the system is known.

- Conducting special studies where pedestrian problems are known to exist. These can be done in conjunction with studies of area revitalization or redevelopment.

Citizen Groups

- Bringing pedestrian-related problems or potential problems to the attention of those in public agencies. Public agencies do not have the time or resources to be in continual surveillance for problems such as burned out luminaires, missing signs, etc. Constructive identification of these types of problems should be welcomed by public agencies.

- Conducting neighborhood inventories of sidewalk, sight distance problems, maintenance needs, etc.

- Being willing to serve on citizen task forces commissioned by public agencies to provide input.

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CHAPTER THREE

PLANNING FOR PEDESTRIAN FACILITIES WITHIN THE CONTEXT OF THE OVERALL PLANNING PROCESS

The process of planning for pedestrian facilities is woven into a complex fabric of other public and private activities. To properly understand why pedestrian facilities are sometimes ineffective, and how the effective ones are properly planned for, one must first take a broad look at the entire process of planning, designing, and implementing public and private improvements and even examine the operation and maintenance of those improvements following construction. This chapter takes a look at the total planning process and how the pedestrian should fit into that framework. It addresses not only the process itself but also strategies of land use that can build more of a pedestrian orientation into the way suburban areas develop.

SUMMARY OF KEY FINDINGS AND OBSERVATIONS

The process of planning pedestrian facilities must take place within the framework of the overall planning process already in existence. It must proceed in parallel with the planning of other land use and transportation elements such as comprehensive planning, subarea planning, zoning, and capital budgeting. Pedestrian planning cannot be divorced from this overall process. However, pedestrian needs must be effectively advocated within that process.

Figure 10 presents a very generalized overview of the planning and development process at the state and local level. There is a place for pedestrian planning at virtually every step. Flaws in the pedestrian network can usually be traced to a problem that occurred within one or more of these steps. The sections below discuss the findings from the project in the areas of comprehensive planning, subarea planning, and overall land-use planning from a pedestrian perspective. Reference will be made to Figure 10 at various points in the discussion. Discussions are presented of findings, observations and planning principles. In each case, the finding or principle is listed, followed by a discussion of the background behind it, and an illustration of how it applies to planning practice.

Findings Concerning the Public Planning Process

Research into local and state planning processes revealed several key elements that appeared to be consistently present in jurisdictions that were adequately treating pedestrian accom-

modations in their planning process. These key elements to effective pedestrian planning are discussed in the sections that follow:

Key Element 1: Policy statements in the comprehensive plan (also called a master plan or general plan) that relate to pedestrian needs and objectives. *Background.* The case studies conducted in this project brought to light a number of localities with effective programs of pedestrian planning. One of the threads that appeared to consistently run through the planning processes in all of these jurisdictions was a recognition of pedestrian needs at the most basic level—statements of jurisdictional objectives and policy. Examples of pedestrian-related policy statements were found in such places as Somerset County, New Jersey; Claremont, California; Montgomery County, Maryland; Charlottesville, Virginia; and Arlington County, Virginia. All of these jurisdictions have aggressive pedestrian planning efforts underway, and these efforts are, in turn, based on policies and objectives stated in their document guiding planning throughout the jurisdiction.

Although policy statements in the comprehensive plan do not automatically guarantee the provision of any pedestrian facilities, they at least indicate that a recognition exists of the need to plan for the pedestrian. Having this recognition at the top level of the planning process increases the likelihood that further steps will be taken toward actually planning for and implementing pedestrian facilities. This is why "planning policies" was placed at the top of the planning process diagram in Figure 10.

Illustration and Application. A quite comprehensive set of pedestrian-related planning policies or objectives was found in the master transportation plan of Arlington County, Virginia (1). These objectives are quoted as follows:

- [P]rovide safe and convenient pedestrian and bicycle facilities linking neighborhoods with transit stops and commercial, social, educational, and recreational activities nearby.
- [P]rovide a network for direct, safe, and pleasant pedestrian travel within the development corridors, especially links connecting to transit stations and retail activity.
- [E]nsure that pedestrian and hiking, biking, and jogging connections are reasonably direct, and free of barriers, with bicycle parking available.
- [I]ncrease the percentage of residences located within reason-

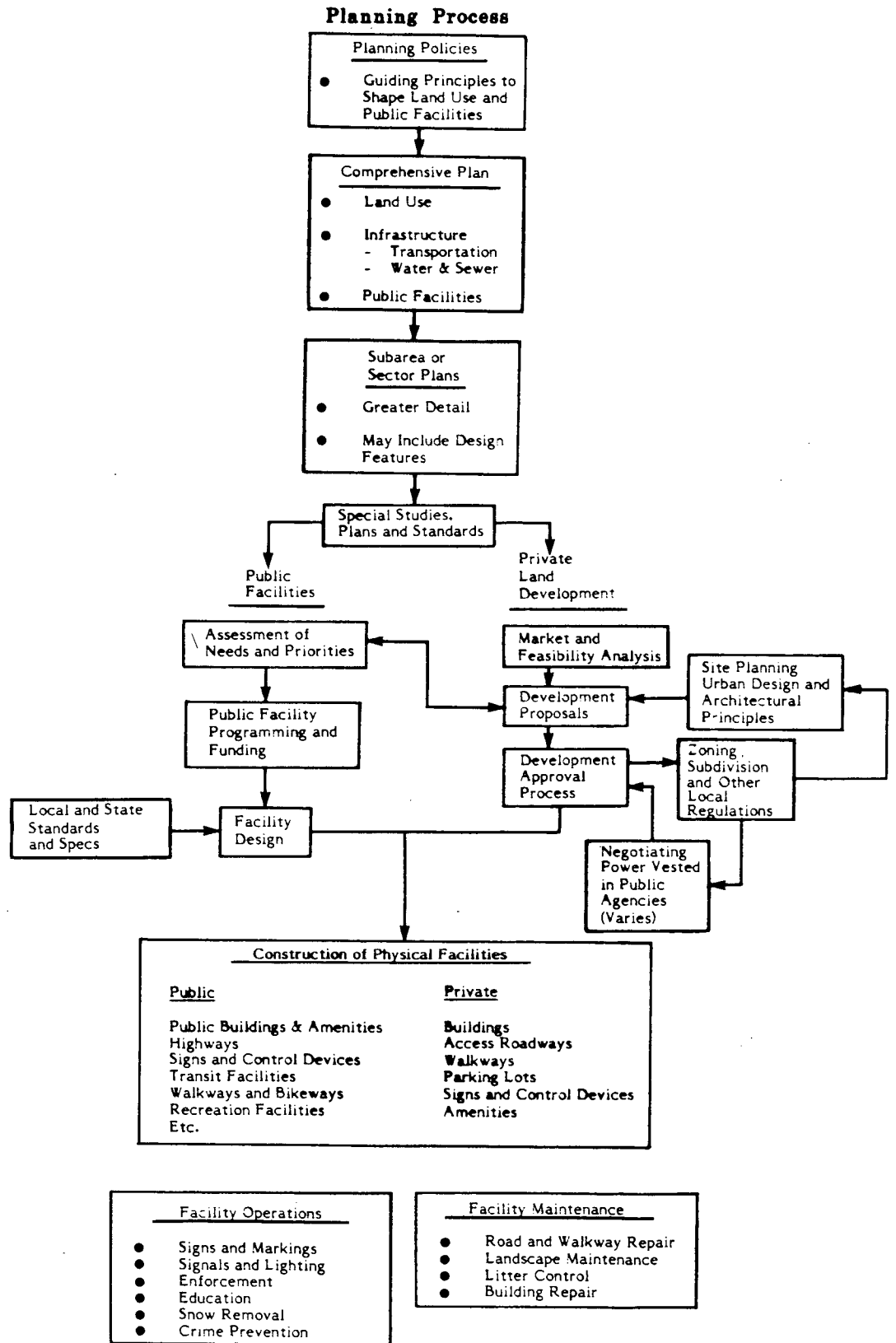


Figure 10. Overview of the planning, design, and implementation process.

able walking distance of transit for each time period—peak periods, midday, evening, Saturday, and Sunday.

- [P]rovide a network of walkways to enable:
 - walking to be a reasonable alternative to vehicular travel for short trips, and
 - walking in combination with transit to be a reasonable alternative for most longer trips.
- [R]educe accidents, and the potential for accidents, between and among motor vehicles, pedestrians, and bicyclists by minimizing the number and severity of conflicts.
- [C]learly delineate safe pedestrian travel ways, emphasizing:
 - separation of vehicular and pedestrian travel along arterial streets using planting strips,
 - crosswalks or grade separations of arterial streets at a reasonable spacing, with a raised median for pedestrian refuge for at-grade crossings of wide streets, and
 - travel within, and key approach routes to development corridors
- [D]esign facilities to reduce vehicular noise for pedestrians and activities nearby.
- [C]reate landscape/streetscape themes which reinforce identities of individual neighborhoods.
- [E]ncourage a type and mix of activities to generate a community active with pedestrians during a wide range of hours.
- [P]rovide adequate lighting for pedestrians and bicyclists.
- [P]rovide walkways and bikeways with reasonable grades and adequate clearances, reducing barriers and restraints.

These policies are generally appropriate for adoption in other suburban jurisdictions as well. The planning policies incorporate considerations of both pedestrian safety and convenience, and even make the connection between land-use planning and propensity for pedestrian travel. The inclusion of such policies in the transportation element of the comprehensive plan brings about a recognition of pedestrian needs that will hopefully carry through the entire planning process.

Key Element 2: Inclusion of pedestrian facility elements in the comprehensive plan. *Background.* Many communities around the country have established a comprehensive plan (also called a master plan or general plan) governing land use and public facility development (see Fig. 10). In many cases it is required by law. A master plan for highways has almost always been integral to that plan. Transit and pedestrian facilities have only recently been included in many suburban comprehensive plans, and many plans are still devoid of any formal pedestrian consideration. This fact became evident in the review of comprehensive plans in this project. Some had extensive consideration of pedestrian accommodations, others had virtually none. Including a master plan for pedestrian facilities forces specific thought to be given to how pedestrians should be accommodated, and provides the framework around which other development activities, both public and private, can be designed. In some cases this is more appropriately done on a subarea basis. However, it is an important step toward promoting continuity and consistency in the overall pedestrian network.

Illustration and Application. Part of the comprehensive planning process should legitimately include what some jurisdictions have called a master plan of walkways or a master trails plan. These can be a combination of recreational and utilitarian paths, including conventional sidewalks, that comprise the pedestrian network. The master plan should be a result of specific thought

about where sidewalks and paths should be provided, formally indicated on a map. The master planned links may be constructed along with new or upgraded highways or may be included in the capital program by themselves.

Elements to be considered in establishing a walkway or trails plan include careful consideration of the function a walkway is to serve. Walkways to serve primarily a recreational purpose are often best located in stream valleys. Other public rights-of-way, such as those reserved for utilities, are also prime possibilities. However, these rarely will serve as effective links between residential, employment, and shopping areas. Walkways serving nonrecreational trip purposes must provide a reasonably direct and not too distant link between pedestrian trip generators or they will not be used. Methods to identify walk trip potential are included in a later section.

It is important to work with neighboring jurisdictions to establish routes for regional trails. Often, the inertia to implement a portion of the walkway system within a jurisdiction will be greater if it is tied to a larger system. These will mostly be recreational trails.

Consideration should be given to the crossing of major highways at an early stage. The feasibility of some trails may be dependent on grade-separate crossings.

In the process of designating trails and walkways, include walking groups. They are knowledgeable in where pedestrians like to walk, and can even do some of the work in preparing the plan. *Walkways*, a publication of the Walkways Center, reported on the process used by Lebanon Township in Hunterdon County, New Jersey, to locate walking trails (2). The township obtained USGS topographical maps and a copy of the township tax map, enabling the location of all public property and rights-of-way for power lines, oil pipes and telephone lines to be determined. Members of the local trails association are being given copies of the maps, and additional formal and informal trails are being sketched in. Trails or potential trails over private property are also being identified, and association members are intending to ask landowners for permission to permit members to use the land, with the understanding that the association will exert discipline over its members in the use of these links.

Finally, specify the criteria to be employed in locating and designing the walkways, including sides of the road, walkway width, types of paving material, and lateral separation from the roadway.

Key Element 3: Preparation of subarea or sector plans for areas needing special coordination. *Background.* The planning process sometimes entails the preparation of subarea or sector plans. These are usually performed where concentrations of development activity are expected. As this higher concentration of development brings with it (or should bring with it) significant pedestrian activity, the subarea plan is an ideal forum for the inclusion of pedestrian planning needs.

A number of good subarea planning studies with heavy pedestrian emphasis were identified in this study. These included developing and redeveloping suburban activity centers, small downtowns undergoing revitalization, commercial strips, and residential areas. Examples of subarea studies included the Peaceful Valley Design Plan (plan for a residential area in Spokane, Washington); the Ann Arbor, Michigan, Corridor Study (design and aesthetic guidelines for major roadways); Central

Business District Sector Plan for Bethesda, Maryland (redevelopment of an existing suburban business district); Sector Plan for Ballston, in Arlington County, Virginia (also the redevelopment of an existing business district); and the Fairfax Center Area Plan (coordinating the new development of a large land area in Fairfax County, Virginia).

Illustration and Application. Figure 11 represents one such plan, prepared as part of the Fairfax Center Area Plan for Fairfax County, Virginia (3). Similar sketches treat other areas of an eventually massive, but hopefully coordinated development. The Fair Oaks Mall shown on the plan will serve as a commercial focal point for the remainder of the development. Pedestrian linkages are designed into the plan along with the buildings and roads. The sketch can be used to illustrate several principles of planning for pedestrian facilities.

- Pedestrian facilities must be considered as an integral part of the development plan from the very outset, otherwise the opportunity will probably be lost as development decisions proceed. This principle of considering pedestrian needs from the initial planning onward is woven throughout many sections of this report.

- Consider topography and probable location of roadways in placing pedestrian links. In Figure 11 notice that a pathway is designated to go under the bridge crossing Interstate 66, taking advantage of the vertical separation. A pedestrian link has also been designated to be added to the flyover ramp over Route 50, an accommodation which could have been more easily provided had it been thought about when the structure was first built. However, it was difficult to foresee how the other side of the highway would develop at the time.

- Make the connections direct, and provide amenities along the route where distances are long. Although commercial properties should be buffered from residential, direct pedestrian connections should still be provided.

Of course, there is no assurance that the concept plan illustrated in Figure 11 will be built as shown. The plan is merely what it states—a concept. Nevertheless, every effort has been made to elevate pedestrian needs in both subarea development policy and visually through illustration. Such a plan can serve as the basis for policies that could guide the concept through to implementation.

A subarea or sector plan can encompass not only new development but redevelopment as well. Suburban business districts are more commonly being treated in this way. Here, there is less flexibility in how the pedestrian system is put together. Realistic pathways are often limited to the traditional sidewalk areas, but opportunities exist in the use of strategic alleyways and “pocket parks,” to make interesting, utilitarian pedestrian connections. Attention in these existing settings is more frequently placed on streetscape improvements and facilitating street crossings.

Certain aspects of the planning process can be undertaken at a still more detailed level than that cited above. Special studies of pedestrian needs may be undertaken, addressing particular areas of concern. These may include:

- Analysis of pedestrian safety problems (i.e., hazard identification and selection of countermeasures). Reference 4 provides some guidelines for this.

- Safe school route planning, pedestrian bridge feasibility studies (see Refs. 5 and 6).
- Guidelines and standards for streetscape design or redesign to enhance the pedestrian environment.
- Sidewalk improvement and street lighting inventories.

Such studies differ from a subarea plan in that they address only one or two functional aspects of the land use or transportation system.

Key Element 4: Careful attention to the implementation process. *Background.* Many of the problems that exist with the pedestrian system are a result of inattention to detail, various institutional impediments, or general lack of follow-through in the implementation stage. Many of the flaws in the pedestrian network can often be traced to these implementation-related problems. Those communities observed in this project that exhibited good pedestrian systems had obviously given substantial thought to the entire implementation process. Several had developed a more formal framework that guided the process of pedestrian facility implementation, from initial conception and planning through construction and subsequent management. It is important to note that the emphasis on implementation is as important in the everyday upkeep of the pedestrian system (e.g. maintaining and expanding the sidewalk system) as it is for a major development project. Although a major development project can serve as a catalyst for pedestrian facility planning and implementation, it is subject to the same potential implementation pitfalls as any other pedestrian-related activity. Because of its importance, an entire chapter is devoted to discussing the subject of implementation, both identifying the pitfalls and suggesting methods of improving the process. A number of these methods are illustrated in Chapter Six from the case studies or from other examples.

Key Element 5: A knowledgeable person or persons on the planning or engineering staff with specific pedestrian-related responsibilities. *Background.* Another element that jurisdictions with effective pedestrian planning activities had in common was a public agency “advocate” for the pedestrian. Someone was assigned the task of directly planning for pedestrian needs or for ensuring that the overall planning process did not neglect the pedestrian. This did not necessarily mean that pedestrian planning was their full time job, but that at least part of their job was to specifically look after pedestrian needs.

Typical job responsibilities for a public agency pedestrian advocate include preparing master walkway plans and pedestrian elements of subarea plans, providing pedestrian-related input on other planning activities, reviewing site plans from the pedestrian point of view, responding to citizen inquiries on problems with the pedestrian system, and coordinating the preparation of pedestrian-related elements of the capital improvement program.

In some of the larger jurisdictions, pedestrian planning has been assigned to a staff member as his or her full time job. In smaller jurisdictions, pedestrian planning has been assigned as one of a number of responsibilities an individual might have. Ideally, the pedestrian-related responsibilities should be spelled out specifically in the job description. Whatever the arrangement, if someone is assigned the specific responsibility of pedestrian advocacy within a public agency, oversights in the pedestrian network are less likely to occur.

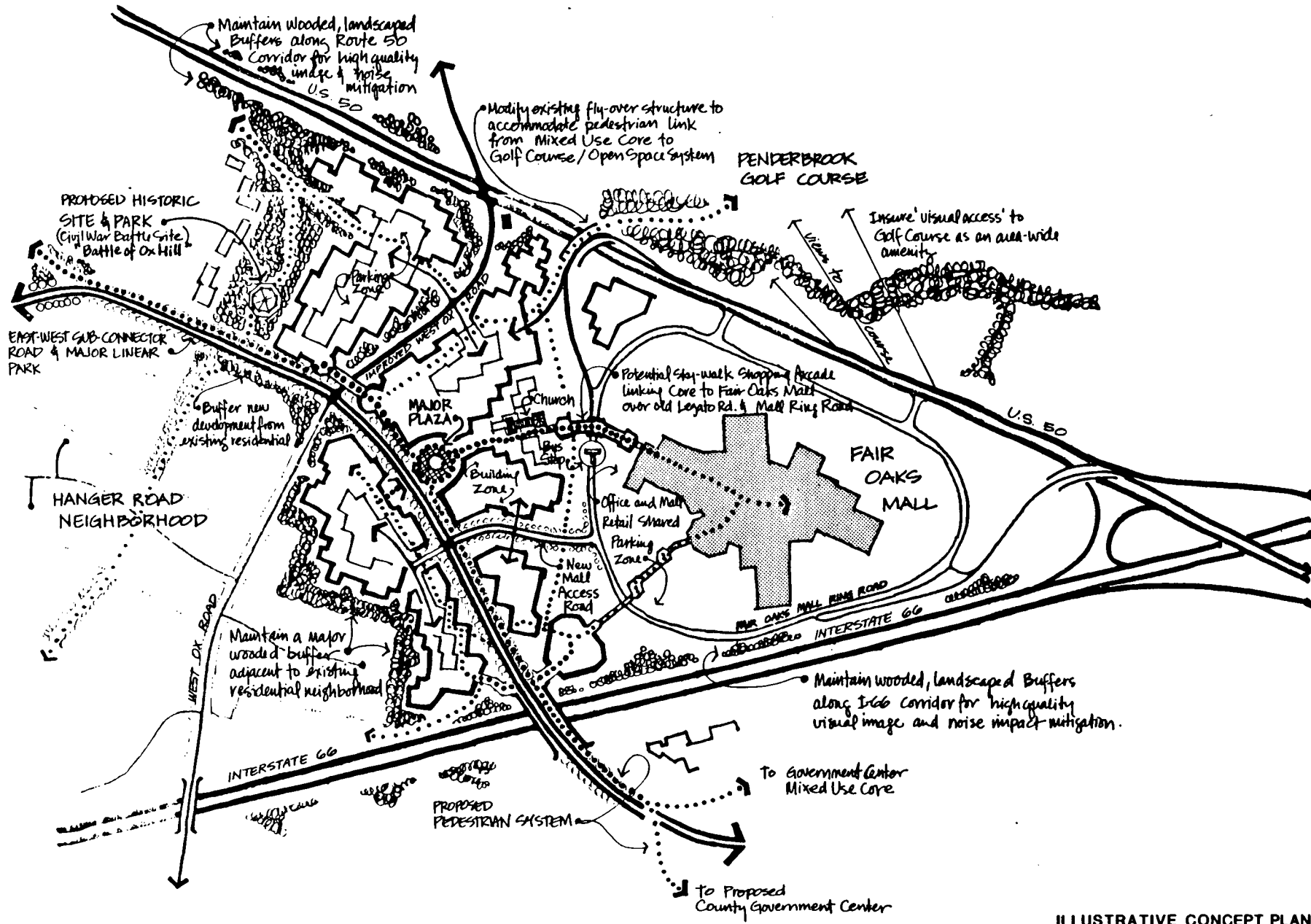


Figure 11. A subarea plan for the Fairfax Center area. (Source: Ref. 3)

ILLUSTRATIVE CONCEPT PLAN
FAIR OAKS MIXED USE CORE

Illustration and Application. Several specific examples of pedestrian advocacy within a public agency were documented in this study. One of these examples, from the New Jersey Department of Transportation, is discussed in more detail in Chapter Six.

Findings Concerning the Role of Private Land Developers

Part of the research effort included an investigation into the role of private land development in the provision of pedestrian facilities. Developers are an ever more integral part of the planning and construction of the transportation system, and have an especially prominent role in the provision of pedestrian facilities, ranging from sidewalks on the periphery of the development to pathways provided for internal pedestrian circulation. Information was assembled on the development process from the literature, from the case study reviews, and from surveys and discussions with developers and the architects and urban designers that typically represent them. Discussed below are several observations on the development process as it relates to the provision of pedestrian facilities:

Observation 1: Pedestrian considerations are one of a multitude of factors involved in the development process and must compete with other design and financial priorities. However, including pedestrian facilities not only improves pedestrian circulation, but can add to the marketability of a property. *Background.* The development of private land is the driving force behind the need for any facilities, pedestrian, or otherwise. Houses, employment centers, entertainment facilities, shopping centers, and a host of other support activities are built, creating the need for public facilities to serve them. The process of determining market potential, putting together a development proposal and shepherding it through the approval process is, in itself, a complex undertaking. The developer, the initiator of the process and the risk-taker, must evaluate the financial aspects of development and put forth the components that are most likely to bring a satisfactory rate of return on the investment.

Both the literature and discussions with developers and architects indicated that there are many items that typically rank higher than the provision of pedestrian facilities in making the development a financial success. However, this does not mean that pedestrian needs can be neglected. When integrated into the development plans from the outset, basic pedestrian facilities are not only a relatively small cost, but can substantially enhance the marketability of a property in addition to improving pedestrian circulation overall.

Illustration and Application. The case studies in Appendix B describe several instances of developer-initiated pedestrian amenity packages that were not only functional but significantly contributed toward the project's economic success. One example was noted in an office park setting (Maitland Center in Orlando, Florida), in which the architect/designers developed a plan for a pedestrian network and extensive landscaping plan in an easement along the property frontages. The landscaping and other pedestrian amenities have been recognized as a major contributor to the popularity of Maitland Center as an employment site, and the development has fared quite well financially, at least as a partial result of the planning strategy.

Other case studies also credited pedestrian improvements and amenities with an improved image or with outright financial benefits. Although there are many factors that contribute toward an "image" or toward financial success, the great majority of case studies pointed toward the provision of pedestrian improvements as a cost-effective investment. The pedestrianizing of suburban downtown areas or of main streets in small towns has generally helped to counter the flight of retail activity to the outlying malls (see case studies for Claremont, California; Fredericksburg, Virginia; Danville, Illinois; Glendale, California; and Iowa City, Iowa). Not all experiences with downtown streetscape and revitalization have been positive, however, as discussed in Chapter Four. Brick sidewalk, street trees, and planters are not a panacea for deep-seeded economic ills in older suburban areas and small city downtowns.

Observation 2: A balance is needed in the flexibility of local zoning and subdivision regulations. Over-regulation will stifle design, while no regulation will continue to permit pedestrian neglect to occur among developers who have less concern for those on foot. *Background.* The clockwise loop of arrows shown on the right side of Figure 10 represents an interactive process between developer and public agency used in tailoring a development to achieve general conformance with specified planning policy. Legal instruments such as zoning and subdivision regulations are implementation tools that can be used to shape the placement and design of structures, roadways, walkways, and other facilities. Unfortunately, these tools can also inhibit good design, when used in a rigid, inflexible way. This was one of the chief complaints of well-intentioned urban designers and landscape architects surveyed in this study—the very instruments designed to enforce good planning can also lead to its demise. Examples were cited of public agency failure to allow features that would have enhanced the pedestrian environment because of very strict interpretation of the regulations. In some cases, meandering walkways (rather than straight) had been suggested by the developer only to be denied by the public agency. In one instance, a developer overseeing the upgrading and densification of an older suburban retail area had called for brick crosswalks, special street and pedestrian light fixtures, and widened sidewalks. These pedestrian improvements varied from local and state standards and, therefore, were initially rejected. They were finally approved after considerable negotiation and developer expense.

On the other hand, examples abound of gross neglect of the pedestrian in many development schemes. Some of the problems were discussed in Chapter Two. Regulatory devices can be of great assistance in many of these cases to assure that more thought is given to pedestrian access and circulation. The dilemma is one of providing flexibility while assuring that the basic elements of a pedestrian system are built. Over-regulation will stifle design, while no regulation will continue to permit pedestrian neglect to occur among developers who have little concern for those on foot. There is no substitute for thoughtful, imaginative planning. The discussion of flexible zoning techniques in Chapter Six provides some insight on the role of regulation in planning for pedestrian facilities.

Figure 12 illustrates the role of zoning approval, site plan review, and other typical steps at the local level (7). Again, the pedestrian must be a conscious consideration not only of the developer but also of the reviewing agency for pedestrian facilities to be promoted through the implementation stage.

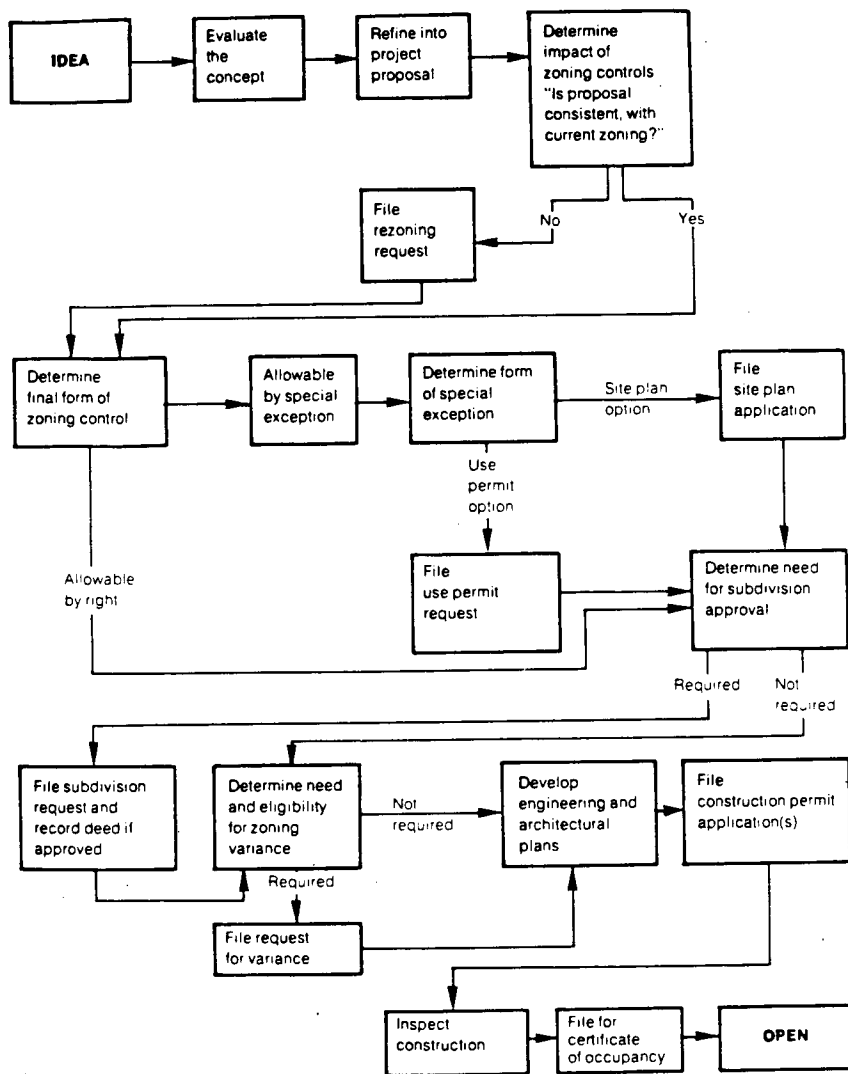


Figure 12. Typical process of zoning and site plan approval. (Source: Ref. 7)

Observation 3: A simple checklist can be useful in reminding both the preparer and reviewer of plans about items that should be considered in the planning of pedestrian facilities. *Background.* The walking inventory of sites from around the country indicated the presence of many defects in the pedestrian system which were probably a result of either a funding problem or of a simple failure of the planner or designer to be thinking about the pedestrian. Numerous instances of missing sidewalk links were noted, particularly in the sidewalk links from the building entrance to the street. Absence of sidewalk was noted even in a number of cases where there was a bus stop adjacent to the site, creating an obvious desire line for pedestrian traffic. Sometimes a simple checklist can be used to remind both the preparer and reviewer of plans about things that should be considered in the pedestrian arena.

Illustration and Application. Figure 13 contains a simple checklist that could be used in reviewing the pedestrian-related features of site plans for many types of developments. Often, this would be all that was necessary to remind a developer of the need to include basic pedestrian facilities in the project. It also suggests some of the design principles that should be employed.

Observation 4: Guidelines for sidewalk installation, including funding responsibility, should be clearly spelled out in state and local ordinances, standards, warrants and specifications. *Background.* State and local ordinances, warrants, standards, and specifications typically govern the design of transportation facilities, and the extent to which pedestrian considerations are included is often dependent on the level of treatment in these documents. Subdivision regulations are the most common document for specifying the location and design of sidewalks and walkways.

Illustration and Application. Table 2, from "Model Subdivision Regulations" (8), provides a reasonable recommendation for the provision of sidewalks in a subdivision situation. Similar tables were found in several local subdivision regulations reviewed in this project. Inclusion of other design criteria into the local regulations and ordinances would further heighten the awareness of developers of the need to plan for pedestrian linkages. As stated earlier, however, flexibility must be incorporated into the regulations to allow the designer to tailor each site and building plan to the unique opportunities that may be afforded at each individual site.

The provision of appropriate pedestrian facilities is largely

Table 2. Requirements for sidewalk installation in "Model Subdivision Regulations." (Source: Ref. 8)

| Nature of Road | | Development Density | | |
|-----------------------|---------------------------|---------------------------|---------------------------|--|
| | | Residential | | Nonresidential Business – Industrial |
| | | Low | Medium | |
| Local Road | Optional* | Both Sides 4 Feet Wide | Both Sides 5 Feet Wide | Both Sides 6 Feet Wide |
| Collector Road | Optional** | Both Sides 5 Feet Wide | Both Sides 5 Feet Wide | Both Sides 6 Feet Wide |
| Secondary Arterial | Optional** | Both Sides 5 Feet Wide | Both Sides 5 Feet Wide | Both Sides 6 Feet Wide |
| Primary Arterial | Both Sides 5 Feet Wide | Both Sides 5 Feet Wide | Both Sides 5 Feet Wide | Both Sides 6 Feet Wide |

*Optional, but where provided 4 feet minimum on either side of road with concrete curbs.

**Optional, but where provided 5 feet minimum on either side of road with concrete curbs.

dependent on the knowledge, experience, and imagination of the planners and engineers involved. Regulatory devices can only guide the process; they cannot create a successful project. However, public regulation often helps the developer's design consultant to sell pedestrian-related amenities and considerations to the developer. Developers and their consultants must be well-informed about the factors that make up a safe and convenient pedestrian environment and the pitfalls that should be avoided. Some of this information should be incorporated into local ordinances and regulations, while other information can be provided in less formal manner.

Findings Concerning the Evolving Nature of Land and Highway Development

An expanding population must give rise to an expanding base of housing, office, and industrial development and public facility infrastructure. Urban growth has tended to move outward, further and further from the downtown nucleus. What were once cow pastures and orchards now encompass commercial development that surpasses the densities of many of the downtowns of decades past.

Urban areas are in a constant state of transition. This complicates the provision of certain public facilities, particularly those related to transportation. Changes to activity patterns over time require streets and highways to handle traffic levels they were not designed to accommodate. Many of the needs for pedestrian travel were also not foreseen.

Figure 14 presents an example of a hypothetical suburban bedroom community, springing up in what was formerly a rural farming area. Roads are narrow and winding, and are not built to accommodate the volumes of commuters generated by the new development. Commuting in this area is highly directional, because almost all employment opportunities are toward the central city, adding to the congestion problem. Shoulders are narrow, and walking along the road is unsafe and generally impractical. Because there was nothing to walk to, pedestrian accommodations were not originally considered in the process of building the residences. Shopping, schools, and recreational facilities follow to support the residents, but pedestrian connections are again not considered. It is the classic "chicken and

Overall pedestrian system

- Are both utilitarian and recreational walking considered in the plan?
- Are utilitarian paths direct? Do they provide for connections to existing pedestrian magnets nearby?
- Do recreational pathways take advantage of unique site features? Are they generally visible from homes or other buildings?
- Does the pedestrian system consider the type and probable location of future development on adjacent or nearby parcels of land? Is there flexibility to provide direct connections to adjacent parcels, should that be desired later on?
- Are pedestrian entrances clearly evident, through either design features, topography, signing or markings?
- Are walkways along the street separated and buffered from traffic as much as possible?

Safety and Security

- Are crossings of wide expanses of parking lot held to a minimum?
- Are pathways generally visible from nearby buildings and free from dark, narrow passageways?
- Is adequate lighting provided for nighttime security?
- Are sight distances adequate for vehicles to see pedestrians at crossings?
- Do pathways lead to the safest crossing points?
- Are pedestrian/vehicle conflict points kept to a minimum?
- Are pedestrians clearly visible to traffic where they cross the street?

Walking Surfaces and Amenities

- Are the walking areas scaled to the pedestrian?
- Are the walking surfaces skid-resistant and sloped for drainage, but less than 12:1?
- Are provisions made for curb ramps and are they properly designed?
- Are major changes in grade properly treated with stairways and handrails?

Figure 13. Checklist of site plan review items.

egg" situation, in which a pedestrian network cannot be justified because of the general absence of pedestrians, but the lack of pedestrian connections between uses discourages pedestrian travel. In addition, there is always the tendency to want to wait until the road is improved before committing to pedestrian paths or sidewalks.

Although some improvement can be made to retrofit this situation, the better, less costly solution is to have planned for the pedestrian from the beginning. Some simple principles, built into local ordinances and regulations to foster implementation, will increase the likelihood of adequate facilities being provided in these developing rural areas. Several principles were developed on the basis of the site inventories and the research team's experience with developing rural and fringe suburban areas. These principles are as follows:

Principle 1: Either a shoulder or separate pathway should always be available to safely accommodate pedestrians walking along arterial and collector roadways. *Background.* A study of rural and suburban pedestrian accidents (9) indicated that approximately 15 percent of the accidents occurred while the pedestrian was walking on the road. Two-thirds of these pedestrians were walking with the traffic, not against it. While a sidewalk, shoulder, or pathway would not necessarily prevent all of these accidents (some of this 15 percent may have even included accidents where a sidewalk, shoulder or pathway was available but not used), it would clearly reduce the potential for an accident in locations where no such facilities existed. Whether or not a sidewalk or shoulder is a cost-effective accident coun-

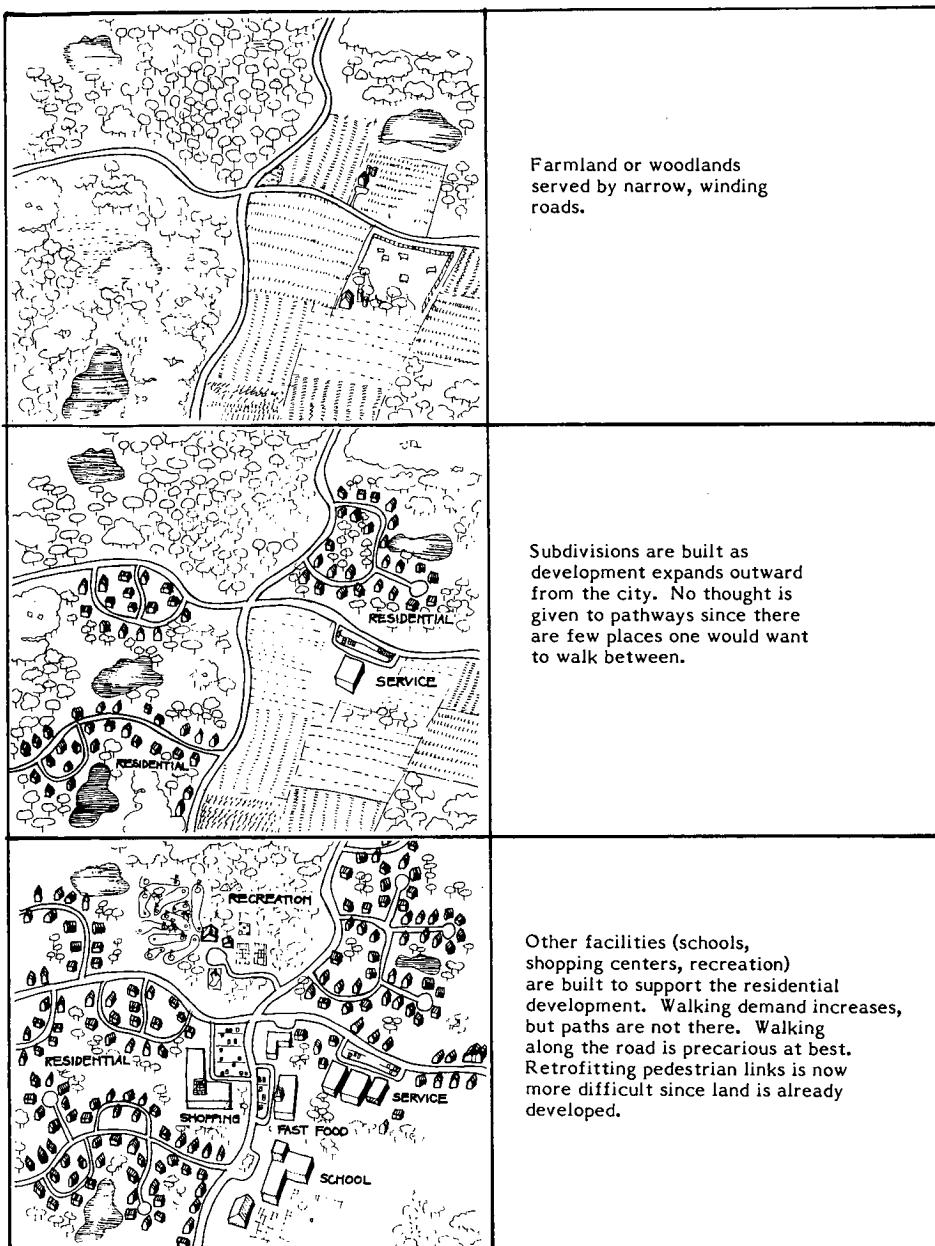


Figure 14. Evolution of a hypothetical bedroom community.

termeasure will depend on a number of factors, such as pedestrian and vehicle volume, traffic speed, and availability of right-of-way. In addition, however, the lack of a sidewalk, shoulder, or pathway discourages pedestrian use. This is a benefit that cannot be quantified, but which is nevertheless real to those who would like to walk but cannot do so because of the safety risk. Consequently, new arterial and collector roads in suburban and developing rural areas should, without exception, be constructed with at least one of these design features (shoulder, sidewalk, or parallel pathway offset from the roadway).

