

City of Holland Bicycle and Pedestrian Transportation Plan

**Adopted by the City of Holland Planning Commission
on January 24, 2006**

**Adopted by the Council of the City of Holland on
March 1, 2006**



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Forward

The City of Holland ad hoc Bicycle and Pedestrian Planning Committee would like to thank the many people who were involved in the creation of this first Bicycle and Pedestrian Transportation Plan for the City of Holland. This Plan could not have been possible without the input, participation, and cooperation of many interested people including but not limited to bike shop owners, all forms of bicyclists, the City Police and Transportation Services Departments, and other civic organizations.

The process for developing this document has involved periodic meetings of the ad hoc committee along with receiving integral information from meetings that were held with the Macatawa Cycling Club and a public informational meeting that was held at City Hall on October 25, 2005.

Produced by City of Holland ad hoc Bicycle and Pedestrian Planning Committee:

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1. Introduction

Purpose

The purpose of this plan is to improve bicycle, pedestrian and other non-motorized forms of transportation in the City of Holland. This is a goal compatible with the City's Central Neighborhoods Plan, the 1995 Strategic Plan for Downtown, the Macatawa Area Coordinating Council's 2025 Long Range Transportation Plan, the 1992 Ottawa County Development Plan, and the 2002 Ottawa County Non-Motorized Pathways Study. Recommended ways to accomplish this will include installation of signage and physical improvements to existing transportation systems, development of new facilities and corridors with clear indication that they are to be used by bicyclists and pedestrians, and promotional and educational efforts to increase bicycle safety awareness and bicycle use in general.

It is the goal of the City of Holland to create and maintain through this plan, a viable bicycle, sidewalk and non-motorized transportation network. These facilities shall provide for safe and convenient travel for all forms of non-motorized travel throughout the City. The City recognizes the need to encourage these forms of travel, since these forms conserve energy, contribute to cleaner air, reduce traffic congestion, reduce noise pollution, improve personal fitness, and result in a more pleasant atmosphere.

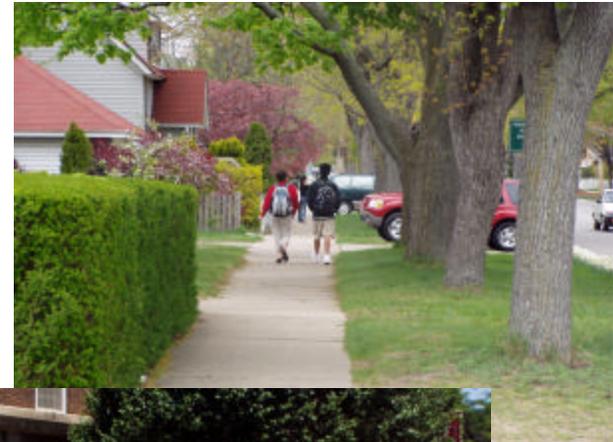


Setting

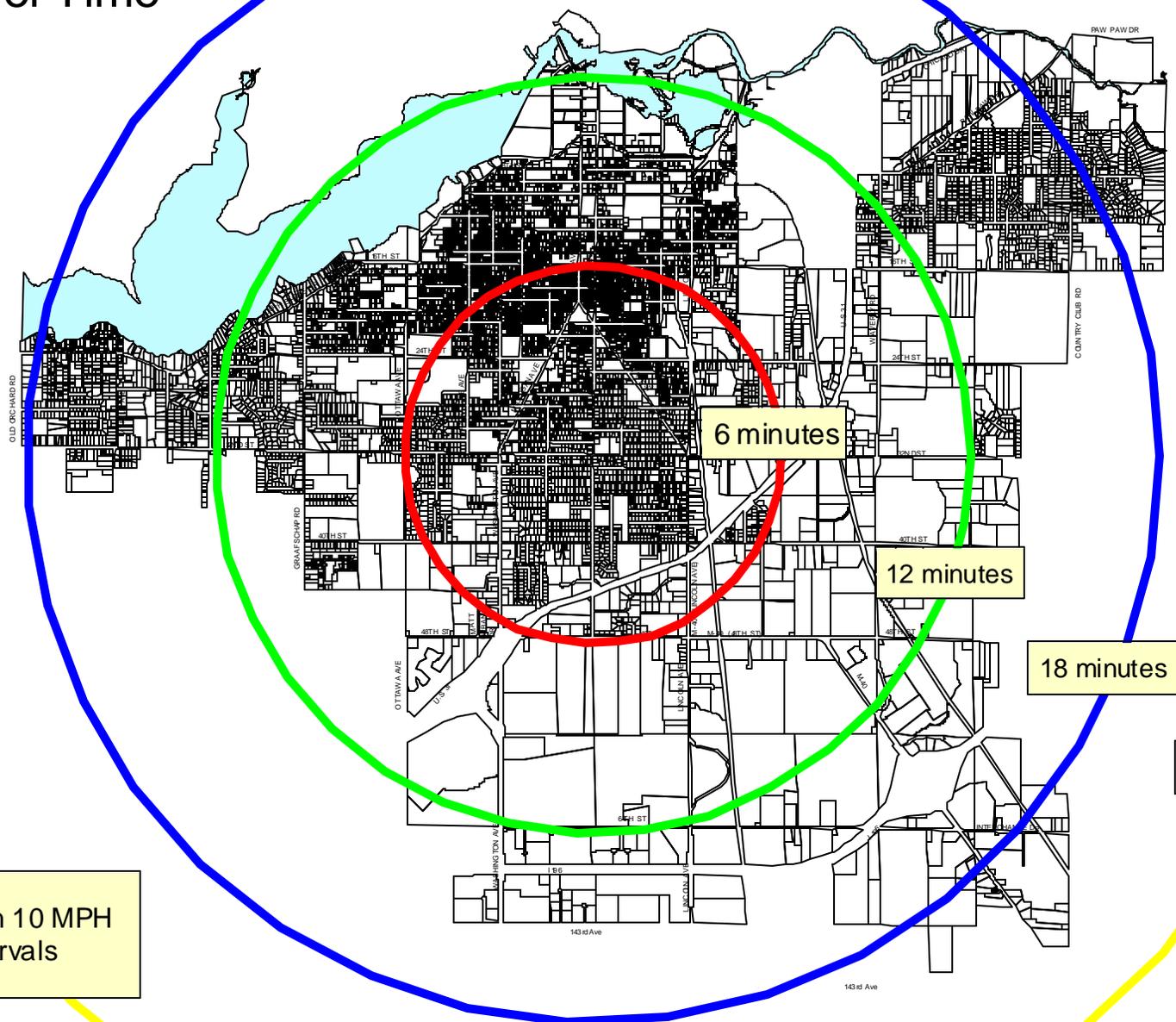
Late spring, summer and fall provide excellent conditions for everyday bicycling and walking commuters, avid recreational enthusiasts and beginner/novices. While the City of Holland's climate is not conducive for year round bicycling due to the relatively long cold and snowy winters, hearty walkers are out in force even during the coldest of winters.

The terrain in the City is somewhat flat but does have some relief in the east and south portions. The beautiful tree lined streets, close knit neighborhoods, waterfront areas and system of City-wide parks provide for wonderful bicycling and walking experiences and destinations. With Hope College being located in the Central Neighborhoods, as well as public and private elementary and secondary schools located throughout the community, there is a large core population of young bicyclists, walkers, and roller-bladers, in the City. In addition to students, many other residents enjoy non-motorized travel modes not only for recreation but also as an alternative to motorized travel.

The Bicycle and Walking Travel Time figures shown on pages 4-5 give an indication of how quickly one may travel on bike and on foot around the City. Many times we think that travel times and distances are larger than they really are and we should pause to think how easy it is to just jump on our bike the next time we need some milk or bread from the store. These figures show that if you happen to live in the central neighborhoods, you can bike to anyplace in the City in under 25 minutes and walk to virtually the most remote place in a little over an hour! Think about the gas you will save and the good you will do your body by exercising instead of driving.



