



4

DESIGN CONSIDERATIONS

VARIOUS DESIGN CONSIDERATIONS ARE SUMMARIZED ON THE FOLLOWING PAGES IN ORDER TO PROVIDE INITIAL GUIDANCE RELATED TO NON-MOTORIZED PLANNING, DESIGN, AND CONSTRUCTION.

Although the content for the Design Considerations is based on established principles, all mandated design standards, such as those dictated by the American Association of State Highway and Transportation Officials (AASHTO), and other state, county, and local agencies, should be referenced at the time of design as they may change or be updated. This Master Plan provides guidance and examples of several of the “typical” non-motorized systems planned or desired within Oakland County.

Designing and constructing non-motorized systems is a process complicated by existing conditions, public sentiment, ownership and jurisdiction, as well as financing and political will. With nearly every proposed non-motorized project, there will be a number of agencies, user groups, and departments that will need to remain involved during planning, design, and construction. An important first step in designing and implementing a non-motorized system is the involvement of the various stakeholders and agencies with jurisdiction or interest in the project.

4.1 USER GROUPS

The types of non-motorized trail users in Oakland County are diverse, and many times each has their own view of what comprises a great trail design and experience. Various user groups can have differing opinions as to where trails should be located, how they should be designed, and what material they should be constructed of. At times, this can create conflicts, however, where limited resources (in terms of land and financing) must be shared, cooperation and tolerance among user groups is key to continuing to successfully implement the Oak Routes system.

General preferences of primary trail user groups are described. In addition to the various user groups, trail systems are also utilized by people of all ages and abilities, adding to design and maintenance considerations.

MOUNTAIN BIKERS

Desire for solitude and to explore new areas while challenging one’s ability. Natural surface, single direction trails are favored with a variety of obstacles and challenges.

CYCLISTS

Desire safe routes while covering a significant number of miles at a fair pace, well kept roads, minimal and respectful vehicles. Asphalt or compacted gravel/limestone are preferred.

EQUESTRIANS

Routes free from unexpected surprises, variety of scenery and terrain. Natural trail surfaces are preferred with day-use trail lengths of 5 to 25 miles.

WALKERS/RUNNERS

Chance for exercise and the ability to get from one place to another without dealing with a significant amount of vehicular traffic. A network of urban and rural trails that offer access to businesses, schools, neighborhoods, and parks.

INLINE SKATERS

Prefer smooth, asphalt surface that is well-maintained and free of debris. Need adequate width and sight distance due to increased speeds.

CROSS COUNTRY SKIERS

Favor loop trails over linear trails with connector trails and cutoffs to allow different lengths and permit easy return access. Groomed trail lengths ranging from 4 to 8 miles are desired.

CANOE/KAYAKERS

Provide access/launch points at fairly frequent intervals (5 miles). Carefully locate portages to ensure the shortest, easiest route. Include information kiosks and brochures at each access to orient users, provide emergency numbers, etc.

4.2 GENERAL DESIGN GUIDELINES

Typical design principles and strategies that are most likely to apply to situations within Oakland County have been extracted from a variety of references and resources. It's important to note that nearly every design guideline has exceptions, necessitated by local conditions, ownership, jurisdiction, funding source, community desire, user groups accommodated, changing trends, intensity of use, and many other factors.

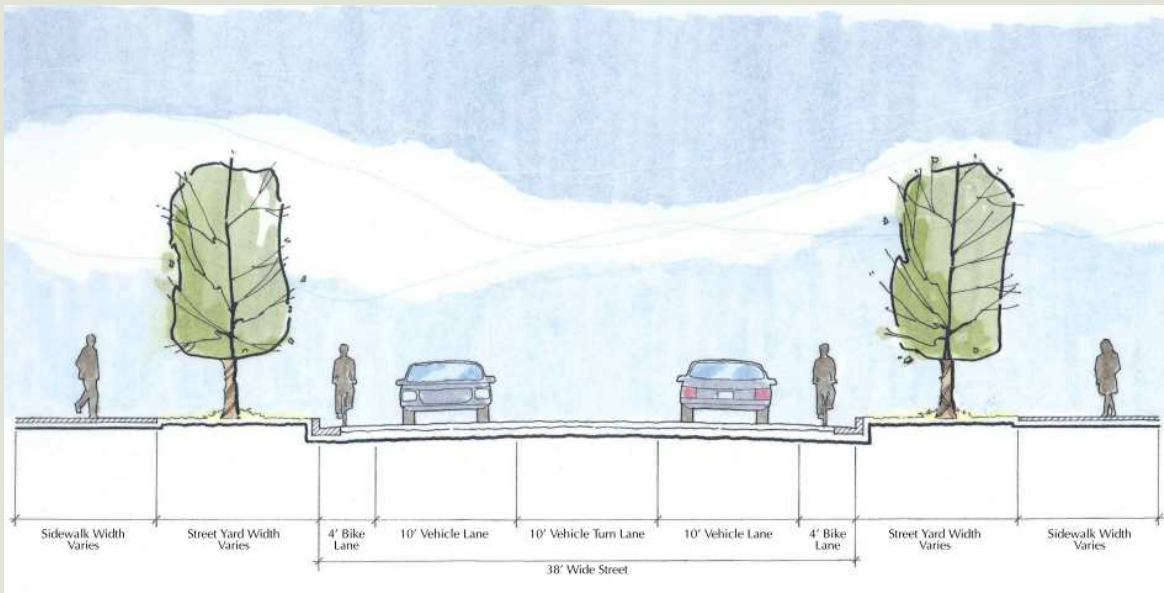
BIKE LANE

Bike lanes can be utilized when it is desirable to delineate available road space for preferential use by bicyclists and motorists, and to provide for more predictable movements by each. As is detailed in the AASHTO standards, bike lane markings can increase a bicyclists' confidence in motorists not straying into their path of travel. Likewise, passing motorists are less likely to swerve to the left out of their lane to avoid bicyclists on their right.

Bike lane striping should not be installed across any pedestrian crosswalks, or railroad crossings, and, in most cases, should not continue through street intersections.

At signalized or stop-controlled intersections with right-turning motor vehicles, the solid bike lane striping to the approach should be replaced with a broken line. The length of the broken line section is usually 50 to 200 feet. If there is a bus stop or high right-turn volume, the 6-inch solid white line should be replaced with a broken line for the length of the bus stop.

Bike lanes sometimes complicate bicycle and motor vehicle turning movements at intersections. Because they encourage bicyclists to keep to the right and motorists to keep to the left, both operators are somewhat discouraged from merging in advance of turns. At intersections, bicyclists proceeding straight through and motorists turning right must cross paths. Striping and signing configurations that encourage crossings in advance of the intersection, in a merging fashion, are preferable to those that force the crossing in the immediate vicinity of the intersection.

