TYPES OF BIKEWAYS

Bicycles are legally classified as vehicles and are ridden on most public roads in Oregon, which are open to bicycle traffic with a few exceptions (mostly the freeways in the metropolitan area of Portland). Roadways must be designed to allow bicyclists to ride in a manner consistent with the vehicle code.

A bikeway exists on any road that has the appropriate design treatment to accommodate bicyclists, based on motor vehicle traffic volumes and speed. The basic design treatments used for bicycle travel on roads are shared roadway, shoulder bikeway, or bike lane. A shared-use path is a facility separated from the roadway.

Bikeway types (listed with no implied order of preference):

Shared Roadway: Bicyclists and motorists ride in the same travel lanes. There are no specific dimensions for shared roadways. They are usually narrow, so a motorist has to cross over into the adjacent travel lane to pass a cyclist. Shared roadways are common on neighborhood residential streets, on rural roads and low-volume highways.

Bicycle Boulevards: The operation of a local street is modified to function as a through street for bicyclists while maintaining local access for automobiles. Traffic calming devices control traffic speeds and discourage through trips by automobiles. Traffic controls limit conflicts between automobiles and bicyclists and give priority to through bicycle movement.

Shoulder Bikeway: A shoulder bikeway is a paved shoulder that provides a suitable area for bicycling, reducing conflicts with faster moving motor vehicle traffic. Most bicycle travel on the rural state highway system, and on many county roads, is accommodated on shoulder bikeways.

Bike Lane: A portion of the roadway designated for preferential use by bicyclists. Bike lanes are appropriate on busy urban thoroughfares. They may be used on other streets where bicycle travel and demand is substantial. Bike lanes are marked to call attention to their preferential use by bicyclists.

Shared-Use Path (formerly called bike path or multi-use path): A facility separated from motor vehicle traffic by an open space or barrier, either within the roadway right-of-way or within an independent right-of-way. These are typically used by pedestrians, joggers, skaters and bicyclists. Shared-use paths are appropriate in corridors not well served by the street system, to create short cuts that link origin and destination points, and as elements of a community trail plan. See Chapter 7 for design standards.

DESIGN STANDARDS

Shared Roadways

Shared roadways are the most common bikeway type. There are no specific bicycle standards for most shared roadways. Most are fairly narrow; they are simply the roads as constructed. Shared roadways are suitable in urban areas on streets with low motor vehicle speeds or traffic volumes, and on low-volume rural roads and highways. The suitability of a shared roadway decreases as motor vehicle traffic speeds and volumes increase, especially on rural roads with poor sight distance. See matrix for suitability of shared roadways based on motor vehicle speeds, volumes and context.

On rural roads with high bicycle use or demand, roads should include shoulders where motor vehicle speeds and volumes are high.

Many urban local streets carry excessive traffic volumes at speeds higher than they were designed to carry. These can function better as shared roadways if traffic speeds and volumes are reduced. There are many traffic-calming techniques that can make these streets more amenable to bicycling on the road.

On major streets where a bike lane would be more appropriate, but with insufficient width for bike lanes,

wide curb lanes may be provided. This may occur on retrofit projects where there are physical constraints, and all other options have been pursued, such as removing parking or narrowing travel lanes. Wide curb lanes are not particularly attractive to most cyclists; they simply allow a passenger vehicle to pass cyclists within a travel lane, if cyclists are riding far enough to the right. Wide curb lanes may also encourage higher motor vehicle speeds, which is contrary to the expressed desires of many residents; wide lanes should never be used on local residential streets. A wide lane should be 14 to 15 feet wide to allow a passenger car to pass a cyclist in the same lane. Widths 16 feet or greater encourage the undesirable operation of two motor vehicles in one lane. In this situation, a bike lane should be striped.

Bicycle Boulevards

The bicycle boulevard is a refinement of the shared roadway concept; the operation of a local street is modified to function as a through street for bicyclists while maintaining local access for automobiles:

- Traffic-calming devices reduce motor vehicle speeds and through trips;
- Traffic controls limit conflicts between motorists and bicyclists and give priority to through bicyclist movement.

Advantages of Bicycle Boulevards

1. Opportunity: traditional street grids offer local streets that can be converted to bicycle boulevards;
2. Bicycle travel on local streets is compatible with local land uses;
3. Bicycle boulevards may attract cyclists who do not feel comfortable on busy streets and prefer to ride on lower traffic streets;
4. Traffic calming techniques are favored by residents who want slower traffic on neighborhood streets;
5. Bicycle boulevards can improve conditions for pedestrians, with reduced traffic and improved crossings.

Successful bicycle boulevard implementation requires careful planning with residents and businesses to ensure acceptance.

