Evaluation of Innovative Bicycle Facilities:

SW Broadway Cycle Track &

SW Stark/Oak Street Buffered Bike Lanes

FINAL REPORT

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2 Executive Summary

Two innovative bicycle facilities installed in late summer and early fall 2009 in downtown Portland by the City of Portland Bureau of Transportation (PBOT) were evaluated to understand how they are functioning on multiple levels. All of these facilities involved removing a motor vehicle lane by restriping to provide additional roadway space to bicyclists. The facilities include:

- A cycle track (a seven-foot bike lane separated from motor vehicle traffic by a row of parked cars and a painted three-foot pedestrian buffer), on SW Broadway from SW Clay to SW Jackson through the Portland State University campus, and
- A couplet of buffered bike lanes (six-foot bike lanes with a two-foot painted buffer on either side separating them from motor vehicle traffic) on eastbound SW Stark Street and westbound SW Oak Street from SW Naito Parkway to West Burnside.

The facilities were evaluated after they had been in place for approximately one year. Data collected to support this evaluation consisted of surveys of multiple user groups for each facility type, and video data was collected by PBOT at intersections along each of the routes to understand the facilities' impact on traffic flow, operations and user interactions. Table 1 provides a summary of data collected and analyzed.

Table 1 Summary of Data Collection

Type	Data	Cycle Track	Buffered Bike Lanes
Survey Responses	Motorists	148	114
	Cyclists	124	125
	Pedestrians	198	Not applicable
	Businesses	Not applicable	35
Traffic Analysis	Video Data Analyzed	18 hours	18 hours
	Intersections Studied	SW Broadway at SW Montgomery/Harrison SW Broadway at SW College	SW Stark at SW 4th and SW 6th SW Oak at SW 5th and 3rd

2.1 Cycle Track Findings

The cycle track was installed by removing one motor vehicle lane from SW Broadway between SW Clay and SW Jackson (1,800 feet), shifting parallel parking from the curb and installing the cycle track adjacent the curb. SW Broadway was a unique test case since it is a one-way street; with the exception of SW Jackson and the entrance to the PSU parking lot at SW College, right turns from SW Broadway are not allowed.

A summary of the findings based on results of the motorist, pedestrian and cyclists surveys, analysis of video data, and comment logs are:

Cyclists expressed support for the cycle track. Over 70% of survey respondents indicated that the cycle track made cycling on SW Broadway safer and easier, and that the cycle track made for a better cycling environment in Portland. Concern about the threat of being "doored" (e.g., having a car door open into the pathway of the bicycle) by a motor vehicle was substantially lower in the cycle track when compared to a standard bike lane (36% vs 95%).

Motorists generally expressed support for the cycle track. A plurality felt that the cycle track made driving safer (48%), and that driver behavior was safer and calmer with the cycle track (45%). Furthermore, motorists generally disagreed with the sentiment that the cycle track made driving less convenient or that it takes longer to drive this section of SW Broadway now. It is notable that motorists who never ride a bicycle (survey respondents stating that they "never" ride a bicycle) were somewhat more likely to be pessimistic about the cycle track than motorists who do ride a bicycle.

Motor vehicle delay is still low after removing one travel lane. An assessment of average motor vehicle control delay (for all vehicles) at signalized intersections on SW Broadway found an average delay per vehicle of two to seven seconds. This corresponds to a level of service (LOS) A. In addition, PBOT has received few complaints about traffic on SW Broadway (only four traffic-related complaints in the comment log). No issues with parking were identified as a long-term problem.

Cyclists are using the cycle track rather than the motor vehicle lanes. Surveys indicated that 97% of cyclists always or usually ride in the cycle track when riding on this section of SW Broadway, which was confirmed in the video observation showing that 97% of cyclists rode in the cycle track. When comparing the prior bike lane configuration to the cycle track design, the percentage of cyclists riding in the motor vehicle lane decreased from 12% to 2% of riders.

Cyclist understanding of and compliance with the traffic signals on SW Broadway is poor. SW Broadway is a one-way street: with the exception of SW Jackson and the entrance to the PSU parking lot at SW College, right turns from SW Broadway are not allowed. The three intersections on the PSU campus (SW Mill, Montgomery, Harrison and Hall) are three-way ("T") intersections. The cycle track is on the far right, and the cross streets are on the left. Therefore, there is no motor vehicle traffic, only pedestrian traffic, crossing in front of bicycles stopped in the cycle track on a red signal indication. The signals are mounted over the motor vehicle lanes but not the cycle track lane. Only 63% of cyclists surveyed indicated that they were required to stop when the signals on SW Broadway are red. Many cyclists expressed confusion about whether they needed to stop or stay stopped in the cycle track on a red signal indication. Consistent with the survey findings, only 56% of cyclists observed in the video review stopped during the red signal phase (though this is consistent with only 59% of observed cyclists stopped during the red signal before the cycle track was installed). Thus, it is likely that the lack of compliance is related to the lack of conflicting traffic rather than the cycle track design.

Cyclist use of the left-turn boxes could be improved. To facilitate left turns from the cycle track, the City installed small green boxes immediately to the left of the cycle track at the signalized intersections, in front of the parked cars. Cyclists are supposed to wait in the box until the pedestrian signal in the cross direction is green. This is sometimes described as a two-stage left turn. Alternatively, a cyclist could leave the cycle track a block ahead of a left turn, proceed across to the left-side traffic lane and turn left. While 76% of survey responses stated that cyclists SHOULD wait in the green box until the signal changes to make a left turn, only 54% stated that they actually turn left in that way. In the video data, 24 of the 407 cyclists made a left turn. Seven cyclists (29%) cycled into the green box and remained there until the signal changed; another seven cyclists (29%) turned from the cycle track once the signal changed but did not wait in the box – this number includes those that waited behind or next to the green box.

Cyclist and pedestrian conflicts are high. Although nearly 90% of pedestrians surveyed indicated they understood where they should wait for a "Walk" sign to cross SW Broadway (on the curb), a plurality (42%) expressed concern about the impact of the cycle track on crossing Broadway. Nearly a third of cyclists surveyed stated that they encounter pedestrians jaywalking across the cycle track 25% or more of the time. Combined with cyclists' low compliance in stopping at a red signal, there are many opportunities for collisions between cyclists and pedestrians. Over 40% of cyclists stated they had been involved in a near-collision with a pedestrian, while 12% of pedestrians stated they had been involved in a near-collision with a cyclist. One cyclist and two pedestrians surveyed stated that they have been involved in bicycle-pedestrian collisions on the cycle track. Video observation data confirms the risk – in situations where pedestrians were present while cyclists rode past on the cycle track, nearly one in 10 resulted in potentially unsafe interactions. These include instances of a cyclist or pedestrian having to stop or change direction as a precaution (3.5%) or an emergency (1%), or instances in which a cyclist rode within two to three feet of a pedestrian walking or standing on the street (4.5%).

A measurable change in cycle volumes was not detected. Cycle-track cyclist counts show a decrease in numbers, though our one-day comparisons are not of the same time period. The "before" video was taken during PSU's spring term, while the "after" video was taken over the summer break. Many survey respondents who currently cycle along the cycle track indicated that they previously cycled on SW Broadway less frequently (38%) and/or chose alternate routes (30%).

Loss of curb access presents a challenge to physically handicapped persons. Multiple comments received by the City of Portland indicated that the loss of the option to park and/or drop-off on the curb on SW Broadway is a problem for physically handicapped persons.