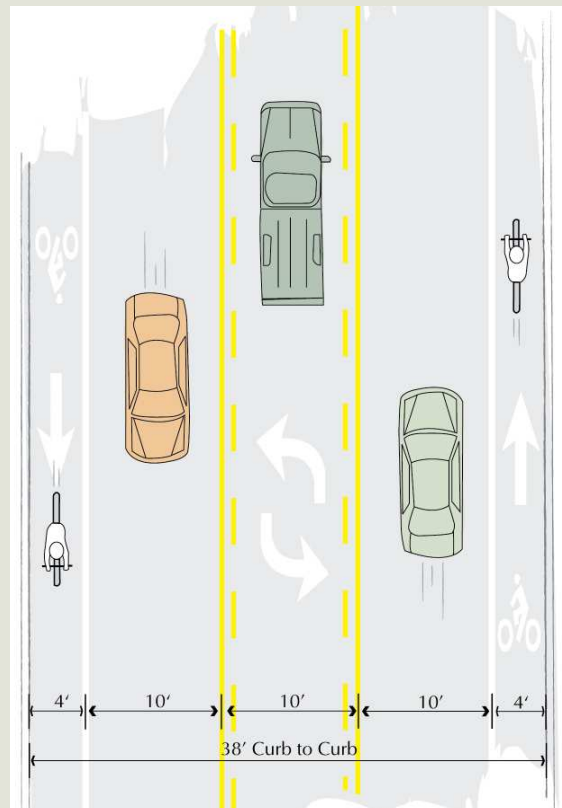


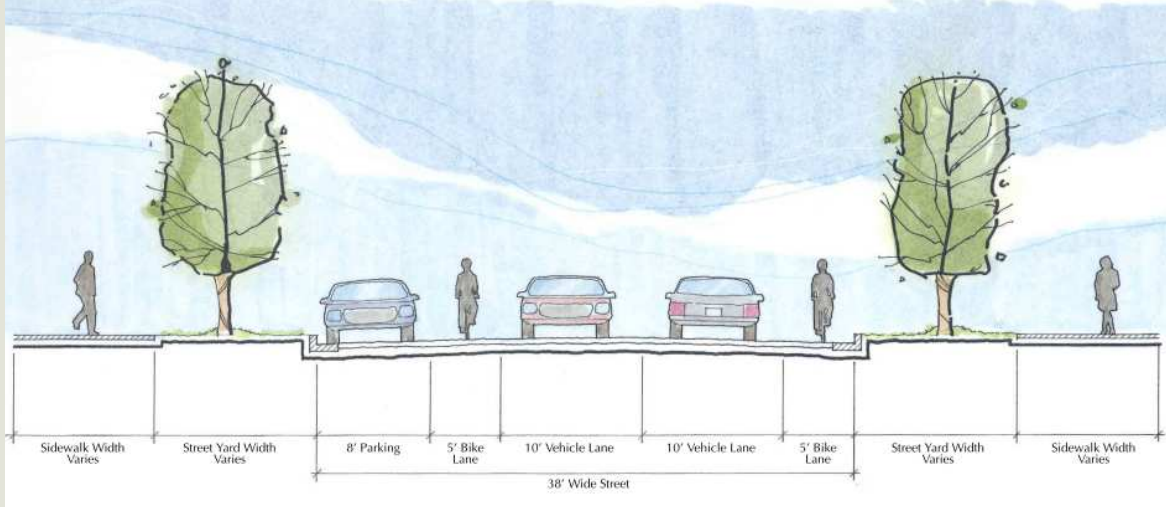
EXAMPLE ON-STREET BIKE LANES

Bike lanes should be one-way facilities and carry bike traffic in the same direction as adjacent motor vehicle traffic.

The recommended width of a bike lane is 4 - 5 feet from the face of a curb to the bike lane stripe. Five feet should be sufficient in cases where a 1-2 foot wide concrete gutter pan exists, given that a minimum of 3 feet of rideable surface is provided. In general, on-road bike lanes greater than 6-feet wide should be avoided as they tend to be used as vehicle driving or parking lanes.

Right-of-way widths, vehicular travel lane widths, etc. will vary depending on jurisdiction, agency, and existing conditions.



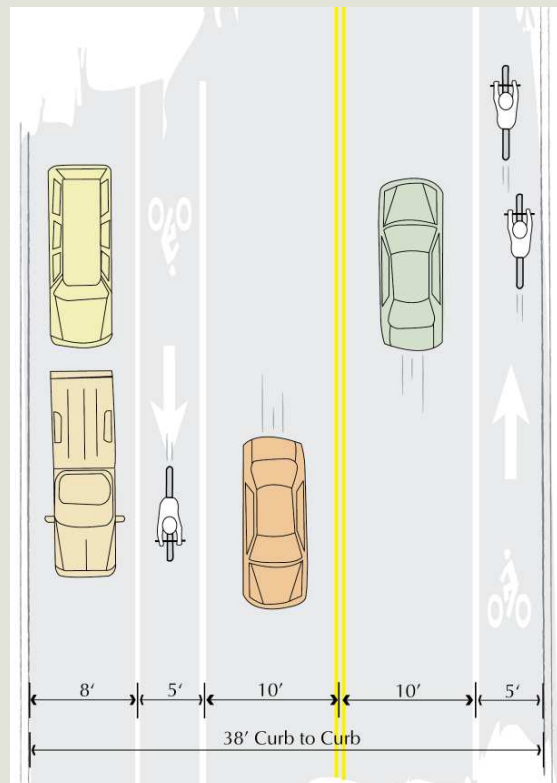


EXAMPLE ON-STREET BIKE LANES WITH PARKING

If parking is permitted, the bike lane should be placed between the parking area and the travel lane and have a minimum width of 5 feet. In no instance should a bike lane be placed between the parking lane and curb.

A bike lane should be delineated from the motor vehicle travel lanes with a 6-inch solid white line. An additional 4-inch solid white line can be placed between the parking lane and the bike lane. This second line will encourage parking closer to the curb, providing added separation from motor vehicles, and where parking turnover or usage is light, can discourage motorists from using the bike lane as a through travel lane.

Right-of-way widths, vehicular travel lane widths, etc. will vary depending on jurisdiction, agency, and existing conditions.



A bike lane should be painted with standard pavement symbols to inform bicyclists and motorists of the presence of the bike lane. The standard pavement symbols are a bicycle symbol and a directional arrow (white and reflectorized 2005 MMUTCD).

