PLANNING FOR THE BICYCLE AS A FORM OF TRANSPORTATION

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16. Abstract

A Bikeway Systems Planning Manual for assisting public officials and bicycle enthusiast groups in designing and implementing safe and economic bikeways in the local community. Detailed guidelines for policy planning, functional planning and implementation planning are included. The manual is based on a comprehensive overview of the available literature of bikeway systems planning and substantially reflects the state-of-the-art. The format of the manual is structured to provide users with a systematic and practical approach to the full range of issues to be addressed in planning and constructing a bikeway system.

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INTRODUCTION

The recent resurgence of public interest in the bicycle has focused attention on the need for safe, efficient, and enjoyable bikeway facilities. Planning for the bicycle to date has received little centralized guidance or assistance. As a result, the development and implementation of bikeway plans has been uncoordinated and repetitive, with each community largely unaware of parallel or prior efforts.

This past pattern of uncoordinated bikeway planning effort is ripe for change. Recreational cycling has increased rapidly. Bicycles also have potential for commuting and general short-distance transport.

The goal of this manual is to assist local governments and cycling groups to plan for the development of safe, desirable and economical bikeway facilities. For this purpose, a bikeway planning process has been defined to provide local government officials with alternative policy and program guidelines.

Systematic and practical working guidelines will help communities in approaching the full range of bikeway issues in a coherent and comprehensive manner. These guidelines consist of alternative strategies and techniques for planning and implementing public action programs to facilitate the use of the bicycle.

There is a substantial literature on integrating bicycles into communities. This manual presents some of the available and representative materials relating to that experience and to abstract from those guidelines that reflect the needs of a wide variety of user groups. This manual is a set of general policy and technical guidelines that will allow for the development of bikeways for the safe and economical use of bicycles for both transport and recreation.

DEFINITIONS AND DESCRIPTIONS OF BIKEWAY CLASSIFICATIONS

The following definitions categorize the various classes and types of bikeway facilities:

The term Bikeway is a generic term encompassing the full range of cycling related facilities - from fully grade-separated facilities to those which are designated by signing only. Within the classification Bikeways, there are three distinct classes of facilities:

Class I: Exclusive Bikeways are those in which a completely separate right-of-way is designated for the exclusive or semi-exclusive use of bicycles.

Class II: Bicycle Lanes are those in which the right-of-way is shared with other forms of transportation and conflicts are minimized through lane and pavement markings and signing.

Class III: Bike Routes are those in which the right-of-way is shared by the cyclist and other vehicles and which are designated by signing only.

For purposes of illustrating the various classes of bikeways, the following discussion of their use is presented.

Class I or Exclusive Bikeways are typically found in parks, recreation areas, and in new developments where bikeways are planned and laid out to isolate bicycles from vehicular traffic. Exclusive bikeways minimize conflicts at-grade with both pedestrians and motor vehicles. Exclusive bikeways are usually developed for recreational purposes in the United States since bicycle volumes have not as yet warranted exclusive facilities in urban areas for commuter cyclists. Some cities in Europe have developed exclusive bikeways as an important part of their overall transportation system, for both recreational and commuter cyclists. Potential locations for exclusive bikeways are along or within parks or open spaces, abandoned railroad rights-of-way, flood control channels or riverbanks, lake fronts, ocean fronts, transmission line rights-of-way, highway rights-of-way, and in conjunction with new development, planned communities and new towns.

Class II or Bicycle Lanes represent an alternative in heavily urbanized areas where cost or land use patterns preclude exclusive bikeways.

A portion of the right-of-way is specified for the preferential use of bicycles. The bikeway is normally developed within the paved area of a roadway, usually in the outside lane adjacent to the curb or on the shoulder of the road. By creating a separate right-of-way for each mode, the shared bikeway reduces parallel conflicts between the bicycle and motor vehicles.

THE BIKEWAY PLANNING PROCESS

Bikeway systems planning is viewed in this manual, as a series of coherent and related alternative actions and decisions to achieve a safe, economic, and comprehensive bikeway system for any community.

The term "comprehensive bikeway system plan" refers to an official public document adopted by a local government as a guide to decisions concerning the development and implementation of a desirable system of bikeways over an extended time. It is conceived as an instrument to be used by leaders in local situations who will establish bicycle-related policies and make the decisions regarding the physical development of bikeway systems.

Elements of the Planning Process: For the purposes of this manual, the bikeway planning process has been divided into three basic elements which are as follows:

1. Policy Planning: The first step in the bikeway planning process is the determination or definition of local bikeway development goals and objectives. These should be operational community goals and when determined would consist of a statement of general principles for local bikeway planning, formulated before a comprehensive bikeway plan is developed.

   The policy planning process consists of identifying and examining the major directions in which any community can move in order to achieve the objectives of, and implement, the proposals contained in a comprehensive bikeway plan.

   Developing a bikeways policy plan will allow officials to determine and specify what they, as representatives of their community, want to see accomplished regarding the bicycle. When completed, a bikeway policy plan should:

   (a) serve as a directive to local planning departments as well as other groups concerned with bicycles;

   (b) facilitate and encourage understanding and participation by the public and its representatives in the development of the local bikeway plan in that it would be embodied in a brief and easily reviewed policy statement form;

   (c) serve as a coordinative device that, by providing a general framework for the interaction of diverse local agencies, would have an impact on the development and implementation of a bikeway plan as well as provide for multijurisdictional situations.

2. Functional Planning: Functional bikeway system planning is the process of translating objectives determined in the policy planning phase into specific proposals to be incorporated into a comprehensive bikeway system master plan. The goal of functional planning activity is the production of a master plan for the systematic development of local facilities. The primary functions of a bikeway master plan are to:

(a) provide a convenient vehicle by which the various participants in the bikeway planning process can interact in a mutually beneficial way;

(b) insure continuity of bikeways through contiguous jurisdictions;

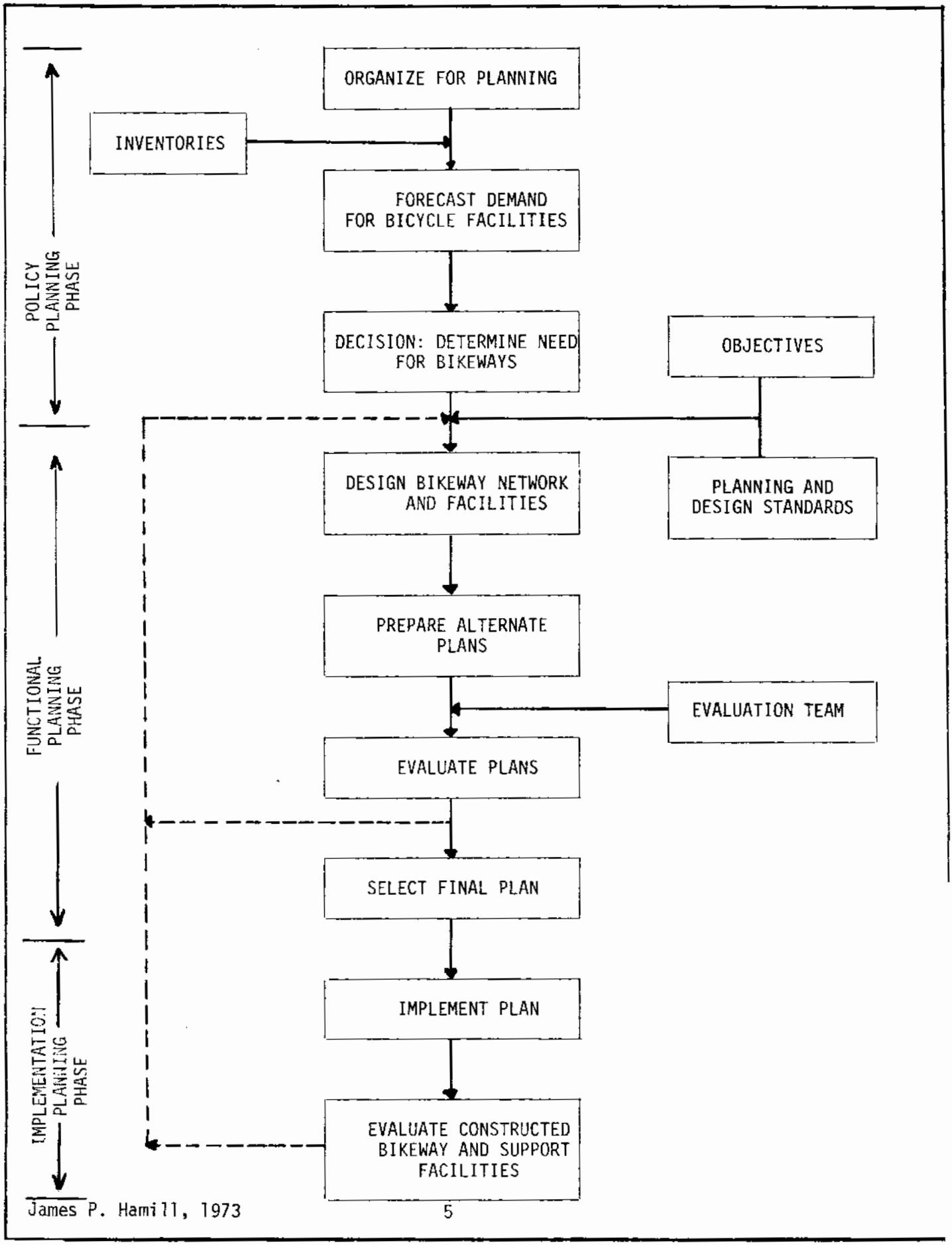
(c) provide for the avoidance of uneconomic duplication of supporting facilities; and,

(d) insure that the designated routes reflect demand for the various bikeway types.

3. Implementation Planning: The third general step in the bikeway planning process entails developing a detailed plan for financing, constructing and monitoring the planned bikeway.

As this manual will show, bikeway planning is considerably more complex than it might appear at first. In the following sections of this manual, the three basic elements of the bikeway planning are developed more fully and guidelines are outlined for carrying out the tasks essential to each of the elements of the planning process.

FIGURE 1. ELEMENTS OF THE BIKEWAY PLANNING PROCESS



James P. Hamill, 1973

OUTLINE OF THE BIKEWAY PLANNING PROCESS

I. POLICY PLANNING

The preparation of a bikeway policy plan requires effective, organized use of community participation from the outset. Unfortunately, the bulk of bikeway planning efforts to date do not reflect adequate community participation.

STEP 1. Develop Community Participation. Public participation in the bikeway planning process should extend beyond the citizen mandate for government action in developing a local system. Local officials should consider citizen participation to be a central element of the planning process, and planners in particular should consciously seek ongoing community input throughout all stages of the planning process.

In undertaking organization for bikeway policy planning, local officials will benefit from association and interactions with various organizations and individuals interested in the development of local facilities.

The experience, expertise, and cooperation of groups such as local police, planning directors, school administrators, civic and service organizations, bicycle advocate groups, parks and recreational personnel, and representatives of local civic and service organizations can provide vital input to the overall planning process. It is critical that all affected parties become involved with and active in the policy making process. In most communities where bikeways have become realities, an active citizen group has been responsible for facilitating the development. Such a group is an essential element in focusing public support.

STEP 2. Develop a Bikeway System Coordinating Committee. In order to insure effective interaction among the groups concerned, it is necessary to establish a vehicle through which all can express their particular positions. In a number of communities where successful bikeway systems have been developed, the establishment of a bikeway system coordinating committee has been an important first step in providing an effective administrative mechanism for coordinating the development of a local bikeway system. The organizational mechanics and exact composition of the committee are not critical to its functioning as a device for focusing community involvement in the planning process. This committee could, for example, be appointed by the local city council and work out specific operating procedures with the city administrator.

The basic functions the committee should perform would include representing the various interests of local government and departments including planning, public works, traffic engineering, parks and recreation, and public safety as well as local school systems, civic organizations, enthusiast groups, and other organizations as appropriate.

In Ann Arbor, Michigan, a bicycle coordinating committee (BCC) was charged with coordinating activities such as reviewing the development of the local bikeway system on an ongoing basis, interpreting design criteria and standards for various city departments, recommending changes in local ordinances, representing the local community in coordinating the development of bikeways on a multijurisdictional basis, and setting priorities for the implementation of the various elements of the proposed comprehensive plan.1/

In the section of this manual entitled Community Participation in the Bikeway Planning Process, a detailed program for developing citizen input to all phases of the planning process is presented.

II. COLLECTION AND EVALUATION OF DATA

The following information will form the basis for preliminary policy planning and evaluation of alternatives in Phase III.

STEP 1. Collect Existing Data

a. Assemble existing land use data for:

- Bicycle traffic generation points
  - Residential areas
  - Employment areas
  - Shopping areas
- Recreational usage
- Scenic points
- Historic sites
- Physical barriers

b. Assemble existing land use plans

c. Assemble existing environmental data

- Soils
- Drainage
- Topography
- Pollution counts

1/ Ann Arbor Bicycle Path Study, Haldon Smith, Ann Arbor, Michigan, 1972.

d. Assemble existing traffic conditions data

- ° Traffic volumes
- ° Routes
  - One way
  - Two way
  - Arterial
  - Local
  - Collector

STEP 2. Conduct User Survey:

Assessing Local Facility Demand for rational planning and development of bikeway systems must take into account the specific interests of a number of different existing and potential user groups. The process of identifying constituencies and assessing potential user demand for bikeway facilities involves the application of a number of specific techniques including developing a user survey instrument. In order to insure both short and long-term effectiveness of a local bikeway system, it is necessary to be able to quantify public demand. Further, it is necessary to accurately assess the dimensions of the demand for a local system if the expenditure of public funds is to be based on supportable facts. The judicious use of questionnaires can provide several dimensions of demand if properly executed and interpreted.

Effective questionnaires must be designed to insure representation of cyclist goals, specialized requirements, attitudes, and suggestions in the data base for bikeway facilities planning.

The major elements of a survey document should be concerned with identifying and recording data in the following categories:

a. the socio-economic characteristics of bicycle users in the community;

b. their preferences, attitudes, and values; and

c. the kinds of trips made, and the cost and quality of those trips.

In the section of this manual entitled, Bikeway Survey Questionnaires, a detailed program for developing useful questionnaires is presented.

STEP 3. Summarize and Evaluate Data

Prepare a general policy plan document which clearly and simply indicates the objectives and needs of local users, the level of demand indicated, and the general conditions that will affect bikeway development.

FUNCTIONAL BIKEWAY PLANNING

III. DEVELOP AND TEST ALTERNATIVE BIKEWAY PLANS

STEP 1. Identify Potential Bikeway Corridors

STEP 2. Identify Alternative Bikeway Routes Based on:

a. Accepted bikeway design and construction standards

b. Land use relationships

c. Environmental impact

- On bikeway facilities
- Off bikeway facilities

d. Right-of-way availability

e. Barriers

- Legal issues
- Aesthetic considerations
- Safety issues
- Rights-of-way data

f. Existing bikeway related data

- Routes
- Physical characteristics
- Bicycle ownership
- Type of use by volume
  - Commuter ridership
  - Recreational ridership
  - Neighborhood ridership

g. Bikeway design and construction standards

° Design

- Grade
- Width
- Turning radius
- Lighting requirements
- Demarcation requirements
  - -- Signing
  - -- Pavement marking
  - -- Intersection channelization

° Construction

- Unit costs
- Lighting costs
- Demarcation costs
- Soil conditions
- Drainage

STEP 3. Evaluate Alternative Routes

a. Develop standards for desirability of alternative routes

- Objective technical criteria
- Subjective criteria

1. Evaluate construction costs of alternative
   - Overcoming barriers
   - Acquisition of rights-of-way
   - Maintenance
   - Lighting
   - Bicycle parking
   - Demarcation

2. Evaluate land use relationships

- Compatability of routes
  - ° On-street parking
  - ° Removal of barriers
  - ° Residential
  - ° Scenic points
  - ° Historic landmarks
  - ° Support facilities
  - ° Schools
  - ° Shopping centers
  - ° Recreation areas
  - ° Community centers
  - ° Employment centers
  - ° Other bicycle traffic generators

b. Evaluate potential routes in relation to existing bikeways and supporting facilities

c. Evaluate environmental impact of alternative routes

d. Evaluate legal barriers to acquisition of alternative routes

e. Evaluate safety characteristics of alternative bikeway routes by type

IV. PREPARE PRELIMINARY BIKEWAY PLAN

Based on the applications of the standards developed in Phase IV, specific routes should be selected and a preliminary bikeway plan developed.

STEP 1. Submit Plan for Public Review to:

a. Interested citizens

b. User enthusiast groups

c. Political decision makers

d. Affected government jurisdictions

STEP 2. Review and Consider Public Comments

STEP 3. Develop Final Bikeway Route Plan

a. Prepare refined cost estimate

b. Identify all constraints in plan document

- legal
- environmental
- cost
- physical barriers
- right-of-way acquisition
- maintenance requirements

STEP 4. Prepare Recommended Staging Plan

a. Identify implementing agency(s)

b. Select demonstration projects

c. Schedule implementation

STEP 5. Identify Applicable Funding Sources

a. Federal

b. State

c. Local

d. Private

V. IMPLEMENTATION

STEP 1. Include Bikeway plan as a component in the general capital improvements program

STEP 2. Initiate construction of the bikeway system demonstration project

STEP 3. Monitor the construction process

STEP 4. Evaluate system periodically

FUNCTIONAL BIKEWAY PLANNING GUIDELINES

In this section of the manual a number of detailed guidelines are presented for assisting in functional bikeway planning. Guidelines are included for the following areas:

1. Community Participation in the Bikeway Planning Process

2. Bikeway Survey Questionnaire Development

3. Criteria for the Selection of Specific Bikeway Classifications and Routes

4. Criteria for the Employment of the Various Classes of Bikeways in Specific Local Situations

COMMUNITY PARTICIPATION IN THE BIKEWAY PLANNING PROCESS

It is usually a concerned citizenry that initiates the bikeway planning process. These are people seeking routes that will allow children to cycle safely to school, to friends' homes, and to recreational areas; for adults to cycle to work, to the commuter railroad station, or to commercial and recreational facilities; and for recreational cyclists to exercise and relax in attractive surroundings.

Although bikeway systems existed in the U.S. in the late 1800's, they generally fell into disuse during the following years. One of the first instances of renewed interest in bikeway development occurred in 1961 in Homestead, Florida, largely through the efforts of two citizens. Their goal was to provide a safe means for children to bicycle to school, and through their efforts a system of bike lanes along lightly travelled roads was devised. These lanes, however, were not a priority item in Homestead and the initiators realized that they would have to personally raise the money necessary for signs to be posted. Fund-raising activities were undertaken and the completed bikeway system was dedicated in 1962.2/

Subsequent citizen efforts through the U.S. have become increasingly sophisticated. Bikeway feasibility studies are increasingly being produced by citizen groups with the assistance of outside expertise.

The role of the citizen lobbyist was singled out for special attention by the Executive Director of the Bicycle Institute of America, at the National Symposium on Trails in June, 1971.3/ Referring to the early history of bikeways, he pointed out that the early bikeway systems were the result of the dedicated efforts of local citizens.

An often cited case of public participation in bikeway planning is that of Davis, California, a rapidly growing suburb of Sacramento. The current population of Davis is slightly over 30,000 people, many of whom are students at the University of California. The Davis Planning Department estimates that over 25,000 bicycles are registered. Through the cooperative efforts of the Davis Planning and Public Works Departments, the University, the various civic groups, an elaborate bikeway system has been devised and implemented.

2/ Bicycle Institute of America, Bikeways, The Homestead Story, (no date), 8 pp.

3/ Auerbach, John, National Symposium of Trails, U.S. Department of Interior, Washington, D.C., June, 1971.

Currently some 10,000 bicyclists travel to the University daily, where the campus is closed to motor vehicles. The city itself has an extensive network of bicycle lanes of various classes.[4/]

As the above examples indicate, there are a variety of ways in which the citizen can become involved in bikeway planning. A citizen group may function as a program initiator, or as a lobbyist, supporter, publicizer or fund raiser for programs developed by the local government.

A citizen participation program can be summarized as follows:

1. Learning about the subject
2. Organizing a base of support
3. Determining demand
4. Inventorying available resources
5. Preparing proposals
6. Publicizing and lobbying in support of proposals

1. Learning about the subject is not difficult; there is a large body of literature on the subject of bikeways. The local planning agency is generally a good source for information. In addition, a national organization, The Bicycle Institute of America, located in New York City, makes available a variety of reference materials on bikeway planning.

2. Organizing a base of support involves creativity, enthusiasm and hard work. An area with a large and vocal cadre of cyclists certainly has an initial advantage, but there are other means of gathering support. Children may be the largest group of cyclists in an area and they and, more importantly, their parents should provide an initial base of support for a local bikeway program.

4/ Institute of Transportation and Traffic Engineering, School of Engineering and Applied Sciences, U.C.L.A., Bikeway Planning Criteria and Guidelines, State of California, Division of Highways, April, 1972, p. 15.

Local schools may conduct programs related to bikeway development. For example, sophomores at Niles West High School, in the Chicago suburb of Skokie, prepared a booklet on bicycle trails in their area, including safety tips and maps. Advertising was sold to local bike shops and department stores to finance the project. The final product served both as a local trail guide and an excellent publicity medium for the further development of the local bikeway system. This particular booklet was produced through a special program which was funded through the Illinois State Office of Public Transportation.[5/]

Bicycle commuters are vocal and enthusiastic supporters of improved bikeway systems. In many areas, the bicycle may be the most desirable and convenient means of travelling to work, door-to-door. In the suburbs, many commuters use a bicycle to travel between their homes and the local rail or rapid transit station. Most of these cyclists have a strong interest in developing safe bikeways, as well as safe parking or storage facilities for their bicycles.

3. The next step in a developing community participation program is to determine the scale of user demand. This can best be accomplished by means of a user or potential user survey. Although they are usually designed by professionals the actual work can also be conducted by a group of interested citizens without any serious difficulty. A local college or junior college should be able to provide technical assistance from personnel trained in statistical analysis.

4. The preparation of an inventory to identify resources requires the consideration of a number of factors. Such an inventory addresses itself to existing and (potentially) useful physical/technical features of the local area such as the following:

a. Existing bikeways and parking facilities.

b. Streets suitable for the addition or incorporation of bike lanes. Such streets should carry relatively low volumes of traffic at low speeds, and connect residential areas with parks, commercial facilities, railway stations, etc.

c. Potential sites for bikeways such as existing railroad, utility, and highway rights-of-way, undeveloped parks, vacant land, potential easement areas along the shores of lakes or streams, and even unused alleys. Land must be viewed from a fresh perspective, particularly in the process of locating bikeways.

d. Potential sources of funds: Federal, state, local, and private. (See detailed discussion included in this manual)

e. Existing ordinances, land use regulations, traffic laws, and safety programs that do or may have an effect on cycling in the given area.

5/ "Niles Students Chart Bike Trails", Little Trib, Chicago Tribune, Chicago, Illinois, May 12, 1973.

Upon completion of the above four steps, a community will have a solid base of supporters and the information base necessary to undertake the design of a local bikeway program.

5. If a community is large enough to have sufficient revenues and staff, the department(s) charged with planning, public works, transportation and/or park administration will generally undertake the specific planning and funding programs. Technical expertise is desirable and useful in dealing with engineering, land acquisition, and funding aspects. Citizen groups can, however, prepare bikeway programs themselves. Knowledge of the current state of the art of bikeway planning is imperative in this situation.

6. The publicity effort is important to the citizen bikeway planning process. Publicity techniques vary in effectiveness, depending upon the socio-economic make-up of the community, and the particular target group. It is important to gear publicity efforts to the specific groups that are to be reached. The following are suggestions that may prove helpful in developing a local bikeway publicity campaign:

a. Dissemination of information is basic to any publicity campaign. Both private citizens and government officials will want to understand the facts. There should be printed matter detailing the fundamentals of the proposed bikeway program. This should incorporate maps of the proposed network, data from the user survey, costs and benefits (economic, social, environmental), and other information that may be relevant.

b. Bikeway promotional materials should be concise and pictorial. The goal is a professional-looking product.

c. A community newspaper can be valuable for publicity, through editorial support, extensive coverage, and prominent placement of articles.

d. Local civic organizations can present and endorse bikeway proposals in their newsletters.

e. Because of the increased safety afforded by separate bike lanes and trails, local police departments should be looked to as source of support. They may distribute literature on the bikeway system as part of a bicycle registration program, and discuss it as part of lectures to school classes, P.T.A's, and other groups.

f. A bikeway committee can sponsor bicycle workshops and seminars on bikeway planning, bicycle safety, equipment mainenance, etc. These activities may serve as a vehicle for recruiting support for the program.

g. Visual aids should be emphasized. Slides or photographs of existing or proposed bike trails can convey the aesthetic experience of riding along a forest or meadow trail far better than words. Films of children riding bicycles dodging in and out of fast-moving traffic are excellent devices for establishing the need for a bikeway system.

h. "Bicycle days" focus attention on bikeway planning. An annual event or even one day a week, when automobiles are banned from certain streets allows the cyclist good publicity. Perhaps the best-known use of this technique is the closing of Central Park in New York City to vehicular traffic on weekends. Bicycle days may also incorporate parades, races, and contests that involve the public in the activity of cycling. These activities can be carried out in conjunction with specific objectives, such as more bike racks at train stations and shopping centers.

i. Bicycle tours along scenic trails, ending in a picnic or camp-out can introduce the public to the pleasures of cycling.

j. Proponents of bikeway systems should attend meetings of community groups, such as the Chamber of Commerce, Lions Clubs, garden clubs, etc. Literature and follow-up letters should be sent out.

BIKEWAY SURVEY QUESTIONNAIRES

A. Characteristics of Surveys

A survey brings the potential beneficiaries of a bikeway system into the planning process. The usefulness of surveys depends on how fully the planner takes advantage of the distinctive possibilities survey research offers. Surveys have the following advantages:

1. Surveys offer a systematic form of data collection. Respondents' answers to the same questions are roughly comparable and can be tabulated for reference. Quantitative analysis is possible.

2. Surveys enable planners to ask relevant questions. For example, planners can survey users about the desired origins and destinations of their trips to aid decisions on bikeway location.

3. Surveys can reach a representative sample of the population to be served by bikeways. This can be accomplished by using proven methods of random sampling.

B. Choice of goals:

One purpose of surveys is to determine the goals of the public regarding bikeways. Before conducting a survey, however, planners must choose between two goal structures with distinct implications for the survey method to be used:

1. Provide for current bicycle enthusiasts: This goal reflects the needs and desires of an existing, identifiable constituency. For example, in Palo Alto, California, bikeway planning was motivated by a desire to reduce bike-auto accidents. To plan for this goal structure, only current bike enthusiasts need to be surveyed.

2. Expand number of bicycle riders. This goal turns to bikeway planning as a means of achieving certain public benefits that accrue to the whole public if more people take up biking. A shift in travel modes from car to bike would reduce air pollution, congestion, noise, fuel consumption, and depersonalization. Bikeways can also improve mobility for those who are too young or cannot afford to drive. To plan within this goal, potential as well as current bike enthusiasts -- the whole public -- must be surveyed.

C. Scientific Sampling Methods

1. Random Sampling

A random method of selecting respondents occurs when every member of the population of interest has an equal chance of being selected. Planners must be careful about the method of sample selection, or the sample may be biased. If a sample has been randomly selected, applicable statistical theorems will specify to what degree the sample is not representative, i.e., the confidence that can be placed in the representativeness of the sample will be known. Moreover, by increasing the sample size, the "confidence level" of the results can be increased. In choosing the sample size to be used, the planner must strike a balance between the level of confidence and the cost of the survey.

2. How to Choose a Random Sample

a. Select the target population

A variety of target populations can be chosen, depending on the goal structure and available resources of the community. The target population from which the sample will be selected is the population that the survey results will represent -- and no other. To choose the sample, list all members of the target population. The choice of the target population will be conditioned by the ease of obtaining such a list. For purposes of sampling, names of the target population can be located through lists of clusters (residential blocks, work places, etc.) where persons are found.

(1) To survey current cyclists, it is usually necessary to use a subgroup of the larger population, such as registered bike owners, members of bicycle clubs, or cyclists using specific routes on particular days. Surveying these subgroups involves a bias toward currently active and interested persons. By surveying these persons only, the results could possibly fail to determine which needs of the cycling population at large were most in need of satisfaction. Survey results should always be evaluated in the light of possible biases.

(2) To survey the general public, a variety of approaches are open. City directories are usually available which provide a good list of households. If shifting transportation modes away from the auto is a major goal, a survey of licensed drivers may be appropriate. A survey of registered voters would be biased against young people. A sample of activity centers can cover one or more types of destinations: work places, schools, shopping centers, central business district destinations, and neighborhood activity centers.

(3) Thus far the discussion has centered on reactive surveys where people are asked to describe their opinions and behavior. It is also possible to observe behavior through nonreactive surveys. Traffic counts can determine the number of vehicles passing particular locations. A "cordon count" will determine the number entering and leaving the central business district or other central place. It is interesting to note that while a reactive Downtown Transportation Mode Study in Denver counted 7% of the respondents biking downtown, a nonreactive cordon count there showed only 1% of peak-hour vehicles to be bikes. Palo Alto, California used

another nonreactive means of determining bike travel patterns. A review of bike-auto accident locations, in addition to indicating danger spots, was used as an indication of how heavy bike traffic was in different locations. Nonreactive studies have the disadvantage of not addressing prospective behavior; therefore, they normally require supplementing with reactive opinion surveys.

b. Select the sample

(1) With a list of the target population at hand, selection of the sample can begin. Randomness is achieved when each member of the population has an equal chance of being selected. The order of selection from the list should not be prearranged in any way. One excellent way to achieve a random order of selection is to follow a random number table, which can be found in most statistics texts. It should be noted that selecting every K^{th}, e.g., 100th, name from the list is not a random sample, but rather a systematic sample, since with such a procedure 99 percent of the names on the list would have no chance of being selected. If, however, a name from the first 100 names is selected at random, then every 100th name thereafter may properly be chosen for the sample. This procedure is simple random sampling.

(2) To assure representation of specific subgroups of the total population in the sample, separate lists should be made of the subgroups and random samples then taken within the subgroups. This is called stratified random sampling. For example, stratifying by age can be done by using school enrollment rosters to identify children and the city directory of voter lists to identify adults; by geographic area, according to quadrants, neighborhoods, or distance from specified activity centers; by type of destination: downtown and neighborhood; or by trip type to work, shopping, school and recreation. Stratification can also be introduced during data analysis.

(3) Sometimes, the desired lists for simple or stratified random sampling are very expensive, if not impossible to develop. This would be so, for example, if the target population were commuters to the central business district. In such a case, cluster or multistage sampling can be employed by beginning with a list of blocks in the downtown area, and taking a random sample of blocks. For each block selected, establishments could be listed, and a random sample of these selected. Then the survey could be taken among commuters to the selected establishments. Similarly, if the target population is households, a random sample of residential blocks could be selected, and surveys distributed to the households on the selected blocks.

