TRANSIT COOPERATIVE RESEARCH PROGRAM

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TCRP Report 19

Guidelines for the Location and Design of Bus Stops

Transportation Research Board
National Research Council

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Report 19

Guidelines for the Location and Design of Bus Stops

TEXAS TRANSPORTATION INSTITUTE
TEXAS A&M RESEARCH FOUNDATION
TEXAS A&M UNIVERSITY
College Station, TX

Subject Area

Public Transit
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TRANSPORTATION RESEARCH BOARD
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The nation's growth and the need to meet mobility, environmental, and energy objectives place demands on public transit systems. Current systems, some of which are old and in need of upgrading, must expand service area, increase service frequency, and improve efficiency to serve these demands. Research is necessary to solve operating problems, to adapt appropriate new technologies from other industries, and to introduce innovations into the transit industry. The Transit Cooperative Research Program (TCRP) serves as one of the principal means by which the transit industry can develop innovative near-term solutions to meet demands placed on it.

The need for TCRP was originally identified in *TRB Special Report 213—Research for Public Transit: New Directions*, published in 1987 and based on a study sponsored by the Urban Mass Transportation Administration—now the Federal Transit Administration (FTA). A report by the American Public Transit Association (APTA), *Transportation 2000*, also recognized the need for local, problem-solving research. TCRP, modeled after the longstanding and successful National Cooperative Highway Research Program, undertakes research and other technical activities in response to the needs of transit service providers. The scope of TCRP includes a variety of transit research fields including planning, service configuration, equipment, facilities, operations, human resources, maintenance, policy, and administrative practices.

TCRP was established under FTA sponsorship in July 1992. Proposed by the U.S. Department of Transportation, TCRP was authorized as part of the Intermodal Surface Transportation Efficiency Act of 1991 (ISTEA). On May 13, 1992, a memorandum agreement outlining TCRP operating procedures was executed by the three cooperating organizations: **FTA**; the National Academy of Sciences, acting through the **Transportation Research Board (TRB)**; and the Transit Development Corporation, Inc. (TDC), a nonprofit educational and research organization established by APTA. TDC is responsible for forming the independent governing board, designated as the TCRP Oversight and Project Selection (TOPS) Committee.

Research problem statements for TCRP are solicited periodically but may be submitted to TRB by anyone at any time It is the responsibility of the TOPS Committee to formulate the research program by identifying the highest priority projects. As part of the evaluation, the TOPS Committee defines funding levels and expected products.

Once selected, each project is assigned to an expert panel, appointed by the Transportation Research Board. The panels prepare project statements (requests for proposals), select contractors, and provide technical guidance and counsel throughout the life of the project. The process for developing research problem statements and selecting research agencies has been used by TRB in managing cooperative research programs since 1962. As in other TRB activities, TCRP project panels serve voluntarily without compensation.

Because research cannot have the desired impact if products fail to reach the intended audience, special emphasis is placed on disseminating TCRP results to the intended end users of the research: transit agencies, service providers, and suppliers. TRB provides a series of research reports, syntheses of transit practice, and other supporting material developed by TCRP research. APTA will arrange for workshops, training aids, field visits, and other activities to ensure that results are implemented by urban and rural transit industry practitioners.

The TCRP provides a forum where transit agencies can cooperatively address common operational problems. The TCRP results support and complement other ongoing transit research and training programs.

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NOTICE

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The members of the technical advisory panel 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 panel, they are not necessarily those of the Transportation Research Board, the National Research Council, the Transit Development Corporation, or the Federal Transit Administration of the U.S. Department of Transportation.

Each report is reviewed and accepted for publication by the technical panel according to procedures established and monitored by the Transportation Research Board Executive Committee and the Governing Board of the National Research Council.

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FOREWORD

By Staff
Transportation Research Board

TCRP Report 19, *Guidelines for the Location and Design of Bus Stops*, will be of interest to individuals and groups with a stake in the location and design of bus stops. This includes those associated with public transportation organizations, public works departments, local departments of transportation, developers, and public and private organizations along or near bus routes.

The primary objective of this research was to develop guidelines for locating and designing bus stops in various operating environments. These guidelines will assist transit agencies, local governments, and other public bodies in locating and designing bus stops that consider bus patrons' convenience, safety, and access to sites as well as safe transit operations and traffic flow. The guidelines include information about locating and designing bus stops and checklists of factors that should be considered.

