CANADIAN INSTITUTE OF PLANNERS
GO FOR GREEN

COMMUNITY CYCLING MANUAL

A PLANNING AND DESIGN GUIDE

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FORWARD

The original version of the Community Cycling Manual was developed with the assistance of funding from Fitness Canada, distributed through the Canadian Institute of Planners, and commissioned through the Canadian Task Force on Cycling. The objectives of the Canadian Task Force on Cycling were:

- **To establish the concept of the bicycle as a valid means of transportation;**
- **To undertake activities to increase participation in cycling;**
- **To enhance public awareness of cycling as both a recreational and utilitarian activity; and,**
- **To provide a safe environment for cyclists across Canada.**

Various national and local agencies interested in cycling were represented on the Task Force.

The manual formed part of an overall program designed to increase public awareness and to review public education as it relates to cycling.

The original intention of the manual was to provide a much-needed body of research and guidelines on appropriate bicycle facilities planning. This manual was meant to be a document that could be up-dated as necessary. This current up-date reflects the changes that have occurred since the original version was published and was commissioned by GO FOR GREEN.

The reader is invited to forward any comments to:

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INTRODUCTION

This manual is a guide for the planning, design and construction of bicycle-friendly infrastructure. This includes an examination of traffic calming devices. The manual discusses the policies and philosophy behind traffic demand management strategies. It also briefly addresses the need for formal education of all cycling age groups, education of other road users, and the role of enforcement agencies. The infrastructure, combined with policy, complemented by appropriate education and enforcement, are key to the creation of a safe cycling environment for all types of users. A comprehensive bibliography has been provided to assist the reader to research certain aspects of the manual.

1 WHO SHOULD USE THIS MANUAL?

This manual provides design standards and process outlines which allow it to be used as a quick reference. In addition, the manual examines transportation demand management strategies, and traffic calming devices. The manual addresses the importance of integrating education and enforcement programs into comprehensive municipal bicycle plans.

This manual will also be useful to other organizations and agencies such as police departments, community groups, and cycling organizations. For these groups, the manual provides an outline for involvement in bicycle-safety program development and the promotion of bicycle activities as well as other recommendations.

This manual is also intended for the decision-maker who may be a municipally elected official, chief administrative officer or provincially- or federally-elected official. The manual examines the importance of incorporating bicycle facilities planning into municipal policy documents. In addition, it shows how proper planning and design relate to liability concerns.

The Community Cycling Manual provides some technical information for the expert, as well as basic groundwork for those less familiar with cycling. It also serves as an

introduction to the process of translating the transportation needs of the community into action.

2 HOW IS THIS MANUAL ORGANIZED?

The information contained in this manual flows progressively from general concepts through the strategic planning process to actual design guidelines, and maintenance. Samples of design drawings and specifications are included whenever possible to assist the professional with implementation, though it is recommended that engineering texts be consulted for design specifications.

In addition, sections on education, enforcement, tourism, and encouragement have been included in sections 30-47.

The appendices include a comprehensive glossary and bibliography to ensure that further research can be undertaken and that terms are properly understood.

3 HOW IS THIS MANUAL USED?

Although the manual is a comprehensive document, the Table of Contents is designed so that the reader can easily determine the sections relevant to a particular problem or situation. References, in the Bibliography, have also been made to supplementary documents from other agencies.

The reader is encouraged, however, to read the entire manual. A better understanding of the entire context of bicycle facility design and implementation can be gained through a thorough understanding of the process.

PLANNING CONCEPTS

4 WHY PLAN FOR BICYCLES?

- **To reduce congestion - Bicycles are a practical and economical means of local transport. As urban centres become more congested, the bicycle provides an excellent and fast option for short distances. It is also an accessible and affordable means of transportation.**

- **To increase the efficiency of the transportation network - Bicycles can make the existing transportation system more efficient. Designs that focus on links between the different types of existing transportation can make the bicycle an integral part of any system. This will complement the existing commuter system. It will also make the system more attractive to those who would prefer to use their bicycles.**

- **To reduce the cost of building infrastructure - When bicycle facilities are considered as part of the basic planning, designing, and implementation of transportation facilities, the overall costs are much less than providing separate bicycle facilities or increasing motor vehicle facilities.**

- **To improve air quality and preserve finite resources - Bicycling contributes to pollution control and energy conservation. It is noiseless, pollution-free, and does not contribute to the drain on existing forms of energy.**

- **To accommodate all road users - The bicycle is an existing and widely used means of transportation and recreation.**

Most major cities are reassessing their transportation priorities and increased bicycle transportation has asserted itself as a viable alternative means of transportation. The bicycle is part of the integrated solution to the transportation challenges faced by municipalities in the 21st century.

5 FUNDAMENTALS OF A BICYCLE PROGRAM

In order to be comprehensive and to safely integrate cyclists onto the roadway, any bicycle program must consider four interdependent fundamental components:

i) Engineering design;

ii) Education programs;

iii) Enforcement programs;

iv) Encouragement programs and activities; and,

v) Transportation demand management

5.1 Engineering design

Facilities must be carefully planned, designed, and maintained to accommodate the bicycle as a vehicle and to enable the cyclist to use the facilities in relative safety and comfort. Properly engineered facilities encourage the cyclist to use them because it is easy, convenient, and demonstrates that cycling has a place in the transportation network. The challenge in the future is to engineer bicycling infrastructure that actively encourages the general public to effect a transportation modal shift resulting in more cyclists and less single occupancy vehicle drivers.

Engineers should:

- **Plan for continuity of cycling travel;**
- **Plan for access to all destination points;**
- **Plan for end of trip facilities;**
- **Design road surfaces (i.e. sewer grates, railway crossings, etc.) accommodating bicycles and providing for safe bicycle travel;**
- **Design sufficient lane width (bicycle route, lane or path) so that other vehicles can pass safely; and,**

- **Maintain a smooth, clean road surface unobstructed by debris.**

These items are covered in more detail in Sections 20-28 of the manual.

5.2 Education programs

The public, both the cyclist and the motorist, needs to be educated to use the transportation facilities properly and legally. Well-engineered facilities assist and encourage the cyclist to use those facilities appropriately. Well-advertised facilities acknowledge and confirm the cyclist's right to share the road.

Public education programs should:

- **Emphasize to motor vehicle drivers and to cyclists that roadways are to be shared by all road users;**

- **Teach the cyclist the rules of the road and how to obey them;**

- **Teach the cyclist their responsibilities as a road user; and,**

- **Teach bicycle-handling skills.**

See Sections 27-31 for more information on Education Programs and some national education programs are described in Appendix H.

5.3 Enforcement programs

Without proper enforcement, the long-term goals of education and encouragement cannot be met fully met. By ignoring the law, cyclists not only risk their own safety, they also antagonize other road users. By allowing cyclists to break the law, enforcement agencies condone irresponsible and potentially catastrophic behaviour and minimize the cyclist's place in the transportation network.

Enforcement programs, therefore, should be aimed at cyclists, motorists, and pedestrians.

Enforcement should have as its objectives:

- **Reduction of the number of crashes and degree of injuries sustained in those crashes;**
- **Compliance with the rules of the road;**
- **Reduction of bicycle theft; and,**
- **Development of public relations programs to encourage all of the above.**

Sections 36-39 provide additional information on Enforcement.

5.4 Encouragement programs and activities

The development of promotional programs is recommended to encourage and increase the use of bicycles for transportation, fitness, and recreation. Many people are simply not aware of designated bicycle facilities, education programs, and opportunities to cycle.

Encouragement programs and activities should:

- **Promote public awareness and acceptance of bicycling;**
- **Develop incentives for the use of bicycles for commuting and utilitarian purposes;**
- **Work towards a safer environment for all types of cyclists;**
- **Be undertaken in conjunction with local bicycle clubs and organizations; and,**
- **Provide assistance to established bicycle advocacy organizations.**

See Sections 45-47 for more information on Encouragement Programs and Appendix A for a list of national and provincial cycling associations.

5.5 Transportation demand management (TDM)

Transportation demand management involves active intervention to change the travel behaviour of a constituency. At the planning level, effective transportation demand management includes a variety of strategies to make more efficient use of the existing transportation network. These strategies include increasing alternatives to the single occupancy vehicle, discouraging automobile use, removing of subsidies for automobile use, reducing the need for travel, and establishing support systems that allow for alternative transportation use.

Transportation demand management planning is a relatively new concept, though many of the strategies have been in use in other aspects of planning. Effective transportation demand management planning involves a large range of strategies with a number of different partners at various levels of government and industry. This manual focuses on those strategies that involve cycling as the means to affect the strategy.

Transportation demand management strategies should:

- **Reduce municipal costs and encourage more efficient land use patterns;**
- **Reduce user travel time and user costs;**
- **Reduce traffic congestion, air pollution, and parking problems; and,**
- **Encourage alternative forms of transportation.**

Specific TDM strategies are covered in section 14.

6 FACILITY SELECTION

Planners and designers face several problems with the task of altering or improving the urban infrastructure. It is clear that bicycle facilities must be included in the infrastructure, particularly in those communities that have committed to a transportation priority policy of providing for pedestrians, cyclists, transit users, and commercial goods movement before providing for the private automobile and the single occupancy vehicle. But the questions remain - What type of route is most appropriate? What facilities are needed?

6.1 The goals and objectives of planners and designers

Planners and designers should work to fully integrate the bicycle into the existing transportation system and to encourage the acceptance of the use of the bicycle as safe and convenient. This implies that all roads are potential bicycle routes. Once this concept is accepted, the facility selection becomes a matter of matching the site with the need and selecting specific sites for upgrading.

Planners and designers also need to address the acceptance of this basic premise in terms of Engineering, Education, Enforcement, Encouragement, and Transportation demand management (see Section 5).

6.2 Basic principles

It is strongly recommended that the following basic principles be considered when beginning any cycling project.

- **Assume that every street will be used by bicyclists;**
- **Treat bicycle facilities as part of the whole picture and consider those facilities as an integral component of any planning decision; thus, the basis and ideas formerly developed in separate "Bicycle Plans" should**

be fully integrated and incorporated into existing policy documents;

- Overcome existing barriers to bicycle travel;

- Allow for options, both in the planning and design phase, and afterwards, when monitoring the success of the project;

- Plan ahead for any changes to the system;

- Ensure that cycling implications in upcoming projects are considered as part of the design and planning; and,

- Encourage links between routes in order to make use of routes more effective and attractive to the cyclist.

7 PUBLIC CONSULTATION

The involvement of the community - residents, merchants, institutions, employees and elected officials - should be viewed as an opportunity to design a better facility. The importance of involving the community cannot be over-stressed. Inviting the public to become involved in the project at a very early stage has the following advantages:

- Information can be presented that will assist the planners, designers and decision makers to develop a system responsive to local needs; and,

- The public will support and become a part of the project.

It is crucial that, during the planning stages, any changes to the project, and their causes, are communicated to those who have expressed interest so that their co-operation is not lost.

Public consultation can take many forms, from open houses to surveys to public meetings. The size of the community, and the extent of the problem will determine which form(s) are most appropriate to use. The importance of contacting local bicycle groups should also not be overlooked. Often these are the people with the

resources, first-hand experience, and expertise that will greatly assist planners and designers.

A well-organized public consultation process reaches and involves the entire community and minimizes the influence of special interest groups. A wide consultation process results in a self-policing procedure which is a very effective method of ensuring that the transportation facilities and solutions which are being implemented are what the public and community wants and will accept.

The public consultation process is dealt with in more detail in Section 12 - Model Planning Process.

Members of the public or citizen groups are advised to follow this same comprehensive approach when dealing with a bicycle facility related issue. The first step should be to talk to municipal staff to alert them to the concern. If this does not resolve the matter, it should be brought to the attention of the elected officials.

8 TRAFFIC CALMING

As defined by the Institute of Transportation Engineers, "traffic calming is the combination of mainly physical measures that reduce the negative effects of motor vehicle use, alter driver behaviour, and improve conditions for non-motorized street users". Traffic calming devices are not bicycle facilities per se, but are devised to reduce the speed and volume of motor vehicle traffic. Areas that have been traffic calmed then become more attractive for cycling as the speed differentials are reduced. At the same time, providing for a safe mix of cyclists and motor vehicles often serves to further reduce motor vehicle speeds and ultimately volumes, as more people are encouraged to cycle.

Residential streets are multi-use facilities that are shared by pedestrians, cyclists, transit, trucks, service vehicles, and automobiles. On occasion, road geometry, traffic volumes, traffic operations, traffic speeds or some combination of these will create a problem resulting in negative impacts to residential streets, perceived or real. When these negative impacts occur, the result is often an

increase in motor vehicle traffic, which is perceived to be the only "safe" method of transportation in the area and is certainly the most comfortable for road users.

The implementation of traffic calming strategies is appropriate where residents and street users consider traffic volumes and speeds to be inappropriate for the neighbourhood or to prevent a neighbourhood from developing inappropriate traffic operations. It is common for traffic calming to be introduced in large urban areas, however, these facilities are also appropriate for small urban centres. The traffic calming devices described in this manual in Section 20.5 are applicable on local and collector residential streets. There are fewer situations where these traffic calming measures could be applied to arterial or rural roads.

It is recommended that where a traffic problem is generated from a regional issue that these broader issues are addressed prior to implementing a local traffic calming fix. The likely result of not dealing with the larger issue is that the transportation problem will simply shift to another neighbourhood.

Traffic calming is generally associated with existing neighbourhoods to address problems that have gradually increased in magnitude. Thus, many of the devices are being retrofitted into an existing street design and will require some modification. Traffic calming is also appropriate for the development of new neighbourhoods to enhance the street environment.

The goal of traffic calming is to maintain accessibility and mobility while restoring residential streets to their original purpose. The objectives of traffic calming are:

- **To improve the neighbourhood environment by reducing the speed and volume of traffic and by landscaping design features which aesthetically enhance the environment;**

- **To discourage non-local through traffic thereby reducing the volume and noise of traffic;**

- **To reduce vehicular speeds to increase the safety of non-motorized street users; and,**

- **To minimize conflicts between street users using physical features rather than physical barriers.**

A traffic calmed community will be a safer community if the planning, design and implementation of traffic calming measures recognize the limitations of all road users. Consistency of design of features, signage, traffic control devices, pavement markings, and landscaping combined with good visibility of those features will achieve a safer community.

STRATEGIC PLANNING

9 GOALS AND OBJECTIVES

A strategic plan for bicycles should increase the use and safety of the bicycle in urban and rural areas. This objective can be met by looking at existing problems and opportunities, and future requirements. Programs and facilities will then be designed in keeping with the fundamentals of bicycle planning (see Section 5). Strategic planning can identify the objectives and the means of implementation (action statements).

Goals and objectives for each bicycle facility project undertaken should be clearly stated. Ideally, these statements are incorporated into the municipality's policy documents, such as the official community plan, and thus become institutionalized. Experience has shown that separate bicycle plans which are not incorporated into the official policy and budget for a municipality are not the most effective means of promoting or incorporating bicycle facilities into the existing transportation, education, or safety-planning process.

9.1 Engineering

The purpose of including engineering in strategic planning is to provide facilities for cyclists. Cycling-specific facilities, properly engineered, will serve to provide a safe environment for cyclists, will encourage the public to try cycling as a transportation option, and will educate other road users to share the road. To this end, planners should consider:

- **Improvements to the existing infrastructure to accommodate a safe bicycle transport system for all types of cyclists;**
- **Links between different types of transport systems to create continuous bicycle routes;**
- **Adequate end of trip facilities;**

- **Introduction of physical structures to affect travel mode choice;**

- **Facilities for recreational and sport/fitness cycling; and,**

- **Increased maintenance of the cycling-specific infrastructure.**

Specific design features of facilities and maintenance are covered in more depth in Sections 15-28.

9.2 Education

Education is the key to ensuring cyclists safety. An understanding of the proper cycling techniques and motorist-cyclist interactions is the single most important factor in the development of a safe cycling environment. Education increases road user awareness and bicycle-safety skills and provides road user information. It can take the following forms:

- **Liaison with local governments, police, cycling groups, and support agencies, such as safety councils and schools, to establish a network of allies working towards a safer cycling environment;**

- **Community education and recreation programs aimed at motorists and cyclists alike to teach safe motoring practices, safe cycling techniques, and to inform about cycling issues (these are often carried out by the local School Boards, Parks and Recreation Departments, and driver training schools); and,**

- **Formal education programs on safe cycling to be taught as core curriculum in the schools.**

Appendix H describes a sample of education programs.

9.3 Enforcement

Enforcement provides an education function as well improving compliance with the law so that all road users

benefit. Legislation covering bicycles is contained in the provincial Motor Vehicle Acts, and local municipal by-laws. Enforcement agents must be trained to understand the law as it applies to cyclists. To ensure enforcement, the following actions are needed:

- **Legislation at both the provincial and municipal levels which addresses cycling issues in a fair and realistic manner with consideration for all cyclists;**

- **Law enforcement programs that are effective and equitable to cyclists and motorists;**

- **Police departments and enforcement agencies that are trained, kept informed, and involved; and,**

- **Regular traffic violation enforcement to reinforce the rights and responsibilities of all road users.**

See Sections 36-39 for more information.

9.4 Encouragement

Encouragement goes beyond the creation of safe cycling facilities. Encouragement must be an active outreach to persuade the general public to overcome perceived fears and safety concerns in order to allow for a travel mode choice. Encouragement promotes the benefits of cycling and helps direct the general public to cycling-specific facilities. The following needs to be developed:

- **Awareness of specific bicycle facilities;**

- **Awareness of available cycling safety programs;**

- **Respect for the cyclist as a legitimate road user; and,**

- **Increased confidence of cyclists in their use of transportation routes for utilitarian, recreational and sport uses.**

More information on Encouragement can be found in Sections 45-47.

9.5 Transportation demand management (TDM)

Transportation demand management involves the implementation of specific strategies to influence the driving behaviour of the general public. These strategies will not require everyone to give up driving their private automobile, but they will encourage people to consider their transportation options - including walking, cycling, and transit use. Transportation demand management is designed to effect small, incremental changes in driving behaviour, and is expected to affect only a small portion of total travel. However, the cumulative influence can be significant, perhaps as much as a 30% reduction in private automobile use.

The multiple benefits of traffic demand management strategies will include reducing collisions, pollution, noise, and congestion as well as reducing infrastructure costs and user costs. The result will include an increase in non-driver travel choices, a transportation network that is more socially equitable, and regional economic efficiencies.

Transportation demand management strategies include:

- **An understanding and consideration of access and mobility concerns of the general public;**
- **The development of programs which enable people to make cycling a realistic transportation option;**
- **The development of programs which discourage people from using the private automobile; and,**
- **The establishment of programs that make more effective use of the transportation network through co-operative or shared use and through the modification of fee structures.**

Section 14 deals with TDM strategies that focus on increasing cycling opportunities.

10 CO-ORDINATION BETWEEN JURISDICTIONS

The full integration of bicycling plans into all government planning processes is key to their initiation and continuation. A framework that recognizes all relevant levels of government and within which planning for bicycle facilities can occur must be established. This framework should include:

- **A clear definition of the responsibilities of the different jurisdictions, whether local, provincial, regional, or federal;**

- **A means of ensuring co-ordination between the different jurisdictions, including mechanisms for co-ordination between departments within one level of government as well as between different levels of government;**

- **A means of training staff to ensure that all staff involved with the planning and implementation of bicycle plans have the appropriate background and education; and**

- **A mechanism to involve the public and particularly cycling related organizations.**

Appendix I is a sample Bicycle Plan template to assist municipalities with this process.

11 IDENTIFYING THE TARGET GROUP

It is important to identify for whom the facility is being designed. It is not sufficient simply to state "cyclists" without acknowledging the variety of different types and skill levels of cyclists. Unlike motor vehicle drivers who have all demonstrated knowledge of traffic regulations through testing and possess a definite understanding of their right to the road, cyclists have not been tested, nor do they always comprehend their rights and responsibilities as road users. Cyclist and bicycle licencing is discussed in Section 34 & 35.

Cyclists, depending on their age and their motivation for using a bicycle, are attracted to, and will be comfortable on very different facilities. Depending on the experience, and confidence of the cyclist and the type of bicycle being used, some cyclists will prefer quiet residential streets, whereas others will want to use the most direct route, and still others will prefer to use off-road paths and trails wherever possible.

It is often difficult to collect data on the extent and type of bicycle use. The Bicycle Institute of America publishes an annual estimate of bicycle use incorporating a variety of categories based on sales figures, demographics, and other sources in the bicycle industry. These statistics show that the number of cyclists has been increasing gradually, as has the number of adults riding regularly. The most significant increase has been in the use of the mountain bike, though numbers of commuters, tourists and vacation cyclists as well as event participants, and racers have all shown increases.

We also know from research that only a small proportion of people are using bicycles to travel back and forth to work. As data collected tends to focus on majority time use, it is difficult to actually determine the percentage of bicycle use for utilitarian purposes, outside of commuting. Regardless of the purpose of the trip, it is safe to say that most cycling occurs on the roadway network.

This chapter outlines the various types of cyclists. It will help the designer to understand cyclists' needs as well as the other factors to consider in the planning and implementation of bicycle facilities.

11.1 Types of Cyclists

From a planning perspective, cyclists can be divided into two broad categories that cover a range of physical abilities: age and skill.

11.1.1 Age

Cycling appeals to people of all ages and planning for cyclists must cover the needs of young and old. However, the majority of planning for cyclists will occur in relationship to the transportation network, incorporating off-road and recreational facilities where appropriate.

11.1.1.1 Adults

Most cyclists are adults. And the number of adults cycling is on the increase. Their abilities range from riding around the block for fitness and recreation to cycling several hundred kilometres in a day. Adult cyclists have no special characteristics. The only exceptions are older cyclists who may have limitations due to slower reaction times, and poor hearing, vision or balance.

Even if the adult is a motor vehicle driver, and therefore has been tested with respect to the use of the road, there is no guarantee that the adult cyclist will transfer that knowledge to the operation of a bicycle.

11.1.1.2 Children

Child cyclists are different from adult cyclists. The most critical factor is the child cyclist is smaller and rides a smaller bicycle, which means they are less visible. Also children's understanding of the interaction of various forms of transportation is limited. And depending on the age, children do not always understand the consequences of their actions. They consider themselves to be in a separate, invulnerable world and ride accordingly.

The motor skills of child cyclists are usually less developed. This can cause erratic bicycle riding. Children are often riding bicycles that are too large for them, that are not particularly stable, and that are not well maintained.

Children typically ride their bikes to school, to the corner store, to the homes of their friends, and to neighborhood recreational areas. Children tend to ride on residential

streets, pathways, and sidewalks. They tend to ignore, as opposed to avoid, traffic. The average range for young children is approximately 1 km, and for older children, up to 5 km.

Most urban municipalities have ordinances banning bicycles with wheels over 24" from sidewalks. This allows young children to ride on sidewalks, a reasonable exception to the general rule that bicycles belong on the road.

11.1.2 Skill levels

Skill levels vary widely in cyclists. This is quite apparent whenever you watch cyclists on the road or pathway. It thus becomes more challenging for planners to design for a specific level or cycling speed.

11.1.2.1 Casual

Casual cyclists are those who ride bikes infrequently. They typically drive to the local library or around the neighbourhood for exercise and tend to avoid busy traffic areas. Most casual cyclists have poor to fair bike handling skills. They generally are focussed on getting around rather than integrating with other traffic and do what is most convenient to accomplish their goals. The casual cyclist considers their limited exposure as limiting their responsibility on the road, if they think about it at all. They tend to obey the rules of the road when it is convenient but may not be cognizant of their role in traffic network. Their range is from 5 to 30 kilometres.

Novice cyclists share the bike handling, traffic avoidance and range characteristics of the casual cyclist. They may either remain casual riders or become more experienced ones by taking a course and gradually increasing the amount and regularity of their cycling. The casual and novice cyclists often favour bicycle paths.

11.1.2.2 Experienced

Experienced cyclists ride their bikes frequently. They have good bike handling-skills and are not afraid to ride in traffic, even on routes that are quite congested with a variety of other users. They ride for a variety of reasons and their range can vary from local neighbourhood riding to over 100 km per trip. Although generally aware of the rules of the road, experienced cyclists may try to take advantage of flexibility and manoeuvrability offered by the bicycle in congested traffic situations. They do this based on a calculated evaluation of the options and the consequences. In general, the experienced cyclist is fully aware of the role in the traffic network and ride defensively.

11.2 Types of trips

Trips can be divided into two categories: destination and recreation.

11.2.1 Destination

A destination-oriented trip is one for which the purpose is to reach a particular place. The means of transportation is secondary. Most urban centre trips are focussed on reaching a destination.

All trips of this type are utilitarian. They include riding to work, to the corner store, going shopping, going to the library, etc. These trips often involve transporting goods.

Commuting is the best recognized destination trip. A commuter is someone who regularly travels the same, or similar, route to a destination. They are usually concerned with keeping the time and distance of their trip to a minimum, unless they are combining their commute with other activities, such as running errands, or fitness training. Bicycle commuters will often use a major thoroughfare because it is the most direct route. Even when there are alternative routes available, the commuter often chooses the major thoroughfare because it has the fewest stop lights or stop signs, and there is less traffic

that is slower (i.e. casual cyclists). For these same reasons, most commuters will avoid bicycle paths unless they lead directly to their destination and have few interruptions. Bikeways that give priority to cyclists and provide direct access are often favoured by this type of cyclist.

11.2.2 Recreation

The destination is of secondary importance to a recreational cyclist. The prime concern of the recreational cyclist is to enjoy the ride and often this means being away from other traffic which is noisy and busy, enjoying the scenery, and being in the company of fellow cyclists. These trips can be taken on bicycle paths, quiet neighbourhood streets or rural roads. The recreational cyclist does not usually ride fast and is not concerned with the amount of time it takes to complete the trip.

Fitness and sports cyclists ride their bicycles for exercise and skill training. Distances can be 100 km long at speeds over 25 km/hour. These trips are often taken alone to improve general fitness or in groups simulating race conditions to improve skill and fitness. These cyclists prefer to ride outside of urban centres where traffic volume is low and trip interruptions, such as stop lights, are minimal.

11.3 Types of collisions

Safety ranks high among the many considerations when planning a bicycle facility, whether it is a roadway design or a bicycle pathway. Many cyclists are afraid of riding their bicycles because of the perceived risks. Planners and facility designers should be aware of the major causes of collisions and attempt to reduce their potential.

Bicycle-related collisions happen in a variety of ways that can be grouped into two categories: 1) those involving motor vehicles; and, 2) those not involving motor vehicles. The reasons for using this type of distinction or grouping are the frequency of the type and the severity of the

injuries sustained. In collisions involving motor vehicles, crashes are fewer in number but the injuries are generally more severe. By contrast, non-motor vehicle collisions tend to be relatively minor with respect the injuries sustained, however, they account for a tremendous number of incidents.

Non-motor vehicle bicycle crashes result from a wide variety of causes, varying from the skill level of the cyclist to the weather and road conditions. Many of these incidents go unreported because the injuries sustained are minor. Because of the lack of research and the limitations on being able to alter the conditions that cause the crash, this manual focuses on bicycle/motor vehicle collisions.

11.3.1 Bicycle/motor vehicle collisions

In 1978, Cross and Fisher studied bicycle crash statistics in four different communities. Although this study is somewhat dated now, the approach taken in this study has aged well. Subsequent studies have not been as extensive, though tend to concur with the results of the Cross/Fisher study. In their study, Cross and Fisher identified 35 different types of bicycle/motor vehicle collisions. These can be grouped into seven different crash types.

11.3.1.1 Mid-block ride-out

Mid-block ride-out is when a cyclist exits perpendicular to the flow of traffic. This type of manoeuvre occurs from driveways, alleys, or simply "hopping the curb". Because the cyclist's entry into the traffic flow is unexpected, and the cyclist is required to yield the right of way, if a collision occurs, the cyclist is most likely to be struck by traffic in the first lane. This likelihood increases with the number of lanes being crossed and the traffic density. This type of collision is most common with children and usually take place in the daytime near the cyclist's home.

11.3.1.2 Controlled intersection ride-out

This occurs when a cyclist fails to honour a stop or yield sign, runs a yellow or red light or if the cyclist, because of their slower speed, is caught in a traffic signal phase change. In this type of collision, the cyclist is most likely to be struck or crash into the side of a vehicle.

11.3.1.3 Motorist turn, merge, drive-through or drive-out

This class of collision occurs when a motor vehicle enters an uncontrolled road from a driveway or lane, or enters a controlled intersection and fails to yield the right of way. Typically, in this type of collision, the cyclist will either be struck or will crash into the vehicle as it merges onto the roadway. This class of collision also includes motorists opening car doors into the path of approaching cyclists.

11.3.1.4 Motorist passing

This type of collision occurs when the motorist either fails to notice the bicycle in front and strikes it, fails to give sufficient clearance and runs the cyclist off the road, misjudges the position or speed of the cyclist and merges into the cyclist's path, or the cyclist's path is obstructed resulting in the cyclist merging or turning into the path of the over-taking motor vehicle.

11.3.1.5 Unexpected turn or swerve by the cyclist

This class of collision occurs when a cyclist fails to signal, and turns or swerves into the path of a motor vehicle which is either travelling in the same direction or the opposite direction. This category also involves wrong-way cyclists. In most instances, the cyclist has also failed to shoulder check, and has not allowed sufficient time to complete the manoeuvre.

11.3.1.6 Unexpected turn by the motorist

This class of collision occurs when a motor vehicle turns into the path of a front or rear-approaching cyclist. In most cases, the motorist fails to signal a turn, or having signalled, fails to check for and yield to the right-of-way to the cyclist.

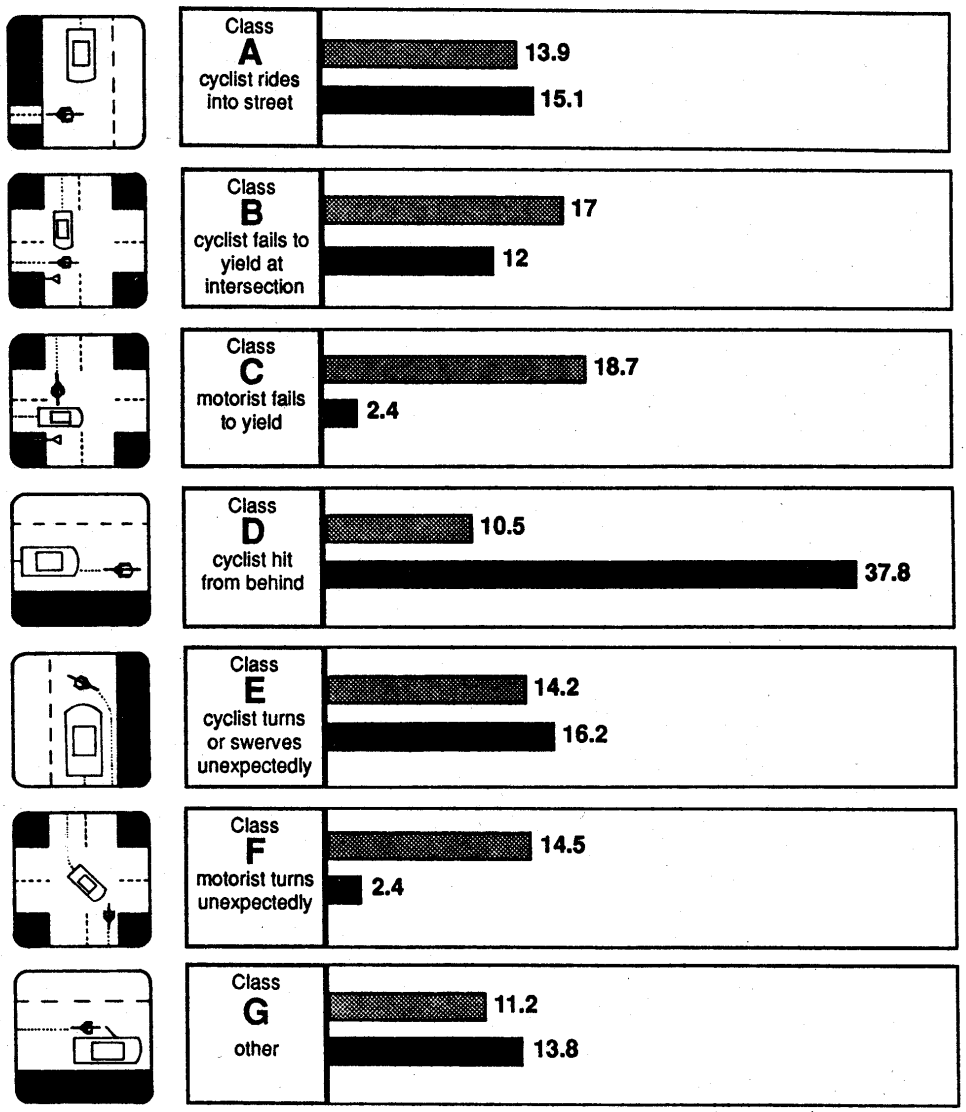


FIG. 1 CAR / BICYCLE COLLISIONS

11.3.1.7 Other

This class of collision includes other crashes such as head-on collisions due to wrong way riding, parking lot collisions, motorists and cyclists cutting corners when turning, motorist pulling out from on-street parking, etc.

11.3.2 Bicycle Crashes

Bicycles are less stable than other modes of transportation and more susceptible to deteriorating road conditions, and poor maintenance. Single bicycle crashes, bicycle-bicycle collisions, and bicycle-animal collisions can happen for a variety of reasons. They are usually due to a lack of skill or attention by the cyclist in combination with a change of facility conditions, traffic conditions or weather conditions. Some examples are: wheels being caught in grates or potholes; sliding out on gravel or ice while turning; wrong-way cyclist on a narrow facility; and, being forced off the road due to vehicle turbulence. These are best avoided by good facility engineering, regular or enhanced maintenance in combination with proper bicycle handling skills training.

11.3.3 Bicycle/pedestrian/in-line skaters collisions

To-date, very little data has been collected on crashes that occur on facilities that are shared by bicyclists, pedestrians, and in-line skaters, though this is a growing area of concern for planners and other municipal officials. Many of these crashes are not reported as no serious injuries are sustained.

12 MODEL PLANNING PROCESS

Strategic planning is used to co-ordinate the goals and actions of several different components, such as engineering, recreation and community design. Short-range planning addresses facilities plans, subdivision design, or a road-construction project. The model planning process presented here can be applied to either a

long-range comprehensive plan or an individual project plan.

The best planning efforts use an "integrated" approach to bicycle-facilities planning. This concept develops a network of routes and facilities based on the existing road system and within the context of the existing urban infrastructure. The separate bicycle plan approach is not recommended. These plans often fail to integrate the various components needed to develop a workable bicycle-facility program. See Appendix I for a sample template of what a typical Bicycle Plan should contain. This Bicycle Plan would then form part of the overall transportation plan and/or community plan.

