PORTLAND'S PLATINUM
BICYCLE MASTER PLAN

EXISTING CONDITIONS REPORT

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2007 EXISTING CONDITIONS EXECUTIVE SUMMARY

CHAPTER 1: INTRODUCTION

The City of Portland adopted its first Bicycle Master Plan in 1996 and updated the plan in 1998. In 2006, the Portland Bureau of Transportation undertook a major effort to update the Bicycle Master Plan. As part of that process a report documenting past developments and the current status of bicycling in the city was written to serve as a starting point for the new master plan. Most of the Existing Conditions Report was completed in 2007, with some chapters revised or updated in 2009. This Executive Summary is excerpted from the completed report.

CHAPTER 2: BICYCLE USE

By all metrics, bicycling in Portland is growing dramatically. Based on PDOT's annual counts and surveys; the annual Service, Efforts, and Accomplishments (SEA) survey administered by the City of Portland Auditor's office; the American Community Survey (ACS); and the US Census, more Portlanders are bicycling for more trips since the adoption of the City's first Bicycle Master Plan in 1996. For example:

- Bicycle traffic across the four bicycle friendly Willamette River bridges has increased 321% since 1990;
- In 2006, 14.5% of Portlanders reported that bicycling served as their primary or secondary commuting mode;
- Between 1990 and 2005 the US Census reported a 190% increase in bicycle commuting in Portland.

Jonathan Maus/BikePortland.org

According to the SEA survey the highest areas of bicycle commuting occur in Inner Northeast and Southeast, while North Portland has experienced the greatest increase in the city (430%).

While bicycle commuting trends are showing significant growth, commute trips make up only about 25% of all trips a person makes each day. Surveys show that Portland residents are also cycling for non-commute trips, such as shopping, leisure, and fitness trips. For example, a 2007 survey of Portland residents revealed that only 29% of active cyclists commute to work by bicycle, however 46% use a bicycle to run errands. Although specific data on mode share for errands and neighborhood trips does not exist, the high number of active cyclists reporting bicycle usage for errands suggests that cycling plays a large role in Portland's transportation system.

Through years of surveys and public outreach campaigns, PDOT knows much more about Portland residents' bicycle usage today than in 1996.

- 70% of Portland residents own or have regular access to a bicycle.

- Between 60% - 70% of cyclists on the road today are male. No other mode of transportation has such a high level of gender inequity.
- Residents over 65 years old are under-represented in bicycle use and over-represented in terms of being negatively predisposed to cycling.

In 2006, the City of Portland conducted surveys and focus groups with Portlanders to better understand the characteristics of cyclists and non-cyclists. The results of that endeavor aided PDOT in developing four classifications to represent Portlanders and their attitudes towards cycling.

- The vast majority (60%) of city residents is categorized as "Interested but Concerned" – they're not quite ready to hit the streets on a bicycle, but they'd like to under the right circumstances.
- 7% of city residents are categorized as "Enthused and Confident" – they will bicycle readily if some kind of bicycle facility, such as bike lanes, exists.
- Less than 1% of city residents are categorized as "Strong and Fearless" – they will bicycle regardless of conditions.
- 33% are categorized as "No Way No How" – they are unable, unwilling, or uninterested in cycling.

It was the "Strong and Fearless" and "Enthused and Confident" cyclists who helped shape the 1996 Bicycle Master Plan. That plan's focus on bicycle lanes on arterial streets reflects the interests and dominant thinking of the time. However, in order to encourage the 60% of city residents considered "Interested but Concerned" the new master plan must address their concerns about cycling: primarily traffic speed and volume and cycling distances.

CHAPTER 3: EVALUATION OF 1996 BICYCLE MASTER PLAN BENCHMARKS

Eight components were used to evaluate the City's progress on meeting the goals and benchmarks in the original Bicycle Master Plan.

1. Increase bicycle mode share
2. Reduce bicycle crashes
3. Complete the bicycle network
4. Reduce maintenance requests by bicyclists
5. Install signal detection and pavement markings
6. Provide end-of-trip facilities for bicyclists
7. Encourage integration of bicycles and transit
8. Provide bicycle education and encouragement to city residents

- *Mode Share*
  - Goal: Inner Portland - 10% bicycle mode share for all trips by 2006; City-wide - 6% mode share for all trips.
  - Results: Data on mode share for all trips is incomplete. The 2000 Census reported 3.14% bicycle commute mode share for Inner Portland and 2.13% city-wide. Other measures, such as specific neighborhood surveys, show commute mode splits as high as 10% in some inner eastside neighborhoods and below 1% in outer eastside neighborhoods.

- *Crashes*
  - Goal: 10% reduction in bicycle-motor vehicle crashes by 2006.
  - Results: Reported bicycle-motor vehicle crashes have remained static from 1996 to 2005. However, based on a significantly decreasing bicycle crash rate conditions for bicycling are safer today than in 1996.

- *Bicycle Network*
  - Goal: 378 miles of developed bicycle multi-use trails, boulevards, signed connections, and bicycle lanes by 2006; 60% of the 20 year goal of 630 bicycle network miles; 204 identified bicycle projects.
  - Results: 290 miles of the bicycle network completed; 48% of the 20 year network goal; 68 constructed bicycle projects.

- *Maintenance of Bikeway Network*
  - Goal: 50% reduction in bikeway network maintenance requests.
  - Results: The number of maintenance requests has not been accurately tracked over the last 10 years. Since 1996 PDOT has developed new reporting mechanisms for residents to make maintenance requests. In 1996, requests were made in writing and mailed to the Bureau of Maintenance. Today, residents can simply dial a number and leave a voicemail maintenance request. Thus, it is expected that maintenance requests have most likely increased.

- *Pavement Markings & Signs*
  - Goal: 50% of all signals with detection should be tuned and retrofitted with pavement markings by 2006.
  - Results: 65% of all loop detectors are set to function for bicycles. In 1996 the City contained 25 loop detectors markings. By 2006, the City had 161 loop detector markings.

- *End-of-Trip Facilities*
  - Goal: Provide 3,440 short-term bicycle parking spaces; 7,527 long-term spaces; shower and changing facilities available to all bicyclists.
  - Results: The City manages 4,705 short-term parking spaces and can account for 569 long-term spaces. While long-term parking may seem well short of the goal, most long-term spaces are administered by private developers and are difficult to count. Shower and changing facilities are also difficult to count because they are also most often found in private developments. The City has made building code changes to promote shower and changing facilities in new construction and has developed a Bike Central program to provide facilities for bike commuters.

- *Bicycle & Transit*
  - Goal: No specific benchmark; statement of intent to incorporate bicycles and transit.
  - Results: In 2006 all TriMet buses and light rail trains carry bicycle racks or designated bicycle areas. TriMet provides short- and long-term bicycle parking, including 340 bicycle lockers.

- *Education & Encouragement*
  - Goals: Stage five citywide promotional events. Provide bicycle safety education in schools. Promote children bicycling to school. Conduct other promotional events.

- Results: Portland hosts 2,100 cycling-related events each year, including those sponsored by the City and other community organizations. Regarding education, 81% of school age children have received bicycle safety education, while 11% of Portland students receive bicycle safety education annually. Portland's Safe Routes to School program showed a 10 – 20% increase in walking and biking to school among participating schools in 2006. PDOT also encourages cycling and other transportation options through its award-winning individualized marketing program, Portland SmartTrips. The program annually shows 9 – 12% reductions in drive-alone trips and includes hundreds of bicycle rides, clinic, and informational events.

Portland Bureau of Transportation

CHAPTER 4: BICYCLE-RELATED GOALS, POLICIES & OBJECTIVES

The City of Portland's goals and policies related to transportation emphasize, above all else, balance between modes competing for limited right-of-way. In 2002, Portland adopted its Transportation System Plan (TSP) as part of the city's Comprehensive Plan. The TSP is Portland's guiding policy and planning document for transportation.

The TSP is laid out in a hierarchical fashion with Goals at the top of the hierarchy, followed by Policies and Objectives which are intended to set more specific language toward achieving the Goal.

The TSP's Transportation Goal does not specifically mention bicycles but contains many elements that favor bicycle transportation, including developing an "efficient transportation system that provide a range of transportation choices; reinforces the livability of neighborhood; supports a strong and diverse economy; reduces air, noise, and water pollution; and lessens reliance on the automobile while maintaining accessibility."

Several policies and objectives supporting the Transportation Goal relate directly to bicycling, most specifically Policy 6.23 which reads "Make the bicycle an integral part of daily life in Portland, particularly for trips of less than five miles, by implementing a bikeway network, providing end-of-trip facilities, improving bicycle/transit integration, encouraging bicycle use, and making bicycling safer." There are a series of Objectives set out to support this Policy.[1]

The TSP also spells out the City's bikeway network classifications:

- City Bikeway – Serve the Central City, regional and town centers, station communities, and other employment, commercial, institutional, and recreational destinations.
- Off-street Paths – Serve as transportation corridors and recreational routes for bicycling, walking, and other non-motorized modes.

[1] Bicycle Master Plan –Existing Conditions Report, 4-3.

- Local Service Bikeway – Serve local circulation needs for bicyclists and provide access to adjacent properties. Nearly all streets that are classified as City Bikeways or Off-Street Paths, with exception of major highways or arterials, are considered Local Service Bikeways.

Each of these classifications includes supporting Objectives to assist implementation.[2] The 1996 Bicycle Master Plan then builds upon these classifications to describe one of three developments for each City Bikeway: 1) Bicycle Lanes, 2) Bicycle Boulevard, or 3) Signed Connection.

The TSP also includes a number of policies and ordinances that may affect future street and bicycle facilities designs. For example, street classifications define the types of movements that should be emphasized on each street such as motor vehicles, freight, transit, emergency vehicles, pedestrians and bicycles. The classifications are used to help determine street improvements. Since an individual street can possess numerous classifications and serve diverse functions, it can be difficult to balance the multiple demands. Providing more definition on the conditions where specific bikeway facilities and designs should be prioritized may help to reduce the level of ambiguity when conflicts occur.

In addition to street classifications, traffic congestion/level of service, mode split, transportation demand management, and transportation system management policies also impact bicycle facilities planning and design.[3]

On-street automobile parking policies also plays a role in planning for and developing bicycle facilities. City policies support the need for both on-street parking and bikeway facilities on certain designated streets.[4] Although conditions must always be evaluated on a case-by-case basis, it may be beneficial to adopt more clearly defined guidelines for prioritization on certain roadways.

Street connectivity and traffic calming and diversion have played major roles in developing Portland's bicycle network. Street connectivity allows bicyclists to find alternative routes to major arterials, but can also lead to more auto traffic on quieter residential streets where Bicycle Boulevards and other low-traffic bicycle routes are located. Traffic calming and diversions work by maintaining the benefits of street connectivity without sacrificing the lower traffic volumes and speed that make for a comfortable cycling environment.

Traffic calming, such as speed bumps and curb extensions, are still permitted under city policy. Traffic diversion, which is an important component of the City's current Bicycle Boulevards' functionality and popularity, appears to violate several policies and City ordinances, while also appearing consistent with other policies in the Comprehensive Plan.[5] The new Bicycle Master Plan will need to address the use of traffic diversion, particularly for the formation of future Bicycle Boulevards.

[2] ibid, 4-4.
[3] Bicycle Master Plan – Existing Conditions Report, 4-9 – 4-11.
[4] Ibid, 4-12 and 4-13.
[5] Ibid, 4-14 – 4-16.

CHAPTER 5: ENCOURAGEMENT

Portland has pursued several strategies to encourage city residents to bicycle. The City's signature effort is the award-winning SmartTrips Program. SmartTrips builds on the principle that individuals engaged in a dialogue about alternative transportation are more likely to actually change their behavior than if simply presented with more traditional advertising and promotional activities. SmartTrips offers city residents the opportunity to order information and resources on transportation options and participate in hands-on programs that assist them in making the choice to walk, bike, ride transit, and carpool.

Portland's SmartTrips program has consistently delivered decreases in drive alone trips and increases in bicycling and walking. Surveys show between a 9 to 12% relative decrease in car trips. SmartTrips focuses on neighborhood trips, such as shopping and leisure activities, as a way to encourage Portlanders to use alternative modes. This approach, coupled with City employees staging and participating in hundreds of community events each year, serves as the key factors in encouraging residents' to take advantage of the city's transportation choices.

There are four basic encouragement strategies: providing service, changing behavior, raising awareness, and providing incentives to ride. While SmartTrips touches on all of these areas, the City employs other strategies and develops partnerships with non-governmental, community, and business groups to encourage cycling.[6]

CHAPTER 6: BICYCLE SAFETY – EDUCATION & ENCOURAGEMENT

Bicycling in Portland has become safer since the adoption of the Bicycle Master Plan in 1996. When comparing bicycle ridership numbers and bicycle crashes, the crash rate has decreased significantly.[7] Nevertheless, safety continues to be a barrier to bicycling both for those who cycle and those who don't.

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The first step in evaluating the safety of cycling in the City requires analyzing crash and safety information. That, however, can be a daunting task, as information for bicycle crashes lacks the detail and uniformity associated with motor vehicle crashes. Bicycle crash data for Portland comes from four main sources:

1. Oregon Department of Transportation Statewide Crash Data System
2. Police Crash Investigation Reports
3. Pedestrian Bicycle Crash Analysis Tool (PBCAT)
4. Oregon Trauma Registry

[6] See Chapter 5, Encouragement.
[7] Table 6.21.

Even with these varied reporting tools, only 10 – 20% of all bicycle crashes are reported. The more severe the crash, the more likely it is to be reported. Additionally, crashes that result in a trauma tend to receive more thorough police investigations, resulting in more details about the crash.

National data from the Federal Highway Administration indicates that 70% of bicycle injuries resulting in an emergency room visit do not involve a motor vehicle and that nearly 31% of crashes occurred on non-roadway locations (off-street paths). In Portland, a gap exists in effectively collecting non-motor vehicle related crashes, thus skewing data on bicycle crashes in the city.

Statewide crash data have significant limitations, as it does not provide a complete picture of the events that resulted in a crash. For example, a motor vehicle driver might be assigned a failure to yield error, when they were actually making a right turn across a bike lane and hit the bicyclist. For policy implications, it is important to have a more detailed description of crashes to see what patterns, if any, exist with the broad error categories set out in the Statewide Crash Data System.[8]

In addition to the error categories in the Statewide Crash Data System, injuries, fatalities, and errors leading to fatalities are also tracked. However, as the bicycling advocacy group *Right of Way* reported, New York City Police inaccurately assigned error to bicyclists in fatal crashes in 40 – 60% of the cases.

Key statistics on bicycle safety:

- 90% of all crashes (including bicycle and motor vehicle), regardless of fault, are caused by human error
- 68% of bicycle crashes in Portland occur at intersections
- 81% of all bicyclist injury crashes and 77% of bicyclist fatalities in Portland take place on streets with higher classifications, such as Neighborhood Collector and Major Traffic Street
- 22 of 25 bicyclist fatalities in Portland between 1995 and 2007 took place where no bike lane existed
- Alcohol played a role in 35% of all bicycle fatalities between 1993 and 2005
- Helmet use has increased nearly 25% between 1992 and 2006

CHAPTER 7: BIKEWAY NETWORK

Between adoption of the Bicycle Master Plan in 1996 and 2006, Portland added 122 miles of developed bikeways to its network and saw bike traffic over the four bicycle-friendly Willamette River bridges (Hawthorne, Burnside, Broadway, and Steel) nearly triple. The development of Portland's bikeway network has been the primary ingredient in the city's success at increasing bicycle use over the past 10 years.

The 1996 Bicycle Master Plan selected bikeways based on several criteria, including:

- Connection to land uses
- Ease of implementation
- Needs for safety improvements
- Lack of parallel facilities
- Need of continuity

[8] Table 6.2, 6-5.

- Providing a bikeway every half-mile both north-south and east-west

In addition, PDOT used previously existing plans for bikeways to identify potential corridors.

The 1996 Bicycle Master Plan recognizes four types of facilities[9]:

- Bicycle Lanes – Striped lanes for the exclusive use of bicycles on roadways where the average daily traffic is 3,000 cars per day or greater.
- Bicycle Boulevards – Rather than exclusive lanes, boulevards are shared roadway environments with other treatments, such as traffic calming, to improve the bicyclist's experience.
- Signed Connections – Generally connector routes with signs leading to points of interests or other bikeways.
- Off-Street Paths

In 2006, Portland's bikeway network was approximately 45% complete; however there are notable differences between different areas of the city. In Southwest, for example, only 28% of the network is complete, whereas the Central City's network is 58% complete.

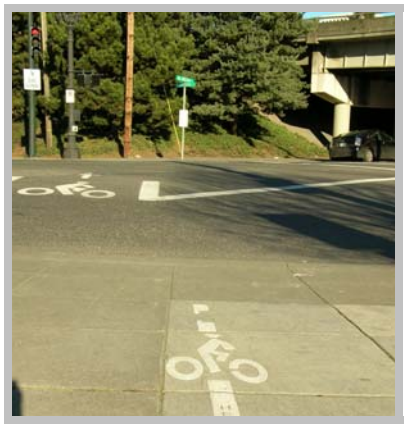
One of the PDOT programs most successful at adding miles to the bikeway network is "Missing Links." The program, funded at a modest $50,000 per year, has opportunistically and efficiently developed city bikeways in conjunction with other projects, particularly working with regularly scheduled pavement overlays. Without the Missing Links program and funding, 41 miles of city bikeways – typically developed as bicycle lanes – would not have been striped or would have cost much more if undertaken as a separate project.

Building the bikeway network has produced more cyclists, as well. There is a strong correlation between the growth of Portland bikeway network and growth in ridership. By examining the four bicycle-friendly Willamette River bridges, the correlation between the bikeway network and ridership is most evident. As the networks serving the Hawthorne, Broadway, and Steel bridges have developed over time, the ridership on those bridges has grown. Similarly, as the facilities serving the Burnside Bridge have not grown, neither have the number of bicycle trips across that bridge.[10]

Recent additions to the bikeway network have added significantly to ease of operation and connectivity, but have not added a lot of miles. Nevertheless, these additions represent sizeable investments in terms of funds expended, planning resources tapped, and engineering resources devoted, including:

- The scramble signal in the Rose Quarter
- The HAWK signal at 41st and E Burnside
- The "Three Bridges" project on the Springwater Corridor
- The Eastbank Esplanade and Riverwalk on the Steel Bridge
- The Bikeway Network Signing Project
- The Port of Portland's multi-use path to the airport

In addition, PDOT is building numerous curb extensions and median refuges that facilitate cyclists' crossings of busy arterial streets.



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[9] For more details on the various bikeway facilities, see 7-11 – 7-19.
[10] See figures 7.4 - 7.6

CHAPTER 8: BICYCLES IN THE CENTRAL CITY

Portland's Central City includes downtown, the Lloyd District, Central Eastside, and several other neighborhoods that make up the region's largest hub for employment and commercial activity. Bicycling in the Central City has seen dramatic increases and its accessibility by bicycle has helped cycling grow in Portland's inner eastside neighborhoods, as well. Furthermore, 280,000 Portland residents (2000 Census) live within three miles – an easy bicycle ride – of the Central City. Such a large population base in such close proximity to the region's major employment, shopping, and entertainment area make the Central City a prime location to encourage an explosion of cycling.

A number of factors will contribute to an increase in bicycle use in the Central City, including:

- Development of new facilities and educating residents about bicycle accessibility
- Increasing gas prices
- Increasing congestion
- Increasing density
- Increasing awareness of the relationship between health and activity
- Continued mixed use land development

In addition, the Central City is increasingly becoming a place where people not only work, but also live and play. There will be more non-work trips to and within the Central City over time that will create more demand for better cycling conditions.

Designing a bikeway network for Portland's Central City has been challenging. For example, based on traffic volumes and street classification bicycle lanes are currently the recommended bikeway treatment for downtown City Bikeways. However, in many areas of downtown where traffic and street conditions are complex, the Portland Bicycle Advisory Committee has historically been unable to reach consensus about striping bicycle lanes. Currently, downtown has limited bike lanes and no bike boulevards. New bikeway designs and classifications, reevaluating the current standards, and increased education and enforcement may be required to increase the amount of cycling downtown and, concurrently, in the Central City.

Access between the Central City and North and East Portland is facilitated by high-quality cycling amenities on the Hawthorne, Broadway, and Steel bridges as well as well-engineered roadway connections to those bridges. While the Burnside Bridge includes bicycle lanes, access to and from the bridge on both the east and west ends is interrupted and substandard and bicycle trips across the bridge have remained relatively flat (compared to the other bridges) since 1996. The Morrison Bridge's current facilities are substandard and dangerous for cyclists, but the bridge is slated to receive a multi-use path in 2009. The Ross Island Bridge also has substandard facilities for cyclists with no direct developed surface bikeway connections and a narrow shared use sidewalk on the bridge itself.

Bikeway facilities between the Central City and other parts of town, including Northwest, Southwest, and the River District can vary greatly. The bikeway network often includes dropped bike lanes, lack of treatments, or

missing links in key areas. Other areas, including South Waterfront and Lloyd District are generally well-served with some access issues in certain key points.

CHAPTER 9: BIKEWAY DESIGN, CONSTRUCTION AND MAINTENANCE PRACTICES

The cyclist's experience riding Portland's bikeway network is largely defined by the physical conditions on the road. What types of facilities are built and how they are built are essential to the creation of an attractive and comfortable environment for bicycling. Once a bikeway feature is established, maintaining its level of quality and performance becomes equally important.

PDOT is the primary architect of the city's bikeway network and design is based on the Bikeway Design and Engineering Guidelines in Appendix A of the Bicycle Master Plan. Ninety percent of the city's bikeway designs are found in Appendix A. That section was based on two main source documents: the American Association of State and Highway Transportation Officials (AASHTO) manual "Guide for the Development of Bicycle Facilities 1999," and the 1996 Oregon Department of Transportation (ODOT) "Oregon Bicycle and Pedestrian Plan." A third document also informs bikeway design. The Manual on Uniform Traffic Control Devices (MUTCD) sets standards for traffic signs and signals and pavement marking.

PDOT has incorporated much of the guidance outlined within the Design and Engineering Guidelines (Appendix A) as standard construction practices. Several issues, particularly storm water catch basins and gutters within bicycle lanes and construction on streets with bike lines, still exist and merit more detailed consideration.[11]

Maintenance practices are also a key component in a functioning bikeway. As with the City's construction practices, many guidelines contained in the Bicycle Master Plan have been incorporated into standard maintenance practices within the City. The key maintenance issues affecting cyclists are:

- New pavement overlay practices ("plugs") may affect the ability to inexpensively incorporate bike lanes into repaving projects (i.e. Missing Links funding)
- Street sweeping
- Gravel cleanup following storm events
- Pavement overlays and substandard drainage grates
- Transitioning from painted lanes and pavement markings to thermoplastic striping
- Roadside maintenance, such as vegetation.

While the majority of the designs for bikeways can be found in Appendix A of the Bicycle Master Plan, new or relevant designs that merit discussion include[12]:

- Bicycle Activated Signals
- HAWK Signals
- Pedestrian Half Signals
- Scramble Signals
- Bicycle Boxes

[11] See, Chapter 9 – Design, Construction & Maintenance for details.
[12] Chapter 9, 11 – 34.

- Crossing Treatments
- Traffic Diversion
- Bicycle Lanes
- Blue Bicycle Lanes
- Shared Lane Pavement Markings
- Hawthorne Bridge Pathway Markings
- Bikeway Signing and Markings

CHAPTER 10: BICYCLE PARKING

Bicycle parking is a key component of a functional bicycle network. A person is much less likely to cycle if she has no place to safely park her bike. In order to function well, bike parking must be:

- Ubiquitous – available everywhere cyclists ride.
- Conspicuous – in plain view to ensure the public that places exist to leave their bikes
- Secure – provide some level of assurance that the bike will not be stolen.
- Accessible – easily serve the needs of the cyclist and the location she is traveling to.

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There is little doubt that the demand from citizens and the business community for high quality bike parking exists and is growing. Several different surveys administered in 2008 show a high level of interest in more extensive parking facilities. For example, several surveys of downtown commuters and residents have revealed between 27% and 37% of respondents said they would bicycle more if more parking existed.[13] Additionally, 52% of Central Eastside residents responding to a PDOT survey reported that more bike parking would help them drive less.[14]

Much of the demand for bicycle parking is met through short-term parking. PDOT primarily installs staple racks in the right-of-way (usually on the sidewalk). In addition, Portland city code requires new private developments to install short-term parking on the property near main entrances.[15] Short-term parking locations are identified in one of four ways:

1. Requests by citizens or businesses in the right-of-way
2. As required by Portland code (33.266.200 Bicycle Parking) on new developments
3. Privately installed parking permitted by PDOT for location in the right-of-way
4. As a component of public works projects

PDOT has also developed several new and innovative methods to meet parking and end-of-trip facilities demand:

1. Bike Corral – Located on-street and providing parking for 16 to 24 bicycles in two motor vehicle parking spaces
2. Bike Oasis – Covered bicycle parking facilities with parking for approximately 10 bicycles; built on the sidewalk.

[13] SmartTrips Downtown Program Participant Survey, 2007 and 2008; Central City Transportation Management Plan (CCTMP) Downtown Resident and Employee Survey, 2008.
[14] CCTMP Central Eastside Resident and Employee Survey, 2008.
[15] For specific code requirements go to: http://www.portlandonline.com/shared/cfm/image.cfm?id=53320

3. Bike Parking Fund – Allows property owners to meet their short-term bicycle parking requirement by paying into a PDOT-administered fund used to provide short-term bicycle parking throughout the city
4. Floor Area Ratio Bonus – Allows developers to build 40 additional square feet—beyond what code would otherwise allow—for every square foot they dedicate to bicycle commuter shower and locker room facilities

Long-term bicycle parking is meant to accommodate employees, students, residents, commuters, and others expected to park more than two hours. Long-term parking should be located in a secure, weather-protected environment and can include, lockers, locked room facilities with standard racks and limited access, or standard racks in a monitored location. In order to assist developers and property owners, PDOT created a guide for building long-term bicycle parking that both meets city code and cyclists' needs.[16]

In order to meet long-term parking demand PDOT developed "Bike Central" in 1996, a network of facilities that provide bicycle commuters with permanent clothes storage, showers and secure bicycle parking. Users must pay a fee to access the facilities. To date, two Bike Central locations still operate; one in downtown and one in the Lloyd District. While Bike Central is an innovative public-partnership designed to meet residents' long-term end-of-trip facilities needs, it only meets a small amount of the demand for long-term parking spaces and only serves cyclists with destinations near the facilities.

Portland has added thousands of bicycle parking spaces since the original adoption of the Bicycle Master Plan in 1996. City staff has developed new tools and worked with stakeholders, community members, and businesses to ensure bicycle parking standards that works for Portlanders. Nevertheless, the City faces several issues in building the next wave of bicycle parking:

- Lack of system or policy to anticipate or calculate bicycle parking demand.
- Inadequate policy to meet demand for on-street bike parking facilities.
- Lack of data on existing long-term parking and facilities and cyclists' needs.
- A building code that allows an apartment or dormitory to serve as long-term parking.
- Effectively addressing bicycle security and theft, particularly as it relates to parking.
- Growing demand for bicycles on transit and for parking at transit stations.
- Lack of policy or rules providing guidance for parking at special events

CHAPTER 11: BICYCLE AND TRANSIT INTEGRATION

Part of the City's goal to make the bicycle an integral part of daily life involves improving bicycle/transit integration. Linking together policies encouraging both bicycle and transit use can effectively reduce Portlanders' dependence on their automobiles.

TriMet is the Portland metro region's main transit provider and the agency's general policy on bicycles is to "permit the transport and operation of a bicycle upon the District Transit System." TriMet's Administrative Rules establish the specific standards for bringing bicycles on buses and rail vehicles and for using TriMet lockers and racks.

[16] *Bicycle Parking Facilities Guidelines*, http://www.portlandonline.com/transportation/index.cfm?&a=58409&c=34813

TriMet's Transit Investment Plan (TIP), a five-year plan outlining the agencies strategies and programs to meet regional goals, contains the follow statement:

> *TriMet will continue to promote bike access to transit by expanding the distribution of bike racks and lockers as new investments in high capacity transit are made. TriMet will work with local jurisdictions to improve bike access and awareness of bicycle facilities in the metropolitan area. High capacity transit corridors will preserve, enhance or establish bike routes.*

Since 1995, every bus operated by TriMet has been equipped with a bicycle rack. In the past, cyclists were required to obtain a special permit to use the racks, however in 2002, TriMet eliminated that requirement. In addition to TriMet, C-Tran, which serves Clark County, Washington, and several other transit providers in the Willamette Valley include bicycle racks on their buses.

Since 1991, bicycles have been permitted about TriMet's light rail system, MAX. In 1996, TriMet eliminated time of day restrictions; however bicycles may still be excluded today if there is lack of room in designated bike areas. Most of TriMet's light rail vehicles are equipped with four hooks for hanging bicycles per railcar. Some of TriMet's older vehicles require bicyclists to stand at the end of the car and no hooks are provided. Similar to light rail, bicycles are allowed on Portland Streetcar and the Portland Aerial Tram but without specific infrastructure.

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The rising popularity of bringing bicycles aboard transit vehicles has increased TriMet's interest in enhancing bicycle parking at transit stations to encourage cyclists to park-and-ride to their destination. Many MAX stations and all transit centers within Portland offer a combination of long-term bike lockers/lids and short-term bike racks. TriMet's website lists where long-term rental lockers are located and their availability. In 2008 and 2009 TriMet is convening a working group to reevaluate and potentially redesign bicycle parking at transit stations.

The creation of complementary bikeway and transit networks contribute to the development of an interconnected multi-modal transportation system. Both TriMet and The City of Portland Comprehensive Plan emphasize integrating the bicycle and transit trip. The City's existing bikeway network was developed with consideration towards providing access to transit stations. Still, with less than half of the network complete, notable gaps remain in the bicycle routes feeding transit. Safe, direct bicycle routes to transit can efficiently expand the convenience, capacity, and feasibility of both modes.

CHAPTER 12: BICYCLE-RELATED INDUSTRY

The City's investment and commitment to bicycling and bicycling infrastructure has helped attract a growing, vibrant bicycle-related industry. In 2006 Alta Planning + Design completed a report documenting bicycling's impact on Portland's economy.

Alta found that total annual bicycle-related economic activity is close to $63 million. The study divided economic activity related to bicycling into four general categories: retail and repair; distribution and manufacturing; tours, rides, races and events; and, professional services. Bicycle-related businesses account for an estimated 600 to 800 jobs, with seasonal variation. Portland's bicycle-friendly reputation attracts planners and designers worldwide to tour Portland's infrastructure. More than 80 percent of businesses surveyed emphatically state that Portland's reputation for being a bicycle friendly city is good for their business.

Following Alta's report, City Council passed a resolution to designate and support Bicycle-Related industry as an official "target industry." The resolution states that it is "in the City's best interest to foster the development of this fast-growing market niche, as it is a strategic economic investment that would contribute to both the City's economy and its transportation goals."

The Portland Development Commission in concert with PDOT has since initiated a collaborative effort with the business community to make Portland the most desirable place in the country for bicycle businesses. The initial set of priorities included:

1. Organizing a large-scale bicycle race
2. Providing assistance (technical/financial) to local bicycle-related companies
3. Forming a statewide business association.

INTRODUCTION

In 1996 as part of the Bicycle Master Plan the City of Portland adopted as policy the desire to "Make the bicycle an integral part of daily life in Portland, particularly for trips of less than five miles, by implementing a bikeway network, providing end-of-trip facilities, improving bicycle/transit integration, encouraging bicycle use, and making bicycling safer".[1] By these measures Portland has performed admirably. The City's bikeway network has grown expansively.

- Requirements for bicycle parking have matured and parking is provided for in a number of creative and routine ways
- People may now effectively and conveniently bring their bicycles on light rail, streetcar, buses, and tram making multi-modal trips easier than ever
- Portland's encouragement programs are fast becoming a national model
- All measurements indicate a significant decrease in the bicycle crash rate and Portland's commitment to safety is reflected in a number of coordinated multi-agency efforts

In the past decade bicycling has truly become an integral part of daily life for thousands of Portlanders who, in 1996, may have viewed it as an occasional if enjoyable means to spend an afternoon along the river, or riding with their children or friends.

And yet, Portland is still only capturing the tip of the iceberg of potential bicycle trips.

By every measure, Portland's integrated approach to bicycle transportation—with its emphasis on providing connected, direct bikeways and encouraging people to use them—has been successful. The number of bicycle trips in Portland has grown steadily, and now seems poised to grow exponentially. Bicycling is a frequent topic of news, conversation, art, and politics—both positive and negative—for many Portlanders. Bicycling in Portland is here to stay. Bicycling in Portland has a future.

The intent of this document is to formalize and organize the conversation about what that future will be. The result of this conversation will be to chart the future of bicycling in Portland. Will bicycling in Portland follow the model of the past decade and continue to make modest inroads into the daily lives of Portlanders—attractive as a means of daily transportation only to that minority of residents confident enough to mix, as they inevitably must, with high volumes of automotive traffic. Or, and more hopefully, will the future of bicycling in Portland leap

[1] At the time this was Policy 6.12 Bicycle Transportation of Portland's Comprehensive Plan. It is now Policy 6.23 following the 2002 adoption of the Transportation System Plan as part of the Comprehensive Plan.

upon the gains already made and upon the native expertise and burgeoning social and health trends here and begin to ascend toward the status of world-class bicycling city, American-style?

Many indications point to a strong latent desire for the latter. First among these is the response of Portlanders to the relatively modest improvements made in the past ten years. Portland is at the apex of American cities for bicycle transportation because so many of our citizens have been attracted to bicycling for transportation. As more people ride, more people know somebody who rides. Word of mouth and friendly encouragement is the best advertisement and promotion for bicycling. Second is a growing awareness of the health consequences of inactivity and the health benefits gained through moderate, regular daily activity. Even the federal Centers for Disease Control and Prevention (CDC) states that "automobile trips that can be safely replaced by walking or bicycling offer the first target for increased physical activity in communities."[2] Third is a growing awareness of global warming and the growing likelihood of severe environmental upheaval. The combination of this awareness with the knowledge that 40 percent of global warming gases arise from emissions from personal transportation, and with people's reflexive desire to do something to personally address such problems, will steer increasing numbers of people away from over reliance on automobiles. Fourth is the fact that bicycling is fun. For many it is not a hard sell. There's good reason that a bicycle is among the most treasured of childhood gifts and possessions. Riding a bicycle makes one young again.

The challenge in addressing these latent desires is being able to effectively respond and create the conditions that address the majority's concerns about personal safety and convenience. Ultimately, it all comes down to questions of priorities in design and effort.

This Existing Conditions Report describes in detail the myriad systems that contribute to bicycle transportation in Portland. This includes the city's bikeway network, encouragement programs, efforts to provide end-of-trip facilities (i.e., parking), and efforts to improve road safety. This report presents our best understanding of the factors that have contributed to a quadrupling of bicycle trips across the Willamette River since 1990. It identifies those elements that we think have worked as well as the deficiencies that remain to be corrected if Portland is to become a world-class cycling city. This detail is provided in order to thoroughly and accurately describe how the 1996 Bicycle Master Plan has been implemented, to foster an understanding among Portlanders as to the mechanics and practice making the bicycle a part of daily life in Portland, and to lay a foundation upon which we can build to take bicycling to the next level as a means of daily transportation.

[2] The quote is attributed to Jeffrey P. Koplan and William H. Dietz, in an article written by them, titled: "Caloric Imbalance and Public Health Policy," from the Journal of the American Medical Association 282(16): 1579-1581 (1999). Jeffrey Koplan was Director of the Centers of Disease Control and Prevention (CDC) from 10/98 through 2/02. William Dietz is the current Director of the Division of Nutrition and Physical Activity at the CDC.

BICYCLE USE

INTRODUCTION

For thousands of Portland residents, the bicycle is an integral part of their daily life; it is not just a vehicle for commuting or recreation, it is a defining characteristic. A 2006 survey showed that 43 percent of Portland residents in inner NE and SE think bicycling is an important part of their lifestyle.[1] Bicycle use in Portland has increased dramatically since the first Bicycle Master Plan was adopted in 1996, and today it is common for residents to know a person or several people who regularly use a bicycle for transportation. The number of residents who now consider it quite normal to use a bicycle for errands, shopping, leisure, and commuting reveals an even more compelling story in terms of the level of support for bicycling in Portland. In one recent survey[2] in a 100,000 person swath of inner NE and SE Portland, 84 percent of respondents agreed that the bicycle provides a good means of basic transportation in Portland, and 76 percent said the bicycle is a good way to take care of errands close to home. Drawing from the wealth of survey data available today, this chapter will describe bicycle use in Portland: who's riding, who's not riding, what the surveys and counts show in terms of bicycle use, and what factors influence the choice about whether to use a bicycle.

Jonathan Maus/BikePortland.org

There are a variety of metrics available for evaluating changes in bicycle use including the US Census or the American Community Survey (ACS). Excellent local measures include Portland's annual count of bicycle trips on the four bicycle friendly bridges over the Willamette River (Hawthorne, Steel, Broadway, and Burnside), the Office of the Auditor's annual neighborhood survey, an annual survey conducted by Portland's "Smart Trips" program, and recent city-wide surveys regarding transportation. Of these, the bridge counts have been taken most regularly and may best reflect the way bicycles are used in Portland and account for not only commuters but for students, shoppers, and recreational riders. Since 1990, bicycle use on these four bridges has increased 321 percent while motor vehicle traffic has remained constant.

The US Census Bureau reported a 190 percent increase in bicycle use among commuters in the City of Portland between 1990 and 2005. In 2005, 3.7 percent of commuters were on a bicycle, representing approximately 9,000 residents who reported that the bicycle was their primary means of transportation[3]. While 3.7 percent is among the nation's highest bicycle mode shares[4] for commuting trips, relying on Census data to evaluate bicycle use misrepresents the level of bicycle use in Portland. The Census focuses solely on commute trips for one week in

[1] Campbell Delong Resources Inc-SmartTrips Program Survey September 2006.

[2] Campbell Delong Resources Inc-SmartTrips Program Survey September 2006.

[3] 1990 and 2000 US Census, Summary File 3, P049. MEANS OF TRANSPORTATION TO WORK - Universe: Workers 16 years and over and American Community Survey, 2000-2006 P047. MEANS OF TRANSPORTATION TO WORK FOR WORKERS 16 YEARS AND OVER - Universe: WORKERS 16 YEARS AND OVER

April. Yet commuting represents only 20-30 percent of the trips made each day; therefore, fully 70-80 percent of trips are not accounted for. Based on PDOT survey data, 10 percent of all trips in Portland's Inner Eastside are made on a bicycle accounting for thousands of bicycles trips to shop, to go to dinner, or just for recreation.

Perhaps the most intriguing aspect of bicycle use in Portland is not the growth that the city has experienced, but rather the potential for continued growth. The flexibility, reliability, and speed of a bicycle relative to transit and walking, as well as the low cost of both purchasing and operating a bicycle make it the ideal mode for trips under five miles. Research and survey work recently completed by the City of Portland indicate that for half of the non-bicycle using population, only subjective reasons keep them from using a bicycle. These people, representing half of non-cyclists, report no objective barriers such as trip distance, time, packages, or passengers that keep them from riding. Rather, they report only subjective barriers such as perceptions of safety and routes, perceptions of time, fitness, or other reasons. And more importantly, 10-15 percent of Portland residents have neither objective nor subjective reasons for not using a bicycle; they just don't. Recent survey work suggests that addressing safety concerns through infrastructure investments may attract a large number of new cyclists, but presently there is a large latent demand for bicycle use in Portland that could, in theory, be attracted to cycling with little or no capital investment.

CHARACTERISTICS OF USERS

In 1982, the City of Portland hired Columbia Research Center to survey Portland residents regarding their bicycle use, attitudes toward cycling, and barriers that prevent them from bicycling more[5]. Their findings indicated that residents can be split into three categories: active cyclists, potential cyclists, and non-riders. Much like today, active cyclists tended to be middle aged males and about 30 percent of the population was either not interested or unable to ride a bicycle. The main barriers identified to increasing bicycle use were perceived danger from motor vehicle traffic, weather, lack of bicycle routes, distance, and danger of dogs.

This survey administered twenty-five years ago resembles findings from recent surveys. While the dog danger has abated, the concepts and trends identified in the 1982 survey have remained relatively constant over the years. What has changed, however, is an increase in the number of potential cyclists, the perceptions of residents toward cycling as a real transportation option, and the demographics of existing and potential cyclists. In 1982, only fifteen percent of the population thought riding a bike to work was a possibility for them; in 2006 63 percent of the population under fifty-five years old agreed that it is likely they would ride a bicycle to work at some point.[6]

This represents quite an evolution in the perception of bicycling and mirrors the evolution that also occurred in bicycle transportation planning as well as bicycle use. That evolution in thinking continues as the city considers how to build a bicycling infrastructure that meets not just the needs of a small percentage of the population, but to thinking about how programs and infrastructure can be designed to appeal to the majority of Portlanders and

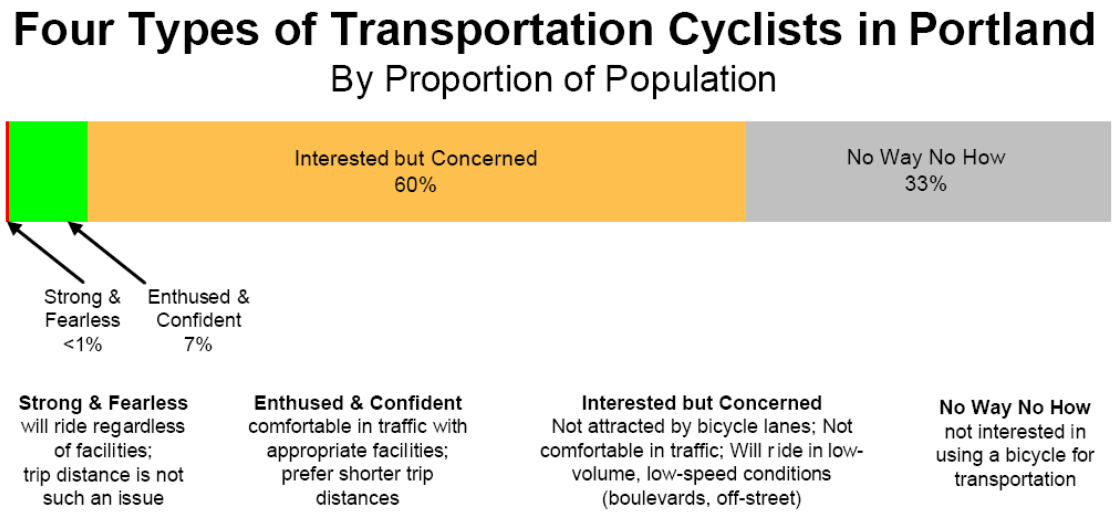
[4] Commute Mode Share is defined by the percentage of the commuting population using a given mode. For the purposes of this document, residents who reported they worked at home were removed from the data set.

[5] Columbia Research Center-Attitude Study for the Portland Metropolitan Bicycle Encouragement Program, 1982.

[6] Campbell Delong Resources Inc-SmartTrips Program Survey September 2006.

respond to the latent demand. In so doing, Portland strives to create a cleaner, healthier community that uses bicycles not just for commuting and recreation, but for shopping, leisure or fun.

When considering this latent demand it is useful to think of Portlanders as falling into one of four categories based on their relative comfort with bicycling. The first category is loosely defined as the "Strong and the Fearless;" who will bicycle regardless of conditions. The second category represents the "Enthused and Confident", and is typified by people who are confident using a bike lane. , The third and largest group are the "Interested and Concerned"; they're not quite ready to hit the streets on a bicycle, but they'd like to under the right circumstances. The remainder are either not interested in bicycling, nor physically able to bicycle, and are called the "No way. No how" group. The continuum is organized, in part, by individual comfort levels with different types of bikeways, but also by perceptions of cycling, and cyclists as a population. These biases are influenced by personal experiences as well as by opinion leaders, workplace culture, social norms and the built environment.



It was the Strong and Fearless and Enthused and Confident cyclists who helped shape the 1996 Bicycle Master Plan. That plan's focus on bicycle lanes on arterial streets reflects the interests and dominant thinking of the time. The presence of bike lanes and incremental investments on the key bridges into downtown raised the visibility of bicycles in the community. People that didn't ride a bike for transportation purposes began to see that this city had a place for them to ride, and they began riding. This phenomenon created a snowball effect, wherein the increasing presence and visibility of cyclists attracted more new cyclists. Many Portlanders previously uninterested in bicycling for transportation began biking to work, to shops, and to restaurants. This group of "Enthused and Confident" riders are those who have been attracted to cycling in Portland by the significant advances the city has made developing its bikeway network and supporting infrastructure over the past 15 years. They are comfortable sharing the roadway with motor vehicles, but they prefer to do so operating on their own facilities. They are attracted to riding in Portland because there are streets that have been redesigned to make them work well for bicycling. They appreciate bicycle lanes and bicycle boulevards. These are the citizens who are and could be attracted to regular riding by continuing to address the barriers on which Portland has focused for the past 15 years: shorter trip distances, better bicycle facilities, and better end-of-trip facilities. Today, they account for perhaps six to ten percent of the population in Portland and are largely responsible for the increase in bicycle use in recent years.

A much larger demographic, representing the vast majority of Portland's citizens, are the "Interested but Concerned." These residents are curious about bicycling. They are hearing messages from a wide variety of sources about how easy it is to ride a bicycle in Portland, about how bicycling is booming in the city, about "bicycle culture" in Portland, about Portland being a "bicycle-friendly" city, and about the need for people to lead more active lives. They like riding a bicycle, remembering back to their youths, or to the ride they took last summer in their neighborhood, or on a path, or on an organized group ride and they would like to ride more. But, they are afraid to ride. They don't like the cars speeding down their streets. They get nervous thinking about what would happen to them on a bicycle when a driver runs a red light, or guns their engines around them, or passes too closely when driving too fast. Very few of these people regularly ride bicycles—some will ride through their neighborhoods to the local park or coffee shop, but will not venture out onto the arterials to the major commercial and employment destinations they frequent. There are probably 300,000 residents in this group, representing 60 percent of the city's population. They would ride if they felt safer on the roadways—if cars were slower and less frequent, and if there were more quiet streets with few cars and paths without any cars at all.

Perhaps one-third of the city's population falls into the last category of 'non-cyclist.' This is the "no way, no how" group who is currently not interested in bicycling at all, for reasons of topography, inability, or simply a complete and utter lack of interest.

The separation between these four broad groups is not generally as precise as described above; there is quite a bit of blurring between the "enthused", the "interested" and those not at all interested. Surveys conducted over the years support this division into four categories and find that Portland residents are generally receptive to bicycling and supportive of investments in infrastructure, education, and outreach efforts aimed at promoting bicycle use regardless of whether or not they actually ride a bicycle. For example, a 2006 survey of residents in Inner Northeast and Southeast[7] revealed that:

- 84 percent of residents surveyed agreed that bikes provide a good means of basic transportation in Portland, and;
- 56 percent want to ride a bike more often but have trouble fitting it in to their lifestyle, and;
- 43 percent agreed that riding a bike is an important part of their lifestyle.

Five hundred face to face interviews in North Portland in 2005[8] revealed that:

- If conflicts arise between cars and bicycles, 80 percent of residents in North Portland think preferential treatment should be given to bicycles, to the disadvantage of cars, and;
- 88 percent think that further developing the bicycle route network and facilities is an effective means for solving traffic problems, and;
- 72 percent "definitely" think more money should be spent expanding the bicycle routes and information.
- 67 percent "definitely" think politicians should be more concerned with bike routes, facilities, and information.

[7] Campbell Delong Resources Inc-SmartTrips Program Survey September 2006.
[8] SocialData America-Portland Interstate Large Scale Individualized Marketing TravelSmart Project-March 2006.

Bicycling is well supported by the Portland public. However, to increase bicycle use will require addressing the needs and concerns of the "Interested but Concerned" audience. Given the above categories and the survey results there appears the potential to increase bicycle use an order of magnitude beyond the current level by targeting the large number of residents who like bicycles, and enjoy riding them, but who do not yet use one for transportation. Similarly, it is becoming increasingly important to market the benefits of bicycles and related safety improvements as a benefit to all users of the transportation system, not just active cyclists.

Bicycle Use for Commute Trips

Each of the several survey tools available for measuring bicycle use in Portland has inherent strengths ands weaknesses regarding their respective designs and the data they gather. The three primary data sources for evaluating bicycle use for commute trips are the decennial US Census, the annual American Community Survey (ACS), and the annual Service, Efforts, and Accomplishments survey administered by the City of Portland Auditor's office (SEA).

- The US Census is administered every 10 years in April to all residents of the United States and provides demographic data including race, gender, and age. The last census was in 2000. One in every six households receives a long survey form that asks many detailed questions including about commuting behavior. Survey respondents are asked to report their primary means of transportation to work in the week prior to the survey. While the US Census provides excellent data for the entire city, it may under-report bicycle use by asking respondents to commit to one mode of transportation. For example, if a person drives three days and rides a bike to work two days, they are reported as a drive alone commuter in the Census. Similarly, the US Census does not report bicycle use for anything other than commuting trips, so bicycle trips to school, shopping, or leisure are not included in this data set.

- The American Community Survey is an annual survey of 1 in every 40 households in the United States. This survey will replace the long form questionnaire on the decennial Census in 2010. The new ACS was first administered to test sites, including Multnomah County, in 2000 and is now done across the country providing data at the city and county level. In terms of transportation, the ACS and Census questions are identical. 6,000 Portland residents participated in the 2005 ACS, which is administered to an equal sample size each month of the year. The ACS data is available from 1996 through 2005.

- The SEA is an annual publication produced by the City of Portland Auditor's Office and reports survey findings from thousands of Portland residents. This self selecting mail survey asks residents how they normally commute to work, similar to the Census and ACS. However, the SEA goes a step further and asks residents whether or not they sometimes use a different mode, and if so what it is and how often they

use it. The SEA is administered in August of each year and reports findings at both the city-wide level and by neighborhood coalition.

Survey Findings

According to the Census, between 1990 and 2000 the percentage of residents in Portland that reported using a bicycle as their primary means of transportation for commuting to work increased 60 percent from 1.12 percent to 1.8 percent.

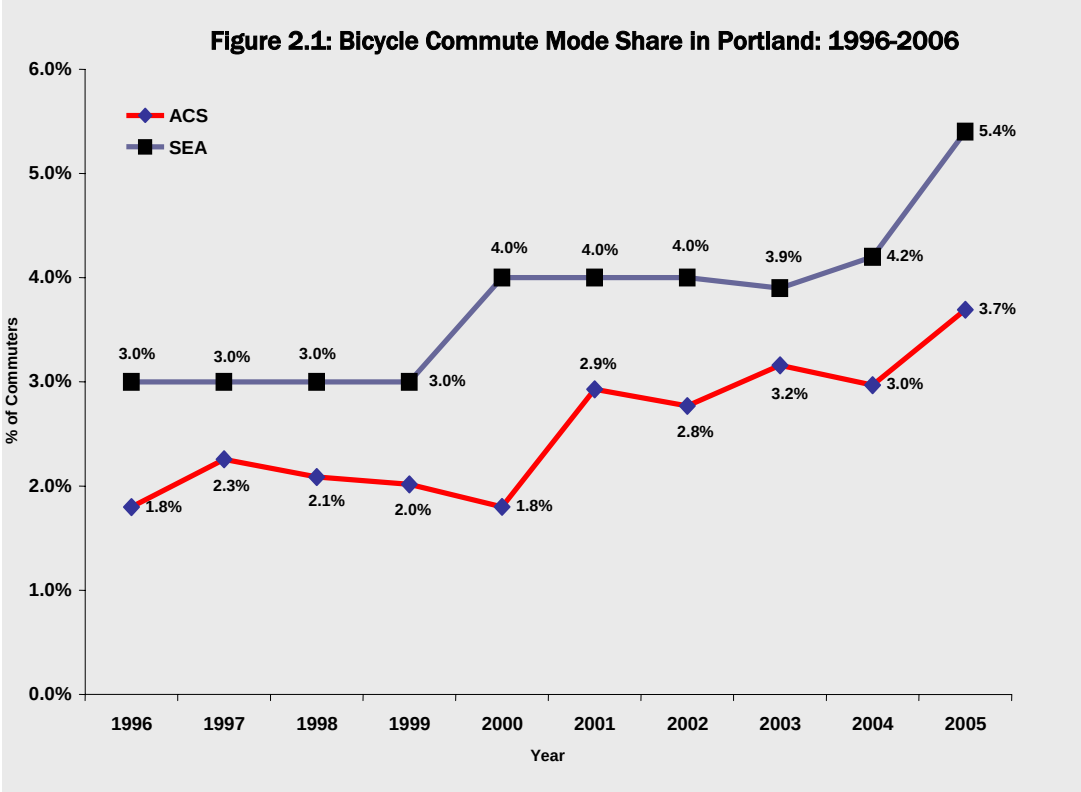
This growth trend continues through the most recent data available from the ACS and SEA. Table 2.1 shows the bicycle commute mode share for Portland as reported by both sources from 1996 through 2006.

Table 2.1: Bicycle Commute Mode Share in Portland 1996-2006

YEAR	ACS	SEA (primary means)	SEA (combined primary & secondary means)
1996	1.8%	–	–
1997	2.3%	3.0%	–
1998	2.1%	3.0%	–
1999	2.0%	3.0%	–
2000	1.8%*	3.0%	–
2001	2.9%	4.0%	–
2002	2.8%	4.0%	–
2003	3.2%	4.0%	–
2004	3.0%	3.9%	10.4%
2005	3.7%	4.2%	12.8%
2006	n/a	5.4%	14.5%

*2000 Census

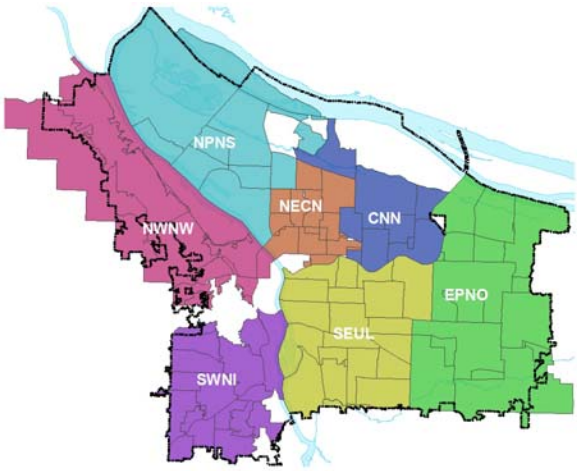
The SEA reports the percentage of residents citywide that use a bicycle for commuting has increased from three percent in 1997 to 5.4 percent in 2005, an 80 percent increase. Figure 2.1 shows both datasets, the bicycle mode share in the SEA is consistently higher than the ACS, likely due to weather and survey methodology (see above description of survey timing and administration). In 2004, a new question was added to the SEA survey asking respondents if they “sometimes use a different mode” instead of their “usual” mode. Between 2004 and 2006, the percentage of residents who reported using the bicycle as either their primary or secondary mode of travel increased by 39 percent (from 10.4 to 14.5 percent).



Bicycle Use-Commute Trips by Neighborhood Coalition

Arriving at an exact bicycle mode share number for the city is an elusive task. However, the available data tells an interesting story of how bicycle use has changed in different parts of the city. This change has been a response to the growth of Portland's bicycle network, and the City's encouragement efforts. Following is an outline of the data available for each of the seven neighborhood coalitions highlighting the differences between each sector. The seven neighborhood coalitions are North Portland Neighborhood Services (NPNS), Northeast Coalition of Neighborhoods (NECN), Central Northeast Neighbors (CNN), Southeast Uplict (SEUL), East Portland Neighorborhood Office(EPNO), Southwest Neighborhoods Inc. (SWNI), and Neighbors West-Northwest (NWNW) *(see map)*. The data available at this level of detail includes the Census and the SEA reports, as well as bicycle counts performed by PDOT.

Portland Neighborhood Coalitions



Census

City-wide census data provides a good snapshot of the region's progress of promoting bicycle use. However, when the data is analyzed at a more localized level it becomes evident that there are major disparities in bicycle use between Portland's neighborhoods. Table 2.2 below outlines the bicycle mode share for commute trips at the neighborhood coalition level using data available from the U.S. Census. Between 1990 and 2000, Inner Northeast Portland experienced significant growth in bicycle mode share, over 130 percent, while Outer East Portland increased only slightly.

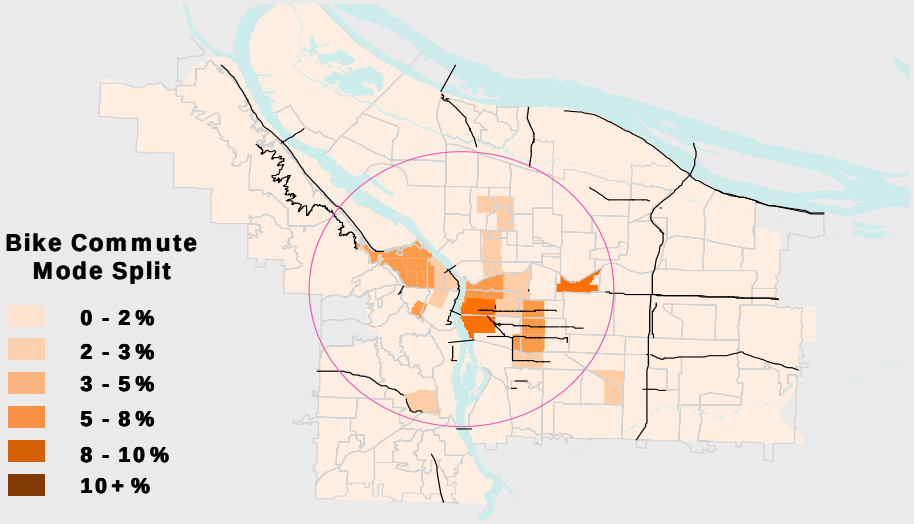
Table 2.2: Bicycle Mode Split by District Coalition: US Census

DISTRICT	1900 MODE SPLIT*	2000 MODE SPLIT*
SW	0.63%	1.04%
NW/Downtown	0.74%	2.49%
North	0.69%	1.04%
Inner NE	1.45%	3.34%
Central NE	0.63%	1.46%
Inner SE	1.63%	2.74%
Outer East	0.37%	0.42%
Total	**1.12%**	**1.79%**

* Mode split calculated after removing "worked at home" from data set

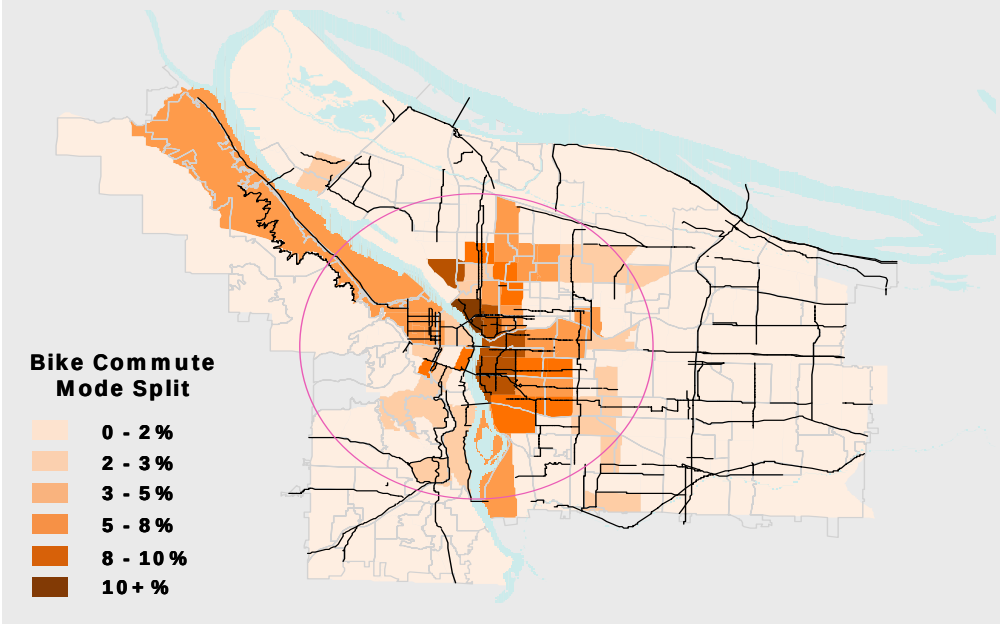
The following maps (Figure 2.2 and 2.3) help illustrate the disparity of bicycle use citywide and shows bicycle mode share for commute trips according to the 1990 and 2000 Census. The circle on the maps represents a four-mile radius from the Burnside Bridge Downtown and the black lines represent bicycle facilities at the time of the Census. It is clear that those census tracts near the central city—where the bicycle network is well established and trip distances to major destinations are short—have much higher bike mode shares than in East or Southwest Portland. Bicycle commuting as a means of transportation to work has closely followed the establishment of the

Figure 2.2: Bicycle Mode Share by Census Tract: 1990 Census



bikeway network. As the bicycle network developed in inner NE Portland, near the Broadway Bridge, so did ridership. As bicycle lanes were added in North Portland, feeding the Broadway Bridge, ridership increased there as well. This is clearly seen in the differences between the 1990 and 2000 Census maps.

Figure 2.3: Bicycle Mode Share by Census Tract: 2000 Census



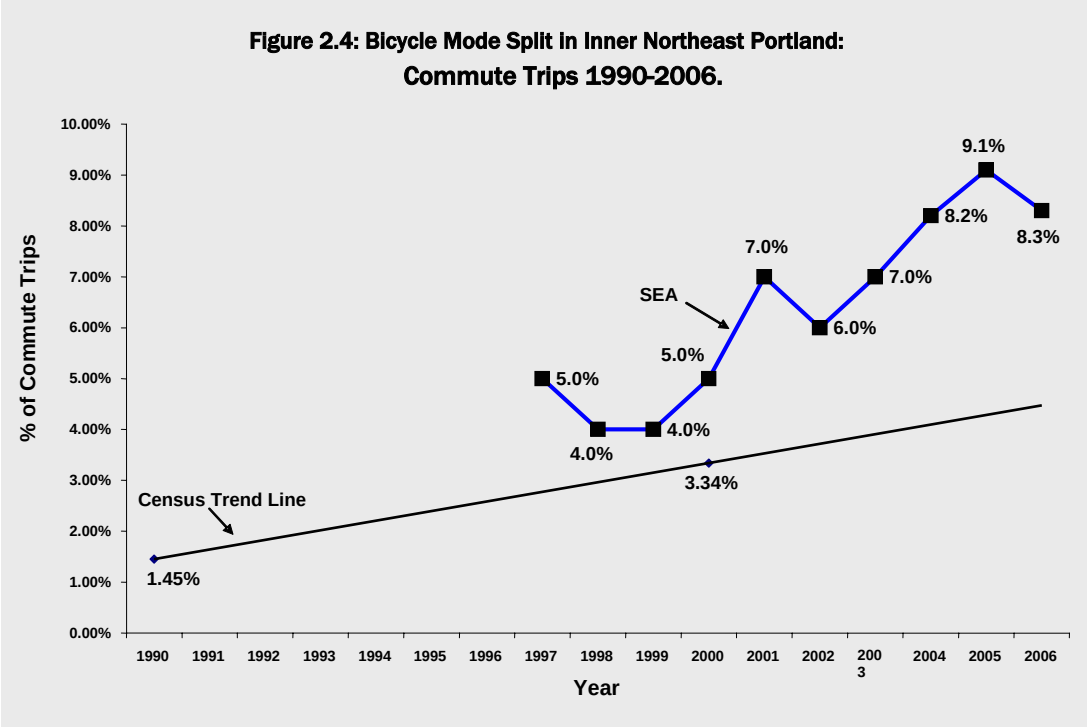
City Auditor's Service Efforts and Accomplishments Survey

The Auditor's annual SEA survey of residents asks a similar question to the Census, and provides an excellent historical account of trends in increasing bicycle use for commuting among the seven neighborhood coalitions. Table 2.3 summarizes the SEA data from 1997 to 2006. The trend demonstrated by the Census between 1990 and 2000 also appears in the SEA. Inner Northeast and Southeast continued to experience growth while Outer East Portland's bicycle mode share remained relatively steady over the years. Similarly, Southwest Portland experienced some growth, but it was modest compared to what had been reported in the inner eastside neighborhoods.

Table 2.3: Commute Mode Split 1998-2006 - Use "bike" to get to and from work (SEA-Auditors Office)

YEAR	SW	NW/ DOWNTOWN	NORTH	INNER NE	CENTRAL NE	INNER SE	OUTER EAST	TOTAL
1997	3.0%	5.0%	1.0%	5.0%	3.0%	6.0%	0.0%	3.0%
1998	2.0%	6.0%	2.0%	4.0%	3.0%	3.0%	1.0%	3.0%
1999	2.0%	7.0%	2.0%	4.0%	3.0%	5.0%	2.0%	3.0%
2000	2.0%	4.0%	3.0%	5.0%	2.0%	5.0%	1.0%	3.0%
2001	2.0%	5.0%	3.0%	7.0%	4.0%	6.0%	3.0%	4.0%
2002	2.0%	5.0%	5.0%	6.0%	4.0%	7.0%	2.0%	4.0%
2003	2.0%	7.0%	3.0%	7.0%	3.0%	10.0%	3.0%	4.0%
2004	2.4%	4.0%	4.0%	8.2%	2.7%	4.6%	0.9%	3.9%
2005	1.9%	3.4%	4.3%	9.1%	3.1%	6.2%	0.9%	4.2%
2006	3.1%	6.1%	5.3%	8.3%	4.3%	9.1%	1.5%	5.4%

Figure 2.4 shows a combination of Census data from 1990-2000 and SEA data from 1999 to 2006 and illustrates the trend of growth in bicycle use for Inner Northeast Portland over the fifteen year period. Similar charts for each neighborhood coalition can be found in Appendix A.

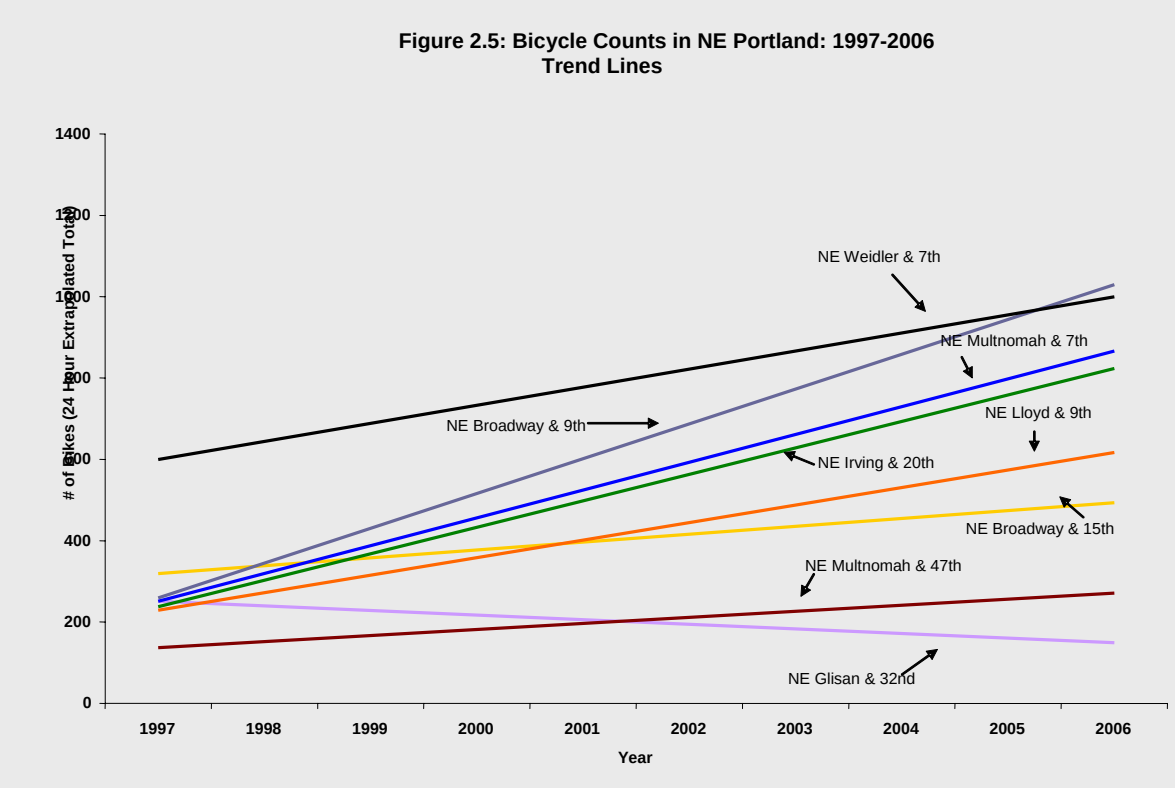


On average, the Census mode share numbers are 55 percent of the bicycle mode shares reported in the SEA, i.e., the bicycle mode share numbers are slightly higher in the SEA than the Census. This may be due to survey methodology; the SEA is administered in August while the Census is administered in March and April, traditionally rainy months in Portland. Bridge counts done during the summer and winter months of 1999 showed winter bicycle use in that year to be approximately one-third that of the summer months.

Bicycle Counts

In the early 1990's, PDOT began doing spot city-wide bicycle counts and maintains a database containing information from almost 900 separate counts. While the count data is sporadic for some locations, many intersections have ten years of count history and provide a good basis for evaluating facilitates and use. The count data reflect actual bicycle use on the streets rather than surveys of commuting trips only. Figure 2.5 illustrates the eight locations in Northeast Portland with enough data to draw a trend line[9]. For the most part, bicycle use has trended upward over the years in Southeast with some locations experiencing a large amount of growth. Bicycle count charts for Northeast, North, Southwest, and NW/Downtown are found in Appendix B. Only two locations in East Portland have been counted, and both show only one count from 2006.

[9] 2 hour peak period counts were always conducted in the summer. Count locations shown have at least two counts between 1996-98, two counts between 2004-2006, and at least one count in between there. The majority of locations graphed had at least six counts done during the ten years shown.



Bicycle Use for All Trips

Portland residents use their bicycles for a wide range of activities. In the most recent survey of active cyclists, commuting to work was the actually the least cited reason for riding a bike: 90% of active cyclists cited riding for pleasure, 84% for exercise, 46% to run errands or other utilitarian purposes, and *only 29% of active cyclists use a bicycle for commuting to work.* [10] A bicycle program that focuses on accommodating commuters and measures its success accordingly is missing a large segment of the active cyclist market. Growing bicycle use in the city for commuting and shopping trips will mean reaching out to the large segment of active cyclists who mountain bike or ride for exercise but do not currently bike to the movies, the store, or work.

The SEA, Census, and ACS all ask survey respondents to report their travel behavior for work trips only. Further restricting the data, each survey asks respondents to report how they "normally" commute to work and therefore necessarily force respondents to choose one mode to represent all their commute trips. This methodology has two major shortcomings. First, asking respondents to only report commute trips means 70-80 percent of trips are not reported in the survey data, as work trips make up only 20-30 percent of everyday travel and around 30% of all bicycle use in the city, as mentioned above. This is significant because home-based work trips in the region have much longer average trip distances (8.4 miles one way) than shopping or leisure trips (4.1 miles one way)[11] and are therefore not always the most likely candidates bicycling. Second, asking respondents to commit to one mode for the week forces a person who drives three days a week and bicycles two days a week to be counted as a driver. Of course, the inverse is true and some respondents who reported bicycling also drive or take transit some of the

[10] Davis, Hibbits, & Midgehall-Survey of Portland Residents on Bicycling and the Barriers to Bicycling, 2007.

[11] Trip distances are averages for Single Occupancy Vehicle trips. Average trip distances for bikes are 4.7 miles one way for work and 1.7 miles one way for shopping. Data from Bill Stein, Metro, August 2006.

time. PDOT's individualized marketing projects, TravelSmart and SmartTrips, have begun to report bicycle use data for non work trips; however, those data are not available citywide at this time. In 2003, the Auditor's Office changed its questionnaire for the SEA report to help address these issues.

In addition to asking residents to report how they normally commute to work, the SEA now asks residents whether they sometimes use a different mode for commuting, and if so, what it is and how often they use it. The findings suggest that the actual number of active cyclists in the city is greatly under-reported if data collection is limited to only asking how residents normally commute. In addition to the 5.4 percent of residents who reported normally commuting by bicycle, an additional 9.1 percent said they bicycle when they're not using their primary mode suggesting that on any given day, 14.5 percent of the commuting population could be considered an active or potential cyclist.