The research began with a literature review and the identification of stakeholders' concerns through mail and telephone surveys and face-to-face interviews. A review of 28 transit agency manuals on bus stop design and location provided the basis for an appraisal of current practice. Observations made at more than 270 bus stops during regional visits to Arizona, Michigan, and California were supplemented with traffic field studies conducted at 14 bus stops and pedestrian field studies conducted at 10 bus stops. Computer simulation of bus stops on suburban highways was also used to develop the findings.

The guidelines include three sections: the "big picture," street-side design, and curb-side design.

- **The big picture** section of the guidelines addresses the need for cooperation and coordination among stakeholders during the design and location of bus stops. Such efforts result in mutually satisfying outcomes for diverse interests and can preclude many problems that often arise.
- **The street-side** section discusses matters such as curb radii and when to consider installing the various bus stop configurations (curb-side, nub, bus bay, open bus bay, and queue jumper bus bay) and different bus stop locations (near-side, far-side, and midblock). This section of the guidelines addresses possible effects of bus stop location and design on bus operations and traffic flow.
- **The curb-side** section addresses community integration; pedestrian access to bus stops; placement of bus stops in the right of way; environmental treatments; bus shelter designs; shelter construction materials; and amenities, such as lighting, benches, vending machines, trash receptacles, telephones, bus route and schedule information, and bicycle storage facilities.

The guidelines also include two appendixes that present the results of the street-side and curb-side studies.

A secondary objective of this research project was to develop or assemble the most comprehensive and technically current information on bus stop design. The research team prepared a final report that presents the research approach and findings, including the results of the literature review, review of transit agency manuals, and survey findings. This report, which is not published, is available, on loan, from TCRP.

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ACKNOWLEDGMENTS

This work, sponsored by the Federal Transit Administration, was conducted in the Transit Cooperative Research Program, which is administered by the Transportation Research Board of the National Research Council.

The research reported herein was performed under TCRP Project A-10 by the Texas Transportation Institute. Texas A&M Research Foundation was the contractor for this study. Kay Fitzpatrick, Associate Research Engineer, Texas Transportation Institute, was the principal investigator. The other authors of this report are Kevin Hall, Assistant Research Scientist; Dennis Perkinson, Assistant Research Scientist; Lewis Nowlin, Assistant Research Scientist; and Rodger Koppa, Associate Research Engineer, all of the Texas Transportation Institute. Other TTI staff who assisted with this project include Pat Beck, Alan Black, Melinda Butts, Jon Collins, Steve Farnsworth, Shirley Kalinec, Stacy King, Joseph Koothrappally, Molly Marshall, Maria Medrano, Angelia Parham, Kelly Quy, Jason Vaughn, and Jennifer White. The work was performed under the general supervision of Dr. Fitzpatrick.

The authors wish to acknowledge the many individuals who contributed to this research by participating in the mail-out surveys, the phone survey, the regional visits, the field data-collection efforts, and the review of the developed guidelines.

The research team is especially grateful for the contributions of William Capps, Alan Danaher, Ed Demming, Charles Felix, Mark Fedorowic, Joe Garcia, E. J. Hynick, Chuck Italino, Michele Korf, Suzanne LaPlant, Chris Leighty, Steve Miraglio, Matilde Miranda, Dennis O'Malley, Larry Shobe, Wayne Tanda, Mayuko Tzanavaras, James Unites, Kiyo Ushino, Bill Volk, Duncan Watry, Christopher White, and Ronald K. Wong.

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INTRODUCTION

Chapter 1

NEED FOR THIS RESEARCH

The bus stop is the first point of contact between the passenger and the bus service. The spacing, location, design, and operation of bus stops significantly influence transit system performance and customer satisfaction.

In recognition of the importance of bus stop location and design, the Transit Cooperative Research Program (TCRP) sponsored research to develop guidelines for use in designing and locating bus stops. The objective of this research was to develop guidelines for locating and designing bus stops in various operating environments. These guidelines can assist transit agencies, local governments, and other public bodies in locating and designing bus stops that consider bus patrons' convenience, safety, and access to sites, as well as safe transit operations and traffic flow. The guidelines include a compilation of information necessary for locating and designing bus stops, as well as checklists of factors that must be taken into consideration. The guidelines list the advantages and disadvantages of various bus stop treatments and discuss the trade-offs among different alternatives.

These guidelines also provide an approach to integrating transit and development. By assembling the information into a single document, public agencies and developers can more easily incorporate transit needs into the design and operations of streets and highways, as well as in land development. Finally, these guidelines should help transit, state, and local agencies in selecting bus stop amenities.