3. Sample Size

According to the laws of probability, it is the absolute number of responses rather than the proportion of the population that determines

the accuracy of the results. This fact is responsible for the ability of an opinion poll of 2,000 people to accurately represent the views of 200 million people. As a rule of thumb, a like number will provide a sufficient sample for a local bikeways survey, with a likelihood that the sample is unrepresentative of less than 5%.

D. Procedures for Distribution and Return of Surveys

Possible procedures include:

For reactive surveys using questionnaires...

- Mail out-mail back
- Hand out-mail back
- Hand out-pick up
- Personal interviews
- Telephone interviews

For nonreactive surveys...

- Direct observation
- Study of records

The choice of procedure depends on the most convenient way of reaching the target population consistent with the dollars and manpower available. If the procedure results in a low response rate, it may magnify limitations in the survey design and distribution procedure which will introduce bias into the data. Since those persons most interested in using bikeways are the most likely to respond, a conservative assumption would be that a "no response" demonstrates lack of interest. The proportion and pattern of "no responses" should be explicitly dealt with when the data are analyzed.

The most common and economical procedure is the mailed-out or handed-out questionnaire form. The range of return rates for mail-back questionnaires generally runs from 10% to 50%. The response rate will be higher to the extent that the questionnaire is:

- Attractively designed
- Short: No more than one page, two sides
- Easy to fill out: Keep in mind the education level of respondents and their language abilities; in some communities a foreign language version may be desirable.

- Easy to return: Provide a stamped, addressed return envelope for mailing back.

- Offers an inducement to respond: Such as the real prospect of a bikeway system.

- Associated with a respected organization: Such as, the respondent's local government.

E. A Sample Questionnaire

To illustrate application of the principles discussed above, a sample questionnaire is provided. No single questionnaire is appropriate to all goals and constraints. This questionnaire assumes one set of goals and constraints. The questionnaire assumes a goal of shifting away from cars and toward bicycles. The survey is therefore divided into two sections: (1) determining current travel patterns, and (2) determining what bikeway policies would encourage a shift to bicycle use.

The one shown here is a reactive questionnaire. The sample is assumed to be a simple random sample selected from the city directory. The questionnaire is to be self-administered, with distribution and return accomplished through a mail out-mail back procedure. Questions are asked to enable stratification by age and location during analysis.

Neither the goal nor the methods selected for the questionnaire should be taken as being intrinsically better than the other approaches discussed above.

A Checklist of Criteria for Survey Design

1. Do questions facilitate systematic analysis? Can responses be readily mapped and/or tabulated?

2. Are questions relevant to characteristics of facilities and services to be planned? Can potential for goal achievement be evaluated?

3. Does sampling procedure assure representative responses? Does survey design and procedure for distribution and return facilitate high response rate?

What do you want your community to do for bike-riding? What your community does depends on what you want done. To find out what you want, the Planning Department is asking you to take a few minutes to fill out this questionnaire. We want to know what biking your family now does, and what kinds of improvements you would like to have in the future. So do yourself and your community a favor. Fill out this questionnaire today, and return it in the enclosed stamped, self-addressed envelope.

1. How many bicycles (do not count tricycles) does your household own? _____

2. List the ages of the members of your household. Circle the age of anyone who sometimes rides a bicycle.

_____

3. What is your home address? _____
(If you do not wish to give your address, please indicate your zip code.)

Workplace address(es) of working family member(s)?

_____

_____

School address(es) of student family member(s)?

_____

_____

4. Please list the total number of round trips made last week by members of your household for each of the purposes listed below, according to the mode of transportation used.

	Number of Round Trips by:				
Purpose of Trip	Car	Public Transit	Bike	Walk	Other(What?)
Work					
School					
Shopping and Errands					
Recreation					

5. Please list the following information about the bike trips made most frequently by members of your household.

From (address)	To (address)	Along (route)	Trip Purpose	Travel Time	Age of Bike-rider

6. Listed below are some of the possible improvements the city could make to encourage biking and to make biking more enjoyable. For each item on the list, check the response that more nearly tells how members of your household would benefit from each suggested improvement.

Suggested Improvements	If this improvement were made, members of my household: (a) Would use improvement to make bike trips not now made	(b) Would use improvement to make bike trips currently made	(c) Would not use improvement
Mark safety routes for biking with "Bike Route" signs to direct cyclists and warn motorists	_____	_____	_____
Set aside special bike lanes on streets	_____	_____	_____
Build bike paths separated from other traffic by barriers, except at intersections	_____	_____	_____
Provide bike paths that do not cross regular intersections	_____	_____	_____
Provide bikeways for recreation	_____	_____	_____
Provide bikeways for going downtown	_____	_____	_____
Provide bikeways for neighborhood travel	_____	_____	_____
Provide bike parking racks	_____	_____	_____
Provide supervised bike parking to prevent theft	_____	_____	_____

Your Suggestions:

_____

_____

7. Describe any trips members of your family would make using the improvements. Put a check next to any trip now taken by car.

From (address)	To (address)	Route Suggestions	Trip Purpose	Number of Trips Per Week	Age of Rider(s)
_____	_____	_____	_____	_____	_____
_____	_____	_____	_____	_____	_____

CRITERIA FOR THE SELECTION OF SPECIFIC BIKEWAY CLASSIFICATIONS AND ROUTES

In developing basic criteria or "warrants" for particular bikeway facilities, it is important to remember that there are three basic types of cycling: activity-centered, recreational and neighborhood.

Three major bicycle user groups must be considered and understood before meaningful efforts can be directed toward the assessment of local bikeway needs. The selection of a local mix of bikeway classes must recognize and take into account both the common and specialized needs of each group of users.

The three major classes of bicycle users are:

1. Activity-Centered: or community oriented cycling, includes activities such as commuting to work and for transportation to specific destinations such as school, parks, playgrounds and other community facilities. This class generally represents the largest and most extensive daily ridership. Therefore, in planning a local bikeway system, this group of users will have the greatest influence on the appropriate mix of the three classes of bikeways. Observations of activity/commuter cyclists indicates that most cyclists in this classification predominantly select collector and arterial streets. Therefore, in assessing the appropriateness of each of the three major classes, it should be recognized that activity centered user preference for arterial and collector streets will significantly shape local bikeway decisions.

2. Recreational: This class includes touring, sightseeing and racing. The character of these activities is inherently more regionally-oriented. These cyclists generally prefer low-traffic and visually interesting routes. Consequently, an appropriate mix of exclusive and shared bikeways should reflect the user's route preference.

3. Neighborhood Riding: This class consists of neighborhood cycling, somewhat oriented to physical fitness. Cyclists in this class cannot be expected to select or use to any significant degree, established routes of any particular class except in situations where their activities coincide with those of the recreational cyclist. It is difficult to plan for this category of user demand.

Factors In The Location And Design Of Activity Centered Bikeways

Activity-centered (commuter) cycling is almost exclusively urban and oriented toward traffic generators such as schools, shopping centers, and places of employment. Therefore, facilities must minimize conflicts between motor vehicles and cyclists. Bikeways for commuter cyclists must: (1) provide facilities which expedite the trip, and (2) minimize conflicts with motorists.

Two basic criteria in planning and selecting specific classes of bikeways for local utility cyclists are as follows:

1. The network of bikeways should be areawide, integrated and have good continuity throughout the community.

2. Routes and facilities developed must afford the utility/commuter cyclist safe and efficient access to the desired terminal points in times equal to or, if possible, shorter than those associated with the automobile. A local commuter bikeway route system should be designed to provide the most direct route possible from points of activity within the community to residential neighborhoods.

In the preliminary route planning stage a bikeway system should be developed which includes alternative rights-of-way. The selection of specific routes should be identified in the final plan once alternatives have been evaluated in terms of superiority and political feasibility. Therefore, in the route planning stage, more miles of bike should be explored than will actually be built. The task of identifying alternative rights-of-way should be based on consideration of the following factors:

1. User demand

2. Physical criteria

3. Design criteria

1. User Demand Factors:

a. Destination: The consideration of destination is an important transportation factor. Origin-destination data must be collected to give the decision maker an idea of where the users are coming from, where they are going, and how many there are. This data, obtained through survey and analysis of existing facilities, should provide the planner a key as to alternative locations. "Origin-Destination Data" will also reveal the best type of rights-of-way, i.e.: neighborhood, local, or regional. If a regional system is advisable, the planner should provide alternatives for connector and feeder rights-of-way.

b. Future Trip Attractors: Research into future trip attractors should be conducted. For example, proposed rapid transit systems should be identified in the proposed plan. Should station stops be included? Other new demand generators that should be explored could include shopping centers, parks, planned development units, and employment centers.

c. Volume of Use in the Community: Actual numbers of bicycle riders in the community must be known. A complete study should be made of current ridership volumes. Counting stations should be set up at various points in the community and counting should be done at varying hours on different days; for example during peak summer Sundays, to measure recreation use, and during peak commuter hours, to measure weekday home-to-work and home-to-school traffic. This type of inventory should be repeated several times for statistical value.

d. User Group: Volume of bicycle traffic by trip purpose must be studied. This data can be obtained by methods of survey discussed elsewhere in this manual, or by count. These data allow the planner to consider what future facilities will best meet the current or future demand for bikeways in the community.

2. Physical Factors: Some of the physical factors to be considered in selecting specific routes include

a) Available Space: Minimum bikeway width requirements, as well as horizontal and vertical clearance requirements must be analyzed in selecting potential routes. Spatial needs vary in relation to the class of bikeway being planned, level of service projected and proximity of the route to automobile traffic lanes.

b) Drainage: Each class of bikeway requires drainage facilities along its full route. This is necessary to ensure that surface water will not accumulate. Normally, on-street bike lanes and routes do not encounter significant drainage problems as existing drainage systems suffice. However, where facilities are planned for hillsides, flat terrain, or seasonally wet areas, the drainage issue should be centrally considered in the route selection process.

c) Grade: Factors such as cyclists age, weight and type of bicycle are each major determinants of maximum acceptable bikeway grades and length of grade. Since cyclists may be deterred from using a facility in direct relationship to the amount of physical effort necessary to traverse a given length of grade, the importance of evaluating grade in selecting potential route should be emphasized.

d) Motor Vehicle Traffic: The generation of motor vehicle/bicycle accident involvements are a result of a number of factors including: judgmental error by both cyclists and motor vehicle operators, differences in merging speeds, limited sight distances at intersections, opening of car doors in the path of a on-coming cyclist paralleling parked cars, and improper angles of interception at intersections and road crossings. These basic factors should be analyzed in the initial stage of the route selection process.

e) Soil Type: Generalized soil information should be consulted during route selection. The soils will dictate to a large extent the cost of construction. Certain soil conditions will require expensive base materials for surfacing. The drainage or lack of drainage by soil type should be analyzed to estimate additional construction and maintenance costs.

f) Water Bodies: The location of bike rights-of-way near water has positive and negative factors. The beauty of water as well as the access to water-based recreation are strong points for locating trails near and over water bodies. However, the cost of constructing bridges should be strongly considered for rights-of-way crossing rivers, streams, creeks, and marsh land. Areas of seasonal high water table should also be identified. The use of flood plains for bike rights-of-way is popular and laudable, however, careful study of the potential flood damage on such a facility should be made.

g) Scenic Areas: Scenic areas should be part of a bikeway system. The Metropolitan Washington Council of Governments lists as an objective that: the system should "traverse a variety of attractive landscapes and cityscapes". If a visual analysis has been completed for the area under consideration, it should be consulted. The quality of a system relies heavily upon its environment. Natural areas such as forest and wildlife preserves make an excellent environment for biking trails.

h) Barriers: Natural and man-made barriers must be identified such as rivers, marshes, swamps, ravines, gorges and freeways, railroad lines, and compatible land uses such as institutions, military bases, and high intensity development. The cost of building an overpass to avoid a freeway or ravine may be prohibitive.

i) Areas of Environmental Quality: Areas of unique geologic, botanic, or other natural features can create a benefit to a bikeway system. Properly constructed and managed, these areas not only provide a good environment for cycling, but also could bring new users to the system.

j) Current and Proposed Land Use: The alternative rights-of-way identified in the preliminary master plan should be consistent with current and proposed land use. The following land uses have been successfully used for bicycle rights-of-way: Towpaths, power line rights-of-way, abandoned rail rights-of-way, stream valley parks, and other linear parks.

k) Land Ownership: Detailed study should be made of not only current land ownership, but also planned public acquisition programs. Public lands (such as park lands) and quasi-public lands (such as utility-owned lands) are preferable for bikeway system development. The proposed metropolitan loop system in Washington, D. C. area, for example, is made up of ninety-five percent currently or proposed public lands. (Acquisition methods are discussed elsewhere in this manual.) Large tracts of privately-owned lands can be considered, but easement agreements and other legal problems must be dealt with.

3. Design Factors:

It is necessary to consider a number of specific design factors in the functional planning process. Primary consideration must be given to those design factors which will significantly affect the safety of the activity centered bikeway.

The layout and routing of an activity-centered bikeway should minimize interference between bicycle and motor vehicle traffic. This can be achieved through the avoidance of routes which have heavily congested intersections and by utilizing lightly-travelled roadways whenever feasible. Steps should be taken in the route selection process to circumvent points of high motor vehicle congestion through the use of alternate routes to major bicycle traffic generating points. The following design factors must be considered in the route selection process:

a. Dimensioning: In determining the appropriate width of an activity-centered bikeway, allowances must be made for the weaving of a bicycle at low speeds. This, plus the width of the bicycle and rider establish a minimum dimension for a workable bikeway. If ample width can be provided to allow the passing of one bike in front of another, this should be done. In cases where obstacles are present which may obstruct the cyclist at shoulder and head level (signs, trees, etc.), they should be removed.

At turning points the bike path should widen to allow for turning judgement discrepancies. A bikeway should also widen at any point where a cyclist may wish to pull over to the side, such as a particularly scenic point or overlook. As in the case of highway design, wherever the bikeway width varies, appropriate signs should warn the cyclist of the change if it isn't visually apparent.

The determination of the number of lanes to be provided is a function of several factors. In the case where a bikeway is primarily for commuting as in urban situations and space is limited, one lane is usually sufficient. However, the volume of cycle traffic on bikeways that are primarily recreational in nature is dependent upon factors such as weather, climate and the day of the week. Generally, one lane will suffice but the design should reflect those conditions which may influence volume, and the width should be designed accordingly.

b. Grade: In urban situations, grade changes are not often a problem. However, when the bikeway enters natural areas such as parkland, steep grades may be encountered. Relatively low slopes over short distances are satisfactory, but the overall route should be as level as possible. This allows the cyclist to conserve his energy on ascents as well as to reduce the inevitable speed which occurs on a steep descent. If a steep ascent is unavoidable, a stopping-off area should be provided at the crest of the rise to allow tired cyclists to rest. Rest areas should be clearly marked and easily entered.

c. Turns: Any turns that may occur on a bikeway should be gradual. A sharp turn can be hazardous if the cyclist is unprepared and traveling too fast to negotiate the turn properly. This danger is intensified if the bikeway allows two-way traffic. Again, the design of a bikeway is not unlike highway design in this respect. Superelevation of turns (i.e., creating a higher edge on the outside of the curve) will increase the cyclist's control and maneuverability of his bicycle.

d. Construction Materials: The surface on which the bicycle travels should provide proper traction to prevent slippage and skidding in inclement weather. In addition, surfaces must be properly sealed to prevent them from becoming impassable after rainstorms. When a masonry or asphalt surface is employed, care must be taken to prevent buckling or large cracks. When an existing roadway is partitioned to create a bikeway the existing surface is generally acceptable. However, an inspection should be made to

ascertain the existence of any drains, old trolley tracks, expansion joints, and potholes, which might have presented no danger to a car, but could cause a bicycle to go out of control.

In general, bikeway surfaces should be designed to be free from slippage; properly drained; smooth and free from obstacles and resistant to changes in temperature.

The technical issues involved in designing bikeway surfaces are detailed in the section of this manual entitled: Bikeway Surfacing, Bases and Subbases.

Factors In The Location And Design Of Recreational Bikeways

While a specific set of criteria cannot be set forth which would be applicable to all communities, it is possible to define some of the primary issues that should be addressed in locating recreational bikeways.

The location of recreational bikeways should reflect the needs of recreational cyclists. There are significant variables which must be taken into consideration. These include the following:

- Terrain: A major consideration in the location of recreational bikeways-trails, terrain affects both the length and steepness or grades that can be economically provided. Recreational bikeway routes with extended sections of steep upgrades will receive little use. They are also expensive. Therefore, the provision of gentle grades is critical.

- Land Use: All recreational bikeway facilities should be fully compatible with adjacent land uses. Ugly, smelly, noisy and windy areas should be avoided where possible. In locating a bicycle trail or network of trails, land use maps of the local region should be carefully analyzed for indications of usages which will result in any of the foregoing.

- Esthetic Considerations: Recreational bikeways should be located to take advantage of outstanding cultural and visual experiences provided by scenic areas, parks, historic sites, etc. The visual element is an important aspect of locating a recreational bikeway. Locating trails in areas where the surroundings are bland or blighted, will result in the user-cyclist being visually dissatisfied and unwilling to use the trail. By the same token, the locating of a bikeway should not interfere with or destroy the existing esthetic assets of an area.

- Support Facilities: Toilets, secure bicycle parking and wastebaskets should be available or provided where necessary.

CRITERIA FOR THE EMPLOYMENT OF THE VARIOUS CLASSES OF BIKEWAYS IN SPECIFIC LOCAL SITUATIONS

In developing basic criteria or "warrants" for selecting the particular bikeway facilities, it is important to remember that there are three basic types of cycling: activity-centered, recreational and neighborhood.

Cyclists engaging in these types of activity have differing objectives which substantially affect the types of local bikeways facilities which should be provided. Recreational cyclists for example, (general riding for pleasure, racing and exercising purposes) consider that the trip is the end in itself. Therefore, their interests will be best served by routes which have aesthetic or cultural interest. By contrast, activity-centered cyclists - because they are destination-oriented - are primarily concerned with directness of route, acceptable grades and minimization of inconveniences caused by detours from the most direct path to their destinations.

Commuter cycling is almost exclusively urban and oriented toward trip attractors, such as schools, shopping centers, and places of employment. Therefore, the criteria for developing local facilities must minimize conflicts between motor vehicles and cyclists. Bikeways for commuter cyclists must: (1) provide facilities which expedite the trip, and (2) minimize conflicts with motorists.

A Technical Criteria

Two basic criteria in planning and selecting specific classes of bikeways for local utility cyclists are as follows:

1. The network of bikeways should be areawide, integrated and have good continuity throughout the community.

2. Routes and facilities developed must afford the utility/commuter cyclist safe and efficient access to the desired terminal points in times equal to or, if possible, shorter than those associated with the automobile. A local commuter bikeway route system should be designed to provide the most direct route possible from points of activity within the community to residential neighborhoods.

B. European Experience

European experience indicates that bicycle facilities should be provided on collector streets or those with average daily motor vehicle volumes in the 2,000-3,000 car range and having current or projected bicycle volumes in the 300-500 range. It should be recognized that these standards do not take into account the desired volume of bicycle travel in any particular bikeway

corridor, but simply reflect conditions in which no facilities for bicycle travel are present. Facilities so designed would be based on established bicycle trip-making.

However, the criteria do imply that if community-wide bicycle assessibility is a goal, it is important to recognize that the U.S. arterial-collector street grid pattern necessitates bikeways. Since the destinations of commuter or utility cyclists are located along the arterial-collector streets, bikeway facilities should be planned along these streets. Using bicycle/motor vehicle volumes as locational warrants, a network grid of facilities will result in spacing roughly one-third of a mile in those settings having cycle traffic generating activity points. Further, arterial and collector streets, being the most direct route between residential and community activity points, indicates that these streets will be the ones most heavily traveled by motor vehicles as well as cyclists. Thus it is desirable to provide on-street cycling facilities on major streets as opposed, for example, to providing facilities on parallel streets which will be under-utilized or ignored.

C. Guidelines for the Selection of Specific Bikeway Design

The design of specific bikeway facilities should be based on the characteristics and constraints posed by the specific route being considered for the bikeway. These include:

a. Motor vehicle traffic volume and speed.

b. Truck traffic volume.

c. Past accident experience.

d. Existence of bus routes.

e. Pavement widths.

f. Availability of rights-of-way.

g. Land uses abutting the R.O.W.

h. Topographical and grade characteristics.

i. Drainage patterns.

j. Curb or shoulder.

k. Frequency of curb cuts.

To date, there have been only limited attempts to integrate all of these elements into a workable and comprehensive set of warrants for selecting specific on-street facility designs. The following guidelines are the result of an overview of the available literature and reflect the current state-of-the-art.

1. Traffic volume and bikeway design requirements: Specifying a particular treatment for a proposed on-street facility, the following bicycle/motor vehicle volumes constitute threshold levels by bikeway classification.

TABLE A
Indicated Bikeway Classifications by
Motor Vehicle Volume/Speed Criteria Only

Motor Vehicle Speed	Average Daily Traffic Motor Vehicle	Bikeway Classification
0-30	2000	Bike route
30-35(a)	2000 8000	Shared bikeway
35-45(b)	8000 14000	
45+ (c)	14000	Exclusive bikeway

(a) based on traffic volume level at which deliberate motor vehicle encroachments into bikelane can be expected.

(b) Speed limit at which signed lane becomes psychologically ineffective.

(c) Upper volume/speed threshold of normal on-street lanes. In urban areas, arterials may have ADT of 40-50,000 and still be the best route for cyclists.

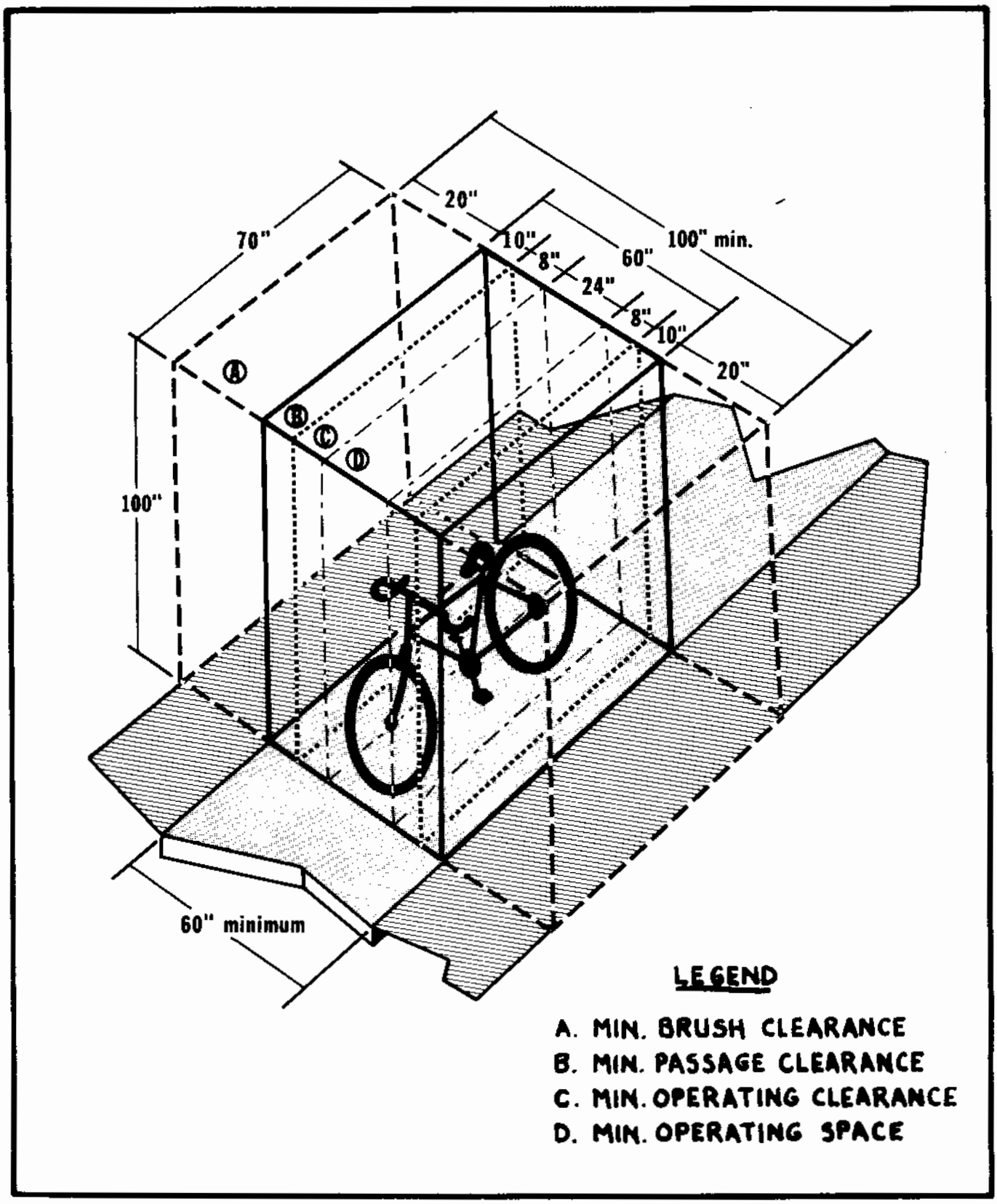
These figures correspond to a specific set of hypothetical street dimensions and configurations. Selection of specific classifications must reflect local conditions.

2. Bikeway dimensional requirements and design selection criteria: Figure 2 relates basic dimensional requirements for establishing specific bikeway designs. The diagram includes:

- The area occupied by the bicycle rider.
- The maneuvering room required for balancing.
- The additional clearances required to avoid horizontal and vertical obstructions of both the static and dynamic type.

As Figure 2 details, the basic minimum land width requirement is 24" plus 8" each side, or a total of 40". This does not include the required 10" clearance distances to obstructions beyond either edge of the basic bikeway.

FIGURE 2: BIKEWAY PLANNING DIMENSIONAL REQUIREMENTS [6/]



James P. Hamill, 1973

6/ Minimum dimensional standards based on a composite survey of in-service bikeway.

According to this set of criteria, the minimum width for a single on-street bikeway would be 40", plus additional clearances necessitated by obstructions, such as trees and signs.

Minimum collector street widths for including on-street bikeways are as follows:

° Minimum collector (local) street pavement width for provision of a single on-street lane - both sides with parking.	40' - 0" minimum
° (with parking prohibited on both sides)	28' - 0" minimum
° Minimum width for provision of two lane on-street bikeway both sides.	50' - 0" minimum
° (with parking prohibited)	34' - 0" minimum

3. Grade criteria and bikeway design requirements: Cyclists are particularly sensitive to grade. The selection of specific routes should, therefore, carefully consider the effect of grades upon the willingness of the user to follow the designated route. Grade-climbing ability varies with the cyclist, and the development of fixed criteria for acceptable grade profiles is difficult. The following comments are based on composites of data derived from European experience:

(a) There will be a significant decrease in the length of grade which cyclists will be capable of tolerating if gradients exceed 5%.

(b) Minimum grades are essential for those facilities intended to divert bicycle traffic away from roadways which are unacceptable for safe cycling.

(c) For bikeway facilities paralleling roadways, standards for gradient and elevation should not exceed those of the roadway itself.

(d) Where terrain makes steep, overall gradients unavoidable, it may be possible to reduce the effective grade of a bikeway by providing gradebreaks (sections of reduced grade which are 300-500" in length).

(e) In situations where sufficient right-of-way is available, bikeway "switchbacks" can be effectively used to reduce effective grade.

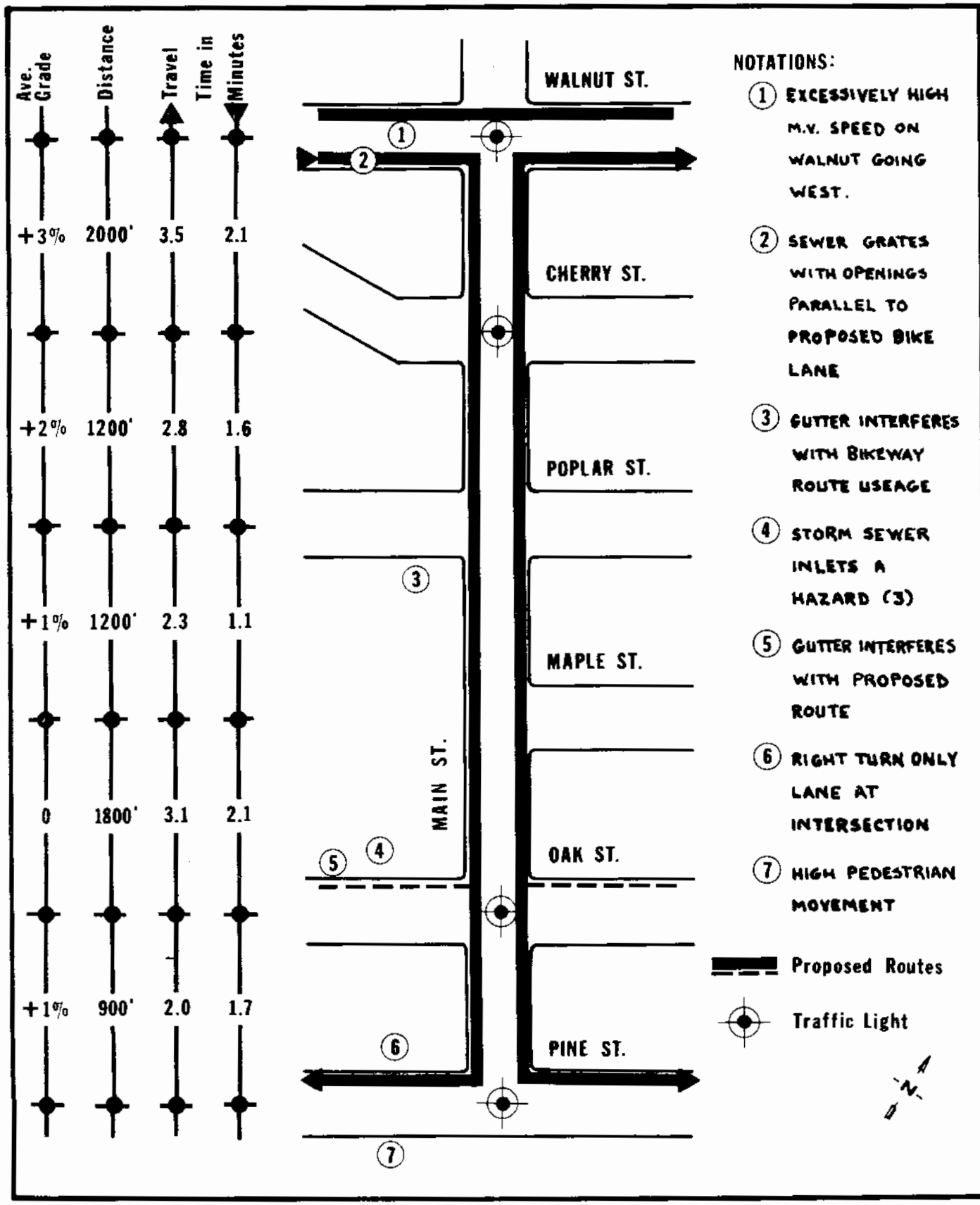
(f) Grade must be carefully analyzed in establishing the design speed of any bikeway facility. Cyclist velocity determines minimum spatial requirements including width, clearances to vertical and horizontal obstructions as well as turning radii.