Elements of a Bicycle Boulevard

A successful bike boulevard project requires:

1. Selecting a direct and continuous street, rather than a circuitous route that winds through neighborhoods. Bike boulevards work best on a street grid system;
2. Placing motor vehicle traffic diverters at key intersections to reduce through motor vehicle traffic (diverters are designed to allow through bicyclist movement);
3. Turning stop signs towards intersecting streets, so bicyclists can ride with few interruptions;
4. Placing traffic-calming devices on streets to lower traffic speeds;
5. Placing directional signs to route cyclists to key destinations, to guide cyclists through difficult situations, and to alert motorists of the presence of bicyclists; and
6. Providing crossing improvements where the boulevard crosses high-speed/high-volume streets such as:
    - Signals, where a traffic study has shown that a signal will be safe and effective. To ensure that bicyclists can activate the signal, loop detection should be installed where bicyclists ride, supplemented with a push button that won't require dismounting; or
    - Median refuges, wide enough to provide a refuge (8 feet min) and with an opening wide enough to allow bicyclists to pass through (6 ft). The design should allow bicyclists to see the travel lanes they must cross.

Potential bicycle boulevards implementation problems

Problems can arise under these conditions:

1. If they’re discontinuous and/or located on streets that do not provide direct access to commerce and

other destinations, cyclists will have to negotiate a more hostile street environment to complete portions of their trip. *Bike boulevards must be continuous and close to corridors that serve many destinations; short connections may have to be built to provide continuity and access.*

2. They can cause traffic diversion onto other streets*. Neighborhood concerns must be properly addressed*.
3. Failure to provide adequate crossings of busy streets can result in unsafe conditions for bicyclists*. The planning phase must develop realistic and fundable strategies for crossings of busy streets.*

Shoulder Bikeways

Besides giving an area for cyclists to ride, paved shoulders are provided on rural highways for a variety of safety, operational and maintenance reasons such as:

- Motorists can stop out of traffic in case of emergency, or escape potential crashes;
- Storm water can be discharged farther from the motor vehicle travel lanes.

Width

In general, the shoulder widths recommended for rural highways in the ODOT Highway Design Manual serve bicyclists well; HDM Table 7-2 should be used when determining shoulder widths:

Average Daily Traffic	< 400	400-1500	1500-2000	> 2000
Rural Arterials	4’	6’	6’	8’
Rural Collectors	2’	5’	6’	8’
Rural Local Roads	2’	5’	6’	8’

When providing shoulders for bicycle use, a width of 6 feet is recommended. This allows a cyclist to ride far enough from the edge of pavement to avoid debris, yet far enough from passing vehicles to avoid conflicts. If there are physical width limitations, a minimum 4 feet shoulder may be used.

Shoulders adjacent to a curb face, guardrail or other roadside barriers must be 5 feet wide, as cyclists will “shy” away from a vertical face. Shoulders adjacent to a curb should have 4 feet or pavement from the longitudinal joint at the gutter pan. Curbed sections usually indicate urban conditions, where shoulders should be striped as bike lanes.

On steep uphill grades, it is desirable to maintain a 6-ft (min. 5-ft) shoulder, as cyclists need more space for maneuvering.

Note: many rural roads are 28 feet wide, with fog lines striped at 11 feet from centerline. The remaining 3 feet should not be considered a shoulder bikeway (min. 4 ft); these are shared roadways, as most cyclists will ride on or near the fog line. But they provide an enjoyable riding experience where traffic volumes are low to moderate.

Pavement Design and Construction

Many existing gravel shoulders have sufficient width and base to support shoulder bikeways. Minor excavation and the addition of 3-4" of asphaltic concrete is often enough to provide shoulder bikeways. It is best to widen shoulders prior to pavement overlays for several reasons:

- The base lift of asphalt adds structural strength;
- The final, full width lift is smooth, with no joint;

- The unit costs are less, as greater quantities of materials will be purchased; and

When shoulders are provided as part of new road construction, the pavement structural design should be the same as that of the roadway.

On shoulder-widening projects, there may be some opportunities to reduce costs by building to a lesser thickness if the following conditions are met:

- There are no planned widening projects for the road section in the foreseeable future;
- The existing shoulder and roadbed are stable and there is adequate drainage;
- The existing travel lanes are in stable condition and of adequate width;
- The horizontal curvature is not excessive, so the wheels of large vehicles do not track onto the shoulder; and
- The existing and projected ADT and heavy truck traffic are not excessive.

The thickness of pavement and base material will depend upon local conditions, and engineering judgment should be used. If there are short sections where the travel lanes must be reconstructed or widened, these areas should be constructed to normal full-depth standards.

Joint between the shoulders and the existing roadway

The following techniques should be used to add paved shoulders to roadways where no overlay project is scheduled; in all cases the joint should not land in the shoulder, where bicyclists ride:

1. **Saw Cut**: A saw-cut inside the existing edge of pavement provides the opportunity to construct a good tight joint. This eliminates a ragged joint at the edge of the existing pavement.

2. **Feathering**: Feathering the new asphalt onto existing pavement works if a fine mix is used and the feather does not extend across the area traveled by bicyclists.