Chapter 1 INTRODUCTION

SOURCES OF MATERIAL

This research includes evaluations of current policies regarding bus stop design and location, reviews of the relevant literature, and extensive interviews and site visits. Appreciation goes to those who assisted in this study, including those who responded to our surveys, met with us during the regional visits, helped with the data collection efforts, and provided reviews of these guidelines. Documentation of the research performed during the development of these guidelines is contained in *Location and Design of Bus Stops, TCRP Project A-10 Final Report*, and Appendixes D and E of this document. The *Final Report* is available for loan on request from TCRP. It includes the following:

- Summary
- Introduction
- Findings
- Interpretation, Appraisal, Application
- Conclusions and Suggested Research
- Appendix A - Literature Search
- Appendix B - Review of Transit Agency's Manuals
- Appendix C - Survey Findings

Several excellent manuals are currently being used by various cities and transit agencies. These manuals, along with the literature, were reviewed during the development of these guidelines. Some figures and text used in these guidelines are reproductions or expansions of material contained elsewhere. The contributions of the following documents in the development of these guidelines are recognized:

- *Bus Stop Handbook: Street Improvements for Transit,* Valley Metro, Regional Public Transportation Authority, Phoenix, Arizona, December 1993.

- *Tri-Met Bus Stops and Passenger Amenities Guidelines,* Tri-Met Transit Development and Planning and Scheduling Departments, Portland, Oregon area, November 1994.

- *Bus Passenger Facilities - Street Improvement Guidelines,* Regional Public Transportation Authority, Draft, Phoenix, Arizona, March 1989.

- *Planning for Transit, A Guide for Community and Site Planning,* Regional Transportation Commission of Washoe County, Nevada, June 1992.

INTRODUCTION

Chapter 1

ORGANIZATION OF GUIDELINES

These guidelines provide a useful and practical tool for the location and design of bus stops. **Chapter 1** introduces the materials included within this document. **Chapter 2** provides a general overview of the broad issues associated with the location and design of bus stops. Special emphasis is placed on the need for coordination and cooperation between public officials and private interests to enhance community acceptance of transit operations and to improve patron access, comfort, and convenience.

The guidelines are organized to reflect the two major issues associated with bus stop design and placement: street-side factors and curb-side factors. Street-side factors are those factors associated with the roadway that influence bus operations. Curb-side factors are those factors located off the roadway that affect patron comfort, convenience, and safety.

To enhance vehicle and system performance, street-side factors are discussed in **Chapter 3**. Bus vehicle characteristics, including vehicle size and turning radii, are provided. In addition, discussions are included on various bus stop designs and when to consider each design. **Chapter 4** addresses the curb-side factors. General discussions of amenities and various curb-side design strategies are included. For quick and easy reference to the factors that influence the final design and placement of a bus stop, checklists are included at the end of Chapters 3 and 4 for street-side and curb-side issues. The final chapter of the guidelines **(Chapter 5)** is the Glossary of terms used in the guidelines.

In addition to the guidelines, this report includes the findings from the street-side and curb-side studies in Appendix D (Street-Side Studies) and Appendix E (Curb-Side Studies), respectively.

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THE BIG PICTURE

Chapter 2

UNIVERSAL CONCERNS

As the first point of contact between the passenger and the transit service, the bus stop is a critical element in a transit system's overall goal of providing timely, safe, and convenient transportation.

Several universal concerns of both users and providers of transit services include the following:

Transit system performance: Travel time for a bus trip has four components: the time it takes to walk to the bus stop, the wait time for the bus, the actual in-vehicle travel time, and the time to walk to the destination. Each is affected by the bus stop location and the frequency of the bus stops.

Traffic flow: Bus stop location and design affect the flow and movement of other vehicles. A well-designed bus stop can allow passengers to board and alight without the bus significantly impeding or delaying adjacent traffic.

Safety: Safety is the freedom from danger and risk. In the transit environment it includes an individual's relationship to buses and general traffic, and the bus' relationship to other vehicles. Pedestrian safety issues include the nearness of a bench to the flow of traffic on a busy street or safely crossing the street to reach the bus stop. Bus reentry into the flow of traffic safely is an example of an operational safety concern. Thus, pedestrians, bus passengers, buses, and private vehicles can all be involved in concerns for safety at or near a bus stop.

Security: Security refers to an individual's feeling of well being. Security is affected by lighting at bus stops, bus stop visibility from the street and from nearby land uses, and bus stop locations with hiding places. Security involves neighborhood residents, bus patrons, and bus drivers.

These are the functional and performance-related concerns in public transportation. Each must be addressed to achieve the goal of timely, safe, and convenient public transportation and to satisfy the needs of the service area. More importantly, to those who plan bus stops, each area of concern is influenced by the bus stop location and design decisions.