The planning process does not need to be cumbersome or difficult. Several key factors, however, should be kept in mind. The most important is to ensure that planning for bicycles becomes incorporated into any document or policy statement guiding local and regional municipal councils. Bicycle-facilities specifications should be included in standard municipal design specifications. Financing the bicycle-facility and program construction or implementation will thus become part of the base-level funding for budget purposes.

Throughout the planning process, every effort should be made to involve the public and bicycle user groups. This can save costly mistakes. One successful method of involving the public and, specifically, those knowledgeable of cycling issues, is to establish a standing committee of council. Staff may support this committee in a technical-advisory capacity. These city cycling committees have been very successful in cities all over Canada and the US.

In addition to a standing committee of Council, ad hoc advisory committees can be struck to deal with specific developments or issues. Other effective means of conducting public consultation are open houses, workshops, focus groups, walkabouts, data collection, public meetings, website, newspaper ads, flyers, and telephone hot-lines.

The following is a model planning process in use in most Canadian jurisdictions. It can be adapted as necessary to

fit local situations. There are eight steps to be considered as an action checklist.

1. **Background research and analysis**

   Public involvement

2. **Examination of opportunities and constraints**

3. **Development of goals and objectives**

   Public involvement

4. **Development of options and criteria**

   Public involvement

5. **Selection of preferred options**

6. **Development of implementation strategy**

7. **Development of monitoring mechanism**

8. **Public consultation program**

12.1 Background research and analysis

At a minimum the following 13 points should be considered when preparing the background report:

i) **Existing conditions**
ii) **Demographics**
iii) **Crash statistics**
iv) **User surveys, questionnaires**
v) **Existing standards (design, engineering)**
vi) **Existing safety programs**
vii) **Existing enforcement programs**
viii) **Existing education programs**
ix) **Known or proposed projects affecting bicycles or cyclists (i.e. new subdivisions, new or redevelopment projects such as commercial, industrial, residential, new or reconstructed roads, bridges, etc.)**
x) **Current planning policy documents**

xi) Forthcoming revisions to existing planning policy documents
xii) Jurisdictions, and,
xiii) Resource groups or individuals (see Section 7).

12.2 Examination of opportunities and constraints

In any planning process, the following tasks should be undertaken: assess the overall situation based on existing knowledge; identify the key projects and opportunities to influence the policy decisions; and, identify the resources. There are two categories of opportunities and constraints related to bicycle planning that should be considered. These are:

i) Physical - The existing road systems (width, surfaces, etc.), traffic volume and speeds, pedestrian flows, gradients, and major barriers (one-way streets, bridges, multi-modal links); and,

ii) Organizational - The funding, jurisdictions, and co-ordination between these various bodies.

12.3 Development of goals and objectives

The formulation of goals should involve planners, engineers, elected officials and the public as represented by key groups, clubs, and others. The process should be conducted in keeping with the fundamentals of a comprehensive bicycle plan (see Section 5 and 8 and Appendix I).

The goals and objectives should then be reviewed in light of the information contained in the background report.

Ideally, an annual review of the goals and objectives in light of feedback from the monitoring mechanism (see Section 12.7) should be undertaken. Recognizing this may not always be possible, the goals and objectives should be reviewed at least every five years when other planning policy documents are reviewed.

12.4 Development of options and criteria for evaluation

Criteria should measure the suitability and feasibility of options. There are three basic sets of criteria to consider:

i) Cyclists' criteria;

ii) Other users' criteria (motorists, pedestrians, etc.); and,

iii) Other criteria (i.e. design standards).

12.5 Development of preferred options

Selection is based on the evaluation of the options developed in Step 4. Each option is evaluated further with respect to goals, objectives, cost-benefit analysis, and community compatibility.

12.6 Development of implementation strategy

There are three steps:

i) Identification of required actions and the departments or agencies to carry them out;

ii) Development of a budget (this may flow from the cost-benefit analysis done for each option in Step 5); and,

iii) Development of a time frame.

12.7 Development of monitoring mechanism

The success of any program or planning exercise can only be determined by assessment at regular intervals. Feedback can be obtained from surveys, comparison of crash statistics before and after implementation, and from solicited and unsolicited comments (see checklist under Section 12).

This monitoring exercise can lead to the reassessment of the goals and objectives and re-evaluation of the selected option.

12.8 Public consultation program

Public consultation (see Section 7) is crucial to the success of any planning exercise. It should not be the last component to be considered. It is integral to the overall process. Any changes occurring during the planning phases must be communicated to those who have expressed interest in the project. Reasons for the changes should also be clearly explained so that the co-operation between the different groups is not lost.

The following mechanisms are suggested to involve the public, interest groups, and staff in a productive team effort:

- **Preliminary meetings with key groups and individuals so that opportunities for advisory assistance, issues and constraints, and the perceived needs of the various users can be identified;**

- **Open house to involve the general public, to publicize the process and allow staff and elected officials a chance to appreciate the concerns which the community has regarding the provision of bicycle facilities in their area;**

- **Properly administered surveys and questionnaires, along with an information hot-line and website to solicit reaction to and suggestions for a proposed project and as a follow-up after a facility has been built;**

- **An advisory committee to communicate the process to the public and to present issues for consideration; such a committee can consist of staff and elected officials or, in larger municipalities, it can include staff, elected officials and members of the public, such as representatives of local cycling or safety organizations;**

- **Workshops and focus groups are useful forums to address sensitive issues, and provide a platform for open debate and focussed discussion on the issues without involving the entire community;**

- **Public meetings to convey information to the community at a point in the process where substantial feedback is not expected;**

- **On-going publicity through press releases, local newspaper articles, door-to-door flyers, a telephone information hot-line and an internet website; and,**

- **Ongoing liaison with interested groups or individuals. This can be a key source of information regarding the project's success.**

The effectiveness of the planning process will ultimately depend upon the following:

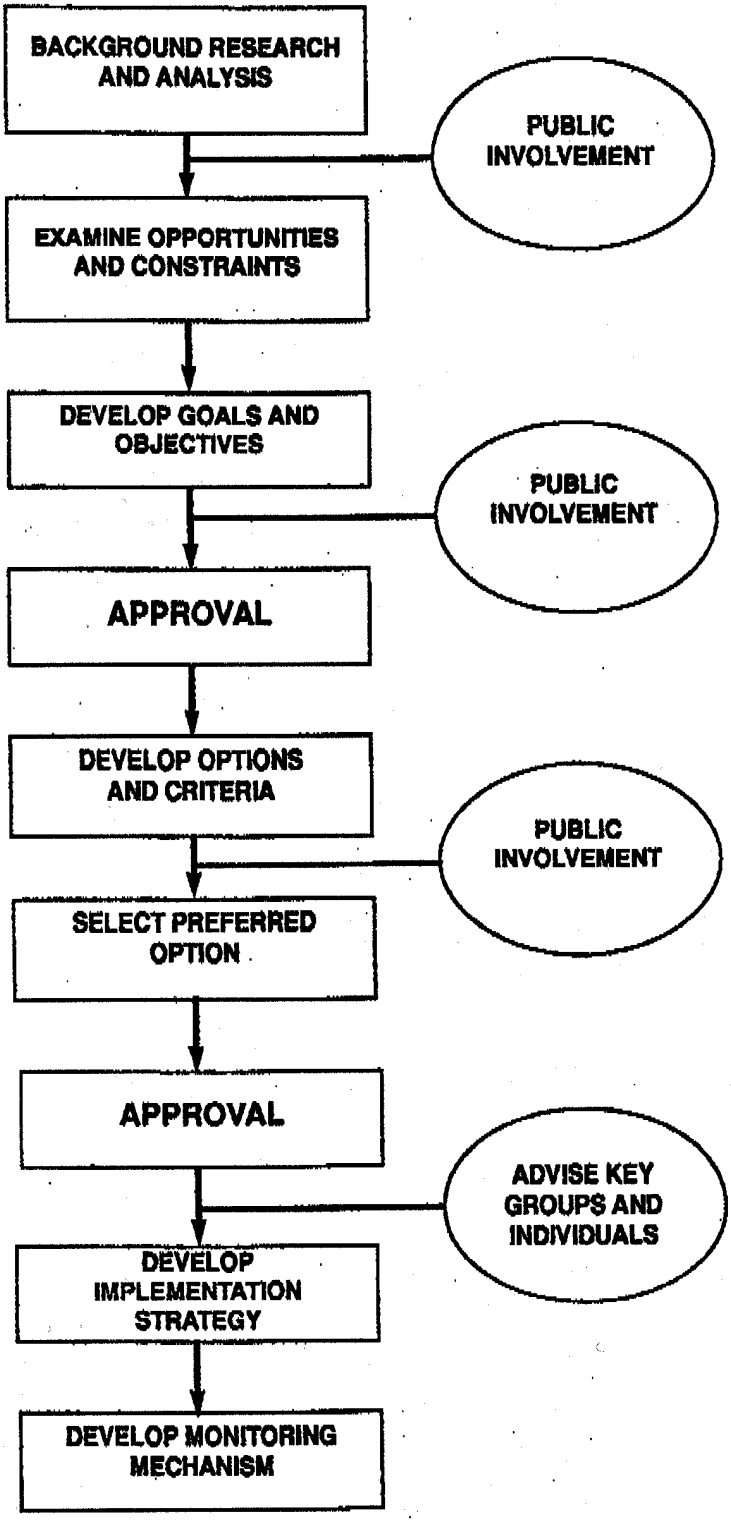
- **Ensuring the integration of the final product into local policy documents by following a clearly defined process involving local elected officials and planners, engineers and the public;**

- **Identifying the size and nature of the area (urban centre or rural locale) being considered for the provision of bicycle facilities or programs and tailoring the process to meet the area's needs; and,**

- **Identifying the available resources (human, financial, and time).**

The flow chart identifies the key decision-making steps and the opportunities for public involvement.

BICYCLE FACILITY PLANNING PROCESS



13 PLANNING TOOLS

There are many sources of information that may be used to integrate planning and design for bicycle facilities into the existing and future urban infrastructure. The following sections describe some of these sources that are available to municipal planners and developers.

13.1 Official (municipal) plans

An official plan, because it is a statement of the policy direction of a municipal council, is the most important means of achieving the full integration of planning for bicycle facilities and programs. The document can address roads, transportation and residential, commercial and industrial land use. It can also direct policy implementation. For these reasons, it is very useful for planners and designers of bicycle facilities to prepare long-range strategic plans and budgets.

13.2 Zoning by-laws

Municipal zoning by-laws are the method of implementing the policies laid down in the Official Plan. Zoning by-laws control the use of land and are enforceable while policies on their own are not. They are key to implementing standards and specific facilities in certain locations or in association with certain uses as defined in the by-law.

Many municipal bicycle plans reflect the implementation of zoning by-laws. For example, the "Vancouver Comprehensive Bicycle Plan" produced by the Bicycle Advisory Committee for the City of Vancouver in 1988, is very specific about the number and type of bicycle parking facilities to be provided for each class of residential dwelling, institutional use, cultural and recreational use, commercial and industrial use (see Appendix E). Examples such as this establish the increasing recognition of the bicycle as an accepted means of transport.

The minimum standards imposed by the local municipality should include bicycle standards.

13.3 Municipal by-laws

Unlike zoning by-laws, municipal by-laws do not regulate the use of land but rather, regulate the actions of residents of the municipality. Such things as parking restrictions, traffic control or permitting bicycles on sidewalks would be covered by municipal by-laws. These tools can be very useful in reinforcing general policies regarding bicycles and bicycle facilities more through positive statements than through prohibitive statements. (e.g. do not restrict attaching bicycles to lampposts if there are no bicycle parking facilities provided).

13.4 Site plan agreements

Development proposals for residential, commercial and industrial projects or for their redevelopment, often involve site plan agreements. The agreements provide the ideal opportunity to negotiate the inclusion of bicycle facilities into the overall design. The agreements can address access, parking, internal roadways (bicycle routes) and the location of structures on the land that will be developed or re-developed.

13.5 New subdivision design

Many of the items mentioned under Planning Concepts (Sections 4 to 8) should also be considered here. Proposal circulation should include agencies such as the local police force, school and parks board. Public notification can assist in developing a mutually acceptable final design. The planning process should examine road patterns and connections with existing transportation routes so that residents of the subdivision will be able to use their bicycles for commuting or other purposes. Main bicycle routes to the workplace, shopping areas, connecting transit depots or other destinations should also be considered. For example, the internal road network should ensure that short trips to schools,

recreation centres or parks and local shops are safe and enjoyable for residents. New subdivision design must also consider links to existing and neighbouring subdivisions.

13.6 Dedication of green space

Many municipal governments require dedication of green space and parkland in development permit applications either in the form of land deeded to the municipality or as cash-in-lieu. This dedication provides an ideal opportunity to plan in bicycle facilities in the form of off-road bicycle paths, and off-road links.

13.7 Urban centre re-development

Most Canadian urban centres are experiencing some form of re-development. This offers the opportunity to incorporate bicycle facilities during the renaissance of an urban centre. There should be guidelines in place in the planning documents directing the planners and designers to incorporate bicycle facilities, providing new opportunities and incentives for residents to use bicycles to reach commercial and recreational areas. Policies should be flexible enough to permit bicycle facility designs without necessitating the re-zoning or re-designation of parcels of land and to take advantage of providing connectors that will actually give bicycle transportation priority over other road users.

13.8 Road re-construction

Whenever roads are scheduled for re-construction, bicycle-facilities provision should be part of the initial planning and design. Whether it is a major arterial, a collector road or a neighbourhood street, the incorporation of features to accommodate and encourage cyclists can be calculated into the overall costs of the project. In this way, as roads are constructed, bicycle facilities will be integrated into the overall infrastructure. This method of integration is more cost-effective in the long run.

13.9 Major urban infrastructure

Planning and design for bicycles must be incorporated into the fabric of any development project. The bicycle facility is not to be viewed as a separate entity anymore than a new arterial road or the re-development of an older industrial area is viewed in isolation from the area surrounding it. The integration of bicycles into the overall transportation network must be dealt with at the base level, within the context of the larger urban area, if it is to be cost-effective, efficient and ultimately successful. The overall concept of an urban design is often lost in the details of many individual projects, but planning for changes to the urban infrastructure is both feasible and practical.

The aspect of budget considerations is of equal importance in the pre-planning stage. The cost of bicycle facilities when they are incorporated into the base budget of the project is minor as compared to the cost of undertaking such a project separately.

13.10 Land exchange

Municipalities have land exchange at their disposal. Often developers or landowners are willing to trade part or all of their land for a more favorable site. In this way, municipalities can acquire lands that can be used for the development of bicycle facilities.

13.11 Warrants

Warrants can be used to justify the need for bicycle facilities. The use of warrants in the field of bicycle planning is relatively new and very few standards have emerged. In general, the guidelines and warrants that exist for pedestrian crossings can be used or modified and used for bicycle crossings. Crossings are the most common application for the use of warrants in planning for bicycle facilities.

13.12 Property Ownership

Occasionally, property owned by someone else can be used to provide a bicycle facility. Often the property is owned by a utility or railway. Where the uses are compatible, the corporation will often donate or allow the use of the property with simple liability agreements. The most common use of such property is to provide linear parkways.

13.13 Regional Jurisdiction

Regional jurisdiction should not pose a problem for the provisions of bicycle facilities that cross boundaries. It is important that neighbouring municipalities and property owners work together to ensure that an investment in a bicycle facility is compatible with the goals and objectives of each party. Often the plans of a neighbouring jurisdiction will be the tool to encourage new facilities to transcend boundaries.

14 TRANSPORTATION DEMAND MANAGEMENT STRATEGIES (TDM)

Transportation plans tend to focus on traffic volumes and speeds because they are easily quantified whereas mobility and access are often ignored. The purpose of transportation demand management strategies is to ensure that land use policies that promote alternative transportation options addressing mobility and access are successful.

TDM involves active intervention to change the travel behaviour of a constituency. At the planning level, effective TDM includes a variety of strategies to make more efficient use of the existing transportation network.

TDM planning is a relatively new concept, though many of the strategies have been in use in other aspects of planning. Effective TDM planning involves a large range of strategies with a number of different partners at various levels of government and industry. This part of the manual

focuses on those strategies that involve cycling as the means to affect the strategy.

14.1 Transportation allowances

Transportation allowances have become the strategy of choice in transportation demand management mainly because it is an add-on strategy rather than a take-away one. Transportation allowances are employment-based allowances that give employees financial benefits for utilizing alternative transportation modes, either directly or indirectly. The allowances can be in the form of a transit pass, subsidized vanpool program, and free membership for cyclists/walkers in a company (or other) fitness centre, etc. Although planners do not have control over employee benefits, the planned facilities will often dictate the necessity of encouraging alternative transportation.

Employers can be encouraged to eliminate "free" parking spots for employees by having the number of motor vehicle parking stalls limited. In their place, a standard transportation subsidy should be encouraged which can be used as the employee wishes. This amount of the subsidy should be aimed to cover the cost of using transit or the use of shower facilities but not cover driving and parking expenses.

14.2 Park-and-ride facilities

Park-and-ride facilities are designed to allow suburban commuters to drive to a central location, park their vehicle, and ride share or take transit from that point. The benefits of park-and-ride facilities are that they reduce the demand for downtown parking space and they reduce traffic congestion in the urban centres. The drawback to park-and-ride facilities is that they encourage urban sprawl by reducing the cost of long distance commuting.

14.3 Free shuttle services

To encourage people to use alternative forms of transportation, free shuttle services can be offered in the central business districts of urban centres and also in other areas of heavy demand. This service can be paid for through a partnership arrangement of businesses, transit and the municipality. Employers can also offer a shuttle service between the place of employment and a convenient transit exchange.

14.4 Carpool/Vanpool

Carpooling and vanpooling work best when the employer takes an active role in coordinating partners and facilitating the purchase of the vehicles. Pooling transportation resources in this way reduces the amount of infrastructure required by the employer and ultimately by the municipality.

From a planning perspective, carpooling and vanpooling can be encouraged through the provision of HOV lanes, and priority parking spaces. Carpooling and vanpooling reduce the need for parking and reduce urban centre congestion at peak times.

14.5 Telecommuting

Telecommuting allows employees to work from home on a regular basis. The advantage of telecommuting is that it reduces the number of times a person is commuting to the office in a given week. Telecommuting is often the first initiation people have to not using an automobile as often and considering other transportation options. It also tends to encourage people to live in areas where shopping and other facilities are close at hand and to which they can travel by bicycle.

In order to telecommute effectively, and depending on the type of employment, the employee must be able to re-create the office resources at home, often requiring cable hook-up for computers, cell phone coverage, and the

ability to create or re-design the house to include a dedicated office space.

14.6 Alternative work hours

Alternative work hours are often arranged to accommodate lifestyles as well as to reduce traffic congestion. The most common alternative work hour strategy is a compressed work week which allows the employee to work 4 days out of 5 or often 9 days out of 10. This strategy reduces the number of commutes and overall demand for parking.

Alternative work hours can also refer to flex-time which alters the start and finish time of the workforce in order to relieve demand on office resources. It also relieves peak-time traffic congestion allowing for more efficient use of the transit system.

14.7 Guaranteed ride home

For those who do choose to use an alternative form of transportation, employers are encouraged to implement a "guaranteed ride home" program in case of an emergency. By providing a contingency plan, employees are more inclined to consider different transportation options. Typical ways to manage this are to provide taxi cab vouchers or access to a company vehicle.

14.8 Bicycle purchase/lease program

Employers are also encouraged to extend financial support to employees to allow them to purchase or lease bicycles for the purposes of commuting, just as they might extend such an offer to purchase a home computer. Often this incentive is the motivation to try bicycle commuting.

14.9 Emergency breakdown support system

One of the biggest stumbling blocks, particularly for women is what to do if the bicycle breaks down or has a

flat tire. Similar to the guaranteed ride home, employers can provide an emergency pick-up service that overcomes that barrier. Studies have shown that this back-up is hardly ever used, but it provides a sense of security for the person who is hesitating about using a bicycle to commute to work.

14.10 Bicycle fleet

Employers who have adjacent buildings or branches within 3-4 km of each other, or a reason for their employees to travel within 3-4 km of a home base can think about providing a fleet of bicycles rather than company vehicles. This fleet requires less parking space and depending on the circumstances is as efficient as a motorized vehicle. Providing such a fleet may actually increase efficiency in some cases. It is also recommended that helmets be provided with the bicycles. Many municipalities have been the leaders in the provision of this strategy.

14.11 Bike-buddy system

To build confidence, a useful system for implementing a successful bicycle commuter program is to establish a "bike-buddy" system. The bike-buddy system allows a more experienced cyclist to mentor a new cyclist, helping them with the selection of gear, choosing routes and negotiating in traffic. If such mentors are not available at a worksite, then liaising with nearby worksites, or local clubs can also provide this link. Often municipal recreation departments can assist with this coordination in conjunction with the provision of bicycle skills training.

14.12 End-of-trip facilities

Key to the success of transportation demand management strategies is the provision of suitable end-of-trip facilities. End-of-trip facilities design is discussed in Section 21. To change the travel behaviour of employees and the general public, there must be secure bicycle parking at the destination. The type of parking provided will differ for employees and for short-term visitors to the facility.

In addition, employees will require shower, change, and storage facilities. By-laws can make the provision of such facilities mandatory in all new construction. Retro-fitting such facilities can be facilitated when there is supporting policy at the municipal level.

14.13 Tolls and Fees

Many municipalities and provincial governments are imposing fees on bridges and roads that have been newly constructed to help defer the costs of these new facilities directly from the taxpayer to the taxpayer and the user. Such tolls and fees can also be assigned to existing roadways, which require additional maintenance and reconstruction because of high usage. These tolls and fees can be collected electronically and need not impede traffic. These measure encourage ridesharing.

14.14 HOV facilities

High occupancy vehicles (HOVs) refer to cars, including commercial vehicles such as taxis with 2 or more passengers, vanpools, all types of buses, motorcycles and bicycles. When special facilities are offered for HOVs to give priority to these types of vehicles, the facilities serve as an incentive for people to consider using these options. Special facilities usually refers to a separate lane restricted to the use of HOVs but may also refer to a bus queue jumper lane, and advanced signaling for HOVs.

14.15 Multi-modal links

Transit is most effective when travelling longer distances along busy arterials. By accommodating bicycles on all types of transit (buses, trains, ferries), the catchment area of transit is enhanced. Bicycles can be accommodated by providing racks or providing secure storage at the transit exchange. Multi-modal links are discussed in Section 23.

14.16 Car co-operatives

Car co-operatives provide a more optimal private automobile usage by offering use of a motor vehicle without sole ownership of it. The advantages are reduced costs of ownership, such as insurance and maintenance, and the convenience of easy access to a car when it is needed. At the same time, not having a motor vehicle at your exclusive disposal means that transportation options are examined before the decision is made to use the car. Early research has shown that households participating in shared vehicle programs have reduced their driving by approximately 50%.

To be workable, car co-operatives are often organized by an outside agency. Planning departments can be instrumental in assisting neighbourhood groups with the logistics and administrative details of creating a neighbourhood car co-operative.

15 HISTORY OF FACILITY DESIGN

During the 1930s and 1940s, the bicycle was a commonly used mode of transportation. This was due to the compactness of most cities, the high cost of a car and, during the Second World War, gasoline rationing.

The 1950s were a time of expansion and affluence. Cities sprawled, cars were less expensive and expressways were being built. All these factors gave the general public the opportunity to live further away from amenities. It is during these years that bicycle use plummeted and the bicycle was reduced to the status of a recreational toy for children.

It was not until the 1970s that there was a general revival in cycling. The status of the bicycle was upgraded to that of fitness and recreational equipment requiring its own roadways separate and protected from motorists. It was thought that motor vehicles and bicycles could not mix and that serious harm would befall anyone foolish enough to ride a bicycle on the road. This was in some respects true. Roadways were being designed and built for high-speed motor traffic. Other road users gave no thought to their use. Instead, it was thought that cyclists would be safer on their own separate bicycle paths or sharing the sidewalks with pedestrians. It is now known that cyclists sharing a congested sidewalk with pedestrians can be disastrous. It is also known that riding on poorly designed bike paths can be more dangerous than riding on the road.

Throughout the 1980s and 1990s, the focus of encouraging cycling as an alternative form of transportation has been to solve the problems of increasing traffic congestion, deteriorating air quality, increasing travel times, increasing infrastructure needs, and to enhance neighbourhood livability. There has been much research undertaken and many experiments have been attempted to try and recreate the "village" setting and to re-instate the values of an urban centre that villages endorse.

The current approach to bicycle-facility design, using the research and experimentation mentioned above, is based on the axiom that every road is a potential bicycle route. This concept endorses bicycles as legitimate road users. Planning for bicycles should be integrated into both the planning and design process. It should not be a separate exercise. This approach ensures that bicycle facilities are properly planned and designed and that they will be used.

16 CHECKLIST FOR DESIGNERS

The following key concepts must be considered by anyone involved in the planning or design of bicycle facilities:

- ☑ **Know the legislation as it relates to bicycles, including federal, provincial and local ordinances and by-laws;**

- ☑ **Know and be familiar with provincial and local policies and plans, such as municipal official, transportation, and community plans;**

- ☑ **Know the bicycles' technical specifications; there are several standards available, including the manuals of the Transportation Association of Canada and the American Association of State Highway and Transportation Officials;**

- ☑ **Know the differences between the needs of pedestrians, cyclists, and motorists; for example, the time it takes to cross an intersection differs for each, the placement of traffic control push buttons differs for each, etc.; and,**

- ☑ **Know a good resource person; the reason for specific standards and needs may often be obscure and can be explained by someone familiar with cycling in all its aspects. Also a knowledgeable cyclist or cycling group can provide valuable insights into why one type of design is preferable over another and can point out subtleties that may not have been considered in the original design.**

17 CHARACTERISTICS OF THE BICYCLE AND RIDER

The average multi-speed bicycle is 0.6 metres wide, 1.75 metres long and stands up to 1.2 metres in height.

Mountain bike handlebars can be up to 0.8 metres wide. Adult tricycles and trailers used to tow children are about 0.8 metres wide. If mirrors or a side mount safety flag is added, the vehicle can be approximately 1.0 metre wide. The bicycle does not travel in a straight line, but in order to balance moves from side to side. Another 0.3 metres are needed at each side for clearance. This gives a design width of 1.6 metres.

Most bicycles are less than 1.75 metres long. A tandem, however, can be over 2.0 metres. A bicycle towing a trailer or baby buggy can be 2.5 metres long. This can affect the turning radius and parking needs. Overall, this gives a design length of 1.75 metres, but the exceptions should be noted.

A bicycle can be up to 1.2 metres high. The total height of a bicycle and rider can easily exceed 2.0 metres. Another 0.5 metres are needed for clearance. This gives a design height of 2.5 metres.

Bicycles generally weigh between 8 and 20 kilograms, though new, lighter materials are being used for bicycle tubing and components decreasing their weight dramatically.

When traveling at 25 km per hour, a cyclist requires 15 metres to stop. However, stopping distance is affected by a number of factors. Gradient and the combined weight of the bicycle, bags, and rider are important factors. A heavy rider or a loaded bicycle can add 30 percent to the typical stopping distance. Wet-weather conditions can double or triple the stopping distance needed. Also, the speed of the bicycle affects stopping distance. While 15 - 20 km per hour is typical for a casual or recreational cyclist, fitness and sports cyclists can easily maintain between 30 and 40 km per hour.

A bicycle can travel on a variety of surfaces. The narrow tires of many bicycles, however, make sand or loose

gravel a treacherous surface, particularly when it is on a decline or unexpected. Most riders prefer a smooth asphalt surface with its low rolling resistance. Mountain bikes are a bit more stable traveling on loose surfaces and can be ridden almost anywhere.

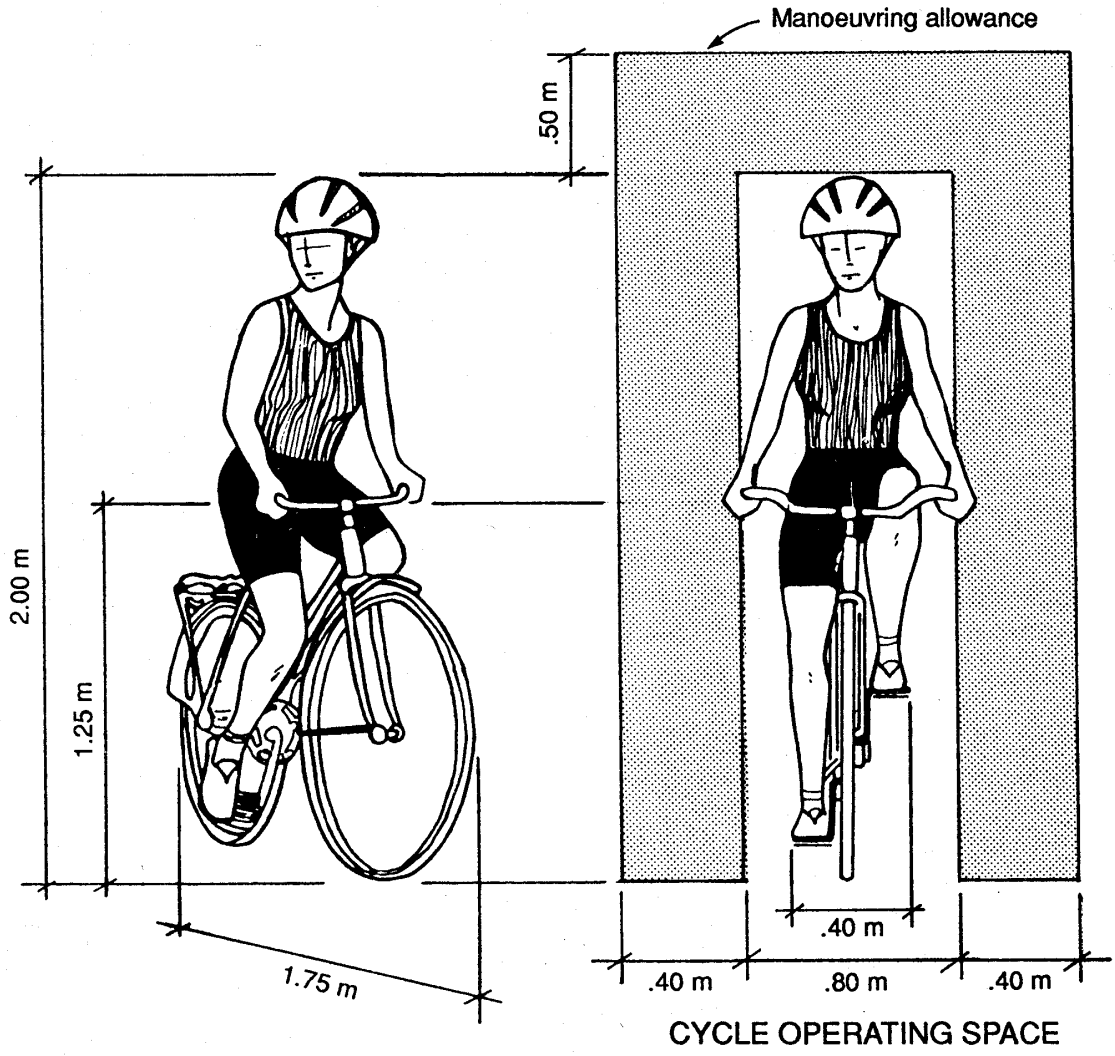


FIG. 2 CYCLE AND CYCLIST DIMENSIONS

18 TYPES OF BIKEWAYS

A bikeway is any transportation corridor that can be used by cyclists. This includes any road, street or pathway, and the bikeway may also be for use by other modes of transportation.

18.1 Bicycle routes

A bicycle route is any road so identified by signs. Often no specific bicycle facilities are in place but often traffic calming devices have been installed. Also bicycle routes may give bicycles priority in certain traffic situations.

A bicycle route is signed because it provides continuity with other cycling facilities or because it is a preferred route through a busy corridor.

18.2 Bicycle lanes

A bicycle lane is a separate lane designated for bicycles on the roadway. A painted stripe, texturing or colouring, or a physical barrier such as a curb physically delineates the lane. The lane is usually identified by signs along the route and/or bicycle symbols painted on the lane.

18.3 Bicycle paths

There are two types of bicycle paths; those that are meant for the exclusive use of bicyclists, and those intended to accommodate multi-users. In reality, even if a facility is designated for use only by bicyclists, there is no effective method of preventing other users from using the facility. It is advised that all recreational pathways be designed for multi-use.

A bicycle path is a separate facility from which all motorized traffic is excluded. It can be located next to existing roadways or in a separate location. Most bicycle-only designs are now incorporated into multi-use recreational pathways. Bicycle paths are usually designed for slow recreational cycling, following waterways and

rights-of-ways to create scenic routes with few roadway crossings.

18.4 Traffic calmed streets

A traffic calmed street is one where physical measures have been introduced to reduce the speed and other negative effects of motor vehicle traffic. Traffic calmed streets are designed to alter driver behaviour and improve conditions for non-motorized street users.