Figure 2.6 shows the percentage of respondents who said a bicycle was their primary means and the percentage who said it was their secondary means of transportation in 2006 by neighborhood coalition. Table 2.4 summarizes how often respondents used the secondary mode. Again the disparity between neighborhoods is evident; Inner Northeast and Southeast have more primary bicycle commuters, and more secondary bicycle commuters. However, Southwest and North reported a large number of residents who sometimes ride a bicycle to work. The highest total in the past three years was in 2005 when 22.4 percent of the population in Inner Northeast reported bicycling as either a primary or secondary mode. With 14.5% of the commuting population using a bicycle as their primary or secondary means of transportation represents 37,000 active bicycle commuters in the city of Portland.

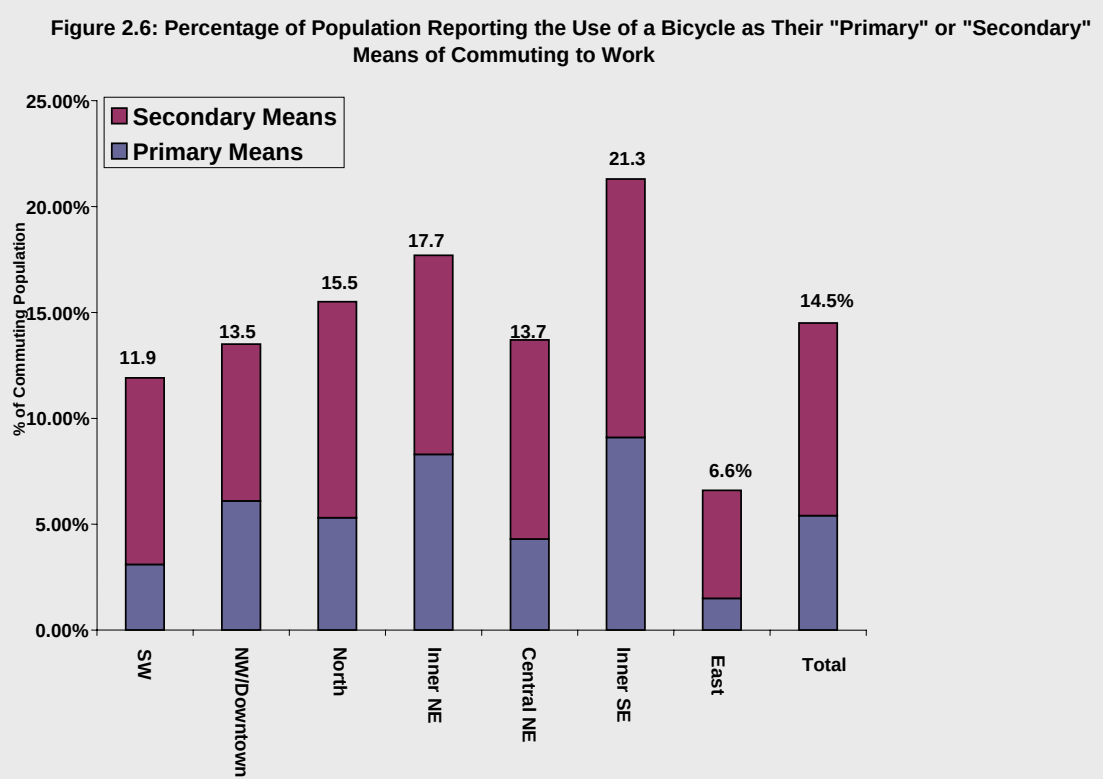
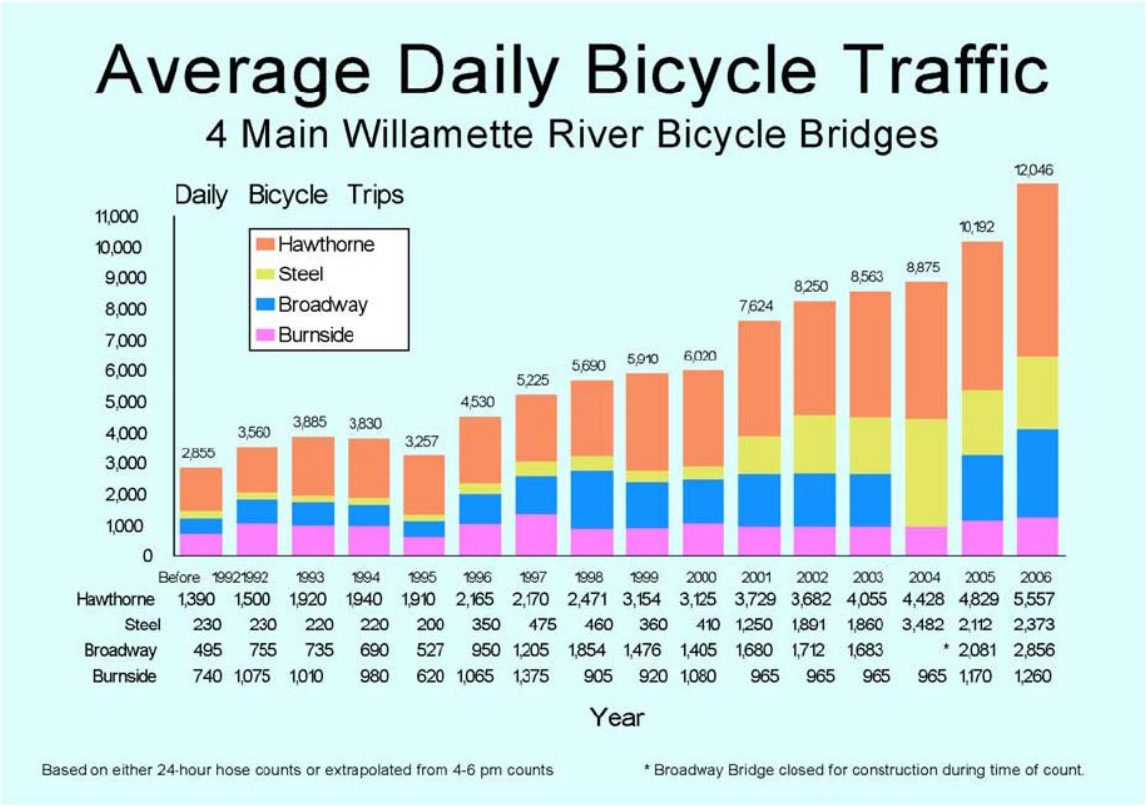


Table 2.4: Use of a bicycle as a "secondary" means of commuting to work (2006 SEA-Auditors Office)

FREQUENCY	SW	NW/ DOWNTOWN	NORTH	INNER NE	CENTRAL NE	INNER SE	E	TOTAL
A Few Times per Year	44.70%	35.20%	36.50%	42.50%	46.10%	37.30%	46.70%	41.20%
More than a few times	24.50%	33.10%	29.70%	29.50%	26.90%	31.60%	39.90%	29.20%
Fairly Frequently	24.50%	20.00%	23.60%	19.70%	21.00%	20.30%	14.00%	20.80%
Almost Half the Time	6.40%	11.70%	10.10%	8.30%	6.00%	1.70%	9.30%	8.80%

The most comprehensive data set available to date are the annual counts of bicyclists crossing Portland's four main bicycle friendly bridges (Hawthorne, Burnside, Steel, and Broadway). Since 1991, PDOT has regularly counted bicycle trips on the four bridges. The counts performed in the summer of 2006 showed a 321 percent increase over 1991 totals, with over 12,000 bicycle trips on the four bridges each day. Bicycle trips represent over 9.6 percent of all vehicles on the four bridges today, including automobiles and buses. Motor vehicle traffic has remained constant at approximately 113,000 vehicles per day. The increase in bicycle traffic on the bridges mirrors the increase in bicycling in and around the neighborhoods. As the number of cyclists in Inner Northeast and Southeast increased, so did the number of cyclists crossing the bridges.



TravelSmart and SmartTrips Surveys

Since 2003, PDOT has completed four individualized marketing projects in select neighborhoods in Portland; two "TravelSmart" projects and two "SmartTrips"[12] projects. Each project included a detailed pre- and post-survey of residents' travel behavior patterns as part of their evaluation[13]. The unique element of individualized marketing projects is that they are based in the household, where most trips begin and end, and encourage people to try an alternate mode for any trip purpose, not just commuting. Table 2.5 shows survey results for all trips for the four completed projects and pre-survey numbers for SmartTrips SE project (2007)[14]. The boundaries for these projects fit nicely with the neighborhood coalition boundaries used above, and are noted in the table. The last two surveys for SmartTrips Northeast and Southeast taken in early Spring and late Summer, show the significance of weather on bicycle use.

Table 2.5: Bicycle Mode Share for All Trips - TravelSmart and SmartTrips Surveys

NEIGHBORHOOD COALITION	SURVEY	DATE	BIKE MODE SHARE
Southwest	TravelSmart Pilot (Pre)	Sept 2002	1%
	TravelSmart Pilot (Post)	Sept 2003	2%
North	Interstate TravelSmart (Pre)	Apr 2004	3%
	Interstate TravelSmart (Post)	May 2005	5%
Southeast	Eastside Hub Target Area	Mar 2005	4.5%
Inner Northeast	SmartTrips NE (Pre)	Mar 2006	4%
	SmartTrips NE (Post)	Sept 2006	10%
Southeast	SmartTrips SE (Pre #1)	Mar 2006	2%
	SmartTrips SE (Pre #2	Sept 2006	7%

The SmartTrips survey data includes bicycle mode share for all trips purposes, not just commuting. When the data is broken out by trip purpose, it's clear that while commuting remains the most common bicycle trip in the region, ignoring the number of bicyclists who are shopping, or on leisure trips (movies, dinner, etc) greatly underestimates the number of cyclists on the roads today. Table 2.6 shows how bicycle mode share varies by trip purpose for the survey results in Southeast Portland. Shopping and leisure trips made up half of the total trips in this survey, and while their bicycle mode share is lower than that of work trips, the number of cyclists on the roads who aren't commuting or crossing a bridge into downtown is significant. For example, this data indicates that people are using bikes to run short errands to local shops in their neighborhood among other purposes and

Table 2.6: Bicycle Mode Share by Trips Purpose: SmartTrips Southeast, Fall 2006

TRIP PURPOSE	% OF TRIPS	BIKE MODE SHARE
Work	27.9%	11.7%
Shopping	23.2%	5.6%
Leisure	27.7%	5.9%
Fitness	2.6%	10.4%
Escort	3.8%	1.5%
School	7.7%	12.0%
Other	7.2%	8.3%

[12] Individualized marketing projects aim to promote walking, bicycling, transit use, and carpooling by allowing residents in the target area to select transportation materials and incentives that work for them. Chapter X, "Encouragement" has a detailed explanation of these projects.

[13] The projects are evaluated using a random, statistically significant sample of one day trip diaries spread equally over a week. Survey respondents report every trip they make for one day, providing valuable insight into actual travel behavior, not just commuting behavior.

[14] SmartTrips Southeast has two pre-surveys. This is a result of PDOT changing its survey methodology to a September to September cycle rather than a March to September cycle as had been done in the past. This change reduces variability in pre and post data stemming from weather differences.

destinations. This trend is mirrored by the SmartTrips Northeast survey data that showed a 13.9 percent bicycle mode share for commute trips, a 10 percent bicycle mode share for shopping, and a 6.7 percent bicycle mode share for leisure trips.

POTENTIAL FOR INCREASING BICYCLE USE IN PORTLAND

Over the past five years, the City of Portland and its partners have undertaken several surveys aimed at gathering input about individuals' barriers to bicycling and what can be done to address these barriers. The public's message is clear: the biggest barriers to increasing bicycle use in Portland are the reality and perceptions relating to safety. This is not new and the tools to address safety have and will continue to include physical improvements to the bicycle network, education and outreach to raise awareness among cyclists and motorists, and campaigns aimed at getting people out riding. It is worth noting that for a number of the trips in the region, riding a bicycle is just not necessarily the best option. Real constraints or objective barriers, like trip distance, or the need to carry passengers or a large parcel, make the use of a bicycle unrealistic for these sorts of trips.

The intent of the recent survey work was to reach the group of potential cyclists and determine what it is that keeps them from riding, and what could be done to encourage them. The culmination of in depth personal interviews, random telephone surveys, and strategic focus groups has yielded a wealth of data that will inform the Bicycle Master Plan update process and help identify target markets for promoting bicycle use in Portland. A few key statistics from the most recent surveys can help shape the conversation about increasing bicycle use:

- There is a consensus among residents that Portland is a bicycle friendly city, and residents are hearing this message from a variety of credible sources and opinion leaders,
- 70 percent of Portland residents own or have regular access to a bicycle,
- Between 60 to 70 percent of cyclists on the road today are male, based on count and survey data. No other mode of transportation has this gender inequity, and;
- Residents over 65 years old are under-represented in terms of bicycle use and over-represented in terms of being negatively predisposed to cycling.

Photo by Dat Nguyen

In the last twelve surveys done by PDOT, safety and weather concerns have been the top two reasons cited by Portlanders for not bicycling, or bicycling more often. The most recent survey work also showed that for cyclists and non-cyclists, the everyday practicality of cycling is a barrier; things like having a passenger or a large parcel make biking difficult for a lot of trips. Anecdotally, a barrier like weather may not stop a regular bike commuter from cycling, as they are often prepared for adversity; however that same barrier is likely magnified for the large number of cyclists who ride for pleasure and fun. If one is riding for fun, there is no reason to ride in the rain, or in any discomfort for that matter. Improving bikeways, making facilities safer and more predictable for all users, and increasing awareness among drivers and cyclists are

the three most often cited ways of increasing bicycle use. In a 2003 survey[15], 57 percent of residents said that safety concerns limited their ability to walk and bike, and 64 percent of Portland residents said they would walk or bike daily if it was safe to do so. There is a strong link between the perception of safety and bicycle use in Portland. However, in comparing stated preference survey data to actual bicycle use, it is clear there is a disconnect between what people say they will do and what they actually do.

The 2004 TravelSmart project in North Portland is the region's best example of comparing stated preference surveys with actual travel behavior. The data from 500 in-depth interviews revealed that people say they would use transit if there were a bus route that worked for them, but when they learned that there was a route and that it actually competed quite well with the automobile, they still didn't use it. In this case, their stated preference did not translate into actual travel behavior. The same can be said for cyclists with respect to perceptions of safe cycling facilities. For many surveyed residents there were safe bicycling facilities in their neighborhood, they just didn't know about them or they perceived them to be dangerous and consequently they did not use them.

Nonetheless, comparing survey results from before and after the TravelSmart project, it is clear that providing information to people is an effective way to change behavior. For example, before TravelSmart, 50 percent or residents in North Portland were "rather satisfied" with the bicycle facilities in Portland; after the project, 73 percent were rather satisfied and the number of residents who did not know how to answer dropped from 29 percent before the project to 14 percent after. Over the course of just a few months, bicycle mode share increased from three percent to five percent for all trips. Providing people with information in the form of maps and literature greatly influenced the perception of bicycling facilities in North Portland and increased bicycle use. Returning to the survey results mentioned above, however, if 64 percent of residents say they would bike daily if there were safe routes, and 73 percent of residents are rather satisfied with the bicycle routes in their neighborhoods, then why aren't bicycle mode shares significantly higher? To some extent, people report "safety" as the reason they don't ride bicycle because it's a socially accepted answer; the reality is that people don't bicycle for a variety of reasons; safety is one reason, and inertia is another.

PERCEPTIONS OF BICYCLING IN PORTLAND

Nine hundred randomly selected Portland residents were recently asked to respond to a series of bike related statements[16]. The testers assumed that the demographic of those who answered favorably would match that of existing cyclists. The surprising reality is that bicycling as means of transportation is widely supported in Portland, and not just among active bicyclists. While women are under-represented among bicycle users, their support for bicycles is equal to those of men. Similarly, families with children are positively predisposed to cycling and want to bike more often. Among those who think it is likely they will ride to work, there is no gender divide or split among those with or without children in the home.

There is a link between the provision of bicycle facilities (lanes, boulevards and paths) and the increase in bicycle use (see Chapter 7 – Bikeway Network). However when asked to respond to safety related statements, particularly in terms of bicycle facilities, the gender and age divides became more apparent. For example, men were 66

[15] Davis & Hibbits, Inc, August 2003.

Photo by Dat Nguyen

percent more likely to feel comfortable on streets with heavy traffic and bike lanes than women, and residents over 65 years old were twice as likely to feel uncomfortable. When asked if having to share the road with cars was the main reason they didn't bike more often, women were twice as likely to agree than men and were more likely to ride out of their way to find a safe street on which to ride. As mentioned earlier, women and seniors are greatly under-represented in bicycle use counts, and this survey data suggests that they are not as comfortable using the existing bicycle network as men or young people.

Perceptions are often based on experience, and a number of people have formed their perception of bicycling in Portland based on one or two personal experiences or stories relayed from a friend, co-worker, or in the news. In 2006, the City convened three separate focus groups of Portland residents to discuss attitudes towards bicycle use. The residents who were negatively predisposed to cycling consistently qualified their stance with a personal story about an experience they had either on a bicycle or when they had a negative interaction with a cyclist while driving. Shifting a person's perception is difficult, but not impossible. One of the most effective means for shifting perceptions of bicycles seems to be getting people out using the system, and encouraging people to base their perceptions on a positive experience of riding a bike rather than on a negative experience interacting with a cyclist. Getting people to try something new is difficult, and if they do not have a positive experience the first time they try it, it is less likely that they will try it again. It is for this reason that the city's bikeway needs to be safe and legible to all users. Bikeways need to be designed in a way that any cyclist could use them, and there needs to be a support system in place where people can learn the ins and outs of riding a bicycle in Portland by finding a map of routes or having contact with other new or experienced users.

Increasing bicycle use will mean listening to the needs of those who aren't riding today, and learning from what they have to say about the perception of safety on Portland streets. Regardless of what is built in terms of bicycle infrastructure, if the target audience either does not know it exists or they perceive it to be dangerous, it will not be used.

[16] Campbell Delong Resources Inc-SmartTrips Program Survey September 2006.

EVALUATION OF 1996 BICYCLE MASTER PLAN BENCHMARKS

INTRODUCTION

The purpose of this document is to evaluate the City of Portland's success in completing its Bicycle Master Plan ten-year benchmarks. This ten-year evaluation serves as a baseline for which to build upon in the 2006 - 2008 Update to the City of Portland Bicycle Master Plan.

This document follows the benchmarks of the 1996 Bicycle Master Plan. Each section of the Master Plan is considered with its ten year benchmarks and the current status of bicycling usage, infrastructure, and programs.

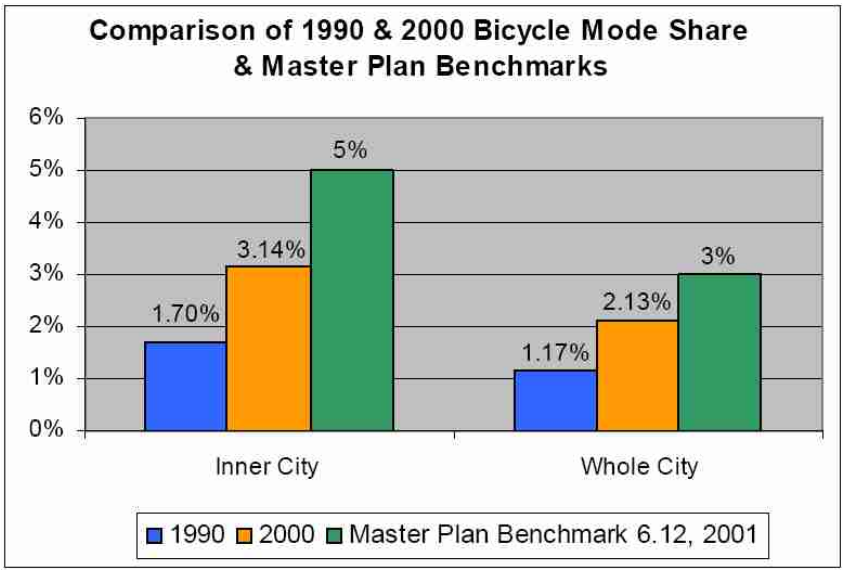
While several key benchmarks do not easily lend themselves to, and thus have not been evaluated by their intended measures, there are closely related data and accompanying narrative that point to trends toward their achievement. Recommendations for new benchmarks and a strategy for their regular and realistic measurement will be included in the second phase of the update of the Bicycle Master Plan.

Mode Share

Increase Bicycle Mode Share (6.12)

According to the Master Plan, Inner Portland should have 10 percent mode share for all trips by 2006, while in the whole of Portland bicycling should capture six percent of the mode share for all trips. Information can be gathered from the 1990 and 2000 censuses. Data from 2006 has not yet been collected. According to the 2000 census, inner Portland boasts 3.14 percent bicycle commute mode share, with a citywide bicycle commute mode share of 2.13 percent. Only commute trip data, excluding all other types of trips, is captured due to the phrasing of the census question, which simply asks the respondent their primary means of transportation to work in the previous week. This measure falls short of the 2001 five-year benchmark of five percent total mode share within the inner city and three percent mode share within the city limits.[1] Though,

FIGURE 3.1



[1] Based on the 2000 census question: "What was your primary means of transportation to work in the past week?" Answer provides a snapshot in March/April of primary means of transportation.

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because the census is a snapshot of commuting only, and only in the early spring of the Census year, and because commute trips represent only approximately 20-30 percent of all trips taken, this measure does not provide a very accurate accounting of how close Portland has come to achieving its benchmark.

Mode Share Variation[2]

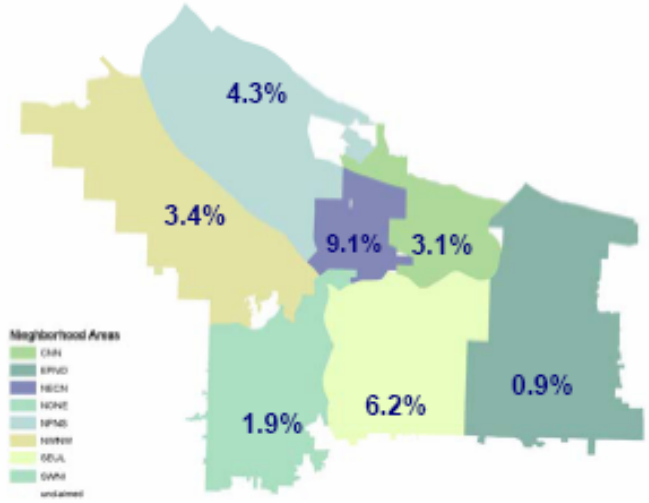
A more complete analysis of user characteristics, including mode share, is found in Chapter 2. This section simply summarizes that data and analysis.

Mode share varies according to the data source and neighborhood. According to findings from recent bicycle relate surveys, the citywide mode split for bicycles in Portland ranges from one percent to five percent for all types of trips. Most recent census data (2000) shows commute mode splits as high as 10 percent in some inner eastside neighborhoods and below one percent in outer southeast and northeast neighborhoods.

More recent surveys in North Portland (Travel Smart) and SE Portland (Davis & Hibbits/Options) suggest bicycle mode split is close to four percent for all trips in the city. In the Hillsdale target area, biking constitutes one percent of the mode share[3]. In the Interstate target area, three percent use bicycles as the primary commute mode.[4] In the inner Northeast and Southeast target areas, the mode share is five percent.[5]

FIGURE 3.2

Map of Bicycle Commute Mode Share by Neighborhood



[2] *Memo: Bicycle Related Surveys, 1982-Present*, December 2005, Dan Bower, City of Portland, Office of Transportation.
[3] 2003, Travel Smart Pilot Project in Hillsdale follow up survey results
[4] 2003-2005 Interstate Travel Smart Baseline Results
[5] 2005 Getting Around Portland, Eastside Hub Target Area. Davis & Hibbits with Transportation Options.

The 2004 City of Portland Service Efforts and Accomplishments report suggests four percent of all residents use a bicycle as their primary means for getting to work. The percentage of residents commuting to work by bicycle fluctuates by neighborhood. In East Portland 0.9 percent residents use bicycles, while Inner Northeast Portland reports 9.1 percent bicycle use. When asked if they sometimes use a different mode than their regular means for getting to work, 7.5 percent of respondents said bicycle, and 17.5 percent said they use that different mode "fairly frequently."[6]

Crashes

Reduce Number of Bicycle Motor Vehicle Crashes (6.12)

As a means of monitoring the safety of bicycling, the Bicycle Master Plan calls for a ten-percent reduction in bicycle-motor vehicle crashes in 2006 compared to 1996. While this reduction has not occurred, conditions can still be said to be safer for bicycling in Portland in 2006 than they were in 1996. This assertion is based on three pieces of information about bicycle crashes. The first is the bicycle crash rate in Portland, which has declined steadily since 1996. The second is what is known from the scientific literature about bicycle- and pedestrian crash rates when both bicycle and walking activity increase. The third is anecdotal as related by numerous Portland cyclists. However, it is information about Portland's bicycle crash rate that is the most measurable and applicable to this Bicycle Master Plan benchmark.

The annual number of reported bicycle-motor vehicle crashes has held relatively steady for the past 15 years, ranging between 160-185. There were 160 reported bicycle crashes in 1996 and 185 in 2005. While the number of reported crashes has held relatively steady, or even increased slightly, this has occurred during a period when bicycle use has increased exponentially.

Ideally, a crash rate would report crashes per mile traveled, or per trip, regardless of length[7]. Portland has not collected data to that level of accuracy. However, Portland has tracked the daily number of bicycle trips across the four bicycle-friendly Central City Willamette River bridges (i.e. Broadway, Steel, Burnside & Hawthorne). Portland's bicycle crash rate is calculated by indexing the annual number of reported crashes to the sum of daily bicycle trips made across these bridges. The relative flat number of reported crashes over the years and the dramatic increase in bicycle trips in the Central City as evidenced by the bridge counts, together indicate that cyclists are less likely to experience a bicycle-motor vehicle crash per trip in 2006 than they were in 1996. While the index itself is a bit tortured, measuring as it does the annual bicycle crashes per 1,000 daily bicycle trips across the four bicycle-friendly Willamette River bridges, the combination of dramatic increases in bicycle use and the relatively flat reported crashes point to safer conditions for bicycling.

Of course, there are significant limitations to this type of index due to two primary sources of uncertainty about the data. Limitation of data sources on the crash rate are due to bicycle crash reporting procedures, and the locations of bicycle crashes relative to the locations of increased bicycle use. The bicycle crash data available to the Portland Office of Transportation are the result of vehicle crash reports recorded by police and sent to the

[6] City of Portland Service & Accomplishments: 2004-05

[7] This is how crash rate is reported and compared between bicycling, walking and driving in a comparison of pedestrian and bicycle systems in Germany, The Netherlands, and the USA in "Making Walking and Cycling Safer: Lessons from Europe," by John Pucher and Lewis Dijkstra in Transportation Quarterly, Vol 54, No. 3, Summer 2000.

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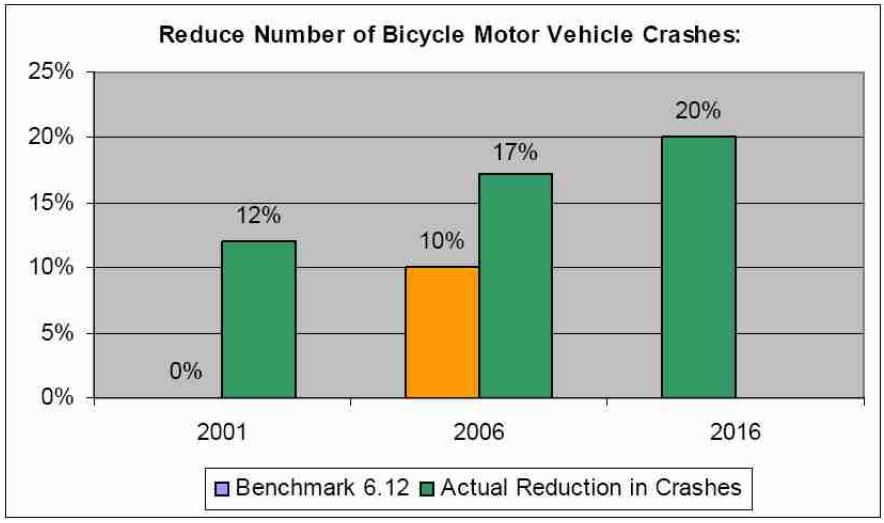
Oregon Department of Transportation's Division of Motor Vehicles (DMV). Which crashes are reported are based upon the policies of the Portland Police Bureau. Generally, only the most severe crashes are reported—those resulting in significant injury to at least one of the participants and/or property damage above a certain monetary value. Thus, the bicycle-motor vehicle crashes reported in Portland over the past ten years are generally the most damaging types of crashes of those displayed in Figures 3.3. Not reported are the types of minor crashes and close calls between motorists and cyclists that can, perhaps more than the occasional injury crash, contribute to concerns of safety riding on Portland's streets. Falling into this category of crashes are "doorings," in which a cyclist runs into a suddenly opened door of a parked motor vehicle, or other minor crashes from which a cyclist may essentially dust themselves off and simply ride, or walk away.

The number of reported crashes is indexed to bicycle trips in the Central City, which is close to inner Portland neighborhoods where conditions for bicycling are arguably better than anywhere else in the city. It is possible that the number of reported crashes has not held steady in all Portland neighborhoods; it's possible that the annual number of reported crashes has increased in some areas and declined in others. Likely, the crash rate differs by area of the city, as the increase in bicycling has not been uniform in all Portland neighborhoods.

However, count data indicates that bicycle use is up in all corners of Portland. This increase in bicycling has a positive effect on cycling safety. Increased use of bicycles means more familiarity by motorists with how cyclists operate, and more practice at riding for cyclists. Scientific research published in the Journal of Injury Prevention[8] reports that rather than seeing increased crashes with more cycling (and walking) activity, the number of reported crashes actually decreased. The researchers opined that it was this increase in visibility and familiarity to motorists that helped create safer conditions for bicycling.

FIGURE 3.3



Anecdotally, the position that having more bicycles on the road results in increased safety is commonly held. The increasing presence of cyclists on the roadway has changed the nature of many interactions between motorists and cyclists. Many cyclists report that motorists are generally driving slower in their presence compared to in previous years. They also report on how motorists will often stop at city-installed curb extensions, medians, or just at stop signs to allow waiting cyclists to cross.

The 2004 City of Portland Service Efforts and Accomplishments report asked residents to rate the overall safety of bicycling on streets in their neighborhoods. Of the 20,788 respondents, 45 percent responded that the streets in

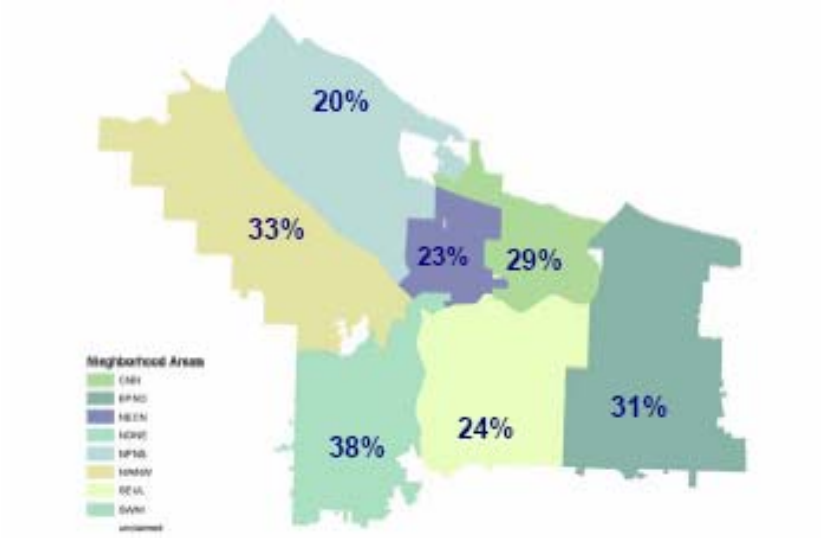
[8] Cite reference

their neighborhood are “very good” or “good” for the safety of bicyclists. In total, 27 percent thought that their neighborhood streets were “bad” or “very bad” for the safety of bicyclists. The remaining respondents found the streets “neither good nor bad”. [9]

A more comprehensive accounting of bicycle safety and the city’s efforts to create safer streets is found in Chapter Six.

FIGURE 3.4

Perception of Bicyclist Safety by Neighborhood, Overall “Bad” or “Very Bad” Rating



Bicycle Network

Complete Bicycle Network Goal (6.12 A)

The bicycle network benchmark has not been met. In 2006, Portland’s Bikeway network comprised 290 miles of developed bicycle multi-use trails, boulevards, signed connections, and bicycle lanes. The Bicycle Master Plan calls for 378 miles by 2006. Portland has completed 48 percent of the bicycle network as defined in the 1996 Bicycle Master Plan[10]. By 2006, the Plan called for the completion on 60 percent of the twenty-year goal of 630 bicycle network miles.

Out of the intended 98 miles of multi-use trails, Portland currently has 68 miles of multi-use trails. This is 70 percent of the Master Plan’s twenty-year goal. This is in addition to 166 miles of bicycle lanes, 30 boulevard miles, and 26 signed connection miles. According to a survey conducted in North Portland as part of the City’s Travel Smart Program, 41 percent of residents are satisfied or very satisfied, 29 percent less satisfied, and only nine percent dissatisfied with the number and locations of bicycle lanes.[11]

[9] City of Portland Service & Accomplishments: 2004-05

[10] The Bikeway Network identified in the 1996 Plan has been modified over time. Chapters 4 and 7, “Goals Policies and Objectives”, and the “Bikeway Network,” respectively, provide a more thorough accounting of the network and how it has changed.

[11] Interstate Travel Smart Survey Results: June-July 2004

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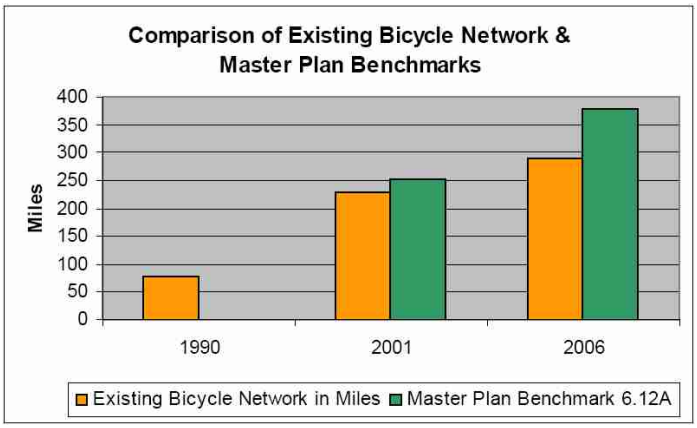
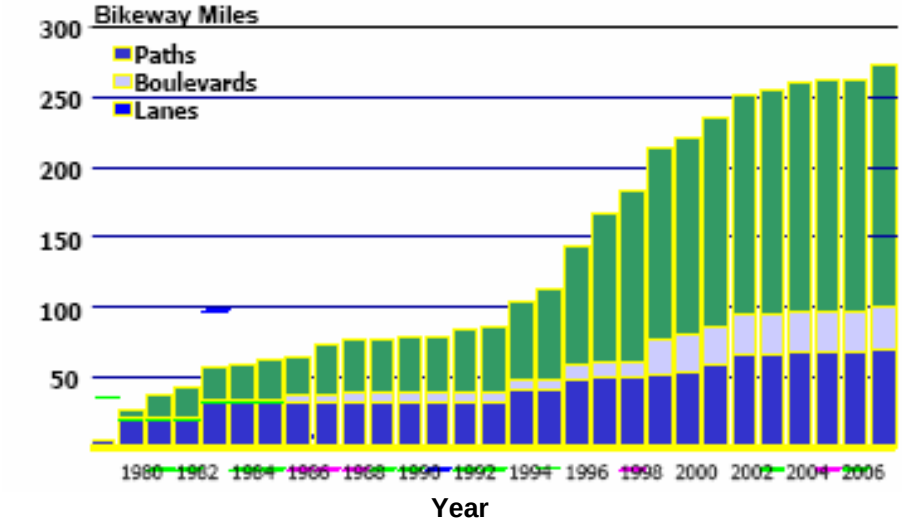
FIGURE 3.5



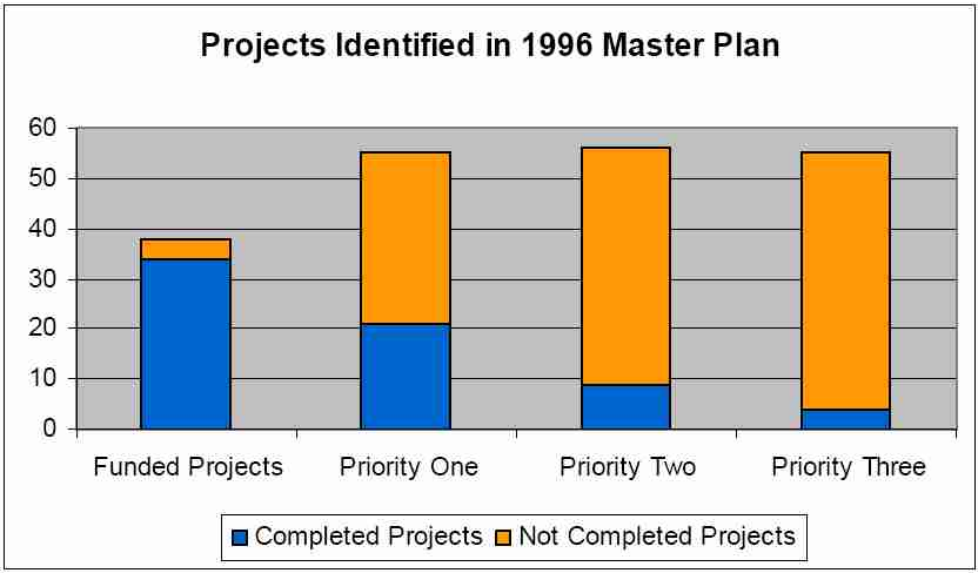
The Bicycle Master Plan identifies a list of 204 bicycle infrastructure projects consisting of bicycle lanes, pathways, and crossings. These projects were prioritized into categories of funded, priority one, priority two, and priority three. Projects identified in the Bicycle Master Plan as priority one were targeted for implementation in the first five years, priority two were years five to ten, and priority three were 10 to 20. Funded projects have the necessary funds for construction and are scheduled for implementation. Since 1996, the City of Portland has constructed 68 of the 204 identified bicycle projects.

FIGURE 3.6



A good number of bikeway miles were completed in coordination with other projects, and therefore, out of priority order. For example, NE Russell Street is listed as the last project on the priority three list, but it has been striped with bicycle lanes. The construction of Interstate MAX is another example of a project that presented an opportunity to develop a bikeway (in this case on Interstate Avenue) that not foreseen during the 1996 Master Plan process.

FIGURE 3.7



Maintenance of Bikeway Network

Reduce Maintenance Requests (6.12 C)

The Bicycle Master Plan calls for a reduction in maintenance requests by bicyclists. Bicyclists can request that any Portland bike lane be swept by calling the 24-hour street maintenance dispatch line, sending an filling in an on-line request form, calling the "bicycle hotline", or mailing in a facility maintenance request card. This is a substantial change from when the Bicycle Master Plan was originally adopted. At that time, people requesting maintenance could generally only mail in a self-addressed, postage-paid "Facility Maintenance Request Form." At the time, there was no phone line dedicated to receiving maintenance requests. Today, that is just one of several options.

Generally, once a request is received, a truck sweeps the area within 24-48 hours. The number of calls has not been accurately tracked over the last ten years. In addition, the reduction of requests is inconsistent with the promotional goals of Transportation Options. As bicyclists become more familiar with maintenance services, the hotline will receive more requests.

FIGURE 3.8

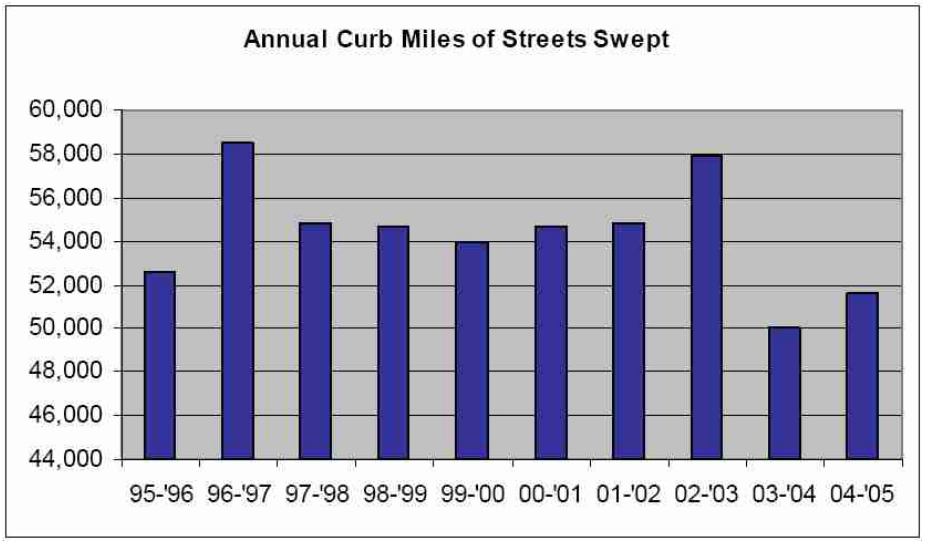


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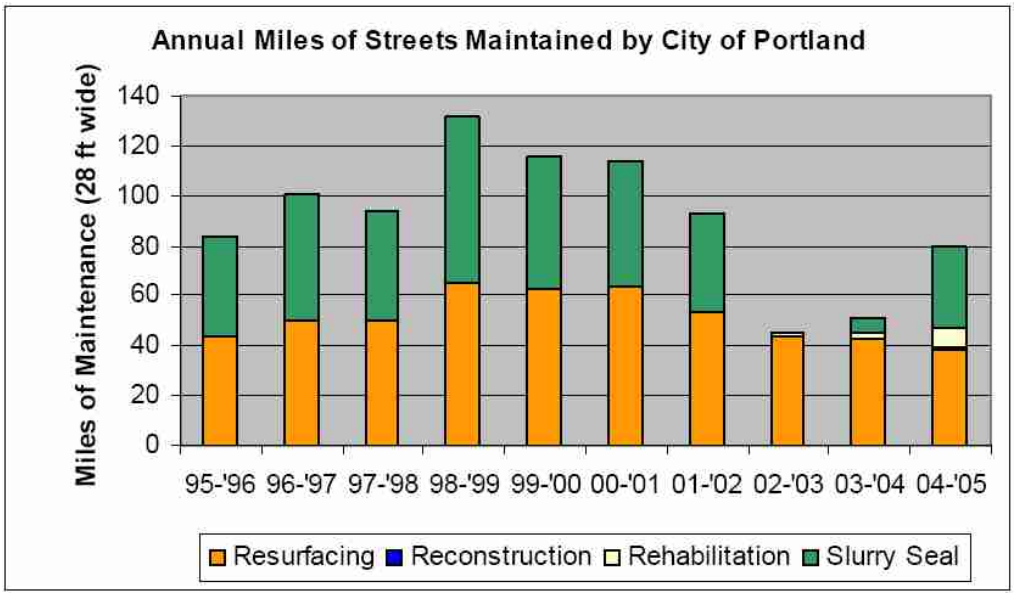
Table 3.1 Bicycle Master Plan Benchmark (Objective 6.12 C)

	Five Year Benchmark	Ten Year Benchmark	Twenty Year Benchmark
Reduce Requests By	15%	50%	75%

Maintenance of bikeways remains a concern of bicyclists. According to the 2004 City of Portland Service Efforts and Accomplishments report, the annual streets swept and miles of streets maintained has declined since 1996, after a period of increased service from 1996 to 2002. In 2004-2005, the Bureau of Maintenance swept 51,616 curb miles. During that same year, 79.3 miles were maintained, including resurfacing (38.7 miles), reconstruction (0.4 miles), rehabilitation (7.8 miles) and slurry seal (37.4 miles).[12]

FIGURE 3.9

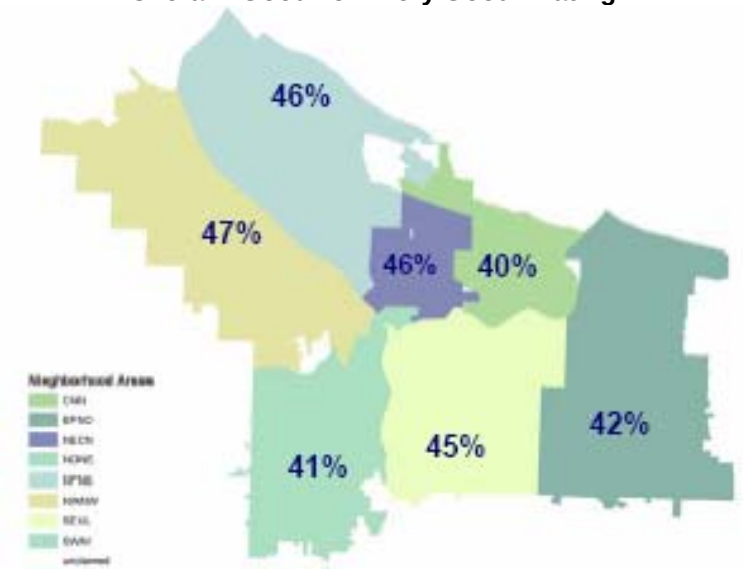


The 2004 City of Portland Service Efforts and Accomplishments report asked residents to rate the overall quality of street maintenance by the City. Of the 20,922 respondents over half (76 percent) found that the streets to be very good, good, or neither good nor bad street maintenance. In total, 24 percent thought that quality of street maintenance was “bad” or “very bad”. [13]

[12] City of Portland Service & Accomplishments: 2004-05
[13] City of Portland Service & Accomplishments: 2004-05

FIGURE 3.10

Perception of Street Maintenance by Neighborhood, Overall "Good" or "Very Good" Rating



Pavement Markings & Signs

Signal Detection Pavement Markings (6.12 C)

The Bicycle Master Plan calls for the installation of signal detection and pavement markings. According to the benchmark, 50 percent of all signals with detection should be tuned and retrofitted with pavement markings for the ten-year benchmark. The City of Portland has exceeded that goal with 65 percent of all loop detectors set to function for bicycles. In 1996, the City contained only 25 loop detector markings. By 2006, the City had 161 loop detector markings.

FIGURE 3.11

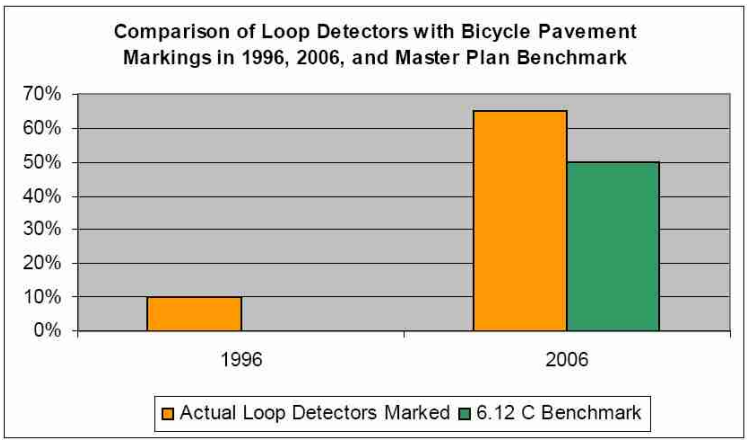


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FIGURE 3.12

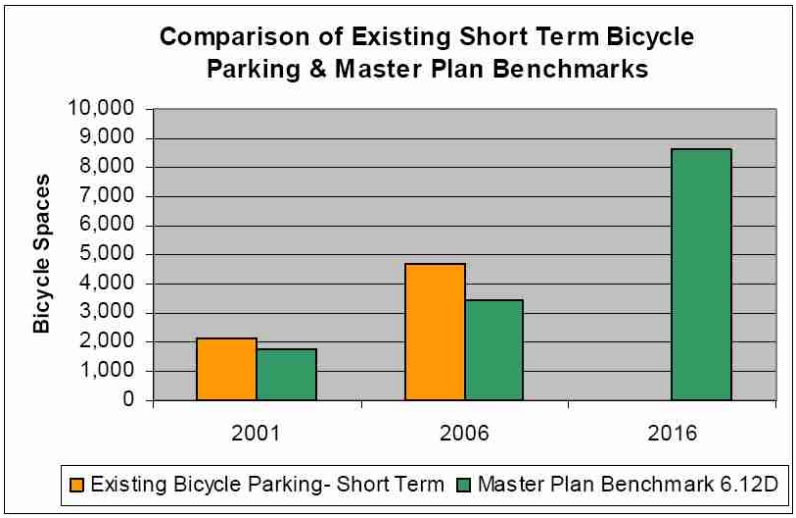
Signal Detection Bicycle Pavement Markings Diagram and Photo

Bicycle Parking

Short- and Long-term Parking (6.12.D)

The City of Portland manages 4,705 short-term bicycle parking spaces. This mark exceeds the ten-year benchmark of 3,440 (136 percent of the targeted number). This has been made possible through changes in City Code requirements of new development and re-development. Developers who lack the space on their property to install short-term bicycle parking pay into a Bicycle Parking Fund. The City of Portland then uses this fund to install bicycle parking in public right of way. City-installed bicycle parking is only a fraction, albeit a large fraction of the total bicycle parking in the city as there is much bicycle parking—particularly long-term bicycle parking installed on private property. Portland City Code now requires that commercial and multi-family residential development provide short-term and long-term bicycle parking on site. In addition, the City of Portland's Transportation Options Division places racks at schools. Since 2002, 214 short-term spaces have been provided at 12 schools.

FIGURE 3.13



Private developers generally administer long-term parking. As such, it is difficult to count long-term bicycle parking without an accounting by development and permit staff through the Bureau of Development Services. This is not an easy measure to come by. Currently, 569 long-term parking spaces are

available to the public through TriMet and the City of Portland. This is eight percent of the ten-year benchmark, which called for 7,527 long-term spaces throughout the city. According to a survey conducted by the Travel Smart program in North Portland, 43 percent of residents are satisfied or very satisfied, 27 percent less satisfied, and only six percent dissatisfied with the quantity and quality of bicycle parking at destinations.[14]

Showers & Changing (6.12.E)

Benchmark 6.12 E calls for showers and changing facilities to be made available to 250 bicyclists in 2001 and all bicyclists by 2006. This is also a difficult benchmark to measure. A 1996 City of Portland code change allows developers to trade 1:1 floor area ratio for the space used for bicycle changing facilities. This has encouraged some developers to include changing facilities in new construction.

In addition, in the mid 1990s, the Bike Central Program provided five shower and changing facilities at Riverplace Athletic Club, Lloyd Athletic Club, YWCA, Princeton Athletic Club, and Commonwealth Fitness Club. The initial program was funded by a $350,000 CMAQ grant. In 2006, two athletic clubs continue to provide this service.

Bicycles & Transit

The Bicycle Master Plan identified transit as an important element of Portland's bicycling system. During the Bicycle Master Plan process, TriMet did not establish any specific benchmarks, but the Master Plan policy placed emphasis on the importance of the integration of transit with bicycles. The following is the statement of intent for the bicycling program according to TriMet's Transit Investment Plan.

> *Bicycle infrastructure extends the reach of the public transit system. All TriMet buses have bicycle racks and all MAX trains have designated bicycle areas. Bicycles are allowed on the Portland Streetcar. Most stations, transit centers, and Park & Ride lots have bike racks or lockers. TriMet offers over 340 bicycle lockers. TriMet will continue to promote bike access to transit by expanding the distribution of bike racks and lockers as new investments in high capacity transit are made.*
>
> *TriMet will work with local jurisdictions to improve bike access and awareness of bicycle facilities in the metropolitan area. High capacity transit corridors will preserve, enhance or establish bike routes. (Transit Investment Plan, TriMet, 2003)*

The data from the early 1990s indicates a strong bicycle presence on transit in Portland. Bicyclists' use of TriMet bus racks, as recorded by bicycle permits sold, doubled between 1992 and 1995. In 2006, all TriMet buses and light rail trains carry bicycle racks. The Bicycles on TriMet Permit Program was abolished in 1999. Now bicyclists may bring bikes on light rail and on the racks on buses without paying extra fare or the requirement of a permit.

[14] Interstate Travel Smart Survey Results: June-July 2004

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Table 3.2 TriMet Bicycle Permits Sold 1992 to 1995

	1992/1993	1993/1994	1994/1995
# of Permits Sold	1349	2758	4848

TriMet lacks current data on bicycle use on buses, streetcar and light rail. TriMet has considered using video, available in all TriMet buses and many light rail cars, to count bicyclist use of transit vehicles. Anecdotally, the use of bicycles on buses, MAX and the streetcar has continued to increase. According to a survey in North Portland, 65 percent of residents are satisfied or very satisfied, nine percent less satisfied, and only two percent dissatisfied with the bicycle connection to public transportation.[15]

To further facilitate the connection between transit and bicycles, TriMet provides short- and long-term bicycle parking spaces. Most of the light rail stations and transit centers outside of downtown have bicycle racks and long-term bicycle lockers and bicycle "lids", which provide a cover over parked bicycles and serve a long-term parking function. Of the 340 lockers provided throughout the tri-county region, 72 are "first come, first serve" and four are smart card lockers. The remaining 264 are managed as monthly rentals through the Bicycle Transportation Alliance.

Education & Encourage

Annual City-wide Events Promoting Cycling (6.12 G)

Portland has exceeded its ten-year benchmark for events. Annual citywide events promoting cycling include Summer Cycle events, Women on Bikes, Tour De Hub event with TriMet, Smart Living classes, Bike Commute Challenge, Bridge Pedal, Bicycle to Work Day, Pedalpalooza, and the Bike Summit. These events constitute more than the expected five citywide events annually.

According to the recent report *Bicycle Industry Related Growth in Portland* by Alta Planning + Design, Portland hosts 2,100 Small, Medium Rides & Events per year for 40,000 participants. This translates into an average of six events per day. Organizations hosting these events include Portland Wheelmen Touring Club, Bike Gallery, Portland United Mountain Pedalers, City of Portland, Transportation Options, Pedalpalooza, SHIFT, and others.

School Age Children Receiving Bicycle Safety Education (6.12 G)

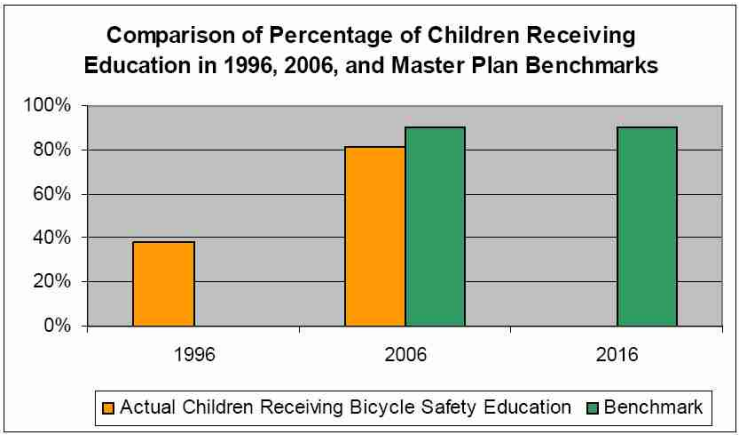
In Portland, 81 percent of school age children have received bicycle safety education over the past eight years. Annually, 11 percent of Portland students have received bicycle safety education. This may include some duplication of students. 7,140 students per year and 51,588 total children have received bicycle safety education since 1998. These students are part of the 63,500 students in private and public schools in Portland. These figures include several programs through non-profit organizations, hospital associations, and government. Included is information from Emanual Legacy Trauma Nurses Talk First, OHSU Think First, Community Cycling Center Education, BTA Bicycle Safety, Oregon Walk & Bike, and PDOT's Safe Routes to Schools.

[15] Interstate Travel Smart Survey Results: June-July 2004

Children Bicycling to School (6.12 H)

Safe Routes Portland is a five-year pilot program, which promotes children bicycling to school. The program started in eight Portland elementary schools in fall 2005 and will increase to 18 schools in fall 2006. Students participated during the 2005/2006 school year at Abernathy, Boise-Elliot, Buckman, Bridelmile, Gilbert Park, Louis, Prescott, and Vestal Elementary schools. The comprehensive program is funded through fines from red light runners and speeders, and is managed by the Portland Office of Transportation, the Bicycle Transportation Alliance, the Willamette Pedestrian Coalition, and Alta Planning+Design. The initial 2006 survey after three months showed a 10-20 percent increase in walking and biking to school.

FIGURE 3.14



Other Promotional Programs: Individualized Marketing

In 2003, PDOT piloted North America's first individualized marketing project aimed at promoting transit, walking, biking, and carpool to residents in a targeted area of the city. The first project in SW Portland reduced drive alone trips by eight percent among the program's 600 participating households. Based on the pilot program's success, PDOT expanded its individualized marketing program in 2004 to include 6,000 households along the new Interstate MAX line. The program reduced drive alone trips by nine percent.

In 2005, PDOT partnered with Kaiser Permanente and Providence Portland Medical Center to promote walking and biking to the 20,000 households in Portland's "Southeast Hub." This individualized marketing program reduced drive alone trips by 8.6 percent and yielded an increase in biking in the target area by 23 percent. The program expanded in 2006 to include 24,000 households in NE Portland.

The surveys used to measure behavior changes resulting from the individualized marketing projects also provided PDOT with data about potentials for change. For example, the in-depth survey performed in Interstate showed that bicycling has the greatest potential for behavior change among residents. The flexibility of cycling relative to transit makes it an attractive alternative to driving for trips under three miles.[16]

Conclusion & Next Steps

The City of Portland has accomplished many of the Bicycle Master Plan's objectives, action items, and benchmarks. The bicycle commute mode share has increased in the central city and whole city. The City of Portland has a lower bicycle-motor vehicle crash rate. The City has increased the bicycle facilities to provide an extensive, well-maintained bikeway network and convenient bicycle parking. Finally, the City of Portland is home to thousands of bicycling promotional events and bicycle safety classes.

[16] Source: Portland Office of Transportation

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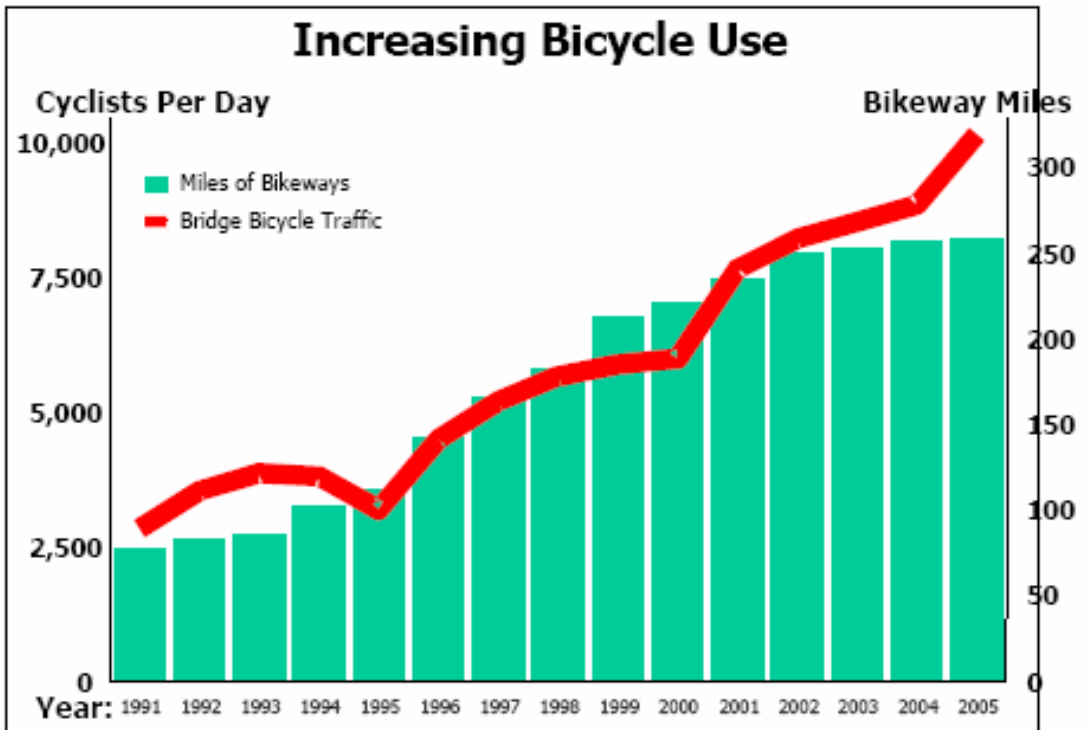
The objectives, benchmarks, and action items that have been partially or fully accomplished by the City of Portland, its governmental and non-profit partners, and its citizens have produced dramatic benefits for the bicycling community. According to the North Portland survey, 58 percent of citizens feel that the bike route

FIGURE 3.15



[18]

The work of the City of Portland, its governmental and non-profit partners, and its citizens can also be witnessed in the increase of bicyclists on the streets from 1991 to 2006. Bridge counts on the Hawthorne, Steel, Broadway, and Burnside Bridges indicate that Portland continues to attract new bicycle riders. Survey data indicates that 31 percent of bicycle riders to the Central City have started bicycling to work within the last two years.[19]

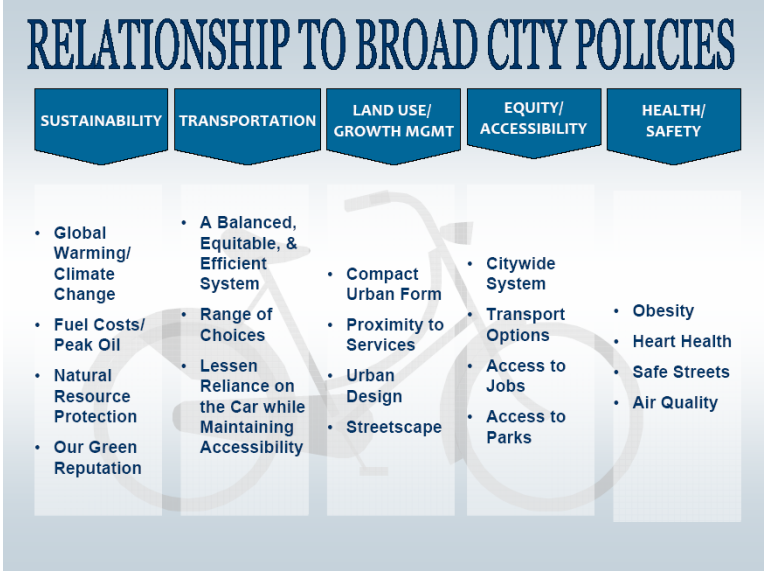
There is evidence that residents of Portland support future growth in bicycle facilities. According to the North Portland survey, 67 percent of citizens would like more improvement within the bike route network, facilities and information, while only eight percent do not support more improvement. The majority (60 percent) think more money should go to expand bike route network, facilities and information. Moreover, the majority (62 percent) believe that politicians should be more concerned with bike route network, facilities and information. [20]

[17] Interstate Travel Smart Survey Results: June, July 2004
[18] Geller, Roger & Birk, Mia: *Bridging the Gaps*
[19] Statistical Methods Course, PSU: September 2003
[20] Interstate Travel Smart Survey Results: June, July 2004

BICYCLE-RELATED GOALS, POLICIES & OBJECTIVES

INTRODUCTION

A City's Goals and Policies provide a foundation by which a City's growth and development may be directed. It is from its goals, policies, and the objectives and action items that necessarily follow, that a city government and staff shape the programs, projects, and practices that define how that city operates and meets the public's needs.



Portland is often touted as one of the "greenest" cities in the world as a direct result of the City's approach to urban planning and adopted policies on issues ranging from managing growth, reducing carbon-dioxide emissions, promoting green building, and developing a comprehensive transportation system of light rail and bus lines, and bikeways. Bicycling plays a role in several of the broader policies adopted by the City of Portland to support a more sustainable and livable future. Notable "non-transportation specific" policies that are consistent with policies to increase bicycle use include the following:

- Reduce Portland-area carbon dioxide emissions by 10 percent from 1990 levels by 2010 in order to reduce greenhouse gasses that contribute to global warming. (ENN-5.01)
- Adopted Sustainable City Principles that impact transportation, housing, land use, economic development, energy use, air quality, water quality and supply, solid and hazardous waste and other areas that may affect sustainable development. (ENN-3.01)
- Reduce oil and natural gas use in Portland by 50 percent by 2030. (Res. No. 36488)

As with many larger cities, there are multiple users vying for limited public right-of-way. Portland's goals and policies related to transportation acknowledge this by emphasizing, above all else, balance between the competing demands. Portland's goals and policies strive to provide its residents with legitimate choices between different modes of transportation.

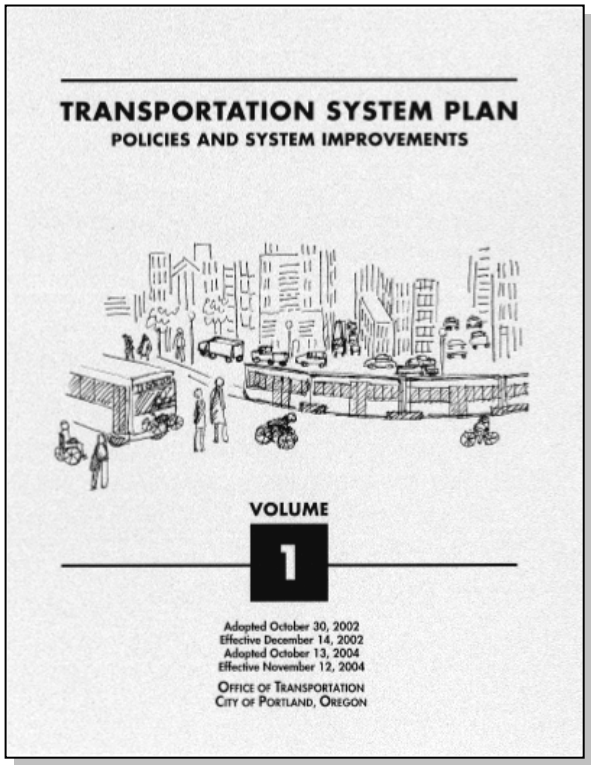
Portland's Transportation Goal and Bicycle Transportation Policy each contain concepts that are pro-bicycle. They are intended to reinforce the livability of neighborhoods; support a strong and diverse economy; reduce air, noise, and water pollution; lessen reliance on the automobile; and make the bicycle an integral part of daily life in Portland. Taken in isolation, this goal and policy statement would seem sure to steer Portland toward achieving status as a world-class bicycling city. However, these statements must be considered alongside the volumes of other policies contained in the City's Comprehensive Plan.

Crafting programs in response to a city's goals and policies requires a thorough consideration and balancing of the many interests. This chapter presents two sets of goal and policy statements. First, this chapter presents the city's transportation goals as they relate to bicycling. Second, this chapter presents other policies and guidelines related to practices and treatments[1] that may hold significance for the next phase of the Bicycle Master Plan update, in which a future direction for bicycling in Portland will be created. As with all good plans, goals and policy will remain the foundation and provide the framework.

Following are the Goals, Objectives and Policies as contained in the City of Portland Bicycle Master Plan, as adopted in 1996. The policies were adopted by Ordinance and became part of the city's Transportation Element of the Comprehensive Plan.

BICYCLE GOALS POLICIES & OBJECTIVES

In 2002 Portland adopted its Transportation System Plan (TSP) as part of the city's Comprehensive Plan. The TSP is Portland's guiding policy and planning document for transportation. In some cases, the adoption of the TSP resulted in changes in the policies adopted by the original bicycle master plan. The following text shows both the language adopted by the Bicycle Master Plan in 1996 as well as the language adopted by the TSP in 2002.



The City of Portland's Comprehensive Plan contains a series of statements that guide the way the City plans and implements improvements. These statements are ordered from the more general to the more specific:

- Goals
- Policies
- Objectives
- Action Items

Goals, policies, and objectives are formally adopted by City Council resolution. Action items are included as a series of steps toward achieving the objectives, but are not formally adopted by City Council.

Goal 6 Transportation

When the Bicycle Master Plan was adopted in 1996 the following Citywide Goal for Transportation was in effect. It had been adopted in 1992:

[1] These may include both local and regional policies and practices related to traffic calming, automotive diversion, connectivity, on-street parking, roadway design, and level of service, to list several of the more prominent.

Provide for and protect the public's interest and investment in the public right-of-way and transportation system by encouraging the development of a balanced, affordable and efficient transportation system consistent with the Arterial Streets Classifications and Policies[2] by:

- *Providing adequate accessibility to all planned land uses;*
- *Providing for the safe and efficient movement of people and goods while preserving, enhancing, or reclaiming the neighborhoods' livability;*
- *Minimizing the impact of inter-regional and longer distance intra-regional trips on city neighborhoods, commercial areas, and the city street system by maximizing the use of regional trafficways and transitways for such trips;*
- *Reducing reliance on the automobile and per capita vehicle miles travelled;*
- *Guiding the city street system to control air pollution, traffic, and livability problems;*
- *Maintaining the infrastructure in good condition.*

This goal changed significantly with the adoption of the TSP. Goal 6 now reads:

Goal 6 Transportation

Develop a balanced, equitable, and efficient transportation system that provides a range of transportation choices; reinforces the livability of neighborhoods; supports a strong and diverse economy; reduces air, noise, and water pollution; and lessens reliance on the automobile while maintaining accessibility.

Policies and Objectives

The next levels down from goals are policies and objectives, which are intended to set more specific language toward achieving the Transportation Goal. Following are the policies and objectives as adopted by the Bicycle Master Plan and amended by the TSP.

Policy ~~6.12~~ 6.23 Make the bicycle an integral part of daily life in Portland, particularly for trips of less than five miles, by implementing a bikeway network, providing end-of-trip facilities, improving bicycle/transit integration, encouraging bicycle use, and making bicycling safer.

The Objectives associated with this policy are:

A. Complete a network of bikeways that serves bicyclists' needs, especially for travel to employment centers, commercial districts, transit stations, institutions, and recreational destinations.

~~B. Provide bikeway facilities that are appropriate to the street classifications, traffic volume and speeds on all right-of-ways.~~ (This objective was incorporated as Objective A of Policy 6.7, Bicycle Classification Descriptions, as described below).

B. Provide continuous bicycle facilities and eliminate gaps in the bike lane system.

~~C. Maintain and improve the quality, operation, and integrity of bikeway network facilities.~~ (This Objective was restated as Policy 6.7, below).

C. Install bicycle signage along bikeways where needed to define the route and/or direct bicyclists to a destination or other bikeway.

[2] The Arterial Streets Classifications and Policies were a Transportation Element component categorizing streets according to their intended function. Examples of classifications include Major and Minor City Traffic Streets, Bikeways, Major and Minor Transit Routes, and Major and Minor Truck Routes.

~~D~~ E.Provide short-term and/or long-term bicycle parking in commercial districts, along Main Streets, in employment centers and multifamily developments, at schools and colleges, in industrial developments, at special events, in recreational areas, ~~and~~ at transit facilities such as light rail stations and park-and-ride lots, and at intermodal passenger stations.

~~E~~ F.~~Provide~~ Encourage the provision of showers and changing facilities for commuting cyclists~~.~~, ~~Support~~ including development of such facilities in commercial buildings and at "Bike Central" locations.

~~F~~G.Increase the number of bicycle-transit trips. ~~Support TriMet's "Bikes on Transit" Program.~~

~~G. Develop and implement education and encouragement plans aimed at youth, adult cyclists, and motorists. Increase public awareness of the benefits of bicycling and of available resources and facilities.~~

H. Promote bicycling as safe and convenient transportation to and from school.

Bikeway Network Classification

The City's bikeway network, as defined and classified in the City's TSP, is a significant component of Portland's bicycle policies. These classifications of bikeways were articulated in the 1996 Bicycle Master Plan, but were not adopted as policy until they are adopted as part of the TSP. Currently, city bikeways are classified in one of three ways:

- City Bikeway
- Local Service Bikeway, and
- Off-Street Path.

These are policy classifications that direct how these roadways are developed. The City's existing classifications for City Bikeways and Off-Street Paths are shown in Figure XX. Local Service Bikeways are not shown on the Bikeway; they are simply all roadways not carrying a City Bikeway classification. Policy 6.7 spells out the intent behind these classifications.

Policy 6.7 Bicycle Classification Descriptions

Maintain a system of bikeways to serve all bicycle users and all types of bicycle trips.