Chapter 2

THE BIG PICTURE

LIVABLE COMMUNITIES

The transit system must be integrated into the everyday life of a community to realize its full potential. Consideration should be given to long-term design and system performance, which can enhance the interaction of transit with communities. Only in this way can transit become an accepted part of the infrastructure and contribute to the creation of a "livable community."

The goal of the Livable Communities Initiative is to strengthen the link between transit and communities by improving personal mobility, transportation system performance, and the quality of life in communities by

- strengthening the link between transit planning and community planning, including land use policies and urban design supporting the use of transit, and ultimately providing physical assets that better meet the community needs;

- stimulating increased participation in the decision-making process by community organizations, minority and low-income residents, small and minority businesses, persons with disabilities, and the elderly;

- increasing access to employment, education facilities, and other community destinations through high-quality, community-oriented, and technologically innovative transit services and facilities; and

- leveraging resources available through other federal, state, and local programs.

Transit is an integral part of livable communities. Specifically, the efficient placement of bus stops near major destinations and within easy access provides a viable transportation alternative to the automobile by making the entire transit trip shorter and more pleasant.

Thus, the key to successful and productive integration of transit into the fabric of everyday community life includes the location and design of bus stops.

THE BIG PICTURE

Chapter 2

THE PLAYERS

The key players in bus stop location and design are as follows:

Transit agency - The transit agency is usually the primary provider of transit service.

City government - The authority with jurisdiction over the streets and sidewalks in the transit service area is usually a city, but county or state agencies are sometimes involved.

Developers - Developers provide new construction and growth in the transit service area. Development may be either residential or commercial. Though both are concerned with access, the specific nature of those concerns may vary between residential and commercial development.

Employers - Employees and retail customers are potential transit riders. Employers benefit when their employees and customers can travel to work easily and efficiently.

Neighborhood groups - Neighborhood residents are potential consumers of transit service, and potential supporters of transit, whether they use this service or not.

Key destinations - These are the trip generators (central business districts, schools, shopping areas, public buildings, medical facilities, etc.) for those who work at these locations, and for those who use the services provided at these locations.

While the individual priorities of these players may vary, the players have the same interest in the potential benefit of timely, safe, and convenient transit service. They are the stakeholders in bus stop location and design. Although specific methods must vary to suit each particular situation, the challenge is to use their common interest to productively involve relevant players so that efficient transit service can result.

Chapter 2

THE BIG PICTURE

IDENTIFICATION OF NEED

Issues transit agencies consider when determining whether a bus stop is needed include the following:

Transit Agency Policy
- Route types (definitions and criteria)
- Guidelines for stop installation (boardings and alightings, headways, land use)
- Special cases/Exceptions (neighborhood requests, hospitals, procedures)

Equity
- Title 6 - Civil Rights Act of 1964 (equity in level of service among different segments of the community)
- Public Relations (perceptions, media attention, community leaders)
- Transit dependent areas (demographics, socioeconomics, unique needs)

Accessibility/ADA
- Access to the stop (sidewalks, curb cuts, pedestrian crossings)
- Access to amenities (shelter dimensions, width of walkways)
- Access at the stop (level loading area, lift deployment space)

Various factors relating to transit operations are also important in determining the need for a bus stop. Some of the more important factors are

Trip Generation/Land Use - How many potential bus passengers?

Walking Distance - How far do passengers have to walk?

Boardings and Alightings - How many passengers are getting on and off?

Dwell Time - How long does the bus dwell at the stop?

Travel Time - How long is the trip from the origin to the rider's destination?