2.2 Buffered Bike Lane Findings

The buffered bike lanes were installed by removing one 10-foot motor vehicle lane from SW Stark (3,400 feet) and SW Oak (2,862 feet) (leaving one 10-foot motor vehicle lane) and replacing it with a six-foot bicycle lane buffered by a two-foot "shy zone" on either side. Curbside parking remained.

A summary of the findings based on results of the motorist, pedestrian and cyclists surveys, analysis of video data, and comment logs are:

More cyclists are choosing to ride on SW Oak and SW Stark. According to the survey data, the number of cyclists choosing to ride on these streets is significantly higher than before the buffered bike lanes were installed. Nearly 65% of the respondents indicated they choose to ride on the buffered bike lanes more often. Observation of the video counts found that the counts increased 77% on SW Stark and 271% on SW Oak. Because the locations of the before-and-after counts were not the same, the 77% increase is most likely understated.

Cyclists expressed support for the buffered bike lanes. Cyclists indicated that they are choosing to ride on SW Oak and SW Stark more often than before the buffered bike lanes were installed. They overwhelmingly agree that the streets are safer, easier and contribute to a better cycling environment in Portland. Cyclists indicated they feel lower risk of being "doored" in the buffered bike lanes, and nearly nine in 10 cyclists preferred a buffered bike lane to a standard lane. Seven in 10 cyclists indicated they would go out of their way to ride on a buffered bike lane over a standard bike lane, while nearly eight in 10 cyclists felt that the City of Portland should install buffered bike lanes in other places.

Understanding of when motor vehicles can be in the buffered bike lane is poor. Both cyclists and motorists expressed confusion over when or if motor vehicles were allowed to be in the buffered bike lane. The most common sentiment voiced by motorists on the comment section of the survey was confusion about when a car can be in the buffered bike lane to carry out actions such as turning right and parking to the right of the buffered bike lane. Asked when cars can be in the buffered bike lanes, over a third of cyclists indicated that they did not know the answer. Over 50% stated that cars could be in the lane when making a right turn, and a similar number felt they could do so when parking. Motor vehicles should only be in the buffered bike lane to park or to cross to get to the right-turn lane (if present).

Motorist actions when turning right without a right-turn lane are inconsistent. For intersections along the buffered bike lane without a right-turn lane, motorists' turning actions are inconsistent and present a danger both to cyclists and other motorists. Over a third of right-turning motorists moved into the buffered bike lane to make the turn, while just over half turned from the left motor vehicle lane. This perception was confirmed by the cyclist survey, which revealed that over a third of cyclists reported being involved in a near-collision with a right-turning vehicle and four respondents (3%) were involved in an actual collision with a right-turning vehicle in the buffered bike lane.

Motorists feel that the buffered bike lanes have made driving on SW Stark and SW Oak more challenging. Motorists indicated that driving on these streets is less convenient (61%), parking is more challenging (56%), and that traffic and travel times have increased with the buffered bike lanes (48-52%). Still, nearly two out of every three respondents indicated that they like the additional separation between cars and bicycles provided by the buffered bike lanes.

Motor vehicle delay has increased, but it is still acceptable. Analysis of the video data found that the average control delay per vehicle increased with the addition of the buffered bike lane, but is still LOS A or B at all peak times, with the exception of 5-5:30 p.m. when delays reach 22-35 seconds per vehicle (LOS C– approaching D).

Businesses that responded to the survey support bicycle routes, but have concerns about loss of access. Businesses surveyed for the evaluation indicated that the buffered bike lanes present challenges to customers looking for parking and deliveries. However, businesses also indicated that the buffered bike lanes were an important part of Portland's downtown bicycle network. A plurality of businesses (42%) indicated that they support the buffered bike lanes (compared to 26% that indicated they do not support the lanes).

3 Background

In the late summer and early fall of 2009, the City of Portland's Bureau of Transportation (PBOT) installed two innovative bicycle facilities in the downtown Portland area. A "cycle track," or bicycle lane separated from motor vehicle traffic lanes by an area including a lane of parked cars, was installed on SW Broadway from SW Clay to SW Jackson streets, adjacent to Portland State University (Figure 1). A set of "buffered bicycle lanes," or bicycle lanes separated from motor vehicle traffic by a painted buffer zone, were installed on SW Stark Street from West Burnside to SW Naito Parkway and on SW Oak Street from SW Naito Parkway to SW 10th Avenue. PBOT asked PSU to conduct an evaluation of these innovative facilities to identify how they are performing on multiple levels.

Figure 1. The Facilities in Downtown Portland

3.1 Cycle Track

SW Broadway between Clay and Jackson streets is one-way southbound through PSU's campus. The street is a major thoroughfare between the downtown core and the area to the south, which includes access to the major freeways leaving downtown. Areas to the west of SW Broadway are closed to motor vehicle traffic between Market and Jackson streets, meaning that there are no opportunities for motor vehicles on Broadway to make right turns (with the exception of motorists turning right into a PSU parking lot at College Street). Prior to the installation of the cycle track, Broadway had three southbound traffic lanes, a bicycle lane on the west side of the street, and a parking lane on either side of the street.

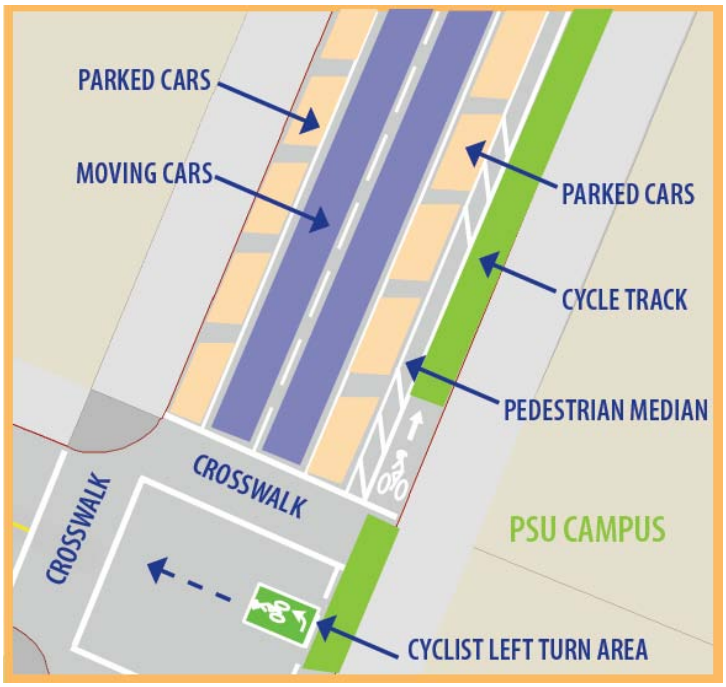


Figure 2. PBOT Graphic of Cycle Track Design

PBOT installed the cycle track in September 2009. A wide bicycle lane was placed adjacent to the curb on the west side of Broadway. The bicycle lane was separated from motor vehicle traffic by a

row of parked cars and a narrow (approximately two-foot) door buffer zone. The resulting configuration had two motor vehicle lanes (Figure 2 and Figure 3). The cycle track was installed by removing one motor vehicle lane from SW Broadway between Clay and Jackson (1,800 feet). Broadway was a unique test case since it is a one-way street; with the exception of Jackson and the entrance to the PSU parking lot at College, right turns from Broadway are not allowed. The only major intersection is with SW Market (one-way orientation of Market excludes right-turn maneuvers).