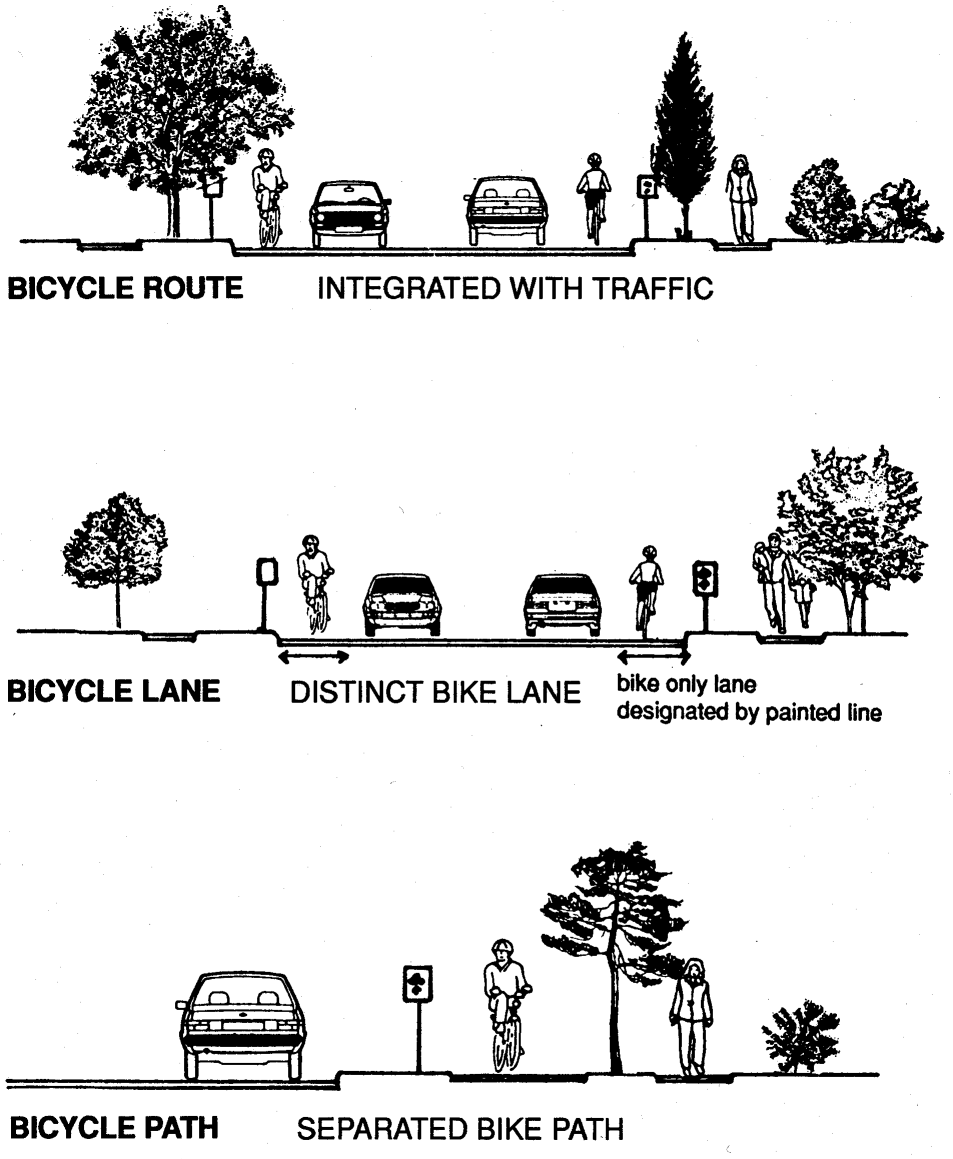


FIG. 3 TYPES OF BIKEWAYS

19 GENERAL DESIGN CRITERIA

All roads are potential bicycle routes. There are a number of criteria to be considered when designing bicycle routes, lanes and paths.

Access
Attractiveness
Continuity
Delays
Destinations
Funding
Surface quality
Topography
Traffic type, volume and speed
User conflicts
Width
Bicycle priority

19.1 Access

Direct access to a bike route is important. Access can be by a path from a neighbourhood or recreation centre, or by a connection from a street. Access to bike routes that are intended to overcome specific barriers, such as bridges or tunnels, must not be overlooked. Access through barriers may be via multi-modal links and these must also be considered. Access for emergency and maintenance vehicles on bike routes must be incorporated into the design.

Signage is important to designate access to bike routes as it facilitates access for bicyclists and alerts other road users to expect more cyclists on specific routes.

19.2 Attractiveness

Recreational cyclists prefer a route of scenic beauty with as little traffic and as little traffic interchange as possible. This means that recreational cyclists are generally willing to go a greater distance to achieve these goals. Designing

a bike route to follow a waterway or right-of-way corridor provides for an attractive, scenic route.

Urban cyclists also prefer attractive routes with less traffic volume, though they are generally interested in as direct a course as possible. Urban cyclists would like to be routed through parks rather than under freeway overpasses as long as the route is direct.

19.3 Continuity

In dense urban areas, bike routes must be designed to connect with other routes in other jurisdictions. Bike routes should be thought of and designed as a regional network.

19.4 Delays

The pleasure of cycling is in moving, not stopping. Accelerating a bicycle from a stop takes considerably more energy than pushing the gas pedal to the floor of a motor vehicle. Cycling on through streets is much faster than cycling on streets where there is a stop sign at every block. Cyclists will avoid streets with extensive delays if there is a parallel through street. Where a bike route has been upgraded to encourage cycling on that route, giving right-of-way priority to cyclists serves to enhance the use of the facility.

19.5 Destinations

A bike route should be along a corridor that will get maximum usage. This implies that bike routes should connect areas of interest to cyclists. Included in this concept are commuter routes from residential areas to work places, shopping districts and community facilities. It could also include recreational pathways in scenic areas away from traffic, and in areas with high bicycle traffic, such as schools and universities.

19.6 Directness

If a bike route exists because of its value as a commuter or connector route, then directness becomes an important factor. Cyclists are rarely willing to go significantly out of their way, and they will take a more direct road unless the added distance is minimal. Commuter and connector routes, therefore, should be as short (direct) as possible.

19.7 Funding

The cost of a bike route often rules out alternative routes, or limits the length or number of bike routes. Care must be taken to ensure there is sufficient funding to build an adequate facility and to maintain, upgrade and extend it as needed. The funding should become a part of the base-level budget for any facility design, as should the design components become an integral part of planning.

19.8 Surface quality

Cyclists are attracted to freshly paved roads because they are smooth and free of cracks and potholes. They will avoid roads with rough or uneven surfaces, broken edges or edges covered with sand or gravel, or sewers and manholes not flush with the road surface. They also tend to avoid routes that have numerous railway or street-car tracks. When resurfacing a bicycle route, macadam and chip seal should not to be used because it can produce a very rough surface.

19.9 Topography

Commuting and utilitarian cyclists prefer a flat route. A route with a large number of hills, and other natural obstacles, such as rivers, cause delays. Not all bicycle commuters have appropriate facilities at their workplace to be able to change clothing before starting their day. Therefore, commuters who must wear their office attire on the bike will not cycle if they arrive at work having sweated over hills. Very steep downhill grades should also be avoided.

Recreational cyclists and cyclists who are using the bicycle for fitness or training purposes, will often seek out hilly terrain because of the changing grades, road curves and the challenging nature of the route.

19.10 Traffic type, volume and speed

For on-street bike routes, the most important factor influencing cyclists' decision to use the route will be the width of the roadway. Secondary factors include traffic volumes, type of traffic and the relative speed of other road users. All cyclists prefer streets with low volume traffic and will use them if they are through streets, which lead to the desired destinations. Narrow streets or streets with a high volume of truck and bus traffic are not favored because of noise and the greater width of these vehicles causes passing problems and cross drafts. Experienced cyclists prefer to ride in traffic that is traveling at nearly the same speed. Cyclists will tend to avoid high speed, high volume truck and bus routes unless the route is wide enough for safe cycling or there is no other readily accessible route. Often, however, multi-lane routes are acceptable if the faster traffic uses the centre lanes and leaves the curb lanes to slower traffic and cyclists.

19.11 Conflict between users

To avoid conflicts and collisions, it is preferable to avoid mixing cyclists and pedestrians on the same facility. Problems between the two user groups are due primarily to the difference in speeds at which each group travels, the unpredictability of pedestrian movement, and the multiplicity of users. Conflicts can also occur between cyclists if paths are not sufficiently wide and are not centre-line striped. Any off-road cycling facility must provide sufficient room for overtaking. Bicycles and horses on a pathway do not mix very well. Horses become skittish around cyclists and some cyclists do not know how to treat horses they encounter on rural roads or paths.

19.12 Width of the bikeway

A minimum width is needed along the entire route of the bike route. Often bike routes end because there is insufficient width to continue a bike lane or other bike facility. In these cases, rather than ending, signs should indicate that cyclists are now merging onto the traveled portion of the roadway. Width requirements for a bike route vary depending on surface conditions, vehicular speed, traffic density and user mix.

19.13 Bicycle priority

Granting right-of-way priority to bicycle traffic will diminish the additional time required to use a bicycle and encourage people to choose the bicycle for transportation purposes. Bicycle priority can be established by having stop signs at all or most of the cross streets intersecting a bicycle route. However, there must be other devices installed to discourage motorized traffic from using the bike routes.

Another way of establishing bicycle priority is to place contra-flow bicycle lanes on one-way streets to establish two-way bicycle traffic and one-way motor vehicle traffic. Two-way bicycle traffic would never be on one side of the road only as this creates a hazardous merging and diverging situation.

Bicycle priority can also be accomplished through short, off-road connectors in residential cul-de-sacs, and by regulating traffic flow with a green wave for cyclists at traffic signals.

20 DESIGN GUIDELINES

The following guidelines were written to convey enough basic information to allow informed and confident decisions on bicycle facility design needs and solutions.

For detailed information, refer to the engineering texts, particularly by Transportation Association of Canada and American Association of State Highway and Transportation Officials, listed in the bibliography.

20.1 Designated Bikeways

The following is a listing of the topics covered in this section.

Sewer grates and manhole covers
Depressed curbs
Railway and streetcar crossings
Bicycle-actuated signals
Bicycle-crossing signals
Delayed green and four-way red traffic lights
Staircases
Access to bridges, tunnels and causeways
Bicycle bridges
Bicycle tunnels
Median refuges

20.1.1 Sewer grates and manhole covers

Sewer grates and manhole covers are hazards for cyclists because they are slippery when wet, they often are not flush with the road surface, they collect debris and water, they are a prime location for potholes and they can trap bicycle tires.

The slippery quality of metal surfaces can be reduced by texturing the surface or, in the case of manhole covers, countersinking the manhole and topping it with pavement. High sewer grates and manhole covers can be made flush by resurfacing the roadway. Collars can be inserted on recessed sewer grates and manhole covers to bring them flush with the road.

Sewer grates with openings parallel to the flow of traffic can trap bicycle wheels. The solution is to adopt a safe grate style. The use of curb inlets mounted in the side of curbs or recessed sewers in coves outside the lane of traffic is the best solution.

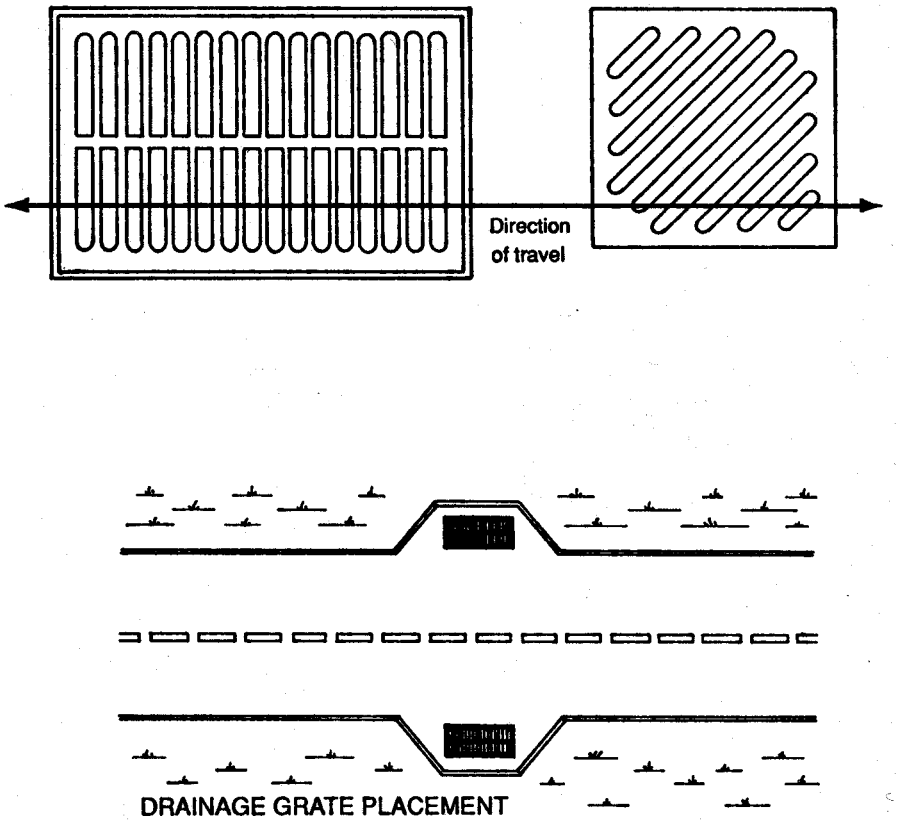


FIG. 4 BICYCLE COMPATIBLE DRAINAGE GRATES

20.1.2 Ramp or curb cuts

When a path intersects another path or a road, they must meet at the same level. Often a path meets a road at a curb. The curb should be cut and a ramp extended from the path to the road. The ramp should extend across the entire width of the path and should be 1.5 metres in length. Where a path runs parallel to a road, a ramp cut of at least 3.0 metres should be used to access the path.

Another solution is to raise the road to the level of the path. See section 20.5.6 and 20.5.7 for more information.

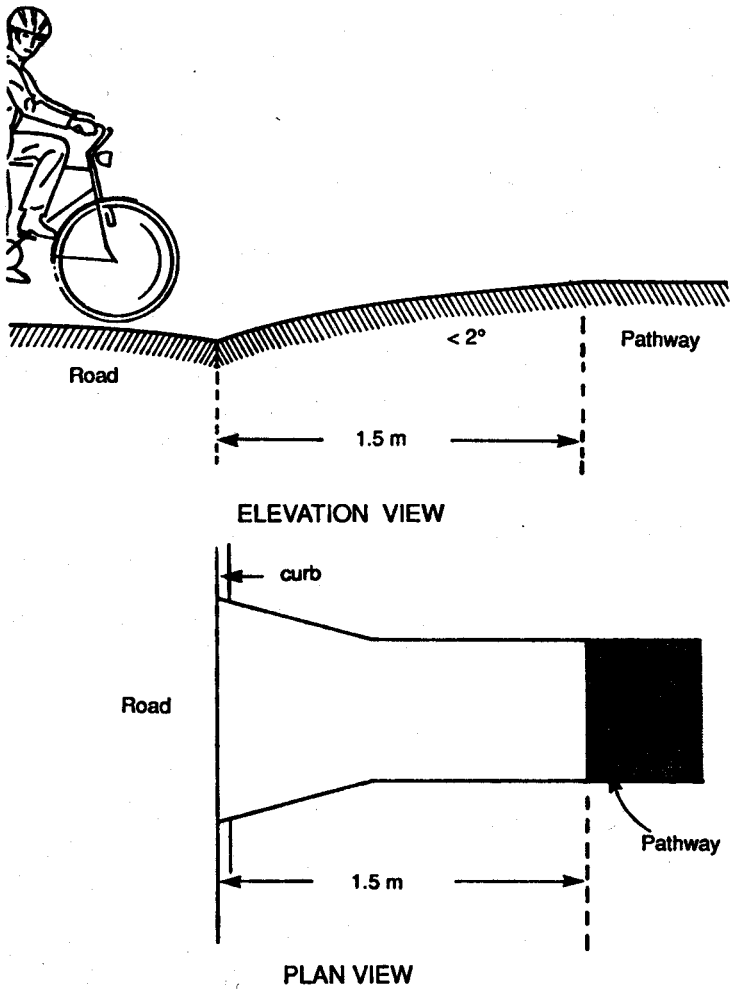


FIG. 5 RAMP CUT

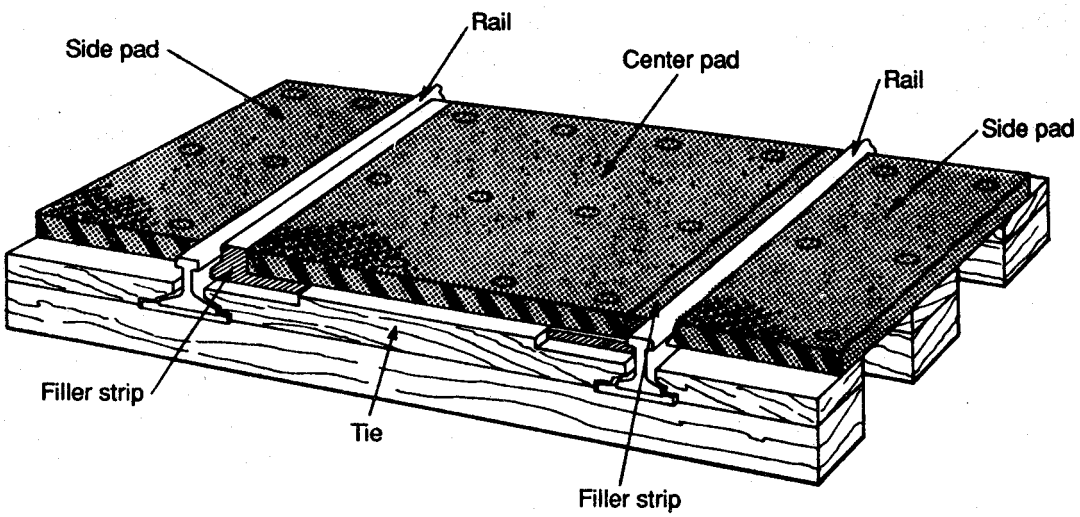
20.1.3 Railway and streetcar crossings

Railway and streetcar tracks can be especially hazardous to bicycles. They may not be flush with the road surface and there can be gaps on either side of the rail where a bicycle wheel can get trapped. Because the rails are metal, they can also be slippery when wet.

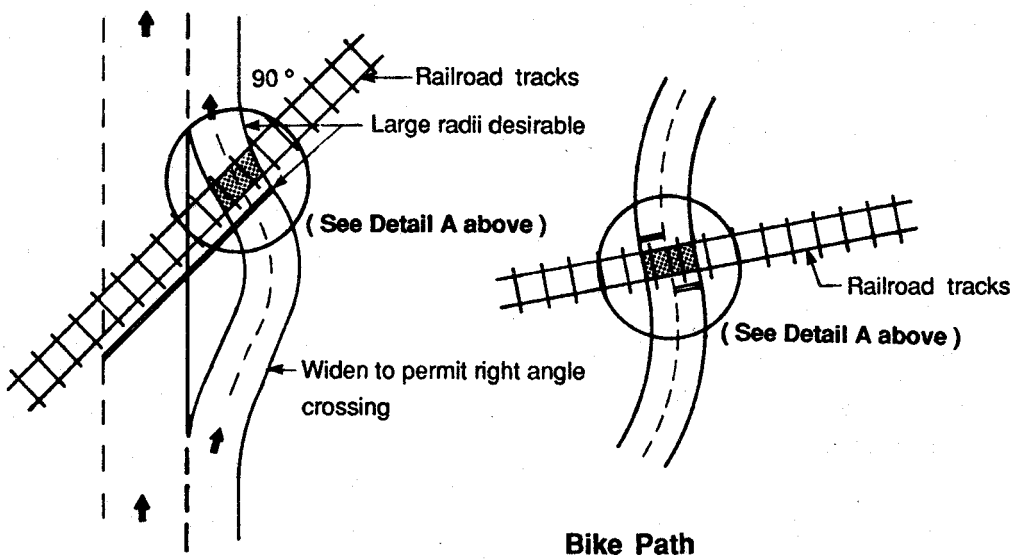
Often the tracks do not cross the road at right angles to the direction of travel. Cyclists will slow and turn in order

to cross railway tracks at right angles. This can put them in conflict with other road users.

Where the tracks do not cross at right angles, the roadway should be widened at the approach to the railway tracks. This will allow the cyclist to manoeuvre the bicycle into a position perpendicular to the tracks without interfering with other vehicular traffic. Where the tracks are not flush with the roadway, the road-bed can be raised or rubber track guards ramping up to the rails can be used. Rubber track guards have the added advantage of narrowing the rail gap and protecting the bicycle wheel from entrapment.



Rubber crossing with filler strips. (Detail A)



Bike Route/Bike

Bike Path

FIG. 6 RAILWAY AND STREETCAR CROSSINGS

20.1.4 Bicycle-actuated signals

Many traffic signals in urban areas are activated by detector loops embedded in the roadway. These traffic signals respond to the magnetic field induced by the metal in a vehicle in the detector loop. The sensitivity of these loops should be adjusted to detect a bicycle without sensing passing vehicles. This can be facilitated by using a quadropole loop, though circular and diamond shaped loops are also popular and perhaps more cost effective on bikeways. Regardless of the configuration used, it is important to minimize the sensitivity outside the loop while increasing it within.

Detector loops are not usually installed across the entire lane and it is quite possible that a bicycle on the far right side of the road will not be detected. Pavement markings, either stencils or thermoplastic indicator dots, should be used on the right edge of the loop. A bicycle symbol stencil or 3 dots are standard indicators of where the sensor is located. This will allow cyclists to line up on the loop and activate the signal.

Some cities are experimenting with overhead cameras mounted on traffic signal poles at intersections. The results of these initial trials are not conclusive as yet, but it would seem that overhead detectors have advantages in that no action is required by the cyclists, the overhead beam can be focused and, they are cost effective. Embedded detectors are still required for other traffic.

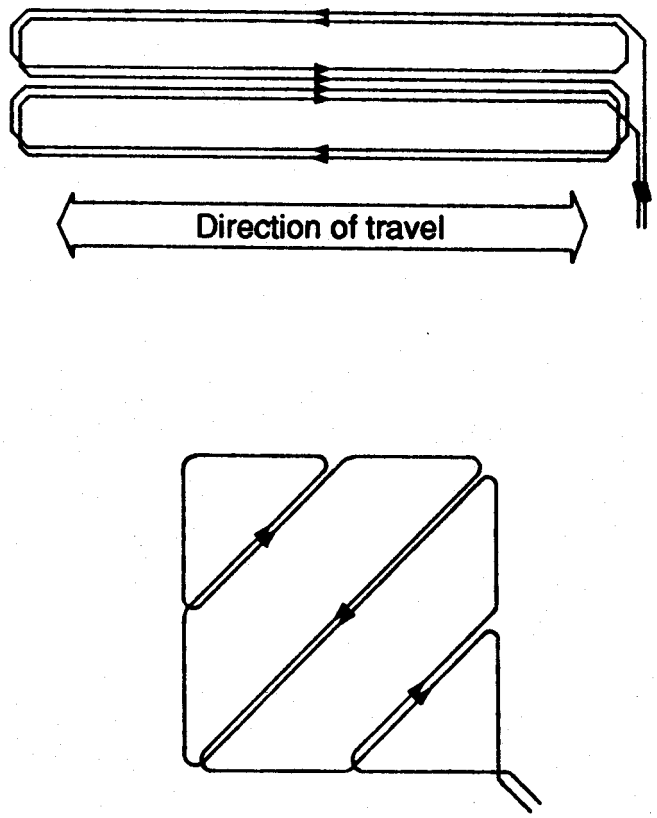


FIG. 7 DETECTOR LOOPS

20.1.5 Bicycle-crossing signals

In several European cities, a separate phase for bicycle use only is included in the traffic signals. This allows cyclists to cross the street and make turns in advance of motor vehicle traffic. The signals are used where there is heavy bicycle traffic, on designated bike routes, and on bike lanes. This approach helps to overcome the problem of intersection conflicts inherent in the use of bike lanes.

In addition to separate phasing, a special advanced stop line is sometimes used for bicycles to put them ahead of traffic waiting at signals. Cyclists then are in a position to make use of an advanced green signal, allowing them to clear the intersection before the remainder of the traffic has the green signal.

The signals used in these cases can be separate lights mounted on shorter poles, or they may be incorporated into the overall traffic signal. In all cases, the light face includes a bicycle symbol to indicate the advance or separate phasing is for cyclists only.

Often bike paths intersect busy roads and thus need signals. Instead of traffic lights, a flashing cycle crossing signal can be used. This can be a pedestrian crossing signal that has been modified for cyclist use. The signal actuation mechanism should be mounted beside the path approximately 1.5 metres above the ground. This allows the cyclist to activate the signal without dismounting. Another method of activating the signal would be a detector loop in the path.

20.1.6 Delayed green and four-way red traffic lights

Because bicycles travel at slower speeds than motorized traffic, they can take longer to clear an intersection, particularly if it is a multi-lane or angled intersection. Delaying the green light that provides a four-way red for traffic not yet in the intersection, but providing a separate advanced green for cyclists allows cyclists to clear the intersection before traffic proceeds. Alternatively, providing an amber cycle that allows sufficient time for a bicycle rider to clear the intersection can be used.

In urban areas with short blocks and congested traffic, a green wave based on typical cyclist speeds will serve to allow for smooth movement of cyclist traffic. This is particularly useful in areas with high bicycle uses, such as educational institutions, recreational facilities, etc.

20.1.7 Staircases

Staircases pose a significant problem for cyclists if the bicycle has to be carried up or down the staircase. A simple solution is to build ramps on either side of the staircase. This allows cyclists to roll their bicycle up or down the staircase without having to carry it. This works particularly well for entrances and exits to and from

overpasses and underpasses or from a bridge to re-join a roadway.

Each ramp should be at least 15 cm wide. Preferably there should be two ramps; one for ascending cyclists; and, the other for descending cyclists. A concave ramp is preferred, as it will help guide the bicycle wheels on the ramp.

FIG. 8 STAIRS WITH SIDE RAMPS

20.1.8 Access to bridges, causeways and tunnels

Often a bridge, causeway or tunnel is the only way to get from one point to another. Unfortunately, many authorities have banned bicycle traffic from these facilities that in some cases leaves cyclists with no option but to take an alternative route usually adding significant distance to their trip. In some cases cyclists are simply unable to reach their destinations. In these cases, the planning process has failed to provide access that includes all road users.

There are two simple and readily inexpensive solutions to the access problem on bridges, causeways and tunnels.

The first is to narrow the inside lanes and widen the curb lane, with a marked bicycle stencil or bicycle lane along the curb if possible. This will not work if the facility is a single lane or was built with narrow lanes.

The second solution is to install ramp cuts and shared-use sidewalks for pedestrian and bicycle traffic. This works well where there are few cyclists or pedestrians and where the sidewalk is sufficiently wide. This solution should only be used where there are sidewalks on both sides and cyclists are guided to use the appropriate one.

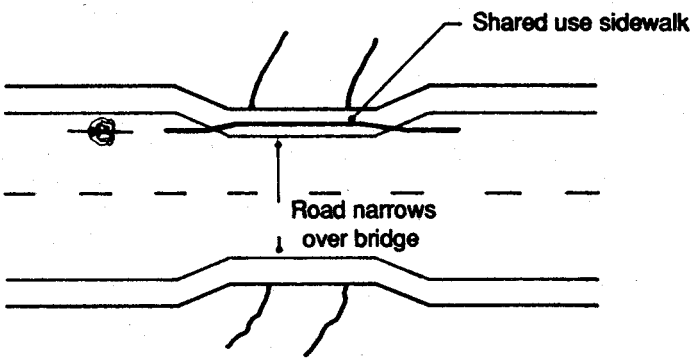
Cyclist/pedestrian conflict can still occur, however, especially if the sidewalk is narrow. This second solution is inapplicable on facilities without sidewalks.

If neither of these solutions work, other, more creative, solutions will have to be tried. Perhaps the structure can be widened. Even a widening of 0.5 metres in either direction makes the structure more compatible with bicycle traffic. Alternatively, it may be possible to add a bicycle path on the sides of the structure. This can be accomplished by providing a cantilevered structure to both sides of the bridge. It is never advisable to provide a two-way facility on one side of a structure as this creates access and egress problems. Unless overpass facilities are provided for access and egress, this solution is not recommended.

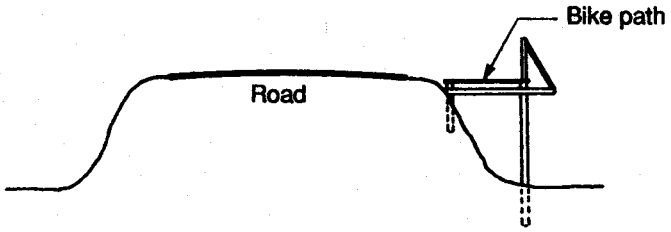
The construction of a bicycle path over or under the existing bridge roadway is another possibility. The small weight increase could well be within the structure's design specifications.

Another solution is to piggyback bicycle bridges onto pipeline crossings, service roads, or other bridges that do not usually carry general traffic.

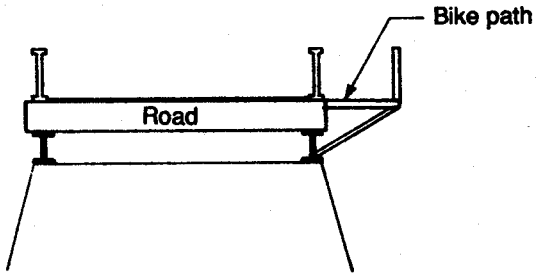
The installation of a "Cyclist dismount and walk" sign is inadequate and not a creative solution.



SHARED USE SIDEWALK



CAUSEWAY WITH SIDE BIKE PATH



BRIDGE WITH SIDE BIKE PATH

FIG. 9 INFRASTRUCTURE ACCESS

20.1.9 Bicycle bridges

Bicycle bridges are very useful to cross heavy traffic arteries (i.e. freeways), railways or canals. There are two basic types of bridges; the linear bridge, and the curved ramp-bridge. Selection of the appropriate design depends upon how high the bridge must rise and the available space.

In general, a linear bridge is preferable because it is the simplest to build and gives the cyclist a straight run-out. This type of structure works best where the height rise is minimal (over a sunken freeway or railway) and where the ramp grade is less than 8 percent. Space limitations and increased clearance heights require greater ramp grades. This can cause excessive exit speeds, especially dangerous if the bridge exits onto an intersection. In these situations, curved ramps should be used.

Linear bridges over a sunken freeway or railway must also consider the effect of wind on the elevated cyclist. Enclosed bridges provide protection from the wind and rain.

Bridges should be 0.6 metres wider than the pathways they are serving to provide adequate clearance. They should also be wide and strong enough to support service vehicles. They should be paved with a non-slip surface. This requirement excludes wooden or metal surfaces because they are slippery when wet or icy.

20.1.10 Tunnels

Tunnels are preferable to bridges where there is minimal access space and/or the obstacle's height would require an excessively high bridge.

The minimum tunnel width should be 3.6 metres. This includes 0.6 metres of clearance based on the typical 3.0 metre bi-directional path. The tunnel should be sufficiently high and wide to accommodate service vehicles. The tunnel should be flat and straight. Any necessary alignment and grade changes should be on the

access ramps. As with bridges, the ramp grades should be under 8 percent.

Planners and designers must also consider tunnel security and maintenance. Tunnels must be well lit. Riding from bright daylight into a poorly lit tunnel can put a cyclist in a momentary blind situation. This may result in a crash from debris on the pathway or a collision with other, unseen, cyclists.

Tunnels must be swept on a regular basis because they will tend to collect debris. If drainage is a problem, a raised central path may be required.

In general, cyclists prefer a tunnel to a bridge if it is shorter and faster. If the tunnel is not maintained properly, or if it presents a personal security risk, it will be avoided.

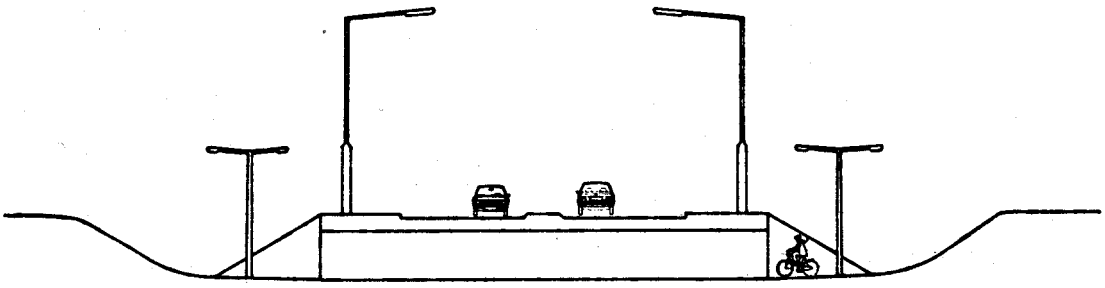


FIG.10 BICYCLE TUNNEL

20.2 Designated bicycle routes

All roads are potential bicycle routes. Some roads, however, make better bicycle routes than others. Designated bicycle routes encourage cyclists to use certain roads and integrate the cyclists with other road users. Designating roads as bicycle routes is the least expensive way of accommodating bicycle traffic. It should not preclude cyclists from using the general road network.

When designating a road as a bicycle route, the route must be appropriately signed to advise motorists that additional bicycle traffic will be present and to advise cyclists of the

road's designation. (See section 22 on Bicycle traffic control devices).

There are certain criteria that should be used to select a bicycle route. One way of determining the best bicycle routes is to determine the routes cyclists are currently using and then evaluate what would enhance those routes.

The following is a list of criteria that can be used to select a designated bicycle route.

Connector route
Commuter route
Surface conditions
Low-traffic volume
Wide curb lane

20.2.1 Connector route

Bicycle routes can be used to connect bicycle paths and bicycle lanes intersecting with that particular roadway. Regional connector routes can overcome the jurisdictional problem at municipal boundaries where a bike lane or bike path may suddenly end.

20.2.2 Commuter route

Commuter routes are routes from residential areas to where people work. Commuter routes must be direct and have as few stops as possible. Good commuter routes often are, or run parallel to, commuter routes used by motorized traffic.

20.2.3 Surface conditions

Bicycles are particularly susceptible to poor roadway surfaces. At the very least, a roadway with a poor quality surface will provide a very uncomfortable ride for the cyclists and cause them to swerve course to avoid road hazards. At worst, the condition of the roadway may cause a crash.

The ideal street surface designed for bicycle travel includes no or limited curbside parking, manhole covers flush with the road surface, sewer grates recessed into the curb and high maintenance standards, including regular sweeping and repair of hazards such as potholes and asphalt ridging.

20.2.4 Low-traffic volume

Most cyclists prefer low-volume traffic and will use a bicycle route that incorporates such roads and streets, providing the route does not take them significantly out of their way.

An average lane is 4 metres in width. This leaves insufficient room for a car to pass a bicycle without crossing the centre line. On roads with less than 1200 ADT, such as rural roads, access roads, and residential streets, this will cause minimal delays to overtaking traffic.

20.2.5 Wide Curb Lane

Where curb lane widths are 4.3 metres, cars can safely overtake bicycles without crossing into the next lane. An existing multi-lane road can be re-striped so that the inside lanes are narrower and the curb lanes are wider.

Lanes wider than 4.5 metres should not be considered. Lanes of 4.5 metres or greater encourage motor vehicle drivers to consider this space suitable for two cars creating a dangerous situation for cyclists. Extra-wide lanes would impede the forward movement of cyclists.

Where roadways are being considered for selection as a designated bicycle route, sufficient space on the road usually accommodated by wide curb lanes are the most important physical criteria to be considered.