Illustration and Application. The State of Florida has mandated that all state roads within 5 miles of an urban area must

include a minimum 4-ft paved shoulder to accommodate pedestrian and bicycle traffic. Figure 15 shows a section of highway on the outskirts of Tallahassee with such a shoulder. A separate pedestrian pathway may actually be cheaper than a shoulder, but a shoulder also has benefits for vehicles. Pathways need not be elaborate or expensive. In these developing rural areas an unsurfaced or narrow 3-ft asphalt path is often all that is necessary. More ample accommodations could await the future widening of the road. Inasmuch as the path could eventually be replaced, grading should be kept to a minimum and the path should follow the natural contour of the ground, curving to avoid trees. Figures 16 and 17 provide two examples of low-

cost pedestrian pathways along side highways in suburban and developing rural areas.

Principle 2: Keep open the possibilities of direct connections between residences and activity areas. *Background.* It is often not difficult to determine where connections between residential areas and adjacent land uses should be placed, even when the area is not fully developed. If plans are not made for these connections, the only way remaining to walk between the uses may be a quite circuitous route. A typical route in a suburban area often takes the pedestrian out of the subdivision to the main road, along the main road for a distance and then back into the shopping center or other destination, as illustrated in Figure 14. This can result in a circuitry ratio (the ratio between the actual walking distance and the air line distance) of 5:1 or more. Easements permitting pedestrian access through the middle of street blocks should be provided along with the initial development in anticipation of making a pedestrian connection with nearby commercial uses at a later date. Easements are relatively simple to provide for in the development stage. They can be very difficult to obtain in already developed areas.

Illustration and Application. In Figure 14, an easement could have been provided between the houses adjacent to the shopping center, in anticipation that the site would develop commercially. Subdivision regulations sometimes contain provisions requiring a mid-block or cul-de-sac easement where blocks are long and pedestrian access is circuitous. Below is a sample statement from "Model Subdivision Regulations" providing general criteria for requiring a mid-block easement:

In long blocks the Planning Commission may require the reservation of an easement through the block to accommodate utilities, drainage facilities or pedestrian traffic. Pedestrianways or crosswalks not less than 10 feet wide, may be required by the Commission through the center of blocks more than 800 feet long where deemed essential to provide circulation or access to schools, playgrounds, shopping centers transportation or other community facilities.

The distance of 800 ft is an appropriate threshold of block length. Ultimately, however, those persons regulating site plan review must decide where the easements are appropriately placed. A knowledge of potential origins and destinations is needed to determine this, and potential locations should be included in early schematics of the site plan (see Chapter Four).

In some instances, easements have been designed for multiple functions. This was the case in the Brandermill case study, in which easements were used jointly for pedestrian movement and for drainage. However, the location of pedestrian easements should not be dependent on where other facilities are located. It is important that the easements be located so as to provide as direct a route as possible (except where the path is clearly recreational). Piggybacking the pedestrian network on the drainage or utility system almost always results in a less-than-effective system. This might be appropriate if major pedestrian destinations included retention ponds or power transformers, but of course this is not the case. However, certain segments of the system may be well suited to joint use. Consult the Brandermill case study in Appendix B for further information on joint use of easements.

Principle 3: Determine eventual roadway cross sections and sidewalk standards at the earliest possible date, so that new

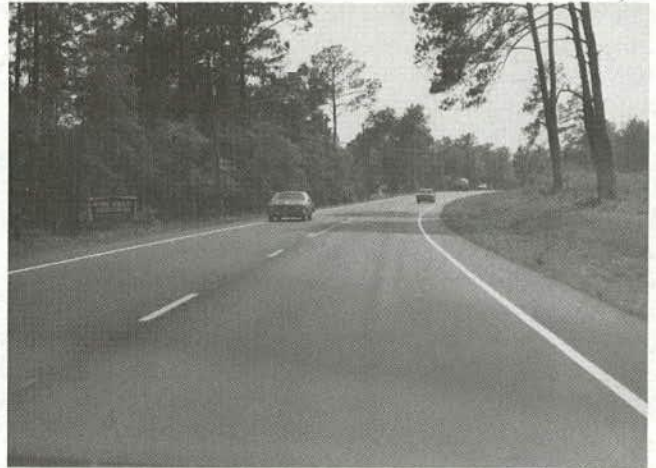


Figure 15. Four-foot paved shoulders being provided by Florida DOT to accommodate pedestrian and bicycle traffic.



Figure 16. Arterial with inexpensive asphalt pedestrian path.



Figure 17. Simple pathway constructed of wood chips in a developing rural area.

development will consistently build to the same standard. *Background.* This is a common-sense principle that will help to ensure system continuity over time. The local agency analysis of sidewalk widths, criteria for planting strips, and other road edge treatments should be comprehensive, so that there is a basis for design that can remain fairly consistent over the years.

Illustration and Application. Inconsistencies in the provision of pedestrian facilities are often obvious, as illustrated in the photograph in Figure 18. Some transitioning between adjacent areas which have fallen under different sets of design standards may be necessary.

Principle 4: Sidewalks or pathways should be required along all developed frontages of arterial and collector streets. *Background.* This is related to Principle 1, but refers more to built-up areas, primarily those in zones of commercial activity. Again, there is no means of quantitatively justifying a sidewalk. However, it is clear that they hold more benefit for areas where there is more pedestrian and vehicular traffic, and that without them, walking becomes awkward and difficult.

Illustration and Application. Table 2 presented criteria for sidewalk installation from Ref. 8. A similar table in the local subdivision regulations will provide both the regulatory power and a notice to developers of what the requirements are. A possible exception could be the deferral of construction of the sidewalk or pathway if, at the time of development, there are no other developments nearby to which one can walk. However, right-of-way should be reserved and an enforceable arrangement must exist to require the walkway installation when the need arises. If an undeveloped parcel separates two or more developed parcels attracting pedestrian trips, creating a missing walkway link, the local government should either require the property owner to construct the missing link, or take the initiative itself to construct the link, with a mechanism for recovering the costs when the property is developed.

Principle 5: Large planned developments should be encouraged over smaller single-use developments. *Background.* Larger developments have been a trend over the past 10 to 15 years, and the pedestrian has benefited in many of them. Zoning regulations can potentially be used to encourage larger planned developments by building in appropriate incentives. Larger planned developments provide more opportunity for coordinating the pedestrian network with the specific land uses and for including some imaginative features into the pedestrian system that can be consistently provided throughout the development.

Example Application. The size of development was a direct contributor to the effectiveness of several of the pedestrian networks examined in the case studies (see case studies in Appendix B on Brandermill, Maitland Center, and International Drive/Plaza International). In Plaza International, the overall developer established a set of development guidelines which specifically addressed the pedestrian network. Developers of individual parcels within the overall site were required to adhere to those guidelines, thus providing coordination and consistency in location and design elements throughout the project. Figure 19 presents a sample of some of the development guidelines for Plaza International. Appendix D presents more information on the guidelines related to the development of the pedestrian network.



Figure 18. Example of inconsistencies in sidewalk setback (see right side of photo).

Findings Concerning the Relationship Between Land-Use Planning and Pedestrian Facilities

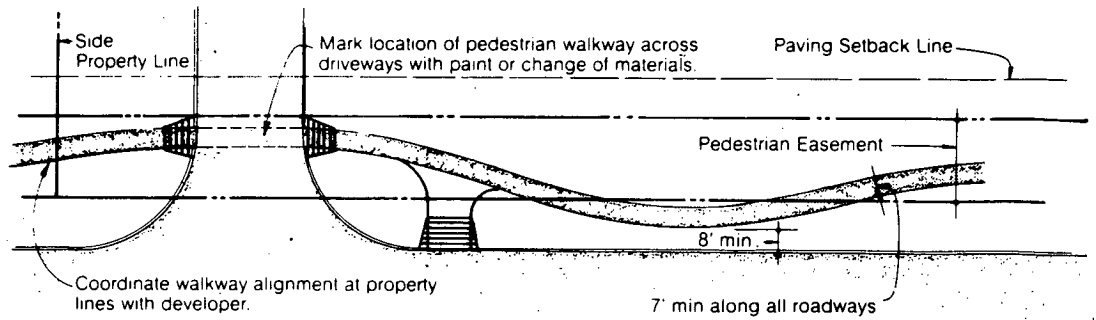
Any discussion of pedestrian planning cannot overlook the importance of land-use planning and the role that spatial relationships among land uses play in building an environment that is friendly to pedestrians. The propensity for walking is heavily dependent on the distance between origin and destination of each trip. Thus, locating origins and destinations closer to one another can have a positive influence on pedestrian travel. This can be accomplished in two primary ways: (1) locating mutually attracting land uses in close proximity to one another and avoiding the proliferation of single use development; and (2) increasing the density of development so that people have a greater degree of access to a wider range of services and facilities. This is why the typical central city is more pedestrian-oriented than the suburbs.

The sections that follow discuss the planning actions and present information on how pedestrian-oriented land-use strategies might be influenced and how such strategies can complement other aspects of suburban development. It should be pointed out that this discussion focuses primarily on growing, developing suburban areas, as these are where pedestrian-orientation can most readily be influenced. This is not to say that planning for small towns is unimportant. However, the small town pedestrian planning problem is more facilities-related than specifically land use-related, and will be discussed later in that context.

Nature of Pedestrian Attractors and Generators

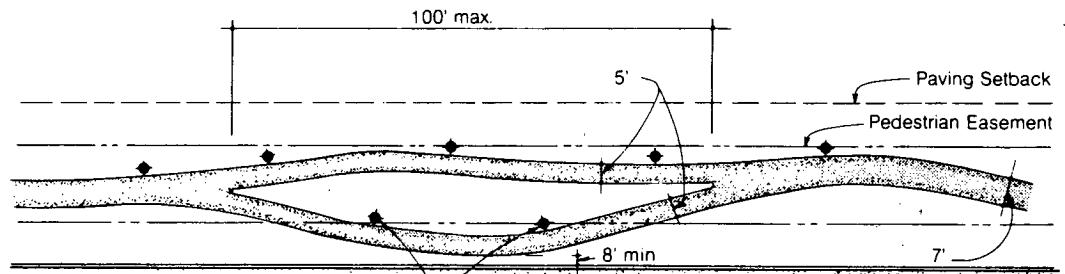
Every pedestrian trip can be defined by an origin and destination, and a particular purpose. Purposes can be utilitarian, such as going to work, school, shopping or the doctor, or they can be simply for the enjoyment, recreation, and exercise of walking itself.

Figure 20, from Ref. 10, illustrates the degree of functional attraction between various land-use types. The wider the line



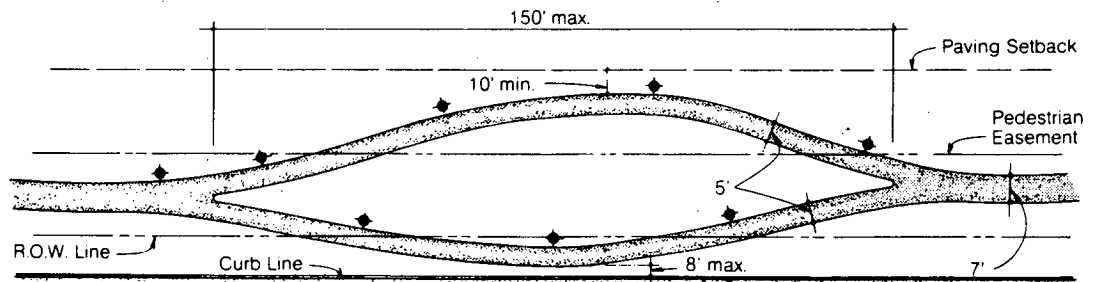
Pedestrian Walkway Criteria

Sketch F-1



Additional pedestrian walkway lighting to meet spacing requirements for both legs of walk

Island Options for Sites Less Than 2.5 Acres



Island Option for Sites Larger Than 2.5 Acres

Pedestrian Walkway Island Options

Figure 19. Sample of pedestrian walkway development guidelines for Plaza International, Orlando, Florida. (Source: Plaza International Development Guidelines, Orlando Central Park, Inc., and Reynolds, Smith and Hills, Inc.)

between the uses, the more the “magnetic” effect and the more important it is to locate the uses close together.

The advantages to pedestrian travel of locating attracting uses in close proximity is illustrated in Figure 21, developed from midday trip data for employees in Tysons Corner, a suburban

activity center in Northern Virginia. It indicates a typical percentage of trips made by the pedestrian mode by distance between origin and destination. It shows that for trips of one-tenth of a mile or less, nearly all are made by walking. As trip length increases, a larger percentage use auto. At distances of

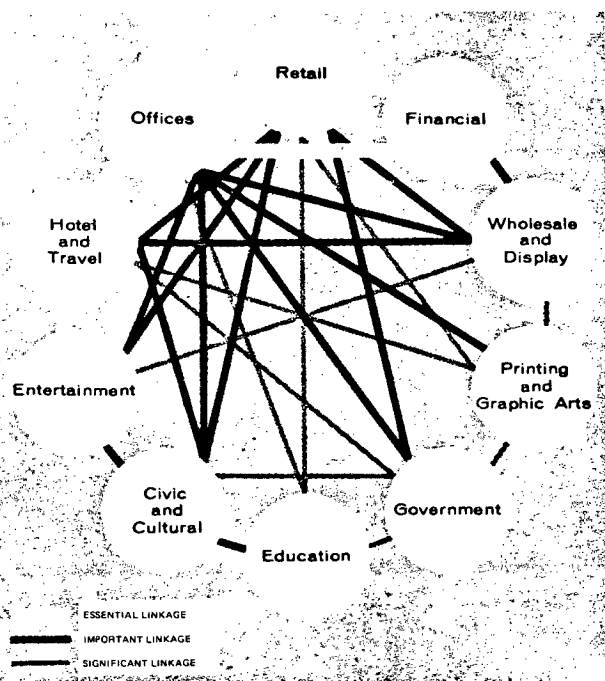


Figure 20. Functional attraction between various land-use types. (Source: Ref. 10)

one-half mile (a little over a 10-min walk) or more, only about 10 percent of the trips are made by walking. The curve in Figure 21 may be higher or lower, depending on specific site conditions. If parking is plentiful and free, the curve may tend to be slightly lower, since auto travel becomes easier under those conditions.

One of the most vivid examples of the impact of land-use type and proximity on the propensity of pedestrian travel is in a comparison of a linear versus a concentric arrangement of land use. For example, a 3 million sq ft land area would translate into a concentric ring of development with approximately a 1,000-ft radius. A linear arrangement might translate into a tract of 500 ft by 6,000 ft. Assuming that the entire site were developed, one could expect a capture rate for walk trips of at least 50 percent for the concentric arrangement, and only about 35 percent for the linear arrangement (based on the relationship in Figure 21). The disparity increases with increasing land area.

Figure 21 can also be used to demonstrate the value of higher density development in diverting auto trips to the pedestrian mode. For example, if the development in the outer two-thirds of the linear center were all placed within the inner third (i.e., density was tripled), the 35 percent walk trip capture rate would go to virtually 100 percent.

The Urban Village Concept

One development concept recently put forth is that of creating

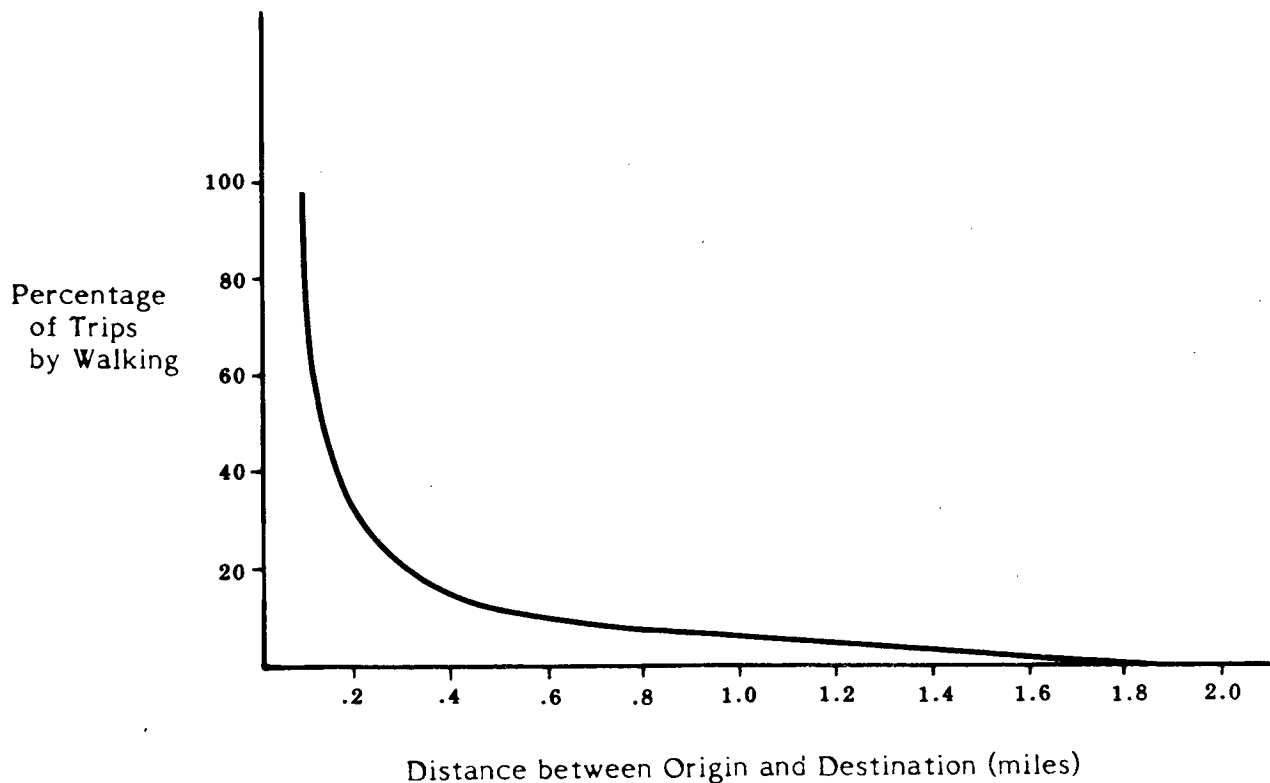


Figure 21. Percentage of midday trips by the walk mode from an office building in a suburban activity center. (Source: Surveys at office building in Tysons Corner, Va.)

“urban villages” throughout a metropolitan area. This concept evolved out of deliberations by the Council on Development Choices of the 80’s, jointly convened by the Urban Land Institute and the U.S. Department of Housing and Urban Development in 1980. The Urban Village Concept incorporates the idea of a mixed, compact land use, fostering transportation options, including walking, and providing a strong sense of community and high level of amenities.

The urban village concept incorporates features that are desirable not only from the viewpoints of economics, energy conservation, land preservation, and the like, but from the viewpoint of pedestrian travel as well. It embodies a central core of activity to which people might ordinarily drive, but once within the core, persons would be able to easily move about on foot. A limited amount of moderate-to-high-density housing would be included within the core, to accommodate persons who prefer to live in such an environment (i.e., convenient to essential services). Lower density housing would be located outside the core area. Those located outside the core would still be able to walk to the core, if desired, but would have the benefit of features of residential housing still preferred by many of the American public (e.g., single family detached homes). Support uses primarily oriented toward residential areas (e.g., schools, convenience retail, recreation, etc.) would be contained within the residential area and centrally located for easy access. While this development style is not always achievable, it represents a type of pedestrian orientation that should be strived for. Local conditions, including parcel size and ownership patterns, topographical constraints and other factors will dictate the extent to which this type of development is possible.

Summary of Pedestrian-Oriented Land Development Principles

Several principles that can be used to guide the development of pedestrian-oriented land-use plans and development strategies are summarized as follows:

- Focus commercial development on activity centers that are generally concentric (rather than linear) in nature. A concentric arrangement puts the greatest number of origins and destinations in close proximity to one another.
- Within activity centers, provide for the highest densities that can be accommodated by the transportation network. Although negative impacts are often associated with higher densities in suburban settings, a more densely developed core area is a significant benefit to pedestrian accessibility, and is generally more efficient in the use of land and natural resources. Particular attention must be paid to maintaining environmental quality and a pedestrian scale in the midst of a high-density setting. Some of the savings in development costs afforded by a dense,

compact development can be invested in amenities to enhance the pedestrian environment.

- Consider use of structured parking to keep distances between uses to a minimum. Where parking cannot be placed underground or in structures, locate it on the periphery of the area rather than in the center. This is similar in concept to a shopping mall arrangement, which enables the central area to be relatively vehicle-free, even though the sea of parking is a significant barrier to pedestrian access.

- Residential uses surrounding the activity center should be of highest density close in, with decreasing densities as distance from the core increases, again to maximize trip interchange potential.

- Avoid bisecting the area with high-volume vehicular thoroughfares. These are natural barriers to pedestrian travel. Instead, provide the major vehicular access from the circumference of the activity center.

- Provide a mix of uses complementing one another in terms of pedestrian trip attraction. Figure 20 provides a general indication of uses that have the most significant trip interchanges.

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PEDESTRIAN-SENSITIVE SITE PLANNING

DEFINITIONS

There are two major arenas in which pedestrian planning, design, and implementation must take place. The *public arena* primarily includes the area within the highway right-of-way as well as public spaces such as parks and recreational areas. The *private arena* encompasses the property on which development projects are built. This chapter focuses on pedestrian mobility in the private arena and describes considerations that are necessary to assure pedestrian-sensitive site planning. The findings in this chapter are largely derived from the literature, the case studies in Appendix B, and discussions with knowledgeable professionals in the field. Chapter Four addresses issues associated with pedestrian facilities in the highway right-of-way.

Site planning is defined by Lynch (*J*) as "... the art of arranging structures on the land and shaping the spaces between" Effective site planning cannot be regulated, but must emanate from the creativity and practicality of the designer. The designer must make the best use of the natural features of a site and its surroundings in light of the intended functions of facilities to be placed on the site. It is critical that the designer be cognizant of the needs of the pedestrian and consider the implications of site design decisions on pedestrian movement. This is what is meant by *pedestrian-sensitive* site planning. One cannot expect pedestrian needs to dominate over all other needs, but the site planning process should at least be sensitive to those needs.

SITE CHARACTERISTICS

Site planning is typically associated with projects involving the conversion of virgin lands into residential, shopping, office, or other uses under the control of a single developer or consortium. However, site planning also takes place in the renewal of older suburban areas or small towns. In the latter case, the options for provision of facilities to support the intended uses is complicated by the pre-existence of structures and the limited space available. This study addressed the process for providing for pedestrian facilities in both the initially developing areas and those undergoing renewal or redevelopment.

In this study, eight types of development projects or site types were considered. These included: (1) *residential development*, ranging from single family subdivisions to multiple family apartment complexes; (2) *shopping centers*, ranging from a few stores to the large regional malls having two or more major anchor stores; (3) *office and industrial parks*, which provide a common setting for a diverse range of office, manufacturing, service, and warehouse functions, (4) *mixed-use development projects*, made up of a diverse array of integrated land uses packaged by a single developer; (5) *suburban activity centers*, comprised of a mix of land uses spread over multiple owners, usually oriented

around a higher density commercial core; (6) *commercial strip developments*, comprised of the full range of land uses developed in linear form along major highways; (7) *main street areas*, in older suburban communities and small towns, generally comprised of a variety of commercial land uses located at the focal point of a community; and (8) *individual single-use sites*, (public or private) on small parcels of land, oriented to a specific purpose and not sharing facilities with other developments.

OVERVIEW OF FINDINGS

Although the case studies and other sources of data indicated a general insensitivity to the needs of the pedestrian in site planning within the United States, examples were also found of exceptionally good site planning and design. Many lessons were learned during the course of the case study investigations that have value for others engaged in the planning, design, and implementation of similar facilities. Although many of these lessons are common among the eight site types, there are also many that are uniquely pertinent to a specific site type. Before proceeding to the discussion of individual site types, however, the overall findings are summarized for three areas of site planning that tend to span across all use types. The first asks the question "What are the essential ingredients of an effective pedestrian-sensitive site plan?" The second identifies factors that can inhibit the introduction of pedestrian-sensitive design elements into the site plan. The third addresses the process of planning for pathway systems for any type of development.

What Are the Essential Ingredients of an Effective, Pedestrian-Sensitive Site Plan?

A pedestrian-sensitive site plan is one in which the pedestrian is recognized as a significant factor in shaping the arrangement of on-site facilities and the relationship of those facilities to others nearby. The case study reviews, the discussions with professionals in the field, and the planning and design experience of the research staff suggested that the following factors or design objectives are important to pedestrian-sensitive site planning. Although these objectives may seem simple, they usually represent the difference between a pedestrian system that works and one that does not. Ineffective pedestrian networks can often be traced to a lack of one or more of these factors:

- A continuous pedestrian network, connecting pedestrian origins and destinations with pathways that are direct and barrier-free. Recreational pathways should be continuous, but need not be direct.
- Minimum number of conflict points between pedestrian and motor vehicle traffic: Consider ways of organizing a site to

reduce the number of places pedestrians must cross vehicular flows, particularly heavy flows.

- Minimum impedance to the pedestrian in terms of the amount of time, distance, or energy expenditure.
- Clear delineation of pedestrian paths to assure that effective walking routes can be selected. Visual cues should logically lead pedestrians to their desired destination, but signing may also be necessary, particularly on the larger sites.
- Pedestrian facilities designed for ease of maintenance. Failure to do this has led to the demise of numerous well-intentioned and otherwise well-thought-out plans.
- Provision of amenities (greenery, shade trees, benches, etc.) to enhance the walking experience.
- Consideration of special pedestrian needs. Certain groups of pedestrians have special needs which should be considered in the layout and design of facilities.
- Facilities designed to maximize pedestrian security. Depending on the setting, a pathway that is not visible from parking lots or buildings can pose a security problem. Discussions with planners and designers pointed to this as a problem of increasing concern.

Factors Inhibiting Pedestrian-Sensitive Site Planning

The inventory of development sites and pedestrian situations from around the country indicated that the site planning process often does not adequately consider the needs of the pedestrian. The reasons for this vary, but generally include: lack of concern for or recognition of pedestrian needs; limitations on site planning options imposed by the existing terrain or infrastructure of a site; lack of established policies or procedures for evaluating planned pedestrian facilities during site plan review; the economics of site development priorities and market competition; the fragmented ownership of land parcels and jurisdictional responsibilities over the development of these parcels; variations in design standards for development projects; the difficulties in demonstrating the cost-effectiveness of pedestrian-facilities; overriding interests in promoting development at the expense of good design; and the difficulties faced by public agencies in fringe areas in coping with the pressures of extensive new development.

Many of the factors inhibiting pedestrian-sensitive site planning are of an institutional or implementation nature. The realities and pressures of the development world have often put pedestrian facilities near the bottom of the list of site planning priorities. However, this is slowly changing, and more developers are recognizing the benefits of paying more attention to pedestrian circulation and amenities as an integral part of site development. More details on implementation problems are presented in Chapter Six.

General Principles in Planning On-Site Walkway Systems

Improving the site planning process requires that thought be given throughout the process to the needs of the pedestrian. The most effective pedestrian systems reviewed in the case studies consistently indicated that pedestrian movement had been a major consideration from the beginning of the planning process,

and was not merely an afterthought. Although the exact planning process could not be traced for all of the case study sites, the compilation of lessons from the various sites suggested a number of basic steps for on-site planning of the walkway system. The steps included:

- *Establish initial concepts for site development program.* There is usually some initial idea of the land uses to be included in the development of the site and some parameters on development philosophy are established in the early stages. Pedestrian considerations must also be included in this stage. In some cases, the pedestrian can even be the *theme* around which development proceeds. For example, the planners of Maitland Center, an office park near Orlando, Florida, developed a theme of creating a park-like atmosphere in a 35-ft wide landscaping and utility easement along the street system. This theme was carried through to the conclusion of the site planning process.

- *Inventory the site.* Conduct a walking inventory of the prospective site. The walking perspective will help to identify vistas which should be preserved, important historical elements, natural features which would complement the walking environment, existing pedestrian magnets, or situations which could be considered undesirable. Lynch (*1*) recommends the use of a sketch inventory technique to record the important impressions and features of a site and its possible opportunities and constraints. Figure 22 shows a hypothetical sketch inventory and the associated initial ideas for a system of pedestrian walkways.

- *Map adjacent site pedestrian magnets.* Existing and planned (where known or anticipated) pedestrian magnets within a half-mile radius of the site should be mapped. In addition, the existing pedestrian networks should be plotted. From this information it will be possible to determine the general directions the pedestrian network on the site should take and the points along the perimeter where interfaces should be planned. Where existing walkways are immediately adjacent, these connection points will be obvious. Where they are not, then it will be incumbent upon the developer of the adjacent land to accommodate the points established by the site plan. The points should, however, reflect linkages as direct as possible. The biggest difficulty involves trying to determine the character of future developments. A master plan, if it exists, will hopefully provide some guidance. The rule in this case should be to leave open at least a single option for future connections through each side of the development.

- *Fix recreational pathways.* If recreational paths are to be considered, identify the most probable locations, taking advantage of stream valleys, utility easements and natural features. If there are no particularly significant features around which to design the recreational network, the network can be developed in conjunction with other design elements. If there are significant features, the pathway system should be locked in at an early stage, with the remainder of the site designed to complement it. A check should always be made of regional pathways planned to pass near the site.

- *Sketch out more detailed site planning options.* This process might be effectively undertaken by creating a series of overlays to the basic site boundary map, showing proposed building locations, parking lots, driveways and utilitarian walkways. Depending on the site, numerous initial sketch plans may be needed before a more limited number of feasible options emerges. Conflicts can be identified where multiple use of the same space

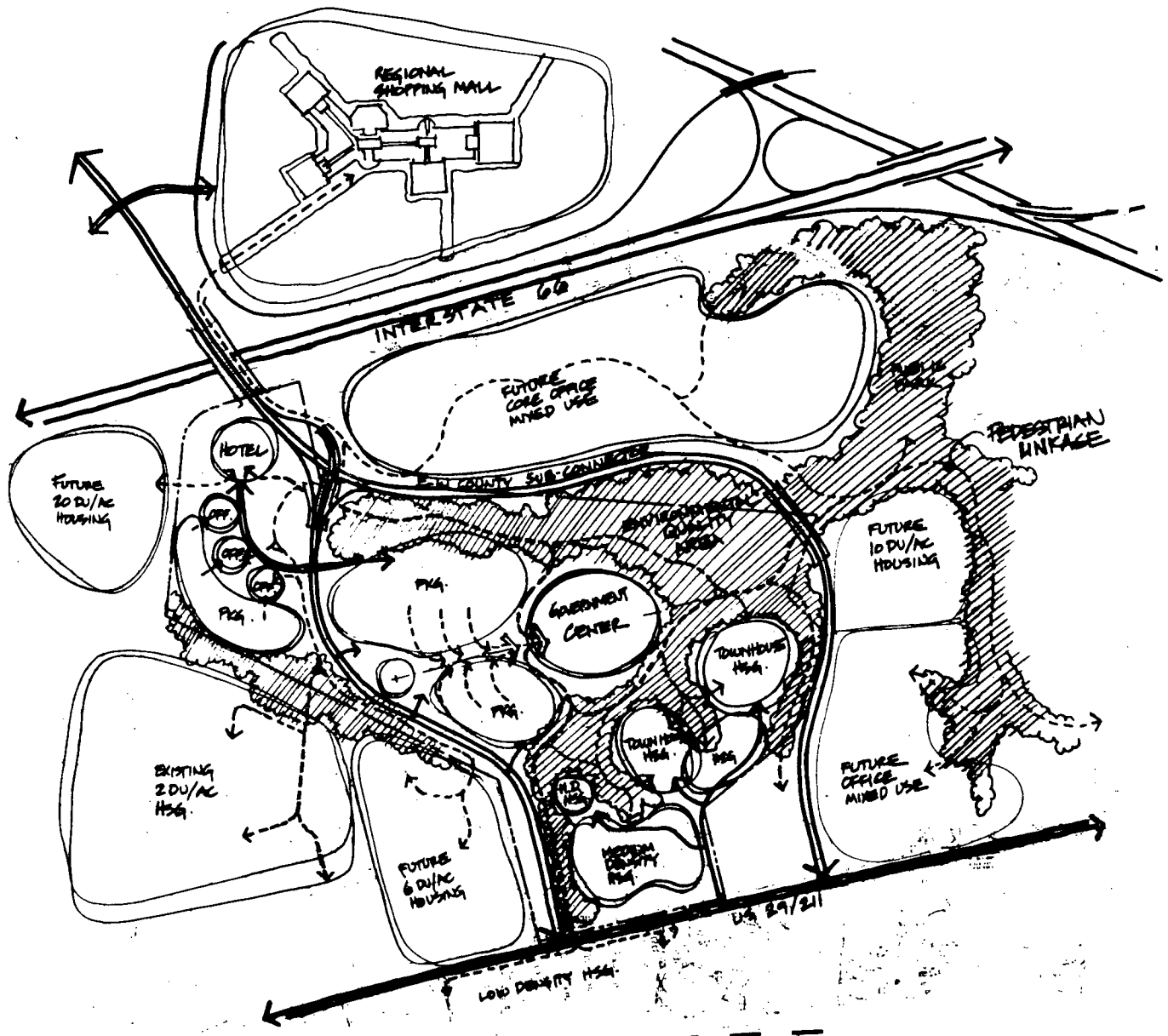


Figure 22. Sketch inventory of a development site, showing consideration of vehicular and pedestrian circulation.

occurs and could be resolved by creating alternative overlays depicting other options.

- *Identify strategic locations for street crossings that take advantage of topography and grade separations for traffic.* Be especially alert to possibilities for underpasses in fill sections or for crossings under bridges which may be needed for other reasons. The incremental cost for accommodating the pedestrian through these facilities is small, if pedestrian planning is done simultaneously with planning traffic needs.

- *Consider the frequency/volumes of pedestrian trips.* The site planning process should review the order-of-magnitude volumes and frequency of pedestrian trips expected. The linkages serving

the most frequent and high volume trips should be given highest priority in design standards and implementation phasing.

- *Review traffic conflict points and refine alternatives.* The planned traffic patterns need to be analyzed in the context of the number of conflict points with pedestrian traffic. This can be accomplished by plotting traffic flow arrows for both motor vehicles and pedestrians each with a distinct legend. The impact of the various crossing points can be assessed individually, once identified, and alternatives to reduce adverse impacts considered. Alternatives may include altering the location of building footprints, rerouting traffic or pedestrian flows, altering access points, discouraging through movements, and/or providing for

grade separation if feasible. Because pedestrian traffic is more sensitive to distance than vehicle traffic, consideration should be given to aligning roadways along preferred pedestrian routes. This is opposite to what normally occurs in site planning.

Simple as it is, the foregoing process provides a logical means to consider pedestrian needs in the site planning process. It is not a straightforward analytical process, but a creative exercise, usually with more than one solution. Structuring the process as above will help the site planner to narrow the options down to those that take advantage of the site's unique features. Public agency review should take place at an early stage in the site planning process, so that the developer can take into account the knowledge of agency staff and probable future requirements to be imposed. A checklist of site plan review items which should be considered by both the developer and public agency was previously shown in Figure 13.

Discussions of the findings from the case studies, literature reviews, and collection of other data are discussed for each of the eight site types in the remainder of this chapter. For each site type, the findings from the research are first presented, indicating trends that appeared, characteristics of pedestrian travel and behavior, or other results having implications on site planning for that use type. The findings are followed by a presentation of planning and design principles, derived from observations made during the course of this research.

FINDINGS CONCERNING RESIDENTIAL DEVELOPMENT

Residential development consumes the major part of the land area in the suburbs. It is also where much of the walking is done, primarily for school and for recreation. Findings and principles concerning site planning in areas of residential development are discussed below.

Street width and configuration have much to do with the pedestrian orientation of a residential area (or lack thereof). Wide, straight streets with long blocks encourage high-speed vehicular traffic. The Dutch "Woonerf" (see Fig. 23 and Ref. 2) has often been cited as a model pedestrian-oriented residential street concept. However, other more traditional street designs can be nearly as effective. Specifically, pedestrian orientation can be enhanced through using the minimum width street to serve the expected traffic volume. For residential areas this means greater widths for collector streets (usually two moving traffic lanes and two parking lanes), and lesser widths for local streets. Reference 3 provides more information on the selection of street width. Wider streets than necessary not only penalize the pedestrian through longer crossing times and higher vehicular speeds, but also add unnecessarily to the cost of development. Reducing street width is probably the most cost-effective method of the street design options for reducing vehicle speeds. However, the street widths listed above may be inadequate in areas with significant snow accumulations.

Reducing block length for local streets, even though short blocks increase the number of intersections and may reduce the yield of residential units slightly, can have a dramatic effect on speed reduction, especially when combined with street width limitations. However, care must be taken to avoid the "maze effect," in making direction-finding difficult. Short blocks also tend to reduce point-to-point walking distances.



Figure 23. The Dutch "Woonerf" (residential precinct). (Source: Ref. 2)

When providing curvilinear streets rather than straight, streets should intersect on straight sections, and primary pedestrian crossing points should not be located on curves.

Although a shoulder can serve as an adequate walkway for low density residential development, a walkway along the road edge is preferable for pedestrian safety and comfort. Pedestrian accidents are about twice as likely to occur on road sections without sidewalks than on sections with sidewalks. The argument is sometimes made by a developer that it is desired to omit sidewalks to maintain the "rural character" of an area. Although this may be a worthy design objective, it can often be achieved to most peoples' satisfaction through use of a winding asphalt pathway in lieu of the traditional curb, gutter, and sidewalk. The pathway can be placed outside the ditch line, with an easement to cover possible width beyond allowable roadway right-of-way. Winding asphalt pathways 4 ft wide are quite adequate to serve pedestrian needs in such settings and blend readily into the rural character.

