



Improving Bicycle Safety in Portland

OCTOBER 26, 2007

Introduction to bicycle safety

The public expects and demands that the transportation system be safe for all users. Improving bicycle safety can help to alleviate a variety of health, economic, and neighborhood livability issues for travelers. Fatalities and injuries from motor vehicle crashes are a major public health problem. According to the Federal Highway Administration, if we are successful in improving the real and perceived safety of bicyclists, we will also increase use.

Bicyclists and pedestrians are frequently combined in the category of non-motorized transportation. Although both are integral parts of Portland Transportation's mission and critical elements of the transportation system, they are very different in terms of demographics, sources of injuries, and legal responsibilities. Bicyclists travel at three to five times the speed of pedestrians, and are vehicle operators both in terms of physics and according to traffic laws.

Traffic safety studies and our own experience have demonstrated that more bicycling activity in and of itself creates safer conditions. This is usually attributed to the increased opportunities it affords motorists and cyclists to learn to operate around each other and share the road.

Using an integrated approach of education, enforcement, and engineering strategies, Portland Transportation has programs to improve bicycle safety.

Portland's bicycle crash rate is decreasing

Over half of Portland residents limit their bicycling due to traffic safety concerns. Between 1990-2000, 10% more Portlanders were killed in auto-related crashes than were murdered, and 40% more Portlanders were injured in auto-related crashes than were injured from assaults. From 1985-2000, one out of every three traffic fatalities was a bicyclist or a pedestrian.

So far in 2007, Portland has seen 6 bicycle fatalities – the highest number of bicycle fatalities on record for one year. Reported crashes will not be received until next year from the Oregon Department of Transportation (ODOT). In 2006, Portland saw zero bicycle fatalities and 203 reported bicycle crashes.

A challenge in talking about crash data relevant to bicycles is only about 10-20% of bicycle crashes gets reported – not a problem specific to Portland. The more severe the crash, the more likely it is to be reported. Portland Transportation is exploring ways to strengthen both the amount of data received and the techniques to analyze the data.

Despite this year's surprising fatalities, bicycling in Portland has become safer. With reported crashes increasing only slightly and ridership increasing exponentially, our bicycle crash rate is decreasing. Data analysis shows that operating either a motor vehicle or a bicycle in Portland are both relatively safe ways to travel.



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We're on the Web!

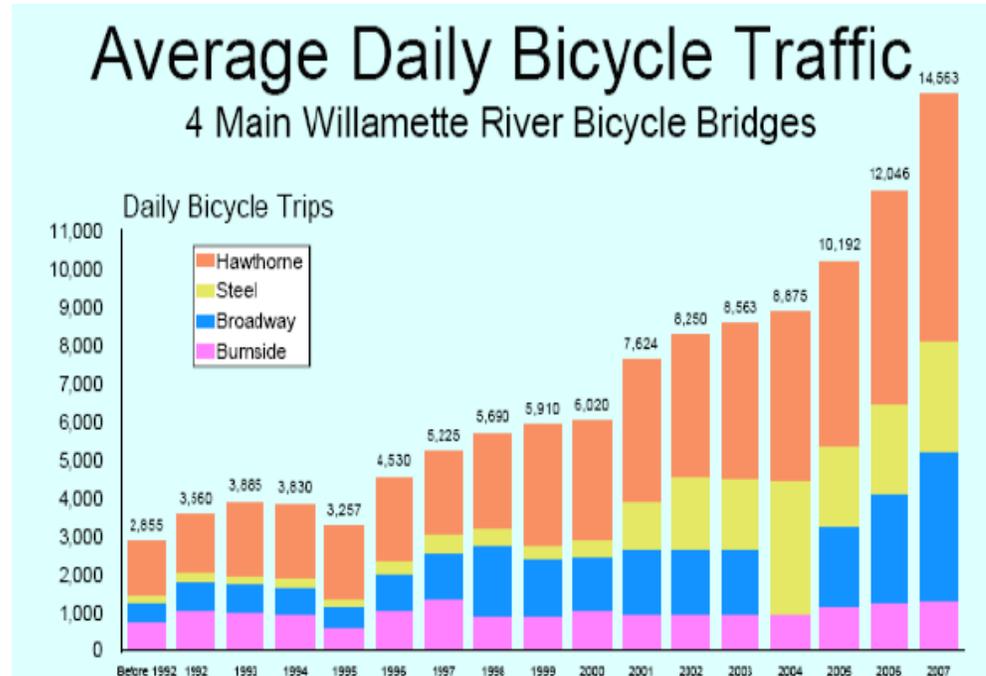
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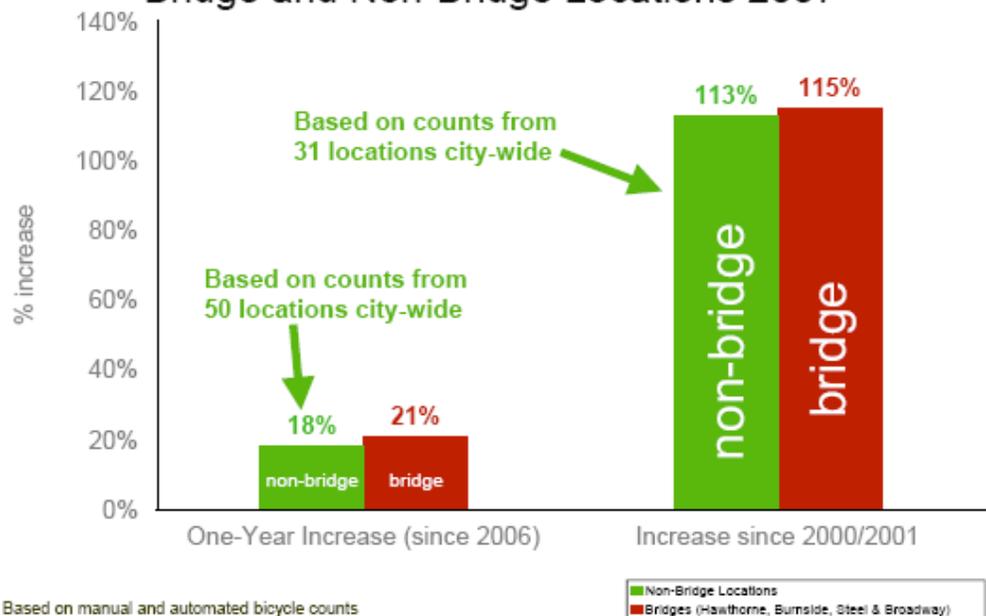
Portland's bicycle ridership is increasing

The primary gauge for measuring bicycle use in Portland is the number of bicycle trips across the four bicycle-friendly bridges over the Willamette River (Hawthorne, Burnside, Steel, and Broadway bridges). The number of cyclists crossing these four bridges has soared, increasing 410% since 1991, more than 115% since 2001, and an additional 21% since 2006. Today, cyclists take more than 14,563 daily trips across the Willamette River to travel between Portland's east and west sides.



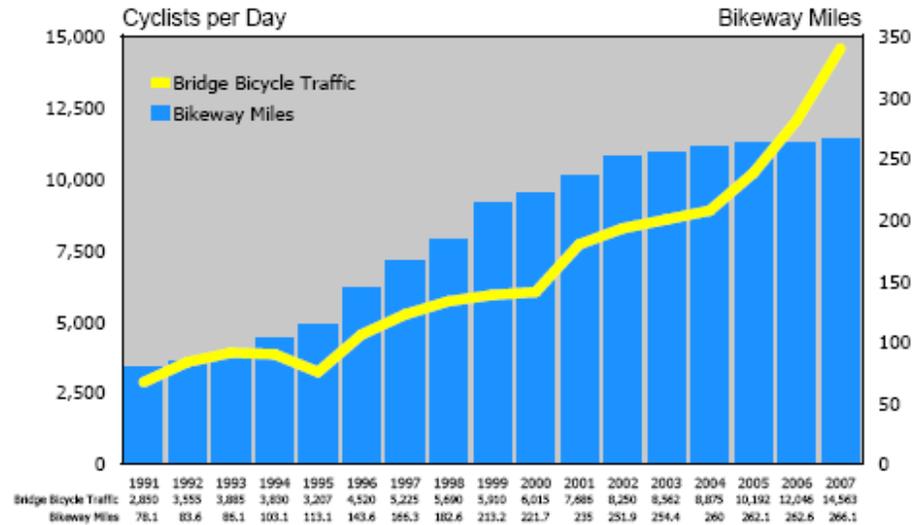
The increase of bicycle traffic on these bridges is consistent with the growth in bicycle use throughout Portland. Comparisons at 50 non-bridge locations citywide show an 18% increase in bicycle use since 2006.