4. Technical Evaluation Criteria for Bikeway Route Selection

Once preliminary bikeway routes are selected, route evaluation can begin. The next task is to inventory characteristics that would affect bicycle riding along the various routes. Traffic volume and speed along the streets should be measured quantitatively and specified as Low, Medium or High. The number of travel lanes and the presence of centerline and lane striping should be noted. The type of curb, or barriers, should be tabulated as well as whether or not there is a shoulder. Sidewalk location, parking usage and parking restrictions should be included in the inventory. An example of an inventory of bicycle route characteristics is summarized in Figure 1, which details information along a major route as well as data pertaining to spur or subroutes connecting to the major route.

The next phase of evaluation should involve determining the actual riding quality of the proposed routes. This should be done by a team of bicycle riding engineers who ride each route in both directions. They should use the special form shown in Figure 3 specifically for bicycle route analysis. Grade categories, travel time in both directions along the route and distance should be tabulated. Potential routes should be sketched with intersections, railroad crossings, bridges and points of special interest located in plan view. The form should also include an area for comments. Comments should be keyed by number to a location on the route map. Distance and route sketches should be prepared before riding the route and supplemented as necessary as result of the field evaluation. This approach provides a graphic presentation of facts which allows easy interpretation by the person evaluating the results. The bicycle route evaluation sheets will provide detailed information which should be considered before final routes are selected.

FIGURE 3: SAMPLE BIKEWAY ROUTE SELECTION EVALUATION DOCUMENT



TECHNICAL CRITERIA FOR BIKEWAY LAYOUT AND DESIGN

In this section of the manual, technical guidelines are presented for bikeway layout planning. Guidelines are included for the following areas:

1. Plan and Section Alternatives for Bikeway Design
2. Bikeway Intersection Channelization Design
3. Bikeway Signs, Pavement Markings and Physical Barriers
4. Bikeway Surfacing, Bases, and Subbases.

PLAN ALTERNATIVES FOR BIKEWAY DESIGN

In this section of the manual, nine alternative designs for bikeways are illustrated in plan view.

Figures 4 and 5 show the use of parking lanes as bicycle lanes where parking can be equitably removed. A solid white line 6"-8" in width separates the bicycle lanes from the existing traffic lanes. The bicycle lane should be clearly marked with both signs and stenciled street messages.

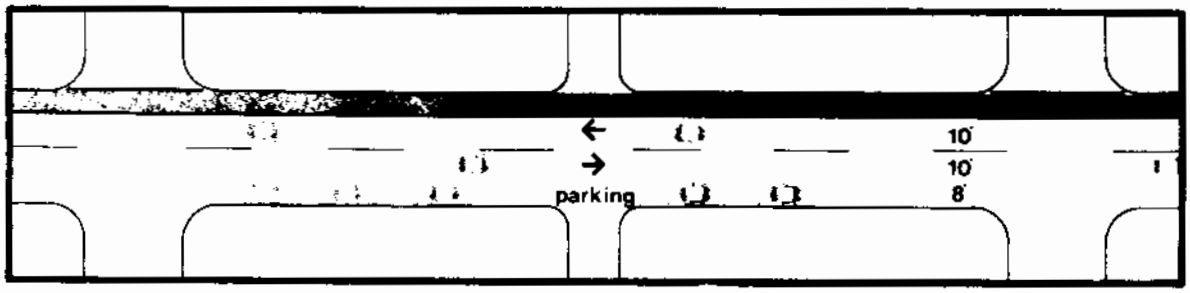


FIGURE 4:

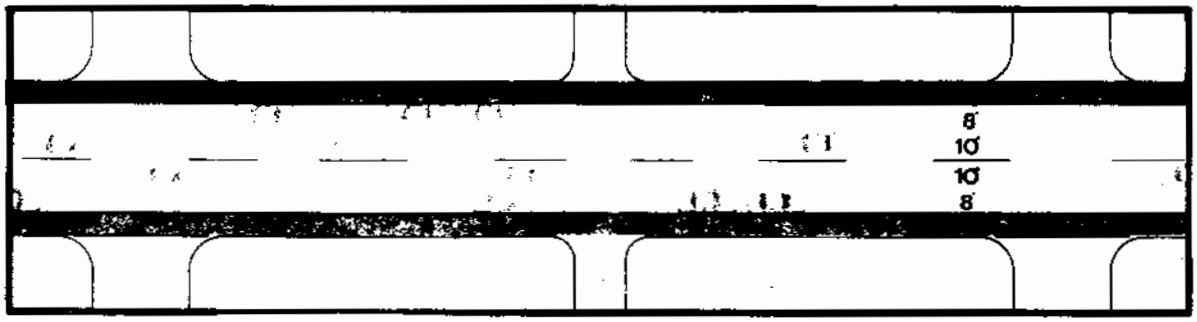


FIGURE 5:

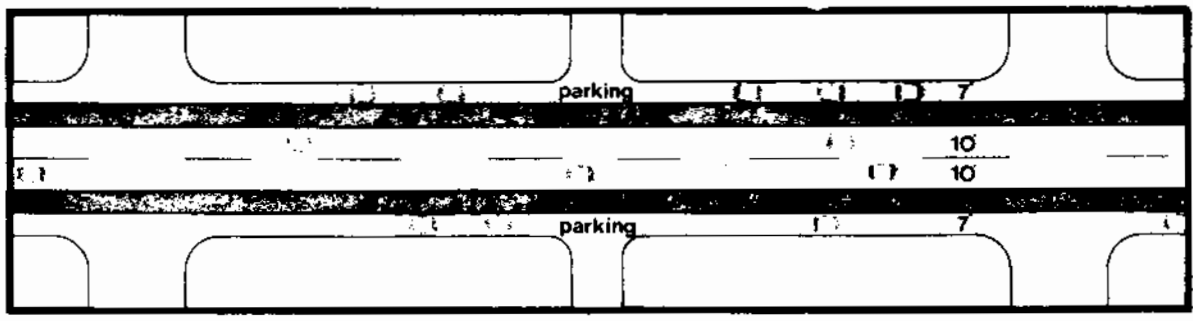


FIGURE 6:

Figure 6 shows the design of an on-street lane where the street width is adequate to retain full motor vehicle movement lanes.

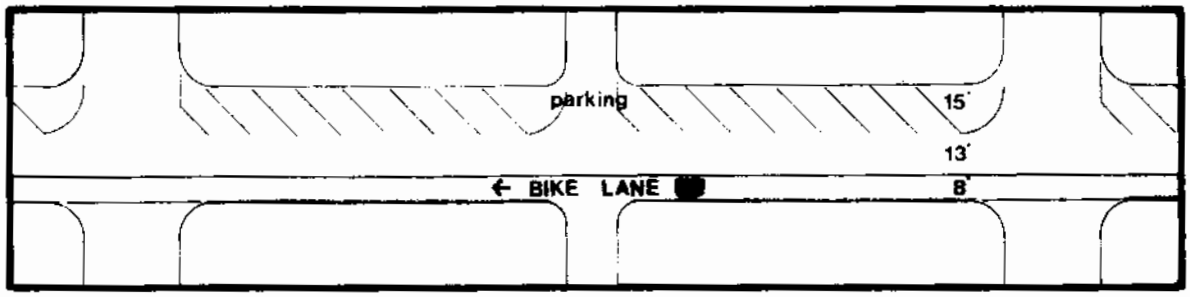


FIGURE 7:

Another lane realignment on a local street can be used where traffic volume is very low. Parking is retained but located on one side of the street at a 45° angle. Motorized vehicles are then limited to a one-way direction allowing an 8-foot bike lane which may have either one- or two-way bicycle traffic. This approach is not widely used in the United States and its effect on parallel cycle/car conflicts is not empirically known. Streets with angle parking are not eligible for Federal-aid highway funds.

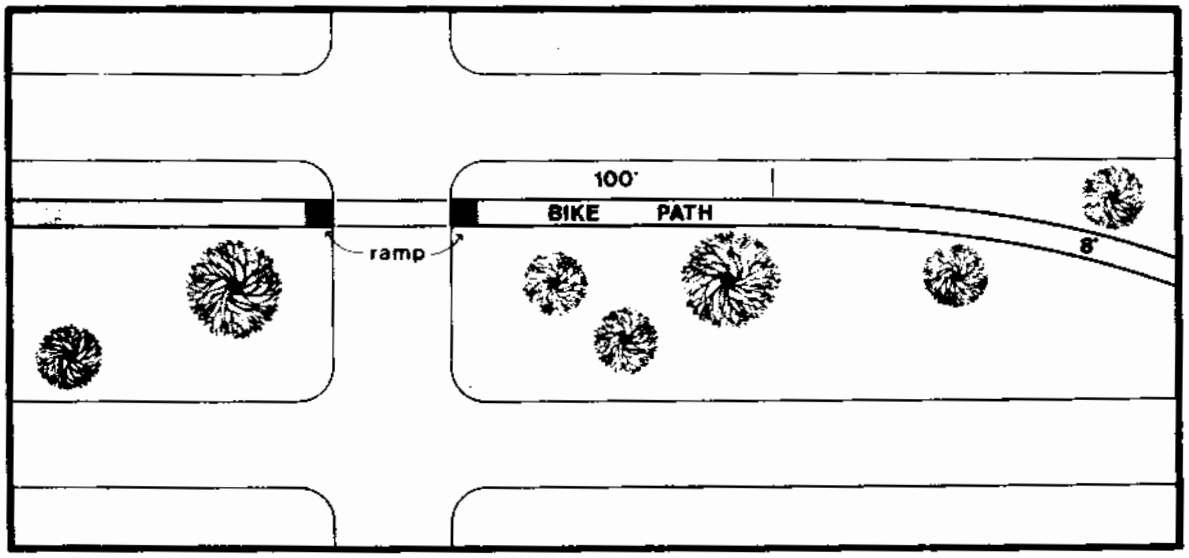


FIGURE 8:

Parkways with wide medians are suitable for bicycle paths. Construction of asphalt paths, curbs cuts, painting at intersections, and signing are necessary. Intersection crossings must be designed to minimize accidents by providing good sight distance: otherwise, parkway bicycle routes separate bicycle and automobile traffic. The bicycle path should parallel the roadway approximately 100 feet on each side of the intersection. This would permit both the bicyclist and the motorist to see one another before arriving at the intersection.

Figure 9 shows a sidewalk bikeway alternative in which the bikelane is either shared with pedestrians or separated by a physical or symbolic barrier. There are two alternatives for sidewalk bikeways. A Class II sidewalk bikeway can be delineated by means of pavement stenciling, striping, signing or by providing barriers, such as curbs. It should be recognized, however, that a minimum lane width for pedestrians is 30". Further, combining pedestrians and bicycles can only be done in low volume situations. The total minimum path width required to safely accommodate a cyclist is from 3'-3" to 5'-6". Therefore, sidewalk alternatives, at a conservative minimum, require 5"-9" total width. Incorporating bikeways on sidewalks may require the widening of existing sidewalks.

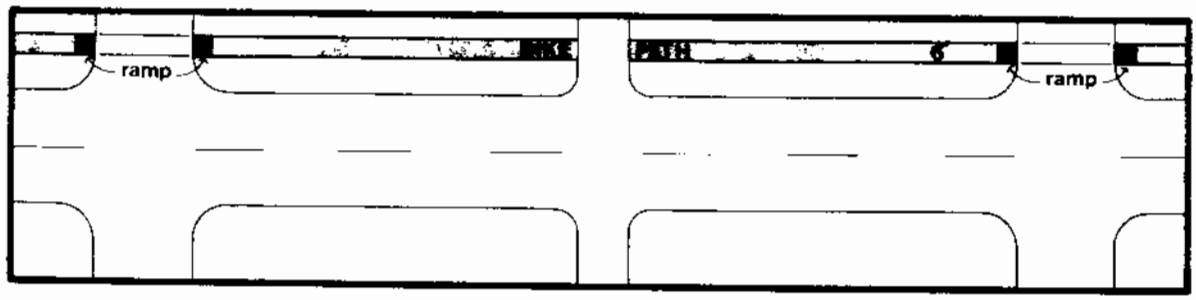
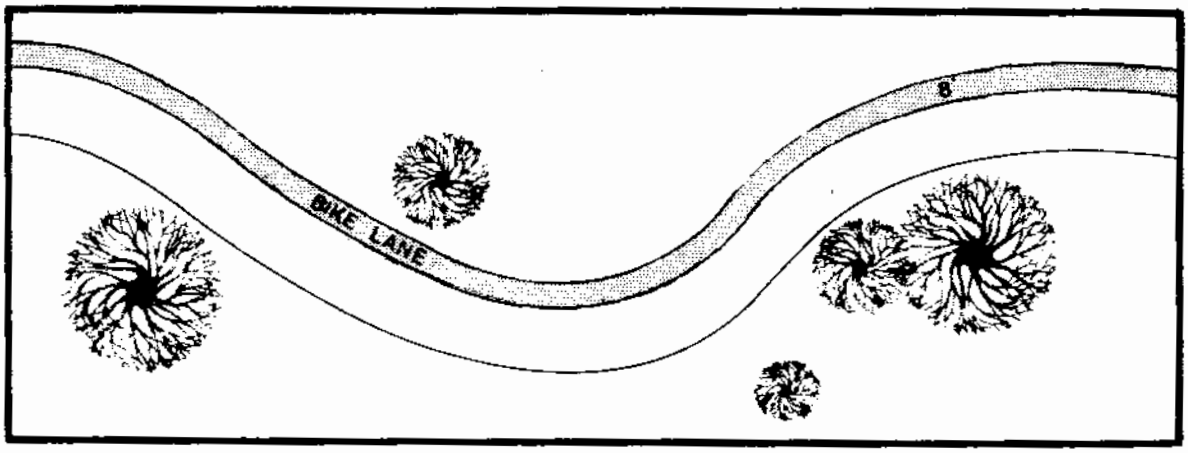


FIGURE 9

The use of sidewalks for bike paths separates the bicyclist and auto traffic but presents other problems. The addition of width to reserve part of the sidewalk for pedestrians and part for bicyclists would be expensive. Special curb cuts would have to be constructed for ease of riding through intersections and prevention of damage to bicycles. Mature trees are often close to the sidewalk, or their roots prevent construction without damage to them. At intersections, motorists have increased difficulty seeing bicyclists who are approaching a street crossing. A bikeway located on a sidewalk may be hazardous for night cycling due to poor lighting conditions. Finally, although the pedestrian has the right-of-way, persons moving in an unpredictable manner, particularly children, would increase the chances for pedestrian-bicycle conflict. For these reasons, sidewalks are not recommended for bikeways, except under special circumstances or for short distances.

FIGURE 10:

Existing roadways in parks serve the recreational bicyclist well, and also serve as linkages for a commuter bicycle system.



Figures 11 and 12 show some additional situations in which exclusive bikeways can be included on otherwise unused continuous linear spaces, such as railroad and electrical transmission line rights-of-way, river banks, flood control levees and canal embankments. Precedents for locating exclusive bikepaths in these settings are found in many communities in the U.S. including the Sausalito-Mill Valley bikeway which is situated along a railroad right-of-way, and the Culver City, California Urban Bikeway System which utilizes a local flood control channel as an exclusive bikepath. Other examples include the City of Chicago which has provided urban bikepaths along Lake Michigan, and the City of Milwaukee which has planned the development of bikeways along local waterways.

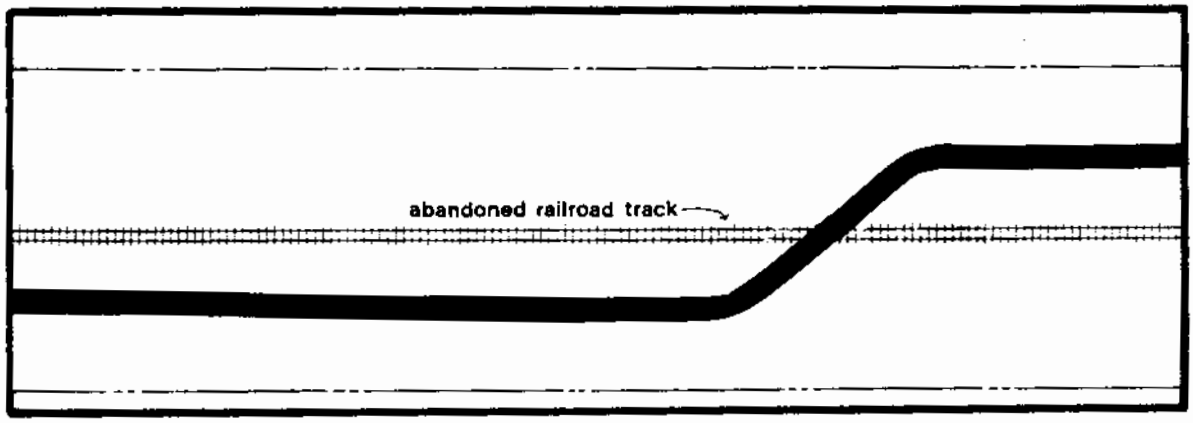


FIGURE 11:

Right-of-way situations such as abandoned railroad tracks offer good routes for bike paths completely separate from streets and with few street crossings.

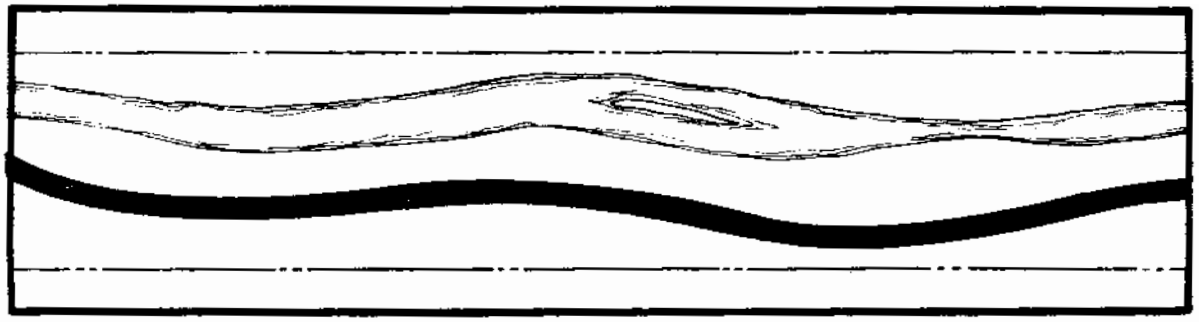


FIGURE 12:

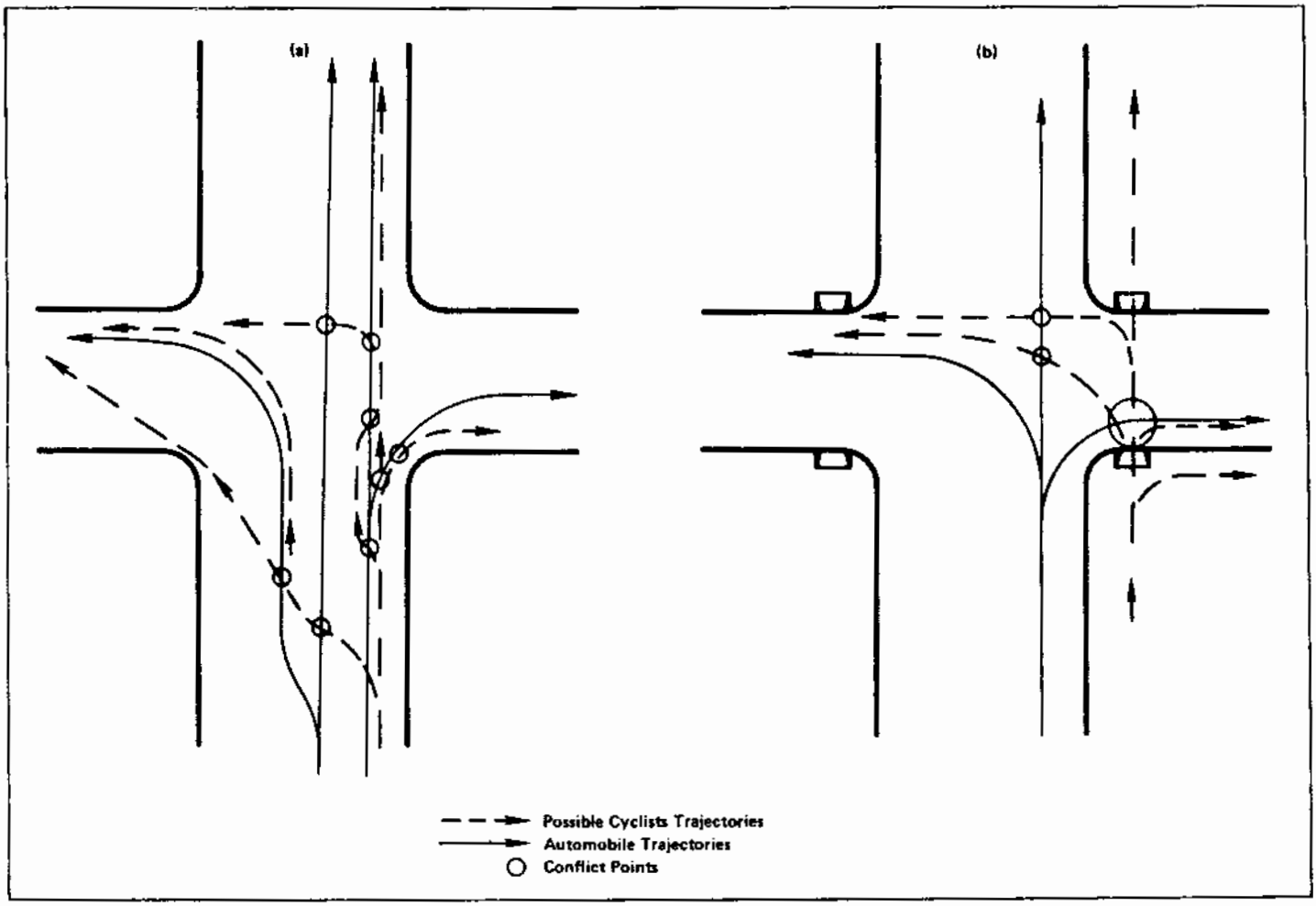
River banks, drainage channels and canals provide excellent routes combining recreational and commuter bikeways.

BIKEWAY INTERSECTION CHANNELIZATION DESIGN

Intersections are the location of the majority of bicycle accidents and the areas of greatest potential motor vehicle/bicycle conflicts. Although bikeways cannot entirely eliminate this potential conflict, proper channelization of bicycles can reduce it significantly.

At intersections where separate channelization is not provided, cyclists will typically follow a multiplicity of paths to cross or turn. Figure 1 shows a variety of methods used by cyclists to cross intersections and diagrams conflict points of the trajectories of cars and bicycles.

FIGURE 13: CONFLICT POINTS BETWEEN BICYCLES AND MOTOR VEHICLES AT INTERSECTIONS[7/]



7/ Institute of Transportation and Traffic Engineering, School of Engineering and Applied Sciences, U.C.L.A., Bikeway Planning Criteria and Guidelines, State of California, Division of Highways, April, 1972 p. 91.

Where channelization is warranted by sufficient bicycle and automobile traffic, high motor vehicle speeds, or large numbers of right turning vehicles - it can provide a significant degree of safety in intersection movement.

Methods of Channelizing bicyclists within an Intersection:

The following figures are diagrams of recommended intersection designs based on German experience. These intersection prototypes are general in character. Exact placement of curbs, barriers, signs and pavement striping must be to a large extent dictated by traffic engineering considerations in the specific setting where the bikeway is being channelized.

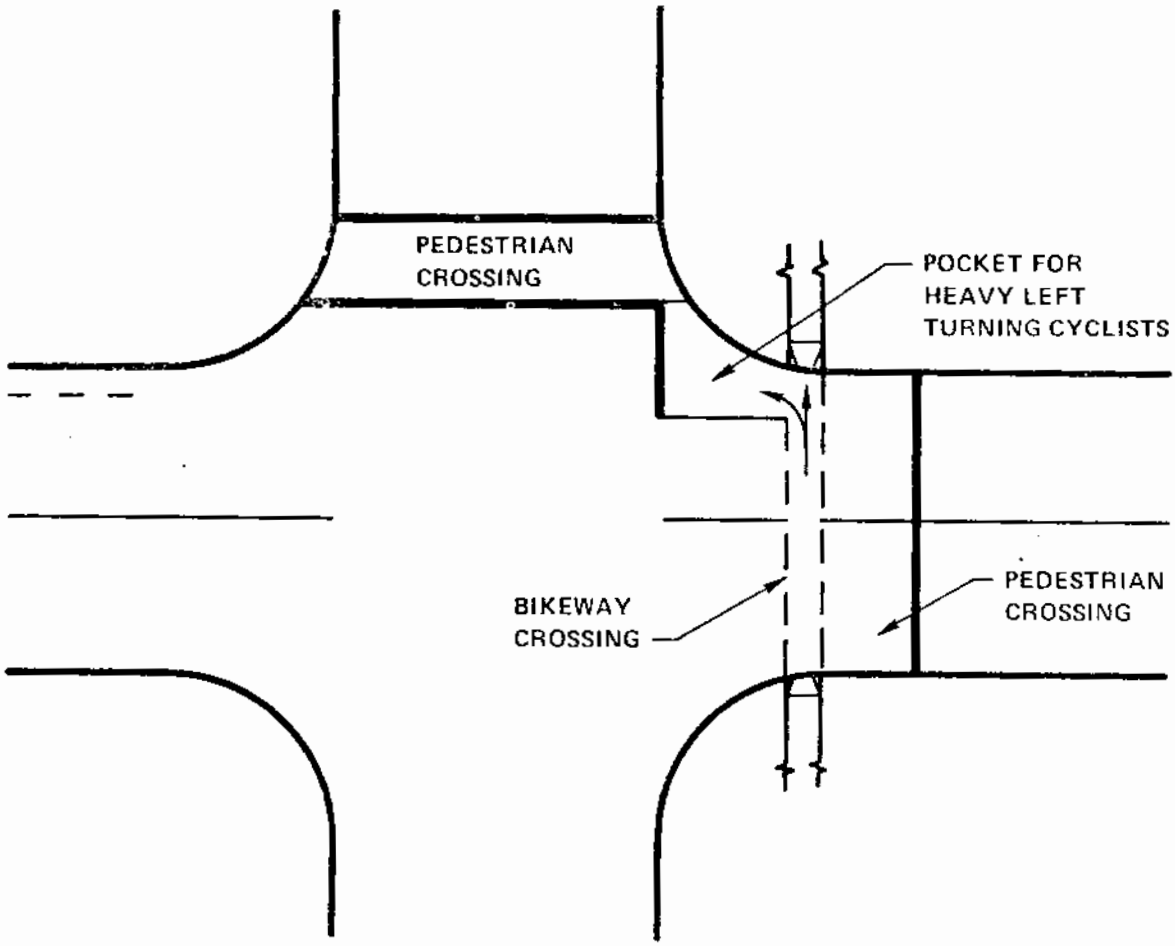


FIGURE 14: Details a method of channelizing an intersection to allow for left turning cyclists. This design provides a pocket which protects cyclists desiring to turn full left. 8/

8/ IBID p. 94.

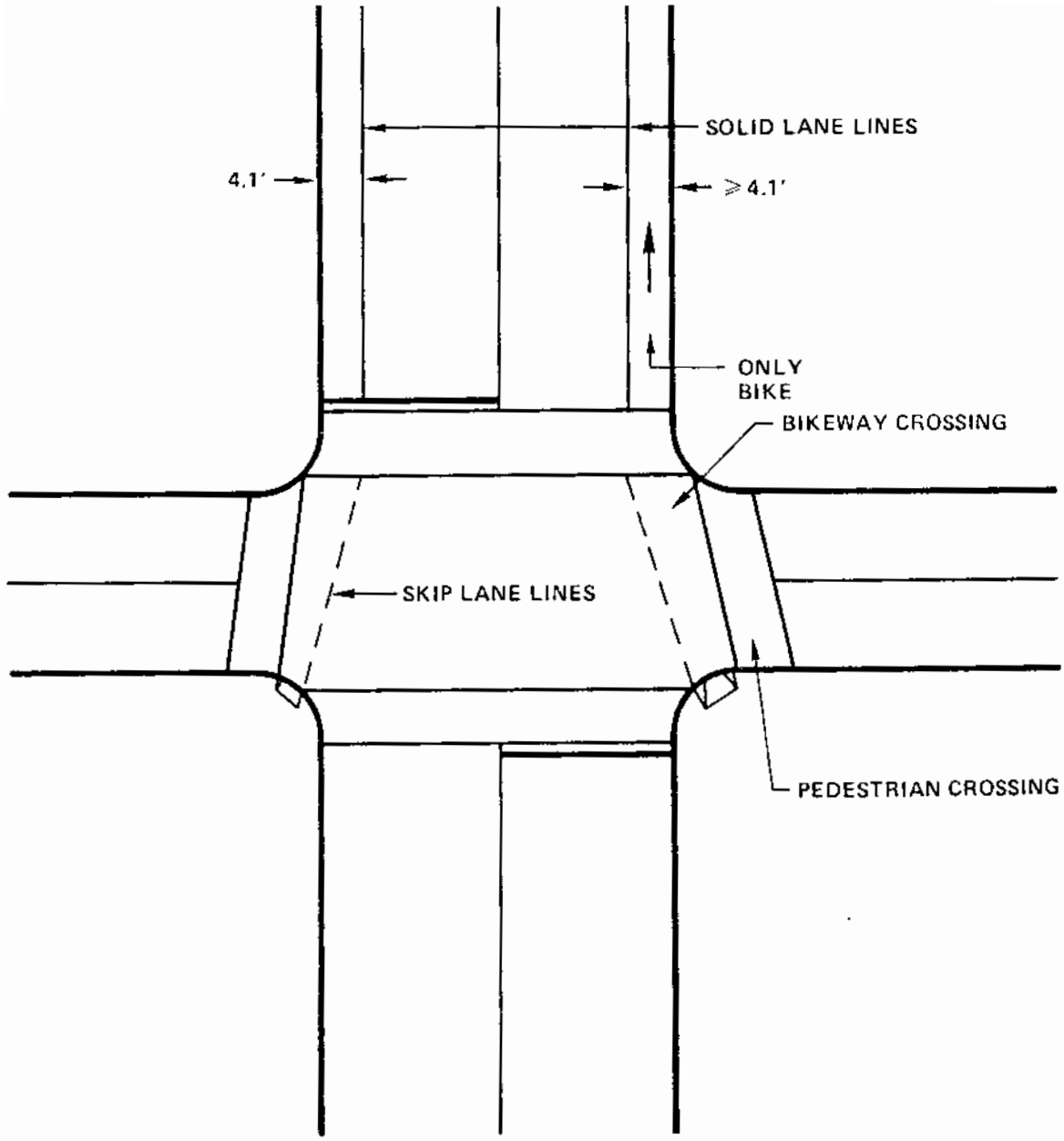


FIGURE 15: Details an intersection design where the bikeway approaching the intersection is on the sidewalk and the bikeway departure from the intersection (on the other side of the street) is routed next to the curb. 9/

9/ IBID p. 94.