3. **Grinder:** Where there is already some shoulder width and thickness available, a pavement grinder can be used to make a clean cut at the edge of travel lane, grind the existing asphalt to the right depth and cast aside the grindings in one operation, with these advantages:
   - Less of the existing pavement is wasted;
   - The existing asphalt acts as a base;
   - There will not be a full-depth joint between the travel lane and the shoulder; and
   - The grindings can be recycled as base for the widened portion.

New asphalt can then be laid across the entire width of the shoulder bikeway with no seams.
In all cases care must be taken to avoid a rough joint in the area where cyclists ride.

Gravel Driveways and Approaches

Wherever a highway is constructed, widened or overlaid, all gravel driveways and approaches should be paved back to prevent loose gravel from spilling onto the shoulders. ODOT standards are 20’ for driveways, 30’ for public road approaches. Where possible, the paved section of the approach to the highway should be sloped downward away from the highway to reduce the loose material tracked into the shoulder.

Bike Lanes

Bike lanes are a portion of the roadway designated for preferential use by bicyclists, and are provided on busy urban and suburban streets (arterials and some major collectors). Motorists are prohibited from using bike lanes for driving and parking, but may use them for emergency avoidance maneuvers or breakdowns. Refer to the DMV “Oregon Motorized Scooter Pocket Bike Guide” for a list of vehicles

allowed and prohibited in bike lanes http://www.oregon.gov/ODOT/DMV/docs/pocketbikeguide.pdf.

Bike lanes may also be provided on rural roadways near urban areas, where there is high potential bicycle use. Bike lanes are generally not recommended on local streets with relatively low traffic volumes and speeds. In this case a shared roadway is the appropriate facility. Urban arterials should have paved shoulders. Bike lanes are created by adding an 8" stripe and stencils.

Bike lanes are generally not recommended on high-speed rural highways: at channelized intersections, the speeds are too high to place a through bike lane to the left of right-turning vehicles (see chapter 4, Intersection Design). Shoulder bikeways, striped with a 4" fog line, are the appropriate facility for these roads.

For planning purposes, refer to the matrix on page xx to determine whether bike lanes are needed or appropriate for any given roadway.

Advantages of bike lanes:

- Bike lanes enable cyclists to ride at a constant speed, even when traffic in the adjacent travel lanes speeds up or slows down, for example at intersections.
- Bike lanes enable bicyclists to position themselves where they will be visible to motorists.
- Bike lanes encourage cyclists to ride on the streets rather than the sidewalks.

Bike lanes are one-way facilities that carry bicycle traffic in the same direction as adjacent motor-vehicle traffic. Bike lanes should always be provided on both sides of a two-way street. One exception may be on steep hills where topographical constraints limit the width to a bike lane on one side only; in these cases, a bike lane in the uphill direction is acceptable as cyclists ride slower uphill. They can ride in a shared lane in the downhill direction.

Width

The standard width of a bike lane is 6 feet, as measured from the center of stripe to the curb or edge of pavement. This width enables cyclists to ride far enough from the curb to avoid debris and drainage grates, yet far enough from other vehicles to avoid conflicts. By riding away from the curb, cyclists are more visible to motorists than when hugging the curb.

The minimum bike lane width is 4 feet on open shoulders, or 5 feet from the face of a curb, guardrail or parked cars. A 4-foot (min 3 feet) wide smooth asphalt surface should be provided to the left of a longitudinal joint between asphalt pavement and the concrete gutter section It is preferable to pave the bike lane to the curb face to avoid a longitudinal joint in the bike lane.

Shoulders wider than 6 feet may be marked as bike lanes in areas of very high use, on high-speed facilities where wider shoulders are warranted, or where they are shared with pedestrians. Care must be taken so they are not mistaken for a motor vehicle lane, turn lane or parking area, with adequate marking or signing.

A bike lane must be marked with pavement stencils and an 8" stripe. This width increases the visual separation of a motor vehicle lane and a bike lane. It is a legal requirement in Oregon (OAR 734-20-055). Refer to page XX for bike lane marking standards.

If on-street parking is permitted, the bike lane must be placed between parking and the travel lane, and be at least 5 feet wide.

Bike Lanes on One-way Streets

Bike lanes on one-way streets should be on the right side of the roadway and should always be provided on both legs of a one-way couplet. The bike lane may be placed on the left of a one-way street if it

decreases the number of conflicts, e.g., those caused by heavy bus traffic or dual right-turn lanes, and if cyclists can safely and conveniently transition in and out of the bike lane on the left.
See Chapter 6 for detailed information on bike lane configuration at intersections.

Contra-Flow Bike Lanes

Though riding against traffic on a one-way street is illegal, many cyclists do this if it avoids circuitous out-of-direction travel; in other instances cyclists are observed riding on the sidewalk against the flow of traffic. Rather than condone or try to prohibit these movements, contra-flow bike lanes on a one-way street should be considered under the following circumstances:

- The contra-flow bike lane provides a substantial savings in out-of-direction travel and/or direct access to high-use destinations.
- Safety is improved because of reduced conflicts compared to the longer route.
- There are few intersecting driveways, alleys or streets on the side of the contra-flow lane.
- Bicyclists can safely and conveniently transition in and out of the bike lane at either end of the section.
- The street is wide enough for a bike lane.