Objectives:

*A. **City Bikeways***

City Bikeways are intended to serve the Central City, regional and town centers, station communities, and other employment, commercial, institutional, and recreational destinations.

- *Land Use. Auto-oriented land uses should be discouraged from locating on City Bikeways that are not also classified as Major City Traffic Streets.*
- *Design. Consider the following factors in determining the appropriate design treatment for City Bikeways: traffic volume, speed of motor vehicles, and street width. Minimize conflicts where City Bikeways cross other streets.*
- *Improvements. Consider the following possible design treatments for City Bikeways: bicycle lanes, wider travel lanes, wide shoulders on partially improved roadways, bicycle boulevards, and signage for local street connections.*

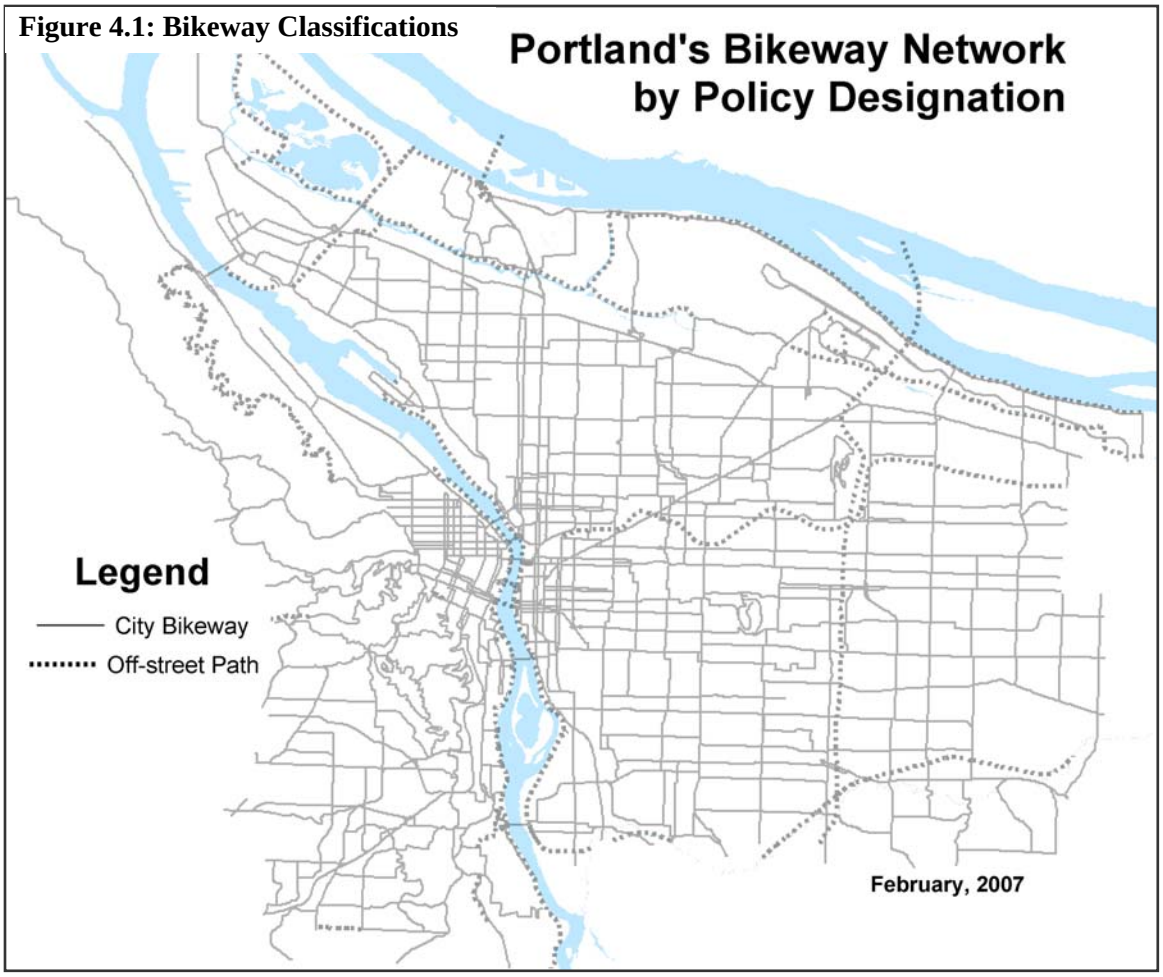
- *On-Street Parking. On-street motor vehicle parking may be removed on City Bikeways to provide bicycle lanes, except where parking is determined to be essential to serve adjacent land uses, and feasible options are not available to provide the parking on-site.*
- *Bicycle Parking. Destinations along City Bikeways should have long-term and/or short-term bicycle parking to meet the needs of bicyclists.*
- *Traffic Calming. When bicycle lanes are not feasible, traffic calming, bicycle boulevards, or similar techniques will be considered to allow bicyclists to share travel lanes safely with motorized traffic.*

B. ***Off-Street Paths***

Off-Street Paths are intended to serve as transportation corridors and recreational routes for bicycling, walking, and other non-motorized modes.

- *Connections. Use Off-Street Paths as convenient shortcuts to link urban destinations and origins along continuous greenbelts such as rivers, park and forest areas, and other scenic corridors, and as elements of a regional, citywide, or community recreational trail plan.*
- *Location. Establish Off-Street Paths in corridors not well served by the street system.*
- *Improvements. Use the Bikeway Design and Engineering Guidelines to design Off-Street Paths. Off-Street Paths should be protected or grade-separated at intersections with major roadways.*

Figure 4.1: Bikeway Classifications



C. ***Local Service Bikeways***

Local Service Bikeways are intended to serve local circulation needs for bicyclists and provide access to adjacent properties.

- *Classification. All streets not classified as City Bikeways or Off-Street Paths, with the exception of Regional Trafficways not also classified as Major City Traffic Streets, are classified as Local Service Bikeways.*
- *Improvements. Consider the following design treatments for Local Service Bikeways: shared roadways, traffic calming, bicycle lanes, and extra-wide curb lanes. Crossings of Local Service Bikeways with other rights-of-way should minimize conflicts.*
- *On-Street Parking. On-street parking on Local Service Bikeways should not be removed to provide bicycle lanes.*
- *Operation. Treatment of Local Service Bikeways should not have a side effect of creating, accommodating, or encouraging automobile through-traffic.*

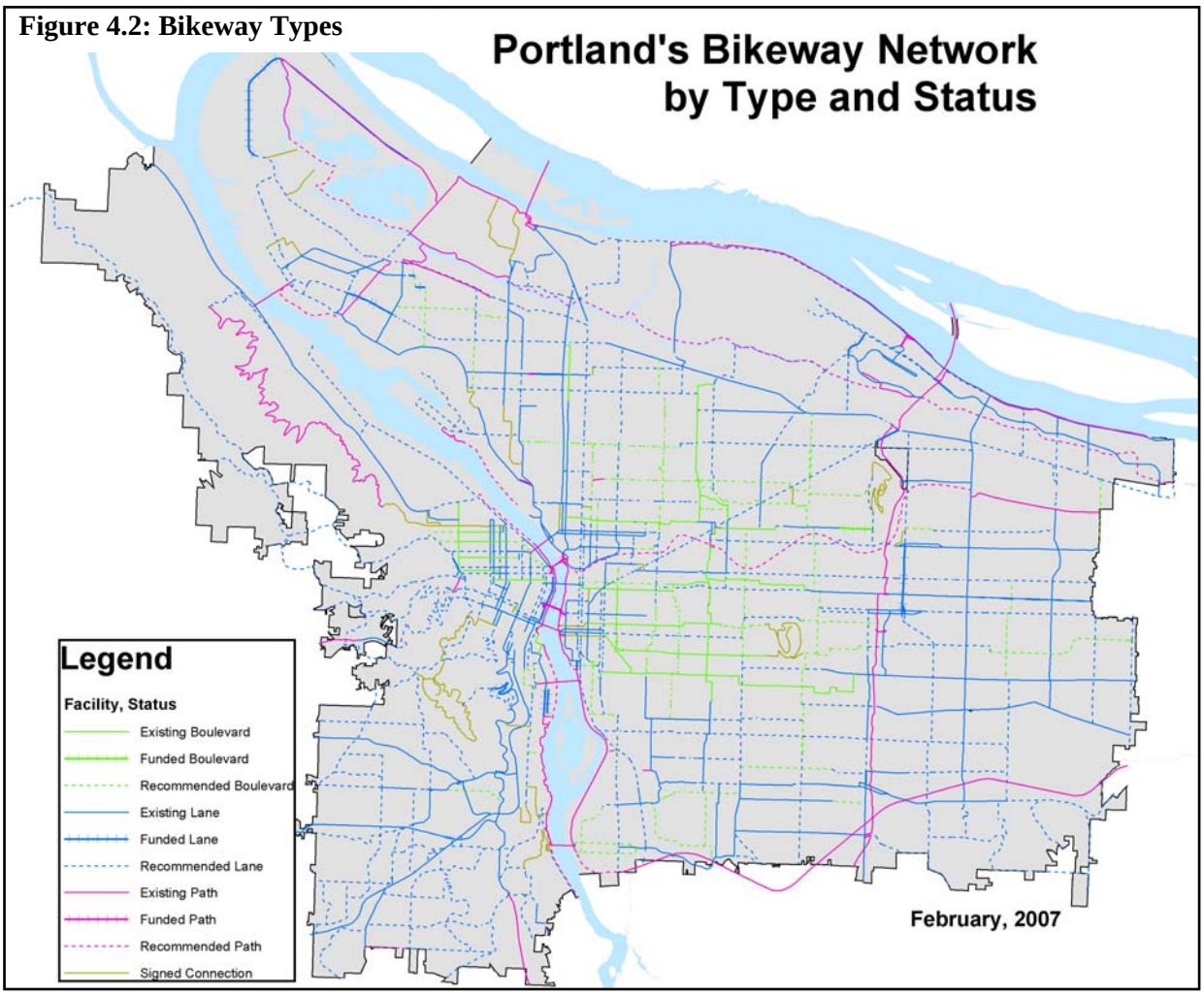
The Bicycle Master Plan goes behind these classifications and describes how City Bikeways are to be developed as one of three types of facilities:

- Bicycle Lanes,
- Bicycle Boulevards, or
- Signed Connection

Figure 4.1 displays the City Bikeways and Off-Street Paths with their intended design treatment as determined at time of adoption of the Bicycle Master Plan. Generally, it is the traffic conditions on a roadway that define whether a City Bikeway is to be developed with a Bicycle Lane or with Bicycle Boulevard treatments. Signed Connections are not recommended for any treatment other than signing; their purpose is to simply direct people to popular destinations or between existing bikeways. In Figure 4.2, the solid lines show the location of existing facilities, hatched lines show funded projects, and dashed lines show recommended facilities. Blue lines are lanes, green lines are boulevards, magenta lines are off-street paths, and olive lines are signed connections.

The Bikeway Network by Policy Designation is the “official map;” the Network by Type and Status does not completely match with it as it is used to track actual conditions on the ground and is readily amended by the Office of Transportation. Occasionally, Local Service Bikeways are treated with bicycle lanes or with bicycle boulevard treatments. While this is not inconsistent with city policy, the Office of Transportation generally strives to have higher order facilities on City Bikeways. Thus, if a project is undertaken to create a higher order bicycle treatment on a Local Service Bikeway, PDOT will amend the TSP at the next available opportunity to make that roadway a City Bikeway. The reason for the discrepancy between the two maps is that amending the policy map requires a public process and city ordinance and occurs only at regularly-scheduled intervals (generally, every two years), whereas the type and status map is amended immediately to reflect on-the-ground conditions.

Figure 4.2: Bikeway Types



OTHER COMPREHENSIVE PLAN ELEMENTS

There are additional Comprehensive Plan elements besides the transportation element, adopted by departments other than Transportation, with policies and objectives relevant to bicycles. As part of the 1996 Bicycle Master Plan, these statements have been reviewed and modifications suggested (bold indicates a suggested addition; a strike-through is a suggested deletion.) The suggested modifications have not yet been adopted by City Council. These policies and objectives are as follows:

Promote safe and pleasant bicycle access to and circulation within commercial districts and strips. Provide convenient, secure bicycle parking for employees and shoppers where appropriate (Policy 5.15, Objective D);

Provide opportunities for non-auto transportation, including ... bikeways... (Policy 7.6);

Promote walking and bicycle commuting by ~~identifying routes~~, implementing bikeways and walkways, encouraging spot hazard improvements on city streets, ~~the provision of~~ providing bicycle lockers at transit stations and park-and-ride lots, and ~~investigating~~ implementing bicycle commuter services, such as long-term bicycle parking, showers, and changing facilities ... (Policy 7.6, Objective H)

Include physical construction standards necessary to assure access and safe passage for bicyclists in design and construction of all new or reconstructed streets, especially on those streets designated as ~~bicycle pathways~~ bikeways in the Arterial Streets Classification Policy~~, as private or federal funds become available~~ (Policy 11.13);

Provide for safe short-term and safe, sheltered long-term bicycle parking throughout the ~~downtown~~ central city and in other appropriate areas~~, as private or federal funds become available~~ (Policy 11.14).

POLICIES AND ORDINANCES AFFECTING FUTURE DESIGN CONSIDERATIONS

Street Classification

Portland's streets are classified within the Transportation System Plan (TSP) to define the types of movements that should be emphasized on each street, i.e. motor vehicles, trucks, transit vehicles, emergency vehicles, pedestrians, and bicycles. Street classifications are used to determine the appropriateness of street improvements and to make recommendations on new and expanding land uses.

Changes to a street to accommodate one mode can affect how that street functions for another mode. Although the TSP establishes street classification and description policies for all city streets, it does not offer specific guidance on how to balance the multiple classifications that are often assigned to a specific street.

Policy 6.4 (Classification Descriptions) sets the following objective for achieving the overall goal to "develop a balanced, equitable and efficient transportation system" in designing street improvements:

> *All of a street's classifications must be considered in designing street improvements and allocating funding. While a proposed project may serve only one classification, improvements should not preclude future modifications to accommodate other classifications of the street. (Policy 6.4, Objective C)*

Based on this objective, transportation projects on a street, such as N. Going Street, which is designated a City Bikeway, City Walkway and Priority Truck Street must look at each classification when making decisions that affect the function of the street for another mode.

Street Design Classification Descriptions are another set of classifications, based on Metro's Regional Street Design Classifications, defining design features that apply across all modes of travel. Each "street design" classification describes generally the modal emphasis and appropriate adjacent land uses (or landscapes), number of lanes, and street design elements.

Metro's manual of street design guidelines, Creating Livable Streets, is also used "as a resource in developing and designing projects for streets on the regional system" (Policy 11.10, Objective D). This manual identifies the priorities for each street type when it is necessary to select among the design elements within a limited right of way. According to the guidelines, lower priority elements (e.g. on-street parking on a "regional street") can be eliminated without having to change the type of street.

Further direction in designing improvements to existing and new transportation facilities is provided under Comprehensive Plan Policy 11.10 – Street Design and Right-of-Way Improvements. One consideration that applies specifically to bicycle facilities states the following:

> *Provide planned bicycle facilities in conjunction with street improvements, or develop equally safe and convenient alternative access for bicycles on parallel streets when the appropriate bikeway facility cannot be provided on the designated street because of severe environmental or topographical constraints, unacceptable levels of traffic congestion, or the need to retain on-street parking. (Policy 11.10, Objective F)*

Based on this objective, bicycle facilities can be eliminated on a City Bikeway if an appropriate parallel bicycle route exists, but only under "severe" or otherwise "unacceptable" conditions. The intent of this wording was to set the bar high when it comes to not including bicycle lanes when they are otherwise the appropriate treatment, while still allowing flexibility.

Oregon Revised Statute 366.514, known as the "Bicycle Bill" requires that…"out of the funds received by the department or by any county or city from the State Highway Fund reasonable amounts shall be expended as necessary to provide footpaths and bicycle trails." The type of bicycle trail (or bikeway) required is set out by guidelines in the City of Portland Bicycle Master Plan. The Bicycle Bill permits street development without bicycle facilities if "the establishment of such…trails would be contrary to public safety;"…if "the cost…would be excessively disproportionate to the need or probably use;" or if "…scarcity of population, other available ways or other factors indicate an absence of any need for such…trails." According to the Oregon Department of Transportation (ODOT), for the third condition to apply, it must be shown that the "other available ways" serve bicyclists as well as or better than, and provide equal or greater access and mobility than, would a facility provided on the roadway in question.

Since an individual street can possess numerous classifications and serve diverse functions, it can be difficult to balance the multiple demands from the range of users. Local and regional polices and adopted design guidelines provide some instruction on the roadway's design; however, when conflicts occur each street must be assessed based on its unique qualities. Providing more definition on the conditions where specific bikeway facilities and designs should be prioritized may help to reduce the level of ambiguity when conflicts occur.

Traffic Congestion/Level of Service (LOS)

The metropolitan area doubled from one to two million residents between 1968 and 2006, and is anticipated to add another million residents by 2030. This rapid growth places a significant strain on the region's transportation system through growing traffic congestion, particularly during peak commute periods. To address this growth, strategies on managing and expanding capacity of the transportation system for all users are needed to identify and prioritize critical new investments. The Oregon Transportation Planning Rule (TPR), which interprets the Statewide Planning Goal on transportation, requires local jurisdictions to establish performance measures for evaluating traffic flow on their transportation system.

Metro's Regional Transportation Plan (RTP) establishes a regional method for measuring traffic congestion by setting minimum "levels-of-service" to evaluate and determine transportation needs at the system planning level.[3] Metro requires local jurisdictions to incorporate these standards into their comprehensive plans and implementing ordinances. The minimum level of service for a given street establishes the degree to which congestion on that street is acceptable. Local jurisdictions may adopt alternative standards as long as those standards do not:

- Result in major motor vehicle capacity improvements that have the effect of shifting unacceptable levels of congestion into neighboring jurisdictions along shared regional facilities;
- Result in motor vehicle capacity improvements to the principal arterial system that are not recommended in, or are inconsistent with, the RTP.
- Increase single-occupant vehicle (SOV) travel to a measurable degree that affects local consistency with the modal targets.

The City of Portland Comprehensive Plan policies adopted to address state and regional level-of-service requirements are primarily contained under Goal 11B (Public Rights-of-Way).

Policy 11.13, Performance Measures
Evaluate the performance of the transportation system at five-year intervals, using a set of benchmarks that measure progress toward achieving transportation goals and objectives.

Objectives:

A. *Maintain acceptable levels of performance on the regional transportation system*
B. *Use level-of-service as one measure to evaluate the adequacy of transportation facilities in the vicinity of sites subject to land use review*

PDOT uses level-of service in land use review cases to evaluate whether streets and intersections in the vicinity of a site will operate adequately when new development or zoning is proposed. The traffic capacity analysis required in the course of land use review or development is used to identify appropriate mitigation as conditions of approval, if needed. City Administrative Rule TRN-10.27 establishes the adequate level of service for signalized intersections as level-of-service (LOS) "D" and stop-controlled intersections as LOS "E".

Goal 11B (Public Rights-of-Way) of Portland's Comprehensive Plan also contains Metro's table on Performance Measures for Regionally Significant Streets Deficiency Thresholds and Operating Standards. The table establishes the preferred, acceptable and deficient level-of-services on the regional transportation system (rated on a scale of 'A', virtually unimpeded, through 'F', breakdown conditions) for mid-day and A.M./P.M. peak hours based on such factors as speed and travel time, freedom to maneuver, traffic interruptions, comfort, convenience, and safety.

[3] Metro is currently updating the region's long-range transportation plan (RTP). The provisional draft of the RTP Framework (Chapter 1) will be considered by the Metro Council on March 15, 2007. This document recommends that the RTP move away from level-of-service (LOS) as the exclusive tool for determining transportation needs. Instead, the policy framework would use multi-modal system design concepts to define transportation need over time.

Mode Split

In evaluating the performance and capacity of the local system, mode split is an important consideration to factor in the share of "drive-alone" trips compared to non-single occupant vehicle trips (walking, bicycling, transit, carpool, etc.). Chapter 15 (System Performance) of the TSP shows the targeted change in non-SOV mode split for each transportation district. Citywide non-SOV mode split is expected to increase from 38 percent in 1994 to 43 percent in 2020. Adequate bicycle and pedestrian facilities along with the amount and quality of transit service help to determine whether transportation goals can be met.

Transportation Demand Management

Transportation demand management (TDM) includes a variety of strategies to encourage more efficient use of the existing transportation system and to reduce reliance on the personal automobile. Some TDM objectives outlined in the TSP are to:

- Work with employers to create programs for their employees to reduce SOV trips and increase use of carpooling, transit, and non-motor vehicle modes.
- Develop new outreach programs and collateral materials to promote and deliver trip reduction strategies.
- Work with businesses and employees in key employment and other regional 2040 centers to develop customized multi-modal transportation programs.

Transportation System Management

Transportation system management (TSM) is the City's primary approach to managing increased congestion. TSM strategies aimed at optimizing the performance of the existing transportation facilities providing a viable alternative to costly new infrastructure or road widening projects.

PDOT uses TSM to increase the efficiency, safety, or flow of traffic on transportation facilities. Some objectives of this approach outlined in the TSP are to:

- Manage operations of the street system to maintain acceptable levels of service on major arterials that connect the Central City, regional centers, industrial areas, and multimodal facilities.
- Reduce and manage automobile travel demand, and promote transportation choices, before considering the addition of roadway capacity for single-occupant vehicles.
- Employ transportation system management measures to improve traffic and transit movements and safety for all modes of travel, including coordinating and synchronizing signals.

In order to ensure the transportation system serves the needs of all residents, regional and local measures adopted to evaluate the performance of the system must consider the demands of all right-of-way users. As part of the 2035 Regional Transportation Plan (RTP) update process, Metro is evaluating ways to broaden its method for determining transportation needs beyond strictly motor vehicle "level of service" indicators. The proposed multi-faceted strategy focuses rather on "multi-modal system design concepts" such as TDM, TSM, and compact urban form policies. This approach would emphasize not only road capacity improvements, but enhancing system connectivity for transit, bike and pedestrian services.

On-Street Parking

As noted in the introduction of this chapter, numerous demands compete for the limited public right-of-way on city streets. One challenge that occurs in designing certain roadways is how to balance the demand for on-street parking against the need to provide appropriate bikeway facilities.

The Oregon Transportation Planning Rule (TPR) requires that metropolitan planning areas establish local parking plans. Metro's Regional Transportation Plan (RTP) directs cities in the region to set minimum and maximum off-street parking ratios, to adopt parking management plans, and conduct studies of market based strategies for the central city, regional centers, town centers, main streets and employment centers (Policy 19.1).

The following section summarizes City of Portland policies related to on-street parking and relevant to the City's Bikeway Network.

Policy 6.7 Bicycle Classification Descriptions

A. City Bikeways

- *On-Street Parking. On-street motor vehicle parking may be removed on City Bikeways to provide bicycle lanes, except where parking is determined to be essential to serve adjacent land uses, and feasible options are not available to provide the parking on-site.*

C. Local Service Bikeways

- *On-Street Parking. On-street parking on Local Service Bikeways should not be removed to provide bicycle lanes.*

Policy 6.25 Parking Management

Manage the parking supply to achieve transportation policy objectives for neighborhood and business district vitality, auto trip reduction, and improved air quality.

B. Consider transportation capacity and parking demand for all motor vehicles in the regulation of the parking supply.

Policy 6.26 On-Street Parking Management

Manage the supply, operations, and demand for parking and loading in the public right-of-way to encourage economic vitality, safety for all modes, and livability of residential neighborhoods.

B. Maintain existing on-street parking in older neighborhoods and commercial areas where off-street parking is inadequate, except where parking removal is necessary to accommodate alternatives to the automobile.

Policy 6.28 Travel Management

D. Require institutions to regulate parking facilities, first to provide short-term parking for visitors and, second, to minimize the amount of employee parking through demand management measures such as carpooling, ridesharing, flexible work hours, telecommuting, parking management, and employer-subsidized transit passes.

E. Require institutions to mitigate excessive parking impacts on residential areas.

Central City Transportation Management Plan (CCTMP) Goal and On-Street Parking
Parking management is a major policy theme of the CCTMP. Managing parking is one method to encourage the use of alternatives to the single-occupant vehicle.

In Donald Shoup's book, The High Cost of Free Parking, he documents the affects on already congested downtown streets from drivers "cruising" for a curb space rather than pay for off-street parking. According to his research, even a small "search time" per car can create a surprising amount of traffic. Under some general conditions, cruising vehicles can contribute to 60,000 vehicle miles traveled (VMT) per block over the course of one year, which is equivalent to circling the globe more than twice.[4]

Portland's CCTMP Goal includes the following statement:
Minimize the demand for parking without negatively impacting development opportunities by managing long- and short-term parking and providing incentives to encourage the use of alternative modes.

Policy 4.1 On-Street Parking
Support on-street parking as a valuable resource in Central City districts where it can support the land uses of the area.

Objectives:
4.1.1 In managing the supply of on-street parking, the priority is first for short-term, followed by carpool, and finally long-term parking.
4.1.2 Encourage on-street parking in locations where it provides a buffer for pedestrians.
4.1.3 Implement on-street parking controls, such as posted limitations, parking permits, or parking meters, as appropriate for the area where managing commuter parking spaces is necessary to encourage the use of alternative modes and to support economic uses in the district. Parking meters are recognized in most cases as the most efficient and effective technique to manage on-street parking use.
4.1.4 Give priority consideration to the designation of loading zone areas on-street in order to support nearby business activity.

Since city policies support the need for both on-street parking and bikeway facilities on designated streets, finding a balance between the needs of one treatment against the other will be necessary when right-of-way is limited. Although conditions must always be evaluated on a case-by-case basis, it may be beneficial to adopt more clearly define guidelines for prioritization on certain roadways.

Street Connectivity, Traffic Calming and Diversion

City and regional policies promote minimum street connectivity standards to facilitate multiple access points into neighborhoods, as well as, a dense network of intersections and parallel streets within these areas. Adopted spacing standards are intended to generate a grid pattern of streets to achieve objectives including the following:

- Reduce the amount of local traffic on major streets
- Reduce average trip length

- Improve traffic flow
- Increase the number of alternate routes
- Improve motor vehicle, bicycle and pedestrian access

The primary trade-off associated with street connectivity is more cut-through auto traffic on quieter residential streets. Measures to redirect motor vehicles off of neighborhood streets and onto nearby arterial streets are referred to as traffic diversion. Traffic diversion, as with other traffic calming measures, is intended to address threats to neighborhood safety and livability. The use of traffic diversion as a strategy conflicts with some current city policies.

As stated above, street connectivity can enhance bicycle access by providing multiple links and routes. However, since connectivity policies do not distinguish between the various modes of travel, there are instances where greater connectivity for automobiles can diminishes conditions for cycling on local streets. In particular, bicycle boulevards can only be constructed on streets with low traffic volumes (fewer than 3,000 motor vehicle trips per day) since cyclists must share the road with motorists.

Daily, thousands of Portland residents benefit from the use of bicycle boulevards such as NE Tillamook, SE Clinton, SE Lincoln-Harrison, and SE Ankeny Street. A bicycle boulevard, as defined under Title 16 (Vehicles and Traffic) of the Portland City Code, is a roadway with low vehicle traffic volumes where the movement of bicycles is given priority. The City of Portland Bicycle Master Plan (1996) provides a threshold of "fewer than 3,000 vehicles per day" for bicycle boulevards. These low-volume boulevards exist primarily because of past projects that diverted automotive traffic from these streets at key locations:

- A diagonal diverter at NE 16th & Tillamook
- Semi-diverters at SE 39th & Lincoln and SE 39th & Clinton
- A snake diverter at SE 20th & Harrison, and
- A snake diverter at SE 20th & Ankeny.

Without diversion, these streets would likely have higher traffic volumes and would not offer riders the same family-friendly cycling environment that currently exists.

The Portland Office of Transportation works to support the policies of the Comprehensive Plan, which guide the development and redevelopment of the City, and its Transportation Element, a subset of policies providing the framework for developing and implementing the City's transportation plans and projects. The following policies and ordinances in the Comprehensive Plan and City Code appear to preclude the use of diversion on local streets:

Policy 6.5.F, Local Service Traffic Streets
Connections. Local Service Traffic Streets should connect neighborhoods, provide local circulation, and provide access to nearby centers, corridors, station areas, and main streets.

[4] This assumes a three-minute search time, parking turnover of 10 cars per space per day, cruising speed of 10 mph, and an average 33 curb parking spaces per block.

Policy 6.13, Traffic Calming

D. Implement measures on Local Service Traffic Streets that do not significantly divert traffic to other streets of the same classification.

Policy 6.16, Access Management

C. Ensure that access management measures do not adversely impact any transportation mode, consistent with the classifications of the street.

Policy 6.20, Connectivity

Support development of an interconnected, multimodal transportation system to serve mixed-use areas, residential neighborhoods, and other activity centers.
Provide interconnected local and collector streets to serve new and redeveloping areas and to ensure safe, efficient, and convenient pedestrian, bicycle, and vehicle access with preference for public streets over private streets.

Policy 11.11, Street Plans

Promote a logical, direct, and connected street system through the development of street plans.

D. Provide full street connections with spacing of no more than 530 feet between connections, except where prevented by barriers such as topography, railroads, freeways, or environmental constraints.

Title 17 (Public Improvements) and 33 (Planning and Zoning) of the Portland City Code contain connectivity standards to ensure access to adjacent properties, reduce out of direction travel and enhance direct movement by pedestrians, bicycles, and motor vehicles.

Title 17.88.040, Through Streets.

New or expanding development must include the following:

A. Through streets as required by the City Engineer connecting existing dedicated streets, or at such locations as designated by the City Engineer, shall be provided for any development or redevelopment.

C. New residential development or development in existing or future mixed-use areas that will require construction of new street(s) must:

2. Provide for street connections no further apart than 530 feet, except where prevented by barriers such as topography, railroads, freeways, pre-existing development, or natural features where regulations do not allow construction of or prescribe different standards for streets;

Title 33.654.110, Connectivity and Location of Rights-of-Way

B.1.a. (In OS, R, C, and E Zones) through streets should generally be provided no more than 530 feet apart.

In practice, Portland discourages the use of diversion devices, prohibiting them on streets classified higher than "local service".[5] Though traffic diversion tools can accomplish the objective of redirecting travel, they are considered tools of last resort in part for the following reasons:

[5] Community and School Traffic Safety Partnership Strategy, PDOT Bureau of Transportation Management, Oct. 2003.

- They may significantly increase the length of vehicle trips, creating added inconvenience for residents;
- They may add significant time to emergency response;
- They eliminate a potential bypass route during construction or emergency closures on adjacent streets; and,
- Diverted traffic may choose to use adjacent local service streets instead of arterials.

When traffic diversion is deemed necessary, measures must be taken to prevent an inappropriate number of vehicles from being rerouted onto other local service streets. The Bureau of Transportation System Management (BTSM) has developed an "impact threshold curve" as a guideline for traffic calming projects to identify the acceptable level of impact on non-project streets. The threshold curve establishes the following limitations to determine (in general) the acceptable level of diversion:

- An increase of up to 150 vehicles per day is acceptable on any local service street. The maximum amount of traffic increase on any local service street is 400 vehicles per day.
- The total traffic volume on any local service street (the existing volume plus the increased volume resulting from the project) should not exceed 3,000 vehicles per day.

The City has used a variety of traffic diversion devices (including semi-/partial-diverters, median barriers, diagonal diverters, cul-de-sac/street closures, etc.) to reduce the number of automobiles and the associated noise, pollution, and likelihood of collisions on a street. Of these devices, partial diversion that maintains fire vehicle, pedestrian and bicycle access is preferred over full diversion.

The following Comprehensive Plan policies appear consistent with the use of traffic calming (including diversion) and limiting non-local traffic on local service streets:

Policy 6.7.A, Bicycle Classification - City Bikeway

Design. Consider the following factors in determining the appropriate design treatment for City Bikeways: traffic volume, speed of motor vehicles, and street width. Minimize conflicts where City Bikeways cross other streets. Traffic Calming. When bicycle lanes are not feasible, traffic calming, bicycle boulevards, or similar techniques will be considered to allow bicyclists to share travel lanes safely with motorized traffic.

Policy 6.13, Traffic Calming

C. Encourage non-local traffic, including trucks, to use streets of higher traffic and truck classifications through design, operations, permitting, and signing.

Policy 6.22, Pedestrian Transportation

C. Increase pedestrian safety and convenience by identifying and analyzing high pedestrian collision locations; making physical improvements, such as traffic calming, signal improvements, and crossing improvements in areas of high pedestrian use; and supporting changes to adopted statutes and codes that would enhance pedestrian safety.

Policy 6.23, Bicycle Transportation

D. Increase bicyclist safety and convenience by making improvements, removing physical hazards such as dangerous storm grates, and supporting changes to adopted statutes and codes that would enhance the safety of bicyclists.

Policy 6.35 Northeast Transportation District

Encourage automobile and truck through-traffic to use major arterials near the edges of the district to reduce peak-period traffic impacts and to preserve neighborhood livability.

Policy 6.36 Far Northeast Transportation District

Support transportation choices by focusing transit and traffic movement on a well-defined system of arterials, implementing demand management measures, and encouraging walking and bicycling in the Far Northeast.

Policy 6.37 Southeast Transportation District

Reduce travel demand and reliance on the automobile in Southeast Portland to protect residential areas and industrial sanctuaries from non-local traffic, while maintaining access to established commercial areas.

Policy 6.39 Northwest Transportation District

Route non-local traffic, including non-local truck traffic, on Major City Traffic Streets and Regional Trafficways in order to minimize conflicts among modes.

CONCLUSION

Reconfiguring Portland to be a world-class cycling city will require effort on several key fronts. Most notably these include enhancements to the bikeway network, encouragement programs, and the safety of people riding bicycles. Becoming a world-class bicycle-friendly city will require truly world-class facilities. These facilities, while they are similar to the standard facilities Portland has used to create its bikeway network, are different enough to be present significant challenges to be fully embraced by our current policies and practices. Thus, creating in Portland a bicycling environment and culture that is truly welcoming to all potential users will require rethinking our existing policies and practices. We will have to look at the policies with from a “bicycling perspective” and evaluate how current policies and practices hinder creating in Portland what other top bicycling cities around the world have created: a transportation environment in which the majority of citizens can feel secure upon a bicycle and within which the bicycle is often the preferred vehicle for a multitude of reasons.

This chapter identifies some of the areas expected to require more in-depth review and consideration and possibly change if Portland is to achieve its Transportation Goals and Policies related to lessening reliance on the automobile and making bicycling an integral part of daily life. It will be the next phase of the Bicycle Master Plan update that will explore these policies and initiate a discussion about how to craft or reconfigure policies to take Portland to the next level as a bicycling city. It is worth concluding this chapter with a question: Can cyclists—ranging in age from 16-90+- on our bikeway network enjoy the same experience that motorists have to operate comfortably, safely, and efficiently on Portland’s roadway network? Answering this question is largely a matter of policy and how it is answered will largely inform the future of bicycling in Portland.

ENCOURAGEMENT

INTRODUCTION

The companion to "build it and they will come" is "tell people about it and they will ride". Through a comprehensive variety of promotional, educational and encouragement strategies, Portland has seen dramatic increases in bicycle trips as expansion of the bikeway network has occurred.

The highlights that follow demonstrate the breath and depth of the encouragement strategies that Portland has pursued for the last 10 years. As Portland turns its attentions to making bicycling an easy, safe, and comfortable choice for most Portland residents, all levels of government, non-profits, neighborhoods, businesses, and residents will need to expand the range of strategies to come up with creative ways to address the real and perceived barriers to bicycling.

Portland has championed the award-winning SmartTrips Program as its signature encouragement effort. SmartTrips builds on the principle that individuals engaged in a dialogue about alternative transportation are more likely to actually change their behavior than if simply presented with more traditional advertising and promotional activities. SmartTrips offers all residents the opportunity to order information and resource materials and participate in hands-on programs in a target area to assist them in making the choice to walk, bike, ride transit and carpool. Key components of this program are the "Portland By Cycle" kit, which includes a packet of maps and information, and the popular "Portland By Cycle" and "Women on Bikes" rides and clinics, which are aimed at getting new and inexperienced riders on their bikes for recreation and transportation.

Jonathan Maus/BikePortland.org

Giving people the opportunity to ride, at whatever level they are comfortable, is crucial to encouraging increased bicycling. There are literally thousands of organized bicycle rides and events every year and throughout the year in Portland. There are large rides such as the Providence Bridge Pedal, which accommodates 17,000 riders across 10 Willamette River bridges in August and is second only to New York City's ride in size. The Worst Day of the Year Ride in February 2006 hosted 1,500 riders. There are also small rides, such as those run by Portland's Office of Transportation (PDOT) offering lessons on three-wheeled bikes for seniors. In addition to the vast number and variety of slow, fast, long and short bicycle rides available to new and experienced riders, Portland has an active racing and mountain biking community. Bicycle safety clubs at schools get more kids riding and riding safely with the Safer Routes to School program (see chapter X Safety). Regardless of their riding experience or interest any person can find an entry point to riding.

Portland also offers a citywide bicycle map of recommended routes. This has been enhanced with Metro's regional *Bike There* map, City of Portland downtown route and parking maps and five neighborhood bike maps.

With the exception of the water-resistant regional *Bike There* map, all other maps are free and available at most bike shops and community centers around town and at many community events and fairs. PDOT distributes 60,000 maps annually. PDOT also offers personalized bicycle trip planning, complete with directions and marked up routes for the Portland metropolitan area, and assistance with long distance bike touring routes. Community activists with Metro developed a sophisticated web-based trip planner, ByCycle.net, which will eventually include choices for travel based on quickest route, hill avoidance, and low-traffic street preferences.

Commuters who want to start bicycling to work or school have a wide variety of programs to choose from to find the support and advice they need. The Bicycle Transportation Alliance's "Bicycle Commute Challenge" recruits more than 550 area businesses for a month-long contest to see who can get the most employees riding in September. The Community Cycling Center's "Create a Commuter" program works with social service agencies to equip and train low-income and newly employed Portland residents with everything they need to start commuting to work by bicycle. Transportation Management Associations (Lloyd District and Swan Island) work with area businesses to implement policies, incentives and programs to benefit cycling employees. PDOT's new SmartTrips Downtown program focuses on encouraging bicycle commuters as a means to address the congestion caused by construction projects downtown. Hundreds of employers and tens of thousands of employees participate annually in one program or another.

The number and types of people cycling has grown and become more and more diverse. Started in 1991, the Bicycle Transportation Alliance (BTA), a Portland-based statewide bicycle advocacy organization, now has 3,000 members in the Portland region. With the BTA focusing on advocacy, combined with the high level of political and agency support for bicycling in Portland, many bicyclists find that they can focus their attentions on the important task of creating fun. This is exemplified by the organized bicycle fun created by Shift to Bikes, self-described as a "loose-knit and informal bunch of bike-loving folks." Shift organizes an annual Bunny on a Bike Ride with dozens of families riding dressed in bunny costumes and the monthly Breakfast on the Bridges where cyclists riding over Willamette River bridges can help themselves to a free morning coffee and donut the last Friday of each month. These and hundreds of other fun activities encourage and entice ever more people to ride And send a message that riding a bicycle is not just for the bicycle advocate, messenger or the self-identified "cyclist".

Beyond the bicycling and potential bicycling constituency, Portland has begun to engage the business community in a conversation about the benefits of bicycling to the Portland economy. The Oregon Bicycle Business Association has been formed to promote these emerging small- and a few large-manufacturing, retail, professional, and tourist businesses representing at least $67 million annually to the Portland economy. The bicycle industry in Portland is more fully discussed in Chapter 12.

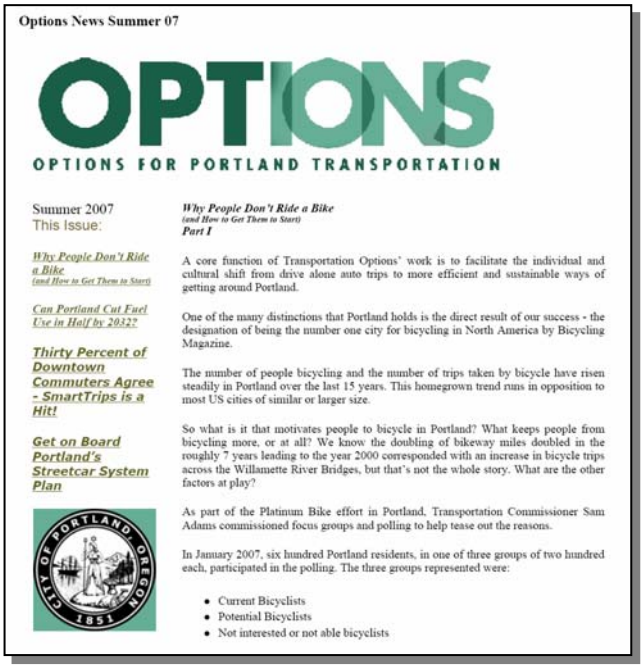
The Portland print media, radio and television and now web have expanded their coverage of bicycling and the variety of topics concerning bicycles. Bicycle fatalities are worthy of significant coverage, as are bicycle cultural events. The City's Portland Bicycle Summit and launching of the BTA's Bike Boulevard campaign made the front page feature article, an editorial supporting the efforts, and Jonathan Nicolas's column in the *Oregonian* all on one day. In 2005 the *Willamette Week* created a special pull out called "I Like Bike" publicizing some of the activities and events happening that spring and summer for bicycling. Lastly, BikePortland.org, a blog all about

Portland's bike community and bike issues, is one of the top blogs in the country with about 40,000 unique visitors on a typical month.

HISTORY OF ENCOURAGEMENT PROGRAMS

Portland prides itself on being on the cutting edge of developing a bicycle-friendly city. For many years Portland focused its energies on building the much-needed infrastructure that allows bicycling to be a viable option for more than just the "brave and fearless" rider. Bicycle lanes were often the facility of choice based on the demands a previous generation of advocates and cyclists combined with the need to increase bicyclists' safety on busier through streets. Early encouragement efforts focused on developing a route map and building of many miles of bikeways.

In the 1990s, Portland looked toward expanding its menu of education and encouragement strategies to increase ridership. The PDOT Bicycle Program, which had been dispersed throughout the agency, shifted most of its outreach and encouragement programs to the newly formed Transportation Options Division. Transportation Options was made up of transportation demand management (TDM), bicycling, walking, traffic calming, and traffic safety project managers. This division investigated a myriad of strategies from around the country and the globe looking for innovations and tried and true programs that would measurably and reliably increase bicycling, walking, transit use, carpooling and carsharing through promotion, encouragement and education.


Options News Summer 07

OPTIONS

OPTIONS FOR PORTLAND TRANSPORTATION

Summer 2007
This Issue:

Why People Don't Ride a Bike (and How to Get Them to Start)

Can Portland Cut Fuel Use in Half by 2032?

Thirty Percent of Downtown Commuters Agree - SmartTrips is a Hit!

Get on Board Portland's Streetcar System Plan

CITY OF PORTLAND OREGON 1851

Why People Don't Ride a Bike
(and How to Get Them to Start)
Part I

A core function of Transportation Options' work is to facilitate the individual and cultural shift from drive alone auto trips to more efficient and sustainable ways of getting around Portland.

One of the many distinctions that Portland holds is the direct result of our success - the designation of being the number one city for bicycling in North America by Bicycling Magazine.

The number of people bicycling and the number of trips taken by bicycle have risen steadily in Portland over the last 15 years. This homegrown trend runs in opposition to most US cities of similar or larger size.

So what is it that motivates people to bicycle in Portland? What keeps people from bicycling more, or at all? We know the doubling of bikeway miles doubled in the roughly 7 years leading to the year 2000 corresponded with an increase in bicycle trips across the Willamette River Bridges, but that's not the whole story. What are the other factors at play?

As part of the Platinum Bike effort in Portland, Transportation Commissioner Sam Adams commissioned focus groups and polling to help tease out the reasons.

In January 2007, six hundred Portland residents, in one of three groups of two hundred each, participated in the polling. The three groups represented were:

- Current Bicyclists
- Potential Bicyclists
- Not interested or not able bicyclists

Options brought TravelSmart – an individualized marketing program – to the U.S. After a pilot project in southwest Portland and a large-scale project in north Portland, Options modified the project to reduce costs and build community. "SmartTrips" adds hands-on approaches to the dialogue about transportation with opportunities to try out bicycling (and walking). Like the rest of the world, Portland demonstrated dramatic decreases in drive alone trips and increases in bicycling, transit use, walking, and carpooling. The SmartTrips Eastside Hub and SmartTrips Northeast Hub saw nine percent and thirteen percent reductions in drive alone trips respectively. A more detailed description can be found in Best Practices – Behavior Change.

During this time new bicycling community groups were forming and growing to address the more diverse interests and encourage more riders on streets, dirt trails, racing venues, and off-street paths. A group of activists, who would later identify themselves as "Shift", organized Bike Summer/Pedalpaloosa in 2002. They have continued this "summer of bike fun" as an annual two week-long festival of bicycling events and rides each June. Portland United Mountain Pedalers (PUMP) is pursuing the development of single-track bike routes, or mountain bike trails, within the city of Portland. Slug Velo leads slow 6paced bike rides. Oregon Bicycle Racing Association hosts dozens of races during the racing season. ZooBombers take 20-30 mini-bikes to the top of the

west hills (the Oregon Zoo MAX stop) and "bomb" down the hill every Sunday night. These are but a few of the newer groups that make up the community of bicycling groups. (For a comprehensive list of current organizations see X.)

PDOT's Traffic Investigations Section, which focuses on safety, took a page from the Marin County Safe Routes to School program to create a comprehensive bicycle education program for middle and elementary school children. Part of this partnership includes bike encouragement safety clubs. A full description of Safe Routes to School can be found in Chapter X – Safety. Investigations also created a new senior bicycling program to encourage the elderly to get safely back on their bikes with three-wheeled vehicles.

What follows is a look at the key promotion and encouragement programs, projects and strategies that Portland has undertaken in the last ten years. The list is representative but not exhaustive. There are just too many interesting and innovative activities to catalog them all. Best Practices section is broken up into types of strategies and is followed by a listing of some of the current ideas for programs and projects to address encouragement deficiencies. These deficiencies are the start of the conversation on developing strategies to include and pursue in the next 10-20 years.

BEST PRACTICES PROMOTION AND ENCOURAGEMENT OVERVIEW

There are four basic encouragement strategies: providing service, changing behavior, raising awareness and providing incentives to ride (or disincentives to drive). Each addresses the top subjective reasons why people choose not to ride a bicycle for a trip. Portland has been at the cutting edge of creating, implementing and evaluating the different strategies.

Encouragement activities tend to start where the vast majority of mode choice decisions are made – in the home. Central to the decision to ride a bicycle for transportation is having employment, shopping, entertainment, leisure, and fitness opportunities close to home. There needs to be a "there there" to which residents can ride their bikes. Portland residents who live within three miles of a main street or town center can reasonably choose to ride there. Many, but not all Portlander's have access to these kinds of land use patterns.

Successful promotion of encouragement programs must necessarily address each individual's barriers to bicycling. Barriers to bicycling fall into two categories: objective and subjective. Objective barriers include things such as poor or no infrastructure, long distances, no available bicycle, inclement weather, and carrying capacity. Subjective reasons include perceived issues regarding safety, travel time, comfort, and acceptance. [See Chapter 2 – Bicycle Use] Numerous surveys identify concerns about safety as the most frequently mentioned barrier to bicycling. Many of these subjective barriers to bicycling can be reasonably addressed with encouragement strategies.

In addition to encouraging individuals to increase bicycling, Portland's community, business and media leaders have a role to play in promoting and mainstreaming bicycling as an easy, convenient and safe option for transportation. This includes ideas and projects aimed at special constituencies such as politicians and other opinion leaders, plus bicycle industry and community organizations. Specific strategies aimed at these audiences

include marketing and public relations activities, awards, networking opportunities, and support for complying with and exceeding the standard regulatory and administrative rules.

Best Practices: Services

Service for cyclists are provided by a variety of public agencies, non-profit organizations, volunteer groups, and business-supported transportation organizations. Some of the better-known programs are identified below.

Maps and Trip Planning

A basic service that most bicycle-friendly communities offer residents and employees is a map of existing bikeways that note safer routes on which to ride. Portland annually produces, prints, and distributes 60,000 free citywide and five neighborhood bicycle maps. They are revised annually. In addition to producing maps, Portland's Office of Transportation has enhanced information for cyclists with a downtown route map including long-term bicycle parking locations and a comprehensive website with information on bicycling, including maps. Traffic detour information that affects popular bicycle routes is posted on the City's "Keep Portland Moving" website showing active downtown and regional construction projects. Community activists with the support of Metro developed a sophisticated web-based bicycle trip planner. It is named ByCycle.net and will eventually include choices for routes based on quickest route, hill avoidance, and low-traffic street preferences.

PDOT Publications (S:/Photos)

Customer Service

The Lloyd District Transportation Management Association (LDTMA) provides a high level of service to its 650 employers and their 21,000 employees. The TMA works with employers to develop bicycle-friendly policies to encourage bicycling by customers and employees. They have a storefront with trip planning and personal service to walk-in customers/employees. This service model is enhanced by bicycling advocates within the TMA creating behavior change and awareness programs for all area employees. Their hands-on service and other work have resulted in steady increases in commuter bicycling.

Equipping Cyclists

The Community Cycling Center, a non-profit organization, implements a robust "Create a Commuter" program for residents. Social service agencies identify low-income and recently employed Portland residents. The "Create a Commuter" program then trains and outfits them (including a bicycle) to commute to their job by bicycle. For workers with limited or no transit service, this service enables them to become working members of the city. In the last five years, 1,500 people have gone through the program. There is currently a 700-person backlog.

Shift to Bikes, a non-profit volunteer organization, started the "Get Lit" program. "Get Lit" uses volunteers to distribute and install front and back bicycle lights on the bicycles of low-income and other needy cyclists'. To date, the program, which was picked up and is now run by the Community Cycling Center, has distributed 1,600 light sets.

Rental, Fleet and Loaner Bicycles

The City of Portland includes bicycles as part of its vehicle fleet available to employees for work trips. These bikes are equipped with chain guards, step-through frames, fenders, locks, helmets, and other amenities to make them ideal for riding in work clothes. On an average month, the fleet bikes are used for 50 round trips. Police Officers and Parking Deputies use bicycles as their work vehicles to increase efficiencies and mobility especially in downtown.

Another service that encourages bicycle use is active bicycle rental businesses for tourists. There are seven bicycle shops in Portland that rent bicycles. These are daily or weekly rental vehicles unlike the hourly rental bicycles that many European cities have adopted.

Lessons Learned: Services

1. As much as providing the on-street bicycling infrastructure is bottom line, providing maps, route planning, and information are essential for riders. Without maps, route planning assistance, and information, potential cyclists use the "mental maps" that they rely upon for driving around town. These busy arterial streets are often not the best place to ride a bicycle.

2. Every year Portland increases the number of maps and information distributed. The demand far exceeds the capacity to print and store enough material. Bike maps are the number one visited item on PDOT's website. Portland has limited distribution for visitors and children – prioritizing Portland adult residents.

3. How one gets from place to place is a well-formed habit, and most Americans have the "habit" of driving. One of the best times to break this kind of transportation habit is to provide new transportation information when residents are making a change – moving into a new neighborhood, changing jobs, or even experiencing the addition of new transportation infrastructure in their area.

4. Access to a working bicycle is one of the top barriers for potential riders. Portland has largely relied upon social service agencies and the Community Cycling Center to work with low- and no-income residents outfitting people with bicycles and bicycle gear. Services that have proven effective at increasing bike access in other cities include rental, loaner and more extensive fleet bikes.

Best Practices: Behavior Change

SmartTrips

For the past four years, Portland has tested, adopted and expanded programs to promote long-term changes in residents' transportation habits. This focused effort is the SmartTrips program, an individualized marketing program that offers information and hands-on experiences to neighborhood residents to encourage bicycling and other transportation options as alternatives to driving alone.. It is described below in broad outline, along with other representative programs aimed at lasting changes in behavior.

"SmartTrips" extends an invitation to every household in a chosen target area to obtain more information about transportation options by ordering information and materials. A comprehensive bicycle kit with maps, tips, rules of the road, rides and clinics series calendars, and incentives (leg straps, patch kits, etc.) is available, or items can be chosen a la carte.

"SmartTrips" offers 25 guided rides annually in the target area for new and inexperienced cyclists. These guided rides and clinics are offered both to all interested parties ("Portland By Cycle") and for women only ("Women on Bikes").

The 2003 TravelSmart pilot program in southwest Portland contacted 600 households. Two hundred and forty seven ordered information with a third requesting bicycling information. The Citywide Bicycle Map was the most requested item on the order form. This pilot program resulted in an increase in bicycling of 40 percent. In 2004, the program expanded to 6,281 households in North Portland with 2,620 of them (or about 42 percent of all households) ordering materials on alternative transportation. Two thirds of north Portland households (1,750) ordered bicycling information. This program also resulted in a 40 percent increase in bicycling in the target area. These programs were conducted with the contractor and creator of the TravelSmart model, SocialData, for $20 per household plus City staff time and materials.

In 2005 to reduce costs and add hands-on activities, Transportation Options took the program in-house at a cost of $10 per person and was able to increase the number of households served to 20,000, reaching 50,000 residents in eastside neighborhoods. This in-house project showed the same nine percent reduction in drive alone trips as with the two previous projects. PDOT conducted on-street video bicycle counts that demonstrated a 23 percent increase in bicycle trips.

The 2006 project in Northeast Portland was even larger with 24,000 households; this showed the most dramatic decrease in drive alone trips at 13 percent. Seventy-five percent of the 4,590 households that ordered materials requested information about bicycling. This project resulted in an increase of 1.5 percent in the mode share for bicycling. In 2007 SmartTrips Southeast will work with the City of Milwaukie to reach out to 3,400 households there plus 20,000 southeast Portland households.

SmartTrips Downtown was launched in February 2007 to work with downtown employees to provide bicycle information and policy initiatives to encourage businesses to create incentives and support for employees who ride their bicycle to work.

Bicycle Commute Challenge

The Bicycle Transportation Alliance coordinates a Bicycle Commute Challenge (BCC) every September. Last year, 550 businesses, agencies and organizations competed to see who could generate the most bicycle commute trips during the month. The program has grown every year since it began in 1995. In 2006, 6,186 cyclists participated. In addition to a web-based trip diary, participants can attend Bicycle Commute workshops to learn the tips, tricks, and rules for commuting by bicycle. Each year the program recruits hundreds of new commuter cyclists.

A key factor contributing to the BCC's success is the personal contacts co-workers have with their colleagues to get them to cycle to work. This personal contact allows new cyclists to learn and to experiment with support from someone they already know and trust.

Lessons Learned: Behavior Change

1. SmartTrips works. It effectively gets people out of their cars and on their bicycles (and walking, riding transit and carpooling). Every Portland neighborhood has experienced dramatic increases in bicycle use as a result of this program.

2. The process of behavior change follows a series of steps that make it possible to make a change. The process starts with motivation, awareness and a triggering event(s). Programs that provide as many "triggering" opportunities to encourage a new rider over a condensed period of time can be very effective. These triggering events can be as simple as a mailer or as complicated as a one-on-one conversation.

3. There is no "silver bullet" that will motivate everyone to ride their bicycles. To effect behavior change, a broad range of activities and programs are needed to activate that one or two or even three motivations that a person may need to start riding.

4. Competition/reward for changing one's behavior is an effective strategy. This increases the commitment and adds a bit of fun.

5. With very few exceptions, behavior change programs enjoy significant public support in Portland. Five percent of households contacted through SmartTrips send positive comments via emails, letters, notes, cards, and phone calls.

6. Polls show that most adults who ride a bicycle had positive experiences from childhood riding a bike. Without that memory/skill it is difficult to change from a non-rider to a cyclist. Children who do not, today, have

experience with riding a bicycle will probably not become cyclists when they get older.

Best Practices: Awareness

Portland's reputation as the best bicycling city in the U.S. is a result of the tremendous citywide commitment to innovation and solid infrastructure investments. This kind of "bragging right" has bolstered Portland's economy with tourist dollars, attracted the important "creative class" to move to Portland, and encouraged new bicycle and other outdoor related industry to locate in Portland. Without consistent and positive promotion and awareness activities over the last 15 to 20 years it is unclear whether the political and community support for bicycling would have continued to expand and deepen as it has.

Awareness programs comprise the bulk of activities in which most jurisdictions engage to encourage bicycling. As a rule, bicycling awareness programs alone do not create behavior change from non-cyclist to cyclist. Awareness programs generally reinforce existing behaviors and inform people about how to behave in a safer, easier, and more comfortable manner. For this reason it is critical that the infrastructure, services, and behavior change programs are promoted through awareness activities.

Some of the awareness projects employed in Portland include community and bicycling outreach events, bicycle rides, visibility campaigns both as earned and free media, and lectures and brown bags, as described in more detail below.

Outreach Events

Transportation Option's "OptionsMobile" – a hybrid vehicle stocked with bicycling brochures and maps, is annually deployed at 70 community fairs, events and concerts. Three of the largest downtown festivals on the waterfront have valet bicycle parking with bicycle information. The Bicycle Transportation Alliance currently manages bicycle parking at The Bite, Oregon Brewers Festival, and the Waterfront Blues Festival. Prominent bicycle parking encourages others to avoid the hassles and expense of driving downtown.

The Lloyd TMA celebrates Bike Commute month in May with transportation fairs and outreach to area employees. Last year 165 people attended. The City has partnered in previous years to celebrate Bike Commute month in Pioneer Courthouse Square. These events consistently draw crowds of 400 with new riders joining the event every year.

Breakfast on the Bridges started as a thank you for bicycle commuters for riding to work and has grown into a Portland institution. Hundreds of bicycle commuters partake in coffee and donuts on the Broadway and Hawthorne bridges from 7:00 to 9:00 a.m. on the last Friday of every month. This fun cultural event is wholly planned and organized with volunteers and mostly donated coffee and sweets.

Pedalpaloosa grew out of the national Bike Summer festival of bike events. In 2006, PedalPalooza 170 bike events culminating in the Multnomah County Bike Fair. All events and programs are organized and implemented by volunteers. Community members fund most of the events. PDOT sponsors printing of the June calendar of

activities. This festival is focused on the fun side of bicycling and enjoys a following of hundreds if not thousands of supporters and participants.

Bicycle Rides

The thousands of organized bicycle events every year allow any person regardless of their riding experience or interest to find a ride to suit their needs and wants. For the recreational rider, the menu of rides include serious spandex crowd rides to leisurely family friendly rides, to Pretty Dress rides where all riders (men and women) dress up. With so many events and rides this report can not begin to capture them all adequately. Some of the more prolific organizations are mentioned below.

The Portland Wheelman Touring Club hosts at least three bicycle rides per day. These are targeted at the recreational rider who wants to get some miles in every week or go for a long weekend ride. A second bicycle club – Portland Velo – has formed to expand the number and tone of rides catering to those who are also looking for more social riding opportunities. Portland United Mountain Pedalers (PUMP) organizes three or four rides each week. The Oregon Bicycle Racing Association (OBRA) has scheduled races, training rides, and classes all year long for the novice and world class racer.

Signature rides for bicycling in Portland are Providence BridgePedal with 17,000 riders including families, bike commuters and serious cyclists riding over 10 of Portland's Willamette River bridges; Summer Cycle rides with PDOT; last year's Portland Century ride organized by ORBike; and Seattle to Portland ride over one or two days.

Visibility Campaigns

Sponsored by area businesses, the City of Portland, TriMet and the Community Cycling Center, See and Be Seen Bicycle Safety Campaign is a public information and education outreach program to increase the public's compliance with bicycle light laws. Specifically, this campaign reminds drivers to watch for bicyclists and bicyclists to use bicycle lights in the front and back at dark. The campaign included a bicycle light parade and bicycle light distribution and installation to 100 needy riders plus 20 bus backs, 20 bus stop, 10 bench ads, 100 in the bus channel cards, and hundreds of See and Be Seen shop window posters. All three network television stations covered the story.

The Bicycle Transportation Alliance conducted two highly visible public service announcement campaigns in the last five years. The "Decide to Ride" public service announcement campaign produced five television spots sponsored by National Highway Traffic Safety Administration (NHTSA) and the Oregon Department of Transportation (ODOT). Produced, directed, edited and written by Matt Giraud of Grapheon Design, the campaign ran over the course of a year with positive success. KGW donated some of the air time and production costs. The campaign was designed to allow other jurisdictions to run the spots with their own sponsor panel at the end.

BTA developed a *Citizens of the Road* visibility campaign with sponsorship from the billboard advertising company Clear Channel and a pro bono advertising firm RWest. “Edgy” posters and billboards captured the attention of motorists and cyclists alike. Posters showed two people standing in the middle of a road holding up something much more difficult to share than the road – underwear, a bath towel or a hairpiece – with the slogan “The Road. An Easier Thing To Share.”

PDOT and bicycling organizations routinely send news releases about events that garner significant coverage in area papers, radio and television stations. Bicycling is either the main topic or included in at least one or two stories a week in one or more media venues. There have also been editorials, opinion editorials, feature and front-page articles, neighborhood articles, and calendar events related to bicycling.

BikePortland.org, a blog for the bicycle enthusiast, sports one of the most active blogs on the web today. Covering everything from stolen bike reports to racing events there are three or four topical stories related to bicycling in Portland every day. These blog postings are monitored by area media to find stories to develop on their own.

Portland Bike Summit

On June 17, 2006, 400 Portland bicycle and community activists and bicycle-industry business members gathered for the first Portland Bike Summit. Representatives from Portland City Council, Metro, and the U.S. Congress participated and took a look back at the last 15 years of successful implementation of bicycle infrastructure and increasing mode share for cycling. The Summit’s main focus was a look ahead to explore community ideas and creative strategies for continuing that legacy of strong citywide support for cycling – to increase the number and breadth of Portland residents and visitors riding bicycles.

The Summit was a key component in the Nine-Part Portland Platinum Strategy. This strategy, involving the City of Portland and community partners, outlines our efforts to make Portland the first large city to receive a Platinum Bicycle-friendly award from the League of American Bicyclists.

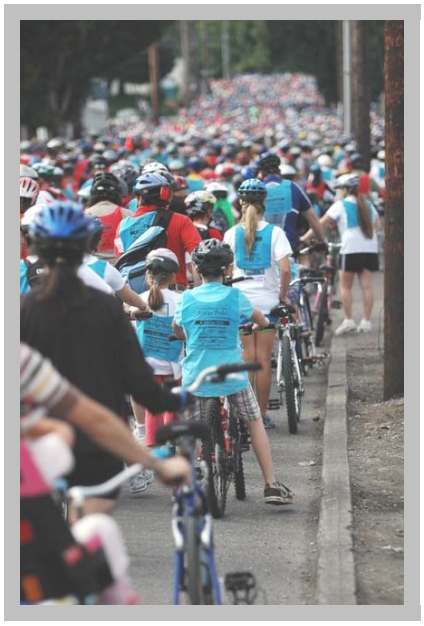
The Portland Bike Summit was primarily about motivating the cycling community and agencies to encourage more people to ride. To capture the best ideas and suggestions, workshop presenters sought feedback from participants as the main focus for all but two of the workshops.

Participants represented the broad spectrum of cycling: commuters, recreational riders, transportation riders, mountain bicyclists, messengers, city planners, neighborhood activists, and bicycle industry owners, managers and staff. The Summit was also attended by neighborhood activists interested in transportation, and specifically bicycling issues.

Lectures and Brown Bags

Transportation professionals have attended lectures by bicycling and engineering experts on bicycle infrastructure planning and design. Increasing the level of skill and competencies of engineering and project professionals enables bicycling capital projects to work more effectively.

Bicycle advocates and government agencies host monthly informative brown bag events to illuminate aspects of bicycling and bicycling cultures from Portland and around the globe. Seeing how other jurisdictions grapple with new and different traffic design and control can spur innovations in bicycle infrastructure design. Attendance varies from 20 to 200 at each event.


Jonathan Maus/BikePortland.org

Lessons Learned: Awareness

1. Even with the incredible number of bicycle rides, events and activities, there seems to be a demand for more car-free environments/events for newer and family riding. Bridge Pedal has reached capacity issues.

2. The print, television, web and radio media have embraced bicycling as a signature Portland activity and frequently publish stories about and including bicycling. Therefore, visibility is mainly garnered through free media/news reporting and, to a much lesser extent, donated advertising projects. With this high level of "free" media attention, limited City dollars have been focused on behavior change instead of awareness programs.

3. Both motorists and cyclists want more clarity on how to share the road safely. Creating more visibility campaigns aimed at sharing the road is useful in reinforcing proper bicycle and driver behavior.

4. Portland can boast some of the most bicycle-friendly transportation professionals and sophisticated activists in the nation. This was achieved in part by consistent training and a willingness to take risks on innovations. This has translated into a richer palette of engineering, encouragement, education, enforcement, and evaluation strategies to try and experiment with.

Best Practices: Incentives

Cash/Income

The City of Portland offers their employees $30 per month if they ride or walk to work on 80 percent of their scheduled work days. The program called "Bike/Walk Bucks" is a model for other agencies to promote employee bicycle commuting. Employees sign a certificate every quarter stating the months they walked or cycled to work.

Then, $30 per month is added to their paychecks on a quarterly basis. About 150 employees participate. Similar to this is the program by David Evans and Associates, a local firm in Portland. They pay employees three dollars a day when they choose to bicycle to work.

Tax Incentives

The State of Oregon allows businesses to claim a 35 percent tax credit on energy efficiency activities and appliances. Adding non-code required bicycle racks and other bicycle infrastructure can be claimed as a credit. Additionally, programs that demonstrate measurable reductions in energy consumption can also apply for the tax credit. Non-profits and government agencies can also take part in this tax credit by partnering with a business that has a tax liability in Oregon. The pass-through partner or business keeps seven percent of the 35 percent credit and the non-profit or government receives the remaining 28 percent. This has amounted to hundreds of thousands of tax credits for businesses while encouraging businesses, non-profits and government to add bike infrastructure and engage in programs that help reduce vehicle miles traveled (VMT).

Lessons Learned: Incentives

1. Cash/income incentives are a motivator to keep riding; it is an easy and relatively inexpensive strategy in the arsenal of programs that keep cyclists riding.

2. The Business Energy Tax Credit (BETC) has opened up hundreds of thousands of dollars to businesses and government agencies to promote bicycling and build bicycle parking and other end-of-trip facilities.

3. Disincentives to driving, such as high priced and limited parking, are very effective measures that provide a motivation for changing from driving to bicycling. The public and business community have not wholly embraced disincentives to driving as they have incentives for bicycling.

Best Practices: Advocacy, Opinion and Business Community Leadership

Bicycle Advocacy

There are several major organizations with a dedicated core of activists committed to working with government and businesses to advocate for better bicycling infrastructure and programs in Portland and Oregon. The Bicycle Transportation Alliance (BTA) is the largest with 4,000 members statewide and 3,000 members in the Portland metropolitan area. The City of Portland Bicycle Advisory Committee advises and recommends on policy, planning and projects for the City of Portland. Portland United Mountain Pedalers advocate for single-track trails as well as other amenities and infrastructure for mountain cyclists.

Awards

The Bicycle Transportation Alliance “Alice B. Toeclips” Awards Dinner and Auction is the largest bicycle recognition and fundraising event of the year. Dozens of award recipients from around the state include bicycle business industry leaders, politicians, advocates, agency leadership, developers, bicycle innovators, health

providers, media representatives, and lawyers. With 650 prominent community and political leaders in the room and only seven award recipients from the 30 nominations each year, competition is stiff for this coveted award.

Businesses for an Environmentally Sustainable Tomorrow (BEST) Awards are presented annually by the City of Portland Office of Sustainable Development and other City partners to recognize businesses with significant and unique achievements in sustainability. The goal of the BEST Awards is to inspire the business community by showcasing innovation and commitment to sustainability. Transportation alternatives is one of the seven categories for awardees. 2006 awardee Providence Portland Medical Center's Bike Group has combined communications, incentive programs and monitoring/measurement for a bike commute rate twice the average for similar companies at the Portland medical campus.

Business Community

Business Symposium and Bicycle-Industry Growth

The Portland Development Commission (PDC) is working in concert with the Portland Office of Transportation to engage local cycling businesses in a dialogue about industry-specific needs and opportunities. Activities currently underway to promote bicycle-industry growth in Portland are described in Chapter 12 – Bicycle-Related Industry.

Get to Work!

PDOT's Transportation Options Division works with 50 to 70 small businesses each year in the SmartTrips areas interested in providing transportation benefits to their staff. The Get to Work! program helps small businesses encourage their employees to walk, bike, take transit or carpool to work by providing information about installing free bike racks, subsidizing transit passes for employees, and other innovative ideas aimed at freeing up parking for customers and keeping workers happy and healthy.

Last year, 19 businesses requested a free bike parking rack for their business. PDOT delivered 177 bicycle kits to employees. The Get to Work! program has helped over 180 small businesses in Portland over the last three years.

Political and Agency Leadership

Portland has benefited from strong and committed political leadership on transportation, and specifically bicycling, at the local, regional, state, and national levels for over 15 years. Transportation agency leadership – ranging from bureau directors, planners, engineers, project managers, and outreach and maintenance staff – is among the best in the country for envisioning, planning, designing, building, maintaining, and promoting bicycling. This kind of leadership and expertise on bicycling, as well as the large and active advocacy organizations, allow Portland to take on risky and innovative strategies other jurisdictions would not have the skills or political will to do. While this is difficult to quantify, this can not be underestimated in deciding the kinds of encouragement strategies to pursue.

Best Practices: Special Constituencies Outreach and Partnerships

Women on Bikes

Currently beginning its fourth year, Women on Bikes has trained, encouraged and empowered over 200 women who were new to cycling. The program holds ten or 11 rides each year as well as eight clinics that focus on building skills for novice riders, basic bike maintenance, tips for safer, easier and more comfortable riding, and most importantly, conversations with other women discovering bicycling. The program teams up two bike shops – Bike Gallery and River City Bikes – to put on the clinics. The program created a comprehensive listing of bicycling organizations, including those with special programs for women, and distributed it to more than 1,500 women over the two year period.

Providence BridgePedal partnered with Women on Bikes to create a women-only start time for the August ride (see Best Practices Awareness – Bicycle Rides section). A portion of these 800 special registrations was donated to Providence's Heart Healthy campaign for women.

Seniors on Bicycles

Traffic Investigation's Community and School Traffic Safety Partnership funded the purchase 20 three-wheeled recumbent bicycles to use for its senior bicyclist rides. Seniors gathered at the Vera Katz Eastbank Esplanade for a guided three-mile ride along the esplanade, waterfront and over the Steel Bridge. The program was designed to show just how safe and easy it can be for seniors to get back on the right bicycle.

Low Income Residents' Outreach

The Community Cycling Center (CCC) is in the forefront of working with low-income families and individuals to make bicycling accessible and viable for these Portland-area residents. In addition to this "Create a Commuter" program, the CCC works with children training them to repair bicycles. With enough hours in the shop working on bicycles, kids can earn a bicycle for themselves. The CCC's Holiday Bike Drive gives bicycles to children identified through social service agencies as needy and desiring a bicycle. The CCC's program gives out 1,000 bicycles each December. There are several other individuals and programs that also give bicycles to children during the holidays.

Bike Shops Advocacy and Encouragement Activities

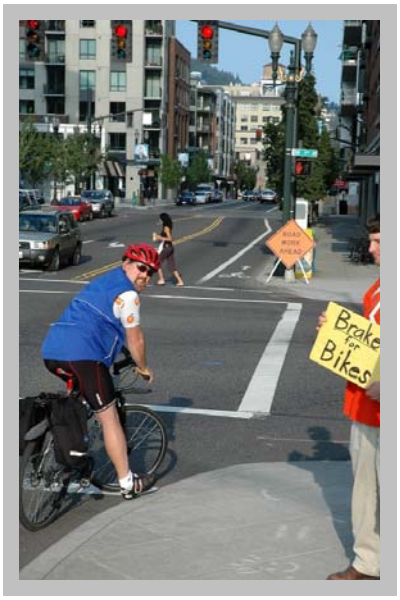
There are several bike shops that consistently support the cycling community through sponsorships, event staffing, planning and logistical support for programs and projects, and donation of bicycles and gear for events and incentives. Among the notable shops that contribute significant time and resources are the Bike Gallery, River City Bicycles, Seven Corners Bicycle Shop, Weir Cyclery, and North Portland Bike Works.