Increase in Bicycle Traffic Bridge and Non-Bridge Locations 2007





Combined Bicycle Traffic over Four Main Portland Bicycle Bridges Juxtaposed with Bikeway Miles



From hose counts and extrapolated from peak period counts

Portland's Bikeway Network increased 240% between 1991 and 2007. During that same period, the number of bicycle riders daily crossing the four main bicycle bridges in Portland increased 410%. This increase was especially noticeable on the Broadway, Hawthorne, and Steel Bridges, where combined daily ridership went from 2,115 in 1991 to 13,238 in 2007. During this period, the bikeway network feeding these bridges was greatly improved, as were facilities on the bridges themselves.



Understanding crash data

When a crash occurs, there are multiple factors that influenced the event. By analyzing crashes that result in injury or fatality, a better understanding of where and why crashes occur will inform policies and actions that might result in facility improvements, enhanced services, or policy changes.

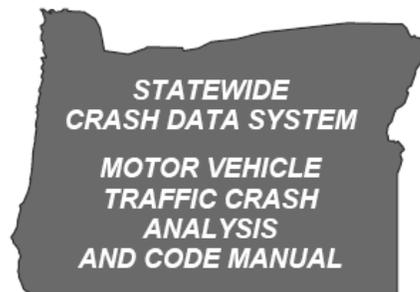
The more severe the crash, the more likely it is to be reported. Crashes that result in a trauma tend to receive more thorough police investigations, resulting in more detail about the conditions and factors causing the crash.

Bicycle crash reporting procedures are not uniform, creating several challenges to understanding bicycle crashes.

One of the biggest challenges to understanding crash data provided through the **Statewide Crash Data System** is that the data on cause of crash often lack enough detail to be able to understand all the factors that contributed to the crash. Reconstructing these events can be difficult or impossible because the records do not include a diagram or drawing of the event.

Sources of crash data

Bicycle safety on Portland's roads can be estimated by the data collected on frequency, causes, injury severity, and factors of bicycle crashes.



Crash data sources include:

- ◆ Police Crash Investigation Reports
- ◆ Pedestrian and Bicycle Crash Analysis Tool (PBCAT)
- ◆ ODOT Statewide Crash Data System
- ◆ Oregon Trauma Registry

Police Crash Investigation Reports provide a detailed description of the crash level events and the factors that contributed to the crash. The current protocol requires that these reports are submitted to the Department of Motor Vehicles and incorporated in the Statewide Crash Data System.

The **Pedestrian and Bicycle Crash Analysis Tool (PBCAT)** is a crash typing software offered by bicyclinginfo.org that is used to define the sequence of events that resulted in the crashes where police investigation reports are available.

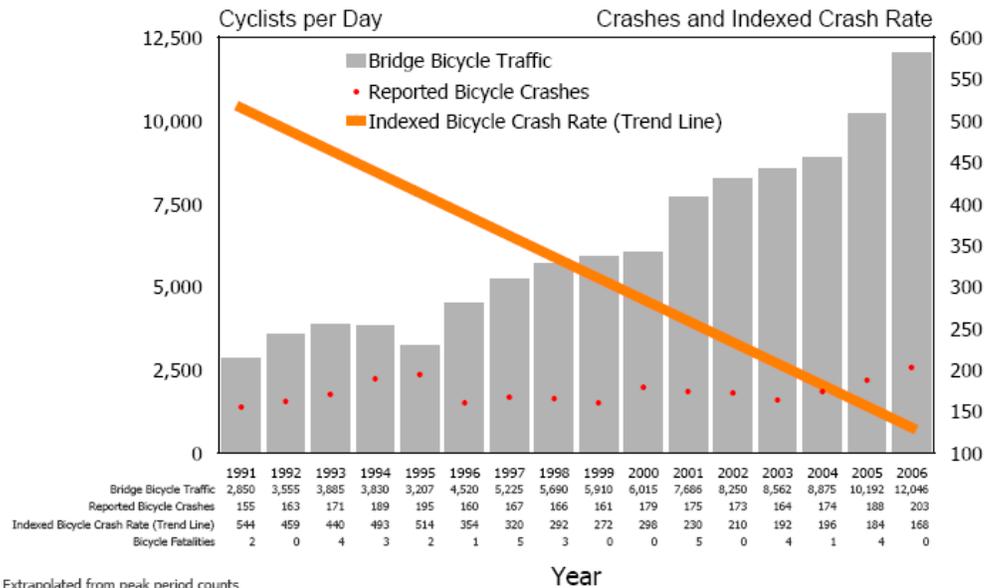
ODOT's Crash Analysis and Reporting Unit maintains the **Statewide Crash Data System**. It contains crash data from police, insurance, and driver exchange forms. The Department of Motor Vehicles is the designated collector of crash records, and those records are compiled into the data system managed by ODOT. Portland Transportation utilizes this data for analysis and mapping purposes.

The Oregon Trauma Systems, a part of Oregon's Department of Human Services, is responsible for development, implementation, and ongoing monitoring of the state's trauma system, including establishment of system standards, designation of trauma hospitals to care for injured patients, and collection of trauma registry data. The **Oregon Trauma Registry** collects information on the cause of trauma such as a bicyclist, pedestrian or motor vehicle crash.



Portland crash statistics

Combined Bicycle Traffic over Four Main Portland Bicycle Bridges Juxtaposed with Bicycle Crashes



Extrapolated from peak period counts

"Crash Rate" represents an indexing of annual reported crashes to daily bicycle trips across the four main bicycle bridges.

Bicycle crash investigations by Portland Police (2002-2006)

Year of Crash	Total	Percentage
2002	26	12%
2003	38	17%
2004	37	17%
2005	44	20%
2006*	75	34%

*This significant increase is due to a change in the types of crashes investigated

Top Six Crash Types*	Total	Percentage
Right hook	21	9.5%
Cyclist runs stop sign	18	8.0%
Motorist runs stop sign	15	7.0%
Left hook	13	6.0%
Cyclist runs signal	11	5.0%
Motorist runs signal	10	4.5%

*All other crash types were in the single digits; i.e. each type occurred fewer than 10 times

Bicyclist Injury Severity	Total	Percentage
Minor injury	74	34%
Serious injury	67	30%
Unknown	32	15%
Complaint of pain	28	13%
No injury	16	7%
Fatal*	3	1%

*Fatal Crash Types: Parallel paths, Bicyclist lost control, Bicyclist ride out

*Fatal Vehicle Types: Large truck, Sport utility, Bus/school bus

Motor Vehicle Type	Total	Percentage
Car	122	55%
Pickup	35	16%
Sport utility	27	12%
Van/minivan	13	6%
Unknown	11	5%
Large truck*	5	2%
Bus/school bus	4	2%
Other	3	1%

*Truck Crash Types: Bicyclist lost control, Bicyclist ride out, Motorist overtaking – bicyclist swerved, Motorist right turn – same direction, Parallel paths

Crashes investigated by police (2002-2006):

- ◆ 221 detailed crash investigations were bicycle crashes
- ◆ 5 of the 221 involved large trucks (2%), with 1 crash resulting in a fatality
- ◆ All 5 crashes were different types; i.e., there was no typical large truck crash

Of the larger data set, from 2002 to 2005, 7 of the 699 bicycle crashes involved trucks (1%); data about trucks is not yet available in the larger data set for 2006.

Of the 1,902 bike crashes from 1995 to 2005, 15 involved large trucks (0.8%).