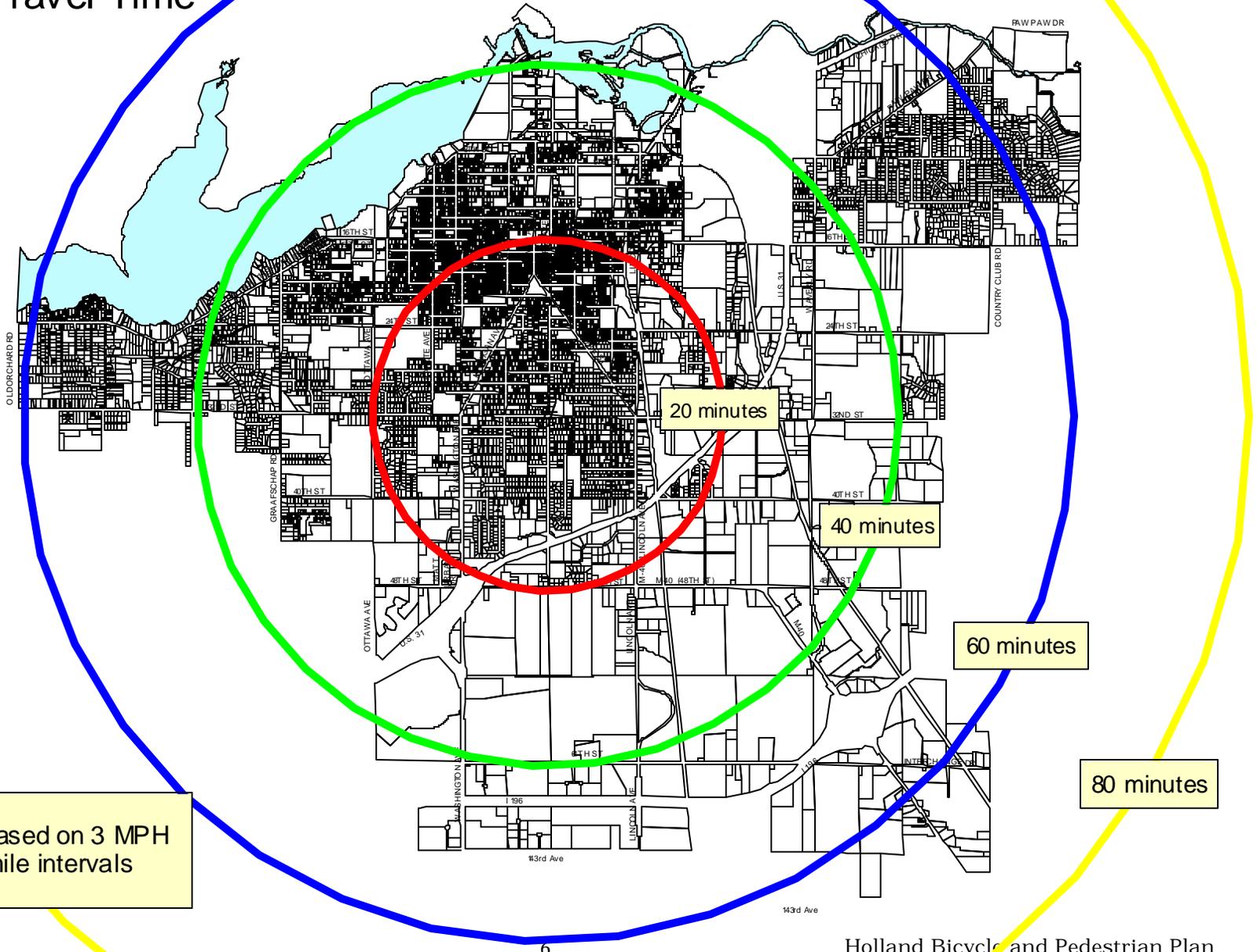
City of Holland Bicycle Travel Time



Estimates based on 10 MPH
Rings at 1 mile intervals



City of Holland Walking Travel Time



Estimates based on 3 MPH
Rings at 1 mile intervals

Benefits of Walking and Bicycling

Walking and bicycling are the two most popular forms of recreation in the US. Walking and bicycling and other forms of non-motorized travel provide many benefits for individuals and the communities in which one lives. Some of these benefits include the following:

- Bicycling is the most energy efficient mode of transportation and generates no air pollution.
- Bicycling is often the fastest mode of transportation from door to door for distances up to 6 miles in urban core cities.
- Ten bicycles can be parked in the same space required for an automobile.
- The cost of a typical car parking space is approxi-



mately \$1,500 for a surface parking lot compared to \$100-\$150 for a post- and-ring bike stand accommodating two bicycles.

- Short distance motor-vehicle trips are the least fuel efficient and generate the most pollution per mile. These trips have the greatest potential for being replaced by walking and bicycling.
- Reducing auto trips will mitigate ground level air pollution such as smog and ozone, and reduce noise pollution.
- Walking and cycling contribute to personal health by enhancing fitness and providing an enjoyable, convenient and affordable means of exercise and recreation. The most effective fitness routines are moderate in intensity, individualized, and incorporated into our daily activities.

2. Plan Development

Background

While the City currently has a Sidewalk Plan that has been in effect since 1999, this will be the City of Holland's first combined Bicycle and Pedestrian Transportation Plan. Although statistics appear to show that bicycling, walking and other means of non-motorized transportation are on a downward trend in some portions of the City, this Plan endeavors to generate and increase the awareness of non-motorized issues in the City and the greater Holland area. As the City continues with its ongoing capital program of repairing and when needed completely reconstructing streets and sidewalks and underground utility systems, it has become increasingly apparent that we need a Bicycle and Pedestrian Transportation Plan that lays out the poli-



cies for including these types of facilities in those larger street and utility projects.

It is anticipated that the creation and adoption of a Bicycle and Pedestrian Plan will help increase our chances of receiving grants, matching funds, and other gifts for the inclusion of these types of facilities in our regular capital improvement programming as well as funding for stand alone non-motorized facilities for the enjoyment of our residents.

It is also anticipated that the adoption of a Bicycle and Pedestrian Plan will help increase levels of project coordination and funding with adjoining municipalities, Ottawa and Allegan Counties, and the Macatawa Area Coordinating Council (MAAC) as the non-motorized facility network gains favor with the area and the desire for expanding the City and area-wide network continues to grow.



3. Policies, Goals and Objectives

General Guiding Policies

In general, the single most important recommendation of this plan is to consider bicycling, walking and other forms of non-motorized travel in the planning of all future new streets and sidewalks, improvements to existing streets and sidewalks, neighborhood and commercial district planning, and park planning. The consideration of these facilities up front in the project planning phase, instead of during or after construction is the most cost-effective method of making such improvements.

In order to ensure safe and convenient non-motorized access throughout the City, the following should be used as general guiding principles:

- Use the safest possible routes.
- Use the most direct possible routes.
- Use the most cost-effective routes.
- Use routes with surfaces that are acceptable for the travel mode.
- Use routes that are adequately maintained.
- Use routes that have adequate road markings and signage.
- Include bicycle route planning as an integral part of street design so that lanes and pathways can eventually form an integrated network.
- Insure through proper planning that non-motorized facilities do not have any unintended negative consequences, such as a widened street with a bike lane causing motorized vehicles to in-

crease their speeds because the motorist feels less constricted. Such a street widening for bicyclists may end up being counter-productive in some situations because the increased vehicle speeds more than detract from the safety increases brought on from the street widening for bicyclists.

- Insure better integration between non-motorized facilities and mass transit opportunities, such as sidewalks and bicycle facilities being provided to each MAX stop.
- Insure that the design of all pedestrian facilities will accommodate all users, including those that are physically challenged.



Holland Bicycle and Pedestrian Plan



- Integrate bicycle facilities into park designs where appropriate.

Specific Goals and Objectives

Goal: Enhance the safety of bicyclists, pedestrians and other non-motorized facility users through education, promotions and marketing efforts, and law enforcement activities.

Objectives:

- Enhance educational programs to teach children and adults to wear helmets and practice safe bicycle riding techniques. Programs can be combined ventures among the City, Hope College, elementary and secondary schools, and local bike clubs.
- Educate the motorized public about the rights and responsibilities of bicyclists and pedestrians, and about appropriate courtesy when encountering bicyclists or pedestrians.