A contra-flow bike lane may also be appropriate on one-way residential streets; this allows cyclists to access the street in both directions.

For a contra-flow bike lane to function well, these features should be incorporated into the design:

- The contra-flow bike lane must be placed on the right side of the street (to motorists' left), separated from on-coming traffic by a double yellow line. This establishes two-way operation for bicyclists, who are riding on the street legally, in a dedicated travel lane.
- Bike lane stencils and arrows must be used to clearly indicate direction of travel, to discourage cyclists from using the bike lane against the normal bicycle flow.
- Intersecting alleys, major driveways and streets must have signs indicating to motorists that they should expect two-way bicycle traffic.

Existing traffic signals should be fitted with special signal heads for bicyclists; this can be activated with either loop detectors or push-buttons (these should be easily reached by bicyclists without having to dismount).

Notes:

1. *Where there is insufficient room to provide a bike lane in each direction, it is not necessary to provide a bike lane in the direction of prevailing traffic; bicyclists and motorists can share the road.*
2. *A contra-flow bike lane should not be installed on a two-way street, even where the travel lanes are separated with a raised median.*

Bike Lanes and Diagonal Parking

Diagonal parking can cause conflicts with bicyclists: drivers backing out have poor visibility of oncoming cyclists and parked cars obscure other vehicles backing out. This is mitigated by the slower traffic speeds found on streets with diagonal parking, and cyclists ride close to the center of the adjacent travel lane. Bike lanes may be placed next to diagonal parking if the following recommendations are implemented:

- The parking bays are long enough to accommodate most vehicles, or long vehicles are prohibited;
- A 4" stripe separates the bike lane from parking; and
- Enforcement actively cites or removes vehicles encroaching into the bike lane.

Consider back-in diagonal parking: Back-in diagonal parking creates conditions advantageous to all traffic, including bicyclists: drivers can pull into the traffic stream with a good view of oncoming traffic, including bicyclists.

Note: approval from the State Traffic Engineer is required for diagonal parking on state highways.

Bike Lanes & Bus Lanes

In most instances, bicycles and buses can share the available road space. On routes heavily traveled by both bicyclists and buses, separation can reduce conflicts (stopped buses hinder bicycle movement and slower moving bicycles hinder moving buses).

Separate bus lanes and bike lanes should be considered to reduce conflicts between passengers and bicyclists, with the bus lane at the curb side. Buses will be passing bicyclists on the right, but the fewer merging and turning movements reduce overall conflicts.

Colored Bike Lanes

Residents often express a desire to narrow a roadway to slow traffic, and so the highway has less of a visual impact on the community. Bike lanes can make a road look wider. To mitigate this effect, bike lanes can be colored so the travel lanes portion of the roadway appears narrower.

There are several methods available for coloring bike lanes, still under evaluation. Best is to pave the bike lanes separately, using dyed asphalt. This requires two passes of the paving machine; care must be taken to avoid a rough joint between the bike lane and the travel lanes. Another method is to cover the bike lane with a tinted slurry seal.

Another method is to extend the concrete gutter pan the full width of the bike lane (5 or 6 feet). The contrast between the concrete and the asphalt roadway makes the latter appear narrower. However, concrete gutter pans can be a very uncomfortable ride for bicyclists if not constructed well: it is imperative the joints be saw-cut, not trowelled, to avoid bumps in the bike lane. When the roadway is resurfaced, the top lift of asphalt must be milled down and removed, so the new surface is flush with the gutter pan.

An 8” white stripe is still necessary to delineate and designate the bike lane. The 8” stripe can straddle the travel lane and bike lane if they are both constructed of the same material. When the bike lane is concrete and the travel lanes are asphalt, the 8” stripe should be wholly contained on the asphalt portion for greater visibility.

Note: approval from the State Traffic Engineer is required for colored bike lanes on state highways.

Alternatives to Bike Lanes on Main Thoroughfares: Guidelines for Providing Bikeways on Parallel Routes

There are occasions when it is infeasible or impractical to provide bike lanes on a busy thoroughfare, or the thoroughfare does not serve the mobility and access needs of bicyclists. The following guidelines should be used to determine if it is more appropriate to provide facilities on a parallel local street:

1. a. Conditions exist such that it is not economically or environmentally feasible to provide adequate bike lanes on the thoroughfare; or
   b. Thoroughfare does not provide adequate access to destination points within reasonable walking distances; or
   c. Bike lanes on the thoroughfare would not be considered safe;
2. Parallel route must provide continuity and convenient access to facilities served by the thoroughfare;
3. Costs to improve parallel route should be no greater than costs to improve the state highway; and
4. Proposed facilities on parallel route must meet state standards for bike lanes.

The above criteria should be satisfied and considered along with other factors when considering parallel routes for the provision of bike access and mobility.