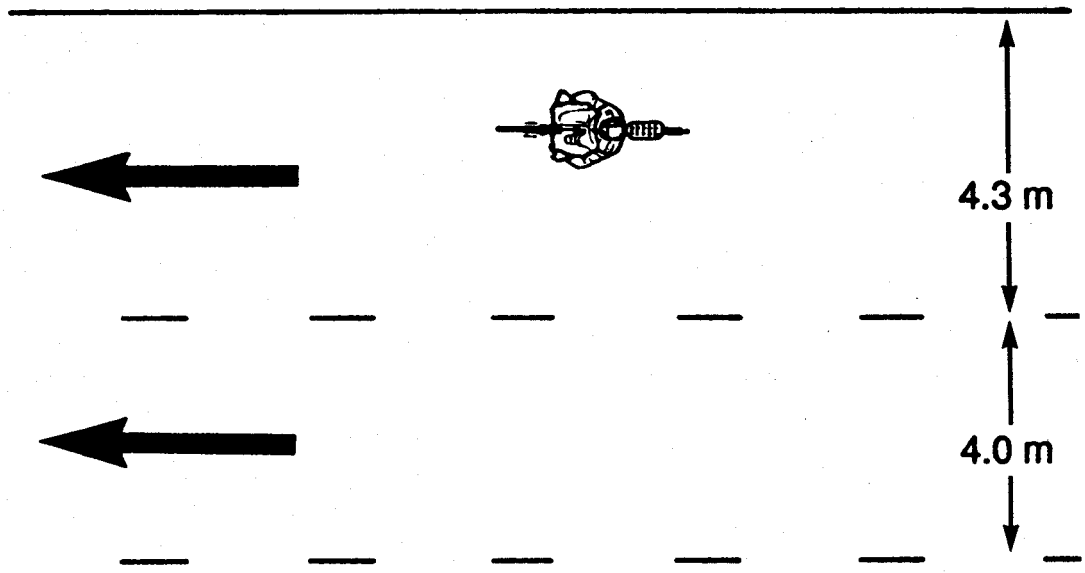


FIG. 12 WIDE CURB LANE

20.3 Bicycle lanes

A bicycle lane is a separate lane designated for bicycles on roadways. Cyclists riding in bike lanes must travel in the same direction as other road users. Two-way bicycle lanes on one side of the road are extremely hazardous, confuse motorists and create a liability for municipalities.

Bicycle lanes can be advantageous because they give the cyclist a clearly identified space on the road and reduce car/bicycle interaction between intersections. They also serve to alert motor vehicle drivers to the fact that cyclists have a right to be on the road and require a certain amount of space. Bicycle lanes are very appealing to cyclists who are nervous about riding in traffic. Cyclists should be aware, however, that the lanes provide no actual security against motorized vehicles and create some confusion at intersections. A good design can prevent this.

Unfortunately, there are many problems with bicycle lanes. Bicycle lanes separated by a physical barrier are particularly hazardous as they prevent cyclists from

entering or exiting the lanes, except at intersections. As a single-purpose, physically separated lane special maintenance must be provided.

Bicycles lanes designated by a painted line can also suffer from maintenance problems. The self-sweeping action of traffic deposits street debris onto the bicycle lane and other road users do not expect cyclists to move out of the lane except to execute a turning manoeuvre.

The most serious problems with bike lanes occur at intersections when motor vehicle drivers attempt to turn right and bicyclists are not turning but travelling straight through. This situation can be clarified by striping the bike lane to within 15 metres of the intersection and then dashing the lane line to indicate that crossover is allowed. This solution is impractical on routes with short blocks.

Car drivers expect bicycle traffic to remain in their lane. Cyclists may choose to ride outside the bicycle lane to avoid hazards created by poor lane maintenance, or a cyclist may be overtaking another cyclist. Cyclists must exit the lane if they are turning left. Finding a cyclist outside the bicycle lane may cause surprise and resentment by car drivers.

There are many types of bicycle lanes. The following is a list of the ones covered in this section:

Exclusive bicycle lanes
Bicycle/parking lanes
Bicycle/bus-only lanes
Contra-flow lanes
Lane demarcation

20.3.1 Exclusive bicycle lanes

Exclusive bicycle lanes are useful where the level of traffic volume and speed makes it uncomfortable for bicyclists to share the road with other traffic, where sight-lines are good, and where there is sufficient width to allow for the additional striping.

The bike lane should be curbside and 2 metres, but must be a minimum 1.5 metres. Where bicycle traffic is heavy and space permits, the bicycle lane can be up to 3.0 metres wide, thus allowing cyclists to pass one another without crossing into the next lane.

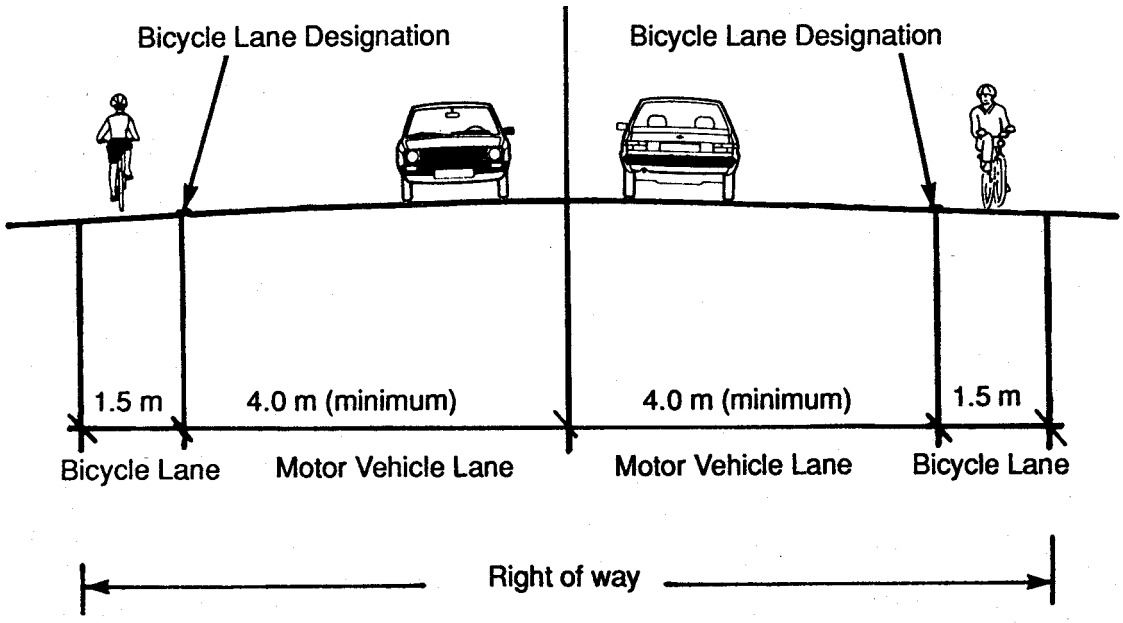


FIG. 13 BICYCLE LANE

20.3.2 Bicycle/parking lanes

Where bicycles and parked cars share a lane, the minimum lane width should be 4 meters. This width assumes a 2.4 meter parking bay and leaves 1.6 metres for the bicycle lane. Anything narrower places the cyclist in danger of being struck by opening car doors.

Car parking bays (for metered parking) or a delineation line ensures that cars park next to the curb and not out into the path of bicycle traffic. Note that cyclists will be forced into the next lane whenever a car exits or enters a parking spot.

If parking is banned during normal rush hours, and the lane is in a high volume cyclist area, such as a school, the lane can be reserved for bicycle rush-hour traffic.

20.3.3 Bicycle/bus only lanes

Bicycles and buses can share a single lane, particularly when other traffic is excluded. Because of the greater width of a bus all bicycle/bus lanes should be a minimum of 5 metres wide.

The travel speed of a bus in traffic is usually faster than a bicycle. If a bus is making frequent stops, however, the same bicycle can pass the same bus many times as they stop to load and unload passengers. This constant "leap-frogging" can pose serious problems unless both bicycle and bus drivers operate their vehicles sensibly.

The basic rule for the bus driver is not to pass cyclists unless the bus can safely merge before slowing for a stop. The basic rule for cyclists is to allow passing buses to merge and to pass stopped buses on the left only. A wide bicycle/bus lane will make bicycle/bus interaction easier.

It is not advisable to mix bicycles and buses where they cannot share the lane because the bus is using a narrow, high-speed commuter route, where there is heavy bus traffic from many lines funneling onto a single route, or where buses use a bus lane as a stopover point. In the last two cases, bicycle lanes between the bus and the motor traffic lanes should be considered. Otherwise, the lane next to the bus lane should be widened to accommodate bicycle traffic.

20.3.4 Contra-flow lanes

A solution to the problems of parked cars and buses on curbside lanes, and/or insufficient street width is to use bicycle-only contra-flow lanes on one-way streets. Contra-flow bicycle lanes are a very effective way of giving traffic priority to bicycles and encouraging bicycle use.

A contra-flow lane can be envisioned as a one-way street with two-way bicycle traffic (bicycles on both sides of the road) or a two-way street with one way restricted to bicycles. The contra-flow bicycle lane is on the right side of the road, which is normally clear of stopped traffic.

These lanes must be clearly marked and painted with a solid "no passing" line. Special signage indicating one-way motor vehicle and two-way bicycle traffic must be installed. Signage will also help to discourage two-way cycling in the bicycle lane. Bollards or medians can be used at intersections to prevent cars from turning into oncoming bicycle traffic.

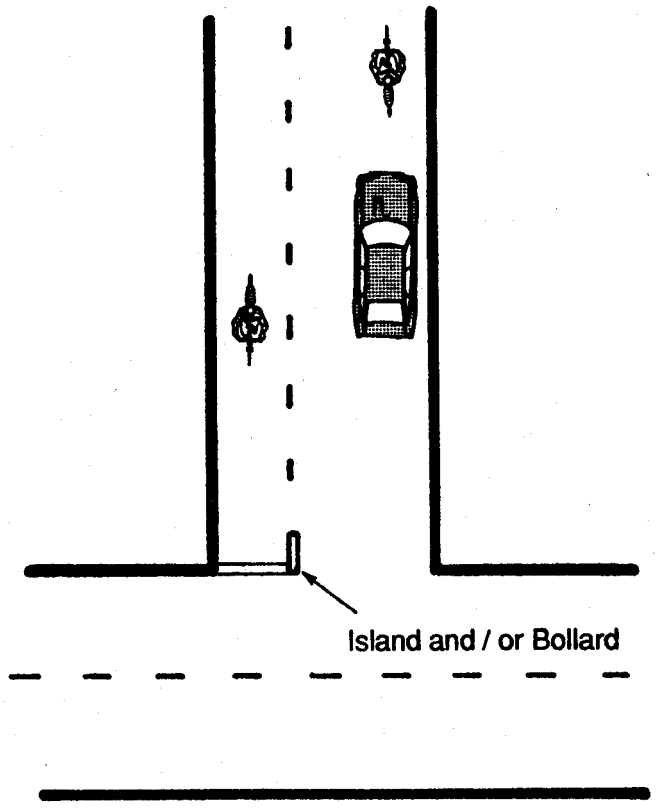


FIG. 16 CONTRA FLOW LANE

20.3.5 Lane demarcation

Bike lanes can be separated by a painted solid or broken line where lane changing or traffic merging manoeuvres are anticipated, reflective tape, a different surface material or colour, or by a physical barrier. Lane demarcation may vary dependent on the traffic

interchange and the surrounding area. However, the standards of width and continuity should remain intact.

The use of a reflective painted line or reflective tape is by far the most preferable. The line should be painted or taped the same colour as the other lines on the road and should be solid except where traffic interchanges are predictable, such as at intersections and bus bays.

Differentiation of bike lanes can be achieved by using a different paving material, such as concrete or paving stones. Although this is a more costly method, it is a very visual means of differentiating use on the road surface and may be appropriate for use in residential or traffic-calmed areas. Using a different colour of asphalt for example, green or red asphalt, is another more costly solution. Painting the entire bicycle lane is also costly and only paints treated with sand or reflective balls can be used to prevent the surface from becoming slippery when wet.

Concrete curbs, pavement markers and bollards are examples of physical barriers. None is recommended for bike lanes except at access points. A continuous physical barrier restricts the entrance and exit of the bike lane to intersections, encourages the build up of debris, limits access of service vehicles for cleaning, and prevents cyclists from being able to avoid obstacles along the route. Bollards can be a safety hazard for both the bicyclist and the motor vehicle driver. Even slightly raised pavement markers, while acceptable for most motor vehicles, can be extremely dangerous for both bicyclists and motorcyclists.

20.4 Bicycle paths

Bicycle paths are off-road bicycling facilities on which motorized traffic is prohibited. Most were originally designed as one-way or two-way single-user pathways. Because it is impossible to ensure single use only on pathways, modern pathways should be designed as bi-directional, multi-user facilities. Pathways tend to be used mostly by slower-speed recreational and casual cyclists, and by walkers, joggers, in-line skaters, etc. Commuters use these routes if they are direct, with few stops, and if

traffic volumes are low, particularly during commute times.

The following is a list of topics covered in this section:

Design speed
Grades
Horizontal curve radii
Crest vertical curves
Stopping sight distance
Length
Width and clearance
Vertical clearance
Slope
Surface types
Centre-line striping
Edge striping
Intersection control
Mid-block crossing
Lighting
Rest stops
Signage
Bollards, gates and barriers

20.4.1 Design speed

Because roadways are designed for higher-speed motor vehicle traffic, there is usually no problem with design speed for bicycles on these roads. Bicycle path design can be compromised if the design speed is too low. Pathways should be designed for a minimum speed of 30 km per hour, regardless of their intended function. Minimums of 40 km per hour should be used wherever the grade exceeds 4 percent or the path is exposed to prevailing winds.

20.4.2 Grades

Grades of 2-4% are comfortable for most recreational cyclists. On bicycle paths, grades should not be over 5 percent. If a steep grade is unavoidable, the length should be kept to less than 100 metres. If the total length is more than that, flat plateaus should be built every 100 metres.

Gradient speed designs are shown in the following figure.

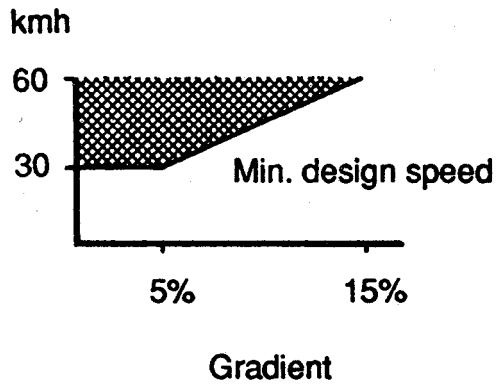


FIG. 17 DESIGN SPEEDS ON GRADIENTS

20.4.3 Horizontal curve radii

As design speed increases, so should the width of the path to allow for increased manoeuvrability. Minimum horizontal curve radii will also increase, as design speeds are increased. Standard design tables are available from which horizontal curve radii can be calculated.

20.4.4 Crest vertical curves

The longer the vertical curve, the farther the cyclist can see from crest to crest or from crest to obstruction on the path. Standard design tables are available from which the minimum lengths of crest vertical curves can be calculated.

20.4.5 Stopping sight distance

Stopping distance is the distance required to bring the bicycle to a full stop. Stopping-sight distance is the distance, clear of visual obstructions that is required to observe a situation and stop. Stopping-sight distance

depends on speed, grade, reaction time, mass, and braking friction. Examples are a stop sign at the end of a curved path or an obstruction over the crest of a hill. Stopping-sight distance must be considered carefully on downhill sections where the cyclist's speed can easily exceed the pathway's design speed. Typical stopping-sight distances are shown in the following figure.

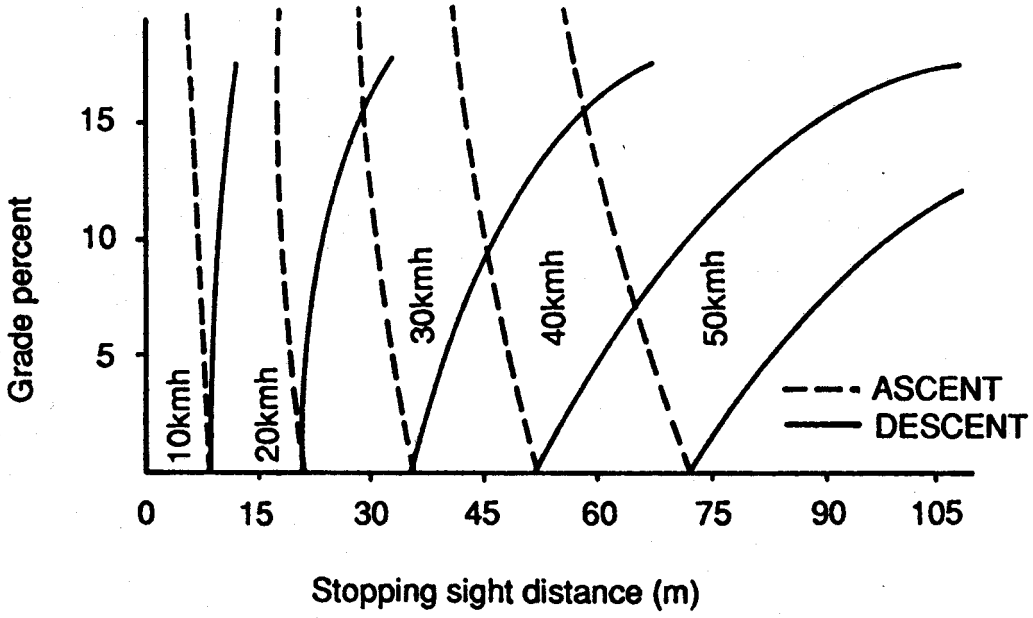


FIG. 18 STOPPING SIGHT DISTANCES

20.4.6 Length

The length of a path should be considered with respect to how long it takes to ride the distance. For example, at a speed of 20 km per hour, a cyclist can cover a 2 km pathway in 6 minutes. A 10 km route will take 30 minutes to travel, and can provide much more enjoyment. A short path is feasible, however, if it connects with another pathway in a network. Regardless of the length of the pathway, access points should be frequent.

20.4.7 Width and clearance

The minimum design width for a one-way bicycle path is 1.8 metres to allow sufficient space for the operational

width of a bicycle plus clearance on either side. However, it is very difficult to enforce a one-way only system on a pathway. As a result, most paths are bi-directional and the minimum design width for a bi-directional bike path is 3.0 metres. On more heavily used bicycle paths, the minimum design width should be 3.4 metres.

A multi-use recreational path is one that is shared by several user groups (bicycles, pedestrians, in-line skaters, etc.). The minimum design width for multi-use recreational paths should be 4.0 metres, again planning for bi-directional.

20.4.8 Vertical clearance

There should be a minimum of 3.6 metres vertical clearance for tunnels and underpasses. Overhanging foliage should be trimmed to the same height. There must also be adequate clearance for service vehicles.

20.4.9 Slope

A pathway should be designed with a 2 percent slope for runoff and slanted towards the inside of a curve for greater cornering safety. Where paths are on a hillside, an upper slope drainage ditch may be needed otherwise runoff debris would be deposited on the pathway. This could be a safety concern and require increased maintenance.

20.4.10 Surface types

Depending on the location of the pathway, the surface can reflect the environment. Paved surfaces are more durable and less prone to potholes; however, a more natural surface can be congruent with the environment and serve to naturally reduce the speed of users.

Two types of pavement surfaces are generally used on bicycle paths: asphalt and concrete.

Asphalt gives a smooth ride, has good traction characteristics and is easy to maintain. Vegetation close to the pathway will tend to intrude on asphalt, particularly trees.

Concrete is not often used as it is more expensive to install, is prone to cracking in cold weather, and can give a bumpy ride across expansion joints. If the path is finished with a smooth concrete surface, it can be slippery when wet or if there is any kind of growth on it.

Loose surfaces, such as gravel, earth and limestone dust, are recommended where the pathway is going through parkland. With more and more cyclists riding mountain bikes, these surfaces are preferred and more in keeping with environment. It is not possible with natural surfaces to delineate a centre-line, so additional signage may be warranted.

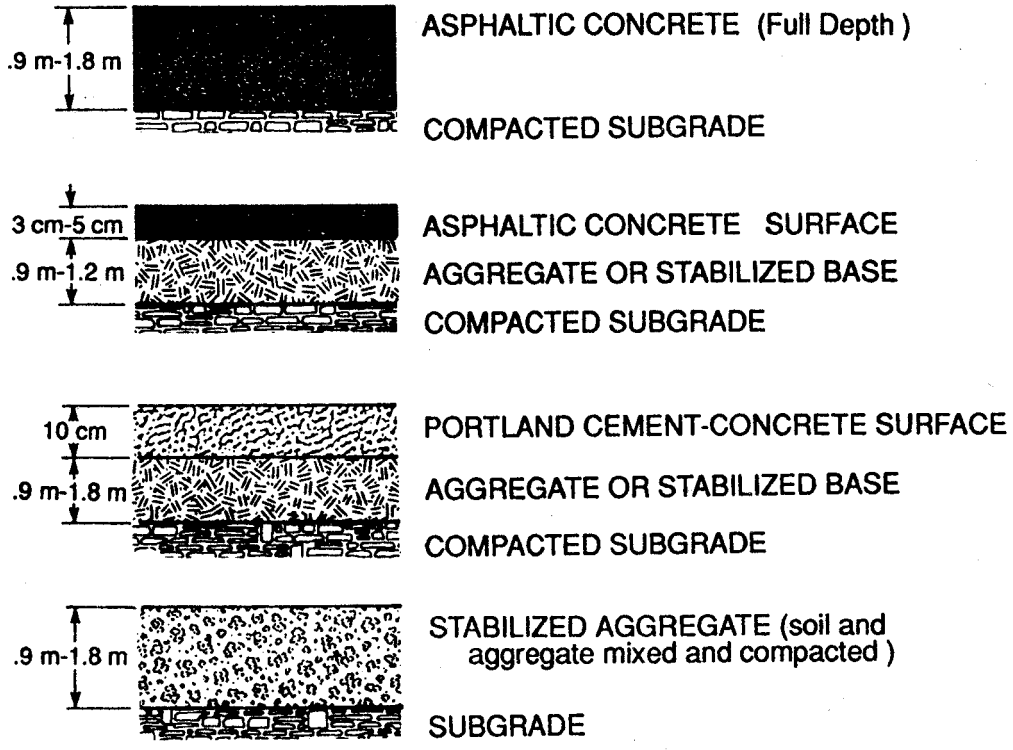


FIG. 21 TYPICAL PATH DESIGN SECTIONS

20.4.11 Centre-line striping

Cyclists will often use the entire available pathway. This can lead to conflicts between users travelling in opposite directions. One method of dealing with this conflict is to use centre-line striping. This gives guidance to users and creates two lanes and separates traffic. Centre-line striping should be white or yellow, whichever is used on the local roads. It should also be reflective and nonskid. Centre-line striping can either be a solid line to discourage passing, or a broken line where passing is allowed.

Where centre-line striping is used, signs such as "Shared Pathway" or "Keep Left/Right" should be installed.

Typical signs on pathways with centre-line striping include:

RB-95
(300mmx450mm)

RB-93
(300mmx450 mm)

RB-94
(300mmx450 mm)

Source: Bikeway Traffic Control Guidelines for Canada, Transportation Association of Canada, 1998.

20.4.12 Edge striping

Edge striping improves the visibility of the path edge, especially for nighttime riding. The edge stripes should be solid, reflective, nonskid, and white.

20.4.13 Intersection control

Intersections can be a three-way "T" or "Y" junction, or a four-way or more-way junction. Pathways can intersect with other pathways or roads. All intersections should be signed with vertical or surface standard yield or stop signs, however vertical signs are recommended.

Advance warning signs should be ahead of the intersection by at least twice the minimum stopping distance for that intersection.

Changes in surfaces can also alert the cyclist to upcoming intersections. Brick or stone inserts across the path are one method. Bright red edge striping or a change in the surface colour is another. Changing the asphalt mix to a coarser grade would give a rougher surface suggesting slower speeds to be used. Loose or rough surface in the deceleration section of the path are not recommended as they can cause the cyclist to lose control. Speed bumps can destabilize a bicycle.

Widening the path at the intersection reduces possible congestion resulting from people slowing or stopping to read signs, look at maps or change directions.

Where it is warranted, cyclist and pedestrian activated lights may have to be installed or pathway crossing markings to properly delineate the intersection on a busy roadway.

20.4.14 Mid-block crossing

Often bicycle paths cross roadways at a point other than a road intersection. On low-traffic roads, signs can indicate to motorists that a bicycle path crossing is ahead. In some cases, a speed hump or plateau plus signage may provide the proper warning to motorists of the presence of a secondary intersection. On roads with heavier motor vehicle traffic, cyclist-activated stoplights, bicycle-crossing signals, path crossing markings or bicycle refuges are needed.

Typical "Bicycle Crossing Ahead" signs include:

WC-7 (600mm x 600mm)

WC-7S (600mm x 300mm)

Source: Bikeway Traffic Control Guidelines for Canada, Transportation Association of Canada, 1998.

20.4.15 Lighting

Cyclists do not stop using pathways at night. Lighting thus becomes a factor that must be considered. Many bicyclists may be equipped with modern lighting equipment. This equipment is generally inadequate to illuminate the pavement or path surface so that bicyclists travelling a reasonable speed are able to see potholes and other hazards.

Commuter cyclists have no alternative but to ride during dusk, dawn, or hours of darkness. Lighting of pathways may be justified if commuter bicycle usage at night is expected. Bicycle paths should have a minimum average horizontal level of lighting of 5 lux.

The most important area for lighting is at intersections. All intersections should be lit far enough back from the intersection in order to allow the cyclist enough time to see the intersection and act appropriately. Lighting should be placed wherever there is signage. This is particularly important with warning signs.

The effect of incidental lighting on the path and on cyclists also needs to be considered. The most common example occurs when a path parallels a road. The lights of oncoming traffic will shine directly on cyclists. This can

cause momentary blindness that is dangerous on a curving path or in the face of oncoming bicycle traffic. In this case, low level path lighting is recommended.

On pathways that service employment locations involved in shift work, such as hospitals, police, factories, it is important to ensure that the pathway itself has sufficient lighting to accommodate late shift workers. Pathway lighting serves to encourage bicycle use, but also provides for security for all path users.

20.4.16 Rest stops

Any long pathway or path network needs rest stops. These should be at midway points, scenic lookouts, or nearby amenities such as restaurants, beaches, picnic areas, etc. Any rest stop should be away from the path so cyclists can pull off the path and not block other users. A rest stop should have, at a minimum, a bench and where appropriate, a parking rack. In addition, water fountains and washroom facilities should be included at frequent intervals on the pathway.

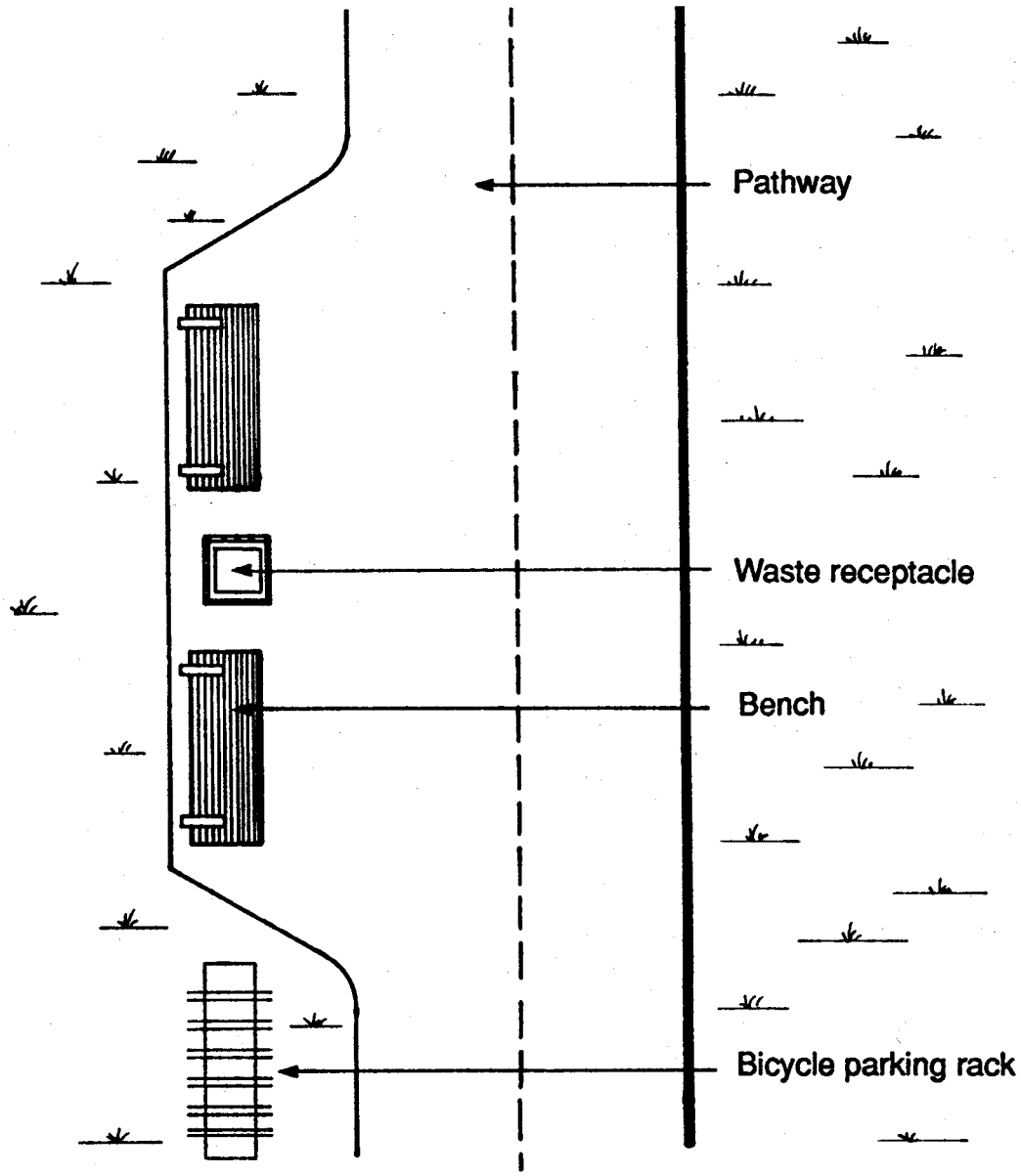


FIG. 22 REST STOP

20.4.17 Signage

Signage on pathways is important for a number of reasons. Signs can give directions, destinations, and distances to those destinations for the pathway; they will also indicate how the path is to be shared; they may indicate recommended speed limits; signs will warn of up-coming intersections or exits; and also points of interest.

In addition to posted signs, paved pathways often have signage stenciled on the path itself. Stencil signs are less visible than posted signs because they cannot be seen until the cyclist is upon them. For this reason it is recommended that stencils which are warning of upcoming intersections be used well in advance of intersections. It is also recommended that stencils be used in conjunction with posted signs.

See Section 22.1 for additional information on signage.

Standard regulatory, warning, and information signs:

Regulatory

RB-67 (600mm x 600mm)

Warning

WC-45 (450mm x 450mm)

Information

IB-23 (450mm x 450mm)

Source: Bikeway Traffic Control Guidelines for Canada, Transportation Association of Canada, 1998.

20.4.18 Bollards, gates and barriers

Bollards, gates and barriers control access to bicycle pathways. They should not be used as speed control devices.

Flexible bollards are recommended. They should be at least 1.2 metres high and coated with a reflective material so they can be seen at night. Bollards should be removable or hinged so service vehicles can access the path. A single, central bollard should be used whenever possible. This configuration prevents collisions between cyclists without causing congestion. When more than one bollard must be used, they should be 1.5 metres apart.

Although not generally recommended, another method of controlling access is to use one or two offset gates. Each gate should cover 75 percent of the pathway and, when two gates are used, they should be 2 metres apart. Offset gates have the disadvantage of forcing cyclists to change their direction of travel to go around them, which can cause congestion.

Both bollards and offset gates should be removable so that service vehicles can access the paths.

Gates are used where access is restricted to certain times or to certain trails (i.e. horse trails). Gates should extend for 1.0 metre on either side of the pathway.

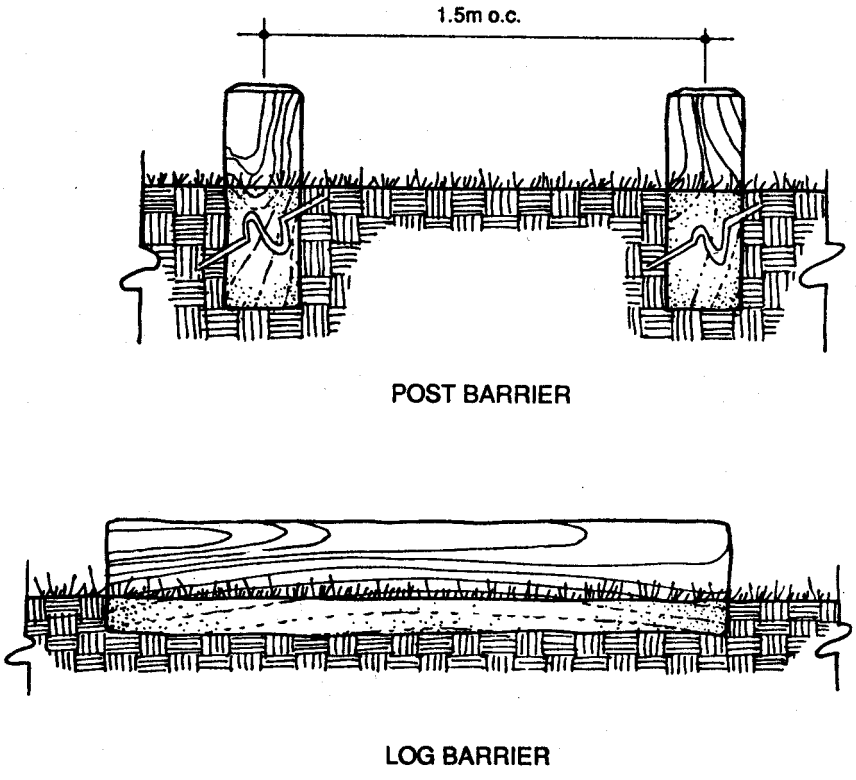


FIG. 24 RIGHTS OF WAY–CORRIDOR MARKERS

20.5 Traffic calmed streets

There are two types of traffic calming devices: those that divert traffic and those that slow traffic.

Physical traffic calming measures include vertical and horizontal deflections in the road as well as obstructions and traffic regulations. Community demand, planning intervention, and engineering options will determine which devices are appropriate for a specific area.

Despite the obvious benefits of enhancing the livability of areas, decreasing traffic noise and speed, and reducing conflicts between motor vehicle traffic and other road users, there are some potential negative effects of traffic calming. Diverting devices may negatively impact the mobility of residents and emergency vehicle response times. Some measures can increase costs and be considered visually unattractive or incompatible with adjacent buildings and land uses.

The following is a list of devices covered in this section:

Traffic circles
Raised median island and raised median through intersection
Curb radius reduction and curb extension
Chicane
On-street parking
Speed Humps and raised crosswalks
Raised intersections and sidewalk extensions
Right-in/right-out diverter and intersection channelization
Full closure
Diverter
Directional closure
Signage
Rumble strips and speed bumps

For explicit engineering designs for the traffic calming devices discussed here, consult an engineering document, such as Transportation Association of Canada and Institute of Transportation Engineers (District 7) "Canadian Guide to Neighbourhood Traffic Calming", December 1998.