- Educate about and enforce bicycle and automobile rules and regulations in order to reduce violations and accidents, including speed limit enforcement.
- Provide literature regarding bicycle, running and walking events and up-to-date route maps for public use free of charge. Provide information in both a printed format and on the Internet.
- Provide additional signage in the form of Share the Road, Bike Route, and other appropriate signage.
- Explore the possibility of creating “Walk and Bike Friendly zones” around Hope College and neighborhood schools and parks where pedestrians and bicyclists would be the preferred mode of travel and where motorists would have to yield the right-of-way.
- Increase local coverage of bicycle, running and walking events and present accurate information about safety and activities.
- Enhance the informal bicycle routes through formal designation and/or signage.

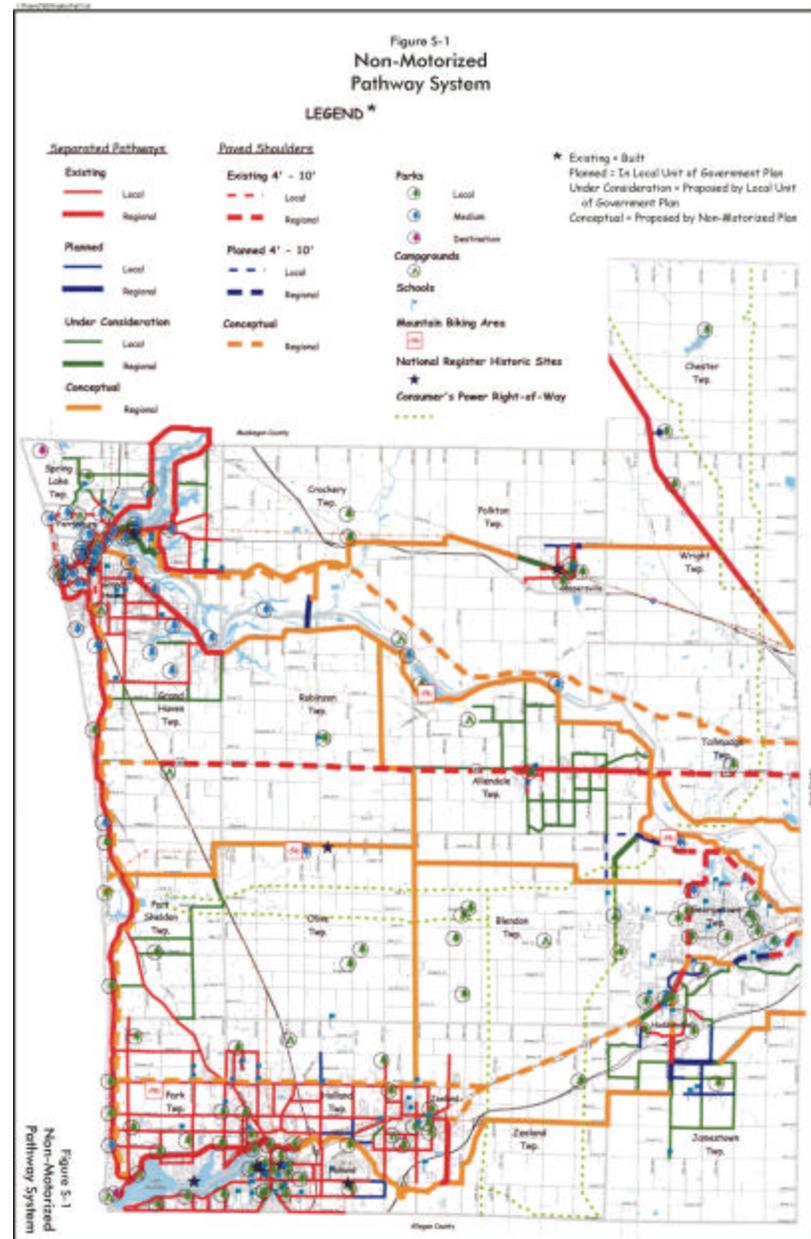


Goal: Coordinate and share resources with the Ottawa and Allegan County Road Commissions, County Planning Commissions, County Recreation and Parks Departments, the MACC, adjacent Municipalities, and local bicycle shops and clubs.

Objectives:

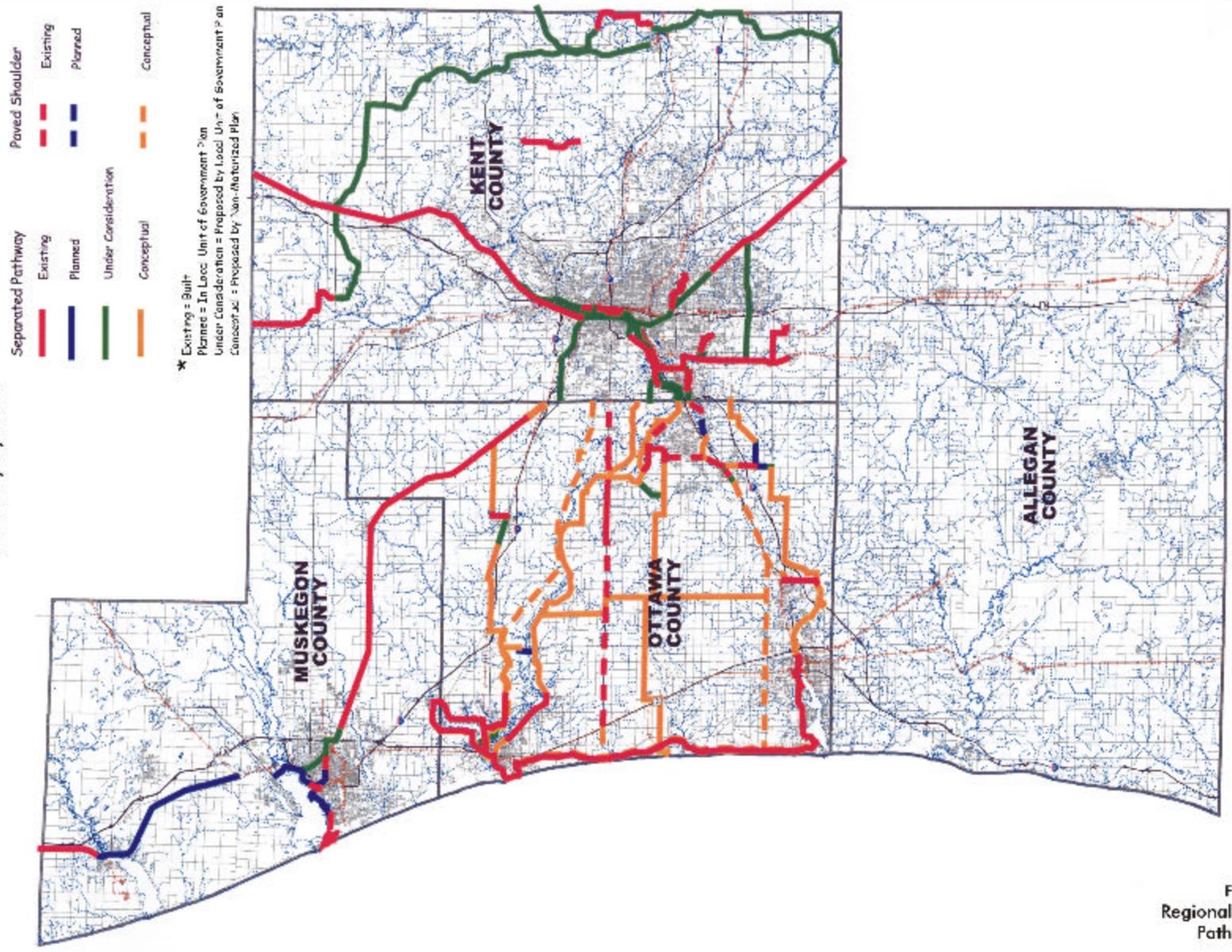
- Share information and resources with the Ottawa and Allegan County Road Commissions, County Planning Commissions, County Recreation and Parks Departments, the MACC, and adjacent Municipalities regarding bicycle and pedestrian facilities and activities.
- Coordinate with the Ottawa and Allegan County Road Commissions, County Planning Commissions, County Recreation and Parks Departments, the MACC, adjacent Municipalities and local bicycle shops and clubs to create an integrated bicycle and pedestrian network. An example is to coordinate with Holland Township and the Ottawa County Road Commission for a better design and reconstruction of sidewalk and/or bicycle facilities in the vicinity of 8th Street and Chicago Drive.
- Use joint ventures to make improvements on streets and sidewalks that provide linkages between localities.