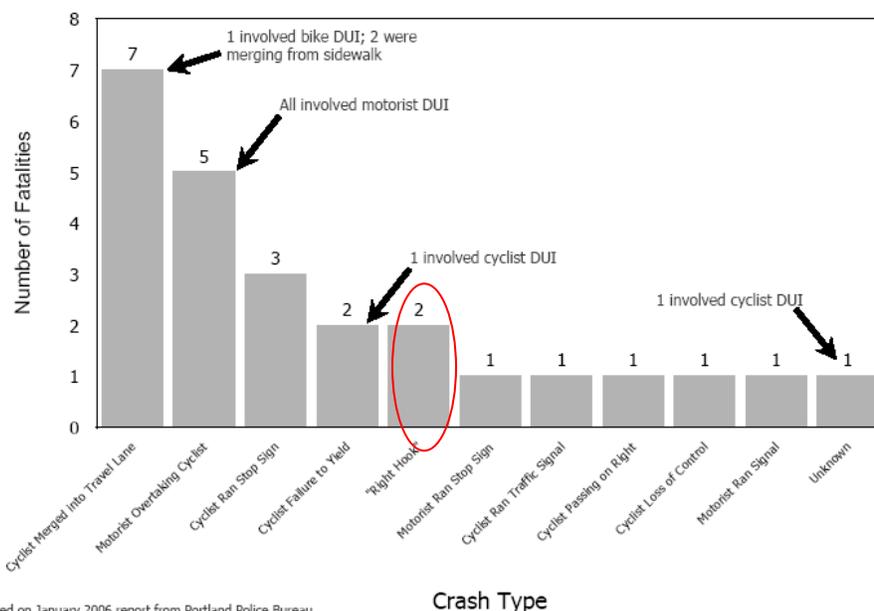
Bicycle crash investigations by Portland Police with bicyclist serious injury or fatality (2002-2006):

Motor Vehicle Type	Total	Percentage	
Car	122	55%	*Truck Crash Types: Bicyclist lost control, Bicyclist ride out, Motorist overtaking - bicyclist swerved, Motorist right turn - same direction, Parallel paths
Pickup	35	16%	
Sport utility	27	12%	
Van/minivan	13	6%	
Unknown	11	5%	
Large truck*	5	2%	
Bus/school bus	4	2%	
Other	3	1%	

Bicycle, pedestrian, and motor vehicle crash statistics (1995-2006):

- ◆ 2,105 reported crashes involving a bicycle – average of 175 per year
- ◆ 25 of these crashes resulted in cyclist fatalities – average of 2.1 per year
- ◆ 134,625 reported automobile crashes – average of 11,219 per year
- ◆ 322 of these crashes resulted in fatalities – average of 27 per year
- ◆ 2,435 reported pedestrian-involved crashes – average of 203 per year
- ◆ 130 of these crashes resulted in fatalities – average of 11 per year

Crash Types of Cyclist Fatalities: 1995-2006



Based on January 2006 report from Portland Police Bureau

0 This chart shows 2 right hook cyclist fatalities in 10 years. In October 2007, Portland had 2 right hook cyclist fatalities in 2 weeks – SW 14th Ave at Burnside, N. Interstate at Greeley

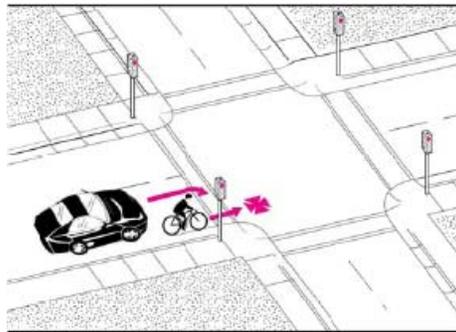
Common bicycle crash types in Portland

The Portland Police Bureau investigates only a fraction of all reported crashes in Portland. Beginning in 2006, the police dramatically increased the number of investigations, resulting in a jump from 700 investigated crashes in 2005 to 1,700 in 2006. Seventy-five of the 1,700 investigated 2006 crashes were bicycle crashes. Overall, the police investigated 221 bicycle-involved crashes between 2002-2006.

Portland Transportation staff explored those 221 bicycle crash investigations and found the following six most common crash types:

1. Right hook
2. Cyclist runs stop sign
3. Motorist runs stop sign
4. Left hook
5. Cyclist runs signal
6. Motorist runs signal

#1 – The right hook



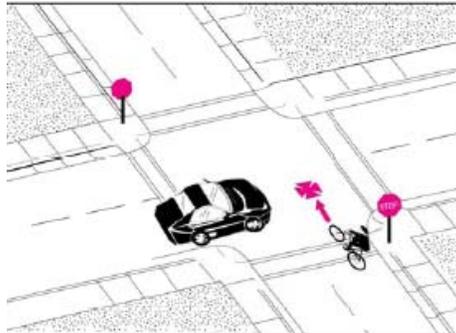
Motorist turns right into cyclist

- ◆ 9.5% of investigated crashes
- ◆ 21 of 221 investigated crashes

Counter measures:

- ◆ Higher visibility for cyclists
- ◆ Education for motorists and cyclists
- ◆ Enforcement
- ◆ Engineering

#2 – Cyclist runs stop sign



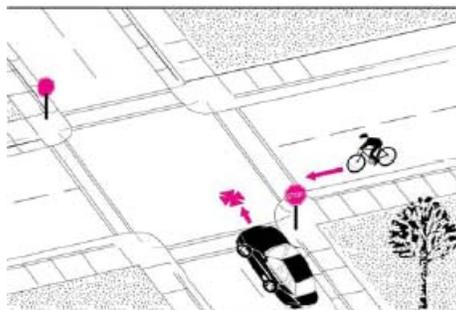
Cyclist runs stop sign

- ◆ 8.1% of investigated crashes
- ◆ 18 of 221 investigated crashes

Counter measures:

- ◆ Education for cyclists
- ◆ Stricter enforcement
- ◆ Engineering

#3 – Motorist runs stop sign



Motorists runs stop sign

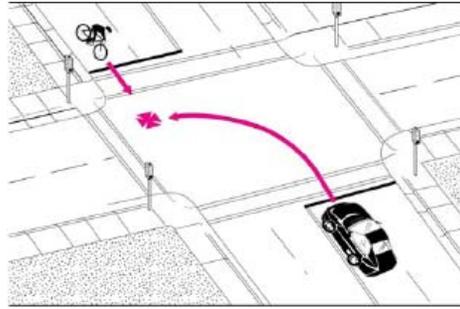
- ◆ 6.8% of investigated crashes
- ◆ 15 of 221 investigated crashes

Counter measures:

- ◆ Education for motorists
- ◆ Stricter enforcement
- ◆ Engineering

Common bicycle crash types continued . . .

#4 – Left hook



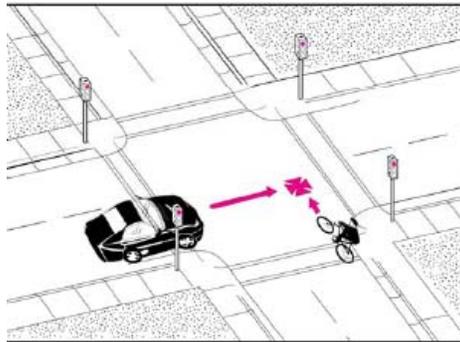
Left hook

- ◆ 5.9% of investigated crashes
- ◆ 13 of 221 investigated crashes

Counter measures:

- ◆ Higher visibility for cyclists
- ◆ Education for motorists
- ◆ Enforcement
- ◆ Engineering

#5 – Cyclist runs signal



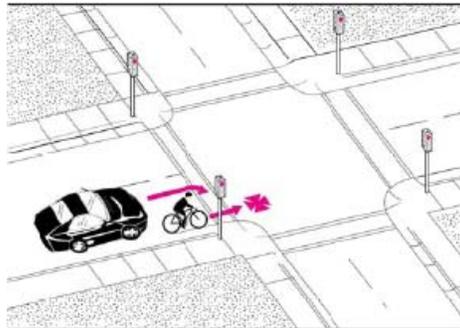
Cyclist runs signal

- ◆ 5.0% of investigated crashes
- ◆ 11 of 221 investigated crashes

Counter measures:

- ◆ Education for cyclists
- ◆ Stricter enforcement
- ◆ Engineering

#6 – Motorist runs signal



Motorist runs signal

- ◆ 4.5% of investigated crashes
- ◆ 10 of 221 investigated crashes

Counter measures:

- ◆ Education for motorists
- ◆ Stricter enforcement
- ◆ Engineering

All other investigated crash types were in the single digits (2002-2006).

Enforcement and investigations solutions

1. The City of Portland will continue to work with Police on enforcement and investigation policies to improve bicycle safety.
2. The City of Portland will also continue to advocate for jail time for drivers with suspended licenses and DUII offenders.
3. Consider change to bike lane usage by right turning vehicles.
4. Enforce bike lane law as written – similar to not seeing a stop or speed sign.
5. Like railroad crossings, trucks and buses must come to a complete stop before crossing a bike lane.
6. Mandatory classes and/or community service for certain serious traffic violations.