20.5.1 Traffic circles

Traffic circles are attractive physical measures designed to slow traffic at intersections, mainly in residential areas. The traffic circle is not a bicycle facility per se, but it does affect the type of interaction cyclist will have with other road users.

The traffic circle directs all traffic movement in the intersection and requires it to follow an indirect path. All traffic movement is directed around a central island that must be large enough so that even straight through traffic is required to take an indirect path. All turning traffic is required to turn around the island in a counter-clockwise direction with the exception of emergency vehicles or extra-long service vehicles and buses. Traffic circles eliminate the need for stop signs at these intersections.

Traffic circles will often contain a small raised landscaped portion. In addition to its esthetic value, the purpose of

the landscaping is to reduce visibility beyond the circle, further encouraging motorists to reduce their speeds.

Traffic circles do not generally affect the speed of cyclists, only motor vehicle traffic. While traffic circles serve to slow motor vehicles, and legally there should only be traffic approaching from the cyclists' left, there may be some confusion about the proper use of circles and cyclists must be wary of wrong way drivers and drivers who fail to yield right of way to those already in the circle.

Although no advance warning of a traffic circle is required, it is recommended that yield signs be placed on all of the approaches and directional signs be mounted in the circle directly opposite the approach.

The size of traffic circles will vary with the width of the roadway from 2.6 metres to 10 metres with a minimum raised island diameter of 1.2 metres.

20.5.2 Raised median island and raised median through intersection

Both the raised median island and raised median through the intersection consist of an elevated median on the centreline of a two-way roadway. The island narrows the width of the travel lanes in each direction, reducing traffic speeds but still allowing traffic to turn. Whereas where the median is through the intersection, it prevents turning to and from manoeuvres and straight through traffic. The latter is constructed with gaps for cyclists. The raised medians may also be used at mid-block crossings and include landscaping.

The raised medians allow a cyclist to cross one direction of traffic at a time without waiting until both directions are clear and without the assistance of traffic signals. Median refuges are used where crossing of a busy street is required, there is a central median or room for an island, and a signal light is not warranted. Giving cyclists the ability of being able to cross only one half of a road at a time is an advantage given the momentum required for cyclists to move off from a stopped position.

For medians, the minimum width of the island should be 1.5 metres and the length of the island will vary with the configuration of the roadway but generally will extend at least 5 metres either side of the intersection. The median through the intersection should provide a minimum of 1.5 metres for the bicycle channels. The islands should be located no further than 3.5 metres from the curb.

Where the median extends through the intersection, signage should be erected indicating cyclists have the right to continue straight through or turn left. Where raised median is used to accommodate a mid-block crossing, signs alerting motorists to the presence of cross-traffic should also be used and, if necessary, additional lighting.

An island median is appropriate for local and collector residential streets with a maximum of two traffic lanes, whereas the median through the intersection is used with collectors or arterials at intersections with local or residential collector roads.

20.5.3 Curb radius reduction and curb extensions

Curb radius reductions and curb extensions are often used in conjunction with each other to reduce vehicle speeds, particularly the speeds of right turning vehicles, and prevent parking close to an intersection. Curb radius reductions effectively narrow the intersection by reconstructing the corner with a smaller radius. Curb extensions narrow the roadway by intruding the curb into the roadway, and can be used mid-block to accommodate bus stops and on-street parking.

Local or collector residential streets where these measures are undertaken should not have bike lanes as bike lanes are incompatible with a narrowing of the roadway. Cyclists may feel squeezed into the path of motor vehicles when cycling on streets that use these measures.

The advantage for cyclists of the use of these traffic calming devices is the curb radius reduction will curtail the tendency of motor vehicle drivers exiting local streets

to not come to a full stop before executing a right hand turn, and to sit beyond the stop line when trying to turn right, and they will narrow the distance across an intersection.

If these measures are used on designated bike routes, the minimum curb radius reduction of 3.0 metres is recommended and curb extensions should not reduce the roadway width to less than 6.0 metres.

20.5.4 Chicane

The creation of a chicane reduces vehicle speeds and can be used to discourage through traffic by reducing two-lane roadways to one lane, requiring traffic to yield.

A chicane is a series of curb extensions on alternating sides of the roadway employed in the mid-block area. A chicane uses a curvilinear path design and a resulting potential conflict between lane flow to reduce the travel speeds of motor vehicles.

Cyclists are expected to follow the S-curving travel pattern established, but this will not generally affect the speed of cyclists. Reduced volumes on roads treated in this manner make these routes desirable for cyclists and encourage people to cycle on them rather than drive. Streets using chicanes are not compatible with bike lanes.

Curb extensions to support chicanes should not commence within 20 metres of an intersection. The width of the roadway should never be reduced to less than 3.5 metres and where drainage channels must be installed, the resulting gaps should discourage cyclists from trying to use them to by-pass the chicanes.

20.5.5 On-street parking

Allowing on-street parking on one or both sides of the road can effectively narrow streets and roads. On-street parking can also be alternated to create a chicane-like effect. Narrowing the roadway serves to reduce travel speeds and volumes.

Angle parking is not recommended as a traffic calming measure as it tends to increase the potential for conflicts. However, back-in only angle parking serves to reduce user conflicts.

Cyclists are never very comfortable around parked cars for fear drivers and passengers exiting on the left hand side will do so without looking. Also, inexperienced cyclists tend to weave in and out of parked cars creating a hazard for other road users. Parked cars affect the sight lines of cyclists and motorists resulting in movement into the intersection to check for cross traffic. Allowing on-street parking on low volume residential streets is the best use of this traffic calming measure.

Where on-street parking is allowed on both sides of the road, this must not reduce the roadway width to less than 5 metres. Alternating parking must leave a roadway width of 6.0 metres and, if concrete curbing is used to delineate the end of the parking, the same curb extension radii is used.

20.5.6 Speed Humps and Raised Crosswalks

Speed humps or plateaus and raised crosswalks are examples of vertical deflectors being used to reduce motor vehicle speeds. Motor vehicle drivers will slow when traversing these devices because the vertical deflection of the wheels of the vehicle produces an uncomfortable sensation at higher vehicle speeds. A raised crosswalk brings the road up to the level of the sidewalk at marked crosswalks rather than lowering the crosswalk to the level of the roadway.

Cyclists are little affected by speed humps or raised crosswalks. On a steep downhill or at excessive speeds, a cyclist may become destabilized. On streets with speed humps and raised crosswalks, cyclists tend to be travelling at closer to the speed of other traffic and this makes them feel much more comfortable.

To avoid any instability, speed humps and raised crosswalks should not be used on roads with grades in

excess of 5 percent, and will not be less than 2.5 metres in width with a 2 metre sinusoidal ramp on either side. Solid white reflective pavement markings are recommended to alert cyclists of the change in the pavement height.

20.5.7 Raised intersections and sidewalk extensions

Raised intersections are the same as raised crosswalks except they occur at intersections. Sidewalk extensions can be the same as raised intersections, or the sidewalk can be lowered to the level of the roadway, but in either case, visually, the sidewalk continues across a local street intersection.

The purpose of raised intersections and sidewalk extensions is slightly different: the intention of raised intersections is to reduce motor vehicle speeds; and, the intention of sidewalk extensions is to indicate to traffic approaching the sidewalk that they must yield the right of way.

Sidewalks can also be treated with a textured or patterned finish to enhance the contrast and better define it with relation to the adjacent roadway. The textured or patterned surface should not be slippery when wet.

In both cases, cyclists are not affected by this traffic calming treatment except indirectly through the reduction in traffic speed.

20.5.8 Right-in/right-out diverter and intersection channelization

A right-in/right-out diverter and intersection channelization uses median islands to divert traffic and prevent motor vehicles from going straight through or making left-hand turns. These diverters prevent shortcutting through residential streets.

Generally, cyclists are allowed to continue straight and make turns at these intersections. This is accomplished by a gap or depression in the island, or by manoeuvring

around the island. Signage excepting bicycles from mandatory right turns and allowing bicycles to travel through the intersection must be added to the right turn only and no access signs.

Cyclists need to be aware of motorists who try to circumvent these regulations. They may create a hazard for the cyclist.

20.5.9 Full closure

Full closure involves creating a barrier that extends across the entire width of the roadway. This barrier prevents through traffic and discourages motorists from using these roads as a short cut through residential areas.

Generally, gaps are provided beside the curb for cyclists to continue through. In this manner, cyclists are given priority in the traffic movement on this street. Signs indicating that cyclists are permitted access through the closure barrier should be erected. Rolled or mountable curbs are recommended to eliminate any possibility of the pedal of the bicycle hitting the edge of the curb or the barrier. Gaps left for emergency vehicles should not permit other traffic to permeate the barrier.

20.5.10 Diverter

Diverters are placed diagonally across an intersection to prevent through traffic and allowing only left or right turns.

Diverters generally include signed gaps to allow cyclists to permeate the barrier.

20.5.11 Directional closure

A directional closure is similar to a right-in/right-out diverter except that the directional closure effectively obstructs one direction of traffic at the intersection. This is accomplished through the use of a curb extension or a vertical barrier (island) extended to the centreline. This type of closure is most commonly used to prevent access rather than egress from a street.

The directional closure allows for two-way bicycle travel with the use of contra flow lanes or gaps in the barrier. Both of these methods must be signed accordingly and the contra flow lane should use pavement markings also. The gap should employ a rolled curb to avoid any hazard for the cyclist.

20.5.12 Signage

Simply reducing the speed limit through signage is an ineffective way of trying to traffic calm a neighbourhood. Any maximum speed signs should be accompanied by physical measures that force motor vehicle drivers to reduce their speeds.

When a neighbourhood has received traffic calming treatments, such as those described above, it may be appropriate to install signs indicating that this is a traffic calmed neighbourhood.

All other barriers, changes to the roadway, and changes to the traffic flow should be signed accordingly.

20.5.13 Rumble Strips and Speed Bumps

Rumble strips are not commonly found in use in neighbourhoods as traffic calming devices. Their main function is to draw the motorists' attention to a change in condition on the roadway. This is done through raised buttons, raised bars, or grooves in the pavement surface. There are a variety of designs of rumble strips.

Occasionally rumble strips are used incorrectly as a speed control device resembling speed bumps which are no longer in common use. Rumble strips and speed bumps create noise and vibration.

Both of these measures are uncomfortable for cyclists. Rumble strips can be particularly annoying when they are used for great lengths along rural highways unless they are restricted to the narrow strip as close to the edge line of the roadway as possible. Both rumble strips and speed

bumps can destabilize the bicycle on descents, in bad weather, or at night when it is hard to see them. The use of rumble strips is not recommended on routes frequented by cyclists or where the shoulder is narrow.

21 END OF TRIP FACILITIES

Providing a means for cyclists to get to their destinations is only one link in the chain. A well-designed route combined with education is key to encouraging cycling in a community.

People will not consider cycling if secure and convenient end of trip facilities are not available. Bicycle parking is perhaps the most important link in a comprehensive bicycle-facilities design. If bicycle parking at destinations is not available, the incentive to use bicycles as a means of transportation is seriously undermined.

Where adequate parking is not provided, cyclists are forced to resort to locking their bicycles to the best available object, whether it is a post, a parking meter, or a staircase railing. This haphazard bicycle parking is undesirable as it produces bicycle clutter at building entrances and on streets and can be potentially dangerous to pedestrians.

A cyclist's prime concern is the security of the bicycle. Parking should, therefore, be close to the destination point, whether it is an office, store, or recreation facility. Ideally, the bicycles should be in clear view of either the owner or a building security officer, or at very least, in open view of passers-by. Bicycle parking should not be hidden as this gives thieves the opportunity and the cover they require.

Bicycle parking may be considered under the same categories as those applied to motor vehicle parking facilities: controlled and uncontrolled access.

Controlled-access bicycle parking includes bicycle lockers, and key-access underground parking (e.g.

apartments, automated parking garages, and locked compounds).

Uncontrolled-access parking is any situation where cyclists must leave their bicycle unattended or out of their view (e.g. bicycle racks). The selection of both location and type of parking facility is critical to ensuring that the needs of the cyclists are met.

21.1 Uncontrolled access bicycle parking

There are two important factors to bear in mind when considering the selection of a bicycle parking rack: support and security.

A rack that supports a bicycle by a wheel must only support the wheel above the axle. Otherwise, unless it is the rear wheel that is inserted so that the front wheel can be angled to provide additional support, the bicycle is likely to fall over. Racks that support a wheel plus the frame are a better choice.

In order to securely lock a bicycle, three points must be secured: the frame and the front and rear wheels. Most bicycles come with "quick release" wheels that can be removed quickly and without tools. This enables the cyclist to lock all three components with a single lock.

Second, bicycle thieves easily cut chains and cables. For this reason, the most secure locking device is the hardened steel U-lock which is almost impossible to break. In order to fully secure the bicycle, the cyclist removes the front wheel, places it beside the rear wheel and frame, and locks all three together. Any parking rack being considered should be capable of being used in this way.

There are many creative and attractive designs for bicycle racks that complement the exterior of buildings and provide interesting street furniture. The following describes some examples.

21.1.1 Single or small bicycle racks

Most bicycle rack designed to hold a large number of bikes can be modified to hold only one or two bikes. The most common style of rack specifically used to hold only a small number of bicycles is based on a post design securing the bicycle by its frame. This style of rack can usually hold one bicycle on either side, though some are designed to accommodate up to four bicycles.

There are three good examples of this type of rack: 1) the bike rail or hitching post consisting of a post and ring; 2) an inverted U-shaped pipe; and, 3) a single post at least 1 metre high with one or two eyelets at the top or bottom.

21.1.2 Multiple or large bicycle racks

Multiple or large bicycle racks are made by many manufacturers and come in many attractive and creative styles. The majority of these are wheel racks, supporting the bicycle by one wheel above the axle. A good wheel rack will have individual openings narrow enough to give the bike support but wide enough to allow the front or rear wheel to be inserted.

Another style of multiple rack is the "ribbon-style" rack. This rack is aesthetically pleasing, can be easily modified to match the architecture of a building, and easy to use. The bicycle is not, however, held as securely as in a wheel rack and may fall over if not securely locked.

There are several styles of racks that park bicycles around a central hub. Although it is attractive, this design uses a lot of space and is less efficient than a single or double row rack.

21.1.3 Installation of racks

Several factors must be considered before installing single or multiple bicycle racks. The first consideration is where to place the rack; the second consideration is the

orientation of the bicycle rack; and, the third consideration is how the rack is secured.

When deciding where to place the rack, one must consider other traffic, protection from the elements, and visibility. Although racks must be accessible to the public, they cannot interfere with the movement of pedestrians or other vehicles, or the opening of doors. Where possible, bicycle racks should be installed under cover to protect the bicycle from the elements, but also to make it more comfortable for the cyclists when they are securing the bicycle and loading or unloading panniers from the bicycle. As mentioned before, to prevent theft and so that cyclists can find them, bicycle racks should be located in plain view. If it is possible to locate them in view of a staffed security or information desk, or a pay kiosk, this will also deter the potential bicycle thief.

Very few racks are accessible from one side only. When determining the orientation of the rack, it must be considered that cyclists will want to get at it from both sides. Allowing for this access increases the capacity of the rack. A minimum of 2.5 metres clearance should be allowed on either side of the rack to ensure maximum usage.

Bicycle racks should be firmly attached to the ground. For new installations, bolts should be set in concrete and the racks bolted in place. Large stakes can be pointed into asphalt or dirt. It is a common practice of bicycle thieves to remove an entire unsecured bike rack complete with bikes and then cut through the rack to release the bicycles.

In areas where cycling is seasonal, racks can be so installed that they can be easily removed for the clearing of snow. In these circumstances, some bicycle parking should still be made available.

21.1.4 Bicycle parking checklist

The following checklist should be considered as part of the decision process for the location of bicycle parking facilities:

- ☑ **For a specific location, where are bicycles now being parked (poles, railings, etc)? For a general area, what are the most likely destination spots for cyclists?**

- ☑ **How many bikes are usually parked at the location? If usually only one or two, then will small bike racks be acceptable?**

- ☑ **Would more bicycles be parked there if parking were available? Will larger and/or more racks be required? Is there sufficient space to provide a larger rack, or should several small ones be used?**

- ☑ **Is bicycle clutter a problem and can it be controlled by directing cyclists to park their bicycles in a specific location?**

- ☑ **Is the location visible to the cyclist to find the rack and to be able to see the rack once they have left the bike there (i.e. in front of a restaurant)? Is the rack visible to others, such as a security guard or parking attendant?**

- ☑ **In which direction will the bicycles protrude from the rack? Is there adequate clearance around the rack for manoeuvring the bike in and out of the rack when there are other bikes in it?**

- ☑ **Will the bikes interfere with other traffic or doors?**

The answers to these questions will provide an indication of what size of rack is required, and where it should be positioned.

21.1.5 Parking space provision

The number of parking spaces needed depends on individual site considerations. For existing locations, once bicycle parking is provided, increased bicycle traffic can be expected. For new developments, Section 13 - Planning Tools examines the various means and standards that may be applied.

Educational institutions, libraries, municipal recreational facilities, and private fitness facilities tend to have a higher usage of bicycles and are areas where a higher bicycle usage can be encouraged through the provision of adequate parking. Neighbourhood commercial areas are another area where bicycle usage can potentially increase.

Within the urban core, apartment buildings and business offices will also require more parking to accommodate utilitarian cyclists.

For further details, consult the recommended bicycle parking requirements in Appendix E.

In Appendix F, there is a list of bicycle locker manufacturers. Some of these vendors also manufacture bicycle parking racks. There are also many local bicycle parking rack manufacturers.

21.2 Controlled access bicycle parking

In general, controlled access bicycle parking is provided in situations where the cyclist wants to secure their bicycle for an extended period, for example, all day whilst they are at work. In this case, simply providing racks in a public area is unacceptable as the bicycle is too vulnerable. A more secure system can be provided through lockers or a bicycle lock-up.

21.2.1 Lockers

Bicycle lockers come in many shapes and forms. In some cases a locking system is an integral part of the locker; in other cases the person leaving their bike must provide a lock. Also, some lockers are outfitted with a coin box and key, similar to storage lockers in train stations. For planning purposes, the type and style of locker to install will depend on who will own the lockers and how they wish to administer them.

The formula for how many lockers should be provided at any given location is based on the number of bicycle

parking stalls recommended. Appendix E gives a good guideline for parking spots, but it is important not to underestimate how many lockers will be used once they are provided. Purchasing a larger number and laying a bigger concrete slab is more cost effective.

Lockers will likely require some administration. Maintenance of the lockers will have to be conducted regularly, probably once or twice a year.

A list of bicycle locker manufacturers is given in Appendix E.

A list of bicycle parking locker manufacturers is given in Appendix F.

21.2.2 Lock-ups

Lock-ups are generally located in a section of the underground parking of office towers or apartment/condominium buildings, and consist of a caged in area or a storage room. Inside the cage or the storage room are racks or hanging hooks, along with hooks for hanging clothing and helmets.

Because there will be a number of different users, securing the access to a lock-up needs to be carefully administered. Also, it is likely that users will want to secure their bicycles within the lock up. With hooks, a U-bolt may need to be bolted into the wall to provide an anchor for a cable lock. Also, regular cleaning and other maintenance should be scheduled.

If there is sufficient space, a changing room and day lockers should be provided for bicycle commuters.

To facilitate the installation of lock-ups, there should be a municipal by-law requiring that bicycle parking be provided as per Appendix E.

21.2.3 Other options

In some cases, it may not be possible to provide facilities in an existing building. It may be possible to use a near-by fitness facility to provide bicycle parking and change facilities, or to have space in one building for the use of employees or residents of several surrounding buildings.

21.3 Other facilities

In addition to secure parking, people who are choosing to ride their bicycles to work or anywhere where they will be staying for an extended period of time, will want to be able to change their clothes and freshen-up before starting their day. Employers and educational institutions should be prepared to provide change-rooms, showers, and short-term clothing storage for bicycle commuters. Community by-laws or guidelines for development permits will help to provide this incentive

21.3.1 Showers and change-rooms

Particularly for owner-occupied office buildings, it is recommended that change-room and shower facilities be required by by-law to encourage employees to consider bicycle commuting and to accommodate other physical activities for employees. The showers and change-rooms from an existing fitness facility may be used for this purpose.

21.3.2 Storage lockers

In addition to change-rooms and lockers, there should be storage lockers provided for individuals to store personal belongings that they require for their bicycle ride, or to shower, whilst they are at work. These should be large enough to allow jackets or towels to be hung to dry during the day.

21.3.3 Bike-aid centres

Many building owners are now providing space for Bike-aid centres. These are centres, generally operated by an independent agent where a variety of facilities are provided. On a small scale, this might be the provision of simple bike accessories such as tubes, batteries, locks, etc. A repair or maintenance service might be provided during the day.

On a larger scale, these facilities might also include the change-room, shower, and storage facilities mentioned above. From a planning perspective, these types of facilities should be encouraged and in some cases, required by by-law.

22 BICYCLE TRAFFIC CONTROL DEVICES

Bicycles are subject to the same traffic control devices as any other vehicle. Bicycle traffic control devices should, therefore, reflect the standard shapes, colours, dimensions, symbols, wording, lettering, illumination, and reflectorization as is used for motorized vehicles. This uniformity will ensure that the message is clearly understood by all users and reduce municipal liability in the event of a collision.

Many of the traffic control devices outlined in this manual will be applicable to both on-road and off-road applications. All the signs and pavement marking illustrated in this document are considered Canadian guidelines.

The principles applied in this section of the manual are outlined in the "Manual of Uniform Traffic Control Devices for Canada", the "Urban Supplement to the Geometric Design Guide for Canadian Rides", and "Bikeway Traffic Control Guidelines", all available from the Transportation Association of Canada (see reference in Bibliography).

Traffic signs and pavement markings are most effective when they are designed carefully and installed properly. Simplicity in design, care in placement, and a high

standard of maintenance are essential. An effective traffic control device will attract attention, be visible, be legible, comprehensible, and appropriate to the needs of all road users. Sound engineering judgement and principles are critical to the proper installation of bicycle related traffic control devices.

22.1 Signage

The shapes of signs are intended to advise motorists and cyclists of the class of the message. The task of cycling can be simplified by enabling the cyclist to judge in advance the type of message to be expected. Standardization of colours also assists the cyclist to recognize classes of signs. Signs used as bicycle traffic control devices usually fit into one of three categories: regulatory, warning, and informative.

22.1.1 Regulatory signs

Regulatory signs indicate the legal requirement to adhere to a traffic regulation that applies at a specific time or place on a roadway or bikeway. Regulatory signs are generally a red, green or black message on a rectangular white background. Regulatory signs must be installed wherever need to indicate a regulation is in force, but care should be taken not to "over-sign". Regulatory signs need to be located where they are visible to the vehicle operator and clearly indicate the requirements of the regulation. Depending on traffic requirements, road conditions, and local legislation, regulations, signage may differ widely from one location to another.

There are special signs pertaining specifically to bicycles. For example, a "No Bicycles" sign. On bicycle paths, special regulatory signs are generally the same ones used on roads, but are smaller and installed at a lower height.

Intersection signs are used where bicycle lane traffic is potentially in conflict with other traffic, for example where there is not enough opportunity for traffic to merge into a single stream before the intersection or the traffic remains separated and neither vehicle operator knows who has the

right-of-way. An example could be the "Motorized Vehicle Passing Prohibited" sign that prohibits overtaking in a specific zone, or the "Yield to Bicycles" sign.

RB-33 (600mm x 600mm)

RB-93 (300mm x 450mm)

Source: Bikeway Traffic control Guidelines for Canada, Transportation Association of Canada, 1998

22.1.2 Warning Signs

Warning signs are designed to alert cyclists, in advance, of a change in the condition on, adjacent to, or above the roadway or pathway that requires caution, diversion, or a change in speed. Typical hazards will include physical conditions, moving hazards, temporary conditions, or new or changed traffic regulations.

Because of its lighter weight and narrower wheels, the bicycle is more susceptible to road conditions than motor vehicles. What may not be signed as a hazard for motor vehicles because it is insignificant can be considered dangerous for bicycles. Good examples of hazards that are more significant for cyclists are railway tracks, broken-edge pavement, sewer grates, raised manhole covers, and road construction.

Like regulatory signs, warning signs convey their message through their colour, their shape, as well as the symbol or words on the sign. Warning signs are generally black symbols or letters on a diamond yellow background. Orange diamond signs with black symbols and lettering depict temporary hazards.

When located on a separate bikeway or path, bicycle warning signs may be reduced in size, as long as they are still visible to the bicyclist. On shared rights-of-way, separate signing is not necessary unless it is aimed solely at the cyclist.

Examples of bicycle specific warning signs may include "Hill Sign for Bicycles", "Slippery When Wet Sign for Bicycles", and "Share the Road" signs.

Some bicycle warning signs are aimed at other road users, for example, to alert them to a location where a bicycle facility crosses a roadway. Another situation may require an advance warning of a constricted facility that requires additional care and attention. Factors that may influence the need for advanced warning signs are: vehicle speeds, bicycle volumes, traffic volumes, traffic types, visibility, road grades, or crash data.

WA-41
(450mm x 450mm)

WC-45
(450mm x 450mm)

WC-47 (600mm x 600mm)

WC-47S (600mm x 300mm)

Source: Bikeway Traffic control Guidelines for Canada, Transportation Association of Canada, 1998

22.1.3 Information or guide signs

Information and guide signs can provide information on route selection, type of facility, the destination of the facility, the distance, alternative routes, points of interest, and physical features. Information and guide signs are generally white lettering on a rectangular green background.

The most frequent type of information and guide signs are bike route/lane marker signs that indicate a road that has been designated a bicycle route or lane. They alert motorists to expect bicycle traffic on the road and to ensure cyclists stay on the route. In order to convey further information, supplemental plates can be placed beneath the bicycle sign indicating the name of the route if it is part of a network, the destination and the distance, directional arrows, and the beginning or ending of the route.

Alternative route signs direct bicycle traffic off a major route and onto an alternative. As these are not regulatory signs, bicyclists are not required to exit. These are signs for information only.

IB-23 (450mm x 450mm)

Source: Bikeway Traffic control Guidelines for Canada, Transportation Association of Canada, 1998

22.1.4 Other signs

Occasionally there is a need to employ temporary condition signs to warn cyclists of an area of construction, maintenance or some other temporary or unusual condition.

As a guideline, there should be as little disruption to the normal traffic movement as possible. Where interference is unavoidable, such as lane narrowing or closing, the frequency should be kept to a minimum and the cyclists' movements should be directed by temporary signs.

Many of the temporary condition signs use the same design and have the same meaning as other signs mentioned in section 22.1, but when this is a temporary condition, the signs should be black symbols on an orange background.

22.1.5 Sign installation and maintenance

Bicycle signage should strive for uniformity in design, application, placement, and maintenance on roadways and should be installed such that motor vehicle drivers and cyclists are encountering similar conditions with similar advance warning and similar placement wherever they see a particular sign.

Generally, signs are installed on the right side of the roadway, on channelizing islands, overhead, or on the left shoulder of a bikeway, but always in the line of vision of approaching vehicles. The actual placement of the sign may vary according to the design and alignment of the bicycle facility.

Stop and regulatory signs are placed as near as possible to the point where the regulation begins. Warnings signs are placed in advance of the hazard. All signs are placed at right angles to the direction of the traffic to which the sign is directed. Signs that have reflectorized material should be placed at a slight angle from approaching traffic to avoid glare. Additional signs may be required to supplement a primary sign on multi-lane one-way streets, or divided roads, for example.

Signs should be between 1.5 metres and 2.5 metres in height in rural areas and between 2.0 and 3.0 metres in urban and suburban areas. Where overhead signs are used, signs should be at least 4.5 metres above the roadway and centred over the traffic lanes affected by the sign. Signs over freeways would be higher. On a pathway, trail or separated facility, the height can be reduced to 3.0 metres, as long as access by service vehicles is not affected.

Bicycle signage should be placed between 2.0 metres and 4.5 metres from edge of the roadway. For multi-use and bicycle paths, this can be reduced to 1.0 meter from the path edge. Where there is a raised curb, signs are placed between .3 metres and 2.0 metres from the curb face.

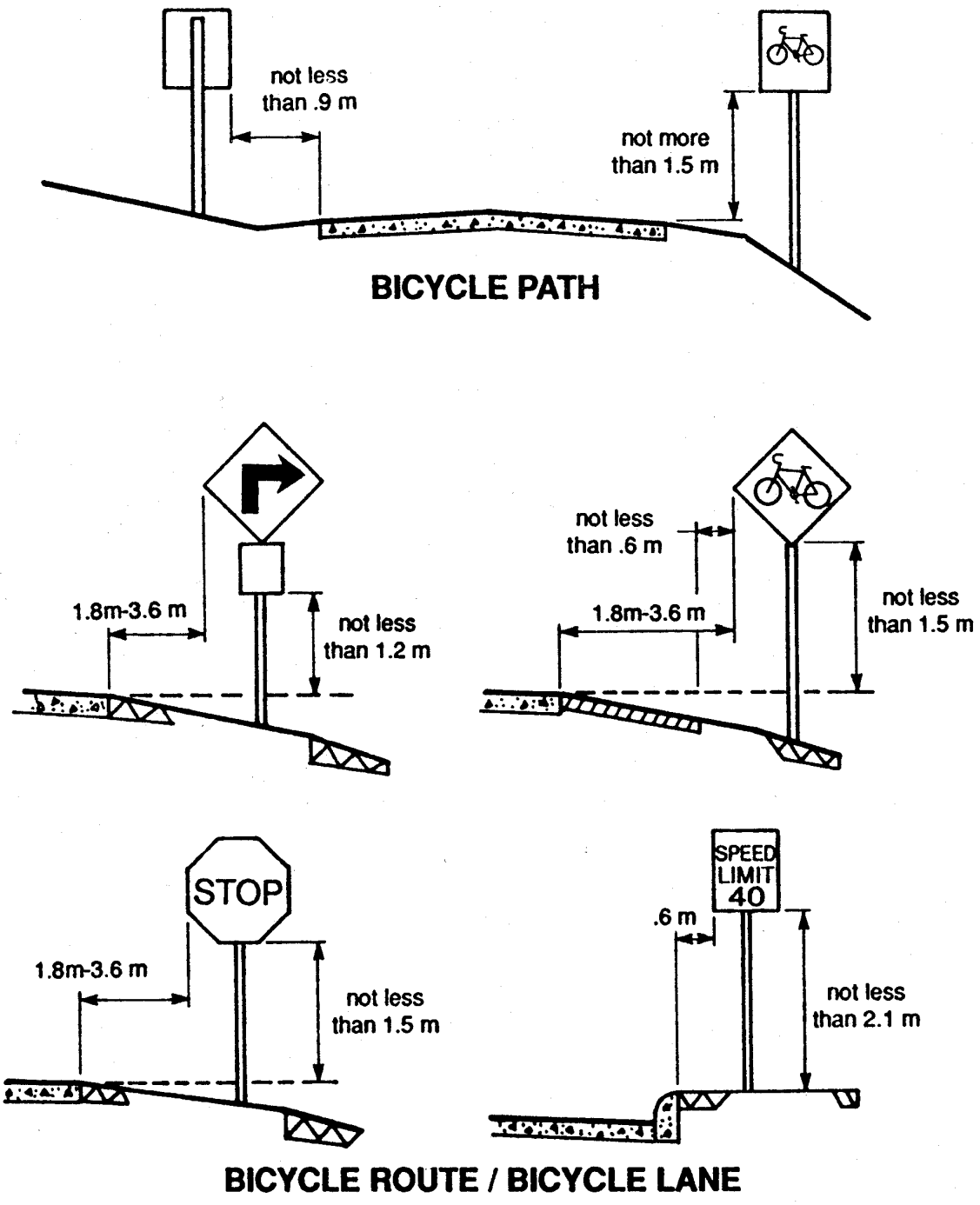


FIG. 25 BIKEWAY SIGNING

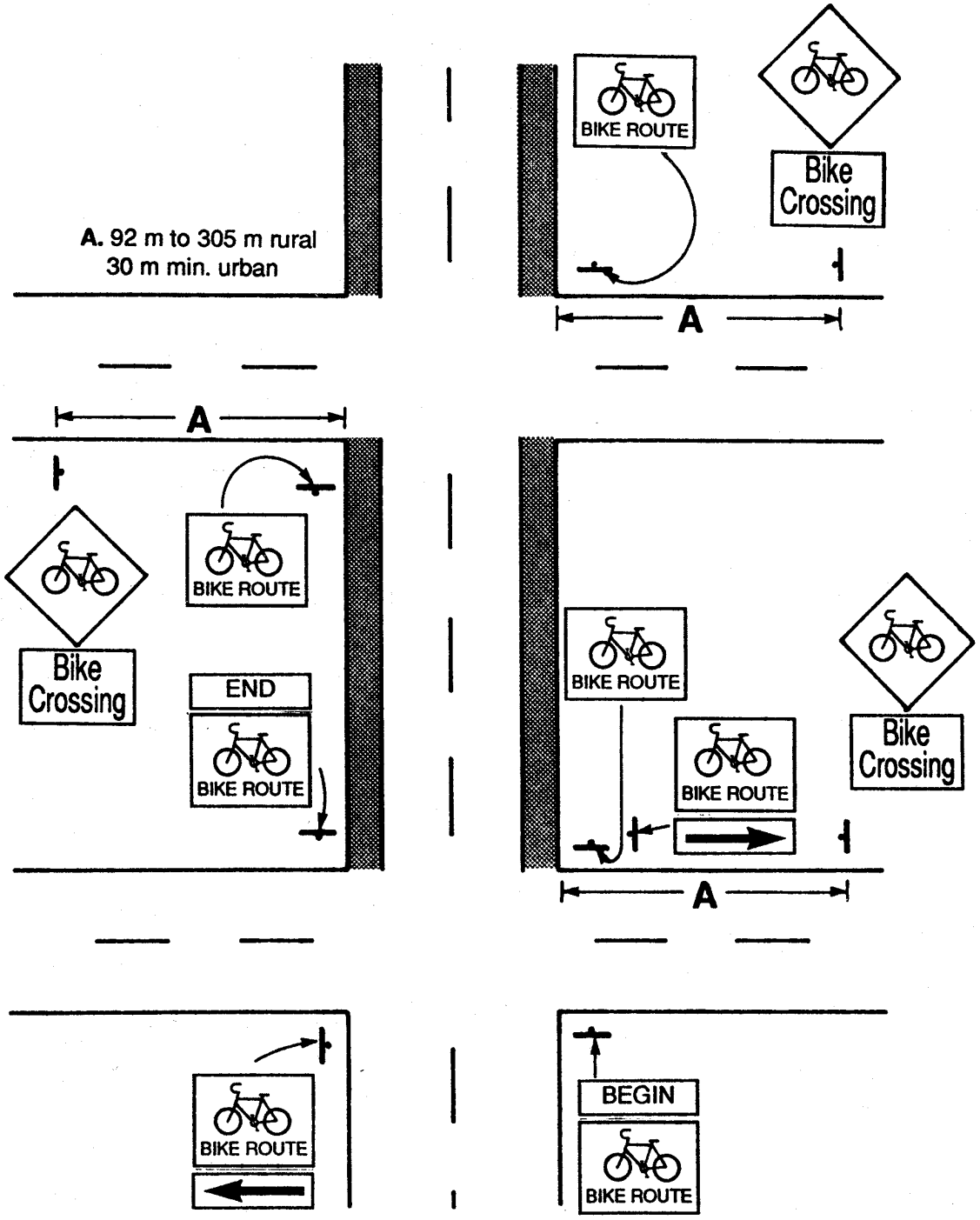


FIG. 27 BIKEWAY SIGNING
BICYCLE ROUTES / BICYCLE LANES

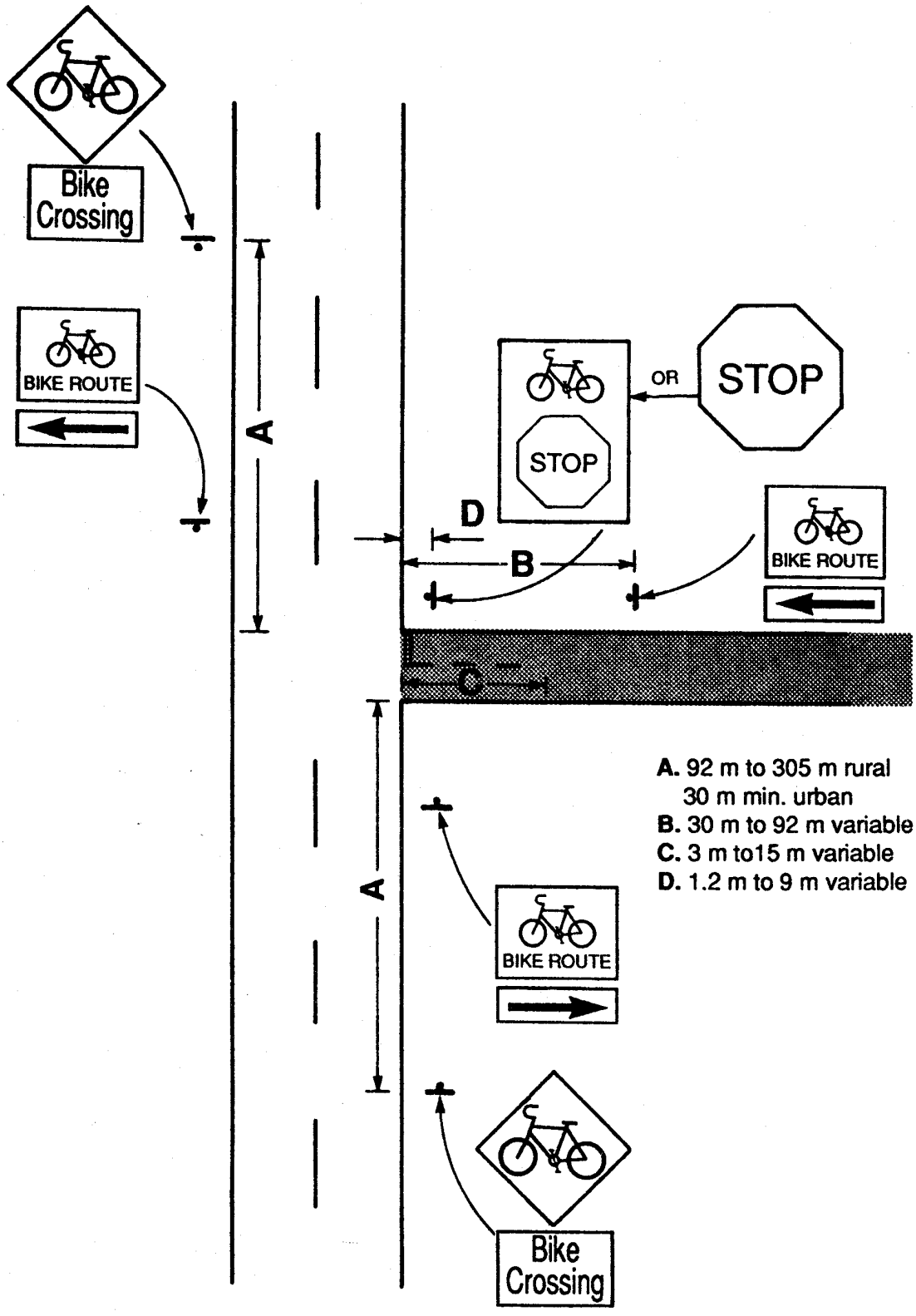


FIG. 26 BIKEWAY SIGNING
SEPARATE BICYCLE PATH

22.2 Pavement markings

Pavement markings are a significant element for traffic regulation on bikeways. Pavement markings are used to define messages in the form of words and symbols, designating bicycle lanes, lane usage, etc. In most cases, pavement markings supplement signage. As with signage, pavement markings should be uniform, easily recognized and understood.