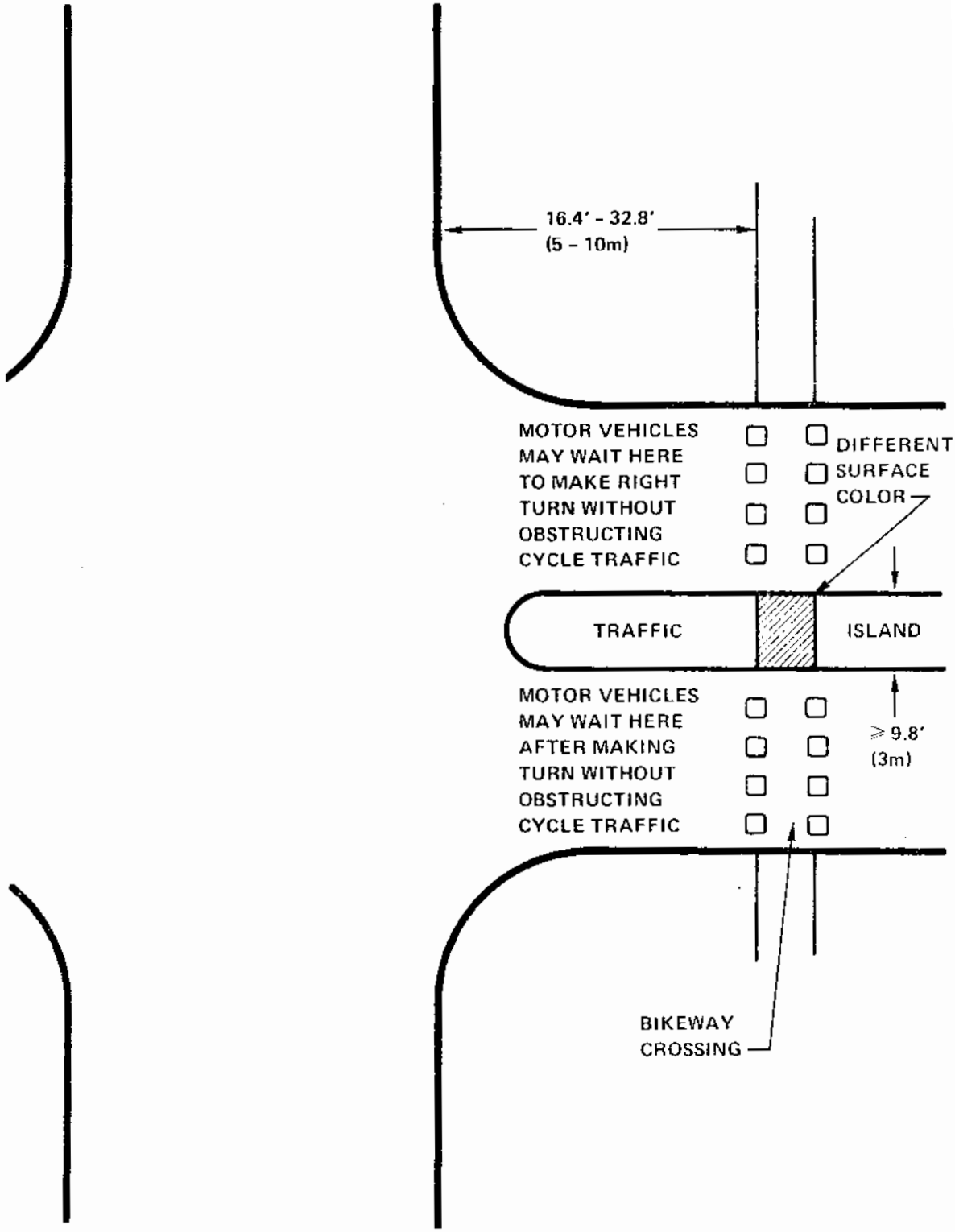
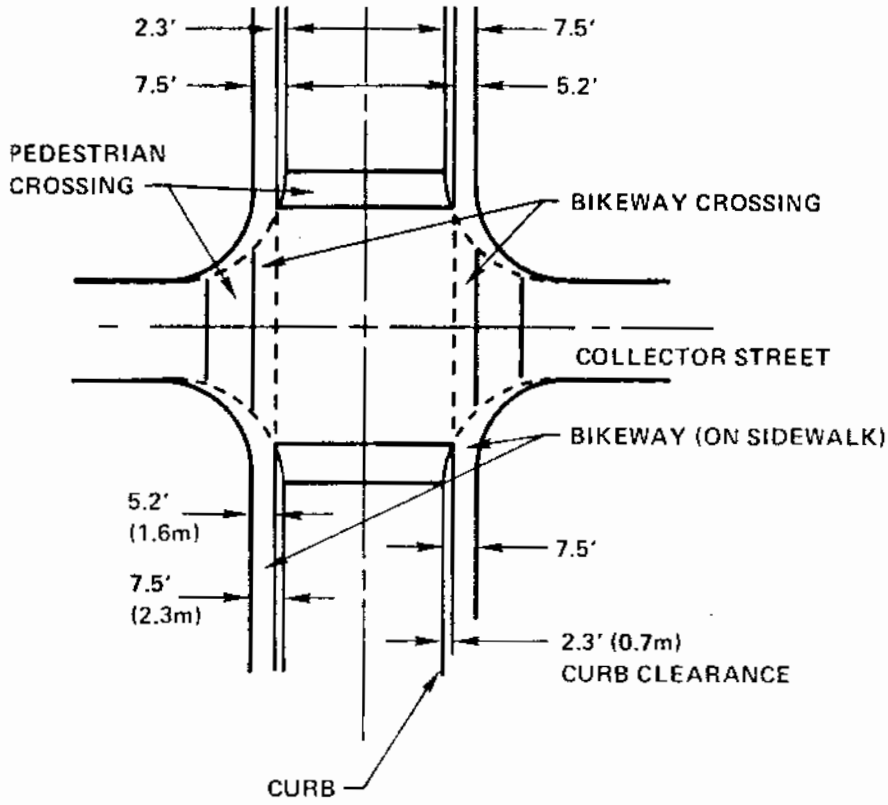


FIGURE 16: Details an intersection channelization design which provides right turning motor vehicles with queue areas which will not obstruct bicycle traffic. 10/

10/ IBID p. 96.

FIGURE 17: Details a recommended intersection channelization design where a bikeway on the sidewalk of an arterial street crosses a collector street. This design is appropriate only when the arterial traffic volume turning left or right is low. 11/



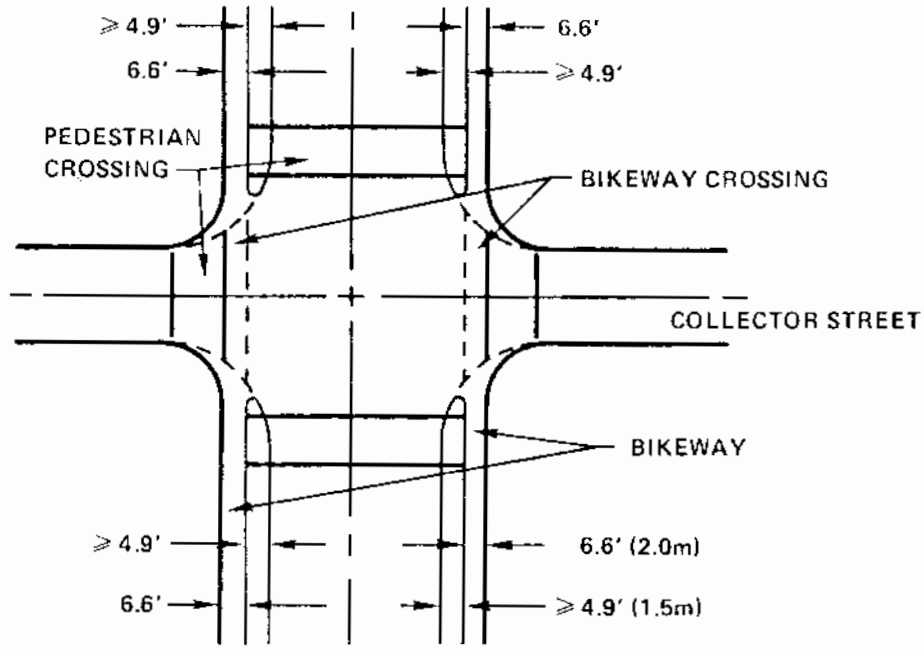


FIGURE 18: Details an intersection channelization design where an arterial street crosses a collector street. In this design the bikeway is physically separated from motor vehicle traffic by a positive barrier. 12/

11/ IBID p. 101.
12/ IBID p. 102.

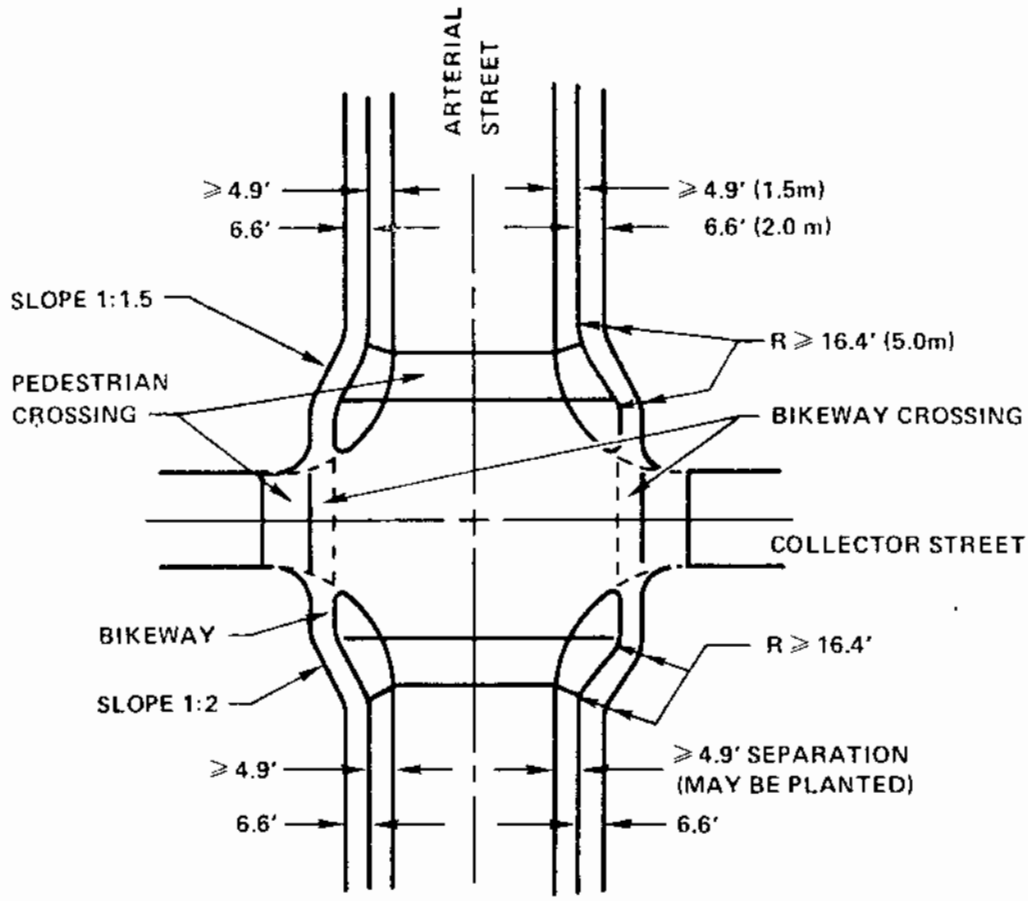


FIGURE 19: Details an intersection channelization design where a bikeway on an arterial crosses a collector street. The physical layout of this design forces cyclists to reduce their speed before entering the intersection. 13/

13/ IBID p. 103.

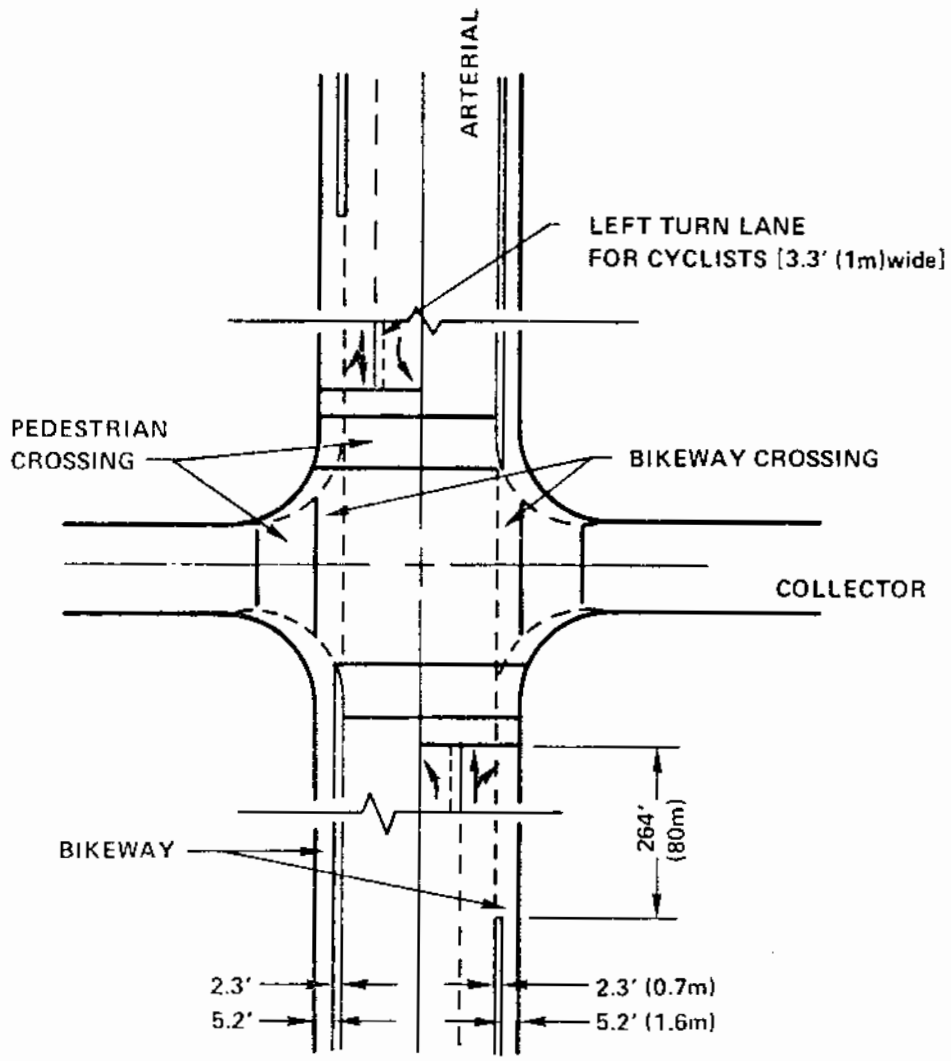


FIGURE 20: Details a channelization design in which a bikeway on an arterial street with heavy motor vehicle turning onto a collector street. 14/

14/ IBID p. 105.

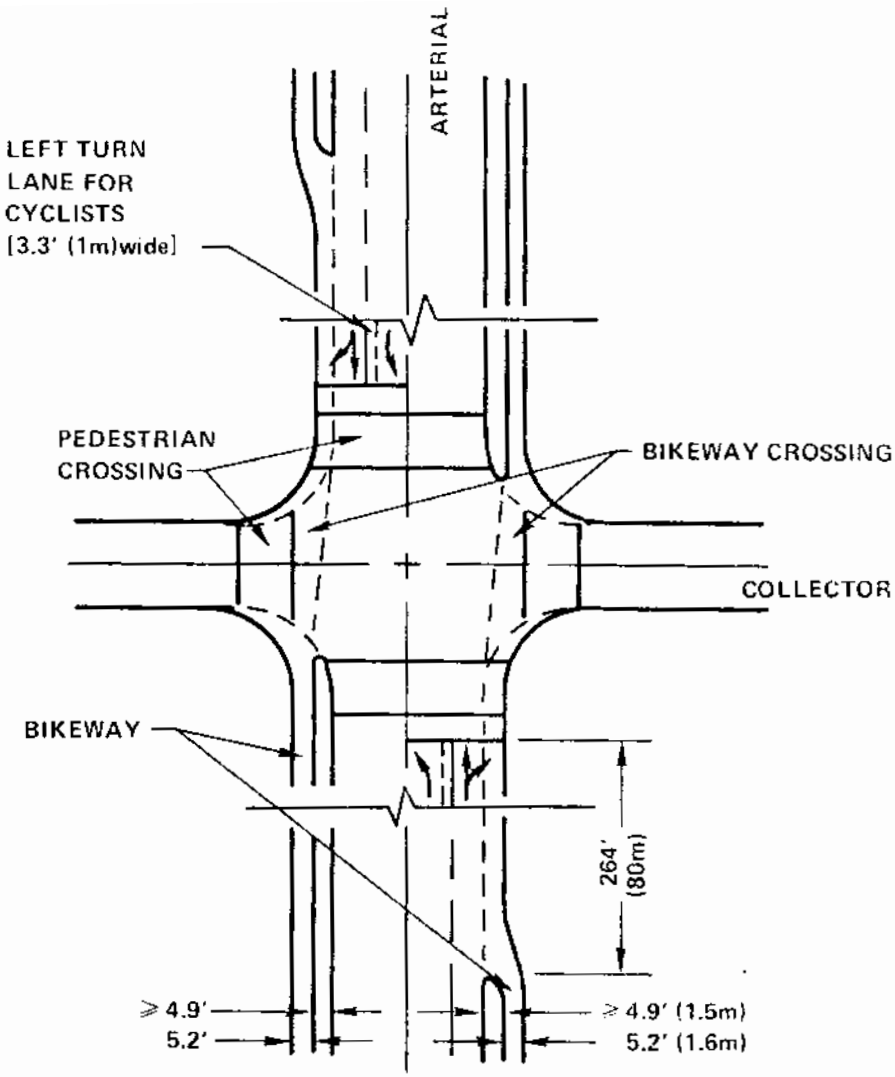


FIGURE 21: Details an intersection channelization design in which a bikeway on an arterial street with heavy motor vehicle turning onto the collector street. In this design the separated bikeway ends approximately 250' before the intersection and continues on beyond the intersection as a striped bikeway. This design endangers bicycle traffic if there is heavy right turning motor vehicle traffic and a right turn lane is provided. 15/

15/ IBID p. 106.

BIKEWAY SIGNS, PAVEMENT MARKINGS AND PHYSICAL BARRIERS

BIKEWAY SIGNS

With the increased popularity of the bicycle as a means of travel, it becomes necessary to make the bicycle an integral part of the transportation network. It is therefore desirable to establish a system of demarcation for bikeways in order to promote safety and convenience in travel for the pedestrian, cyclist and motor vehicle operator. Bikeway signing facilitates the establishment of an easily discernible right-of-way and the smooth flow of all moving vehicles.

In the promotion of these basic aims, clarity and communicability must be considered as well as the use of signs which are not disruptive of the environment.

The first point to consider is the delineation of the bikeway system itself from other roadways or pedestrian ways. The three types of bikeways each may require different methods of signing.

1. The Bicycle Route

The bicycle route is designated by sign only for bicycle as well as automobile traffic. This method of delineation is useful for routing cyclists in historic areas or between parks and on lightly traveled routes.

2. The Bicycle Lane

The bicycle lane is part of the roadway exclusive to bicycles and forbidden to motor vehicles, but is marked for cyclists' use by means of a painted stripe or the use of plastic discs. It, however, enables cars to cross easily into the bicycle lane, thereby allowing access to driveways and turning movements. The placement of reflectorized plastic discs on a painted stripe enhances the safety of the cyclist in that motorists will be aware of his passing into the bike lane, as it will be marked by reflectors at night.

3. The Exclusive Bikeway

The exclusive bikeway is a right-of-way designated specifically for bicycles and separated from motor vehicle lanes by a space or physical barrier, such as a berm (a short mound divider) or a series of bollards (rubber posts). A series of bollards with reflecting markers protect the cyclist and define the bikeway, but costs (material and installation) become a consideration. The path may also be separated from traffic lanes by a barrier such as a hedge.

Recommendations for bikeway delineation:

a. Bicycle lanes in existing roadways should combine signing, lane marking and stenciling.

b. Physically separated bikeways may employ low cost berm or bollards where adjacent to traffic lane.

c. Natural barriers, such as shrubs or tree plantings, should be preserved or instituted wherever possible. However, their use must not reduce vision in such a way that cross traffic of bicycles and motor vehicles will conflict.

Signing on the Bikeway

It is also necessary to examine the adequate signing of the bikeway.

A. Standard Signs

Two standard bicycle signs have been authorized by the Federal Highway Administration, U. S. Department of Transportation: these are set forth by the National Joint Committee on Uniform Traffic Control Devices in the Manual on Uniform Traffic Control Devices.

1. Designation sign

The designation or bike route sign, marks an officially designated bikeway. This sign announces and defines a bikeway from beginning to end, and is appropriate for use with a bike path (separated from a street or highway), or a bike lane (routed on selected roads and streets). This sign is specifically for the cyclist.

With a bicycle symbol and the words, "BIKE ROUTE," printed on it in 3" Series C letters, this designation sign, mounted as a horizontal rectangle 24" x 18", should be colored Standard Interstate Green (PR Color #4, June 1965) and White. 16/

2. Crossing sign

The second standard, the bikeway crossing sign, is specifically for car drivers and placed prior to the point at which an officially designated bikeway intersects or crosses a street or highway. This sign should exhibit the same bicycle symbol as the bike route sign, with the term "XING" in 6-inch Series D letters. It should be 30" x 30", mounted as a diamond and colored Standard Highway Warning Yellow (PR Color D1, June 1965)17/ and Black. Alloy aluminum or any other suitable metal, plastic or high-density plywood have been suggested as material for these signs.

16/ 17/ Standard Color Charts, Federal Highway Administration, 1970. Color tolerance charts showing acceptable standard colors and variations may be obtained by sending $6.00 to Clearinghouse, National Technical Information Service, Springfield, Virginia 22151.

3. Placement of crossing sign

Crossing signs should be placed prior to any point at which the bikeway crosses another route of transportation, be it bridle path, railroad crossing, roadway or hiking path. The positioning of the sign should be approximately 50 feet from the point of intersection which, at an average speed of 8 to 10 mph, allows for a reaction and adjustment interval of 3 to 4 seconds. Where the motorist is being warned, standard highway practice should be employed. This sign makes the cyclist aware of the bikeway's intersection points so that he may adjust his speed accordingly and, of equal importance, alerts other traffic, pedestrian or vehicular to the possibility of encountering cyclists at specified points. For utmost safety in the bikeway, an awareness of its route by adjacent traffic is imperative. The use of standard bikeway signing is strongly urged to ensure a system of similarly signed bikeways throughout the United States. This will enable visitors to recognize the signs with ease, and also enhance accuracy and speed of response on the part of motorists, cyclists and pedestrians.

B. Other Signs

To ensure the smooth flow of bicycle traffic and to inform cyclists of any changes or impediment in the bikeway surface, a set of regulatory and warning signs becomes necessary.

1. Warning signs

Variations in the character and configuration of the road surface, which to the motorist elicit no concern, become potentially dangerous to the cyclist. It is important that warning signs be posted with reference to:

- slopes
- effects of weather conditions on road surface
- loose gravel
- trolley or cable car tracks (especially those parallel to bikeway)
- sewer grates
- right turn only lanes
- narrowing of the bikeway surface
- any other change in the road surface
- bus lane

Standards similar to those established for the designating and crossing signs consistent with the system of warning signs found in the Manual on Uniform Traffic Control Devices should be used.

2. Points of interest signs

In addition to signs aiding the safety of cyclists, a community may wish to indicate points of particular interest on or near the bikeway, such as a neighborhood museum or a nearby scenic view.

3. Signs of direction to a bikeway

A community may also wish to direct its visitors to a bikeway system by using a set of standardized signs placed near an access point to the bikeway.

° Height and Placement

Sign placement depends upon the particular type of bikeway in use. Lateral sign placement along a path may be 1'-6" to 3'-0" from the path's edge. Because an exclusive bikeway is separated from existing highways, signs are not likely to become mud-splattered, obstructed from view by parked automobiles or damaged by automobile impact. In the case of a shared bikeway or bike route, however, at least 5' should be allowed from the bikeway edge because of the above factors.

Since the bicyclists' field of vision is directed lower than that of a pedestrian or a motorist, the clearance of a sign from the ground should be no more than 6 feet. Where bicycle lanes share motor vehicle roadways, the placement of signs overhead with an 8' to 10' clearance may be desirable.

° Frequency

No specific sign placement interval standards exist; however, signs should be spaced according to vehicle speed, visibility of sign on bikeway and time of comprehension. The sign should be positioned about 50 feet in advance of special occurrences, where directed to cyclists. Warning signs directed to motorists should be spaced according to normal highway practice. Existing standards should be utilized if possible in the placement of bikeway signs.

° Lighting

Of importance to the safety of the cyclist is the illumination of the bikeway for use at night. Bikeways sharing existing roadways can, for the most part, utilize the roadway lighting of the shared lane.

Bicycle headlights are generally not strong enough to define a large lateral area or to illuminate a reflectorized sign. Therefore, where roadway lighting is absent and the bikeway will be used for commuting at night, or a separate bicycle path exists, illumination should be considered. Possible solutions may be examined in terms of the cost, amount of expected night use,

the particular location of the path (re: crime) and the character of the path (e.g., numerous signs, rough or uneven surface). This will determine how much and what type of illumination is actually needed. Light fixtures should be at least 12 feet overhead and should illuminate:

- intersections
- access and egress points
- significant grade changes
- significant curves
- curbing
- signs
- street furniture

Illumination of these hazards would parallel the installation of reflectorized (or well lit) warning signs placed appropriately before the hazard.

In conclusion, the following points bear careful consideration:

- Clarity and communicability in bikeways signing is critical to:
  - delineate the bikeway from other networks of transportation
  - define the beginning, end and intersection points of a bikeway
- Standardized signing is essential for:
  - safer routes
  - ready recognition of bikeway marking by cyclists, pedestrians and motorists
  - least cost

The bicycle "XING" sign is a nationally approved warning sign for placement on a street or highway just in advance of a point where an officially designated bicycle trail crosses the street or highway. Its finish of black on a yellow background should also be reflectorized for night use. Because it is a warning sign, its shape is that of a diamond.

The "BIKE LANE ONLY" sign will be located immediately adjacent to an on-street bicycle lane. It is an informational sign to motor vehicles as well as to bicycles. Its finish will be black lettering on a white background.

The "TURNING VEHICLES YIELD TO BICYCLES" sign would be located immediately adjacent to an on-street bicycle lane at major cross streets and one-way cross streets. This informational sign would alert motor vehicles as to the bicycles right-of-way through the intersection. Its finish will be black lettering on a white background.

The "BIKE ROUTE" sign is a nationally approved sign for marking an officially designated bicycle route, appropriate where a trail is separate from a street or highway and where a trail may be routed on selected roads or streets. Its finish of white on a green background can be reflectorized for night use.

FIGURE 22: NATIONALLY RECOGNIZED BIKEWAY SIGNS

International City Managers' Association, Inc. Planning and Development of Bikeway Systems, James P. Hamill, Washington. April 1973 Vol. 5 No. 4 MIS Report.

	BIKE PATH	BIKELANE	BIKEROUTE
Lateral Placement	1-3 ft. from edge	Roadway criteria	Roadway criteria
Vertical placement	6ft.	6ft.	6ft.
Positioning before hazards	50 ft.	not less than 50 ft.	not less than 50 ft.
Sign Spacing	At all decision points	10-20/mile	10-20/mile
Sign Message	Standard	Standard	Standard
Sign Illumination	If considerable night usage, must be illuminated	Roadway criteria	Roadway criteria
Sign Size:			
a. Route	Standard	Standard	Standard
b. Warning	May be less than standard	Standard	Standard
Overhead Signs: Clearance	8.2 ft.	8.2 ft.	Not recommended
Stencilled Warnings - Size and Use:			
a. "BIKE ROUTE" (D11-1)	24" x 18"	Recommended for sidewalk use only (24" x 18")	Recommended for sidewalk use only (24" x 18")
b. Bicycle symbol	-	3.5 x 7.0 ft.	3.5 x 7.0 ft.
c. "BIKEWAY" (lettered)	size to be determined	size to be determined	size to be determined
d. "BIKE ONLY" (lettered)	6.0 x 31.0 ft. (Total)	6.0 x 31.0 ft. (Total)	-
Additional Signs:			
a. "NO MOTOR VEHICLES" (wht)	Rectangular 24" x 18"	Rectangular 24" x 18"	
b. "WATCH FOR BIKES" (Yel)	-	Diamond 30" x 30"	Diamond 30" x 30"
c. "BEGIN, END BIKE ROUTE" (Grn)	Standard	Standard	Standard

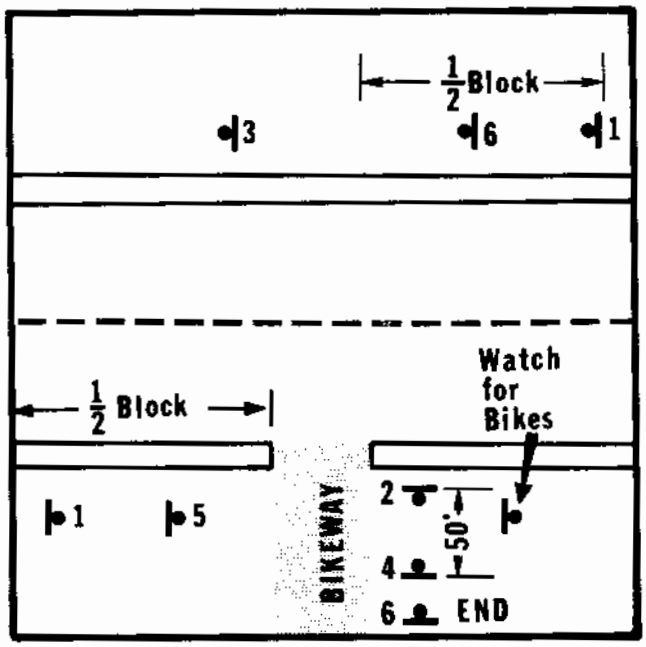
NOTE: - Indicates designation is not generally recommended.