Figure 3. SW Broadway, Before and After Cycle Track Installation

3.2 Buffered Bike Lanes

SW Stark and Oak are one-way streets in downtown Portland. Oak runs westbound starting at SW Naito Parkway. Stark runs eastbound starting at West Burnside. Prior to installing the buffered bike lanes, each street had two traffic lanes and a lane of parked cars on either side of the road. There were no bike lanes on either street.

PBOT installed the buffered bike lanes in September 2009. In each case, the right traffic lane was converted into a wide bike lane separated from a motor vehicle traffic lane by a narrow painted buffer (Figure 4 and Figure 5). There is on-street parking on both sides of both streets. Motor vehicles are not allowed to drive in the buffered bike lane, except when parking and crossing into a right-turn lane (see Table 2 for right-turn options and presence of right-turn lanes). Because of the one-way grid orientation, right turns are only allowed at every other intersection.

Table 2. Summary of Right-Turn Options and Presence of Right-Turn Lane

Intersection	SW Oak		SW Stark	
	Right turn possible	Presence of turn lane	Right turn possible	Presence of turn lane
SW 12th Ave	--	--	Start	--
SW 11th Ave	--	--	Yes	No
SW 10th Ave	Yes	Shared bike lane / turn lane	No	--
SW 9th Ave	No	--	Yes	No
SW Park Ave	Yes	No	No	--
SW Broadway Ave	No	--	Yes	Yes
SW 6th Ave	Yes	No	No	--
SW 5th Ave	No	--	Yes	No
SW 4th Ave	Yes	Yes	No	--
SW 3rd Ave	No	--	Yes	Yes
SW 2nd Ave	Yes	No	No	--
SW 1st Ave/ SW Washington	No	--	Yes	Shared bike lane / turn lane
SW Naito Parkway	Start	--	Yes	Shared bike lane / turn lane

In order to assess how the buffered bike lanes are working, we conducted surveys of affected user groups, including intercept surveys of cyclists and motorists and a comprehensive survey of street-facing businesses along Oak and Stark. Using video collected by PBOT, we analyzed motorist queuing, delays, lane choice (incursions into the buffered bike lane), turning actions, and cyclist counts. In addition, we summarized data provided by PBOT.

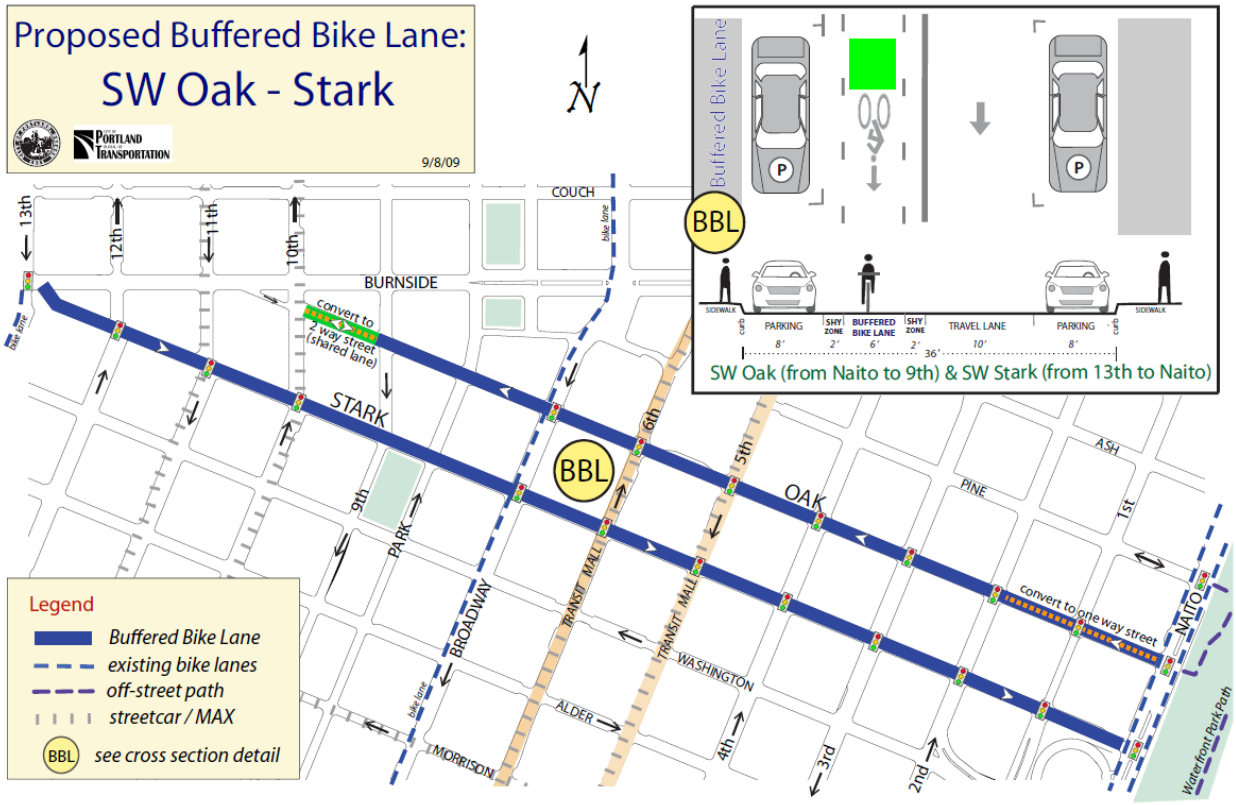


Figure 4. PBOT Graphic of Buffered Bike Lane Design

Figure 5. SW Stark at 4th Avenue, Before and After Buffered Bike Lane Installation

4 Methodology

To understand how the cycle track and buffered bike lanes are performing, multilayered evaluations of each facility were conducted to get at the experiences and behavior of various users of the affected portions of Broadway, Oak and Stark. Intercept surveys were conducted of user groups. Using video collected by PBOT at various locations along Broadway both before and after the installation of the cycle track, we analyzed motorist queuing conditions and delays, cyclists turning and compliance measures, and cyclist/pedestrian interactions. In addition, we summarized data from PBOT on motorist parking compliance, email and phone complaints, concerns, questions or support regarding treatments, and other relevant data.

4.1 Cycle Track

For the cycle track, surveys were conducted of cyclists, pedestrians and motorists in order to uncover their experiences, concerns and knowledge about the facility. In addition, using video data collected by PBOT from cameras set up along the SW Broadway cycle track corridor, user actions and interactions were recorded and analyzed, with a particular focus on how the changes affected the users' safety, understanding and adherence to the new rules, and motorist delay.

4.1.1 Cyclist Survey

Between Aug. 31 and Sept. 8, 2010, 398 cyclists biking along the cycle track or locking/unlocking bikes along Broadway were invited to participate in an online survey. Two research assistants stood on the sidewalk next to the cycle track; one held a sign stating, "Bicycle Survey Ahead," while a second waited a block downstream with a sign stating, "Bike Survey Here." Cyclists were handed a postcard explaining the project and directing them to an online survey. Cyclists locking or unlocking bicycles along the cycle track were also given a postcard inviting them to participate in the survey. Each postcard contained a unique code to ensure that the survey was taken by actual users. As an incentive, respondents who completed the online survey were invited to enter a drawing for one of four $25 gift cards. We collected **124 valid responses** – a 31% response rate. Survey postcard distribution dates and times are listed below:

- Aug. 31, 2010, 7:30-10:30 a.m. 65 postcards distributed.
- Sept. 2, 2010, 3-6 p.m. 135 postcards distributed.
- Sept. 4, 2010, 9-11:30 a.m. 40 postcards distributed.
- Sept. 7, 2010, 12-2 p.m. 20 postcards distributed.
- Sept. 8, 2010, 12-2 p.m. and 4-6 p.m. 100 postcards distributed.
- Sept. 9, 2010, 8-9:30 a.m. 35 postcards distributed.