The advantage of pavement markings, particularly for cyclists is that this surface signage can convey a message without distracting the road user's attention from the roadway or pathway. In order to do this, they must be large enough for users to observe as they ride and drive. The disadvantage of pavement markings is that they are easily obliterated by debris, leaves, snow; they are not easily read in the wet; and, they have limited durability.

The materials used for pavement signage include thermoplastics, oil and water based paints and pre-formed marking tapes. Some products address environmental concerns whilst others offer greater durability, visibility, and retro-reflectivity. Whatever material is used, skid resistance and reflectivity are important to consider.

Maintenance is also an important issue with pavement markings. The frequency with which markings will have to be re-marked will depend on the surface, climate, and volume of traffic.

22.3 Bicycle signals

Traffic light regulation has a tremendous influence on the promotion and regulation of bicycle use. In many European cities where separated bicycle paths and bicycle lanes are common, separate bicycle signals are incorporated to provide a higher priority to bicycle traffic. Bicycle signals can also be used in situations where bicycle traffic is being given an advanced green signal.

Bicycle signals are mounted on poles approximately 3 metres high and use a smaller light with a bicycle symbol on the face. They can be activated by detection strips in

the pathway or lane or by push buttons at the intersections.

23 MULTI-MODAL LINKS

A multi-modal link connects different methods of transportation (i.e., bus, car, bicycle, walking, etc.), thus creating a transportation system. In a multi-modal transportation system different inter-modal links are used during the trip from origin to destination. In some cases, the transportation vehicle is changed. In others, such as driving onto a ferry, the original vehicle is transported as well.

Multi-modal links are an important part of mass transit and providing multi-modal links in conjunction with mass transit greatly extends the catchment area, and provides a greater incentive for people to use mass transit.

The bicycle is an important transportation vehicle in its own right. The bicycle is limited in the distance over which it can be used, the terrain it must cover, and the speed at which it can go. There are also significant barriers, such as bridges and tunnels, which discourage bicycle use. The bicycle is also very flexible and can be easily transported. Therefore, there is a large potential for bicycles to form important links with other forms of transportation, such as buses and trains.

Many households own bicycles, but very few use them for commuting purposes because of the limitations mentioned above and also because of inclement weather and the fear of traffic. The majority of bicycles are used irregularly and for utilitarian or recreational purposes. Surveys have shown that some recreational cyclists would use their bicycles to commute to work if multi-modal links existed.

23.1 Bike and ride

Most metropolitan areas are serviced by high-speed, mass-transit systems. This can be a rail system, such as in Calgary or Vancouver, a subway system, such as in Toronto and Montreal, or an express bus system, such as

in Ottawa. Feeder routes and multi-modal links service these high-speed systems. Often the time spent on feeder routes is greater than the time spent on the main transit system. Cycling to the main transit system eliminates using the feeder network, which can greatly decrease overall transportation time. Bicycle parking or rental facilities at the transit stations would encourage bike and ride transit.

In parts of Europe and Japan many mass transit users cycle to the main transit stations because the facilities exist for secure bicycle storage and parking. More advanced facilities include attendant-secured parking and bicycle parking garages.

Bicycle rental is another common method used in Europe and Japan. Bicycles can be rented for a small fee at the station, ridden to work and returned to the station before taking the transit system home. At the end station, a bicycle can be rented, ridden home, kept overnight and returned the next morning before taking the transit system to work.

23.2 Carry-on transit

An alternative to parking the bicycle is to carry the bicycle onto the transit system. Parking spaces on the transit vehicle or a designated carrying area may have to be provided. Appropriate placement of bicycles within a transit vehicle can be accomplished in a variety of ways.

23.2.1 Buses

Most buses are not readily accessible to bicycles. One solution to this is to have bicycle racks on the outside of the bus where cyclists can secure their bikes. The best location for these racks is on the front where the driver can see the bicycle. This is important to ensure the bicycle does not become dislodged, but also to ensure that the bicyclist has completed mounting or dismounting the bicycle from the rack before the bus pulls away from the stop. Front-mounted bicycle racks are limited as to how many bicycles they can carry (two). Rear racks can

carry up to 8 bicycles. Front-mounted bicycle racks on buses have met with success, particularly where there are no peak times for the demand for the service, or where the provision of racks is system-wide and service is frequent.

Several European bus lines have specially modified buses on high traffic bicycle routes. The buses have a lowered front or central section allowing cyclists to wheel their vehicle onto the bus and secure it in a designated area while the bicyclist either stands or sits.

23.2.2 Light rapid transit, subways and streetcars

There are several methods of transporting bicycles onto light rapid transit, subways and streetcars. The simplest allows cyclists to carry their bicycle onto the transit system where it can be secured, usually by the cyclist holding the bicycle at all times. Bicycle access may have to be restricted to end cars and to certain times of the day based on the capacity and usage.

On some subways, the operator booths at either end of each individual section are empty and can be used to store bicycles.

Sections of cars can be modified by raising existing seats and allowing for the securing of the bicycle to a ceiling hook and wall flange. This method is in use on several European streetcar lines.

It is difficult for cyclists to carry their bikes up and down stairs or over turnstiles, particularly if they are using panniers. Service entrances, escalators, elevators, and wheelchair access facilities are a possible solution to the problem of access to the station and onto cars for bicycles.

23.2.3 Railways

Railway baggage cars are the best place to store bicycles for transport. They must be secured so that they will not shift or move during transit. Floor racks are not recommended; they are in the way when not in use. Wall-

mounted racks secure the bicycle out of the way. A ceiling hook can suspend the bicycle by its front wheel and a U-flange mounted on the wall secures the rear tire by means of a lock or strap. This method has been successfully used on buses and trains in several European countries.

23.2.4 Ferries and sea-buses

For short trips on calm waters, no special provisions for bicycles are required. The cyclist secures the bicycle by holding it. On long trips or on rough waters, ferries and sea buses must have systems to secure the bicycle safely and prevent its movement. Racks that secure both wheels and the frame are recommended. Wall-mounted racks, which hold bicycles parallel to the ship wall, are useful where available space is limited. Floor mounted racks are not recommended as they cannot be removed when not in use. All bicycle parking should either be in the hold or in an enclosed area on deck to protect the bicycles and exposed luggage (i.e., panniers) from water and salt-spray damage.

23.2.5 Airports

For people travelling with their bicycle, both the access to airports and the handling of the bicycle once in the terminal are critical issues. Clearly marked bicycle lanes or access routes to the departures level is important to assist the cyclist in negotiating the traffic conditions at our larger airports. The cyclist will also need clearly marked exit routes when leaving the terminal to join the roadway network.

For cyclists arriving by automobile, the distance the bicycle has to be carried along with additional luggage is critical. Accommodation for checking the bicycle as close to the entrance as possible can greatly improve the service. For those arriving by taxi or bus, the comments noted in the above sections regarding transport of bicycles on public transit would apply. Again, the proximity of the bicycle check-in to the drop-off point improves the service.

For cyclists arriving on their bicycles, all of the above apply as well as special considerations for easy access to the terminal itself. In many cases, the access for handicapped individuals would serve the cyclist as well. These entrances should be clearly marked and accessible to both groups.

Once inside the terminal, the handling of the bicycle should be kept to a minimum to decrease the risk of damage, where the bicycle is to be picked up by airline personnel should be clearly marked, and at no time should the cyclists be required to leave the bicycle unattended.

24 RURAL FACILITIES

24.1 Rural roads

Rural roads can include local municipal roads, provincial highways, or provincial parkways. Cyclists use them either as a transportation link between destination points or as a scenic recreation experience.

In the case of provincial highways, the main issue is available space on the road, the volume and type of traffic, and the speed of traffic. It is rarely necessary to physically separate bicycles and motor vehicle traffic as long as there is sufficient space to accommodate both. Where there is a paved shoulder, this provides cyclists with a shoulder bike lane. Where there is no paved shoulder, it is likely that traffic volumes are low enough to allow for integrated use of the roadway. It may be necessary to provide additional signage, and enforce the speed limit in these areas.

In a small number of cases, it may be necessary to provide a parallel route to permit cyclists to use the direct transportation linkages. This may be the case where there are a significant number of large trucks using the highway, or to provide direct access to a school or recreational facility. Direct routes just off or beside the main highway should be identified with the appropriate signage. The identification of such routes on maps would

further increase their use by cyclists and encourage more people to bicycle.

As new highways are built, many of the former "main" highways become relegated to secondary highways. In some cases, because of their historic association or scenic attributes, they are also designated as provincial parkways. Such routes are an attractive alternative to the major roadways and should be considered for development as bicycle facilities. If the roadway itself is wide enough paved shoulders can be provided or added. Signage indicating the existence of the bicycle facility should be installed at key intersections.

All routes that encourage the use of bicycles can contribute significantly to the local economy. Cyclists spend much more money per travelled mile on food, beverages, and other items than other travelers do. As a result, smaller towns and villages will definitely benefit by encouraging cyclists and providing for their needs.

24.2 Rights-of-way

Rural cyclists can take advantage of a variety of existing facilities in their quest for a different kind of cycling experience. Many of these facilities would be considered "off road" in the sense that paved surfaces are not being used. By using railway, hydro and other types of rights-of-way, these facilities can provide direct linkages between destinations or simply an enjoyable or challenging experience on their own. The absence of motor vehicle traffic could also be an added attraction.

One of the issues with rights-of-way is the grade of the terrain. Grades exceeding 8% can be fairly challenging and except for short distances, should not be incorporated into a designated bicycle route.

24.2.1 Active rail corridors

Railway corridors provide ideal facilities for cyclists, even when the railway line is still active. Rail beds rarely exceed grades of 4%, which is ideal for cyclists. Railway

rights-of-way on either side of the line are generally very wide and where trains are infrequent, and could link urban centres, it may be possible, in some instances, to develop a bicycle facility parallel to existing railway lines. When planning for this type of facility, safety must be considered carefully but with the proper alignment and design, particularly at level crossings, it is possible for cyclists and active rail lines to use the same space.

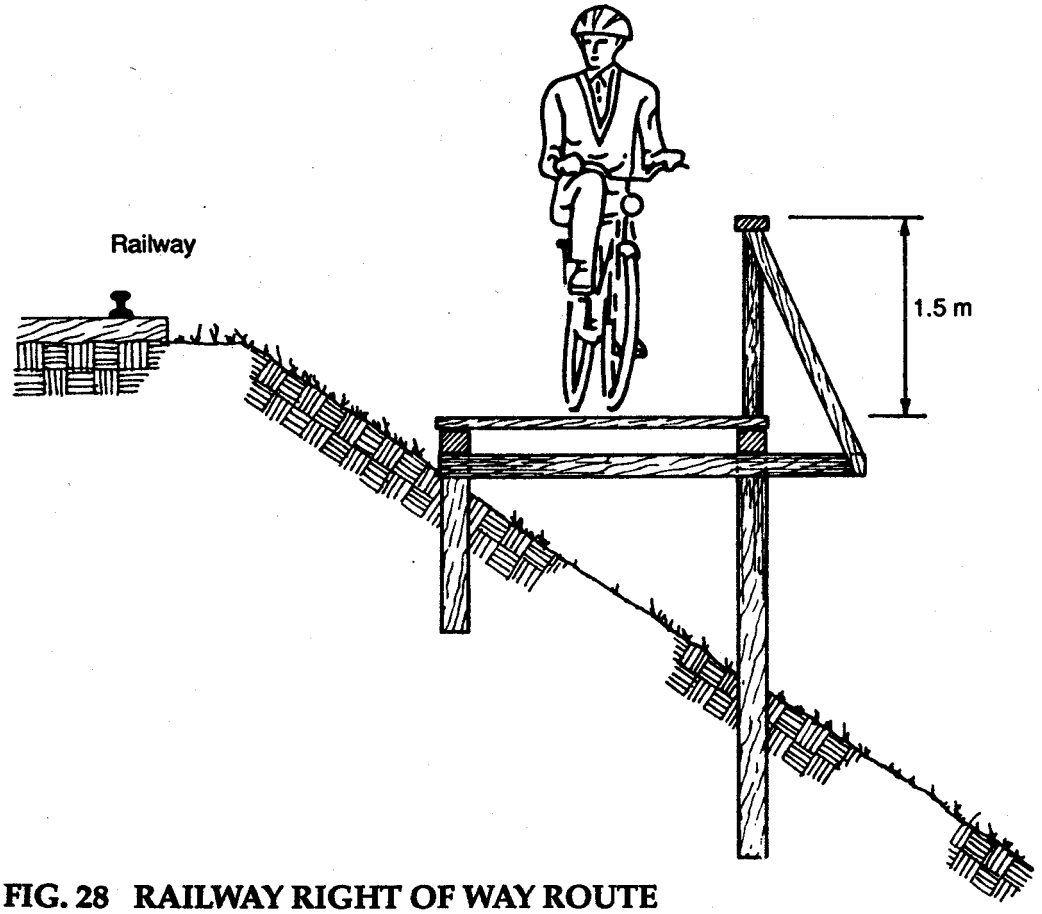


FIG. 28 RAILWAY RIGHT OF WAY ROUTE

24.2.2 Rails-to-greenways

Because of the grades and because rail lines link urban centres, many abandoned railway rights-of-way have the potential to become attractive rural cycling facilities. Once abandoned, the railway corridors become linear parkways accessing otherwise inaccessible green areas.

Rails-to-greenways can often be used year-round by a variety of users ranging from cyclists in the summer to cross-country skiers in the winter, thereby justifying the initial financial and time investment. It is important, in the abandonment process, not to have the continuity disrupted through the sale of parcels of land and not to have existing infrastructure, such as bridges and trestles removed. Where possible, an abandonment procedure should be put in place that allows for a level of government, or a private group, to take control of the facility for recreational and utilitarian purposes.

24.2.3 Utility corridors

There are many different opportunities to develop trails using the various types of service corridors.

Hydro lines present an opportunity for rural cycling facilities on the land beneath them provided the terrain is not too steep and the right of way does not cross too many existing roadways. The trails can remain strictly "off road" or in certain cases, they can be developed as a multi-use pathway.

Gas and oil pipeline corridors are other area types of utility corridors to consider for off-road bicycle facilities.

Fibre-optic corridors are another type of service corridor to consider for piggy backing bicycling facilities. These easements or rights-of-way can accommodate either a gravel or pavement on their surface with no damage to the underground system.

Some of these corridors can provide an extensive inter-connecting system complementing an existing network.

24.2.4 Fire roads and logging roads

The responsibility for fire protection on Crown Land rests with the provincial governments. In large areas of Crown land holdings, roads are cut to access the interior in an emergency. These are often dirt tracks that can provide a challenging rural cycling experience.

In some provinces, logging is also allowed on Crown Land. Logging companies will construct logging roads to transport the timber to sawmills. These roads provide access to wilderness that wouldn't exist otherwise. The only barrier to their use may be permission from appropriate agency.

24.2.5 Ski and snowmobile trails

Winter ski and snowmobile trails can be used during the off months for cycling. Often no development is necessary as the cyclists most likely to use these trails are on mountain bicycles that are ideally suited for rough terrain. Areas that can pose a problem are trails that cross lakes, swamps and other water hazards. These are of course frozen over in the winter.

MAINTENANCE

25 General Maintenance

Roadway maintenance has more impact on cyclists than it has on motorists. Most bicycles have wheels that can be easily damaged by rough surface conditions. Bicycle tires are more susceptible than motor vehicle tires to cuts and flats from glass and other road debris. Although most mountain bikes now come with shock absorbers on the front forks, most of the road shock is absorbed by the cyclist, and not by the bicycle. Surface irregularities can mean an unpleasant ride at best and crashes at worst.

In addition to a rough surface, water accumulation, ice, leaves, and other debris pose hazards for cyclists. As a result, the maintenance schedule for all roadways, but in particular bikeways, is very important for a municipality not only to avoid bicycle crashes, but also to avoid any liability relating to those crashes.

25.1 Roadways

Motor vehicles tend to sweep the road and move any debris to the road edge where most bicycle traffic occurs. Loose materials, such as gravel, can destabilize a bicycle where the gravel is deep or if it is on a turn. Also, the road edge is where leaves and other debris tend to accumulate. Therefore, road edges need more frequent cleaning than the road centre.

Cracking and pavement breakup occurs at the road edge first. Repairs are required immediately and cannot wait for general resurfacing. Filling the cracks with tar is not advised. In hot weather, bicycle tires can sink in the tar and be caught in the cracks. Asphalt filling should be used. At the time of resurfacing, new or recycled surface material must completely overlap; otherwise, there will be an edge line in the cyclist's path.

Most sewer grates and service covers are at the road edge. Constant pounding by heavy vehicles tends to depress and break up the road surface around them. This

kind of breakup can also occur around railway tracks. This breakup should be repaired immediately.

Patching and hole repair must result in an even edge between the old and the new road surface. Otherwise the cyclist's wheel could catch on the resultant edge.

Spring maintenance and clean-up schedules should give top priority to designated bicycle routes, roads with bicycle lanes and bicycle paths. This can be successfully achieved with only minor modifications to the maintenance schedule.

25.2 Bicycle lanes

All of the maintenance requirements for roadways apply to bicycle lanes. In addition, the following maintenance items are necessary:

- **maintenance of the lane delineation and any pavement markings within the lane;**
- **maintenance and replacement of signage for the bicycle lane as needed; and,**
- **if the lane is delineated with a solid barrier, then special sweeping will be required because road sweepers cannot clean the lane.**

25.3 Bicycle paths

In addition to the requirements for roadways and bicycle lanes, bicycle paths have special maintenance requirements of their own. They are:

- **repair of surface breakup by tree roots and other plants growing up through the path;**
- **removal of any shrubbery encroaching on the path;**
- **maintenance of sight-lines on either side of the path; and,**

- **surface sweeping of debris after heavy winds, and more frequently in the autumn when leaves fall onto the path.**

25.4 Maintenance notification

Preventive maintenance can only do so much. Often, the first notification of a maintenance problem is when there is a complaint. The following methods can help cyclists notify the appropriate department about maintenance needs:

- **"Telephone Hotline": Most municipalities have a telephone number that can be called to inform the municipality of road condition problems. The reporting system can be expanded to include cyclists' concerns about the roads and path systems.**

- **"Post Cards": Another method involves the use of postcards to report the location and condition of a problem. These postcards can be made available at bicycle shops, shops selling outdoor gear, other cyclists' gathering points, and through local, active cycling clubs.**

With both of these methods, the location of the problem (street name, side of street/path, distance from landmark, etc.), the description and seriousness of the problem should be recorded by the person receiving the call or sending in the post card.

The responsibility for correcting the problem may belong to another department or even municipality. The maintenance requests should be passed on to the appropriate jurisdiction wherever possible. Otherwise, the individual reporting the problem should at least be informed of the appropriate department or municipality to contact.

It is important that maintenance requests be followed up promptly. Any municipality that does not maintain its facilities properly could be liable for any subsequent damage or injury to a user.

An example of a Road Maintenance Request Form is located in Appendix G.

26 RETROFITTING AND UPGRADING

26.1 Bicycle routes and lanes

Whenever a roadway is being resurfaced or rebuilt, the road edge should be extended to allow extra width in the curb lane for bicycle traffic. Often the roadbed is wider than the road surface, so there will be no damage to the underlying structure. If this is not possible, the road could be re-striped to make the outside lane wider than the inner lanes. This will benefit cyclists as well as wide vehicles that use the lane.

26.2 Pathways

Many existing bicycle paths were built during the 1970s when their design was still in the trial-and-error stage. Since then, certain observations have been made:

- **many bicycle paths are used by a multiplicity of users, including cyclists, walkers, runners, in-line skaters, etc.;**
- **they were designed for a speed that is lower than the average cyclist's travelling speed;**
- **many are too narrow to handle the traffic load placed upon them; and,**
- **many do not connect with other paths or lanes.**

Upgrading the facility in conjunction with a proper education program on their use can reduce these problems. The following options are upgrade options that can also be considered.

26.2.1 Widening

Widening the path system provides more room for users. There often is insufficient space or money available, however, to widen the entire path. In this case, selective widening may be preferable. The pathway could be widened at all intersections where there is congestion and at all curves where the design speed was insufficient to allow for safe cornering or cornering with other users on the path.

26.2.2 Lengthening

Many pathways are very short or do not go anywhere. These can be extended and connected with either a destination point or another facility. Special consideration is needed to co-ordinate pathways between municipal boundaries so that there is system or regional continuity.

26.2.3 Twinning

Twinning is the construction of two paths side by side. One is designated for cyclists, the other for joggers, in-line skaters, and pedestrians. Experience has shown that these paths must be built within a few metres of each other, otherwise users will tend to use whichever path is the most convenient, has the best view, etc. Experience has also shown that in cases where one of these paths is unpaved, most users will tend to use the paved one, regardless of the designation.

26.2.4 Curb cuts

Where pathways end at road edges, the needed curb cut or ramp allowing the bicycle onto the roadway should be installed.

26.2.5 Conversion to a multi-use recreational pathway

Bicycle paths can have a multiplicity of users. It is simply not cost effective to try and enforce exclusive use. This can cause friction between cyclists and other users on the path because they will be constantly coming into conflict with one another. Upgrading or designating the route a multi-user pathway, posting signs, and recommending caution will at least alert users to the need to share the use of the path.

26.3 Traffic calmed streets

In general, when a neighbourhood adopts strategies of traffic calming, the existing infrastructure will undergo retrofitting, as described in Section 20.5. Exactly what upgrading or retrofitting objectives will be undertaken will be determined by what exists and by what the community desires.

EDUCATION

27 EDUCATION NEEDS

Education relating to bicycle use is focussed in two areas: cycling skills training programs aimed at the cyclist, and programs for the education of motorists and pedestrians regarding the right of bicyclists to share the road.

There is a definite need to educate cyclists on the proper way to ride their bicycles on the road and pathways. This need can be met through the use of bicycle education programs that include one or more of the four following topics:

1) Rules of the road
2) Bicycle handling skills
3) Safety and protection
4) Bicycle maintenance

Examples of cycling education programs are found in Appendix H.

28 COURSE EVALUATION

Courses should be evaluated in terms of their prospective audience.

Children are a distinct type of cyclist (see section 11.1.1). They have a limited attention span, a simplistic concept of the world and do not consider their own mortality. Any program aimed at children has to take these facts into consideration.

There are several programs available to teach children cycling skills. When evaluating these programs, consider the following four points:

i) What is the course actually teaching? Some courses teach the rules of the road only; others teach how to ride a bicycle but not how to ride in traffic.

ii) How is the course taught? Some courses are classroom orientated, others are taught in the schoolyard or some similar environment, while other courses will take children right out into traffic.

iii) Who is teaching the course? Is the course being taught out of a manual? Has the instructor taught the course before? Is the instructor a cyclist? Is the instructor qualified to teach the course?

iv) Are parents involved with the teaching? Some courses use parents as part of the teaching process. This teaches both the parents and the child safe cycling skills and allows the parents to monitor their child's cycling skills.

The first three points for evaluating children's courses also apply to adult courses. In addition, the following points should be considered:

- How sophisticated is the course material and presentation? Adult courses should be much more thorough than children's courses. They should also include on-the-road training and evaluation. Other points to consider are whether the course is for novice or advanced cyclists.

- What is the duration of the course (they can vary from one day to courses spread over several weeks to allow time in between for practice)? This can impact on who will take the course. Generally, there is a market for courses of both short and long duration.

- Who teaches the course? More sophisticated information would require a knowledgeable and trained instructor. All courses should be taught by qualified instructors. The Canadian Cycling Association certifies instructors in CAN-BIKE instructional training courses.

29 BICYCLE AWARENESS PROGRAMS

Bicycle awareness programs are public relations exercises aimed at creating a greater awareness of cyclists' rights and responsibilities on the road and to

encourage more people to consider cycling as an alternative to driving their cars. Bicycle awareness programs can be aimed at cyclists, motorists, or both. A very passive style of bicycle awareness program is to develop a "Share the Road" campaign with bumper stickers, billboard signs, and media advertisements promoting courtesy amongst road users. Other, more active programs consist of "Bike to Work Weeks" with activities each day with high profile community members participating. Both styles of programs (and others in between) will serve to heighten awareness of the general public of the benefits of cycling to the community. All awareness programs should include media coverage and co-ordination with other groups, such as bicycle clubs, police, municipal departments, safety councils, etc.

30 SHARE-THE-PATH PROGRAMS

Share-the-path programs are special information programs aimed at all pathway users. These programs attempt to teach proper use of the pathway system and the concept that the pathway is shared by all users with rights of and obligations to each party. Most share-the-path programs start at the beginning of the cycling season. Information booths, posters, and brochures can be used. Some share-the-path programs involve trail maintenance and special activity days. Permanent signs should be installed along the pathway to remind users to share the pathway and to illustrate how to do it properly (see Section 20.4.11).

RB-95
(300mmx450mm)

RB-93
(300mmx450 mm)

RB-94
(300mmx450 mm)

Source: Bikeway Traffic Control Guidelines for Canada, Transportation Association of Canada, 1998.

31 MOTORIST EDUCATION

Just as cyclists need to know the rules of the road, motorists should know the special characteristics (slower speed, lateral movement to avoid road hazards, etc.) of bicycles on the road. Expanding driver education programs to include information about bicycles and cyclist behaviour and adding a section on bicycles to the provincially published driver training handbooks can accomplish this. "Share the Road" campaigns using billboards, bumper stickers, posters, and radio and newspaper announcements are also effective.

A very basic but effective form of motorist education can be accomplished by installing "Share the Road" signs throughout the community or at known trouble spots. This confirms the municipality's commitment to the promotion of cycling and alerts motorists to be cognizant of cyclists on the road.

WC-47 (600mm x 600 mm)

WC-47S (600mm x 300 mm)

Source: Bikeway Traffic Control Guidelines for Canada, Transportation Association of Canada, 1998.

ENFORCEMENT

The system of traffic laws and rules were designed to move vehicles safely and efficiently on the road. Our knowledge of the rules of the road is tested before we are granted the privilege of a licence to operate a motor vehicle.

Bicycles are covered under the Motor Vehicle Traffic Act. Motor vehicle traffic laws are a provincial jurisdiction and vary from province to province. In addition, municipalities have jurisdictional by-laws that will affect cyclists. Although the laws tend to be similar, there are variations, and this makes it more difficult for cyclists and motorists to understand their respective rights and responsibilities when using the public roadways.

There are no licencing requirements to ride a bicycle and no opportunity to test cyclists for their knowledge of the rules of the road, including local rules and regulations. Many cyclists have never had formal training and do not have sufficient knowledge of how to ride their bicycle correctly. Even when they are cognizant of the regulations, the flexibility of the bicycle makes it easy to take advantage of certain situations. Also, there is no overt obligation for cyclists to ride correctly, except for personal safety, because law enforcement is inconsistent.

32 SELECTIVE TRAFFIC ENFORCEMENT PROGRAM (S.T.E.P.)

It is recognized that cyclists' traffic infractions are not a high priority with many of the enforcement agencies. When it comes to cyclists, many police forces concentrate their resources on selective enforcement of specific violations. This selective enforcement generally occurs for a limited period of time, usually two to three weeks, and at a specific time of the year. The most effective times are spring when the majority of people are getting out on their bicycles after the winter weather and fall when students are going back to school. A selective traffic enforcement program of less than two weeks will generally not have a significant impact. Concentrating on

cyclists' traffic violations is an excellent way of letting cyclists know they are not outside of the law and that a certain type of behaviour is expected from them. Riding a bicycle, consistent with the operation of a motor vehicle, is the best way to decrease collisions between bicyclists and motor vehicle drivers. Cyclists fare best when they behave like motor vehicle drivers.

There are four areas of common cycling infractions. They are:

- **cycling without lights at night;**
- **failing to stop or yield;**
- **failing to indicate the intention to turn or alter course; and**
- **cycling the wrong way.**

These four have been shown in the Cross/Fisher study (see section 11.3) to be the major cause of bike/car collisions and should be targeted for safety reasons.

Violations for riding without lights should be enforced 1/2 hour after dusk when there still is enough light to see the cyclist. Unlike motor vehicles, bicycles are not sold with lights and many cyclists do not think that they will be cycling after dark. In early spring and late fall, it is very easy to be caught unprepared. Also, most bicycle lights rely on batteries and it is easy to forget to replace them. However, with the introduction of "Vista" style lights, the cost of effective lighting has been dramatically reduced. An effective headlamp and rear light can now be purchased and easily installed very economically. In addition to enforcement, bicycle stores and outdoor equipment stores should be encouraged to promote the purchase of lights when bicycles are purchased.

Because bicycles require human powered energy to maintain motion, it is very tempting for a cyclist to continue momentum at a stop or yield sign, rather than come to a complete stop or to slow significantly. Other road users have the expectation that cyclists will be

obeying the traffic signs. It is important to enforce the need for cyclists to obey stop and yield signs, particularly at intersections where a large number of collisions have occurred. Intersection violations should be enforced on heavily travelled bicycle routes. Rush hour is an appropriate time to enforce traffic laws, as this is when the risk is the greatest.

Bicycles do not come equipped with indicators and it is up to the cyclist to ensure that other road users are aware of their intentions through the use of hand signals. It is sometimes tricky to maintain control of the bike while signaling as this requires one hand to be removed from the handlebars. Cyclists need to be made aware of the importance of communication with other road users for their own safety.

Unfortunately, some educators relate riding a bicycle to walking and promote riding against traffic, particularly in rural areas. And in some jurisdictions, bicycle facilities have been engineered and designed to put cyclists in a position where they are riding against traffic. This is a very dangerous design, puts cyclists in positions where they are not looked for or expected by other road users and therefore, this type of design should never be considered. Where it is necessary to relegate cyclists to one side of a bridge or overpass, the access and egress designs must be very carefully implemented in order to eliminate the possibility of collision. For cyclists who cycle against traffic, enforcement is very important, as the types of injuries sustained in head-on collisions are severe and often fatal.