FIGURE 23: RECOMMENDED BIKEWAY SIGN PLACEMENT

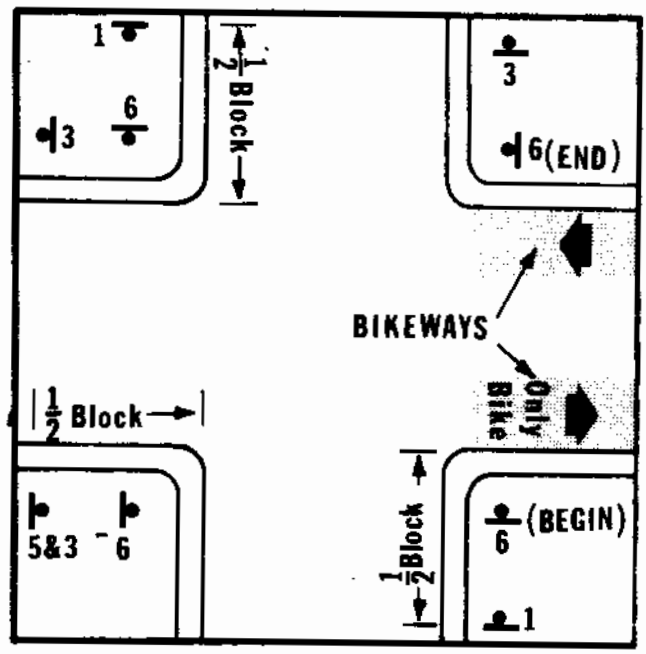
Institute of Transportation and Traffic Engineering, School of Engineering and Applied Sciences, U.C.L.A., Bikeway Planning Criteria and Guidelines, State of California, Division of Highways, April 1972. p. 135.

FIGURE 24: SUPPLEMENTARY AND SPECIAL PURPOSE BIKEWAY RELATED SIGNS

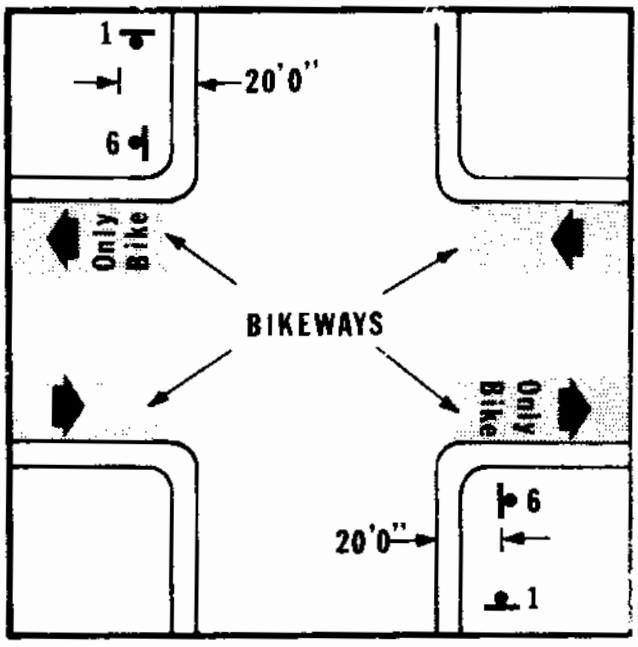
FIGURE 25: TYPICAL BIKEWAY INTERSECTION SIGNING IN PLAN



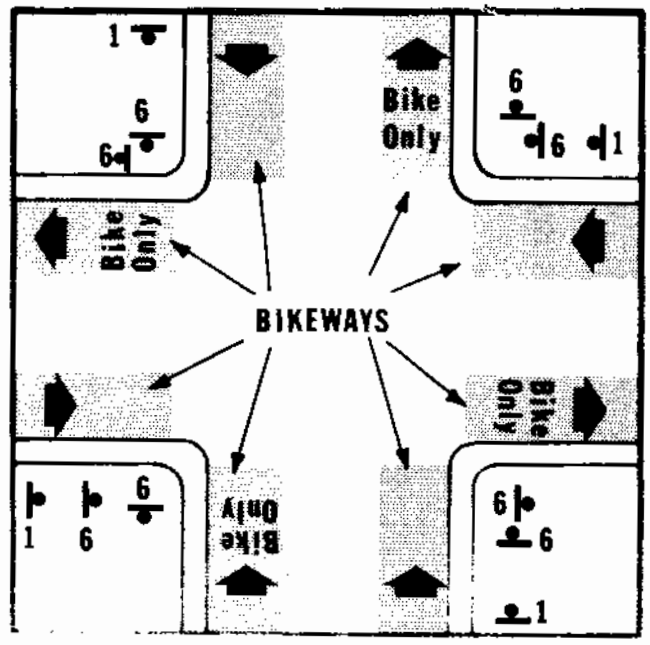
(a). Bikeway Begining/End Signing



(b). Bikeway Begining/End



(c). Bikeway/Non-Bikeway Intersection Signing



(d). Bikeway/Bikeway Intersection Signing

Sign Reference Numbers: "BIKE XING"-1; "STOP"-2; "WATCH FOR BIKES"-3; "YIELS"-4; "BEGIN BIKE ROUTE"-5; "BIKE ROUTE"-6; "NO BICYCLES"-7; "PEDESTRIANS PROHIBITED"-8.

Supplementary Bikeway Related Signs

The NO BICYCLES; PEDESTRIANS PROHIBITED; and MOTOR DRIVEN CYCLES PROHIBITED; are selective exclusion signs designed to regulate types of traffic which may or may not enter a particular right-of-way. The NO BICYCLES sign consists of a square upper plaque measuring 24 inches on a side with a black bicycle symbol circumscribed by a slashed red prohibitory circle. The lower plaque, 24 inches x 18 inches reads "NO BICYCLES" in black letters. Both signs have a black border on a white background.

Additional standard signs which may be particularly relevant to Class I bikeways include the "Curve," "Winding Road," "Stop Ahead," "Stop", "Yield Ahead," "Yield," and "Slide Area" designations. These signs are commercially available in several different sizes. Although 30" x 30" are the standard dimensions, reducing this size by a multiple of 6 inches (to 24" x 24") may be desirable for placement along Class I bikeways. A similar procedure, combining a substandard sized warning sign with the standard "Bike Route" designation has been adopted in some communities.

The limited number of uniform signs outlined above may not apply equally well to all situations and certain additional sign messages are suggested for possible use. These include:

1. "Begin" or "End Bike Route" - this would consist of the standard "Bike Route" sign with an above mounted supplemental "Begin" or "End" plaque. Its use would be to inform bicyclists of the origin and termination of a Class I, II, or III bikeway.

2. "Watch for Bikes" - This warning sign would be the standard yellow 30" x 30" diamond shape. Since the "Begin" or "End Bike Route" designation may not be adequately comprehended by motorists, the "Watch for Bikes" sign may be used to supplement it. Its use would be to warn motorists that slow moving bicycle traffic may be encountered regardless of whether a bikeway is located at that point.

3. "No Motor Vehicles" (comparable to "No Bicycles") - This black and white sign would be similar to that currently in use throughout Europe. If adopted, its use would be to exclude all motor vehicles from entering Class I or II bikeways.

4. "Bike Parking" - Based upon the standard "Parking" design, this sign would be positioned at or near bicycle storage facilities along any class bikeway, and would be used to inform bicyclists of the location of these facilities.

STENCILED PAVEMENT MARKINGS

The use of white pavement stencils as a supplement to existing signs has been growing. At intersections, directional markings (arrows) have become a common method of channelization. As an extension of this trend the use of symbolic stencils as an adjunct to signs on Class I and II bikeways presents a promising alternative which has begun to be realized both in this country and abroad.

In Europe a pavement stencil consisting of an elongated bicycle 3.5 feet wide and 7 feet high is sometimes painted on the surface of Class II bikeways. The large size of the symbol is intended to ensure motorists' recognition of the bikeway and hence of the presence of slow moving traffic. In this country, a stencil of the standard "Bike Route" sign, 24" x 18", is available through the Bicycle Institute of America. Due to its small size, this marking is only recommended for use where it is not intended to warn motorists of the presence of bicyclists. For the benefit of motorists, bikeway pavement markings should be as large as the bikeway width will permit, and made of as few letters as possible. Therefore, "Bike Only" as shown in Figures 25 and 30 is recommended. The decision, which word to place on top, is determined by how elongated the letters are, which in turn is decided by the width available and the expected speed of automobile traffic.

In most situations, the use of symbolic pavement stencils is recommended to supplement posted signs. This is particularly true on upgrades where the cyclist, preoccupied with his pedaling efforts, will tend to be looking more toward the ground than to the side of the bikeway. Also, pavement stencils are useful at locations where pedestrians are likely to attempt to use or cross the bikeway, such as at intersections.

It is recommended that stencils be used only as a supplement to posted signing on Class I bikeways where only bicyclists will need to read it. For Class II bikeways, the largest possible "BIKEWAY" marking is recommended. recommended.

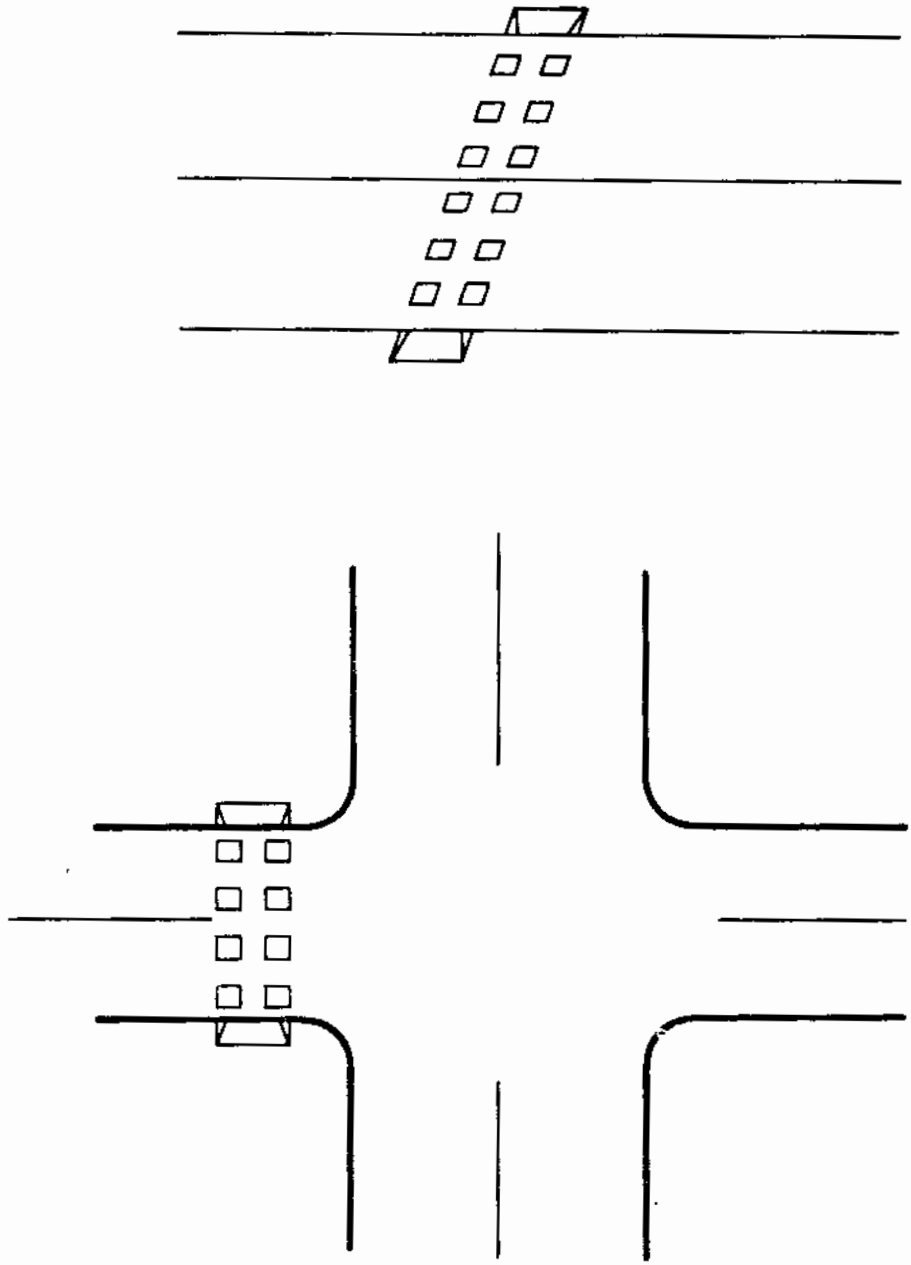
Lettered pavement stencils "BIKE ONLY" may be used to discourage motorists from entering bikeways where motorists might not be aware of the bikeway. When painted on a Class II bikeway surface at the far side of an intersection, "Bike Only" reinforces the "Bike Route" sign. The message conveys the fact that not only are bikes to be expected along the bikeway route, but that they are the only through traffic allowed on the bike right-of-way.

The "Bike Only" stencils consist of the words "Bike" and "Only" spelled out in 4 foot high reflectorized and elongated white letters, separated by a 6-foot space; a 7-foot long by 3-foot wide arrow specifying the direction of travel may be added. The length of the complete marking totals approximately 31 feet, and its width is approximately 6 feet. In order to be utilized on

Class II bikeways narrower than 6 feet, the stencils would have to be reduced in size, thereby detracting from their impact and visibility to the motorist. However, even in this case the "Bike Only" designation is highly recommended at intersections.

Other markings that can be used include "STOP," "YIELD AHEAD," "YIELD," "PED XING," "SLOW," and turn arrows.

FIGURE 26: Illustrates that painted bikeway crossing squares should be designed in pairs paralleling the direction of motor vehicle traffic.



Institute of Transportation and Traffic Engineering, School of Engineering and Applied Sciences, U.C.L.A., Bikeway Planning Criteria and Guidelines, State of California, Division of Highways, April 1972, p. 99.

FIGURE 27: Figure 27 illustrates a method of marking bikeway crossings where the bikeway crosses the road at curb cuts.

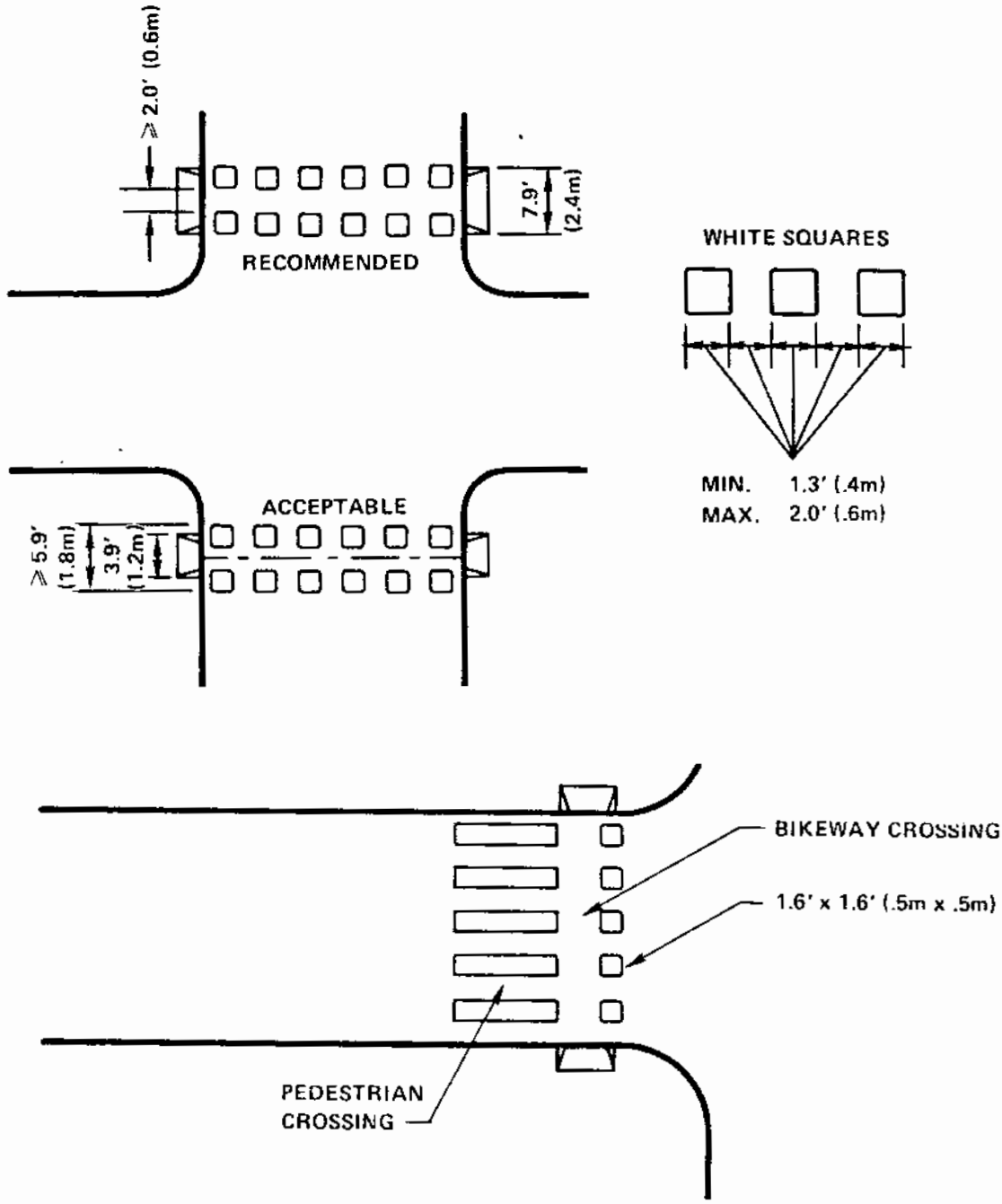


FIGURE 28: Figure 28 illustrates a pedestrian and bikeway crossing demarcated by elongated rectangular surface painted markings and blocks.

Ibid., pp. 97-98.

Figures 33 and 34 detail the stenciled signing for on-street alternatives. Dimensions for developing these designs must reflect the specific conditions at a particular intersection. The general rule in developing pavement marking designs is the larger the better. In that pavement marking stenciling is not a physical means of preventing cyclist-motor vehicle accidents; it should be designed for maximum psychological effect. Therefore, the visual impact of this type of barrier should be carefully considered in developing particular designs.

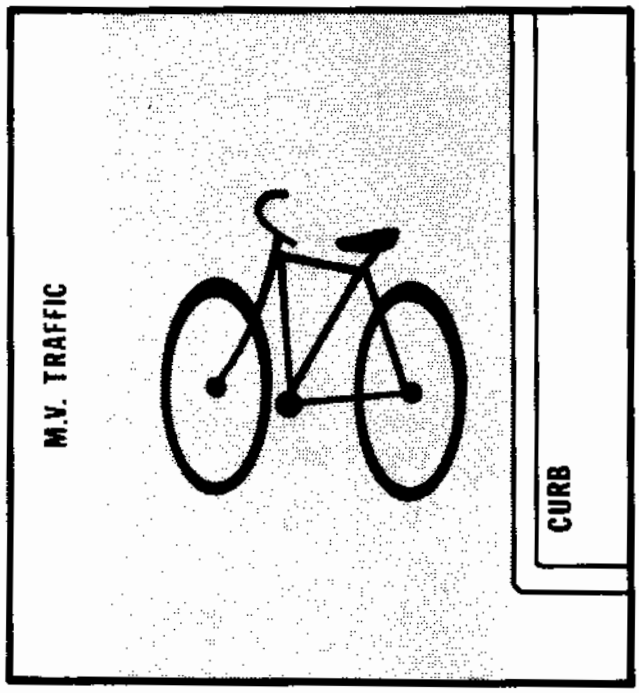


FIGURE 29

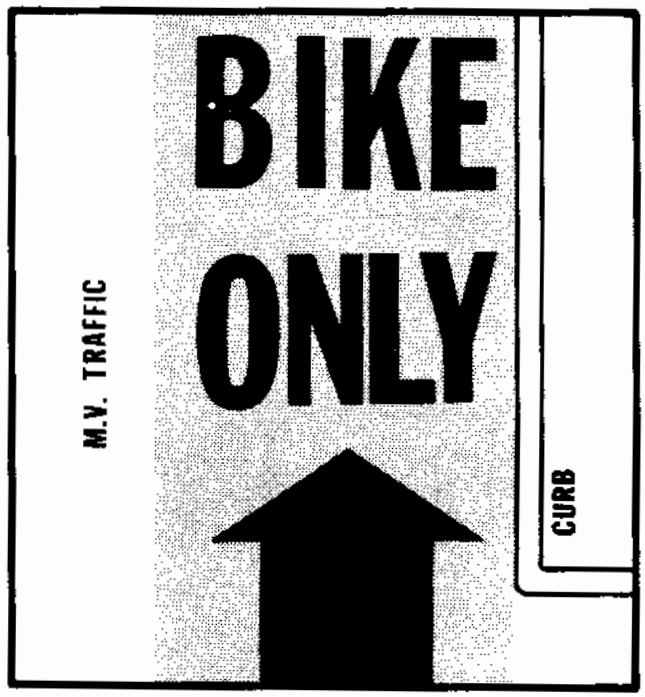


FIGURE 30

PHYSICAL BARRIERS

Recommended Physical and Symbolic Barriers for On-Street Bikeways:

The degree of safety from cycle/car conflicts provided by a bikeway is a function of the type of barrier employed at the interfaces between the bikeway and the adjacent rights-of-way. Barriers at the interfaces can range from symbolic (e.g., striping) to physical (e.g., berms, median barriers, islands fences). Symbolic barriers may be used to indicate to cyclists, drivers and pedestrians their separate rights-of-way.

Figure 31 shows the placement and dimensions of a typical 3"-5" striping design for delineating three specific bikeway designs.

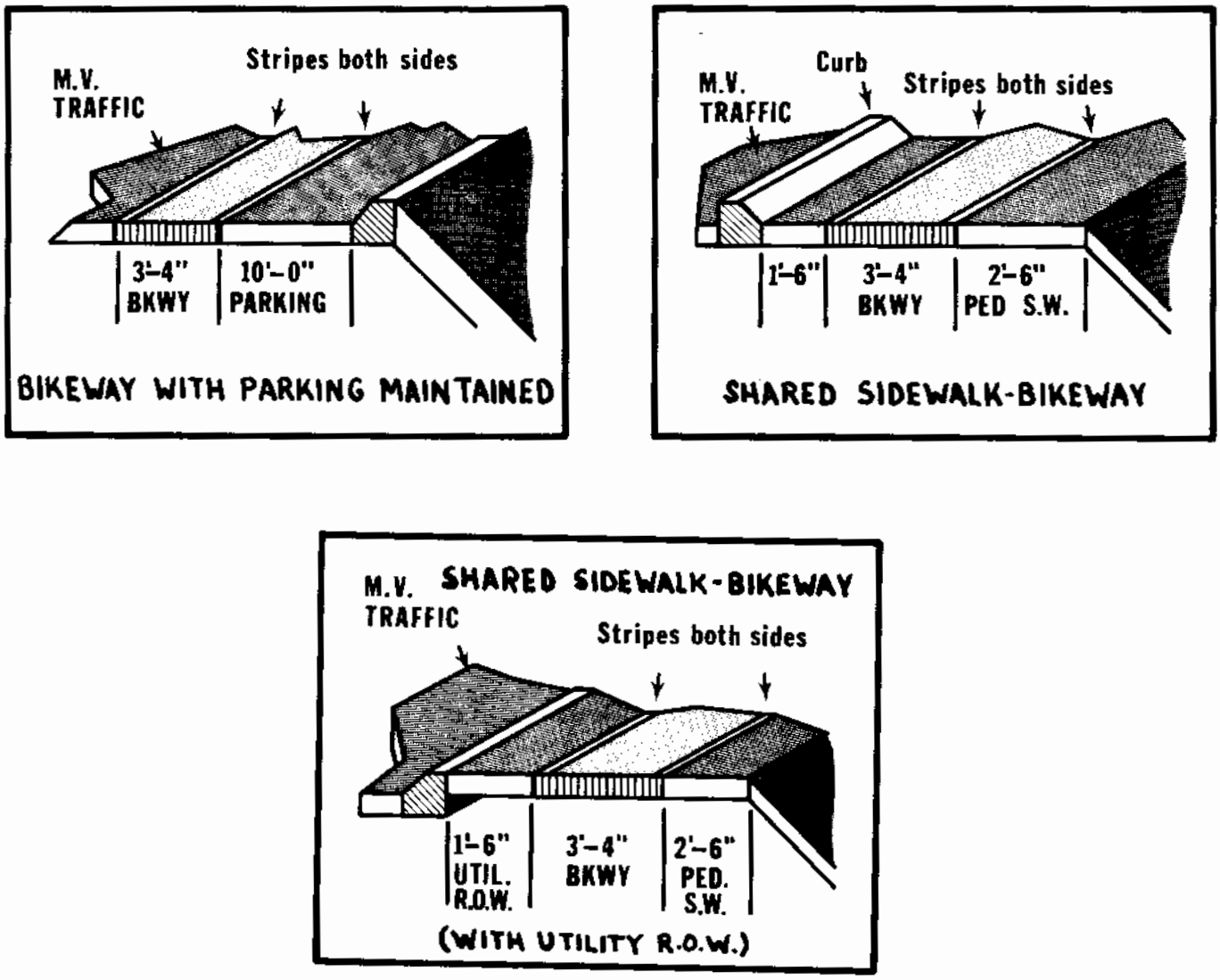


FIGURE 31: STRIPING LAYOUTS FOR BIKEWAY DESIGN

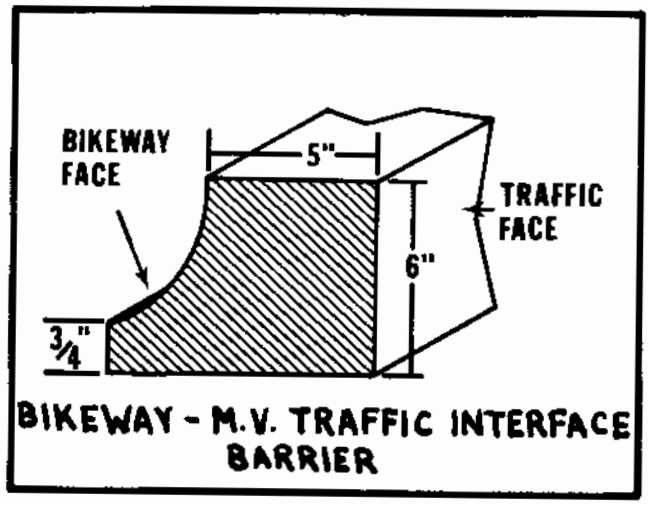


FIGURE 32

Figure 32 shows a physical barrier design suitable for use in developing Class II - Protected On-Street Bikeways. This barrier's dimensions are considered the minimum necessary to prevent intentional or accidental encroachment on a restricted bikeway.

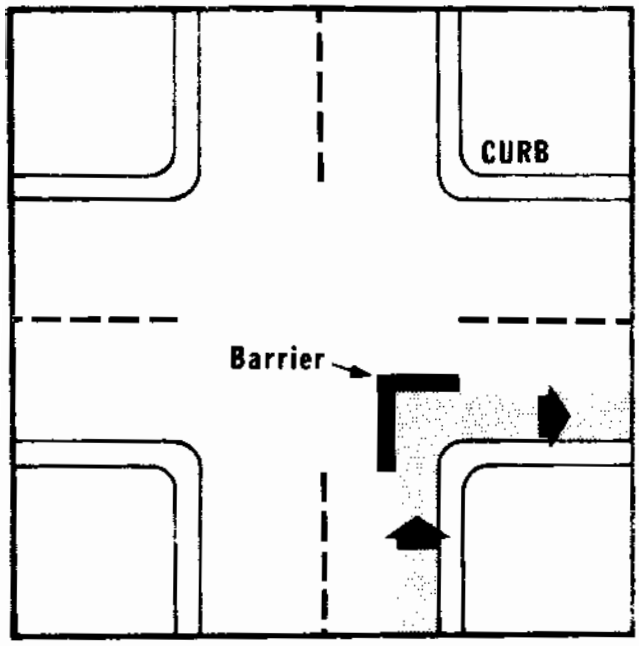


FIGURE 33

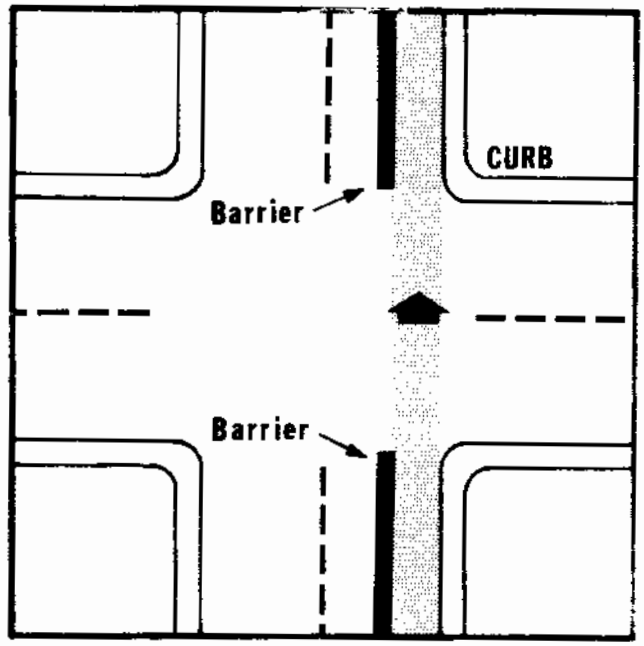


FIGURE 34

Figures 33 and 34 detail two distinct uses of physical barriers to positively separate bicycles from motor vehicle traffic. Figure 33 shows the use of a traffic interface barrier to protect bicyclists' turning right from right turning motor vehicle traffic. Figure 34 discloses the use of an interface barrier to protect a bikeway approaching and leaving an intersection going straight through.

There are a number of factors to be considered regarding the types of surfaces, bases and subbase best suited for bikeways. Considerations must be given to safety, cost of construction, ease of maintenance, and appearance. 18/

The underlying criterion for all bikeway structural sections is that they must be capable of supporting both the wheel loadings posed by bicycles as well as maintenance vehicles that may be required to traverse the bikeway if the bikeway cannot be serviced from the roadway. The loadings resulting from the bicycle-rider combination are delivered over relatively small tire contact areas. Although this loading should be considered a factor in the structural section design, it is generally not the controlling factor. The following discussion is directed primarily at the types of trail designs that will suffice for use in various sections of the U.S.

A. Bikeway Structural Bases and Subbases

Proper preparation of the base and subbase is central to the construction of bikeway structural sections. Careful planning and construction of bases is necessary so that the surface of the bikeway will not rapidly deteriorate and become unusable. Subbase is initiated by removing all top soil and obstructions in the direct path of the construction. The subbase must then be compacted and, if necessary, stabilized by the addition of materials such as crushed stone. Specific local conditions will require analysis by qualified engineers.

When fully stabilized, the subbase is then ready for the addition of the base course which supports the loads posed by the bicycle travelling on the surface of the bikeway. In most situations, the base course will consist of graded aggregate, crushed stone, or the equivalent. Under some specialized local circumstances, the base course may be constructed of soil cement, soil asphalt or alternative materials.

B. Bikeway Surfaces

Bikeway surfaces are varied and the choice of a specific surface should be keyed to local circumstances. Alternative surfacing materials include the following:

1. Stabilized earth: In the case where stabilized earth is chosen, it is vital to remove all top soil and provide a minimum 4" graded aggregate base on a previously excavated 4" soil subbase. Crushed rock can be substituted for aggregate if this material is more readily available. The subsoil and aggregate should be mixed and, if necessary, additional soil binders

18/ American Institute of Park Executives, Bike Trails and Facilities. Chicago. pp. 33-39.

added. When the surface has been mixed, it should be graded to make a center crown equal to approximately 1/2" per foot and fully compacted. At this point the surface is usable as a basic bikeway; however, it is desirable to seal the surface with asphalt and chipped stone for waterproofing and stabilization.