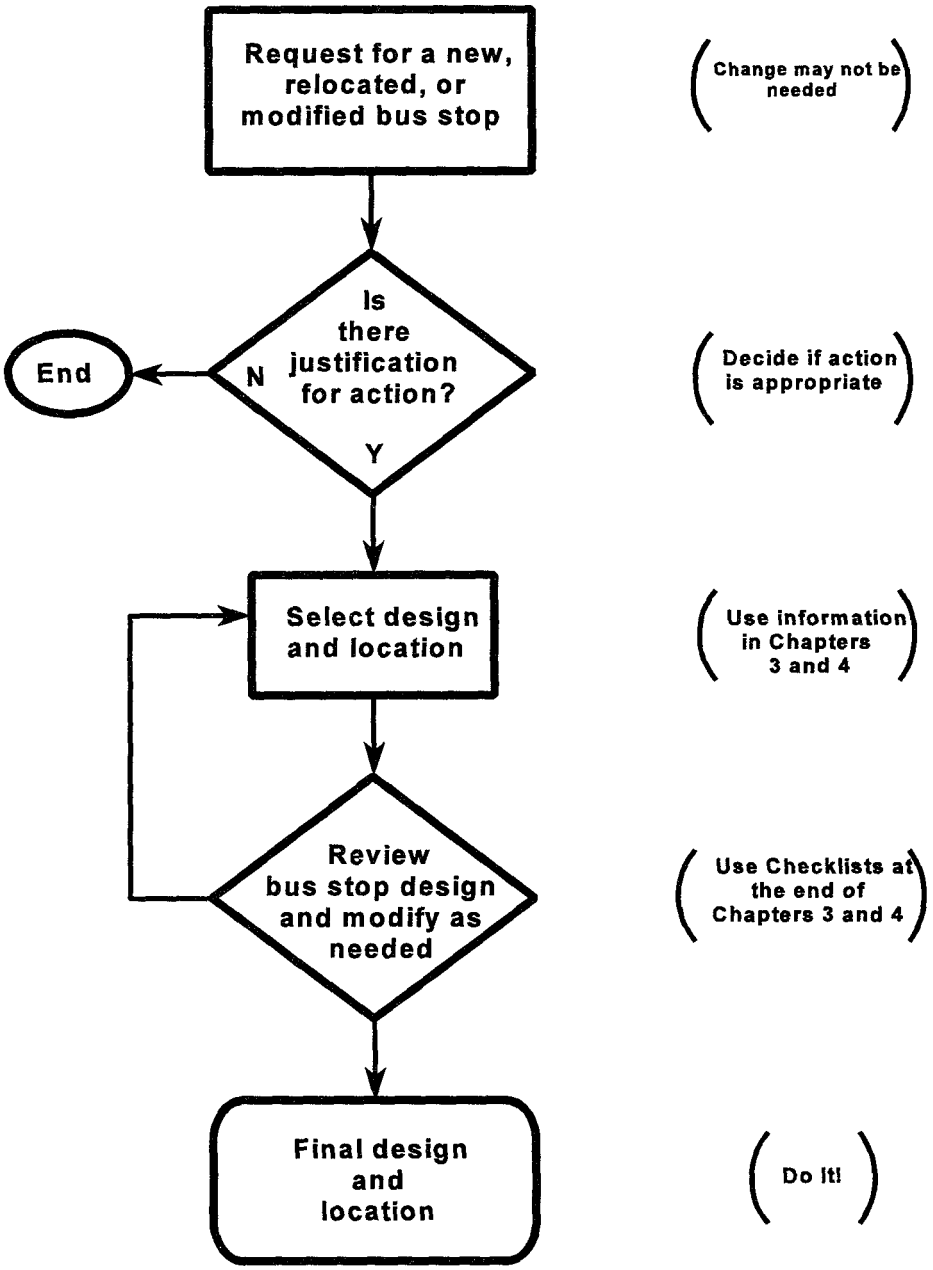
Transfer Potential - How many routes serve this stop?

THE BIG PICTURE

Chapter **2**

LOCATION AND DESIGN FLOWCHART

Bus stop design and location decisions begin with the request or the recognition that a new or modified bus stop is needed. The process concludes with the implementation of numerous interrelated decisions. A flow chart of the decision process is shown below.



Chapter 2

THE BIG PICTURE

COORDINATION AND COOPERATION—Hypothetical Medical Center

Both transit and city officials agree that advantages exist when coordination occurs among governmental entities and with neighborhood organizations, developers and others. Most major successes (i.e., design and access, proper placement) involved a good, close working relationship between the transit agency and the city.

Hypothetical Medical Center Example

Locating bus stops at land uses surrounded by large parking lots is a common occurrence. This situation is especially evident along suburban arterials developed with current zoning regulations that encourage the building of extensive parking lots in front of the land use. The large parking lots serve as barriers between the bus stop and the land use. Bus patrons must walk through an uninviting environment (i.e., long stretches of asphalt, between parked cars) to reach the building or bus stop. The size of the parking lot also discourages the transit vehicle from boarding and alighting passengers directly adjacent to the building due to the potential for increased points of conflict with general vehicular traffic and pedestrians in the parking lot. The bus travel time and distance would also increase considerably if route deviations into parking lots occurred at every stop.

An example of the need to coordinate the location of the bus stop with the land use is illustrated by the hypothetical medical development on the following pages. Because elderly or medically disabled individuals may use this bus stop more than other bus stops along the route, it is critical that bus patrons are provided with a safe and direct route from the bus stop to the hospital.