While not specifically targeting Portland, Jay Graves of the Bike Gallery has been working with Shimano and Trek to research, build, and market bicycles for adults who haven't ridden since they were a kid. They have been developing bicycles with 1) easier geometry for riders who may not be very flexible or want to put their feet flat on the ground while stopping; 2) simplified or automatic gear shifting; 3) familiar and intuitive coaster brakes that allow a one-hand-free ride; 4) stain-resistant chain guards; and 5) comfortable seats and shock absorbers. These amenities make the job of the encouraging newer adult riders much easier. Having leadership on this strategy in Portland helps the local community get a leg up (literally and figuratively) in the market for these new bicycles.

BICYCLE SAFETY – EDUCATION & ENFORCEMENT

INTRODUCTION

The public expects and demands that the transportation system be safe for all users. Improving pedestrian and bicycle safety can help to alleviate a variety of health, economic, and neighborhood livability issues. Fatalities and injuries from motor vehicle/bicycle 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 pedestrians and bicyclists, we will also increase use.[1]



Jonathan Maus/BikePortland.org

In a recent survey of Portland residents on bicycling and the barriers to bicycling, both bicyclists and non-bicyclists reported weather and safety as top concerns for bicycle riding.[2] 26 percent of bicyclists and 18 percent of non-bicyclists reported safety concerns. Almost half of both groups reported a fear of being hit by a motor vehicle. Volume and speed of traffic were also fears that were cited as barriers to riding. People's perceptions and fears are personal and cannot be argued. However, with data on bicycle crashes and conditions that contribute to those crashes, the "real" (vs. perceived) safety issues can be illustrated. (For more information on people's perceptions of safety, see Chapter 2)

This chapter highlights real safety issues and trends that can be addressed with engineering, education, and enforcement techniques. It also draws a distinction between the public's concerns about the safety of bicycling in Portland and the actual risk of harm from bicycling. In fact, data shows that operating either a motor vehicle or a bicycle in the City of Portland are both relatively safe ways to travel.

Bicycle safety on Portland's roads can be estimated by the data collected on frequency of causes, injury severity and contributing factors of bicycle crashes. The data sources that were used for this chapter include:

<u>Crash Data</u>:

1. <u>Oregon Department of Transportation (ODOT) Statewide Crash Data System</u>
   ODOT's Crash Analysis and Reporting Unit maintains this data system, which 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. The

[1] *Transmittal of Guidance on Bicycle and Pedestrian Provisions of the Federal-aid Program*, Memorandum, U.S. Department of Transportation Federal Highway Administration, February 24, 1999
[2] Survey of Portland Residents on Bicycling and the Barriers to Bicycling. May 2007. Portland Office of Transportation, Options. Davis, Hibbits, and Midghall.

Portland Office of Transportation utilizes this data for analysis and mapping purposes. Analysis for this report represents the years 1993-2005 and includes 2,198 crashes.

2. Police Crash Investigation Reports
   Police reports that contain information on bicycle crashes from 2002 to 2006 were collected. The Portland Police Bureau extracted all reports on record for those dates. These 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.

3. Pedestrian Bicycle Crash Analysis Tool (PBCAT)
   PBCAT is a "crash typing" software offered by bicyclinginfo.org that will be used to define the sequence of events, through "crash typing," that resulted in the crashes where police investigation reports are available. The PBCAT system has been updated with all 228 crash investigation reports obtained from the Portland Police Bureau for the period from 2002 to 2006.

4. Oregon Trauma Registry
   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 trauma registry collects information on the cause of trauma such as a bicyclist, pedestrian or motor vehicle crash.

When a crash occurs, there are multiple factors that influence 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.

This analysis only includes those crashes that were reported, as not all crashes are reported. Based on analyses comparing hospital data on bike-related admissions to police report data, only 10 – 20 percent of all bicycle crashes are ever reported.[3] The more severe the crash, the more likely it is to be reported. Additionally, 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 cause of crash data often lack enough detail to be able to understand all the contributing factors. Reconstructing these events can be difficult or impossible because the records do not include a diagram or drawing of the event.

[3] *Enforcement for bicycle Safety*, Peter Flucke, Wisconsin Department of Transportation, 2003

National data from the Federal Highway Administration indicates that 70 percent of bicycle injuries resulting in a visit to the emergency department do not involve a motor vehicle.[4] The study also reported that close to 31 percent of crashes occurred on non-roadway locations such as bike paths. Another study conducted in 1998, with the League of American Bicyclists members, who were surveyed about their cycling experiences during 1996, found that only 11 percent of self-reported crashes involved a motor vehicle.[5] The Portland-specific analysis, in this chapter, represents only those bicycle crashes that involved a motor vehicle, since involvement of a motor vehicle is the basis for inclusion in the database. Table 6.1 below illustrates the distribution of bicyclist injuries treated in the hospital by location and type of event.

Table 6.1: Distribution of bicyclist injury cases treated in hospital emergency departments by location and type of event (From 8 National Hospitals) **(with percentage of row total indicated)**

Location	**Bicycle-Motor Vehicle**	**Bicycle Only**	**Total (row)**
Roadway	280 (44.7%)	347 (55.3%)	627 (100%)
Non-Roadway	23 (8%)	264 (92%)	287 (100%)
Unknown	17 (11.2%)	135 (88.8%)	152 (100%)
Total (column total)	**320 (30%)**	**746 (70%)**	**1,066**

Despite the fact that the analysis completed for this chapter covers only motor vehicle and bicycle crashes, many non-motor vehicle related crashes do occur in Portland. A gap exists in being able to collect the non-motor vehicle related crashes and it is important that those crashes and related safety issues are not overlooked. Ideally, to collect the non-motor vehicle related crashes, a reporting mechanism must be established for fixed object crashes to be able to accurately capture that data.

In order to improve the accuracy of the data used in this report, City staff will cross-reference police reports with the Statewide Crash Data System. Using crash diagrams and extensive narrative description included in the police reports, a more complete story about contributing factors that lead to the crash can be told. For example, the detailed information will allow for the identification of patterns to crashes in certain spots where no facilities exist. This will inform policies and facilities that will be created to ensure a safe bicycling environment.

The information included in this chapter is not exhaustive of all the analysis that can be conducted to tell the safety story of Portland's streets. This chapter serves as the first comprehensive report on bicycle safety in Portland. The intent is to continue to expand the data analysis and level of detail of information presented.

Crash Background

Bicycling on Portland's streets has increased substantially in the past ten years. In that time period, there has also been an increase in the number of crashes that involve a bicyclist, however, Portland's streets are getting safer for bicyclists and pedestrians. From 1985 to 2000, there were 225 pedestrians and bicyclists killed, with bicyclists

[4] Stutts, J.C. & Hunter, W.W. (1997). *Injuries to Pedestrians and Bicyclists: An Analysis Based on Hospital Emergency Department Data.* (FHWA-RD-99-078). Washington DC. US Department of Transportation, Federal Highway Administration.

and pedestrians representing approximately one in three traffic fatalities. During those 15-years, Portland averaged just over two bicycle fatalities per year. Despite the fact that fatalities remain fairly low, the number of bicycle crashes increased by 20 percent over that time period.

Unfortunately, too many children (on bicycles or as pedestrians) in the city are being struck by motor vehicles. In the first half of the 1990s there were 615 children struck by motor vehicles -- this is equivalent to a child pedestrian or a bicyclist being hit once every three days. That number is decreasing , possibly due to investments in encouragement, education and engineering.

In the second half of the 1990s, there were almost 200 fewer children hit by a motor vehicle. That rate was reduced from a child hit every third day to a child hit every fourth day. This is an improvement, but it is not enough.

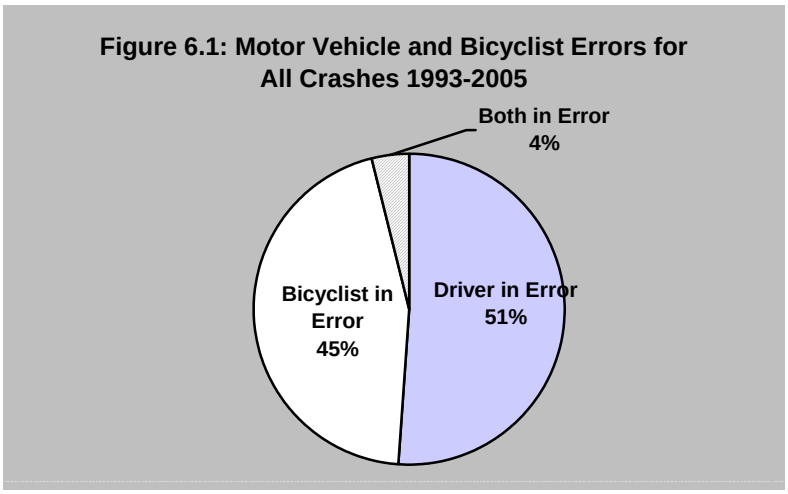
Investments in transportation safety frequently provide an outstanding benefit to cost ratio. The reduction of crashes means fewer deaths and injuries, and lower economic costs. From 1996-2005, Portland residents spent as much on the impact of motor vehicle crashes as on the entire transportation system budget. Calculable costs of motor-vehicle crashes include wage and productivity losses, medical expenses, administrative expenses, motor vehicle damage, and employers' uninsured costs. In addition to the tangible costs, the value of lost quality of life is estimated through empirical studies of what people actually pay to increase their safety and decrease health risks. In 2005, in Portland, the total cost to society for all crashes where a motor vehicle was involved was $3,943,856,700. For bicycle crashes in Portland, that cost is estimated at $167,619,200.

Jonathan Maus/BikePortland.org

Crash Types

When a crash report is filled out, either by a police officer or an involved party, a designation is made as to the error that was a contributing factor in the crash. According to the Statewide Crash Data System, motorists were in error 51 percent of the time and the bicyclist was in error 45 percent of the time (see Figure 6.1). In 4 percent of the cases, both bicyclist and driver were assigned an error that contributed to the crash. An error assignment does not necessarily mean that a traffic citation was issued.

[5] Moritz, W.E. (1998). *Adult Bicyclists in the United States: Characteristics and Riding Experience in 1996.* Transportation Research Record. Annual Meeting of the Transportation Research Board N 77, ETATS-UNIS (01/1998) 1998, n 1636(7 ref.), pp 1-7.



As coded in the Statewide Crash Data System, the most common errors on the part of the bicyclist cited as a contributing factor that leading to the crash include: disregarded traffic signal, did not have the right-of-way, and riding on the wrong side of the road. In 36 percent of the crashes where an error was assigned to the motor vehicle driver, the driver did not have the right-of-way over the bicyclist. The table below illustrates the most common error categories assigned to crash participants.

Table 6.2: Errors Cites as Contributing to a Crash	Count	Percent
Bicycle Cited Errors		
Right of way errors	374	35%
Disregarding maneuver	273	25%
Miscellaneous maneuvers (including driving on the wrong side of the road)	214	20%
Turning Error	54	5%
Improper maneuvers	41	4%
Passing Maneuvers	30	3%
Motor Vehicle Cited Errors		
Right of way errors	891	74%
Turning Errors	115	10%
Disregarding Maneuvers	86	7%
Miscellaneous Maneuver (including door opening)	64	5%
Improper maneuvers	27	2%

Statewide Crash Data have significant limitations, as it does not provide a complete picture of the events that resulted in a crash. It can provide information on who was involved, when the crash occurred and where, but the level of detail on how the crash occurred is often lacking. As such, Statewide Crash Data provides a high level overview – but a low level of precision – of the most common factors that result in crashes. For example, a motor vehicle driver might be assigned a failure to yield error, when they were actually making a right turn across a bike lane and hit the bicyclist who was traveling in a parallel direction. For policy implications, it is important to have a more detailed description of crashes to see what patterns, if any, exist within these broad error categories.

The limitations described with the Statewide Crash Data System are not unique to Oregon. This challenge exists nationwide and was the impetus for the creation of the Pedestrian Bicycle Crash Analysis Tool (PBCAT). PBCAT allows for a more detailed look at the factors surrounding crashes by utilizing very descriptive police reports collected from the Portland Police Bureau. The benefits of the high level of precision in PBCAT allow for a more detailed analysis of crash characteristics. For example, PBCAT includes information on position of the bicyclist, which allows for a greater understanding of the relationships between bicyclist position, likelihood of collision, and level of injury severity, among others.

Error types from the Statewide Crash Data System will be compared to the crash typing system of PBCAT. The crash typing, which will provide more information than the error types in the Statewide Crash Data System, will allow for the description of the sequence of events and precipitating actions that lead to the reported crashes. Table 6.3 illustrates a sample of variables from the Statewide Crash Data System that are facts of the crash that are not left up to interpretation and those variables that are subjective in nature. Those variables that are left up to interpretation are the ones that will be cross-referenced utilizing PBCAT.

Table 6.3: Variable Types From Both ODOT's Statewide Crash Data System and PBCAT

Non - Interpretive Variables	Subjective Variables
Time of crash	Error type
Age of participants	Injury severity type
Location of crash	Error assignment

Injuries

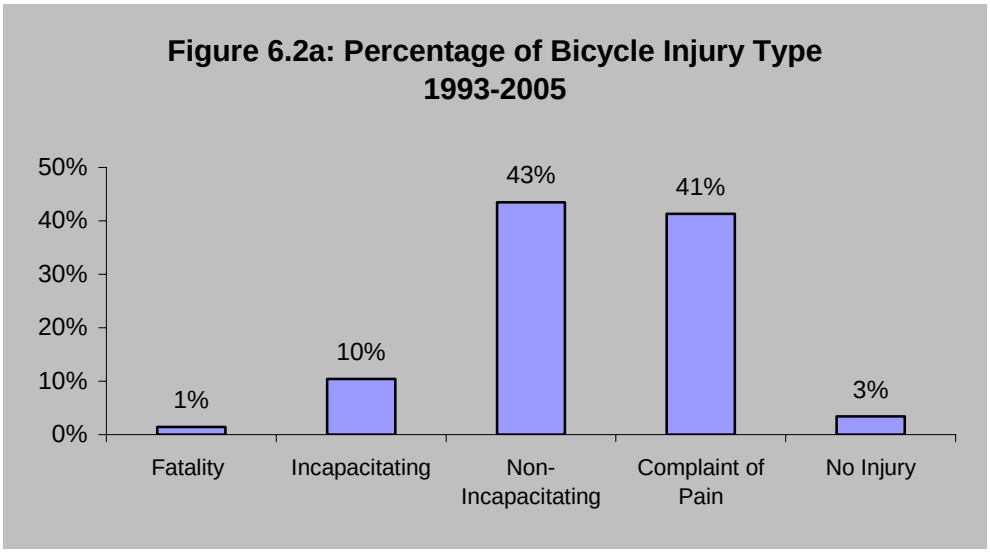
For the purpose of this analysis, injuries are categorized into five different groups. For the police investigation reports, the police officer checks a box that denotes the observed severity of the injury. It is worth noting that the outcomes from many severe injuries are not known after the crash participant has been taken away in an ambulance.

For each crash, there are five possible types of injury severity that may be assigned:

1. **Fatality** – The crash victim dies as a result of the injuries sustained in the crash.
2. **Incapacitating injuries** – The participant suffers a severe injury that is non-fatal, but prevents the injured person from walking, driving, or normally continuing the activities the person was capable of performing before the injury occurred (i.e., broken bones, severe bleeding, unconsciousness).
3. **Non-incapacitating** – The participant suffers moderate injuries which, though not severe, are evidence that an injury occurred (i.e., lumps, bruises, abrasions, swelling, minor bleeding).
4. **Complain of Pain** – The participant reports an injury, but no injuries are apparent (i.e., momentary lapse of consciousness, complaint of pain).
5. **No injury** – The participant is not injured in the crash.

The majority of bicycle crashes included in the Statewide Crash Database resulted in some form of injury to the cyclist. Very few of the crashes reported each year (3 percent) resulted in no injury to the bicyclist. The majority of the crashes result in a non-incapacitating or complaint of pain injury. Over the 13-year span, there were 31 bicycle fatalities. Figure 6.2a illustrates the different severities of injuries for all bicycle crashes from 1993-2005. It is important to note that these crashes do not include injuries to a bicyclist that occur when no motor vehicle is

involved. For comparison, Figure 6.2b provides a distribution of injury severity type for crashes in the PBCAT database, each of which represents a detailed police investigation report. This comparison reveals that more severe injury types are disproportionately accompanied by a detailed police investigation report, and underscores the need for greater uniformity and consistency in data collection and reporting.



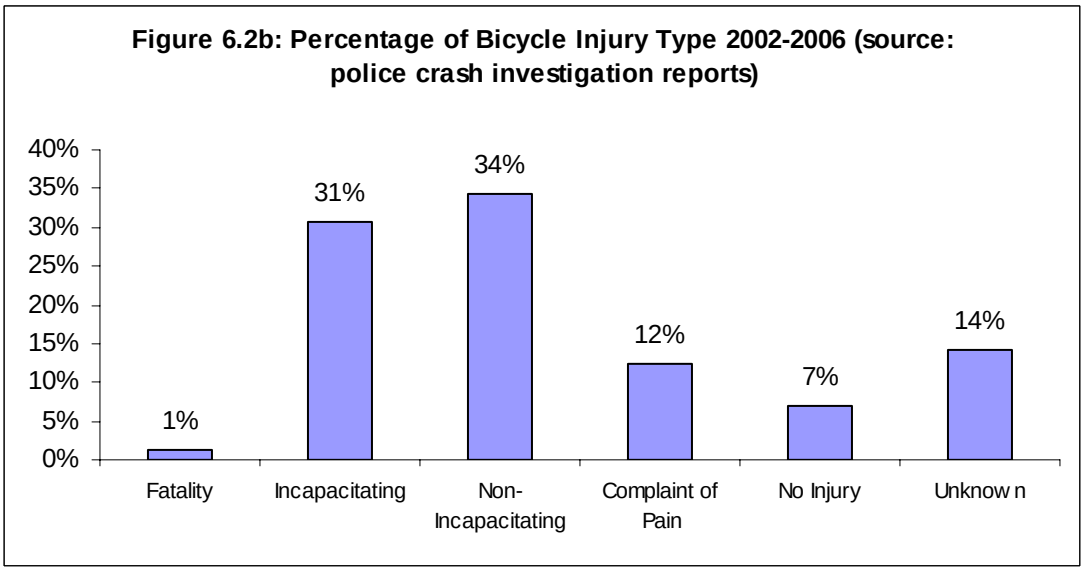
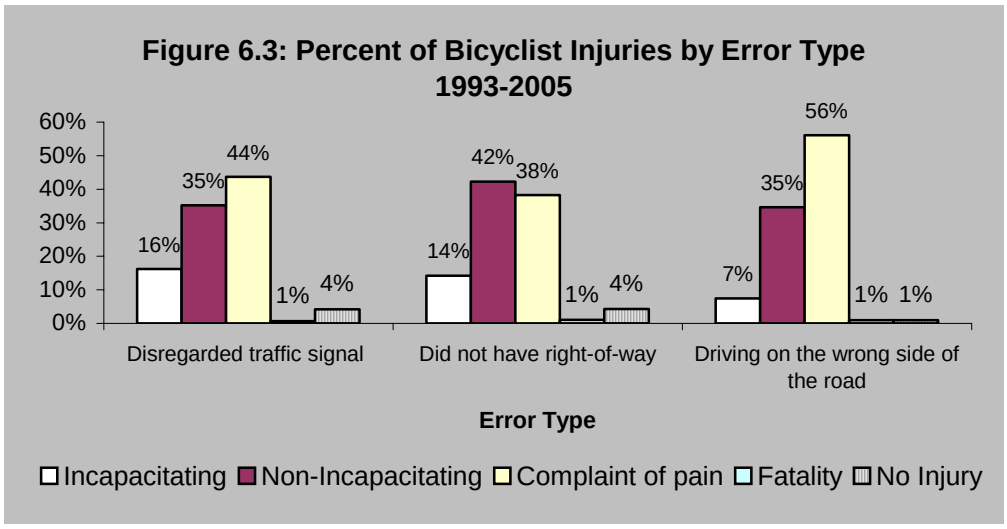
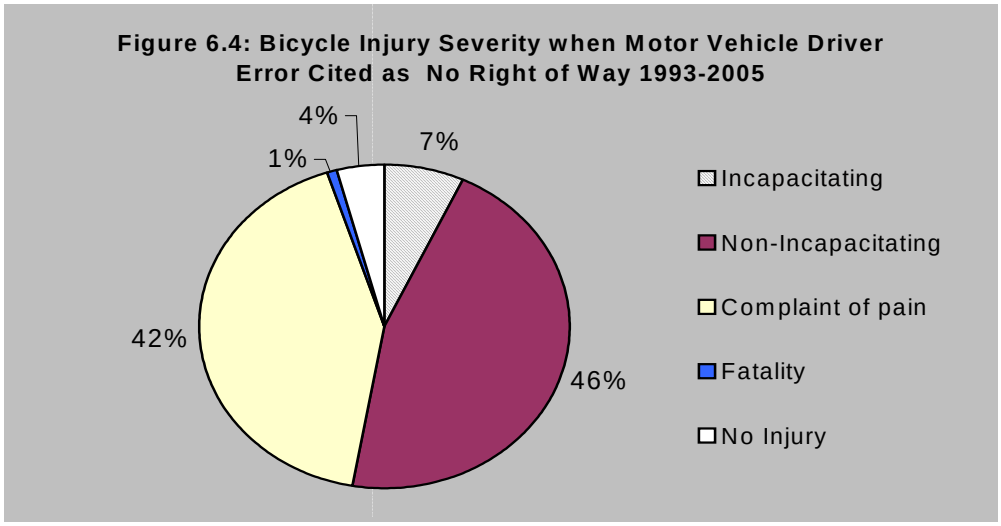


Figure 6.3 below shows the three most commonly cited bicyclist errors and the resulting severity of those injuries. The majority of the injuries from the error types resulted in the non-incapacitating to complaint of pain severity level.



The most common error type cited for the motor vehicle driver is, "did not have right of way over the bicyclist." Figure 6.4 shows that 88 percent of bicyclists who were hit when the driver did not have the right of way received a non-incapacitating or complaint of pain injury. A relatively small percentage of crashes resulted in an incapacitating injury or fatality.



While the ultimate goal is to reduce the number of injury crashes, the data show that most crashes do not result in the most severe-injury outcomes. This pattern of reported injury severity, falling between non-incapacitating and complaint of pain, may have important implications for encouragement and outreach programs. Safety concerns are a top reason cited for why people do not ride a bicycle, or bicycle more often (see Chapter 2 for more on perceived safety); however, the chance of having a life altering or fatal injury is very small.

Fatalities

Over the 11-year period, 31 bicyclist fatalities were reported. Bicyclists between the ages of 15-54 years accounted for 88 percent of fatalities – two fatalities occurred among those 14 years of age or less and two were among those over the age of 65 years.

Table 6.4: Fatalities by Age 1993-2005		
	Count	**Percent**
Birth - 4 years	0	0%
5 - 14 years	2	6%
15-24	6	19%
25-34	9	29%
35-44	8	26%
45-54	4	13%
55-64	0	0%
65+	2	6%
Total Fatality	31	100%
18 years and younger	4	13%
65+	2	6%

The following two tables highlight the errors assigned to the bicyclist or motor vehicle involved in a bicycle fatality. In 19 cases, or 61 percent of the time, the bicyclist was cited with an error that contributed to the crash. Motor vehicle drivers were assigned an error in 12 of the cases, most commonly for not having the right of way or disregarding a stop sign.

Table 6.5: Participant Type and Errors That Contributed to a Bicyclist Fatality

Bicyclist Error That Contributed to the Fatality	Percent (count)
Did not have right of way	21% (4)
Disregarded stop sign or flashing red light	16% (3)
Improper change of traffic lanes	11% (2)
Miscellaneous Error	11% (2)
Disregarded traffic signal	5% (1)
Turned from the wrong Lane	5% (1)
Improper or no lights	5% (1)
Passing at intersection	5% (1)
Driving on wrong side of the road	5% (1)
Straddling or driving on wrong lanes	5% (1)
Driving too fast for conditions	5% (1)
Failed to maintain lane	5% (1)
Total	**100% (19)**

Motor Vehicle Error That Contributed to the Fatality	Percent (count)
Disregarded stop sign or flashing red light	25% (3)
Did not have right of way over bicyclist	25% (3)
Failed to decrease speed for slower moving vehicle	16% (2)
Driving too fast for conditions	8% (1)
Passing on straight road under unsafe conditions	8% (1)
Total	**100% (12)**

Error coding for fatalities should be interpreted with caution. From 1993-2005, bicyclists were in error 49 percent of the time for crashes that result in an injury to themselves. When analyzing errors contributing to a bicyclist fatality, the bicyclist was cited as in error 61 percent of the time. This same pattern exists when analyzing pedestrian fatalities and errors that led to those events. From 1985-2002, a pedestrian was cited in error 52 percent of the time when an injury occurred. That percentage jumped to 66 percent when the pedestrian was

killed. Having reviewed this issue with police and the courts, it appears that the serious ramifications of coding a driver in error for a fatality combined with corresponding evidentiary standards may result in significantly fewer drivers cited in error for a fatal crash than cited in an injury crash. It is also relevant to note that in most bicyclist fatality crashes, the bicyclist will have little or no opportunity to contribute evidence on their behalf.

A study conducted by New York City-based bicycling advocacy group, *Right of Way*, demonstrated that police investigation reports for bicycle fatalities inaccurately assigned error to the bicyclist in the majority of fatalities. New York City Police estimated that the bicyclist was in error 75 percent of the time. When *Right of Way* reconstructed the police crash investigation reports, they found that the bicyclist was in error between 15 – 35 percent of the time.[6] Error assignment is subjective and dependent upon witnesses and investigating the crash. City staff obtained Portland police crash reports with the aim of reconstructing those crashes to obtain a better understanding of the errors that contributed to the crashes.

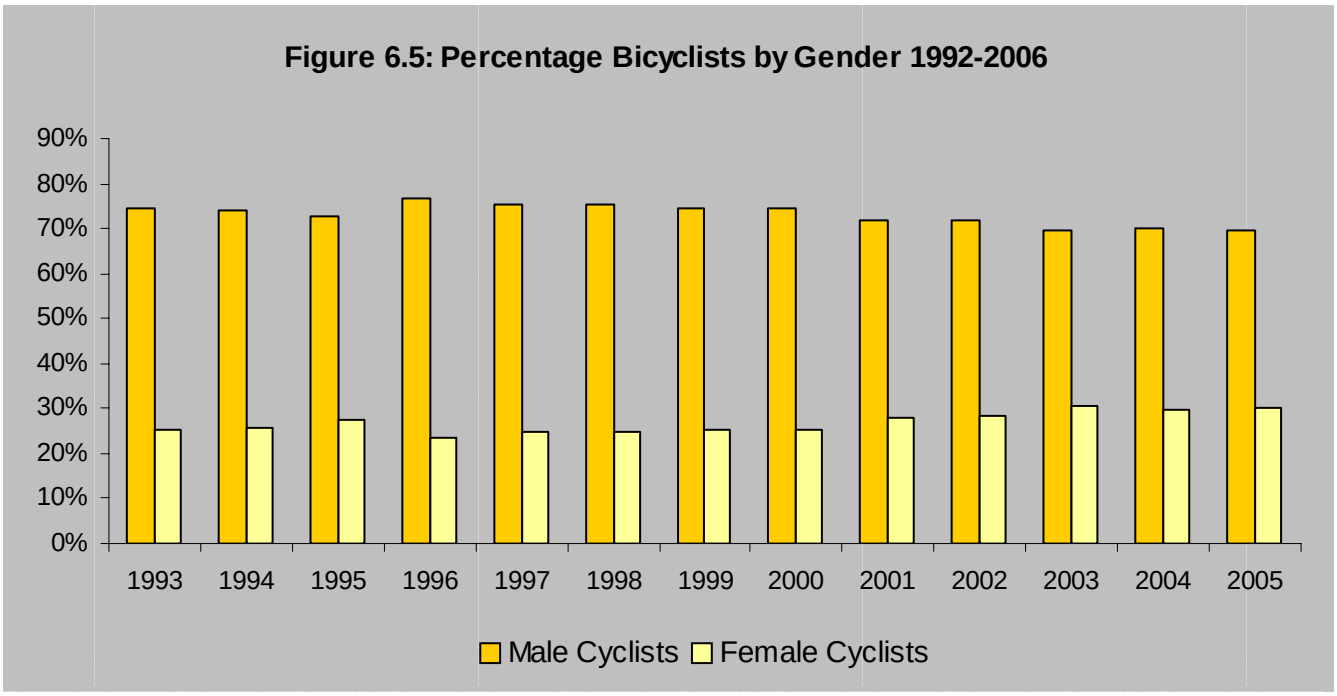
C. Crash Factors and Conditions

Numerous traffic studies have indicated that well over 90 percent of crashes are the result of human error. Human error includes actions such as driving/riding too fast for conditions, driving/riding while impaired, driving/riding while distracted, or failing to follow traffic regulations. The majority of crashes for which a police investigation report is submitted are assigned an error type. Although each crash is assigned an error type, there are unique circumstances that factor into the events that resulted in the crash and the subsequent outcomes of that crash. These factors include human conditions such as age and gender, environmental conditions, substance use, and protective equipment.

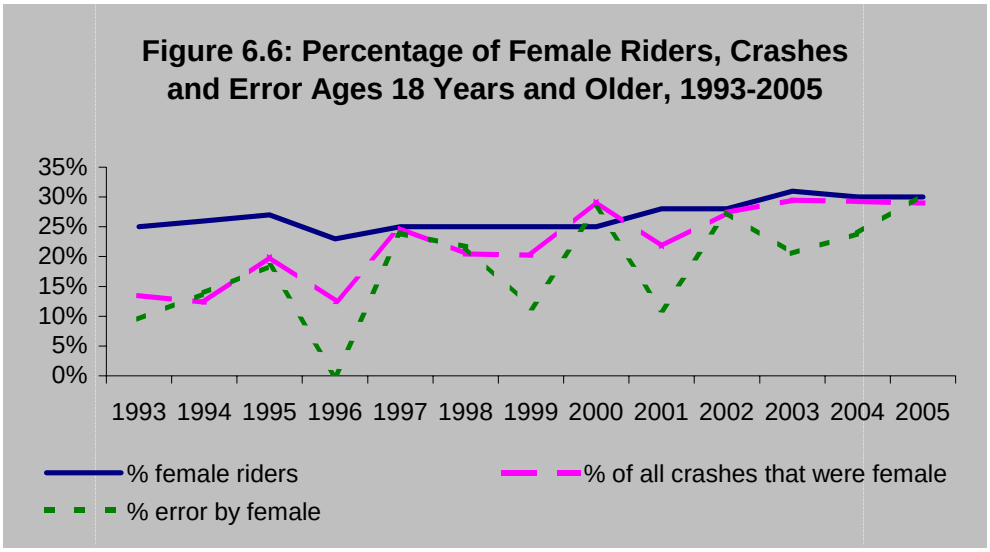
Gender

The demographics of Portland's bicyclists are changing: more females are riding their bikes. However, males continue to represent the majority of bicyclists (70 percent in 2005). Figure 6.5 below shows the percent increase for both male and female ridership in Portland from 1993-2005. This ridership data comes from actual in-person counts of riders crossing designated locations in the City of Portland. From 1993-2005, there was a 20 percent increase in the percentage of female bicyclists on Portland's streets. In 2005, 30 percent of all cyclists on the road were female, up from 25 percent in 1993. (See Chapter 2 for more information on ridership).

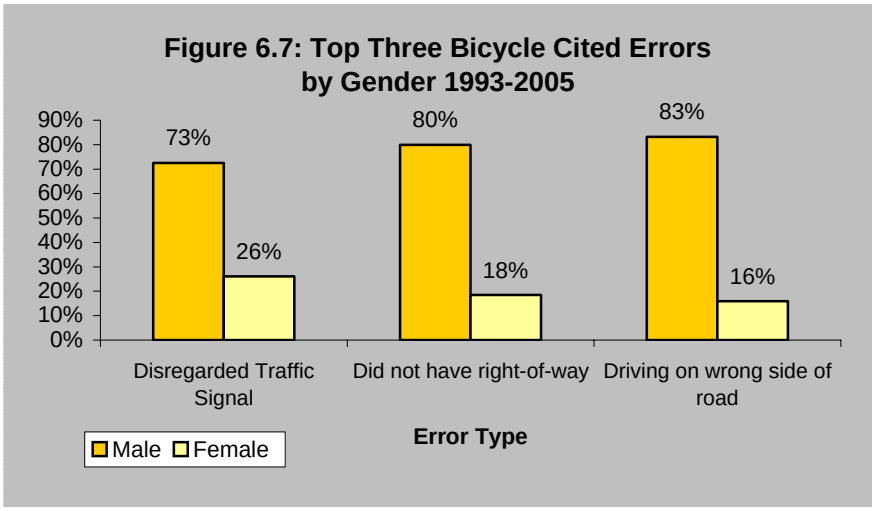
[6] *The Only Good Cyclist: NYC Bicycle Fatalities – Who's Responsible?* Charles Komanoff and Michael J. Smith. Right of Way. May 2000



With the increase in female riders, there has been a corresponding increase in the number of crashes in which females are involved (see Figure 6.6 below). The percentage of crashes involving a female cyclist was 13 percent in 1993, rising to 29 percent of all bicycle crashes in 2005. Even though in 2005, slightly less than one-third of the bicycle crashes involved women, it is disconcerting that with the increase in percentage of female riders, there is an increase in the percentage of crashes involving women. Also on the rise is the number of female cyclists who are assigned an error that contributed to a crash. Despite these increases among females, males are still more likely to be involved in a crash and be assigned an error as a contributing factor to a crash. More analysis will be conducted to explore if patterns exist for female crashes.



For the three most common bicycle error types (disregarded traffic signal, did not have the right-of-way, and riding on the wrong side of the road), males were more likely to be assigned those errors than females. Overall, males commit 80 percent of all possible errors. Women are less likely to create an error that results in a bicycle crash.



Age

A cyclist injured in Portland is most likely to be over 18 years old. Like most of the country, Portland has experienced a decline in the number and percentage of children involved in bicycle/motor vehicle injury crashes.

In 1995, the national average age of bicyclists injured in traffic crashes was 22.7 years. By 2005, this had risen dramatically to nearly 29 years of age.[7] Nationally, the percentage of victims that are adults is climbing steadily, perhaps signifying that more adults are riding, or that fewer children are riding.

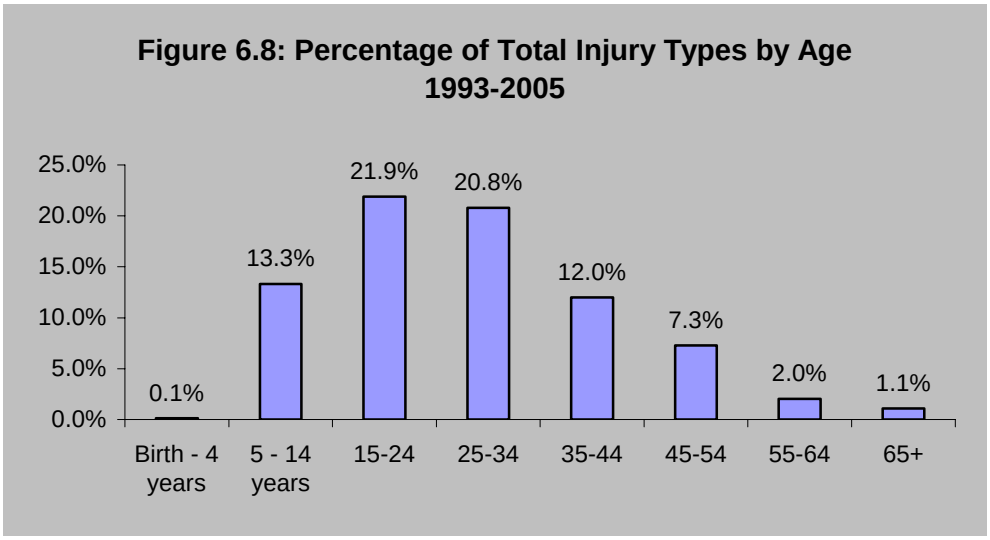
[7] NHTSA's National Center for Statistics and Analysis, *Traffic Safety Facts, 2005 Data*

In Portland, in 1995, the average age of a bicyclist injured in a crash was 27 years, which rose to 32 years in 2005. The youngest person to be injured in a crash was four-years old. The oldest person was 95 years. Table 6.6 below illustrates that the majority of injuries are among those less than 34 years of age.

Portlanders 18 years of age and under make up 19 percent of the crashes that occurred from 1993-2005. Nationally, in 2005, bicyclists under the age of 16 accounted for 35 percent of all those injured in a traffic crash.[8]

Table 6.6: Age Distribution of Cyclists Involved in Crashes 1993-2005

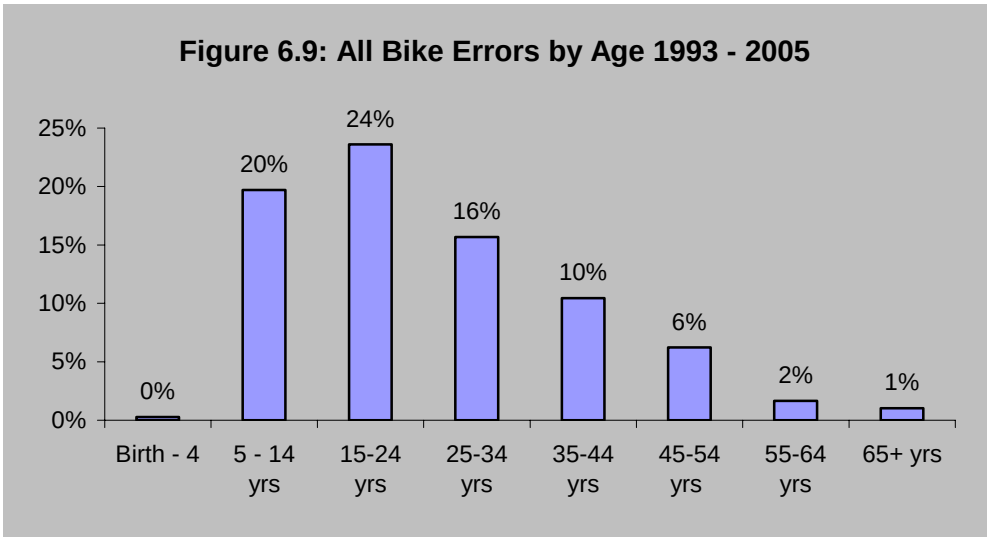
	Portland	
	Count	**Percent**
Unknown Age	471	21%
Birth - 4 years	3	0%
5 - 14 years	293	13%
15-24	481	22%
25-34	457	21%
35-44	264	12%
45-54	160	7%
55-64	45	2%
65+	24	1%
Total Fatality	2198	100%
18 years and younger	419	19%
65+	11	1%



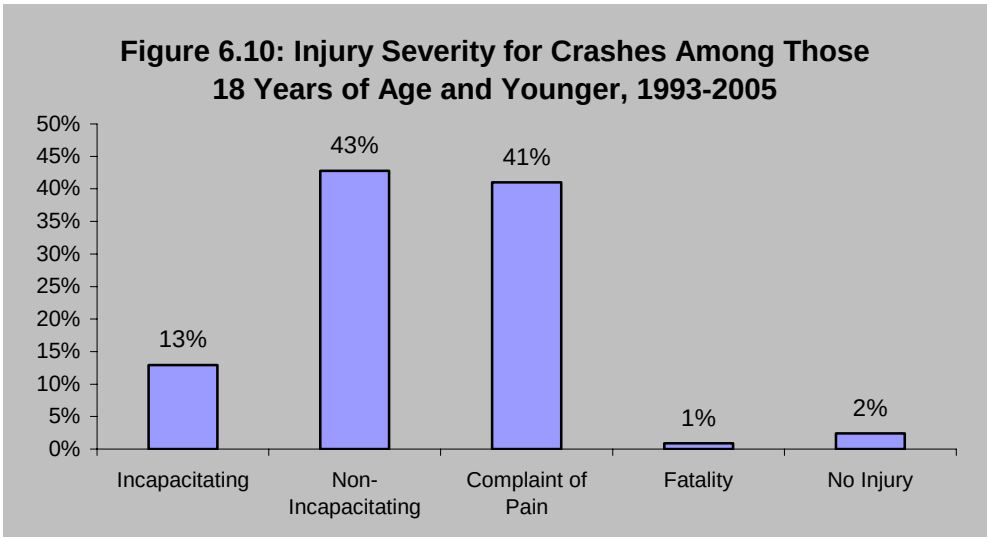
Children are more prone to errors due to risk taking while on a bicycle. As a result, the majority of crashes that involve a child are due to an error on the part of that child.[9]

[8] NHTSA's National Center for Statistics and Analysis, *Traffic Safety Facts, 2005 Data*
[9] www.dot.wisconsin.gov - Bicycle crash prevention and protection.

The majority of bicycle participants who are assigned an error tend to be less than 34 years of age. Older bicyclists are assigned an error less often. Only 1 percent of all errors assigned to a bicyclist were among those 65 years or greater. This might be due to the fact that fewer people over the age of 65 years are riding bicycles. Out of all crashes involving those 18 years of age or younger, 69 percent of those children were assigned an error. Figure 6.9 shows the age distribution of bicyclists involved in a crash that were assigned an error.



The severity of injury among this younger population reflects the same pattern as adult injury severity, where the majority of crashes result in a non-incapacitating or complaint of pain injury.



Environmental Conditions

Several factors, in addition to human errors, play a role in a crash. These factors include lighting, road condition, location and type of roads.

The majority of crashes occurred during the daylight hours, which means that lack of lighting may not have played a role in the majority of crashes. Only 15 percent of the crashes occurred during darkness where street lighting was available. Just as motor vehicles should have their headlights on during darkness, it is important, and lawful, for bicyclists to have lights and be visible. In 2006, Portland promoted the *See & Be Seen* campaign to encourage bicycle riders to be visible using bicycle lights and reflective materials. By being visible on the road, a bicyclist reduces his/her chance of being involved in a crash.

Table 6.7: Lighting Conditions of Bicycle Crashes 1993-2005

	Portland	
Condition	**Count**	**Percent**
Daylight	1733	79%
Darkness w/ street lights	329	15%
Darkness w/o street lights	51	2%
Dawn (twilight)	23	1%
Dusk (twilight)	60	3%
Total	2198	100%

Table 6.7 shows the distribution of crashes for lighting conditions by month. The majority of the crashes that occurred during daylight hours occurred during the summer season when daylight hours are longest and ridership is highest. There is an upswing in the number of crashes reported during darkness with streetlights from November to February. During these months, daylight hours are the shortest and most bicycle commuting trips may be made in the morning, before the sun rises or in the evening, after darkness has set in. During those months, the average time of sunrise is about 7:30-8:00 am and sunset is around 4:30 – 5:00 pm.

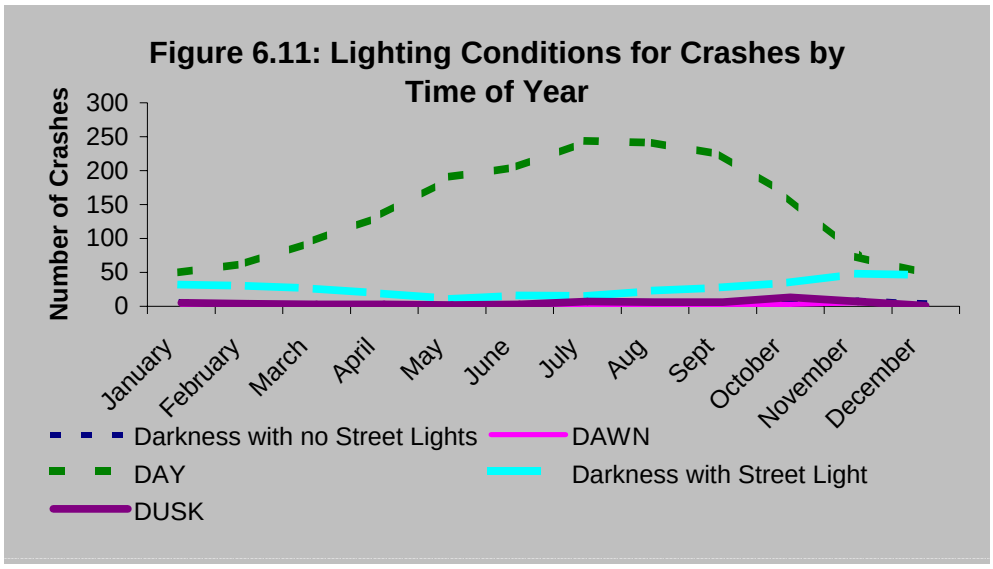
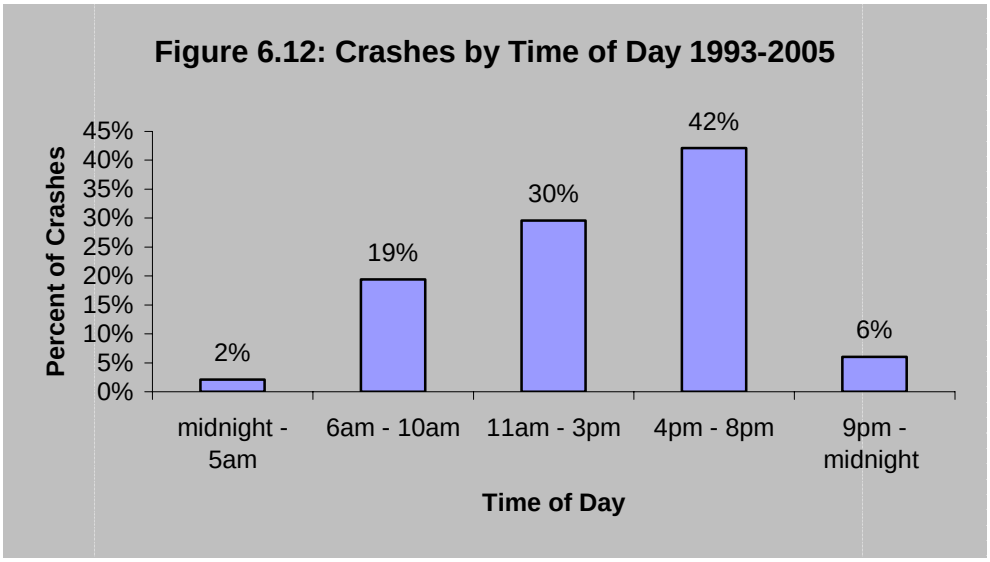
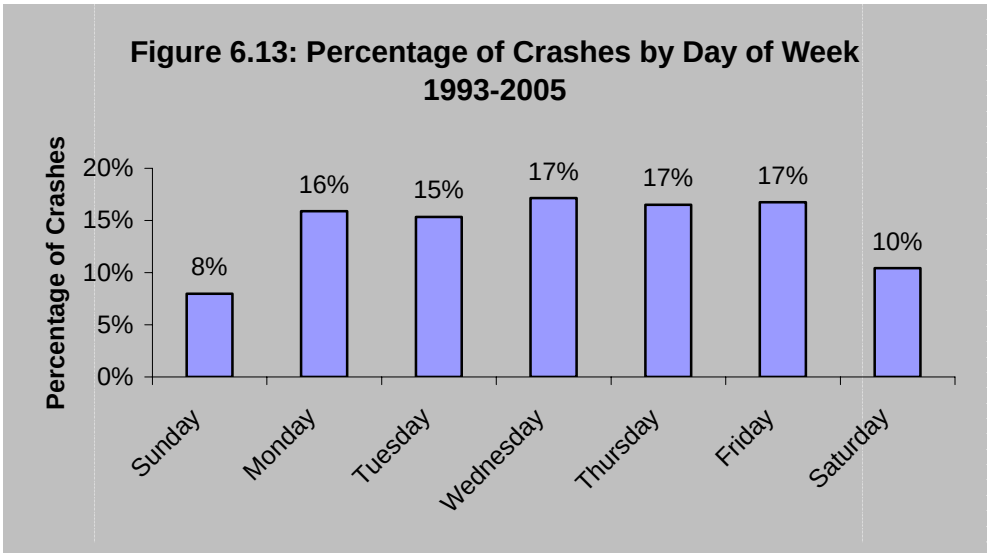


Figure 6.12 shows the most common time frames for which crashes occurred. Slightly less than half of the crashes occurred during the 4 pm-8 pm time period. Although 30 percent of the crashes occurred during the middle of the day, the percentages of crashes were still high during the typical commuting hours.

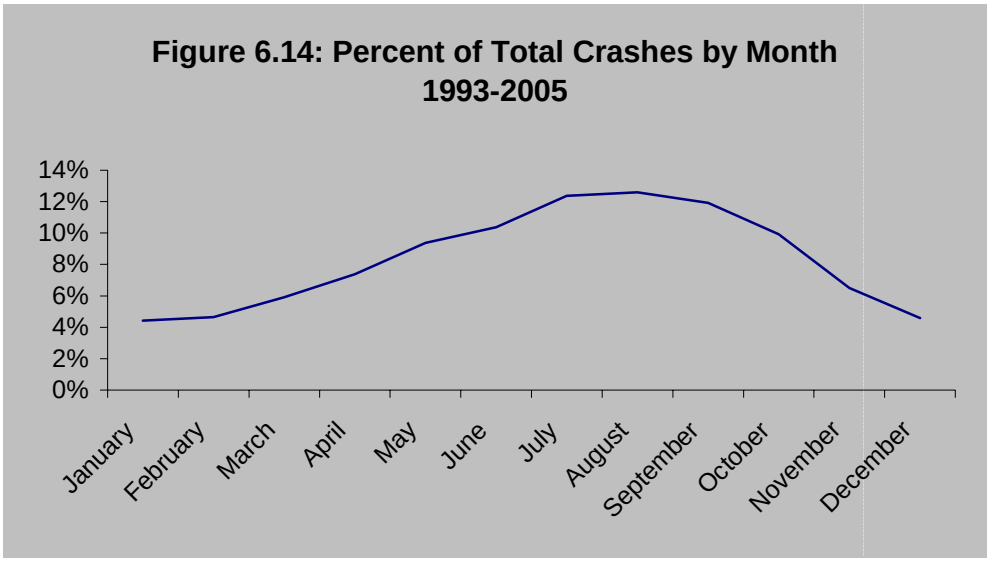


More crashes occurred during the work week than on the weekend. This may be due to the fact that of the bicycle trips made for utilitarian purposes, 35 percent were made for the purpose of commuting to work.[10] (See Chapter 2 for more information on trip types). There is little variation between the percentage of crashes that happened on Monday through Friday.



During the drier summer months, there are typically more bicyclists on the roads. This is also a time period in which the percentage of crashes increases. Figure 6.14 shows that the highest percentage of crashes from 1993-2005 occurred during July, August and September, Portland's driest months.

[10] Campbell Delong Resources Inc-SmartTrips Program Survey September 2006



The majority of crashes happened on a clear day, with only 11 percent occurring in rainy conditions. Portland has an average of 155 days of rain per year, which means that during a year, it rains 42 percent of the time. Portland's weather is a factor in why people chose not to ride their bikes; however, when it comes to weather as a contributing factor in the reported bicycle crashes, it does not appear to play a large role. Moreover, because City bicycle counts are conducted during dry, summer months, correlating crash data with projected rainy day ridership is particularly difficult.

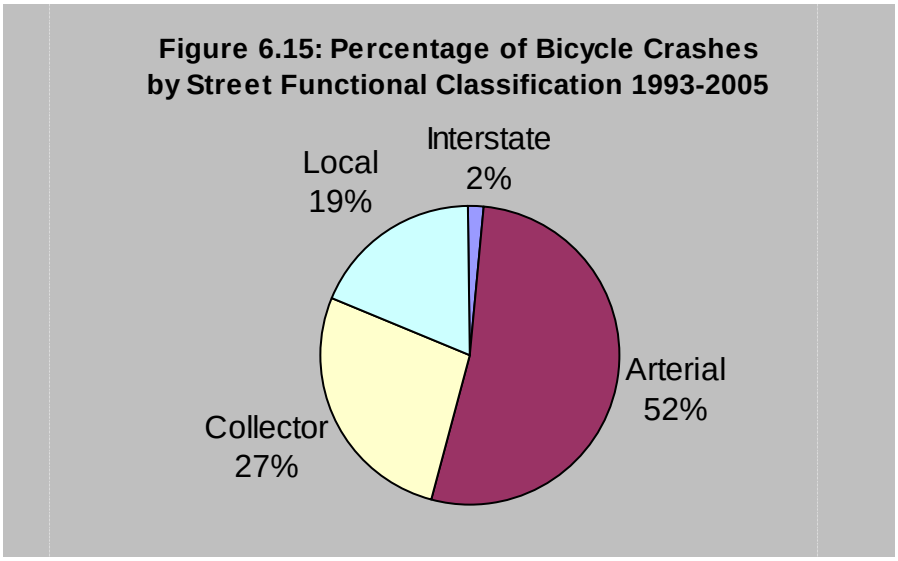
Figure 6.8: Weather Conditions for Bicycle Crashes 1993-2005

Weather Condition	**Number of Crashes**	**Percent**
Unknown	13	1%
Clear	1725	78%
Cloudy	201	9%
Rain	247	11%
Fog	12	1%
Total	2198	100%

Crash Locations

A cyclist injured in Portland is likely to be injured on a relatively busy street. Seventy percent of Portland's 2,200-mile road network is comprised of streets classified as Local Service streets. Local Service streets generally have a lower speed limit (25 mph) and have relatively low volume of cars (500-2,500 cars per day). The other 30 percent of Portland's 2,200-mile road network is comprised of streets with higher classifications (e.g., Neighborhood Collector and Major Traffic Street). These streets often have higher speeds (30-45mph) and a higher volume of cars per day (2,500-30,000 cars per day).

Although higher classification streets account for only 30 percent of Portland's roadway network, the crashes that occur on these facilities account for 81 percent of all bicyclist injury crashes and 77 percent of bicycle fatalities. Of the 70 percent of local roads, only 19 percent of crashes occur on these lower classification streets.



There are a number of reasons why higher order streets have such a high number of crashes. Travel demand for motorists and cyclists is highest on these streets. Higher volume streets have much higher rates of conflict between users – specifically at intersections. Generally, these facilities have higher operating speeds that reduce the opportunity to react to a conflict and increase the stopping distance required to avoid a collision. Additionally, streets with higher speeds are more likely to result in crashes with injuries. Table 6.9 illustrates the crash severity across type of road. When looking within each type of injury category, the majority of injuries fall within the higher classification roads.

Table 6.9: Comparison of Crash Severity by Functional Class for Crashes 1993- 2005

Street Classification	**Fatality**	**Incapacitating**	**Non-Incapacitating**	**Complaint of Pain**	**No Injury**
Local Road	23%	19%	18%	19%	24%
Arterial/Collector	77%	81%	82%	81%	76%
Total	100%	100%	100%	100%	100%

The majority of bicycle crashes in Portland occur at intersections (68 percent). Fourteen percent of all crashes were related to movements in a driveway or alleyway. The remainder of the crashes occurred in a straight roadway, most likely in a mid-block section. Consistent with the overall trends in injury severity, the majority of crashes that occurred at an intersection resulted in a non-incapacitating or complaint of pain injury.

Cyclist Position

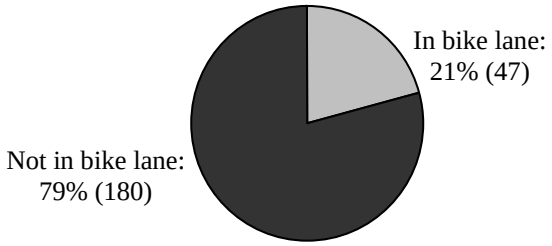
In addition to road type and crash location along a given stretch of road (intersection, mid-block, etc.), bicyclist position may also be a factor contributing to bicycle-related collisions. Because ODOT's Statewide Crash Data System does not include information on cyclist position, the following bicyclist fatalities analysis is limited to trends identified in Portland Police Bureau crash reports that do detail cyclist position. Table 6.10 shows the breakdown of bicyclist fatalities by position of the bicyclist. By far, the majority of bicyclist fatalities occurred when the bicyclist was positioned outside of a designated bike lane or shoulder (25 total fatalities), either because no such facility existed (22) or because the bicyclist was operating outside of such a facility (3). Of the five fatalities that occurred when the bicyclist was positioned in a designated bike lane or shoulder, one involved a hit and run DUII motorist, and another involved a bicyclist riding the wrong direction in a bike lane. Moreover, of the collisions occurring in the absence of a designated bike lane or shoulder facility that resulted in a cyclist fatality, most occurred on higher order streets as opposed to low volume/speed local streets.

Table 6.10: Fatalities by position of bicyclist 1995-2007

Bicyclist Position	Fatalities
Cyclist in bike lane	5
Lane present but cyclist *not* in lane	3
No bike lane present at date of collision	22

Because of the relatively small sample size involved in analyzing bicycle fatalities, it would be irresponsible to make definitive conclusions based on these results. However, extending this analysis of bicyclist position to the full PBCAT database (n = 227) appears to validate the assumption that the vast majority of bicycle collisions occur when the cyclist is positioned outside of a designated bike lane or shoulder facility. These results are shown in Figure 6.16.

Figure 6.16: Proportion of cyclist-related crashes by cyclist position

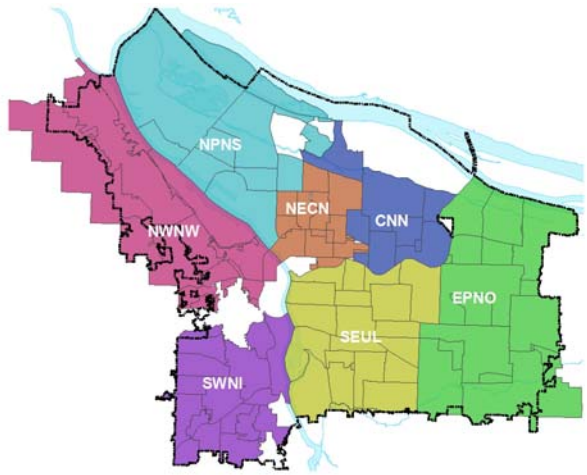


Again, while the PBCAT database represents a relatively small sample size between 2002-2006 (ODOT's Statewide Crash Data System, by comparison, represents 2,198 crashes between 1993-2005), these data nevertheless suggest that the overwhelming majority of bicycle-related crashes occur when the bicyclist is positioned outside of a designated bike lane or shoulder facility.

Crashes in Portland's Neighborhoods

Seven neighborhood district coalitions support Portland's 95 neighborhood associations. These district coalitions and offices provide support and technical assistance to the volunteer-based neighborhood associations, community groups and individual citizen-activists. Generally, neighborhood associations have a transportation and land use chair who is responsible for those issues in their community. The following table represents the distribution of bicycle crashes that fell in each of the seven district coalitions. Those crashes that were not assigned to a district coalition were removed from the analysis. The Southeast section of the city has the highest percentage of crashes but only makes up 18 percent of Portland's total land area. Southeast also has the most bikeways in the city. The East and North sections of the city have the second and third highest number of crashes, and make up 19 percent and 16 percent of Portland's area, respectively. For more information on the bicycle network and existing facilities in the neighborhood districts, see Chapter 7.

Figure 6.16: Neighborhood Coalition Map



Analyzing the distribution of crashes in the neighborhoods provides residents and neighborhood representatives with data that support efforts to improve safety in their neighborhoods. This data also has implications for "Smart Trips", an encouragement program (see Chapter 2) through Portland's Office of Transportation. With the distribution of crashes, the most dangerous corridors can be identified and efforts can be taken to make them safer for bicyclists.

Table 6.10: Crash Distribution by District Coalition

District Coalition	**Percentage of Crashes**
Central North East Neighbors	5%
East Portland Neighborhood Office	17%
Northeast Coalition of Neighborhoods	12%
Southwest Neighborhoods Inc.	6%
North Portland Neighborhood Services	7%
Neighbors West/Northwest	7%
Southeast Uplift Neighborhood Program	34%
Recognized but not-affiliated with a coalition	12%
Total	**100%**

Substance Abuse

From 1993-2005, 41 crashes had alcohol flagged as a contributing factor. This number is likely to be under represented because only more serious crashes involving alcohol were reported. Additionally, for those self-submitted crash reports, people may under report their alcohol use. One limitation with these data is that data reported for all crashes during the 12-year period do not distinguish if it was the motor vehicle driver or the bicyclist that was impaired.

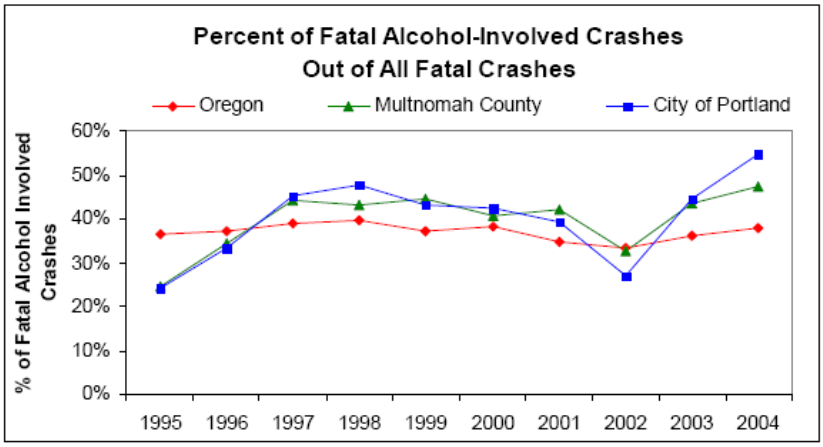
According to National data on pedestrians and bicyclists, approximately 10 percent of bicyclists involved in a crash with a motor vehicle were under the influence of alcohol.[11] Another Oregon-specific study reports that 15 percent of injured adult bicyclists had an elevated blood alcohol level. For fatalities, that number rose to 50 percent.[12] Table 6.11 below shows the Injury types resulting from those crashes where alcohol was involved.

Table 6.11: Injury Types For Crashes Where Alcohol Was A Factor

Injury Type	Count	Percent
Fatality	11	27%
Non-incapacitating	14	34%
Complaint of Pain	6	15%
Incapacitating	9	22%
No Injury	1	2%
Total	**41**	**100%**

A good proxy indicator of alcohol use among bicyclists involved in crashes is to look at the overall involvement of alcohol in all motor vehicle crashes. Figure 6.17 illustrates the share of all fatal crashes that are alcohol-involved in Oregon, Multnomah County, and Portland, per year. For Portland, the percentage share of alcohol-involved crashes has increased to over 50 percent of all fatal crashes.[13]

Figure 6.17:

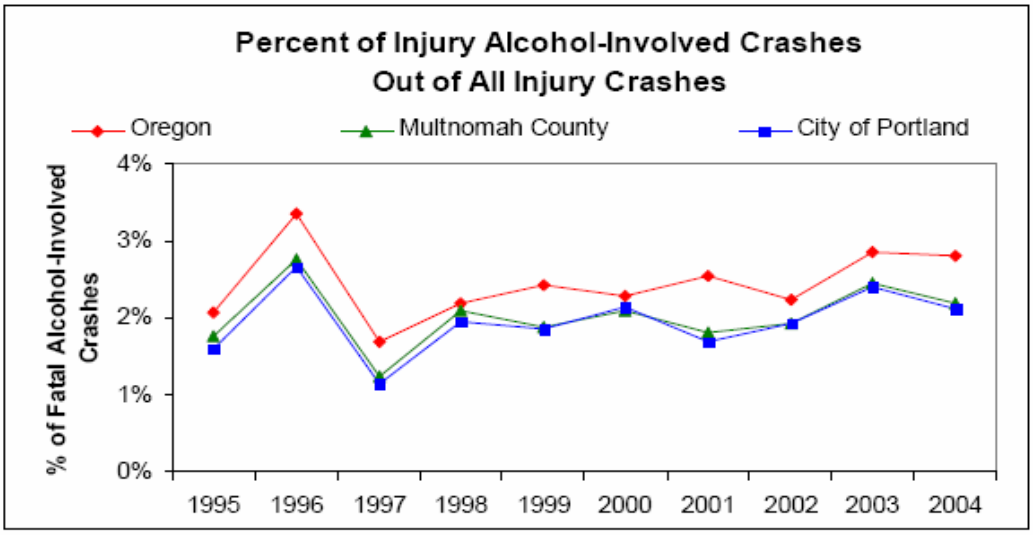


[11] US Department of Transportation Federal Highway Administration, *Injuries to Pedestrians and Bicyclists: An Analysis Based on Hospital Emergency Department Data.* FHWA-RD-99-078,
[12] Rank E., Frankel P., Mullins RJ., Taylor N. *Injuries resulting from bicycle collision.* Acad Emerg Med. 1995. March; 2(3): 200-3.
[13] PSU Draft Data Chapter and Outline for Literature Review, 2006. www.its.pdx.edu/cstsp/duii.php

When looking just at bicycle-to-motor vehicle data from ODOT's Statewide Crash Data System on bicycle crashes, 35 percent of all bicycle fatalities between 1993 and 2005 involved alcohol.

Over a ten-year period, the percent of motor vehicle-to-motor vehicle alcohol related crashes that result in an injury have remained fairly constant at about two to three percent of all crashes. The following Figure 6.18 illustrates that of the crashes that resulted in an injury, there is a fairly consistent distribution, over the years, of those crashes in which alcohol was involved.[14] According to data reported in ODOT's Statewide Crash Data System, less than 1 percent of all bicycle crashes that resulted in an injury were alcohol related. Again, interpretation of this data should be made with caution, as underreporting of crashes involving alcohol is a limiting factor.

Figure 6.18:



Speed

One of the biggest challenges when working with error types included in the Statewide Crash Database is interpreting the influence of speed. Unfortunately, speed as an error type is infrequently cited in the Statewide Crash Database. In Portland, speed was cited as a factor in only two percent of all crashes between 1993-2005. This does not mean that speeding was not involved in other crashes; it was only reported in these few cases. Other studies mirror the findings that speed is not often listed as a contributing factor to a crash.[15,16] For example, a report on Bicyclist Fatalities and Serious Injuries in New York City lists motor vehicle speed as a factor in crashes only four percent of the time.

[14] PSU Draft Data Chapter and Outline for Literature Review, 2006. www.its.pdx.edu/cstsp/duii.php

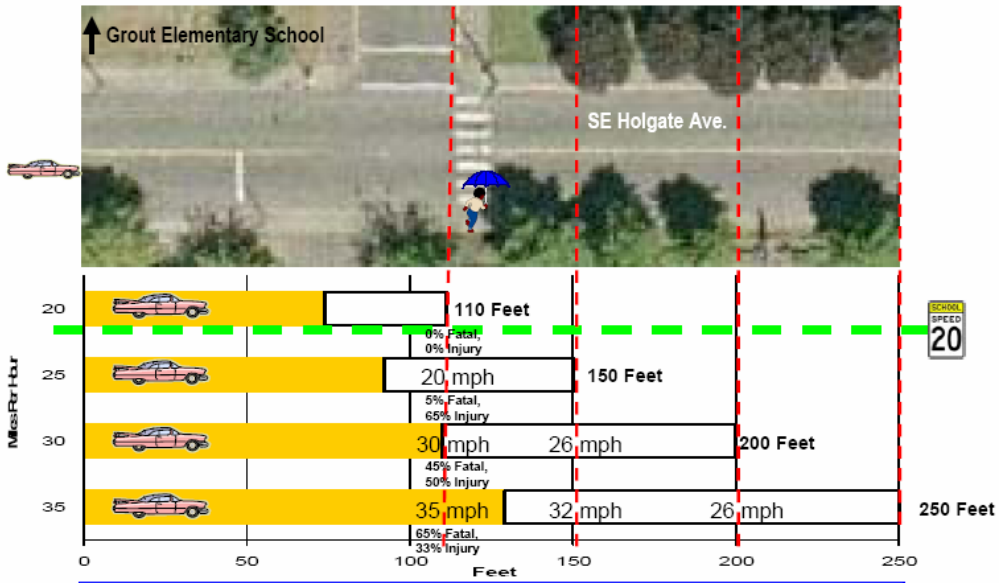
[15] Bicyclist Fatalities and Serious Injuries in New York City, 1996-2005. A Joint Report from the New York City Department of Health and Mental Hygiene, Parks and Recreation, Transportation, and the New York City Police Department.

[16] Bicycle Crash Analysis. 2005. City of Mesa, Arizona, Transportation Division Studies Group.

Despite the infrequency in reporting speed, it is most often the dominant factor in determining the severity of an injury. The following table illustrates how speed increases the likelihood that a conflict will result in a crash. Stopping distance increases the faster a motor vehicle is moving. Therefore, if one is traveling at a higher speed and spots a pedestrian or bicyclist in the road, it will take longer to come to a stop than at a lower speed, increasing the potential of hitting the pedestrian or bicyclist. For example, if a motor vehicle is traveling at 35 mph, it will take 250 feet to come to a complete stop, versus 110 feet if the motor vehicle is moving at 20 mph. Speed also increases the severity of a crash, where someone struck by a faster moving motor vehicle has a higher risk of being killed. Thus, slower speeds make it more likely that a bicyclist or pedestrian will survive a crash.

Figure 6.19:

EFFECTS OF SPEED ON STOPPING DISTANCE



Traffic calming treatments and facilities can reduce traffic volumes and speeds, making those streets more attractive and safer for bicyclists. In 1988, a project to reduce traffic volume and speed was implemented on SE Division. This corridor is one of the oldest bicycle boulevards in Portland. The project, the "Division Corridor Project" tested volume and speed pre and post addition of speed limit changes, stop signs, and diverters and traffic circles. With the addition of these treatments, traffic volumes were significantly reduced in the corridor. Motor vehicle to motor vehicle collisions increased slightly, but it was determined that they were not the result of the change in the traffic patterns. For speed, the analysis showed that diverters and speed limits did not change the 85th percentile speeds; however, the traffic circle reduced the average speed by five to seven miles per hour.[17]

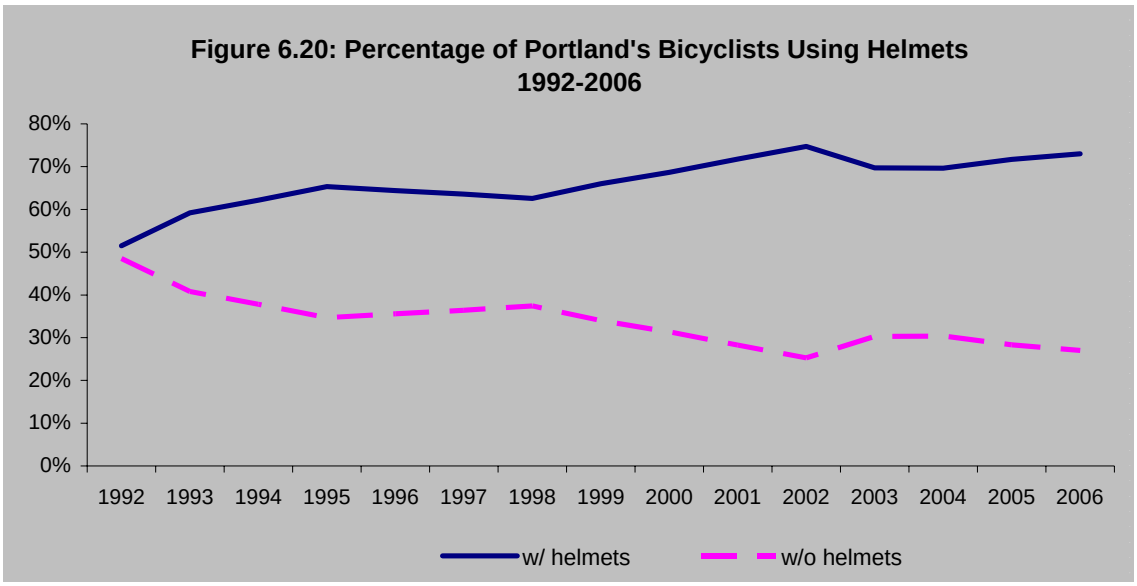
Given the role that speed plays in severity of injury of a crash, this was a positive change and demonstrates that traffic calming facilities can make the roads safer. For those individuals in Portland who cite fear of being hit by

[17] Division Corridor Neighborhood Traffic Management Project, Report and Recommendations of the Test Evaluation Committee. City of Portland, Office of Transportation. December 1988.

a car, or volume and speed of cars as a barrier to riding a bicycle, creating bikeways where these elements are minimized might result in a greater increase in bicycle ridership.[18]

Helmet Use

The number of Portland bicyclists who are wearing helmets is increasing. In 2006, more women and men were wearing helmets than in 1992, according to citywide bicycle counts and observed helmet use. In 1992, 52 percent of all cyclists were using helmets. By 2006, three out of four riders were observed wearing helmets.