Goal: Design, Construct and Maintain cost effective bicycle and sidewalk facilities that provide safe and comfortable conditions.



12-1000000-000000

Figure 3-4
Regional Non-Motorized
Pathway System



★ Existing = Built
 Planned = In Local Unit of Government Plan
 Under Consideration = Prepared by Local Unit of Government Plan
 Conceptual = Prepared by Non-Motorized Plan

Figure 3-4
Regional Non-Motorized
Pathway System

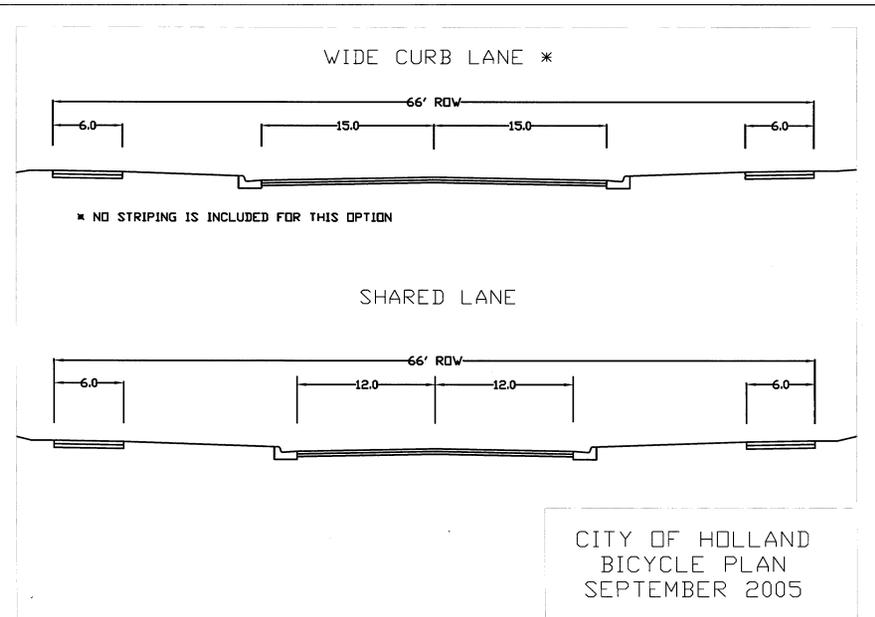
Objectives:

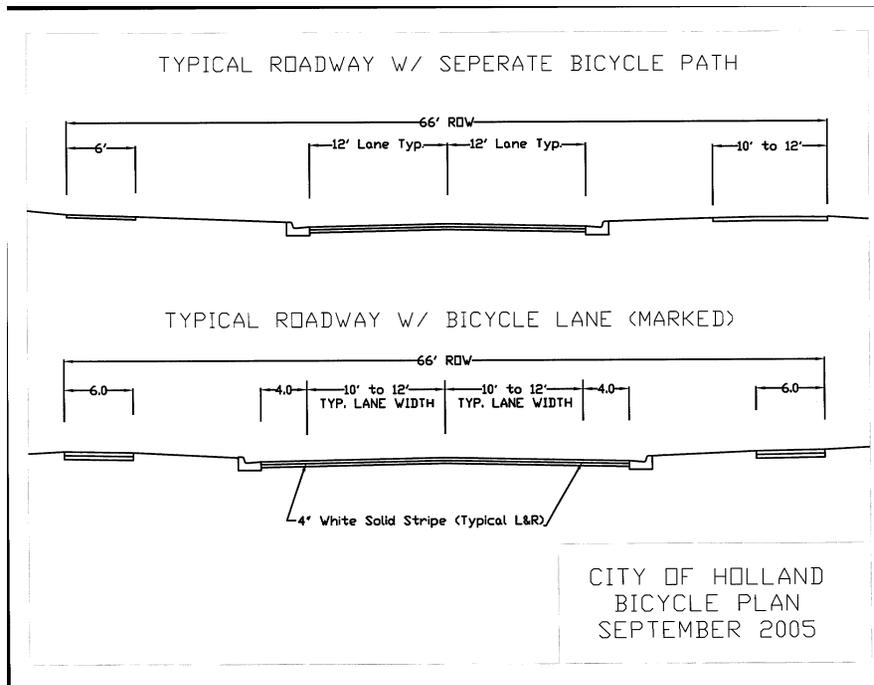
- Establish a comprehensive and coordinated bicycle and sidewalk system. City staff from the Transportation Services Department, Community and Neighborhood Services Department, Leisure and Cultural Services Department, as well as the Police Department should review planned road and sidewalk improvements during the planning stages. Consultations with local bicycle shops and bicycle clubs along with a potential citizen’s non-motorized committee should also occur to ensure adequate design and construction of bicycle and sidewalk facilities.
- Review and evaluate the Bicycle and Pedestrian Transportation Plan every year.
- Plan for bicyclists and pedestrians in the design of intersections and traffic control systems including signals, signs and pavement markings.
- Plan for all bridges to include safe and adequate facilities for bicyclists and pedestrians.
- Promote all forms of non-motorized transportation, including rollerblading and other recreational forms of transportation.
- Provide adequate facilities for the parking of bicycles on both public and private properties.
- Maintain streets, sidewalks, bike paths and other non-motorized facilities so they provide safe and comfortable conditions for users. The level of maintenance for non-motorized facilities should be no less than that of streets used

by motorized vehicles.

- Design facilities to minimize maintenance costs by specifying quality materials and standard products.
- Maintain non-motorized facilities through construction zones, if possible.
- Design facilities to minimize maintenance costs by specifying quality materials and standard products.
- For additional design and improvement information refer to Addendum A.

4. Typical Bicycle Facilities





Separate bicycle paths are likely the most safe bicycling facility for the broad range of users as there is no interaction with passing motorists, except at intersections and at driveway locations. It is this last interface though that makes these types of facilities somewhat unsafe for bike commuters and avid recreational bicyclists that travel at higher speeds and therefore need longer stopping distances.

Bicycle lanes are areas of the road striped off for preferential use by bicyclists. They should be striped with a 4 to 6 inch white line, include pavement markings like “BIKE LANE” or a bicycle symbol, and signing. Bicycle lanes should be at least 4 feet wide, not counting the gutter pan area. These lanes should be placed between the right-most through lane and the curb, and if there is a right turn only lane, the bike lane should be to its left.

Wide curb lanes of between 14 and 16 feet allow motorists and bicyclists to share the roadway more comfortably, and should at a minimum be used on arterial streets. The primary benefits of wide curb lanes are to give extra clearance between bicyclists and passing motorists and to reduce conflicts between through motor traffic and vehicles entering or leaving commercial driveways.

Shared lanes are where motorists and bicyclists share the same travel lane. These types of lanes function safely on local streets where traffic volumes and speeds are minimal.



If the street forms part of a true bikeway system, bicycle lanes may well be the alternative preferred by most local bicyclists because of the psychological effect of having a space reserved for them.

Bicycle routes are not true bicycle facilities, but they do function well to inform bicyclists of how to best get from one point to another, or identifying a particularly advantageous corridor. They are inexpensive because they usually only involve installing signage.