2. Stone chip: In using stone chip, it is necessary to construct the subbase by removing all the top soil and then thoroughly compacting the subbase. A 5" layer of graded stone chip is then added to the compacted subbase and itself compacted to a depth of 3". When using stone chip surfaces, it is necessary to provide an edging strip to act as a physical barrier between the stone course and the soil shoulders. This will prevent the stone course from creeping laterally.

3. Soil cement: Soil cement is composed of a simple mixture of regular soil combined with measured amounts of portland cement and water and compacted to high density. Basic construction techniques for using soil cement in bikeway construction are as follows:

a. All top soil (that containing organic matter) should be removed and replaced with sandy-gravelly soil. The amount of cement which has to be mixed with a particular local soil composition must be determined experimentally. Too little cement will result in an unacceptable surface. For purposes of estimation, it is safe to assume that a 10% by volume of the soil cement will be required. A higher percent (up to 16%) will not have an adverse effect however.

b. The general construction techniques are as follows:

- Till and pulverize the soil.
- Spread cement over the soil and dry mix thoroughly.
- Incrementally add water and mix soil cement mixture with harrows or disc blade equipment.
- Compact the mixture and finish grade to crown and make a final compaction.
- Cover with a protective cover of moist straw or dirt and allow soil cement to cure to strength for a period of 7 days.

c. Surfacing soil cement is necessary. Soil cement is an excellent base for bikeways, but it must have a seal coat surface in order to withstand wear and reduce the effects of moisture. Because soil cement is composed of soil fragments bonded by the cement, water will penetrate the bond after a period of time and it will deteriorate. Further, surface abrasion will cause exposed soil particles to deteriorate; therefore, surfacing is mandatory.

The most cost effective surfacing for soil cement bikeways is bituminous seal coat mixed with stone chips. However, a more durable coating may be provided by using an asphalt concrete wearing surface on the soil cement base. This can be done by laying down a coat of bituminous material on the soil cement base and subsequently spreading, finish grading and compacting a 1" (minimum) layer of high density asphaltic concrete. In that the soil cement approach is not widely used in other types of construction, local contractors may not be fully familiar with its characteristics. This may pose problems for both obtaining accurate construction cost estimates (discussed in the following section) and for assuring quality control in construction supervision.

4. Asphalt cement: Asphalt cements are strong, adhesive, waterproof and provide highly durable surfaces for bikeways. Asphalt cements are locally available in variety of grade of hardness and consistency, as well as curing times.

5. Hot mix asphalt concrete: This is one of the most commonly used paving materials suitable for bikeway use. It is normally composed of screened aggregate and crushed stone mixed with hot asphalt. It is a widely available commercial material which is transported to the construction site while in a heated and workable mix. When compacted and cooled, it immediately provides a highly durable, smooth cycling surface.

Construction procedures and techniques for asphaltic-concrete bikeways will vary significantly from region to region in the U.S. However, for bicycle paths, asphalt concrete is normally specified at 1-1/2" - 2" thickness on a 4" aggregate base. In situations where an aggregate base is not used, the asphalt concrete section depths should be increased to a minimum of 3"-6".

6. Soil asphalt: Soil asphalt is a semi-rigid durable bikeway base material composed of a soil-asphalt binder mix. A subbase is established by regular scarification and compaction procedures. Pulverized soil is then mixed with liquid asphalt at the rate 3-6% of the total volume of the soil required. The soil asphalt is then final graded. Prior to compaction, the soil asphalt mixture should be allowed to cure for a sufficient period adequate for a minimum of 50% of the solvents in the liquid asphalt to evaporate. After compaction, the mixture should be allowed to further cure consistent with the type of liquid asphalt used. Soil asphalt, although it is an excellent base material for bikeway construction, is still a mixture of soil particles which will degrade unless a cover or seal coat is put on the surface to prevent moisture from penetrating. A bituminous seal coat combined with stone chips will provide a fully serviceable surface.

7. Concrete: Concrete, as a construction material for surfacing bikeways, has a number of significant advantages. Concrete is an extremely durable material and relatively maintenance free. Concrete, however, unlike

the other types of construction materials discussed here, is a rigid material requiring the construction of a high-quality base. Without an adequate base, concrete can be expected to crack, as any shifting in the pliable subbase will be directly transmitted to the concrete structural section.

In constructing concrete structural sections for bikeways, specifications applied in constructing local concrete sidewalks are transferable. The general construction procedure is as follows:

a. A high quality subbase must be prepared and compacted.

b. A 6" aggregate base must be placed on the subbase.

c. The concrete slab is then poured in place. The thickness of the slab will be dependent on existing local soil conditions and the type of foundation base and subbase. Under most circumstances, a slab of approximately 4" thickness will provide sufficient cross sectional and linear structural strength.

d. The poured ribbon slab will require the inclusion of expansion joints at regular intervals to allow for thermal expansion and contraction.

e. Form work will necessarily be required to permit leveling and sloping for proper drainage.

f. The concrete slab will require surface finishing to provide appropriate friction contact for bicycle tires. A stiff-bristled broom can be used to score the surface of the slab after it has been poured and leveled.

8. Wood-based bikeway: Wood sections are a usable base material for bikeways in areas where soil shifting is a problem. For example, bikeways in beach and shore areas may be obscured by shifting sand. In these types of situations a wooden base can be laid directly on the surface of the sand. One approach that has been successfully used is as follows:

Place 2" x 6"s or 2" x 8"s, which have been preservative treated for rot prevention, side by side and interconnect by steel cables and spacers underneath. This approach can be constructed in modular pieces and interconnected on site. An advantage of this approach is that the bikeway can be shifted as needed to compensate for the shifting of the sand subbase.

One important consideration in utilizing wood subbase for bikeways is that it is necessary to provide a high friction coating on the top surface of the planks. This is necessitated by the fact that the untreated wood surfaces will become dangerously slippery for bicycle use when wet. However, this problem can be easily overcome by the application of any one of a number of readily available high friction surface coatings specifically used for this purpose.

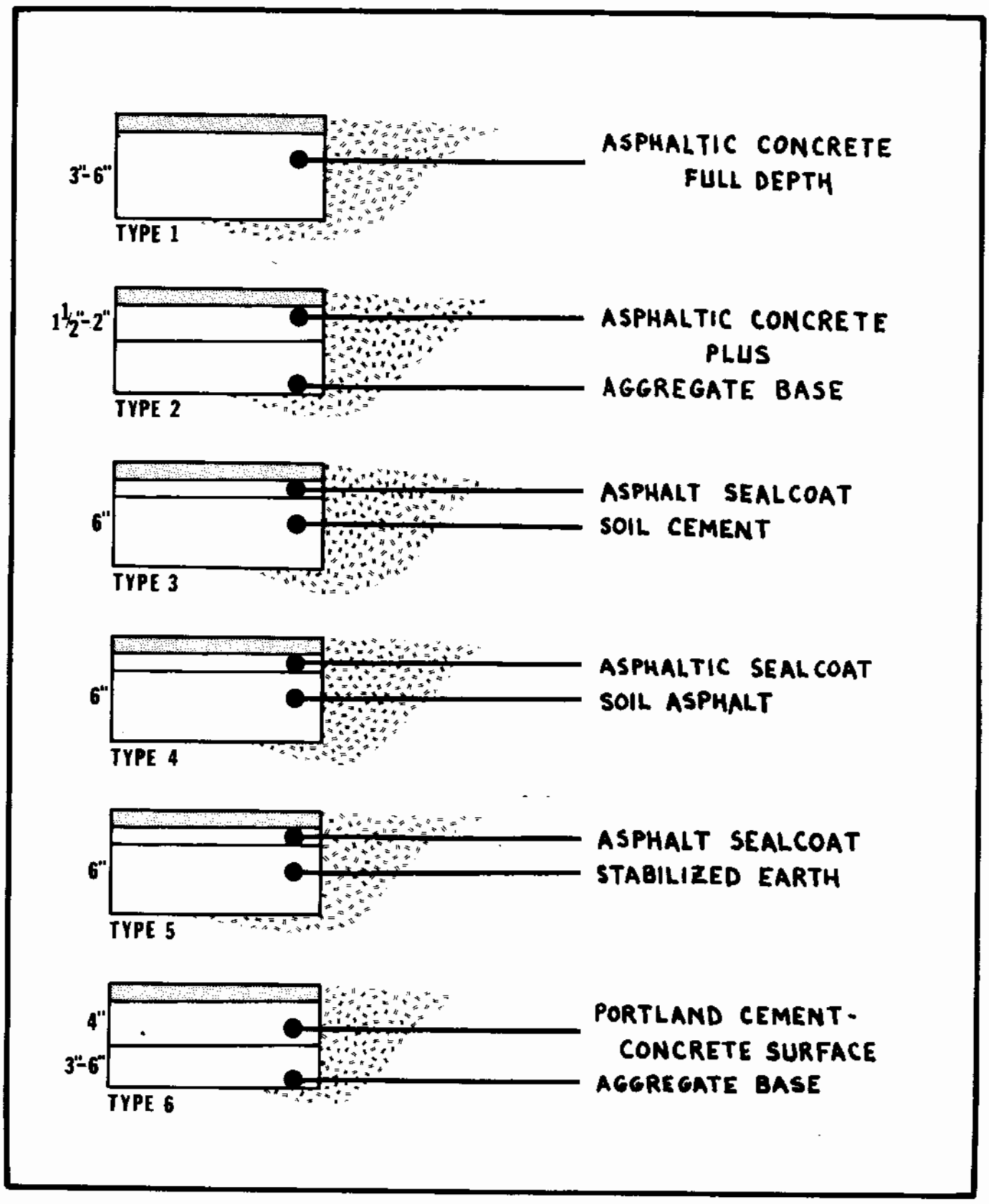


FIGURE 35: TYPICAL BIKEWAY STRUCTURAL SECTIONS

BIKEWAY IMPLEMENTATION

In this section of the manual, guidelines are presented for assisting in the implementation of bikeway systems. Guidelines are included for the following areas:

1. The Relative Cost of Developing Alternative Bikeway Systems

2. Identification of Funding Sources

3. Legal Considerations in Developing Local Bikeway Systems

4. Guidelines for Bicycle Interface with Other Modes of Transportation

5. Bicycle Parking Facilities and Theft Prevention

6. Maintenance

THE RELATIVE COSTS OF DEVELOPING ALTERNATIVE BIKEWAY SYSTEMS

The question of how much money it will be necessary to invest in bicycle facilities is complex. The cost of facilities varies considerably with Bike Routes and Bike Lanes costing far less than Exclusive Bikeways. Since facilities vary greatly in cost, these costs must be weighed against the estimated local benefits of increased safety, aesthetic and recreational enhancement of the community, and system continuity for commuter cyclists.

In beginning to assess the potential costs and benefits of developing a local bikeway system, a number of points should be kept in mind:

Considerable expenditure for bikeway facilities can be justified when safe system can be implemented in a local setting. This is particularly true with regard to commuter trip making. One way of quantifying the potential cost of a local system is to estimate the number of system-miles that would be desirable, and then to assess the potential costs of such a system for each of the bikeway classifications.

For purpose of illustrating this procedure the following table is provided for detailing a hypothetical situation in which the relative cost of the various classes are compared on a per mile basis.

TABLE B

HYPOTHETICAL COST ESTIMATES FOR BIKEWAY FACILITIES BY CLASS [19/]

In Thousands of Dollars per Mile of System Provided

Facility	Signing	Striping	Barrier	Base & Pavement	Total
Class I-Bikeway	.2	0	0	10.5	10.7
Class II-Bicycle Lane (protected)	.4	0	2.75	0	3.15
Class II-Bicycle Lane (unprotected)	.5	.5	0	0	1.0
Class III-Bike Route	.5	0	0	0	.5

19/ The Bicycle: A Recreational Mode of Transportation For The Atlanta Metropolitan Region, Barton-Aschman Associates, 1973.

A. Exclusive Bikeway Costs

The cost of new exclusive bikeways varies according to the topographical, soil and climatic characteristics of particular geographic areas. The following table indicates minimum estimated construction costs, exclusive of right-of-way, for providing a typical exclusive bikeway structural section consisting of a 2" thick asphalt concrete blanket over a 4" thick aggregate base.

TABLE C

ESTIMATED MINIMUM PER MILE CONSTRUCTION COSTS 20/
FOR PROVIDING EXCLUSIVE BIKEWAYS

Item	Unit Cost	Bikeway Width 2 Lanes 8 ft.	3 lanes 12 ft.	4 lanes 16 ft.
2" Asphalt Concrete Surface	$8.00/Ton	$0.82/LF*	$1.23/LF	$1.64/LF
4" Aggregate Base	$4.00/CY**	$0.39/LF	$0.59/LF	$0.78/LF
Excavation	$2.00/CY	$0.30/LF	$0.45/LF	$0.60/LF
Subtotal		$1.51/LF	$2.27/LF	$3.02/LF
10% Contingencies		$0.15/LF	$0.23/LF	$0.30/LF
TOTAL		$1.66/LF	$2.50/LF	$3.32/LF
Minimum Cost Per Mile		$8,800	$13,200	$17,600

*LF = Linear Feet
**CY = Cubic Yard

Additional features that might be necessary for a Class I bikeway are:

1. Drainage

This varies considerably from place to place and depends greatly on soil, topographical, climatic and bikeway cross-sectional characteristics.

a. Graded Ditch (ditch excavation)

1' Wide Vee ditch, 2 to 1 side slopes $ 2.50/Cubic yard
or $ 0.06/Linear foot

b. Cross Drains

6" Asbestos - cement drain pipe $ 6.00/Linear foot

20/ Cost estimates were supplied by Richard H. Kermode, District Design Coordinator, Design B, State of California, Division of Highways, District 7, Los Angeles.

c. Modify existing catch basin grates (welded cross bars to prevent bicycle wheels from dropping in) — $10.00 each

2. Grading, excavation and embankment

Table II assumes a 6" excavation with no fill or borrow, on flat terrain. This item cost will vary extensively depending on the topography and location. Embankment material or imported fill may be required.

a.	Roadway excavation	$ 2.00/Cubic yard
b.	Imported fill	$ 2.00/Cubic yard

3. Barriers, fences and curbs

a.	Concrete median barrier	$12.00/Linear foot
b.	Single metal beam barrier	$ 8.00/Linear foot
c.	Cable barrier (with mesh)	$ 3.50/Linear foot
d.	Cable barrier (without mesh)	$ 3.00/Linear foot
e.	72" Chain link fence	$ 2.50/Linear foot
f.	48" Chain link fence	$ 2.00/Linear foot

4. Signs, stenciled messages and striping

Signs:

a.	Regulatory signs 3' x 3' enamel painted sign mounted on wooden post	$25.00 each
b.	Bikeway sign enamel painted mounted on wooden post	$15.00 each

Striping:

a.	Single 3" solid white or green line (paint)	$ 500/Mile
b.	Single 3" solid white or green line (thermoplastic)	$2000/Mile
c.	Single 4" dashed white lane line (paint)	$ 500/Mile
d.	Single 4" dashed white lane line (thermoplastic)	$2000/Mile

e.	Double 4" solid yellow center line (paint)	$ 700/Mile
f.	Double 4" solid yellow center line (thermoplastic)	$2800/Mile
g.	Cross walk stripe (12" white thermoplastic)	$ 1.00/Linear foot
h.	Remove traffic stripe (paint)	$ 0.20/Linear foot
i.	Remove traffic stripe (thermoplastic)	$ 0.50/Linear foot

Pavement Markings - Stencil:

a.	Pavement markings (paint)	$ 0.50/SF
b.	Pavement markings (thermoplastic)	$ 2.00/SF
c.	Remove pavement markings (paint)	$ 0.60/SF
d.	Remove pavement markings (thermoplastic)	$ 1.50/SF

5. Lighting

If night time use of the bikeway is anticipated, adequate lighting facilities should be provided. Light Standard and conduit: $1,000/unit. Utilization of existing street lighting facilities may reduce this item cost.

6. Bridges and retaining walls

Overcrossings, undercrossings, and retaining walls may be necessary along portions of the bikeway route.

a.	Pedestrian Overcrossing, including ramps 8' width, max. 100' span		$ 280/Linear foot
b.	Pedestrian Undercrossing, min. 18' wide x 14' high required for freeways. Cost does not include traffic detour.		$1250/Linear foot
c.	Cantilevered bikeway attached to existing bridge. 10' width including wire mesh railing.		$ 155/Linear foot
d.	Retaining walls:	4' height	$ 25/Linear foot
		6' height	$ 35/Linear foot
		8' height	$ 50/Linear foot

7. Signal modifications

Signal modifications may be required to interface an exclusive bikeway with the existing street system.

Modify signal heads and controllers	$10,000/Intersection

8. Land acquisition costs

Where the proposed exclusive bikeway right-of-way is not in public ownership, the cost of acquiring land may be the most significant cost item. The square foot value of right-of-way needed is only one element of the total cost of acquiring right-of-way. Severance damages, value of improvements, and the necessity to often acquire more land than actually needed, are substantial items that must also be taken into account. If the acquisitions necessitate any purchasing of occupied improvements, relocation costs will be additionally incurred. Provision of exclusive bikeways where new right-of-way must be acquired will involve large expenditures.

B. Restricted Bikeway Costs

Table D provides cost estimate guideline figures for providing Class II - On-Street Bikeways.

TABLE D

ESTIMATED MINIMUM COST PER BLOCK FOR PROVIDING [21]
CLASS II ON-STREET BIKEWAY - ONE SIDE

	Item	Cost
1.	Signs 1 per block: 24" x 24" reflective	$ 7.50
2.	Sign Base Installation:	14.50/sign
3.	Paint 5" Striping:	0.40/Linear foot
4.	Intersection Striping: assuming 5-12" x 36" stripes	14.00/Intersection
5.	In-Street Stenciling: assuming 2 per block	14.00/Block
	Short Block (266') Total: assuming 266' stripes, two stenciled signs, two bikeway post signs, and 60' intersection striping	178.40/Block
	Long Block (600') Total: Assuming 600' stripe, two street messages, three bikeway post signs, and 60' intersection striping	320.00/Block

C. Sidewalk Bikeway Costs

Table E provides cost estimates for on-sidewalk alternatives.

TABLE E

ESTIMATED MINIMUM COST PER BLOCK FOR PROVIDING SIDEWALK BIKELANES [22/]

	Item	Cost
1.	Signs 2 per block Installation	$ 7.50/each 14.50/sign
2.	Striping and Stenciling stripe	14.00/Intersection
3.	Curb-Cuts assuming two per block and a 5"-0" sidewalk width	1000.00/Block
4.	Addition of 3'-0" to Sidewalk width on existing right-of-way	3.00/Linear foot
	Short Block (266') Total assuming two post signs and installation, one on-street stencil, two curb-cuts, and intersection cross striping	1050.00/Block
	Long Block (600') Total	1100.00/Block

22/ Bikeway Planning Criteria and Guidelines, Institute of Transportation and Traffic Engineering, University of California, Los Angeles, 1972.

IDENTIFICATION OF FUNDING SOURCES

This section identifies a number of assistance programs available for bikeway planning development and construction. Federal, state and private assistance programs are discussed, together with application procedures for each. Existing assistance programs are still evolving and certain programs discussed in this section are currently being revised. The future ramifications of these programs for bikeway planning are uncertain and officials must carefully research each particular project.

The Land and Water Conservation Fund

The Land and Water Conservation Fund, administered through the Bureau of Outdoor Recreation, Department of the Interior, has been a source of Federal monies for trails programs. Originally these funds were earmarked for open space and recreation land acquisition programs. In 1966 the Secretary of the Interior announced distribution of $367,000 from the Contingency Reserve of the Land and Water Conservation Fund to twelve urban areas for trail development. Of those municipalities receiving grants, several invested their funds in bike trail development. Chicago's allocation of $10,667 was used towards the rehabilitation of over a mile of dilapidated trail along Lake Michigan. Milwaukee received $25,820 which helped fund construction of over four miles of scenic bike paths.

In 1968, Federal interest in recreational trail development culminated in the passage of Public Law 90-543, the National Trails Act. Three categories of trails were designated under the Act: National Scenic Trails, National Recreation Trails and Connecting or Side Trails. Of these, the latter two are of interest for bikeway development programs.

National Recreation Trails have an urban orientation and provide for such activities as hiking, snowmobiling, trail biking and horseback riding in addition to bicycling. These trails are established and administered by the Secretaries of the Interior and of Agriculture. The Illinois Prairie Path, a 31 mile trail following an abandoned railroad right-of-way in DuPage County, Illinois, was recently declared a National Recreation Trail.

Connecting or Side Trails may feed or interconnect major elements in the trail system.

Trail development and construction under the provisions of the National Trails Act is financed from the Land and Water Conservation Fund. Grants may be awarded to States, cities, counties or park districts. Private organizations or individuals are not eligible to receive funds. Trails must be open to the general public. Priority is given to projects for urban areas, with proposals of a basic nature more favorably received than those for complex facilities. Funds may not be used for maintenance.

The Land and Water Conservation Fund Act provides that not more than 50% of the project cost may be federally funded. Under certain conditions, all or part of the project sponsor's matching share may be taken from certain other Federal assistance programs, such as those which created Model Cities or the Appalachian Regional Commission. Two-fifths of the available funds are apportioned equally and three-fifths on the basis of need.

These grants funded approximately 9,000 projects by the beginning of fiscal year 1973. Approximately 53% of the monies obligated was for the use of State agencies, 12% for counties and 35% for cities; however, most of the county and several of the State grants were spent in urban areas. Available levels of funding are indicated by the fact that grants awarded in fiscal year 1972 totaled $192,007,000, and appropriations for 1973 are estimated at $220,000,000.

Grant applications must be directed through the State agency charged by the governor with administration of the State's Land and Water Conservation Fund Program, usually the State agency concerned with Outdoor Recreation. The governor appoints a State Liaison Officer to process applications and administer state programs. The Liaison Officer determines whether a proposal is in conformance with the State Comprehensive Outdoor Recreation Plan, especially in its designation of high priority recreation sites or programs. He aids the local agency in the complexities of the application process.

A detailed discussion of application procedures can be obtained from the Outdoor Recreation Grants-in-Aid Manual, Superintendent of Documents, Government Printing Office, Washington, D. C. 20402, at a cost of $8.50. The following is a discussion of application procedures generally for Federal funds. With a few individual variations, this process is repeated when applying for any grant.

Three documents and two (or three) agencies are involved in the application process. Sample copies of the application documents are included in this section of the manual. The Letter of Intent is a notification of application with a brief project description. The standard application forms furnished by most Federal agencies and required by Office of Management and Budget Circular A-102 must be used. Finally, application forms prepared by the local A-95 clearinghouse agency must be completed. Normally the applicant will supply additional documentation as follows:

(1) A legal description of any property to be acquired or leased.

(2) A physical description of the property including waterways and flood plains, geological features and prominent flora.

(3) Existing man-made features, such as roads, bridges, structures.

(4) A map indicating proposed location of trails, service facilities, fencing, etc.

(5) A written description detailing the scope of the project and proposed facility improvements together with estimated costs and time schedules.

(6) An environmental impact statement, if required.

The agencies involved include the regional A-95 clearinghouse (if any), the state A-95 clearinghouse and, of course, the state bureau administering the funds.

The State Liaison Officer also reviews the application. If approval is recommended, the notification of Grant Award is made to the designated State Central Information Reception Area and to the local official. Should an application be refused, the applicant may appeal to the Secretary of the Interior.

Highway Trust Fund

A second major Federal funding source has been the Federal Highway Administration of the Department of Transportation, through the Highway Trust Fund. Funds are apportioned to the states for construction and improvement of roads on the Federal-aid highway system. They may also be used for appurtenant structures or for parallel development in conjunction with a Federal-aid Highway Project. Bicycle paths may be constructed in highway rights-of-way while the road is being constructed, or in the right-of-way of an existing highway being improved. Section 124 of the 1973 Federal-aid Highway Act permits the construction of bikeways and pedestrian walkways as separate projects (including those not located on the normal highway right-of-way) with an annual limitation of $2,000,000 of highway funds for each State. Federal funds match State funds on a 70-30 basis except for Interstate highway projects which are funded on a 90-10 basis. Requests for funding for specific projects should be directed to the State highway agencies.

HUD Programs

Two grant programs under Community Development, Department of Housing and Urban Development, may be applied to bikeways and other forms of recreation. Urban Renewal Project programs, designed to provide assistance for rehabilitation of slum areas, authorize land acquisition and construction of improvements including streets, sidewalks and recreational areas. Bikeway systems could be developed under these provisions. The application process is similar to that described earlier except the application forms are directed to state or local housing or renewal agency. Grants may range from $800,000 to $40,000,000 with 2/3 or 3/4 funding.

HUD also encourages and aids communities in acquiring permanent Open Space Land for growing urban recreational demands under its Open Space Land Programs. Roadways, signs and landscaping may come under the aegis

of this program. Application should be made to the state agency administering the program in the usual manner. Although bikeways are not specifically mentioned in the program description, nothing discourages their development. These are 50-50 grants and have ranged from $4,900 to $2,500,000. This program, as of the writing of this report, is inactive.

Funding for bikeway system planning may be sought through the HUD Comprehensive Planning Assistance Fund ("701"), especially if sought as part of a city or county wide comprehensive planning effort.

Local governments may choose to expend general revenue sharing funds on the acquisition or development of bikeway rights-of-way.

Appalachian Regional Development Act

Finally, for those states covered by the Appalachian Regional Development Act of 1965, various recreation grants are available. Eligible states include Alabama, Georgia, Kentucky, Maryland, Mississippi, New York, North Carolina, Ohio, Pennsylvania, South Carolina, Tennessee, Virginia and West Virginia.

State Assistance

State assistance is more difficult to describe due to variances in funding procedures. There are three basic types of assistance, but it is doubtful that all three are available in a single state.

First, several states offer grants-in-aid programs through State Land and Water Conservation Funds. Such funds may exist separately from the state share of the Federal funds or may be offered together with Federal assistance. Some states, i.e., Michigan, Minnesota and Wisconsin have dual grants-in-aid programs. Awards may be provided either independently or to supplement other programs. In states with large wilderness areas, such as Idaho, Washington and Montana, funds for wilderness conservation may be divertable to bike trails under certain circumstances. Many states also provide planning and technical assistance to municipalities. Outdoor recreation grants-in-aid together with technical assistance services can aid local bikeway planning. Usually services involve liaison and time expenditure, but not monetary grants. Additional aid may be available through state university extension services.

The State of Oregon has a strong commitment to the bicycle, both as transportation and as recreation. In May 1971 the Oregon Legislature passed House Bill 1700 which requires the expenditure of 1% of the State Highway Fund monies for the establishment, construction, redevelopment and maintenance of trails, whether for hiking or bicycling. Such paths are restricted to non-motorized vehicular or pedestrian use. Similar bills to fund bike systems have passed, or are pending, in several states including California, Colorado, Iowa, Illinois, Massachusetts, Maryland, New York

and Ohio. Other states are experimenting with new funding approaches. Diverting up to 1% of state motor fuel tax funds has been proposed in Washington, as well as Illinois.

Local Funding Sources

Local funding sources, such as the general obligation bond are available to park districts or municipal governments, subject to the approval of the taxpayer. Monetary assistance may also be available from local service groups through donations, fund raising activities and equipment purchases. These sources are often helpful in providing the necessary matching funds for state or Federal programs.

Land Donation

Landowners may donate or lease easement rights on their properties for bicycle trails in order to see their land that surrounding it retain a desired character. Up to 30% of adjusted gross income of a gift of land may be deducted for Federal Income Tax purposes. Rutherford Platt has explained the process as follows:

> "In the case of land whose value has appreciated greatly in the hands of the donor, the net after-tax cost of a donation (as compared with a sale) may be surprisingly low for the high tax bracket taxpayer...the deduction for a donation of land is measured by its value at the date of the gift rather than at original price. If the land is sold, a tax must be paid on 'appreciation', the difference between the actual acquisition cost and the sale price, which even at long-term capital gains rates runs as high as 25%. The savings of taxes due to deducting the appreciated value as a donation may actually exceed the net proceeds of a sale remaining after payment of the capital gains tax." 23/

The example cited by Platt is as follows:

Adjusted gross income - $40,000

Original cost of land gift - $12,000

Current fair market value of gift - $72,000

30% of adjusted gross income deducted year gift made - $12,000

Now paying tax on $28,000 instead of $40,000

Tax savings as follows:

Tax on $40,000	$14,400
Tax on $28,000	8,600
Tax saving 1st year -	5,800

23/ Platt, Rutherford H., Open Land in Urban Illinois, Northern Illinois University Press, 1970, pp. 58-59.

The $15,000 capital gain tax is eliminated and over the years of carrying the deduction, a $34,800 savings will result.

So the actual cost to the donor is $22,200 ($57,000 - $34,800), not $72,000. 24/ Thus, the local agency would receive what amounts to a $50,000 local grant.

A local agency can also purchase certain easement rights, including railroad beds or flood plain land along streams. Long-term leases are feasible for some open space programs, but development of trails requires a capital expenditure which may be incompatible with a leasehold arrangement. Permanent leases on utility rights-of-way at low rates are more practical.

In summary, it can be said that a wide spectrum of financial assistance is available for bike system planning and implementation. The status of Federal and state funding programs are constantly changing both in scope and availability. Local bikeway planners should attempt to keep up with all developments.

24/ Platt, Rutherford H., Open Land in Urban Illinois, Northern Illinois University Press, 1970, pp. 58-59.

LEGAL CONSIDERATIONS IN DEVELOPING LOCAL BIKEWAY SYSTEMS

There are a number of important legal issues and considerations associated with development of a local bikeway system. Some of these include:

Conflicts with Existing Municipal Codes: It will not be uncommon for a community to have to revise and amend existing municipal codes and ordinances if legal obstacles exist to the development of a proposed bikeway system. In order to insure the prevention or resolution of potential legal problems it will be necessary that local ordinances be thoroughly researched to determine if the implementation of a proposed bikeway system is feasible within their intent. If, in the process of carrying out this research, it is clearly determined that existing ordinances are in conflict with a proposed plan, it will be necessary to develop legislative proposals to resolve the problem. These proposals should be developed by the local bikeway planning staff and submitted to the municipal attorneys office as recommendations.

Use of Road Surfaces: The legal right of bicyclists to use the public roads has been well established and should not be an issue. In instituting street bikelanes, however, there may be questions about the legality of excluding automobiles from a reserved bikelane. If such action is legal, enforcement policies will have to be determined, and the reciprocal situation of excluding bicycles from automobile lanes will have to be dealt with. In such a case, the conditions under which a bicyclist can legally leave a bikelane will have to be resolved.