In all crashes reported from 1993 to 2005, when helmet use was known, 55 percent of crash participants were wearing a helmet. Unfortunately, in 70 percent of the crashes, use of helmet by the bicyclist was unknown. The reasons for this may be that by the time the police arrived at the scene, the emergency medical technicians had already begun caring for the victim and may have removed the helmet, or data entry oversight may have occurred. Very few participants were noted as wearing their helmet improperly. Improper use of helmets can include things such as not having the helmet strapped, wearing on the back of the head instead of on the top, or wearing a helmet that is too big.

Jonathan Maus/BikePortland.org

Table 6.12: Reported Helmet Use for all Crashes 1993-2005

Helmet Usage	total helmet use	% helmet use from all reports	% helmet use adjusted with out unknown

[18] Survey of Portland Residents on Bicycling and the Barriers to Bicycling. May 2007. Portland Office of Transportation, Options. Davis, Hibbits, and Midghall.

Helmet used	365	17%	55%
Improper helmet use	8	0%	1%
No helmet	295	13%	44%
Unknown	1530	70%	N/A
Total	**2198**	**100%**	**100%**

Looking at severity of injuries by helmet use, it appears that the percentage of individuals wearing helmets is greater when the resulting injury is non-incapacitating or a complaint of pain. Fatalities and more severe injuries involve more bicyclists who were not wearing a helmet than those who were wearing a helmet. This may suggest that due to the helmet use, lower severity of injuries were sustained. National data shows that head injuries are the most serious or often fatal type of bicycle injury. Nationally, since 1994, bicyclists not wearing helmets accounted for between 83 to 97 percent of all bicycle fatalities. Between 1996 and 2005, there were 6,592 bicycle fatalities without helmets compared to 493 helmeted fatalities.[19]

Table 6.13: Bicycle Helmet Use by Reported Crash Injuries, 1993-2005

Helmet Usage	**Fatality**	**Incapacitating**	**Non-Incapacitating**	**Complaint of Pain**	**No Injury**
Helmet used	5	50	202	105	3
Improper helmet use	0	3	2	3	0
No helmet	13	56	131	89	6
Unknown	13	120	620	711	66
Total	**31**	**229**	**955**	**908**	**75**

When looking at helmet use by those 18 years of age and younger, more bicyclists involved in a crash were not wearing helmets. This is alarming considering that the law states that those under16 years must wear a helmet.

Table 6.14: Reported Helmet Use by Those 18 years and Younger
For All Crashes 1993-2005

	Birth - 4 years	**5 - 14 years**	**15-18 years**
Helmet used	0	49	23
Improper helmet use	0	1	1
No helmet	1	65	25
Unknown	2	178	111
Total	**3**	**293**	**160**

[19] Insurance Institute for Highway Safety, Bicycle Fatality Facts 2005.

CRASH Analysis

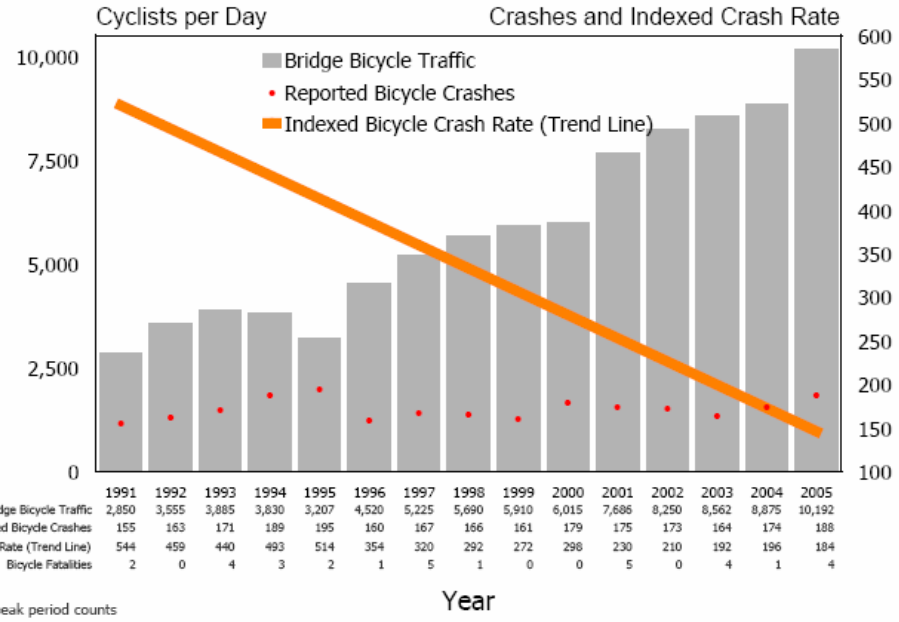
Bicycle traffic on Portland's streets has increased over the last ten years. Findings from Portland bridge and citywide counts, the American Community Survey, and US Census clearly show that bike mode share has increased. Although the number of reported bike crashes has increased slightly, the rate of crashes and the probability of having a bike crash have decreased.

The City of Portland has tracked the daily number of bicycle trips across the four bicycle-friendly bridges that cross the Willamette River (Broadway, Steel, Burnside, and Hawthorne) since 1991. The indexed crash rate was calculated by comparing the total number of bicycle crashes in Portland to the number of bicyclists crossing Portland's downtown bridges. For more information on mode share and bicycle ridership, see Chapter 2.

Figure 6.21 shows that ridership by bicycle has increased by 250 percent from 1991 to 2005. In 1991, 2,850 trips were counted crossing the four bridges and that number rose to 10,192 trips in 2005. This might be due in part to improved facilities for crossing the bridges. The reported number of bicycle crashes for Portland has remained relatively flat, only increasing 20 percent over the 1991 to 2005 time period. This slight increase in bicycle crashes is not directly proportional to the large increase seen in bicycle traffic. When crashes are indexed against ridership, there is a downward trend, as evidenced by the downward diagonal line. In other words, the rate of bicycle crashes decreased with the increase in trips made by bicycle.

Figure 6.21:

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

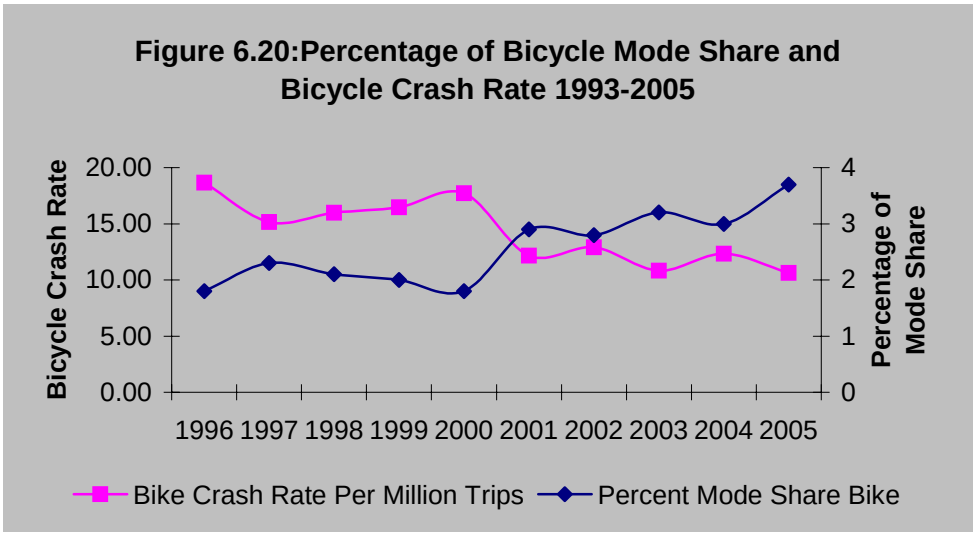


	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Bridge Bicycle Traffic	2,850	3,555	3,885	3,830	3,207	4,520	5,225	5,690	5,910	6,015	7,686	8,250	8,562	8,875	10,192
Reported Bicycle Crashes	155	163	171	189	195	160	167	166	161	179	175	173	164	174	188
Indexed Bicycle Crash Rate (Trend Line)	544	459	440	493	514	354	320	292	272	298	230	210	192	196	184
Bicycle Fatalities	2	0	4	3	2	1	5	1	0	0	5	0	4	1	4

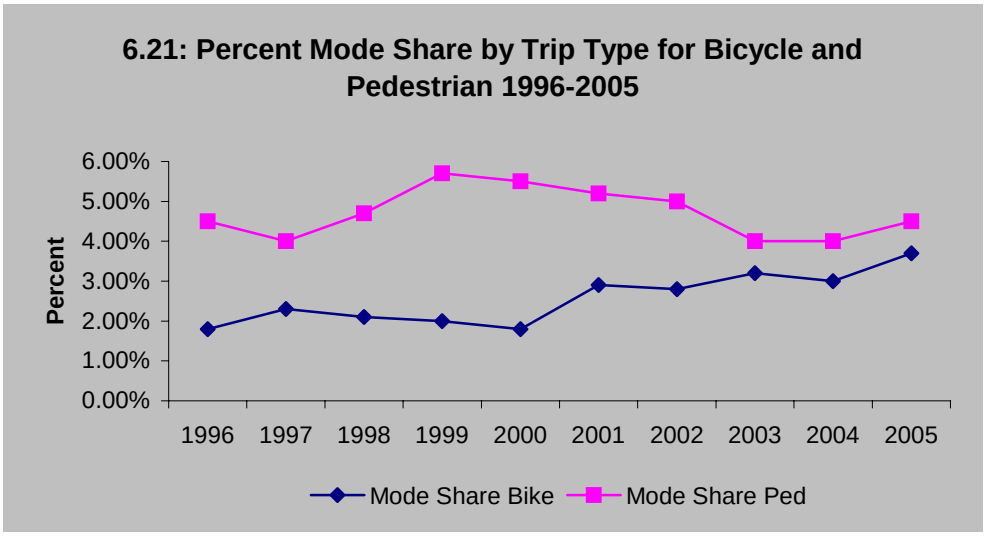
Extrapolated from peak period counts

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

US Census data provide another measure of estimating mode share per year. Figure 6.20 illustrates the mode share and crash rates over the ten-year period from 1996 to 2005. US Census data estimate that commute mode share by bike citywide has increased over time from 1.8 percent of trips made by bike in 1996 to 3.7 percent in 2005. During that time period, motor vehicle mode share remained fairly constant. Utilizing the number of bike injuries reported through Statewide Crash Data System, and estimating the trips per year by bicycle, the rate of bike crashes per year was calculated. In 1996 the bike crash rate was 18.66 crashes per million trips. In 2005, the bike rate per million trips fell by 43 percent to 10.63 bike crashes per million. Because of the declining rate, it has become safer to be a bicyclist on Portland's roads. In 2005, people who rode bikes were 8 percent less likely to have a crash than a motor vehicle driver on any given trip. The overall trend shows that as Portland's bicycle mode share increases, there is a decrease in the rate of bicycle crashes.



When comparing bicycle safety to pedestrian safety, bicyclists have a 38 percent higher chance of having a crash than pedestrians. Despite the fact that the pedestrian mode share has remained relatively constant over time at about 4.5 percent of all trips, the crash rate for pedestrians fell by 38 percent.



Despite the increase in bicycle mode share, bicycle fatalities have remained fairly low over the past fifteen years. Due to the limited number of fatal crashes and the often small difference between a crash that results in fatality versus a serious injury, there is a high degree of variation in tracking fatalities from year-to-year. Even with this limitation on the data, fatality trends in Portland have remained fairly constant. Since 1985, Portland has had from zero to five fatalities per year. Similar to all bicycle crashes, the bicycle fatality rate per trip has decreased significantly.

Summary of Crash Trends

In an analysis conducted using bicycle and pedestrian crash data in both European and American cities, PL Jacobsen found that, "a motorist is less likely to collide with a person walking and bicycling when there are more people walking or bicycling." The reasons provided for this phenomenon focus on behaviors and perceptions. Motorists are more likely to change their behaviors, such as going slower, when they see more people walking or bicycling. The motorist may also utilize those modes of transportation and may be more aware of and give greater consideration to pedestrians and bicyclists.[20]

The findings by Jacobsen are reflective of the bicycle traffic and crash trends seen in Portland. The data the City of Portland collects on bicycle mode share clearly shows that there are more bicyclists on the streets today than there were ten years ago. Even though there are more crashes involving bicyclists each year, the bike crash rate is decreasing and so are the odds that a bicyclist is going to be involved in a crash.

This increase in bicycle mode share and concurrent decline in the crash rate may be due to several factors. As Jacobson posits, the declining crash rates may be due to the increased volume and the resulting change of perceptions of motorists. Another possible reason for the decline in the crash rates is due to the bicycle facilities that have been built on Portland's roadways. There are more facilities for bicyclists than there were ten years ago, providing safer and easier access for traveling around the city.

According to the bicycle use surveys conducted by PDOT's Transportation Options Division,[21] perceived safety still remains a barrier to encouraging new riders. Providing more information to the public on actual risks of cycling in Portland should help allay these fears.

[20] Jacobsen PL. Safety in numbers: more walkers and bicyclists, safer walking and bicycling. *Injury Prevention* 2000; 9: 205-209.
[21] Survey of Portland Residents on Bicycling and the Barriers to Bicycling. May 2007. Portland Office of Transportation, Options. Davis, Hibbits, and Midghall.

BICYCLE SAFETY EDUCATION

Despite what statistics say about safety of bicycles on Portland's roads, how people feel when they are riding a bike is important. Current efforts aim to improve the perception of safety to better match the reality of the safety of bicycling on Portland's roads. These efforts are focused on education and enforcement, which creates an aware and safer user of the transportation system.

There are many stakeholders involved in ensuing safety of bicyclists in Portland. Many of these organizations and agencies work together towards the common goal of safety. These partnerships also maximize resources and provide a broader reach for safety projects and address bicycle safety issues across Portland. The following organizations and agencies work together to provide and promote bicycle safety education, outreach, engineering and enforcement across the City:

- Bicycle Transportation Alliance
- City Fleet
- Community Cycling Center
- Exchange Cycle Touring Club
- Five Public School Districts
- Kaiser Permanente
- Multnomah County Circuit Court
- Multnomah County, Metro Regional
- Oregon Department of Transportation
- Oregon Health Sciences University
- Portland Office of Transportation (Transportation Options, Traffic Investigations, Community and School Traffic Safety Partnership, Bureau Of Maintenance, Traffic Design, Planning, Project Management, Parking, Bridges)
- Portland Planning Bureau
- Portland Police Bureau
- Portland State University
- Trauma Nurses Talk Tough
- TriMet

Several different 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 the agencies and programs that support and promote safety for bicyclists.

Portland Office of Transportation's Community and School Traffic Safety Partnership (CSTSP)

Portland residents consistently identify traffic safety as one of their biggest neighborhood problems. In 2003, the Portland Office of Transportation launched the Community and School Traffic Safety Partnership (CSTSP) 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. 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.

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

1. Reducing Driver Error
2. Pedestrian and Bicycle Safety
3. Safe Routes to School

Bicycle Safety Leadership Workshops:

The Portland Office of Transportation conducted Bicycle Safety Leadership Workshops in each of the seven neighborhood district coalitions in the City during the summer of 2005. Those meetings provided an opportunity to create a network of community partners and educate them about bicycle safety issues and services that are available. Attendees included neighbors, transportation staff, police staff, and bicycle advocates. The Workshops led to the initiation of bicycle safety groups in those neighborhood district coalitions.

Each Workshop included three elements:

1. A presentation about bicycle safety (including bike crash map information)
2. A bicycle ride to locations emblematic of issues related to bicycle safety in the district
3. 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?)

The intended outcome of the Workshops was to form neighborhood bicycle safety groups that would serve as ad-hoc grassroots groups. These groups would have membership defined by district coalition boundaries, but would not initially be a formal part of district coalition work. The purpose was for the grassroots groups to become strong enough to approach the district coalitions about formally becoming part of the neighborhood structure. Through this effort, a number of people have become active in their neighborhoods for the first time.

Youth Education

Many adults have happy memories of learning how to ride a bicycle as a child. It is also said that once you learn how to ride a bike, you never forget. For these reasons, it is important to target today's youth to teach them proper safety for riding a bicycle. Portland supports several programs to instill within youth safe bicycle riding habits and techniques. Additionally, many community organizations in the city of Portland offer programs to help children get on their bikes and learn proper safety techniques. These programs simultaneously educate children to make safe decisions when they are on the roads, and create a future generation of safe and aware cyclists.

Safer Routes to School

Safer Routes to School (SR2S) has been operating in Portland since the 2004 school year. The project currently serves 19 elementary schools in the City of Portland and will expand to 25 schools in the 2007-2008 school year. In the first year of the program, SR2S demonstrated, on average, a 10 percent increase in students walking to school and nearly a 5 percent increase in those students who bicycled to school.

SR2S is a comprehensive traffic safety program that strives to increase the number of children who walk and bicycle to school. The program brings leadership in transportation together in partnership with schools and community organizations to encourage students and families to get to and from school in ways that reduce traffic, increase safety, build strong bodies and clear minds, and provide a cleaner environment. The SR2S program emphasizes education, encouragement, engineering, enforcement, and evaluation to support students in: being safe; having fun; growing healthy; and getting to school.

Elements of the program include:

- Examine the routes that children must take to get to and from school, paying particular attention to places where they must cross major roads
- Identify and recommend relatively safe routes through engineering analysis
- Propose improvements to make these routes even safer
- Supply students and parents with a map indicating suggested routes to encourage kids to walk or bike to school
- Provide bicycle safety education to students

Helmet Promotion: Trauma Nurses Talk Tough (TNTT)

In Oregon, by law, children under the age of 16 years are required to wear helmets. Several programs in Portland promote helmet use and provide education for proper fitting.

TNTT is involved with bicycle safety through age- and audience-specific school programs and presentations to community groups and at businesses. For the past fifteen years, TNTT's helmet program has provided low-income families access to bicycle helmets.

TNTT distributes approximately 10,000 helmets annually through monthly sales to patients admitted to Legacy Emmanuel Hospital and at various community events. At these events, TNTT also provides helmet fitting and adjustment services to ensure that helmets are worn correctly. About one third of the helmets are given away and the balance is sold at a subsidized price of $5 (about $2.50 below our cost). The Legacy Foundation, Legacy Medical Staff and the Trauma Nurses Talk Tough program provide financing to continue offering helmets at the reduced rate.

Community Cycling Center

The Community Cycling Center created the "Bike Safety Clubs." The Clubs are hands-on, experiential after-school workshops where low-income 9 to 12 year olds learn safe riding skills, basic bike maintenance, and the importance of wearing a properly fitted helmet. At the end of the 12-session program, youth get their own refurbished bicycle and new lock and helmet to take home.

The Community Cycling Center also offers a Summer Bike Camp. This camp offers youth the opportunity to discover their own city by riding to different destinations, learn valuable bike mechanic skills, and team up with peers to solve technical problems. One goal of the camp is to build self-esteem and knowledge of safe riding.

B.I.K.E. - Bicycles & Ideas for Kids' Empowerment

B.I.K.E. facilitates the development of values and life skills essential for productive citizenship in inner-city youth through bicycling, tutoring, year-round mentoring, and leadership training. B.I.K.E. coordinates Kids On Bikes USA, a six-week summer camp that provides children with bicycle skills, physical fitness, self-confidence, fun, and valuable time spent in a pro-social activity.
The program is provided at no cost to participants, who are socially and economically disadvantaged. Year-round component members participate as coaches in this program. Offering these children intense, long-term, positive interaction with adult role models in a fun, safe environment provides benefits well beyond bicycle skills.

Bicycle Transportation Alliance (BTA)

The Bicycle Transportation Alliance (BTA) is a non-profit membership organization working to promote bicycling and improve bicycling conditions in Oregon and SW Washington. Since 1990, the BTA has worked in partnership with citizens, businesses, community groups, government agencies and elected officials to create communities where people can meet their daily transportation needs on a bike.

In addition to being a primary partner with the Safer Routes to School Program, the BTA teaches bicycle safety education courses in 4th-7th grade classrooms, meeting numerous curriculum benchmarks mandated by the State of Oregon.

The BTA's Bicycle Safety Education Program brings resources into schools, including a trained instructor, a fleet of 30 bikes, helmets, brochures and pamphlets, safety vests, videos, and other equipment to promote bicycle safety.

Another education tool for youth is the Pedal Power Squad, an after-school bike program providing students with the tools and hands on practice to become safe cyclists and encourage biking as a means of transportation and recreation. The program is delivered on school grounds and on local neighborhood streets.

Adult-Specific Education

Safety programs targeting adult riders are offered by several different organizations. These programs combine encouragement with education on how to safely bicycle on Portland's roads. The following are examples of safety and education programs offered in Portland.

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 with education from experts in the field of traffic safety. By taking the class, those cited are given the opportunity to avoid conviction or a fine for certain, non-criminal traffic violations.

The goal of the class is to improve traffic safety by increasing education of, and compliance with, Oregon laws that apply to motorists, pedestrians and bicyclists who share our roadways.

The Share the Road Safety class 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.

I Share the Road Campaign

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.

The purpose of the "I Share the Road Campaign" was to make the city the most pleasant place it can be, by sharing responsibility to show courtesy and to take a deep breath when human error is witnessed. Bumper stickers were the primary means of disseminating the message and they were meant to emphasize citizen's responsibility for personal safety.

The City facilitated a coalition of community partners who committed to the principle that Portland Shares the Road. From 2006-2007, those groups worked together on a number of actions to improve civility. The following are examples of those actions:

- All city vehicles displayed an "I Share the Road" decal.
- The City made the decals available to any resident to place on their bicycle, skateboard, car, or truck.
- Implementing strategies identified at the 2006 Portland Traffic Safety Summit.

SmartTrips

PDOT's Transportation Options Division promotes the SmartTrips program as a means of encouraging alternative transportation choicesby ensuring that anyone who lives, works or runs a business in Portland is aware of all the available options for getting around. By choosing to walk, bike, take transit, and carpool Portlanders can increase fitness, save money, reduce traffic congestion, and help maintain a livable environment. Safety education is a component of their program offered through materials and safety seminars.

Create a Commuter

The Community Cycling Center's Create a Commuter (CAC) program provides low-income adults with fully outfitted commuter bicycles and five hours of training on safe bicycle commuting. Federally funded through the Job Access Initiative, CAC is the first program of its kind in the nation. This program provides a flexible option to meet the transportation needs of low-income adults.

Every year, around 850 people apply to the program, of whom approximately 375 receive assistance. Some recipients with young children have also received child-carrying trailers.

See and Be Seen: Light The Bike. See The Bike.

This is a safety program that promotes visibility among cyclists during darkness. By encourageing bicyclists to use lights and wear reflective clothing while at the same time, reminding motorists to watch out for bicyclists.

The Community Cycling Center participated with their "Get Lit" campaign. They targeted different Portland neighborhoods, providing unlit bicyclists with free lights, information on how being visible can prevent crashes from occurring, as well as general bicycle safety information.

ENFORCEMENT

Enforcement is a key component of traffic safety as it reinforces the laws that serve to protect the users of the road. The primary roles of traffic enforcement are to reduce crashes, save lives, and facilitate the safe and efficient movement of vehicular, bicycle and pedestrian traffic throughout the City. The Portland Police Bureau is an active and key partner in ensuring safety of cyclists.

The City of Portland will adopt a Community Policing Agreement on Multi-Modal Enforcement that is currently under development between the Portland Police Bureau and Portland Office of Transportation. The goal of this Agreement is to provide a sustainable framework for equitable, clear, and community-supported multi-modal enforcement efforts. In the development of this agreement, several issues and questions have been raised. These include: How to improve communication between police and the bicycle community; what type of training should be provided to police regarding laws and reporting requirements; and, how do police and the Office of Transportation respond to concerned citizens regarding enforcement activities?

Oregon Bicycle Laws

There are several resources for bicyclists that provide education of the laws that serve to protect them. These resources include:

Oregon Bicyclist Manual:

The Oregon Bicycle and Pedestrian Program prepared this manual in cooperation with DMV. This booklet was created to help adult bicyclists and parents of younger bicyclists understand how to ride safely and legally on Oregon's streets, roads and highways. All laws pertaining to Oregon bicyclists are explained in the Oregon Bicyclist Manual. http://www.oregon.gov/ODOT/HWY/BIKEPED/docs/bike_manual_06.pdf

Pedal Power: A Legal Guide for Oregon Bicyclists:

Ray Thomas, one of the state's leading experts on bicycle law, writes this booklet, which is a collection of information about bicycles and the law in Oregon that serves to provide bicyclists with information about the laws of riding in the roadway. This book is available for $10 or can be downloaded for free at: http://www.stc-law.com/pdf/Pedal_Power_Jun19.pdf

In conjunction with Ray Thomas, the Bicycle Transportation Alliance provides bi-monthly clinics on bicycle laws and safety as a free service to bicycle riders.

Enforcement for Safety

Speeding: Speeding in neighborhoods and school zones compromises the livability and safety of those areas. It makes playing outdoors hazardous to children, increases background noise from vehicles, and makes walking, bicycling, and driving dangerous for all.

Speed is a major safety concern for bicyclists. The risk of sustaining a more severe injury increases as the speed of a motor vehicle increases. The speed of a motor vehicle is directly proportional to the severity of injury to a cyclist. Thus, the faster the motor vehicle is moving, the more likely a bicyclist will sustain a severe injury when the two collide. As a result, it is important to enforce speed limits on Portland's roads.

In addition to traditional speed limit enforcement, Portland uses other methods for enforcing speed laws.

Photo Radar: Photo radar is one way to enforce speed laws. It is operated from a marked police van by a trained Police Officer. Photo radar combines a camera, radar and a reader board that displays the speed of each passing vehicle. If a speeding car is detected, a picture is taken of the driver and license plate. The registered owner of the speeding vehicle then receives a ticket in the mail.

Red Light Cameras: The City of Portland Red Light Camera Program is based on a very successful partnership between the City Council, the Portland Police Bureau, the Portland Office of Transportation and the Citizens of Portland. The Program was born out of citizen demands for safer streets and is constantly striving to improve its

effectiveness in the community. Locations with high incidents of crashes caused by red light running are prioritized for red light cameras.

Driving Under the Influence of Intoxicants (DUII): DUII is a major threat to bicycle safety. While DUII is involved in a relatively small amount of bicycle crashes, it has a high proportion of involvement in bicycle fatalities. The City of Portland facilitates a a multi-agency, multi-jurisdictional DUII working group. The purpose of the working group is to reduce the number of fatalities, injuries and crashes that result from drunk and drug driving through a community partnership. The working group includes representatives from drug and alcohol prevention and treatment professionals, law enforcement, safety stakeholders, and academia. In 2006, the committee commissioned a study from PSU regarding DUII issues and services.

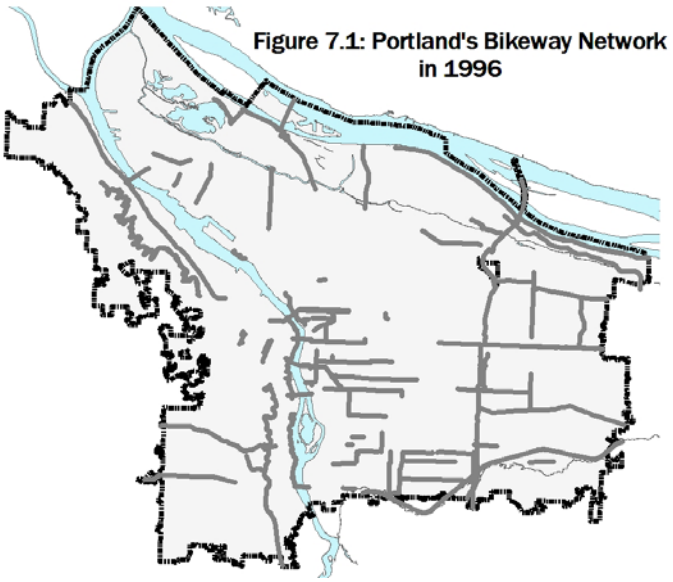
PORTLAND'S BIKEWAY NETWORK

INTRODUCTION

In June 1996 Portland's City Council adopted the Portland Bicycle Master Plan. Among its ambitious goals was the development of 630 miles of bikeways within Portland's city limits. At the time of adoption, Portland had 144 miles of bikeways divided among bicycle lanes, shared off-street paths, and bicycle boulevards. Figure 7.1 shows the bikeway network as it existed in 1996. At that time, there were approximately 4,500 daily bicycle trips made across the four Central City bridges commonly used by cyclists[1].

Over the past 11 years Portland has added 122 miles of developed bikeways to its network and has seen bicycle traffic—across what are now four truly bicycle-friendly Central City bridges—increase from 4,500 daily trips in 1996 to over 12,000 daily trips in 2006. This correlation is not coincidental; it is the result of focused improvements on City Bikeways that prioritized connections, the filling in of important gaps, with a focus on projects that could generally be readily and realistically achieved

The development of Portland's bikeway network has been the primary ingredient in Portland's success at increasing bicycle use in the past ten years. It is the facilities for bicycling on Portland's streets and public lands—the bikeway network—that largely shape the experience of each cyclist and largely determine whether their cycling experience will be pleasant, or merely acceptable, or worse. It is not just the quantity of facilities, but also whether they are connected and continuous. It is not whether Portland's bikeways meet current standards but whether their quality meets the desire for Portlanders to feel comfortable and safe. For those reasons will this chapter describe not just the quantity of bikeways, but also focus on the quality of experience they provide.

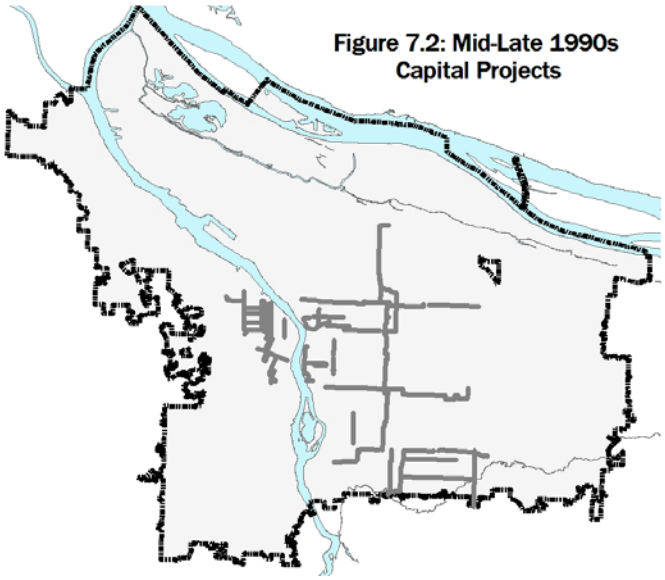


Criteria for Selecting Bikeways and Projects

Portland focused its bikeway development along roadways and in areas of the city that were likely to benefit the most people. Focused capital projects conducted in the mid- to late-1990s included "Central City Bikeways", "Southeast Bikeways", "Northwest Bikeways", the "Tillamook Bikeway," the "Forties Bikeway," and the "Clinton-Woodward Bikeway." Figure 7.2 shows the location of these projects. What they generally had in

[1] At the time, only the Hawthorne, Burnside, and Broadway had facilities that could be described as "bicycle-friendly." The Steel Bridge had only very narrow shared sidewalks.

common was a focus on providing connected bicycle access to regional and town centers, most notably, the Central City and Downtown. Special attention was focused on providing complete, comfortable, and safe routes to the Central City and the Willamette River bridges, recognizing that the Central City is the primary employment destination in Portland.



Many of these projects, particularly those with bicycle lane elements, were selected because they offered relatively few impediments to bicycle improvements. They were on roadways with oversized travel lanes that could be easily narrowed to allow bicycle lanes. Or, they were roadways with four travel lanes that could undergo a "road diet" and be reconfigured to a 3-lane roadway with bicycle lanes. Or, the roadways included lightly-used on-street parking that could be eliminated from one side of the street to allow bicycle lanes. While these types of projects always involved discussion, public process, and some controversy, such projects were generally considered to be "low-hanging fruit," as they were readily achieved without much difficulty or cost.

Other projects were undertaken as opportunity arose. Portland's regular repaving of arterial roadways always presents opportunities to inexpensively restripe these roadways to include bicycle lanes. Such was the case on SE Sandy (to SE 7th) and NE Glisan Street, among others. This strategy remains as one of the most cost-effective ways to provide bicycle lanes. It avoids the relatively high cost of grinding out existing striping, and does not create the "ghost lines" in the roadway that remain from the physical grinding of skip-striped lines. Such line remnants can be confusing to motorists, especially at night and during wet weather when the gouges carved by grinding reflect pooled water. Light reflected from this pooled water creates a visual impression of striping and makes the roadway look like it has two sets of striping.

Portland's Office of Transportation initiated a two-year process in 1994 to develop a classified bikeway network as part of the Bicycle Master Plan. The creation of that network considered bikeway corridor plans that had been previously proposed[2]. Prior to the Bicycle Master Plan, Portland had identified specific popular bicycling corridors that would offer benefit to more cyclists through implementation of formal bikeway designs. However, to create a comprehensive bikeway network, Portland needed more than the existing corridor plans.

To develop an interconnected bikeway network the Master Plan selected bikeways based on several criteria, including:

- Connection to land uses

2 There were numerous previous plans that recommended bikeway improvements. These included: "Bicycle Facilities for Portland" (1973), "Improvement of the SW Sunset Blvd-SW Dosch Rd Bikeway" (1977), "Reed-Hawthorne Bicycle Route Study" (1985), "Analysis of the Reed-Hawthorne Bicycle Route" (1987 and 1988), "Upper Southeast Corridor Bicycle Route Study" (1986), "Outer Central Corridor Bicycle Route Study" (1987), "Lower Southeast Corridor Bicycle Route Study" (1987), "NE Fremont Street Bikeway Project" (1989), "Lower Northeast Corridor Bicycle Route Study" (1989), "Albina Corridor Bicycle Route Study" (1989), "Northeast Bikeway Signing and Improvement Plan" (1991), "SW Terwilliger Boulevard

- Ease of implementation
- Need for safety improvements
- Lack of parallel facilities
- Need for continuity, and
- Providing a bikeway every half-mile both north-south and east-west.

These criteria, combined with extensive fieldwork, resulted in the initial classification of 630 miles of City Bikeways and Off-Street Paths. Additional roadways were developed as City Bikeways when the Office of Transportation determined, in the context of undertaking a capital project, that certain roadways could not be designed as bikeways as called for in the Bicycle Master Plan. This typically occurred on Major or Minor City Traffic streets where bicycle lanes could not be provided for one or more reasons.[3] For example, the Northwest Bikeways Project, in 1998-1999, determined that Glisan and Everett streets, though classified as City Bikeways, could not be striped with needed bicycle lanes. Instead, the project developed parallel bicycle boulevards on NW Johnson and NW Flanders Streets. Similarly, the 40's Bikeway Project developed NE 37th Avenue as a bicycle boulevard rather than striping bicycle lanes on NE 42nd Avenue. The Office of Transportation incorporated these modifications—classifying these roadways as City Bikeways—into the City's Transportation System Plan (TSP)[4] after the fact.

The City's Transportation System Plan identifies only two bicycle classifications: "City Bikeway," for bikeways within the public right-of-way, and "Off-Street Paths," for shared, multi-use paths that are not open to motorized vehicles and are generally, though not exclusively, outside the boundaries of the public right-of-way. However, the City's Bicycle Master Plan identifies four separate types of facilities for Portland's City Bikeways: Bicycle Lanes, Bicycle Boulevards, Signed Connections, and Off-Street Paths. These facilities reflect different criteria for their development, different treatments to develop them, different locations in the private and public realm, and different functions.

Bicycle lanes are the most ubiquitous bikeway facility, both in the existing Bicycle Master Plan, as well as developed on Portland roadways. Bicycle lanes are developed as striped lanes for the exclusive use of bicycles on roadways where the average daily traffic is 3,000 cars per day or greater. Roadways classified as City Bikeways with bicycle lanes as the recommended treatment are also generally classified for higher volumes of motor vehicle traffic, transit, and/or freight, as well. They are generally Neighborhood or District Collector streets that are intended to work well for everybody.

Bicycle Boulevards are developed along City Bikeways that carry fewer than 3,000 daily motor vehicle trips. There is no special striping on boulevards, though other treatments are used to create conditions conducive to bicycling in a shared roadway environment.

Though signed connections are identified as City Bikeways in the City's Transportation System Plan, the Bicycle

Bikeway Project" (1991), "North Portland Bikeway Improvement Plan" (1993), "Central City Transportation Management Plan Bicycle Study" (1993), and the final adopted "Central City Transportation Management Plan" (1995).

3 Bicycle lanes generally could not be provided on Major or Minor City Traffic Streets when parking could not be removed, the configuration of travel lanes could not be altered, and/or travel lanes could not be sufficiently narrowed to allow striping of bicycle lanes.

4 The Transportation System Plan is the City's guiding policy document for transportation.

Master Plan does not recommend any treatment for these roadways other than the placement of signs. These bikeways are generally connector routes that link other City Bikeways, or that lead to a point of interest.

Off-Street paths are in areas of the right-of-way, or outside the right-of-way, that are intended for non-automotive use only. In Portland, these paths are often along rivers, freeway right-of-way, rail right-of-way, and on bridges.

Growth in Network

By Facility Type and District Portland's bikeway network has grown steadily since the Bicycle Master Plan was adopted in 1996. Since 1990 Portland's bikeways grew from 78 miles of roadway to more than 265 miles today. Much of this growth occurred in the years between 1994 and 2002. During this period the city built 166 miles of bikeways, representing 60% of today's existing network. These 166 miles included 20.5 miles of bicycle boulevards (68% of today's total of 30 miles), 111 miles of bike lanes (66% of today's total of 167 miles), and 34 miles of off-street paths (49% of today's total of 69 miles). Figure 7.3 shows the annual development of bikeways by type.

Figure 7.3:

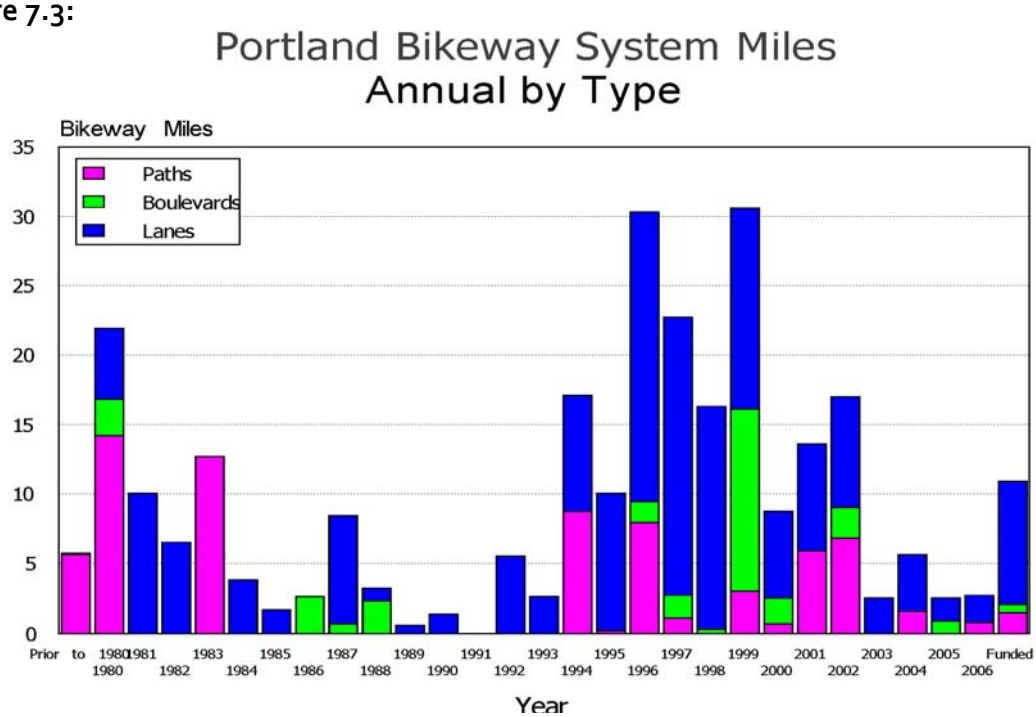


Table 7.1:

Bicycle Facilities by City District (miles)
02/07

		Existing	Funded	Recommended	Total	% of Existing/Fun to Total
North	Bicycle Lanes	26.0	3.3	24.2	53.5	54.7%
	Bicycle Boulevard	1.2	0.0	4.4	5.6	21.0%
	Off-Street Paths	15.4	0.1	5.5	21.1	73.8%
	Signed Connections	0.0	0.0	6.0	6.0	0.0%
	Subtotal North:	42.6	3.5	40.1	86.2	53.4%
Inner Northeast	Bicycle Lanes	23.6	0.6	51.0	75.2	32.1%
	Bicycle Boulevard	9.2	0.6	19.0	28.7	33.9%
	Off-Street Paths	6.6	0.4	12.7	19.7	35.4%
	Signed Connections	0.0	0.0	3.6	3.6	0.0%
	Subtotal Northeast:	39.3	1.5	86.3	127.2	32.1%
Southeast	Bicycle Lanes	20.6	0.7	29.3	50.6	42.1%
	Bicycle Boulevard	13.4	0.0	19.8	33.2	40.4%
	Off-Street Paths	12.8	0.0	1.0	13.8	92.6%
	Signed Connections	0.0	0.0	3.2	3.2	0.0%
	Subtotal Southeast:	46.8	0.7	53.3	100.8	47.2%
Outer East	Bicycle Lanes	44.3	1.5	43.9	89.8	51.0%
	Bicycle Boulevard	0.0	0.0	5.5	5.5	0.0%
	Off-Street Paths	14.7	0.0	7.3	22.0	66.8%
	Signed Connections	0.0	0.0	0.4	0.4	na
	Subtotal Outer East:	59.0	1.5	57.2	117.7	51.4%
Northwest	Bicycle Lanes	10.1	0.2	25.4	35.8	28.9%
	Bicycle Boulevard	3.7	0.0	0.7	4.5	83.5%
	Off-Street Paths	9.3	0.0	1.3	10.6	88.1%
	Signed Connections	0.0	0.0	2.5	2.5	0.0%
	Subtotal Northwest:	23.2	0.2	29.9	53.4	43.9%
Southwest	Bicycle Lanes	24.2	0.7	63.9	88.9	28.1%
	Bicycle Boulevard	0.0	0.0	1.9	1.9	0.0%
	Off-Street Paths	4.6	0.0	1.7	6.2	73.4%
	Signed Connections	0.0	0.0	9.4	9.4	0.0%
	Subtotal Southwest:	28.8	0.7	76.9	106.4	27.8%
Central	Bicycle Lanes	21.8	1.7	18.0	41.5	56.6%
	Bicycle Boulevard	2.2	0.0	2.8	5.0	44.3%
	Off-Street Paths	5.7	1.1	1.3	8.1	83.9%
	Signed Connections	0.0	0.0	1.9	1.9	0.0%
	Subtotal Central:	29.7	2.8	24.0	56.6	57.5%
Citywide (summed from above)	Bicycle Lanes	170.6	8.8	255.9	435.3	41.2%
	Bicycle Boulevard	29.7	0.6	54.1	84.4	35.9%
	Off-Street Paths	69.2	1.6	30.8	101.6	69.7%
	Signed Connections	0.0	0.0	26.9	26.9	0.0%
	Total Citywide**:	269.5	11.0	367.7	648.2	43.3%

Portland's Bikeway Network is approximately 45% complete. Under the existing plan, when complete it will comprise 431 miles of bicycle lanes, 84 miles of bicycle boulevards, 101 miles of off-street paths, and 27 miles of signed connections. Not including signed connections, those facilities are 41%, 36%, and 70% complete, respectively. Table 7.1 shows the relative completeness of bikeways by area of the city.

There are notable differences between different areas of the city both in terms of what has been developed and what is slated for development. As shown in Table 7.2, city-wide, 45% of the network is complete. There is significant variation in percent completeness in the seven recognized transportation districts in Portland. Percent completeness of the network ranges from a low of 28% in Southwest Portland, to a high of 53% and 58% in North Portland and the Central City, respectively.

Table 7.2: Bikeway Completion by District

District	Total Miles	Existing & Funded Miles	Percent Complete	Percent of Existing Facilities That Are		
				Boulevards	Lanes	Paths
North	86	46	53%	3%	64%	34%
Inner Northeast	127	41	32%	24%	59%	17%
Inner Southeast	101	48	47%	28%	45%	27%
Outer East	118	61	51%	0%	76%	24%
Northwest	53	23	44%	16%	44%	40%
Southwest	106	30	28%	0%	84%	16%
Central	57	33	58%	7%	72%	21%

Of the 280 miles that have been developed (includes 9 miles of funded, but not yet constructed projects), 64% have been developed as bicycle lanes, 26% have been developed as off-street paths, and 11% have been developed as bicycle boulevards. As bicycle boulevards are the most "family-friendly" of bikeways in the public right-of-way it is worthwhile to consider how these facilities have been developed in the different sectors of Portland. Inner Northeast and Inner Southeast Portland have the highest percentage of their existing network comprised of boulevards. Boulevards are 24% and 28% of the existing bikeways in these parts of the city, respectively. Northwest Portland is next highest, with 16% of their developed bikeways consisting of boulevards.

Contrast this to Outer East and Southwest Portland, where there are no boulevards. North Portland and the Central City also contain relatively few miles of boulevards, with only 3% and 7%, respectively.

By Project

Portland's Bikeways have been developed by a number of agencies and projects over the past 15 years. While the Portland Office of Transportation has been the primary architect of the city's bikeway network and its principal developer, others have contributed notably. Table 7.3 displays the number of bikeway miles developed by different agencies and projects.

Table 7.3:

Bikeway Development By Project
(miles)

Development Before 1993	82.1	*82.1*
Bicycle-Specific Capital Projects		*130.5*
40's Bikeway	7.7	
Burnside Corridor Project	2.2	
Central City Bikeways	9.0	
Clinton-Woodward Bikeway	4.6	
Lovejoy Ramp	0.4	
Missing Links	41.4	
North Portland Bikeways	6.8	
Northwest Bikeways	8.0	
Other	23.4	
Southeast Bikeways	14.6	
Greeley Bikeway	1.5	
Tillamook Bikeway	4.5	
Vancouver-Williams Bikeway	6.3	
Other Projects		*13.9*
Arena Project	1.3	
Broadway-Weidler Project	2.5	
Capitol Highway Project	1.1	
Interstate MAX	3.4	
LID Improvements	0.3	
Streetcar	0.2	
Traffic Calming Projects	0.4	
Unassigned	4.7	
Other Agencies		*39.9*
BES	4.0	
Parks	18.3	
ODOT Bikeways	12.3	
PDC	0.3	
Port of Portland	5.0	
Total		*266.3*

Of particular note is the miles developed by PDOT's "Missing Links" program. This program, funded at a modest $50,000 per year, has allowed the Office of Transportation to opportunistically and efficiently develop City Bikeways in conjunction with other projects, notably regularly-scheduled pavement overlays of roadways. Without the Missing Links funding, those 41 miles of city bikeways—typically developed as bicycle lanes—would not have been striped, or would have cost much more if undertaken as a project requiring grinding of existing lines and then re-striping with bicycle lanes.

Network Growth and Ridership

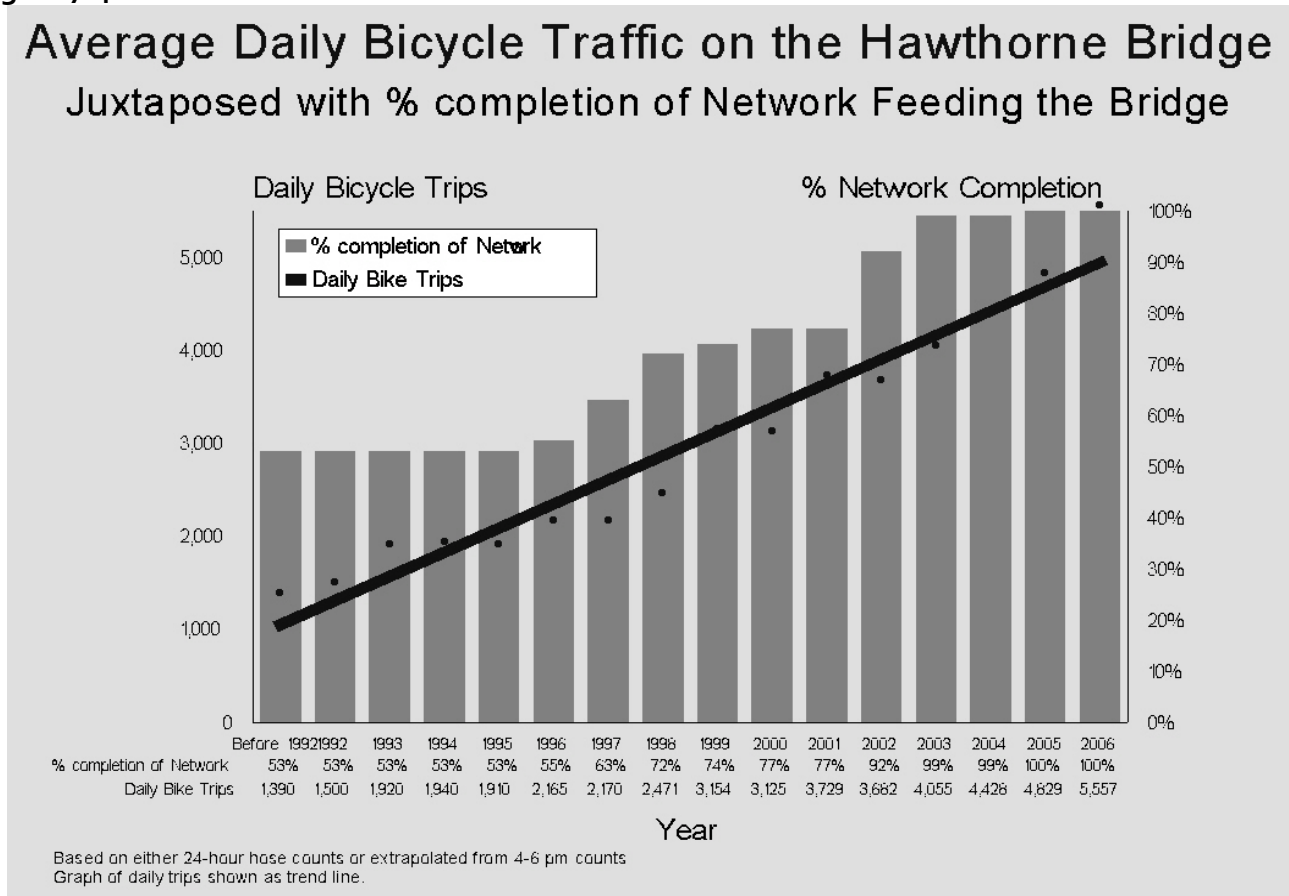
There is a strong correlation between the growth of Portland's bikeway network and growth in ridership. Figure XX shows this correlation between overall network growth and increases in ridership across the four bicycle-friendly Willamette River bridges.

This correlation is particularly evident when looking individually at these four bridges and the relative merits of the local bikeways feeding and serving each bridge. As the figures show, the positive correlation is strong. As the networks serving the Hawthorne, Broadway, and Steel bridges have developed over time, the ridership on those bridges has grown. Similarly, as the facilities serving the Burnside Bridge have not grown, neither have the number of bicycle trips across that bridge.

It is also worthwhile considering the quality of the facilities both serving the bridges and on the bridges themselves. The Hawthorne Bridge has the longest established facilities; they were in place by 2003. In addition, XX% of those facilities are bicycle boulevards and off-street paths—the two types of bikeways that offer the least interaction with motor vehicles. In addition, the bikeway on the bridge itself is an off-street path that was significantly improved in 1999 when it was widened from two six-foot sidewalks to two ten-foot sidewalks. Also

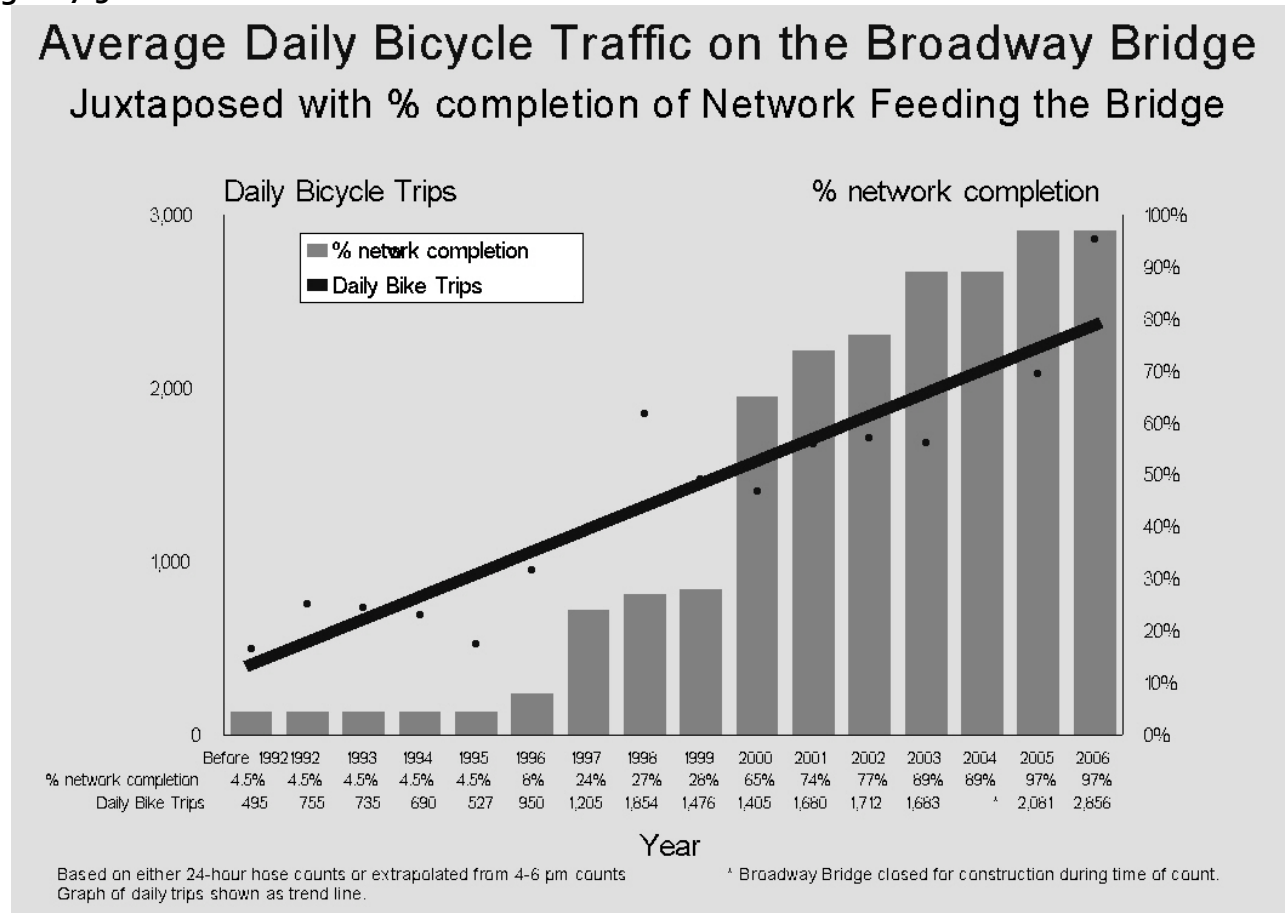
improved at that same time were interactions between cyclists and motorist with the closing of one ramp from what was then Front Avenue, the stop sign control on another, and the striping of two blue bicycle lanes.

Figure 7.4:



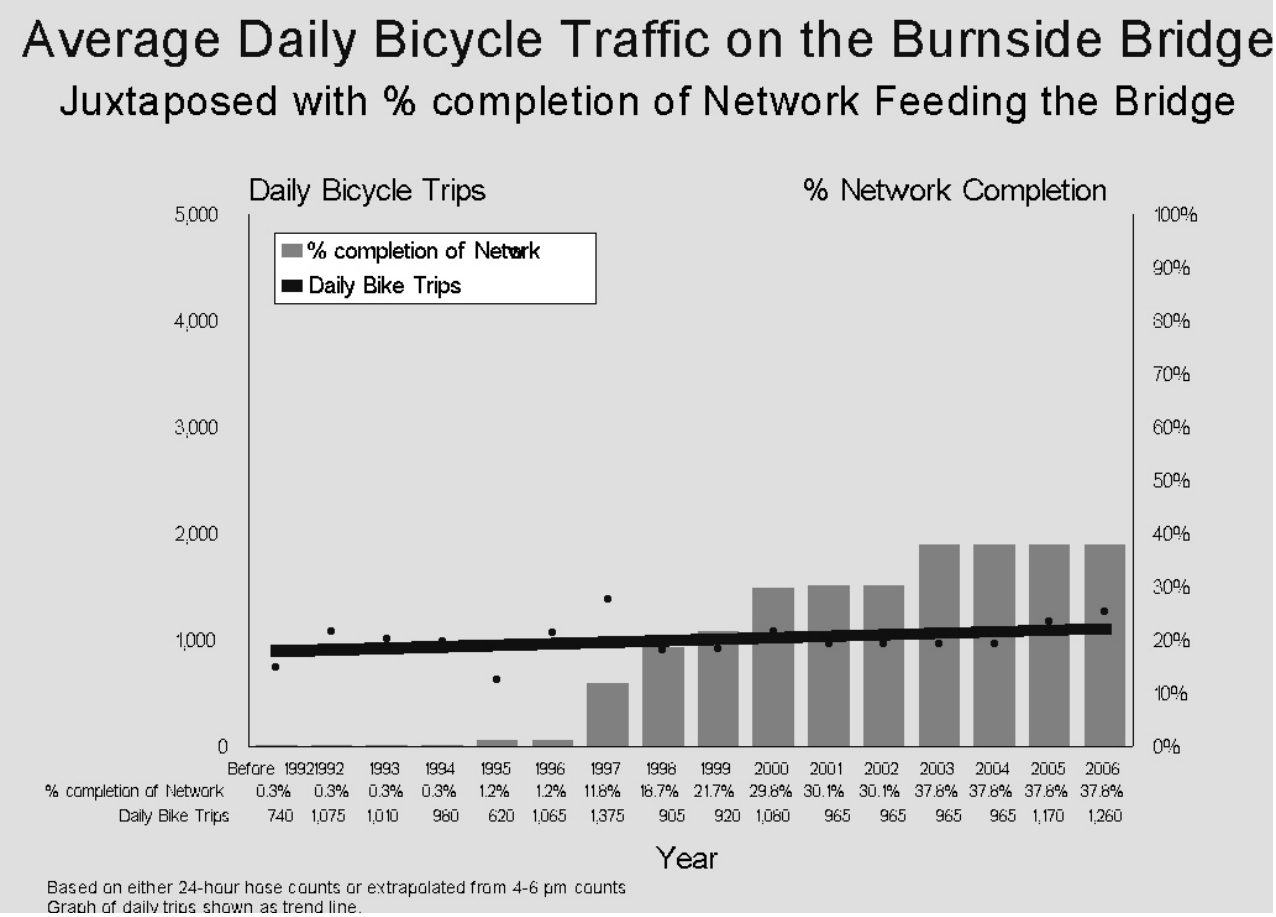
With the Broadway Bridge the network developed piecemeal over time. However, as with both the Steel and Hawthorne bridges, the facility on the Broadway Bridge is an off-street path. While it principally bicycle lanes on arterial streets feeding the Broadway Bridge, these lanes are on relatively low volume and low speed arterials (Broadway-Weidler and Vancouver-Williams). The same arterials, as well as Lloyd Boulevard and Multnomah Avenue, both of which carry even lower volumes than the two couplets feeding the Broadway, similarly serve the Steel Bridge. In addition, the Steel Bridge is notably served by two of the principal off-street paths in the region: Waterfront Park and the Eastbank Esplanade.

Figure 7.5:



The Burnside Bridge is unique among the four bridges, for a number of reasons. Primary among those is the incomplete nature of the network feeding it. While Ankeny Street is a bicycle boulevard that well serves inner SE Portland, final access to the bridge requires cyclists to ride on Grand Avenue and then along Burnside, neither of which has bicycle facilities. None of the other recommended facilities that would serve the bridge on either the east or west sides of the river have been developed. The bridge itself is striped with a five-foot bicycle lane, rather than having an off-street path as do the other three bridges. In addition, the bicycle lanes on the bridge drop at both the east and west ends before connecting to other bikeway facilities. Overall, access to the Burnside Bridge suffers from not only a lack in quantity of facilities, but also in the quality of facilities provided. It is therefore not surprising that bicycle trips across this bridge has remained relatively flat over the past 16 years.

Figure 7.6:



Recent Additions to the Bikeway Network

Some more recent additions and changes to the city's bikeway network, while adding significantly to ease of operation and connectivity, have not added many bikeway miles. Nonetheless, these additions represent sizeable investments in terms of funds expended, planning resources tapped, and engineering resources devoted. These recent additions include:

- The scramble signal in the Rose Quarter at the intersection of Oregon Street and Interstate Avenue
- The HAWK signal at the intersection of 41st and E Burnside
- The "Three Bridges" project in Sellwood along the Springwater Corridor
- The Eastbank Esplanade and Riverwalk projects along the Central Eastside and hanging from the Steel Bridge, respectively
- The Bikeway Network Signing Project, and
- The Port's path to the Airport

This listing does not include the handful and growing number of curb extensions and median refuges that have been added to facilitate cyclist's crossing of busy arterial streets. While not significant to the total miles of bikeways, these more focused point projects have nonetheless addressed significant gaps in the city's bikeway system.

Bikeway Facilities

Ownership

Portland's Office of Transportation is the "road authority" for the City of Portland. While this means that PDOT owns and manages (and constructed) the majority of roads, and thus bikeways in the city, it is by no means the only agency involved in developing and managing the city's bikeways. The Oregon Department of Transportation owns a number of roadways in Portland, and is thus directly responsible for the existing and future bikeways on their roads. Multnomah County also owns and operates significant bikeways in the city—most significant among their holdings are a number of the bridges across the Willamette River. Portland Parks and Recreation also plays an important role in the city's bikeway system as they are the principal owner and manager of several significant off-street paths. Other jurisdictions and agencies with ownership and management responsibility for city bikeways include Metro, the Port of Portland, and the Multnomah County Drainage District.

Primary Facilities: Lanes

Bicycle lanes are the most frequently used bikeway treatment on Portland's streets. Portland currently has 167 miles of roadway striped with bicycle lanes. PDOT has followed three primary strategies for striping bicycle lanes on city streets:

- Narrow existing travel lanes in order to stripe bicycle lanes
- Reconfigure a roadway to remove travel lanes to provide the needed width, and
- Remove on-street parking to provide for bicycle lanes.

Portland's roadways are typically striped with bicycle lanes only when the average daily traffic on the street (ADT) exceeds 3,000 vehicles per day (vpd). In limited circumstances Portland has striped bicycle lanes on roadways carrying lower volumes for a number of reasons. The most significant of these other reasons are speed and stopping patterns. For example, the 40's Bikeway Project striped bicycle lanes on SE 42nd even though traffic volumes were lower than 3,000.vpd Because of traffic volumes that approached 3,000 vpd, in combination with relatively high speeds and traffic operations that allowed long stretches of free flowing traffic, PDOT judged that bicycle lanes offered the most benefit to people riding bicycles on that street.

PDOT's general practice is to stripe two bicycle lanes on a two-way roadway. Occasionally, because of serious width or operational constraints, there is room for only one bicycle lane. In those instances the city has striped bicycle lanes in the uphill direction, if there is one. PDOT will also stripe these climbing lanes on roadways with lower traffic volumes in recognition that it is not a pleasant experience for cyclists to slowly climb a hill leading a "slow-moving parade" of motorists eager to pass.

Most of Portland's bicycle lanes are the traditional "right-running" bicycle lane. They run either against the right curb or adjacent to parking on the right side of the roadway. There are few examples of bicycle lanes that run along the left side of a roadway. One example is on SW 14th Avenue between SW Jefferson and SW Stark, which is a one-way street section. Because of significant conflicts with I-405 traffic entering the right side of 14th, PDOT staff decided to stripe the bicycle lane to the left. This creates difficulties "down the road" when the bicycle lane

necessarily must return to the right hand edge of the roadway in order to integrate into the standard roadway configuration.

There are other circumstances when a bicycle lane moves away from the right edge of the roadway. This notably occurs when the right hand lane becomes a right-turn only lane. In this case the desire is to have through cyclists—and thus the bicycle lane—to the left of the right-turn lane. This "right-turn drop lane[5]" generally presents cyclists with a difficult situation. Those cyclists continuing straight on the roadway must merge across what are typically heavy volumes of right-turning traffic in the absence of a bicycle lane or clear guidance. With a right-turn drop lane the bicycle lane ends, disappears for some distance determined by the speeds of motor vehicles on the roadway, and then reappears to the left of the right-turn lane. This design is considered so incompatible to pleasant bicycling that the city attempts to provide options to this type of maneuver whenever possible. An example of this is on NE Killingsworth just west of I-205 where the recently-designed "East End Connector"[6] includes a right-turn drop lane on a high-volume, high-speed roadway. Initially, every effort was made to create a right-turn add lane, for reasons that will be described below. When that proved undoable, cyclists were given an option. Just before the curb-tight bicycle lane drops and migrates left, cyclists are provided a curb cut allowing them easy access to a sidewalk widened for their use. From the sidewalk, cyclists are then able to cross the right-turning traffic at the intersection and with a signalized crossing. While slower and less efficient than riding on the roadway, the sidewalk path provides cyclists with a much less harrowing option than merging across 1,000 motorists per hour traveling at 45 mph. Cyclists may choose to stay in the travel lane if they wish, and use the bicycle lane, but at least they are offered a second option.

A right-turn add lane is much more comfortable for cyclists as the bicycle lane continues uninterrupted. The add lane design is one in which the roadway widens to add an additional travel lane that is designated for right turns only. Right turning motorists must merge across the bicycle lane and yield to any cyclists. The bicycle lane is continuous, though it may be dashed—and colored blue—in the area where motorists are expected to pass through it.

There are occasions where a right turn lane is added but without sufficient roadway width to continue the bicycle lane. A similar situation occurs when a bicycle lane and unused on-street parking—with a combined width of 12-13 feet—serve as a de facto right-turn lane. This latter situation presents potential road hazards, particularly for motorists. Motorists traveling in the travel lane who wish to turn right from the travel lane can be surprised by right turning motorists to their right who are using the width offered by the combined bicycle lane and parking strip. This also presents difficulties should two motorists try to turn right at the same time as in these situations there may be only one lane to receive them. In situations like this PDOT's practice has been to drop the bicycle lane, create a true right-turn only add lane and sign it "Right Turn Only Except Bikes." This allows cyclists to proceed in a straight-line path. The advantage of this is that cyclists aren't required to merge left into a through travel lane. The disadvantage is that cyclists lost the positive guidance and designated and identified place in the roadway.

Another design for addressing this type of limitation—i.e., the need for a bicycle lane and turn lane but

[5] So called because the lane drops—i.e., does not continue—beyond the intersection.
[6] Connecting Killingsworth conveniently and directly with Columbia Boulevard—an important freight connection.

insufficient width for both—is found in the Oregon Department of Transportation's Bicycle and Pedestrian Plan, and at one location in Oregon. Along St. Helens Road (Hwy 30), which is owned and managed by ODOT, the state created a "shared turn lane." This design continues the bicycle lane through the middle of the turn lane. When a cyclist is present the motorist must yield and/or wait. With smaller motor vehicles there can be enough room for the cyclist and motorist to operate side-by-side at very slow speeds.

Bicycle Lane Widths

Five feet is the standard width for bicycle lanes in Portland. However, there are bicycle lanes of width ranging from as narrow as 3-feet—used only in exceptionally unusual circumstances, to four-feet, the more typical 4.5 feet, 5.5 feet, 6.0 feet, and 6.5 feet. It is worth describing in detail some of the decisions made to create bicycle lanes of these widths in order to better inform future decisions about bicycle lanes.

Three-foot bicycle lanes are found, for very short stretches, in at least two locations. One is on Capitol Highway, just south of Multnomah Village. A capital improvement project could not afford to widen the roadway enough to stripe bicycle lanes in both directions so climbing lanes were provided. Nearing the crest of the hill, from both directions, and due to topographic and roadway constraints, the bicycle lanes, which are full-width beginning at the bottom of the hills, narrow to approximately 3 feet before they drop at the crest. PDOT decided to maintain this minimal width because to end the bicycle lanes at a wider width would have dropped them well shy of the crest and the benefit of having a separating stripe in the uphill direction seemed to outweigh the potential harm of a narrow bicycle lane. Planners took into account the speed of the traffic on the roadway (it is posted at 25 mph), the grade (steep—making it difficult for cyclists to comfortably share the lane), the absence of a curb line, and the value of maintaining some level of separation between motorists and cyclists as these vehicles approached the crest of the hill.

A second location is inbound on SW 6th Avenue at the overcrossing of I-405 at the south end of the Central Business District. Existing travel lanes on the overcrossing did not allow for a full-width bicycle lane to begin at the intersection with SW Broadway. Instead PDOT began striping a bicycle lane at the point where they could achieve a three-foot width. This width immediately begins tapering to a full-width bicycle lane within fewer than 200-feet. Several advantages to beginning the bicycle lane informed this decision. Beginning the bicycle lane as soon as possible would have the effect of encouraging motorists to begin moving to the left as soon as possible, conferring an advantage to cyclists even before the bicycle lane begins. Because of other challenging conditions in SW Portland, many cyclists using this route are assumed to be more skilled than the average cyclist and would feel comfortable in a 3-foot bicycle lane.

Four-foot bicycle lanes are rarely used, despite being the minimum acceptable standard width according to the American Association of State Highway and Transportation Officials (AASHTO).[7] One instance in Portland is on NE Tillamook Street between NE 37th and 43rd avenues. There, the roadway is 42 feet from curb-to-curb with parking on both sides of the street. This cross-section allowed for two ten-foot travel lanes, two seven-foot parking lanes, and two four-foot bicycle lanes. This configuration does not meet PDOT's own design guidelines for bicycle lanes, which states that "a four-foot bicycle lane should not be used in combination with a 7 foot

[7] The AASHTO manual is the primary guide and standards document for roadway design. The AASHTO *Guide for Development of Bicycle Facilities*. published in 1999, provides guidelines and standards for bikeway designs.

parking lane and/or a 10 foot travel lane[8]." PDOT decided to stripe the bicycle lane based an analysis of the unique conditions on this stretch of Tillamook, including:

- Traffic volumes are relatively low, but still high enough to call for bicycle lanes
- It is a relatively short, 6-block segment
- Parking turnover is not uniformly high across the segment, and, most importantly,
- It is not a typical arterial segment in that traffic is stopped every other block.

It was this last element that was most significant as it helps to keep traffic speeds very slow.

Portland has many bicycle lanes measuring 4.5-feet as this width is recommended on bicycle lane retrofits of 36-foot wide roadways, which Portland has in abundance. On such roadways, the recommended configuration with bicycle lanes is for one seven-foot parking lane, two ten-foot travel lanes, and two 4.5-foot bicycle lanes. Similarly, as five feet has been the standard for bicycle lanes in Portland, all streets, where width exists, are generally striped as such. There are many examples of five-foot bicycle lanes in Portland.

Five-and-a-half-foot bicycle lanes are typically used on streets with gutter pans. The standard width for a concrete gutter pan is 18 inches and Portland bicycle lane design guidelines call for leaving four feet clear of a longitudinal joint in a bicycle lane. Such longitudinal joints are formed at the 1.5-foot width between the concrete and the asphalt of the roadway. Hence, the 5.5-foot bicycle lane.

Six foot bicycle lanes are used on higher volume roadways, or on roadways where sufficient width exists. Examples of six-foot bicycle lanes can be found on portions of SW Barbur Boulevard, NE Lombard Street, NW 18th and NW 19th avenues, N Vancouver and Williams avenues, to list a few.

There is one bicycle lane of 6.5 feet in Portland. It is on N Vancouver Avenue between Fremont Street and Broadway. This width is the equivalent of the European standard bicycle facility width of 2 meters. When asked why this width, Dutch transportation planners universally responded that it is at 2 meters that two cyclists could comfortably ride side by side. This recognition of the social component of travel is intended to make the cycling experience more pleasing and enjoyable. In addition to this "sociability factor," bicycle lanes of this width also offer the advantage of providing a wider margin for cyclists relative to both passing traffic and on-street parking.