SURFACE TREATMENTS

Pavement condition is important to cyclists, as they ride on lightweight two-wheeled vehicles with narrow, high-pressure tires (necessary for the bicycle's inherent efficiency). Rough surfaces and imperfections such as joints can cause a rider to loose control and fall. Debris such as gravel and glass are also problems, and these can be addressed through maintenance. Adequate drainage is critical to cyclists, as they ride in the area where water ponds when drains get clogged, or surface irregularities prevent water from entering drain grates.

Surface Types

The preferred roadway surfacing for bicycling is a finely graded asphaltic concrete. Rough open-graded mixes are very uncomfortable for cyclists, as they cause vibrations and increased rolling resistance, contributing to greater cyclist fatigue.

Chip Seals

Chip-sealed surfaces are particularly unpleasant to ride on and should be avoided when possible. Where used, chip seals should be limited to the travel lanes on roads and highways with paved shoulders: the shoulders should NOT be chip-sealed. On roads with no shoulders (where cyclists ride in the travel lanes), chip seals should use a fine mix and be covered with a fog or slurry seal.

Drainage Grates

Care must be taken to ensure that drainage grates are bicycle-safe, as required by ORS 810.150. If not, a bicycle wheel may fall into the slots of the grate causing the cyclist to fall. Replacing existing grates (A, B, preferred methods) or welding thin metal straps across the grate, perpendicular to the direction of travel (C, alternate method) is required. These should be checked periodically to ensure that the straps remain in place.

Note: grates with bars perpendicular to the roadway must not be placed at the bottom of curb cuts, as wheelchairs could get caught in the slot.

If a street-surface grate is required for drainage (ODOT types G-1, G-2, CG-1 and CG-2), care must be taken to ensure that the grate is flush with the road surface. Inlets should be raised after a pavement overlay to within 1/4" of the new surface. If this is not possible or practical, the pavement must taper into drainage inlets so they do not cause an abrupt edge at the inlet.

The gap between the grate and the inlet should be kept tight, no more that ¾", to prevent bicycle wheels from getting trapped.

The most effective way to avoid drainage-grate problems is to eliminate them entirely with the use of inlets in the curb face (type CG-3). The cross-slope of the outer 3 feet or so of the bike lane should stay constant, with no exaggerated warping towards the opening. This may require more grates per mile to handle bypass flow; but this is the most bicycle-friendly design.

Another bicycle-friendly option is to ensure the inlet grate is entirely contained in the gutter pan.

Railroad Crossings

Special care must be taken wherever a bikeway intersects railroad tracks. The most important concerns for bicyclists are smoothness, angle of crossing and flange opening.

The combination of smoothness, angle and flange opening create conditions that affect cyclists. By improving smoothness and flange opening, the angle becomes less critical. A common mistake is to overcorrect for the angle, as the resulting sharp reversing curves needed to create a right angle crossing can be more difficult for cyclists to negotiate than the crossing itself. Sometimes all that is needed is a slight widening of the shoulders to allow cyclists to align themselves better at the track crossing.

By statute, all public highway, bikeway, shared-use paths, and sidewalk crossings of a railroad in Oregon are regulated by the Rail Division of the Department of Transportation. The Rail Division must approve, by issuance of an Order, the construction of new crossings or alterations to existing crossings, to include the approaches to these crossings. Crossing Orders specify construction details, installation of traffic control devices, and assign maintenance responsibilities to the road authority and the railroad, who are parties to the application.

Crossing Surface

The four most commonly used materials, in descending order of preference, are:

- Concrete: Concrete performs best under wet conditions and, when laid with precision, provides a smooth ride.
- Rubber: Rubber provides a ridable crossing when new, but they are slippery when wet and degrade over time.
- Asphalt: asphalt pavement must be maintained in order to prevent a ridge buildup next to the rails.
- Timber: Timbers wear down rapidly and are slippery when wet.

Crossing Angle

The risk of a fall is kept to a minimum where the roadway (or bikeway portion of the roadway) crosses the tracks at 90°. If the skew angle is less than 45°, special attention should be given to the bikeway alignment to improve the angle of approach, preferably to 60° or greater, so cyclists can avoid catching their wheels in the flange and losing their balance. OAR 741-115-0070 specifies regulations for bicycle lanes and multi-use paths that cross railroad tracks at the same grade. Under OAR 741-115-0070 (3), an engineering study is required whenever bicycle lanes or multi-use paths are proposed to cross railroad tracks at 59 degrees or less.

Efforts to create a right-angle crossing at a severe skew can have unintended consequences: the reversing curves required for a right-angle approach can create other problems for cyclists. It is often best to widen the roadway, shoulder or bike lane to allow cyclists to choose the path that suits their needs the best. On extremely skewed crossings (30° or less), it may be impracticable to widen the shoulders enough to allow for 90° crossing; widening to allow 60° crossing or better is often sufficient.

Creating a separated path to angle the bikeway at 90° degrees is feasible, but special care should be taken to maintain the path regularly.