4.1.2 Pedestrian Survey

Between Aug. 23-27, 753 pedestrians were approached at intersections along SW Broadway between Clay and Jackson and invited to take a short written survey. Research assistants stood next to a sign which read, "Pedestrian Survey Here" and asked pedestrians walking along Broadway adjacent to the

cycle track or crossing the cycle track to participate by filling out a two-page survey. As an incentive, respondents who completed the written survey were invited to enter a drawing for one of four $25 gift cards. Over three outreach periods (listed below), we collected **198 responses** – a 26% response rate:

- Aug. 23, 2010, 3-5 p.m. 239 pedestrians invited. 69 responses collected.
- Aug. 25, 2010, 8-10 a.m. 260 pedestrians invited. 68 responses collected.
- Aug. 27, 2010, 11:30 a.m.-1:30 p.m. 254 pedestrians invited. 62 responses collected.

4.1.3 Motorist Survey

Between Aug. 20-31, approximately 500 motorists (those parking motor vehicles on SW Broadway and those self-identified as driving on Broadway) were invited to take a short written survey. Research assistants approached motorists getting into or out of parked cars and stood next to a sign stating, "Do you drive on SW Broadway? Take our Survey." Passers-by were asked if they drive on Broadway, and if so, to participate by filling out a two-page survey. As an incentive, respondents who completed the written survey were invited to enter a drawing for one of four $25 gift cards. We collected **148 responses** over four outreach periods (30% response rate), the dates and times of which are listed below:

- Aug. 20, 2010, 8-10 a.m. and 2:30-5 p.m. 73 responses collected.
- Aug. 28, 2010, 10 a.m.-1 p.m. 49 responses collected.
- Aug. 31, 2010, 3-5 p.m. 24 responses collected.

4.1.4 Video Observation

PBOT collected before-and-after video along the cycle track. "Before" video was collected June 3 and 4, 2009, at three locations along the cycle track – each location included a camera positioned looking in each direction (north and south). "After" video was collected at two intersections between Aug. 3-12, 2010. For each of the "after" intersections (SW Broadway and Montgomery; SW Broadway and College) two peak hours on two different days were identified for in-depth analysis.

Before-and-after cyclist counts were conducted using the video. "After" video was reviewed to assess cyclist actions, including left turns, compliance with traffic signals, cyclist/pedestrian interactions, and motorist queuing actions and delays.

4.1.5 Review of PBOT Data

PBOT provided the results of their surveillance study of parking compliance along the cycle track. These findings are included in this report (Section 5.5.1 on page 27). PBOT also provided a compilation of all comments, questions and concerns received regarding the cycle track, which has been analyzed for themes and issues.

4.2 Buffered Bike Lanes

For the buffered bike lanes, surveys were conducted of cyclists, motorists and businesses fronting SW Oak and Stark, in order to uncover their experiences, concerns and knowledge about the facility. In addition, using video data collected by PBOT from cameras set up at locations on Oak and Stark, user actions and interactions were recorded and analyzed, with a particular focus on how the changes affected the users' safety, understanding and adherence to the new rules, and motorist delay.

4.2.1 Cyclist Survey

On Sept. 21 and 22, 2010, 297 cyclists biking in the buffered bike lanes were invited to participate in an online survey. Two research assistants stood on a sidewalk next to the cycle track; one held a sign stating, "Bicycle Survey Ahead," while a second waited a block downstream with a sign stating, "Bike Survey Here." Cyclists were handed a postcard explaining the project and directing them to an online survey. Each postcard contained a unique code to ensure that the survey was taken by actual users. As an incentive, respondents who completed the online survey were invited to enter a drawing for one of four $25 gift cards. We received **125 valid responses**– a 42% response rate. Survey postcard distribution dates, times, and locations are listed below:

- Sept. 21, 2010, 4-6 p.m. SW Stark and 5th. 150 postcards distributed.
- Sept. 22, 2010, 7:30-10 a.m. SW Oak and 2nd Avenue. 147 postcards distributed.

4.2.2 Motorist Survey

Between Sept. 16-30, approximately 500 motorists (those parking motor vehicles on SW Oak or Stark, and those self-identified as driving on these streets) were invited to take a short written survey. Research assistants approached motorists getting into or out of parked cars and stood next to a sign stating, "Do you drive on SW Oak [or SW Stark]? Take our Survey." Passers-by were asked if they drive on these streets, and if so, to participate by filling out a two-page survey. As an incentive, respondents who completed the written survey were invited to enter a drawing for one of four $25 gift cards. We collected **114 responses** (~23% response rate), the dates and times of which are listed below:

- Sept. 16, 2010, 12-4 p.m. 65 responses.
- Sept. 23, 2010, 8:30-10 a.m. 10 responses.
- Sept. 30, 2010, 10:30 a.m-12:30 p.m. 39 responses.

4.2.3 Survey of Businesses on SW Oak and SW Stark

On the afternoon of Sept. 22, 2010, research assistants walked from SW Naito to the eastern end of each buffered bike lane (SW Oak and 9th, SW Stark and 13th) and invited 59 businesses to complete a two-page written survey. Research assistants approached each open ground-floor business and asked to have an owner or manager complete the survey. In cases where there was no manager or owner available to take the survey, a postage-paid return envelope was left with the request that the completed surveys be returned in the mail (the option of calling for a survey pickup was also

provided). We received **35 completed surveys** (59% response rate); 24 surveys were collected onsite and 11 were mailed back. The breakdown of businesses visited and surveys collected onsite are included below:

- SW Oak Street: Twenty-three businesses were asked to complete the survey. Fifteen completed surveys were collected onsite. Seven blank surveys were left with return mail envelopes, of which two were mailed back. One business refused the survey.
- SW Stark Street: Thirty-six businesses asked to complete the survey. Nine completed surveys were collected onsite. Twenty-six blank surveys were left with return mail envelopes, of which eight were mailed back. One business refused the survey.

4.2.4 Video Observation

PBOT collected before-and-after video at locations on each of the buffered bike lane routes. "Before" video was collected Sept. 2-4, 2009, with one camera capturing actions on SW Stark and another on SW Oak. "After" video was collected from Aug. 9-19, 2010. For each of the "after" intersections (SW 4th and Stark, SW 5th and Oak) two peak hours on two different days were identified for in-depth analysis.

Before-and-after cyclist counts were conducted using the video. "After" video was reviewed to assess motorist lane choice, turning actions, queuing and delays.

4.2.5 Review of PBOT Data

PBOT provided a compilation of all comments, questions and concerns received regarding the buffered bike lanes, which has been analyzed for themes and issues.

5 Findings: Cycle Track

A copy of the survey instruments can be found in the Appendices. Except where noted, the following conventions are used when summarizing data:

- Motorists or pedestrians who answered "Never" in response to "How often do you ride a bicycle?" were categorized as "Non-Cyclists."
- Motorists or pedestrians who answered 2) Less than one day a month; 3) 1-3 days a month; 4) 1-3 days a week; or 5) 4 or more days a week in response to "How often do you ride a bicycle?" were categorized as "Cyclists."
- Respondents who selected "Strongly Agree" and "Somewhat Agree" were aggregated to "Agree."
- Respondents who selected "Strongly Disagree" and "Somewhat Disagree" were aggregated to "Disagree."