Some roads can accommodate bike lanes with the addition of striping and traffic signs, while others require pavement widening and/or reconstruction.

Drainage Inlet Grates

Drainage grates within roadways should be bicycle-safe. Parallel bar drainage grates can trap the front wheel of a bicycle, causing the bicyclist to be pitched over the handlebars. Parallel bar drain grates can be replaced with modern bicycle-safe and hydraulically efficient models, such as the “vane” or “honeycomb” grates.



DRAINAGE GRATE

Inlet grates within roadways are an important consideration when designing on-street non-motorized facilities. --PBIC Image Library

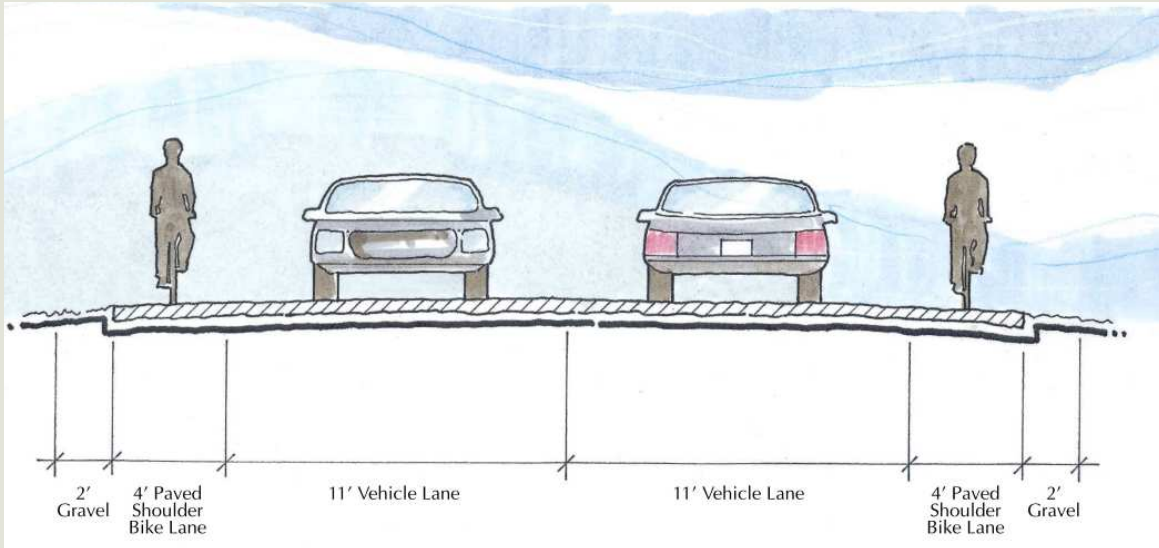
Eliminating drainage grate and utility cover hazards for bicyclists can be accomplished by:¹

- Replacing parallel bar drainage grates with bicycle-safe models.
- Adjusting grates or utility covers that are above or below the level of the surrounding roadway.
- Adopting bicycle-safe design standards for drainage grates on all new construction.
- Adopting bicycle-safe standards for leveling utility covers and drainage grates.
- Encouraging the location of utilities away from the normal path for bicyclists.

PAVED SHOULDER

Adding or improving paved shoulders often is the best way, particularly in more rural areas, to accommodate bicyclists and benefit motor vehicles. Paved shoulders can also extend the service life of the road surface since edge deterioration is significantly reduced. Paved shoulders also provide a break-down area for motor vehicles.

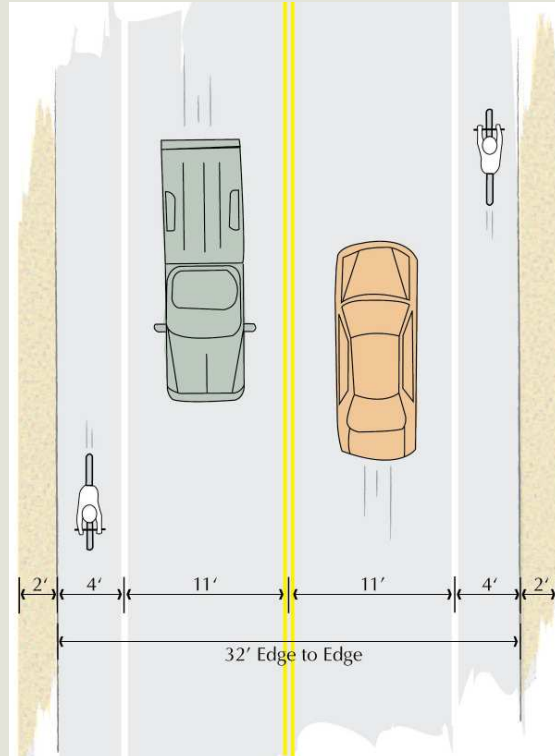
Rumble strips or raised pavement markers are not recommended where shoulders are used by bicyclists unless there is a minimum clear path of 1 foot from the rumble strip to the traveled way, 4 feet from the rumble strip to the outside edge of paved shoulder, or 5 feet to adjacent guardrail, curb or other obstacle. Sufficient right-of-way is needed to accommodate the addition of the paved shoulders and, if necessary, to relocate drainage ditches that run parallel to the roadway. The paved shoulder should be of adequate width, smoothly paved, and have adequate strength and stability to support vehicle loads without rutting.



EXAMPLE PAVED SHOULDERS

AASHTO suggests that paved shoulders be at least 4-feet wide to accommodate bicycle travel. However, where 4-foot widths cannot be achieved, any additional shoulder width is better than none at all. The measurement of “usable” shoulder width should not include the width of a gutter pan. A five-foot shoulder is recommended measured from the face of guardrail, curb or other roadside barriers. Additional shoulder width is desirable if motor vehicle speed exceeds 50 mph, or the percentage of trucks, buses, etc. is high.

Right-of-way widths, vehicular travel lane widths, etc. will vary depending on jurisdiction, agency, and existing conditions.

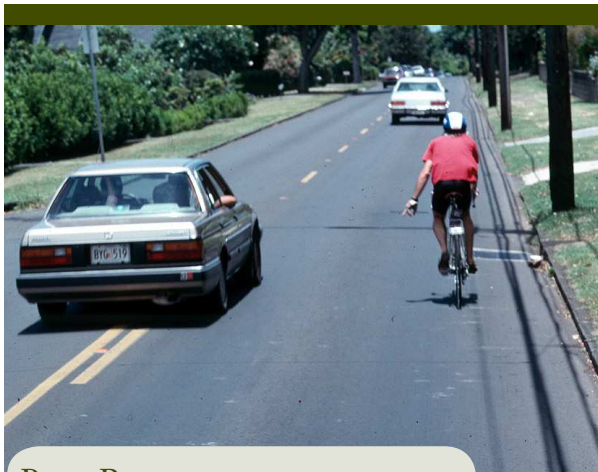


BIKE ROUTE

Signed shared roadways are designated by bike route signs, and serve either to:

- Provide continuity to other bicycle facilities; or,
- Designate preferred routes through high-demand corridors.