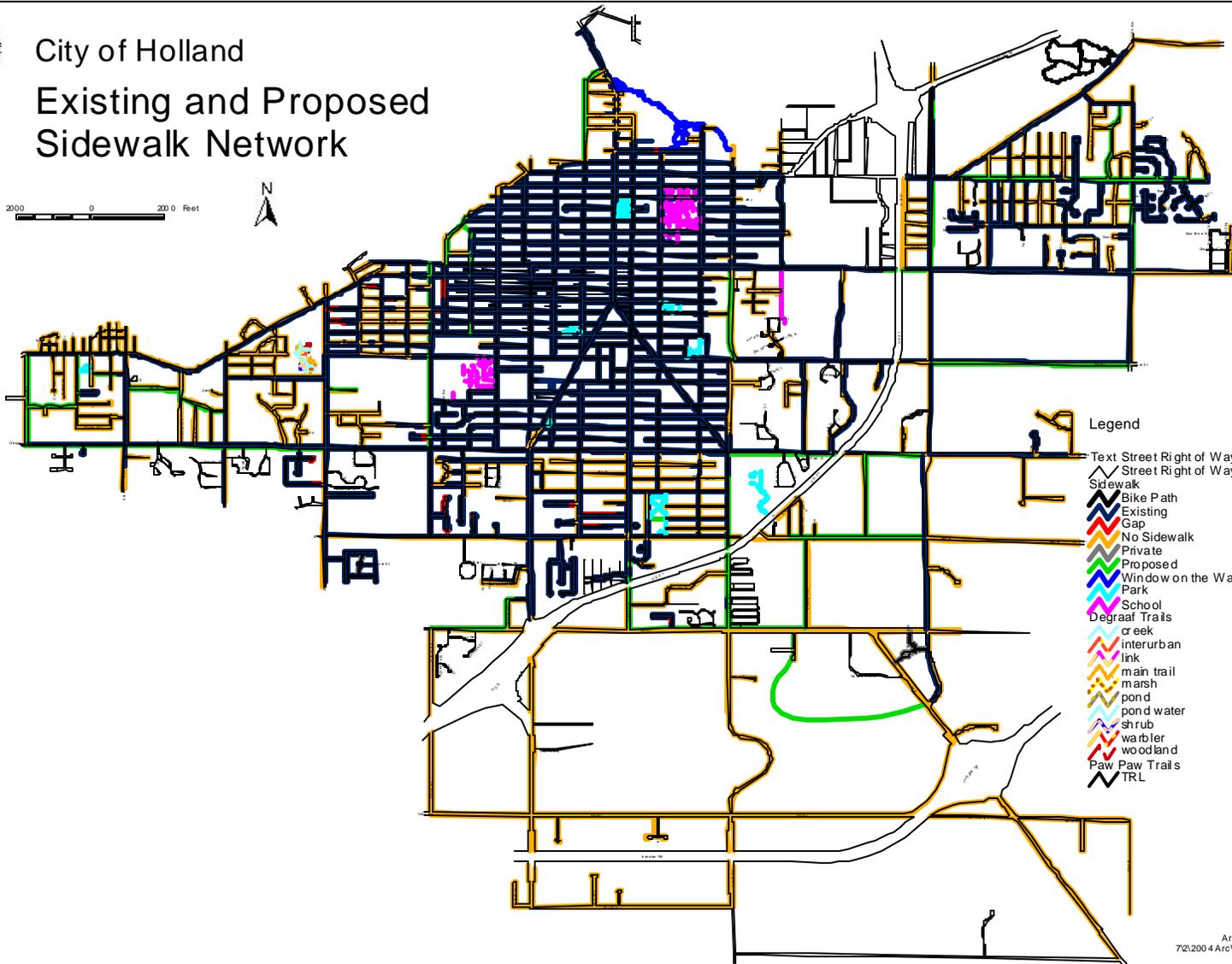
Bicycle Racks. In order to assure that bicyclists can park and secure their bikes at various destinations, the City should provide additional bike racks at high destination spots such as Downtown and at City parks. Private businesses should be encouraged to provide bicycle parking facilities and when new development occurs that may generate bicycle traffic, the City should require the installation of bicycle racks. The type of racks should be user friendly, fun and whimsical to help catch the freedom one feels when riding a bike.





City of Holland Existing and Proposed Sidewalk Network

2000 0 200 Feet



Legend

- Text Street Right of Way Names
- Street Right of Way
- Sidewalk
 - Bike Path
 - Existing
 - Gap
 - No Sidewalk
 - Private
 - Proposed
 - Window on the Waterfront
- Park
- School
- Degraaf Trails or creek
- interurban link
- main trail
- marsh
- pond
- pond water
- shrub
- warbler
- woodland
- Paw Paw Trails
- TRL

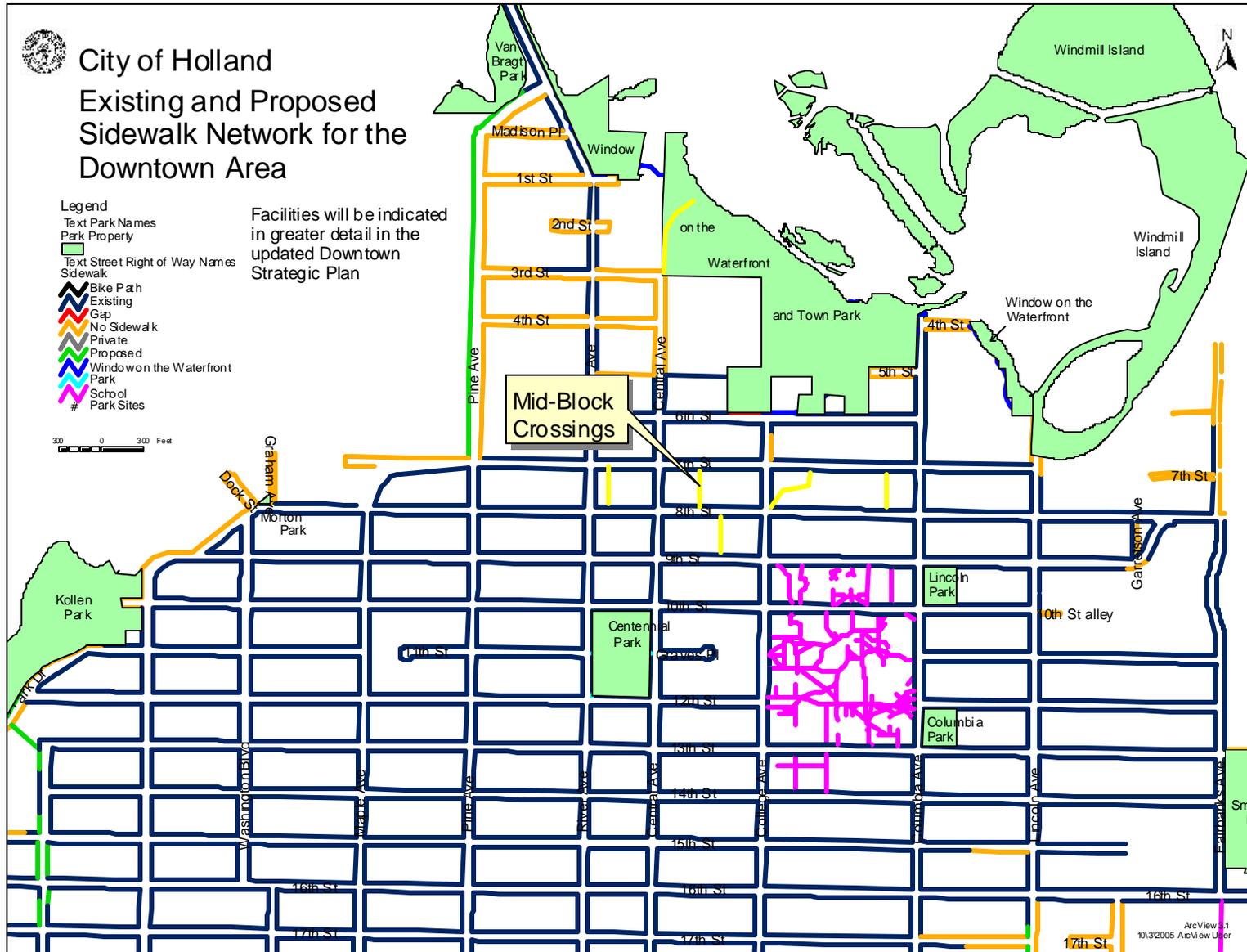
ArcView 3.1
7/2/2004 ArcView User



City of Holland Existing and Proposed Sidewalk Network for the Downtown Area

- Legend**
- Text Park Names
 - Park Property
 - Text Street Right of Way Names
 - Sidewalk
 - Bike Path
 - Existing
 - Gap
 - No Sidewalk
 - Private
 - Proposed
 - Window on the Waterfront
 - Park
 - School
 - Park Sites

Facilities will be indicated in greater detail in the updated Downtown Strategic Plan



ArcView 3.1
10/3/2005 AcView User

5. Existing Non-Motorized Network

The existing non-motorized network in the City of Holland as shown in the figure on page 16 is huge as it includes the entire sidewalk network in the City. This non-motorized network also includes the very large number of wide curb lane streets and the many trails in City parks, such as the Paw Paw Preserve, Van Raalte Farm, DeGraaf Nature Center, and Window on the Waterfront.