An internal pathway system, oriented toward the rear of residences, is a desirable amenity for resident recreation. Several site plans of extensive pathway systems are shown in the case studies in Appendix B. An example from the Chesterbrook case study is shown in Figure 24. However, a separated pathway system does not eliminate the need for sidewalks on the street right-of-way. A separated system intended primarily for resident recreation is generally inadequate to serve utilitarian trips, unless it uses the most direct routes between magnets. This was verified in several of the case study sites that had such systems. The resident survey in both Columbia, Maryland, and Chesterbrook, near Philadelphia, indicated resident desire for more sidewalks, especially along the major roads. In Chesterbrook, 56 percent of the residents responding indicated the need for more sidewalks, even though the pathway system was extensive. The site inventories also indicated worn footpaths along the road edge in some areas of these new towns (see Fig. 25). On-site observation, interviews with individuals, and surveys of residents in the case studies indicated that the planning and design of separate pathway systems should consider the following: (1) Security is a primary concern. To the extent possible, visibility should be maintained between the pathway and the residences

VALLEY FORGE NATIONAL PARK

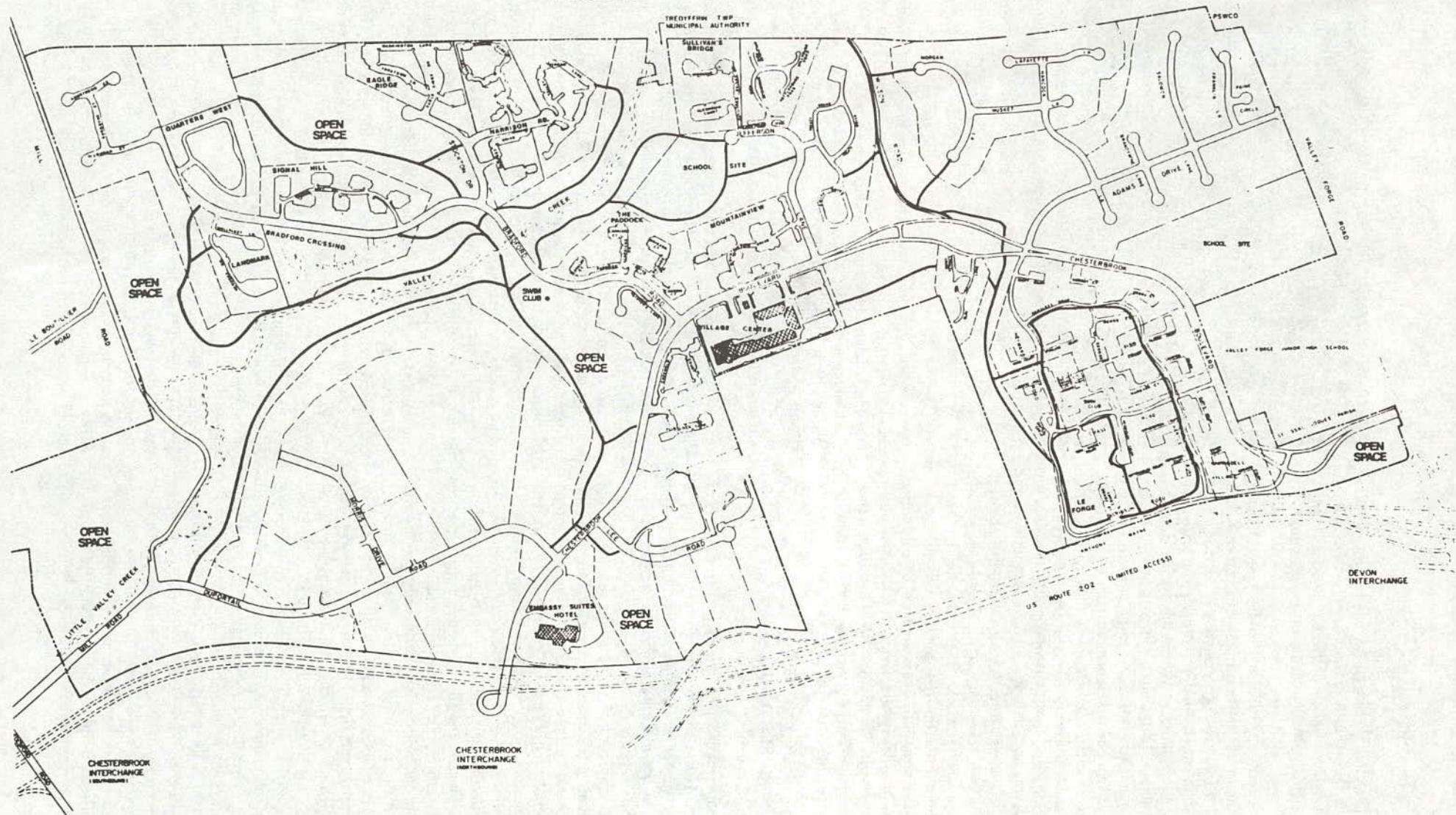


Figure 24. Walkway/bikeway system in Chesterbrook, near Philadelphia.

or roadways. However, many residents consider such a pathway as an intrusion of privacy, and it is difficult to satisfy both criteria. (2) The pathway system should be in place prior to any residents moving in. Experience has demonstrated that residents may object to having the pathways constructed once they move into their homes. This was noted as a particular problem in the Brandermill case study, in which pathway links were not completed due to the objections of residents nearby. (3) To reduce costs, take advantage of the natural features of the site in planning a recreational walkway system. Joint drainage/pedestrian easements were employed in Brandermill to minimize costs. This included several tunnels that served a dual purpose of drainage (only needed at flood level) and grade separated pedestrian crossings (see Fig. 26). (4) Utilitarian paths must be addressed separately, by determining the most direct paths between origin and destination. (5) If bicycle traffic is anticipated, take care to minimize blind curves, and consider a pathway width wider than 4 ft. Sight distance must be as much a concern for bicycle-carrying pathways as for vehicular streets. It is a detail that is often overlooked.

A pedestrian network at the street frontage has several significant advantages over an internal (rear yard) network. The primary advantage is the reduced security problem, at least in perception. One of the case study sites originally planned with an internal pathway system is now emphasizing a front-yard system, but with greater sidewalk setback and more amenities than found in the traditional sidewalk system. In a new development, it is a simple matter to develop the easement agreements to accommodate greater setbacks. If land is to be invested in a pathway system, serious consideration should be given to enhancing the front yard sidewalk system in deference to the internal network, including such features as meandering walkways and additional landscaping between the walkway and street.

Retrofitting a pathway system to an existing neighborhood is difficult. This was a question addressed in a major FHWA study entitled "Feasibility Analysis and Design Concepts and Criteria for Community-wide Separated Pedestrian Networks" (4). The study report indicated the following conclusions: (1) In most residential neighborhoods, the density of development is below that which is required to produce sufficient user demand and systems utilization. In these low density environments, the ability to aggregate random trip-making through consolidation of pathways is virtually impossible. The conventional sidewalk is, without question, the most effective pedestrian accommodation. (2) Pedestrian facilities often do not have a high priority in the overall needs of the community. (3) Success of a facility depends, to a large extent, on the existence within the community of a means to assure adequate maintenance. (4) The most successful pedestrian systems are found in stable, socially cohesive neighborhoods than in less stable, transient neighborhoods where urban problems are greatest. (5) The existence of an organization within the community to assess public information and to participate in the facility planning and location is critical to its success. (6) Neighborhoods that are demographically diverse often have difficulty reaching agreement on collective community priorities regarding environmental upgrading and improvement. (7) For the pedestrian systems examined, most of the neighborhoods where the facilities were implemented had a higher renter occupancy rate than their respective cities in a whole. (8) Those facilities which provide a direct benefit to the



Figure 25. Lack of sidewalks is evident even in this planned community.



Figure 26. Inexpensive pedestrian/bicycle underpass provided in Brandermill.

neighborhood are implemented in response to an existing dysfunction within the community. (9) Facility utilization is directly influenced by the orientation and placement of home sites, as well as the internal room layouts, relative to the pathways. Adequate privacy and provision for supervision of children playing on the facilities are affected. (10) In most cases examined, the existing sidewalk system was adequate for accommodating pedestrian movement within the neighborhood. (11) Where neighborhoods are auto-dependent, and pedestrian facilities lead to a reduction of pre-existing levels of parking, personal mobility and accessibility the community reaction will be negative.

Although retrofitting a comprehensive pedestrian system is difficult at best, progress can be made bit by bit as opportunities arise. Filling in missing links, providing a pocket park in an unused intersection corner, or strategies to control traffic volume



Figure 27. Small "pocket park" created at a residential street intersection in Arlington, Virginia.

and speeds all add to the pedestrian orientation. Figure 27 shows a small rest area for pedestrians, created when one leg of a multileg intersection was closed to traffic.

Subdivision regulations should require additional pathway links through a block, where blocks are long, or through the end of a cul-de-sac where this would provide a substantially shorter pedestrian route. Reference 5, quoted earlier in Chapter Four, provides model language that can be included in the regulations.

FINDINGS CONCERNING SHOPPING CENTERS

Suburban shopping centers have been one of the most visible products of an auto-oriented society. Although, on one hand, the shopping mall affords an almost ideal, climate-controlled pedestrian environment, pedestrian connections from the site periphery are not normally considered a major planning factor and are often an afterthought. While it is true that many other physical and financial considerations drive shopping center development decisions, pedestrian access is a more important design element than typically acknowledged. This is becoming more of a concern as office development springs up around the centers and there becomes more potential for generating pedestrian trips from the site periphery. Outparcel development at shopping centers is becoming a common practice, but a safe, convenient pedestrian trip linkage is often lacking. This section summarizes findings from the analysis of shopping centers along with several principles of pedestrian planning for shopping centers gleaned from the research. Comments are oriented around the regional shopping mall, but could be applicable to smaller shopping centers as well.

Findings

Few examples were found in the site inventories and case studies of exceptional planning for the pedestrian at shopping centers. The several noteworthy examples include the following.

At Columbia Mall, structured parking was employed on one side of the mall as a way to keep the mall and a nearby office building spatially close. A grade-separated crossing of a major street was planned into the building connections, as shown in Figure 28. A series of pedestrian islands was installed, in the Oxford Valley Mall, to provide refuge for pedestrians traversing the parking lot. The islands were oriented diagonally to bring pedestrians in from nearby intersection crossings (see Fig. 29). They not only provide for refuge but help to slow traffic through the parking lot. At the Plymouth Meeting Mall, a pedestrian aisle and inexpensive canopy were provided to connect the main part of the mall with a mall expansion area nearby (see Fig. 30). A small shopping center in Brandermill provided special pedestrian aisles and elevated sidewalks across vehicular driveways (creating a hump over which vehicles were required to drive—see Fig. 31). However, the aisles were underutilized. A few other shopping centers provided clearly delineated walkways and crosswalk markings coming in from the site periphery.

Special pedestrian aisles in parking lots, separate from vehicular driveway aisles were investigated in this research. Observation of pedestrian usage rates of these special aisles, however, indicated that they are not useful for widespread application. Counts of the use of special parking aisles in one shopping center parking lot indicated that 81 percent of those parking *did not* use the pedestrian aisle, but walked in the vehicular aisle instead (sample size = 83 persons observed; percentage is plus or minus 8 percent with 95 percent confidence). Visual observation of one other parking lot suggested similar percentages. From these observations, it was concluded that special pedestrian aisles may be appropriate where pedestrians are being guided between major destinations directly to and from the building entrances. They are not appropriate for most parking lot aisles, especially those that are not located directly in front of a building entrance.

Chapter Two reviewed the characteristics of pedestrian trips to shopping centers. It is typical to find that approximately 2 percent of trips made to a regional mall were by walking. Smaller neighborhood or community centers would have 2 to 8 percent arriving by walking, but 15 to 20 percent have been noted in some cases. Retail sites in suburban activity centers receive a much larger percentage, indicating the advantages of compact mixed-use in promoting pedestrian travel.

Guidelines

Some general guidelines for pedestrian-sensitive design of shopping centers were derived from the case studies, review of the literature, and experience of the research team. These guidelines include the following.

Locate the most important pedestrian linkage from the mall to a major adjacent development. If the mall is well-linked in one direction, a great deal has been accomplished. Two directions are unusual. However, additional potential desire lines to other magnets should also be mapped to determine whether reasonable connections can be made through the parking lots.

Incorporate the primary pedestrian walk trip desire line (and secondary desire lines, where practical) into early site design schematics. Try to coordinate this path with auto access intersections and roads and mall entry points. Only by orienting the basic layout of the site around the pedestrian linkage(s) will effective pedestrian pathways be provided. Pedestrian connections must be direct or they will be underutilized.

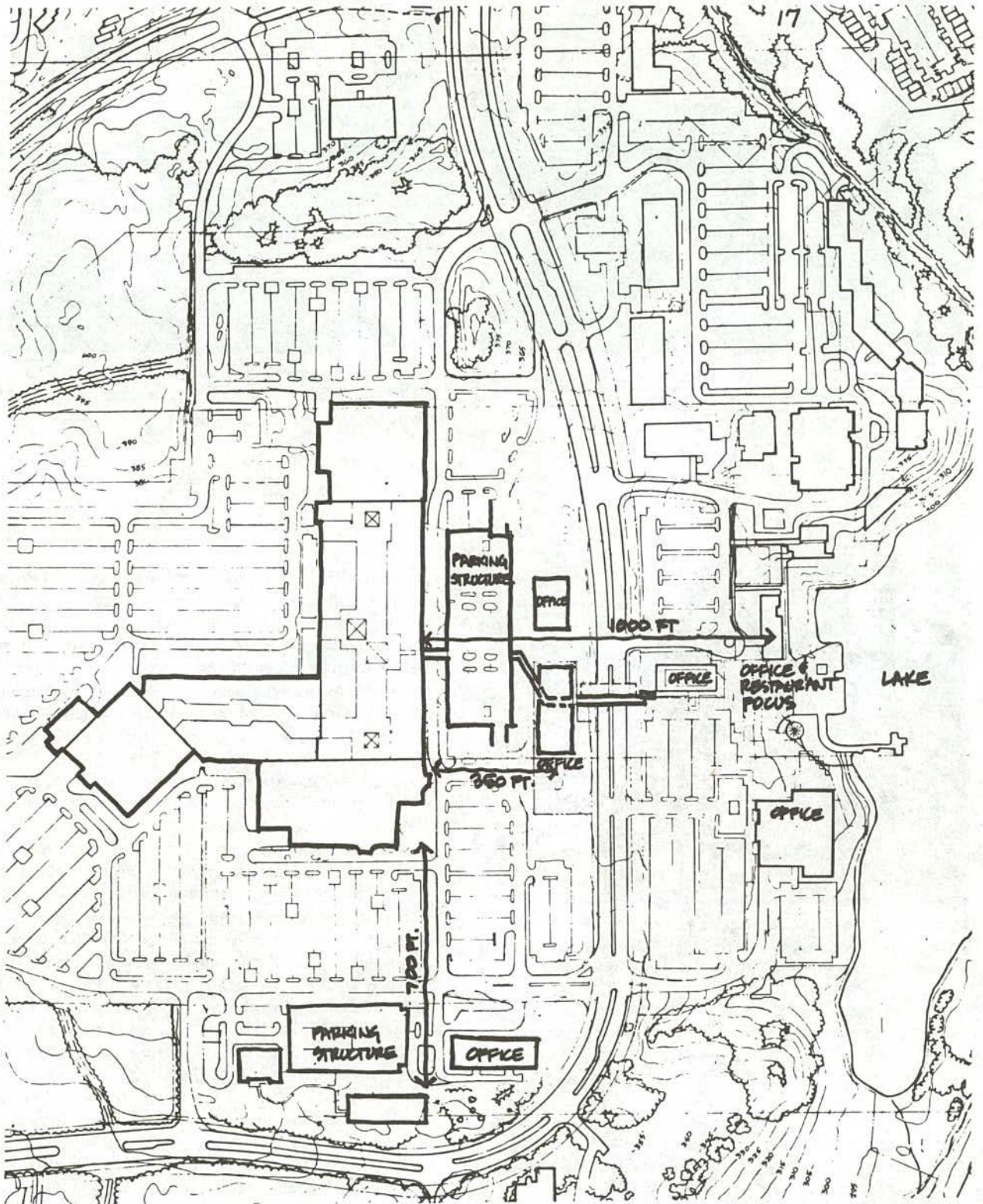


Figure 28. Site layout showing orientation of structured parking on the mall side attracting the most pedestrian trips.



Figure 29. Diagonal pathway through parking lot constructed using islands at each parking aisle.



Figure 30. Covered walkway through a parking lot. (This canopy at the Plymouth Meeting Mall delineates the walkway location to both pedestrians and motorists.)



Figure 31. Elevated walkway/speed hump. (These elevated walkways at the Brandermill PUD provide a convenient path for pedestrians while controlling vehicle speeds. However, they are underused.)

Where it is not possible to orient the pedestrian path longitudinally down the parking aisle, use a "stepping stone" approach, in which landscaped islands are placed along the pedestrian desire line. These will not only serve as a refuge for the pedestrian in an otherwise open parking lot, but will also channelize and discipline traffic flow (see Fig. 32 and the Oxford Valley Mall case study).

Minimize the distance from the shopping mall to the adjacent uses along the primary pedestrian desire line by: (1) incorporating structured parking on the side of the mall from which the most pedestrian trips are being attracted (see example from Columbia

Mall, presented previously); (2) locating department stores away from this path area; (3) considering the adjacent or outparcel uses like an anchor in themselves; and (4) configuring the mall to put the bulk of the leasable area away from this path in order to minimize parking needs adjacent to this side of the mall.

Minimize the delay in pedestrian access by limiting or eliminating the number of points at which traffic is encountered. Alternatively, institute arrangements for assigning right-of-way to pedestrians over motorists (e.g., STOP signs).

Animate the pedestrian path to the maximum extent possible; i.e., add small-scale convenience uses to the mall site along the path; create development sites for higher density office; locate the path along some amenity such as water, and include other amenities, such as plantings and street furniture, along the path.

Integrate the major pedestrian linkage into auto access points, in order to provide safe, easily-perceived pedestrian entries. (1) At major intersections provide clear crosswalks, with median refuge points and an adequately timed pedestrian walk and clearance interval. If possible, choose an intersection for the major pedestrian entry that is not the most severe in terms of traffic movements but which will be controlled by a traffic signal (see Figs: 33 and 34). This will create a safer pedestrian entry. (2) At entry roads (see Fig. 35) provide sidewalks with some protection from the street and a clear path to a major mall entry. The need for directional signage will be minimal if the destination and path are clear. (3) Avoid having pedestrians cross major traffic streams without the protection of traffic control (signals or stop signs). Creative entry configurations can minimize pedestrian-vehicular conflict. The ring road concept reduces pedestrian conflict adjacent to the building but displaces the volumes to the site periphery. Stop signs can be considered at pedestrian entry points along the ring road, if no other traffic control is provided and if the volume of pedestrians is believed to warrant it.

Provide a reasonable path through surface parking lots. (See Fig. 36.) The major pedestrian connection to the mall may be

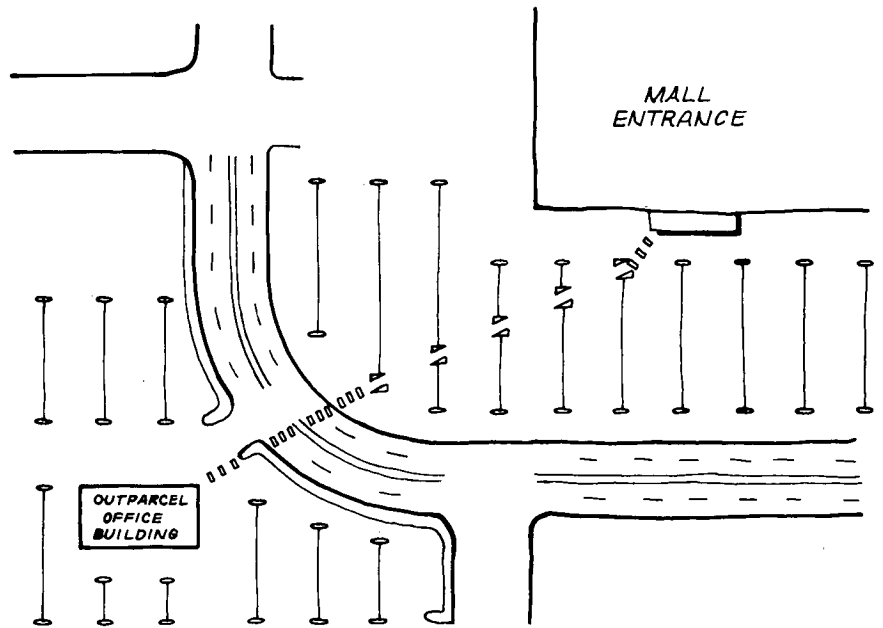


Figure 32. "Stepping stone" approach to assisting pedestrians across a wide, open parking lot.

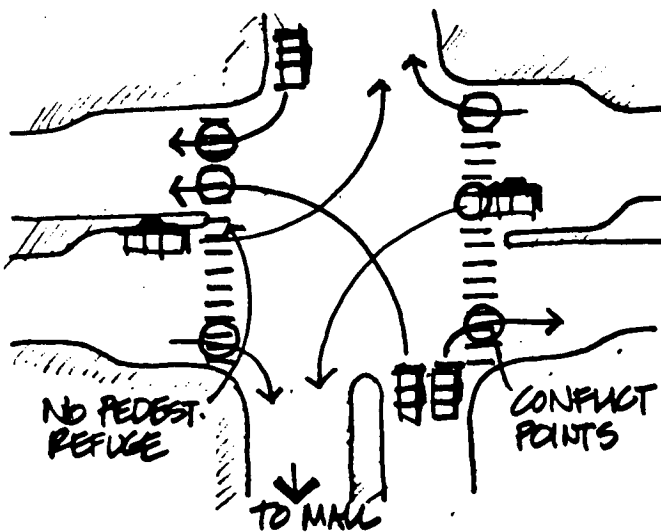


Figure 33. Four-way intersection design creating numerous pedestrian/vehicle conflict points.

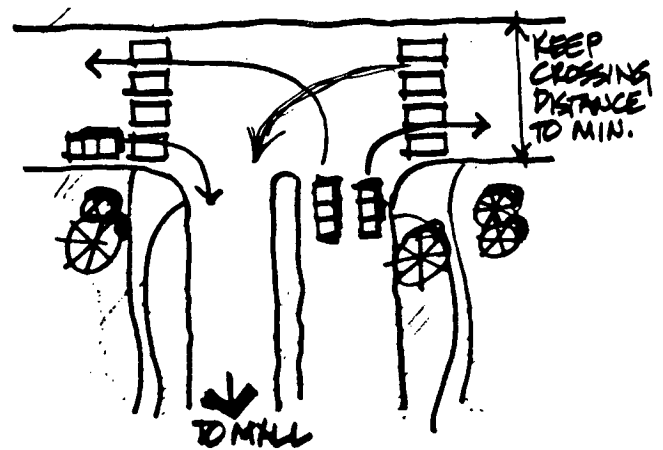


Figure 34. Driveway design which is more pedestrian-oriented by virtue of its simplicity.

able to be done within a landscaped median if only done once. If this is impossible, one of the solutions in Figure 36 will also provide good access. However, these solutions are to be designed not primarily to move people from parking to the mall, but to safely guide pedestrians in from the site periphery.

Channelize vehicular paths through parking lots with landscaped islands. Open parking lots, such as the one shown in Figure 37, produce undisciplined vehicular movements, and provide no points for pedestrian refuge. This parking lot has since been retrofitted with landscaped islands and vehicular driving aisles (in conjunction with the expansion of the shopping center).

As a result, the pedestrian walking across the parking lot is much more secure and less exposed to vehicles, which previously traversed the lot in random fashion. Reference 6 provides guidelines on the landscaping of parking lots.

Provide pedestrian paths through structured parking garages. Where structured parking is between the mall and the pedestrian path, people will be brought through the parking either on the top level or within/under the structure. Either one is possible if some attention is paid to making the path clear, safe, and direct. Utilize the top deck of parking where permitted or dictated by topography (Fig. 38). Provide some sunlight or planting where the path is located underneath the parking deck (Fig. 39).

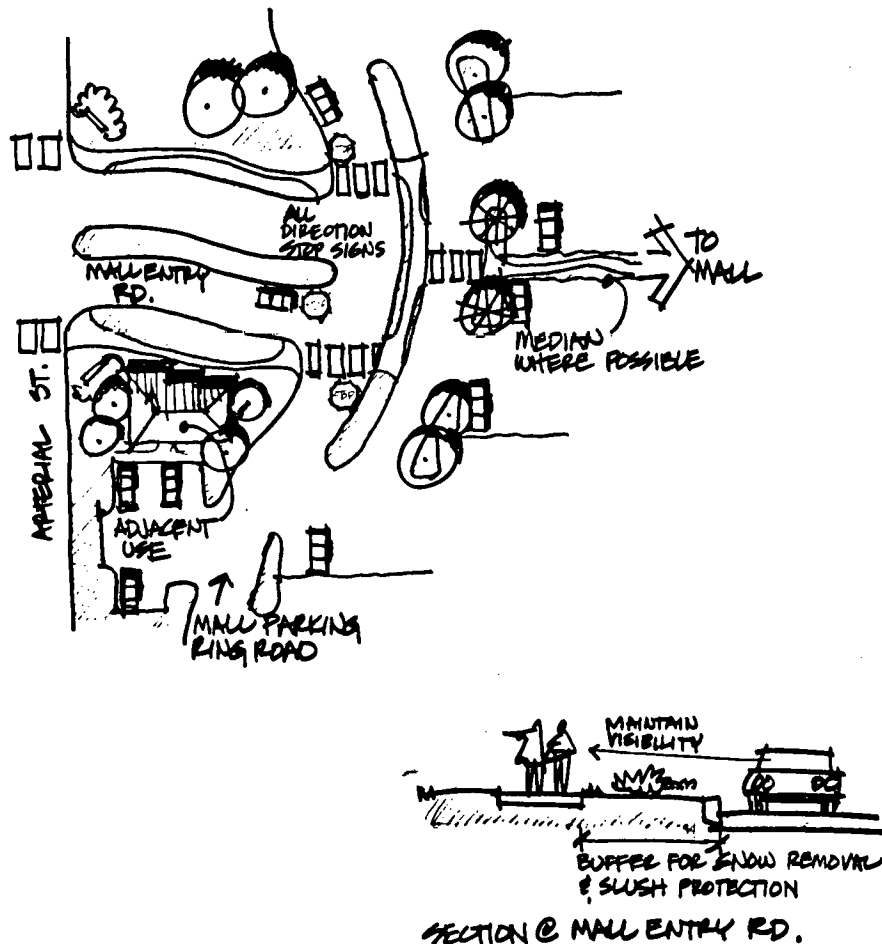


Figure 35. Entry road designs incorporating safe pedestrian walkways.

Do not use pedestrian bridges or tunnels unless dictated by topography. Keep the path at grade and as visible from the street as possible.

Speeds along the driving aisle in a major shopping center are usually low, as there is little through traffic and pedestrian volumes tend to inhibit speed. In areas of a shopping center where significant pedestrian flows conflict with higher speed traffic, consideration should be given to some form of traffic control. The heaviest conflict points are potential locations for application of stop control.

FINDINGS CONCERNING OFFICE/INDUSTRIAL PARKS

Office and industrial parks are typically large-lot subdivisions containing buildings designed for office, manufacturing, or warehousing functions. These complexes represent concentrations of employment and may have high volumes of truck traffic. While much of the access to these sites is by automobile, walk trips from transit stops for lunch time activities and recreational

purposes can be significant, particularly for office-oriented uses. The prevalence of walk trips within the park is largely dependent on the mix of uses. Listed below are some of the findings related to site planning for office and industrial parks.

Findings

The mixing of land uses in a predominately office park setting is a worthy goal. Providing significant residential opportunities nearby will permit a larger share of work trips to be made by walking. Research has indicated, however, that the number of residents living close to work will be relatively small. Studies at a Los Angeles area mixed-use megacenter indicated that only 5 to 10 percent of residents that lived within or near the center worked there (7). Other studies have indicated that one can expect no more than 6 to 7 percent of employees in a major mixed-use area to walk to work. Yet, compared to a completely auto-oriented arrangement of uses, mixed office/residential uses provide a significant incentive for reduced auto travel. According to a 1984 survey of large-scale office parks, over 40 percent

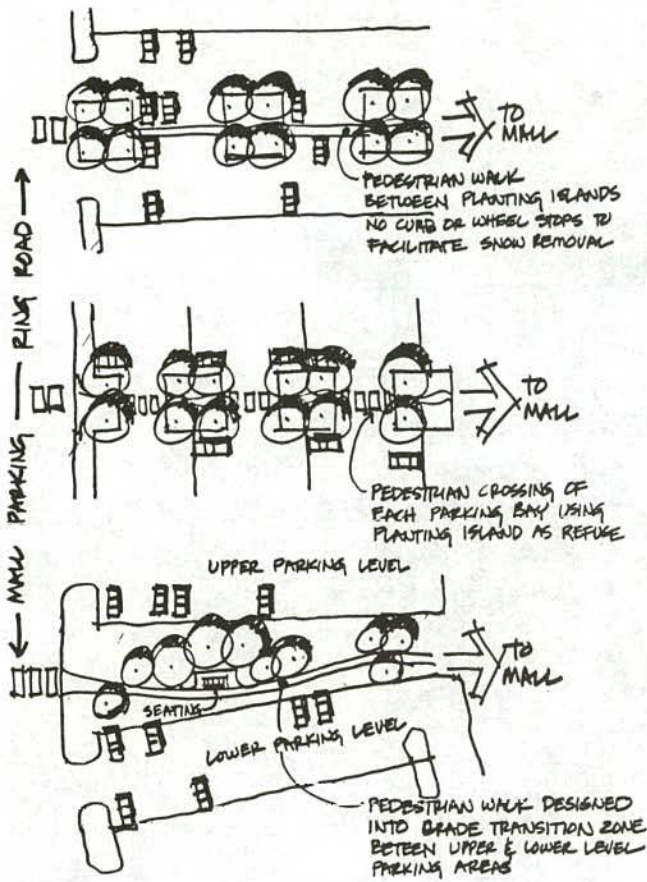


Figure 36. Design concepts for providing reasonable paths through parking lots.

are now providing support retail and service uses (7). Restaurants are the primary supplementary use.

Transit service to most office parks is minimal, and deficient linkages between transit stops and office buildings further discourage transit use. The survey of office parks cited earlier indicated that the average distance between the nearest bus stop and the building entrance was 480 ft. This was four times farther than the average parker had to walk.

The case studies of office parks pointed out the deficiencies in many of the parks. However, several instances were found of particularly good pedestrian planning. The Maitland Center office park near Orlando, Florida, provided an extensive front-lot pedestrian pathway system along a landscaping and utility easement (typically 35 ft wide) created especially to enhance the pedestrian environment. Figure 40 shows an example of the pathway. Refer to Appendix B for more details.



Figure 37. Open, high hazard parking lot.

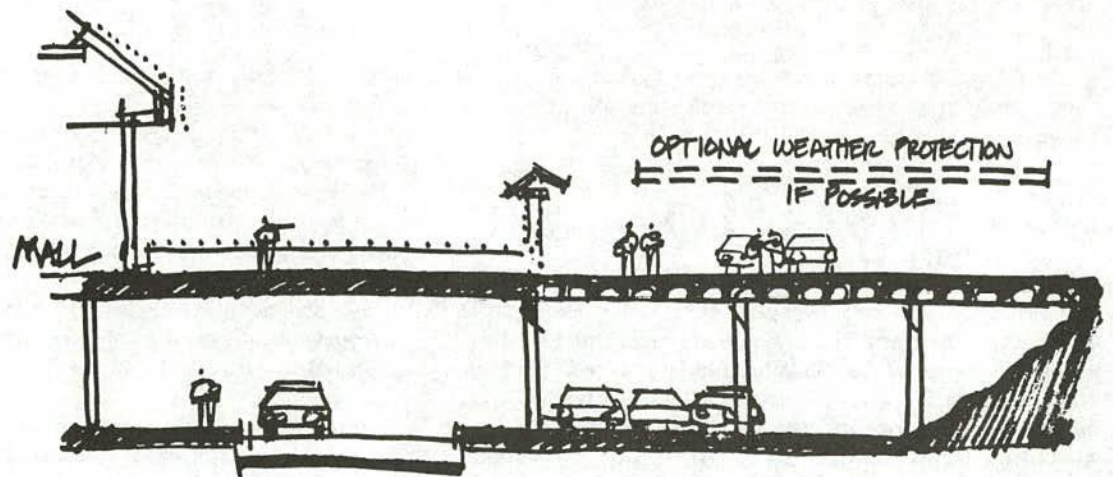


Figure 38. Design concepts for providing multilevel passage to mall area.

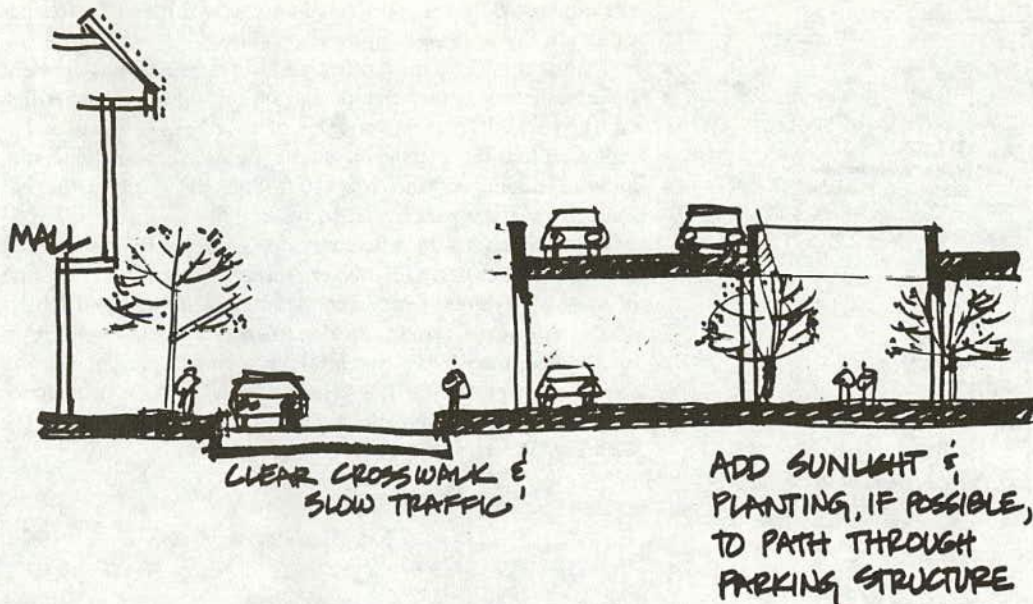


Figure 39. Design concepts for adding sunlight and plantings within structured parking.



Figure 40. Pedestrian pathway in Maitland Center. (Source: Urban Land Institute Project Reference File, Vol. 14, No. 13)

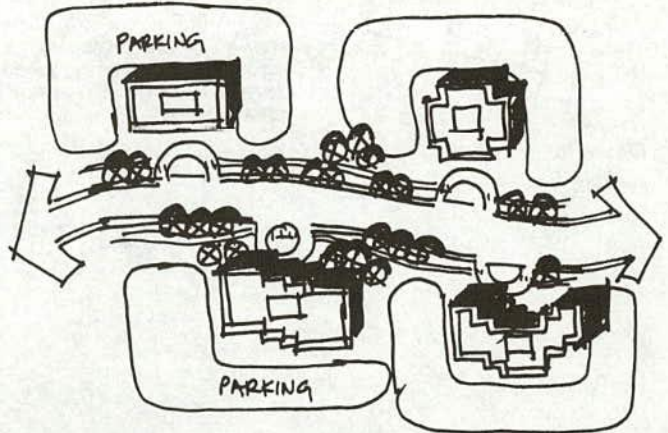


Figure 41. Typical design concept in which buildings are oriented along streets with sidewalks.

The following discussion presents several guidelines for consideration in creating pedestrian-sensitive site plans for office parks.

Guidelines

Encourage compact building grouping patterns that will allow and even encourage some pedestrian trips within the park: (1) Buildings can be oriented along a primary street with sidewalks, such as in Figure 41. (2) Buildings can be oriented around or along a pedestrian amenity space, such as in Figure 42. (3) Buildings can be organized around a centralized service commercial or recreation focus (see Fig. 43) often with increased density closer to that focus. (4) Buildings can be grouped in combinations of 2, 3, or 4 rather than single freestanding units

in order to create a pedestrian and amenity zone between them, as in Figure 44.

Orient site layout to effectively connect with nearby off-site pedestrian facilities (e.g., recreational facilities and retail stores).

Create pedestrian route continuity by building sidewalks on all major boulevards and streets. Sidewalks need not slavishly follow the street alignment, but can meander slightly, creating interest and variety in the route.

Make provisions for a continuous pedestrian network while the park incrementally develops. In other words, do not allow gaps in the system even though all site frontages may not be developed.

Provide pedestrian amenity space within these parks. For example, provide landscaping, benches offset from the walkway and pedestrian level lighting. Appendix B provides several examples from the case study sites.

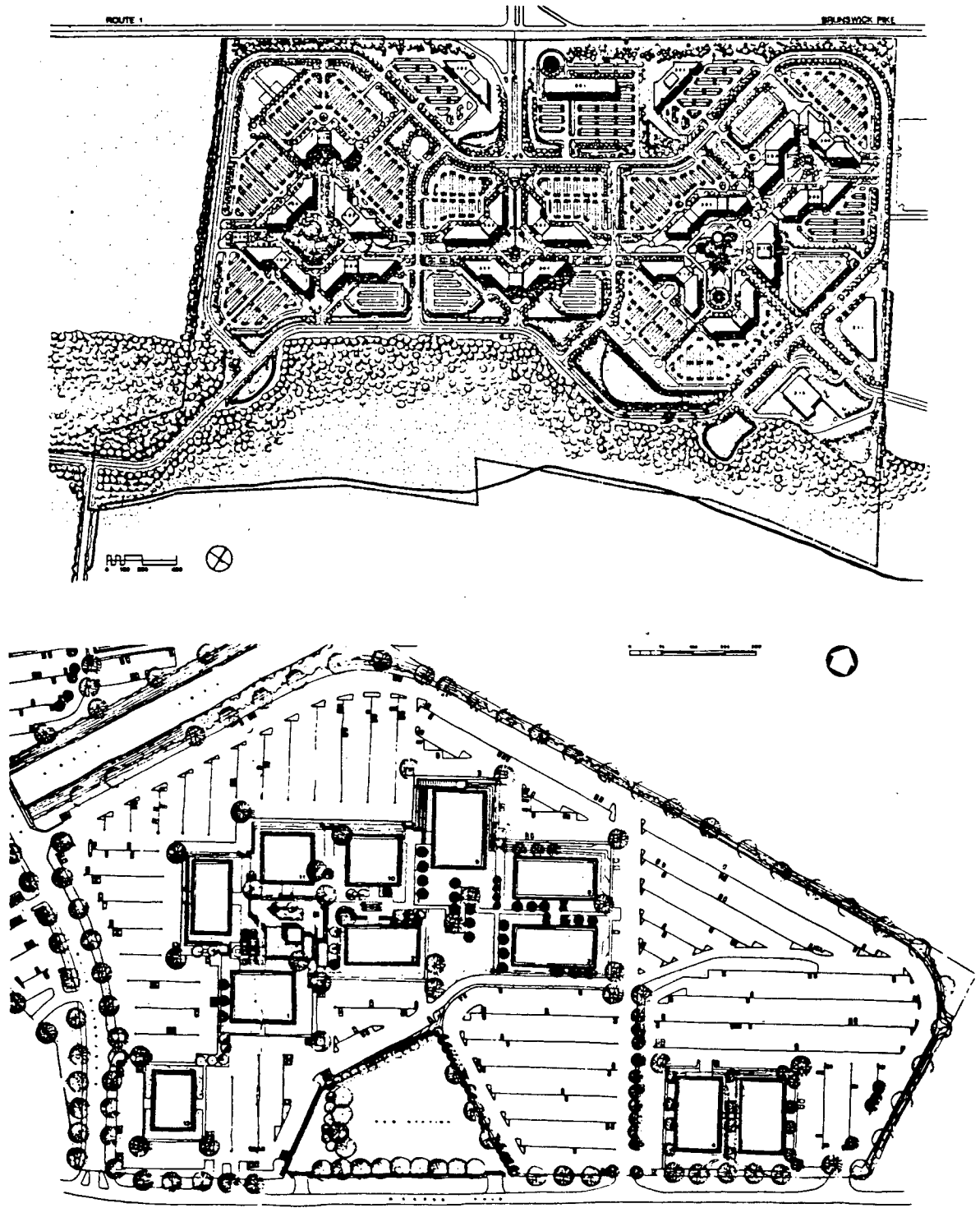


Figure 42. Examples of buildings oriented around pedestrian amenity space.

Applying these design guides may be constrained by the size of the office park and the individual lots; the fragmentation of ownership in developed parks; the high auto/truck orientation of some parks; the lack of requirements for sidewalks in subdivision regulations; the extensive areas usually required for

parking; and the often remote locations. Several office park case study sites illustrated the effectiveness of developer-initiated design guidelines in coordinating the overall design and implementation of pedestrian facilities.