Signing of shared (bike and vehicle) roadways for bike routes should indicate to bicyclists that particular advantages exist to using these routes compared with alternative routes. Signing also serves to raise the level of awareness to vehicular drivers that bicyclists are present.



BIKE ROUTES

Designated bike routes are facilities where both bikes and vehicles “share the road” with little treatment other than signage.

--PBIC Image Library

The AASHTO guide recommends considering a number of factors before signing a route:

- The route provides through and direct travel.
- The route connects discontinuous segments of shared use paths or bike lanes.
- Bicyclists are given greater priority on the signed route than on the alternate route.
- Street parking has been removed or limited to provide more width.
- A smooth surface has been provided.

- Regular street sweeping and maintenance is assured.
- Wider curb lanes are provided compared to parallel roads.
- Shoulders are at least four feet wide.

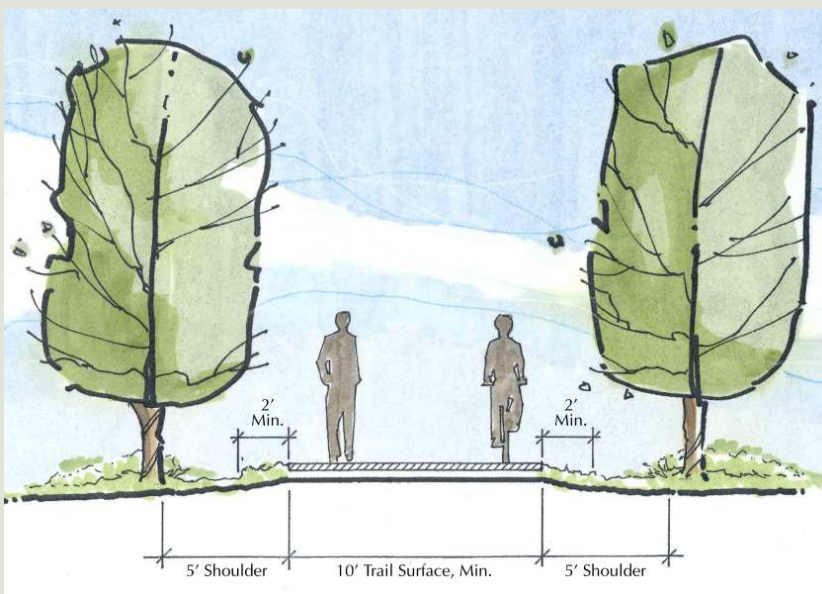
In all cases, shared use roadway signing should include information on distance, direction and destination, and should not end at a barrier such as a major intersection or narrow bridge.

SHARED USE TRAIL

Users of multi-use or shared use trails and trail corridors may include bicyclists, in-line skaters, wheelchair users, runners, pedestrians, and equestrians. These facilities are designed for two-way travel and serve a variety of purposes. Shared use trails can be located along rivers, creeks, railroad and utility rights-of-way, limited access freeways, within parks, etc.

Paths shared by pedestrians and bicyclists need to be designed in accordance with AASHTO design requirements. In particular, the following design considerations should be used in planning for a shared-use facility.

- Horizontal and vertical alignment to ensure clear sight lines.
- Two feet minimum clear zones on each side, to provide stopping and resting areas and allow for passing and widening at curves.
- Avoid view obstructions at edges of the trail by placing signs, poles, utility boxes, waste receptacles, trenches and other elements away from the edge of the path and using low-growing shrubs and groundcovers or high-branching trees.
- Use bicycle speed limits.
- Use delineation and separation treatments such as colored paving, textured paving, pavement markings, and signing.



EXAMPLE SHARED USE TRAILS

The minimum width of a shared path is 10 feet with a 12-foot minimum desirable in more heavily-used sections. Where equestrian accommodations are located within the same trail corridor, the preference is for 5 - 10 feet of buffer between the ped/bike trail and equestrian trail to reduce the potential for bike/equestrian conflicts. If space is limited, equestrians can safely utilize a 4 - 5' wide clear area to one side of an asphalt trail.

- Use directional signing.
- It is recommended to sign and mark a four-inch wide solid yellow line at the center of the path as well as edge lines when curves with restricted sight distances are experienced.
- The desired vertical clearance to obstructions should be a minimum of 8 feet (10-foot is desirable), however, vertical clearance may need to be greater to permit passage of maintenance and emergency vehicles. In undercrossings and tunnels, 10-foot of vertical clearance is desirable.
- Selective clearing and grubbing a width of 5 feet on each side of the trail is desired so as to reduce the amount of vegetation encroachment and minimize the frequency of needed maintenance trimming.

EQUESTRIAN TRAIL

As previously described, equestrian activity and interest in the provision, expansion, and maintenance of trails that permit equestrians exists in Oakland County. Equestrian trails can be provided either as separate trails or as part of a Shared Use Trail provided there is adequate space, as well as appropriate design and signage. The greatest potential for conflict exists between equestrians and bicycles due to the speed of bike travel and the potential for horses to be spooked if “surprised” by another trail user. In terms of specific design, local equestrian groups should be consulted to ensure adequate setbacks, signage, and considerations.

Trails for horses have some flexibility in design. One of the most important considerations for equestrian trails is that the surface minimizes injuries to animals and riders. Avoid using asphalt or concrete as both may injure horses’ hooves. Equestrian requirements should also be



PREFERRED EQUESTRIAN TRAIL GUIDELINES

Trail Width	3 - 4 feet
Clear Zones	3 feet on each side
Vertical Clearance	10 - 12 feet
Surface	Dirt, grass, crushed limestone, wood chips
Desirable Grade	0% - 10%
When Adjacent to Asphalt Trail	4 feet on one side of asphalt permits safe passing

--- Iowa Trails 2000;
Oakland Co
Equestrian Info CD
Dec. '03

considered when designing crossings, bridges and tunnels. In addition, equestrian safety signage and awareness that trails are used by multiple forms of non-motorized transportation including feet, wheels, and horses is essential to improve safety and awareness.

MOUNTAIN BIKE TRAIL

Mountain bike trails are more rugged, off-road facilities with less stringent guidelines. Mountain bike trails are typically “single track”, narrow pathways with hills and sharp turns. Mountain bike trails can vary greatly in difficulty.