6. Proposed Bicycle and Sidewalk Network Improvements

See figures on page 16 and 19. In addition to improvements that may occur as a component of a larger street and/or utility system project, the following bicycle, sidewalk and trail improvements should be considered as stand alone projects.

- Sidewalk “Fill in the Gap” program in public street right-of-ways - This is an annual program where City Council reviews existing “gaps” in the sidewalk network and orders in the construction of those gaps based on certain established priorities.
- Macatawa Greenway Network - This is planned to be an interconnected system of public and private parks and other dedicated open undeveloped lands in the greater Holland/Zeeland area. In the City this network will stretch from the Paw Paw Preserve in the very NE corner of the City west along the banks of the Macatawa River to Windmill Island, then continuing on through

Window on the Waterfront Park to the River Avenue bridge. The build out of this trail network will also require that improvements be made in the vicinity of Waverly Road and the Macatawa River to provide a safe trail crossing of Waverly Road. Improvements should also include widening the Windmill Island access road to provide safer conditions for pedestrians and bicyclists along that drive.

- North River Avenue Pedestrian Bridges - The east pedestrian bridge is already built and should be operational within the next few months. The west pedestrian bridge will be operational within the next 1-2 years. These two bridges when coupled with a safe crossing of North River Avenue



will provide an exceptional crossing of the Macatawa River for pedestrians and bicyclists alike to access the north side bike route system, and for north side residents to safely access the City.

- “Cross Town” Bike Routes - While most every street other than the very busy ones may be safely used by bicyclists for both recreational and commuting purposes, there is a benefit to identifying and more formally designating a network of bike routes that cross the City and tie into the larger bike route networks of the adjacent municipalities and beyond. This Plan identifies and advocates for the creation of the following list of bike routes and as graphically portrayed on the Proposed Bicycle Network Improvement Map on



page 19:

- East/West - South Shore Drive/Kollen Park Drive/8th Street/Pine Avenue corridor
- East/West - 24th Street/Central Avenue/32nd Street corridor
- East/West - 40th Street corridor
- East/West - 64th Street/Ottawa Avenue/48th Street corridor
- North/South - River Avenue/State Street/Lincoln Avenue corridor
- North/South - Pine Avenue/8th Street/Van Raalte Avenue corridor
- Paw Paw Drive/Legion Park Drive/Country Club Road corridor

- Hamilton Railroad Spur and Trail - There is an opportunity to work with CSX, the Hamilton Farm Bureau, and the Allegan County Parks Department to create a non-motorized trail along this railroad spur from 48th Street south through the remainder of the City to Hamilton.
- Improve sidewalk crossings of US-31 at 8th, 16th, 24th, and 32nd Streets as well as Lincoln, Central, and South Washington Avenues - Although the crossings at 8th, 16th, and 24th Streets were “improved” in 2004 by the MDOT as a component of the US-31 pavement project, much should still be done to make those intersections truly friendly for pedestrians and bicyclists. The crossings at 32nd Street, Lincoln, Central and South Washington Avenues still need to be improved.
- Improve non-motorized crossings of I-196 on South Washington Avenue, Lincoln Avenue, and M-40 - Again, as the City continues to grow to the south into the areas on the south side of I-196, it is imperative that these three crossings over Interstate Highway 196 be improved to safely provide for bicycle and pedestrian traffic. Right now, the highway acts as a huge barrier to the point that people will not even consider using the three crossings on foot or on bike. This is not an acceptable situation as we expect our residents to be able to safely move about with more than just motorized vehicles.
- Long range plan for new crossing of US-31 at 40th Street - This is a long term goal that envisions a

new non-motorized bridge crossing of US-31 at the point where 40th Street would cross US-31. 40th Street has been identified as a major east/west route through the City and a new non-motorized bridge crossing in this location would not only make a safe east/west connection, but would provide a safe north/south connector from the large central neighborhood areas of the City to the large industrial areas on the south side.

- Long range plan for making the East 16th Street corridor the major pedestrian and bicycle route into the Central Neighborhood area.
- Airport Tunnel By-pass trail to Ottawa Avenue and new sidewalk/trail along Ottawa Avenue/64th Street - This proposed non-motorized



route would establish a safe bicycle and pedestrian route through the Airport area. Previous to the Airport runway expansion, bicyclists and pedestrians were able to use the South Washington Avenue right-of-way, albeit it was not a safe route for this type of traffic. With the construction of the new airport tunnel, pedestrians and bicyclists are prohibited from using the tunnel, which effectively closes this entire South Washington Avenue corridor and lands south of the airport to non-motorized traffic. In order to re-establish a non-motorized route through this area, this Plan envisions establishing some form of a trail from the north side of the Airport west around the JCI property to the Ottawa Avenue right-of-way where a new sidewalk or bike path facility would be constructed south to 64th Street, then extended east along 64th Street to South Washington Avenue, then extended south along South Washington Avenue over I-196 to the City and Fillmore Township lands on the south side of I-196.

7. Prioritization, Implementation and Financing

Prioritization of improvements recommended by this plan will occur in conjunction with projects of the Major and Local Street Capital Improvement Program, the MACC, the MDOT, MDEQ, and MDNR, the Ottawa and Allegan County Road Commissions, and the availability of other funding sources.

The implementation of a Bicycle and Pedestrian

Transportation Plan requires its consideration in all aspects of land use and transportation planning. Implementation of the Plan should be considered during the planning phases for the construction and reconstruction of most all public facilities. Additionally, updates to the City's Master Plan in the form of our neighborhood planning area updates should include a review of this plan to insure that area recommendations are being implemented in the Neighborhood Plans and that new information from the neighborhood planning updates are being included in updates to this Bicycle and Pedestrian Plan.

Although the optimal financing of the facilities anticipated by this Plan should occur independently based solely on the merits of the program, it is recognized that the practical financing of any facilities anticipated by this plan would occur in conjunction with the financing of general facilities and street construction that occurs within the City. Investigation of all sources of state, federal, non-profit, and private sector funding should be considered to assist in the development of the improvements and programs anticipated by this Plan. Additionally, independent consideration of funding improvements anticipated in this Plan should become part of the City's annual capital improvement plan and budget process.

8. Other Resources

In addition to Addendum A that discusses simple and inexpensive ways to improve bicycling in our community, the following web sites provide a wealth of information regarding bicycling, walking, and other forms of non-motorized transportation.

- www.bikeplan.com
- www.greenwaycollab.com
- www.city.toronto.on.ca/cycling/bikeplan
- www.bicyclinginfo.org
- www.bikeleague.org/index.cfm
- www.bikewalk.org/
- www.pedbikeimages.org/
- www.walkinginfo.org/





BASIC IMPROVEMENTS FOR BICYCLISTS

by John Williams, editor of *Bicycle Forum*

Here are some simple ways to improve bicycling in your community. These improvements are mostly inexpensive and require a minimum of specialized bicycle planning. They can help ease conflicts and congestion for all modes of transportation—cars, bikes, and even pedestrians.

Why encourage bicycling?

Bicycling is one of the most popular forms of recreation in America — in fact, it's number two over all. It's also excellent aerobic exercise. According to the Bicycle Federation of America, more than 80 million Americans ride bicycles. Further, the bicycle is an economical non-polluting energy-efficient means of transportation. Some communities have worked hard to support bike use and, as a result, significant percentages of their work forces commute by bike.