When cyclists are issued a ticket, like any other road users, they should be issued a standard moving violation ticket or by-law infraction ticket.

33 BICYCLE PATROLS

33.1 Bicycle police patrols

Many communities in Canada now use bicycle police patrols. Bicycle police patrols are police officers or community officers patrolling by bicycle. They complement patrols by car and on foot. Bicycle police patrols have been very effective in deterring crime and catching criminals in the act. They are very effective for drug violations and other "street" type crime.

Bicycle police patrols have a very high arrest rate generally 2 to 3 times the arrest rate of squad car police or beat patrols. In addition to their high arrest rate, bicycle police patrols are cost effective. It has been shown that in areas where bicycle police patrols operate, less officer time is spent on reporting crime and more is spent on intercepting and preventing crime. Bicycle police patrols are also more cost effective with respect to equipment. Approximately 25 bicycle police officers can be outfitted and trained for the cost of one squad car.

Bicycle police patrols have been introduced in dense urban areas to re-introduce community policing and to overcome some of the physical barriers presented by the urban environment. Bicycle police officers are not as intimidating as officers in motor vehicles and have a better rapport on the street. It is important that bicycle training is provided for the police officers that are using bicycles

Bicycle police patrols serve the dual purpose of setting an example of proper cycling behaviour and they are also a physical reminder that the police are aware of cyclists on the road. The bicycle police patrol should not be restricted to ensuring cyclists obey traffic laws. They can also be very effective in core urban areas or in places where patrol cars cannot go, such as pathways. They are also effectively deployed during large gatherings and public events.

33.2 Civilian bicycle patrols

Another type of bicycle patrol uses civilian cyclists and provides information and assistance rather than enforcement. This type of patrol is very effective in parks or on pathways. These on-bike employees and volunteers will help with minor repairs, give directions, administer basic first aid, and inform cyclists when they are not riding properly. Civilian patrols are often used in high traffic areas where there are a number of different recreational activities going on, such as cycling, in-line skating, and jogging. Again, these cyclists should be properly trained and outfitted.

34 REGISTRATION OF THE BICYCLE

There are many reasons for registering bicycles. Three of the more frequently cited reasons are:

1) **legal owners of bicycles can be identified;**
2) **a sense of responsibility by the owner and an awareness of the bicycle as a vehicle is generated; and,**
3) **lost, stolen or abandoned bicycles can be identified and recovered.**

Recently, other reasons have been cited. They are:

4) **licenses are a law enforcement tool;**
5) **licenses provide a database on community cycling;**
6) **licenses are a communications link with cyclists; and,**
7) **licenses provide a source of revenue that can be directed towards bicycle programs.**

Cyclists, unlike motor vehicle drivers, are not required to produce identification relating to their vehicle when they are stopped by the police while riding their bicycles. Every citizen, however, is required to be able to identify themselves under vagrancy laws. Because there is no age limitation for riding bicycles and no requirement to have passed a test, and no licence is issued, it is easy for a cyclist to forget to carry identification.

Bicycle registration enables the police or an emergency service person to confirm an individual's identity by calling up the registration number of the bicycle. This ability is crucial in the event of a traffic incident, or if there is suspicion that a bicycle has been stolen.

Registration of the bicycle lends credibility to the cyclist and their right to use the roadway. It transfers a sense of responsibility to the cyclist by eliminating their anonymity. It is hoped that registration will instill in the cyclist the idea that there is a process involved in cycling that includes registering the bicycle, maintaining the bicycle, and understanding and following the rules of the road. Unfortunately, bicycle registration is a municipal requirement and very few municipalities have active programs, particularly larger municipalities who border other municipalities. As a result, even where registration programs exist, they are often not enforced because of the cross-jurisdictional travel of cyclists.

Many enforcement agencies have initiated bicycle registration programs that consist of marking the bicycle and its removable parts with a driver's licence number that can be traced back to an owner or family member. This enables lost or stolen bicycles and parts to be returned to their rightful owners. A key component of any marking system is to have a unique number assigned to the bike. Often serial numbers on bicycles are not unique but indicate a certain lot of frames. Although a nation-wide program would assist law enforcement agents in the return of stolen goods, to-date no such program has been successfully sustained. The Insurance Bureau of Canada has indicated that the value of bicycle thefts in certain years has exceeded the value of automobile thefts when recovery rates are taken into consideration.

A database on cyclists can provide useful demographics for planners and designers when new facilities are being planned. It must always be remembered that new facilities will not only attract existing cyclists but also new ones. A database can also provide a communications link for the promotion of education programs, a community cycling newsletter, and direct mail campaigns.

Bicycle registration, if properly administered, can also bring in revenue which can then be used to fund bicycle education programs or awareness campaigns.

Examples of bicycle registration forms are included in Appendix J.

34.1 Registration criteria

In order for a bicycle registration program to succeed, it must meet the following four criteria:

1) **It must be established nationally, provincially and/or regionally;**
2) **it must be mandatory and enforced;**
3) **it must use a unique registration number; and,**
4) **it should recover the cost of administration.**

In order to be enforceable, bicycle registration programs must be nationally, provincially, or regionally established. Local programs in metropolitan areas consisting of several separate cities are not very effective because of the cross-jurisdictional nature of cyclists' travel. Although local programs still aid in the recovery and return of stolen bicycles, they are ineffective for fund-raising or law enforcement.

In the past, most bicycle registration programs were voluntary. This system relied on owners coming to the town hall and registering their bicycles. This resulted in a low level of registration compliance and high administrative costs. Mandatory registration ensures enough revenue is generated to pay for the cost of the program, the objectives of having a program being met, and additional revenue for educational and/or encouragement programs.

Registration can provide a licence plate for the bicycle. This plate should be hard to remove without tools in order for it to be an effective method of returning bicycles to their rightful owners. The licence plate number should be registered against a unique number on the bicycle; whether it is a stamped serial number or an applied engraved number. This number should also be applied to

any removable parts of the bicycle, as often stolen bikes are dismantled and the parts sold separately and in different parts of the country.

Registration has been successfully used to control the bicycle couriers used by message services and other businesses. In some areas, bicycle couriers are required to take a test before being issued a licence plate. This licence plate is like a business licence and is used to identify the courier. If the courier is working exclusively for one company, the business can then be held responsible if its couriers flagrantly disobey the rules of the road. In severe cases, this could result in a business licence being withdrawn.

Registration is also used to identify cyclists in the event of a collision or some other mishap.

34.2 Bicycle identification

Licenses are generally metal plates that attach to the bicycle underneath the saddle or at the head tube. Metal plates are costly to produce and administer, but they are durable and can be used like a motor vehicle licence plate, where they remain with the bicycle even after it is sold.

Other methods of identifying the bicycle are engraving, stamping, or using identification stickers. Using a sticker, in the same manner that motor vehicles use identification stickers on licence plates, is the easiest method to administer. No special tools are required, unlike engraving or stamping, and decals can be easily covered over when the bicycle is sold. Decals should be placed in the same spot on all bikes so they are easily found. Decals should also not be easily removed.

Bicycles usually have several manufacturer numbers stamped on the frame. These numbers should not be used for registration purposes unless it can be determined that the number is unique.

35 LICENSING THE CYCLIST

Licencing the cyclist is a controversial issue. For motorized road users, a licence is issued after a competency test is administered and it gives motorists the right to drive a motor vehicle on the road. It follows that other road users should also require similar certification that they understand the rules of the road and are capable of handling their vehicles.

However, this is not the case for cyclists. The reasons cyclists are exempt from this licencing process is there is no age restriction for riding a bicycle and it would be difficult and controversial to test children. Also, the bicycle is not always recognized as a vehicle, but is sometimes wrongly considered to be a toy.

There are three reasons to license bicycle riders:

1) **all riders will have been tested for bicycle handling skills and rules of the road;**
2) **police forces will have an enforcement tool not currently available to them, and**
3) **all riders will be able to be identified.**

Of the most frequent complaints about cyclists are that they do not necessarily ride in a predictable and safe manner and that they tend to only follow the rules of the road when it is convenient for them to do so. If testing were in place, in order to receive a licence, cyclists would have to demonstrate they can properly and safely operate their vehicle and know the rules of the road.

Licencing cyclists will also allow police to deal with cyclists with the same system of fines, points deduction, and possible loss of licence, as motorists. Currently, in some provinces, a cyclist may receive demerit points against a motor vehicle licence, if they hold one, for infractions committed while riding a bicycle.

The controversial issues with licencing the operator of a bicycle are:

1) **At what age is testing and licencing undertaken?;**

2) Does the requirement of having a licence apply to residential streets as well as arterials?; and,
3) Can responsibility be applied to minors?

Licencing the operator of a bicycle has been successfully applied to bicycle couriers. In some cities, before a cyclist is allowed to operate as a bicycle courier, they must pass a written examination which tests their knowledge of the rules of the road and their behaviour as a cyclist on the road, and a road test which examines their skill and understanding of positioning on the road.

The provision of bicycle facilities is rarely equated with economic development opportunities, but current trends indicate that encouraging cycling does attract tourists, whether transient or destination oriented. Adventure travel, including cycletouring is becoming more and more popular. Because of the limitations on the daily distances that cyclists can or want to travel, and their daily food requirements, cyclists contribute greatly to the economies of local communities.

Destinations offering day-trips and other amenities, such as good restaurants, shops, interesting sights, and accommodations should be promoted more actively.

In order to encourage adventure travel and cyclotourism, a co-ordinated approach to providing information is essential. Maps, information on various types of accommodation, restaurants, bicycle shops etc. are all helpful. The destination point and its surrounding area will reap the benefits of the tourist dollar.

The growing popularity of the mountain bike opens up new areas for the development of tourist-oriented facilities. Municipalities are recognizing this potential and instead of banning mountain bikes from their parklands, are making provisions for them.

36 URBAN TOURISM

In an urban setting, the approach should be towards the recreational sightseeing cyclist and the cyclist who is transiting the municipality.

The recreational cyclist is the type of tourist who plans to visit the municipality and see the sights by bicycle. They prefer full or half day scenic trips and often combine cycling with walking. Information on bicycle rentals, bike shops, bike routes, scenic routes are the types of information that a cyclotourist is looking for. Other information such as where to eat, what entertainment is on, and shopping areas should also be available. In

addition, self guided tours (similar to walking tours), and bicycling maps are very useful.

For the transiting cyclist, maps showing the routes between the airport and downtown, and any route restrictions are most important. These cyclists will also be concerned with being able to transport their bicycle by bus to hotels, or accessing roadways where they can start or continue their journeys.

37 RURAL TOURISM

Rural communities can target two types of cycling tourists, the single and the multi-day tourist. Rural communities appeal to cyclotourists, who unlike tourists using a motor vehicle, need to stop frequently, usually to eat, and will take time to visit spots of local interest.

The single-day tourist is similar to the urban tourist and has similar wants and needs. Touring information should include scenic loop routes of distances of between 40 to 100 kilometres. Food stops, picnic areas, and swimming facilities should be included wherever applicable.

The multi-day tourist may be by him or herself, or are often in groups, touring from one community to a new destination every day. These cycling tourists require meals, and accommodations in addition to the requirements of the day tourist.

Off-road facilities are of great interest to mountain bicyclists. Cross country ski trails, snowmobile routes, fire roads, bush roads, abandoned railways, and particularly areas with single track trails can be successfully promoted for mountain biking. Although most mountain bicycling is done as a one or two day activity, long distance, cross-country mountain biking is becoming more popular. These multi-day cyclotourists will take advantage of facilities similar to those provided for back-country skiers.

38 REGIONAL PROMOTION

Although an individual community can promote the virtues of cycling in its area, it often makes more sense to promote cycling on a regional basis. This could be done at the regional, county, or provincial level. Collaborating with other jurisdictions to provide printed materials that can be distributed or sold through a wide network will help promote areas as cycling destinations.

Often, promotional information can be advertised in other publications. Simple examples are referencing bicycle maps on general road maps or advertising bicycle promotional material in a general-area tourist guide. It is also important that the local Chamber of Commerce, the Tourist Board and the Provincial Tourism Ministry is aware of what provisions have been made for cyclists and can respond to cycling specific inquiries.

ENCOURAGEMENT

Encouraging the use of the bicycle and bicycle facilities can take many forms and goes beyond simply providing the information or the facilities. Encouraging bicycle use involves changing behaviours and perceptions and requires an active promotion. In some cases, encouraging bicycle use will also involve discouraging the use of the private automobile.

The provision of maps showing designated bicycle routes, pathways, and other facilities is an easy way of promoting and encouraging cycling. The provision of engineered facilities, signage, parking, and the accommodation of bicycles on public transit also serve to accomplish this objective.

The main areas of emphasis for encouragement are as follows:

1. **Promote awareness of bicycle facilities and programs**
2. **Provide incentives for bicycle commuting**
3. **Provide a safer cycling environment**
4. **Work towards creating a position of mutual understanding and positive attitudes between motorists and cyclists**

39 MAPS

Maps are one of the key tools for increasing awareness of bicycle facilities and thereby promoting their use. Bicycle maps provide specific information that is not usually found on ordinary road maps. They may include information on the following:

- **Designated bicycle routes**
- **Commonly used bicycle routes**
- **Trouble spots (such as areas of with high collision rates)**
- **Restricted areas and alternative routes**
- **Special Restrictions (such as bridge crossings)**
- **Off-road recreational pathways**

- **Scenic tour routes**
- **Location of bike stores**

40 PROGRAMS

The importance of cycling education programs cannot be stressed enough. Cycling education programs are of value to cyclist and motorist alike and can serve to improve the way in which cyclists, as users of the road, are viewed by all. The promotion of these programs can be carried out through the municipal parks and recreation departments, safety councils, as well as police departments and cycling clubs.

Recent studies have shown that the general public is willing to consider cycling as an alternative to driving a car, but they perceive it to be very dangerous, particularly as traffic volumes continue to increase. This perception has lead to an unprecedented increase in the numbers of children being driven to schools and to extra-curricular activities, when these trips could easily be undertaken by bicycle.

The single most effective tool that can be used to change these perceptions and subsequent behaviour patterns is through the provision of meaningful and effective cycling education programs.

Specific education programs have been discussed in Section 5.2 and Sections 27 - 31 and examples are found in the Appendix H.

41 TRANSPORTATION DEMAND MANAGEMENT

As discussed in Section 5.5, encouragement can also take the form of transportation demand management (TDM). TDM involves the control of the number of vehicles on the road to increase the effectiveness of the existing roadway network through the use of incentives and disincentives.

Transportation demand management is a relatively new concept and the scope of TDM strategies is changing as new ideas and technologies develop. Many municipalities

have invested in a coordinator to initiate new strategies and encourage major employers in the municipality to incorporate TDM strategies.

Transportation demand management strategies focus on:

- **Enabling programs;**
- **Alternative mode improvements and encouragement;**
- **Driving disincentives;**
- **Parking programs;**
- **Marginalizing user costs and reducing automobile ownership; and,**
- **Land use management.**

Specific transportation demand management strategies are discussed in Sections 9.5 and 14.

APPENDICES

APPENDIX A

NATIONAL AND PROVINCIAL CYCLING ASSOCIATIONS

Canadian Cycling Association
702 - 2197 Riverside Drive
Ottawa, Ontario, Canada K1H 7X3
Tel - (613) 248-1353; Fax - (613) 248-9311
E-mail - general@canadian-cycling.com
Website - http://www.canadian-cycling.com/

Atlantic Canada Cycling
P.O. Box 1555, Station Central
Halifax, Nova Scotia, Canada B3J 2Y3
Tel – (902) 423-BIKE; Fax – (902) 423-2452
E-mail - cycling@atlanticcanadacycling.com
Website - http://www.atl-canadacycling.com/

Bicycle Newfoundland & Labrador
P. O. Box 2127, Station C
St John's, Newfoundland, Canada A1C 5R6
Tel - (709) 576-2453
E-mail - bnl@bnl.nf.nospam.ca
Website - http://www.bnl.nf.ca/

Bicycle Nova Scotia
5516 Spring Garden Rd., 4th Floor
Halifax, Nova Scotia, Canada B3J 1G6
Tel - (902) 425-5454 Ext. 316; Fax - (902) 425-5606
E-mail - canoens@sportnovascotia.ca
Website - bicycle.ns.ca

Velo New Brunswick
P.O. Box 3145
Fredericton, New Brunswick, Canada E3A 5G9
Tel - (506) 474-0214
E-mail - andrew.mcnair@velo.nb.ca
Website - http://www.velo.nb.ca/

Cycling PEI
Tel: (902) 368-4208; Fax: (902) 368-4548
E-mail - kmcintosh@sportpei.pe.ca
Website - http://www.cpei.ca/

Fédération québecoise des sports cyclistes (F.Q.S.C.)
4545 Ave. Pierre-de-Coubertin
Montréal, Québec, Canada H1V 3R2
Tel - (514) 252-3071; Fax - (514) 252-3165
E-mail - info@fqsc.net
Website - http://www.fqsc.net/

Velo Quebec
La maison des cyclistes, 1251 est Rachel
Montreal, Quebec, Canada H2J 2J9
Tel - (514) 521-8356; Fax - (514) 521-5711
E-mail - velo_quebec@velo.qc.ca
Website - http://www.velo.qc.ca/

Ontario Cycling Association
408 - 1185 Eglington Ave E.
North York, Ontario, Canada M3C 3C6
Tel - (416) 426-7416; Fax - (416) 426-7349
E-mail - info@ontariocycling.org
Website - http://www.ontariocycling.org/

Manitoba Cycling Association
309-200 Main St.
Winnipeg, Manitoba, Canada R3C 4M2
Tel - (204) 925-5686; Fax - (204) 925-5703
E-mail - info@cycling.mb.ca
Website - http://www.cycling.mb.ca/

Saskatchewan Cycling Association
2205 Victoria Ave.
Regina, Saskatchewan, Canada S4P 0S4
Tel - (306) 780-9299 or 780-9289; Fax - (306) 525-4009
E-mail - cycling@accesscomm.ca
Website - http://www.saskcycling.ca/

Alberta Bicycle Association
11759 Groat Rd/Percy Page Centre
Edmonton, Alberta, Canada T5M 3K6
Tel - (780) 427-6352; Fax - (780) 427-6438; Toll-free - (877) 646-2453
E-mail - office@albertabicycle.ab.ca
Website - http://www.albertabicycle.ab.ca/

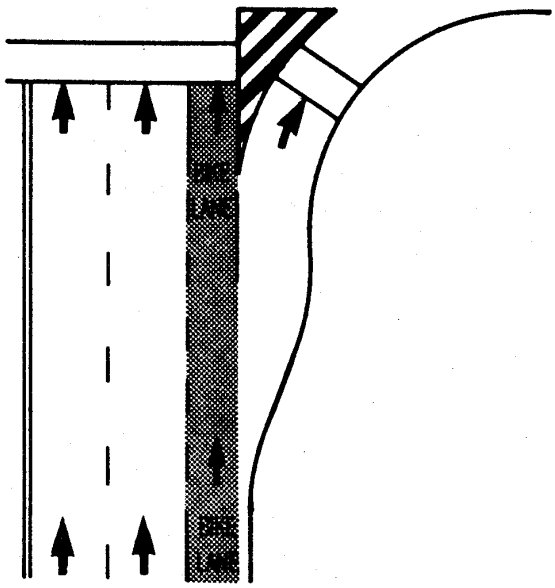
Cycling British Columbia
332 - 1367 West Broadway
Vancouver, BC, Canada V6H 4A9
Tel - (604) 737-3034; Fax - (604) 737-3134
E-mail - mailto:assist@cycling.bc.ca
Website - http://www.cycling.bc.ca/

Cycling Association of Yukon
4061 4th Avenue
Whitehorse, Yukon, Canada Y1A 1H1
Tel - (867) 668-2785 (Grant Owen, President)
E-mail - gjowen@yknet.yk.ca

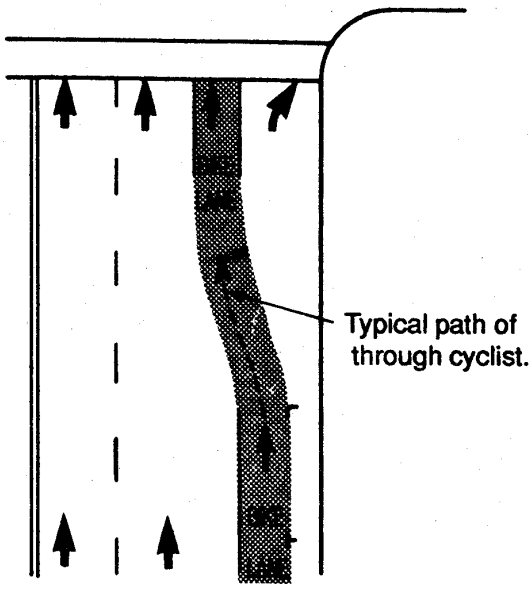
APPENDIX B

Included in this appendix are some sample Bicycle Facility Designs.

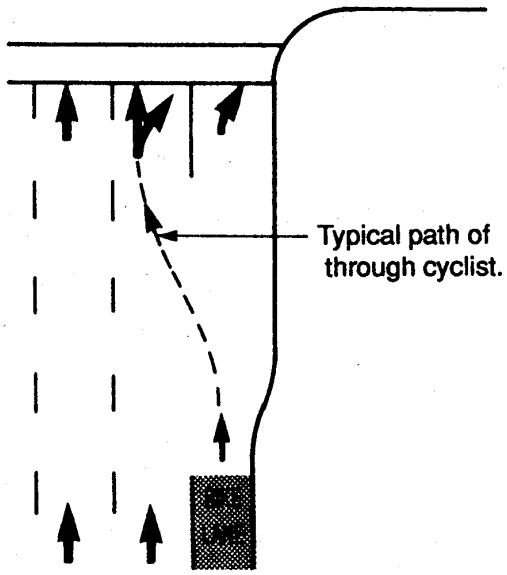
For a more complete engineering summary, please consult the Transportation Association of Canada's "Bikeway Traffic Control Guidelines for Canada", December 1998, Section 8.0 Typical Applications and the Transportation Association of Canada and the Institute of Transportation Engineers' (District 7) "Canadian Guide to Neighbourhood Traffic Calming", December 1998, Section 4.0 Design Guidelines for Traffic Calming Measures.



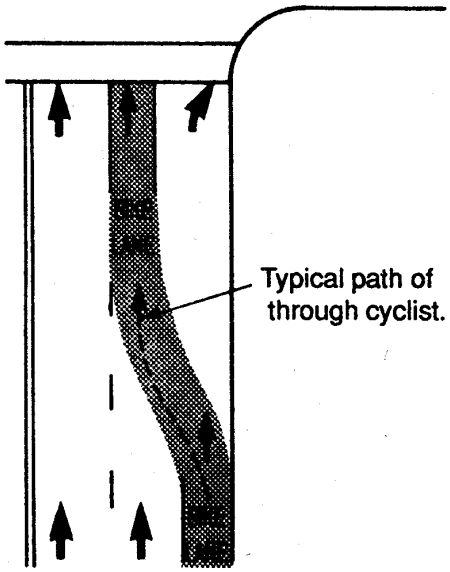
RIGHT-TURN-ONLY LANE



PARKING AREA BECOMES
RIGHT-TURN- ONLY LANE

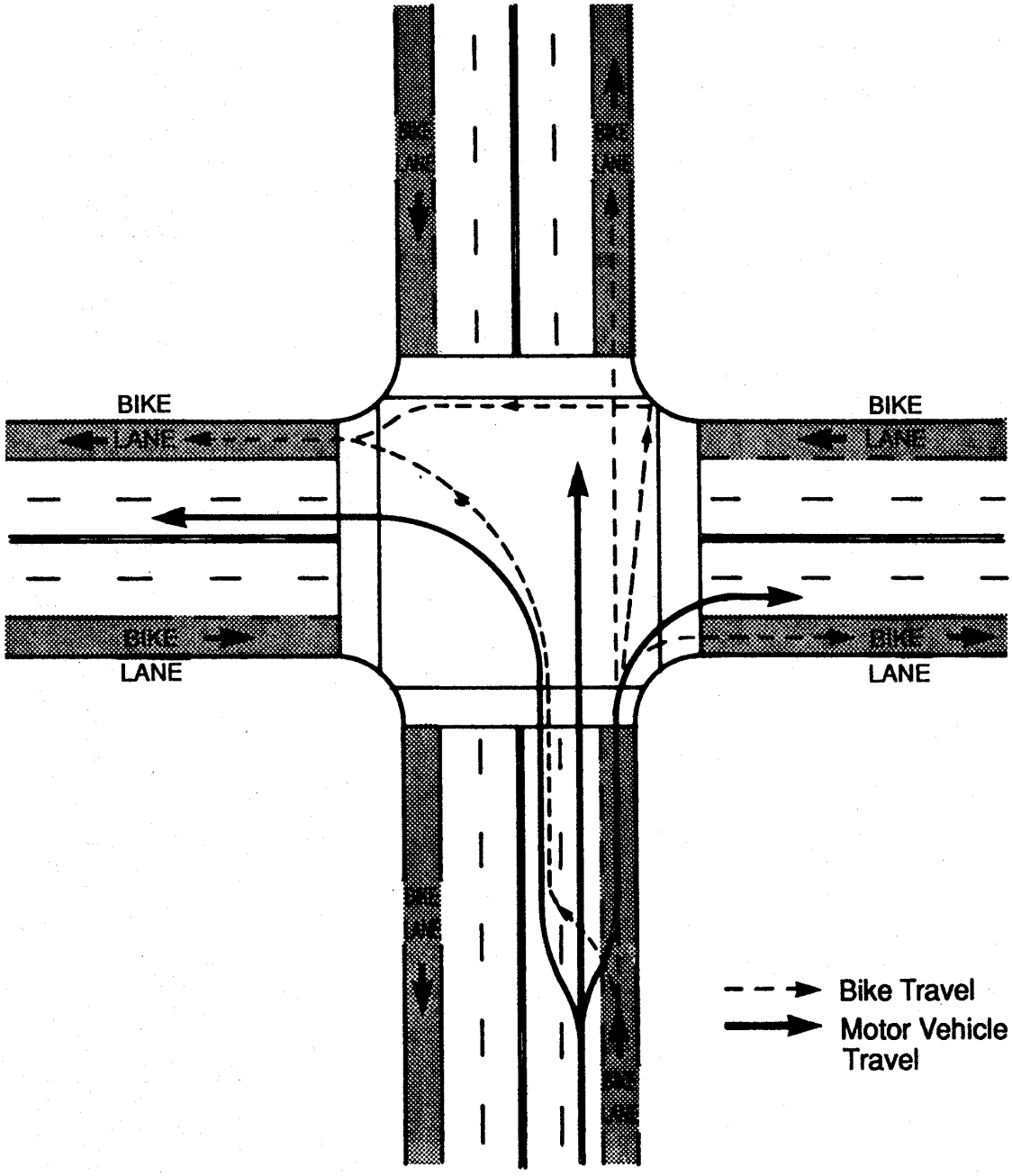


OPTIONAL DOUBLE
RIGHT-TURN-ONLY LANE

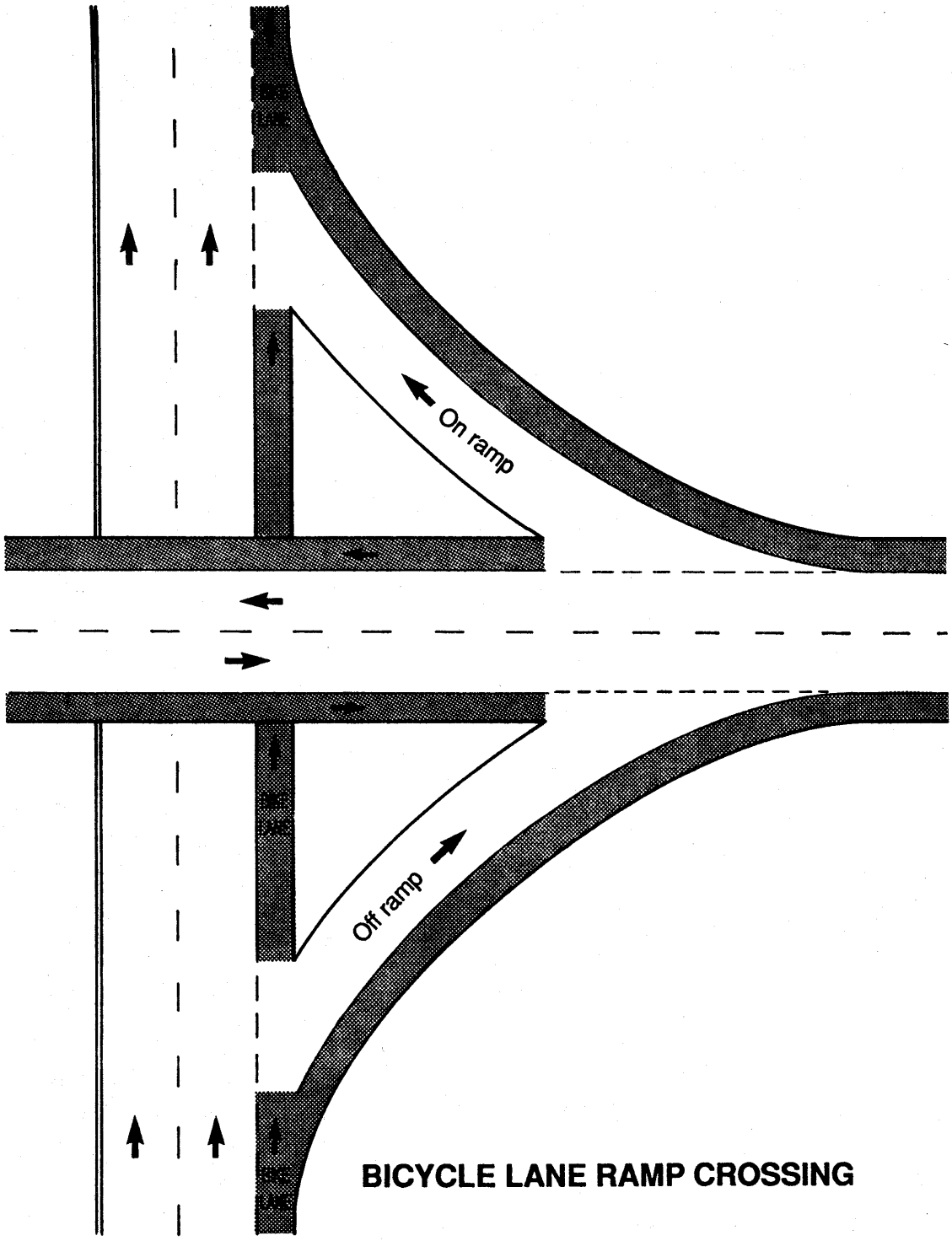


RIGHT LANE BECOMES
RIGHT-TURN-ONLY LANE

BICYCLE LANES APPROACHING MOTORIST
RIGHT-TURN- ONLY LANES



TYPICAL BICYCLE/AUTO MOVEMENTS AT INTERSECTION OF MULTILANE STREETS



BICYCLE LANE RAMP CROSSING

APPENDIX C

LIST OF FIGURES AND PICTURES

Additional Figures are found in Appendix B, D, G and K.

APPENDIX D

PLANNING SURVEY FORMS

Sample Questionnaire on how facilities might be improved for cycling or how cycling might be promoted:

1. **Are your neighbourhoods designed to promote cycling to get to school, work, recreation, transit, and retail outlets? Are these facilities used?**
2. **If these facilities are not used, what improvements might be made to make them more accessible?**
3. **Is the street lighting adequate?**
4. **Does your community master plan include facilities for cycling?**
5. **Are there cycling organizations in your community promoting the use of bicycles?**
6. **Are there bicycle racks at transit stations and outside municipal facilities?**
7. **Do school organizations promote cycling and safety programs for cycling?**
8. **Do schools and workplaces provide secure bicycle parking?**
9. **Are local governments in your community aware of the cycling needs of neighbourhoods?**
10. **What measures could be taken to calm traffic in your neighbourhood?**
11. **Can community groups be encouraged to organize bicycle safety workshops?**
12. **Can local government planners and transportation engineers be made aware of the need to promote active transportation as communities are planned or retrofitted?**
13. **Is local retail business aware of the benefits of encouraging cycling to their stores?**
14. **Are there partnerships to be formed in your community to promote active transportation? What groups should be involved?**
15. **Is there sufficient bicycle parking near shopping areas and other destinations?**

Taken from Building Walking and Cycling Communities: A Guide to Current Best Practices for the Development of Local Government Pedestrian and Cycling Plans, Anne Fritzel and Todd Litman, British Columbia Ministry of Municipal Affairs and Housing, Growth Strategies Office.

PLANNING SURVEY FORMS

POST CARD SURVEY(side one)

Dear Resident,

The municipality is developing a plan for bicycle facilities in this area. We would like to determine the number of people who use bicycles and the types of bicycling they do. Please take a few minutes to complete this questionairre and drop it in the mail today. Thank you for your cooperation.

1) How many people reside in your household? _____
2) how many of them ride bikes? _____
3) How many bicycles are in your household? _____
4) Please complete the following table, one line for each cyclist (# of times/distance (km) for each type of cycling per month).

	AGE	COMMUTING	RACING	TOURING	BMX	RECREATION	OTHER
1.							
2.							
3.							
4.							
5.							

(side two)

Municipality of Anytown
1234 Main Street
Anytown

Attn: Planning Department

SAMPLE BICYCLE SURVEY

The municipality would like to provide a safer, more enjoyable cycling environment. Please take a few moments to fill out the following questionairre. Comments are welcome.

1) **What type of bicycle do you have?**

10 or more speed _____ mountain bike _____ single/three speed _____ BMX ___

2) **Why do you ride your bicycle?**

Fitness _____ Recreation _____ Transportation _____ Other _____

Commuting (please enclose route map) _____

3) **What discourages you from riding your bicycle?**

Poor road conditions _____ No bike paths _____ Heavy automobile traffic _____

No parking _____ No connecting routes _____ Bad weather _____

4) **Which other modes of transportation do you combine with bicycling?**

Bus _____ Car _____ Subway _____ Ferry _____ Rail _____

Other _____

5) **Have you ever had any bicycle accidents? If yes, which?**

Fall _____ Car _____ Bike _____ Pedestrian _____ Dog _____

Other _____

6) **Have you had a bicycle stolen?**

Yes _____ No _____

7) **Do you ocassionally ride your bicycle illegally? If yes,which?**

Fail to stop/yield _____ Ride on sidewalks _____

Ride at night without lights _____ Ride against traffic _____

Why? _____

8) **Which of the following safety items do you use?**

Helmet _____ Reflectors _____ Lights _____ Reflective Clothing _____

Other _____

9) **How could the municipality be improved to make cycling more enjoyable and safer?**
(Please comment on the back of this form.)