In terms of specific design, state and local mountain bike associations and users should be consulted to discuss routes, challenges, obstacles, construction, and maintenance.



PREFERRED MOUNTAIN BIKE TRAIL GUIDELINES

Trail Width	2 - 3 feet
Clear Zones	3 feet
Vertical Clearance	8 - 10 feet
Surface	Compacted earth

--- Iowa Trails 2000

WATER TRAIL

A water trail is a stretch of river, stream, or lake that has been mapped out with the intent to create an educational, scenic, and challenging experience for recreational canoers and kayakers. Designation as a water trail educates users as to the location of navigable waters and natural resources in the County.

A map is a key element to a water trail. The map should identify paddling routes, describe levels of difficulty, identify public lands, warn of hazards and communicate rules and regulations. It is a critical guide to provide information to visitors. To prevent inadvertent use of private lands, a water trail map should clearly and accurately indicate all public lands and rest areas. ²

Guiding Principles for Water Trails³

Water trails follow three guiding principles:

1. Environmental Enhancement

- natural resource conservation, preservation and restoration
- volunteer resource stewardship by the users of the resource
- sensitive, sustainable, no-impact use by individuals and business

2. Community Livability

- citizen's rights of access to public waterways and enjoyment of the resource
- scientific, historical and cultural interpretation, appreciation and education
- citizen involvement, local community involvement, action and pride

3. Personal Wholeness

- health and wellness through outdoor exertion
- character growth - building confidence and self-reliance through outdoor skills
- growth through solitude, observation and communication with the wilderness

Design guidelines for launches that are safe and easy to access for paddlers while accommodating the topography and environmental characteristics of the location have been developed by the National Park Service. (Logical Lasting Launches, 2004)



WATER TRAILS

Designation as a water trail educates users as to the location of navigable waters and natural resources such as the Huron River.

4.3 OTHER DESIGN CONSIDERATIONS

In addition to the general design guidelines, desirable widths, setbacks, and clear zones, there are a variety of elements to take into consideration when designing a non-motorized facility. A few of the more frequently encountered situations and potential solutions are described in greater detail on the following pages.

TYPICAL TRAIL CROSS SECTIONS

When planning, designing, and building a shared use/multi-use trail, there are a wide variety of cross sections that may be utilized. The selected design, material, and construction method is highly dependent on the existing conditions, soils, funding agency, user group(s), etc. A professional engineer or landscape architect should provide assistance in the design of the typical trail cross-section.

The following page provides graphic illustrations of “typical” cross-sections for two different situations. The top graphic illustrates a typical cross-section for the construction of a newly constructed multi-use trail. The cross-section illustrates the use of asphalt, however, limestone or recycled asphalt may be preferred by the trail owner. The bottom two cross-sections illustrate different treatments for an abandoned railbed that has sufficient ballast material in place to be utilized as a base material for new construction. The use of recycled asphalt on a former railbed was utilized by the City of Auburn Hills in 2003 and again by the City of Rochester Hills in 2007. For all trail design and construction, drainage, compaction, and material selection are key design considerations.



NON-MOTORIZED DESIGN RESOURCES

Guide for the Development of Bicycle Facilities, American Association of State Highway and Transportation Officials (AASHTO), 1999.

Michigan Manual on Uniform Traffic Control Devices, 2005 Ed.

Bike Lane Design Guide. Pedestrian and Bicycle Information Center. www.bicyclinginfo.org.

A Policy on Geometric Design of Highways and Streets “Green Book”, AASHTO.

Recommendations for Accessibility Guidelines: Outdoor Developed Areas, US Architectural and Transportation Barriers Compliance Board (US Access Board), 1999.

Designing Sidewalks and Trails for Access: Part II of II: Best Practices Design Guide, Federal Highway Administration (FHWA), 2000.

Selecting Roadway Design Treatments to Accommodate Bicycles, Federal Highway Administration, 1994.

Michigan Non-Motorized Transportation Facilities Best Practices CD, MDOT Intermodal Policy Division, 2002.

Innovative Bicycle Treatments. An Informational Report. Institute of Transportation Engineers. May 2002.

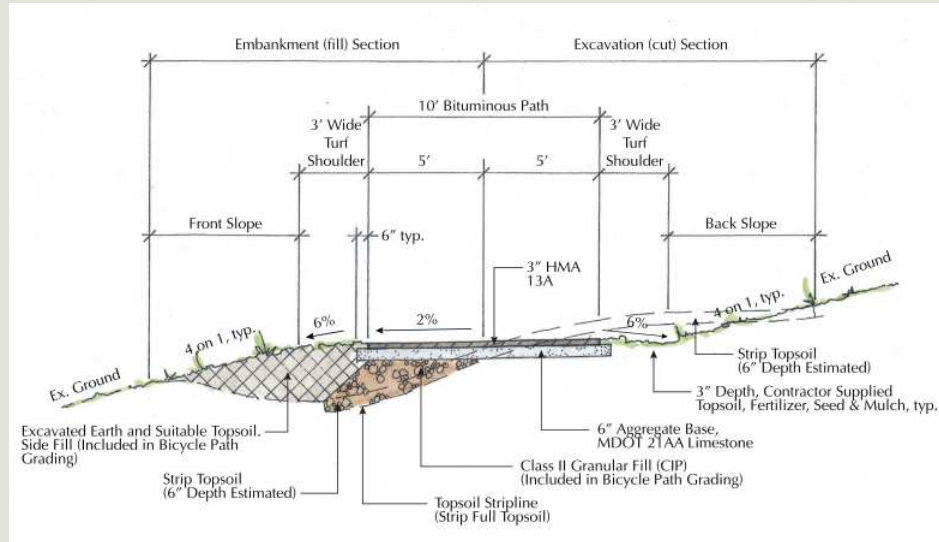
Universal Access to Outdoor Recreation: A Design Guide, USDA Forest Service.

PEDSAFE: Pedestrian Safety Guide and Countermeasure Selection System, FHWA, September 2004.

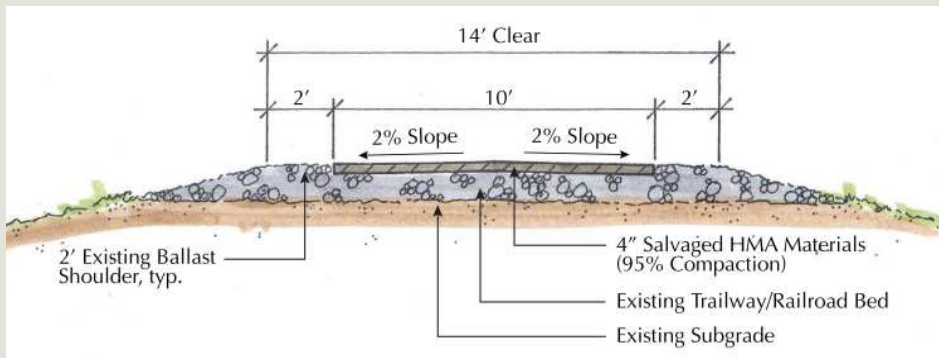
Design Guidelines for Active Michigan Communities, 2006.