For example, more than 10% of the commute trips in Madison, Wisconsin, are made by bike. Other bicycling cities include Davis, California, Eugene, Oregon, Boulder Colorado, and Gainesville, Florida. By encouraging bicycle use, these cities reap benefits like improved air quality, reduced traffic congestion, and a healthier citizenry. While some of their projects have been expensive, other have not. Let's look at those mostly inexpensive—but good—ideas.

Approaches for all streets

Studies show that bicycle users can be found in all parts of a city. They share destinations and trip purposes common to other road users and use all types of streets. For this reason, add basic bicycle improvements to all streets where bikes are allowed.

Different types of users, however, prefer different types of streets. Children and casual

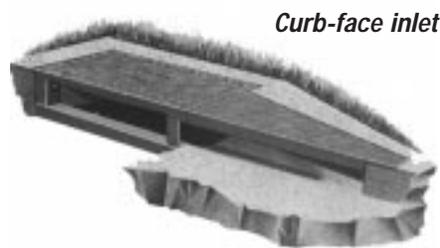
adult riders often ride on quiet neighborhood streets or paths. Serious commuting and recreational cyclists often ride on major streets and highways.

Fix or replace dangerous drain grates.

Drainage grates can be the bane of the bicyclist's existence. The worst ones are parallel-bar grates which can trap a bicyclist's wheel, causing a serious crash.

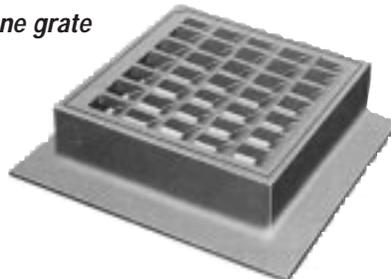
Replacing such grates with bicycle-safe models is the best approach. There are numerous designs that are both bicycle-safe and hydraulically-efficient. One good design is the curb-face inlet. These present no obstacle at all to the bicycle, as long as slopes to the inlets are not excessive.

Other safe designs include "vane" grates with short angled slots and honeycomb-style steel grates. Most grate manufacturers produce bike-safe models.



Curb-face inlet

Vane grate



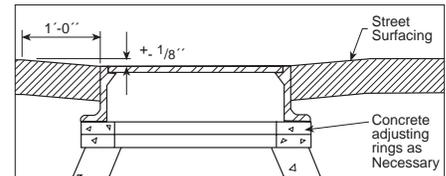
Graphics courtesy Neenah Foundry

Honeycomb design



In the short term, retrofitting may be a viable approach. Some agencies weld flat steel bars across the grate, perpendicular to the flow of traffic. This approach may work well for a while if you don't have to worry about snow plows. Other agencies use covers of one sort or another. If not cleaned frequently, however, these can collect debris that restricts the flow of water.

Retrofitting can solve the immediate problem and reduce an agency's potential exposure to liability. However, replacing dangerous grates is the best solution and has the lowest maintenance costs. Also, don't forget to change grate standards so that future installations will use bike-safe models.



Adjusting utility cover level with road.

Graphic courtesy Montana Public Works Assn.

Installation is also important. Make sure grates and utility covers are installed level with the pavement and are adjusted flush with future pavement overlays (see above).

Reference: *Bicycle-Safe Grate Inlets Study, 1977, Report #FHWA-RD 77-24; Montana Public Works Standard Specifications, MPW, 1988; Neenah Foundry Construction Castings Catalog R, 1998*

Patch and sweep carefully.

Many bicycles have relatively narrow tires and no shock absorbers. So, good surface conditions are essential. And paying particu-



Maintenance is an important concern for all bicyclists.

Careful patching can save bicyclists lots of grief.



Photo courtesy Alex Sorton

lar attention to the roadway edge and patching practices can do a lot of good.

For example, a Palo Alto, California, policy requires utility companies to patch their roadway excavations to a high standard, with no big gaps or ridges. And if a patch fails within one year, the company must fix it.



A sweeper keeping the bike lanes clean.

Sweeping is also important for bicyclists. Passing motor traffic moves debris off to the side of the roadway, where bicyclists often ride. Sweepers should pay special attention to the right edge and to places in intersections where debris builds up.

Fix railroad crossings.

There are two main railroad crossing problems. First, tracks that cross the roadway at less than 45° can divert a bicyclist's front wheel and cause a crash. Second, rough crossings can cause a bicyclist to lose control or damage a wheel.

For rough crossings, replacement with smooth concrete or rubberized installations can eliminate the problem entirely. While these are expensive, they can significantly reduce maintenance costs. Some cities, such as Seattle, Washington, install 4-foot sections of rubberized crossing near the right edge of popular bicycling streets. This can save money while benefitting bicyclists.

One good way to solve the angle crossing problem is to flare the approaches on either

side of the crossing. This allows bicyclists to cross the tracks at a right angle (see below).



Flared rubberized crossing allows bicyclist to cross safely.

On slow-speed rail lines with rubberized crossings, an alternative is to install flange-way fillers, which fill the wheel-grabbing gap next to the rail. However, this approach isn't recommended on high speed railroad lines; the filler does not compress quickly when a fast-moving train wheel hits it.

Reference: North Carolina Bicycle Facilities Planning and Design, 1994

Use current bike facility guidelines.

Since the 1960s, bicycle facility designers have learned much about how bikes perform and what riders need. Some common mistakes still exist, however, and some are being re-created today; such mistakes can lead to multi-million dollar law suits. Here are a few tips from the AASHTO (American Assn. of State Highway & Transportation Officials) 1991 *Guide*:

Don't designate sidewalk bikeways. These cause car-bike conflicts at intersections and driveways, as well as conflicts with pedestrians. Eugene, Oregon, and other cities have found that sidewalk bikeways have very high crash rates.



Two-way trail on one side of a road puts bicyclists in jeopardy.

Don't put two-way bikeways on one side of a street. These also cause serious conflicts at intersections and driveways. Two-way bike lane use has led to a number of fatal head-on collisions. And it encourages wrong-way riding.

Generous design speed on trail curves leads to safer conditions.



Use a realistic design speed on separate trails. Twenty miles per hour is a reasonable design speed on level ground. On hills, increase it to 30mph or more.

Be especially careful designing bike path curves and intersections. Unexpectedly tight curves can cause crashes, as can sight restrictions at intersections.



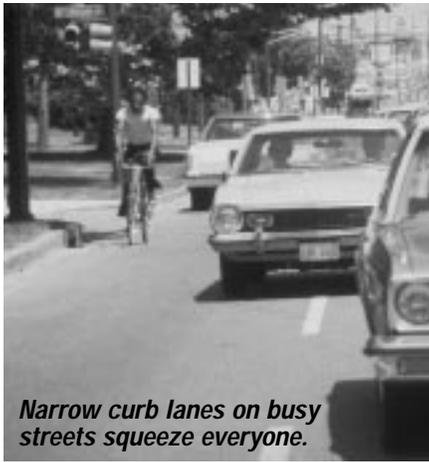
Some cities separate bikes and pedestrians on busy trails.

Shared trail use can cause problems. While it's seldom possible to avoid, mixing bikes and pedestrians on a trail can lead to serious conflicts if either bike volumes or pedestrian volumes are high. Some cities, like Calgary, Alberta, and Denver, Colorado, separate bicyclists and pedestrians onto individual trail segments in areas where use is particularly high. When shared use is unavoidable, add width and increase sight distance on curves and at intersections. *Reference: Guide for Development of Bicycle Facilities, 1991, American Assn. of State Highway & Transportation Officials*

Improving Major Streets

For experienced bicyclists, cycling on major roads, while not always pleasant, has important benefits. These benefits are the same ones that motorists appreciate. Major roads tend to be more direct than quiet neighborhood streets. They are often protected by stop signs and signals at intersections. And those intersections often have good sight distance. Skilled bicyclists have little trouble riding safely on major roads.

In some cases, it is possible to add bike lanes to arterial streets. Some cities have done this by removing a traffic lane with positive results. If this is not possible, it's still feasible to improve conditions for bicyclists. Here are some important options:



Narrow curb lanes on busy streets squeeze everyone.

Create wide curb lanes.

One option for improving cycling conditions on major roads is to add width to the curb lanes. This approach gives motorists and bicyclists enough room to coexist in relative comfort.