The city of Davis, California, was the first to institute street bikelanes, and the California legislature passed special legislation allowing for variance with the Motor Vehicle Code. Street bikelanes are being used in many other cities without any apparent legal problems. However, it is recommended that officials proceed with the development of street bikelanes on the basis that they are for the convenience of motorist and bicyclist alike. Motorists and bicyclists would not be prohibited from using any portion of the roadway, but they would be expected to stay in their respective lanes as a safety measure.

The Right-of-Way of Bicyclists: "Who has the right-of-way on a marked bicycle path?" There are really two questions that need to be answered: (a) what are the right-of-way rights and obligations of bicyclists in general? and (b) does establishing an officially recognized and properly marked bicycle path change these relations?

The general rule is that a less maneuverable traveler has the right-of-way. Thus, pedestrians are generally viewed as having precedence over all other forms of travel. Just how this applies to bicycles and pedestrians, and bicycles and autos is not clear in view of the various criteria of mobility that might be used. The second question is further complicated by virtue of the different types of paths which may be established. The principal distinction between a bicycle pathway and sidewalk bikeway is the intended first use, whether for bicycles or pedestrians. This distinction can only serve to complicate the right-of-way problems. Certainly one reason for establishing bicycle paths should be to provide a place where bicyclists have a more clearly defined right-of-way.

Of all legal issues, the right-of-way problem should be given the highest priority. Quite likely a local ordinance or other legislation will be needed ultimately to settle this question.

Legal Requirements for Identification: The legal requirements for establishing the presence of a bicycle path will have to be set forth as soon as legal sanctions such as special use of a road surface or right-of-way privileges are assigned to officially designated bicycle paths. Minimum requirements for the identification of a path will be necessary, just as there now are specific requirements as to the minimum signing needed to establish restrictions on the use of roads and highways, e.g., "no parking". This issue will have to be resolved through a local ordinance or other legislation.

Drainage Gratings: Drainage gratings and streetcar tracks constitute a recognized hazard for bicyclists and represent a possible source of civil action. This potential liability may be reduced by the use of traffic control devices, signs or pavement markings, to warn and/or guide the cyclists around them. Only local law suit experiences and court rulings can provide the precedents for answering these questions. However, this potential legal problem should be thoroughly explored by communities contemplating on-street bikeway systems.

Sidewalk Bikeways: Sidewalk bikeways, in many communities are expressly prohibited by ordinance. Therefore the development of either restricted or shared facilities on the sidewalk will require specific local ordinances to either restrict cyclists to the bikeway if it is of the restricted type or define the obligations of the cyclist if it is of the shared type. It should be fully recognized that the passage and enforcement of laws and ordinances for all parties concerned is a necessity if the sidewalk bikeway is to meet both the requirements of the cyclist as well as those with whom he will interact. In general, the use of sidewalks as bikeways is not recommended as an alternative in developing local facilities for cycling. There are, however, situations in which sidewalks may be safely and effectively used, particularly in the less densely developed parts of an urban area.

GUIDELINES FOR BICYCLE INTERFACE WITH OTHER MODES OF TRANSPORTATION

Considerable overall improvements in a local bikeway system are possible through simple changes that will allow the bicycle to interface safely and conveniently with public transportation facilities. Guidelines are set forth below.

In many local situations minimal and inexpensive modifications to the local transport system will greatly extend the capabilities of the bicycle for short trips. By combining the bicycle with trains, buses and airplanes it can more fully serve as a basic element in the local transportation network and provide both rapid and effective local distribution at the origin and destination of longer trips.

The term "dual-mode" as used here refers to the use of a small, short range vehicle which is carried by a larger vehicle during long trips. Examples of this concept include bicycles carried on car racks and bicycles carried on buses. The bicycle is the only vehicle which is small and light enough to be carried efficiently on all larger vehicles. Therefore, it has substantial dual-mode possibilities, and this potential is already being realized in some communities. Berkeley, California, developed a system which allows people to take their bicycles on special public "bike-buses." Additionally, a number of airlines will carry bicycles at a slight charge and will provide special boxes for carrying bicycles. Railroads will carry bicycles when the trains have baggage cars. Large ships and ferries ususally accept bicycles as well and can be expected to develop better provisions for doing so if the nationwide trend toward cycling continues.

There are two basic methods by which local communities may enhance the use of bicycles and public transportation for both commuting and other trips. They are:

- "Park and Ride" - where bicycles are not taken on board public transportation vehicles.
- "Dual-mode" where the bicycle is actually carried on board the public transportation vehicle.

The Park and Ride approach is particularly desirable if the bicycle is not needed at the ultimate destination, and where high security bicycle parking facilities are made available at the origin of the transit trip. The Dual-Mode system, in which the rider and bicycle are carried together, allows the cyclist to ride directly to the public transport vehicle, load the bicycle on-board, ride to this destination, disembark and cycle to his final destination. This approach has not been fully developed. However, the following guidelines are offered:

a. In the case of level terrain, the bicycle-bus should have planned stops at intervals of no less than 3-5 miles. This takes into account the fact that a cyclist will not object to the relatively easy negotiation of a 1-2 mile post-bus trip. However, in areas where hills or long uphill grade are prevalent, it will be vital that stops be carefully designated. Further, bicycle-bus route selection should reflect, and complement established bikeway routes and trails. Bicycle-buses would be particularly useful where cycling would be dangerous, such as the heavily utilized intersection with a history of high accident rates, and expressways where the cyclist-motor vehicle speed differential is dangerously high.

b. Bicycle-buses should generally be express buses. The bicycle-bus concept is incompatible with those situations where the average speed of the bus is under 25 MPH. Since a cyclist can travel 15 or more miles per hour, there would be little incentive for riding the bicycle-bus if it were to be slower than the regular required cycling time. Often it may not be feasible for a bus to go over 25 MPH, but still there may be reasons for the use of a bike-bus, i.e, no place for bicycles to ride and very steep hills.

c. In planning the selection of bicycle-bus routes it is critical to include the input of local groups, including cyclist groups, planners, transit professionals and traffic engineers. In order to make a local system workable it will require the active participation of each of these groups.

BICYCLE PARKING FACILITIES AND THEFT PREVENTION

An important component of a bikeway system is the provision of parking facilities at appropriate locations, together with locking devices to prevent casual and professional theft.

With the exception of schools, playgrounds, and libraries, parking facilities for bicycles in large cities are almost non-existent. While the current practice of leaving bicycles unattended on sidewalks or chaining them to signposts may be adequate at the present level of bicycle use in many areas, a substantial increase in bicycle use will require better parking. Facilities can be provided by public agencies, service organizations and by the businesses and office buildings along the bikeway routes. Installation of bicycle racks may necessitate amendments to municipal bylaws and may, in the case of private firms or institutions, require permits from local agencies. New York City's Department of Traffic has encouraged installation of bike racks by private firms. Where numbers of potential parkers is great, consideration should be given to larger bicycle parking "lots". Such areas designated for parking of bicycles are feasible in public open spaces such as parks and plazas or other publicly owned land for which no specific land-use has been designated. However, usually several scattered areas located close to destinations will serve better than a large, centrally located lot.

Consideration should also be given to the installations of bicycle parking racks in public or private automobile parking lots and structures.

Estimates have been made that a minimum of fourteen bicycles can be stored in the area occupied by one automobile. Should parking garage and lot operators not want to substitute bicycle for auto parking space, many of the unused marginal spaces in lots and garages could be used for bicycles without affecting auto storage capacity or flow.

In planning for adequate bicycle parking, facilities should be developed for:

- All new commercial development along proposed bikeway routes
- All schools and civic buildings
- All churches, hospitals and other non-commercially zoned sites where large numbers of people gather
- All new office and industrial development along proposed routes
- All new remodeled apartment and townhouse developments

Theft prevention devices associated with bicycle storage facilities are of utmost importance, in view of the significant current rate of bicycle theft. Three primary methods can be provided to protect bicycles from theft. The first consists of a means of enclosing the bicycle in a cabinet, closet or other lockable space. A second method is to make the bicycle inoperable by weaving a chain (with lock) through the frame and wheels of the bicycle. The third method involves the provision of a means of locking the bicycle either to the ground, or to a large heavy rack so that the bicycle cannot be removed without breaking the chain or lock. Examples of this third method are the following:

- A concrete block with a pre-cast slot for the front wheel and an eyebolt cast into the block;
- A metal loop attached to a metal strip fixed to the ground;
- A chain in place of the loop.

The mechanical aspects of each of these devices insure that the bicycle cannot be removed without cutting the lock, eyebolt, loop, strip, or chain. In this sense all are equally effective - up to a point. All of the above styles provide a convenient anchor point and some support for the front wheel. The bike user must, however, carry his own case-hardened heavy duty lock. He also must risk the theft of his rear wheel and damage to his front wheel if his bike is pushed laterally or other bikes fall against it.

Another recently developed design consists of a strong metal post, approximately 4" in diameter and 3'-6" high against which the bike frame is leaned. Two heavy chains, one near the front wheel, the other near the rear wheel are securely embedded in the surface. Each chain is woven through the nearest wheel and through the frame and around the post to a common point where a lock, carried by the user, is placed through both chains.

In planning parking facilities, it is necessary to recognize that the standard pipe frame rack does not provide a level of security commensurate with the value of today's bicycles, the currently skyrocketing bicycle theft rate or the ready availability of bolt cutters. Consequently, the need for high-security, anti-theft bicycle parking is mandatory if a local bikeway is to receive favorable acceptance by the cyclist. In the category of high-security bicycle parking there are essentially two approaches to providing facilities with adequate security.

The first approach, as shown in Figure 36, is the utilization of fully enclosed bicycle lockers which provide a high level of protection against bicycle thieves. Although lockers are perhaps the most expensive facility for parking -- they can become revenue generators if leased on a monthly basis or, alternatively, they can be purchased commercially with a dime or quarter operated key-lock.

There are several commercially available parking units which protect the bicycle frame and wheels. Figure 37 shows the general configuration of these units. This equipment is also available in coin operated versions which can provide revenues to amortize their initial acquisition costs.

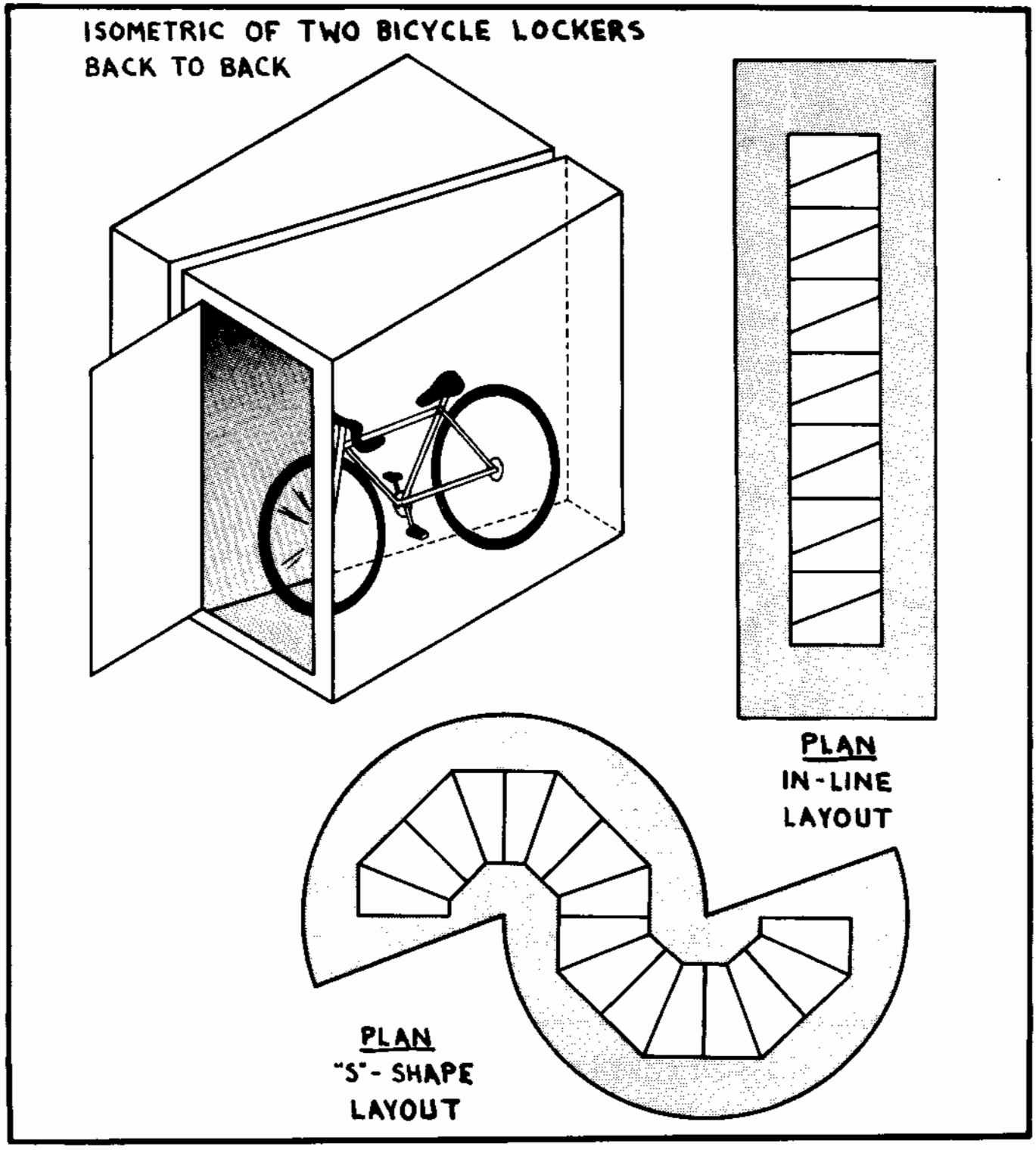


FIGURE 36: HIGH SECURITY BICYCLE PARKING LOCKERS

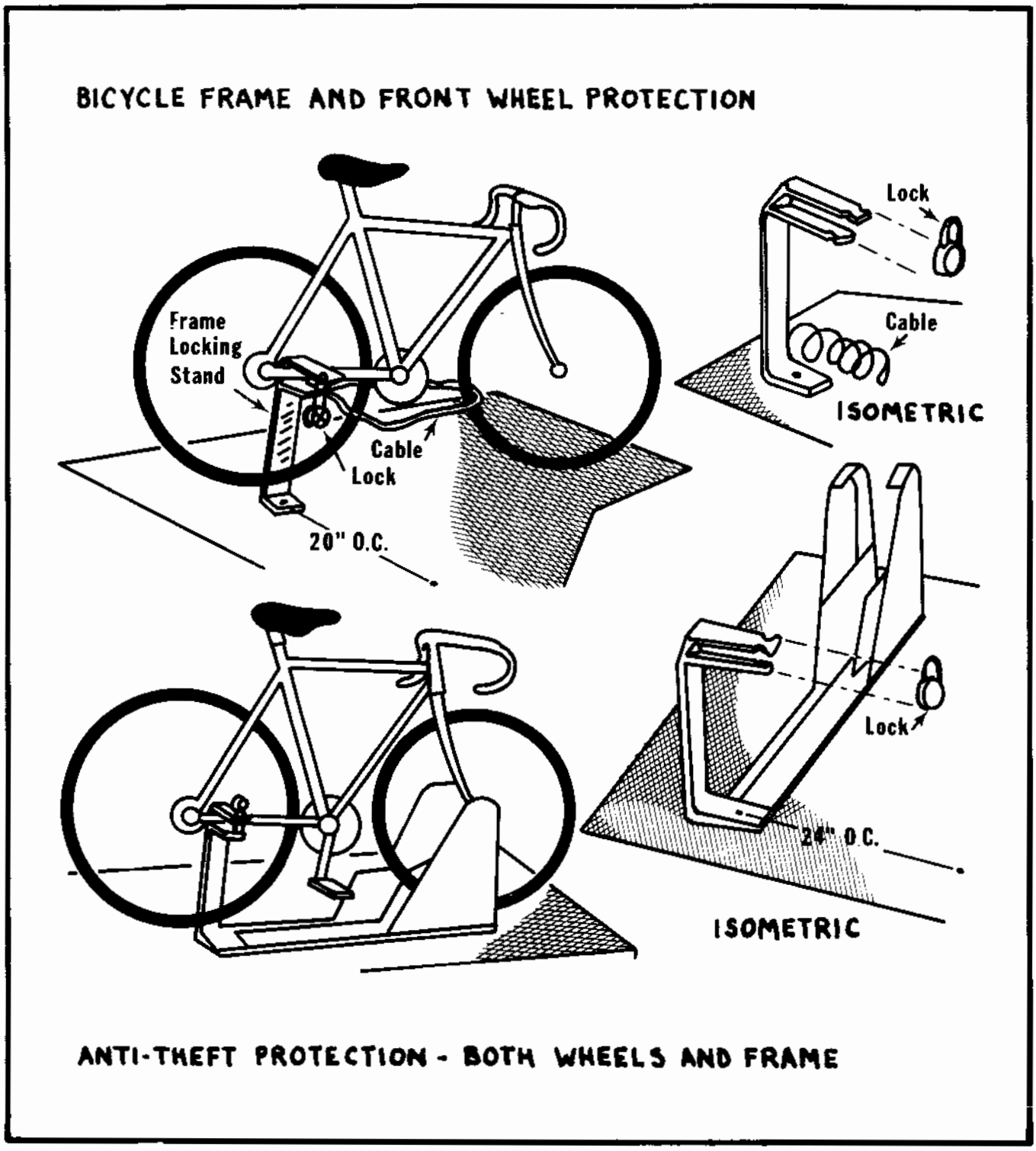


FIGURE 37: ANTI-THEFT BICYCLE PARKING UNITS

Proper maintenance is crucial to the successful operation and safety of a bikeway system. Proper maintenance can limit accident liability, prevent costly repairs and, serve as a focal point for community pride and civic responsibility.

Maintenance Agreements

In order to serve their purposes, bikeway systems require interagency agreements to assure acceptable and consistent maintenance. These agreements should be worked out during the planning phases. In cases where bikeways traverse more than one jurisdiction, the participation required of each jurisdiction should be defined before construction.

Maintenance Programs

The type of maintenance program developed depends upon the area in which the bikeway system is located. For example, an urban bikeway system often consists of a part of the existing street system. Maintenance of paved surfaces, demarcation stripes and directional signs can often be carried out using the same equipment and crews used in normal street maintenance. By contrast, rural bikeways, which are often exclusive systems, independent of motor vehicle roads may involve additional expense by requiring special crews and vehicles.

Timing

The timing of maintenance is important. Daily and weekly maintenance programs are suggested, where feasible in local urban bikeway systems. The cost factor involved in maintaining a large rural system at this level of maintenance would be prohibitive.

Maintenance Areas

Certain maintenance requirements are common to most bikeway systems. The extent to which these needs are satisfied can have an important influence on public use and support of a bikeway system.

A. Surface Maintenance

Compared with motor vehicles, bicycles are sensitive to road conditions. Therefore:

- Inspecting surface conditions should be a part of a weekly maintenance program.

TABLE F

ESTIMATED ANNUAL MAINTENANCE COSTS PER MILE
BY BIKEWAY TYPE

	Component	Estimated Cost	Remarks
CLASS I			
Exclusive Bikeway	Barriers	$ 528.00	5%/yr-20 yr life span (20%)
	Signs	46.20	15% vandalism
	Striping	30.00	Life span 2 yr.(50%)
	Stencils	50.00	Life span 2 yr.(50%)
	Sweeping	120.00	Operator & Equip. @ $10/hr.
	Litter cleanup	144.00	$3/hr for 4 hr/mo.
	Drainage & Shoulder Blading	240.00	Operator & Equipment @ $10/hr.
	Total without structural	$1,158.20	
CLASS II			
Shared Bikeway	Signs	360.00	20% depreciation 15% vandalism 10% other causes
	Striping	120.00	Life span 2 yr (50%)
	Stencils	120.00	Life span 2 yr (50%)
	Double yellow line	1,080.00	Life span 1 yr
	Barrier	878.00	35% accidents, vandals, etc.
	Total w/o barrier	$1,680.00	
	Total with barrier	$1,478.00	
CLASS III			
Bike Routes	Signs	90.00	20% depreciation 15% vandalism 10% other causes
	Striping	225.00	Life span 2 yr. (50%)
	Stencils	60.00	Life span 2 yr (50%)
	Total	$ 375.00	

Sources: Arizona Highway Department, City of Phoenix.

- The elimination of poor surface conditions such as "wash boards" and chuckholes should be continuous.

- The removal of broken glass, loose stones, nails, pieces of metal, etc., by sweeping is mandatory if the bikeway is to be safe and fully utilized by cyclists.

B. Construction Maintenance

Areas of new bikeway construction are particularly vulnerable to environmental damage.

- Construction site conditions should be inspected daily.

- In areas where protective vegetation has been removed, baled straw should be placed in runoff channels. This serves to trap eroding topsoil, yet allows passage of water.

- Soil piles should be protected from erosion by covering with plastic tarps and for baled straw at bases.

- Tree roots should be protected by fencing at a diameter corresponding to that of the branch spread. This is important if the tree is to survive the construction stage.

C. Obstructions

In order to allow passage of maintenance and emergency vehicles and to protect riders, certain safety considerations should be adhered to.

- Overhead branches should be cut back to provide a minimum of 7-10' clearance from paving to lowest branches.

- Edge vegetation should be a minimum of 2' from paving edge.

- Vegetation overhanging drainage ditches should be trimmed to allow a 1' clear space from ditch bottom to vegetation.

- Diseased and leaning trees should be removed.

- Fire access lanes, 20' wide, should be kept clear from all flammable structures to nearest motor vehicle road.

D. Drainage Systems

- Drainage ditches and culverts should be inspected weekly for rubbish.

- Storm sewer grates must offer both hydraulic efficiency and rider safety.

E. Signs and Path Demarcations

Signs and demarcation are crucial to rider safety, especially in areas where bikes and motor vehicles share road systems.

- Signs should be inspected for damage weekly and assigned a regular replacement and repainting schedule.

F. Fences and Guard Rails

- Fences and guard rails, where utilized, should be inspected weekly.

G. Rest Facilities

Since bicycling involves physical effort and occasional mechanical problems, rest and aid stops are imperative. These may require frequent maintenance.

- Rest/aid facilities should be inspected weekly.
- Garbage and litter should be collected at least weekly, more often if holidays incur heavy traffic.
- Sanitary facilities should be inspected weekly.

H. Litter Collection

The pleasure of bike riding lies in the opportunity for the perception of the natural world. Litter degrades that perception. In addition, trash such as broken glass presents an immediate hazard to bicycle tires. Therefore, removal of litter and garbage should be a priority item in any maintenance program.

- System inspection for litter buildup should be at least weekly.
- Litter collection should be routine.
- Garbage collection should be at least weekly at each receptacle.
- Local environmental groups might be enlisted to supplement goal efforts, if there is litter collection and periodic large scale removal of downed branches and accumulated rubbish.

I. Lighting

Bicycles are extremely vulnerable to collision damage and theft. Proper lighting maintenance is one of the few deterrents to these problems.

- Lighting fixtures should be inspected periodically.

J. Vandalism

Vandalism is difficult to control by maintenance practices alone. Damage potential is largely related to design; however, damage may be lessened by:

- Periodic inspection of all bikeway facilities
- Washable coatings on structures
- Careful lighting maintenance

K. Police and Rescue

Because of the potential for personal injury, vandalism and theft on bikeways, policing can be considered as a regular part of the maintenance program.

- In areas where necessary and feasible, police (on scooters or bicycles) could be used without causing distractions from the spirit of bicycling.
- Citizen bike clubs might be invited to form patrols much like ski patrol groups as a part of their regular use of a particular bikeway. These individuals might be prepared to render services such as first aid and reporting of maintenance needs, and as mentioned earlier, serve warnings to cyclists violating rules of the road.

L. On-Street Bikeways

A separate consideration is the maintenance of on-street bikeways.

- Street sweeping should be weekly
- Re-painting of lanes and signing should be periodic.

Summary and Recommendations

Maintenance of a public facility such as a bikeway system is normally administered by a governmental agency.

It is recommended that:

- Planning and design be oriented towards maximum potential users and that ease of maintenance and protection from vandalism be stressed.
- Maintenance agreements be executed between jurisdictional units before construction.
- Community education be undertaken to develop awareness of bikeways as a community asset whose maintenance serves the public interest, and
- User groups be encouraged to make inspections, remove litter and generally oversee the maintenance requirements of a bikeway system.

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Baerwald, John E., Ed., Traffic Engineering Handbook, Institute of Traffic Engineers, Edwards and Broughton Co., Raleigh, North Carolina, 1965, 770 pp.

Investing In Urban Bicycle Facilities: How Much? What Type? Where? Richard Podolske, Barton-Aschman Assoc., Inc., May 7, 1973.

Davis (California), City of, The Code of the City of Davis, Article IV, Section 4-3, 1713, June 20, 1967.

VI

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U.S. Department of Transportation. Federal Highway Administration.

Manual of Uniform Traffic Control Devices. 1971. 377 p., illus. U.S. Government Printing Office, Washington, D.C. 20402. Document No. TD 2. 8: T 67.

APPENDIX A

SAMPLE BIKEWAY FUNDING GRANT APPLICATIONS FORMS

LETTER OF INTENT

DATE LETTER OF INTENT IS SUBMITTED TO THE SUBSTATE CLEARING HOUSE

STATE APPLICATION IDENTIFIER 1-8	CARD TYPE 9	STATE OF ILLINOIS **LETTER OF INTENT** Page 1

10-11 1	APPLICANT PROJECT TITLE 12-71				
2	APPLICANT AGENCY 12-45		DIVISION 46-79		
3	APPLICANT ADDRESS (street) 12-45		CITY 46-60	COUNTY 61-75	ZIP CODE 76-80
4	CONTACT PERSON 12-45	AREA 46-48	PHONE 49-55	EXT 56-59	
5	line 1 12-71	PROJECT DESCRIPTION — NATURE, PURPOSE AND BENEFICIARIES (use 6 lines if needed)			
6	line 2 12-71				
7	line 3 12-71				
8	line 4 12-71				
9	line 5 12-71				
10	line 6 12-71				
11	PROJECT LOCATION CITY 12-45		PROJECT LOCATION COUNTY 46-79		

12	FEDERAL FUNDS		MATCHING FUNDS		OTHER FUNDS 44-51	TOTAL FUNDS 52-60
	GRANT 12-19	OTHER 20-27	STATE 28-35	LOCAL 36-43		

13	TYPE OF OTHER FEDERAL FUNDS 12-45	TYPE OF OTHER NON-FEDERAL FUNDS 46-79
14	FEDERAL PROGRAM TITLE 12-71	
15	FEDERAL AGENCY NAME 12-45	FEDERAL SUB-AGENCY 46-79

16	FEDERAL CATALOG NUMBER 12-31	ACTION DATE 32-37			STARTING DATE 38-43			ENDING DATE 44-49		
		MO.	DAY	YR.	MO.	DAY	YR.	MO.	DAY	YR.

17 TYPE OF APPLICANT: (check the single most applicable box)

STATE	INTER-STATE	COUNTY	CITY	SCHOOL DISTRICT	SPECIAL UNIT	COMMUNITY ACTION	SPONSORED ORGANIZATION	OTHER
☐ 12	☐ 13	☐ 14	☐ 15	☐ 16	☐ 17	☐ 18	☐ 19	☐ 20

TYPE OF ACTION: (check as many boxes as apply to this action)

NEW GRANT	CONTINUATION GRANT	SUPPLEMENT GRANT	LOAN	INCREASE DURATION	DECREASE DURATION	CANCEL-LATION	INCREASE DOLLARS	DECREASE DOLLARS
☐ 21	☐ 22	☐ 23	☐ 24	☐ 25	☐ 26	☐ 27	☐ 28	☐ 29

IS STATE PLAN REQUIRED?		IS PROJECT UNDER A95 JURISDICTION?		ENVIRONMENTAL IMPACT		FORM 240 APPROVAL	
YES	NO	YES	NO	YES	NO	YES	NO
☐ 30	☐ 31	☐ 32	☐ 33	☐ 34	☐ 35	☐ 36	☒ 37

SCH 1

How to Use the Letter of Intent

Please type or print all entries

State Application Identifier — Leave blank, State Clearinghouse will assign a number.

Line 1 — Applicant Project Title. A brief descriptive name of the project. Use location of the project title when feasible. For Example: "Altus Airport Expansion."

Line 2 — Applicant Agency. The state agency, county, city, town or other unit of government authorized and making application for federal aid.

Division. When applicable, the sub-agency of the applicant responsible for administering the project, i.e., City Police Department.

Line 3 — Applicant Address. Official mailing address of the applicant.

Line 4 — Contact Person. The representative of the applicant, or the applicant, considered as legally authorized to act on behalf of the project, and his telephone number.

Lines 5 to 10 — Project Description. A brief narrative description of the nature, purpose and beneficiaries of the project.

Line 11 — Project Location City. The city or town primarily benefiting from the project. If the project will benefit a whole county or multi-county region write in *countywide* or *regionwide*. Do not name the county or region.

Project Location County. The name of the county primarily benefiting from the project or the county in which the impact city is located. If the project has multi-county benefits write in the word *regionwide*.

Line 12 — Federal Funds-Grant. Enter total amount of money requested in the grant. Please use numbers ONLY. DO NOT USE dollar signs, commas or decimals. Your amount should reflect rounding to the nearest dollar and *omit* the cents. (*Example:* $12,000.33 should be 12000).

Federal Funds-Other. Enter total amount of federal money received that is not considered a grant. This includes but is not limited to loans, payments, agreements and others. Please observe format for reporting money.

Matching Funds-State. Enter dollar amounts as applicable observing reporting format.

Matching Funds-Local. Enter dollar amounts as applicable observing reporting format.

Other Funds. Enter total amount of money received from private donations, fellowships, etc., observing format for reporting money.

Total Funds. Enter dollar amounts as applicable observing reporting format.

Line 13 — Type of OTHER FEDERAL Funds. When Line 12 "Federal Funds-Other" is used, please indicate on Line 13 the type of funding used. For Example: Ford Foundation, private donation, etc.

Line 14 — Federal Program Title. Enter program title as listed in Office of Management of Budget (OMB) catalog of Federal Domestic Assistance. (Formerly O.E.O. Federal Domestic Assistance Catalog)

Line 15 — Federal Agency Name and Federal Sub-Agency. Enter the administering federal agency and sub-agency listed in the OMB catalog, i.e., Department of Agriculture, FHA.

Line 16 — Federal Catalog Number. If known, the Federal Catalog Number for the project as listed in the Federal Domestic Assistance Catalog.

Action, Starting, and Ending Dates. Enter if known.

Line 17 — Type of Applicant. (Check most applicable box with an X only.)

State — an organizational unit of State government.

Interstate — an organizational unit established by two or more States to coordinate certain regional programs such as water pollution.

County — an organizational unit of the government of the county.

City — an organizational unit of the government of a city, town, township or other municipality.

School District — a specified school district.

Special Unit — a special district or other limited-purpose political subdivision of a State, county, or city other than a school district (include here such institutions as public colleges and universities and intrastate regions such as water and sewer districts).