5.1 Cycle Track - Cyclist Surveys

The gender split of the cycle track cyclist survey respondents is consistent with City counts of cyclists at 72% male and 28% female. The respondents were generally confident cyclists. Only 3% identified themselves as "Interested but concerned" cyclists, while 71% were "enthusiastic and confident," 15% were "strong and fearless," and 11% identified as "other." As seen in Figure 6, the respondents represented a broad array of age groups, with the largest age groups being "25-34."

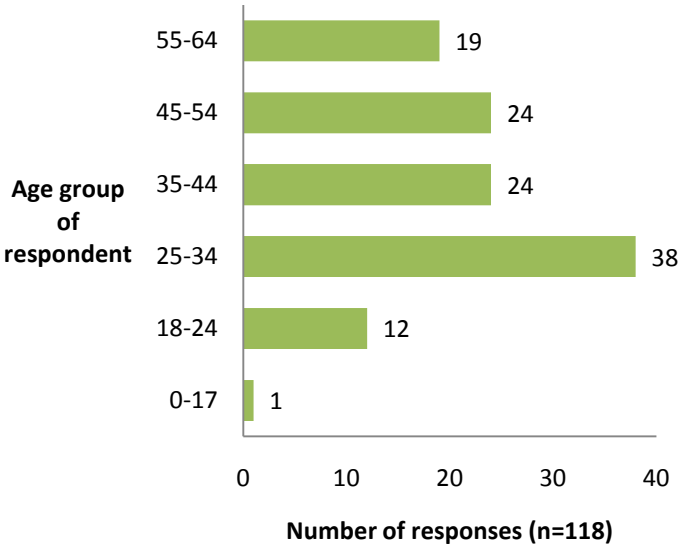


Figure 6. Respondent Age – Cycle Track Cyclist Survey.

5.1.1 Choosing to Ride on SW Broadway

As seen in Figure 7, respondents indicated they are riding on this section of SW Broadway more than they did previously – 39% of respondents rode on this section of SW Broadway less than once a month prior to the installation, while now only 9% ride the section less than once a month. Nearly a third (30%) of respondents stated that before the cycle track was implemented, they rode on a different street. Of those, a third indicated that they previously chose Park Avenue or the Park Blocks as an alternate route, 14% chose Waterfront Park, and 11% chose 5th Avenue.

The vast majority of respondents indicated that they always ride in the cycle track when cycling on SW Broadway - 88% stated that they always ride on the cycle track, while 9% stated that though they usually ride in the cycle track, they sometimes ride in the traffic lanes. (These numbers agree with video review findings that 97% of cyclists rode in the cycle track – see cyclist counts in section 4.1.4).

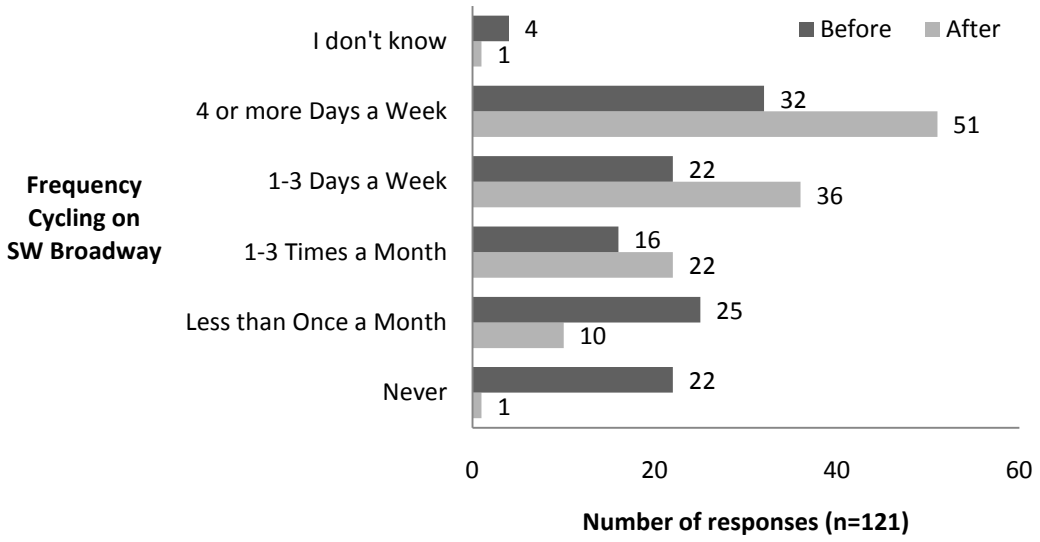


Figure 7. About How Often did you Ride your Bicycle on this Section of SW Broadway?

5.1.2 Cyclist Experience

Cyclists generally expressed positive sentiments about the experience of riding a bicycle on the cycle track; 71% of respondents agreed with the statement that, "The cycle track has made this section of SW Broadway SAFER for me as a cyclist." An equal percentage of respondents agreed with the statement that, "The cycle track has made this section of SW Broadway EASIER for me as a cyclist." More than three-quarters of respondents (78%) agreed that, "The cycle track makes for a better cycling environment in Portland."

Further, responses on several questions indicate that the cyclists prefer the cycle track over standard bike lanes and are willing to go out of their way to use the facility. To the statement, "Since the SW Broadway cycle track was installed, I choose to cycle on SW Broadway more often," 45% expressed agreement and 19% expressed disagreement; the remainder chose neither agree nor disagree. The survey asked respondents to choose between two hypothetical routes: (1) 4.5 miles, two of which are on a cycle track; and (2) 4 miles, including two miles on a busy street with a bike lane. A majority (59%) of respondents stated they would choose the longer route with the cycle track. Finally, 65% of respondents stated that they think the City of Portland should install cycle tracks at other locations.

5.1.3 Cyclist Sense of Safety

Survey responses indicate that most cyclists feel more comfortable and safe riding on a street with a cycle track than on a street with a standard bike lane. Most respondents agreed that motor vehicle behavior was safer and calmer since the cycle track was installed (63% agreed, while only 12% disagreed). Just over a third of respondents (36%) indicated that they have to pay a lot of attention to avoid being "doored" while riding in the cycle track. In comparison, 95% of respondents indicated that they have to pay a lot of attention to avoid being "doored" when riding in a standard bike lane.

5.1.4 Intersections and Pedestrians

Understanding of appropriate operating procedures and rules along the cycle track, particularly at intersections, is poor. Only 63% of respondents indicated that they were required to stop at a red signal indication on SW Broadway while riding in the cycle track if there is no through-street to the right. Of the respondents, 16% believed that they were not required to stop or that they could proceed after coming to a complete stop, while over a fifth (21%) stated that they did not know if they were required to stop.

Cyclist responses indicated that interactions with pedestrians were problematic. Nearly a third of respondents (31%) stated that they encountered a pedestrian crossing or waiting in the cycle track during green-light phases at least a quarter of the time. Only 36% of respondents agree that, "MOST pedestrians understand how they are supposed to cross this section of SW Broadway, including where to wait and when to cross." One person stated they had been involved in a collision with a pedestrian, while three people had witnessed collisions between pedestrians and cyclists. In addition, 41% of respondents stated they have been involved in a near-collision.

5.1.5 Making Left Turns

Cyclists were asked how they SHOULD and ACTUALLY make left turns off of the cycle track. As illustrated in Figure 8, respondents were asked to choose between 1) merging into the left traffic lane a block before the turn; 2) waiting in the green box until there is a gap in traffic; 3) waiting in the green box until there is a red signal for traffic on SW Broadway; 4) waiting in the green box until there is a green pedestrian signal across SW Broadway; or 5) other.