Further, wide curb lanes can reduce conflicts between cars on the roadway and cars waiting to exit from driveways.



Wide curb lanes give more space for bikes and cars.

Photo courtesy Tom Walsh

Tom Walsh, Assistant Traffic Engineer for the City of Madison, Wisconsin, says "The wide curb lane is one of the most effective bicycle accommodation techniques available. It goes the furthest to integrate the bicycle

into the normal traffic flow, allowing the bicyclist to use the existing street system as a vehicle without adversely interfering with other vehicles passing in the same lane."

How wide is wide enough? On a four-lane arterial street with 12-foot lanes, simply narrowing the inside lanes to 11 feet and widening the outside lanes to 13 feet is worth the effort, according to a study done by the Maryland DOT.

The consensus, however, seems to be that 14 to 15 feet of usable lane width (not counting curb and gutter) is the best.

References: Evaluation of Wide Curb Lanes as Shared Lane Bicycle Facilities, 1985, Maryland Department of Transportation; Highway Capacity Manual, 1985, Transportation Research Board. Road Diets: Fixing the Big Roads, Burden & Lagerwey, 1999; 1991 AASHTO Guide

Install bike-sensitive traffic signals.

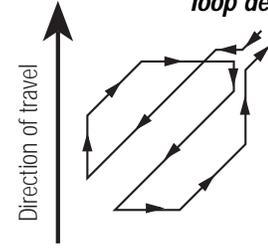
Demand-actuated signals are known for being unresponsive to bicycles. Bikes generally don't have enough metal to trip the actuators. And, as a result, many bicyclists have poor attitudes regarding signals.

But modern detection systems can detect bicycles. The best standard design for general purpose lanes is a modified quadrupole loop (CalTrans Type D). This loop (shown below and above right) is sensitive over its entire width but the sensitivity falls off rapidly outside. This feature helps avoid detection of vehicles in adjoining lanes. The diagonal quadrupole is an excellent design for new intersection loop installations.



However, many signals can detect bicycles if the cyclists know where to position themselves. At intersections with standard square or rectangular loops, for example, the

CalTrans Type D Diagonal quadrupole loop detector.



right edge of the loop is often sensitive enough to detect bikes and can be marked with a special pavement marking. A number of cities have experimented with various designs; the San Diego design is shown below.

References: Bicycle Forum Tech Note F-2, "Bicycles and Traffic Detectors;" Traffic Signal Bicycle Detection Study: Final Report, 1985, City of San Diego.

San Diego's bicycle pavement marking shows "hot spot" for detection.



Improving Local Streets

Many bicyclists prefer riding on quiet neighborhood streets. These bicyclists are often less skilled than those who ride on major roads. Quiet streets may be less stressful than busy streets. However, they may harbor hazards that can catch bicyclists unaware.

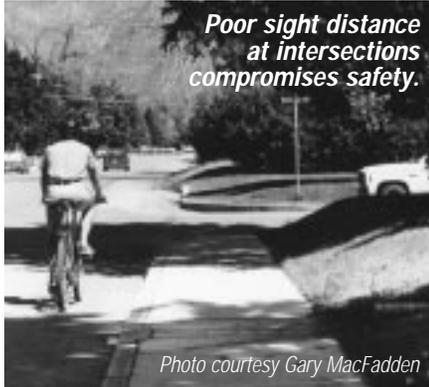
Several Federally-sponsored studies have shown that the majority of car-bike crashes happen on residential streets AND that residential streets may even have higher crash rates than do busier roadways.

The next sections discuss some of the improvements that will make local streets safer.

Here are a few local road tricks:

Improve sight distance at crossings.

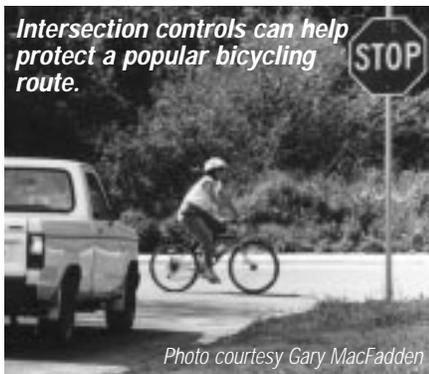
Visibility at intersections is crucial to everyone's safety. This is especially true for bicyclists, since they are so much smaller and often harder to see than the typical car. Many car-bike crashes result from motorists' and bicyclists' inability to see each other due to sight obstructions like large bushes, fences, and parked cars.



Keeping sight lines clear at intersections can do much to improve bicycle safety. While such improvements aren't exotic, they can be very effective.

Add effective intersection controls.

In the West, many residential street intersections are uncontrolled. Unfortunately, experience suggests that motorists (and bicyclists) often misunderstand the traffic laws governing such intersections.

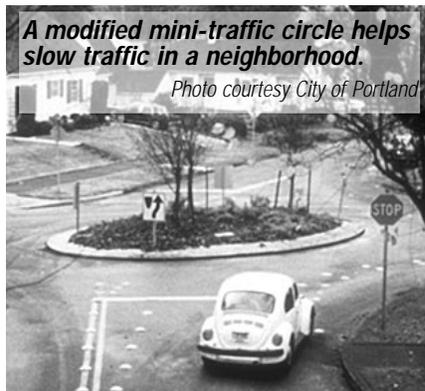


Consider installing traffic controls on low-volume streets which meet popular bicycle routes. These can be stop or yield signs, depending on local preference.

Reference: Manual on Uniform Traffic Control Devices, FHWA, 1988

A modified mini-traffic circle helps slow traffic in a neighborhood.

Photo courtesy City of Portland



Use traffic calming measures.

While not strictly bicycle improvements, carefully-designed traffic calming techniques can often reduce dangers of riding on local streets. By reducing either traffic speeds or traffic volumes on residential streets, such provisions as mini-traffic circles, chicanes, diverters, and speed humps can help make quiet streets even quieter.

Seattle's mini-traffic circle program is one example of a program that has been both popular with residents and has reduced the number of crashes in residential street intersections significantly.

References: Traffic Calming, CART, 1989; Traffic Circles in Residential Areas, City of Seattle, 1993; Traffic Calming in Practice, Landor Publishing, 1994

Improving Rural Roads

Rural roads offer miles of quiet and enjoyable cycling. Many bicyclists consider this type of riding to be the very best recreation available. What can be done to improve rural roadways?



Pave shoulders on busy rural roads.

Some states, such as Wisconsin, add paved shoulders to rural highways when they reconstruct. They do this to encourage bicycling — they have a very active tourism program — and to improve conditions for motorists as well.

On narrow rural roads without paved shoulders, cars and trucks occasionally drop a wheel off the pavement edge. When the driver corrects, the wheels tend to tear up that edge. This damage can lead to continuing maintenance problems. Paved shoulders can cut down on maintenance costs by giving the motorists more room to correct steering errors. Further, paved shoulders can cut the incidence of run-off-the-road accidents.

How wide is wide enough? Consider paving at least three to four feet to a reasonable high standard with adequate sub-base. The Maryland Department of Transportation, for example, covers their previously-paved shoulders with a slurry seal for smoothness. They find that cyclists appreciate and use the smooth shoulders.

Reference: Guidelines for Wide Paved Shoulders on Low-Volume, Two-Lane Rural Highways; Rollins & Crane, TRB, 1989; Facilities Development Manual: "Shoulder Bikeways", WisDOT, 1993.

Use caution with rumble strips.

Rumble strips along the edge of rural highways have been shown to reduce the incidence of run-off-the-road crashes among motorists. However, unless carefully designed, they can cause serious problems for bicyclists. A rumble strip that covers the entire paved shoulder gives the bicyclist nowhere to ride except in the travel lane.

A number of states have worked hard to design rumble strips that cause fewer problems for bicyclists. For example, some state policies require the use of a narrow 12" rumble strip next to the shoulder stripe and discourage use on shoulders narrower than 6 feet.

References: Rumble Strips & Bicycle Wheels, Bicycle Forum, 1987; Survey of State Rumble Strip Policies, Adventure Cycling Assn., 1996

For more information...

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A free sample copy of the latest Bicycle Forum is available for the asking.