Other Design Conditions

Occasionally bicycle lanes are provided on only one-side of a two-way roadway. As mentioned previously, this occurs only when insufficient width exists to stripe both directions. A good example of this is on SW Palantine Hill Road, adjacent to Lewis and Clark Law School. A recent development allowed the roadway to be widened to 28-feet of total width. This width could have allowed for two ten-foot travel lanes and two four-foot bicycle lanes. However, this is a hilly area. Both uphill and downhill grades generally require wider than normal bicycle lane widths. In the uphill direction, cyclists go slowly and tend to wobble a bit, requiring more than standard width. Cyclists going downhill travel at a higher than normal speed and require extra width in order to have more

[8] According to PDOT's design guide, a four foot minimum bicycle lane *may* be acceptable when either physical constraints exist, for a segment of less than 1 mile that links to existing bikeways on both ends, or, is implemented in conjunction with traffic calming devices, or is adjacent to parking with [very] low use and turnover, or is adjacent to an uncurbed street shoulder.

maneuvering room to avoid potential obstacles in the bicycle lane. For these reasons, PDOT decided to stripe a six-foot uphill bicycle lane adjacent to an 11-foot travel lane, and provide an 11-foot downhill travel lane for shared travel. Similar conditions exist on NW Wardway Street between Nicolai and Vaughn streets.

Bicycle lanes approach intersections in a number of different ways that can be divided into two general categories: the bicycle lanes either carry all the way through to the crosswalk, or they drop prior to the crosswalk. The desirable and most common condition is for the lanes to run continuously to the crosswalk. However, there are numerous examples where bicycle lanes drop prior to an intersection. This has been commonly described by cyclists as a distressing deficiency in the network. Such a condition is distressing to many cyclists in part, because one condition under which the bicycle lane drops is when travel lanes are added to accommodate high volumes and high demand at a signalized intersection. Thus, the bicycle lanes are often dropped just when cyclists need them the most: on a high volume roadway where people are switching lanes to turn left or right, or continue straight through an intersection.

The most common situations in which bicycle lanes are dropped are with the development of a right-turn lane or an additional through travel lane at an intersection. Such lanes are added in a number of ways:

- by dropping the bicycle lane(s) and/or parking lane(s) and/or narrowing the existing lanes on the roadway
- by combining the width of unused on-street parking with the width of the bicycle lane, and
- by widening the roadway, but not enough to provide for bicycle lanes.

There are also situations where bicycle lanes continue through an intersection. Mostly notably, this occurs with blue bicycle lanes, which are discussed later. Striping through an intersection also occurs when bicycle lanes are “skip-striped” through an intersection. The Office of Transportation does this in areas where the intersection is either very large, skewed so that movement through the intersection is not clear or requires some diversion from a straight path, or otherwise in need of positive guidance. Skip striping is one means of addressing some Portlander’s stated preference for increased guidance about where to be in the public right-of-way.

Primary Facilities: Bicycle Boulevards

Bicycle boulevards are those City Bikeways with fewer than 3,000 vehicles per day (vpd). These are generally Local Service Streets, but can also be Neighborhood Collector Streets. Portland currently has approximately 30 miles of developed bicycle boulevards.

These are streets that generally work well for bicycling because they are low volumes. However, there are things that PDOT does to make them perform better. The sum of PDOT’s efforts in creating a bicycle boulevard is to create a supremely family-friendly bikeway on which bicyclists are given priority both by design and operation. This is accomplished by addressing four principal issues:

- Motor vehicle volumes
- Motor vehicle speeds
- Free-flow for cyclists
- Ease of crossing arterial intersections, and
- Way-finding.

Primary among these treatments is reducing volumes of motor vehicle traffic.

As already noted, Portland's best-functioning bicycle boulevards—those on Ankeny, Lincoln and Harrison, Clinton, Williams (north of Killingsworth), and Tillamook streets—owe much of their good performance to prior improvements that dramatically reduced motor vehicle volumes. These diversion devices, of which there are a handful of types and examples in Portland, are the most cost-effective and efficient manner in which to permanently reduce motor vehicle volumes on a roadway. Their type, application, and policies for use are discussed elsewhere in this document.

Reduction in volumes has also occurred on roadways following traffic calming. Traffic calming is used on bicycle boulevards—and elsewhere—to reduce motor vehicle speeds. In addition to keeping motor vehicle volumes low, keeping motor vehicle speeds low is also crucial to the comfortable operation of a bicycle boulevard. PDOT's experience with traffic calming has been that not only are speeds reduced, but volumes of motor vehicles generally drop, as well. For example, after speed bumps were placed on SE Clinton between 12th and 39th avenues, as part of the Clinton-Woodward Bikeway Project, motor vehicle volumes on stretches of the roadway dropped by 25 percent. This was particularly significant because prior to the drop volumes exceeded 3,000 vpd on that stretch. Normally, this would have triggered the striping of bicycle lanes. Because of a narrow roadway, heavy demand for parking, and traffic circles already on Clinton Street, striping bicycle lanes was not a feasible option. While unable to directly address the higher than desirable volumes, we could address speed, which we did by building speed bumps. A beneificial side-effect of addressing speed was to cause a drop in volume below the 3,000 vpd threshold.

Cyclists generally do not like to stop their forward movement; as objects in motion they tend to like to stay in motion. This is true for any mode of transportation. However, the cost of stopping, in terms of personal physical effort required to start again, is greatest for cyclists. Thus, it is generally more desirable for cyclists to stop as infrequently as possible. To accomplish this on boulevard streets PDOT will typically move stop signs as often as possible, to allow free-flow conditions on the boulevard, and instead stop traffic entering the boulevard street. The potential downside to this is that such free-flowing conditions can be attractive to motorists who may decide to use the boulevard street rather than a potentially congested parallel arterial street. This is a condition that the PDOT carefully considers and closely monitors.

One of the conditions on a bicycle boulevard street that helps to keep motor vehicle volumes low, is the difficulty motorists have crossing arterial streets crossed by the boulevard. While moving stop signs can attract motorists, the difficulty of crossing high volume streets tends to deter them. Of course, this crossing difficulty applies to people on bicycles, as well. Therefore, another principal improvement on a bicycle boulevard route is to provide cyclists with good crossings, without simultaneously creating good crossing opportunities for motorists. PDOT's guideline for sufficiency in crossings is an average of one crossing opportunity ("gap") per minute over the peak traffic hour ("rush hour"—generally 5:00-6:00 pm). PDOT has addressed crossings in one of three ways:

- Curb extensions
- Median refuges, and

- Specialized traffic signals.

Curb extensions serve to make cyclists more visible to motorists, and give cyclists a better view of oncoming traffic. Their primary design purpose is to decrease the distance cyclists must cross, and thus decrease the time required to cross. Advance analysis of the intersection identifies whether this approach will be successful in creating more crossing opportunities. Curb extensions work best on two-lane roadways with just one travel lane in each direction of travel.

Median refuges can be used on either two or more lane roadways. They allow cyclists to focus on just one direction of traffic at a time. Rather than requiring a cyclist to wait for gaps in both directions of travel, they can cross one side of the roadway, take refuge, and then consider the second side. Median refuges are generally a raised concrete island of one form or another. Examples can be found at SE Sandy and Ankeny, N Williams at Portland, and NE Davis at South 39th. A painted version of a median refuge is found at SE 41st and Stark. This is more of a bicycle "center turn lane," though it operates as a median refuge, facilitating north-south travel along the 40's Bikeway and the crossing of Stark Street.

Specialized traffic signals—typically either a "pedestrian half signal" or a HAWK[9] signal—are a very effective means to facilitate bicycle crossings because they completely stop the crossing traffic. Portland has not installed new pedestrian half-signals since the late 1980s because the Federal Highway Administration (FHWA) disallowed their use. Portland still has 48 in place, and have incorporated them into several successful bicycle boulevards[10]. Examples can be found at 41st and Hawthorne, 41st and Glisan, Taylor and 39th, and 16th and Hawthorne. In 2006 Portland installed its first HAWK signal at 41st and E Burnside. Its operation has been successful to date and will likely become the standard for additional signalized crossings A significant impediment to their installation is cost. A signalized intersection can cost 2 to 4 times more than either a median refuge or curb extensions.

While Bicycle Boulevards are appealing facilities for riding, until recently they suffered from relative anonymity. Unlike streets striped with bicycle lanes, where the striped lanes themselves advertised those roadways as suitable for bicycling, there was nothing to distinguish a boulevard street from any other street. The improvements that make them work well—crossing treatments, speed bumps, diversion, few stop signs—are either subtle, widely-spaced, or both. As such, there was no obvious visual cue that bicycle boulevards were designed for bicycling. That changed beginning in 2005 with the installation of Bicycle Boulevard Pavement Markings. These one-foot diameter "bike dots" make the bicycle boulevard streets as visible to cyclists as do the bicycle lanes on higher volume roadways. In addition, the boulevard pavement markings also serve a way-finding function as they incorporate arrows to direct cyclists around the inevitable jogs taken by a boulevard route over the miles it runs.

"Bike Dot"

Primary Facilities: Shared Use Paths

Shared use paths are restricted to bicycles, pedestrians, and other non-motorized users. They are among our most

[9] High Intensity Actuated WalK signal is essentially a modified pedestrian half signal.
[10] The existing half-signals were grandfathered in following the FHWA ban. These are called half signals, in part, because they retain stop signs on the local streets entering the roadway and only offer a traffic signal to the arterial traffic on the collector street.

popular places in the city to bicycle, and range from paths across the Willamette River on the Hawthorne, Steel and Broadway bridges, to the Springwater Corridor Trail, the I-205 Bike Path, the Eastbank Esplanade, and the extensive trail system in North Portland, including the Marine Drive Trail. Portland has 70 miles of shared, off-street paths.

Design standards for trails have changed significantly since Portland began building trails in the 1970s. Standards formerly called for an eight-foot wide path to be shared by two-way bicycle and pedestrian traffic. Such conditions exist on the Greenway Trail along the Willamette River in SW Portland. Some trail planners also designed blind curves into paths as a means of managing bicycle speeds, believing that if cyclists were unable to see what was approaching around a corner then they would slow down. Portland's experience has demonstrated that wider paths are better for high volumes of mixed users and that ample sight distance is preferable to not being able to see around corners.

Pathways in Portland include some with widths that are significantly substandard by any measurement, including four- to five-foot sidewalks on the St. Johns Bridge, Ross Island Bridge, Sellwood Bridge, and the upper deck of the Steel Bridge. The widths of other paths on bridges also include approximately 8.5-feet of clear space on the Broadway Bridge, eight-feet along the lift span of the Riverwalk on the Steel Bridge, and ten feet on the approaches to the Steel Bridge and on the Hawthorne Bridge sidewalks. Because the bicycle traffic on the Broadway and Hawthorne bridges is essentially one-way on each sidewalk, those facilities operate more like 17-foot and 20-foot pathways—with really wide medians down the center.[11]

The I-205 pathway is generally 10-feet wide, as are the Peninsula Crossing Trail, Marine Drive Bike Path, and Columbia Slough Trail in North and Northeast Portland. The width of the Eastbank Esplanade ranges from 12-14 feet. The predominant width of the Springwater Trail along the Willamette is 14 feet, though it narrows at pinch points. The original section of the Springwater Trail east of Sellwood, is 12-feet wide. Two trails that are currently funded but not yet built are those for the south side of the Morrison Bridge, which will be 15-feet wide (with approximately 13.5 feet of clear space) and the Greenway Trail through South Waterfront. The latter facility will include separate paths for pedestrians and bicyclists. The total width of the Greenway Trail is planned to be 25-30 feet, with 12 feet for the bicycle path, ten feet for the pedestrian path and a landscaped median of varying width between them. Except for this last planned path, pedestrians and cyclists share all other multi-use paths in Portland.

The design of many of Portland's paths, and the operating conditions resulting from those designs has been a source of much friction in recent years. The friction has been between cyclists and pedestrians and among cyclists themselves. The high volumes of cyclists and pedestrians, combined with the great difference in their operating speeds and expectations along our pathways, has resulted in many complaints about their operating conditions. The chief complaints arise from pedestrians uncomfortable with the manner in which cyclists pass them in close proximity and speeds that make them feel uncomfortable and unsafe. This complaint is beginning to be made more frequently by cyclists, similarly complaining about being passed in silence, and in close proximity by faster

[11] In 2005 Multnomah County, which owns and manages the Hawthorne Bridge, formally signed the sidewalks as one-way for bicyclists. This followed a multi-year consideration of how to best address the many complaints received from pedestrians (and some cyclists) about conflicts and uncomfortable conditions resulting from crowded two-way bicycle traffic.

cyclists.

The narrower pathway width of eight or ten feet called for in design guidelines developed in previous decades was sufficient when the numbers of cyclists were much lower than today. With bicycling becoming more popular, and with higher densities of bicyclists and pedestrians on paths, and with expectations of higher volumes to come, current designs seem inadequate to the task of creating a welcoming and comfortable environment for all users.

Primary Facilities: Signed Connections

Portland's Bicycle Master Plan calls for approximately 26 miles of signed connections. In the Transportation System Plan these streets are simply identified as City Bikeways, the same as every other on-street bikeway. Signed connections are intended to be on local, low-traffic streets where bicycle lanes or boulevard treatments are not needed. They are intended to connect two developed bikeways or to provide a connection to major attractions. Examples of Signed Connections are the roadways leading to Mt.Tabor and Rocky Butte, as well as roadways leading to Council Crest and Forest Park. Shorter examples include the segment of SE Clay Street between 12th and Water, and SE 7th between Ankeny and Sandy. Some of these segments could clearly benefit from a more advanced bikeway treatment, notably NW Thurman Street leading to Forest Park. There, traffic volumes are relatively high and speeds can be fast. Other Signed Connections are vestiges of the bikeway system that was in place ten years ago. Such a street is N Concord Avenue, which connected to an overcrossing of N Going Street and served as a continuation of the Denver Avenue bicycle lanes. The striping of bicycle lanes on N Interstate greatly relieved pressure on that route.

Since the only recommended treatment for Signed Connections is signing, these facilities were considered incomplete until the city began to comprehensively sign the city's bikeway network in 2005. Now, most of the designed signed connections have bikeway signing directing people to the appropriate destinations.

Secondary Facilities

There are a number of bikeway network design treatments that help create, augment, or in some cases, substitute for the Primary Bikeway Facilities, described above. These include:

- Shared lane pavement markings
- Arterial crossing treatments
- Traffic calming treatments
- Traffic diversion
- Signing and marking
- Blue bicycle lanes, and
- Bicycle-specific signalization.

These are all described in depth in Chapter 9, Design, Construction and Maintenance Practices.

Intersection Quality

Intersections generally pose the most difficulties for cyclists and are the locations where the majority of bicycle-motor vehicle crashes occur. Intersection treatments typically represent the bulk of the cost for the development of bicycle boulevards, befitting the difficulties they pose to cyclists. Beginning with the 2006 Portland Bike Summit, staff has been gathering information about which intersections, and which intersection types, present cyclists with the biggest challenges, and what those challenges are.

Cycling Zones

The urban fabric that forms Portland is more a mosaic of distinct neighborhoods than a homogenous mass of streets, homes and businesses. As a result, Portlanders commonly possess a great deal of pride and affinity for their own neighborhood. Therefore, understanding the mix of qualities and characteristics that make each neighborhood unique is essential to any citywide planning effort.

To better understand how conditions for bicycling vary across Portland, city staff developed an innovative Cycle Zone Analysis (CZA) method for tailoring the City's bicycle strategy to districts with similar conditions and potential for bicycling. The CZA approach allows a better understanding of existing conditions for bicycling and how they vary across Portland. It will also allow a more tailored approach to improving conditions for bicycling by directly addressing the unique deficiencies in each cycle zone.

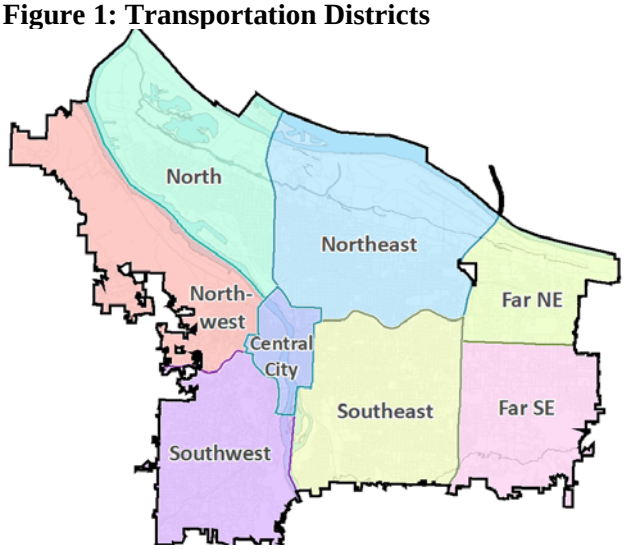
Goals of the Analysis:

- Better comprehend the different existing conditions for bicycling in Portland.
- Project which areas have the greatest potential for cycling.
- Combine the bikeway quality index (BQI) with the cycle zone analysis (CZA) to understand the relationship between cycling potential and bikeway quality
- Use this information to target investments that will achieve the best results in terms of increased cycling.

Defining Cycle Zones?

Portland's 20-year plan for transportation improvements, its Transportation System Plan, segments the City into eight transportation districts for planning and policy guidance. These political divisions are somewhat arbitrary and are based principally on geography and roadways. The limitation with these political divisions is that they do not reflect the unique conditions for cycling within each area. A more accurate depiction of the City's various cycling environments might resemble more closely a watershed map, which defines each area by a unifying condition (i.e. drainage basin).

Figure 1: Transportation Districts



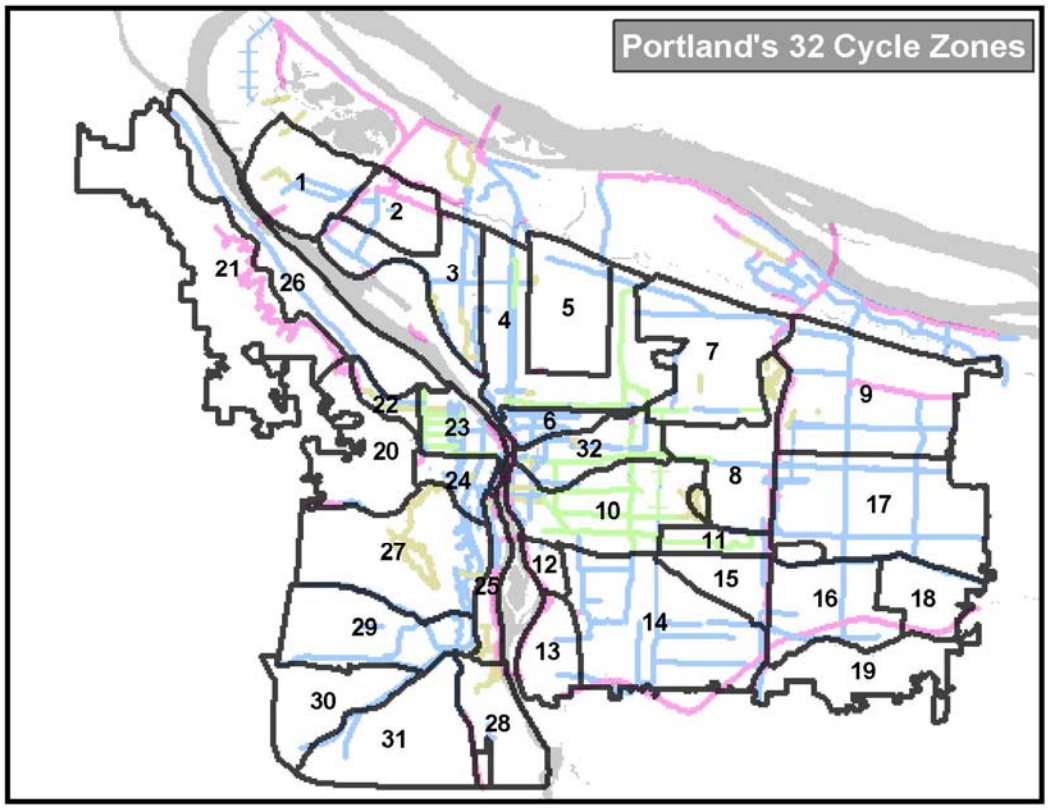
In order to establish a more fitting basis for bicycle analysis and planning, the City defined a new unit of analysis

referred to as “cycle zones”, or distinct areas within the City that possesses similar characteristics for cycling.

We defined the boundaries of the 32 cycle zones based on the following conditions:

- Quality and density of the established bikeways (both City Bikeways and local service bikeways)
- Geographic and infrastructure barriers and the frequency and ease of crossing the barriers
- Trip distance to common destinations from each zone,
- Local knowledge of cycling conditions based on input from Portland bicycling advocates, Bicycle Advisory Committee members, residents, and city/consultant planning staff.

Table XX displays Portland’s 32 cycle zones, along with the existing bikeway network.



Bikeway Quality Index

In order to evaluate the qualities and deficiencies of City Bikeways, staff divided the 220 miles of existing, bike lanes and boulevards into discrete segments. These segments included major intersections in order to capture the quality of the associated intersections. We then evaluated the bikeways using a number of factors, as defined below. The GIS-based methodology developed for determining the quality of each bikeway segment is referred to as the Bikeway Quality Index (BQI). Table 1 shows the final list of BQI factors analyzed by staff. We calculated the score for each segment as the percentage of the ideal condition for a given segment. We assigned ach of these

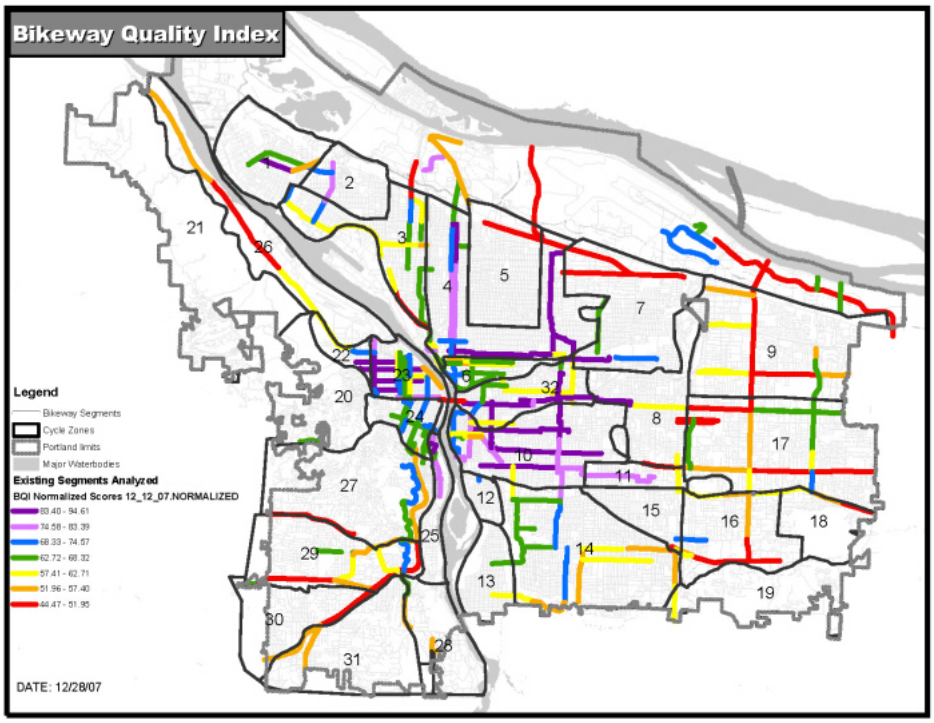
factors a weight based on its importance relative to the other factors analyzed.

We considered slightly separate factors in assigning bikeway quality to bicycle lanes and bicycle boulevards. We did not assign a quality to off-street paths. Table XX displays the factors and weights used to define quality for lanes and boulevards. Map XX displays the results of the analysis. The segments are color coded based on the spectrum (red, orange, yellow, green, blue, indigo, violet) with violet segments reflecting the highest quality and red the worst.

Table 2: BQI Analysis Showing Analysis Factors and Weighting

	A	B	D	E	H	I	K	L
1			Boulevard				Lane	
2			Max/Ideal	Weight			Max/Ideal	Weight
3		Speed/Vol	7.5	64.8		Speed/vol	8	40.9
4						Lane Drop	4	8.0
5		Difficult Transition	2	6.4		Difficult Transition	4	6.3
6						Bike Lane Width	7	32.7
7		Jogs	8.36	3.2				
8		Pavement Quality	3	3.2		Pavement Quality	3	3.0
9		Intersection Quality	5	16.0		Intersection Quality	8	9.1
10						**Total**		**100**
11		Stops	40	6.4				
12		**Total**		**100**				
13								

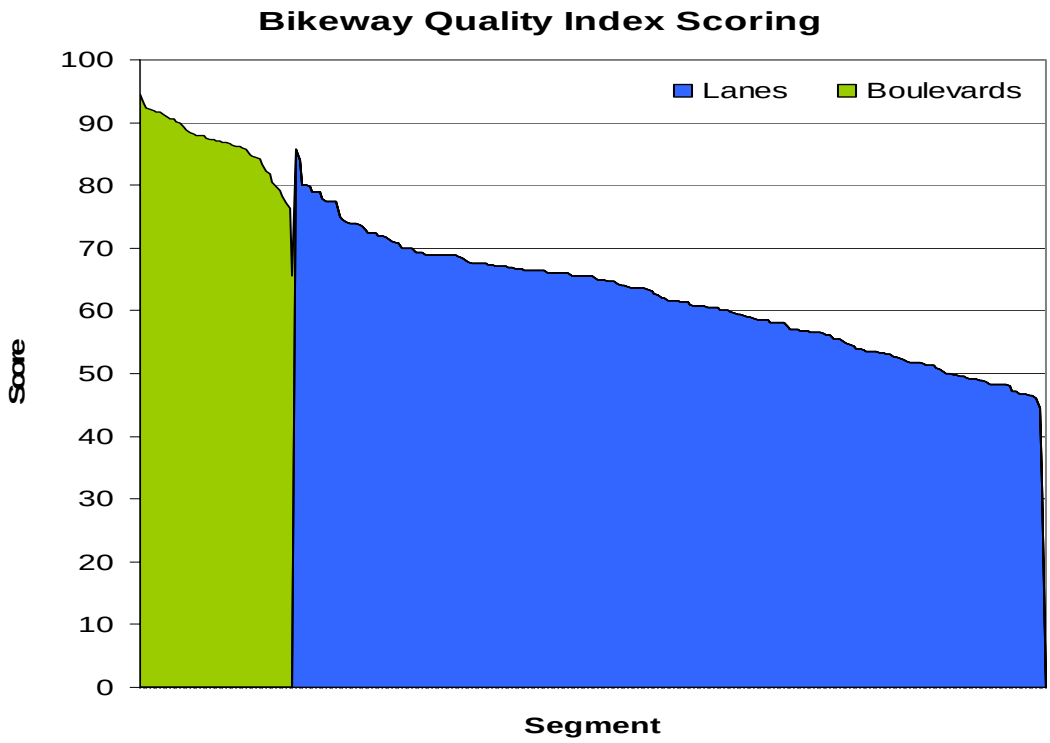
Case Testing | **Control Panel** | Lane S



We assigned automobile speed/volume as the most significant factor in the model. Of the different methodologies developed to produce bike lane and boulevard scores, speed/volume contributes more heavily towards the scores of bike boulevard segments (64.8% weighting), since this factor is assumed to have greater influence on cycling conditions for shared roadways than streets with bike lanes (40.9% weighting).

Figure XX displays the relative scoring of the boulevard and lane segments we analyzed. This shows that while the most highly rated bicycle lanes score higher than the lowest rated bicycle boulevards, in general, bicycle boulevards score much higher in bikeway quality that the large majority of bicycle lane segments.

Figure 2: BQI Scores for Bike Lanes and Bicycle Boulevards



Cycle Zones Ratings

Integrating the BQI analysis with an analysis of Cycle Zones To make it possible to account for a range of other factors beyond facility quality, we integrated the BQI analysis into the overall analysis of cycle zones.

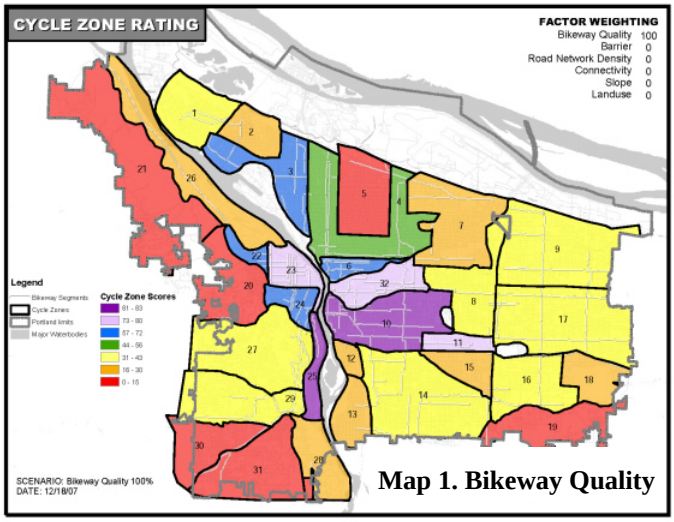
Findings

The Cycle Zone analysis provides us with four tools for assessing existing conditions and the potential of bicycling in Portland. First is a series of maps that rate conditions for cycling in each zone by the individual

metrics of bikeway quality, physical barriers, density of roadway network, street connectivity, land topography (slope) and land use. These are displayed in Maps 1-6. Next is a table (Table 6) to accompany these individual maps that displays the individual and overall rankings of each zone. Third is an Existing Conditions Map (Map 7) that combines the individual measurements for each zone into an overall cycle zone rating. This map reflects overall conditions for cycling in each area of Portland. The last tool (Map 8) is a map the removes the bikeway quality and barrier metrics from the equation and instead focuses only on street connectivity, roadway network density, land use and topography. This last map displays the relative potential of each cycle zone for increased bicycling.

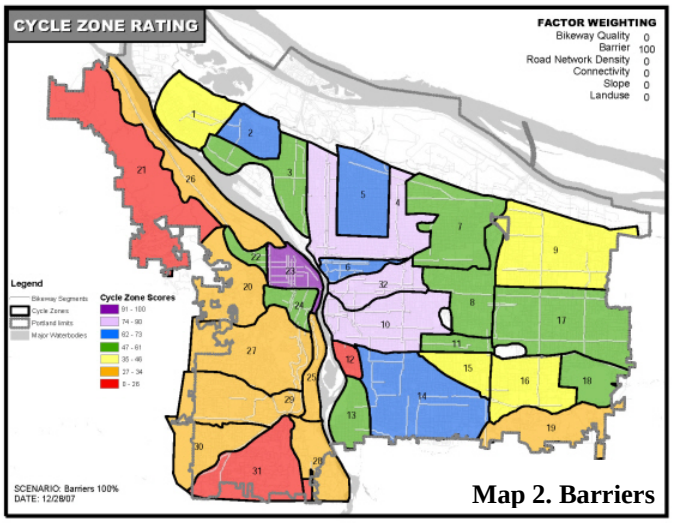
Individual Metrics

Map 1 shows the rating of each zone based on bikeway quality. The zones representing inner SE Portland and NW Portland, which contain a high concentration of bicycle boulevards, are rated the highest. Also high is South Waterfront, with ample bicycle lanes and low traffic volumes. Downtown and Lloyd District, with a relative high concentration of bikeways, also rate well. SW Portland, the NW Hills, East Portland, and deep Southeast Portland rate poorly for bikeway quality. In some cases this is due to a paucity of facilities. In the case of East Portland it is because the existing facilities are narrow bicycle lanes on high volume, high speed roadways.



Map 1. Bikeway Quality

Map 2 shows the rating of barriers. The Brooklyn neighborhood (Zone 12), bounded by McLaughlin Boulevard on two sides, Powell Boulevard to the north, and the Brooklyn Rail Yards to the east is among the worst in the city for barriers. Poor ratings in SW, NW and East Portland reflect either steep topography and/or large collector streets to cross with infrequent crossing opportunities. Areas of inner east Portland and NW Portland rate the highest due to flat topography, relatively small collector streets, and good connections across the Willamette River.



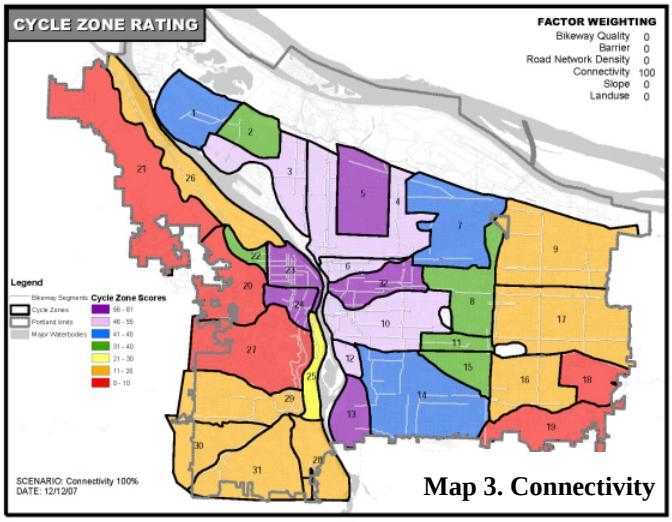
Map 2. Barriers

Map 3 shows the zones rated by the connectivity of the road network. High connectivity, in conjunction with a

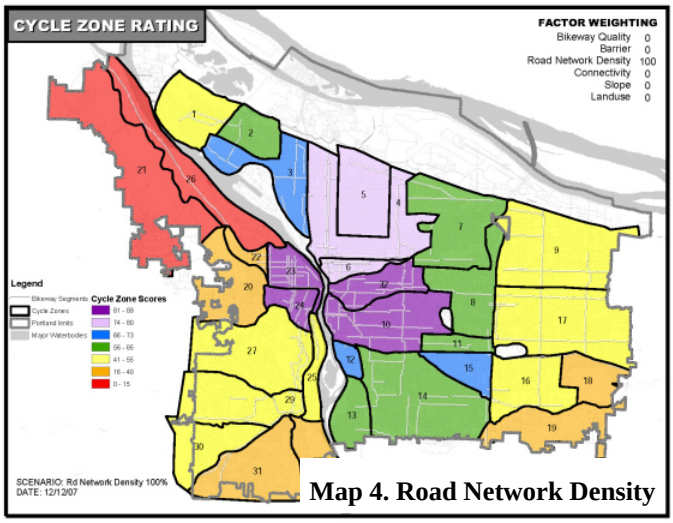
high density of roadways (Map 4) indicates opportunities for bicycling other than along collector streets. Inner N/NE, SE and NW Portland, where the roadways were laid out in a tight grid network, score the highest in these areas. East Portland and much of the west side, where the development pattern did not follow a grid, score lower.

Map 5 rates the relative slope in each zone. Most of SW Portland and the upper reaches of NW Portland score poorly due to steep and frequent changes in topography. The overwhelming majority of the area east of the Willamette River rates well for slope.

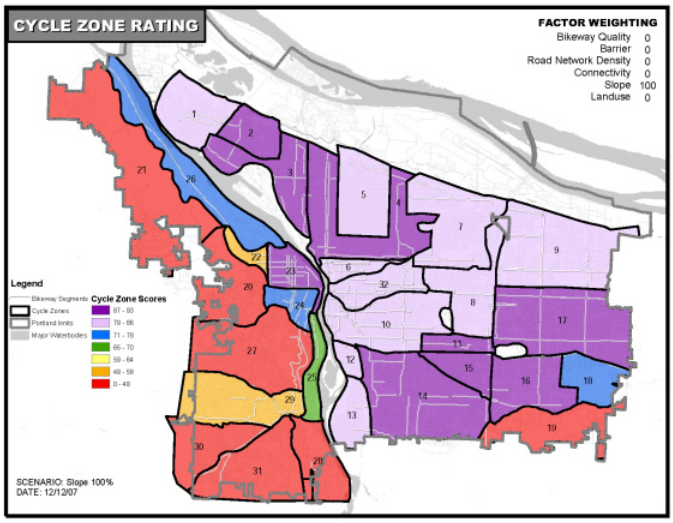
Map 6 rates land use patterns in each zone. This gives an indication of how far a person living within each zone must travel to obtain typical services within the zone and thus provides an indication of overall trip length. The Downtown (Zone 24) and Lloyd District (Zone 6) rate the highest. Most of the areas east of the Willamette and west of I-205 are mid range in terms of land use. East Portland, SW Portland, and far NW Portland comparatively display worse characteristics for land use.

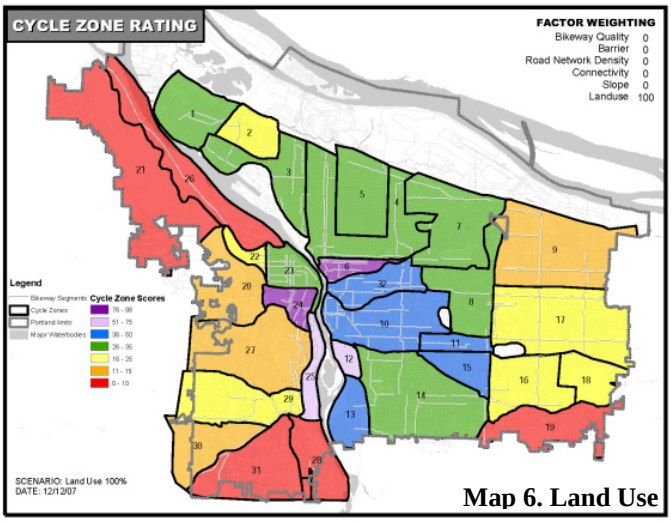


Map 3. Connectivity



Map 4. Road Network Density

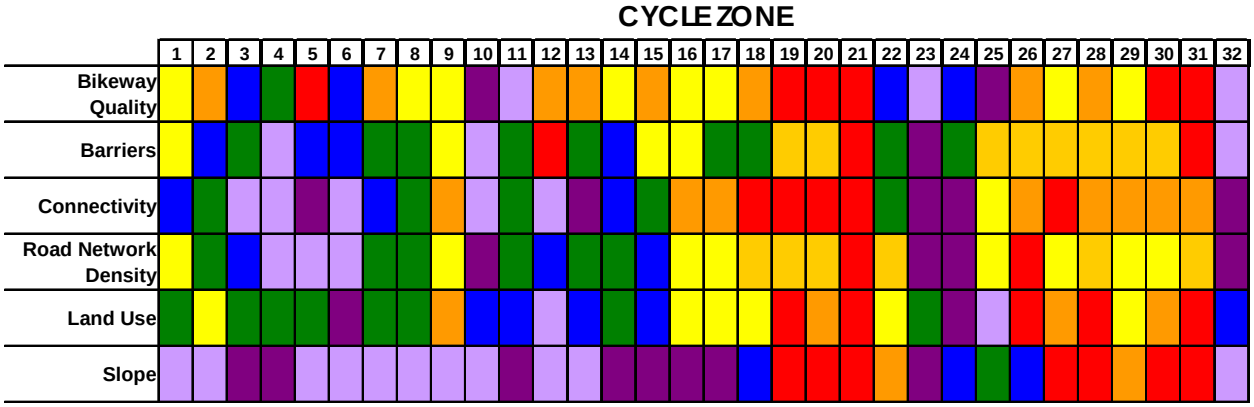




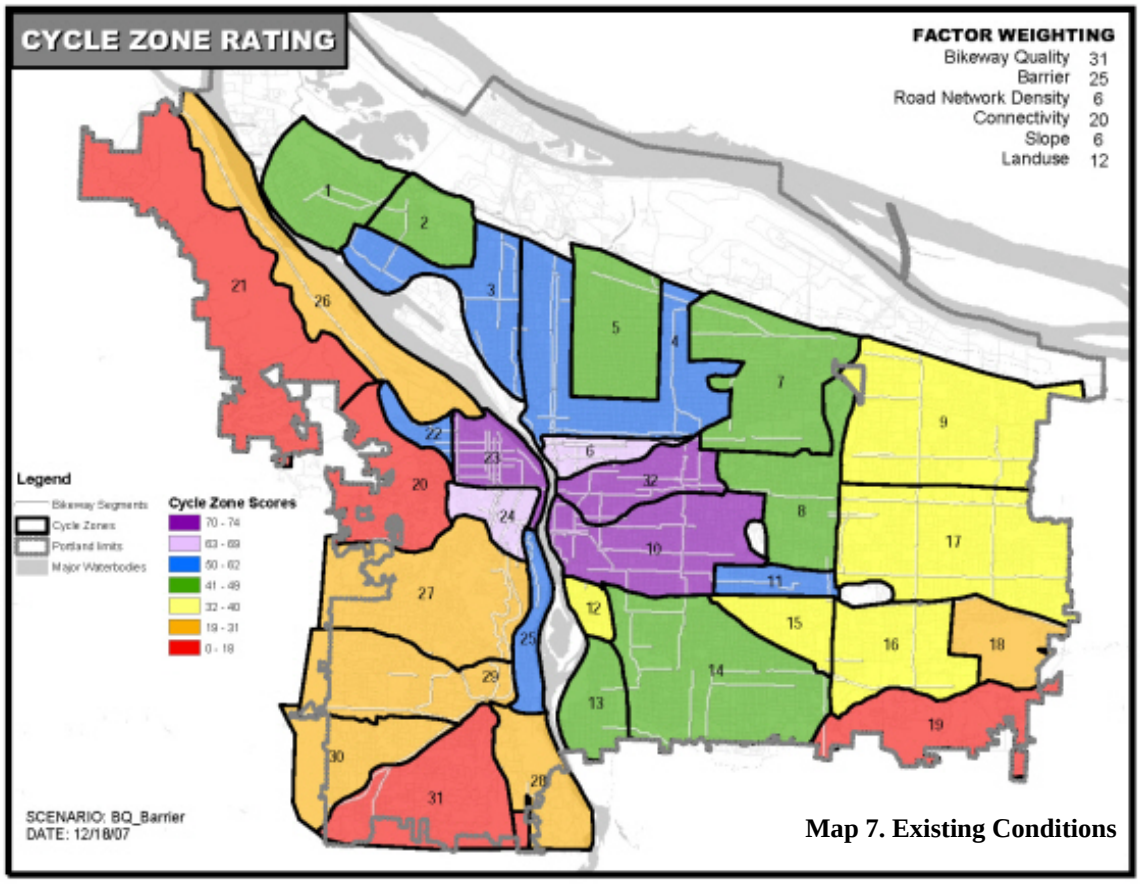
Map 6. Land Use

Table 6 displays the individual ratings for each cycle zone. It is illustrative to see how some zones score toward

the bottom in almost every category, some score in the top in many categories, and other zones score near the middle in each category. Following sections will describe in detail the opportunities, constraints and suggested treatments for each cycle zone based on this overall analysis.



Description of Existing Conditions



Map 7. Existing Conditions

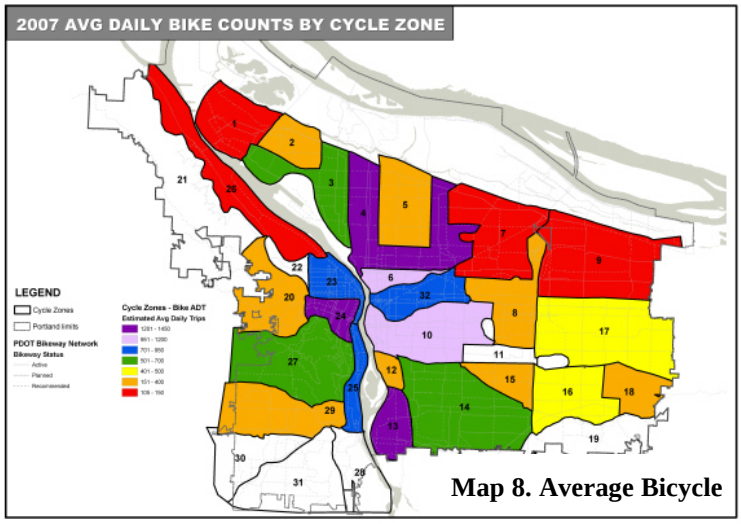
As seen above, there are a number of factors to consider when describing existing conditions for bicycling in Portland. Map 7 displays the overall Existing Conditions Map that takes and weights all these factors. Doing so

creates a range of ratings from best to worst in Portland. In considering this range it's important to note that these ratings are all relative to one another. "Best" just means best when compared to other areas within Portland. Similarly, those areas with worse characteristics for cycling in Portland are only so described in comparison to other areas throughout the city. These ratings do not necessarily mean that conditions for cycling are objectively poor. Cycling in areas of Portland that rate poorly in this analysis are clearly still comfortable and pleasurable for many cyclists. Similarly, areas that are rated among the best in Portland are found to want by many Portlanders because of conditions they subjectively perceive as uncomfortable or unsafe.

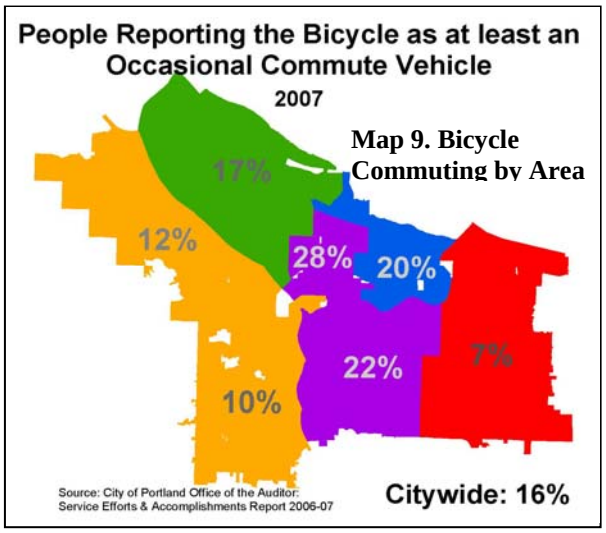
Not surprisingly, conditions for bicycling are best in those areas of Portland where the quality of the bikeway network is the highest, where street connectivity is the best, where the roadway network is the most dense, where physical barriers to bicycling are moderate to minimal, where land use is most integrated, and where slopes are minimal. As shown in Map 7, those areas comprise, or are adjacent to the central city. In contrast, those areas with the worst conditions for bicycling are the furthest from the Central City. It is in these areas, where topography (in the case of the west side), limited roadway network, poor street connectivity, limited commercial and retail destinations, significant physical barriers, and, perhaps most importantly, poor bikeway quality, all conspire against the quality of the cycling environment. In between the best and the worst, in a circular band ranging from Sellwood, along the western edge of I-205 and up through St. Johns, are areas where the cycling experience is intermediate in quality.

Cycle Zones and Bicycle Use

It is illustrative to observe how bicycle use lines up with ratings for existing conditions in each cycle zone. Maps 8 and 9 use the same color-coding schemes to describe bicycle use in different areas of the city. Map 8 shows the 2007 average for bicycle counts in each cycle zone (for which we have data; we're lacking data in 7 of the 32 zones). Map 9 displays data from the 2007 Service Efforts & Accomplishments Report, produced by the City



Map 8. Average Bicycle



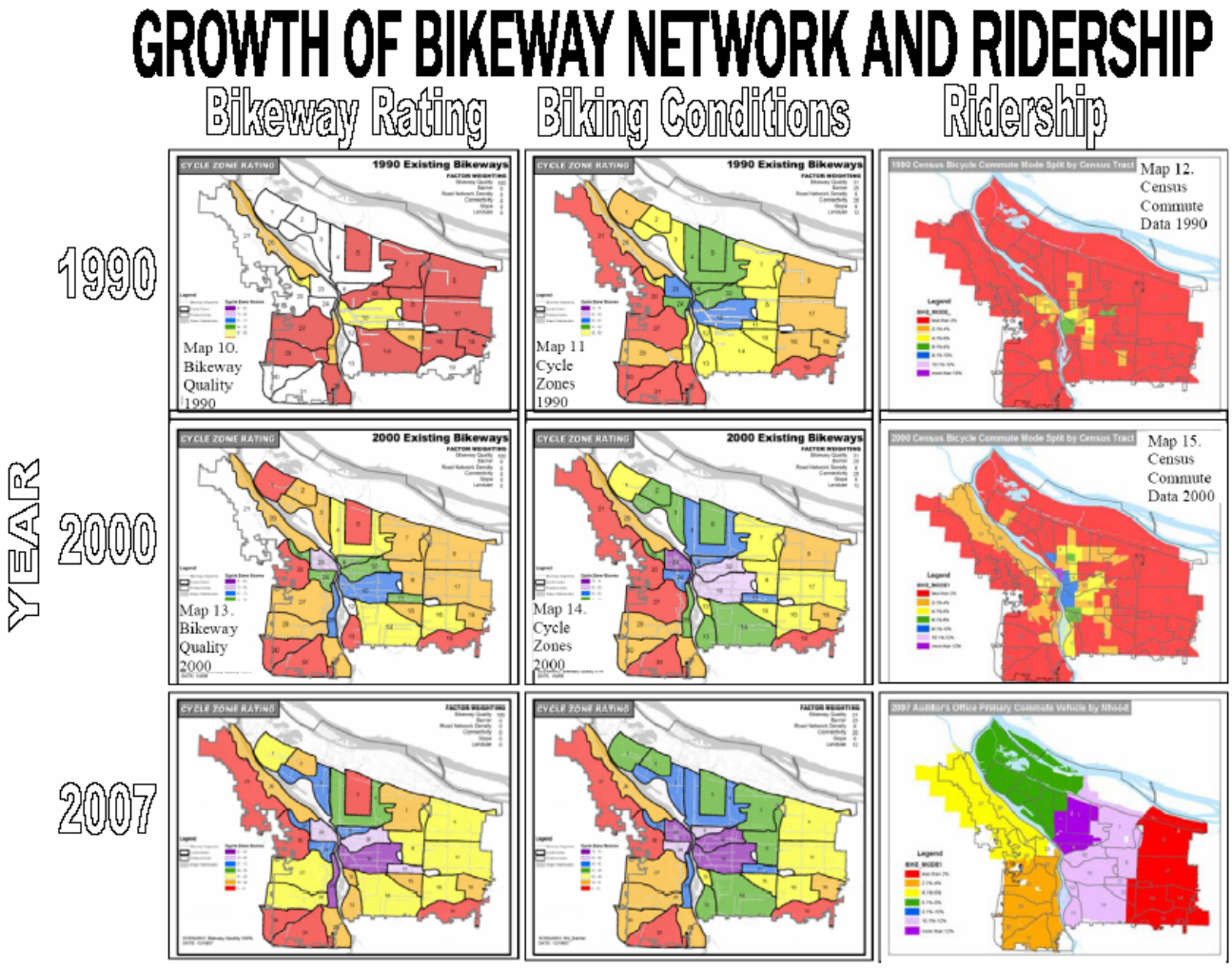
Map 9. Bicycle Commuting by Area

Auditor, reporting on the number of people in

Portland who use the bicycle as at least an occasional means of commuting to work. The Auditor's report breaks out the city in just seven main areas.

Comparing Map 7 (Existing Conditions) with Maps 8 and 9 we see general correlation between ridership and cycling conditions. Those areas of the city where conditions for cycling are the best generally have the highest levels of ridership and those areas with the worst conditions have the lowest ridership. Those areas intermediate for bicycling have intermediate areas of cycling. This finding is not unexpected. Rather, it endorses the notion of "build it and they will come, and they will continue to come." When Portland is able to create conditions conducive to bicycle transportation, then Portlanders ride in ever growing numbers. There is no reason to believe that replicating good cycling conditions across all cycling zones will not also produce high and growing levels of bicycle ridership.

One of the stories of bicycling in Portland has been "build it and they will come," which has most notably been demonstrated by comparing overall bikeway miles with central city ridership. Juxtaposing the conditions in cycle zones in 1990 and 2000 with what we know of ridership during those years is another way to tell that story. The



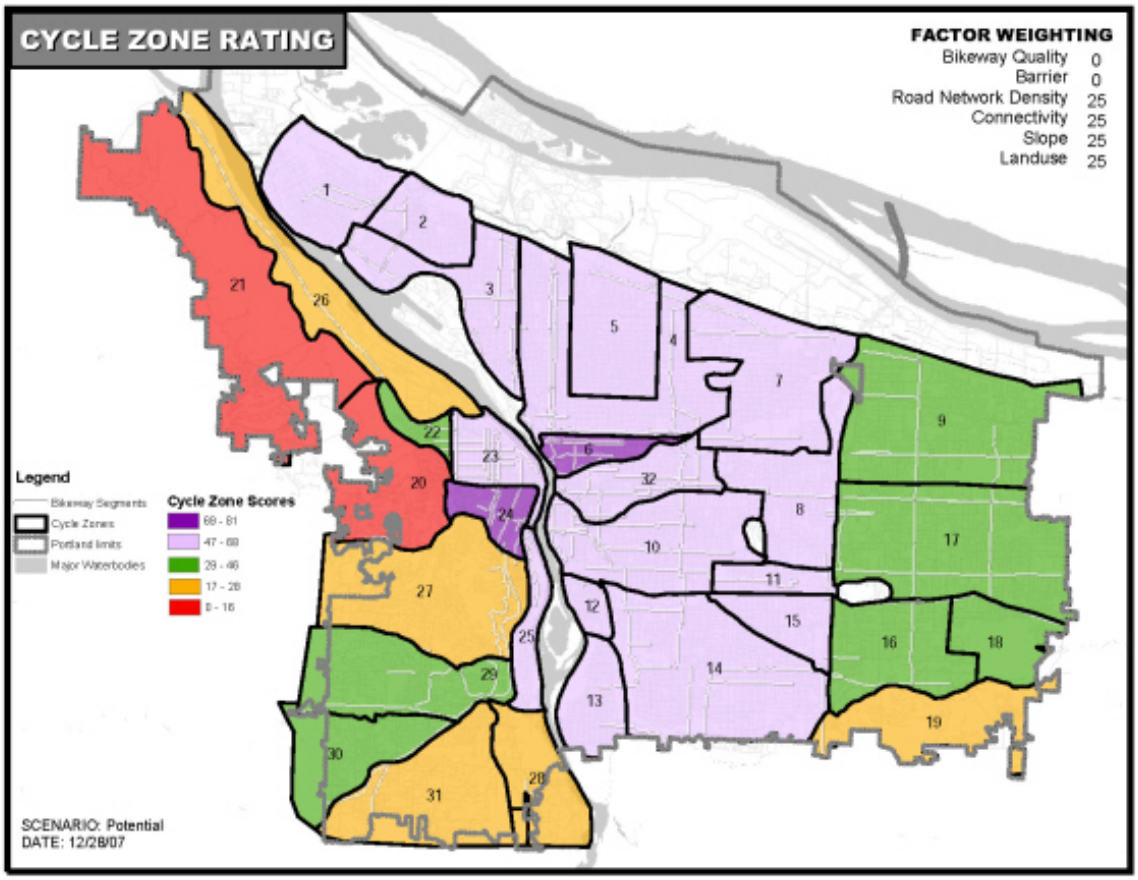
growth in ridership that follows improvements in these zones between 1990, 2000, and 2007 indicates that cycling activity follows improving cycling conditions in each zone. The message here is that if Portland can improve all cycling zones to the highest levels, then ridership will achieve and exceed the levels currently displayed for Central Portland in Map 9.

The above series of maps show bikeway quality, overall cycle zone rating, and census data on bicycle commuting by census tract for 1990 and 2000. Bikeway quality and overall cycle zone rating are based on the ranges defined in the 2007 analysis. In other words, the above quality maps reflect how we would rate the zones by bikeway quality and overall based on today's standards. For ease of comparison, maps 1, 7 and 9 are repeated here at the same scale.

There is no comparable census tract map for 2007. Our measurement of cycling activity is thus based on count activity in each zone and reports from the city auditor's office, as shown in Maps 8 and 9, respectively.

Assessing Bikeway Potential

In addition to describing existing conditions, the Cycle Zones Analysis lends itself to identifying those areas in the city with the most potential for advancing bicycle transportation. Removing consideration of "bikeway



quality" and "barriers" from the analysis of cycle zones, leads to a map of "Cycle Zone Potential," displayed in Map 16. These two elements—bikeway quality and barriers—are both within the ability of the City of Portland to address, given sufficient funding, adequate designs, and clear policy direction. Slope generally cannot be addressed; neither can the density of the roadway network nor street connectivity. Creating a dense, mixed-use land use is something on which Portland and the region is always working, so it can be addressed, albeit perhaps more slowly than can improvements to address barriers and the quality of the bikeway network.

The best potential for achieving the highest mode splits for bicycling is found in the Central City, and in those areas lying between the Willamette River and I-205. The Lloyd District and the Downtown, as the core of retail activity in Portland, are the areas with utmost potential for bicycling. East Portland, and much of SW Portland show moderate potential for making the bicycle a more important means of daily transportation, while other areas of SW Portland, and outer NW Portland are the areas with the least potential.

The following section will provide a more detailed discussion of the opportunities, constraints and suggested treatments for each of the 32 Cycle Zones.

Opportunities, Constraints, and Suggested Improvements

The Cycle Zone analysis lends itself to consideration of the factors that contribute positively and negatively to a zone's overall rating and to suggested improvements. This section discusses those factors zone by zone. This section is organized into three subsections, starting with those cycle zones displaying the highest potential, then those with middle-range potential and then those with the least potential. The suggested improvements are here limited mostly to what can be achieved by the Portland Office of Transportation, so the focus is primarily on facilities and encouragement. This is also a preliminary list appropriate for an existing conditions report. The Phase II report, which will comprise the bulk of the update of the master plan, will include more detailed suggestions for improvements to foster increased cycling.

Cycle Zones with the Highest Potential. Cycle Zones with high potential for bicycling are those 19 zones bordered by the Willamette River and I-205, as well as NW Portland, Downtown, and South Waterfront.

Table 7. Cycle Zones with Highest Potential

Cycle Zone	Opportunities	Constraints	Suggested Improvements

24	The Downtown and Lloyd District have the highest retail and employment density in Portland and are thus major destinations. These zones should be the most bicycle-friendly in Portland. These zones also benefit from moderate quality bikeways. The Lloyd District, in particular, is surrounded by the most bike-friendly and highest bike potential areas in Portland. The areas of highest existing ridership also surround it.	The bikeway quality in this zone tends toward moderate, as it's comprised mostly of bike lanes on higher volume roadways.	Improve bikeway quality by widening bicycle lanes and seeking more opportunities for low-traffic connections Create a denser network of bikeways Consider creating a "Bicycle District" so that all roadways in district can receive focused improvements Address barriers particularly at south end of zone. Focused, employment-based encouragement programs
6		The bikeway quality in this zone tends toward moderate, as it's comprised mostly of bike lanes on higher volume roadways. Barriers along the southern boundary at MLK, Lloyd at 7th and the 12th to Lloyd connection.	Improve bikeway quality as above Reduce barriers for entry to the district, particularly at the southern boundary both to SE Portland and the Central Eastside Focused, employment-based encouragement programs
1	Good roadway connectivity Quality of existing bikeways moderate to good Good land use potential	Barriers: St. Johns Bridge; Railroad cut Overall bikeway quality low due to low density of bikeways	Higher density of bikeways Improved crossings of railroad cut Dedicated bikeway on St. Johns Bridge
2	Good roadway connectivity and density Barriers are moderate Existing bikeways good	Density of existing bikeways low Land use mix not strongly supportive of short trips	Higher density of bikeways
3	Good bikeway quality and density, especially north-south	I-5 is a significant barrier with few good crossings	Improve conditions on Willamette Blvd (lower speeds / widen bike lanes) Improve crossings of I-5 Focused encouragement programs More east-west bikeways
4	High existing bicycle use Good connectivity and road density Barriers relatively insignificant Good quality bikeways with moderate bikeway density Good proximity to burgeoning commercial areas	I-5 is one significant barrier Aside from Tillamook, no east-west bikeways	Develop more east-west bikeways Widen existing bike lanes on Vancouver-Williams Focused encouragement programs
5	Excellent roadway connectivity and density Good proximity to commercial areas Barriers relatively minor	Essentially no developed bikeways in zone	Develop bikeway network in zone Focused encouragement programs
7	Generally good roadway connectivity	Density of bikeways is very low Quality of bikeways moderate at best	Develop bikeway network, particularly north-south connections Address barriers posed by Sandy & Halsey

		Sandy & Halsey are significant barriers	
8	Proximate to most bicycle-friendly areas in city Barriers are moderate, especially to west	I-205 presents a barrier Halsey Street overcrossing is poor Mt. Tabor presents localized barrier Burnside is only through bikeway	Develop more bikeways Emphasize connection to Gateway Improve Halsey Street overcrossing
10	Best cycling network in City Good connectivity and roadway density Good and growing supportive land use pattern Very high existing and growing ridership	Bikeway quality is lower at west end of zone Powell Blvd is a significant barrier	Improve quality of existing bikeways and develop to higher standard Focused encouragement programs Address bikeway deficiencies closer to river Address crossing of Powell
11	Good quality bikeway Good connectivity	Powell Blvd Absence of N-S bikeways Division St	Address crossings of Powell & Division Develop north-south bikeways
12	Excellent connectivity Excellent proximity to major central city destinations	Severe barriers to north, south, east and west Essentially no developed bikeways	Address barriers: bridge to Springwater; bike lanes on Milwaukie Take advantage of all opportunities to develop bikeways in zone, especially those that address barriers
13	Excellent connectivity Good land use pattern Benefits from Springwater Trail and direct connection it provides to Central City	McLaughlin Blvd is a big barrier to the north and east Poor bikeway network in zone	Fully develop Spokane & Umatilla bike boulevards in district Develop more comprehensive bikeway network, including north-south connections Better connections to Bybee Bridge
14	Moderate barriers Beginnings of a god bikeway network	Bikeway network too fragmented Woodstock gap	Shared lane markings for Woodstock Complete and link east-west and north-south bikeways
15	Good land use with Lents Good road network density Light rail line in Lents	Foster, Powell and I-205 are significant barriers	New crossing of I-205 Develop Foster Bypass bikeway Crossings of Foster and Powell Emphasize connections to Lents
23	Northwest Portland has high density of bikeways of relatively high quality Barriers are relatively minor Excellent street connectivity and density Good proximity to commercial areas	Bikeway network insufficiently dense to address density of land uses Difficult north-south access between Downtown and River District Breakdown of grid south of Burnside and west of I-405 complicates north-south travel Important bikeways are discontinuous	Better north-south connections Focused encouragement programs Flanders Street Bikeway with bridge across I-405
25	The South Waterfront area has a good and developing bikeway network with excellent connections to the north	Existing Greenway Trail to south is significantly sub-standard Connections from the river to Corbet, Lair Hill, Terwilliger are hampered by slope and insufficiency of bikeways	Modernize Willamette Greenway Construct South Waterfront Greenway trail Construct Gibbs Street overcrossing Focused encouragement programs

32	Well developed network of bikeways Porous barriers to south and east Strong land use pattern	Banfield is a barrier with limited crossing opportunities	Improve connection to Rose Quarter Improve connections across the Banfield to the Lloyd District Improve Coe Circle Focused encouragement programs

Cycle Zones with the Mid-Range Potential. Cycle Zones with mid-range potential for bicycling include seven zones that define much of East Portland, approximately half of residential SW Portland, and a small area of NW Portland.

Table 8. Cycle Zones with Mid-Range Potential

Cycle Zone	Opportunities	Constraints	Suggested Improvements
9	Proximate to Gateway Outline of bikeway network	Poor connectivity Bikeway network defined by narrow bicycle lanes on high-volume collectors Significant barriers presented by large roadways	Bikeway network requires significant improvements in order to create comfortable cycling conditions Develop wider bike lanes Seek opportunities to increase connectivity for bikeways in support of bicycle boulevards Improved and new crossings of I-205 beginning with Halsey Street Overcrossing to north and new bike-ped bridge in zone 16 Extend existing bike lanes, especially those that cross barriers
16	Proximate to Lents Outline of bikeway network		
17	Bikeway grid		
18	Springwater Corridor Trail Powell Butte as an attraction	Poor connectivity Powell Blvd bike lanes not comfortable for most users	Widen bicycle lanes on Powell Create connections to north
22	Proximate to area with good bikeway network Moderate barrier toward Central City	Small zone with barriers formed by topography and Hwy 30 Slope	Better wayfinding Focused encouragement programs
29	Existing network of bike lanes on major collectors Good existing bicycle use Multnomah Village and Hillsdale commercial areas	Poor connectivity and roadway density Steep in areas Major roadways as barriers Most bikeways not conducive to family-friendly conditions Topography will make widening improvements expensive and difficult Only existing bikeway is on high-volume roadway	Seek every opportunity for low-volume routes Seek alternate standards for bikeways Fill gaps in existing bikeways
30			

Cycle Zones with the Low Potential. Cycle Zones with low potential for bicycling include seven zones that define much of about half of SW Portland, the outer and upper NW Portland, and one zone in East Portland. Common to these zones are topographical challenges, significant barriers,

Table 9. Cycle Zones with Low Potential

Cycle Zone	Opportunities	Constraints	Suggested Improvements

19	Proximity to developing light rail lines	Severe topography Lack of connectivity Poor land use pattern	Improve access to Springwater Corridor Trail
20	Proximity to Central City	Severe topography Lack of connectivity	Develop bikeway along Sunset Corridor
21	Forest Park pathway and road system	Severe topography Poor connectivity	
26	Existing developed bikeway on Hwy 30	Significant barrier to west	Improve, or provide alternative to bike lanes on Hwy 30
27	Proximity to Central City Existing bikeways on Terwilliger and Barbur	Severe topography Poor connectivity	Improve connections to Central City Seek every opportunity for low-volume routes Seek alternate standards for bikeways Fill gaps in existing bikeways
28	College provides focused origin / destination Terwilliger and Tryon Creek provide some bikeway facilities	Severe topography Poor connectivity	Improve connections to Sellwood Improve Greenway Trail and connections to it Secure easement through cemetery Seek every opportunity for low-volume routes Seek alternate standards for bikeways Improve intersection of Terwilliger / Boones Ferry to improve access to / from Tryon Creek
31	Some through routes with potential for bikeway development	Severe topography Poor connectivity Significant roadway barriers	Improve access to Terwilliger and Barbur Blvd Seek every opportunity for low-volume routes Seek alternate standards for bikeways

Limitations of the Cycle Zone Analysis

The Cycle Zone analysis is a broad and somewhat blunt tool for assessing the strengths and needs of discrete areas of Portland. It is a combination of art and science. The algorithms used to define each of the six metrics are insufficiently sensitive to display the nuances within and between zones that can have a large impact on the quality of the cycling experience. Similarly, as this is the first time this analysis has been attempted, it has not benefited from a level of peer review necessary to more finely hone the tool.

The manner in which we determined the individual metrics was occasionally subjective, as was the relative weighting we ultimately applied in defining existing conditions for each of the zones. We similarly struggled to develop an objective measure to determine absolute and relative quality of the individual bikeways. This is significant, as bikeway quality is an important factor in the overall analysis. As noted earlier, much of our calibration of the model relied more on the “smell test” rather than on measuring conditions in the field.

The model is very data intensive. We gathered extensive data on bikeways (traffic volumes, speed, width of bike lanes, number of times bicycle lanes dropped, number of stops on boulevard routes, difficulty of collector street crossings), roadway connectivity, land use, barriers, etc. in order to develop the metrics. While a labor-intensive effort, this also produced a wealth of useful information, albeit also at somewhat of a gross rather than specific level.

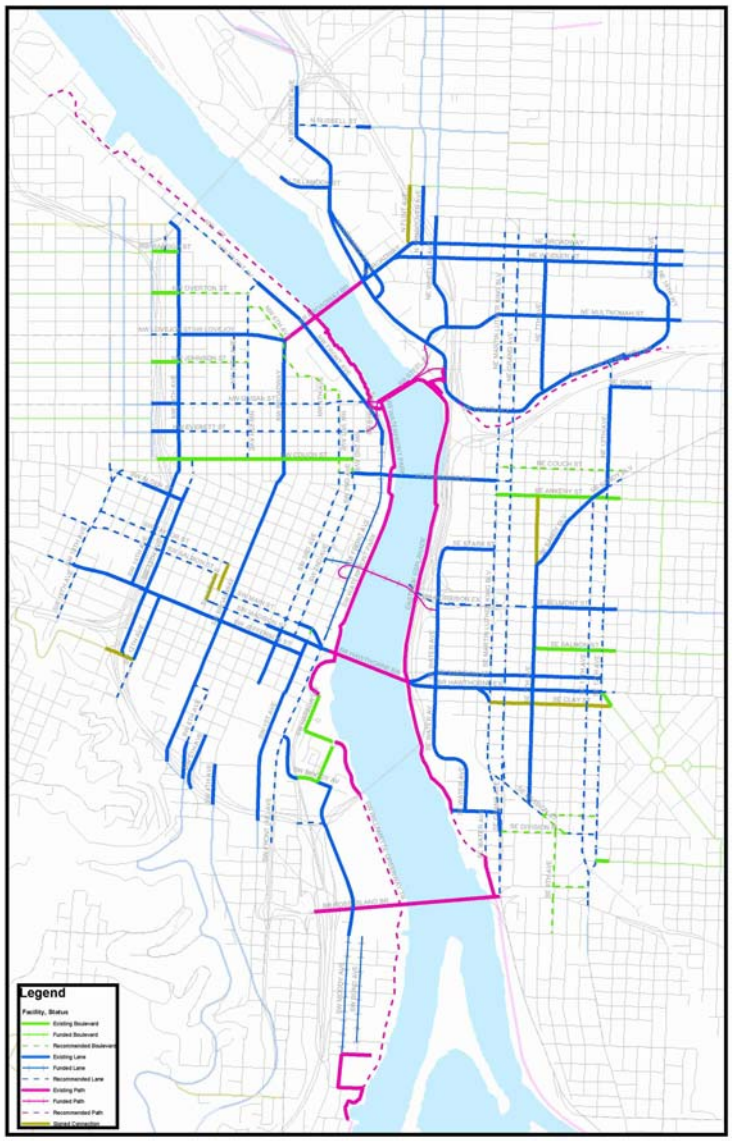
BICYCLES IN THE CENTRAL CITY

INTRODUCTION

Bicycle use in the Central City has steadily increased. Bicycle counts and mode split are higher than ever citywide and particularly high in inner Northeast and Southeast Portland. Many factors citywide have contributed to this increase; for these two neighborhoods especially important is their proximity to the Central City.

There is much in Portland's experience and current actions that point to the continuation of this trend toward increasing bicycle use. Indeed, Portland is poised for dramatic increases in bicycle volume in and near the Central City. Many pieces needed to accelerate this trend are substantially completed or close to completion. However, we still need much. What amounts to operational tweaks in a lot of places and more demanding effort in others still represents a significant departure from how we currently prioritize transportation. Nonetheless, the recommended improvements in this document are well within our capabilities to achieve. While bicycle use will continue to grow, the actions we take in the next three to five years will largely determine how rapid that growth will be.

Figure 8.1: Central City Bikeways in 2006



This chapter presents a beginning point for a focused, good, and long conversation about the future of bicycling in the Central City. Before collectively engaging in that conversation, let us first individually think about what we want that future to be. What do we want to see when we look at the Downtown, the Lloyd District, and the Central Eastside out our windows? How do we want our neighborhoods and commercial areas to look? How do we want to move about the city? How healthy do we want to be? Who do we want to be able to get on a

bicycle and ride? Where should they be able to ride? How would we ideally like to live in Portland? Whatever we collectively decide, Portland has the knowledge and experience to truly and widely make the bicycle a prominent part of daily life in Portland.

Bicycle use in Portland's Central City has steadily increased. This increase is strongly correlated to the development of bikeway miles and other investments in the city's bikeway network. According to the City Auditor's Office, bicycle commute mode split citywide was 4.2 percent in 2004-2005. The rate is significantly higher in inner NE Portland (9.1 percent) and inner SE Portland (6.2 percent)[1]. These higher numbers likely result from a number of factors, not the least of which is their proximity to the Central City. Based on available data, which indicates acceleration in the increase in the rate of bicycle use the past two years, bicycle use will continue to increase in Portland's Central City, especially insofar as we are able to provide the facilities and knowledge that attract Portland residents to bicycling.

A number of other factors will contribute to an accelerating increase in bicycle use and/or desire to use bicycles in the Central City, including:

- increasing gas prices
- increasing congestion
- increasing density
- increasing awareness of the relationship between health and activity
- continued mixed use land development
- continued promotion of bicycling at all levels of society

Further influencing the future of bicycling in Portland is the city's resolve to become a "Platinum Bicycle Friendly City", as certified by the League of American Bicyclists, and to become a world-class bicycle-friendly city. These factors, influencing the actions and desires of individuals and the actions of city government, will all contribute to an increased demand by residents on the City to address their safety concerns in regard to bicycling.