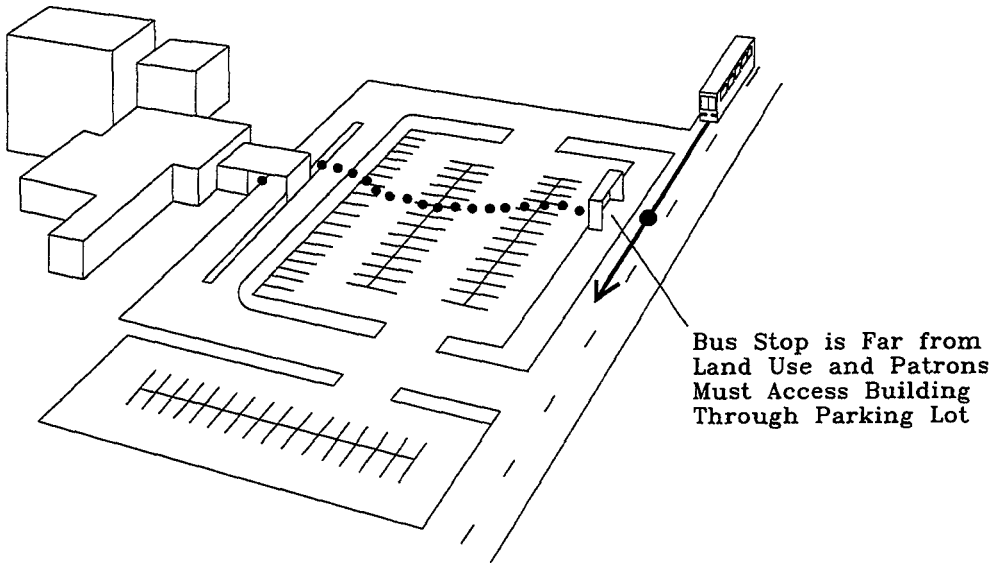
The examples show the potential problems and solutions associated with coordinating a bus stop with this type of development. Both existing and new development scenarios are presented and advantages and disadvantages of each potential solution are listed below. The large number of solutions for the same problem highlights the fact that each site can have multiple solutions. Coordination among the different players involved (i.e., transit agency, city, medical center, developer) can enhance the comfort and safety of bus patrons getting to this stop and can improve transit service to this site.

THE BIG PICTURE

Chapter **2**

COORDINATION & COOPERATION—Hypothetical Medical Center

Hypothetical Medical Center: Providing access without coordination and cooperation.



Positives:

- (+) Bus remains on a main thoroughfare, minimizing total travel time along the bus route.
- (+) Bus stop is more visible to passing vehicles and helps advertise the availability and location of public transit.

Negatives:

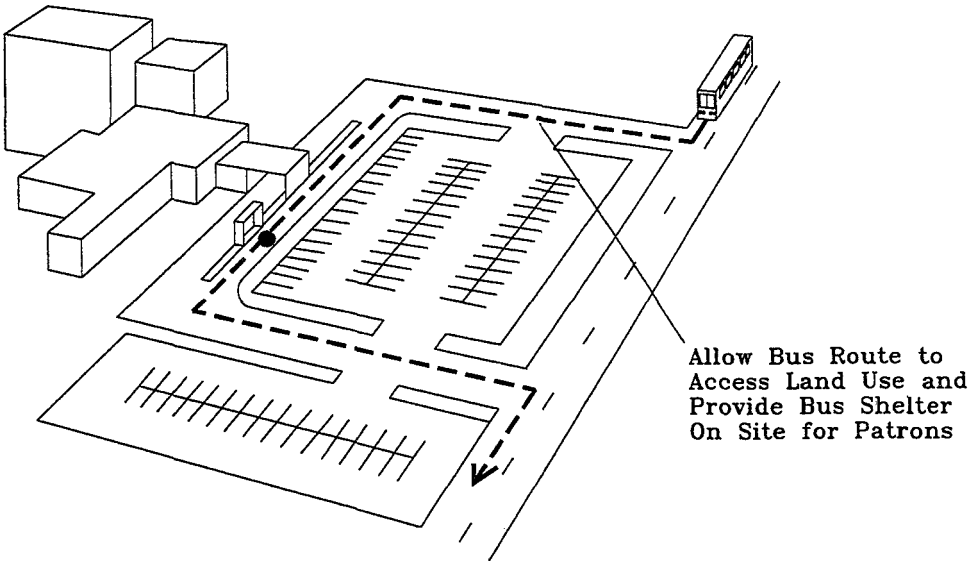
- (-) Patrons must walk through a vast parking lot to reach the medical center.
- (-) Potential exists for vehicular and pedestrian conflicts as patrons walk through parking lot.
- (-) Parking lot is uninviting and offers little in the way of environmental comfort.
- (-) Security of patrons may be compromised as they walk through parking lot.