Flange Opening

The open flange area between the rail and the roadway surface can cause problems for cyclists, since it can catch a bicycle wheel, causing the rider to fall. Flange width must be kept to a minimum.

Rumble Strips

Rumble strips are provided to alert motorists that they are wandering off the roadway. They are most common on long sections of straight freeways in rural settings, but are also used on some two-lane undivided highways. Rumble strips should not extend across the entire width of the shoulder, because they create an unridable surface for bicyclists. Rumble strips should not be used if they leave less than 4 feet of rideable space.

A more bicycle-friendly rumble strip design is 16" grooves cut into the shoulder, 6" from the fog line. On an 8-foot shoulder, this leaves 6 feet of usable shoulder for bicyclists. Rumble strips can also be cut directly at the fog line, leaving the entire shoulder available for cycling.

Another alternative is the use of profiled fog lines. They are highly retro-reflective, alert drivers when they've strayed from the travel way, and leave the entire width of the shoulder available for bicycling. Should a bicyclist need to cross the fog line occasionally, the bumps are not too severe. They should not

be used on narrow shoulders (under 4') as they will be located in the area where cyclists prefer to ride.

For the most up-to-date information on rumble strip placement, design and alternatives, refer to the ODOT Traffic Manual and standard drawings.

SIGNING AND MARKING OF BIKEWAYS

Introduction

Signing and marking of bikeways must be uniform and consistent for them to command the respect of the public and provide safety to users. Signing and marking must be warranted by use and need. Signing and markings of bikeways on the state highway system should conform to the recommendations of this section. To provide uniformity and continuity, cities and counties are encouraged to adopt these standards. Consult the MUTCD, the ODOT Traffic Manual and the ODOT Traffic Line manual for up-to-date details and dimensions.

Well-designed roads make it clear to users how to proceed, and require very little signing. Conversely, an over-abundance of warning and regulatory signs may indicate a failure to have addressed problems. The attention of drivers and bicyclists should be on the road and other users, not on signs on the side of the road. Over-signing degrades the usefulness of signs, causes distractions, creates a cluttered effect, is ineffective and wastes resources.

Language Barriers: Many people don't read English. The message conveyed by signs should be easily understandable by all roadway users: symbols are preferable to text.
Sign Placement: Signs placed adjacent to roadways must conform to adopted standards for clearance and breakaway posts.

Shared Roadways

Signing

In general, no signs are required for shared roadways. Bicyclists should be expected on all urban local streets, which are mostly shared roadways.

On narrow rural roads commonly used by cyclists, it may be helpful to install bike warning signs (W11-1) with the supplemental plaque ON ROADWAY or ON BRIDGE ROADWAY, where there is insufficient shoulder width for a significant distance. Signs should be placed in advance of the roadway condition. If the roadway condition is continuous, an additional rider "NEXT XX MILES" may be used.

Directional signs are useful where bicyclists are directed to follow a routing that differs from the routing recommended for motorists. The routing must have obvious advantages over other routes, such as for safety, convenience, or because bicyclists are banned from a section of roadway. ODOT recommends against the use of D11-1 BIKE ROUTE signs with no indication as to where cyclists are being directed. Cyclists will usually ignore these signs if they send them out of direction.

ODOT has developed a special bicyclist destination sign, OBD11-1, that incorporates the bicycle symbol, a destination and a directional arrow to provide guidance.

Bike Boulevards

No signing standards have yet been adopted specifically for bike boulevards. OBD11-1 signs should be adequate to convey information to cyclists. Portland has developed a bike boulevard sign that incorporates information such as the name of the bike boulevard, destinations, and time and distance to destinations.

Shoulder Bikeways

Signing

In general, no signs are required for shoulder bikeways. Bicyclists riding on shoulder bikeways are well served with adequate width and smooth pavement.

Marking

A normal 4" wide fog line stripe is used on shoulder bikeways.

Bike Lanes

Bike Lane Designation

Bike lanes are officially designated to create an exclusive or preferential travel lane for bicyclists with the following markings:

- An 8" white stripe; and
- Bicycle symbol and directional arrow stencils.

Where a bike lane is next to parking, parking should be defined by parking space markings or a solid 4" stripe. Optional NO PARKING signs (R7-9 and R7-9a) may be installed if problems with parked cars occur; in many jurisdictions, painting curbs yellow indicates that parking is prohibited. Where the bike lane ends, sign OBW1-9 may be used where cyclists enter the motor vehicle travel lanes.

Stencil Placement

Stencils should be placed after most intersections; this alerts drivers and bicyclists entering the roadway of the exclusive nature of the bike lanes. Stencils should be placed after every intersection where a parking lane is placed between the bike lane and the curb.

Supplementary stencils may also be placed at the end of a block, to warn cyclists not to enter a bike lane against traffic.

Additional stencils may be placed on long sections of roadway with no intersections. A rule of thumb for appropriate spacing is: multiply designated travel speed by 40. For example, in a 35 MPH speed zone, stencils may be placed approximately every 1400 feet.