Portland's Central City is also increasingly becoming a place where people live and play and not just work. There will be more non-work trips to the Central City over time that will create more demand for better bicycling conditions into and through the Central City.

It will be challenging for Portland to increase bicycle use in the Central City to world-class levels. To do so will require taking dramatic steps to improve the reality and perception of cyclist safety, and to make bicycling a preferred means of travel for more city residents. An overwhelming majority of Portland's inner city residents own bicycles (approximately 73 percent in inner NE and SE neighborhoods),[2] and while our ownership and ridership is high by American standards, it does not yet approach levels that would qualify Portland as a "world-class" bicycle friendly city. However, focused and relatively modest investments in both facilities and promotion would successfully continue the trend toward accelerating growth in Central City bicycle trips.

[1] Office of the City Auditor, "City of Portland Service Efforts and Accomplishments: 2004-05", November 2005.
[2] Data from Transportation Options survey on Smart Trips programs in NE and SE Portland.

Portland's standard bikeway facilities consist of bicycle boulevards, on-street bicycle lanes, and off-street paths. However, these standard facilities have neither been seen to be feasible, nor, because of trade-offs associated with their implementation, always advisable in all areas of the Central City. Based on traffic volumes and street classification, bicycle lanes are currently the recommended bikeway treatment for Downtown City Bikeways. However, in areas of the Downtown where traffic is progressed at slow speeds, the topography is flat, the short blocks offer constant opportunities for turns, and parking turnover is high, the city's Bicycle Advisory Committee (BAC) has historically been unable to reach consensus about striping bicycle lanes on most Downtown City Bikeways. Where they have reached consensus is on the striping of bicycle lanes on uphill Downtown streets. These streets, they have concluded, should be striped.

Programs like Bike Central or BikeStation© are designed to provide secure, long-term bicycle parking in areas where parking is deficient. Bike Central is a program established by PDOT in partnership with independent athletic clubs in the Central City. Following the initial capital investment by the city for bicycle parking and clothing lockers, and an initial outlay for advertising, the program was designed to be operated by each participating club. It is a membership program with each club receiving all revenue. Bike Central provides not only bicycle parking, but also access to showers and changing facilities. It serves the commuting cyclist who does not or cannot ride in normal work attire.

BikeStation© is a franchise business that has established long-term bicycle parking in five West Coast jurisdictions. Its operating model requires a partnership, typically with a public agency, to provide the needed subsidy for operation. BikeStation© is a heavily subsidized program. Its operation includes sale of services other than bicycle parking—most notably bicycle shop sales and services. Unlike Bike Central, the BikeStation© does not include showers or changing facilities. It seems to operate best in an area with a high density of cyclists and a lack of other options for secure bicycle parking.

Good progress has been made in implementing bikeways in the Central City. There are approximately 146 miles of roadway in the Central City. Of these, 62 miles are classified as either City Bikeway or Off-Street Paths. Of these 62 miles, 34 have been developed as bikeways, including 2.3 miles of bicycle boulevards, 21.8 miles of bicycle lanes, 8.9 miles of off-street paths, and 1.2 miles of signed connections. Based on these numbers, and excluding the off-street paths, approximately 17 percent of Central City roadways carry a bicycle treatment and approximately 33 percent of Central City roadways are slated to receive a bikeway treatment.

Figure 8.2 displays the success in completing the networks of facilities feeding the four bicycle-friendly Central City bridges. Figure 8.3 display a solid correlation between the completeness of the facilities feeding these bridges and increasing ridership.

The concentration of employment and/or retail in the Downtown, Lloyd District, Central Eastside, and Lower Albina contribute to make the Central City the region's primary commute destination. While the entire Central City should have excellent bicycle facilities, the Downtown, as the pre-eminent focus of central city employment and retail, should present conditions to local residents that especially facilitate and encourage the increased use of bicycles. Such conditions would go a long ways toward encouraging increased bicycling by the approximately

280,000 Portland residents (2000 Census) who live within three miles—or an 18-minute, slow-paced bicycle ride—of the Central City.

Figure 8.2: Bikeway Facilities Feeding the Four Bicycle-Friendly Central City Bridges

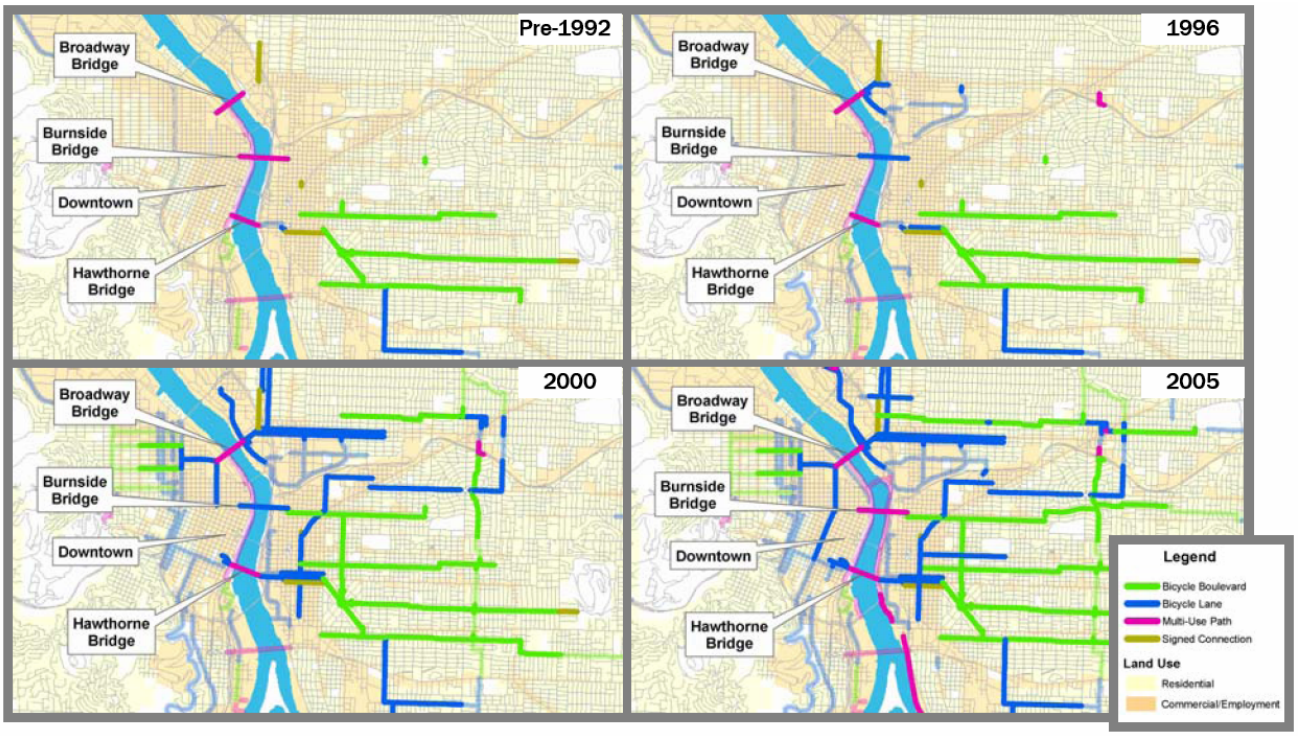
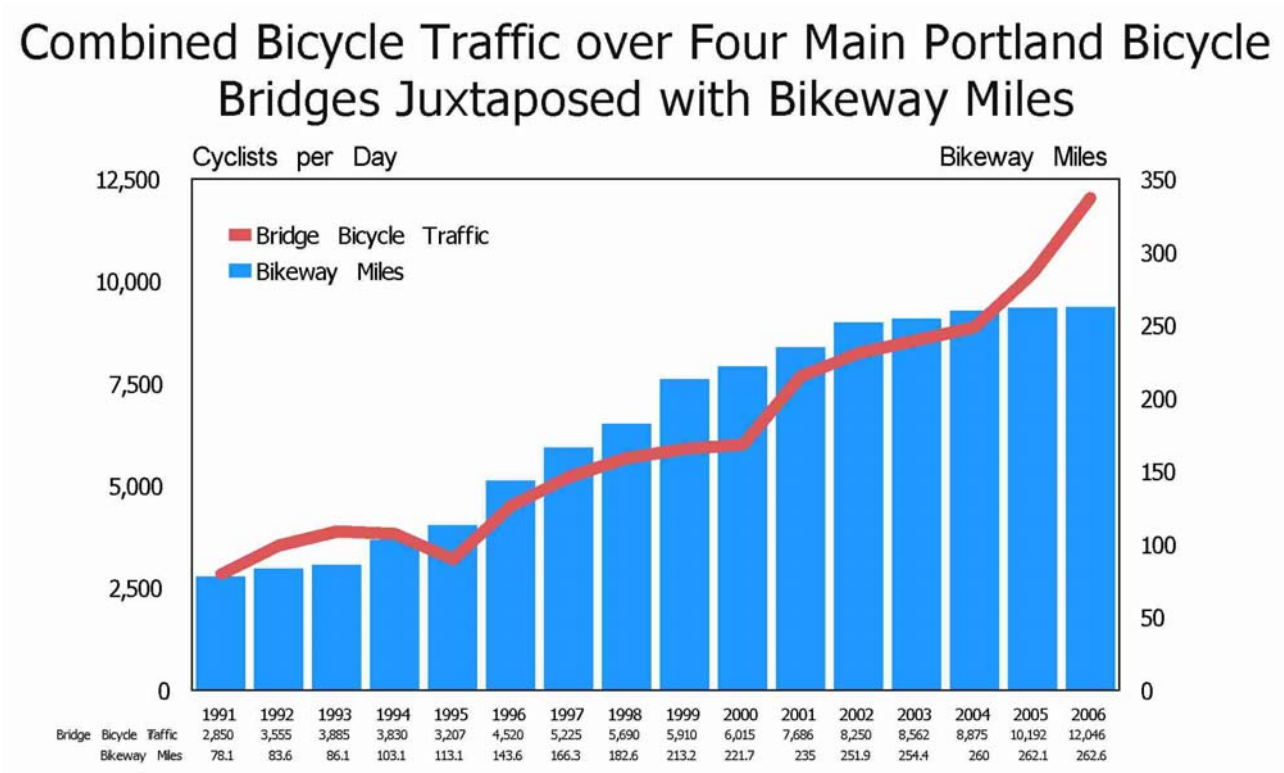


Figure 8.3:



Bicycling Issues in the Central City

Because of an urban form generally favorable to bicycling in and near the Central City, including: high population density, a developed grid network, and short trip distances, increasing bicycle mode share in Portland's Central City is crucial to Portland achieving its overall goal for increased bicycle mode share. Portland must therefore endeavor to create in the Central City a supremely bicycle-friendly and encouraging environment for cyclists of all skill levels. Creating this type of environment will require facilities in which a relative novice cyclist will feel safe, traffic conditions that are conducive to young children and older adults cycling, ample parking to serve short and long trips, and programming Central City space to encourage and promote bicycling. Essential to achieving this must be a mindset among Central City stakeholders that welcomes and embraces increased use of bicycling—not born from a sense of obligation at achieving the city's stated goals, but born from a recognition and understanding that increased bicycle use in the Central City has true and deep benefits for all.

Cycling Conditions in Downtown

Many of those who consider riding, or who would like to ride to Downtown, or who have ridden Downtown in response to the development of bicycle facilities surrounding the Downtown report that they feel abandoned once they reach the Downtown. Most experienced riders are comfortable sharing many of the Downtown streets with automobiles. There are multiple travel lanes, speeds are generally slow (travel signals are timed to 12 or 16 mph, depending on time of day). Nonetheless, the sheer volume and noise of cars, not to mention the unpredictability of motorists and the vulnerability of cyclists, creates conditions that are not conducive to the lesser skilled or less confident cyclist sharing high volume travel lanes.

Table 8.1. Central City Bikeways (Miles)

Status	Boulevards	Lanes	Paths	Signed Connections	Totals
Existing	2.3	21.8	8.9	1.2	34.3
Funded	0.0	1.6	1.0	0.0	2.6
Recommended	2.8	18.0	4.4	0.0	25.2
Total	**5.1**	**41.4**	**14.3**	**1.2**	**62.1**

On the other hand, because much of Downtown is quite rideable for experienced cyclists under shared lane conditions many experienced cyclists would prefer to not be relegated to a specific space on the roadway. Cyclists sharing travel lanes are able to avoid conflicts with motorists turning either at intersections or into or out of parking structures. Cyclists in travel lanes can also easily set themselves up for both left and right turns on the short city blocks that typify Downtown. Cyclists are also best able to avoid conflicts with parking maneuvers (including motorists opening their car doors into bicycle lanes) when "taking the lane," i.e., riding in the middle of a shared travel lane.

That said, bicycle lanes create a sense of space for cyclists—clearly defining an area of the roadway where cyclists have the right of way. Lanes also allow cyclists to bypass congested Downtown traffic, though an

amendment to ORS 814.430 that went into effect in January, 2006 allows cyclists to pass automobiles on the right even in the absence of bicycle lanes.

Because of these issues, the City's Bicycle Advisory Committee has generally been evenly split on the question of striping bicycle lanes in the Downtown, except on uphill streets where they have reached a consensus opinion that bicycle lanes offer enough of an advantage that they should be striped uphill. This discussion and considerations, which are not unique to Portland, point to the challenge of developing treatments that create for cyclists the same type of comfort and ease they experience in approaching the Downtown on developed bikeways without unnecessarily limiting the movement of cyclists while traveling through the Downtown.

Whether or not to stripe bicycle lanes in Portland's Downtown has been the subject of frequent discussion among PDOT staff, the City's Bicycle Advisory Committee, and among advocates and the general population of cyclists. The pros and cons shown in Table 8.2 summarize the tradeoffs associated with striping bicycle lanes on Downtown streets.

Table 8.2: Pros & Cons of Dedicated Downtown Facilities

Providing Bicycle Facilities		Not Providing Bicycle Facilities	
PROS	CONS	PROS	CONS
• Provides dedicated roadway space for cyclists • Largely keeps inexperience cyclists away from flowing automotive traffic • Clearly indicates to motorists and cyclists about expectations of how to use Downtown roadways	• Without parking or lane removal, bicycle lanes will be narrower than desired • Places cyclists in conflict with car doors • Places cyclists in conflict with turning movements at garages and intersections	• Allows cyclists to "take the lane" • Cyclists can position themselves out of the door zone • Cyclists can more easily avoid conflicts with turning motorists • Cyclists can use the middle travel lane, which has least amount of friction with automobiles	• Does not address concerns of less-experience cyclists, who represent majority of Portland residents • Does not provide clear direction for cyclists and motorists • Cyclists cannot always keep pace with traffic speeds

Where bicycle lanes are striped, inexperienced cyclists feel welcomed; whereas, experienced cyclists feel constrained or even unsafe.

Solving the problem will require either new techniques and approaches—including striping wider bicycle lanes—or a reprioritization of traffic management schemes in order to create conditions in which cyclists of all skill levels and abilities will feel confident and secure.

The approach will necessarily need to be multi-disciplinary and likely highlight education and enforcement, as well as development of facilities. One such approach is found in San Francisco. That city, with limited roadway width, has undertaken wide implementation of shared lane markings. As of August 2006 they have installed more than 1,000 such markings on over 500 block faces. While analysis of this treatment demonstrated that it achieved its goal (i.e., more room between cyclists and automobiles in a shared lane), it is not yet evident that this treatment

will provide a level of security and comfort that will attract to bicycling those people currently uncomfortable riding in a shared travel lane.

Access between the Central City and North and East Portland

Bicycle access to the Downtown from North, Northeast, and Southeast Portland has improved greatly over the years. The number of bicycle commuters who daily cross the four main bicycle-friendly Willamette River bridges reflects this. However, among these bridges are differences in the quality of the bikeway connections and facilities, and this is indicated by the relative change in ridership across these bridges.

Facilities on the Broadway, Steel, and Hawthorne bridges are off-street shared pathways with well-engineered roadway connections. The bikeways on the Burnside Bridge are on-street bicycle lanes. There is a qualitative difference between on-street and off-street facilities on bridges. Motor vehicle speeds on the bridges tend to be higher than on adjacent surface arterials. This occurs because bridge spans do not provide the cues to slow traffic that one finds on arterial streets, including: frequent signalized cross-street, on-street parking, pedestrian activity, and close-in store fronts and trees, among others. Because of the higher speeds on bridges (reflected by the generally higher posted speeds on bridges compared to nearby surface streets), and relatively narrow bicycle lanes (five-foot wide on the Burnside), on-street facilities on bridges provide a lower quality of cycling experience than do the wider shared-use paths found on most bridges. In addition, while the networks feeding the Steel, Broadway and Hawthorne bridges are relatively complete, access to and from the Burnside Bridge at both ends is interrupted and substandard. The relative worse conditions leading to/from and on the Burnside are reflected in the essentially flat number of bicycle trips on this bridge compared to its peers.

A multi-use path will be constructed along the south side on the Morrison Bridge in 2009. Integration of this facility into the city's bikeway network will be a bit awkward at both ends of the bridge—particularly at the west end—but should still work effectively, if not necessarily efficiently.

Access to and from the Ross Island Bridge is awful. There are no direct developed surface bikeway connections at either end. The surface connections that do exist are not bicycle-friendly. The facility on the bridge itself is a significantly sub-standard shared pathway along the north side of the bridge. Next to the Morrison Bridge, the Ross Island Bridge sees the lowest volume of daily bicycle trips. The Ross Island Bridge sees more cyclists than the more centrally-located, but equally poorly appointed Morrison Bridge simply because the next nearest bridge—the Hawthorne—requires an approximate two-mile detour.

Ross Island (East End) – Shared Use Sidewalk

Naito Parkway will be striped with bicycle lanes from Davis Street to Jefferson Street as part of the rebuilding of that roadway. This will facilitate bicycle connections between the

Steel Bridge and Downtown. However, the project will leave a gap in bicycle lanes between Davis Street to just north of the Steel Bridge, where there are existing lanes. Filling in this gap will be crucial to realizing the full usefulness of the Naito Parkway bicycle lanes, as will creating a signalized crossing of Natio at Glisan, as has been previously proposed.

Access between the Central City and Northwest Portland

The primary bicycle access into Downtown from NW Portland is via NW 19th Avenue to SW Alder. Four bicycle boulevards feed NW 19th from the west (Flanders, Johnson, Overton, and Raleigh). Of this route, only SW Alder is within the Central City boundaries. Because of demands of motorized traffic, the bicycle lane is missing for approximately one-half mile between NW Hoyt Street and SW 16th Avenue. Such dropped bicycle lanes are among residents' chief complaints about Portland's bicycle network as this practice places cyclists in a shared lane environment where our guidelines call for a dedicated bicycle lane.

The City is currently testing shared lane pavement markings in this area (known as "sharrows") to see if they effectively create bicycle lane-like conditions on the roadway without either reducing traffic capacity or eliminating on-street parking. Results from the test will be available within one-two years.

Bicycle connections out of the Downtown into NW Portland are fractured. NW Couch would be an effective route if recommendations made in the Northwest Bikeways Project had been implemented.[3] NW 14th Avenue provides connections to the east-west bicycle boulevards that run through NW Portland. Gaining access to NW 14th Avenue from the Downtown requires riding uphill in a shared lane, high volume environment. Such conditions are not desirable or particularly bicycle-friendly to less-than-experienced cyclists.

Access between the Central City and Southwest Portland

Connections between Southwest Portland and the Central City are among the most challenging for cyclists in Portland. There are two main access points for cyclists from SW into the Downtown: SW Barbur to 4th Avenue, and SW Terwilliger to 6th Avenue. Where there are bicycle facilities on SW Barbur and SW Terwilliger/6th, the bicycle lanes soon drop upon crossing the I-405 overcrossing[4]. Cyclists face two main challenges in the area between the drop of the bicycle lanes and the beginning of slowly progressed traffic. First, cyclists must merge out of the ending bicycle lane into a higher-speed travel lane. This merge occurs in an area where freeway off-ramp traffic is entering the roadway to the cyclists' right. Second, motorists tend to travel at a higher rate of speed at the southern end of downtown as the every-block signal pattern has not yet started with its attendant 12-15 mph progression.

There are also three primary egress points for cyclists out of the Downtown to Southwest Portland: SW Broadway, providing access to either SW 6th/Terwilliger or SW Barbur, SW 5th Avenue, and SW Jefferson providing access to neighborhoods west and north of Washington Park. While the connection between Broadway and 6th/Terwilliger is consistently striped with bicycle lanes, that is not the case leading to Barbur. Nor is it the case leading from 5th to either 6th/Terwilliger or Barbur. The bicycle lanes on 5th Avenue end at Broadway, and

[3] That plan called for a crossing treatment of Couch at Broadway and a treatment to facilitate westbound access across the I-405 ramps and NW 16th Avenue. The lack of this second treatment makes westbound travel on Couch difficult.
[4] In the case of SW 6th Avenue, the bicycle lane drops briefly after crossing SW Broadway, and picks up again, briefly, on the overcrossing.

there is no convenient means for cyclists to cross to 6th/Terwilliger as the most direct crossing of the intersection is diagonal. Similarly, there is no bicycle facility that brings cyclists from either Broadway or 5th to Barbur Boulevard. SW Caruthers and SW Sheridan are classified as City Bikeways, though facilities are not developed on either. SW 5th south of Broadway is not classified as a City Bikeway.

River District

The bikeway network breaks down in the River District. While a number of roadways are classified as City Bikeways, only NW Broadway, NW 14th, NW Lovejoy (between the Broadway Bridgehead and NW 14th) and NW Couch are considered developed. Connections between the River District and the Downtown are difficult. NW and SW Broadway provide a developed north-south bikeway in the area, but Couch Street is the only east-west bikeway running in the River District that connects to Broadway, and there are no other north-south bikeways in the district that connect to Couch.

NW Lovejoy Bike Lane (Facing South)

While 9th Avenue is classified as a City Bikeway, it lacks the required facilities (bicycle lanes). Many cyclists make use of 10th and 11th avenues, but these streets are not classified as City Bikeways and do not include any bicycle facilities. In addition, they present cyclists with the additional challenge of right-running streetcar tracks. Many crashes of cyclists on the trackway have been reported to PDOT.

Everett and Glisan are currently classified as City Bikeways, though the NW Bikeways Project, undertaken in the late 1990s, developed Flanders and Johnson as alternatives to the two arterial streets as opportunities to stripe them with bicycle lanes did not extend beyond the boundaries of 14th to 19th avenues.

NW Naito/NW Front has long been recognized by NW Portland's cyclists to be the quickest bicycle connection between Downtown and NW Portland. Facilitating this connection will require filling the gaps on Naito Parkway between NW Davis and the bicycle lanes north of the Steel Bridge, as well as the gap on Front Avenue between 9th and 15th avenues.

Central Eastside

Bicycle access to the Central Eastside is generally well provided for by a network of bicycle boulevards, on-street bicycle lanes, and the Eastbank Esplanade. The most pressing bicycle issues for this district are access from close-in neighborhoods to the south (notably Brooklyn Neighborhood), access through the district from the Clinton Bikeway to the Springwater Corridor, access to and from the Burnside Bridge, and access and adequate facilities on the Ross Island Bridge.

With development of a solid connection to the Eastbank Esplanade through the Clay Street right-of-way west of Water Avenue, the City Bikeway classification on Clay Street should be extended west from its current terminus at SE Martin Luther King Jr., Boulevard.

South Waterfront

South Waterfront is ideally positioned and planned to emphasize bicycle transportation to the Downtown. The striping of bicycle lanes on Moody and Bond and the development of the planned Willamette Greenway, combined with its proximity to Downtown should result in high transportation-related and recreational bicycle use in the district.

Downtown

As the primary retail and employment district in the region, the Downtown should be supremely friendly to cyclists of all skills and abilities.

Conditions in the Downtown generally lend themselves to adequate cycling conditions for more skilled cyclists, as noted above. Where bicycle lanes have been striped on Downtown City Bikeways they have often been narrow—generally at 4.5 feet—because of the demand for travel lanes and on-street parking. For these reasons, bicycle lanes have not been universally embraced as a treatment for Downtown streets.

However, new tools are being developed for bikeways, including shared lane travel markings and bicycle scramble signals, and existing tools that have been lightly used—such as “bicycle boxes” (advanced stop lines)—may find useful application in the Downtown. To make these tools available on Downtown streets, to highlight Portland’s commitment to creating a world-class bicycle-friendly city for all residents, and to ensure the widest possible source of funding opportunities, the City Bikeway classification needs to be greatly expanded in Portland’s Downtown.

The current City Bikeway classifications in Downtown do not provide sufficient access to all areas of the Downtown. Northbound access to the Broadway Bridge is not well provided for, nor is eastbound access paralleling Jefferson Street from the corner of SW Portland. There are currently no east-west classifications serving the pathway to be constructed on the Morrison Bridge and access to and from the Burnside Bridge is difficult. Similarly, north-south access between the River District and Downtown is very limited as currently classified and does not reflect existing travel patterns.

Creating a Downtown “Bicycle District” would signal the City’s intent to make the Downtown supremely bicycle friendly and allow all current and developed bicycle operation tools to be used throughout the Downtown.

Lloyd District

The Lloyd District generally has good bicycle access to and good mobility within its boundaries. However, there are both mobility and access issues for cyclists coming to and moving within the district. Access from the south into the Lloyd District is limited by the Banfield Freeway. Because of the freeway there are only limited access points to the district: the Eastbank Esplanade, the Martin Luthur King, Jr. Boulevard-Grand Avenue couplet, and

12th Avenue. MLK-Grand, though classified as City Bikeways, do not have bicycle facilities on them and have no identified plans to include them. The Eastbank Esplanade works well for getting to the Rose Quarter, though past that the connection into the District is awkward for a couple of reasons. The first is the lack of a direct connection to both the Vancouver-Williams Bikeway and to the Broadway-Weidler Bikeway. This can be addressed by creating a direct bicycle connection through the Rose Quarter Transit Center. The second is that eastbound left turns are not permitted onto NE 7th Avenue from NE Holladay Street.

Access via NE 12th Avenue is similarly problematic. The bicycle lanes on 12th drop on the structured overcrossing of the Banfield Freeway. The narrow curb-to-curb distance and the presence of four travel lanes preclude the striping of bicycle lanes on this segment between Irving Street and Lloyd Boulevard.

Mobility within the Lloyd District is hampered by the lack of north-south facilities. Currently, NE 7th Avenue is the only street that crosses the district north to south. This street is not the logical connection between the crossing of the Banfield Freeway at 12th as it is not the first through street that cyclists cross when traveling south to north. Rather, NE 9th Avenue provides the first avenue to continue north through the district. Ninth Avenue also provides direct access to Lloyd Mall, which is a major attractor and employer in the district. Mobility within the district is also hampered by a direct connection between the Vancouver-Williams and Broadway-Weidler Bikeways and the Eastbank Esplanade.

Goose Hollow

SW Jefferson Avenue currently provides a good westbound connection between the Downtown and Goose Hollow. There is no comparable eastbound connection. While Salmon Street carries a City Bikeway classification (to the Parks Blocks), it has not been developed as a bikeway. A challenge for this area is to provide a functioning connection to the Downtown.

Lower Albina

Bicycle lanes on N Interstate and Russell Street provide bicycle transportation to and through Lower Albina. While the bicycle lanes on Russell do not connect directly with Interstate Avenue, the automotive volumes and speeds on Russell are low enough that an alternate treatment—such as shared lane markings—will likely suffice.

The most significant issue for Lower Albina is extending bicycle access along N River Street, into the Albina Yards, and eventually to and past Swan Island. Portland Parks and Recreation has long considered that project, and it is currently being explored through the Bureau of Planning's "River Concept" planning effort.

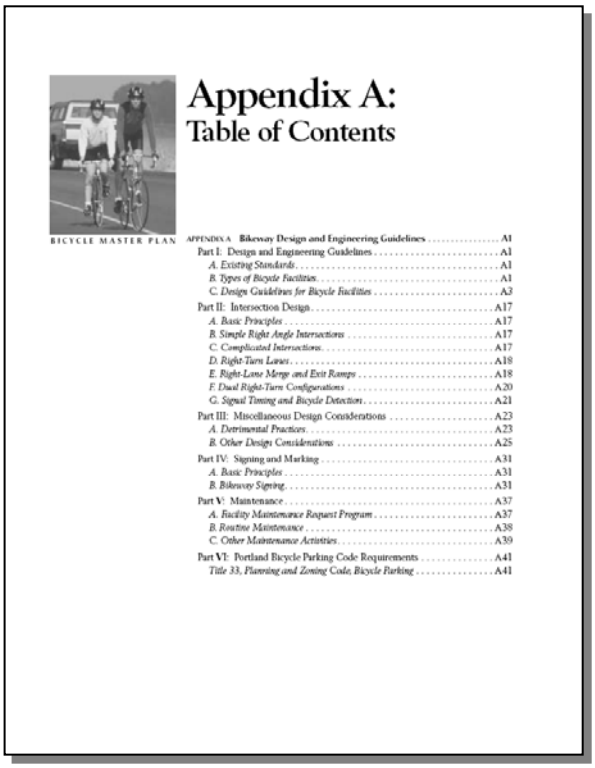
BIKEWAY DESIGN, CONSTRUCTION AND MAINTENANCE PRACTICES

INTRODUCTION

The cyclist's experience riding Portland's bikeway network is largely defined by the physical conditions on the road. What types of facilities are built and how they are built are essential to the creation of an attractive and comfortable environment for bicycling. Once a bikeway feature is established, maintaining its level of quality and performance becomes equally important.

The Portland Office of Transportation (PDOT) is the primary architect of the city's bikeway network. PDOT uses several standard design, construction and maintenance practices to build and maintain its bikeway network. The guidelines and standards developed for design, construction and maintenance of bikeway facilities ensure that both public and private improvements within the public right-of-way are uniform citywide, function properly and conform to the Bicycle Master Plan and other City requirements.

The City's Bikeway Design and Engineering Guidelines established as Appendix A of the 1996 Bicycle Master Plan serve as a manual for the design, construction and maintenance of the city's bikeway network, including bicycle lanes, off-street paths, bicycle boulevards, and shared roadways. These design practices and guidelines were based on two main source documents: the American Association of State and Highway Transportation Officials (AASHTO) manual "Guide for the Development of Bicycle Facilities 1999," and the 1996 Oregon Department of Transportation (ODOT) "Oregon Bicycle and Pedestrian Plan." The ODOT plan is currently being updated. A third document, the Manual on Uniform Traffic Control Devices (MUTCD) also informs bikeway design in that it regulates the implementation of traffic signs, signals and pavement markings.


BICYCLE MASTER PLAN

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As Portland's bikeway network is developed, city-specific construction specifications are implemented by the Engineering Services and Development Services Divisions of PDOT. The Bureau of Maintenance protects the investment of public funds in bikeways by implementing maintenance practices, which ensure that existing facilities function as intended and remain safe for cyclists.

In addition to these standard practices, Portland has a reputation for implementing innovative designs that are not found in any domestic bikeway design manual. These innovations, ranging from signal treatments, bicycle lane treatments, and other striping marking and civil designs, have

been employed in a spirit of determination to solve problems for which standard design treatments will not suffice. This chapter will present in detail some of these innovations, as well as standard designs, following the discussion of construction and maintenance practices that are particularly relevant to bikeway construction and operation. Not all designs and issues are addressed. Appendix A of the 1996 Bicycle Master Plan still holds as the design guide for the 90 percent of bikeway elements that are easily and clearly implemented.

Construction Practices Relevant to City Bikeways

Since adoption of the Bicycle Master Plan, PDOT has successfully incorporated much of the guidance outlined within the Design and Engineering Guidelines (Appendix A) as standard construction practices within the City. As the City's bicycle facilities have grown significantly over the past 15 years, standard designs have been implemented for bike lane widths, right-turn lane configurations, curb cuts and many other roadway treatments.

As the bikeway network had developed, a number of issues have surfaced that merit further clarification or more detailed consideration. These issues are presented below:

Storm Water Catch Basins (Inlets) and Gutters within Bicycle Lanes

A catch basin is an inlet to a storm drain system that typically includes a grate where storm water enters, and a basin to capture sediment, debris, and associated pollutants. Care must be taken to make sure that grates installed on city bikeways are suitably designed to allow for bicycle safety. There are three issues with them:

- The grate itself must be bicycle-friendly and not catch wheels
- The slope of the roadway leading to the inlet must not be too severe, and
- The inlet and accompanying concrete box must not extend too far into the bicycle lane.

The Engineering Services Division is responsible for designing bicycle-friendly catch basin grates. This section addresses the design of storm water inlets.

Inlets in the curb face (type CG-3 grates), rather than street-surface grates (such as CG-1 &CG-2), are the preferred catch basin for streets with curb-tight bicycle lanes (see Figures XX-XX). CG-3 is a curb-opening inlet with no grate in the roadway. The maintenance access to the inlet is in the sidewalk corridor (typically in the furnishing zone) through a vault cover. CG-3 inlets are called for in the Contracts Database in the presence of a bicycle lane. On rare occasions, placing the inlet in the curb face has been precluded by utilities behind the curb.

There is some debate as to which inlet types are easier to maintain. CG-2 grates have long been considered easier to maintain. However, Bureau of Maintenance staff responsible for maintaining inlets states that there is not significant difference between a CG-1 and CG-2. One trade-off associated with clearing out these types of inlets is that a CG-2, because it includes a larger volume, often requires service by a large, and expensive piece of equipment to vacuum out any obstructions. A single crew who clears obstructions by hand can often maintain CG-1 inlets. For cyclists the discrepancy is significant as CG-2 inlets stick further out into a bicycle lane and almost ensure that cyclists will ride across the grate.

Depending on the slope of the roadway, depression may be needed to cause water to shift course. A gutter pan is often placed around the grate to provide a downward slope directing storm water into the inlet. The total depressed area includes the grate width plus three feet on both sides of the inlet along the curb.

Depression around inlets may be exaggerated following a pavement overlay. According to the Bike Master Plan, drainage grates should be raised to within one-quarter inch of the new paved surface. If this is not possible, the pavement must taper into the inlet. The City has recently performed some retrofits using a trial riser ring around the grate to eliminate abrupt edges. There is interest at PDOT in revisiting this pilot technique.

The Bicycle Master Plan calls for four-feet clear between a longitudinal joint and the bicycle lane stripe. While this is true for asphalt seams as well, it is particularly important for an asphalt-concrete joint, as is found when a concrete gutter pan is included in a roadway design. Because the two materials have different qualities, over time a pronounced “lip” will develop along that seam. This presents a potential crash hazard to cyclists.

Standard gutter pans are 18-inches wide. PDOT has addressed this in one of two ways: either using 12-inch gutter pans with five-foot bicycle lanes, or 5.5-foot bicycle lanes with 18-inch gutter pans. A third approach was employed by ODOT in their reconstruction of NE Sandy Boulevard between 102nd and 122nd avenues. Unable to construct a wider bicycle lane, and not willing to use a narrower gutter pan, ODOT instead extended the concrete gutter pan to the width of the bicycle lane. While this eliminated any type of longitudinal joint in the bicycle lane, it created a rougher ride. Cyclists feel every regular bump in the concrete caused by the seams created by how the concrete was poured. Nonetheless, this practice has promise for similar situations if the concrete can be poured and scored in a manner that does not create a bumpy ride. This practice is also worth pursuing because the wider concrete, contrasting with the darker asphalt, visually narrows the travel lanes, which is considered to have a slight traffic calming effect on automotive traffic.

Construction on Streets with Bike Lanes

On occasion, temporary advance construction signs to warn motorists of work zones are placed within the bike lane. Best practices, and the Bicycle Master Plan design and construction guidelines call for placing these signs either within the planter strip or half on street and half on the roadway and half on the sidewalk (if no planter strip is present). From the construction crew’s perspective, the bicycle lane offers the best place to locate these construction signs, as it doesn’t interfere with either the travel lane or on street parking, or the sidewalk corridor. In addition, it is difficult to stably balance a tripod supporting a sign partially on the street and partially on the sidewalk.

Where temporary motor vehicle detours are in place, it is dangerous to permit cyclists to bypass the construction zone, either along the curbside or the center of the roadway. Current practice is to close the street to the curb, so

crews do not have to work between traffic. If cyclists were allowed to pass a construction zone along the center of the roadway, they may encounter construction materials spilling over or machinery swinging out into the street.

Metal plates covering construction holes or depressions can create dangerous conditions for cyclists. A temporary asphalt lip is required around all steel plates on city roadways to serve as a ramp onto and off of the plate for bicycles. The Bicycle Design and Engineering Guidelines state that "plates may not have a vertical edge greater than one inch" to accommodate bicyclists.

In order to avoid having an asphalt seam in a bike lane where utility trenches are cut and later backfilled, it is now practice within the City to cut the entire width of the bicycle lane, even if the specific trenching needs do not require such a wide cut. While asphalt-to-asphalt seams are not necessarily as hazardous as asphalt to concrete seams, they still create a roadway condition that cyclists will attempt to avoid when riding. This tends to push cyclists toward one side of the bicycle lane or other and discourages cyclists from using the entire width of the bicycle lane, if necessary. Asphalt trenches and cuts are backfilled to be flush with the original pavement surface. Construction standards related to backfilling are contained within City of Portland Standard Construction Specifications and PDOT's Moratorium Street Cut Replacement Guidelines.

Maintenance Practices Relevant to City Bikeways

The condition of the roadway surface is particularly important to those riding a bicycle, as debris, pot-holes or seams in the pavement can have a significant and negative effect on them. Inadequately maintained bicycle facilities can create hazardous conditions on the roadway and disrupt connectivity of the bikeway network.

As with the City's construction practices, many guidelines related to bike facility maintenance contained in the Bicycle Master Plan have been incorporated, over time, into standard maintenance practices within the City. Some key maintenance issues that have surfaced with the implementation of the Bicycle Master Plan are presented below:

Street Sweeping

The Bureau of Maintenance implements the City's Street Cleaning Program that is aimed at removing dirt and debris from City streets to protect water quality, prevent physical damage to pavements, and minimize the burden on the sewer system from surface debris.

The City of Portland cleans only streets with curbs. Due to the profile of the street and the fact that vehicle movement scatters debris to the edges of traffic lanes, most debris settles between the vehicle travel lane and curb. This also happens to be the area where bicycle lanes are positioned; thus reinforcing the importance of cleaning streets with bicycle lanes.

Currently, the general schedule for sweeping streets within the City is as follows:

- Residential streets are typically swept six to eight times per year. NW Portland is swept only 3 times per year because of the effort involved in removing parked cars.

- Arterials streets are cleaned every 15 to 20 working days
- Downtown streets are swept every ten working days. This includes all streets in the Central Business District plus streets in the "North Core", which includes Old Town out to 14th Avenue. Street sweeping crews work in the downtown five days of the week.

In addition to streets, the Bureau of Maintenance also sweeps the roadways on most bridges within the city with the exception of the St. Johns Bridge, which is a state facility, and the Sellwood Bridge, which is weight restricted.

In addition to routine maintenance, the City has a program to respond to incidental requests for small-scale, low-cost maintenance, such as spot sweeping, repairing potholes, and replacing unsafe grates. Requests are received in a number of ways:

- Via an on-line maintenance request form from PDOT's web site
- By phone calls to one of several numbers, including the bicycle "hot-line", the Maintenance Bureau's 24-hour line, the Maintenance Bureau's pothole line, and
- By email directly to city staff.

If a sweeping crew is scheduled to be near the area of a sweeping request, BOM will redirect them to clean the site generally on same day or evening in which the request is received1. If there is no crew in the general proximity of the site, a supervisor will often make a site visit. If the debris can be swept by hand, it will be moved to curb until the sweeping crew can sweep it up. This practice also reduces wasted effort, since it can take a good deal of time for a sweeping crew, with its large, slow-moving street sweeper, to reach a destination for spot sweeping. Occasionally, once they reach the site there is no debris to be found. Some locations are regular problem areas, and it would be inefficient to revisit the site on a daily basis.

Source: Northwest Clean Sweep / portlandonline.com

Gravel Cleanup Following Storm Events

During a snow or ice event, more than 60 city trucks are used to broadcast gravel onto city streets. The Bureau of Maintenance follows a map of primary and secondary routes to prioritize streets for gravel crews to visit.

Following the event, gravel left in the roadway can present serious hazards for cyclists, particularly for those riding in the bicycle lanes where gravel tends to accumulate. Clean-up crews are sent out to recover the gravel from the roadways. In contrast to the 60 plus broadcast vehicles, there are only a maximum of six to eight

sweepers in operation to recover the gravel2. These sweepers operate in three recovery convoys, comprised of: a flusher to spread water on the roadway, a mechanical sweeper (big brush sweeper: Elgin), and then a vacuum sweeper (air machine: Tymco). Each convoy is accompanied by two dump trucks to haul away the swept gravel.

Often, gravel recovery requires multiple passes by the crew for each roadway, depending on the length of the snow event, temperatures, etc. In addition, automobile tires will pick up and carry gravel for days, with gravel slowly falling back to the roadway; thus requiring subsequent sweeping passes. Up to ninety percent of the gravel placed on the roadway is recovered. Following a snow event in January, 2007, maintenance recovered roughly 3,500 cubic yards of gravel.

Recognizing the disproportionate impact gravel has on cyclists, BOM prioritizes gravel recovery on streets with bicycle lanes. Recovery first focuses on arterial streets with bicycle lanes within four miles of the Burnside Bridge and then targets arterials with bicycle lanes outside that radius. This strategy is based on the assumption that because bicycle use is more concentrated in the Central City, focusing first on those facilities benefits the greatest number of cyclists the soonest.

Pavement Overlays and Substandard Drainage Grates

As time allows, maintenance crews patrol the city identifying substandard inlets, focusing primarily on roadways with bicycle lanes. They are primarily looking for “tire-catching” inlets with openings parallel to the direction of travel. After years of practice retrofitting such grates with straps so that bicycle tires cannot fall into them, PDOT believes few, if any such grates remain in bicycle lanes in the city.

As previously mentioned, the entire inlet sinks below the surface of the roadway following a pavement overlay project, which typically adds two inches of asphalt to the existing roadway surface. Prior to development of an inlet “riser ring”, raising grates to grade was very labor-intensive and costly. The inlet would have to be substantially rebuilt, requiring that the Bureau of Maintenance first bust out the catch basin and replace the entire unit. A riser ring—which can be placed on top of the existing concrete box and under the grate itself—has proven to be a substantially less costly but still effective alternative. However, given the dimensions of the ring, an overlay must add two inches of asphalt to the roadway for the ring to be effectively used. Although overlays are typically two inches of pavement, the space above the grate may be less due to grinding or catch basin configuration.

Based on bicycle considerations, prioritization for substandard grate replacement first addresses streets with bike lanes (particularly with CG 2 type grates), then other arterial streets without bike lanes, and finally local streets.

The Bureau of Maintenance does not have a preferred type of drainage grate for certain classifications of streets. An appropriate grate is selected based on site-specific conditions. As described earlier, CG-3 type grates are a curb-opening inlet with no grate in the roadway. The maintenance access to the inlet is in the sidewalk corridor (typically in the furnishing zone) through a vault cover. CG-3 inlets are called for in the contracts database in the

[1] Most of the city sweeping crews operate at night.
[2] The City has a fleet of 10(?) sweeper trucks. They require frequent maintenance and typically are not all in working order at any one time.

presence of a bicycle lane. However, since catch basins are often situated near corners, ADA access and vault cover stability issues may preclude this option.

According to Maintenance Bureau staff, there is not significant difference in the maintenance needs of the two common “street surface” type grates, i.e. CG-1 and CG-2. One trade-off associated with clearing out these types of inlets is that a CG-2, because it includes a larger volume, often requires service by a larger and more expensive piece of equipment to vacuum out any obstructions. A single crew who clears obstructions by hand can often maintain CG-1 inlets.

Transition to Thermoplastic Striping

The City is currently in the process of completely switching over from paint striping to thermoplastic on city roadways. This transition has occurred over the past three years, and it is estimated that the entire city will be converted to thermoplastic within another three years. To date, over one-third of city streets have been striped with thermoplastic.

Because they last so much longer, there is a significant benefit to cyclists with thermoplastic striping. Striping applied with the former standard roadway-grade paint, had to be applied two to three times per year. Typically, bicycle lane stripes would disappear sometime between the time of the last striping in the fall before the rains begin, and the first striping of the spring, once the rains have reliably stopped. This created uncomfortable situations for cyclists as streets striped with bicycle lanes for nine months of the year would generally be lacking striping between January and April.

The equipment needed to perform thermoplastic striping is relatively expensive. However, the lifespan of thermoplastic (three to five years) is considerably longer than paint, which typically wears away after the first winter. The durability of the thermoplastic depends greatly on how clean the surface was, and the weather conditions on the day it is applied.

Thermoplastic is applied in two ways: a long-line striper is used for roadway travel lane striping; crosswalk stripes and back lines on bicycle lanes are applied with a pushcart applicator. Back lines, which visually separate the bike lane from on-street parking, are applied by hand to avoid painting the tires of parked cars. Subsequent applications of all existing thermoplastic striping are applied as a thinner layer to reduce lines building up in height.

Since the conversion to thermoplastic began, there have been no major issues reported by cyclists concerning lack of traction or stripe build up. Cyclists may benefit from a two-foot break in crosswalk line to eliminate a potential bump. This practice could be considered in future applications of crosswalk stripes.

Roadside Maintenance

In addition to cleaning roadways, the Bureau of Maintenance also maintains some areas adjacent to the street as part of its Roadside Maintenance Program. The City’s Roadside Maintenance Program is responsible for managing vegetation in ditches, storm water facilities, off-street bike paths, pedestrian areas, and rights-of-way.

Managing vegetation along our roadways3 increases public safety and enhances the natural environment by:

- Eliminating sight distance problems and providing areas for pedestrian and bicycle traffic, as well as safe pull-off areas for motorists;
- Ensuring an appropriate flow in the open storm water system, erosion control, restoration of disturbed areas after maintenance activities, improves water quality, management of noxious weeds, and provides habitat for birds and butterflies; and

Roadside maintenance is managed with a full complement of methods: mechanical (tractor mowing), cultural (hydroseeding and planting appropriately), biological, and chemical (such as spraying invasive plants to slow growth and allow for cutting before problems arise).

BOM is aware of common problem areas for bicycles, i.e., those areas where weeds and shrubs overgrow and intrude into the bicycle lane during periods of peak growth. The Roadside Maintenance Program intends to address some of the more problematic areas with a three-pronged approach:

- Spray early to retard growth
- Spray late to kill growth
- Mechanically cut as necessary.

Pavement Overlay Practices

An overlay refers to laying a new asphalt layer on a roadway stretching from the curb to curb across the street. In the past, overlays had been the Portland Office of Transportation's standard procedure for replacing worn pavement. This process typically required initial grinding and profiling of the roadway to be overlaid. "Grinding" and "profiling" refers to the practice by which the existing layer of asphalt is ground down in order to provide enough room for the new asphalt layer below the existing curb and so as to not create a roadway that had too high of a "crown" in the center of the road. A single machine has the capacity to pave an 11-foot travel lane and 5-foot bike lane in one pass.

Grinding and profiling can occur several months in advance of the overlay since it is not weather-dependent and also because it takes significantly longer to grind and profile than it does to lay down the new asphalt. As a result, roadways scheduled for overlays could be in poor cycling conditions for some time in advance of the actual overlay.

The current practice is to no longer to perform a "curb to curb" overlay but to simply replace the worn asphalt just in the area of wear—typically only the travel lane. This process, referred to as a "plug", does not require significant grinding and profiling in advance as neither the roadway crown nor the area near the curb is affected. To perform a plug, the Maintenance Bureau grinds the top two inches in a travel lane and replaces it with two inches of pavement, typically on the same day.

[3] Some of the more notorious areas include: Terwilliger, Capitol Highway east of Hillsdale, Interstate Avenue climbing the hill to North Portland.

This new practice of performing a “plug” rather than an “overlay” generally does not affect the bicycle lane as the work ends at the outside stripe of the bicycle lane. However, a transition/joint may be created when the travel lane is ground down and the roadway is repaved.

There is a potentially significant issue with this new practice. Overlays provide a “blank slate” on the roadway in terms of striping, and offer the opportunity to efficiently and cost-effectively restripe a roadway with bicycle lanes. Plugs, because they are working on one travel lane at a time, and operate between the lane striping, may no longer allow for this relatively inexpensive reconfiguring of City Bikeways to provide bicycle lanes.

If the Bureau of Maintenance has to cut into the bike lane, standard practice is to replace the entire lane to the curb. This eliminates the need to mitigate for a longitudinal seam within the bike lane with techniques such as “feathering” the new asphalt by working it into existing asphalt by decreasing the thickness of the new asphalt over a certain distance until it blends into the existing layer.

For newly paved shoulders, the Bike Master Plan guidelines recommend a “saw cut” joint to avoid ragged joints at the edge of the existing pavement or “feathering” a fine mix of new asphalt onto the existing pavement.

Surfacing Roadways with Chip Seal

Chip seal is a roadway surfacing material that is less expensive than, but also considered inferior to asphalt. Chip seal has a shorter life expectancy than asphalt, it does not hold up as well to heavy traffic, it tends to ravel (i.e., small pieces continually break off) and produce dust, and thermoplastic striping does not adhere well to it.

For cyclists, chip seals leave a rough riding surface, varied textures, and ragged edges in the shoulder. This surface can also be painful to fall on if a crash occurs. If chip seal is used it must be capped with slurry to mitigate for the rough surface. Currently, the City does not use chip seal to surface its roadways; however, it is commonplace in a number of neighboring jurisdictions.

Design Treatments

Appendix A of the 1996 Bicycle Master Plan serves as the design guide for developing Portland's Bikeways. With few exceptions these designs require little further elucidation. However, during the past 15 years—and often on a project-specific basis—Portland has identified situations not readily addressed by standard designs. The following pages define and describe a number of bikeway designs that were either not explicitly addressed in the design guide, or that have particular relevance for future conditions for the bikeway network. These designs include:

- Bicycle Activated Signals
- HAWK Signals
- Pedestrian Half Signals
- Scramble Signals
- Bicycle Boxes
- Crossing Treatments
- Traffic Diversion
- Bicycle Lanes
- Blue Bicycle Lanes
- Shared Lane Pavement Markings
- Hawthorne Bridge Pathway Markings
- Bikeway Signing and Markings

BICYCLE-ACTIVATED SIGNALS

A bicycle-activated signals detect the presence of cyclists at a signalized crossing and provide adequate intervals in the traffic stream where they can cross safely.

The city of Portland uses inductive **signal loop detectors** (metal sensitive wires in the road) to detect traffic at most traffic-actuated signals. Sensors may be set so bicycles trigger the signal when they pass over the inductive loop. **Fully-actuated** signals have detection on the approaches from all directions; while **semi-actuated** signals have only detection on the side street or left-turn lane.

Purposes

- Allow cyclists to trigger a traffic signal
- Provide adequate time for bicycle crossing

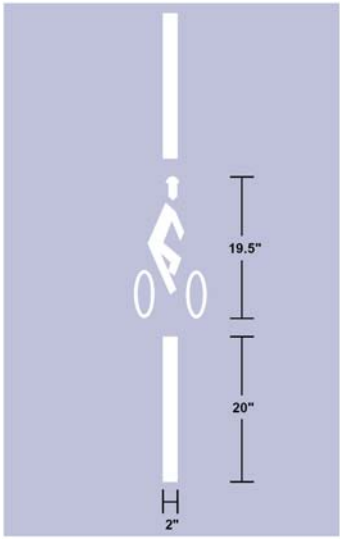
Issues

- Loop detectors should be set to detect bicycles
- Sensitivity of detector loops may degrade over time
- Cyclists may not know the proper placement to get a green light

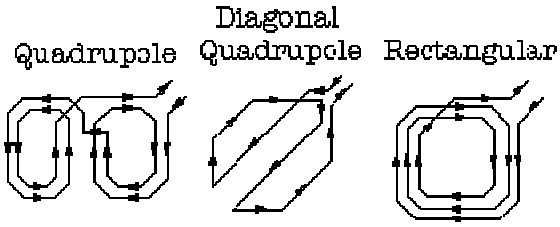
These loops are commonly placed in circular loops. There are a few locations where the loop is in the shape of a fifty-foot rectangle with wires also in the middle of the rectangle. These are called quadrapole loops and are usually placed in left turn pockets. For economical reasons, when a quadrapole loop is replaced, the City prefers to install four circle loops placed twelve feet center to center to achieve the same detection area.

Some detection loops which have been tuned to detect bicycles are marked with a thermoplastic bike symbol to position cyclists where detection is most consistent. Loops that have lost there sensitivity are replaced as time and budget permit.

The signal is triggered only as long as the bicycle is positioned over the loop detector. If a cyclists moves away from the detector, the call for a green light will be discarded. Even once a signal has been triggered, the length of the signal cycle may be very long requiring cyclists to maintain their position over the loop detector.



Detector Pavement Marking



Various Loop Detector Configurations

Source: www.bikeplan.com/signal.html

HAWK SIGNAL

A **H**igh-intensity **A**ctivated **W**al**K** (HAWK) signal is intended to stop vehicles on a major street at an intersection with a minor street and provide a safe and comfortable crossing for cyclists (and pedestrians). The HAWK is a type of half signal, where there are main street signals and side street stop signs and pedestrian/cyclist push buttons to activate the signal. Pedestrians and cyclists are not required to use the HAWK signal to cross. It is simply there for their convenience when needed.

Purposes

- Provide a protected bike and pedestrian crossing
- Minimize traffic delays

Issues

- The dark signal display may confuse drivers
- Drivers have a tendency to remain stopped when it is safe to proceed
- Educational outreach may be required

The HAWK signal is designed to get the attention of motorists on the arterial street and remains dark, or "off", until activated. The beacon signal has a triangular arrangement with two red lights over a yellow light. Cyclists and pedestrians have their own signal heads with bicycle-shaped red, green and amber signals, and standard pedestrian shapes, respectively.

Once a cyclist (or pedestrian) pushes the call button, the vehicle signal begins flashing a yellow light; then a solid yellow is given, followed by a solid red light. Shortly following the vehicle "red" indication, cyclists and pedestrians are allowed to cross.

During the pedestrians "don't walk" indication, the bike and motorist signals change to a flashing red. This allows motorist to proceed with caution once the crosswalk is clear before the light switches back to dark mode.

Figure 1. HAWK Signal Sequence

Interval	Veh	Bike	Ped	Length (sec)
1	dark	dark	dark	rest
2	FY	R	DW	3
3	Y	R	DW	4
4	R	R	DW	2
5	R	G	W	8
6		G	FDW	4
7	R	Y	FDW	6
8	R	R	FDW	4
9	FR	FR	DW	3
10	FR	FR	DW	1
11	dark	dark	dark	rest

Portland Experimentation with a HAWK signal

There is one HAWK signal installed in the City of Portland at the intersection of East Burnside and 41st Avenue. At the intersection with 41st, Burnside a major east-west arterial crosses an important north-south bikeway. The City is experimenting with the HAWK signal as a way of providing breaks in arterial traffic for safe bicycle and pedestrian crossing.

Seemingly, the advantage of the HAWK signal over the standard pedestrian "half signal" is that it rests in dark mode. The concern with the standard half signal is that motorists,

having only seen a green indication, may no longer pay attention to signal changes. The activation of the HAWK signal from dark to flashing yellow is intended to provide additional warning for motorists at a signal with infrequent display changes.

The concern with the HAWK signal is that there may be confusion during the dark beacon signal, which might be interpreted as a power outage, as well as the flashing red signal, where vehicles may remain stopped once it safe to proceed.

The City will collect and evaluate data on signal compliance and crashes at the intersection. Because of their high cost they are used only when other civil treatments, such as curb extensions and refuge islands, cannot be made to work.

Bike and Pedestrian Crossing Signals

HAWK Signal for Motorists

PEDESTRIAN HALF-SIGNALS

At unsignalized intersections on arterials with high traffic volumes and speeds, pedestrians and cyclists wishing to cross may have difficulty finding adequate gaps between motor vehicles. Moreover, many bikeways are designated on lower volume neighborhood streets leading to an unsignalized crossing of a major arterial. Many of these low volume streets do not meet current traffic signal warrants. Installing a full signal at this type of intersection may create excessive delays and safety issues to the arterial street or may attract excessive traffic to the low volume neighborhood street.

A pedestrian half-signal allows pedestrians and cyclists to cross a major street with a standard pedestrian signal where it intersects with a stop-controlled minor street. It is called a "half-signal" because only the major street has a traffic signal while the minor street has only stop signs. Pedestrian movements across the arterial are controlled by traditional "walk/don't walk" signals.

This tool is most effective where the number of pedestrians and bicyclists crossing is high, but motor vehicle traffic on the minor street is low.

This type of signal has not been allowed for use by the Federal Highway Administration (FHWA) since the late 1980's. A significant concern is that the major street signal rests in green until interrupted by a pedestrian or cyclist seeking to cross. If pedestrians don't regularly press the buttons to activate the signal, motorists on the major street become accustomed to seeing only a green indication. As a result drivers may, over time, ignore the signal.

Purposes

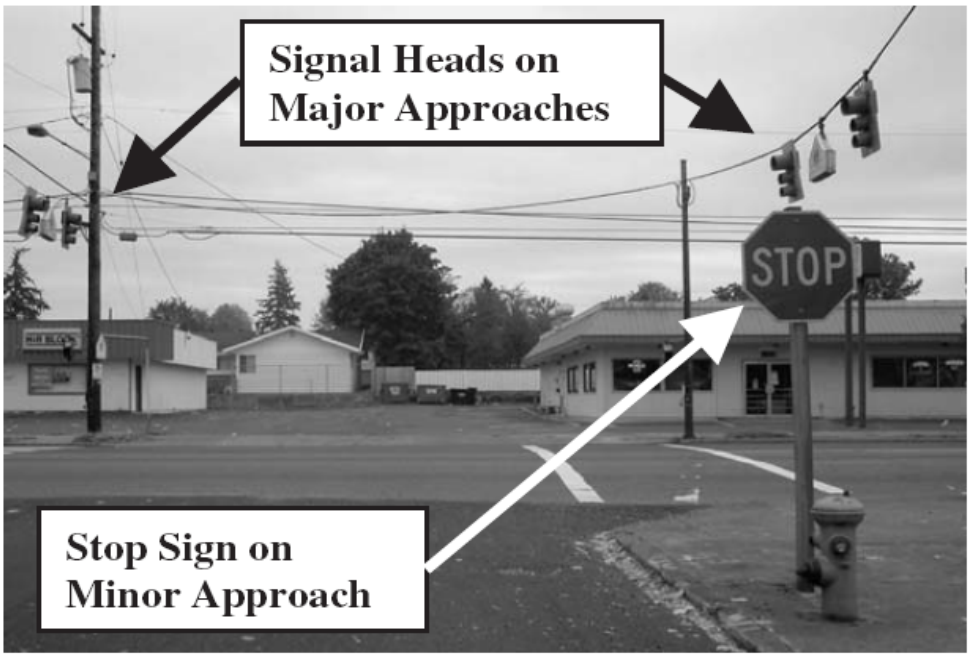
- Provide a controlled pedestrian and bicycle crossing at intersections where a full signal is not warranted.

Issues

- Minor street traffic crossing with pedestrians/cyclists may not know when major street signal is about to change.
- Minor street drivers may be tempted to activate the pedestrian push button.
- Major street traffic may become accustomed to having a green light at the intersection causing them to miss future red indications.

Other concerns caused by the mixed traffic control messages are that the side street traffic may be confused when arterial traffic stops, or major street motorists may be surprised when side street vehicles pull out into the intersection while the major street signal is green.

The City of Portland has 48 legacy pedestrian half-signal intersections (with the last one installed in 1985) located throughout the City. These signals serve an important function of creating gaps for safe pedestrian and bicycle crossing. Given Portland's common short block spacing (typically 200 by 200 foot blocks); it is difficult to simply move crosswalks to a mid-block point away from the intersection. The City is currently experimenting with a High-intensity Activated WalK (HAWK) signal at East Burnside and 41st Avenue as an alternative to the standard pedestrian half signal.



Intersection Pedestrian Signal (Half Signal)

Source: Transportation Research Board

SCRAMBLE SIGNAL

A "scramble" signal, once activated, stops all automotive movements at an intersection and allows pedestrians, cyclists and others to move in any direction through the intersections.

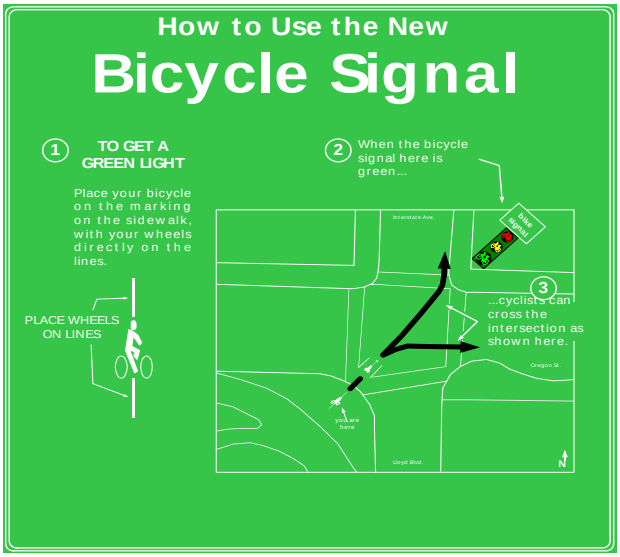
Purposes

- Allow bicycles to diagonally cross an intersection.
- Stopping all vehicle movement provides better separation between cars & bikes.

Issues

- Longer crossing intervals are required at wider intersections
- Educational outreach may be required

In April 2004, Portland installed its first bicycle scramble signal (along with accompanying signs and markings) at the intersection of Interstate Avenue and Oregon Street near the east end of the Steel Bridge. The signal features red, yellow and green lights illuminated in the shape of a bicycle.



Scramble Signal Instructional Sign

This scramble signal was designed to both ease and make safer cyclists' transition from the Eastbank Esplanade, a popular multi-use trail on the eastside of the Willamette River, to the on-street bicycle lanes. Prior to installation of the signal, cyclists wishing to travel north along N. Interstate Avenue were often frustrated by having to perform a "two-phase" crossing (first west, then north).

Cyclists activate the scramble signal by positioning themselves over a "bike loop" marking on the sidewalk. Once triggered, the scramble signal stops all automotive movement through the intersection of N. Interstate, Oregon and Lloyd, and allows cyclists exiting the Eastbank Esplanade to diagonally cross the intersection and access the north-bound bicycle lane on N. Interstate Avenue. Motorists turning right onto Lloyd Boulevard from the Steel Bridge are not allowed to proceed while their signal is red.

An evaluation of data collected before and after implementation found that prior to installation of the scramble signal, approximately 33% of northbound cyclists crossed the intersection illegally. After installation, those crossing illegally dropped to 5% of northbound cyclists.

Traffic Light – No Right Turn on Red

Bicycle Signal – Green Phase

BICYCLE BOXES

At a signalized intersection, a bicycle box can be installed to place cyclists in front of queuing motor vehicles and enable them to more easily clear the intersection during the signal cycle. Bicycle boxes require motorists to stop in advance of the crosswalk and allow cyclists to wait in the area (or reservoir) between the cars and the crosswalk. Placing bicycles in front makes them more visible to motorists and allows them to get through busy intersections before the signal turns red.

Purpose

- Give cyclists priority at intersections
- Help cyclists get through busy intersections
- Reduce turning conflicts, particularly associated with bike left-turn movements
- Make cyclists more visible to motorists

Issues

- Identify dimensions that work best for cyclists
- Boxes may be disregarded by motorists if not regularly filled by cyclists
- No right-turn-on-red allowed
- Consider surface color and markings to reduce vehicle encroachment

Bicycle boxes are most useful at intersections with high volumes of automobile and bicycle traffic and where turning conflicts exist. Sites can be evaluated for bicycle boxes based on the frequency of bikes queuing and the rate of left turning movements. Bicycle boxes may be problematic at intersections with high volumes of right-turning traffic.

Clinton Street Bicycle Box

Portland's only intersection with bicycle boxes (on Clinton Street east and west of 39th Avenue) was put in place in 1999 as part of the development of the Clinton-Woodward Bikeway. Bicycle boxes were installed on Clinton Street because of the relatively short length of the green signal; if cyclists waited in the queue with motorists, they would often miss the signal. The bicycle box allows cyclists to go through first on the green, which is consistent with giving cyclists priority on bicycle boulevards.

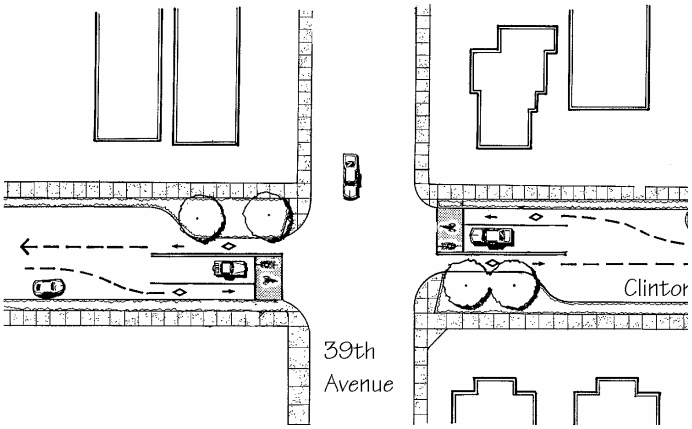
Portland Bike Box - Clinton/39th

Bicycle Box Design

The bicycle box reservoir stretches across the full-width of the travel lane enabling left-turning cyclists to position themselves in the far left side of the lane. The depth of the Clinton Street boxes from the crosswalk to the vehicle stop line is 14 feet (or 4.3 meters). Recommended dimensions for a bicycle box are typically between 4 and 5 meters; however, some places offer cyclists much more space (such as Muenster, Germany which provides 10 meters).

A bicycle symbol is placed in the center of the Clinton Street bike boxes to clearly assign the space to cyclists. In some cities a distinct surface color is also applied to the cycle reservoir to discourage encroachment by motorists. For maintenance purposes, the use of thermoplastic is preferred over faster wearing paint.

A bicycle lane segment on Clinton Street provides a dedicated approach path leading to 39th Ave. for cyclists to pass queuing vehicles along the far-right side of the roadway. Another feature accompanying bike boxes in some other cities is a separate “head start” signal to give cyclists an earlier green light than motorists traveling in the same direction.



Evaluation

In 2004, a review was performed on the Clinton Street bike box to evaluate its performance for cyclists traveling eastbound on the bikeway. During the three-hour study, 109 cyclists and 408 motorists crossed the intersection. Of these, 97% of cyclists used the bike box and 16% of motorists encroached upon the designated bicycle area.

SAFE CROSSING TREATMENTS

Curb extensions, refuge islands and bicycle center turn lanes are essentially safety improvements to assist bicycles to cross a busy street. These tools may also calm (or slow) traffic, but their primary intent is to reduce exposure, in terms of the time and distance in which a pedestrian or cyclist must share a common space with auto traffic. Traffic signals also assist cyclists at crossings; however, they are addressed as art of a separate information sheet.

With the exception of devices aimed primarily at slowing traffic, such as speed bumps and street signs, treatments to improve pedestrian and bicycle safety are among the most widely used traffic calming devices. Curb extensions and refuge islands can be found throughout the Portland area.

Curb extensions are short sections of roadside curb at signalized and non-signalized crossings that have been constructed closer to the centerline of the street, replacing the existing curb. Curb extension are generally placed on streets with heavy traffic and on-street parking.

Curb extensions reduce the distance a pedestrian or cyclist must cross at street level allowing them to pass between shorter gaps in vehicle traffic. In addition, motorist's visibility of pedestrian and cyclist is increased by moving the curb out closer to the travel lane.

Curb extension have been installed in Portland at signalized and unsignalized, typically as part of a street improvement or a traffic calming project. This treatment is considered at locations where there is more than a one minute wait between gaps in traffic during peak hours or where pedestrians must cross multiple lanes.

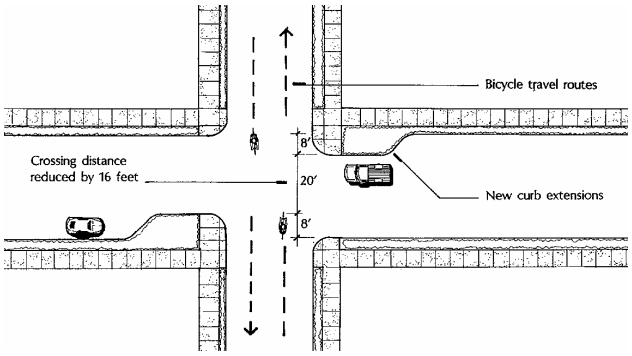
On streets with a centerline stripe, cyclists may be forced to veer out into traffic, or motor vehicles will "squeeze" bicyclists as they pass the curb extension. Bicycle Master Plan design guidelines recommend that curb extension be placed such that a 12 to 14 foot outside lane is left at intersections without a bicycle lanes.

<u>Purpose</u>

- Reduce the time and distance required to cross a busy street
- Enhance visibility between motorists, pedestrians and cyclists
- Encourage pedestrians to cross at designated locations
- Visually prompts motorists to slow down

<u>Issues</u>

- Must be wide enough to protect cyclists from the travel lanes
- Any landscaping should not compromise the visibility of the crossings
- May impact available parking and larger vehicle turning needs

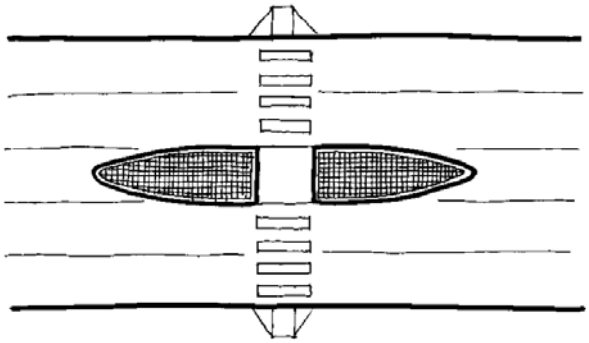


Refuge islands are short medians of full-height curb constructed between the travel lanes. These islands reduce pedestrian and cyclist exposure during crossing by shortening crossing distance and increasing the number of available gaps for crossing. Islands may be installed at intersections or mid-block locations.

Crossing islands allow pedestrians and cyclists to cross a single direction of traffic and pause before continuing across the street. This is particularly beneficial where there are insufficient gaps in the two directions of traffic.

REFUGE ISLANDS

Refuge islands can be found throughout Portland at unsignalized pedestrian and bicycle crossings. As with curb extensions, islands are most commonly installed in Portland as part of a street improvement or a traffic calming project. Preferred locations in Portland are where there is more than a two minute wait between gaps in traffic during peak hours or where pedestrians must cross multiple lanes.


MID-BLOCK REFUGE ISLAND

It is important that refuge islands are design such that they do not squeeze through bicycle movements on the major street. For cyclists crossing the major street, islands should be wide enough so it allows a bicyclist with a trailer to be protected from the travel lanes (i.e. between 8 to 10 feet).

Bicycle-Only Center Turn Lanes provide a refuge for cyclists on bikeways that traverse an off-set intersection. This treatment allows cyclists to cross one direction of traffic at a time while maintaining all vehicle turning movements.

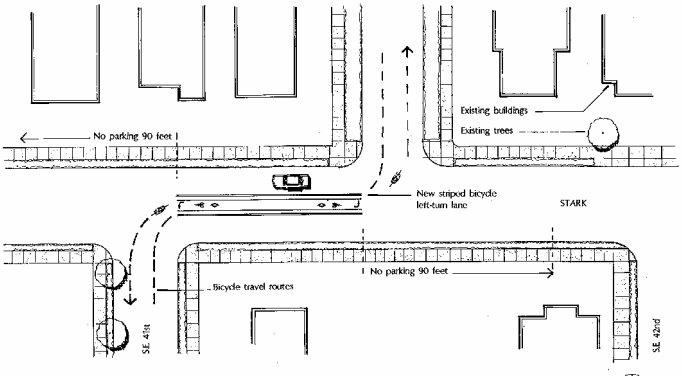
This treatment has been implemented at one location within the City of Portland. The north-south "40's Bikeway" that runs along SE 41st Avenue is off-set by 35 meters (115 feet) as it crosses SE Stark Street, a minor arterial street. North and south approaches to this intersection along the bikeway are stopped with stop signs.

BIKE CENTER TURN LANE

The City installed a two-way, 10-foot center lane exclusively for cyclists to execute first a right-turn onto Stark and then a left-turn back onto the

bikeway. The only effective alternative would have been a median refuge, which would have prohibited some turning movements from SE Stark to 41st.