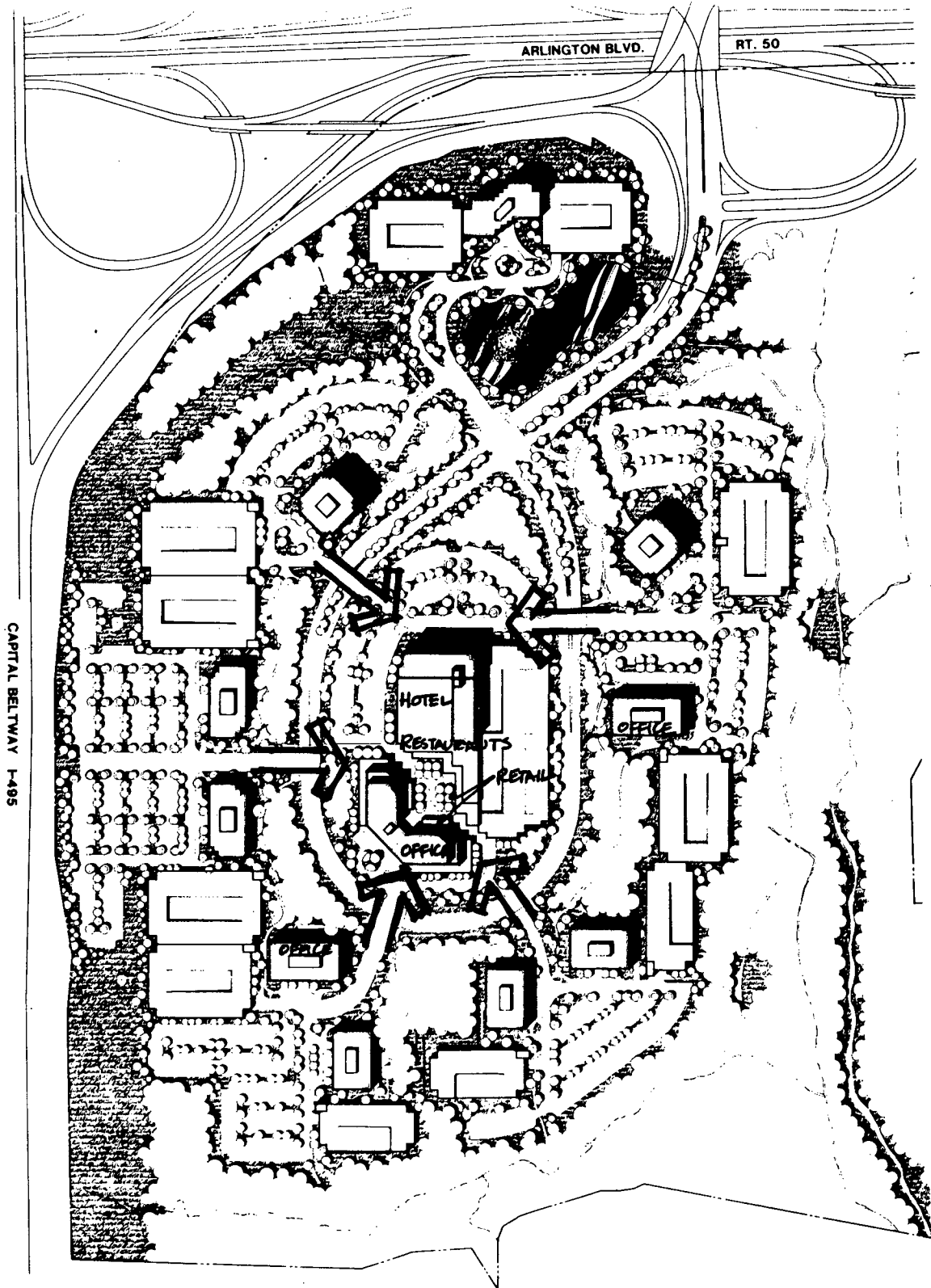


Figure 43. Buildings oriented around centralized service commercial or recreational focus.

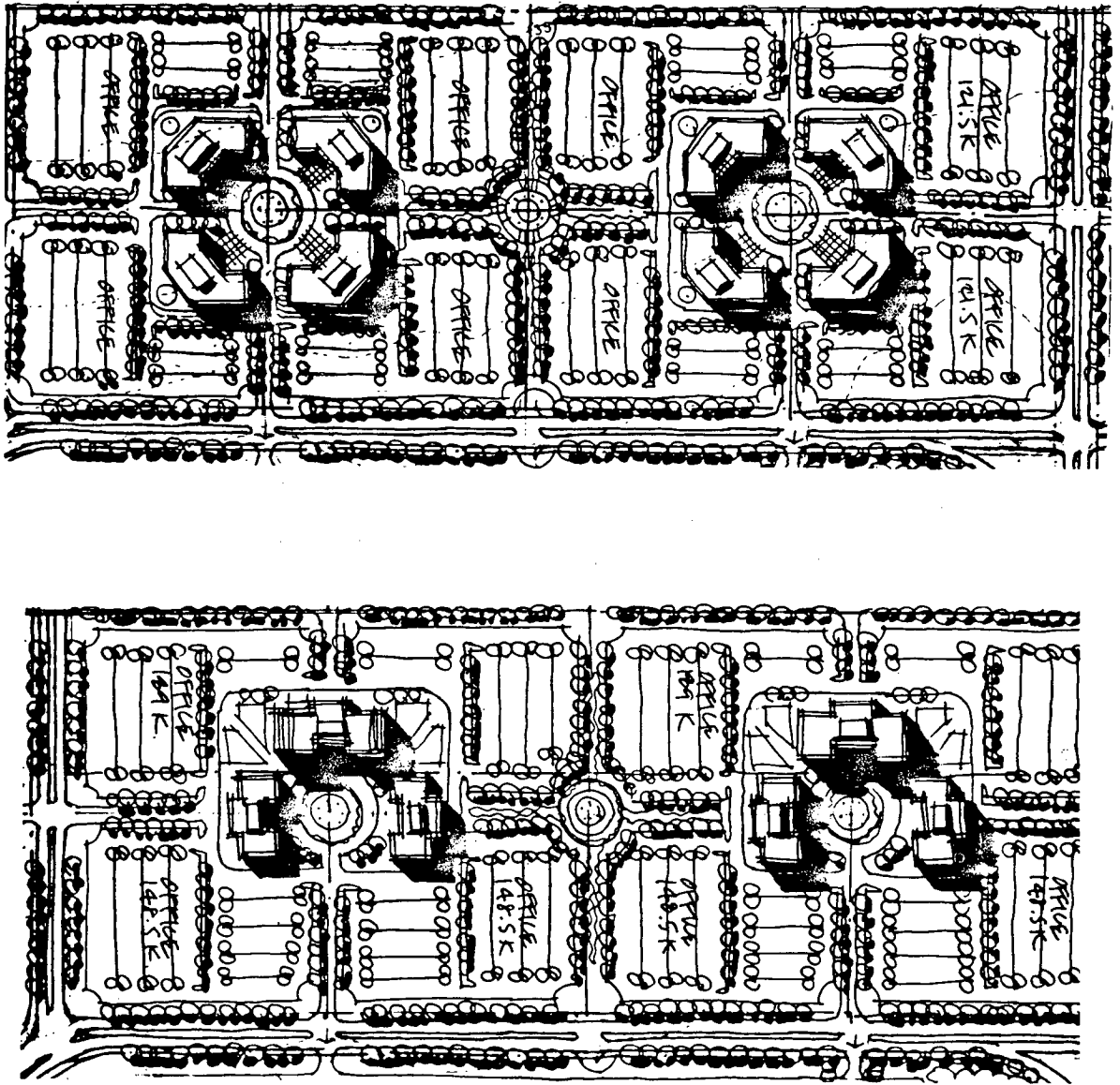


Figure 44. Design examples showing a clustering of groups of buildings to provide pedestrian focus areas.

FINDINGS CONCERNING MIXED-USE DEVELOPMENTS

Suburban mixed-use development began with the new communities movement in the 1960's but has evolved to also include many smaller developments. While these smaller developments do not create an entire community, they are more complex in pattern and development process than single-use projects. This development type is characterized by a single owner or developer who maintains long-term control over the character and quality of development that occurs, most often starting the project from the raw land stage, and includes a mixture of synergistic uses such as office and hotels, retail or service commercial uses, housing and perhaps even cultural or recreational facilities. Because of this synergy, total development density may exceed that of stand-alone office/industrial parks. Mixed use, in the

context of this discussion, represents a single-owner site, with emphasis on commercial activity. PUD's were treated under residential development.

The following findings from the analysis of pedestrian planning and design elements for mixed-use development are highlighted in the following discussion.

Findings

Mixed-use developments provide the highest potential for persons to live close to work of any development type. Still, only 5 to 7 percent, at best, of those employed at a mixed-use center walk to work. Surveys at Skyline Center in Falls Church, Virginia (see case study in Appendix B), indicated that only slightly more than 3 percent of the employees walked to work. Cervero

(7) suggests the possibility that many workers may prefer a change in environment between their workplace and home location. Others may prefer a housing style not available near the mixed-use center. Higher density housing on the site, surrounded by a mix of lower density multi-family and single-family homes would appear to optimize the potential for pedestrian commuting.

The travel characteristics of midday trips at mixed-use centers are highly dependent on the spatial relationship among uses. Data tabulated from surveys of office buildings in Fairfax County, Virginia, indicated that 20 to 30 percent of midday trips from office buildings in mixed-use settings were made by walking (mostly for shopping and eating). Only 3 to 8 percent of midday trips from office buildings not in mixed-use settings were made in the walk mode. Thus, the proximity of mutually attracting land uses is, in fact, an important element of convenience for those that live and work there, and has a significant effect on midday auto usage. Even at mixed-use centers, however, there can be much variation in the spatial relationship among uses. The more compact forms will always be advantageous to pedestrian travel, but must be more careful to preserve pedestrian amenity space.

The case studies of mixed-use developments indicated a variety of design philosophies, ranging from superblocks to parkway type arrangements (more diverse). The more dense arrangements, such as Skyline Center, incorporated a great deal of structured parking. Still, much of the housing was too far away to expect most residents to walk to the central shopping mall. Several of the buildings were also separated from the rest of the development by an arterial roadway. Disney Village was an example from a rather unique implementation setting but which incorporated some exceptional design elements for pedestrian convenience and safety. They would do well to be copied elsewhere.

The layout of a site for mixed-use development can be conceptualized to enhance the pedestrian-character and promote walking trips to and within the site. Mixed-use development, almost by definition, has perhaps the greatest pedestrian-orientation potential of any land-use type. In fact, much like shopping malls, the pedestrian circulation system can be turned inward and even enclosed. Even if the central area is not enclosed, there is still a very favorable pedestrian orientation. The following guidelines should be used in the site planning process.

Guidelines

Establish the overall philosophy for the traffic network. Figure 45 shows several alternatives. The superblock will be most pedestrian-oriented internally, but poses greater access problems from the perimeter, and longer walking distances from the parking lot.

Create small zones of uses integrated with each other so that destination uses such as retail services, restaurants, schools, recreation centers, etc. can be as close to origin uses such as housing or office as possible, while still respecting the development needs of each use (see Figs. 46 and 47).

Orient uses and buildings along a street system with sidewalks. These sidewalks may meander along the street edge in order to create visual interest and some separation from the street pavement in addition to landscape opportunities (see Fig. 48).

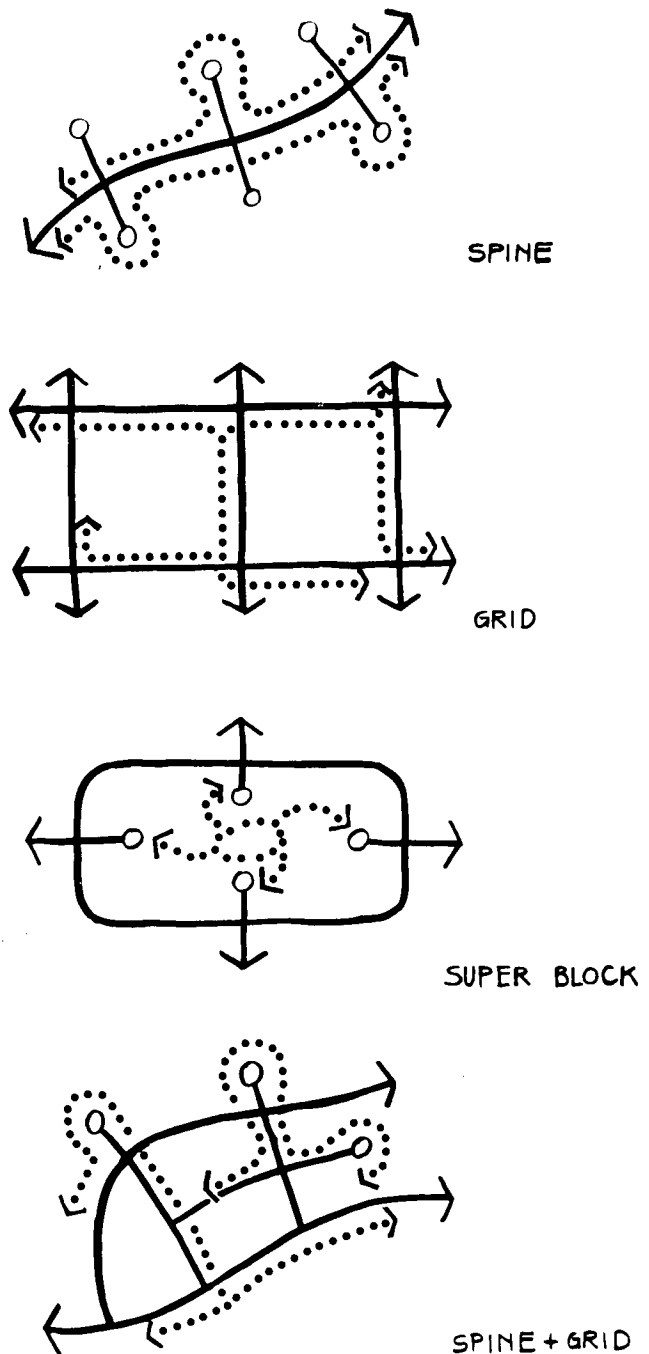
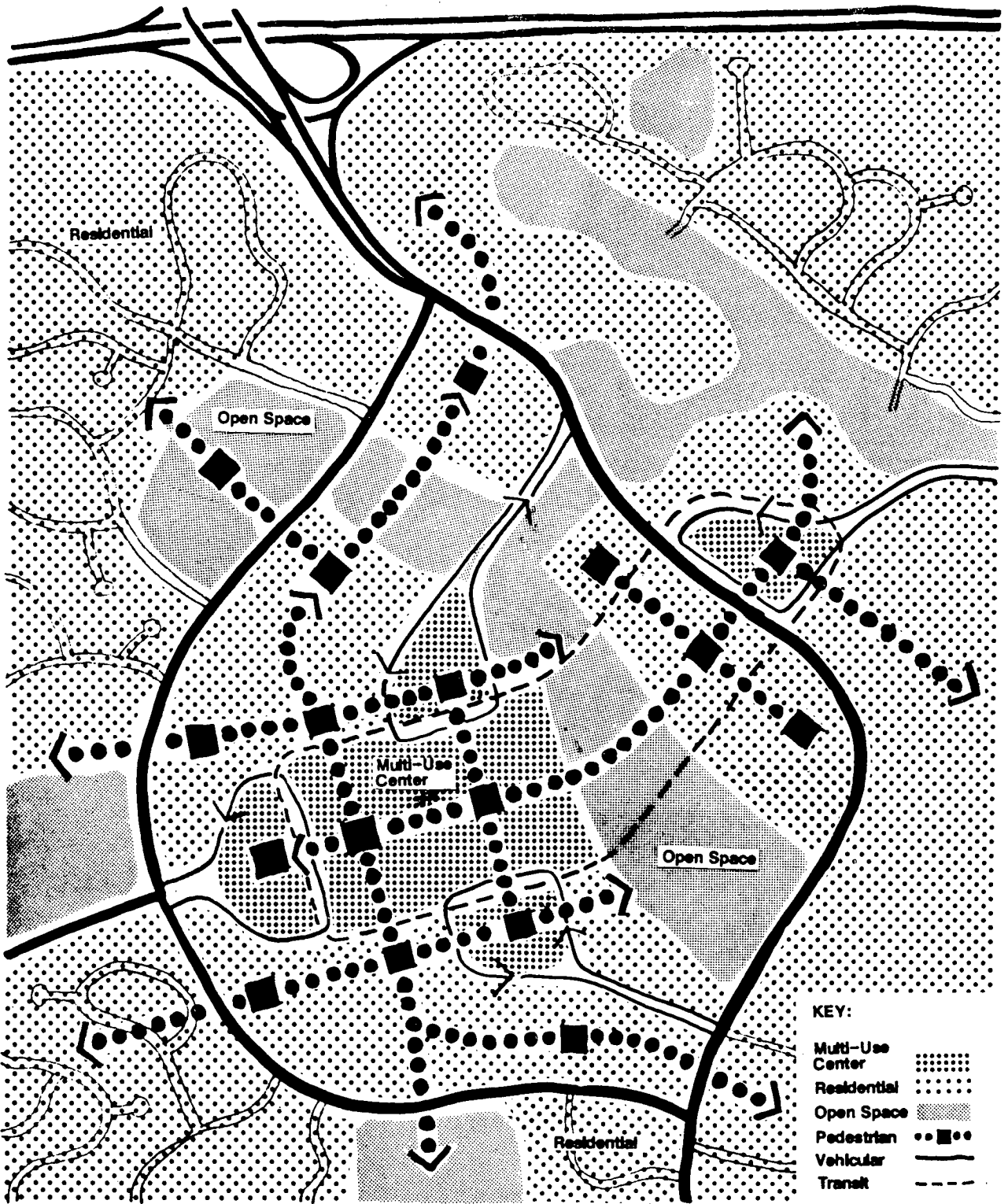


Figure 45. Alternatives for the traffic and pedestrian network.

Identify potential linkages to other magnets nearby and provide a walkway from anticipated transit stops (usually next to a vehicular entrance).

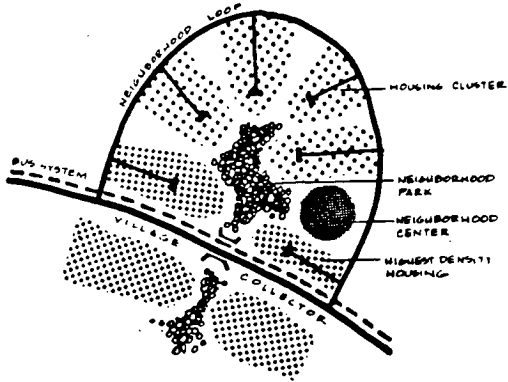
Although most people will be dependent on the auto to reach a mixed-use site, once there they should be able to move about exclusively on foot. Sometimes, however, the large size of these projects leads to a scale that is not conducive to pedestrians, especially if the FAR (floor area ratio) is low. The urban village concept, discussed in Chapter Three, is a worthy pedestrian-oriented design strategy to pursue.



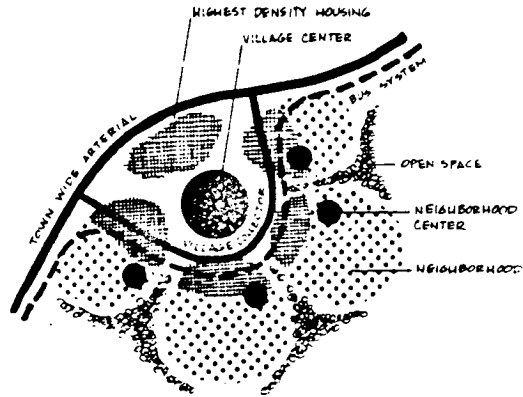
DESIGN CONCEPT FOR A NEW COMMUNITY

Figure 46. Multi-use center integrated with housing and transportation facilities, including a pedestrian network.

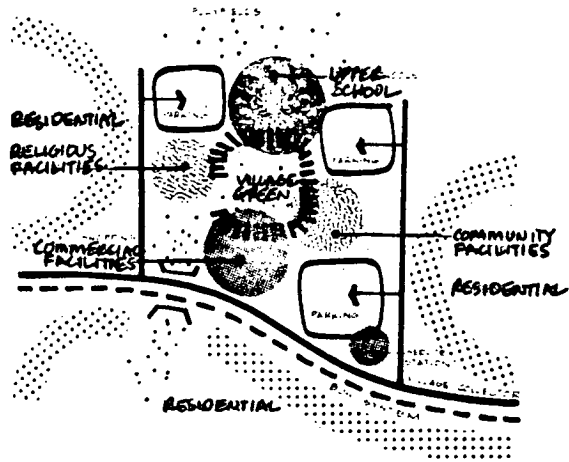
Below Diagram of a neighbourhood.



Below Diagram of a village.



Below Diagram of a village centre.



SOURCE:
THE COLUMBIA PROCESS:
THE POTENTIAL FOR
NEW TOWNS BY
MORTON HOPPENFELD

Figure 47. Concepts for maintaining integration of uses to keep origins and destinations close.

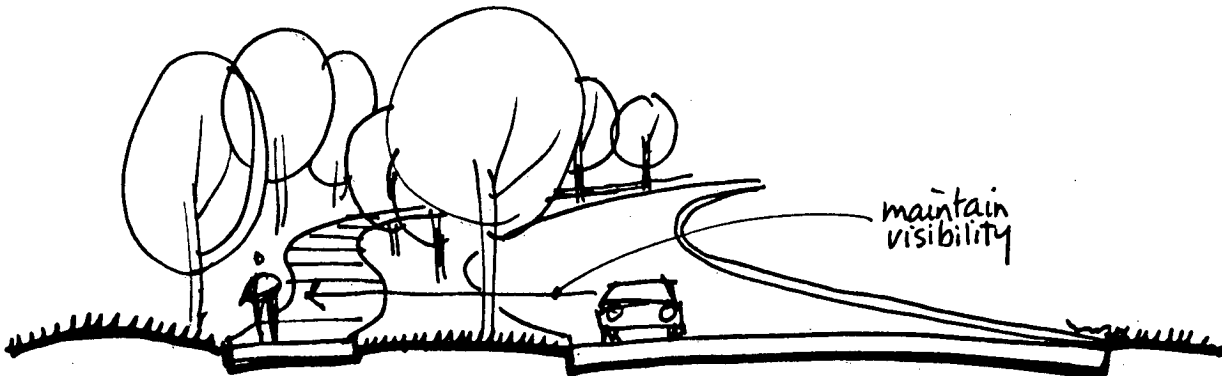


Figure 48. Interesting pedestrian space provided while maintaining visibility.

FINDINGS CONCERNING COMMERCIAL STRIP DEVELOPMENT

Commercial strips are defined as those areas fronting on major streets and highways which develop for commercial purposes to take advantage of access by and exposure to traffic. Commercial strips may be made up of fast-food places, specialty retail shops (i.e., hardware or paint stores), service stations, convenience food stores, drug stores, and other such commercial establishments. Typically, these developments take place on a relatively narrow strip of land immediately adjacent to the road right-of-way and are randomly mixed. Strip development is typified by frequent driveways, many conflicting vehicular turning movements, visually cluttered backgrounds, and a generally undisciplined vehicular and pedestrian environment. It is a development type not to be encouraged; but where it does occur, the adverse impact on pedestrian convenience and safety can at least be controlled.

Findings from the analysis of site planning for commercial strips are as follows.

Findings

The perception of an area as a commercial strip is flavored heavily by the extent to which vehicular access is controlled. Access is more controllable and the pedestrian environment more friendly where parcels are of larger size. Figure 49 shows two sections of International Drive near Orlando, Florida. The top photograph shows the section north of Sand Lake Road developed in the traditional strip commercial style. The section immediately to the south is developed on linear parcels of similar width, but has been planned as one cohesive unit. Both lateral and longitudinal pedestrian movement is easier in the southern section. Better traffic discipline allows pedestrians to more readily spot turning vehicles. Medians make it easier to cross the street (the northern section has no median—see Chapter Five for discussion of the importance of medians).

Pedestrian overpasses are not usually appropriate in commercial strips, unless topography is particularly favorable (e.g. roadway is in a cut section, with little vertical rise needed in the bridge). Although there may be exceptions, the pedestrian crossing locations are too diverse and street-level crossings are usually most direct. Counts at several pedestrian overpasses along an arterial in Albuquerque, New Mexico (see case study of Tramway Boulevard in Appendix B), indicated that only a little over 10 percent of the pedestrians crossing Tramway Boulevard in the vicinity of the pedestrian overpasses used the overpasses. Reference 8 describes some of the problems and suggests warrants for pedestrian overpasses.

Wide, undivided arterial highways and highways with two-way left-turn lanes pose particular hazards and inconveniences to pedestrian crossings. Commercial strip areas with medians were observed to have much more disciplined traffic movement and make the crossings easier by staging them over one direction at a time (see Chapter Five for functional analysis of medians).

Based on the case studies and on information obtained from the literature and from practitioners, the following guidelines are suggested for pedestrian planning and design strategies along commercial strips.

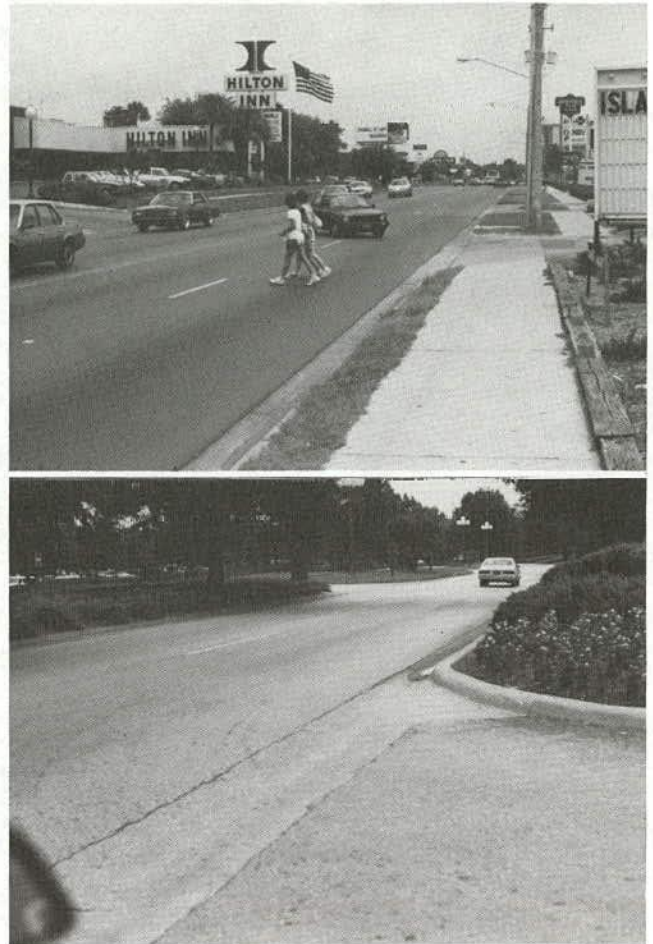


Figure 49. Contrast of divided and undivided sections in Orlando. Top photo shows undivided section—pedestrians exposed to additional safety hazard and delay; bottom photo shows divided section—crossings are easier and environment is more pleasant for walking.

Guidelines

Clearly define pedestrian space between the developed property and the highway. Sidewalks should always be provided, preferably with a planting strip between the sidewalk and the highway. Figure 50 shows the “ideal” cross-section design for accommodating the pedestrian along the road edge, taken from a design study for arterial roadways in Ann Arbor, Michigan (9). However, this much right-of-way at the road edge is seldom available. In principle, the designer should always attempt to place the pathway as far from the road edge as possible, but not closer than 4 ft from the curb of the parking lot (vehicle overhang is typically 3 to 5 ft). Where there is a service road, sidewalks should ideally be placed on both sides of the service road. If only one side can be accommodated, place it on the side of the service road closest to the main highway (this is

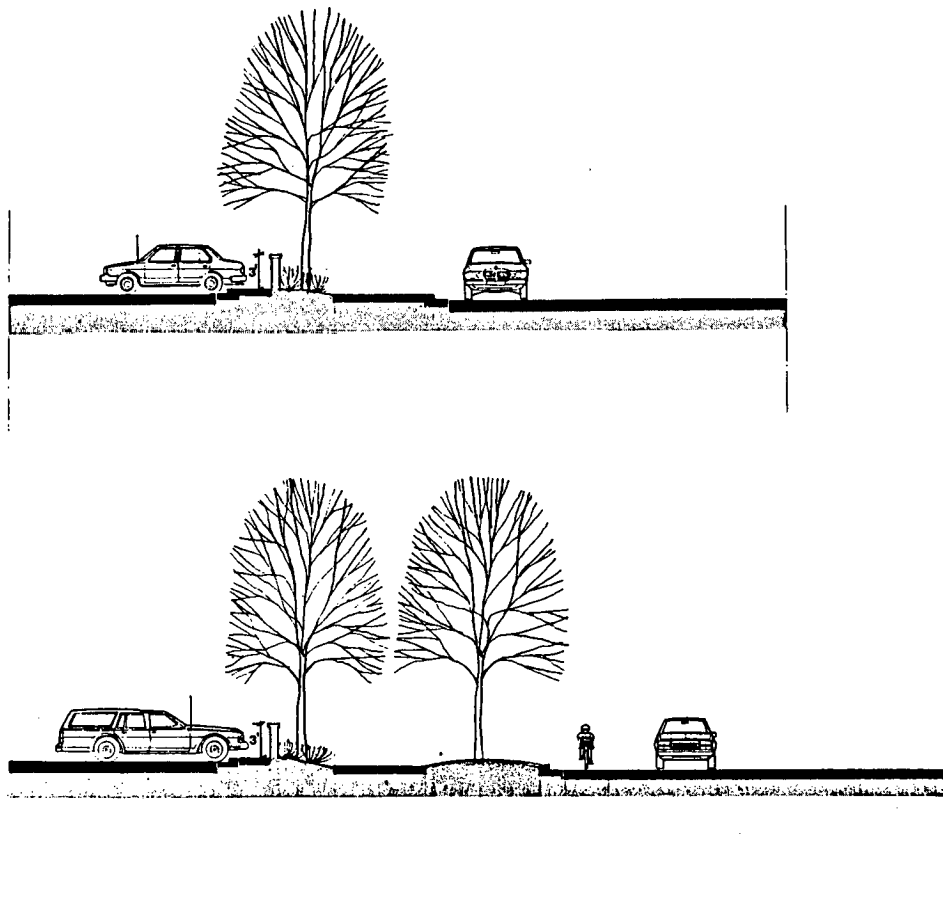


Figure 50. Alternatives for defining pedestrian space between the highway and developed property. (Source: Ref. 9)

indicated by observation of pedestrian movement along a service road in Fairfax County, Virginia).

Minimize and consolidate the number of driveways. This is most easily done where land ownership is not fragmented and larger planned development can take place. Figure 51 from the Ann Arbor study, illustrates the idea of consolidating driveways on a commercial strip. Although pedestrians will still cross the same volume of traffic, the more organized approach helps drivers to more easily scan for pedestrians, making it less likely that the pedestrian will be lost in the visual clutter.

Provide some form of raised separation between the street and parking lots. This is a particular problem in some of the older areas with limited right-of-way. Some of these property frontages have no driveway *per se*, but an open area where vehicles can pull off the road, providing no protection for the pedestrian. This is also one of the easier problems to solve, but usually requires public initiative. Untermann (10) provides a number of illustrations of how this can be done. Often, parallel or angle parking is needed to make this design work.

Channelize driveway entrances and exits. Driveway design objectives differ for vehicular and pedestrian traffic. For vehicles, curb radii should be large, to minimize abrupt deceleration requirements, which increase the potential for rear-end accidents in the right lane. For pedestrians, large driveway curb radii increase the crossing length and subsequent exposure to vehicles. A compromise design, now more commonly used for major

entrances, involves channelized right-turn lanes with pedestrian islands. Where possible, driveways should be divided so that the island creates a refuge area for pedestrians crossing it. Figure 52 illustrates the several alternatives.

Separate conflict points. The safety of the pedestrian is highly influenced by the number of conflict points that are encountered enroute to a destination. A major type of conflict along commercial strips occurs at driveways. The usual high frequency of driveways place high attention demands on pedestrians, as conflicting vehicles may come from several different directions. A more disciplined driveway scheme reduces the hazard. An overall treatment of access management strategies is presented in Ref. 11.

Channel pedestrian flows to safe crossing points. The number and variety of commercial attractions found along a typical strip imply that crossing of the main arterial must be accommodated. Medians and/or refuge islands are almost indispensable. Traffic signal placement should consider not only vehicular entry points, but strategic pedestrian crossings as well.

Soften the harsh visual environment through landscaping, sign control, and related techniques. Two landscape buffer strips, one between the road and the sidewalk and another between the sidewalk and the parking lots are ideal. If only one can be accommodated, place the buffer between the highway and the sidewalk.

Maximize the directness of the routes. Pedestrian facilities

located along the commercial strip should be designed to maximize directness. The layout of corner sites should consider opportunities for diagonal shortcuts for pedestrians as well.

Coordinate facility design through consistently applied design standards.

Interface with other pedestrian facilities. Pedestrian facilities on adjacent development site should be carefully interfaced with the commercial strips. For example, fences and barriers along the rear lot lines of commercial strips should have planned breaks where they meet with the pedestrian network in the adjacent development.

Commercial strips represent the most difficult development type for which to create a pedestrian scale. Common barriers to the implementation of the foregoing guidelines include: fragmented ownership of land along these commercial strips, difficulties in controlling and regulating driveways, auto-oriented mentalities, standard commercial building site designs, and the limited number of pedestrians.

FINDINGS CONCERNING SUBURBAN ACTIVITY CENTERS

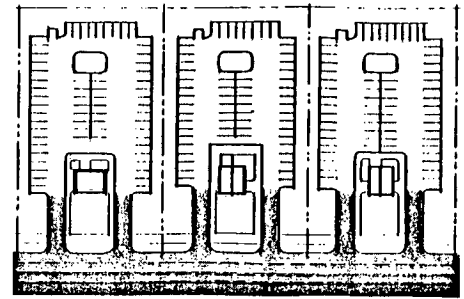
Suburban activity centers were defined as multiple-owner developments consisting of a mix of uses, usually oriented around a higher density commercial core. They could include new high-density development or the redevelopment of an existing area. Several of the findings from the analysis of activity centers are discussed below.

Findings

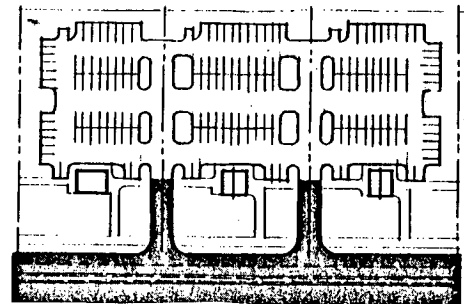
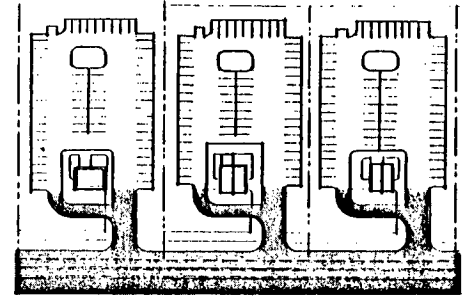
The scale and number of actors involved requires a greater public agency involvement in design coordination and controls to assure that pedestrian facilities are adequate. A special study is often needed to establish the design criteria for the activity center subarea and to identify financing options and incentives. Of the several activity centers studied in this project, those for which subarea plans had been prepared were far more coordinated and cohesive than those for which no plan had been prepared. Four of the five case studies at suburban activity centers (Warner Center, Bellevue, Bethesda, and Ballston) had subarea plans that gave extensive treatment to pedestrian facilities. Figure 53 shows the table of contents from the Bethesda Sector Plan, providing an indication of items typically included.

One of the major problems with providing sidewalk continuity in an activity center is in the staging of development. Development takes place over time, and the sidewalk on each property frontage has traditionally been built or improved only when the site is developed or redeveloped. Again, public agency intervention is usually needed to provide interim network links to assure a continuous system. Mechanisms for doing this are discussed in Chapter Six.

The pedestrian orientation of the activity center is somewhat dependent on the density of development. In Bethesda, Maryland, for example, the floor area ratio (FAR) is estimated to be four times the FAR of Tyson's Corner, Virginia (estimated at an overall average of 2.0 versus 0.5, respectively). Pedestrian counts at key intersections indicate pedestrian volumes at least 10 times greater in Bethesda than in Tyson's Corner. In a sense, Tyson's Corner is dense, but not dense enough. The distances



Least preferred



Most preferred, but not practical in many cases

Figure 51. Driveway layout options for commercial strips. (Source: Ref. 9)

between buildings (and the generally available free surface parking) make it unfriendly to pedestrian travel.

Implementation strategies play a particularly critical role in the development of the pedestrian system in an activity center. Experience with various types of implementation strategies and developer incentives is discussed in the following section.

Guidelines for Existing Suburban Activity Centers

There are a relatively limited number of controllable design features in the typical existing suburban activity center. Because little can be done with the alignment of the walkways, most emphasis is usually placed on providing appropriate amenities. Several design considerations and guidelines are discussed below.

Sidewalk and walkway designation. In suburban activity centers, sidewalk is unquestionably needed on the frontage of every building. There should be no exceptions. However, the width of the sidewalk and nature of the planting strip may vary. Depending on the nature of the street system and location of

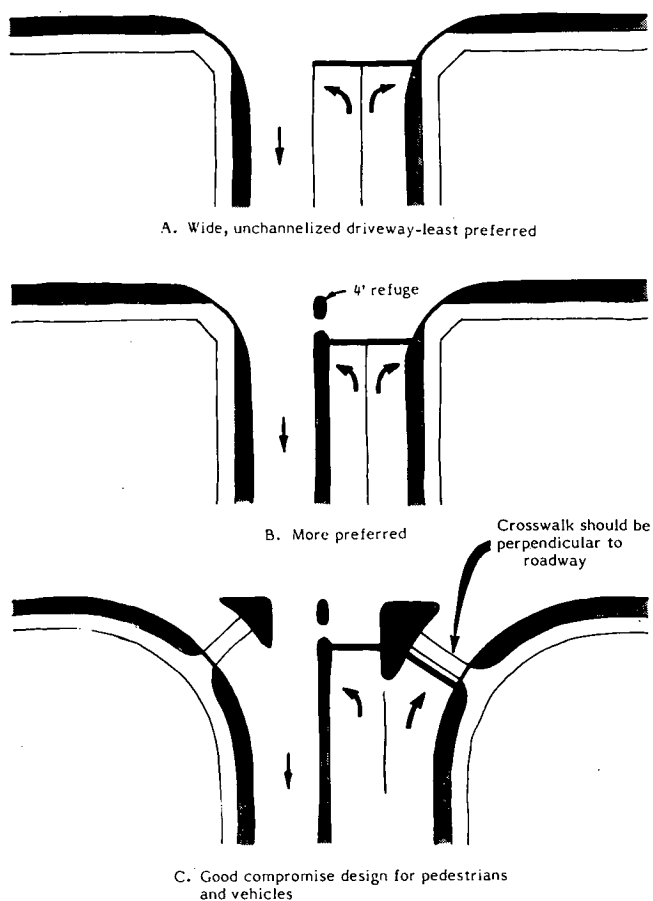


Figure 52. Alternative driveway channelization designs.

buildings and parking lots, intra-block pedestrian paths may or may not be necessary. One way to establish this is to plot "desire lines" between the major known or anticipated origins and destinations. Bus stops and transit stations should be included as potential destinations. This may indicate locations for natural pedestrian linkages for which opportunity would otherwise be lost. It may suggest requiring the reservation of space between buildings or a passageway through a building for a pedestrian connection. The City of Stamford Connecticut has an interesting amenity package, available to developments in certain zoning districts, that provides density bonuses for improved accommodations in their pedestrian network. Shown in Figure 54, these amenities are tied into the Pedestrian Access and Thoroughfare System in their Master Plan. The most interesting is the amenity for reduction of walk trip length by providing for more direct pedestrian routes. Through-block pedestrian pathways can significantly reduce pedestrian trip lengths. The City of San Francisco has established a proposed pedestrian network with extensive through-block pathways. The concept is equally applicable to suburban activity centers. The guidelines for its implementation suggest that through-block locations that would encourage jaywalking should either be avoided or should be provided with midblock crosswalks, where vehicular and pedestrian traffic conditions warrant.