Engineering solutions to improve bicycle safety

Creating safer conditions for bicycling is the result of efforts in at least three areas – education, enforcement, and engineering. Engineering fixes cannot address safety by themselves; nor can education or enforcement if done in a vacuum. To truly create safe conditions, there must be a coordinated, integrated approach that features all three strategies.

The Portland Office of Transportation has several programs underway to educate motorists and cyclists about bicycle safety, partner with Police on enforcement activities, and explore and implement engineering solutions to improve bicycle safety.

Reduce left and right “hooks”

As noted on pages 5-8, the left and right “hooks” are two of Portland’s top six bicycle crash types. The toolbox of engineering solutions to improve bicycle safety includes measures to reduce the especially problematic left and right “hooks” where a motorist turns into a cyclist.

A **“bike box”** (or “advanced stop line”) is an idea that originated in Europe. It gives cyclists a legal place to idle when waiting for a red light to turn green. It works like this. There are actually two stop lines at a traffic light. The first stop line is for motor vehicles. The second stop line, closer to the intersection, is for bicyclists. When the traffic light is red, bicyclists can then overtake waiting motor vehicles and cut in front of them.

The bike box provides a visual clue to motorists to expect cyclists. It also positions a cyclist in front of a motorist, providing more visibility so the cyclist is not in the motorist’s blind spot. In this way, it reduces the chance of a “hook” crash.

A bike box is frequently implemented along with a bike lane so bicyclists have a designated space in which they may overtake motor vehicles. In the diagrams on the next two pages, the bicycle lane is proposed to be colored before and after the bike box – through the intersection. The intent is to give motorists a strong visual cue to expect cyclists moving through the intersection. While the box works best when the signal is red, allowing cyclists to go to the head of the line, the colored bicycle lanes are intended to alert motorists to the presence of cyclists when the signal is green and everybody is moving.



The only Portland intersection currently with a bike box is at SE Clinton Street at 39th Avenue.

An engineering design that features a bike box, a colored bike lane, and skip-stripes through the intersection may prevent motorists from making the type of deadly “right-hook” turns that killed two Portland cyclists in two weeks in October 2007.

Proposed engineering solutions

Measures for the most dangerous intersections for cyclists

For the city's top intersections known to be problematic for cyclists and motorists making left or right turns, Portland Transportation will consider installing the following engineering treatments:

- ◆ Bike box at stop bar at the intersection
- ◆ Blue-colored bike lane approaching the intersection
- ◆ Blue-colored bike lane into the intersection in area where a vehicle would turn
- ◆ Skip-stripes, with or without color, through the intersection
- ◆ Widen bike lane at intersection
- ◆ Bike warning sign, like a flashing beacon, activated by bike loop
- ◆ Pedestrian and bike signal advances
- ◆ No right turn on red lights with bike boxes

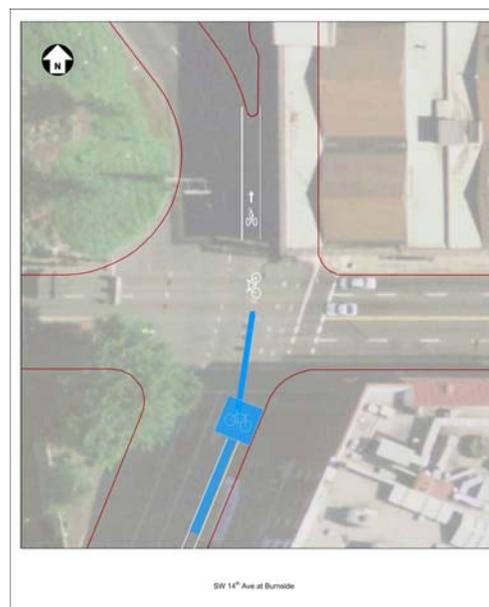
These intersections will include SW 14th Avenue at Burnside and N. Interstate at Greeley – the locations of the two recent bicycle fatalities involving trucks making right turns and hitting cyclists.

Measures specifically for N. Interstate at Greeley

- ◆ Eliminate southbound right turn for vehicles
- ◆ Eliminate bike lane coming down the hill
- ◆ Install bike warning sign activated by bike loop
- ◆ Add special bike lane treatment; e.g. color, at conflict point

The following diagrams illustrate the engineering treatment to reduce left and right “hooks:”

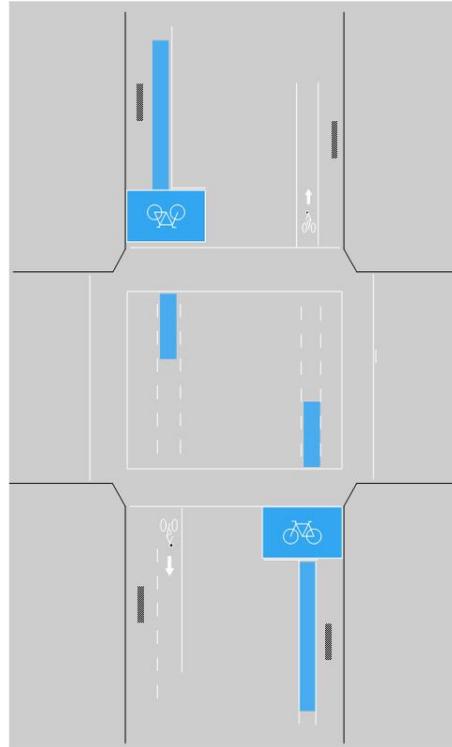
SW 14th Avenue at Burnside



N. Interstate at Greeley

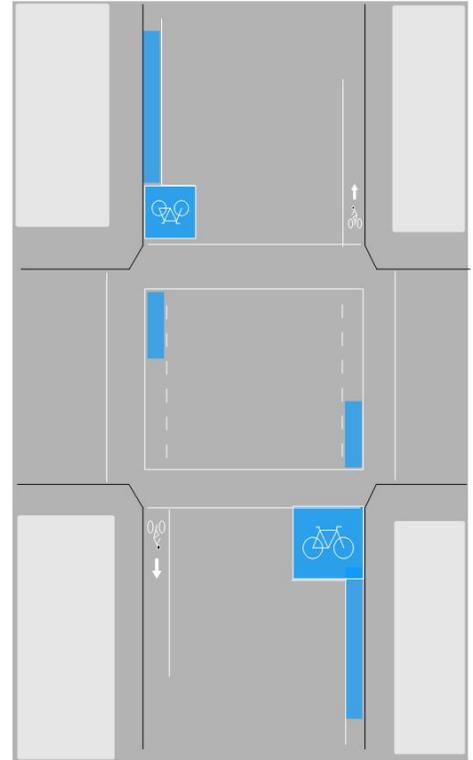


Bike box with parking lane



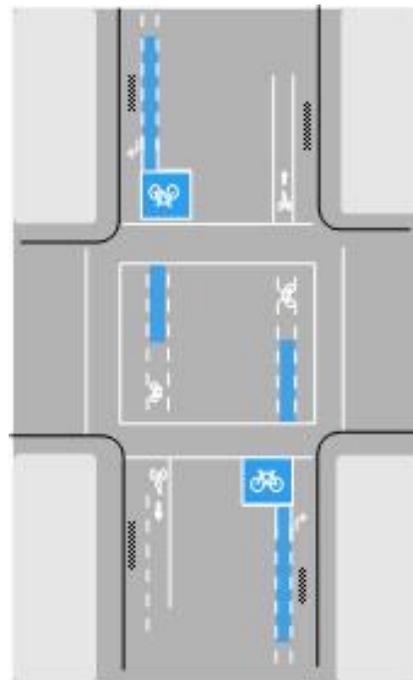
Bike Box with Parking Lane

Bike box at curb lane



Bike Box Curb Lane

Bike box with turn lane



Bike Box with Turn Lane



Equipment solutions to improve bicycle safety

The toolbox of solutions to improve bicycle safety includes equipment measures, such as the following:

- ◆ Mirrors on vehicles, including bicycles, to improve visibility and reduce or eliminate blind spots
- ◆ Metal plates and guide bars to prevent people from going under vehicles
- ◆ Reflective signs warning people not to scoot up alongside the vehicle
- ◆ Proximity sensors that sound a buzzer in the cab when an object is next to the truck
- ◆ Audible warning devices that sound when the right turn signal is on
- ◆ Cameras to provide video feed into the vehicle of a wide angle view of the outside environment
- ◆ Noisemakers, bells, and whistles for bicycles and cyclists

Blind spots

Blind spots are areas of the road that cannot be seen while looking forward or through either the rear-view or side mirrors in an automobile.