Trail Planning, Design, and Development Guidelines, Minnesota DNR, 2006.

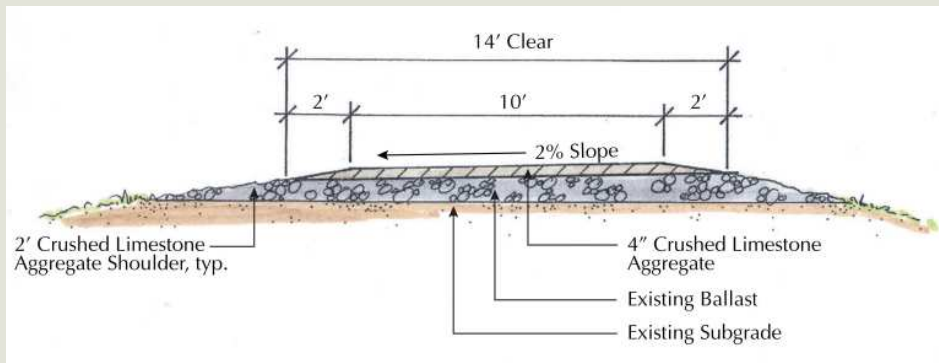
Typical Asphalt Trail Cross-Section
(modified from Huron-Clinton Metroparks)



Typical Recycled Asphalt Trail Cross-Section
(introduced by City of Auburn Hills and cross-section modified from City of Rochester Hills)



Typical Limestone Trail Cross-Section



For railbeds with sufficient ballast remaining

The illustrations above are for planning purposes and discussion only. The cross-section for a shared use trail is heavily dependent on existing conditions including soils, slope, potential user groups, funding agency, environment, etc. A landscape architect or engineer should design a trail cross-section that meets the needs of the trail and will be appropriate for the existing conditions of the land.

UNIVERSAL DESIGN

“Universal design is the design of products and environments to be usable by all people, to the greatest extent possible, without the need for adaptation or specialized design.” (Ron Mace)

Universal design benefits people of all ages and abilities and goes beyond designing and building to only meet ADA requirements. It is recommended to consider universal design when planning, designing, and building non-motorized systems within Oakland County. In addition, many funding agencies and grantors respond more favorably to projects that incorporate universal design.

ROAD CROSSINGS

Each time a non-motorized user must cross a vehicular roadway, a potential conflict is created. Some intersections or crossings prove to be more problematic than others. During design and construction of road intersections and crossings, there are multiple solutions that can be utilized to provide for a friendly environment for non-motorized users. The two most common types of non-motorized crossings are those that occur mid-block and those that occur at existing road intersections.

Mid-Block Crossings

These types of crossings should be far enough away from existing road intersections to be clearly separate from the activity that occurs as motorists approach the intersections. Non-motorized systems should be at 90-degree angle as much as is possible. Other considerations include traffic control devices, sight distance for both non-motorized users and motorists, refuge island use, access control, and pavement markings.



UNIVERSAL ACCESS DESIGN CONSIDERATIONS FOR TRAILS

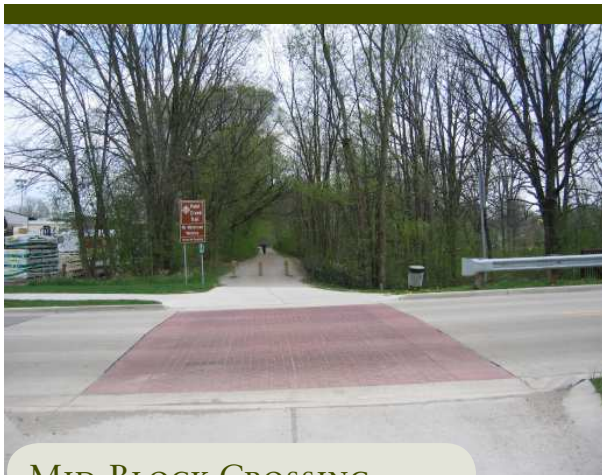
Trails and Paths

- Wider width so two people can walk side by side or people can pass
- Unitary surface like concrete, boardwalk or asphalt, crushed aggregate that has been “stabilized” or natural soils enhanced with soil stabilizers
- Transition plates between trail and pedestrian bridges and decks
- Contrasting color treatment of the surface and textured surface treatments such as brushed concrete at intersections or interpretive stations to cue people who have vision impairments
- Close to level cross slopes and very gentle running slopes, no steep sections, larger level areas at all turns and intersections
- Thoughtfully laid out on the site to maximize the experience with minimal difficulty
- Accessible amenities such as benches, restrooms, drinking fountains, etc.

Boardwalk

- Wider width so two people can walk side by side or people can pass
- Edge treatment to prevent roll/step off
- If side rails, all lowered for easy viewing
- Interpretive information in a variety of alternative formats such as auditory, large print, Braille, pictures, etc.

--- MDNR Michigan Natural Resources Trust Fund 2008 Application Guidelines



MID-BLOCK CROSSING

A road crossing treatment along the Paint Creek Trail utilizes material, color change, and signage to clearly indicate crossing location.

Intersection Crossings

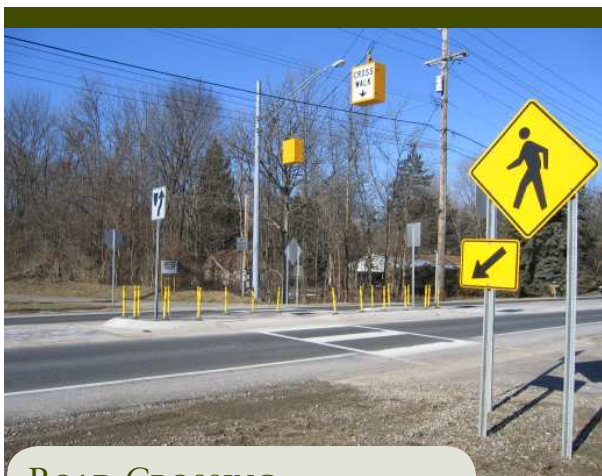
Where non-motorized facilities cross at an existing road intersection, it must be integrated close to the intersection in order to allow motorists and non-motorized users to recognize each other as intersecting traffic.