Sidewalk widths. Sidewalks should be wider than the typical 4 to 6 ft in low-density commercial areas, but not as wide as needed in most major downtowns. Along commercial frontages, minimum widths of 12 to 15 ft are usually adequate. This would include space for street trees, parking meters, poles, mailboxes, and other street furniture. Where existing buildings are being kept and setbacks provide only minimal sidewalk width, care should be taken to not install objects that would hamper pedestrian flow. At intersection corners, building corners should be cut back for at least the first floor to provide for pedestrian queuing and circulation as well as vehicular sight distance. Figure 55 shows an example of providing the additional corner setback, landscape treatment and pathway through the corner.

Designation of pedestrian open space, mini-parks and plazas. Although this study emphasizes the aspects of pedestrian movement, and not the social aspects, the need for open space to accommodate pedestrian activities cannot be overlooked. Pocket parks, small plazas with benches and similar amenities not only are positive features in themselves, but encourage pedestrianization in general. Space for these can sometimes be found in buffer zones between residential and commercial areas or in the corners of some blocks. Interior courtyards may be included with some developments. Figure 56 shows a small park buffering the residential and commercial areas in Bethesda, Maryland. A short street block was closed and landscaped as part of the plan.

Streetscape. Streetscape has become an almost standard feature of many urban settings. Its usefulness should not be taken for granted, however, as it adds to pedestrians' sense of having their "turf," separate from the vehicle's domain. Streetscape standards should maintain a balance between requiring specific types, quantities, and spacing while retaining flexibility to accommodate unique design needs on a given block. In some cases standards may need to be specified by block.

Street Crossings. Streets within suburban activity centers have one primary advantage over streets in other suburban settings—many of the intersections are typically signalized, creating easier crossing opportunities for the pedestrian. Pedestrian volumes are such that pedestrian signal heads would usually be warranted. Because there is usually a higher proportion of elderly citizens living in these areas (because of the convenience of shopping and services), longer pedestrian clearance intervals should be considered, especially where capacity problems do not exist (see Chapter Five).

Older arterial streets in suburban activity centers are often undivided. At unsignalized intersections and natural midblock crossings, pedestrian refuge islands should be seriously considered. Chapter Five presents a discussion of techniques to assist pedestrians in street crossings, many of which can be applied to suburban activity centers. Pedestrian overpasses are extremely difficult to retrofit into an existing activity center, and would normally be provided with new building construction, if at all. Second level connections from a parking garage on the opposite side of a major street are a natural opportunity, but each situation must be carefully weighed on its own merits.

Guidelines for Newly Developing Activity Centers

Many of the design principles discussed above also apply to the newly developing activity center. However, there is a tendency, in the case of a newly developing area to fall short of the compact land use necessary to create origins and destinations

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Figure 53. Table of contents from the Bethesda sector plan.

that are truly accessible on foot. There are many examples of this in suburbia throughout the United States. A number of arguments are made against dense suburban development, primarily its being out of character with adjacent residential areas and perhaps the lack of adequate road capacity. However, when done with quality in mind, higher density development affords many accessibility and aesthetic benefits to the pedestrian.

Several guidelines to counter activity center development trends potentially detrimental to pedestrian travel are as follows.

Concentrate as much of the development as possible into a compact central core. For large areas of commercial land, it will not be possible to cluster all development into a central core of development, all within easy walking distance. A central core, surrounded by satellite cores may be the preferred design. Few walking trips would be expected between the core areas, but once within the central or satellite cores, all uses would be accessible by walking. In one sense, it is an extension of the shopping mall concept, in which cars are left on the periphery, leaving an auto-free interior. Another significant advantage is the greater ease of transit service, both to and between the core areas.

Provide for structured parking, where possible, to facilitate land-use compactness. Second-level entrances above street level can often be integrated into a structured parking scheme without substantial additional cost. Structured parking is substantially more expensive than surface parking, but land costs in these higher density settings make it more attractive.

Provide for access to street frontages with clearly delineated paths across parking lots and access roadways.

Within the interior of the core, provide walkways and amenities, coordinated through a set of reasonable design standards.

Guidance for Implementation

The case studies conducted as part of this project and the review of other literature and experience indicate the following ingredients as keys to the creation of an effective walking environment in the setting of an activity center:

- A well-thought-out and documented plan, approved in the political process and based on the inputs of community representatives.
- Development momentum, including developable land or land that can be redeveloped, as well as healthy local economic conditions conducive to development. Public funding cannot be expected to foot the entire bill for major pedestrian improvements.
- Reasonable design standards to serve as the basis for coordination of the pedestrian system as associated amenities.
- An initial public project to serve as a catalyst for the plan's implementation.
- Funding mechanisms to assure completion of the pedestrian network, even across undeveloped sites.

4 - Amenity: Low Coverage at Upper Floors

Specifications for Qualification: The upper floors of a building or buildings extending upward from a level forty feet (40') above the average grade shall be set back from the side lot line not less than twenty feet (20'). Said setback area shall be unobstructed to the sky except for pedestrian walkways or bridges extending through said area. The maximum creditable side yard setback shall be forty feet (40') per side.

Districts: CC-S, CC-N, C-G and C-L

Premium: For each creditable square foot of side yard setback area, one square foot may be added to the structure total floor area; however, in no case shall the maximum premium exceed 4,000 square feet.

5 - Amenity: Arcades

Specifications for Qualification: A portion of a zoning lot or building that is developed as a covered passageway with stores and shops fronting thereon and extends through the lot from block to block or from street to street so as to form a portion of an interconnected system of pedestrian access and thoroughfares shown on the Master Plan; shall be paved and landscaped and be unobstructed except for columns or piers required to support the building or roof above; have a height of not less than twelve feet (12'); be accessible to the public during normal business hours; have an area of not less than 1,000 square feet; and provide a minimum horizontal dimension for public passage of fifteen feet (15').

Districts: CC-N, CC-S and C-G

Premium: For every square foot of arcade, two (2) square feet may be added to the structure total floor area. The premium may be pro-rated to a maximum arcade horizontal width of thirty feet (30').

6 - Amenity: Direct Pedestrian Connection to a Public Parking Garage

Specifications for Qualification: A portion of a zoning lot or building that contains a direct enclosed pedestrian connection to a public parking garage situated in the CC-N or C-G District in accordance with Pedestrian Access and Thoroughfare Systems shown on the Master Plan, and consists of a hallway, tunnel or way which provides access without crossing a street, alley or private driveway at grade. Such hallway, tunnel or way shall be not less than twelve feet (12') in width; and shall be open to the public during normal business hours. All buildings in a block or blocks may connect to or provide for the extension of such common pedestrian hallway, tunnel or way so long as the minimum width herein specified is maintained.

Districts: CC-N, CC-S and C-G

Premium: A floor/area ratio increase of .2 in the CC-N and CC-S Districts and .1 in the C-G District.

7 - Amenity: Shortening Walking Distances

Specifications for Qualification: A portion of a zoning lot or building that is developed to shorten walking distances in accordance with the objectives of Pedestrian Access and Thoroughfare Systems shown on the Master Plan. The shortening of walking distance shall be computed by comparing walking distances along existing streets, alleys and driveways having a minimum sidewalk width of seven feet (7'), with distances along proposed walkways through the subject lot or building. Such walkway may either be within or outside a building; shall be readily identifiable from the public sidewalk; shall have a minimum width of ten feet (10') plus two feet (2') for each side which has shops, lobbies, elevator entrances or similar pedestrian traffic generators fronting thereon; and shall be open to the public during business hours common in the area.

Districts: CC-N, CC-S and C-G

Premium: For each linear foot by which walking distance between streets is shortened, four (4) square feet of floor area may be added to structures in CC-S, CC-N and C-G Districts.

Figure 54. Density bonuses allowed for pedestrian amenities in Stamford, Connecticut.

- Incentives sufficient for developers to provide more than just the basic pedestrian features.
- A maintenance system available to assure the perpetuity of pedestrian amenities provided.

Although developer funding for pedestrian improvements and amenities may be substantial, the local government cannot expect that a complete system can be installed relying simply on individual parcel development or redevelopment. The system will inevitably be incomplete in the long term and will have significant gaps in the short term as development or redevelopment is awaited. As stated previously, local contributions to a key initial public project can be a great stimulus toward seeing additional positive change. In Bethesda, Maryland, for example, a major capital improvement project was programmed to provide missing sidewalk connections (see case study in Appendix B). Entitled the "gap program," it earmarked nearly \$5 million for sidewalk and streetscape improvements that would not otherwise have been provided for in development. In the Ballston area of Arlington, Virginia, \$1 million was allocated to a streetscape project that set the standard for other similar projects by private development.

One funding alternative particularly appropriate for suburban activity centers is the creation of a "revolving fund," in which the public agency would front the bulk of the cost of construction of a complete pedestrian network, eliminating barriers to safe and convenient pedestrian access. However, as each parcel is developed or redeveloped, the developer would contribute toward that fund, in effect reimbursing the public agency for the costs the developer would have otherwise incurred.

PEDESTRIANIZING OLDER SUBURBAN AND SMALL TOWN MAIN STREETS

In many areas community leaders have decided that the traditional commercial center should be revitalized through various forms of street/pedestrian improvements, building renovations, and parking enhancements. The interest in revitalizing these "Main Streets" ranges from improving the business climate to preserving a small town character. Revitalization projects have been undertaken in many older suburban areas and small towns in an effort to strengthen competition with outlying malls and shopping centers. These main street areas are often located along the major artery through the community. Traffic movement on the main street represents a hindrance to convenient pedestrian movement from one side of the street to the other, as would be permitted in a shopping center. In these situations there is also the need to provide adequate parking to encourage business patronage. Usually, patron access to businesses in these areas is provided through the front of the parcels. This limits the options for the placement of parking facilities and puts more reliance, at least as perceived by merchants, on the typically inadequate on-street parking supply. The typical narrowness of the available right-of-way also implies that sidewalk space is limited in these areas.

Several findings from the analysis of the case studies and from information obtained in the literature and from discussions with practitioners are discussed in the following.



Figure 55. Example of additional setback at corner.



Figure 56. Small park buffering residential and commercial area in Bethesda.

Findings

The motivation behind most of the main street improvement efforts to date has been economic revitalization, not primarily pedestrian safety and convenience. This was clear in the several case study reviews conducted for this type of development (e.g., Iowa City, Iowa; Fredericksburg, Virginia; Glendale, California). However, improving the pedestrian environment was found to be a key strategy in all the projects, as a way to lure people away from competing suburban shopping malls.

Providing an improved pedestrian environment has been credited with bringing some main streets back to life, but there is no assurance that this will always happen. The problems of older suburban and small town main streets are often deeply rooted in economics and in changes in social and mobility patterns. "Revitalizing Older Suburbs" (12) provides a perspective

on solutions to some of these problems. Michael J. Pittas (13) in his address to the Fourth Annual Pedestrian Conference in Boulder, Colorado, provided some strong arguments for precautions against rotely imitating what others have done or having a “quick-fix” attitude about downtown revitalization. He observed that:

- Some pedestrian malls have been initial successes but have failed over the long term for various reasons (e.g. lack of land development nearby to support it, or failure to keep it maintained).
- Maintenance is often an unforeseen major expense, which can cost more than the initial improvement, several times over.
- The fundamental problem usually goes unaddressed—the lack of a coherent land use policy at the regional or state level.
- The typical revitalization scenario is leading to the “boutique-ification” of downtowns. The older department stores are disappearing and being replaced by specialty and luxury shops. Whether this is inherently good or bad depends on the perspective.
- Good design, tailored to the unique needs of each area, requires an assessment of the demographic and economic trends.

Creating a vehicle-free pedestrian mall is usually not the design solution for the older suburban area or small town. Experience indicates that there is a base level of pedestrian activity that is needed to sustain an “active” atmosphere in a pedestrian mall. This implies a source of pedestrians from the immediate area. The level of pedestrian activity in the older suburban and small town main streets is lower than in major city central business districts. In Iowa City, the student population and reasonable downtown densities provide that supply. However, the development of a pedestrian mall can be a risk, as the absence of an active pedestrian atmosphere can leave the area cold and sterile feeling, almost assuring its decline. Allowing controlled vehicle access reduces this risk. Pavlos provided some excellent insights into the safety and accessibility characteristics of pedestrian malls at the Fourth Annual Pedestrian conference in Boulder (13). For example, he analyzed the accident experience from two malls, the Nicolet Transit Mall in Minneapolis and the Chestnut Street Mall in Philadelphia, and found little change in accident experience. He concluded that although vehicular traffic was greatly reduced, pedestrians appeared to become more careless. He proposed several design principles for pedestrian treatments at other malls.

Controlling vehicular speed and volume is the key to creating a pedestrian orientation in a main street area. Pedestrians and vehicles can co-exist, but a change must be perceived in the normal dominance of vehicles over pedestrians. In Tallahassee, this was accomplished by realigning and narrowing the street (Fig. 57). In Fredericksburg, a series of sidewalk flares was used (Fig. 58). In Glendale, sidewalk widening, large street trees, and brick crosswalks were used to completely transform the character of the street (Fig. 59). A variety of techniques for accomplishing this are discussed below.

The pedestrianizing of “Main Street” areas represents an interesting challenge for pedestrianization. These areas usually have long historical roots, sometimes from an era predating the automobile. In one sense this is an advantage, because the basic structure of what was once a pedestrian scale may still be there. The need to accommodate motor vehicle traffic over the years has in many cases seriously disrupted that scale and the pro-



Figure 57. Main Street redesign with major realignment in Tallahassee.



Figure 58. Sidewalk flares in Fredericksburg, Virginia.



Figure 59. Improvement of a shopping street in Glendale, California.

visions of the earlier features designed to accommodate pedestrians. The challenge lies in restoring the pedestrian elements, while simultaneously accommodating traffic demands and meeting the needs associated with modern commercial operations.

Although the principles and techniques applied to pedestrianizing a suburban or small town main street are similar to those that work for other types of development, following some simple design principles will increase the probability of success. The following planning and design guidelines and principles are suggested

Guidelines

Street width. Options depend on the original street cross section and traffic volumes. If the street is a major thoroughfare and at or near capacity, only minor traffic strategies are possible unless a significant proportion of traffic can be diverted from the main street. An undivided four-lane road should be considered for retrofitting with a median if the original traffic lanes are wide enough to sustain some narrowing. If properly landscaped, a median can dramatically change the character of the street toward a pedestrian scale. Functionally, it makes crossing the street much easier than before (see analysis of medians in Chapter Five). If traffic demand is low already, a major sidewalk widening can be undertaken and, if desired, curvature introduced to the remaining width (see example from Tallahassee). A two-lane street with parking is best kept at that configuration.

Intersection treatments. A number of small towns and suburban retail streets observed in this project had introduced sidewalk flares (also called curb bulbs or the "safe-cross") at intersection corners. The sidewalk is extended out to near the edge of the parking lane for at least one car length from the intersection. Parking loss is usually minimal. The pedestrian waiting to cross is more visible to traffic, and the traffic more visible to the pedestrian. More importantly, the crossing distance is shorter. Mid-block sidewalk flares can also be employed, usually with the loss of only one parking space on each side. Chapter Five provides more detail on this technique.

Crosswalk treatments. Brick crosswalks are becoming a popular design feature. They were applied in several of the case study locations and made a favorable impression on local staff. Stated benefits included (1) creation of a distinctive entry point for vehicles; one that lets the vehicles know that there was something different about the area they were entering; (2) reductions in vehicular speed—although there have been no known before/after studies of brick crosswalks, observations by planners and designers suggest that brick crosswalks have some effect on speed—most of the installations create a roughness in the roadway (something like crossing a railroad track) that causes drivers to slow; (3) an aesthetic improvement over plain street paving—the crossings simply look better.

Other types of crosswalk treatments ranging from special striping patterns to other paving materials were observed, most of which appeared to also accomplish the foregoing to varying degrees.

Sidewalk widths. A widened sidewalk is a welcome addition, but is probably not possible in many cases, because of parking loss. Convenient parking nearby may overcome this deficiency and allow for creative use of sidewalk widening.

Streetscape. As much as can be spent on streetscape enhancements as there is budget. Street trees are always contribute

toward the pedestrian scale. Other landscaping should be low in maintenance and carefully placed to not impede pedestrian flow. Sidewalk flares are usually ideal locations, having made available the additional area for pedestrian use and amenity. Paving and special lighting fixtures are the more expensive features. They are not functionally necessary, but add to the total appeal of the street.

Parking. Increased auto access and parking has usually gone hand-in-hand with main street revitalization schemes. Usually, the additional parking must be found in the rear of the establishments. In Fredericksburg, the property of a burned-down building was acquired and converted into additional parking area, this also being an additional entry way into the retail area (Fig. 60). Entry ways from rear parking to the main street should avoid the feel of an alleyway. Two different treatments of connections from rear parking lots are shown in Figures 61 and 62.

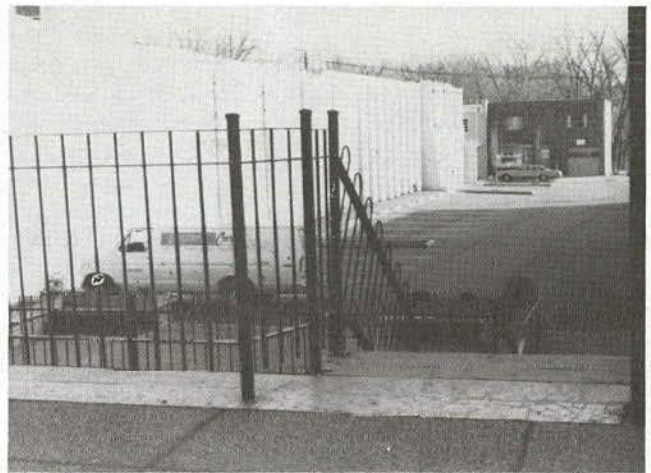


Figure 60. Parking lot and pedestrian connection in Fredericksburg.

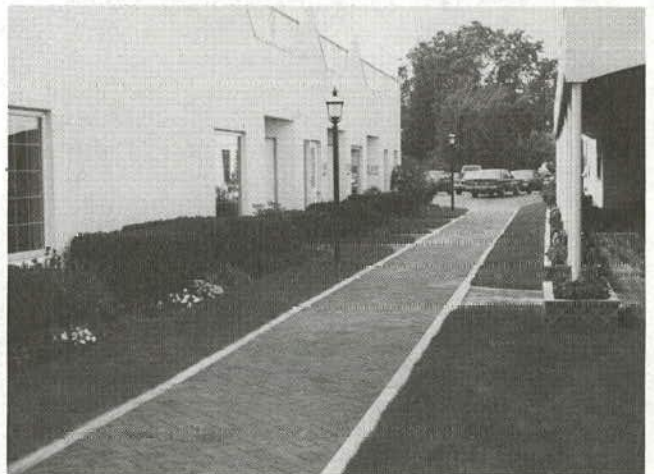


Figure 61. Walkway connecting parking lot and Main Street in Westhampton Beach.



Figure 62. Mid-block alleyway in downtown Waynesboro, Virginia, to facilitate walking to parking areas behind stores.

Signing. Simple, well-placed signs, particularly at entry points from the parking lots and from the ends of the street, can serve to orient first-time visitors and help to implement the theme.

Signals. Traffic signals controlling at least one nearby intersection provide a more secure crossing point, and introduce gaps into traffic to facilitate pedestrian crossings downstream. If the geometric recommendations listed above are followed, there should be little need for a mid-block signal. It would only tend to increase vehicle and pedestrian delay.

Deliveries. Where opportunities exist for off-street delivery zones, these are preferred. If off-street areas are not available, loading zones should usually be designated in at least two locations on each block to reduce the double parking problem.

SITE DEVELOPMENT FOR FREESTANDING SINGLE-USE SITES

The last category of land use, which is only briefly discussed here, relates to smaller scale, single-use sites. These sites, by virtue of their size and relative independence from other uses, often are designed and built without considering the needs of the pedestrian. Land uses that fall into this category include schools, churches, hospitals, parks and other recreational facilities, high-rise residential units, elderly housing, restaurants, motels, convenience stores, and other small-scale residential and commercial developments.

These developments, depending on the location and type, can generate significant amounts of pedestrian traffic using linkages through parking lots, across major vehicular thoroughfares, or along the community pedestrian network. A fast food restaurant across from a school or office building can generate many pedestrian trips.

The primary focus of pedestrian facilities on these types of sites is the connections from the periphery of the site, parking areas, and/or transit stops to the entrances to the building. These connections require thought regarding vehicular and pedestrian

movement on the site and how to most directly connect with nearby development.

The following planning concepts should be incorporated into the design process:

- *Anticipate paths needed from adjacent and nearby development.* This is easier to do if the surrounding area is already developed. Connections to nearby magnets must be direct. Where nearby parcels are not yet developed, the designer should make a "best guess" of where the connection will be needed, or leave options open until surrounding development occurs. As with all planning of pedestrian networks, the chief concern is that the pedestrian connections be considered early in the planning stage and carried through to project completion. Unanticipated pedestrian access points can be retrofitted into the site as experience is gained.

- *Plan the site to facilitate access to and, in some cases, through the site.* Buildings and other structures can be designed not to impede through movements of pedestrians on a site. For example, the elements of a church/school development may be situated to permit the diagonal movement across the site by pedestrians. Simple openings in fences, where through pedestrian traffic can be tolerated, can reduce walking distances significantly.

- *Consider traffic interfaces.* The layout of the site should also consider the points of interface created between various modes of traffic, taking into account the layout of parking areas, delivery areas, and other facilities. Designs that minimize the number of conflict points should be given preference.

- *Review nature of pedestrian traffic.* The layout of walkways internal to a site should consider the character of the pedestrian population and the nature of the activities that will take place. For example, within park areas there may be value to locate play areas far enough off of walkways which may also serve utilitarian trips.

One of the major problems experienced with single-use sites is in facilitating access across major thoroughfares. Bus stops, by their nature, are frequently located along major arterial streets and highways, and traversing the street at the heaviest traffic period may be the most difficult part of the commute. Because signalized traffic control is appropriate at only a small fraction of crossing locations, suburban settings must rely primarily on medians and refuge islands as the primary pedestrian assist. Chapter Five discusses the importance of medians and refuge islands in the suburban environment, and states the case for their more widespread use. Care should be taken not to locate bus stops in areas where sight distance problems or other safety hazards exist.

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CHAPTER FIVE

PLANNING FOR PEDESTRIAN FACILITIES IN THE HIGHWAY RIGHT-OF-WAY

Chapter Three addressed the broad perspective of pedestrian planning and how it fits into the overall planning process. Chapter Four focused in on building pedestrian networks through proper site planning of private property. This chapter addresses pedestrian movement in the highway right-of-way.

The public right-of-way represents the thread that ties these individual land uses together. It is land dedicated to the public sector to assure access to all parcels of land. The space provided in the right-of-way is used for the construction of transportation facilities and the placement of the various utilities necessary to support development. Walking facilities are also provided in the right-of-way to provide for both the lateral movement of pedestrians across streets and longitudinal movement between the various parcels of abutting land. Chapter Two indicated that one of the major problems with pedestrian mobility in suburban and rural areas is in making it safer and more convenient to cross heavily trafficked roadways. Much of this chapter focuses on that problem.

The succeeding sections discuss the findings regarding the provision of pedestrian facilities in the right-of-way. For each heading, a general finding is listed, followed by the background of the problem and related research and by the illustration and application of planning and design principles. This chapter touches on the following design elements: (1) cross sections (the arrangement of the roadway lanes, medians, refuge islands, shoulders, curbs, and pathways within the right-of-way); (2) intersections (the points where two or more traffic arteries meet

and compete for limited space—the pedestrian is a legitimate sharer of that space); (3) interchanges (a special type of intersection requiring a grade separation and a high-type design to provide the necessary capacity—they pose particular problems for pedestrians); (4) other elements (accommodating the pedestrian in the right-of-way requires the consideration of the impacts of other elements on pedestrian movement—these elements include features such as pedestrian overpasses and underpasses, traffic signals, transit stops, guardrails, fences, median barriers, parking, street lights, and street furnishings, i.e., telephone booths, mail boxes, landscape treatments).

These categories cover all of the situations and items normally found in the public right-of-way. This chapter is not a comprehensive treatment of all the foregoing design elements, but elaborates on those elements of design having greater impact on pedestrian safety and convenience. General design objectives are discussed first, followed by the reporting of findings in selected areas.

PEDESTRIAN-RELATED HIGHWAY DESIGN OBJECTIVES

Many of the problems of pedestrian safety and convenience are related to the design of the highway. The traveled lanes of a roadway, when occupied, are a major barrier to pedestrian movement and they are the locations at which the vast majority

of pedestrian-vehicular accidents occur. Cross-section design elements have perhaps the most significant bearing on overall pedestrian convenience and safety in suburban and rural areas. Important cross-section elements include road width, number of lanes, and right-of-way limits, shoulders and curbs, medians and refuge islands, walkways, and landscaping and aesthetic features.

The AASHTO Green Book (1) provides design guidance on cross-section elements, intersections, interchanges, and, in general terms, discusses pedestrian considerations. However, substantially more sensitivity to the pedestrian could be incorporated into design without adversely affecting the traffic-related functions of the highway. The major reference for guidelines on traffic signals and other control devices is the *Manual on Uniform Traffic Control Devices* (2).

This section identifies specific findings from the case studies, functional analyses, and other research and indicates how some of the commonly occurring design and operational problems identified in Chapter Two can be overcome. As a basis for establishing preferred cross-section designs, a number of fundamental pedestrian-related design objectives and principles are first reviewed. These design principles and objectives are subsequently translated into specific treatments for new roadways, and the upgrading and retrofit of existing roadways.

Pedestrian-sensitive highway design and operation must be based on an understanding of what constitutes desirable traffic and pedestrian behavior. Effective design encourages proper behavior in each situation. Specific design objectives related to this goal are discussed below.

Control Vehicular Speeds. Vehicular speeds, both absolute speeds and speed variances, are a major factor in the hazards associated with crossing a street. For some functional highway classes, particularly rural arterials, facilitating reasonable traffic speeds for longer distance vehicular travel is a primary objective in highway design. On the lower functional highway classes, particularly local residential streets, the desire should be to constrain speeds for purposes of not only pedestrian safety but vehicular safety as well. Experience has demonstrated that the most effective way to control speed is not through regulation but through effective street and highway design.

Minimize Vehicular Impedance and Pedestrian/Vehicle Conflict. Although the pedestrian has the "theoretical" legal right-of-way in some cases, the "practical" right-of-way essentially always belongs to the vehicle by virtue of its greater mass and kinetic energy. The pedestrian is never the winner when confronted with a 2,000- to 3,000-lb projectile. Minimizing pedestrian impedance is an important aspect of geometric design. Reductions in impedance can be accomplished through improving the discipline of vehicular and pedestrian flows or through providing temporal or spatial separation between vehicles and pedestrians in design and operation.

Minimizing Conflicting Attention Demands. Inattention is one of the primary reasons that accidents occur. Although some of these inattention problems are self-induced, many attention problems are either induced or exacerbated by geometric design. One good example is a vehicular left turn at an intersection, as illustrated in Figure 63. In addition to watching for oncoming traffic, a left-turning driver must also be on guard for pedestrians in the crosswalk into which the turn is being made. It is sometimes difficult to pay attention to all of these things at once. Reference 3 provides additional background on the safety as-

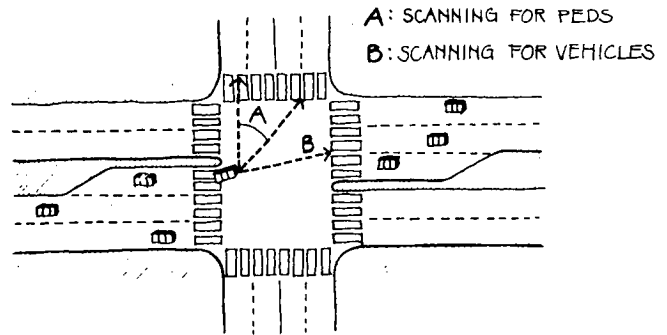


Figure 63. Conflicting attention demands in the left-turn maneuver.

pects of the left-turn maneuver. Segregating or staging these attention demands, through either geometric design or operational strategies, makes the driving and walking tasks easier and less hazardous.

Assure Adequate Walkway Separation. Walkway separation is also an important factor in cross-section design. In theory, greater separations from the traveled way reduce the chance of pedestrians being hit by vehicles. Good cross-section design seeks to provide as much separation as practical under the constraints of cost, right-of-way, building setbacks, terrain, and other factors.

Provide Aesthetic Designs. The ultimate desire in pedestrian-sensitive design is not only to maximize safety and convenience, but also to make the walk pleasant and enjoyable. Vehicle design has gone a long way toward achieving this for drivers with environmentally insulated, highly comfortable interiors, and special amenities. The pedestrian, however, remains exposed to traffic noise and environmental elements and is more sensitive to the condition of the walking surface. Design should seek to minimize the potential negative influences and emphasize the positive ones. One of the attractive features about walking is being able to observe more detailed features of the landscape or streetscape. These opportunities should be enhanced.

CROSS-SECTION DESIGN AT INTERSECTIONS (SIDEWALK FLARES)

General Findings: The roadway cross section can be narrowed at intersections on streets with parking without significant impact on traffic flow. This provides several major benefits to pedestrians. **Background.** Narrowing of the cross section (through widening of the sidewalk) has proved to be a design strategy that favors pedestrians while causing minimal interference with vehicular needs. It can be considered at intersections and mid-block pedestrian crossings where vehicular capacity is not an overriding concern. This is seldom possible or desirable for new arterial streets, but may be possible on some new collector streets or on existing arterial and collector streets with 24-hour curb parking. The technique is commonly called the sidewalk flare, curb-bulb, neck-out or safe-cross.

Illustration and Application. Sketches of alternative sidewalk flare arrangements are shown in Figure 64. A photograph of a sidewalk flare was previously shown in Figure 58. This design

provides an extension of the sidewalk at selected locations, which reduces the time of pedestrian exposure to traffic, increases their visibility to motorists, and elevates the pedestrian above the parking lane by the height of the curb (usually 6 to 9 in.). The concept has been widely applied in older downtown areas in conjunction with revitalization and streetscape improvement efforts (see Chapter Four), but it is equally applicable to new roads, under the appropriate conditions.

A functional analysis of this design showed that the sidewalk flare reduces the curb-to-curb pedestrian crossing distance. Time exposure to the traffic lanes can be cut virtually in half in some cases. It elevates the pedestrian above the pavement surface, to provide the pedestrian with better visibility of vehicles and vehicles with better visibility of pedestrians, particularly young pedestrians. It tends to slow traffic at intersections or at mid-block locations where sidewalk flares are provided. The extent to which traffic is slowed depends on the design. Additional room is provided for sidewalk landscaping and amenities and for pedestrian queuing, if needed.

Possible detrimental aspects of properly designed sidewalk flares are few, in comparison with the benefits. Considerations in applying this technique are as follows.

The design is not usually appropriate where the right lane is important for vehicular capacity. Locations with 24-hour curb parking are ideal for this design, since the flare is assured of having little or no impact on vehicular capacity.

The design is not appropriate for high-speed arterial and collector streets, and is primarily suited to more compact commercial areas. Many streets in the downtowns of small towns and in older suburban areas are well-suited to this technique.

Care should be used in providing adequate curb radii where it is important to maintain truck access. Required curb radii vary by the cross section of the intersecting streets.

Adequate delineation of the flares is needed to keep vehicles from straying into the parking lane at night.

MEDIANS AND REFUGE ISLANDS

General Finding: Multi-lane highways with medians are substantially more convenient for pedestrians to cross than comparable highways without medians. Medians should be provided as a standard feature of multi-lane suburban highways. *Background.* A large proportion of the demand for pedestrian crossings on suburban streets occurs at unsignalized intersections. One study of an arterial street in suburban Virginia indicated that almost 90 percent of the pedestrian crossings occurred mid-block (what normally would have been thought of as jaywalking). When faced with long distances between intersections and traffic signals, pedestrians must be expected to cross at mid-block locations.

The AASHTO Green Book (1) states that "a median is a highly desirable element on all arterials carrying four or more lanes." The Green Book suggests seven functions of medians, none of which make reference to pedestrians. Actually, medians are one of the most significant benefits to pedestrian convenience and (potentially) safety on multi-lane highways. This is particularly true at mid-block locations or unsignalized intersections, as medians greatly simplify the pedestrian's task of crossing the street. Figure 65 illustrates this point for a multi-lane divided highway in comparison with an undivided highway. On the divided highway, the street crossing task can take place for one

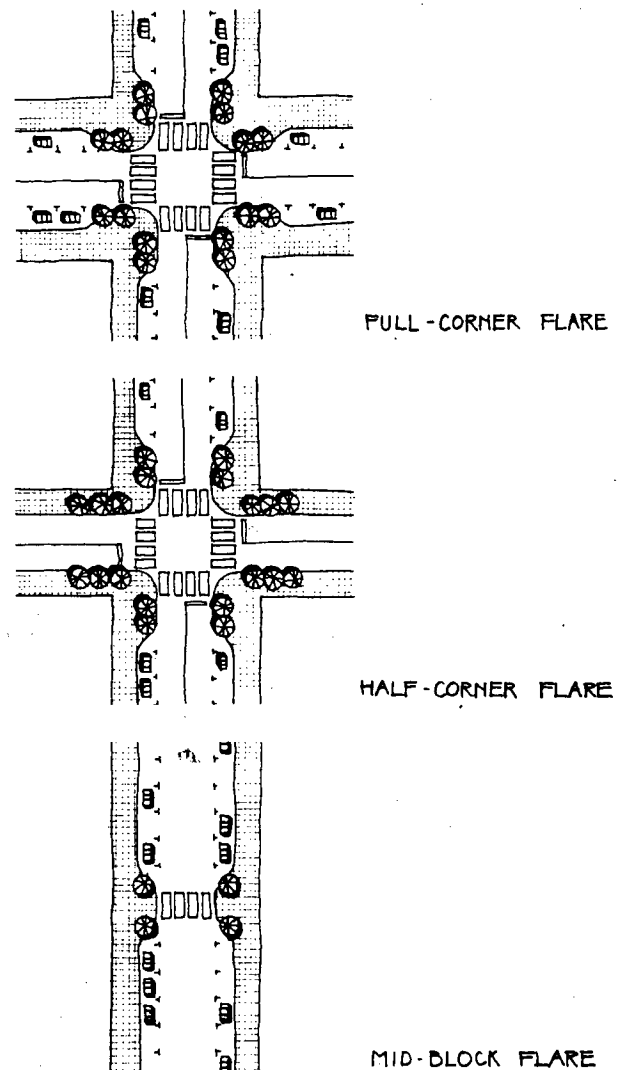


Figure 64. Alternative sidewalk flare designs.

direction at a time. The pedestrian need only look in one direction to cross to the median and in the opposite direction when crossing from the median to the far side of the street. The ability to segment the crossing into two simpler parts not only increases the safety of the crossing but also reduces the delay. The FHWA publication, "Access Management for Streets and Highways" (4), presents extensive material on the associated traffic considerations for medians and other access control measures.

The provision of medians offers significant benefit to the pedestrian by reducing crossing delays. Figure 66 provides an example of the delay reductions resulting from a median on a four-lane arterial highway. The pedestrian delays are somewhat typical of a suburban arterial during peak traffic hours, assuming occasional signalized intersections. If a pedestrian crossing an undivided street waits until adequate gaps are available in both directions of travel, the delay in crossing the road can be as much as 10 times the delay incurred while crossing with a median. The heavier the traffic volume, the more important a median becomes in facilitating street crossings.

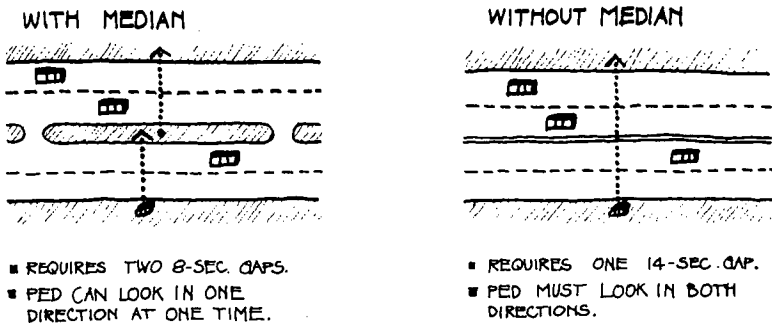


Figure 65. Benefits of medians in simplifying the crossing task.

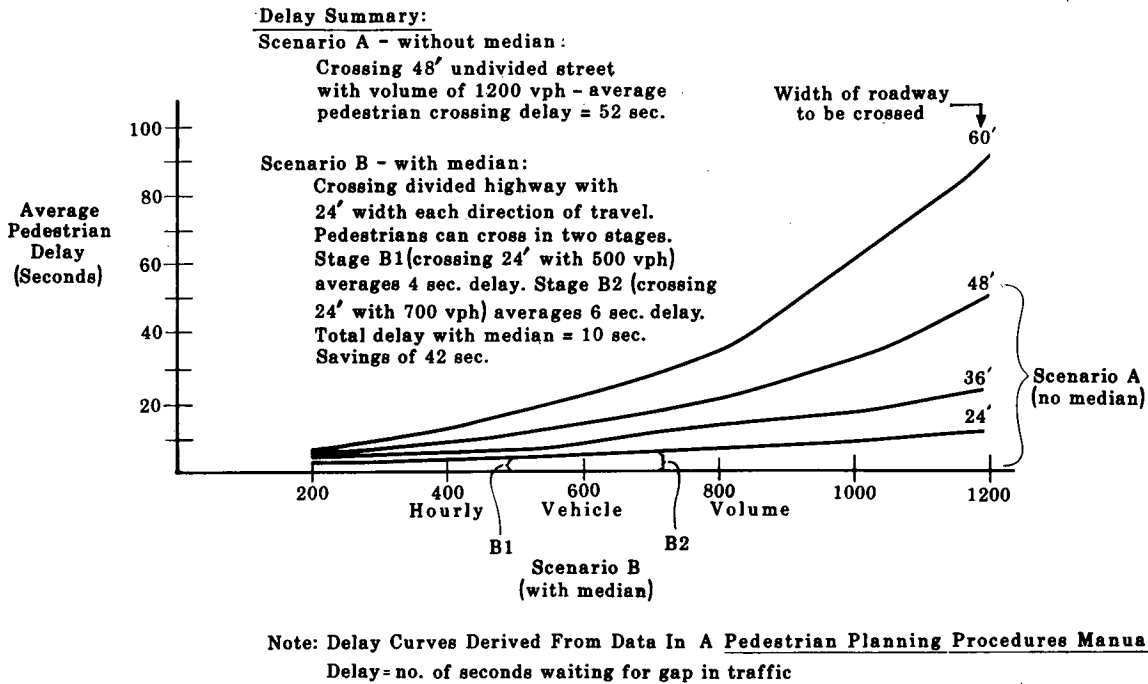


Figure 66. Illustration of savings in pedestrian delay afforded by installation of median or refuge islands.

The effect of medians and refuge islands on pedestrian safety is unclear. One study (4) reported that refuge islands installed to specifically address a safety problem were effective in reducing the number of pedestrian accidents. It is entirely possible, however, that this may have been a classic example of regression to the mean (see Ref. 5). Another study reported a slight increase in accidents after refuge islands were installed. There is a substantial lack of definitive information on this subject, and no conclusions can be drawn.

Illustration and Application. In light of the foregoing, it is strongly suggested that a median of at least 4 ft in width should be included on all newly constructed arterial and collector highways of four or more lanes. Wider medians are not necessarily needed for pedestrian crossings, but may be desirable for greater vehicular separation and accommodation of turning lanes.