Generally speaking, larger vehicles have larger rear blind spots. The blind spot behind a typical sedan could only hide a small vehicle, while the blind spot of an SUV can hide small children or vehicles, resulting in as many as 50 children being killed by reversing SUVs in the United States each year.

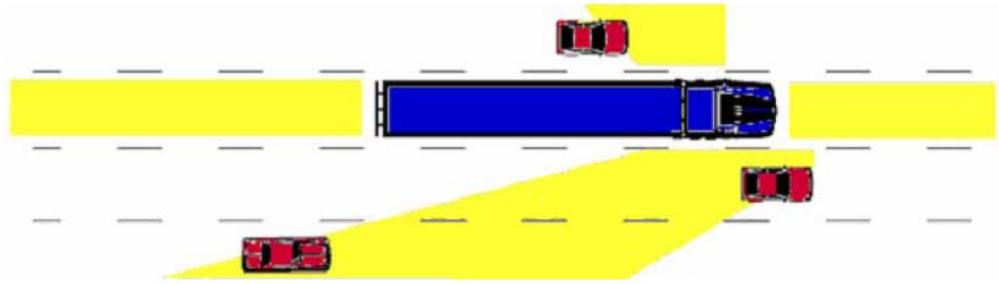
A number of products are available to consumers to deal with the blind spot problem. Convex mirrors, often called "spot mirrors," can bring blind spots into view, but their optical properties impart a great deal of distortion so as to make it difficult to judge distances.

Newer technology using "**aspheric**" mirrors allows the blind spots to be virtually eliminated while minimizing distortion by enlarging the field of view by 1.4 to 1.7 times.

The blind spot behind large trucks and tractor trailers can contain entire vehicles, which is one reason many trucks carry warnings not to follow too close, such as "If you can't see my mirrors, I can't see you." This is partly because the driver's position is higher in a tractor-trailer.

Larger vehicles also have much larger front and side blind spots. Tractor-trailers have not only large rear quarter blind spots, but also a large blind spot directly to their left and to their front-right.

Blind spots on a large truck



Most larger trucks have a huge blind spot on the right hand side. Therefore when turning right, there is the awful possibility that there's a cyclist in that blind spot. In a confrontation between a multi-ton truck and a 150-pound person, the truck is the usual survivor.

One trucking company tries preventive measures

To address the safety concern of a cyclist getting caught in a truck's blind spot, a London-based concrete mixing company with a 1,000+ truck fleet is trying a number of measures to reduce truck/bicycle conflicts on roads.



Collision prevention measures on a London-based cement mixing truck

- ◆ Mirrors
- ◆ Metal plates and guide bars
- ◆ Reflective warning signs
- ◆ Proximity sensors
- ◆ Audible warning devices

Initially all the vehicles will be fitted with an extra set of blind spot mirrors to completely eliminate that particular danger, plus a reflective rear sign warning of the danger of scooting up alongside the truck.



One truck has even added a two-foot by five-foot reflective sign on the side again warning of the danger. The sign is fitted with a number of proximity sensors so that when they detect an object next to them, a buzzer sounds in the cab, alerting the driver.



Metal Plate and Guide Bar

The London-based cement mixing company has also added under-run protection to prevent a cyclist from being dragged under the wheels should the worst happen.

Another measure is an audible warning device that sounds when the turn signal is on. It shouts at a reasonable volume "Warning! This vehicle is turning left!" In the U.S. that warning would be for right turns, of course.

Portland City Fleet trial

1. The City of Portland will explore a project with City Fleet to try one or more of these equipment measures on its trucks.
2. The City will share what it learns about costs and other issues with the freight community.



ADVICE TO MOTORISTS: How to set mirrors to eliminate blind spots

The quick test: if you look in your side mirrors and you see the side of the car, then you've got it wrong! By spreading your side mirrors, you lose no information about what's behind you, but gain valuable insight into what's beside you.

According to *Wikipedia*, to set mirrors to eliminate all blind spot areas, use the following steps:

1. Start by setting your central (inside) rear-view mirror. Place it facing the center of the rear window.
2. Then, lean your head all the way to the left so it touches the driver's window. From that position, set your left side-view mirror so you can just barely see the back corner of your car.
3. Now lean your head to be just between the two front seats, at your normal height, and position the right side mirror so you can just see the rear quarterpanel of the passenger side in the mirror.

4. Test your newly adjusted mirrors on a multi-lane road. When a car comes up behind you, you should first see it in your rear-view mirror. But as it passes you (let's say on your left), you should see it move to the left side of your rear-view mirror. And as its left headlight disappears from your rear-view mirror, it should instantly show up in your left side-view mirror. There should be no delay. It should slip from one to the other, so you can always see it.
5. If the passing car becomes invisible at any time during your test, slightly adjust the left side-view mirror so that as soon as the passing car's left front headlight disappears from your rear-view mirror, it appears in your left side-view mirror.
6. Repeat the above adjustment step for right side-view mirror. A significant portion of your blind spots have now been eliminated.

Warnings

1. Don't adjust mirrors while driving.
2. ALWAYS look over your shoulders before changing lanes! While this mirror method is very effective at reducing blind spots, one can not depend on it to eliminate them. It is still possible for motorcycles, smaller cars, or even bicycles to hide in unexpected areas around your car.
3. Looking over your shoulders gives you additional necessary information about the behavior of traffic around you that you can never get from mirrors no matter how well they are placed.
4. Constantly scanning your mirrors instead of just checking them when you want to change lanes or pass someone will help to prevent someone from "sneaking" up on you. Pairing this mirror setting method with constant scanning will allow you to be aware of those around you at all times.

Equipment for bicycles



Noisemaker – With a horn, bell, or whistle, cyclists are able to make motor vehicles, pedestrians, and other cyclists aware of their presence. These noisemakers make a cyclist seem more polite, and then everyone can share the road together.

Mirror – Sometimes it's difficult for cyclists to keep looking over their shoulders to see what is coming up from behind them (especially if they wear a backpack). A mirror, mounted on the left side of their bike, will allow a cyclist to see what's coming up behind while still keeping an eye on the road ahead.





Education programs to improve bicycle safety

Several agencies and organizations work together to ensure that Portland's streets are safe for all modes of transportation. The following is a brief overview of some of Portland Transportation's programs that promote safety for bicyclists.

Community and School Traffic Safety Partnership (CSTSP)

In 2003, the City of Portland Office of Transportation launched the Community and School Traffic Safety Partnership in response to strong public demand for services that protect neighborhoods from the negative impacts of traffic and to provide a safe environment for all modes of travel.



The Community and School Traffic Safety Partnership programs and services are structured around three primary areas of emphasis:

- ◆ Reducing Driver Error
- ◆ Pedestrian and Bicycle Safety
- ◆ Safer Routes to School

Funding to support Community and School Traffic Safety Partnership programs and services are provided with the annual increase in traffic fine revenue from House Bill 2759.

Bicycle Safety Leadership Workshops

During the summer of 2005, Portland Transportation conducted Bicycle Safety Leadership Workshops in each of the city's seven neighborhood district coalitions. These meetings were an opportunity to create a network of community partners empowered with a common understanding about bicycle safety issues and deeper understanding of available services. Attendees included neighbors, Transportation staff, Police staff, and bicycle advocates. Those Workshops led to the initiation of bicycle safety groups in neighborhood district coalitions.

Each Workshop included three elements:

- ◆ A presentation about bicycle safety (including bike crash map information)
- ◆ A bicycle ride to locations emblematic of bicycle safety issues in the district
- ◆ A discussion about some of the more challenging questions (e.g., how do we respond as a community after a fatality? how do neighborhoods better access Transportation or Police services?)

Outreach was conducted through the neighborhood district coalitions, Bicycle Transportation Alliance, Shift2Bikes.org, BikePortland.org, News4Neighbors.net, and PortlandTransport.com.

The Workshop effort is catalyzing neighborhood bike safety groups that will initially be grassroots, ad-hoc citizen groups. These groups will have membership that will be defined by district coalition boundaries, but will not initially be a formal part of district coalition work. It's hoped that the grassroots groups will become strong enough to approach the district coalitions about formally becoming part of the neighborhood structure. Through this effort, a number of people are becoming active with their neighborhoods for the first time.