The center turn lanes on SE Stark successfully address three issues: the offer a refuge for crossing cyclists and allowed them to cross one direction of traffic at a time; it maintained all automotive turning movements; and it served as an inexpensive alternative to conventional civil treatments.



TRAFFIC DIVERTERS

Traffic diversion is an auto volume management tool where physical barriers (i.e. diverters) are installed to intentionally direct motor vehicles off a particular street. The intent of traffic diversion is to reduce traffic volumes on a neighborhood street and move non-local traffic onto nearby arterial streets.

Although traffic diverters are effective at reducing automobile volumes, they are primarily used as a tool of last resort and are prohibited on streets classified higher than "local service". The main concern with diversion is its effect on connectivity, such as significantly increasing the length of vehicle trips, adding time to emergency response, eliminating potential bypass routes, and shifting excessive traffic onto other local service streets. Since diversionary measures are generally permanent physical barriers, they must be appropriate at all hours of the day and night.

Purpose

- Reduce the volume of motor vehicles
- Create a safer and more attractive environment for cyclists and pedestrians

Issues

- Delays to emergency vehicles, transit services
- Diverted traffic may move to other local street
- The effect on street connectivity
- Maintaining pedestrian and bicycle access
- Must be appropriate during all 24 hours

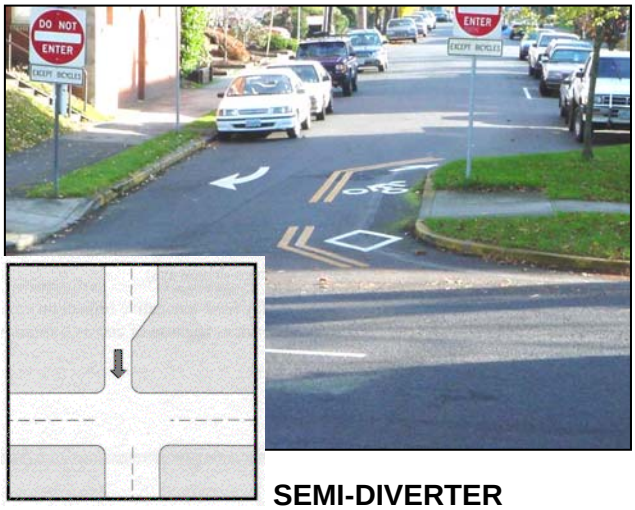
The following issues must be addressed when designing any form of traffic diversion:

- How will diversionary measures effect connectivity in the area?
- Will emergency vehicles have access and or experience delays?
- What Impact will diversion have on transit services?
- Is the facility designed to accommodate pedestrian and bicycle passage?
- How much traffic will be diverted to other local service streets?

A variety of diversionary devices may be used to reduce the number of automobiles and the associated noise, pollution, and likelihood of collisions on a street. Traffic diverters found in Portland include the following:

Semi-diverters, also referred to as partial- or directional-closures, block only one travel lane to prevent drivers from entering or exiting certain legs of an intersection. Semi-diverters eliminate movement in one travel direction; however, they can be design to accommodate bicycle, pedestrian, emergency or transit access.

Semi-diverters are typically placed on minor streets at an intersection with a major street. Adequate alternative entry points into the



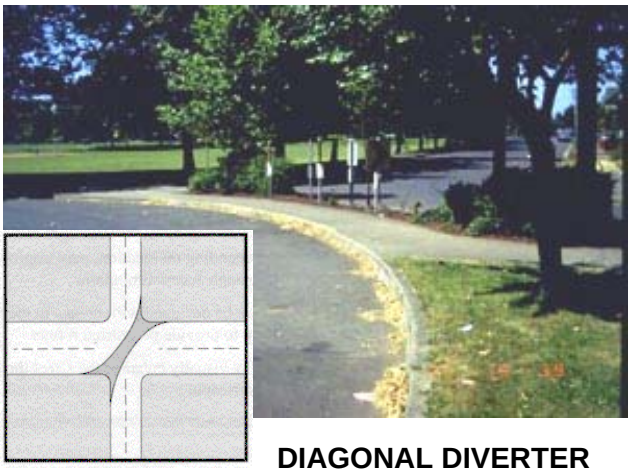
SEMI-DIVERTER

neighborhood and parallel routes are necessary to ensure connectivity for drivers.

Semi-diverters can be designed to incorporate safe bypass for pedestrians, cyclists and people in wheelchairs. In addition, the facility can integrate stormwater management and landscaping functions.

Semi-diverters are the most common type of diverter used in the City and can be found at 17 different locations Portland sites: SW Boones Ferry at Taylors Ferry Rd, SW Virginia at Taylors Ferry, Clinton at SE 39th (east and west sides), Lincoln at SE 39th (east and west sides), Klickitat & 35th, Weidler and 24th, Arthur and 2nd, NE 18th and Failing, NE 18th and Shaver, NE 17th and Mason, NE 17th and Shaver, SE Ankeny and SE 32nd, NE Jessup and Williams, Tillamook and 39th, Willamette Blvd and Rose Parks.
mette Blvd at Rosa Parks.

Diagonal diverters are a barrier placed across a four-way intersection from one corner to the opposite corner. This tool prevents through movements, and motorists are only allowed to turn in one direction. Although through traffic is eliminated, a diagonal diverter does not totally prohibit vehicle passage as would a cul-de-sac. Diagonal diverters significantly reduce conflicts between pedestrians, bikes and motor vehicles and provide a substantial area in the roadway for landscaping or stormwater management.



DIAGONAL DIVERTER

A diagonally diverter can be designed to permit bicycle and pedestrian passage, as demonstrated at the intersection of NE Tillamook and 16th Avenue. Pavement markings, showing a bicycle and directional arrow, have also been installed at the Tillamook diverter to direct bicyclists through the appropriate curb-cuts.

In order to ensure that traffic problems are not shifted to another residential street, it is important that traffic is diverted (by clustering diverters if necessary) as directly as possible onto a nearby busy street. Adequate signage must be installed to alter motorist of the traffic device, and posted speed must reflect the turning radius if there are no stop signs.

Diagonal diverters can only be found at two locations in Portland, i.e. Houghton Place at Hamlin Ave and NE Tillamook at 16th Ave.

Median barriers are a concrete curb or narrow island that is located on the centerline of a major street across an intersection with a side street. Median barriers prevent through movements on the side street and left turns on some or all streets.

Median barriers can be designed with curb cuts or ramps to allow safe bicycle crossing (as on Ankeny and SE 20th). In addition, they can provide a safe refuge for pedestrians and cyclists from automobiles traveling along the major street. A median refuge is particularly beneficial on multi-lane streets, as on Broadway at NE 30th, so one direction of traffic can be crossed at a time. The median must be wide enough to fully protect the pedestrian or cyclist from the traffic.

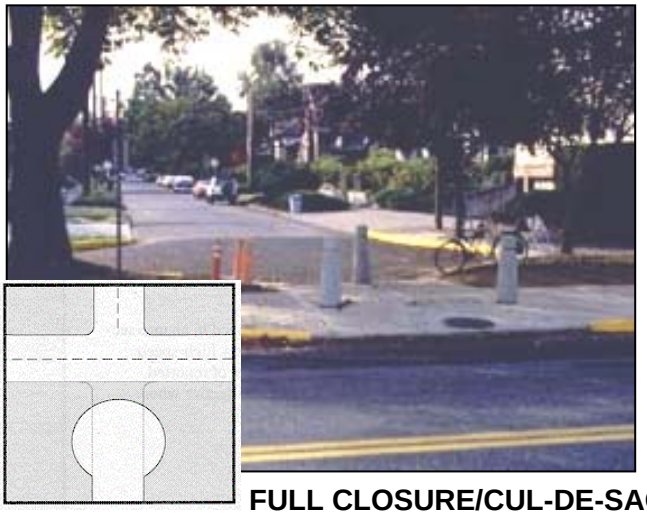
MEDIAN BARRIER

If median barriers reduce the width of the travel lane, accommodations may be necessary to ensure bicyclists traveling along the major street are not squeezed out by motor vehicles.

There are four median barriers located within the City, including SE Ladd at Clay, SE 20th at Harrison Street, SE 20th at Ankeny Street, and Broadway and 30th.

Full-Street Closure *or* ***Cul-de-sacs*** are barriers extending the entire width of the roadway to close off one end of the street. This treatment is most commonly used on the edge of a neighborhood to eliminate all through traffic on the residential street by completely removing access to the roadway.

Cul-de-sacs can be designed to provide bicycle and pedestrian access to the street through curb cuts and ramps. Another effect of installing a cul-de-sac is that pedestrians no longer have to cross the street once it's closed.



FULL CLOSURE/CUL-DE-SAC

In general, full-street closures have the most severe impact on emergency vehicle and transit access. While it is possible to design a facility with emergency vehicle passage, these measures might be hindered by inappropriately parked cars.

It is important to clearly warning, such as "no outlet" or "dead end" signs, for motorist of the street closure. Large vehicles may have difficulty turning around once they reach a cul-de-sac.

In Portland, cul-de-Sacs can be found at 11 locations, including NE 32nd at Schuyler, NE 17th at Thompson, NE 28th at Weidler, NE 28th at Halsey, NE 28th at Clackamas, NE 28th at

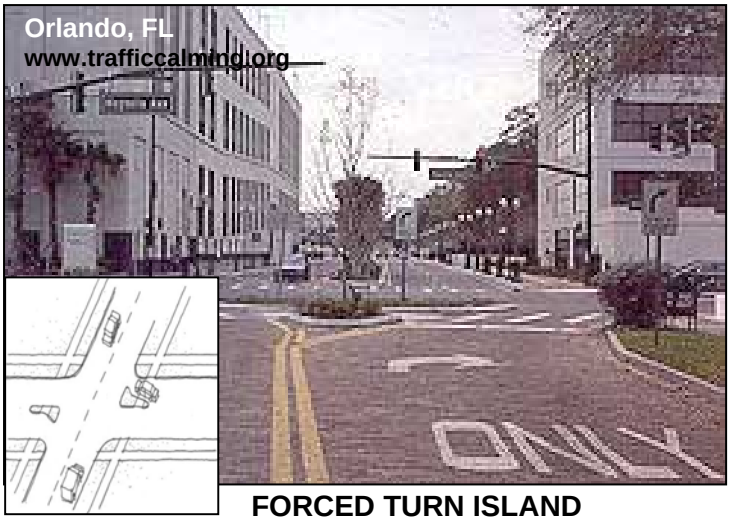
Wasco, NE 36th and Brazee, Brookside and 117th, NW Wilson and 29th, NE 14th and Killingsworth, NE 14th and Alberta.

Forced turn diverter are raised islands designed to prevent traffic approaching an intersection from making certain movements. This tool deters traffic from cutting-through on a side street by forcing motorist to turn onto a major street.

Forced turn diverters can be designed to incorporate safe bypass for bicycles and wheelchairs and pedestrians benefit from the reduced crossing distance on the side street. While motor vehicles are forced to turn, bicycles should be permitted to maintain a through traffic position.

Reducing the conflicts between motorists at the intersection may result in drivers speeding through the crosswalk area and right-turning vehicles may fail to look for pedestrians crossing on their right.

Forced turn diverters are installed at three locations, including SE Harold and Foster, NE 28th and Schuyler, and Belmont and 25th.



FORCED TURN ISLAND

BICYCLE LANES

Bicycle lanes, the most common bikeway facility on Portland's streets, is a portion of the roadway designated by striping and pavement markings for exclusive or preferential use by bicyclists in urban areas. Bicycle lanes are one-way facilities that carry bicycle traffic in the same direction as adjacent motor vehicle traffic and are the preferred facility for urban arterial and collector streets.

Bicycle lanes provide significant benefits to all transportation users. They define a space in which to ride, eliminating the need to weave in and out of traffic or parked cars. They increase the visibility of cyclists and help novice riders feel more confident. Bicycle lanes also help motorists predict where to expect cyclists.

Purposes

- Create an on-street exclusive lane for bicyclists
- Define space separation between cyclists and motorists
- Increase comfort for novice cyclists
- Increase cyclists visibility

Issues

- Provide adequate bike lane width
- Maintain a smooth and clean surface
- Provide adequate space to reduce the risk of "dooring" from parked cars
- Determine the need for accompanying signs or markings

Bicycle Lane Variations

Blue bike lanes, and the accompanying street signs, are used to alert motorists and cyclists at high conflict areas and to assign right-of-way to cyclists. Motorists are required to yield to cyclists in these areas.

A shoulder bikeway is a street upon which the paved shoulder, separated by a four-inch stripe and no bicycle lane markings, is usable by bicycles. Although the shoulder can be used by bicycles, auto parking is also permitted.

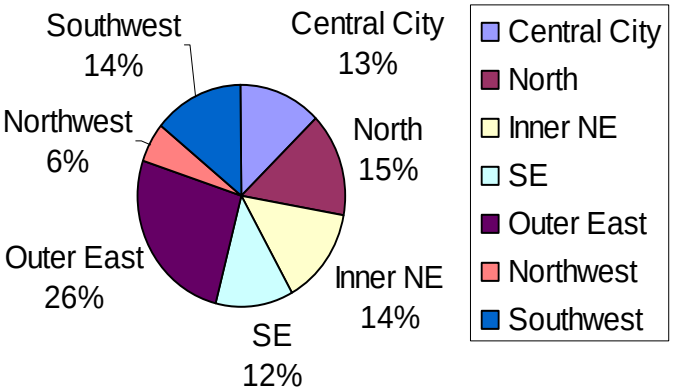
Implementing Bicycle Lanes

Bicycle lanes may be implemented through stand-alone bikeway projects, through reconstruction or construction of roadways, and through routine resurfacing of roadways when the street configuration can be modified without parking removal or serious additional congestion.

On some streets where bicycle lanes are the preferred treatment, conditions preclude the installations of the lanes. These conditions include: 1) harm to the natural environment or character of the natural environment due to additional pavement; 2) severe topographical constraints; 3) economic or aesthetic necessity of retaining on-street parking; and 4) crippling levels of traffic congestion that would result from eliminating travel lanes or reducing lane widths. Only if after careful investigations bicycle lanes are proven unfeasible, then traffic calming improvements, a wider outside lane, or alternative parallel bikeways may be substituted.

Bicycle Lanes in Portland

Bike lanes are the preferred treatment for city bikeways on streets with more than 3,000 vehicles per day. As of February 2007, 167.3 miles of bike lanes have been installed on streets across the City. Roughly 41% of the total planned bike lanes within the City have been marked or are already funded. Of all existing bike lanes, 13% are in the Central City, 15% are in North Portland, 14% are in Inner Northeast, 12% are in Southeast, 26% are in Outer East, 6% are in Northwest, and 14% are in Southwest.



Portland "Bike Guys" – bike lane stencil art

Blue Bike Lane Markings and Sign

BLUE BIKE LANES

Blue bike lanes, and the accompanying street signs, are intended to alert motorists and cyclists at high conflict areas and to clearly assign right-of-way to cyclists. As with all bike lanes, motorists are required to yield to cyclists in these areas.

Purposes

- Increase safety for cyclists
- Clearly assign right-of-way to cyclists

Issues

- Cost to maintain is higher than normal bike lanes

Standards governing the use of traffic control markings contained in the Manual on Uniform Traffic Control Devices (MUTCD) do not provide for the use of colored markings to delineate bike lanes or conflict areas. The City of Portland is testing the use of colors in bike lane conflict areas through a partnership with the University of North Carolina Highway Safety Research Center and the Federal Highway Administration. The color blue was selected based on several factors including conflicting meaning for other colors, color blindness, public support, and evidence from other cities.

In 1998, the City painted blue ten short bicycle lane segments where cars and bikes weave. The ten trial locations listed below were selected to test blue lanes in four different conflict situations (i.e. right-turn lane, entrance ramp, exit ramp and through-right turn):

- Hawthorne Bridge, east end (eastbound)
- S.E. Madison, Sixth to Grand (westbound)
- Broadway Bridge, east end (eastbound)
- East end of the Broadway Bridge (westbound)
- NE Weidler, at Victoria (eastbound)
- NE Broadway, at Williams (westbound)
- Beaverton-Hillsdale Hwy, at Bertha (eastbound)
- SE 7th, at Morrison (southbound)
- SW Terwilliger, at I-5 on ramp (northbound)
- SW Multnomah, at Garden Home (eastbound)

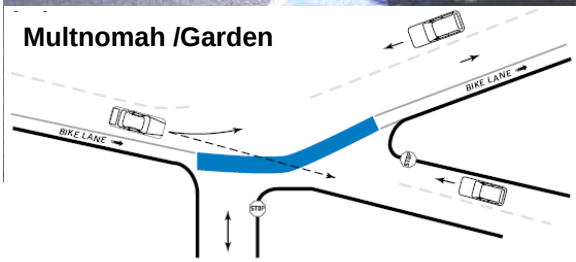
Street Sign: Blue Lane

A detailed study of the blue bike lanes was conducted using a video footage from each site both before and after the blue application. In addition, staff conducted a field suvey of cyclists and a mail survey for motorists. Key results from this study included the following:

- More drivers yielded to cyclists than before
- More drivers slowed or stopped when approaching than before
- More cyclists followed the recommended path than before
- Fewer cyclists performed a “head check” to look for vehicle traffic
- Nearly 50% of motorists surveyed felt the area was safer
- More than 75% of cyclists felt the locations were safer

Most locations have performed well, although bike-automobile crashes have continued to occur at North Broadway and Williams. Since the original ten installations, the Bureau of Maintenance switched from paint (which wore out completely at all locations following the first winter) to thermoplastic, which lasts several years. The Portland Office of Transportation (PDOT) has recently decided to expand the use of blue bike lanes to other similar intersections.

Before and After: Hawthorne Bridge (east end)



SHARED LANE MARKINGS

Shared lane pavement markings, or “sharrows”, are markings used to indicate a shared lane environment for bicycles and automobiles. Sharrows are placed on streets that according to City policies should be striped with bicycle lanes; however, due to either narrow right-of-way, demand for multiple travel lanes, and/or on-street parking, bike lanes are not feasible. This technique is considered a last resort for creating acceptable operating conditions in the absence of bike lanes.

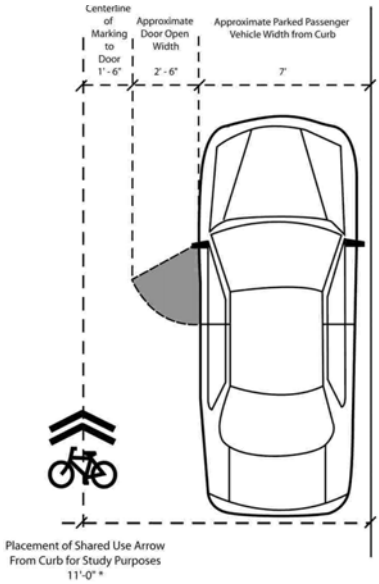
Purpose

- Create safe operating conditions for cyclists
- Mimic the effect of bicycle lanes
- Increase space between cyclists and parked cars/ moving cars
- Reduce the number of bicycle on the sidewalks

Issues

- Visible placement of markings
- Need for accompanying signage

Problems occur when a roadway narrows and bicycle lanes end abruptly, and as a result, cyclists may ride too closely to parked cars (i.e., within the “door zone”), or motorists may pass cyclists too closely.



Sharrows are intended to direct cyclists to better position themselves on the roadway. The message for cyclists is to "take the lane," i.e., to move away from parked cars and ride through the center of the sharrow marking. For motorists the message is expect bicycles to move into the travel lane and exercise patience and caution when sharing the roadway with cyclists. Motorists wishing to pass cyclists should either change lanes or wait until the cyclist turns off the street.

Locations in Portland

Portland is testing shared lane markings in a limited number of locations as part of an experiment monitored by the Federal Highway Administration. Sharrows are not a federally adopted traffic management tool in the Manual on Uniform Traffic Control Devices (MUTCD).

A total of 22 markings have been installed in Portland; including eleven on NW 19th (Hoyt to Burnside), six on NW 18th (Burnside to Everett) and five on SW Alder (Burnside to 16th). The markings are 3 foot 3 inches wide and 9 foot 3 inches tall and are spaced approximately 100 feet apart. If the markings prove effective, the City will slowly expand their use to other, similar locations that meet our guidelines.

HAWTHORNE BRIDGE SHARED PATHWAY

Among cyclists, the Hawthorne Bridge is the most popular Willamette River crossing (with more than 5,000 daily trips) of the four bicycle-friendly bridges which cross the River in the Central City. Bicycle and pedestrian facilities on the Hawthorne Bridge comprise off-street shared pathways along the north and south sides of the bridge. In 1999, both pathways on the bridge were expanded from six to ten feet wide.

As the bicycle facilities feeding the Hawthorne Bridge were developed between the early 1990's and 2006, ridership on the Bridge increased by nearly 300%. As the popularity of the Hawthorne Bridge has grown, so have conflicts between cyclists and pedestrians. Recent improvements were made in order to address safety and operational concerns on the Bridge.

In 2005, new markings where painted on the sidewalks to clearly separate pedestrian and bicyclist users by dividing the shared pathway into two lanes. The markings direct pedestrians to use the wider outer portion (right side) of the sidewalk and bicyclists to use the road (left) side portion.

Through operational changes on the bridge were also introduced creating one-way travels for bicycles on both bridge sidewalks. Pedestrians are permitted to travel in either direction on both sides of the bridge.

Purposes

- Reduce conflicts between cyclists and pedestrians through separation
- Improve safety conditions for all users

Issues

- Accompanying signs and markings
- Deterring wrong way riding
- Allowing cyclists to pass
- Addressing excessive bicycle speeds

North side of Bridge: facing West

North side of Bridge: facing East

BIKEWAY SIGNING AND MARKINGS

In 2005, Portland launched a citywide effort to install a comprehensive signing system for its bikeway network. A variety of signs and markings are available to enhance the bicycle environment and make cycling safer.

Portland's signing system has two components: bicycle boulevard pavement markings and destination signs. The bicycle boulevard pavement markings are white, one-foot diameter circles containing the image of a bicycle. They are placed on the city's developed bicycle boulevards, i.e. low volume streets without striped bicycle lanes but with improvements to make them work well for cyclists.

The intent of the pavement markings are two-fold: to make bicycle boulevard streets as recognizable to cyclists as are the bikeways striped with bike lanes; and to guide cyclists along the occasional jogs taken by these boulevard routes.

Purpose

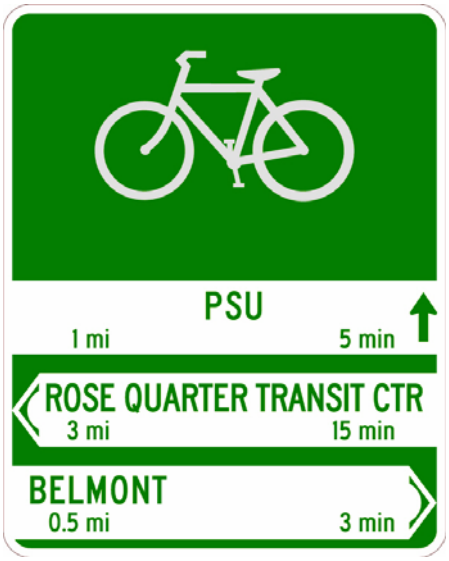
- Guide cyclists along developed city bikeways to key destinations
- Assist new cyclists in finding appropriate, convenient and attractive routes
- Make Bicycle Boulevards as visible as streets with bike lanes
- Provide guidance on making critical bikeway connections
- Dispel misperceptions about bicycling time and distance

Issues

- Make markings visible to cyclists and/or motorists

Approximately 800 bicycle boulevard markings, to date, have been installed within the City. Markings are typically placed 50 feet from the intersection and standard spacing between markings is between 600 to 800 feet. A directional arrow is added to guide cyclists through bicycle boulevard twists and turns.

Bikeway destination signs are placed at intersections along all developed bikeways, at key decision points and as guidance through difficult turns. These signs inform cyclists of significant destinations to which different bikeways will lead them. Sign dimensions are 24 by 30 inches with 2 inch tall lettering.



The locations identified on the signs include Portland's commercial centers, parks of regional significance, transit facilities, and certain institutions. In addition to providing the distance from the sign to the destinations, the sign includes a suggestion of how long it may take to reach the destination by bicycle. The riding times are based on a "no-sweat" pace of 10 mph, or six minutes per mile. Inclusion of riding times is intended to dispel the common misperception that "it takes too long to get there" by bicycle.

As of February 2007, approximately one-half of the planned network signs had been installed. An Oregon Department of Transportation grant will fund the remaining sings in late 2007-2008.

BICYCLE PARKING EXISTING CONDITIONS

INTRODUCTION

Bicycle parking is a key component of a functional bicycle network. A person is much less likely to cycle if she has no place to safely park her bike. In order to function well, bike parking must be:

- Ubiquitous – available everywhere cyclists ride.
- Conspicuous – in plain view to ensure the public that places exist to leave their bikes
- Secure – provide some level of assurance that the bike will not be stolen.
- Accessible – easily serve the needs of the cyclist and the location she is traveling to.

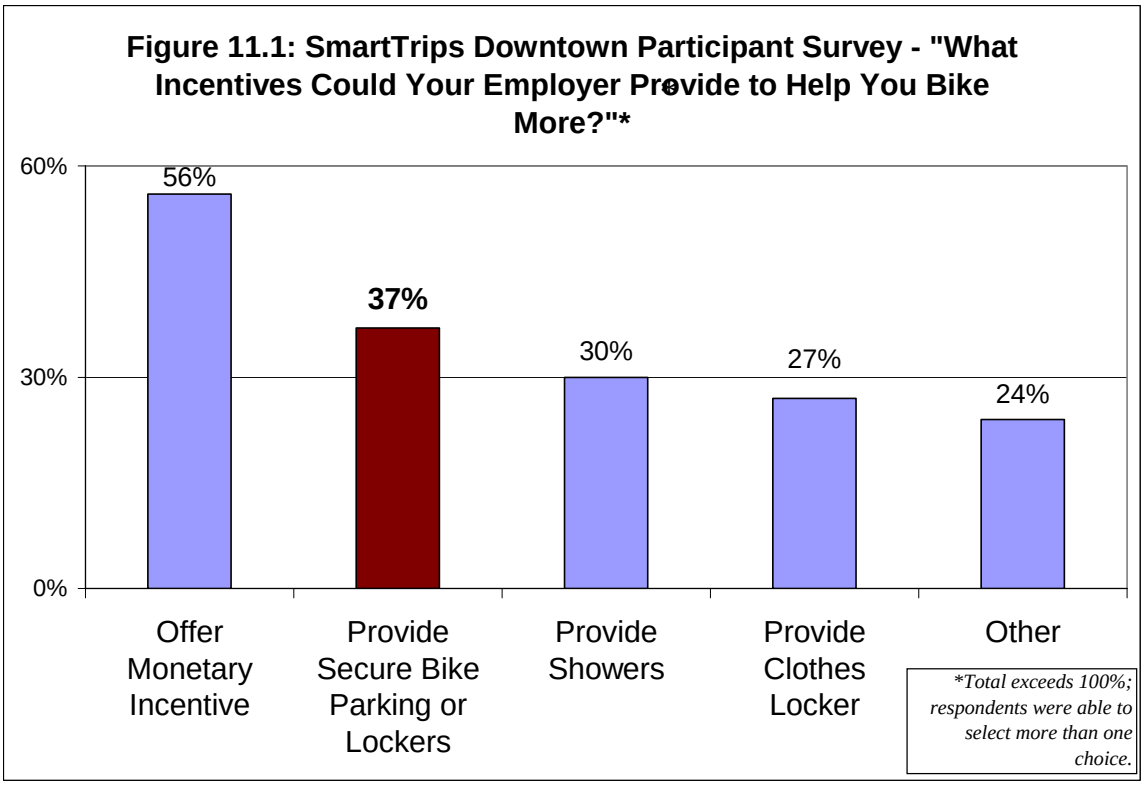
In Portland today, some areas of the city have bike parking that meets most or all of the requirements above. However, many locations either lack bicycle parking or has parking that does not fully serve cyclists' parking needs. Nevertheless, much progress has been made since the adoption of the Bicycle Master Plan in 1996. The Portland Bureau of Transportation (PBOT) currently manages 4,705 short-term spaces and the agency has developed innovative policy and infrastructure solutions to meet changing needs, worked with the community to meet citizen and business demand, and continually researched new strategies to find the best solutions for the community.

Photo: Steve Dotterer

There is little doubt that the demand from citizens and the business community for high quality bike parking exists and is growing. Several different surveys administered in 2008 show a high level of interest in more extensive parking facilities. For example, several surveys of downtown commuters and residents have revealed between 27% and 37% of respondents said they would bicycle more if more parking existed.1 Additionally, 52% of Central Eastside residents that responded to a PBOT survey reported that more bike parking would help them drive less.2

If everyone currently commuting downtown via transit was to switch to driving alone an additional seven US Bancorp towers worth of automobile parking garages would need to be built in order to accommodate the new vehicles. Bicycle parking is very space efficient; approximately 10 bicycles can park in one automobile space.

[1] SmartTrips Downtown Program Participant Survey, 2007 and 2008; Central City Transportation Management Plan (CCTMP) Downtown Resident and Employee Survey, 2008.
[2] CCTMP Central Eastside Resident and Employee Survey, 2008.



Short-Term Bicycle Parking

Much of the demand for bicycle parking is met through short-term parking. Short-term bicycle parking provides shoppers, customers, messengers and other visitors who generally park for two hours or less a convenient and readily accessible place to park bicycles. PBOT primarily installs staple racks in the right-of-way, usually on the sidewalk (see Appendix for pictures and descriptions of bicycle parking varieties). In addition, Portland code requires private developments to install short-term parking as a permit condition for new developments or renovations.

1. Short-term parking locations are identified in one of four ways:
2. Requests by citizens or businesses in the right-of-way
3. As required by Portland code (33.266.200 Bicycle Parking) on new developments or building renovations
4. Privately installed parking permitted by PBOT for locations in the right-of-way
5. As a component of public works projects

Bicycle Parking Requests by Citizens or Businesses

In (YEAR) PBOT established a program and funding to respond to community and business requests for bicycle parking. This program has been hugely successful in expanding the City's supply of bicycle parking. In 2008 alone, 320 staple racks were installed to accommodate requests for bicycle racks.
Responding to citizen and business requests meets several important components of successful bicycle parking. Most importantly, it places parking directly adjacent to the businesses and services that cyclists are traveling to. Research has shown that bicycle parking located more than 150 feet from the destination it is intended to serve

will be underused.[3] By responding directly to cyclists and business owners, PBOT takes much of the guess work out of successful placement. In addition, responding to the community's input for parking demonstrates a growing demand for cycling facilities.

Short-term bicycle parking requests are called into PBOT's bicycle hotline (503-823-CYCL) and, as of August 2008, fielded by a PBOT employee dedicated to managing the requests. The bicycle hotline is well publicized on the tens of thousands of maps and brochures distributed by PBOT each year, through the gettingaroundportland.org website, and with information sticker displayed on each newly installed bicycle rack. After fielding a request, the location is investigated and a work order is generated in the order of the request. The creation of a part-time PBOT position to deal directly with bicycle parking requests demonstrates both the growing demand and effective solutions devised to meet the demand.

While filling requests for short-term parking responds well to citizen demand, it is a reactive approach. PBOT currently has no system or policy in place to anticipate or calculate bicycle parking demand.

Bicycle Parking Required by Portland Code

In 1996, Portland city code under Title 33 was amended to include a number of provisions for bicycle parking. In general:

- New developments were required to include short and long term bicycle parking; the required amount being spelled by the code based on a number of factors.
- Incentives were adopted to encourage the inclusion of locker-room and shower facilities in major new Central City buildings [see Chapter 33.510.210.C.8]
- The provision of additional non-required bicycle parking was permitted to substitute for up to 25 percent of required automobile parking [see Chapter 33.266.110.B.4]
- Improved weather protection and signage requirements were required.

By 2003, a number of problems had been identified regarding effectively meeting and administering the new requirements. PBOT convened a Short-term Bicycle Parking Task Force of community leaders, advocates, citizens, and City staff to tackle problems with the provision's design, implementation, and compliance. The task force recommended, and in 2004 City Council adopted, two key changes to facilitate short-term parking development. The main changes included:

1. Simplifying the requirements for short-term parking to ensure that bike racks were sited adjacent to main entrances and in clear view.
2. Creating a "Bicycle Parking Fund" to allow property owners, whose buildings are configured without setbacks from the street lot lines and/or without adequate space within a short distance of the main entrance, to meet their short-term bicycle parking requirement by paying into a PBOT-administered fund used to provide short-term bicycle parking throughout the city.

Prior to simplifying the requirements for short-term parking, bicycle racks were often placed in out-of-the-way locations or where cyclists were not accustomed to accessing parking. The simplifications brought parking within

[3] http://www.dft.gov.uk/pdf/pgr/roads/tpm/tal/cyclefacilities/supplyanddemandforcycleparking

50 feet of the main entrance or entrances of buildings and spelled out specific guidelines for measuring distance and designing placement. Finally, recognizing some of the difficulties in identifying sufficient space to cover short-term bicycle parking, particularly if a building is built to its property lines, the previous requirement to cover short term bicycle parking (50 percent if ten or more spaces are required) was removed. Removing the requirement for covered short-term bicycle parking was a trade-off for not allowing parking to be installed inside buildings where it was often not visible and inconvenient.

The Bicycle Parking Fund has also helped eliminate much dissatisfaction on the part of property owners and cyclists alike with how short-term bicycle parking had previously been provided. Property owners may only pay into the Bicycle Parking Fund if they have no room on their property to provide all their required short-term bicycle parking. Before the Bicycle Parking Fund, short-term parking would all too often end up in underground parking or in out of the way locations on private property that did not serve cyclists' needs and created dissatisfaction among developers. The Bicycle Parking Fund devised a new mechanism to create short-term parking throughout the city and aid developers in meeting the code's requirements.

Privately-installed Permitted Bicycle Parking in the Right-of-Way

Portland's iconic blue staple racks are the most common type of short-term parking found in the city and are the primary rack PBOT uses in the right-of-way. Occasionally, private installations of bicycle parking in the right-of-way are also permitted by PBOT. The City is seeing more and more developers incorporating additional bike parking into design plans. While this is advantageous in terms of increasing capacity, there are a number of cases where bicycle parking is not installed according to design and spatial guidelines. PBOT attempted to resolve this issue with the creation of a design guide written to assist developers and property owners choose racks styles and situate racks in a way that both meets city code and cyclists needs4. It may be advantageous for the City to revise and redistribute these guidelines.

Portland's staple rack

Bicycle Parking as a Component of Public Works Projects

When public works projects occur, PBOT can act more proactively on short-term bicycle parking. For example, a recent street improvement project on Hawthorne Blvd included four covered bicycle parking facilities, called "Bike Oases," each with parking for 10 bicycles and additional short-term staple racks built in the right-of-way. Incorporating bicycle parking into public works project helps add more parking to the city's inventory, however because of the limited number of public works projects, this approach can only satisfy a small amount of bike parking demand city-wide.

[4] *Bicycle Parking Facilities Guidelines*, http://www.portlandonline.com/transportation/index.cfm?&a=58409&c=34813

Other Approaches to Meet Short-term Parking Demand

In addition to the covered grouped bicycle parking facilties that has been included in several city streetscape projects, the "Bike Corral" is another innovative infrastructure tool that PBOT has developed to meet growing bicycle parking demand. Bike corrals are located on-street and provide parking for 8 to 12 bicycles per each allocated vehicle parking space.

On-street bicycle parking can provide many advantages in areas of the city where bicycle-use is high and growing; as such the design is popular with various stakeholders:

- Businesses: Corrals provide a 10 to 1 customer to parking space ratio and advertise "bike-friendliness." They also improve the pedestrian environment in business cores.
- Pedestrians: Corrals clear the sidewalks and serve as de facto curb extensions.
- Cyclists: Corrals increase the visibility of bicycling and add additional parking where demand is high.
- Government: Corrals validate the message that cycling is a legitimate and valuable means of transportation in a manner that encourages bicycling as a convenient and popular mode, especially for short trips.

The City has received numerous requests to remove on-street auto parking and install bicycle parking from not only business owners, but from developers as well. This is a recognition that many businesses recognize that an increasing number of their clientele will be arriving by bike and the infrastructure to serve them is lacking.

PBOT is currently working with a number of local businesses and neighborhood associations to develop plans for increasing the number of corrals and other grouped bike parking facilities across the city. An internal effort is also underway to revise the criteria and policies informing the installation decisions.

Long-Term Bicycle Parking

Development Code

Long-term bicycle parking is meant to accommodate employees, students, residents, commuters, and others expected to park more than two hour. Long-term parking should be located in a secure, weather-protected environment and can include, lockers, locked room facilities with standard racks and limited access, or standard racks in a monitored location. Long-term parking is a key component of any bicycle network.

Portland City Code (33.266.220) spells out the specific requirements for developing long-term parking facilities in commercial, residential, industrial, institutional, and other developments.

The 1996 Bicycle Master Plan proposed a requirement of 1 long term space per dwelling unit, however by 2004 the City's minimum code requirements for long-term bicycle parking only required 1 space per 4 units. As such, the assumption that over 10,000 commercial, residential, and school-based long-term bike parking spaces were be installed by the 10 year benchmark, and over 20,000 spaces by the 20 year benchmark are most likely inflated.

Further, for multifamily complexes or dormitories, the code continues to allow long-term parking to be located inside the residence without supporting infrastructure or space.[see Chapter 33.266.220.B.2.d(7)] This aspect of the code has thwarted the development of long-term parking facilities in many residential developments and has placed the onus on the resident to find space within the living area. This is particularly problematic during the winter months when bicycle parking must accommodate dirty, wet bikes; living space is not the most appropriate place and does not encourage year-round cycling.

City code has no authority to augment bicycle parking for existing buildings. In certain areas of the city, such as the inner eastside where bicycle mode splits approach 15% and much of the residential housing is comprised of apartments, lack of long-term parking can be problematic.

The Oregon Department of Energy developed its Business Energy Tax Credit program to encourage investments in energy efficiency, including bicycle parking facilities. Qualifying projects can take up to a 35% tax credit on the cost of the facilities. The program serves as an incentive to construct new parking facilities in existing buildings, however it is not very well known.

Public Bike Lockers

To date, the City of Portland and TriMet manage approximately 500 long-term lockers to meet bicycle commuters long-term parking needs. Further discussion of the bicycle parking needs at transit hubs and stations is explored in the Transit and Bikes section of the Bicycle Master Plan.
Many private developments, including employment centers and residential complexes, also include long-term parking that is not administered or accounted for by public agencies. An in-depth survey would help reveal more precise figures. Nevertheless, recent surveys indicate the need for more long-term bike parking exists throughout the city.[5]

End-of-Trip Facilities

Using an alternative method to meet long-term parking demand PBOT developed "Bike Central" in 1996, a public-private venture with local athletic clubs in which a network of facilities were created to provide bicycle commuters with permanent lockers, showers and secure bicycle parking for a monthly fee . The Bike Central program began with a $350,000 CMAQ grant and included five locations. The grant included funds to build parking and clothes storage, as well as marketing for two years. After the initial two years, the private companies behind the Bike Central facilities were expected to continue the service. To date, two Bike Central locations still operate; one in downtown and one in the Lloyd District. While Bike Central is an innovative public-partnership designed to meet residents' long-term end-of-trip facilities needs, it only meets a small amount of the demand for long-term parking spaces and only serves cyclists with destinations near the facilities.

[5] Alta Planning and Design, *White Paper: Bicycle Parking Options at Transit Stations*

Bike Central's allure was the housing of the key end-of-trip facilities cyclists need in order to complete their trip – parking, changing and shower facilities, and clothing and personal item storage. While many employers provide all or some of these facilities for bicycle commuting employees, the City lacks a clear understanding of both the supply and demand. Currently, no data exists on the total amount of privately supplied long-term parking spaces and related end-of-trip facilities.

In addition to Bike Central, Portland adopted code changes to encourage developers to provide end-of-trip facilities by providing a significant bonus to developers who provide both showers, changing areas, and locker rooms for commuting cyclists (see Chapter 33.510.210.C.8). Developers who install such a facility are able to then claim a 40:1 floor area ratio bonus. This is a tremendous incentive as it allows developers to build 40 additional square feet—beyond what code would otherwise allow—for every square foot they dedicate to bicycle commuter shower and locker room facilities.

Other long-term parking facilities are currently being developed that will help augment the city's supply. As part of the downtown Portland Mall revitalization project, Portland State University (PSU) has received a grant to develop a secure, long-term parking facility for a minimum of 28 public bicycles. PSU is currently developing the facility and may incorporate it into its existing bicycle repair and education center. Another long-term bicycle parking facility is slated for a redevelopment project at SW 1st Avenue and Main in downtown Portland. The developer is planning for the facility, however the design has not been finalized as of this writing.

Parking and Transit

Providing high quality, secure parking at transit stations is a key component in linking cycling and transit. TriMet provides hundreds of bicycle lockers at light rail stations and transit centers throughout the Portland region (see Chapter 11, "Bicycles at Transit Stations and Park-and-Ride Facilities"). The bicycle lockers fall into three categories:

1. Reserved, fee-based lockers;
2. Free bike lockers requiring a user-provided lock;
3. Free bike lids requiring a user-provided lock.

In addition to providing parking facilities, TriMet also allows bicycles on all of its buses and light rail vehicles. While this strategy has been successful (see Chapter 11), particularly at expanding cyclists' travel distances, it is limited by the number of bicycles that transit vehicles can accommodate. Several MAX light rail lines are well beyond bicycle capacity at peak hours, forcing TriMet to research new solutions for linking transit and cycling. As part of that research, TriMet surveyed cyclists who ride transit and commissioned Alta Planning and Design to evaluate the data. Alta reported that 75% of the riders surveyed said they were unwilling to leave their bicycles at light rail stations and 40% said lack of safe bicycle parking was a reason they brought their bike on board a transit vehicle. These numbers suggest that better bicycle parking at transit

MBTA's new Alewife Station Bicycle Parking

stations may encourage many cyclists to park their bikes and ride transit to their destination, freeing up space on vehicles for riders who need their bicycles to reach their final destination.

As part of its on-going effort to improve bicycle and transit integration, TriMet has initiated a working group of planners, advocates, and City staff to develop new guidelines for bicycle parking at stations. The working group convened in late 2008 and will continue through 2009 to help develop new parking guidelines, as well as generate other innovative solutions to strengthen the links between cycling and transit in the region.

One example of new innovations includes the Massachusetts Bay Transit Authority's development of several secure bicycle parking facilities at one of its most heavily used transit stations. Although that exact facility may not serve the Portland area's needs, it is a good example of meeting cyclists needs and developing a tool to attract new cyclists.

Bicycle Parking, Theft, and Security Issues

According to a recent U.S. Department of Justice report, concerns about bicycle theft are a barrier for Americans wanting to cycle more.6 The same concerns were apparent in the 1990s when the Bicycle Master Plan was first undertaken. What steps have been taken and what steps could be undertaken to alleviate cyclists concerns?

A key strategy the City has employed to combat theft is to develop adequate bicycle parking facilities and site them in the most secure locations possible. Available parking that meets the City's standards and cyclists' needs will provide a more secure environment for bikes and help eliminate locking to insecure objects such as newspaper trust boxes or street furniture and signs. Perhaps as important, ubiquitous bicycle parking lets all Portlanders know that facilities exist and security is a priority.

Education is a key component to combating bicycle theft. For example, the 2008 Department of Justice report on Bicycle Theft reported that several surveys from Europe revealed that most stolen bicycles were either unlocked or secured with a lock that required little force to break or remove. Educating cyclists about the importance of proper locks and locking techniques may go a long way towards eliminating bike thefts. PBOT's Transportation Options Division distributes thousands of bicycle maps and other informational materials that contain a section on proper locking devices and techniques. However, Portland still has a reputation for high bicycle thefts. Kryptonite, one of the world's foremost bicycle lock companies, has ranked Portland in its Top 10 lists two years in row for cities with bicycle theft problems. The company would not reveal their data sources so the accuracy of the report is unknown, but the publicity can cement Portlanders' concerns about bicycle theft in the city. There are currently no extensive public outreach campaigns educating cyclists about security issues.

Data on bicycle thefts in Portland is currently collected by the Portland Police Bureau based on reported thefts. Coordination between PBOT and the Police Bureau on theft data, education, enforcement, and other security measures are not currently underway. It is unclear if coordination among the bureaus would provide tangible

[6] Problem-Oriented Guides for Police Problem-Specific Guides Series Guide No. 52, Bicycle Theft. www.cops.usdoj.gov

benefits in combating bicycle thefts. In addition to reporting bicycle theft to the police, bikeportland.org founder Jonathan Maus, began an initiative allowing cyclists to post their stolen bikes in a single on-line forum. The list is distributed to the police bureau and local bike and pawn shops weekly. While Maus' service is invaluable to bike theft victims, it is a voluntary effort with no public funding.

Special Events

Bicycle parking for special events has grown from a quirky feature of Portland events to a key component of managing traffic and transportation. Special event bicycle parking, however, is provided only when the event sponsor elects to arrange for temporary facilities. For example, the residents of Peacock Lane in Southeast Portland contacted PBOT for bicycle parking for their annual Christmas lights viewing. On the other hand, when then-candidate Barack Obama spoke to thousands of Portlanders at Tom McCall Waterfront Park no bicycle parking plan was in place and bicycles were locked to anything bolted or planted in the ground.

In the past, the bicycle advocacy and education group Bicycle Transportation Alliance, provided valet bicycle parking at special events. [Waiting for details from BTA]

Since the BTA stoped offering its special event parking services, PBOT has worked to help fill the gap. PBOT's "Missing Links" fund aims to connect gaps in the bicycle network and fill voids in bicycle services. Missing Links has funded approximately 5 – 10 special events parking facilities in the past two years, spending approximately $1,500 in total. In general, the program focuses on not-for-profit events and hires a private contractor to set-up and staff the parking facility.

Bikes parked on railings at the Oregon Convention Center are emblematic of demand for parking at certain special events.

Due to the significant increase in the number of Portlanders cycling over the last five years, bicycle parking for special events is developing into a considerable traffic and transportation management issue. However, event permits, even for City-sanctioned areas such as parks, do not require any bicycle parking management plan.

Bicycle Parking at Schools

Providing bicycle parking at schools is an important aspect of encouraging students to cycle more. Much of the bicycle parking built at schools since 1996 has occurred either because schools have requested racks or through engineering by the Safe Routes to School Program (see, Chapter 5 Encouragement).

Since 1996, 22 schools that are not involved in the Safe Routes to School program have requested and received a total of 354 parking spaces. PBOT's "Missing Links" program fielded the requests and arranged for installation. Seven additional schools, proposed to receive a total of 122 spaces, are also slated to receive parking in 2009.

In previous years, the Safe Routes to School program included funding for engineering and installation of bicycle parking. During that time, the Safe Routes program encouraged 18 schools to add 192 staple racks (maximum 384 parking spaces). In addition, the program worked with PBOT engineers to install a number of concrete pads to site the parking and one shelter to cover the parking. Currently, Safe Routes schools are expected to request parking through the bicycle hotline just as other businesses or institutions in Portland.

Non-Standard Bicycle Racks (Art Racks)

PBOT recognizes that the installation of bicycle parking racks, especially racks of innovative and aesthetic designs by property owners improves Portland's transportation infrastructure and enhances Portland's image as a livable innovative city. In particular, the installation of bicycle racks on city streets furthers these goals:

- To provide needed parking for the increasing number of people who choose bicycling as a transportation option.
- To enhance Portland's image as a people- and bicycle-friendly city; a community that regards bicycles as a permanent and important part of the city's transportation infrastructure.
- To encourage more people to choose cycling as a transportation option.
- To create a symbol for our city's livability that will gain positive attention locally, regionally and nationally.

While PBOT permits art racks, it is the property owner's responsibility to procure, install, and maintain the rack. In 2008, PBOT permitted three racks and fielded approximately 12 requests for information.

Conclusion

Portland has added thousands of bicycle parking spaces since the original adoption of the Bicycle Master Plan in 1996. City staff have developed new tools, such as the Bike Corral and Bike Oasis, to meet increasing demand and worked with developers and cyclists to ensure bicycle parking standards that works for Portlanders. Yet with progress comes new challenges and the City of Portland faces several issues in building the next wave of bicycle parking:

- Lack of oversight by BDS in regard to types of racks being installed by private developers
- Lack of education in some areas of the City on the need for bicycle parking and the significance of the design of that parking
- A building code that allows an apartment or dormitory room to serve as long-term parking in multi-unit dwellings
- A "one-size-fits-all" code requirement that doesn't reflect different levels of demand in different parts of the city
- Lack of system or policy to anticipate or calculate bicycle parking demand
- Lack of policy or rules providing guidance for parking at special events
- Inadequate policy to meet demand for on-street bike parking facilities

- Growing demand for bicycles on transit and for parking at transit stations
- Insufficient quantity of public bicycle parking in many areas of the City
- Lack of long-term parking at older buildings
- Lack of cover for short-term parking
- Lack of data on existing long-term parking and facilities and cyclists' needs.

Ineffective system for addressing bicycle security and theft, particularly as it relates to parking.

BICYCLE AND TRANSIT INTEGRATION

INTRODUCTION

Portland-area transit providers are striving to keep pace with the growing number of cyclists by making significant advances in accommodating bicycles on transit and at transit stations. Part of the City's goal to make the bicycle an integral part of daily life involves improving "bicycle/transit integration" by increasing "the number of bicycle-transit trips" and supporting "TriMet's Bikes on Transit Program." This approach links together policies for both bicycle and transit use to more effectively reduce Portlanders' dependence on their automobiles.

Bicycle and transit integration can serve to expand the number of residents who consider both bicycling and transit feasible transportation alternatives. By using transit for a portion of their trips, cyclists have the option to avoid segments with steep hills or difficult connections, as well as, poor weather or other barriers to bicycling. Improving bicycle access on transit, at transit, and to transit provides Portlanders with more transportation options to save money and keep fit while reducing congestion, pollution and the demand for parking.

BICYCLES ON TRANSIT

TriMet is responsible for providing public transportation within the Portland Metropolitan Area. TriMet operates a comprehensive transit network including the MAX light rail system, Portland Streetcar and 91 bus lines.

Recently, TriMet has endeavored to make transit more attractive to the growing number of cyclists by emphasizing that "when you can't bike the whole way, take TriMet." This strategy to accommodate bicycles has resulted in new policies and bike-oriented features on transit vehicles and at transit centers and stations.

TriMet's general policy related to bikes is to "permit the transport and operation of a bicycle upon the District Transit System" as stated in the TriMet Code (TMC). The agency's other policy document, which sets forth guidelines related to bicycles, is TriMet's Administrative Rules. These rules establish specific standards for bringing bicycles on District buses, rail vehicles and for using TriMet bike racks and lockers.

TriMet's Transit Investment Plan (TIP), a five-year plan outlining the agencies strategies and programs to meet regional goals, contains the following statement:

> *TriMet will continue to promote bike access to transit by expanding the distribution of bike racks and lockers as new investments in high capacity transit are made. TriMet will work with local jurisdictions to improve bike access and awareness of bicycle facilities in*

the metropolitan area. High capacity transit corridors will preserve, enhance or establish bike routes.

Only TriMet buses and trains are equipped to allow for bicycle transport. Bikes are not prohibited on the Cedar Mill Shuttle (to/from the Sunset Transit Center), the Vintage Trolley (running between Lloyd Center and SW 11th Avenue), or LIFT paratransit vehicles (for individuals with disabilities).

Bicycles on the Bus

Since 1995, every bus operated by TriMet has been equipped with a bicycle rack. Today, bicycle racks are provided on all bus lines, at all hours and in all seasons of the year. No additional fare is required to use TriMet bus racks.

Jonathan Maus/BikePortland.org

Each TriMet bus is equipped with a front-mounted rack that can hold two bicycles. Only collapsible bikes are allowed inside buses. Administrative rules adopted by TriMet on bringing bikes on the bus specify the following:

- Only standard size bicycles are allowed
- Bicycles with oversized wheels, tandems, three or more wheels, trailers, or internal combustion powered bicycles are not allowed
- An adult must accompany children under the age of 12 who wish to use bus racks

Users are responsible for loading, securing and removing their bicycle from the rack. Drivers have a higher degree of visibility since the bicycle racks are mounted to the front of the vehicle. Racks not previously in use must first be lowered using a release on the top handle. Cyclists are responsible for placing their bicycle in the wheel trough and raising the spring-loaded bar over the front wheel.

Other Bus Service Providers

Besides TriMet, there are a number of other bus operators that serve the metropolitan area by connecting Portland with other communities in the region. Each of the bus operators noted below offers services to accommodate bicycles on their buses.

C-TRAN provides bus service along 27 routes within Clark County, Washington and to destinations within the City of Portland. Commuter routes are popular, in particular express routes to Downtown Portland, among Washington residents who commute to Oregon for work. All C-TRAN buses are outfitted with front-mounted bicycle racks. The standard fare for C-TRAN covers the use of bicycle racks. C-TRAN also offers bicycle lockers at five different locations around Clark County for use with payment of a refundable security deposit.

Four other transit agencies offer regular bus service either along routes within the City of Portland or linking riders to TriMet's transit system. Each of the following bus operators provides bike carrier racks on their vehicles:

- South Metro Area Rapid Transit (SMART) – route from Wilsonville to the Barbur Transit Center.
- Sandy Area Metro (SAM) – routes from Sandy to the Gresham Transit Center.

- Canby Area Transit (CAT) – route from Canby to the Oregon City Transit Center.
- Tillamook County Transit – route between Tillamook and Downtown Portland.

Bicycles on Rail Vehicles

In addition to its 91-line bus system, TriMet also operates the regional light-rail system, known as the Metropolitan Area Express (MAX), and the Portland Streetcar. Both rail services offer access for riders with bicycles.

Light Rail and Bicycles

The MAX light-rail system, originally opened in 1986, currently comprises three lines and 64-stations connecting Downtown Portland with the Portland International Airport, the Metropolitan Expo Center, and the suburban communities of Hillsboro, Beaverton and Gresham. Bicycles have been permitted aboard MAX trains since 1991 and the level of access has increased over time. Since completion of the 1996 Bicycle Master Plan, TriMet has eliminated time of day restrictions on the MAX. Still, today bicycles may be excluded if there is a lack of adequate room in designated bike areas.

The majority of TriMet's light-rail fleet consists of "low-floor" rail cars (referred to as Type 2, 3, or 4). TriMet's original light-rail vehicles, known as "high-floor" cars (Type 1), had stairs located at each door. The configuration of the older cars caused many conflicts for cyclists getting to and from the designated bicycle area. Now, "high-floor" cars are only operated in combination with a "low-floor" car to ensure that all trains are fully accessible.

The "low-floor" cars are equipped with four bike hooks per railcar, or eight hooks per two "low-floor" car train. These hooks are located near the entrance to facilitate boarding and disembarking. The hooks are used to suspend the bicycles in a vertical position reducing the floorspace occupied by the bicycle. Cyclists are advised to wait until all other passengers have boarded and must enter only through train doors with a bike symbol. The vertical rack (or hook) must be used first if available. Riders with bicycles must also yield priority-seating areas to seniors and people with disabilities.

Streetcar and Bicycles

In 2001, the City of Portland became home to the nation's first modern streetcar system with the opening of a rail loop running north to south through the downtown and west into Northwest Portland. Portland's streetcar system is owned and managed by Portland Streetcar Inc., a non-profit established by the City of Portland. As with MAX, the streetcars are operated and maintained by TriMet. Today the Streetcar runs on an eight-mile loop from NW Portland (Legacy Good Samaritan Hospital) through the Pearl District and west end of downtown to Portland State University continuing to RiverPlace and South Waterfront.

Riders with bicycles are permitted on board the streetcar; however there are no special accommodations for passengers with bicycles. In addition, bicycles are restricted to the "low-floor" section in the center area of the

train. As is the case on the MAX, cyclists must allow passengers without bicycles to board first and must yield priority seating areas to seniors and people with disabilities. Riders bringing bicycles on the streetcar must simply hold on to them while aboard and may be required to leave trains that become overcrowded.

Bicycles on the Aerial Tram

The Portland Aerial Tram is the most recent form of transit in Portland. The Tram connects the emerging South Waterfront District with Oregon Health and Science University's main campus and the Marquam Hill area. The Tram's two cabins depart from opposite terminals every five minutes and carry passengers through the air a distance of 3,300 linear feet in roughly three minutes.

Jonathan Maus/BikePortland.org

Since January 2007, the Portland Aerial Tram has been open to the public and serves as a unique part of Portland's public transportation system. The Tram is owned by the city, which provides regulatory oversight and is responsible for maintaining the upper and lower stations. OHSU oversees day-to-day operation of the Tram. The lower (South Waterfront) tram terminal is directly adjacent to the Portland Streetcar stop located at the intersection of SW Moody and SW Gibbs.

Regulations related to bringing bicycles on the Tram state that the transport of bicycles is permitted given the "person loading a bicycle shall do so in accordance with the instructions of the Tram Cabin Attendant." There are no hooks or designated bicycle areas on the Tram. Bicycle access is simply "roll-on, roll-off". Cyclists departing the Tram are instructed to exit using the walkway from the ninth floor terrace, then use wheel gutters on the staircase to access the seventh floor terrace and exit onto Sam Jackson Park Road.

BICYCLES AT TRANSIT STATIONS AND PARK-AND RIDE FACILITIES

The rising popularity of "bikes-on-transit" and the design constraints of bike facilities aboard buses, trains and the tram have resulted in growing pressure on the limited space for both passengers and bicycles, particularly during peak hours. As an alternative to bringing the bicycle onboard, TriMet is interested in enhancing bicycle parking at transit stations to encourage cyclists to park-and-ride to their destination.

Not surprisingly, cyclists are more likely to leave their bicycles if they are confident that it will be there when they return. For this reason, it is important to offer secure locations for "long-term" bicycle parking. Parking is considered by the City to be "secure" only if it meets one of the following conditions:

1. Be in a locked room or area enclosed by a fence with locked gate;
2. Be within view or within 100 feet of an attendant or security guard;
3. Be in an area that is monitored by a security camera; or
4. Be in a location that is visible from employee work areas.

Many TriMet MAX stations and all transit centers within the City offer a combination of bike lockers/lids and

bike racks. A TriMet transit center is a major transit hub which is served by several bus or MAX lines. The City's zoning code currently requires eight long-term bicycle parking spaces at each light-qrail station or transit center. Some TriMet bicycle lockers have built-in locks. Riders must first obtain a key by paying a refundable $50 deposit. The eight bicycle lockers installed at each of the "Yellow" line MAX stations north of the Rose Quarter are available on a first-come basis free of charge. Cyclists provide their own lock but must reclaim their bicycle within 24-hours. Table 11.1 contains a list of TriMet facilities with secure lockers.

TriMet has an innovative approach to administering their bicycle locker program. The transit agency has enlisted the support of the Bicycle Transportation Alliance (BTA), a local advocacy group working to promote bicycling and improve bicycling conditions in Oregon and SW Washington, to manage the locker program for the "Blue" and "Red" MAX lines. Cyclists contact the BTA to inquire about locker availability and to obtain a key with payment of a refundable deposit.

Table 11.1: TriMet Facilities with Bicycle Lockers

TRIMET LOCKERS WITH BUILT-IN LOCKS	TRIMET LOCKERS REQUIRING PERSONAL LOCKS
• E 122nd Ave./Menlo Park Park & Ride	• Albina/Mississippi MAX Station
• Gateway/NE 99th Ave. Transit Center	• Overlook Park MAX Station
• Hollywood/NE 42nd Ave Transit Center	• N Prescott St. MAX Station
• NE 60th Ave. MAX Station	• N Killingsworth St. MAX Station
• NE 82nd Ave. MAX Station	• N Portland Blvd. MAX Station
• Parkrose/Sumner Transit Center	• N Lombard MAX Station
• Rose Quarter Transit Center	• Kenton/N Denver Ave. MAX Station
• Barbur Blvd Transit Center	• Delta Park/Vanport MAX Station
• Washington Park MAX Station	• Expo Center MAX Station

The City of Portland offers secure, weather-protected, bicycle lockers for rent at locations throughout the Downtown. The rate for renting a locker is $25 for 3 months, or $45 for 6 months. In addition, the City requires an $80 refundable key deposit. Table 11.2 lists the City's downtown bicycle locker locations.

Table 11.2: City of Portland Bicycle Lockers

DOWNTOWN LOCKERS RENTAL LOCATIONS	
• SW 5th & Pine	• NW 1st & Davis
• SW 5th & Stark	• PSU Campus
• SW 6th & Washington	• SW 1st & Jefferson
• SW 4th & Morrision	• SW 3rd & Clay
• SW 4th & Yamhill	• SW 4th & Clay
• SW 6th & Yamhill	• SW 5th & Clay
• SW 6th & Pine	• SW 6th & Salmon
• SW 10th & Morrison	

BICYCLING TO TRANSIT

Besides providing good bicycle parking at transit facilities, cyclists also rely on adequate bicycle routes to access these destinations. The creation of complementary bikeway and transit networks contribute to the development of an interconnected multi-modal transportation system. A seamless link between the bicycle and transit networks can extend the reach of users for both modes of transportation.

As stated earlier, one of TriMet's objectives for bicycle-transit integration is to "preserve, enhance or establish bike routes" within high-capacity transit corridors. The City of Portland Comprehensive Plan, which guides future growth and development within the City, emphasizes integrating the bicycle and transit trip with the following objective:

> *Provide convenient and safe bicycle and pedestrian connections to transit routes, schools, and parks, as well as within and between new and existing residential developments, employment areas, and other activity centers where street connections are not feasible. (Policy 6.20, Connectivity, Objective C)*

One of the four primary criteria used to designate bikeway streets for the original Bicycle Master Plan was based on how the route connects cyclists to desired destinations, including transit stations. Thus, the City's existing Bikeway Network was developed with consideration towards providing access to transit stations. Still, with less than half of the Bikeway Network complete, notable gaps remain in the routes feeding transit.

Transit centers and stations with the most significant potential for bicycle usage are those that allow riders to avoid hilly terrain, difficult connections, long distances and other barriers to cycling. Thus, it is of particular interest to examine bikeway connections to transit centers/stations with long-term bicycle parking serving residents in outlying areas of the city, such as outer Southwest, East and North Portland. By combining bicycle and transit for these longer-distant trips, cyclists can avoid some of the more significant barriers to cycling.

The most notable TriMet facility in Southwest Portland is the *Barbur Boulevard Transit Center* at the intersection of SW Barbur and Taylors Ferry Road. This facility offers outer southwest cyclists secure bicycle parking and access to four bus lines connecting to Downtown Portland, Marquam Hill and southwest suburbs. There are three City Bikeways near the Barbur Transit Center, namely SW Barbur Blvd, SW Taylors Ferry Road and SW Capitol Highway. The only existing facilities, however, are bike lanes running the length of Barbur and on Capitol Highway (south of Barbur). These facilities only provide connections to neighborhoods to the southwest to northeast, leaving areas directly north, west and east without existing connections to the transit center.

The *Gateway/NE 99th Ave. Transit Center* serves as a prime destination for Outer-East Portland cyclists to transfer onto a bus or the MAX. Access to the transit center from neighborhoods to the west is constrained by the adjacent north-south running freeway (I-205) and the poor connection on NE Halsey Street. Two recommended bikeways that have not yet been funded, namely bicycle lanes on NE Halsey west of I-205 and the Sullivan's Gulch trail, would enhance the connection west of the freeway. A north-south path running along the east side of I-205 provides an off-street route for cyclists linking directly to the Gateway Transit Center. Funded bike lanes on 102nd Ave will provide a parallel north-south on-street bike route. Both bikeways provide connections to the existing east-west bicycle lanes on E Burnside St. south of the transit center. Funding has not yet been identified for another bikeway on NE Glisan, between Burnside and the transit center, which would provide a closer east-west

route. Existing bicycle lanes on NE Halsey/NE Weidler link the transit center to neighborhoods to the east and north-east. As described, the existing facilities provide reasonable access to the north, south and east of the transit center; thus offering cyclists who reside in these areas the potential to avoid a longer-ride to destinations (including downtown) served by bus and MAX.

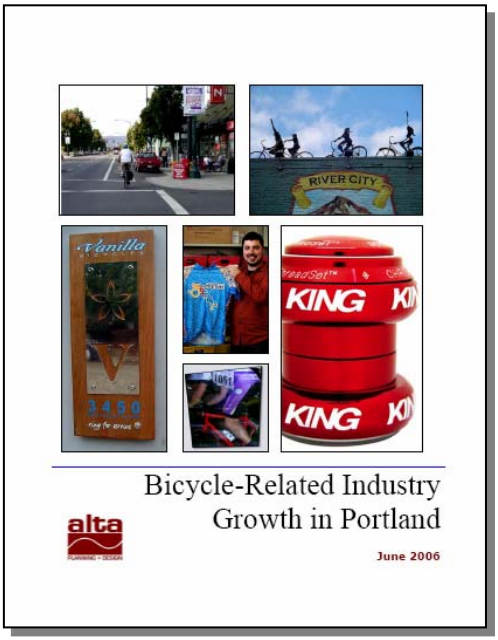
In spring 2004, TriMet opened the Interstate MAX Line, which connects North Portland to the City Center. As mentioned in the section on bicycle parking, bike lockers have been installed at each of the Yellow Line MAX stations north of the Rose Quarter. The station with perhaps the greatest potential for combining bicycle and MAX into a single trip, particularly for residents on the St. Johns peninsula, is the *N Portland Blvd. MAX Station*. East-west bike lanes on N Rosa Parks Way provide a direct connection to this MAX station from the popular bikeway on N Willamette Blvd., a primary route for cyclists heading to/from neighborhoods and bike trails further to the north. The eastbound connection from the station along N Rosa Parks (across I-5) has been funded and will be constructed shortly. Recommended bike lanes on N Interstate Ave., the north-south bikeway directly adjacent to the Portland Blvd. Station, do not yet exist. Currently a gap in the N Interstate bike lanes exists between N Dekum St. and N Willamette Blvd. Bicycle lanes on N Denver Ave, three blocks west of the MAX line, provide a parallel north-south route for cyclists.

The above assessment of city bikeway connections to three key TriMet facilities illustrates the connectivity between the City's transit and bicycle transportation networks. Most transit centers/stations are served by multiple bikeways. However, access to these facilities from surrounding neighborhoods remains limited due to numerous incomplete connections in the designated bikeway network. Where bikeways have been constructed near transit stations, access to these destinations may still be enhanced by creating more direct bicycle routes or making safety improvements on existing routes.

BICYCLE-RELATED INDUSTRY

INTRODUCTION

The City's investment and commitment to bicycling and bicycling infrastructure has earned it the distinction of being the country's most bicycle friendly large city. A positive by-product of this investment is Portland's growing, vibrant bicycle-related industry. In 2006 Alta Planning + Design surveyed more than 100 businesses to obtain a more complete picture of bicycling's impact on Portland's economy. Alta summarized their findings in the report *Bicycle-Related Industry Growth in Portland*, dated June 14, 2006.



Total annual bicycle-related economic activity is close to $63 million. The study divided economic activity related to bicycling into four general categories: retail and repair; distribution and manufacturing; tours, rides, races and events; and, professional services (see Figure 12.1). Bicycle-related businesses account for an estimated 600 to 800 jobs, with seasonal variation. Portland's bicycle-friendly reputation attracts planners and designers worldwide to tour Portland's infrastructure. More than 80 percent of businesses surveyed emphatically state that Portland's reputation for being a bicycle friendly city is good for their business.

Economic Activity by Sub-sector

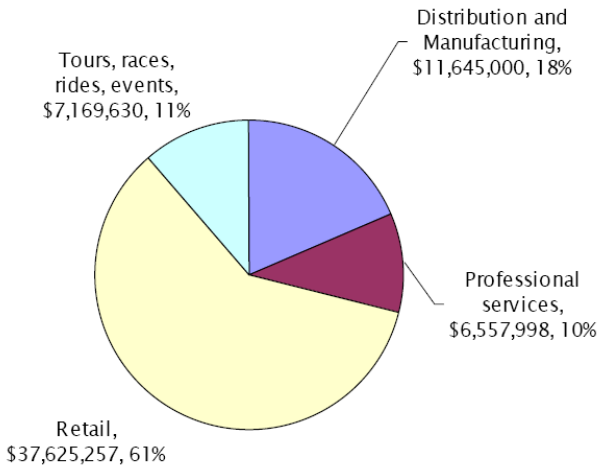
The **retail and repair** businesses account for the largest share (61 percent) of the City's bike-related industry. There are close to 40 Portland specialty bike, bike clothing/gear, and rental shops with a combined $34 million in gross revenue. Another $3.8 million is estimated to be spent on bicycles at larger discount, department, and toy stores in Portland. The remainder of bicycle-related sales is made through person-to-person or internet sales.

Most specialty shops have experienced growth in the past decade, and several are less than five years old. Many retailers say that the sheer number of cyclists helps convince other people to try riding a bike. They also cite the many accommodations that the city has made for cyclists as a factor in encouraging more people to bicycle. Most wish for more such accommodations.

The fastest growing sector, **manufacturing**—comprised of small-scale bicycle manufacturers, larger bicycle and parts producers, and bike rack manufacturers—accounts for 18 percent of the bicycle industry and contributes more than $11.6 million annually to the economy. Although the City lacks a large bicycle-oriented manufacturer, all areas of the bicycle industry have experienced growth, and this sector presents a strong level of promise.

Tours, rides, races, and events represent 11 percent of the bicycle industry and annually bring in over seven million dollars, including $2.7 million in registration fees. In addition, these groups employ dozens of people. On an annual basis, an estimated 40,000 people participate in more than 2,100 small and medium-sized rides and events. Portland group riders are estimated to spend a range of $1.2 to $2.4 million annually in food, lodging, and incidentals. All touring companies reported growth in activity.

Figure 12.1:
Economic Activity Related to Bicycling



Portland is also home to many businesses that provide **professional services** related to bicycling, which contribute over $6.5 million (10 percent of the industry total) annually. People-powered services, including delivery and pedicab services, generate close to $2.5 million. Portland also has a number of service-sector industries (bars, restaurants, and coffee shops) that make a significant amount of their revenue from bicycles, as well as, a few enterprising individuals that create bike-themed cards, blogs, cycling apparel, and other crafts.

A number of companies and organizations focus entirely on bicycle issues; together they employ 32 full-time and eight part-time employees, and generate over $2.5 million annually. In addition, the City of Portland and numerous private engineering, planning, and design firms employ staff that devotes a significant share of their time to bicycle issues.

Industry Growth Report Conclusion

All sectors of Portland's bike-related industry are experiencing strong growth, with burgeoning activity in the manufacturing areas of high-end components and bicycles, as well as in the tourist industry. Portland's bicycle-friendly reputation is attracting a wide variety of entrepreneurs who are helping fuel this growing economic sector. Job growth has been steady, with the availability of skilled and motivated workers a major attractor to these business owners. Most businesses surveyed expressed a preference that Portland's efforts to make the city safe and accessible for bicycles continue.

Promoting Portland's Bicycle-Related Industry

Alta Planning + Design presented their report on local bicycle-related industry growth at the first Portland Bike Summit held on June 17, 2006. During the Summit, 400 Portland bicycle and community activists and bicycle-industry business representatives gathered to discuss ideas and strategies to build upon the City's accomplishments and bicycle-friendly reputation. One of the key recommendations that emerged from the Portland Bike Summit was to engage local cycling businesses in the development of strategies for growing the industry.

Also in June 2006, the City Council passed a resolution to designate and support “Bicycle-Related Industry” as an official “target industry”. The resolution states that it is “in the City’s best interest to foster the development of this fast-growing market niche, as it is a strategic economic investment that would contribute to both the City’s economy and its transportation goals.”

The Portland Development Commission (PDC), in concert with PDOT, has since initiated a collaborative effort with the business community to make Portland the most desirable place in the country for bicycle businesses. A series of meetings has been held with interested business leaders to identify industry-specific needs, challenges, and opportunities. In October 2006, industry representatives convened with Portland's Commissioner for Transportation, Sam Adams, and staff from his office and the PDC to establish an initial set of priorities and next steps for achieving identified goals. As a result of the meeting, subcommittees were formed to explore the following three priority concepts:

1. Organize a large-scale bicycle race
2. Provide assistance (technical/financial) to local bicycle-related companies
3. Form a statewide bicycle business association

One next step identified for subcommittee work includes crafting a well thought-out process for formalizing an organization (or association) to promote the sector. This process will examine the basic purpose and function of the organization, including potential structure, mission, services, etc. Another step is to consider ways to coordinate with other organizations throughout the State currently involved in research and promotion of economic activities associated with cycling.