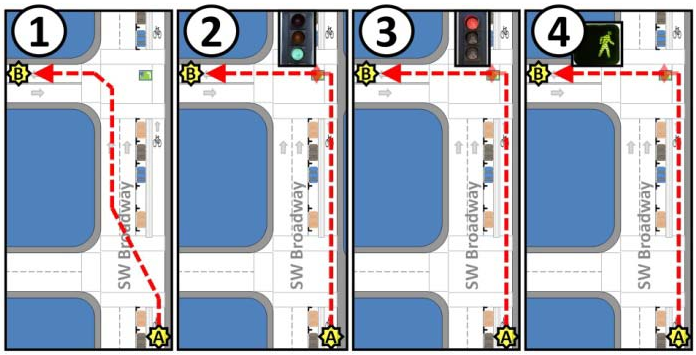


Figure 8. Cyclist Cycle Track Survey Left-Turn Options

Just over three out of four respondents indicated an understanding of how they SHOULD use the green left-turn boxes to complete the turn (Options 3 or 4). However, asked how they ACTUALLY make left turns out of the cycle track, a more varied palate of options is utilized. Of the respondents, 29% stated they don't ever make left turns. Of those that do, 54% stated they would

use the green box in the intended way (3 or 4), while 33% stated they would merge into the left traffic lane. Another 7.5% stated they would wait in the green box until a gap emerged.

5.1.6 Motorist Parking in the Cycle Track

Most respondents indicated that they encounter motor vehicles parked in the cycle track one to three times a month or less. Fewer than 10% indicated they saw motor vehicles of any type parked in the cycle track at least once per week. Table 3 shows the breakdown in parking violation frequency by vehicle type.

Table 3. Respondent Observation of Motor Vehicles Parked in Cycle Track

	Passenger Cars, Pickups and SUVs	Buses	Commercial Vehicles (e.g. Delivery Trucks, etc.)
Never	34%	64%	37%
Less than Once a Month	35	17	26
1-3 Times a Month	34	13	37
1-3 Days a Week	8	4	6
4 or more Days a Week	1	2	1
Total	100%	100%	100%
n	112	100	107

5.1.7 Improving the Cycle Track

Asked in an open-ended question what they would do to improve the cycle track, 23 respondents indicated that improving pedestrian awareness about where to wait and how to cross the cycle track would be helpful. Thirteen respondents indicated that improving the separation between parked cars, either through a wider buffer, grade separation, or installation of some type of barrier, would improve the cycle track. Other common themes included adding signage regarding proper use of the facility for various users (16 respondents), improving motorist awareness about cycle track rules (9 respondents) and improving cyclist awareness about how to use the cycle track (5 respondents).

5.2 Cycle Track - Pedestrian Survey

Survey respondents were 50% male and 50% female. A third indicated that they never ride a bicycle, while an additional 17% indicated they ride less than one day a month. Two-thirds of respondents indicated that they have never ridden a bicycle on the cycle track. Figure 9 shows the age breakdown of pedestrian survey respondents.

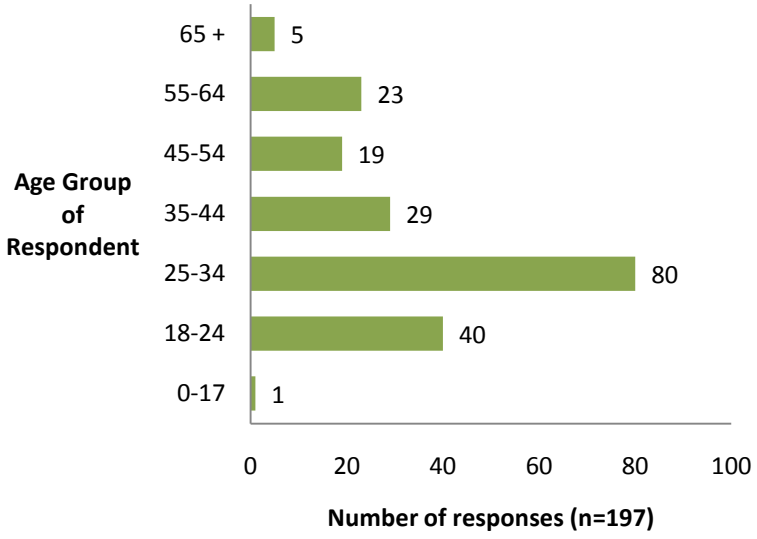


Figure 9. Respondent Age – Cycle Track Pedestrian Survey.

5.2.1 Understanding of Crossing Actions

Asked where they should wait to cross SW Broadway (when passing cars have a green signal), 85% of respondents correctly noted that pedestrians should wait on the sidewalk to cross at a crosswalk (rather than in the cycle track, adjacent to parked cars, etc). An additional 4% listed the correct answer along with one of the other options.

5.2.2 Interactions with Cyclists

A total of 17 respondents (8.5%) indicated that they were involved in or witnessed a collision between a cyclist and a pedestrian. Two respondents indicated that they were personally involved in a collision with a cyclist while crossing SW Broadway on foot, while an additional 15 respondents indicated that they had witnessed such an encounter. A total of 24 respondents (12%) stated that they were involved in a near-collision with a cyclist, and 48 respondents (24%) stated they had witnessed a cyclist/pedestrian near-collision.

5.2.3 Cycle Track Impact on the Pedestrian Environment

As seen in Table 4, respondents who self-identified both as cyclists and non-cyclists generally agreed with the statement, "The cycle track makes for a better environment for pedestrians walking on the sidewalk next to the cycle track." However, non-cyclists disagreed with the statement that the cycle track makes for a better environment for pedestrians crossing SW Broadway; cyclists were evenly split on this question.

Table 4. The Cycle Track Makes for a Better Environment for Pedestrians . . .

	All		Pedestrians who are Non-Cyclists		Pedestrians who are Cyclists	
	Disagree	**Agree**	**Disagree**	**Agree**	**Disagree**	**Agree**
. . . walking on the sidewalk next to the cycle track.	19%	59%	17%	58%	20%	60%
n	185		60		125	
. . . crossing SW Broadway.	42%	34%	54%	28%	37%	36%
n	181		54		127	

5.3 Cycle Track - Motorist Survey

A total of 148 motorist surveys were collected along the cycle track. Survey respondents were 50% male and 50% female. 45% of respondents indicated that they never ride a bicycle, while an additional 19% ride less than one day a month; 23% ride one or more day a week. Figure 10 shows the age breakdown of motorist survey respondents.

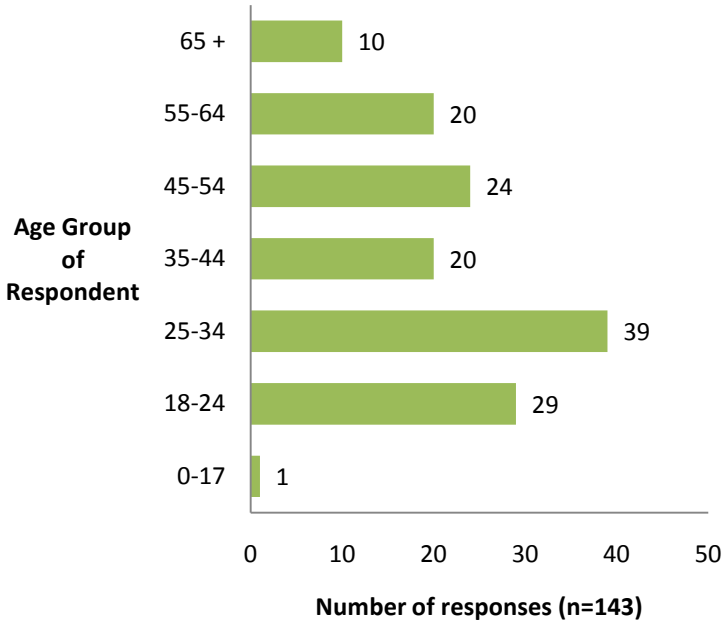


Figure 10. Respondent Age – Cycle Track Motorist Survey.