Please return this survey to:

INVENTORY OF LOCAL BICYCLE FACILITIES

JURISDICTION _____

LOCATION	TYPE OF FACILITY	TYPE OF CONSTRUCTION	IN PLACE OR PLANNED	LEVEL OF USE (HEAVY, MODERATE, LIGHT)	TYPE OF USEAGE	COMMENTS

APPENDIX E

PARKING SPACE PROVISIONS

A bicycle parking stall is defined as a space measuring 1.8m in length by 0.6m in width. Vertical parking is allowable up to 40% of the total required number of stalls and should be 1.1m in length by 0.6m in width.

Aisles between parked bicycles should be 1.2m wide.

Vertical clearance should be a minimum of 1.9m.

Each bicycle stall must be accompanied by a secure bicycle parking device which enables the use to lock the frame and at least one wheel with a "U" style locking device without having to remove a bicycle wheel.

Number of Bicycle Spaces Required for

Use	Class I Residents/Employees	Class II Patrons/Visitors
Multiple Unit Dwelling	1.5/unit	6/building
Office	1/750 sq m GFA	6/building
Hotel	1/20 rooms	6/building
Retail Restaurant	1/500 sq m GFA or 1/10 employees	6/building
Industrial	1/10 employees	6/building
Institutional	As this depends greatly on the location, the number should be determined by the Planning Department at the time of the permit application.	

APPENDIX F

BICYCLE LOCKER MANUFACTURERS

There are many local providers of bicycle racks that have not been listed here. A key point to remember when choosing what style of rack to use is that the rack must be supported above the axle and allow for securing both wheels and the frame.

This list of bicycle locker manufacturers lists only those manufacturers who advertise on the web or who have submitted their name to be listed. There may be local manufacturers who should be consulted. A key point to remember when choosing what style of locker to use is that the locker must have a secure locking system and have provision for locking the bicycle inside the locker.

American Bicycle Security Company
PO Box, 7359, Ventura CA USA 93006
Tel - 1-800-245-3723 or (805) 933-3688;
Fax: (805) 933-1865
E-mail - turtle@ameribike.com
Website - http://www.ameribike.com/

Bike Guard
8149 South 600 East, Rexberg, ID 83440
Tel - (208) 356-0744; Fax - (208) 356-7333

BikeLid Systems, LLC
324 Evans Street
Caldwell, Idaho USA 83605
Tel - (208) 454-3874; Fax - (208) 454-3875
Website - http://www.bikelid.com/

Cycle-Safe Inc.
4630 Ada Drive SE
Grand Rapids, MI USA 49546
Tel - 1-888-950-6531 or (616) 954-9977;
Fax - (616) 950-6531
Email - info@cyclesafe.com
Website - http://www.cyclesafe.com/

Creative Pipe Inc.
P.O. Box 2458
Rancho Mirage, California USA 92270-1087
Tel - 1-800-644-8467 or (760) 340-5555;
Fax - (760) 340-5883
Email - sales@creativepipe.com
Website - http://www.creativepipe.com/

Guardian Bicycle Locker Systems
Sudden Fun, Recreation Equipment Ltd.
Box 48298 Midlake RPO
Calgary, AB Canada T2X 3C7
Tel - 1-800-490-0501 or (403) 254-0500;
Fax – (403) 254-0524
Email - info@suddenfun.com
Website - http://www.suddenfun.com/
OR
SPI Industries Inc.
Shallow Lake, Ontario Canada N0H 2K0
Tel - 1-800-269-6533 or (519) 935-2211;
Fax – (519) 935-2174
Email - spi@spiplastics.com
Website - www.spiplastics.com

Madrax Inc
2700 Laura Lane
Middleton, WI USA 53562
Tel - (608) 831-9040; Fax - (608) 831-7623
Email - sales@madrax.com
Website - http://www.madrax.com/

Park Oxile, Kryptonite Corp.
437 Turnpike St
Canton, MA USA 02021
Tel - 1-800-SAY-LOCK or (781) 828-6655
Website - http://www.kryptonitelock.com/

Sunshine U-Lok Corp.
102 - 31316 Via Colinas
Westlake Village, CA USA 91362
Tel - (818) 707-0110; Fax - (818) 707-0111

APPENDIX G

MAINTENANCE SURVEY FORM

CITIZEN BICYCLING IMPROVEMENT REQUEST

The Bike Spot program makes low cost improvements to enhance bicycle safety and access. We do maintenance work, signs and striping, and small construction jobs. Almost anything is possible!

LOCATION: Roadway Name ____________

Landmarks (cross street, # of feet from curb, address). Be specific! ____________

____

____

DESCRIPTION OF PROBLEM (What is it, and why is it a problem) ____________

____

____

Where did you get this form? ____________

REPORTED BY: Name ____________ Day Phone ____________

Address ____________ Zip ______ Date ______

APPENDIX H

CYCLING EDUCATION PROGRAMS

The following is a list of nationally certified programs available through the Canadian Cycling Association. There are other provincial and local programs available. To judge the effectiveness of a local program, consider whether these four topics are covered:

- **Rules of the road;**
- **Bicycle handling skills;**
- **Safety and protection; and,**
- **Bicycle maintenance.**

All cycling education programs should be taught be certified instructors, and should include an on-road section to be truly effective.

Technical training available through Vélo Québec:

Bikeway planning and development
Vélo Québec's Bikeway planning and development is a one-day course including a theoretical component and a field trip. This training will allow the participant to better understand the major steps involved in bikeway planning and development projects, and to learn the basics about facility design and operation. For more information, visit http://www.velo.qc.ca/.

All courses listed below are part of the Can-Bike program:

Children
Kids Can-Bike Festival
The Kids Can-Bike Festival is a playground-based event that introduces to children key bike handling skills they will need to ride safely on the road. It does not focus on traffic situations. The Festival is designed for children between ages 8 and 13.

Smart Cycling
Smart Cycling is an educational kit designed to introduce the fundamentals of cycling safety elementary school students. The materials encourage students to treat their bicycle as a vehicle, illustrate to them how to care for

their bikes and teach basic traffic concepts and cycling skills. The kit consists of three components: An instructor's manual, a 15-minute videotape, and an optional student activity fun book.

While Smart Cycling is an introductory course designed for classroom use, teachers and students are encouraged to follow it up with on-bike lessons. On-road lessons can provide the ultimate learning experience for young cyclists.

Cycle Right

Cycle Right is a basic cycling course for young beginners at the Grade 5 to 8 level. This course teaches basic bicycle handling skills, basic traffic skills, and basic safety maintenance requirements for safe and proper use of bicycle son two-lane, two-way roads. It teaches use of the bicycle both for riding alone and for riding in groups.

The basic goals of the course are to prepare children to ride independently or in groups from home to school, to recreational facilities, and to prepare children to participate in school or recreational organized cycling activities.

Adult

Skills 1

Course content is basic and designed for beginners and occasional cyclists. While touching on many aspects of cycling from maintenance to touring to Effective Cycling techniques, it does not cover any of these topics in depth. Upon completion of the course, participants should feel confident enough to ride regularly and safely for utilitarian and recreational purposes. They will also have information on organized cycling activities in their area and be encouraged to continue with their cycling education and enjoyment.

Skills 11

The objective of Skills II is to teach those cycling skills that enable cyclist to use their bikes more safely, efficiently, and with greater enjoyment. Upon completion of the course, the student should be able to ride with

competence and confidence in varied conditions of traffic, weather, and terrain.

The following subject areas are covered in Skills II:

- **riding skills;**
- **traffic cycling proficiency;**
- **bicycle maintenance;**
- **health and fitness;**
- **equipment; and,**
- **consumerism.**

Contact your local bicycle club, provincial association or the Canadian Cycling Association for more information on cycling courses.

APPENDIX I

BICYCLE PLANNING TEMPLATE

Planning for non-motorized travel is an essential part of any Official Community Plan (OCP) and local Transportation Plan. The OCP is the basic element of community planning. A local Transportation Plan is a document linked to the OCP that outlines how transportation services are to be provided. The Bicycle Plan can be a component of the Transportation Plan, or a separate document.

Walking and bicycling provide "basic mobility". They are critical components of any transportation system because they serve everyone, particularly those who do not own or drive automobiles. The provision of adequate cycling facilities is essential to guarantee a minimal level of mobility.

Objectives that are addressed by a bicycle plan include:

- **Increasing comfort and safety for cyclists**
- **Improving travel options for non-drivers**
- **Reducing conflict between motorists and other road users**
- **Reducing automobile traffic**
- **Increasing recreational activity**
- **Encouraging non-motorized tourism activities**
- **Creating more equitable transportation**
- **Creating more livable communities**
- **Creating a healthier population**

A bicycle plan is not just a map with lines showing paths and trails. It must be designed to address the following issues:

- **Bicycle facility planning**
- **Traffic management and traffic calming**
- **Bicycle safety and education programs**
- **Improving enforcement of traffic laws related to cycling**
- **Encouraging bicycling for transportation and recreation**
- **Co-ordination of cycling improvement with other community plans**

A bicycle plan must consist of the following components:

- **Goals and Objectives - a definition of the outcomes which are to be achieved by the plan**
- **Bicycle Network Plan - a definition of the infrastructure (bikeway and pathway system) that provide access to destinations, and connections to regional and provincial bicycle routes**
- **Design Guidelines - reference to published standards recommended by a professional or government organization specific dimensions, clearances, safety features, materials, surface treatments, signage and pavement markings, etc. for facilities**
- **Maintenance Procedures and Policies - including standards, responsibilities, and priorities**
- **End-of-Trip Facilities**
- **Capital Expenditures Plan - project costs and implementation schedule**
- **Support Programs - safety education, law enforcement, and promotion**
- **Evaluation - on-going monitoring of facility use, conditions, and problems.**

The bicycle plan should be co-ordinated with other municipal and regional planning activities. When developing a planning process, other appropriate agencies should be consulted. Because of the distances cyclists can cover, consultation should be quite widespread to create and effective regional bicycle network.

Bicycling should be included in the following planning processes:

- **Strategic, Comprehensive, or "Sustainability Planning"**
- **Regional and Local Transportation**
- **Neighbourhood Plans**
- **Municipal and Zoning By-Laws**
- **Street and New Subdivision Design Standards**
- **Land Preservation**
- **Traffic Enforcement**
- **Economic Development**
- **Parks**
- **Schools**

Sample Bicycle Plan

Vision

To create transportation choices that emphasize the use of bicycles and integrates the bicycle into the physical and social fabric of the community.

Goals

- **To ensure that our transportation system safely accommodates the bicycle.**
- **To double the number of bicycle commuters by the year 2015.**
- **To make cycling safer.**
- **To provide more opportunities for cycling to residents and tourists.**

Objectives

- **To make all neighbourhoods bicycle friendly by eliminating barriers to cycling**
- **To provide the necessary facilities to support safe and pleasant cycling**
- **To promote appropriate land use and zoning regulations that encourage bicycling**
- **To increase awareness and safety of bicycling through education, enforcement, and encouragement programs**

Evaluation

- **Consult users and potential users annually to identify perceived barriers to cycling**
- **Provide an annual report for tracking the progress made to solve the problems of barriers to cycling**
- **Provide an annual summary of bicycling crashes and injuries resulting from those crashes**
- **Monitor the use of bicycling to identify if goals and objectives are being met.**

Taken from Building Walking and Cycling Communities: A Guide to Current Best Practices for the Development of Local Government Pedestrian and Cycling Plans, Anne Fritzel and Todd Litman, British Columbia Ministry of Municipal Affairs and Housing, Growth Strategies Office.

APPENDIX K

BICYCLE REGISTRATION

BICYCLE REGISTRATION

SAMPLE BICYCLE REGISTRATION

Type of bicycle _____
(multispeed, BMX, mountain bike, tricycle, etc)

Manufacturer and model _____

Serial Number _____

Date of Purchase _____

Description of Bicycle _____
_____
_____
_____

Name of Owner _____
Address _____
_____
_____

REGISTRATION # _____

BIBLIOGRAPHY

Allen, John. "Complete Guide of Bicycle Commuting". Rodale Press: 1981.
This book covers all aspects of cycling in an urban environment. Topics include riding in traffic, parking and multi-modal transportation.

American Association of State Highway and Transportation Officials (AASHTO). "AASHTO Guide for Development of Bicycle Facilities". AASHTO: 1991. Available from AASHTO, 249-444 Capitol St. NW, Washington, DC 20001 Tel: (202) 624-5800; Fax: (202) 624-5806; Website: http://www.aashto.org/
This guide has been approved by the American Association of State Highway & Transportation Officials, and can be considered the bikeway facilities bible. It includes planning criteria, inventory analysis, as well as selection and design criteria for new facilities.

American Association of State Highway and Transportation Officials (AASHTO). "AASHTO Maintenance Manual". AASHTO: 1987. Available from AASHTO, 249-444 Capitol St. NW, Washington, DC 20001; Tel: (202) 624-5800; Fax: (202) 624-5806; Website: http://www.aashto.org/
Includes a better discussion of trail maintenance than does the Guide for the Development of Bicycle Facilities.

American Planning Association (APA). "Reinventing the Village: Planning, Zoning and Design Strategies". APA: Available from American Planning Association, 1600-122 S. Michigan Ave., Chicago, IL 60603; Tel: (312) 431-9100; Fax: (312) 431-9985/1-800-800-1589; E-mail - library@planning.org; Website - http://www.planning.org/
Describes advantages of a village: a pedestrian/cycling environment with mixed use zoning in a small compact area. Practical information on zoning ordinances, design review, and incentives for developing a village commercial district.

American Society of Civil Engineers. "Bicycle Transportation: A Civil Engineer's Notebook for Bicycle Facilities". ASCE: 1980. Available from ASCE, 345 East 47th Street, New York, New York USA 10017.
This is a detailed look at bikeway planning, landscaping, bicycle bridges, bikeway surfaces, drainage, traffic controls, lighting, parking, maintenance and security. The engineer is provided with a planning, design, maintenance and operation notebook for the bicycle facilities.

Appleyard, Donald. "Livable Streets". University of California Press: 1981
A classic look at what makes streets places to live rather than simply conduits for motor vehicles.

Arendt, Randall. "Rural by Design: Maintaining Small Town Character". American Planning Association (APA): 1994. Available from American Planning Association, 1600-122 S. Michigan Ave., Chicago, IL 60603; Tel: (312) 431-9100; Fax: (312) 431-9985/1-800-800-1589; E-mail - library@planning.org; Website - http://www.planning.org/
Covers character of towns, alternative scenarios for conservation and development, implementation techniques and case examples.

Aultman-Hall, L. and Adams, M.F. "Sidewalk Bicycling Safety Issues" Transportation Research Board (TRB) Annual Meeting. National Academic Press: 1998. Available from TRB, Box 289, Washington, DC 20055; Tel: (202) 334-2989; Fax: (202) 334-2527; E-mail - dmartin@nas.org; Website - www.nas.edu/trb/index.html
Cyclists accidents by facility (roads, sidewalks, and paths/trails) are analyzed and accident rates by exposure (per kilometre) on each facility type are compared using Ottawa and Toronto statistics.

Ballard, Andrew. "Efforts to Control Speeds on Residential Collector Streets". Compendium of Technical Papers, Institute of Transportation Engineers (ITE): 1990. Available from ITE, 410-525 School St. SW, Washington, DC

20024; Tel: (202) 554-8050; Fax: (202) 863-5486; Website - http://www.ite.org/
An examination of some of the more effective traffic calming strategies.

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Box, Paul. "Warrants for Traffic Control Devices at Low-Volume Urban Intersections". ITE Journal: 1995. Available from ITE, 410-525 School St. SW, Washington, DC 20024; Tel: (202) 554-8050; Fax: (202) 863-5486; Website - http://www.ite.org/

British Medical Association. "Cycling Towards Health & Safety". Oxford University Press: 1992.
An analysis of the health and fitness benefits of cycling compared to the risks and deterrents including collisions, and air pollution.

CART. "Traffic Calming". CART (Australia): 1989. Available from STOP, 202B-15405 SW 16th Ave., Tigard, OR 97224.

Centre for Research and Contract Standardization in Civil and Traffic Engineering - the Netherlands (CROW). "Still More Bikes Behind the Dikes!", Record #6. CROW: 1991. Available from CROW, P.O. Box 37, NL-6710 BA EDE, The Netherlands; Tel: 31.8380-20410; Fax: 31.8380-21112.
A review of Dutch policy, practice and research supporting bicycle usage.

Centre for Research and Contract Standardization in Civil and Traffic Engineering - the Netherlands (CROW). "Cycling in the City: Pedaling in the Plodder", Record #9. CROW: 1991. Available from CROW, P.O. Box 37, NL-6710

BA EDE, The Netherlands; Tel: 31.8380-20410; Fax: 31.8380-21112.
Elaborates and updated versions of 19 Dutch papers on a wide range of topics.

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Comprehensive guide to planning and implementation of bicycle facilities designed for urban planners, engineers, landscape architects, private developers, and recreational service employees.

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GLOSSARY OF TERMS

Access: Refers to modes of transportation that are permitted to enter or exit an area or pass a specific location (such as a barrier incorporating gaps to permit bicycle access), or specific movements which are permitted at an intersection (such as with an obstruction which permits right turn access only). Is also used when describing the location of driveways and walkways that provide access to property.

Angled parking: Parking at an angle of between 0-90° to the roadway. Generally viewed as detrimental or unsafe on bicycle routes unless "back-in" only is designated.

Arterial: Refers to a major street for which the primary function is to provide vehicular movement. Direct access to an arterial street from adjacent properties is typically discouraged. Intersections are spaced relatively far apart, and are frequently signalized.

Bank: Sloping distance from a structure.

Bicycle: A vehicle with two wheels (as opposed to tricycle which has three wheels). For the purposes of this manual, bicycle shall be understood to mean any bicycle, tricycle or other vehicle which is human-powered without the assistance of a motor.

Bicycle connector: A facility of short length between two routes which is accessible to bicycle traffic, but not motorized traffic.

Bicycle crossing: A place, usually mid-block, where bicycles can cross the roadway, indicated by cross-sectional markings which are carried out a block-marking

Bicycle facilities: Any facility designed to assist cyclists. It includes any physical construction - such as parking racks, road construction with bike lanes or signage.

Bicycle indicators (sensors or loop detectors): A magnetic device usually buried in the road to detect the presence of bicycles at intersections and cause any traffic

control mechanism (i.e. traffic control lights) to change to permit the advancement of the cyclist.

Bicycle lane: A dedicated portion of the road for bicycle use, which is designated by a lane marking separating the portion of road used by motor vehicles from the portion of the road used by bicycles.

Bicycle locker: A lockable space for the storing of a bicycle.

Bicycle network: Any system of routes for cyclists which provides safe, continuous and convenient travel. It may form part of the existing road system or be a combination of specific pathways and parts of the existing roadways that meet the needs of cyclists.

Bicycle parking facilities: A generic term referring to any facility provided for parking bicycles. It can include any of the following: racks, compounds, stands or lockers.

Bicycle path: The term implies any off-road, dedicated, facility for bicycles. In practice, these have often become multi-use recreational pathways.

Bicycle parking racks: A specific type of parking facility designed to hold one or more bicycles. Also known a bike racks, bicycle stands.

Bicycle permeable: Refers to a barrier incorporating gaps to permit bicycle access.

Bicycle rodeo: These events feature games and competitions to demonstrate or test bicycle handling skills. Often used as a bicycle education exercise.

Bicycle route: Any specially signed road which encourages bicycle use. Such routes have often been enhanced with traffic calming devices to encourage bicycle use and discourage continuous motor vehicle use.

Bicyclist: Anyone who operates a bicycle regardless of whether it is on the road or off-road.

Bikeway: Any road, street or path which is specifically designated as being open to bicycle travel, regardless of whether or not such facilities are designated for the exclusive use of bicycles, or are to be shared with other transportation modes.

Bus lane: Road or lane intended for the exclusive use of buses. Often open to use by other multi-passenger vehicles and bicycles. See also HOV lane.

Carpooling: Where two or more people use the same private automobile to travel to the same destination.

Centre line: A longitudinal road marking which separates traffic lanes for traffic in opposite directions.

Channelization: The separation and direction of vehicle and pedestrian movements at an intersection into defined paths, through the use of roadway features and signs.

Chicane: A series of curb extensions on alternating sides of a roadway, which narrow the roadway and require vehicles to steer from one side of the roadway to the other to travel through the chicane. Typically, a series of at least three curb extensions is used.

Collector: A street for which vehicle movement and access are of equal importance. Direct access to adjacent properties may be permitted in some cases, typically in lower-density residential areas. Intersections are spaced at varying intervals, and are typically only signalized where the collector street intersects an arterial street or in some cases another collector street.

Community: A group of individuals with common interests. A community is often defined by neighbourhood boundaries, but may also include individuals who live outside the neighbourhood, but who work or operate businesses in the neighbourhood, or whose children attend school in the neighbourhood.

Commuter bicyclist: A person who repetitively cycles over the same or a similar route. Any person who uses a bicycle primarily for travel to and from work or school.

Continuity: In the context of this manual, cycling infrastructure that forms a coherent and connected whole and links to all points of departure and destination of cyclists.

Controlled crossing: Part of the roadway indicated by cross-sectional markings where pedestrians and/or cyclists can cross the roadway with the aid of a traffic regulation installation.

Corrugated paving stone: Paving stone with a corrugated surface. Often coloured to differentiate it from the asphalt or concrete roadway surface.

Cost benefit analysis/assessment: Typically, this term refers to the comparison of the total cost and the total benefits. This comparison often takes into account risk assessment and social/environmental responsibilities.

Cost-effective: To be cost-effective, a proposal must demonstrate that its implementation meets design, social and environmental objectives at an acceptable cost.

Cost-efficient: A proposal must demonstrate that it meets specified economic objectives.

Criteria: Qualitative or quantitative measures of performance; may require technical expertise when applied to specific standards or cost-benefit assessments.

Curb extension: The intrusion of the curb into the roadway resulting in a narrower section of roadway.

Curb cut (see depressed curb).

Curb radius: The circular curved curb which connects the tanget curb sections of two intersecting streets.

Curb radius reduction: The reconstruction of an intersection corner using a smaller radius.

Curve: A horizontal or vertical deviation in a roadway. A horizontal curve appears as a bend in the roadway, requiring motorists to turn the steering wheel. A vertical

curve appears either as a "crest" or a "sag" to provide for a change in gradient.

Cycle (see also 'Bicycle'): When referring to a traffic signal, cycle describes on complete sequence of signal indications.

Cycle ramp: Ramp at the side of a staircase which provides cyclists with a way of moving bicycles up and down staircases without having to carry them.

Cycling infrastructure: All facilities, particular constructed for bicycle traffic, which are made use of by bicycle traffic.

Cyclist (see 'Bicyclist')

Cyclotourist: Any person using a bicycle for long distance travel, usually on multi-day trips and carrying baggage.

Deflection: A vertical and/or horizontal change in the course or path of a vehicle as the result of a physical feature of a roadway. For example, a speed hump deflects the wheels, suspension, and chassis of a vehicle in a vertical direction. A traffic circle requires that the vehicle be steered or deflected horizontally from its straight path to manoeuvre past the circle.

Depressed Curb: A section of concrete curb in which the height of the vertical face has been reduced to allow passage while maintaining positive guidance and drainage control. Also referred to as a drop curb or a curb cut.

Device: A physical feature of the roadway, constructed for the purpose of affecting the movement of traffic.

Directional closure: A physical device extended across the width of a roadway which obstructs (prohibits) one direction of traffic.

Directness: In the context of this manual, cycling infrastructure which provides as direct a route as possible (to eliminate or reduce detours).

Divert: To redirect traffic, typically through the use of physical obstructions in the roadway and/or regulatory signs.

Diverter: A raised barrier placed diagonally across an intersection, which requires traffic to turn rather than proceed straight through. A diverter effectively creates two separate roadways with no connection between them for motor vehicles, often with exceptions for emergency vehicles and bicycles.

Drop curb (see depressed curb).

Egress: A way of exiting or travelling away from a location. Is used when describing which vehicle movements may be permitted at an intersection (such as with an egress-only barrier). Is also used when describing the location of driveways and walkways that provide egress from a property.

Freeway: A restricted access highway which handles high volume, high speed motorized vehicle traffic. Bicycles are usually excluded from these roadways.

Full Closure: A physical device extending across the width of a roadway, which obstructs all motor vehicle traffic movements.

GDGCR: Geometric Design Guide for Canadian Roads, which provides design standards applicable to all road design in Canada. Its general purpose is to assist in generating optimum designs for the prevailing conditions and to promote uniformity of design across Canada.

Geometry: When referring to roadway design, geometry refers to the physical characteristics and dimensions of parts of the roadway.

Goal: A generalized statement of a desired end or product.

Guideline: A recommended practice, method or value for a specific design feature, but not a requirement.

Highway: A public roadway which is normally accessible to bicycles and other vehicles (mopeds, motorcycles, etc.).

Inter-modal link: A transportation mode which is part of one or more other modes.

Intersection channelization: Raised island located in an intersection to separate and direct vehicle and pedestrian movements. As a traffic calming measure, these are used to obstruct specific movements.

Jurisdiction: A legal or other authority with responsibility and control for specific actions within a defined area.

Landscaping: An area of non-agricultural varied vegetation (trees, bushes, ground-cover, etc.)

Linking elements: These are the connecting parts of a bicycle network.

Local street: A street for which the primary focus is access to adjacent properties. Vehicle movement is accommodated only to the extent to which it is necessary to provide access. Intersections are spaced relatively close together, and are typically unsignalized.

Local traffic: Traffic which originates from or is destined to a location within a neighbourhood.

Measure: A physical device, regulation or action which affects the movement of motor vehicles, bicycles and/or pedestrians.

Median barrier: A raised island located near the centre line of a roadway through an intersection that prevents left turns or straight through movements from being made to and from a side street. Often bicycle permeable and providing a refuge for pedestrians mid-roadway.

Median parking: Angled or parallel parking provided for motor vehicles in the median of the roadway.

Mode: A way or manner of travelling. Examples of common modes of transportation include drive-alone

automobile travel (SOV - single occupancy vehicle), carpooling, transit, cycling, and walking.

Motor vehicle: A vehicle powered by a motor, not to be used interchangeably with the term `vehicle' which also refers to bicycles.

Motorist: The operator of a motorized vehicle, generally a private automobile.

Motorcyclist: The operator of a motorcycle or moped.

Multi-modal trip: Any trip which makes use of more than one modes of transport.

Multi-user recreational pathway: Any off-road dedicated pathway or recreational system which is used by more than one type of user (cyclists, walkers, joggers, etc).

MUTCDC: The Manual of Uniform Traffic Control Devices for Canada, which provides a consistent basis for the design, usage, signals, and pavement markings and placement of signs along roadways.

MVA: Motor vehicle act, separate for each province.

Neighbourhood: A cohesive urban area defined by geographic features, the street network or socio-economic characteristics. With respect to traffic calming, neighbourhood boundaries are often defined by the arterial street network, which typically presents a significant barrier to travel and interaction. Neighbourhoods are often also defined by physical terrain.

Neighbourhood Transportation Management: A phrase often used to describe an approach which encompasses traffic calming measures as well as design, operations, legal and other techniques to address transportation issues within a neighbourhood, such as speeding and excessive volumes or conflicts.

On-street parking: Motor vehicles parked on the roadway surface, or on the unpaved shoulder of a roadway.

Parallel parking: Motor vehicle parking which is parallel to the centre line of the road.

Parking lane: Paved lane, usually at the right-hand side of the roadway, intended for parking of motor vehicles.

Parking restriction: A limitation which prevents vehicles from being parked in specific locations, at specific times, or for specific types of vehicles. Most often used to control on-street parking. Examples include restrictions preventing parking during the morning or afternoon peak periods, preventing parking within proximity of a marked crosswalk, or preventing non-residents from parking on a residential street.

Paved shoulder (extended pavement edge): That portion of the road not normally used for motorized vehicular traffic, but paved for the use of bicycles as a separate bicycle lane, bicycle route, or shared use lane. Dependent on pavement markings, a separate bicycle lane, bicycle route, or shared use lane may be provided on a paved shoulder. This is also dependent on the volume of traffic and the vehicle mix. In rural areas in some provinces shoulders have been paved to permit bicycle use.

Peak period: That time of the day when traffic volume is at its highest. It typically occurs during 'rush hour' in the morning and evening.

Plan: A formulated and sufficiently detailed description of how an objective or a number of objectives are to be accomplished. A traffic calming plan typically describes measures to be used, where they are to be located, in what order and at what times they will be implemented and how the costs of the measures will be funded.

Phase: When referring to traffic signals, phase describes the part of a cycle allocated to any combination of vehicle movements that receive the right of way simultaneously. For example, a phase might permit opposing through movements combined with right-turns.

Raised crosswalk: A marked pedestrian crosswalk at an intersection or mid-block location constructed to a higher elevation than the adjacent roadway.

Raised intersection: An intersection - including crosswalks - constructed at a higher elevation than the adjacent roadways.

Raised median island: A concrete island constructed near the centre line of a roadway to reduce the overall width of the adjacent travel lanes. Often bicycle permeable and providing a refuge mid-roadway for pedestrians.

Raised median through intersection: An elevated median located on the centre line of a two-way roadway through an intersection, which prevents left turns and through movements to and from the intersecting street. Often bicycle permeable.

Rat-running (see short-cutting).

Recessed sewer grates: Sewer grates which are recessed into the curb and not in the path of vehicles.

Recreational bicyclist: Any person who uses a bicycle primarily for pleasure, typically taking short trips at lower speeds.

Regulation: A prescribed rule, supported by legislation. Examples of traffic regulations include posted speed limits, "no left turn" prohibitions and "bicycle only" exemptions. Regulations are typically not reinforced by physical barriers.

Retrofit: The reconstruction of a roadway or other transportation facility with physical improvements to the existing design. An example is reconstruction of the curbs at an intersection to incorporate curb extensions.

Right-in/Right-out island (barrier): A raised triangular island at an intersection approach which obstructs left turns and through movements to an from the intersecting street or driveway. Often bicycles are exempt.

Road foundation: The bottom layer of a pavement construction which consists of more layers.

Rolled curb: A concrete curb in which the face is sloped or curved away from the vertical.

Roundabout: A raised circular island located in the centre of an intersection, which requires vehicles to travel through the intersection in a counter-clockwise direction around the island. Roundabouts are typically used on arterial and collector streets, and are distinguished by yield signs and raised median islands on all approaches, and in some cases, flare on the entry approach to two or more lanes.

Rumble strips: Raised buttons, bars, or grooves closely spaced at regular intervals on the roadway that create both noise and vibration in a moving vehicle to alert the driver or cyclist to an upcoming situation or of the proximity of the edge of the roadway.

Self-enforcing: A traffic calming measure that does not require police enforcement in order to be effective. A speed hump is self-enforcing, for example, where as a posted speed limit is not self-enforcing.

Shared use lane: A wider than normal travel lane intended for motor vehicles and bicycles to share. It is not defined by special longitudinal pavement markings. Motor vehicles and bicycles are expected to operate side-by-side.

Short-cutting (rat-running): Traffic which is travelling through a neighbourhood to bypass congestion on the arterial street network, or to make use of a more direct route.

Sidewalk extension: A sidewalk is continued across a local street intersection either at an elevation higher than the adjacent roadway, which is raised to the level of the sidewalk at this location, or at the approximate elevation of the adjacent roadway.

Sight line: An imaginary line from the eye to a point which obstructs one's vision.

Signalized: An intersection at which traffic signals have been installed, typically to control vehicle movements on

all approaches. May also describe a location which as been signalized to permit pedestrians/cyclists to actuate signals which stop vehicles on an arterial street or collector street so the pedestrians/cyclists may cross.

Speed control bump (hump, plateau): A locally introduced raising of the roadway with a sinusoidal shape in a cross-sectional profile, intended to lower the speed of motorized traffic.

Speeding problem: To determine whether speeding is a problem on a street during a particular time period, the 85th percentile speed of all vehicles passing during the time period is typically regarded as the representative speed. The 85th percentile speed is the speed exceeded by the fastest 15% of vehicles. When the 85th percentile speed exceeds the legal speed limit, this is generally considered as indicating a speeding problem.

Stakeholder: An individual or organization with an interest in transportation issues in a neighbourhood or specific location. Examples of stakeholders include residents associations, a chamber of commerce, a local transit agency, cycling advocates, an agency assisting disabled persons, business association, and school boards.

Standard: A value for a specific design feature, which practice or theory has shown to be appropriate where the prevailing circumstances are normal and general, and where no unusual constraints influence the design.

Streetscaping: A means of enhancing the street environment for all users of the right of way, and a means of modifying motorists behaviour, through the use of physical features which provide protection, coherence, security, convenience, community identity, way-finding, and orientation, aesthetic quality, and interest along the urban street.

Textured crosswalk: A crosswalk incorporating a textured and/or patterned surface which contrasts with the adjacent roadway.

Through traffic: Traffic that travels through a neighbourhood, and does not originate from, nor is destined to, a location within the neighbourhood.

Timing: When referring to traffic signals, timing describes the amount of time allocated to each interval within each signal phase. For example, 25-second might be allocated to the green interval, followed by a 4-second yellow interval and a 4-second all-red interval, before the next phase begins.

Touring cyclist (see 'cyclotourist').

Traffic calming: The combination of mainly physical measures that reduce the negative effects of motor vehicle use, alter driver behaviour and improve conditions for non-motorized street users.

Traffic circle: Road-section of a limited extent executed as a raised part or road-markings in the centre of an intersection, which requires vehicles to travel through the intersection in a counter-clockwise direction around the circle. The shape of the circle is determined by the configuration of the intersection and my not be circular. Traffic circles are typically used to calm traffic in residential neighbourhoods. Stop signs are not used with traffic circles.

Traffic management: The change in traffic routing or flow within a neighbourhood street system through a combination of measures which alter route options.

Transportation bicyclist (see 'utilitarian bicyclist').

Turn prohibition: A regulation prohibiting a left turn or right turn at an intersection. Turn prohibitions are sometimes reinforced with physical devices that obstruct vehicles and prevent a turn from being made. Often bicycles are exempt.

User groups: Bicycle clubs, organizations or other bodies which make use of bicycle facilities or programs.

Utilitarian bicyclist: Any person who uses a bicycle primarily for utilitarian purposes, to travel to and from

specific destinations such as school, shops or recreation centres for a specific purpose.

UVC: Uniform vehicle code, national standards used and respected by each province.

Vehicle: Includes both motorized and non-motorized machines including bicycles, mopeds, motorcycles, automobiles and trucks amongst others.

Volume: When referring to traffic, volume is a measure of the number of vehicles that travel along a section of roadway or make a particular movement during a specific time period. Most often, traffic volumes are indicated as vehicles per hour during peak hour, or vehicles per 24-hour period.