Although this design principle becomes more important where there are attracting pedestrian magnets on opposite sides of the roadway, there should virtually never be an occasion for omit-

ting a median on a new road facility, because future development or redevelopment always raises the potential for pedestrian traffic. This should be reflected in the acquisition of right-of-way and in the establishment of state and local highway design policies. If the roadway is built as an undivided section, it will be more difficult and costly to add a median at a later date.

As obvious as the foregoing design principle may be, failures to recognize it are abundant. For example, in a major office and industrial development project near a suburban rail transit station in Prince George's County, Maryland, a new four-lane undivided highway was built to provide access to the development parcels (see Metro East Office Park case study in Appendix B). The roadway separates the transit station from the office development and poses a significant pedestrian barrier. Pedestrians are completely exposed to high-speed traffic without a space for refuge midway through their crossing. A median would have greatly simplified the crossing task and would probably have induced a reduction in vehicle speeds as well. Although a traffic signal has now been provided near the transit station, it does not accommodate many of the pedestrians where they desire to cross at other nearby points.

Another dramatic example of the difference between divided and undivided highway cross sections was found along International Drive in Orlando, Florida. The photographs previously presented in Figure 49 show the undivided four-lane section as well as a newer divided section. There is a distinct difference in not only the appearance of the two sections, located less than $\frac{1}{2}$ mile apart, but also in the ease and perceived safety of the pedestrian crossings. In the undivided section, it was observed that pedestrians often became "trapped" at the centerline, with traffic passing by within several feet of either side of the pedestrian. In some cases, pedestrians waited an inordinately long time to begin their crossing on the undivided road.

One argument often raised against medians is that they encourage street crossings at locations other than signalized intersections. It is argued that, by making the mid-block crossings more difficult, pedestrians are more likely to cross the road at a signal, where it is supposedly easier and safer. The major flaw in this argument is that it ignores typical pedestrian behavioral patterns. It has long been recognized that pedestrians seek the most direct route between points. Although the perception of risk may alter the paths of some pedestrians, observation of pedestrian behavior suggests that most pedestrians will increase their risk to make their route shorter. The solution is not to attempt to discourage this behavior by increasing the risk, but to accommodate observed pedestrian tendencies and to make street crossing more convenient and less of a risk.

Another of the purported problems with medians on roadways with many driveway access points is that medians hinder direct site access. While this may be true, there are other feasible design alternatives to provide access. Where there are small, individually developed land parcels, a service road may be the best solution to controlling access and enabling a median to properly function on the major arterial. However, service roads pose additional safety problems for pedestrians at intersections. Where development parcels are large, the number of driveways is more easily controlled and service roads are not usually required.

Even if driveways are frequent and a service road cannot be provided, periodic median breaks still provide for adequate vehicular access while enhancing pedestrian convenience and

safety. Figure 67 shows an example of a median with periodic openings for vehicular access. Some of the median segments are little more than pedestrian refuge islands, but they add greatly to the channelization of pedestrian and vehicular flows. To have required pedestrians to cross the entire width of this street without a median refuge in these situations would have been a serious detriment to convenience and safety. Locating the median segments during snow plowing operations can be a problem, but it is possible to designate the ends of the median islands with markers that pose no vehicle hazard. "Access Management for Streets and Highways" (4) provides additional alternatives for the channelization of traffic and provision of medians. It also provides information on the impact of retrofitted medians on business activity.

If access to all the driveways cannot be accomplished through direct median breaks, provisions can be made to permit U-turns. The AASHTO Green Book (1) describes several methods of incorporating U-turns into highway design. The most difficult situation in which to accommodate U-turns is a four-lane highway with a narrow median. Many vehicles cannot turn within the space provided, but provisions can be made to widen the far-side pavement to provide the required space, as illustrated in Figure 68. This seldom-used technique can permit the construction of a median to accommodate pedestrian crossings where one could not otherwise be installed. The median break for U-turns should be provided away from intersections and driveways (i.e., should be for the exclusive use of U-turns to avoid driveway traffic conflicts), at least 200 ft upstream of an intersection. This is an underutilized design feature on many arterial and collector streets. Functionally, it appears safer than providing for U-turns at intersections, as there are fewer attention demands on the driver making the maneuver.

The width of a median is not a major issue in pedestrian crossings, as long as it is at least 4 ft wide. Grass medians are preferred, but concrete medians are acceptable if there are overriding considerations of maintenance costs or other factors. For grass medians, paved walkways should be provided at all locations where pedestrian crossings are expected and especially



Figure 67. Application of short median segments to a wide arterial street.

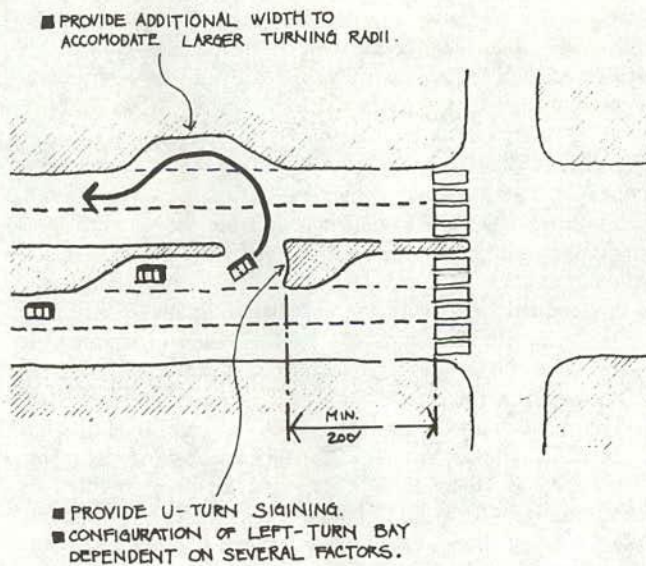


Figure 68. Example application of provision for U-turns to allow median to be included for pedestrian convenience and safety.

where paths across the median are evident. These will primarily occur at intersections. Ideally, breaks in the median should be provided so that pedestrians can cross at street level (Fig. 69). However, a median-level walkway with properly designed curb ramps (Fig. 70) may be preferred to more effectively accommodate mowing operations and to prevent ponding in the pedestrian walkway.

In areas where a continuous median is, for some unusual reason, impractical to include in new roadway construction, efforts should be made to place pedestrian refuge islands at strategic points along the highway. Refuge islands should be at least 4 ft wide, and 10 ft long, and should be well signed, marked, and lighted. These may be needed where intersection areas are large and crossing distances great. Refuge islands are a larger issue in the upgrading of existing streets, and more details may be found later in this chapter.

SHOULDERS AND WALKWAYS

General Finding: Evidence indicates that providing separate pedestrian walkways or wider shoulders will reduce pedestrian accidents in suburban and rural areas. This taken in combination with the benefits and convenience make walkways or wider shoulders desirable elements of the highway cross section, even in some rural areas. **Background.** Approximately 15 percent of pedestrian accidents in suburban and rural areas occur with pedestrians walking along the roadway (6). Although having a sidewalk, pathway, or wide shoulder does not provide assurance that a pedestrian will not be struck by a vehicle, it certainly reduces the possibility. This is verified through vehicle encroachment theory (see Ref. 7 for background). The greater the distance of the walkway from the road edge, the lesser the chance of a pedestrian-vehicle collision. However, the exact safety benefits of walkways and wider shoulders have not been quantified.



Figure 69. Median opening to accommodate street-level pedestrian crossings.



Figure 70. Well-designed-elevated median crossing.

Illustration and Application. To accommodate pedestrian needs, one of the following combinations of shoulder, curb, and walkway can be provided: (1) shoulder with separate pedestrian walkway; (2) curb and gutter with separate pedestrian walkway; and (3) wide, paved shoulder with no pedestrian walkway. Design details for the first two of these three alternatives are referenced in the AASHTO Green Book (1). Separate walkways are always preferred, but shoulders may suffice in areas with low pedestrian volume.

Figure 71 illustrates a high speed suburban arterial highway, provided with a 10-ft paved shoulder. Pedestrians are able to walk far enough away from the traffic lanes to achieve a reasonable sense of safety. Even though the right-side shoulder was designed primarily for vehicular accommodations and safety, it also benefits pedestrians. The State of Florida has mandated

that paved shoulders at least 4 ft in width be provided on all roadways within 5 miles of an urban area, specifically in response to bicycle and pedestrian needs. Figure 15, presented previously, illustrated such a cross section on a two-lane road on the outskirts of Tallahassee, Florida. Where sufficient shoulder width cannot be provided separate paths are needed. Figure 72 illustrates a cross section with a narrow shoulder, but a separate pedestrian path. Because of the alternative path provided, the shoulder width is less of a concern.

Walkways or sidewalks in the highway right-of-way represent the major element of pedestrian facilities serving longitudinal movement. The AASHTO Green Book acknowledges the need for walkways even in many rural areas, because of high vehicular speeds and inadequate lighting.

In areas where pedestrian activity is likely to be significant, such as commercial areas, separate walkways should be required on both sides of arterial and collector roadways. One of the major deficiencies in the pedestrian system noted in agency surveys, interviews with pedestrians, and discussions with planners, designers, and engineers is the lack of sidewalks and walkways where they ought to exist. Approximately 25 percent of those responding to the resident surveys (see Chapter Two) suggested that more sidewalks were needed in and around their area. Worn pedestrian footpaths along many arterial and collector streets attest to the lack of sidewalks where they are needed. Arterial and collector highways in high activity areas are likely to incur significant pedestrian volumes as they develop and will clearly warrant walkways. The appropriate type of walkway (e.g., sidewalk or asphalt path) should be addressed for each individual situation. Concrete sidewalks are usually more appropriate in curb and gutter sections, while asphalt walkways are preferred in many situations without curb and gutter. Asphalt walkways are being increasingly used because they can be constructed at lower costs.

Walkway width in commercial areas should typically be at least 5 ft. Pedestrian capacity analysis techniques described in the "1985 Highway Capacity Manual" (8) can be used to evaluate the widths of sidewalk required to accommodate higher levels of pedestrian flow. A planting strip of at least 4 ft should be provided, but would not usually be more than 2 ft where on-street parking is expected. A greater separation is needed in areas where snow plowing may require increased space. Consideration should be given to variable sidewalk separation in areas where meandering walkways can be accommodated. Figure 73 shows an example of this in an office/industrial park setting. This may require wider right-of-way, a variable right-of-way, or provision of pedestrian easements. This can be accomplished more easily where a major land development is taking place and the public agency can work with one developer to make these arrangements. Zoning and subdivision regulations should be flexible enough to accommodate these types of designs where they are appropriate. Ways to provide flexibility in these regulations are discussed in Chapter Six.

UPGRADING AND RETROFITTING EXISTING HIGHWAYS

General Finding: Many problems of pedestrian convenience and safety are built into the existing highway system (see Chapter Two for description). Therefore, significant strides in improving pedestrian safety and convenience must include the



Figure 71. High-speed suburban arterial with 10-ft paved shoulder.



Figure 72. Cross section with narrow shoulder but separate pedestrian path.



Figure 73. Variable walkway separation to accommodate meandering paths.

upgrading and retrofitting of existing highways. *Background.* The previous sections indicated that there are significant opportunities for molding a favorable pedestrian environment where there is a "clean slate" from which to work. Areas in which the land and road system are largely developed, however, do not afford these opportunities. Design standards and practices employed in earlier years have not always accommodated the pedestrian effectively. Consequently, the flexibility for improvement of the pedestrian environment in these developed areas is restrained by outmoded highway designs, limited right-of-way, cost and other factors.

Nevertheless, significant improvement in pedestrian accommodations are possible even in these existing settings. This is an extremely important area in light of the many miles of suburban and rural roads already in service. The mileage of the U.S. highway system grows at only about 0.3 percent per year (out of a total of mileage of nearly 3.9 million miles). Working only with new development, although very important, would have relatively little impact on the overall pedestrian system. Progress is being made in some parts of the country to retrofit existing roadway systems to better meet pedestrian needs.

Illustration and Application. The following paragraphs present ideas for modifying existing cross-section designs to better accommodate the pedestrian. In some cases, it will be appropriate to implement these concepts along with other general road upgrading. In other cases, the benefits to the pedestrian alone may justify the improvement.

For projects involving widening to four or more lanes, an attempt should be made to include a median. There should be exceptions to this rule only if signalized intersections are frequent enough (e.g., nearly every block), or if traffic lanes would have to be made too narrow to provide for safe traffic movement. If the trade-off is between narrow lanes with a median and standard width lanes (12 ft) without a median, the median option is preferred, from the pedestrian point of view.

Widening should never be allowed to eliminate a sidewalk, even if only on one side.

At least a 2-ft separation between the sidewalk and traffic lanes should be maintained. On lower speed roads, the planting strip could be eliminated if the additional width must be found. However, if sufficient land is available outside the right-of-way, every effort should be made to maintain the separation by relocating the walkways to private property using pedestrian easements.

All multi-lane undivided highways in developed suburban areas should be considered candidates for median placement. Alternative median configurations for roads with frequent access points were discussed previously.

Although a 2-ft median is a minimum under constricted cross-section constraints, at least 4 ft is preferred. If existing lane widths on undivided roads are at least 12 ft, lane widths should be reduced to 11 ft to accommodate the median width. If access to commercial establishments is a major factor, provide for frequent median breaks and/or U-turn capability.

An example of an arterial street in the Washington, D.C., area retrofitted with a median is shown in Figure 74. Sixteenth Street, a radial arterial roadway through an older residential area, has gone through several phases of cross section development and lane control over the past decade. Recently, a median was installed over an approximate 6-mile length, providing both channelization for vehicular turns and a pedestrian refuge



Figure 74. Retrofitted median on 16th Street in suburban Washington, D.C.

for those crossing this heavily trafficked street. Brick work and landscaping provide an attractive look, blending the median with an overall character of the area. Medians do not always need to be this elaborate, but when installed on an existing undivided road, they clearly have a positive effect on the pedestrian environment.

A simpler, but less effective, approach to providing medians on existing highways is to provide a 4-ft striped median rather than a raised median. An example of this from Phoenix, Arizona, is shown in Figure 75. Local engineers indicated that this design completely eliminated complaints by users of the crossing. It required merely narrowing the lanes and restriping, and provided a low-cost, effective solution.

Another example of a low-cost refuge area is shown in Figure 76. Although the refuge island is not raised, the stanchions provide a high-visibility holding area for pedestrians. Other types of flexible, high-visibility barriers could be developed to provide a similar function perhaps more attractively.

In some situations, isolated pedestrian refuge islands may be warranted on undivided multi-lane streets. Figure 77, from the MUTCD, illustrates a recommended striping and signing configuration for a fixed object on an undivided highway. Although not intended for pedestrian refuge islands, this same configuration can apply. It may require reductions in lane width or increases in curb-to-curb cross section near the refuge island. Figure 78 shows the application of a refuge island on an arterial street in Orlando, Florida. The island links a parking lot with an office building across the street. If large enough, refuge islands can be landscaped with low bushes to improve their appearance. However, object markers or other reflectorization should always be provided, and the crossing location must be well lighted.

There are many opportunities for using pedestrian refuge islands as a result of their relatively low cost and limited impact on vehicular delay and safety. They should be installed where medians cannot be provided, speeds are generally less than 45 mph, and pedestrian crossing volumes are in excess of 100 persons per day or where any pedestrian accidents have occurred. Refuge islands should not be used for mid-block pe-



Figure 75. Retrofitted striped median in Phoenix to solve a pedestrian crossing problem.



Figure 78. Pedestrian refuge island linking a parking lot and office in Orlando.

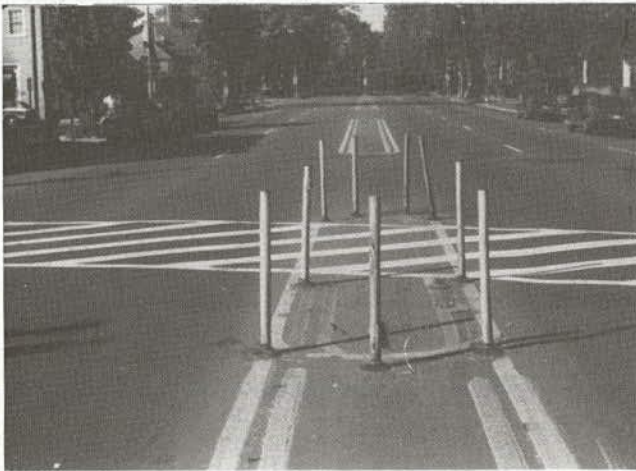


Figure 76. Street-level median with special refuge island delineation.

pedestrian crossings across high volume streets where speeds are 45 mph or more. Such situations are candidates for traffic signals or pedestrian overpasses.

A possible objection to medians and refuge islands relates to snow plowing operations. Although refuge islands do not make snow plowing or removal easier, it is not apparent that they are so detrimental to snow operations to justify their not being provided. If medians and refuge islands are properly designed and marked, they should not significantly interfere with this activity in most areas.

Two-way left-turn lanes (TWLTLs) have been widely applied to facilitate left turns on roads with many access points. Their operational and safety effectiveness has been well-documented, but their impact on pedestrian crossings has received little attention. Accident reductions for TWLTLs have typically averaged 30 percent (4). There is no conclusive evidence of its effect on pedestrian accidents.

This is perhaps one of the most uncomfortable and dangerous situations that pedestrians may encounter in suburban areas. The pedestrian must carefully observe not only two directions of through traffic, but two directions of left turning traffic simultaneously. Consideration of pedestrian needs is important, since two-way left-turn lanes are often installed in locations

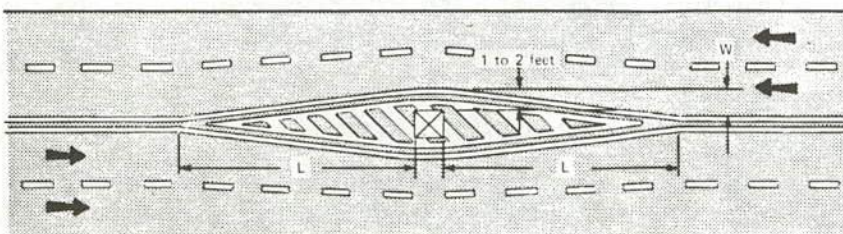


Figure 77. Sample striping pattern recommended in the MUTCD for fixed-object delineation.

where pedestrian crossing traffic can be expected (i.e., strip commercial development). There are many 5-lane roadway sections with two-way left-turn lanes, and even some seven-lane sections. Observation of pedestrian activity at two-way left-turn sections indicates that they often use the middle lane as a refuge. This leaves them vulnerable to both directions of turning traffic.

Solutions to the two-way left-turn lane problem are not easy. The ideal solution is to have a median with frequent openings, but this is not always possible. The only other option is to have a series of carefully placed, well-delineated pedestrian refuge islands. Because of the unique combinations of the number and locations of driveways, each situation must be treated as a special case. In principle, however, islands should be located every 300 to 500 ft. The best way to locate the refuge islands is to plot all turning radii into and out of the driveways from both sides of the road. Nonconflict areas are candidate locations for refuge islands. Refuge islands should be as long as possible without interfering with vehicular turning movements or limiting possible future driveway locations.

INTERCHANGES

General Finding: Many suburban interchanges appear to be designed assuming there will be no pedestrian demand to traverse them. Most suburban interchanges do have pedestrians crossing them, and this demand needs to be anticipated in design. *Background.* Interchange areas occur in the highway right-of-way at arterial-to-arterial or arterial-to-freeway junctions. Although interchanges may be legal for pedestrians to negotiate (on the arterials, not the freeways), they are particularly unfriendly to pedestrians. Pedestrians attempting to negotiate an interchange area may face long walking distances, grade changes, exposure to high-speed traffic, numerous conflict points, and a generally uncomfortable walking experience. Thus, interchange areas must be considered as a major impediment to pedestrian movement.

A study by Ferlis and Kagan (9) analyzed the planning needs for pedestrian movement at interchanges. They determined that interchange designs should be conceived to increase pedestrian/vehicle awareness, control pedestrian movement, and utilize traffic control devices to manage traffic movements. Possible treatments include providing pedestrian information/directional signing, installing pedestrian crossing signals, illuminating the interchange/walkway areas, installing vehicle warning signs, marking crosswalks, regulating traffic speeds and movements, channelizing vehicular and pedestrian traffic, constructing pedestrian barriers, utilizing overpasses and underpasses to separate pedestrian traffic, and installing traffic signals (including actuated signals).

The treatments appropriate for any given situation are dependent on a range of factors including cost, sight distances, vertical and horizontal alignments, delay and stop impacts, traffic movement patterns, and so on.

Illustration and Application. The Ferlis and Kagan study analyzed a number of interchange designs to determine how pedestrians can best be accommodated. Figure 79 shows one approach for a cloverleaf interchange. Note that the crosswalks are marked perpendicular to the roadway and the crossing location is signed for vehicles.

Another crossing strategy analyzed was to have the pedestrian cross to the median, then traverse the interchange and cross

back to the side of the road once past the interchange area. Observation of pedestrians in this study indicated this to be a line of least conflict in some cases, especially when there is no sidewalk along the roadway and there are traffic signals in close proximity to the interchange.

Other creative applications were also found in this study for helping pedestrians across interchanges. Figure 80 shows a retrofitted ramp arrangement taking pedestrians behind the bridge piers. Figure 81 shows a bridge designed with additional pedestrian accommodations. Again, the cardinal rule is to remember that pedestrians are also users that need to be accommodated. Usually there is a way to accomplish this at relatively little additional expense, if thought about at an early stage. Appendix F provides a collection of additional photographs presenting ideas on these and other pedestrian treatments.

PEDESTRIAN OVERPASSES AND UNDERPASSES

General Finding: Pedestrian overpasses and underpasses are not appropriate for widespread application in suburban areas, but are applicable when certain conditions are met. There is more potential for cost-effective applications when overpasses and underpasses are integrated into other land development or highway construction schemes. *Background.* Pedestrian overpasses and underpasses have been one of the more controversial and most studied pedestrian-related issues. Extensive effort has gone into establishing design criteria for overpasses (Ref. 10). Methods for establishing the costs and benefits of overpasses and underpasses have also been developed (11). A recent FHWA study developed warrants for pedestrian crossings (12).

Illustration and Application. Several of the case studies included reviews of pedestrian overpasses and underpasses. One underpass treatment was found along a major arterial highway in Normal, Illinois, constructed to accommodate major movements of pedestrians at the University of Illinois. The underpass was a solution to not only the pedestrian problem, but to the traffic problem as well. The pedestrian movements had been bringing traffic to a virtual halt during class changes. Key to the success of the design was the time savings afforded the pedestrian, ensuring that the underpass would be used in deference to crossing at-grade. Stevenage, the British new town, is perhaps best known for its integration of separate pedestrian and bicycle facilities into the roadway system (see Fig. 82). Although this design may not be cost effective for many other locations, it demonstrates that a separated system is possible when designed with gradual slopes and direct routes, making use by pedestrians easier and more likely. Columbia and Brandermill (see Appen. B) both provide underpass treatments that seem to work. When designed and built along with the remainder of the development, the cost of grade-separated pedestrian crossings is cut substantially. The references cited earlier should be consulted for additional information.

TRAFFIC SIGNALS

General Finding: Traffic signals offer significant benefits to pedestrians in the crossing of streets. However, they are rarely warranted in suburban areas on the basis of pedestrian use alone. *Background.* There has been a great deal of research into the effects of traffic signalization on delay and accidents. Two of

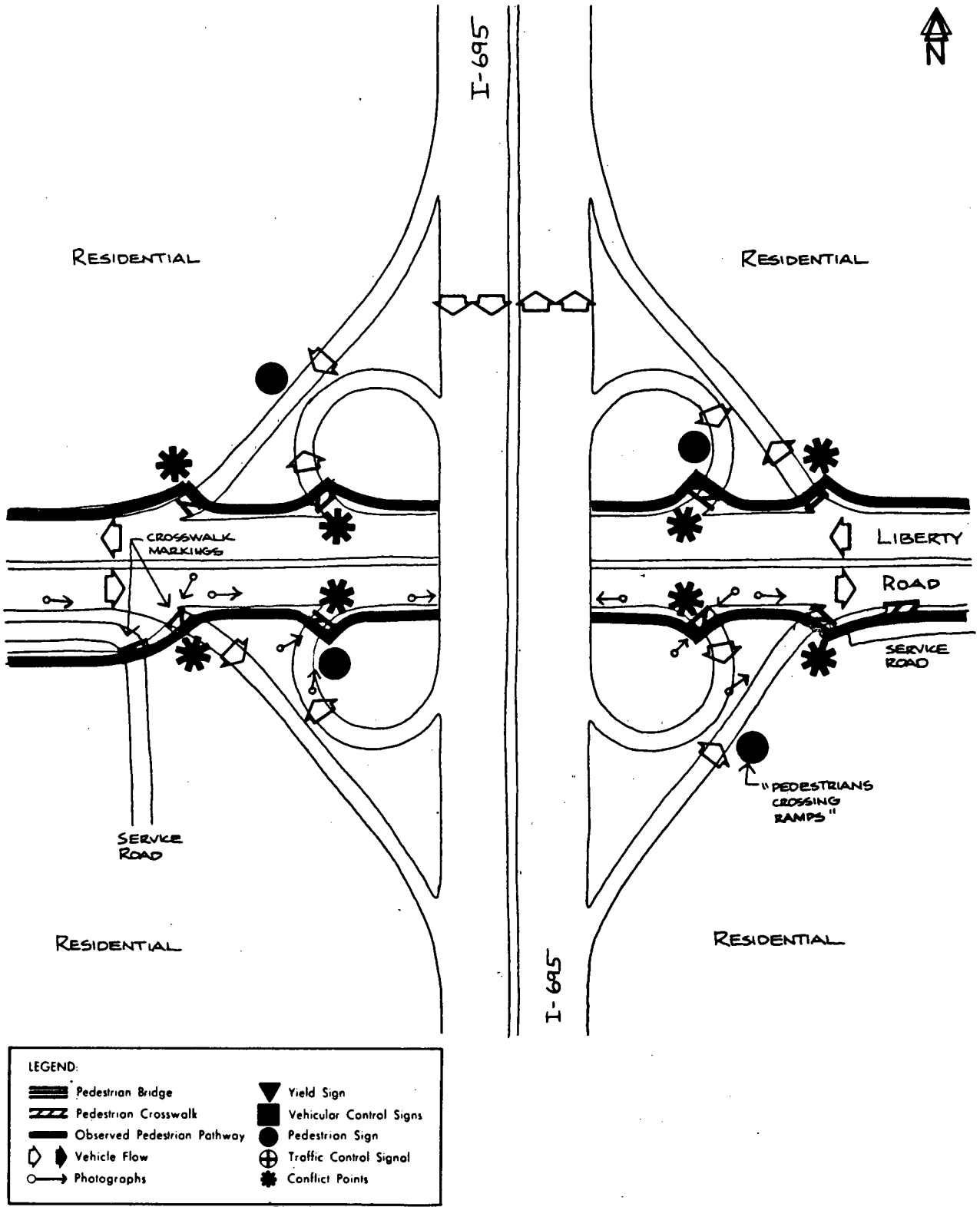


Figure 79. Pedestrian accommodations at an arterial-freeway interchange. (Source: Ref. 9)



Figure 80. Pedestrian accommodations at an underpass.

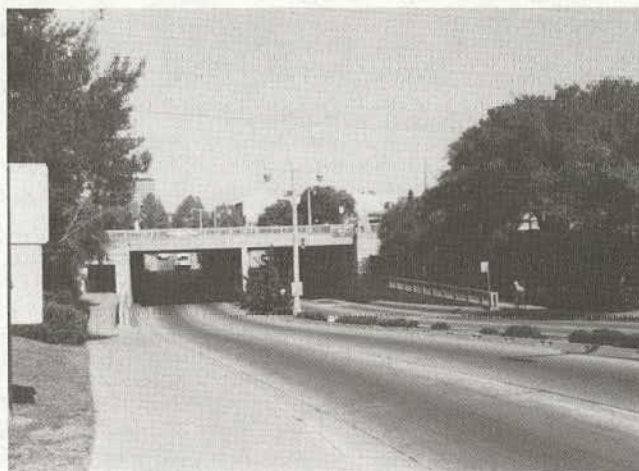


Figure 81. Pedestrian accommodations at an underpass minimizing grade change.

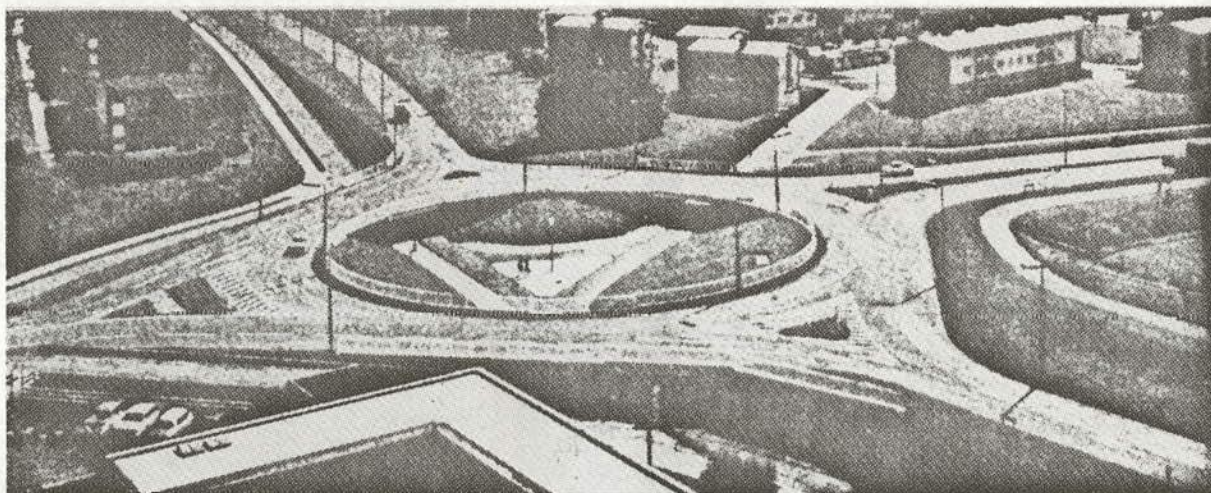


Figure 82. Walkway/bikeway/roadway junction treatment in Stevenage, England.

the more significant pedestrian-related studies can be found in Refs. 13 and 14. While traffic signals are certainly a help to pedestrians crossing the street, they cannot realistically be located frequently enough to accommodate pedestrians everywhere they want to cross. However, they do create gaps in traffic that enable pedestrians to cross more easily upstream or downstream from the signal, as indicated by data on traffic gap distributions (15).

It was not the intent in this study to completely explore the effect of traffic signals on pedestrian delay and safety. However, the reader should be aware of the references that provide guidelines on the application of traffic and pedestrian signals. These can be found in Refs. 16 and 17. Warrants for pedestrian signals (WALK/DON'T WALK or the symbolic counterpart) are suggested in Ref. 18.

PEDESTRIAN ACCOMMODATIONS IN THE VICINITY OF BUS STOPS AND OTHER TRANSIT FACILITIES

General Finding: A substantial amount of walking takes place in the vicinity of transit stops, even in the suburbs. Therefore special attention should be given to pedestrian accommodations near bus stops and other transit facilities. *Background.* Transit was once the primary mode of transportation for most individuals living in major U.S. cities. Cities were more compact, fewer autos were available, and transit service was generally more extensive than even today. Although transit ridership declined in the 1950's and 1960's, it has been on the increase since the early 1970's, and the rapidly increasing traffic congestion suggests that the role of transit will become even more prominent in the future.

Every transit trip requires two walk trips, one at the origin and one at the destination. Part of the walk trip at the origin end usually also requires a period of waiting for the transit vehicle to arrive. Observation of pedestrian facilities at or around transit stops in suburban areas revealed a wide disparity of accommodations. On some highways in developing areas, bus stops were commonly placed in areas without sidewalk. It was not uncommon to find locations where pedestrians would be forced to stand in dirt (mud in rainy weather), in high grass, or along the shoulder adjacent to high-speed traffic. Other locations were equipped with full bus shelters.

Many cities have criteria for providing various amenities (pads, benches, or shelters) at bus stops. These criteria are usually based on the volume of boarding passengers. However, it would seem logical that other criteria should also enter into the decision, particularly conditions at the bus stop location. If the bus stop location results in substantial hazard or inconvenience to even a few transit riders, there is reason enough to install at least some type of mud-free surface set back from traffic. On roads with narrow shoulders, consideration could be given to spot shoulder widening at bus stops, supplemented by small concrete (or other appropriate material) pads. Even concrete patio blocks can sometimes suffice as a temporary solution. The provision of these facilities will usually require the coordination of highway and transit agencies.

In addition to facilities at the transit stops themselves, a careful examination needs to be made of walking facilities approaching the stops. If the bus stop is on an arterial street, the nearest cross streets are usually at least collectors, and these should be checked for the presence of walkways. Linkages between the stops and major destinations (e.g., apartment buildings or offices) should receive particular scrutiny. The best time to conduct this review is when the bus stop is first placed at that location or when a major development project comes on line nearby. The review would normally be conducted by the local agency's pedestrian advocate. Transit patrons should certainly bring deficiencies to the attention of the proper authorities. In essence, the transit stop, even though it may be little more than a sign along the road, should be considered as a significant pedestrian destination, and the same analysis of linkages conducted as would be undertaken for a large development project.

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IMPLEMENTATION

Many of the current deficiencies in the pedestrian system can be attributed not to lack of knowledge or technical skill, but to the institutional, economic, and legal impediments to implementation. This became clearly evident in the logging of problems during the site inventories and case studies. The many missing sidewalk links, the controller cabinets infringing on the pedestrian walking area, the stark, open parking lots, and the land development patterns adverse to pedestrian travel appeared to stem largely from oversight, funding problems, conflicting priorities, general insensitivity to pedestrian needs, and institutional barriers inherent in the planning process.

Implementing pedestrian systems in suburban and developing rural areas is a joint responsibility of public agencies and the private sector. Each must realize the importance of an effective and safe pedestrian system to their interests. The provision of adequate pedestrian facilities should become as routine in the suburban and developing rural setting as they have become in well-planned urban environments. Implementation issues fall into four general categories: (1) strategic opportunities for action in the planning process, (2) development regulation, (3) financing pedestrian facilities, and (4) operations and maintenance. Implementation strategies relating to each of these areas are discussed in the sections that follow.

STRATEGIC OPPORTUNITIES FOR ACTION WITHIN THE PLANNING PROCESS

An overview of the planning process and how the pedestrian fits within its framework was presented in Chapter Three. The key points about the planning process in Chapter Three were: (1) To be successful, the efforts to plan for pedestrians must be integrated into existing processes for planning land development, transportation systems and public facilities. Pedestrian planning cannot be divorced from the overall planning framework. (2) Pedestrian planning must begin at the policy formulation level (i.e., establishment of community goals and objectives), by developing planning policies that recognize pedestrian needs and by adopting and clearly stating these policies in documents that govern local and state planning. (3) The comprehensive plan, more detailed subarea plans, and special studies should provide more specific guidance on pedestrian facility location and design. (4) Site planning must consider pedestrian needs in parallel with other site considerations and not after the major site decisions have been made.

These actions might be considered as “leverage points” in the overall planning process—strategic footholds for ensuring that pedestrian needs are not overlooked. Specific actions can be taken by public agencies, developers, and citizens to provide a greater chance that effective pedestrian facilities will be provided.

Information collected in this project pointed toward a number

of implementation-related actions that can be taken by each of these groups to foster the provision of effective suburban pedestrian systems. Suggested actions are listed below.

Public Agency Actions

- Designate a pedestrian advocate, assigned with specific pedestrian-related responsibilities, within each local and state planning agency. This staff person would not necessarily devote full time to pedestrian concerns, except in the largest of agencies. The advocate would be designated as the person to review site plans, review public complaints, and consider the implications of other agency actions on pedestrian needs. In very small agencies, pedestrian advocacy would ordinarily be a small part of a staff person’s overall function, but specific reference should be made to pedestrian-related tasks in the job description. In the New Jersey Department of Transportation, a job position has been established with the specific title “Pedestrian/Bicycle Advocate.” The responsibilities of this position are in keeping with the job title, as listed in Figure 83.

- Ensure that plans for highways and site development are reviewed from the pedestrian point of view. The pedestrian-oriented review can be brief, but need not extend the time frame of the review process. Reference 1 contains information and suggestions on streamlining the permit process, including the necessary reviews.

- Structure the administration of the planning, design, and implementation process to include pedestrian considerations at every step. This includes formalizing pedestrian facility needs in the comprehensive plan and in other local and state planning instruments.

- Involve the community in the planning process. Community involvement is a legitimate and important element of the planning process. Taxpayer dollars go to improve facilities, and there should be input and feedback from the community in planning for them. Failure to include residents, merchants, and related groups in the initial stages often results in costly changes or complete rejection of a plan. Sometimes, citizens can be put to work to address certain aspects of the plan. For example, the City of Spokane, Washington, coordinates with its citizens in the preparation of Community Development Neighborhood Design Plans. Funded under the Community Development Block Grant program, the preparation of a plan is citizen-oriented and guided by a neighborhood task force. Figure 84 is an excerpt from a recently prepared plan for the Peaceful Valley Neighborhood. The City of Athens, Georgia, has a simple procedure for sidewalk inventory that can be undertaken by citizens.

- Pursue methods to provide proper funding for pedestrian facilities. Possible funding methods are discussed later in this chapter.

As the Department's primary pedestrian and bicycle contact person, review and respond to contacts directed to the Department from outside agencies and the public that relate to pedestrian and bicycle issues, and, when necessary, refer these matters to other units for reply or remedial action. This includes referrals to district offices of the Bureau of Local Aid Programs on inquiries related to the Department's Bikeways program.

Review matters brought to the Pedestrian and Bicycle unit's attention by units within NJDOT or other units of state government (e.g. NJ TRANSIT) that concern pedestrian and bicycle issues and provide advice or direction as required.

Maintain technical proficiency and a knowledge of pedestrian and bicycle issues by reviewing technical publication and maintaining contact with individuals who are knowledgeable in the field of pedestrian and bicycle issues and research. Attending and participating in conferences, meetings and seminars to expand my knowledge of pedestrian and bicycling matters; e.v. serve on Transportation Research Board Committee for Pedestrian and Bicycle issues.

Carry out coordination with FHWA and other federal agencies to keep abreast of federal policy and programs pertaining to the pedestrian and bicycle modes. This includes reviewing and commenting on proposed federal rules relating to the pedestrian and bicycle modes.

Identify physical, procedural or institutional barriers to pedestrian access or the use of bicycles and take action to encourage the development of projects, programs or policy both within the Department and in other agencies.

Develop and periodically review Department Policy and Procedures as they relate to pedestrian and bicycle interests and, as appropriate, make recommendations to the Assistant Commissioner for Transportation Services for additions to or changes in policy.

Develop and implement Departmental programs which enhance the pedestrian and bicycling environment and promote the increased use of the bicycle and pedestrian modes - particularly for utilitarian types, e.g. bicycle suitability mapping or bicycle parking facilities.

Through continuing coordination with NJDOT and county planning and design units develop procedures and provide directions so that these units take into consideration the needs of pedestrian and bicyclists as they conceive, plan, design, implement and maintain New Jersey's transportation infrastructure.