Traffic control devices and separation distance between the road and path are also important considerations. Clear sight lines are especially important to reduce the possibility of conflicts between trail users and motorists.



CROSSING AT INTERSECTION

Landscaping, lane reduction, marked crosswalks, revised signal timing, and other traffic management devices reduce vehicle speeds and improve pedestrian safety.



ROAD CROSSING

A road crossing treatment along the Clinton River Trail provides a designated crosswalk and refuge area for trail users.

SIGNAGE

Traffic, regulatory, warning and directional signs provide important information to all road users. Care should be given to follow the guidelines and standards in the Manual on Uniform Traffic Control Devices - 2003 Edition, to ensure that the proper messages are given to the users. Also be aware that overuse of signs can breed noncompliance and lead to visually obstructing the most important messages.

BIKE RACKS AND PARKING

Bicycle parking is an important part of non-motorized facilities. Long-term bicycle parking is needed at residences, worksites, schools and transit centers to safely store bicycles for several hours at a time. It must be protected from



BIKE STORAGE

Long-term bicycle parking is ideal at residences, worksites, schools and transit centers to safely store bicycles for several hours at a time. ---PBIC Image Library



BIKE PARKING

Short-term parking that is highly visible and close to entrances is needed at commercial, retail, and recreation centers.

---PBIC Image Library

weather and enclosed in a secure space. This can include lockers, storage rooms and fenced areas with restricted access.

Short-term parking is needed at commercial, retail, and recreation centers. It should be as close to entrances as possible in a highly visible area to discourage theft and vandalism. Ideally, at least some short-term parking should be covered. Bike racks should be well anchored to the ground and located where there is adequate clearance, they are visible, conveniently located, and secure. Bike racks should support the bicycle upright by its frame in two places; prevent the wheel of the bicycle from tipping over; and, enable the frame and one or both wheels to be secure. Vandal-resistant fasteners can be used to anchor a rack in the ground. The rack should provide easy, independent bike access. Inverted



“U” rack elements mounted in a row should be placed on 30” centers to allow for two bicycles to be secured to each rack element.⁴

The location of the rack area in relationship to the building or facility it serves is very important. The best location for a rack area is immediately adjacent to the entrance it serves. Racks should not be placed so that they block the entrance or inhibit pedestrian flow in or out of the building. Racks that are far from the entrance, hard to find, or perceived to be vulnerable to vandalism will not be used by most cyclists.

RAILROAD CROSSINGS

When at grade railroad crossings are necessary, the non-motorized crossing should be at a right angle to the tracks as much as possible by either a separate path or a widened shoulder. The greater the crossing deviates from 90 degrees, the greater the potential for a bicyclist’s front wheel to be trapped in the flangeway, causing loss of steering control. If a right angle crossing is not possible, consideration should be given to the following options:

1. Widening the approaching roadway, bike lane or shoulder will allow the user to cross at approximately 90 degrees without veering into the path of overtaking traffic. The minimum amount of widening should be six feet; however, eight feet is desirable, depending on the amount of available right-of-way. Adequate tapers should be provided.
2. On low-speed, lightly-traveled railroad tracks, commercially available flangeway fillers can eliminate the gap next to the rail. The filler normally fills the gap between the inside railbed and the rail. When a train wheel rolls over it, the flangeway filler compresses. This solution, however, is not acceptable for high-speed rail lines, as the filler will not compress fast enough and the train may derail.
3. In some cases, abandoned tracks can be removed, completely eliminating the problem.
4. If no other solution is available, warning signs and pavement markings should be installed in accordance with the Michigan Manual of Uniform Traffic Control Devices (MMUTCD). A warning sign with an appropriate subpanel message (e.g., Bike Cross at Right Angle) may provide sufficient warning for bicyclists.

SAFETY AND SECURITY

Careful consideration for safety and security is an essential component in the planning and design process for any non-motorized project. Several design guidelines and suggestions have been made within this chapter as they relate to improving and ensuring safety for users. The combination of a multitude of factors assists in developing and maintaining a safe non-mo-



RAILROAD CROSSING

At grade railroad crossings should be at a right angle to the tracks.

torized system. These include elements such as bicycle safe drainage grates, and providing adequate clearance along the edges of trails, paths and bike lanes. Considering pavement textures, sign distances, design speeds, proper striping and signage go a long way to help make non-motorized systems safe. Choosing an appropriate type of trail based on the situation and conditions is also important. For example, when there are a significant amount of curb cuts, it is typically much safer to have on-road bike lanes rather than trails off road, but within the right-of-way.

A security plan to ensure the health/safety of trail users and discourage illegal activities (i.e., the use of the trail by motorized vehicles) is another important consideration for a trail system. In addition to policing, a trail system must be flexibly designed to allow access by emergency vehicles but discourage access by unauthorized vehicles. In the Oakland County Trail/Path Network Study (described in detail earlier in this report), three recommendations for security on the County's non-motorized trail system were offered:

- Local jurisdictions should be responsible for policing and patrolling local trails and the sections of County trails that pass through each municipality;
- OTAC should consider providing County policing on County trails; and,
- OTAC should study the possibility of implementing a volunteer citizen patrol force for County trails.

Finally, proper and regular maintenance of non-motorized systems is essential when it comes to providing a safe and enjoyable system. This topic is addressed below.

MAINTENANCE

Developing maintenance guidelines, standards, and policies will be essential in assuring a safe, well-used non-motorized system. Common maintenance concerns and solutions for on-road bike lanes and off-road multi-use trails are presented below.

On-Road Bike Lanes⁵

- *Surface Problems* - For potholes and other surface irregularities, patch to a high standard, paying particular attention to problems near bicyclists' typical travel alignments. Require other agencies and companies to patch to a similarly high standard; if repairs fail within a year, require remedial action.
- *Debris (sand, gravel, glass, auto parts, etc.) near the right edge of the road* - Sweep close to the right edge. If necessary, use vacuum trucks to remove material, especially if it accumulates adjacent to curbs. Pay particular attention to locations such as underpasses, where changes in lighting conditions can blind bicyclists to surface hazards. For debris or surface irregularities on curves or at intersections, pay special attention to the areas between the typical paths of turning and through motor vehicle traffic; often these fill with debris and are in typical bicyclist trajectories. In addition, areas where debris washes across the paved surface should receive special attention; for example, eliminating the source of the problem by providing better drainage is ultimately a more cost-effective solution than increased sweeping.
- *Chip Seal Gravel* - Many local agencies use chip seal to extend the lives of their roadways. However, the technique, which involves laying down a coating of oil and a layer of crushed rock, often leaves deep piles of gravel just to the right of the typical travel paths of motor vehicles. To reduce the impact on bicyclists, remove excess gravel as soon as possible and suggest alternative routes as detours.
- *Ridges or Cracks* - These should be filled or ground down as needed to reduce the chance of a bicyclist catching a front wheel and crashing. Pay particular attention to ridges or cracks that run parallel to the direction of travel. One common location to check is where a merging lane is provided just beyond an intersection. Because traffic must merge left to continue traveling straight, the bicyclist will be crossing the joint between the merge lane and the through lane at a very shallow angle.
- *On-Road Bicycle Signs* - Special bicycle signs (regulatory, warning, or information) should be maintained in the same way that other roadway signs are. Pay particular attention to bike route signs at decision points, warning signs at special hazard locations, and regulatory signs on popular bike-lane streets.