I Share the Road

The I Share the Road Campaign is a partnership that includes a wide array of stakeholders with the goal of increasing civility on Portland's streets. The partnership includes PDOT, ODOT, Portland Police, TriMet, American Automobile Association, Bicycle Transportation Alliance, Willamette Pedestrian Coalition, Oregon Truckers Association, Elders in Action, and many other organizations.



I SHARE THE ROAD

Share the Road Safety Class

The Share the Road Safety Class is an option for bicyclists, pedestrians, and motorists who receive a citation for violating specific laws related to bicycle and pedestrian safety. The class provides first-time offenders direct education from experts in the field of traffic safety and the opportunity to avoid conviction or a fine for certain, non-criminal traffic violations.



The goal of the two-hour class is to improve traffic safety by increasing education of, and compliance with, Oregon law that applies to motorists, pedestrians, and bicyclists who share our roadways. Offered up to twice monthly, the class is a combination of lecture and digital PowerPoint presentation that focuses 100% on traffic laws and traffic safety issues.

The Share the Road Safety class, first offered on March 14, 2007, was developed and is provided through a partnership between the Trauma Nurses Talk Tough, Multnomah County Circuit Court, Portland Office of Transportation, Portland Police Bureau, Bicycle Transportation Alliance, and the Willamette Pedestrian Coalition.

Portland Safer Routes to School

Safe Routes to School is a program in its third year of implementation to enable and encourage children to walk and bike to school safely. Portland Transportation manages this coalition-led program with services provided by Alta Planning + Design, Bicycle Transportation Alliance, Willamette Pedestrian Coalition, Alliance for Community Traffic Safety in Oregon, Community Cycling Center, Trauma Nurses Talk Tough, Multnomah County Health Department, Healthy Eating Active Living, and Northwest Service Academy/Americorp.



Students and families are encouraged to walk and bike to school to:

- ◆ Relieve congestion
- ◆ Teach and raise awareness about bicycle and pedestrian safety
- ◆ Get daily exercise and keep physically fit

The program is partnering with 25 schools this year to develop fun and healthy ways to get to school safely. Coordinators work with the school community to bring education, encouragement, engineering, and enforcement activities that meet the school's particular needs.

Bicycle lights programs

During the past decade, there have been several efforts to increase the use of lights on bicycles in Portland.



Notable examples include the following:

- ◆ Get Lit Program
- ◆ See and Be Seen Campaign
- ◆ Police Bicycle Light Program

The volunteer-based **Get Lit Program** is sponsored in part by Portland Transportation. Since its inception in 2004, it has installed more than 2,000 sets of front and rear bicycle lights for free throughout the city. This effort was originally organized through the Shift to Bikes organization. Volunteers install free lights at events and popular path locations.

The **See and Be Seen Campaign** was initiated by Commissioner Sam Adams in 2006. Portland Transportation teamed with TriMet and other partners to encourage cyclists to use lights and to remind motorists to watch for bicycles. The campaign, now in its second year, includes ads on TriMet buses, shelters, and benches displayed through December and January. Public awareness events such as the See & Be Seen Bike Light Parade (November 15) help publicize the message. In addition, local bicycle shops offer discounts on lights, and a number of Get Lit bike light giveaways are sponsored in part by Portland Transportation.

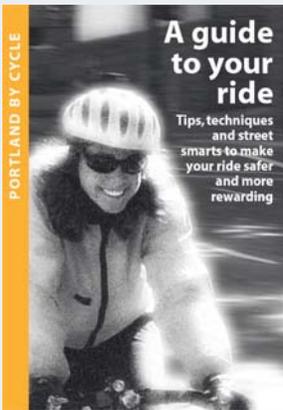
The **Police Bicycle Light Program** was initiated in 2005. When a police officer observed a cyclist without lights, they would pull them over. The officer would then install a free set of front and rear bicycle lights, provide a handout with basic bicycle safety information, and issue a warning to the cyclist. The program, funded by Portland Transportation through a federal Safe Communities grant, distributed approximately 500 bicycle light sets and was discontinued in 2006.

Bicycle helmets programs

Portland Transportation's Transportation Options Division promotes the use of bike helmets at all events and activities, at tabling events, and through related articles in their neighborhood target area newsletters. Transportation Options also requires the proper use of bike helmets at all Options sponsored bike rides including the PortlandByCycle rides and the Women on Bikes rides throughout the year.

From 2002 to 2005, Transportation Options fit and distributed approximately 5,000 bicycle helmets primarily to low-income children and families in Portland. Helmets were fit, adjusted and distributed to those in need at a variety of events throughout the city.





Transportation Options programs

Portland Transportation's Transportation Options Division offers a number of programs that enable and encourage bicycle safety. These include the following:

- ◆ Portland By Cycle
- ◆ SmartTrips Downtown
- ◆ Women on Bikes
- ◆ Bike Safety Materials

Portland By Cycle offers slow-paced evening neighborhood rides throughout the summer with a focus on safety and a variety of workshops during the spring and fall that focus on riding skills and safety.

SmartTrips Downtown offers bike safety information to downtown employees and students and hosts sessions on bike commuter safety.

Women on Bikes offers a number of clinics featuring riding skills and safety for women. The program also developed a Resource Guide to support women interested in cycling.

Bike Safety Materials developed by Transportation Options include the booklet *A Guide to Your Ride*, which has extensive information on bike safety and riding techniques. All of Portland Transportation's bike maps include bike safety pieces.

Other bicycle safety resources, either developed by or distributed by Portland Transportation, include the ODOT-produced *Oregon Bicyclist Manual*, the *Share the Path* brochure, and the Safer Routes to School *Pedal Power* guide and *Safe Biking* handbook.

In addition, Transportation Options has tabled over 75 community events so far this year promoting safe cycling, at which the program distributed bicycle maps and safety information to the public.

New and enhanced education solutions to consider

Portland Transportation will facilitate conversations with community partners about additional education efforts to improve bicycle safety, which may include:

1. Develop an Oregon Department of Motor Vehicles supplemental urban driver's guide and test
2. Provide enhanced truck driver education for urban truck drivers
3. Provide enhancements to existing programs like Share the Road, See and Be Seen, and I Brake for People
4. Provide Street Maintenance Fee household reduction for attending a bicycle/motorist seminar
5. Provide information online, in print, and through classes for how to share the road, not just the rules of the road
6. Institute biannual bicycle safety public service announcement campaigns including See and Be Seen
7. Provide children who participate in the Safe Routes to School bicycle education curriculum "Riders Licenses" with tips for safe and defensive cycling
8. Monitor blogs and Internet sites to add tips and rules for sharing the road
9. Establish a Speakers Bureau for community groups
10. Pitch "48 Hours"-type story from a trucker's point of view who has been involved in these bicycle crashes
11. Continue having planners, engineers, and police participate in ride-alongs on bicycles to experience traffic on bikes

Colored Bicycle Lanes, Bike Boxes and Right Hooks

In the light of two recent “right-hook” bicycle crashes resulting in fatalities, Commissioner Sam Adams and the Portland Office of Transportation (PDOT) have recommended a pilot treatment at 14 targeted intersections to create safer conditions for bicycling. People following this issue—motorists and cyclists alike—legitimately have questions about the effectiveness of the proposed design and how we selected the 14 intersections.

Following these crashes, there arose two leading and opposing options for treating intersections. One of these options eliminates the separation of cyclists and motorists as they approach intersections; the other maintains and enhances the separation. PDOT has strongly endorsed the design that enhances separation. Our approach is based on two guiding principles:

- 1) To increase bicycle ridership in Portland we need to create comfortable conditions for people to ride. The more people who ride, the better will be conditions for cycling,
- 2) Bicycling is safer when awareness and visibility of road users is enhanced and movements are well defined and universally understood.

We are further encouraged in our decision by the fact that similar designs are employed in the world-class cycling cities throughout Europe whose ridership levels, policies and practices we hope to emulate.

The design we propose consists of three main elements: a bicycle lane that is colored as it approaches the intersection, a bicycle box or advanced stop line at the intersection, and a colored bicycle lane leading away through the intersection (Figures 1 and 2). Other elements will include signing that alerts motorists to the presence of the bicycle lane and expected motor vehicle and bicycle movements through the intersection, a prohibition against turning right on a red signal, and, where feasible or considered necessary, flashing warning signing triggered by the presence of a cyclist approaching the intersection.