Respondents were asked how often they drive and park on the section of SW Broadway from Clay to Jackson streets both before and after the installation of the cycle track. As seen in Table 5, respondents generally drive on SW Broadway more now than they did prior to the installation of the cycle track. In both the before-and-after situations, greater than 50% of respondents indicate that they park on SW Broadway never or less than one day a month.

Table 5. Frequency of Driving and Parking on SW Broadway, Before and After Cycle Track Installation.

	Never	Less than one day a month	1-3 days a month	1-3 days a week	4 or more days a week	Total	n
Drive, Before	13%	18%	30%	18%	21%	100%	131
Park, Before	33%	25%	31%	2%	8%	100%	123
Drive, Now	3%	16%	30%	26%	25%	100%	129
Park, Now	31%	25%	27%	5%	11%	100%	124

5.3.1 Safety

Respondents generally expressed agreement with the statement that the cycle track has made driving safer, although a greater percentage of cyclists expressed agreement. Both non-cyclists and cyclists expressed agreement with the statement that driver behavior is safer and calmer with the cycle track. Finally, respondents overwhelmingly expressed a liking for the fact that bikes and cars are more

separated with the cycle track. Table 6 shows respondent levels of agreement with various safety-related statements pertaining to the cycle track.

Table 6. Motorist Agreement, Safety

	ALL		Motorist who are Non-Cyclists		Motorist who are Cyclists	
	Disagree	**Agree**	**Disagree**	**Agree**	**Disagree**	**Agree**
The cycle track has made driving safer	29%	48%	38%	46%	23%	50%
n	139		61		78	
I like that bikes and cars are more separated with the cycle track	15%	78%	19%	71%	11%	84%
n	144		63		81	
Driver behavior is safer and calmer with the cycle track	29%	45%	35%	45%	25%	44%
n	123		50		73	

5.3.2 Convenience

The survey also asked a number of questions pertaining to the level of convenience, delay and stress experienced by motorists. Each of the questions pertaining to convenience received a mixed reception. Fewer respondents indicated that the cycle track made driving less convenient or parking more stressful and challenging than not; however, in each case, respondents who never ride a bicycle were somewhat more likely to take a negative view. Asked if they changed how they drive on SW Broadway because of the cycle track, a nearly equal number indicate in the affirmative, the negative and remained neutral. Table 7 shows respondent levels of agreement with convenience-related statements pertaining to the cycle track.

Table 7. Motorist Agreement, Convenience

	ALL		Motorist who are Non-Cyclists		Motorist who are Cyclists	
	Disagree	Agree	Disagree	Agree	Disagree	Agree
The cycle track has made driving less convenient	46%	36%	33%	45%	55%	28%
n	138		60		78	
Parking on SW Broadway is more stressful and challenging with the cycle track	49%	35%	39%	45%	55%	28%
n	134		56		78	
I have changed how I drive on SW Broadway because of the cycle track	35%	40%	33%	45%	37%	36%
n	131		55		76	

5.3.3 Traffic

There was general agreement that traffic had not "gotten worse" (50% disagreed, 23% agreed and the remainder were neutral), and that it does not "take longer" to drive this section of SW Broadway (47% disagreed, 27% agreed, and the remainder were neutral). However, in both cases, respondents who indicated that they never ride a bicycle were more likely to take a negative view toward the impact of the cycle track on traffic and travel times. Table 8 shows respondent levels of agreement with traffic- and delay-related statements pertaining to the cycle track.

Table 8. Motorist Agreement, Traffic

	ALL		Motorist who are Non-Cyclists		Motorist who are Cyclists	
	Disagree	Agree	Disagree	Agree	Disagree	Agree
Traffic has gotten worse since the cycle track	50%	23%	40%	32%	56%	17%
n	121		50		71	
It takes longer to drive this section of SW Broadway with the cycle track	46%	27%	32%	40%	55%	18%
n	123		55		68	

5.4 Cycle Track – Video Observations

An assessment of cyclist lane choice and counts at comparable intersections[1] was undertaken to understand where cyclists are choosing to ride on SW Broadway. As seen in Table 9, the counts reveal a decrease in the percentage of cyclists riding in the motor vehicle lane (down from 12% of riders to 2%). The counts also show a slight decrease in the number of cyclists riding on SW Broadway during the comparison times; however, the before video was taken during PSU's spring term, while the after video was taken over PSU's summer break. As discussed in the survey findings, many respondents appear to be cycling on this section of Broadway more often than before the cycle track was installed. A more in-depth counting scheme would need to be undertaken to arrive at a conclusion regarding attraction of cyclists to the cycle track.

Table 9. Cyclist Lane Choice and Counts along SW Broadway

	Before: SW Broadway at Harrison 6/3/2009 (Weds)				After: SW Broadway at Montgomery 8/4/2010 (Weds)			
	Bike Lane	MV Lane	Sidewalk	Total	Cycle Track	MV Lane	Sidewalk	Total
7-8am	36	4	1	**41**	45	1	0	**46**
8-9am	32	5	0	**37**	44	1	0	**45**
9-10am	47	7	0	**54**	35	0	1	**36**
AM Total	***115***	***16***	***1***	***132***	***124***	***2***	***1***	***127***
4-5pm	40	4	1	**45**	36	2	0	**38**
5-6pm	51	8	0	**59**	59	1	1	**61**
6-7pm	40	5	0	**45**	23	0	0	**23**
PM Total	***131***	***17***	***1***	***149***	***118***	***3***	***1***	***122***
Totals	***246 (88%)***	***33 (12%)***	***2 (1%)***	***281***	***242 (97%)***	***5 (2%)***	***2 (1%)***	***249***

To assess cyclist and motorist actions and interactions at intersections along the cycle track, eight hours of video were reviewed. During that time 407 cyclists were observed. The particular intersections, days and times, along with the number of cyclists observed during each period of time, are outlined below.

- SW Broadway at Montgomery Street: 8/3/10 4-6 p.m. (108 cyclists)
- SW Broadway at Montgomery Street: 8/4/10 4-6 p.m. (99 cyclists)
- SW Broadway at College Street: 8/10/10 4-6 p.m. (114 cyclists)
- SW Broadway at College Street: 8/11/10 4-6 p.m. (86 cyclists)

[1] Video camera placement and angle resulted in the clearest and most accurate intersections to assess being SW Broadway at Harrison (before) and SW Broadway at Montgomery (after) – the intersections are one block apart.

5.4.1 Cyclist Signal Compliance

The bicycles in the cycle track are controlled by the vehicle signals on SW Broadway. Note that the signal heads are over the motor vehicle lanes, as seen in Figure 11. Of the 407 cyclists observed, 113 arrived on a red signal indication. Fifty of those 113, or 44%, violated the red signal either by continuing through the intersection without stopping or by stopping and continuing prior to the signal changing back to green. However, cyclist compliance with the vehicle signals was also poor in before the cycle track was installed (with the bike lane), when 41% of observed cyclists (23 out of 55) did not stop at a red signal[2]. Thus, it is likely that the lack of compliance is related to the lack of conflicting traffic rather than the cycle track design.