Community Action — a community action agency set up under Economic Opportunity Act of 1964 (amd).

Sponsored Organization — a public-purpose organization, other than an organizational unit of government that is a beneficiary under a plan or program administered by a State or a political subdivision of a State, county, or city and which is subject to approval by a Federal agency (e.g., Economic Development Districts).

Other — if the applicant is not covered by any of the previously mentioned types.

Type of Action — (check most applicable boxes with an X only).

New Grant — an action considered by the grantor to be an award of a new grant.

Continuation Grant — an action that constitutes a continuation action within a multi-year grant (e.g., the second year award under a five year project period grant).

Supplement Grant — an action that increases the Federal contribution in certain cases where the eligible applicant cannot supply the required match share of the basic Federal program (e.g., grants awarded under the Ozarks Regional Commission's program).

Loan — a request for a loan from a Federal agency.

Change in Existing Grant.

Increase in Duration — an extension of the period of time the grant is available.

Decreases in Duration — a reduction in the period of time the grant is available.

Cancellation — a cancellation of a previous grant request.

Increase ($) — an increase in the dollar value.

Decrease ($) — a decrease in the dollar value.

Is State Plan Required? — Check appropriate block with an X.

Is Project Under A-95 Jurisdiction? — Check block Yes.

Environmental Impact — Check appropriate block with an X.

Form 240 Approval — Check Block No.

Preparation of this pamphlet was financed in part through a comprehensive planning grant from the Department of Housing and Urban Development.

Quantity 5M, printed by Authority of the State of Illinois

CLEARINGHOUSE APPLICATION FORM

FORM APPROVED BOB NO. 042-R1596

UNITED STATES DEPARTMENT OF THE INTERIOR

BUREAU OF OUTDOOR RECREATION

BOR Project Number	Stage

☐ Initial ☐ Revised ☐ Final

Land and Water Conservation Fund
Project Application
PART II

Date _____

Acquisition Cost Analysis

	Activity or Facility	Acres	Estimated Cost		Activity or Facility	Acres	Estimated Cost
A	Family Campground			I	Trails		
B	Group Campground			J	Winter Sports		
C	Picnic Ground			K	Hunting		
D	Sports and Playfields			L	Fishing		
E	Golf Course			M	Impoundments		
F	Swimming Pool			N	Other		
G	Beach			Y	Project Administration		
H	Boating				TOTAL		

Acquisition Schedule

Code*	Parcel Number	Acreage	Estimated Date of Acquisition	Estimated Value Of Land to be Acquired	Estimated Value of Improvements to be Acquired	Total Estimated Cost
	Total				Sub-Total	
					Project Administration	
					Total	

*Code: 1. Negotiated Purchase; 2. Condemnation;

FOR STATISTICAL PURPOSES ONLY

PART II

1. A separate acquisition cost analysis and schedule must be completed for each project, project amendment affecting cost or scope, or each stage of a staged project, and an "as purchased" cost outline must accompany each final billing.

2. Acquisition Cost Analysis – Indicate the acreage to be devoted to each planned activity, and give the total estimated cost, including the cost of improvements. If more than one activity is contemplated for a particular acreage, prorate the acreage and costs in proportion to the expected use by each activity.

3. Acquisition Schedule – List each parcel to be acquired and give all information indicated.

4. The Total Estimated Cost and Total Acreage on the Acquisition Cost Analysis should equal the Total Estimated Cost and Total Acreage on the Acquisition Schedule.

PART III

For Acquisition Projects, attach the following additional documentation:

1. Agreements (copies may be required by the Bureau)

   A. List any current agreements with other agencies, individuals, or organizations for participating in this project, including its later operation and maintenance.

   B. Describe any contemplated agreements with others for participating in this project, including its later operation and maintenance.

2. Maps

   A. State, county, or city maps showing the geographic location of the project.

   B. A subdivision plat or boundary map showing the exterior boundaries of each parcel to be acquired. Annotate all existing improvements and explain their proposed disposition. Indicate use of adjoining lands.

PROJECT ADMINISTRATION

An appraisal report which includes a five-year history of conveyances, and satisfactory evidence of title are required prior to payment for each parcel acquired. The Bureau may request additional documentation when deemed necessary.

GPO 896-983

FORM APPROVED BOB NO. 042-R1596

UNITED STATES DEPARTMENT OF THE INTERIOR
BUREAU OF OUTDOOR RECREATION
LAND AND WATER CONSERVATION FUND
PROJECT PROPOSAL

FOR BOR USE ONLY

State or Territory	Project Number
Geographic Code	Congressional District

☐ Acquisition ☐ Development
☐ Planning ☐ Combination

Latitude ____° ____' ____" Longitude ____° ____' ____"

Date Received

PART I

1. Project Title

2. County

3. Brief description of project

4. Applicant's name, address and phone number

5. a. Total project costs $_____
Federal assistance requested ____% $_____
b. Source(s) of remainder of funds:

6. Other Federal Grant? ☐ Yes ☐ No
If "Yes," attach an explanation of nature of the grant, indicate whether independent or supplemental, and give name of the granting agency.

7. Previous L&WCF Grant? ☐ Yes ☐ No
Project Number_____

8. ☐ New
☐ Addition

9. SITE ORIENTATION
☐ Marine
☐ Lakes, including reservoirs
☐ Rivers or streams
☐ Non-aquatic

10. Time-Distance Classification
A. ☐ Neighborhood
B. ☐ Community/Town
C. ☐ Metropolitan/Regional
D. ☐ Overnight
E. ☐ Weekend/Vacation

11. Census Classification
☐ Urban ☐ Rural

12. Page numbers from State Plan:
_____
If appropriate, attach a narrative explanation.

13. Ownership:
☐ Fee Simple ☐ Less than Fee (Specify)_____
If leased, is lessor: ☐ Federal ☐ State/Local Government ☐ Private
Original term in years_____
If any outstanding rights are to be held by others, attach an explanation of how they will affect the project.

FOR USE BY STATE LIAISON OFFICE ONLY

On behalf of the Governor, I request this application be considered for financial assistance under the terms of the Land and Water Conservation Fund Act of 1965 (78 Stat. 897), as amended, the Bureau of Outdoor Recreation Manual, and other pertinent directives and policies of the BOR and the Department of the Interior.

OMB A-102 APPLICATION

Part I

1. Project title is limited to 36 spaces.

2. If project is located in more than one county but not statewide, give the name of the county in which the major portion of the project is located. If "Statewide", so indicate. All planning projects are statewide.

3. Describe the property to be acquired or developed, its outstanding features and its location. If part of a larger recreation complex, describe the relationship of this project to the total area.

4. Applicant's name includes the name of the applying agency as well as the name and title of the agency head if appropriate. Include zip code in the address and area code in the telephone number.

5. a. Enter the total estimated cost of the project, and the percent and dollar amount of Federal assistance requested.

   b. Indicate the source or sources of the balance of the funds needed for this project.

6. If other Federal assistance has been given or promised for any work within the boundaries of the park or recreational site affected by this request, describe the nature and extent of such assistance. Include the name of the grantor agency and whether the assistance is independent of this request or supplemental to it.

7. Indicate whether there has been a previous Land and Water Conservation Fund grant for the park or recreational site affected by this request.

8. For acquisition projects, indicate whether this is a new area or an addition to an existing area. For development projects, indicate whether these facilities are being placed on a new area or will be an addition, expansion, or replacement of facilities in an existing area.

9. Self-explanatory.

10. Check one of the following categories to indicate the relationship of the area to its primary users:

    A. Neighborhood areas serve primary users within walking distance.

    B. Community/Town areas serve primary users within a fifteen minute driving distance.

    C. Metropolitan/Regional areas serve primary users within a one hour driving distance.

    D. Overnight use areas serve primary users within a three hour driving distance.

    E. Weekend/Vacation areas serve primary users over three hours driving distance from the project.

    Primary users are defined as those users comprising 80 percent of the total users of the project site.

11. An urban project is located in an incorporated or unincorporated place of 25,000 inhabitants or more. All other projects are rural.

12. Provide the State Plan page numbers which support this project. If the project cannot be clearly supported in this manner, provide a narrative explanation.

13. For acquisition projects, indicate the proposed interest to be acquired. For development projects, indicate the existing interest the applicant holds in the property to be developed.

ATTACHMENTS

For all projects, attach a properly executed civil rights Assurance of Compliance form and provide all information required by the instructions accompanying that form. For acquisition or development projects, complete Parts II and III in accord with the instructions on the Part II Cost Analysis form. For State planning projects, refer to Subparagraph 635.2.5A and Illustration 1, 635.2.5A of the Outdoor Recreation Grants-in-Aid Manual for additional documentation requirements.

OMB NO. 80-R0184

APPLICATION FOR FEDERAL ASSISTANCE (FOR CONSTRUCTION PROGRAMS)

PART I

1. State Clearinghouse Identifier

2. Applicant's Application No.

3. Federal Grantor Agency

U.S. Department of the Interior
Organizational Unit

Bureau of Outdoor Recreation
Administrative Office

Street Address – P.O. Box

City State Zip Code

4. Applicant Name

Department Division

Street Address – P.O. Box

City County

State Zip Code

5. Descriptive Name of the Project

6. Federal Catalog No.

15.400

7. Federal Funding Requested

$

8. Grantee Type

_____ State, _____ County, _____ City, _____ Other (Specify)

9. Type of Application or Request

X New Grant, _____ Continuation, _____ Supplement, _____ Other Changes (Specify)

10. Type of Assistance

X Grant, _____ Loan, _____ Other (Specify)

11. Population Directly Benefiting from the Project

#

13. Length of Project

12. Congressional District

a.

b.

14. Beginning Date

Date of Approval of Project Agreement

15. Date of Application

16. The applicant certifies that to the best of his knowledge and belief the data in this application are true and correct, and that he will comply with the attached assurances if he receives the grant.

Typed name	Title	Telephone Number		
		AREA CODE	NUMBER	EXT.

Signature of Authorized Representative

For Federal Use Only

PART II

PROJECT APPROVAL INFORMATION
SECTION A

Item 1.
Does this assistance request require State, local, regional, or other priority rating?
_____ Yes _____ No
Name of Governing Body _____
Priority Rating _____

Item 2.
Does this assistance request require State, or local advisory, educational or health clearances?
_____ Yes _____ No
Name of Agency or Board _____
(Attach Documentation)

Item 3.
Does this assistance request require clearinghouse review in accordance with OMB Circular A-95?
_____ Yes _____ No
(Attach Comments)

Item 4.
Does this assistance request require State, local, regional or other planning approval?
_____ Yes _____ No
Name of Approving Agency _____
Date _____

Item 5.
Is the proposed project covered by an approved comprehensive plan?
_____ Yes _____ No
Check one: State ☐ Local ☐ Regional ☐
Location of plan _____

Item 6.
Will the assistance requested serve a Federal installation?
_____ Yes _____ No
Name of Federal Installation _____
Federal Population benefiting from Project _____

Item 7.
Will the assistance requested be on Federal land or installation?
_____ Yes _____ No
Name of Federal Installation _____
Location of Federal Land _____
Percent of Project _____

Item 8.
Will the assistance requested have an impact or effect on the environment?
_____ Yes _____ No
See instruction for additional information to be provided.

Item 9.
Will the assistance requested cause the displacement of individuals families, businesses, or farms?
_____ Yes _____ No
Number of:
Individuals _____
Families _____
Businesses _____
Farms _____

Item 10.
Is there other related Federal assistance on this project previous, pending, or anticipated?
_____ Yes _____ No
See instructions for additional information to be provided.

INSTRUCTION

PART II – SECTION B

11. SITES AND IMPROVEMENTS: _____ Not required, __X__ Attached as exhibits
Applicant intends to acquire the site through:
_____ Eminent domain, _____ Negotiated purchase, _____ Other means (specify)

12. TITLE OR OTHER INTEREST IN THE SITE IS OR WILL BE VESTED IN:
__X__ Applicant, _____ Agency or institution operating the facility, _____ Other (specify)

13. INDICATE WHETHER APPLICANT/OPERATOR HAS:
_____ Fee simple title, _____ Leasehold interest, _____ Other (specify)

14. IF APPLICANT/OPERATOR HAS LEASEHOLD INTEREST, GIVE THE FOLLOWING INFORMATION:
a. Length of lease or other estate interest _____, and number of years to run _____
b. Is lease renewable? _____ Yes _____ No
c. Current appraised value of land $ _____
d. Annual rental rate $ _____

15. ATTACH AN OPINION FROM ACCEPTABLE TITLE COUNSEL DESCRIBING THE INTEREST APPLICANT/OPERATOR HAS IN THE SITE AND CERTIFYING THAT THE ESTATE OR INTEREST IS LEGAL AND VALID.

16. WHERE APPLICABLE, ATTACH SITE SURVEY, SOIL INVESTIGATION REPORTS AND COPIES OF LAND APPRAISALS.

17. WHERE APPLICABLE, ATTACH CERTIFICATION FROM ARCHITECT ON THE FEASIBILITY OF IMPROVING EXISTING SITE TOPOGRAPHY.

18. ATTACH PLOT PLAN.

19. CONSTRUCTION SCHEDULE ESTIMATES: _____ Not required, _____ Being prepared, _____ Attached as exhibits
Percentage of completion of drawings and specifications at application date:
Schematics _____ % Preliminary _____ % Final _____ %

20. TARGET DATES FOR:
Bid Advertisement _____ Contract Award _____
Construction Completion _____ Occupancy _____

21. DESCRIPTION OF FACILITY: _____ Not required _____ Attached as exhibits
Drawings – Attach any drawings which will assist in describing the project.
Specifications – Attach copies of completed outline specifications.
(If drawings and specifications have not been fully completed, please attach copies or working drawings that have been completed.)

NOTE: ITEMS ON THIS SHEET ARE SELF-EXPLANATORY; THEREFORE, NO INSTRUCTIONS ARE PROVIDED.

OMB NO. 51 R0184

PART III – BUDGET INFORMATION – CONSTRUCTION

SECTION A – GENERAL

1. Federal Domestic Assistance Catalog No. 15.400

2. Functional or Other Breakout . . . . . .

SECTION B – CALCULATION OF FEDERAL GRANT

Cost Classification	Use only for revisions		Total Amount Required
	Latest Approved Amount	Adjustment + or (–)	
1. Administration expense	$	$	$
2. Preliminary expense			
3. Land, structures, right-of-way			
4. Architectural engineering basic fees			
5. Other architectural engineering fees			
6. Project inspection fees			
7. Land development			
8. Relocation Expenses			
9. Relocation payments to Individuals and Businesses			
10. Demolition and removal			
11. Construction and project improvement			
12. Equipment			
13. Miscellaneous			
14. Total (Lines 1 through 13)			
15. Estimated Income (if applicable)			
16. Net Project Amount (Line 14 minus 15)			
17. Less: Ineligible Exclusions			
18. Add: Contingencies			
19. Total Project Amt. (Excluding Rehabilitation Grants)			
20. Federal Share requested of Line 19			
21. Add Rehabilitation Grants Requested (100 Percent)			
22. Total Federal grant requested (Lines 20 & 21)			
23. Grantee share			
24. Other shares			
25. Total project (Lines 22, 23 & 24)	$	$	$

SECTION C – EXCLUSIONS

26 Classification	Ineligible for Participation (1)	Excluded from Contingency Provision (2)
a.	$	$
b.		
c.		
d.		
e.		
f.		
g. Totals	$	$

SECTION D – PROPOSED METHOD OF FINANCING NON-FEDERAL SHARE

27. Grantee Share	$
a. Securities	
b. Mortgages	
c. Appropriations (By Applicant)	
d. Bonds	
e. Tax Levies	
f. Non Cash	
g. Other (Explain)	
h. TOTAL – Grantee share	
28. Other Shares	
a. State	
b. Other	
c. Total Other Shares	
29. TOTAL	$

SECTION E – REMARKS

PART IV PROGRAM NARRATIVE (Attach – See Instructions)

PART IV

PROGRAM NARRATIVE

Prepare the program narrative statement in accordance with the following instructions for all new grant programs. Requests for supplemental assistance should be responsive to Item 5b only. Requests for continuation or refunding or other changes of an approved project should be responsive to Item 5c only.

1. OBJECTIVES AND NEED FOR THIS ASSISTANCE.

Pinpoint any relevant physical, economic, social, financial, institutional, or other problems requiring a solution. Demonstrate the need for assistance and state the principal and subordinate objectives of the project. Supporting documentation or other testimonies from concerned interests other than the applicant may be used. Any relevant data based on planning studies should be included or footnoted.

2. RESULTS OR BENEFITS EXPECTED.

Identify results and benefits to be derived. For example, include a description of who will occupy the facility and show how the facility will be used. For land acquisition or development projects, explain how the project will benefit the public.

3. APPROACH.

a. Outline a plan of action pertaining to the scope and detail of how the proposed work will be accomplished for each grant program. Cite factors which might accelerate or decelerate the work and your reason for taking this approach as opposed to others. Describe any unusual features of the project such as design or technological innovations, reductions in cost or time, or extraordinary social and community involvements.

b. Provide for each grant program monthly or quarterly quantitative projections of the accomplishments to be achieved, if possible. When accomplishments cannot be quantified, list the activities in chronological order to show the schedule of accomplishments and their target dates.

c. Identify the kinds of data to be collected and maintained, and discuss the criteria to be used to evaluate the results and success of the project. Explain the methodology that will be used to determine if the needs identified and discussed are being met and if the results and benefits identified in Item 2 are being achieved.

d. List each organization, cooperator, consultant, or other key individuals who will work on the project along with a short description of the nature of their effort or contribution.

4. GEOGRAPHIC LOCATION.

Give a precise location of the project and area to be served by the proposed project. Maps or other graphic aids may be attached.

5. IF APPLICABLE, PROVIDE THE FOLLOWING INFORMATION:

a. Describe the relationship between this project and other work planned, anticipated, or underway under the Federal Assistance listed under Part II, Section A, Item 10.

b. Explain the reason for all requests for supplemental assistance and justify the need for additional funding.

c. Discuss accomplishments to date and list in chronological order a schedule of accomplishments, progress or milestones anticipated with the new funding request. If there have been significant changes in the project objectives, location, approach or time delays, explain and justify. For other requests for changes or amendments, explain the reason for the change(s). If the scope or objectives have changed or an extension of time is necessary, explain the circumstances and justify. If the total budget has been exceeded or if individual budget items have changed more than the prescribed limits contained in Attachment K, Office of Management and Budget Circular No. A-102, explain and justify the change and its effect on the project.

PART V

ASSURANCES

The applicant hereby assures and certifies that he will comply with the regulations, policies, guidelines and requirements, including Office of Management and Budget Circulars Nos. A-87, A-95, and A-102, as they relate to the application, acceptance and use of Federal funds for this federally-assisted project. Also, the applicant gives assurance and certifies with respect to the grant that:

1. It possesses legal authority to apply for the grant, and to finance and construct the proposed facilities; that a resolution, motion or similar action has been duly adopted or passed as an official act of the applicant's governing body, authorizing the filing of the application, including all understandings and assurances contained therein, and directing and authorizing the person identified as the official representative of the applicant to act in connection with the application and to provide such additional information as may be required.

2. It will comply with the provisions of: Executive Order 11296, relating to evaluation of flood hazards, and Executive Order 11288, relating to the prevention, control, and abatement of water pollution.

3. It will have sufficient funds available to meet the non-Federal share of the cost for construction projects. Sufficient funds will be available when construction is completed to assure effective operation and maintenance of the facility for the purposes constructed.

4. It will obtain approval by the appropriate Federal agency of the final working drawings and specifications before the project is advertised or placed on the market for bidding, that it will construct the project, or cause it to be constructed, to final completion in accordance with the application and approved plans and specifications, that it will submit to the appropriate Federal agency for prior approval changes that alter the costs of the project, use of space, or functional layout; that it will not enter into a construction contract(s) for the project or undertake other activities until the conditions of the construction grant program(s) have been met.

5. It will provide and maintain competent and adequate architectural engineering supervision and inspection at the construction site to insure that the completed work conforms with the approved plans and specifications; that it will furnish progress reports and such other information as the Federal grantor agency may require.

6. It will operate and maintain the facility in accordance with the minimum standards as may be required or prescribed by the applicable Federal, State and local agencies for the maintenance and operation of such facilities.

7. It will give the grantor agency and the Comptroller General through any authorized representative access to and the right to examine all records, books, papers, or documents related to the grant.

8. It will require the facility to be designed to comply with the "American Standard Specifications for Making Buildings and Facilities Accessible to, and Usable by, the Physically Handicapped," Number A117.1-1961, as modified (41 CFR 101-17.703). The applicant will be responsible for conducting inspections to insure compliance with these specifications by the contractor

9. It will cause work on the project to be commenced within a reasonable time after receipt of notification from the approving Federal agency that funds have been approved and that the project will be prosecuted to completion with reasonable diligence.

10. It will not dispose of or encumber its title or other interests in the site and facilities during the period of Federal interest or while the Government holds bonds, whichever is the longer

11. It will comply with Title VI of the Civil Rights Act of 1964 (P.L. 88-352) and in accordance with Title VI of that Act, no person in the United States shall, on the ground of race, color, or national origin, be excluded from participation in, be denied the benefits of, or be otherwise subjected to discrimination under any program or activity for which the applicant receives Federal financial assistance and will immediately take any measures necessary to effectuate this agreement. If any real property or structure thereon is provided or improved with the aid of Federal financial assistance extended to the Applicant, this assurance shall obligate the Applicant, or in the case of any transfer of such property, any transferee, for the period during which the real property or structure is used for a purpose for which the Federal financial assistance is extended or for another purpose involving the provision of similar services or benefits.

12. It will establish safeguards to prohibit employees from using their positions for a purpose that is or gives the appearance of being motivated by a desire for private gain for themselves or others, particularly those with whom they have family, business, or other ties.

13. It will comply with the requirements of Title II and Title III of the Uniform Relocation Assistance and Real Property Acquisitions Act of 1970 (P.L. 91-646) which provides for fair and equitable treatment of persons displaced as a result of Federal and federally assisted programs.

14. It will comply with all requirements imposed by the Federal grantor agency concerning special requirements of law, program requirements, and other administrative requirements approved in accordance with Office of Management and Budget Circular No. A-102.

15. It will comply with the provisions of the Hatch Act which limit the political activity of employees.

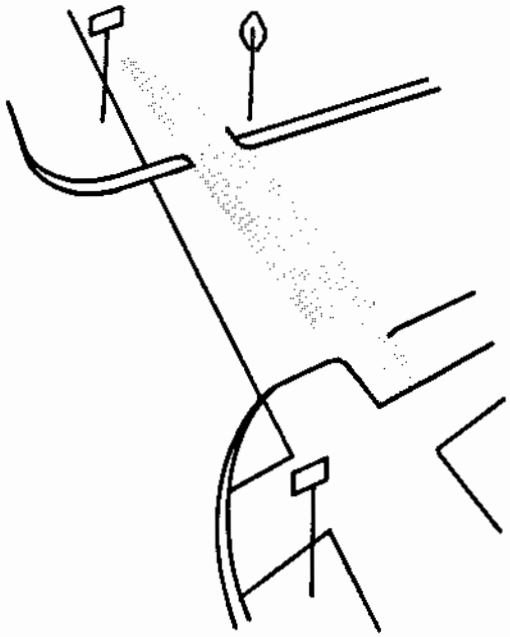
16. It will comply with the minimum wage and maximum hours provisions of the Federal Fair Labor Standards Act, as they apply to hospital and educational institution employees of State and local governments.

INT: 3138-72

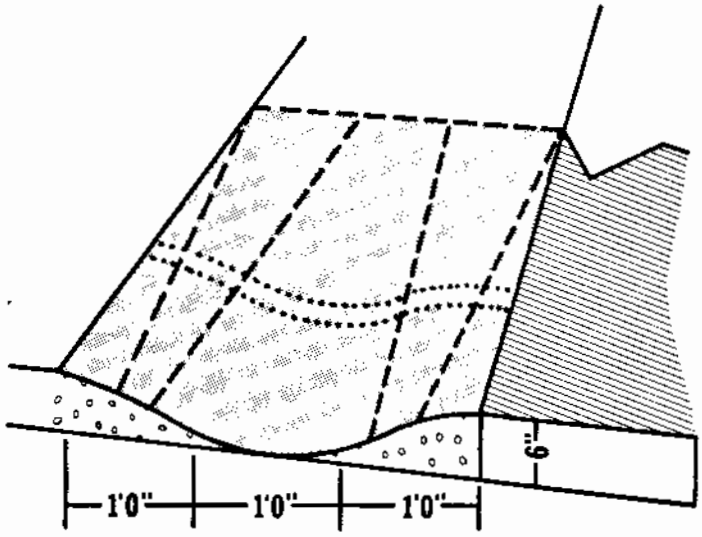
APPENDIX B

SUPPLEMENTAL TECHNICAL CONSTRUCTION AIDS

EXHIBIT 1: STANDARD BIKEWAY CURB-CUT

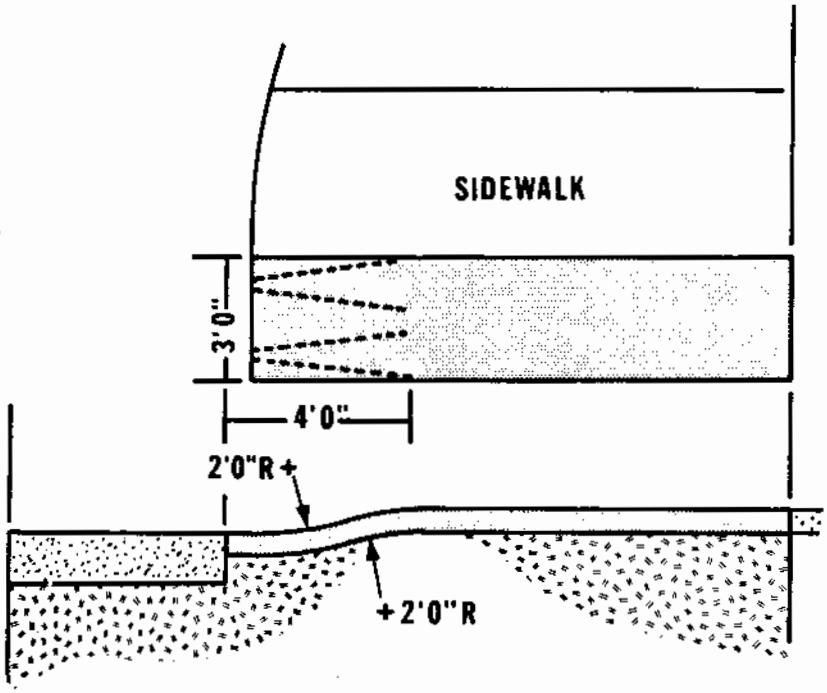


ISOMETRIC : AT INTERSECTION



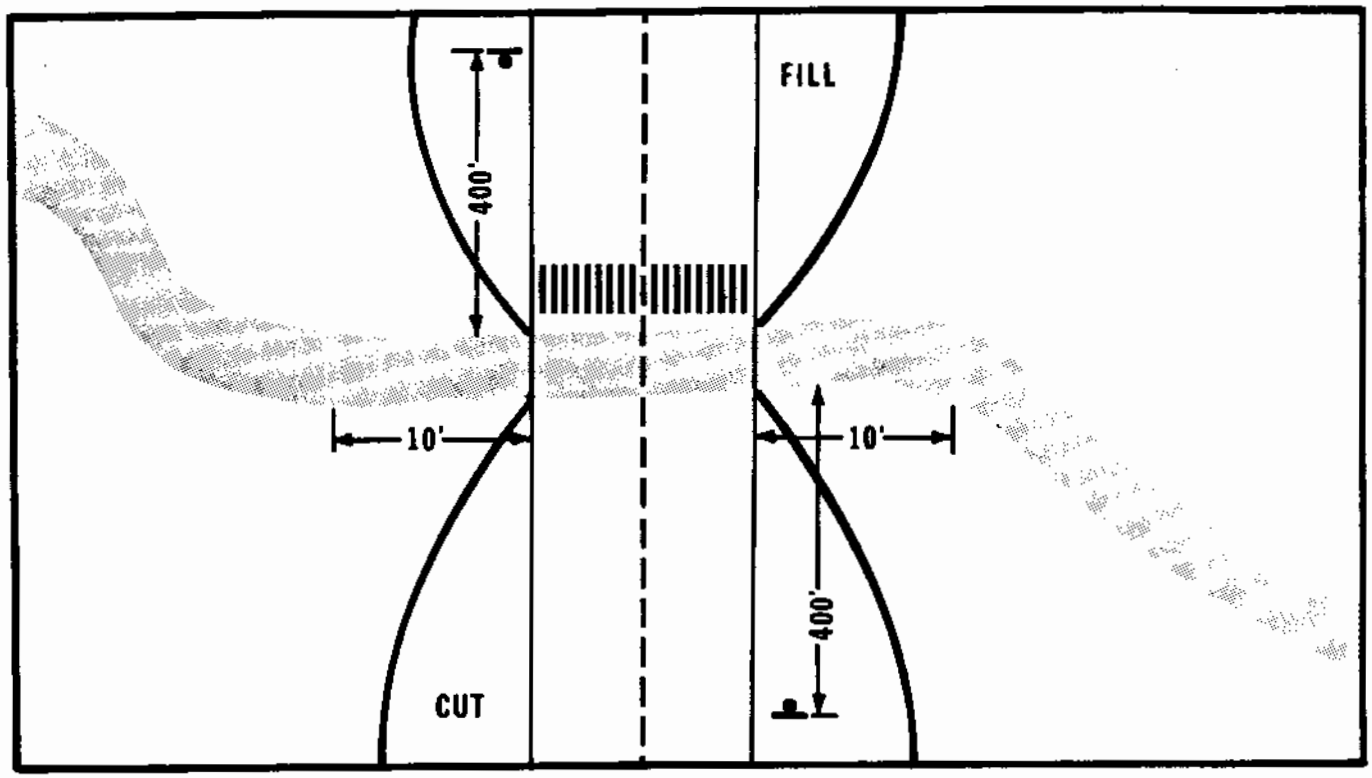
ISOMETRIC : AT GRADE

PLAN



SECTION : AT GRADE

EXHIBIT 2: TYPICAL OFF-STREET BIKEWAY APPROACH TO MOTOR VEHICLE TRAFFIC



Notes:

1. Grade of Bikeway at approach to motor vehicle lane must be less than 10% for 10' and should be at right angles to motor vehicle land if at all possible.

2. Where arterial roads are crossed by bikeways the road must be marked with crosswalk stripes and advance warning signs installed 400' before the crossing.

3. A bicyclist on the bikeway - 4' from the edge of the motor vehicle lane must be visible to approaching vehicles at a distance of 200' in a 25 MPH zone; 275' in a 35 MPH zone; and 350' in a 45 MPH zone.

4. Crossing should: (a) be at controlled intersections; (b) adjoin existing pedestrian crossings; (c) be in reduced speed zones; (d) occur where roadside cut changes to fill or where no cut or fill is present.

5. Bikeway should be clearly marked with a sign indicating approach to a motor vehicle intersection 100' from entrance to intersection.