The primary intent of this design to increase the visibility of cyclists at the intersections. We wish to heighten motorist’s awareness to the presence, or potential presence of cyclists. We want to remind motorists to look for cyclists who may be crossing their paths as they proceed through the intersection. The blue lanes approaching and leading away from the intersections are intended to be the primary trigger for this awareness. By coloring blue the approach, and especially the trailing lanes through the intersection, we will send motorists a clear message to expect cyclists moving through the intersection.

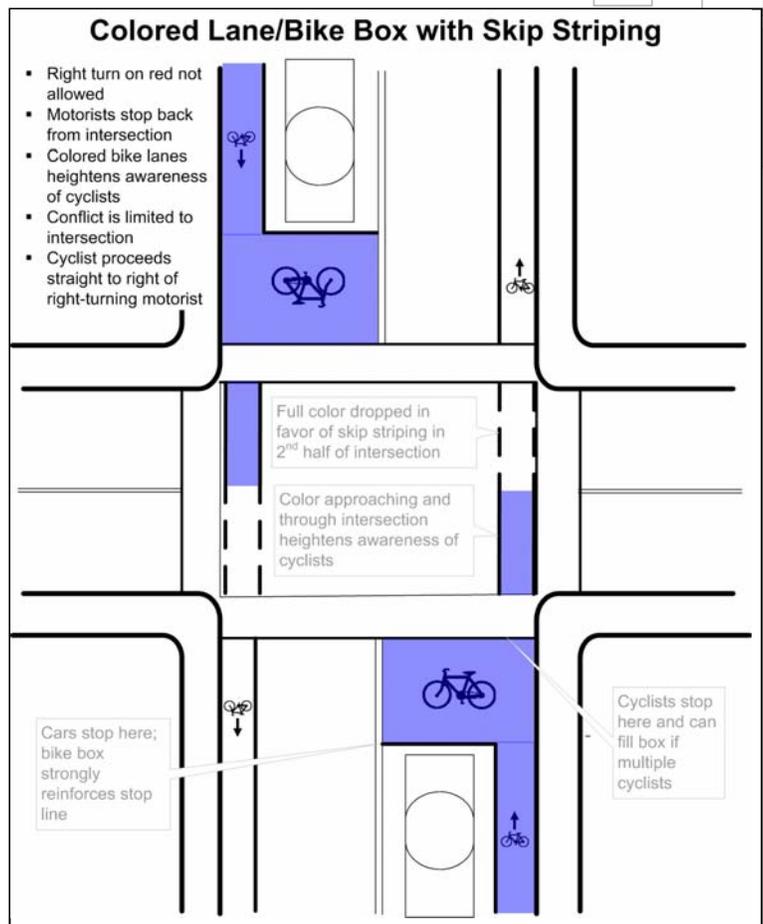


Figure 1 Colored Bike Lane/Bike Box Treatment

This practice of using color to define a cyclist’s path through an intersection is a common design feature in the bicycle-friendly cities of Denmark, The Netherlands, and Germany. It is also common in those countries to keep cyclists to the right of the roadway—in their own designated space—and to the right of right-turning motorists. Why? Because, those countries have determined, through the repeated feedback from their citizens and following decades of experimenting and refining their designs, policies, and approaches to managing traffic, that people riding bicycles want to stay separated from motor vehicles. It is this separation that creates comfortable conditions for bicycling. It is this feeling of comfort that serves to encourage more people to bicycle. Creating more cyclists, and having fewer people driving cars, makes bicycling safer.

Of course, separation without safety doesn’t serve anybody well. In this case, safer conditions will be achieved, in part, by clearly and unavoidably making known the presence of cyclists at the approach to and through the intersection. We believe the colored bicycle lanes in Portland, as in Copenhagen, Amsterdam, Muenster, and in bicycle-friendly cities throughout Europe, will encourage motorists to stay out of the bicycle lane when approaching an intersection, and look for cyclists before executing their turn through an intersection.

The bicycle box is a separate but related part of the design and is intended to do two things:

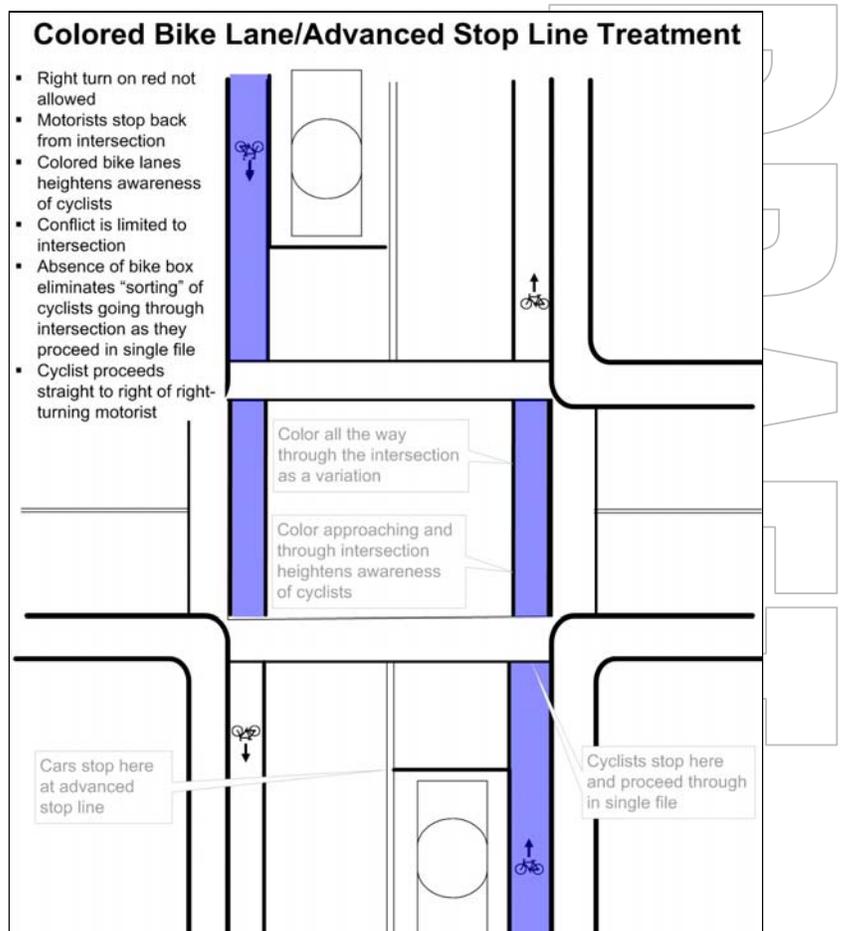


Figure 2 Advanced Stop Line without Bike Box

- 1) It will allow cyclists to go to the head of the line when the light is red so that they are more visible to queuing motorists and allowed to proceed through the intersection ahead of them,
- 2) It will allow the entire queue of cyclists to come up to the head of the line, so that when the signal turns green there are none or few cyclists moving through the bicycle lane to the right of motorists.

Additional signing and flashing lights would reinforce to motorists the idea to expect cyclists. We feel comfortable testing these designs in Portland because of their successful use in Europe.

However, there is another approach that encourages mixing motor vehicle and bicycle traffic when approaching and going through the intersection. This second approach encourages cyclists and motorists to share either the travel lane by dropping the bicycle lane before the intersection, or to share the bicycle lane, by allowing motor vehicles into the bicycle lane in advance of their making a right turn (Figures 3 and 4). This is an approach based on a “vehicular cycling” model, which suggests that bicycles, as vehicles operating on the roadway, should behave the same as the primary vehicles for which the roadways were designed: automobiles. The benefit of this approach is that it takes cyclists who are going straight through an intersection away from the path of a right-turning motorist. It conforms to standard

automobile operating rules, in which a vehicle going straight is always to the left of a vehicle turning right.

We believe there are a few problems with this approach. The main problem is that vehicular cycling is generally best used by those cyclists who are already the most fit and confident. While knowledge of vehicular cycling and the skills it encourages are beneficial to all cyclists, requiring such behavior at each intersection would not feel comfortable to the vast majority of Portlanders—the very people we are working to attract to bicycling. Keep in mind that Dutch cyclists (and motorists) are perhaps the best trained in the world. They are taught throughout elementary school how to ride a bicycle. They generally begin riding a bicycle very young and continue to ride well into old age. Despite this intensity of training, the Dutch have firmly decided that maintaining separation between cyclists and motorists is what creates the most comfortable conditions for bicycling.