Care must be taken to avoid placing stencils where motor vehicles are expected to cross a bike lane, such as driveways and the area immediately after an intersection; this will help reduce maintenance costs, as vehicles don't drive over the stencils repeatedly.

Intersections

Bike lanes should be striped to a marked crosswalk or a point where turning vehicles would normally cross them. Marking the bike lane with 8” wide dotted lines prior to the intersection indicates a potential conflict area to drivers and bicyclists, as some drivers pull over to the right to make a right turn. The bike lane should resume at the other side of the intersection. Bike lanes are not normally striped through intersections; however, it may be appropriate to do so where extra guidance is needed; in this case, they may be marked with 8” wide dotted lines, to guide bicyclists through a long undefined area.

Right Turn Lanes at Intersections

The through bike lane to the left of a right-turn lane must be striped with two 8" stripes and connected to the preceding bike lane with a dotted line (8" x 2’ on 8’ centers [6’ gaps]). This lets turning motorists cross the bike lane. A stencil must be placed at the beginning of the through bike lane.

Sign R4-4, BEGIN RIGHT TURN LANE, YIELD TO BIKES, may be placed at the beginning of the taper in areas where a through bike lane may not be expected. For example, on sections of roadway where bike

lanes have been added where there weren't any previously.

Reflectors

Reflectors and raised markings in bike lanes are discouraged as they can deflect a bicycle wheel, causing the cyclist to lose control. If pavement markers are needed for motorists, they should be installed on the motorist's side of the bike lane stripe, and have a beveled front edge.

Special use signs

Railroad Crossing

Where a shared roadway, shoulder bikeway, bike lane or shared-use path crosses a railway at an unfavorable crossing angle, or if the crossing surface is rough or slippery, warning signs OBW8-19R and OBW8-19L should be used.

Sidewalk Users

Where bicyclists are allowed to use sidewalks, and the sidewalks are too narrow for safe riding (usually on a bridge), sign OBR10-13 may be used to encourage cyclists to walk.

Bicycle Use of Push-Buttons

Where it is recommended that bicyclists use a push-button to cross an intersection (usually where a shared-use path crosses a roadway at a signalized intersection), the following signs should be used.

Bike Stencils at Intersections

Many traffic lights are actuated by wire loops placed under the surface of the roadway. An electrical current passes through these loops, creating an electro-magnetic field. When a motor vehicle stops over them, the vehicle metal disrupts the electro-magnetic field, sending a signal to the traffic controller that a vehicle is waiting for the light turn. Many bicycles don’t contain enough conductive metal (steel or aluminum) to trigger the signal, causing frustration.

To help bicyclists trigger a signal, stencils placed over the most sensitive area of the loop detector indicate to cyclists where to place their bicycles for maximum sensitivity.

Tunnels & Bridges

Where substantial bicycle traffic is expected in a narrow tunnel, the signs OBR10-10 and OBW1-8 may be used; it can be adapted for use on long narrow bridges, especially where there are sight distance constraints.

The push-button sign should be placed at a location that allows cyclists to proceed at a normal speed and enter the tunnel as lights begin to flash. The duration timing of the flashing lights should be based on normal bicycle travel speed, plus an extra margin of safety (though leaving the flashing lights on for too long may render them ineffective if motorists enter the tunnel and cyclists are no longer present).

Touring Routes

Special signs may be created to guide cyclists along touring routes, such as the Oregon Coast Bike Route or Willamette Valley Bikeway signs:

These signs should be used sparingly, mainly at intersections (with right or left run arrows) to guide cyclists along the route.

Bicycle Races

For a complete description of measures to be taken for bicycle racing, please consult the "Guidelines for Administration of Bicycle Racing on Oregon Roads." Consult the appropriate road jurisdictions, especially

if a race is planned over several jurisdictions.

INNOVATIVE DESIGNS

These concepts are presented as information, to help ODOT, cities and counties to come up with new solutions to common problems.

RAISED BIKE LANES

Normally, bike lanes are an integral portion of the roadway and are delineated from motor vehicle lanes with painted stripes. Though most bicyclists ride on these facilities comfortably, others prefer more positive separation; but separated paths are not practical in most urban settings.

Raised bike lanes incorporate the convenience of riding on the street with some physical separation, with these advantages:

- Motorists know they are straying from the travel way when they feel the slight bump created by the curb;
- Mountable curb allows motorists to make turns into and out of driveways;
- Mountable curb allows cyclists to enter or leave the bike lane (for turning left, overtaking another cyclist etc.); and
- Novice bicyclists are more likely to ride in the bike lane, leaving the sidewalk for pedestrians.