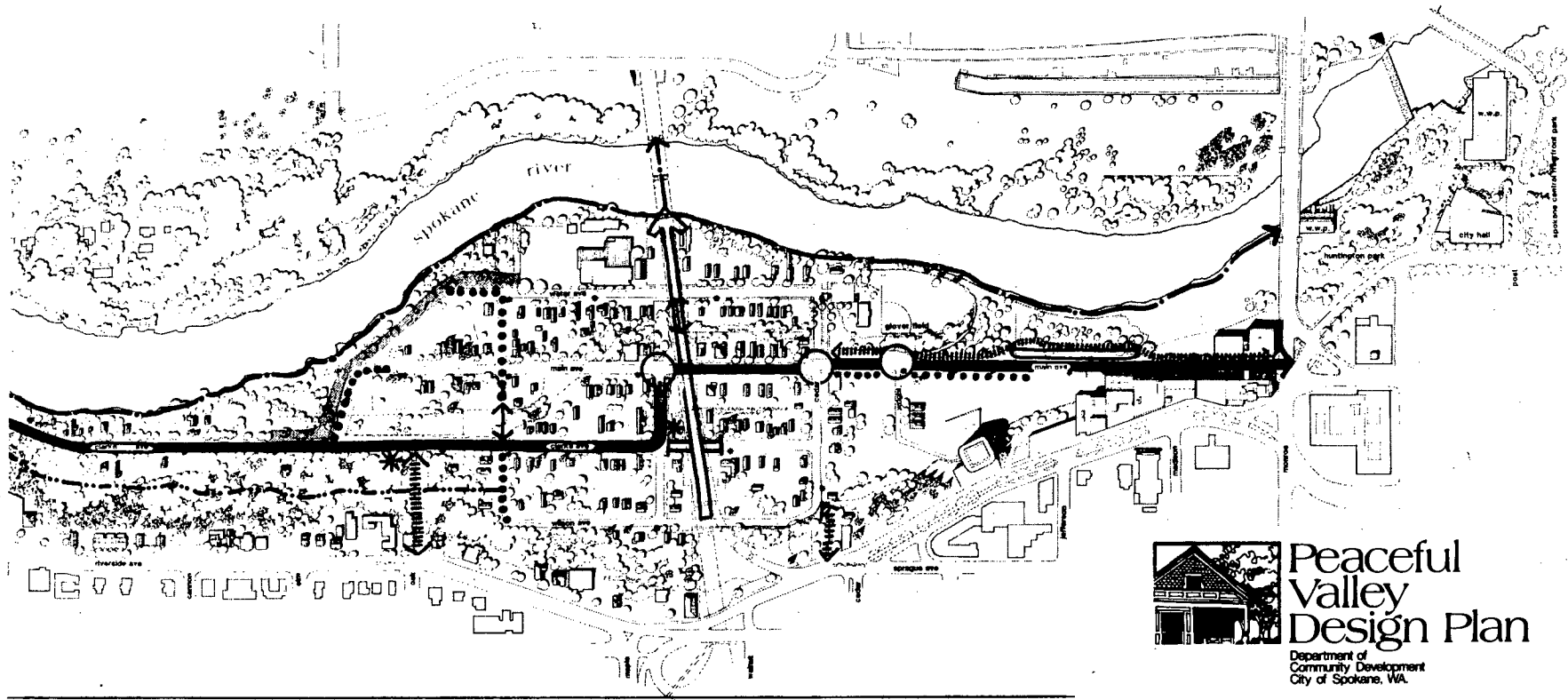
Design, direct, and/or carry out research studies or surveys related to the pedestrian and bicycle modes in order to solve specific problems or to create an information base for the development of pedestrian or bicycle policy, programs, or procedures.

Administer the FHWA, Section 141 Bicycle Grant Program. This includes solicitation of proposals, proposal review, coordination with and the provisions of technical assistance to participating project sponsors and project monitoring.

Serve as the Department's advisor to the New Jersey Trails Council and maintain coordination with NJDEP in matters pertaining to proposed or potential linear (trails) facilities. This includes attending monthly Trails Council meetings and participating in the development of the New Jersey Trails masterplan.

Carry out all paperwork and record keeping associated with the Department's pedestrian and bicycle programs. This includes issuance of interstate bicycling permits and the compilation and distribution of bicycle touring information packets.

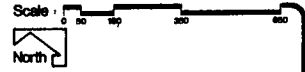
Figure 83. Responsibilities of the pedestrian/bicycle advocate in New Jersey.



| PEDESTRIAN | | | | | |
|------------|---------------------------|--|-----------------------|--|-------------------------------|
| | LIMITED ACCESSES | | SIDEWALK IMPROVEMENTS | | STAIRWAY CONNECTORS |
| | STREET CLOSURES | | RIVERFRONT PATHWAYS | | INTER-NEIGHBORHOOD CONNECTORS |
| | INTERSECTION IMPROVEMENTS | | HILLSIDE PATHWAYS | | RIVERFRONT CONNECTION |

 **Peaceful Valley Design Plan**

Department of Community Development
City of Spokane, WA.



Circulation Element

Figure 84. Excerpt from the Peaceful Valley neighborhood design plan in Spokane, Washington.

Community Actions

- Provide input into the comprehensive plans. If there is no master walkways plan, lobby for the inclusion of one into the comprehensive plan.
- Become involved in other subarea planning activities, or even initiate them. Most agencies are willing to work with community groups who desire to address a particular problem or to develop plans for neighborhood improvement.
- Provide input at public hearings or work sessions addressing specific pedestrian-related issues.
- Understand the decision-making process and the background for engineering and planning practices. Many of the basic texts for planning and engineering have been cited in this document.
- Provide useful information to public agency staff on legitimate concerns of pedestrian safety and convenience (e.g., burned out bulbs in pedestrian signal heads, missing signs, overgrowth creating sight distance problems, tripping hazards in the sidewalk, etc.).

Developer Actions

- Consider pedestrian needs as part of every project design. Even though the planning and design of pedestrian facilities may be straightforward, inclusion in early plans will make it less likely that needed facilities will be overlooked.
- Recognize the benefits of quality design and pedestrian amenities in project development. These not only benefit the user, but often add marketability to the project. Several case studies in Appendix B provide evidence that quality design pays off in the long run (e.g., see case study of Maitland Center).
- Consider how surrounding land uses (both existing and future) will be connected with the proposed development.
- When developing large tracts, consider employing pedestrian-oriented development schemes. Chapter Three presented ways to foster pedestrian orientation in the spatial arrangement of land uses.
- Development of large tracts should also be governed by a set of coordinated development guidelines. The guidelines would normally be developed by the design consultant, in conjunction with the overall developer, and contractually required to be followed by developers of individual parcels.

DEVELOPMENT REGULATION

A variety of legal tools have been employed over the years by public agencies as mechanisms to bring about orderly development in keeping with stated planning goals and objectives. The need for regulation implies that without it, development would occur in a fashion that was not necessarily in the public interest. Development patterns of earlier years in which there was less regulatory control are evidence that regulation has brought about at least some measure of public benefit. But there is great controversy over the extent to which regulation does, in fact, achieve its intended purpose and there is concern over the misuse of regulation.

Regulation is distinct from planning. A plan defines how one would want the built environment to eventually look; regulation is a tool to foster accomplishment of the plan. Although many

regulatory tools have been introduced into the development process, the most basic instruments guiding development in general and pedestrian facilities in particular are still the local zoning ordinance and subdivision regulations. Although there are some areas of overlap, the zoning ordinance generally controls use type, density, and site layout features (e.g., setbacks, parking requirements, landscaping requirements, etc.), and subdivision regulations govern design (e.g., roadway cross sections, sidewalk widths, driveway locations, etc.). The Model Land Development Code, proposed by the American Law Institute in 1976, merges the zoning ordinance, subdivision regulations, and building code. However, most local governments still retain the separate instruments.

Most local jurisdictions also have a site plan review and approval process through which the reviews of site planning proposals are based on the requirements of the zoning ordinance but, depending on how the ordinance is written, there may be some flexibility within those requirements. A good balance in the rigidity of the regulations is needed, taking care not to make them so loose that developers can avoid complying with their intent, but not so rigid as to discourage creative solutions and lose unique opportunities.

Jurisdictions differ as to their degree of flexibility and willingness to negotiate within the site plan review process. Through the site plan review process, Arlington County, Virginia, has been extremely successful in securing various pedestrian amenities. Developers wishing to locate in Arlington are required to include pedestrian amenities in their project proposals, but negotiation takes place as to their exact form for each site. Most of these improvements include standard sidewalk widths, lamp posts, underground utilities, and street trees.

The following sections discuss the application of these devices to the implementation of pedestrian facilities.

Zoning Ordinances

Zoning ordinances typically establish the process for approval of the right to develop private property. As such, they should require that pedestrian needs be considered along with the other facets of development. The ordinance outlines the elements that will be examined for each proposed development and the processes that will be used to conduct the review and resolve conflicts.

One criticism of zoning has been its inability to accommodate unique needs that arise. Variances, special permits, and rezonings have traditionally been available to accommodate the unique aspects of various sites and development objectives, but their application is often cumbersome and time consuming. An array of zoning techniques has been developed in recent years to lend flexibility to the process. Several of these techniques are particularly applicable to the provision of pedestrian facilities. The American Planning Association document entitled "The Administration of Flexible Zoning Techniques" (2) provides an excellent review of discretionary zoning practices. The discussion below briefly presents information on the several techniques that have been applied or have the potential for being applied to the implementation of pedestrian facilities through Planned Unit Development (PUD) designations, special permits, overlay districts, and incentive zoning. The immediate advantage of these zoning techniques is that they are specifically intended to offer the developer and the community more options and, hence,

usually more potential for successfully incorporating pedestrian facilities into plans for on and off-site development.

Planned Unit Development (PUD's)

A PUD "... is a device which allows a development to be planned and built as a unit, and which, as a result, permits variations in many of the traditional controls related to density, land use, open space, and the timing and sequencing of the development" (2). The PUD zoning concept allows communities to grant developers flexibility in project density, design, building, and staging in return for desired amenities. PUD's always require a site plan review, in which general rules and standards are established by local officials. It is at this point that developer proposals are tailored to meet community objectives. Some municipalities have taken the public review power, even outside the PUD technique, as far as to require that developers commit in writing to provide various on-site improvements or features or even make certain off-site improvements. Examples of large PUD's are abundant. Many of the PUD's incorporate pathway systems, linking the different land uses. Brandermill, a PUD in suburban Richmond, Virginia, is one such development, with separated pathways along major pedestrian routes between recreational, residential, retail, and office uses (see case study in Appen. B).

Special Use Permits

Special use permits can be used as a device for seeking higher levels of amenities during the development negotiation process. By definition, a special use permit allows development of a land use in a given zone that would not otherwise be permitted. A developer must file an application for a special permit with the local planning agency stating that the proposed use is in conflict with the existing zoning ordinance. Prior to granting approval of the permit, the planning agency usually attaches additional requirements or regulations. It is at this point that the community and public officials may negotiate with the developer. A typical example of a development requiring a special permit would be a school located in a residential area. Because schools have characteristics different from residential uses, they require the addition of special features to make them compatible. For instance, street landscaping, special street crossing facilities, or wider sidewalks might be required to grant approval of the permit. Special permits are becoming more widely employed as communities seek greater involvement in land-use decisions and in the administration of land-use regulations. These special use permits, in some senses, provide increased flexibility in controlling land uses as areas change or develop.

Incentive Zoning

Incentive zoning is a device that permits greater or more intensive use of property by a developer in exchange for additional pedestrian facilities or amenities. This has become one of the most powerful tools to encourage pedestrian-sensitive designs, particularly in suburban activity centers. Bonuses are usually elective, but if developers wish to obtain the bonuses, they must submit the site plan for review during which time specific bonuses and amenities are negotiated.

Incentive zoning is most prevalent in high density districts but is becoming more common in suburban areas. Chapter Four presented some examples of pedestrian-related bonuses in Stamford, Connecticut. Montgomery County, Maryland, has successfully implemented an incentive program in CBD zones or suburban areas. Entitled the "Optional Method of Development," this bonus program gives developers the option of doubling the floor area ratio (FAR) of any project that has a lot size greater than 22,000 sq ft. A developer first files an application requesting an increase in density. The planning commission approves the application only if there is a provision for pedestrian amenities. Typical amenities include: pedestrian plazas, standard sidewalk widths, sidewalk benches, lamp posts, and street trees. Because of the financial attractiveness of increased densities, all of the developments occurring under Montgomery County's Optional Method of Development Program have included pedestrian amenities. The establishment of the base and bonus density levels is, of course, a major planning issue in itself. Critics of incentive zoning argue that land can be intentionally underzoned in order to wield greater negotiating power and that this defeats the purpose of the comprehensive plan. However, this has been one of the most powerful techniques to date in encouraging greater emphasis on pedestrian design.

Overlay Districts

Overlay districts single out specific areas for special treatment—from protection of a neighborhood against commercial encroachment to the provision of special public facilities or amenities in exchange for some development benefit. Examples include overlay districts for historic preservation, sign control, natural resource conservation, etc. Overlay districts could also be created for the enhancement of pedestrian accommodations. Overlay district boundaries are mapped and may or may not be contiguous with other zonal boundaries. Development within the district is regulated by two zones, the primary or underlying zone and the secondary or overlay zone. Because overlay districts involve a high degree of public review and because the public may specify in substantial detail the types of facilities to be provided, this technique could have significant impact on the provision of pedestrian facilities by private developers. The greater demands that would typically be placed on design in such districts, and the resulting higher costs, suggest that a pedestrian overlay district be provided only where development is inherently attractive and where the special design features will preserve some distinctive characteristic of the area. For overlay districts focusing on the character of urban design (including pedestrian amenities), it would be common for a design review board to be established to evaluate the proposed designs. Board members should have credentials in areas related to design, but may include knowledgeable nonprofessionals from the community.

Subdivision Regulations

Specific design requirements for subdivision access roadways, walkways, and other facilities are usually contained in local subdivision regulations. The document entitled "Model Subdivision Regulations: Text and Commentary" (Ref. 8 in Chapter

Three) provides guidelines for locally implemented regulations. Typical pedestrian-related concerns covered in subdivision regulations include sidewalk or pathway width and width of the planting strip, guidelines for the location of walkways in the street ROW, sidewalk or pathway surface material, and need for mid-block easements for passage across long blocks or for easements in cul-de-sac streets. The document suggests criteria for installation of sidewalks. These criteria vary greatly from city-to-city, but requirements for design and funding responsibility are usually explicitly discussed in the regulations. Although flexibility similar to the zoning provisions discussed earlier is not strictly available, exceptions to the regulations can be granted. The willingness to permit variations in design, such as meandering sidewalks, also varies from location-to-location.

Other Ordinances and Regulations

Specific Plan Ordinance

Legislation in the State of California enables the preparation of a Specific Plan Ordinance by local jurisdictions. A Specific Plan is an ordinance which provides controls and incentives for the achievement of the General Plan through a unique set of policies, standards, and regulations. Specific plans are typically applied to small geographic areas with unique characteristics. The ordinance, and guidelines for pedestrian amenities contained in it, are established through a process of community involvement.

The City of Los Angeles has implemented a specific plan to resolve some of the pedestrian/auto conflicts occurring within a suburban residential/commercial development in suburban Los Angeles. This specific plan, applied to the Warner Center development in the San Fernando Valley (see case study in Appen. B), supplements the Los Angeles municipal and building code. Twelve-foot wide walkways, pedestrian bridges between street blocks, and elevated accessways between buildings are a few of the improvements provided by the Specific Plan. These pedestrian facilities are required of all development once it attains a floor area ratio of 1.3, or a residential density of 30 units per acre. The ordinance written for Warner Center is presented in the case study. The case study indicates, however, that pedestrian accommodations specified in the ordinance will be resisted if there is little apparent need for them. There has been hesitation in building required overpasses, even though they are specifically written into the ordinance to be implemented when certain conditions occur.

Sign Ordinances

Sign ordinances, although not directly related to pedestrian convenience and safety, can enhance the pedestrian experience through changes in the visual environment. The classic application of sign ordinances is along commercial strips. Properly written and applied, it not only reduces the visual clutter, but may improve vehicular and pedestrian safety by presenting fewer potential attention conflicts.

Appearance Codes

A 1983 American Planning Association report, entitled "Appearance Codes for Small Communities" (4), presents information on the potential role of such codes in regulating design. Implemented under police powers, appearance codes set standards for design of specific areas, and they establish a review process for evaluation of specific designs. More information can be obtained from the above report.

Adequate Public Facilities (APF) Ordinances

With the increasing burden placed by developers on transportation facilities and on other elements of the public facility infrastructure, some jurisdictions have found it necessary to place a cap on development until such time as capacity becomes available to serve the development. Although there is no direct pedestrian-related incentive for an APF ordinance, the controls can be used imaginatively to create indirect incentive opportunities. For example, in Bethesda, Maryland, the ordinance was used to place a cap on development on the basis of limited roadway capacity. The zoning ceiling was greater than the cap, and thus not all parcels could be developed to their full potential. Since development capacity was less than the amount of development desired by individual developers, it was decided that a design competition would be held and development approval would be given to the top ranking designs, up to the development limit. Pedestrian amenities played heavily in the designs and their evaluation. In the end, nine out of the ten proposals were accepted.

In areas with poor development potential, these incentive programs have limited effectiveness. In such cases, land grants, development districts, and other such programs may focus on improvements to an area, including pedestrian facilities to foster or encourage new development. Once a critical mass is achieved, the other forms of controls may become viable.

Easements for Pedestrian Facilities

One of the serious constraints that reduces the flexibility with which pedestrian facilities are planned and designed is the limited right-of-way, and there is not enough room for creative use of the sidewalk area and landscaping. A number of planners responding to the agency survey of planning and design practices cited this as a hindrance to providing more effective facilities. Obtaining easements for the construction of pedestrian facilities outside the right-of-way can sometimes be used to circumvent this constraint.

The primary objection to obtaining easements, even if there is no cost involved, is the time and effort required in negotiating and executing them. Staff in the right-of-way sections of local agencies stated that such easement agreements may take between 2 months and 2 years to execute. The longer period is needed if eminent domain proceedings are involved. If the potential facility involves many property owners, one can see why a project would have to be quite important to warrant going through the process. However, the "quick-take" method is available for use under some conditions. It has the potential for speeding up the process but is usually more costly in the long run.

Easements are common for new development. This is the most advantageous time for working out arrangements for wider sidewalk/planting strip areas or for mid-block or cul-de-sac passageways. Some subdivision regulations require an easement for blocks that are unusually long. Figure 85 shows a sample easement agreement for a sidewalk-related improvement.

FINANCING PEDESTRIAN FACILITIES

Surveys of state and local agencies conducted in this project indicated a wide range of funding sources for pedestrian improvements. The case studies surfaced additional funding sources, including contributions from the private sector. Possible funding sources and their application to provision of pedestrian facilities are outlined below.

Capital Budgeting

This is one of the most basic sources of public works funding, but one which local officials are reluctant to rely on too heavily for pedestrian improvements because it comes directly from local tax revenue. There are several approaches to the capital budgeting of pedestrian projects. The State of Washington is required by law to spend no less than 0.3 percent of all funds, both state and federal, expended for the construction of state highways on pedestrian trails and paths (see Fig. 86 for regulations). The amount may be deferred and accumulated in a fund for up to 4 years, but can only be spent on pedestrian improvements. State law also specifies that a minimum of 0.5 percent of the state contribution to local highway funds be spent on trails and paths. While this may not seem like a large amount, it mandates that pedestrian facilities be included in the budgeting process.

On the local side, many jurisdictions include sidewalk construction in their annually updated capital program. Some communities even have a special capital project with a pool of money for discretionary funding of sidewalks. It eliminates the need to include specific sidewalk projects in the capital budget before they can be programmed.

Pedestrian Facility Funding Included with Other Highway Construction Projects

Several states indicated that their only real funding of pedestrian facilities was included as part of a larger highway construction project. Highway construction projects should always be examined from the pedestrian's eye view to ensure that pedestrian accommodations are included. Thought should be given to future pedestrian use as well as existing use. The only convenient opportunity to fund a pedestrian facility needed in the future may be to construct it along with a current highway project. These opportunities should not be lost. This method was used to construct four pedestrian overpasses across Tramway Boulevard, in Albuquerque, New Mexico (see case study in Appen. B). Although several of the overpasses are not well utilized, the approach to financing the pedestrian elements is valid for pedestrian facilities in general. The potential cost effectiveness of each project needs to be evaluated, however, before investing in projects that will have little benefit.

Other Government Funding Sources

A range of additional federal, state, and local funding sources were mentioned in the agency surveys. Most of the federal funding comes from the same sources as used for other highway improvements (e.g., Federal Aid Urban System funds). Local agencies frequently employed Community Development Block Grants for sidewalk construction, main street revitalization projects, and neighborhood improvements. In Boulder, Colorado, a city sales tax is used to fund transportation improvements, including pedestrian facilities. In some areas gasoline taxes are increased with the revenue earmarked for specific transportation improvements. Conceivably, this could include pedestrian facilities.

Local Assessments for Sidewalk Construction

The Institute of Transportation Engineers conducted a survey of local practices in pedestrian facility planning and design in 1983. In existing residential areas, over half of the agencies indicated that sidewalks were installed on the basis of petitions of the residents and that most of these required resident contribution to their construction. A common public/private share is 50 percent.

Arlington County, Virginia, has a well-established and documented program of sidewalk construction priorities. Regular sidewalk repair is provided for aging sidewalk links out of county funds, but residents may accelerate construction if they are willing to contribute a specified percentage of the funding. Promotional literature used in the Arlington program is presented in Figure 87. For areas of heavy pedestrian activity by persons from a broad cross section of the population (i.e., not just local residents or office workers), it could be argued that sidewalk funding should come from the public agency and not simply through front-foot assessments.

Special Assessment Districts

Special assessment districts are a device for financing public improvements within a limited area, and have been frequently applied to the construction and maintenance of pedestrian facilities, especially pedestrian malls. They are almost exclusively applied in commercial areas. Special assessments can be used to fund all or part of the construction and operating expenses, depending on the agreed-upon public/private share and the willingness of merchants to participate. Several case studies, including Glendale, California, and Fredericksburg, Virginia, employed special assessment districts to fund their improvements. Capital costs can be covered through the issue of revenue bonds, paid back from the income generated by the assessments. Participation is usually voluntary, indicating that a large majority of owners need to be willing contributors for this method to work.

Revolving Funds and Developer Payback Arrangements

One of the classic problems in building a continuous sidewalk system is that of missing sidewalk links created by time lags in development of certain parcels. Inasmuch as developers are usu-

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| DEPARTMENT OF TRANSPORTATION OFFICE OF PROPERTY ACQUISITION EXECUTIVE OFFICE BUILDING 101 MONROE STREET, TENTH FLOOR ROCKVILLE, MARYLAND 20850 | SLOPE EASEMENT AGREEMENT with Montgomery County, Maryland | Project No. 81-3587 |
|--|---|------------------------|

THE UNDERSIGNED, on this _____ day of _____, 19 _____, for and in consideration of One Dollar (\$1.00) in hand paid, the receipt of which is hereby acknowledged, and further in consideration of the agreement by Montgomery County, Maryland, to improve and reconstruct _____

VEIRS MILL ROAD SIDEWALK

a public road in the said County, do grant to the said County a **RIGHT OF ENTRY** by the County, upon the following described land for the purpose of constructing, installing, maintaining or reconstructing necessary slopes for draining and/or stabilizing the abutting property, said slope area being described as:

ACCOUNT NO. 1406776 ELECTION DISTRICT NO. 13 ADDRESS 11619 Veirs Mill Road

AND the said Grantors do grant and convey unto the County, its successors and assigns, easements for the purpose of creating and maintaining graded slopes necessary for constructing a 5 foot wide sidewalk adjacent to the roadway and abutting property over 778 square feet, more or less, of the remaining property of said Grantors as it abuts the land conveyed to the State Highway Administration for the construction of Veirs Mill Road. Said slopes to extend varying distances from zero feet minimum to 12 feet maximum into said property from the northern line of the existing right of way for Veirs Mill Road all as shown on sheet 2 of 4 of the construction drawings for Montgomery County Department of Transportation Project No. 81-3587 on file at the Department of Transportation, Montgomery County, Maryland.

SAID slope easement shall be extinguished after all required improvements have been completed and accepted for maintenance by Montgomery County, Maryland.

1. It is also understood and agreed that upon completion of the sidewalk project, the County will replace the English Ivy ground cover on a 6 foot by 80 feet area, at no cost to the Grantor.
2. It is further understood and agreed that the County will replace 75 feet of hedge, at no cost to the Grantor.
3. The 36 inch Maple tree, the 8 inch Elm tree and the 5 foot bush will receive Tree Treatment A which means that they will be retained in their existing place and will be protected during the construction work.
4. The 4 inch Dogwood tree and the 8 inch Cherry tree in the easement area will be replaced with trees of similar size (preferably the same species). These trees will be planted in the same location the Dogwood and Cherry trees now occupy.
5. The landscaping work will commence immediately upon completion of the sidewalk construction providing planting conditions are favorable or at the first such favorable planting time.

IT IS HEREBY FURTHER UNDERSTOOD AND AGREED that the grantors herein convey the right to the said County to remove any and all trees or shrubbery, fences or improvements lying within the above described slope area, provided, however, that the said County shall reset any existing fences removed in connection with the above project.

IT IS HEREBY FURTHER UNDERSTOOD AND AGREED that the contents of this Slope Easement Agreement and the acceptance thereof comprise the entire agreement, and that no verbal representations made before or after the signing hereof or anything not herein written shall vary the terms of this Agreement, and that the said County shall have no further obligation.

IN WITNESS WHEREOF the Grantors have hereunto set their hands and seals, the day and year first above written.

Figure 85. Sample easement agreement.

Chapter 47.30
TRAILS AND PATHS

| | |
|-----------|---|
| Sections | Definitions. |
| 47.30.005 | Severance or destruction of recreational trail—Alternative, construction or reconstruction required—Signing. |
| 47.30.020 | Facilities for pedestrians, equestrians, or bicyclists to be provided—Joint usage of rights of way. |
| 47.30.030 | Facilities for pedestrians, equestrians, or bicyclists authorized—Expenditure of available funds. |
| 47.30.040 | Establishing paths and trails—Factors to be considered. |
| 47.30.050 | Expenditures for paths and trails—Minimum amount. |
| 47.30.060 | Expenditures deemed to be for highway, road, and street purposes—Powers and duties of department of transportation—Restrictions on use of paths and trails. |

Recreation trails system: Chapter 67.32 RCW.

47.30.005 Definitions. For the purposes of this chapter, "trail" or "path" means a public way constructed primarily for and open to pedestrians, equestrians, or bicyclists, or any combination thereof, other than a sidewalk constructed as a part of a city street or county road for the exclusive use of pedestrians. The term "trail" or "path" also includes a widened shoulder of a highway, street, or road when the extra shoulder width is constructed to accommodate bicyclists consistent with a comprehensive plan or master plan for bicycle trails or paths adopted by a state or local governmental authority either prior to such construction or prior to January 1, 1980. [1979 ex.s. c 121 § 4.]

47.30.010 Severance or destruction of recreational trail—Alternative, construction or reconstruction required—Signing. (1) No limited access highway shall be constructed that will result in the severance or destruction of an existing recreational trail of substantial usage for pedestrians, equestrians or bicyclists unless an alternative recreational trail, satisfactory to the authority having jurisdiction over the trail being severed or destroyed, either exists or is reestablished at the time the limited access highway is constructed. If a proposed limited access highway will sever a planned recreational trail which is part of a comprehensive plan for trails adopted by a state or local governmental authority, and no alternative route for the planned trail exists which is

[Title 47 RCW—p 90]

satisfactory to the authority which adopted the comprehensive plan for trails, the state or local agency proposing to construct the limited access highway shall design the facility and acquire sufficient right of way to accommodate future construction of the portion of the trail which will properly lie within the highway right of way. Thereafter when such trail is developed and constructed by the authority having jurisdiction over the trail, the state or local agency which constructed the limited access highway shall develop and construct the portion of such trail lying within the right of way of the limited access highway.

(2) Where a highway other than a limited access highway crosses a recreational trail of substantial usage for pedestrians, equestrians, or bicyclists, signing sufficient to insure safety shall be provided.

(3) Where the construction or reconstruction of a highway other than a limited access highway would destroy the usefulness of an existing recreational trail of substantial usage for pedestrians, equestrians, or bicyclists or of a planned recreational trail for pedestrians, equestrians, or bicyclists incorporated into the comprehensive plans for trails of the state or any of its political subdivisions, replacement land, space, or facilities shall be provided and where such recreational trails exist at the time of taking, reconstruction of said recreational trails shall be undertaken. [1971 ex.s. c 130 § 1.]

47.30.020 Facilities for pedestrians, equestrians, or bicyclists to be provided—Joint usage of rights of way. Facilities for pedestrians, equestrians, or bicyclists shall be incorporated into the design of highways and free ways along corridors where such facilities do not exist upon a finding that such facilities would be of joint use and conform to the comprehensive plans of public agencies for the development of such facilities, will not duplicate existing or proposed routes, and that safety to both motorists and to pedestrians, equestrians, and bicyclists would be enhanced by the segregation of traffic.

In planning and design of all highways, every effort shall be made consistent with safety to promote joint usage of rights of way for trails and paths in accordance with the comprehensive plans of public agencies. [197 ex.s. c 130 § 2.]

47.30.030 Facilities for pedestrians, equestrians, or bicyclists authorized—Expenditure of available funds. Where an existing highway severs, or where the right of way of an existing highway accommodates a trail for pedestrians, equestrians, or bicyclists or where the separation of motor vehicle traffic from pedestrians, equestrians, or bicyclists will materially increase the motor vehicle safety, the provision of facilities for pedestrian equestrians, or bicyclists which are a part of a comprehensive trail plan adopted by federal, state, or local governmental authority having jurisdiction over the trail hereby authorized. The department of transportation, or the county or city having jurisdiction over the highway, road, or street, or facility is further authorized to expend reasonable amounts out of the funds made available to them, according to the provisions of RCW 46.68.100, if

(1983 Ed)

necessary for the planning, accommodation, establishment, and maintenance of such facilities. [1979 ex.s. c 121 § 1; 1974 ex.s. c 141 § 12; 1972 ex.s. c 103 § 2.]

Severability—1972 ex.s. c 103: "If any provision of this 1972 amendatory act, or its application to any person or circumstance is held invalid, the remainder of the act, or the application of the provision to other persons or circumstances is not affected." [1972 ex.s. c 103 § 8.]

47.30.040 Establishing paths and trails—Factors to be considered. Before establishing paths and trails, the following factors shall be considered:

- (1) Public safety;
- (2) The cost of such paths and trails as compared to the need or probable use;
- (3) Inclusion of the trail in a plan for a comprehensive trail system adopted by a city or county in a state or federal trails plan. [1972 ex.s. c 103 § 3.]

Severability—1972 ex.s. c 103: See note following RCW 47.30.030.

47.30.050 Expenditures for paths and trails—Minimum amount. (1) The amount expended by a city, town, or county as authorized by RCW 47.30.030, as now or hereafter amended, shall never in any one fiscal year be less than one-half of one percent of the total amount of funds received from the motor vehicle fund according to the provisions of RCW 46.68.100: *Provided*, That this section does not apply to a city or town in any year in which the one-half of one percent equals five hundred dollars or less, or to a county in any year in which the one-half of one percent equals three thousand dollars or less: *Provided further*, That a city, town, or county in lieu of expending the funds each year may credit the funds to a financial reserve or special fund, to be held for not more than ten years, and to be expended for the purposes required or permitted by RCW 47.30.030.

(2) In each fiscal year the department of transportation shall expend, as a minimum, for the purposes mentioned in RCW 47.30.030, as now or hereafter amended, a sum equal to three-tenths of one percent of all funds, both state and federal, expended for the construction of state highways in such year, or in order to more efficiently program trail improvements the department may defer any part of such minimum trail or path expenditures for a fiscal year for a period not to exceed four years after the end of such fiscal year. Any fiscal year in which the department expends for trail or path purposes more than the minimum sum required by this subsection, the amount of such excess expenditure shall constitute a credit which may be carried forward and applied to the minimum trail and path expenditure requirements for any of the ensuing four fiscal years.

(3) The department of transportation, a city, or a county in computing the amount expended for trails or paths under their respective jurisdictions may include the cost of improvements consistent with a comprehensive plan or master plan for bicycle trails or paths

(1981 Ed)

adopted by a state or local governmental authority either prior to such construction or prior to January 1, 1980. [1979 ex.s. c 121 § 2; 1972 ex.s. c 103 § 4.]

Severability—1972 ex.s. c 103: See note following RCW 47.30.030.

Six-year program for arterial road construction—Expenditures for bicycles, pedestrians, and equestrian purposes: RCW 36.81.121.

47.30.060 Expenditures deemed to be for highway, road, and street purposes—Powers and duties of department of transportation—Restrictions on use of paths and trails. For the purposes of this chapter, the establishment of paths and trails and the expenditure of funds as authorized by RCW 47.30.030, as now or hereafter amended, shall be deemed to be for highway, road, and street purposes. The department of transportation shall, when requested, and subject to reimbursement of costs, provide technical assistance and advice to cities, towns, and counties in carrying out the purposes of RCW 47.30.030, as now or hereafter amended. The department shall recommend construction standards for paths and trails. The department shall provide a uniform system of signing paths and trails which shall apply to paths and trails under the jurisdiction of the department and of cities, towns, and counties. The department and cities, towns, and counties may restrict the use of paths and trails under their respective jurisdictions to pedestrians, equestrians, and nonmotorized vehicles. [1979 ex.s. c 121 § 3; 1972 ex.s. c 103 § 5.]

Severability—1972 ex.s. c 103: See note following RCW 47.30.030.

Figure 86. Regulations governing mandatory expenditure on pedestrian facilities in the State of Washington.



On the Street Where YOU Live

Sidewalks can be beautiful with your help

Naturally, only the young, daring and agile employ sidewalks for breakdancing. The rest of us content ourselves with merely treading the sidewalks to walk to the bus or Metro stop, pushing the baby's carriage, exercising the family dog, pedaling tricycles, rollerskating, or playing hopscotch.

But Arlington's sidewalks are more than an impressive taxpayers' investment. They are social walkways that link community avenues and pastimes. Sidewalk appeal to people is reflected in American song and fancy—*The Sidewalks of New York*, cupid's graffiti, and the Hollywood penchant for imprinting in wet cement movie stars' footprints, handprints, etc. (Jimmy Durante's nose, John Barrymore's profile, and Betty Grable's legs).

And there are other concrete benefits. Properly maintained sidewalks, curbs and gutters enhance the appearance of individual neighborhoods and the entire community. The investment is solid: new concrete installations have a life expectancy of 30 years. Just as importantly, the new voluntary concrete maintenance options give residents a way to help the County protect the taxpayers' investment in Arlington's 500 miles of sidewalk and 587 miles of curb and gutter, valued at a \$75 million replacement cost.

The Arlington County Department of Public Works now offers four options for repairing residential concrete sidewalks, curb and gutter, and driveway entrances. The options range from free (or tax supported) emergency asphalt-patching repairs and routine maintenance to shared-cost options for faster repair, and full cost for immediate repairs. Based on SPEED, each option is described to help property owners decide which method best meets their individual needs.

IT'S UP TO YOU

All of the quick repair plans are completely voluntary. You may inquire about the program with no obligation by merely returning the attached inspection-request form to Public Works. And remember to check with your tax adviser: your concrete repair expenses may be tax deductible.

DRIVEWAY ENTRANCES

Due to spiraling concrete construction costs, tax supported replacement of driveway aprons no longer is provided. The options available are the same as detailed above, except you must pay 100 percent of the cost. If you elect to participate in either of the out-of-sequence programs, you need only notify Public Works of your decision. Repair is scheduled within ONE MONTH when full payment is made in advance, and within FOUR MONTHS if voluntary assessment is chosen. In 1984, the standard driveway entrance replacement cost was about \$750.

If your neighborhood is scheduled to receive routine concrete maintenance, you will be notified before the crew arrives. If you would like the driveway apron repaired while the crew is in the area just give the check to the crew leader, who will arrange the work.

Commercial Area Concrete Repairs

Sidewalk maintenance for commercial parcels is based on a 100 percent assessment program. For details, call the Department of Public Works at 558-2551.

PUBLISHED BY THE ARLINGTON COUNTY
DEPARTMENT OF PUBLIC WORKS

H. S. Hulme, Jr., Director
Dennis R. Johnson, Chief,
Operations Division
Larry J. Brown, County Manager



Private Permit

EASIEST

This option makes IMMEDIATE repair a reality. Simply hire a private contractor for concrete work the same as you would hire a contractor to perform any home repair or remodeling project. This option enables you to select the private contractor of your choice to perform concrete maintenance work. You

schedule the work and you pay the contractor. The County is not involved, except it is necessary for the contractor to obtain a cost-free inspection permit from Public Works before beginning the job. This enables County inspectors to monitor the job to ensure quality control.



Voluntary Payment

EASIER

This new program is designed for the property owner who needs concrete repair in 30 days. For example, a homeowner planning to sell his home in the near future can have the concrete work done on sidewalks, curbs or gutters in time for prospective buyers to notice the improved front-yard appearance.

The procedure is simple: just return the attached inspection-request form, and Public Works will inspect the repair area and offer a written cost estimate. If you opt to take advantage of the program, the County will pay half of the repair cost and you also will pay half. (Concrete repair costs average about \$50 for a 4x4-foot slab.) The work is then done by the County's low-bid contractor within ONE MONTH of receiving the citizen's check. County inspectors monitor the work.



Voluntary Assessment

EASIER

The County's low-bid contractor performs the work within FOUR MONTHS of your request. The County pays 50 percent of the cost, and you pay 50 percent plus a \$50 advertising-recording fee. The citizen also signs a letter of agreement on the assessment payment schedule. A lien is placed against the property until the

full assessment is paid. The assessment is not due until the property is transferred, but a six percent annual interest is assessed on the unpaid balance. The procedure is the same as the Voluntary Payment method, except once your decision is made to have the work done, you will have to sign an authorization for a formal assessment.

AND: Routine County Zone Maintenance

Major sidewalk repairs are provided by the County at no direct cost to property owners on a sequential zone-by-zone basis. Property owners are notified when their maintenance work is scheduled. The average countywide zone cycle is about 16 YEARS, a wait that may be inconvenient for some citizens. Two crews begin work in a zone and remain there until repairs in that zone are completed. A third crew concentrates in residential high-use areas, such as those adjacent to schools, churches, parks, libraries and hospitals.

Why Does Zone Repair Take So Long?

Most of Arlington's sidewalks were built in the 1940s and '50s and they all began deteriorating together in the 1960s and '70s, causing a massive repair backlog. Meanwhile, concrete repair costs tripled in the past 20

Repair Zones Map

This map shows the Arlington County tax-supported concrete repair zones. The shaded area indicates where crews were working in Summer 1984. They will work in these two zones for at least another year, with one crew concentrating on North Arlington and the other on South Arlington. Then each crew will advance to the zone that has waited the longest time since its last repairs—sometimes a cycle of 16 years. The next zones scheduled for repair are S-5 and N-3; crews will work in these two zones for about 1½ years.

years. An estimated 500 miles of Arlington sidewalks and 587 miles of curb and gutter need routine maintenance, posing a formidable budget challenge in times of inflation and escalating construction costs. There also are many miles of driveway entrances which could be added to this inventory. In Fiscal Year 1985, the Arlington County Board expanded the program by adding a maintenance crew to reduce the repair cycle by 20 percent, or from 20 to 16 years.

How the Zone Repair System Works

Zone maintenance repair is concentrated on seriously deteriorated concrete rather than concrete with only chips and cracks. Examples of serious deterioration are tripping hazards over an inch-and-a-half, curb more than two inches out of alignment, buckling or dips that pond water, and surface spalling deeper than an inch or larger than a desk top. One cost-cutting measure used by Public Works is the old-fashioned "mudjacking" repair method. This technique raises sunken but still-sound sidewalk slabs to grade level by pumping wet concrete underneath the slabs. The method saves concrete maintenance dollars: mudjacking costs only \$10 a slab compared to \$50 a slab for concrete replacement.