The other main problem with this approach is that cyclists and motorists will still cross paths at some point. Either motorists will merge into the bicycle lane (under the California law approach) or cyclists will have to weave across the path of cars (under the dropped bicycle lane approach). In either case, there will still be multiple conflict points. Instead of having one conflict point at the intersection, it is now moved some indeterminate and varied distance back from the intersection. Cyclists can still be in a motorist’s blind spot when the motorist merges to the right.

We believe that inviting motorists into bicycle lanes creates three conditions that will be uncomfortable to most cyclists. First is the merge itself. It is not clear where this merge will occur and it still allows cyclists to be in a motorist’s blind spot when the motorist moves to the right. Second is the blocking of the bicycle lane. One of the advantages of having a bicycle lane—the uninterrupted flow for the

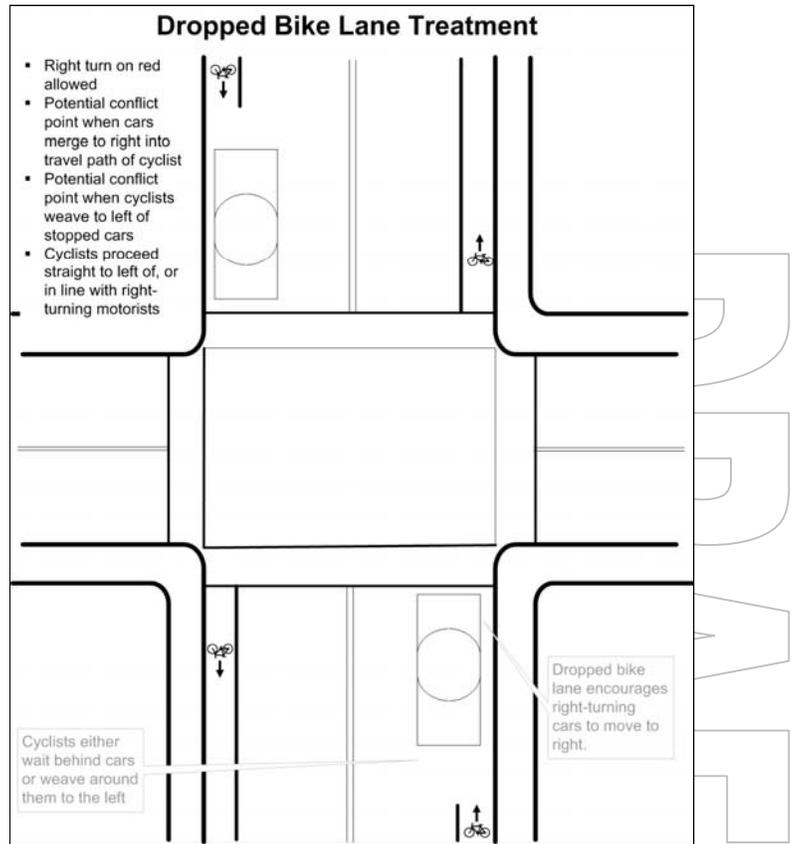


Figure 3 Bike Lanes Drop

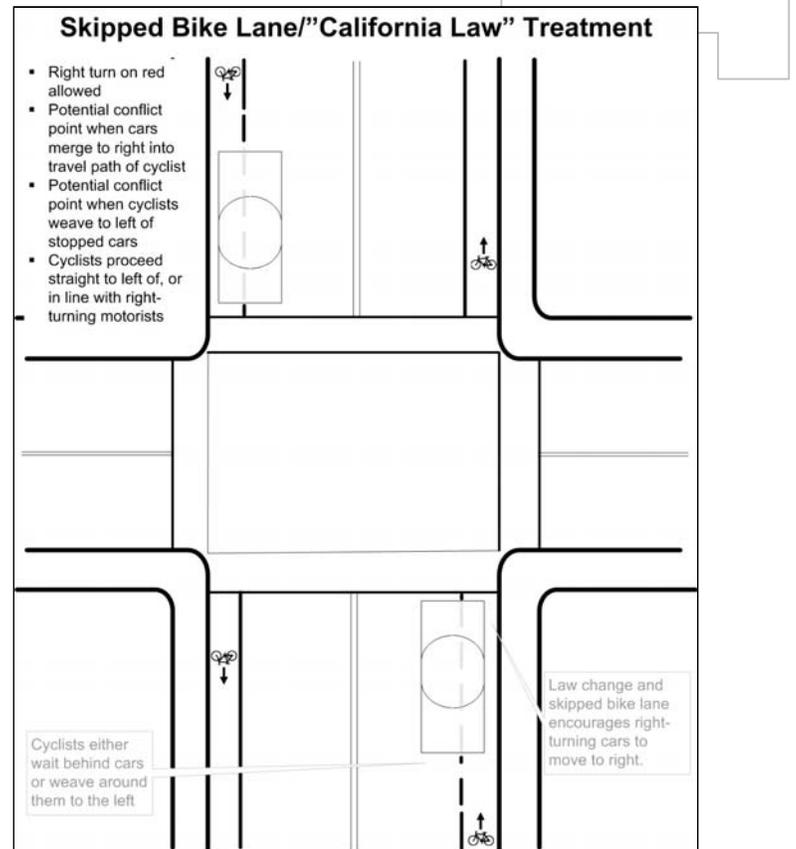


Figure 4 Bike Lanes Skipped to Intersection

bicycle—would be eliminated at almost every intersection where there is a line of motorists waiting to turn right. Third is the weaving behavior this will encourage of cyclists, who will understandably not be content to stop in a bicycle lane, near the intersection, when the signal is green, and who will instead move left into the travel lane around the right-turning automobiles.

There are places in Portland where we have dropped bicycle lanes before an intersection. We hear many complaints from cyclists where that occurs. We don't do it to create safe conditions for cyclists. Instead, we drop bicycle lanes in order to better serve motorists at the intersection, typically dropping the bicycle lane in order to add an additional turn lane.

If Portland is to be successful in attracting the general public to bicycling as a main means of transportation, then we need to create conditions where cyclists both feel comfortable and are safe when operating their bicycles. Dropping bicycle lanes shy of an intersection and encouraging or requiring cyclists to merge left into the travel lane, is not the ticket.

We developed the list of 14 targeted intersections from three primary sources:

- Comments received from the cycling public at the June 2006 Portland Bike Summit
- Feedback from Portland's Bicycle Advisory Committee regarding deficiencies in the city's bikeway system
- Feedback from the general public and analysis performed by technical staff as part of the city's work to define existing conditions for bicycling in Portland as part of the city's process to update the bicycle master plan.

We have chosen a design approach that we believe will create comfortable conditions for cyclists, improve safety by clarifying what we expect of motorists and cyclists, and continue to encourage increased bicycle use among more of the general public. We recognize that intersection design alone does not create safe conditions. Appropriate user behavior is crucial to an individual's safety. Being aware, looking out for others, yielding to others, and operating at slower speeds all help promote safety for all. This is true no less for cyclists than it is for motorists.

Exhibit 2. City of Portland Fleet Vehicle Equipment Safety Upgrades

With the goal of promoting the safety of all citizens and City workers that travel on Portland's roadways, the City of Portland has installed many safety devices in its heavy equipment fleet. These include additional mirrors, side signal lights, backup cameras, reflective tape, and frenzel-optical lenses that allow drivers to see through the passenger-side door. These safety items, combined with extensive operator training, significantly improve safety for pedestrians, bicyclists, other vehicle operators, and City workers.

The City has reviewed its dump trucks, street sweepers, aerial tower trucks, boom trucks, vacuum trucks, and equipment trailers to determine if a side guard retrofit will reduce the likelihood that vehicles or people would go under the side of our large trucks in the event of a crash. Almost all of the City's equipment already includes a side protection between the axles. The protection comes from the tool bins mounted to the body or frame of the truck, or, in some cases, the space between the axles is filled with a fuel tank and tool bins.

An assessment of the fleet showed that twelve trucks could benefit from the installation of the side-underrun guards. The cost is about \$4,500 per side, and includes design, fabrication, installation, and wiring of the new lights. Adding one side guard to each of these twelve pieces of equipment would cost the city approximately \$54,000.

A side-underrun guard is typically a barrier that is affixed along the side of the truck. This barrier is present so that in the event of a crash, the vehicle or person crashing with the truck is not able to go under the truck. Vehicle Services is finalizing design and installation plans that are specific to the twelve trucks that do not currently have adequate side-underrun protection.