Chapter 2

THE BIG PICTURE

COORDINATION & COOPERATION—Hypothetical Medical Center

Hypothetical Medical Center: Deviating the route.



Positives:

- (+) Permits bus route to access land uses more directly.
- (+) Potential for shared use of overhang for bus patrons during inclement weather.
- (+) Reduces walking time and distance from the land use to the bus stop.
- (+) Reduces the potential for vehicular/pedestrian conflicts in the parking lot.
- (+) Patron security may be enhanced through proximity to land use. Indirect surveillance from the land use may be increased and the number of potential hiding places is removed by placing the stop adjacent to the building.

Negatives:

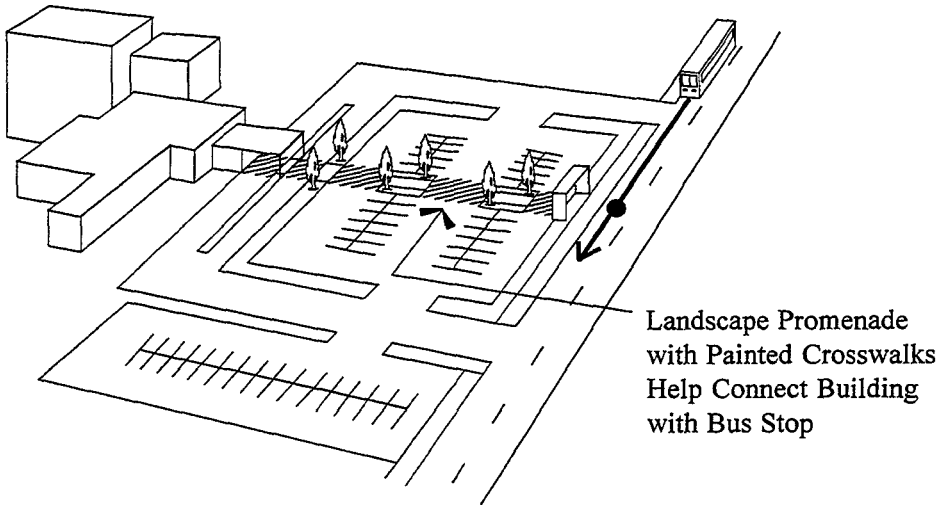
- (-) Bus/general vehicle conflicts may increase by having the route deviate into the parking areas.
- (-) Route travel time and distance are increased.

THE BIG PICTURE

Chapter 2

COORDINATION & COOPERATION—Hypothetical Medical Center

Hypothetical Medical Center: Installing a pedestrian promenade through the parking lot.



Positives:

- (+) Bus vehicle remains on a main thoroughfare, minimizing trip time and distance.
- (+) Reduces opportunity for pedestrian/vehicular conflicts in parking lot by constructing a well-defined pedestrian corridor.
- (+) Patron comfort is enhanced by providing shade trees along a promenade.
- (+) Security of patrons may be enhanced if the promenade is well-lit.

Negatives:

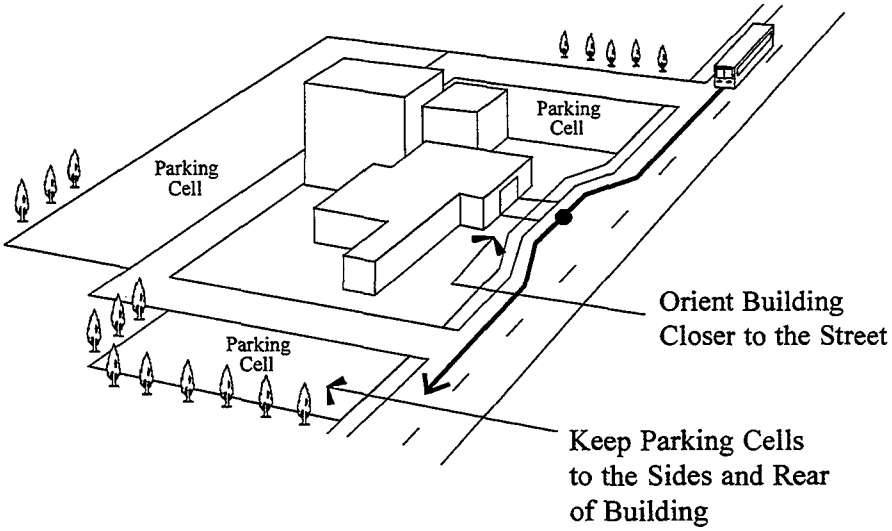
- (-) Does not reduce walking distance or time between the land use and the bus stop.
- (-) Patron security may still be compromised if the promenade is not well used, well-lit, or sight-lines are restricted by vegetation.