- *On-Road Bicycle Markings* - Bicycle lane striping should be renewed at the same time that other stripes are painted. The same goes for bike-lane pavement markings. Some markings may suffer from more wear-and-tear than others and deserve special attention.

Off-Road Multi-Use Trails⁶

- *Trail Inspection* - Trails must be inspected on a routine basis. Inspections should include the trail surface, any culverts and water crossings, all amenities, signs, and surrounding vegetation. User safety should always be the primary consideration of any inspection. Potential safety problems should always take precedence when scheduling maintenance. Vandalism left unattended encourages more of the same and should likewise be a high priority for maintenance. Graffiti and “tagging art” should be documented with incident reports and police should be notified, then the graffiti removed or covered as soon as possible. Inspections may also need to be done after severe weather events or storms.
- *Mowing* - Mowing should be done on a regular basis to prevent trails from becoming overgrown. Brush and grass that grow along trails should not be allowed to grow to excessive heights within two feet of the edge of the trail surface.
- *Tree and Brush Pruning* - Pruning is performed for the safety of the trail user and to protect the trail and other assets located along the trail. Proper pruning also allows mowing operators to do a thorough and safe job. Inspectors need to be trained to identify potential hazards and to determine what can be handled by staff and what will require the attention of a private contractor.
- *Leaf and Debris Removal* - Keeping the trail surface clean is one of the most important aspects of trail maintenance. Mud and other sediment should be removed along with fallen leaves and branches to ensure the safety of users and to increase the life expectancy of the trail itself.
- *Snow and Ice Removal* - Decisions should be made early on as to whether trails will be cleared of snow and ice. Snow and ice should be removed, particularly from trails used by children going to and from school sites.
- *Cleaning and Replacement of Culverts* - Culverts often become clogged with trash and debris that must be removed to prevent flooding and undercutting of trail surfaces. Culverts may also need to be upgraded in size or replaced because of deterioration or increased storm water flow due to increased surrounding development.
- *Maintenance of Water Crossings* - Water crossings can be bridges, fair weather crossings, or open box culverts. Debris needs to be removed on an as-needed basis from these structures to allow for free flow of water and to reduce the risk of flooding. These structures need to be inspected on a regular basis for erosion control and action taken accordingly to preserve or replace the structure.
- *Repairs to Signs and Other Amenities* - These repairs may include kiosks, wood and metal signs, benches, etc. These amenities need to be kept in safe and aesthetically pleasing condition. Items that fall into disrepair often become the target of vandals. Repairs should be completed as quickly as possible to discourage vandalism.

4.4 LIABILITY

The operation of publicly accessible parks and recreation facilities, including non-motorized trails, brings legal responsibility for safety and maintenance and exposes the facility owner to liability. Concerns relating to liability are often an obstacle to the development and/or management of non-motorized trails, as public agencies, trail groups, and private landowners fear lawsuits from trail users. However, general legal protections afforded to trail operators significantly reduce liability risks. Coupled with the implementation of sound risk management practices, these legal protections should offset the liability concerns associated with non-motorized trail development and/or management.

Most states have recreational use statutes that substantially limit public landowner liability as long as fees are not charged for facility usage. If not protected by recreational use statutes, public agencies are often protected by governmental immunities. The recreational use statutes also protect private landowners who want to open their land to the public for free. Private landowners who have land adjacent to a trail are protected by trespassing laws.⁷

In Michigan, liability for landowners, tenants or lessees for injuries to persons on property for the purpose of outdoor recreation and trail use is limited by Part 733 of Public Act 451 of 1994 (Natural Resources and Environmental Protection Act). The Section generally states that such trail operators are only liable if the injuries were caused by gross negligence or willful and wanton misconduct on the part of the operator.

Therefore, it is important to implement a sound trail management and risk management

strategy. The following recommended risk management action items can be employed to minimize the possibility of injuries on the non-motorized trail and to protect the trail owner in the event they are sued:⁸

- Design the trail for safety.
- Use prominent signage to warn users of potentially dangerous areas.
- Regularly inspect the trail and correct any unsafe conditions; keep records of inspections and remedial changes.
- Prominently post hours of operation and other rules and regulations, along with emergency contact information.
- Develop procedures for handling medical emergencies.



WARNING SIGNS

Signs alerting users of safety hazards, park rules and guidelines, and emergency information help minimize the threat of liability.

- Incorporate, which may limit the personal liability of principals.
- Purchase insurance or place the trail in public ownership, where it can be covered by the overall insurance policy of the city, county or state.
- Understand the state recreational use statute and other pertinent laws.

Another means of liability protection is insurance. According to a Michigan Trail Maintenance Survey conducted by the Michigan Trails & Greenways Alliance in 2006, approximately two-thirds of trail operator respondents carry liability insurance, with identifiable coverage ranging from \$1 to \$15 million.

Liability issues were addressed in the Oakland County Trail/Path Network Study. The Study concluded that liability for non-motorized trails should remain the responsibility of the local municipalities with jurisdiction, in the same manner that local parks are covered. The Study further recommended that OTAC should study the possibility of assisting local governments as they secure liability insurance.

FOOTNOTES

- ¹ Drainage Grates and Utility Covers. Implementing Bicycle Improvements at the Local Level.
- ² Case Studies of Water Impacts on Rural Communities. L. Johnson, Sept. 2002.
- ³ www.nps.gov.
- ⁴ Bicycle Parking Guidelines. Association of Pedestrian and Bicycle Professionals.
- ⁵ USDOT Federal Highway Administration. Bicycle Facility Maintenance.
- ⁶ Fairfax County, VA, Trail Maintenance Standards.
- ⁷ Rail-trails and Liability: A Primer on Trail-Related Liability Issues & Risk Management Techniques. Rails-to-Trails Conservancy, September 2000.
- ⁸ Liability and Rail-Trails in Pennsylvania. Rails-to-Trails Conservancy, May 2007.