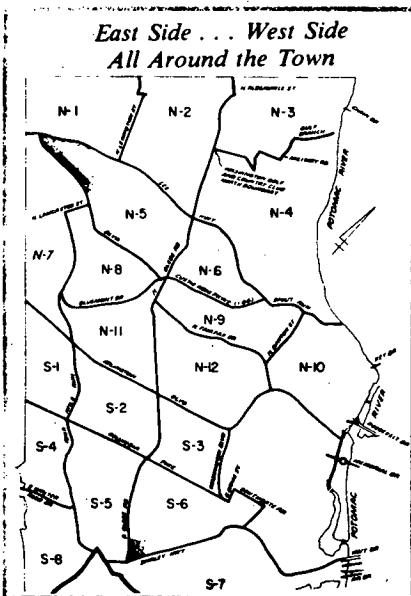


Figure 87. Promotional literature for Arlington County sidewalk repair program.

ally expected to pay for the sidewalk fronting on their own property, an undeveloped property between two developed ones leaves an incomplete system for an indefinite period of time.

At least two potential mechanisms exist for dealing with this problem. The first is the establishment of a "revolving fund," in which the public agency finances missing sidewalk links up front and is reimbursed by the property owner when development takes place. The developer contribution would be equivalent to the cost of construction of an equivalent facility at the time of construction. A dollar value per linear or square foot should be established to apply within a given jurisdiction. The most appropriate legal instrument to implement this mechanism is the subdivision regulations. Provisions are usually made in subdivision regulations to either require the developer to build the sidewalks himself or to place an equivalent amount into escrow so that sidewalks can be built by the local government. The revolving fund would add a third option, to require payment by the developer at a definable point in the development cycle. Tax increment financing is one way of funding the front-end costs. Improvements within a given area are financed through bonds that must be repaid from increased tax revenues on the new development.

Another type of mechanism involves a developer payback arrangement, in which a developer who recognized the need for additional sidewalk off the premises of his own property constructed the sidewalk, with a legal obligation to be paid back by adjacent owners when development occurs. The public agency is the coordinator, and financial arrangements are directly between developers. The advantage is that the public agency can avoid having to wait on a capital budgeting process to build the project. The disadvantage is that there is less certainty of the links being built because the public agency is not a direct actor.

Low Interest Loans

Some municipalities have offered low interest loans to commercial property owners as part of a revitalization effort to encourage the fix-up of store frontages or provision of facilities that would otherwise enhance the streetscape. The interest rate depends on the level of benefit believed to be provided to generate interest sufficient to bring about significant change.

Other Programs

Other forms of public assistance, such as tax abatement, are also available, but these are more pertinent to the stimulation of development, in general, than specifically to the financing of pedestrian facilities. References 5, 6, and 7 can be consulted for additional information on these and other funding mechanisms.

MAINTENANCE MANAGEMENT

In the early days of pedestrian malls, municipalities that had constructed them quickly learned that continuous attention was needed to preserve the original character. Sidewalks needed sweeping, shrubs needed trimming, lights required energy and bulb changing, and concrete needed repair. Low maintenance design is thus an important aspect of the total pedestrian package. "Managing Downtown Public Spaces," by the Project for

Public Spaces, Inc. (8), provides a number of practical ideas on the management and maintenance funding of public spaces. Although oriented toward the downtown, many of the ideas are applicable to suburban and developing rural areas as well, particularly older suburban retail areas and activity centers. Maintenance ideas include encouragement by public agencies for property owners to maintain portions of street frontage that are not public responsibility, voluntary contribution arrangements by merchants to have basic maintenance conducted, and formal special assessment districts (as described above).

In residential areas, the community association must usually play a significant role. Some condominium and townhouse associations have in their covenants language that specifies the owner's responsibility for upkeep of the property, the sidewalk, and the buffer strip (including the trimming of overhanging branches or shrubs and the shoveling of the sidewalk). Common areas and pedestrian pathways are usually the responsibility of the community association or developer, and maintenance or operational problems would need to be brought to their attention.

Publicly sponsored sidewalk maintenance programs reviewed in Berkeley and Dearborn, Michigan, include periodic sidewalk inspection, identification of segments not adequate, notice to property owners, contracting of firm to do community-wide replacements, assessing property owners all or part of the costs, and incentives for participation include low cost replacement of other residential paved areas including driveways and walks.

Similar arrangements can be made in large, new commercial developments, such as office parks. Maitland Center, an office park in Orlando, Florida, has extensive landscaping in a 35-ft buffer strip between the street and parking lot (see case study in Appen. B). Maintenance was originally the function of the overall project developer, but was handed over to individual property owners once the development was nearly built out. Owners contribute toward a maintenance fund at a rate based on the length of property frontage.

Public agency operational procedures are also an important contribution to maintaining safe and convenient pedestrian facilities. Maintenance management programs for street lighting, traffic signal maintenance, and trimming of publicly maintained landscaping are necessary. Reference 8 is a good source of information on how to improve management of these facilities. Departments of Parks and Recreation are often responsible for the management of recreational pathways.

CHANGES IN STATE LAW TO ENCOURAGE THE PROVISION OF PEDESTRIAN FACILITIES

Several provisions in state law were cited by respondents to the agency survey as possible impediments to better pedestrian planning and design. A provision apparently in many state laws limits state responsibility for sidewalk on existing roadways to "in kind replacement." This reduces the flexibility in how sidewalk problems might be solved along state roads, and creates disputes regarding whose responsibility it actually is. Relaxation of the in-kind provision, although it could involve greater state expenditure for sidewalks, would at the same time benefit the pedestrian.

Some states now require local jurisdictions to include pedestrian and bicycle facilities in their comprehensive plan. Legal requirements for including pedestrian considerations, if imple-

mented in every state, would be a major advance in formalizing pedestrian planning requirements at the local level.

One of the concerns that has surfaced in the safety arena is insurance coverage for pedestrians when hit by a driver carrying no-fault auto insurance. Mechanisms are lacking for the pedestrian being able to recover medical expenses. More importantly, no-fault insurance adds no sense of responsibility toward the pedestrian. While this may not be the cause of additional accidents, it reinforces the attitude of the vehicle's dominance over the person on foot.

The propensity for vehicles to yield the right-of-way to pedestrians has been observed to vary widely across the United States, despite the fact that state laws are relatively uniform across the country. The difference has been attributed to level of enforcement and to longstanding driving habits. Of the three E's (education, engineering, and enforcement), enforcement is probably the weakest link. Campaigns to enforce both proper pedestrian behavior and driver yielding to pedestrians are unpopular both for the enforcer and the enforces, but are probably one of the most direct ways to affect driver and pedestrian behavior.

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CHAPTER SEVEN

SUMMARY OF PEDESTRIAN-RELATED PROBLEMS, SOLUTIONS, AND IMPLEMENTATION STRATEGIES

The findings presented in Chapters Two through Six represent a collection of important principles and guidelines that have emerged from the case studies, literature review, interviews and discussions with professionals in the field, and observation of many pedestrian situations across the country. Much attention has been given in this effort to the planning and implementation process, recognizing that many of the solutions to problems with pedestrian facilities will require institutional change, not just intelligent planning and design.

This research has been conducted with the practitioner in mind. It has addressed many of the day-to-day problems faced in dealing with pedestrian concerns in the context of other highway and land development needs. Chapters Seven and Eight provide a direction for following up the findings with specific actions. Chapter Seven summarizes the problems, solutions, and potential implementation actions, while Chapter Eight concludes the report with suggestions for additional research.

The remainder of this chapter presents the summary of problems and potential solutions, followed by a listing of implementation actions appropriate for local and state agencies, federal agencies, private citizens, and developers.

POTENTIAL SOLUTIONS TO PEDESTRIAN-RELATED PROBLEMS

Task 3 of the project involved an assessment of possible solutions to pedestrian facility problems in suburban and developing rural areas. These solutions involved both conventional and unconventional ideas, both proven and unproven. They addressed not only the physical facilities, but also ways to improve and streamline the implementation of those facilities.

There will be no magical or instant solution. To substantially improve the pedestrian environment will require a multifaceted approach that addresses both the physical and the nonphysical problem elements within both the public and private sectors. Progress in the institutional area is often laborious and slow. Nevertheless, real change must often come through this avenue. Methods of reducing the cost of implementing pedestrian facilities is an extremely important area, allowing more to be done with the same dollars. Several cost-cutting ideas are presented among these solutions.

Table 3 presents the results of the problem/solution assessment. The left-hand column lists the more significant problems

identified in the study. Although other problems and concerns were raised, they were omitted from the table, not because they were unimportant, but because they were felt to be less significant than those listed. It should be noted that a number of solutions are posed in Table 3 that have not been tested adequately enough to assure their success. Other solutions have been applied relatively widely in other countries but used very little in the United States.

The second column in Table 3 identifies the relative magnitude of the problem, based both on the severity of the problem and the number of pedestrians affected. The magnitude of the problem is judged from field observation of the research staff, information in the literature, discussions with public agencies, and interviews and surveys of the users of pedestrian facilities themselves. Although the assessment is subjective, it at least indicates the overall significance of the problem and the relative energy that should be invested in solving it. The following are descriptive definitions of each of the levels of magnitude of problems: (1) *major*—impacting a large proportion of the pedestrian population (usually at least one fourth) and significantly adding to pedestrian delay and to the hazard and inconvenience of walking; (2) *moderate*—regularly impacting pedestrian convenience and safety for less than one fourth of the pedestrian population, but for more than a few isolated pedestrians; and (3) *minor* (not used in Table 3, because only the moderate to major problems were included)—impacting convenience and safety for only a small proportion of pedestrians.

The third column in Table 3 identifies possible solutions to each problem. The solutions are derived from the review of literature and observation of pedestrian treatments from around the United States. In some cases, there may be several solutions, while in other cases only one is listed. Again, it was not possible to list all potential solutions in the table, and a screening needed to be done to exclude those solutions believed to be infeasible or relatively impractical. Over 200 “possible” solutions were identified by the research team to address the some 100 problem areas listed earlier in the project. For each solution, the following are evaluated:

- **Current level of use or acceptance**—How widely it is used and accepted in the U.S. as a planning, design, or implementation device or strategy: *high*—used at almost every location where it could have beneficial effects; *moderate*—used regularly by many agencies and organizations, but not employed as often as warranted; *low*—rarely employed by agencies and organizations in the U.S.
- **Limitations in its applicability**—Limitations in where it is appropriate for use, either by geographic area, development type, or highway situation (evaluated descriptively).
- **Potential effectiveness**—The degree to which the solution may improve pedestrian convenience and safety, both in terms of the number of people affected and the individual effect on safety or convenience of pedestrian movement: *high*—would virtually eliminate the problem, if solution was applied on a broad scale; *moderate*—would substantially reduce the problem, but elements of the problem would still remain; *low*—does little to solve the problem.
- **Barriers to implementation**—The degree to which the solution is likely to encounter implementation barriers, reducing the likelihood of adoption as a practice in the U.S. Some solutions, even though they may be highly effective for pedestrians, have little likelihood of implementation because of their effect

on other groups of users or because of the nature of the institutional structure in the U.S. A classic example is the use of traffic signals to assist pedestrians in crossing suburban streets. Installing traffic signals strictly for the convenience and safety of pedestrians can only rarely be justified in suburban areas because of the adverse impact of signals on vehicular delay and, in some cases, on vehicular safety. Descriptive definitions of each of the levels of barriers to implementation are: *high*—solution is unlikely to be implemented, except on a small scale, for social, economic, environmental, or other reasons; *moderate*—there are implementation barriers to be overcome, but the probability is that they will be overcome by many agencies and organizations; *low*—the solution could be immediately implemented on a broad scale.

- **Cost**—The relative cost of implementing the solution: *high*—typically over \$100,000 for a spot location and over \$500,000 for a section of highway; *moderate*—typically \$10,000 to \$100,000 for a spot location or \$50,000 to \$500,000 for a section of highway; *low*—from negligible costs up to \$10,000. Solutions such as the administration of guidelines or installation of signs would usually fall into the low category.

- **Impact on other groups**—How the solution may affect groups other than pedestrians: *positive*—produces highly desirable effects on individuals or groups other than pedestrians; *minimal impact*—little if any impact on individuals or groups other than pedestrians; *slightly negative*—produces some possible adverse impacts, but few people are affected and the impact is not great; *negative*—definite negative impacts on other groups, but impacts can probably be tolerated; *highly negative*—impacts will probably prohibit widespread implementation.

- **Comment**—Any other observation concerning the solution that might affect its practicality.

It is clear that deficiencies abound in the pedestrian facilities of suburban and developing rural areas. At the same time, however, progress is being made, as evidenced by the greater emphasis being placed on nonmotorized facilities in some areas of the country and by the creativity being employed in site development. There appears to be a greater consciousness of the benefits of quality design, and the pedestrian is usually one of the primary benefactors. The following sections suggest implementation actions that can be taken to further the recognition of pedestrian needs and to help pedestrian considerations to become a more routinely accepted element of the planning process.

HIGH PRIORITY PEDESTRIAN PLANNING, DESIGN, AND IMPLEMENTATION ACTIONS FOR SUBURBAN AND DEVELOPING RURAL AREAS

This section describes ways in which the findings in Chapters Two through Six can be more effectively implemented in state and local practice. Although the principles and guidelines outlined in this report will be useful in themselves, thought needs to be given to the means to encourage their application. This section answers the question, “Where do we go from here?” It suggests aids to implementation that could be considered, and outlines actions from the involvement of public agencies, citizens, and private enterprise.

State and local agencies and private developers are the primary implementers of pedestrian systems and facilities, and the responsibility for change ultimately rests on their shoulders.

Table 3. Summary of pedestrian facility problems and possible solutions.

| Description of Problem | Magnitude of Problem | Possible Solutions | Current Level of Use or Acceptance | Limitations in Applicability | Potential Effectiveness | Barriers to Implementation | Cost | Impact on Other Groups | Comment |
|--|----------------------|--|------------------------------------|---|---------------------------------|----------------------------|------------------|------------------------|--|
| Cross-section Design | | | | | | | | | |
| Difficulty of crossing wide arterial streets, especially undivided arterials | Major | 1. Install medians on all new suburban highways of 4 or more lanes. | Moderate | Virtually no limitations for new highways. However, some limitations are currently perceived. | High | Moderate | Moderate | Positive | Potentially the most effective solution to street crossing problems. |
| | | 2. Install European style refuge islands in strategic locations on existing undivided hwy's. | Low | Must usually narrow lanes on existing hwy's, to accommodate refuge islands. Must be well lighted. | High | Moderate | Low to moderate. | Minimal impact | This solution is greatly under-utilized in U.S. |
| | | 3. Design for reduced street width between signalized intersections (since capacity constraints are at signals). | Low | Could only be done where spacing between intersections is high. | Moderate | High | Low | Negative | Probably not feasible as a general practice. |
| | | 4. Introduce additional traffic signals to facilitate ped crossings. | Low | Could only be done in a few selected locations | Moderate | High | Moderate | Highly negative | More feasible were ped crossings are concentrated at a point. |
| | | 5. Provide midblock actuated flashing ped signal. | Low | Should only be installed in key locations | Moderate | Moderate | Low | Slightly negative | Designed to inform driver of presence of ped. Does not necessarily make crossing easier. |
| | | 6. Provide ped overpass. | Low | Only effective where at-grade crossing is blocked or is inconvenient. | Moderate - depends on no. peds. | Moderate | High | Positive | Lack of use of facility continues to be a problem. |
| Difficulty of crossing highways with two-way left turn lanes | Moderate to Major | 1. Reduce use of this technique and provide medians to control access. | Low | Would need to design in frequent U-turn capability | High | High | Moderate to high | Negative | Merchants and drivers will object heavily. |
| | | 2. Install refuge islands in spots where no turning is necessary. | Low | Must have at least some "dead spots" where turning would not generally occur. | High | Moderate | Low | Minimal impact | Islands must be well lighted and marked. |
| No facilities provided for ped to walk along side of road | Major | 1. Require sidewalk/pathway with all new hwy. construction. Paved or stabilized shoulder adequate in outlying areas. | Moderate | Only allowed exclusion should be low volume residential streets. | High | Moderate | Moderate | Minimal impact | Could be required by FHWA for Federal projects. |
| | | 2. Provide easier methods for obtaining easements, to address existing highways constrained by right-of-way. | Low | Probably would be viewed as giving excess authority to public agencies. | High | High | Low | Negative | Would put property owners at a disadvantage. |
| Narrow bridges with no pedestrian accommodations | Moderate | 1. Design all new bridges with shoulder or raised walkway. | Moderate | None | Moderate to high | Moderate | Moderate to high | Positive | |
| | | 2. Design low-cost walkway system for attaching to outside of bridge. | Low | Feasibility and design dependent on structural nature of existing bridge. | Moderate to high | Moderate | Moderate | Positive | |

Table 3. Continued.

| Description of Problem | Magnitude of Problem | Possible Solutions | Current Level of Use or Acceptance | Limitations in Applicability | Potential Effectiveness | Barriers to Implementation | Cost | Impact on Other Groups | Comment |
|---|----------------------|---|------------------------------------|--|-------------------------|----------------------------|------------------------|----------------------------|---|
| Excessive traffic speeds in residential or commercial areas | Moderate to major | 1. Design curvature and circuitry into road system. Keep streets narrow. | Moderate | Limited mostly to local and collector streets. Not appropriate on major highways. | High | Moderate | Moderate | Slightly negative | Can create some waste or inefficiency in lot layout. |
| | | 2. Increased enforcement | Moderate | Cost is primary limitation. | Moderate | Moderate to high | High | Negative | Better to control speed thru geometric design. |
| | | 3. Provide speed control devices (e.g., speed humps, traffic circles, intersection flares, etc.) | Low | Primarily used in residential areas. Not appropriate for major highways. | High | High | Low to moderate | Negative | Devices have been controversial and not yet widely accepted. |
| Safety/convenience of walking in commercial area with many poorly channelized driveways | Moderate to major | 1. Consolidate driveway entrances - requires local regulation. | Low | Feasible in some newly developing strips. Generally infeasible in existing strips. | High | High | Moderate in new strips | Both pos. and neg. impacts | |
| | | 2. Provide service road in newly developing areas. | Low | Must have ample right-of-way. | Low to moderate | High | High | Both pos. and neg. impacts | Greatly amplifies problems at intersections. |
| | | 3. Improve driveway channelization. Would require local mandate. | Moderate | Particularly needed where parking areas open directly to street. | Moderate to high | High | Moderate | Positive | Public participation in financing would usually be needed. |
| Difficult and hazardous pedestrian movement thru interchange area | Major | 1. Provide sidewalk and markings on all new interchanges accessible to peds | Moderate | Applies only to facilities not excluding ped traffic. | High | Moderate | Moderate | Positive | Should become routine practice, required in state/local guidelines. |
| | | 2. Provide barrier between traffic lanes and ped walkway. | Low | Not necessary for low speed facilities. | Moderate | High | Moderate | Minimal impact | Provides additional measure of safety for pedestrians. |
| | | 3. For existing interchanges w/o sidewalk or shoulders, consider routing peds onto median | Low | Primarily applicable to full or partial cloverleaf interchanges. | Moderate | Moderate | Low | Low | Removes peds from hazardous ramp crossings. |
| Missing sidewalk links | Major | 1. Perform sidewalk inventory, priority improvement program, and master plan of walkways. | Moderate | None | High | Low | Low | Minimal impact | Must be followed with funding and construction. |
| | | 2. Provide public funds for sidewalk construction with provision for recovering costs from landowner when development occurs. | Low | Legal mechanism must be provided to recover costs. | High | Moderate | Low | Minimal impact | Allows sidewalk to be completed even if area is only partially developed. |
| | | 3. Obtain easements or take part of roadway lane to fill in missing links where barriers exist (e.g., retaining walls). | Low | Will be unusual to be able to take part of roadway lane. | Moderate | High | Moderate | Slightly negative | Practical only for limited set of conditions. |

Table 3. Continued.

| Description of Problem | Magnitude of Problem | Possible Solutions | Current Level of Use or Acceptance | Limitations in Applicability | Potential Effectiveness | Barriers to Implementation | Cost | Impact on Other Groups | Comment |
|---|------------------------|---|------------------------------------|---|-------------------------|----------------------------|------------------|---------------------------|--|
| Obstructions in sidewalk | Moderate | 1. Provide local guidelines limiting location of obstacles. | Low | None | Moderate | Moderate | Low to moderate | Minimal impact | Can easily be provided in local ordinances. Alternate locations not always possible. |
| | | 2. Obtain easements, where necessary, to locate objects out of ped path. | Low | Most common objects are controller cabinets, mail boxes and trash containers. | High | High | Moderate to high | Minimal impact | Easement process time consuming and sometimes costly. |
| Security problem on certain isolated pedestrian pathways | Major | 1. Refrain from constructing pathways in secluded areas. Provide paths primarily along street frontages. | Moderate | Residents must be willing to accept pathways in front of homes. | High | Moderate | Low | Minimal impact | Rear yard walkways known to have security problems in some areas |
| | | 2. Provide clearview of pathways from residences and/or street. | Moderate | Difficult to maintain visibility on many recreational pathways. | High | Moderate | Low to moderate | Slightly negative | Residents can perceive visibility as invasion of privacy |
| | | 3. Provide more lighting, telephones, patrols or alarm systems. | Low | Primarily needed where visibility is a problem. | Moderate | Moderate | Moderate to high | Minimal impact | Security problem will still be perceived. |
| Signalization | | | | | | | | | |
| No accommodation for peds at some suburban signals, but ped volumes are low | Moderate to major | 1. Provide ped actuated signal regardless of ped volume. | Moderate | Only needed where min. crossing time not provided each cycle. | High | Moderate | Moderate to high | Slightly to very negative | Represents the classic dilemma in facilitating ped. vs. vehicular flow. |
| | | 2. Inform ped that full crossing time may not be available in one phase. | Low | None | Moderate to high | Low | Low | Minimal impact | If adequate full crossing time not provided, ped should be informed of this. |
| Minimum ped clearance time inadequate to accommodate slow walking peds | Moderate to major | 1. Lengthen ped clearance times where proportion of slower peds is higher than normal. Take time from WALK phase if WALK longer than minimum. | Low | Needed primarily near elderly housing, schools, etc. | High | Moderate | Low | Varies by circumstance | Impact depends on nature of traffic congestion. |
| Peds frequently do not obey signal indications | Moderate (see comment) | 1. Upgrade ped enforcement efforts. | Low | If done, should be selective enforcement. | Low | High | High | Slightly positive | Although lack of compliance is rampant, impacts are not necessarily negative. |

Table 3. Continued.

| Description of Problem | Magnitude of Problem | Possible Solutions | Current Level of Use or Acceptance | Limitations in Applicability | Potential Effectiveness | Barriers to Implementation | Cost | Impact on Other Groups | Comment |
|--|----------------------|--|------------------------------------|---|-------------------------|----------------------------|------------------|------------------------|---|
| Lack of, or improper application of crosswalk markings | Moderate | 1. Develop and implement reasonable crosswalk application guidelines. | Moderate | None, but acceptable guidelines need to be developed. | High | Moderate | Low | Positive | |
| | | 2. Develop symbol to identify preferred crossing location without marking crosswalk. | Low (some in Europe) | Needs to be more fully tested before widespread application. | Moderate | Moderate to high | Low | Uncertain | Primary purpose is to reduce false sense of security. |
| Open parking areas, not enforcing disciplined traffic flow and making pedestrian crossings hazardous | Moderate to high | 1. For new parking lots, enact local parking lot landscaping standards, emphasizing landscaped islands. | Moderate | None | High | Moderate | Moderate | Positive | |
| | | 2. For existing parking lots, islands sufficient to discipline traffic flow. | Low | Parking lot must have ample spaces to accommodate users. | High | Moderate | Moderate | Positive | Owners often more concerned about having adequate space than having landscaping. |
| Overpass or underpass underutilized because at-grade route more convenient | High | 1. Install barrier in median. | Low | Must have median available and no nearby intersections | High | Moderate | Moderate | Minimal impact | Limits accessibility but increases safety. |
| | | 2. Design over/underpass to minimize travel path (e.g., provide stairs in addition to ramps and grade approaches). | Low | Topography must be conducive. | High | Low | Moderate to high | Minimal impact | Handicapped requirements sometimes counterproductive in accessibility for others. |
| Inadequate street lighting at pedestrian crossing points | Moderate to major | 1. Provide traditional street lighting. | Moderate | None | Moderate | Moderate | High | Positive | Should be more intense at intersections and key crossing points. |
| | | 2. Provide special pedestrian-oriented lighting. | Low | Provide only at primary crossing points with heavier ped volumes. | High | Moderate | Moderate | | Contrast to normal lighting provides greater conspicuity at key points. |
| <u>Institutional and Legal Problems</u> | | | | | | | | | |
| General lack of respect of pedestrians by drivers | Major | 1. Selective enforcement (preceded by publicity) of ped right-of-way. | Low | Should focus on situations where driver yielding is a problem. | High | High | High | Perceived negative | Affect on accident rates is uncertain. |
| | | 2. Increase fines for violations of ped right-of-way. | Low | None | Moderate | Moderate | Low | Perceived negative | Needs to be backed by increased enforcement. |

Table 3. Continued.

| Description of Problem | Magnitude of Problem | Possible Solutions | Current Level of Use or Acceptance | Limitations in Applicability | Potential Effectiveness | Barriers to Implementation | Cost | Impact on Other Groups | Comment |
|--|----------------------|--|------------------------------------|--|-------------------------|----------------------------|------|------------------------|--|
| Lack of coordination and continuity in pedestrian facilities | Major | 1. Make master planning for pedestrian facilities mandatory in state law. | Moderate | None | High | Moderate | Low | Positive | Only way to ensure ped planning takes place is to require it by law. |
| | | 2. Increase public investment in completing sidewalks and pathways. | Moderate | None | High | Moderate to high | High | Positive | Consider specifying minimum funding levels by law. |
| Lack of communication in development process | Major | 1. Develop more rigorous administrative procedures to force communication. | Moderate | None | Moderate | High | Low | Positive | Cannot make administration so elaborate that it slows down the development process. |
| | | 2. Designate person in public agency as the pedestrian advocate. | Low to moderate | None | High | Moderate | Low | Positive | One of the most effective low-cost actions. |
| Lack of vocal, organized advocacy group addressing ped needs | Major | 1. Establish citizen task force on pedestrian needs. | Low | None | High | Moderate | Low | Positive | Relies on citizens taking an interest. |
| | | 2. Establish pedestrian facility "hot line". | Low | None | Moderate | Moderate | Low | Positive | Provides recognized avenue for input. |
| Inflexibility in zoning and subdivision regulations | Major | 1. Build in flexibility to regulations (e.g., performance zoning). | Moderate | Usually depends on local perspective on development | High | High | Low | Depends on situation | Offers greater potential benefit but also greater risk. |
| | | 2. Provide special zones of development for pedestrian orientation. | Low to moderate | Subject to local and state law | High | Moderate | Low | Positive | Special ped-oriented design guidelines would be provided. |
| Suburban land use patterns discourage pedestrian travel | Major | 1. Provide incentives for mixed-use and development clustering. | Low to moderate | Some areas not physically or politically suited to ped-oriented development. | Moderate | Low | Low | Possibly negative | Higher density development needed for ped-orientation sometimes opposed by community |
| | | 2. Employ "urban village" concept. | Moderate | Must be planned under right physical conditions | High | Moderate | Low | Positive | Applicable to original development or redevelopment. |
| | | 3. Provide for minimum F.A.R.'s as well as maximum. | Low | Only in areas planned for higher density development | Low | High | Low | Possibly negative | Developers usually incentive toward higher F.A.R.'s anyway. |

However, agencies and institutions at the national level can act as catalysts for implementation (1) by providing implementation aids; (2) by undertaking research and development for new analysis methods, designs and materials; and (3) in the case of the federal government, by regulating certain state and local activities. Listed below are the areas in which additional implementation effort is suggested, listed by the group that would most likely be responsible.

State and Local Agency Actions

- Employ pedestrian-sensitive highway design and operational practices. Examples of high priority items include increased use of medians and refuge islands, requiring sidewalks on all arterial and collector streets, as well as certain local streets, taking greater care in determining the alignment and location of sidewalks, and providing special lighting at crosswalk location. Other important practices are discussed in Chapters Three through Six.

- Formalize pedestrian planning practices by: (1) adopting specific pedestrian planning and design objectives at the local and state level; (2) including a master walkways plan in the comprehensive plan; (3) designating an individual or individuals to have responsibility for the planning of pedestrian facilities; and (4) performing a pedestrian facilities review as part of the site plan review process.

- Incorporate sidewalk requirements and other requirements for pedestrian facilities into zoning and subdivision regulations.

- Develop incentives for developers to provide improved pedestrian facilities as part of site development.

- Set aside funding for pedestrian facilities, and include such facilities as a regular part of the capital budgeting process.

- Establish revolving fund or payback mechanisms in the subdivision regulations (or other appropriate legal instrument) to permit gaps in the pedestrian system to be completed by the public agency even when undeveloped parcels remain (with cost recovery from developer or property owner at a later date).

- Set up volunteer funding programs enabling citizens or organizations to donate or contribute toward items such as sidewalks, trees, and benches for the improvement of public property.

- Establish maintenance programs for sidewalks, streetscape, and other public pedestrian facilities. In some cases, it may be possible to set up volunteer sidewalk inventory and maintenance teams in neighborhoods or commercial areas.

- Make zoning and land use decisions that favor pedestrian trip making. This includes favoring compact land use, fostering the proximity of mutually attracting pedestrian magnets, and providing for densities (in environmentally and politically acceptable locations) that will encourage pedestrian trip interchange.

- Coordinate highway and land-use decisions so as to not create unnecessary barriers to pedestrian movement.

Federal/National Level Strategies

- Encourage greater use of medians and refuge islands by: (1) preparing a model set of standards for design and application of median treatments designed to accommodate pedestrian needs; (2) developing warrants and guidelines for the installation

of refuge islands (marking and signing should be specifically treated in *Manual on Uniform Traffic Control Devices*); and (3) disseminating information on the importance of medians and refuge islands for suburban pedestrian mobility.

- Provide more detailed guidelines on pedestrian treatments in commonly used reference texts, such as the AASHTO Green Book.

- Develop less expensive methods for constructing overpasses and underpasses. Relaxation of some of the existing design requirements, under certain conditions, could help to make overpasses and underpasses more feasible.

- Prepare a model set of zoning and subdivision provisions to foster adoption into local codes. The model provisions would specify pedestrian-sensitive treatments that maintained a reasonable balance between the needs of motorized and nonmotorized facilities.

- Develop a pedestrian design assistance team, providing a group of knowledgeable professionals available for consulting on how to solve pedestrian-related problems. A hot-line telephone number could be employed to provide convenient access.

- Develop other lower cost materials and construction methods, especially those designed to reduce the cost (or increase the service life) of sidewalks and pathways.

- Develop a legal procedure to make it easier to obtain an easement in an existing development. The pursuit of an easement is sometimes avoided because of the time and expense of obtaining it. Easements in new subdivisions are relatively simple to obtain.

- Prepare a set of guidelines that a local agency can use for pedestrian planning. The guidelines could cover the following areas: (1) preparing a master plan of walkways; (2) performing (with staff or volunteer citizen help) a sidewalk inventory and priority improvement program; (3) locating and designing walkway systems (providing guidelines for both in-house use and for developers wishing to design such systems); (4) performing site plan reviews with the pedestrian in mind; and (5) preparing a model inventory and maintenance management program for sidewalk and other pedestrian-related facilities. Microcomputer software could be developed to implement the system.

- Provide a model set of state regulations to foster the implementation of pedestrian facilities, such as: (1) language requiring the allocation of a percentage of highway funds to go toward pedestrian facilities (i.e., such as in Washington State); (2) less restrictive replacement-in-kind regulations; (3) treatment of insurance coverage for pedestrian accidents in areas where no-fault insurance is in use; (4) requiring the inclusion of pedestrian considerations in local comprehensive plans; and (5) requiring local agencies to designate an individual to be responsible for pedestrian planning.

- Develop a guidebook for citizens seeking to understand pedestrian problems and to be involved in finding solutions in their locality. The guidebook would provide information on basic principles of pedestrian facility planning and design, and suggest how a citizen could become involved. The document could serve as a model for local agencies to use with their citizens, or could be used directly as an informational tool.

Citizen Actions

- Report pedestrian facility deficiencies to the local government agency responsible for correcting them.

- Become involved in lobbying for improved pedestrian facilities in the local area. If the locality does not have a formalized approach to pedestrian planning, work with them to develop one. Chapter Six suggests specific ways in which a citizen can become involved.

Developer Actions

- Seek to include pedestrian considerations from the outset

of a project. This can be done quickly and simply even in larger projects, and ensures that pedestrian facilities will not inadvertently be forgotten.

- Provide amenities to enhance the pedestrian environment. These usually pay off in project marketability later on.
- Find out from the literature and from the experience of others what has worked and what has not. The case studies in Appendix B are a good starting point.
- Follow pedestrian-sensitive planning and design principles outlined elsewhere in this report.

CHAPTER EIGHT

CONCLUSIONS AND SUGGESTED RESEARCH

CONCLUSIONS

The primary objectives of this study were: (1) to identify deficiencies in the planning, design, and implementation of pedestrian facilities in suburban and developing rural areas; (2) to determine how and why those deficiencies occur; and (3) to recommend practical methods and principles that can be employed in correcting existing deficiencies or in planning new development.

During the course of the study it was discovered that many of the pedestrian problems in suburban and developing rural areas are implementation-related. The physical design solutions are often obvious. Solving the problems, however, is a matter of coordination, financing, and public/private interaction—tasks that are considerably more complex than building a sidewalk or installing a traffic signal.

If there had to be one single conclusion chosen to summarize the results of this research, it would be *THINK PEDESTRIAN*.

Many of the deficiencies of the pedestrian network in suburban and developing rural areas can be attributed simply to the failure to think about pedestrians and how to get them safely and conveniently from one place to another. This is not to say that there is no room for improved planning and design techniques and strategies. However, the consistent recognition of the pedestrian in planning processes, land development, and highway design will make great strides toward improving suburban pedestrian facilities.

Substantial improvement can also be made both in the way that pedestrian planning is done and in the actual design of highway facilities and the layout of development sites. As always, there is a cost associated with any improvement, and there are other competing priorities. Situations exist in which pedestrian facilities would be desired, but for which the cost cannot be justified. Other dilemmas of the relative priority of vehicular versus pedestrian movement also remain. It is clear, however, that the pedestrian is a legitimate user of highway space, just as drivers are, and that there are substantial problems of neglect in the facilities provided. Much of this neglect stems from simple

oversight and lack of systematic planning. These are correctable, and with even modest improvements in the planning process, significant benefits can be achieved.

SUGGESTED RESEARCH

Additional research will also help to clarify some of the strategies necessary to improve the pedestrian environment. Some of the higher priority research needs suggested by the results of this study are as follows:

- *Research on medians and refuge islands.* Although these are important devices for improving the convenience and safety of crossing major suburban highways, there is relatively little research on their effectiveness, particularly their safety effectiveness. Research should include a safety evaluation of medians and refuge islands, and, if possible, an operational analysis of actual field installations. Warrants or criteria for the application of refuge islands should be developed.

- *Implications of two-way left-turn lanes on pedestrian safety.* It is clear that two-way left-turn lanes are a source of concern to pedestrian convenience, but research has not determined their effect on pedestrian accidents. Basic before and after studies in this area would at least help to establish the approximate impact so that further recommendations can be made. It would also be desirable to conduct field tests of refuge islands integrated in with a turning lane treatment to gauge the operational effects.

- *More rigorous before and after studies of certain types of pedestrian-related improvements.* Some examples include sidewalk flare installations, retrofitting of sidewalks or other pedestrian pathways, various types of pedestrian malls (both vehicle-free and not vehicle-free), improved roadway lighting (both spot and longitudinal) for pedestrian safety. Good before and after evaluation data are quite scarce, and studies usually need to rely heavily on the involvement of local agencies making the improvement.

- *Alternatives to traditional crosswalk striping.* In light of the divergence of opinion and research results on the safety effects of crosswalk striping, alternatives to traditional crosswalk striping should be investigated, with emphasis on reducing the false sense of security purported to be a problem with traditional crosswalk markings. An alternative could include denoting the crosswalk location for the pedestrian by means of a sign or marking on the sidewalk, without actually marking the crosswalk. Testing of some of the European versions of crosswalk markings should also be considered.

- *Ways to reduce the cost of constructing certain pedestrian facilities, particularly sidewalks.* Other needs include the development of aesthetic but effective barriers to prevent pedestrian crossings at undesirable locations, low-cost refuge island installation kits, and low-cost pads for isolated bus stops to keep pedestrians from having to stand in mud and dirt.

- *Ways to improve driver compliance (or to change pedestrian / driver expectations) at crosswalks.* Recognition and enforcement of the pedestrian right-of-way at crosswalks is lax. New signal and signing strategies may be needed to bring about a change in driver behavior. Enforcement strategies could be tested in combination with the traffic control devices. Lack of pedestrian compliance is also a problem, but the safety impact from the lack of compliance is uncertain.

- *Research into creative funding techniques and development of model legal documentation in support of these concepts.* Examples include revolving funds with payback provisions, prop-

erty assessments combined with tax abatement for improvements across undeveloped property to complete the pedestrian system.

- *Development of aesthetic but low maintenance types of landscaping, making streetscape improvements more practical.* There are ongoing developments in this area in the private sector.

- *Development of additional computerized planning applications.* Examples include simple pedestrian route planning and approximate demand forecasting procedures, applicable to suburban areas.

The above research is oriented toward answering questions that will help practitioners to make more informed decisions on the planning, design, and operation of pedestrian facilities. Research to find lower cost materials is important to all areas of highway planning and engineering, and is often undertaken by the private sector in developing marketable products. Public agencies having a need for a product not commercially available should work with the commercial interests to ascertain the feasibility of product development.

Although empirical research is important, one must still recognize that the solutions to the suburban and rural pedestrian problem rest largely on the shoulders of the planning and implementation process. This is where many of the deficiencies creep in and where there is the most potential for progress. Research in these legal, institutional, and implementation areas should not be neglected.

APPENDIXES

A, B, C, D, E, AND F

Appendixes A through F are not published herein but are contained in a separate document, *NCHRP Report 294B*, "State-of-the-Art Report." Readers are referred to that report who may have an interest for more detailed treatment of the following topics:

A Study Procedures: • literature review • national survey of agencies and individuals • focus group interviews • residential surveys • pedestrian surveys • site inventories • other data collection • conduct of case studies • development of evaluation criteria • problem and solution identification

B Case Studies: • Branderville, Chesterfield County, Virginia • Columbia New Community, Howard County, Maryland • Claremont, California • Fremont, California • Sun City, Arizona • Chesterbrook Tredyffrin Township, Pennsylvania • Towne Center/Vermilion Park Mall, Danville, Illinois • Oxford Valley Mall, Langhorne, Pennsylvania • Plymouth Meeting Mall, Plymouth Township, Pennsylvania • Maitland Center, Orlando, Florida • Bellemead Office Park, Lyndhurst, New Jersey • Metro East Office Park, New Carrollton, Maryland • Bethesda Central Business District, Montgomery County, Maryland • Ballston/Parkington Area, Arlington, Virginia • Tyson's

Corner, McLean, Virginia • Suburban Activity Center, Bellevue, Washington • Warner Center, Woodland Hills, California • Montrose Shopping Park, Glendale, California • Fredericksburg, Virginia • Market Way, Doylestown, Pennsylvania • Small City Downtown Redevelopment, Iowa City, Iowa • Decatur, Illinois • International Drive, Orlando, Florida • U.S. Route 51/Illinois State University, Normal, Illinois • Tramway Boulevard, Albuquerque, New Mexico • Skyline Center, Falls Church, Virginia • Town Center, Costa Mesa, California • Disney Village, Orlando, Florida

C Walk Trip Characteristics and Pedestrian Accident Statistics for Suburban and Rural Areas

D Pedestrian-Related Development Guidelines from Plaza International, Orlando, Florida

E A Collection of Photographs Illustrating Pedestrian Planning and Design Treatments

F Annotated Bibliography of Selected References: • general planning texts • pedestrian facility planning • site planning • walk trip characteristics • pedestrian facility design • implementation and funding • pedestrian safety • highway design and traffic operations

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