Chapter 2

THE BIG PICTURE

COORDINATION & COOPERATION—Hypothetical Medical Center

Hypothetical Medical Center: Orienting building closer to the street and having parking to the rear and sides of the facility.



Positives:

- (+) Transit passenger walking time and distance is reduced since the building is near the road.
- (+) Patron security is enhanced by having indirect surveillance from the building and passing vehicular traffic.
- (+) Potential for pedestrian/vehicular conflicts are reduced between the land use and the bus stop.
- (+) Potential for shared use of the building facilities, such as overhangs and atriums, by bus patrons during inclement weather.
- (+) Bus remains on main route by eliminating the need to deviate into a parking lot.

Negatives:

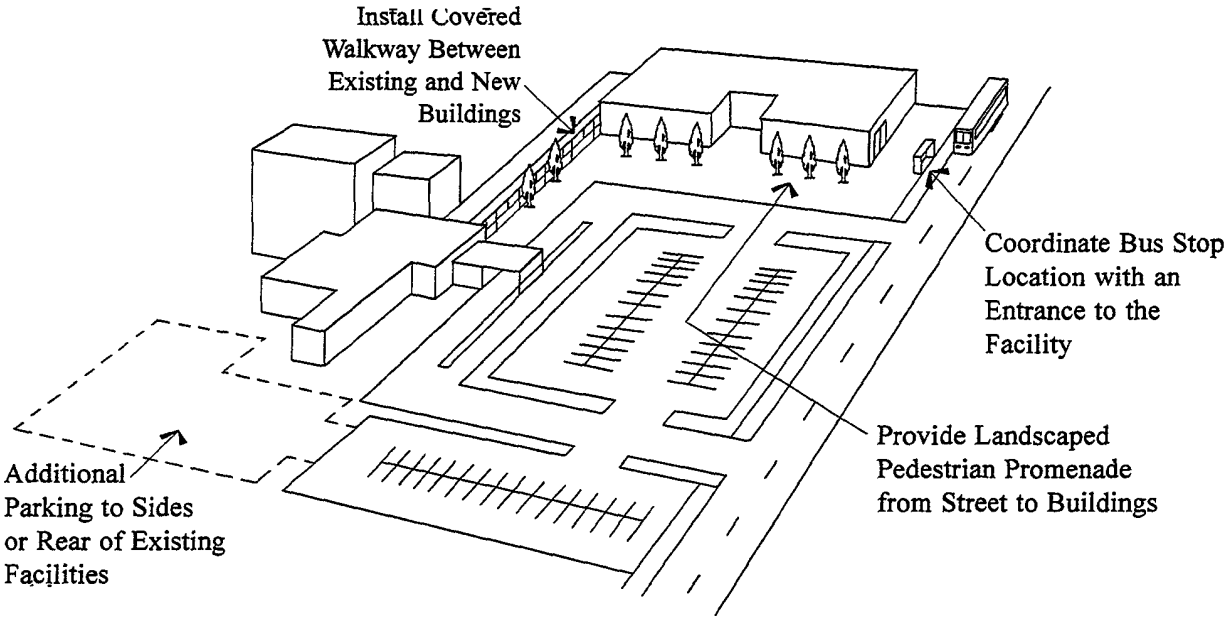
- (-) Challenges traditional land use practices, which may make communities more reluctant to implement such a strategy.
- (-) Confusion may develop concerning responsibilities for the maintenance and up-keep of a bus stop that is near a major generator of activity.

THE BIG PICTURE

Chapter 2

COORDINATION & COOPERATION—Hypothetical Medical Center

Hypothetical Medical Center: Expanding facility.



Positives:

- (+) Bus vehicle remains on a main thoroughfare.
- (+) Pedestrian access to bus stop is enhanced by juxtaposing building with bus stop and having pedestrian promenades.
- (+) Bus patron comfort is enhanced by the addition of shade trees along the promenade and the installation of a covered walkway between buildings.
- (+) Reduces bus patron exposure to poor weather.

Negatives:

- (-) Pedestrian improvements are costly to construct.
- (-) Requires coordination among many different "players."
- (-) Orientation of new building and parking may challenge traditional land use practices.