An effective design provides a gentle (4:1) slope, with no lip, so a bicycle tire is not caught during crossing maneuvers. Using concrete curbs in an asphalt roadway increases the visibility of the bike lane stripe. The raised bike lane drains to the roadway, not the curb or sidewalk; this requires drainage inlets in the travel lanes. The raised bike lane is dropped prior to intersections, where the roadway surfacing is uniform. Raised bike lanes cost more to construct, as the travel lanes and bike lanes must be paved separately and a narrow paving machine is required for paving the bike lane. The additional costs may be mitigated by reduced long-term maintenance costs:

- The bike lane portion receives less wear and tear than the motor vehicle travel lanes;
- The bike lane accumulates less debris, requiring less frequent sweeping; and
- The bike lane stripe doesn't need frequent repainting.

Notes:

- *On roads with parking, the bike lane should be placed between the travel lanes and parked cars, elevating the parking lane.*
- *Raised bike lanes must include the standard stencils and 8" white stripe. For better visibility of the 8" stripe, it should be placed entirely on the lower surface.*

SHARROWS

Sharrows, also known as "shared lane markings," are a new form of pavement marking approved for inclusion in next MUTCD draft. They are primarily intended for use on narrow, low-speed roadways with on-street parking. Their primary purposes are to:

- Encourage bicyclists to ride away from the door zone
- Encourage drivers to pass cyclists with adequate space

Sharrows should be used on streets with high bicycle demand, and where there is potential competition for the use of a narrow lane. Early observations indicate that bicyclists ride further from parked cars (reducing their risk of being hit by an opening car door), and drivers pass bicyclists with more clearance, often moving completely into the adjacent lane on multi-lane roads.

PRACTICES TO BE AVOIDED

The Oregon Department of Transportation has 35 years of experience designing bikeways, and has also learned from local city and county experiences; some practices have proven to be poor ones.

Sidewalk Bikeways

Some early bikeway plans designated sidewalks for bicyclist use. While in rare instances this may be necessary (such as on narrow bridges), or acceptable for use by children, in most cases it should be avoided. Most cities ban bicyclists from the sidewalks in business districts.

Cyclists are safer when they function on the roadway as vehicle operators, rather than as pedestrians. Sidewalks are not suited for cycling for several reasons:

- Cyclists face conflicts with pedestrians;
- There are often utility poles, sign posts, benches, etc. placed in sidewalks;
- Bicyclists face conflicts with motor vehicles at driveways, alleys and intersections: a cyclist on a sidewalk is generally not visible to motorists and emerges unexpectedly. This is especially true of cyclists who ride against the flow of adjacent motor vehicle traffic: drivers do not expect cyclists coming from this direction;
- Bicyclists are put into awkward situations at intersections where they cannot safely act like a vehicle operator but are not in the pedestrian flow either, creating confusion for other road users.

Where width constraints do not leave room for bikeways, solutions should be sought to accommodate both modes (e.g. narrowing travel lanes). In some urban situations, preference may be given to accommodating pedestrians. Sidewalks should not be signed for bicycle use - the choice should be left to the users.

There are circumstances where it may be advisable to allow bicyclists to ride on a sidewalk: on long narrow bridges with high traffic volumes. This can help cyclists if the bridge sidewalks are wide enough for bicycle use (minimum 5 ft). Ramps should be built to provide cyclists access to the bridge sidewalks; signs should be placed advising cyclists to walk their bikes on the sidewalk if it’s too narrow for riding.

Extruded Curbs

These create an undesirable condition when used to separate motor vehicles from cyclists: cyclists may hit the curb, lose control and fall onto the roadway. At night, the curbs cast shadows on the lane, reducing the bicyclist's visibility of the surface. Extruded curbs are often hit by motor vehicles, causing them to break and scatter loose pieces onto the surface. They make bikeways difficult to maintain as debris accumulates.

Reflectors & Raised Pavement Markers

These can deflect a bicycle wheel, causing cyclists to lose control. If pavement markers are needed for motorists, they should be installed on the motorist's side of the stripe, and have a beveled front edge.

Two-way Bike Lane

This creates a dangerous condition for bicyclists. It encourages riding against traffic, causing several problems:

- At intersections and driveways, some riders approach from a direction where they are not visible to motorists;
- Bicyclists closest to the motor vehicle lane have opposing motor vehicle traffic on one side and opposing bicycle traffic on the other; and
- Bicyclists are put into awkward positions when transitioning back to standard bikeways.

A two-way bike lane on one side of the road is sometimes proposed in areas where there is insufficient room for two minimum width bike lanes. If constraints allow widening on only one side of the road, the centerline stripe may be shifted to allow for adequate travel lanes and bike lanes on both sides.

Continuous Right-Turn Lanes

This configuration is difficult for cyclists: riding against the curb puts them in conflict with right-turning cars, but riding to the left of the continuous right-turn lane puts them in conflict with cars merging in and out of the right-turn lane.

Continuous right-turn lanes are rarely created intentionally; they happen as development occurs, and a deceleration lane is provided for each new access. If the access points are too close together, the deceleration lanes merge into one continuous lane. The best solution is to implement an access management strategy to consolidate accesses and add short deceleration lanes only where warranted. Then a continuous through bike lane can be striped to the left of the deceleration lanes.

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