Figure 11. Cycle Track Traffic Signal Location

5.4.2 Cyclist Left-Turn Actions

Twenty-four of the 407 cyclists made a left turn – of those 24, seven cyclists (29%) cycled into the green box and remained there until the signal changed. This is the intended course of action for a cyclist making a left turn at this type of intersection. Another seven cyclists (29%) turned from the cycle track but did not wait in the box – this number includes those that waited behind or next to the green box. Seven cyclists moved into the motor vehicle lane prior to arriving at the intersection and completed the left turn from the left lane. Figure 12 shows how cyclists chose to make left turns from

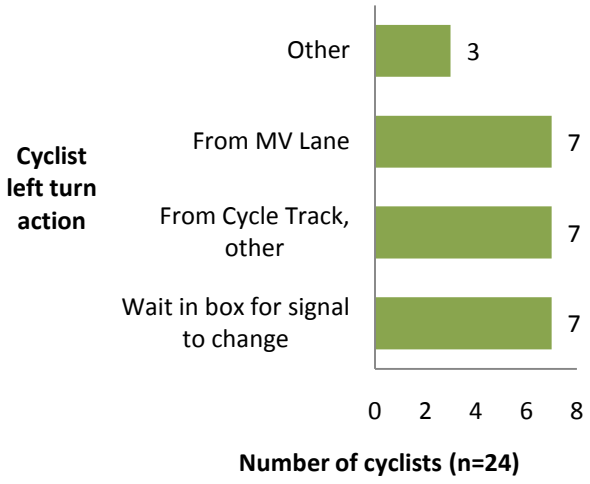


Figure 12. Cyclist Left-Turn Actions

[2] We re-reviewed before video of SW Broadway after we found low compliance in the after configuration.

the cycle track.

5.4.3 Cyclist/Pedestrian Interactions

Of the 407 cyclists observed, 113 passed through the intersection when there were pedestrians nearby (within approximately 15 feet of the cyclist). Ten instances (9%) of cyclist/pedestrian interaction were noted – any instances of cyclists or pedestrians having to stop or change direction on either a precautionary or emergency basis, or instances in which a cyclist rode within two to three feet of a pedestrian walking or standing on the street. Of the 10 interactions, five involved cyclists passing within two to three feet of cyclists, while another five involved some type of evasive action by either the cyclist or pedestrian. One interaction involved an "emergency" evasive action, which was taken by the pedestrian.

5.4.4 Motorist Delay

Eight hours of video were reviewed to assess whether the cycle track was negatively impacted the travel time of motor vehicles or the motor vehicle level of service. For each 15-minute period during the PM rush period, the total number of motor vehicles were counted. For each car that came to a stop at the intersection, the length of the control delay was recorded (the time the vehicle departed the stop bar or the queue minus the time the vehicle stopped at the bar or in the queue). The average control delay per vehicle was assessed by taking the total number of cars in each 15-minute period and dividing that by the total delay during that segment of time. As seen in Table 10, the average control delay per vehicle never rose above 6.9 seconds for any 15-minute period, and averaged from 3.2 to 4.0 seconds per vehicle over the entire two-hour period. Average control delay is the service measure for intersections – LOS A is defined as average control delay of less than 10 seconds.

Table 10. Motor Vehicle Delay on SW Broadway during the PM Peak

SW Broadway at Montgomery Street		4:00-4:15	4:15-4:30	4:30-4:45	4:45-5:00	5:00-5:15	5:15-5:30	5:30-5:45	5:45-6:00	Totals
8/3/10	Total Cars	182	214	213	222	228	235	190	181	**1665**
	Total Delay (seconds)	1051	621	659	612	847	995	366	443	**5594**
	Delay per car in seconds	**5.8**	**2.9**	**3.1**	**2.8**	**3.7**	**4.2**	**1.9**	**2.4**	**3.4**
8/4/10	Total Cars	187	190	222	198	230	226	224	186	**1663**
	Total Delay (seconds)	715	482	803	921	774	683	567	359	**5304**
	Delay per car in seconds	**3.8**	**2.5**	**3.6**	**4.7**	**3.4**	**3.0**	**2.5**	**1.9**	**3.2**
SW Broadway at College Street		**4:00-4:15**	**4:15-4:30**	**4:30-4:45**	**4:45-5:00**	**5:00-5:15**	**5:15-5:30**	**5:30-5:45**	**5:45-6:00**	**Totals**
8/10/10	Total Cars	211	206	192	204	225	262	230	203	**1733**
	Total Delay (seconds)	765	607	601	610	1349	1800	698	528	**6958**
	Delay per car in seconds	**3.6**	**2.9**	**3.1**	**3.0**	**6.0**	**6.9**	**3.0**	**2.6**	**4.0**
8/11/10	Total Cars	216	193	199	209	239	207	203	217	**1683**
	Total Delay (seconds)	626	508	646	573	1191	810	867	444	**5665**
	Delay per car in seconds	**2.9**	**2.6**	**3.2**	**2.7**	**5.0**	**3.9**	**4.3**	**2.0**	**3.4**

5.5 Cycle Track – City of Portland Data

PBOT provided PSU with the data from several projects related to the SW Broadway cycle track, including a study of parking compliance on Broadway and a log of comments and questions the City received pertaining to the cycle track.

5.5.1 Parking Violations

PBOT conducted a study observing locations along SW Broadway to gain an understanding of the frequency of vehicles parking illegally in the cycle track. The study involved observations made on a block-by-block basis from Oct. 8-23, 2009. All seven blocks of the cycle track were observed at 41 different points in time, for a total of 287 block observations. Parking violations were observed in relatively few instances:

- Five violations were found over 287 total block observations (1.72%)
- Three of 287 observations yielded an illegally parked vehicle(s) (1.04%)
- Three of 41 total observation times revealed at least one violation (7.32%)

- Twice, two vehicles were illegally parked together. Both double violation cases occurred just to the south of SW College Street
- The single violation occurred just north of SW Montgomery Street and involved a vehicle using the bike lane as a loading zone

5.5.2 Comment Log

PBOT also provided PSU with a list of all comments received regarding the SW Broadway cycle track. In all, 41 comments were received. Of those, eight were categorized as being supportive of the existing new facility, while 24 were categorized as pointing out problems with the existing cycle track facility. Some themes that recurred in the comments include:

- Concerns about confusion surrounding the current parking situation (16 comments). A prominent parking-related concern was that the cycle track, as currently implemented, compromised the safety of disabled persons because it did not provide a curbside parking and drop-off option (seven comments).
- Concern about the potential for a collision between pedestrians and cyclists (five comments).
- Concerns about motor vehicles parked in the cycle track (five comments).
- Concerns about increased traffic due to the loss of a lane (four comments).
- Concern that a repainting of the parking spaces along the cycle track resulted in parking spaces at the corner of SW Jackson and Broadway, where the cycle track ends and motor vehicles can make a right turn. The new parking extends near to the intersection, decreasing visibility between cyclists and motorists whose paths may soon cross (four comments).
    - Note that as of this report there are now two spaces at the front of the intersection where parking is prohibited, addressing the concern raised here.

5.6 Cycle Track - Summary of Findings

Cyclists expressed support for the cycle track. Over 70% of survey respondents indicated that the cycle track made cycling on SW Broadway safer and easier, and that the cycle track made for a better cycling environment in Portland. Concern about the threat of being "doored" by a motor vehicle was substantially lower in the cycle track when compared to a standard bike lane (36% vs 95%).

Motorists generally expressed support for the cycle track. A plurality felt that the cycle track made driving safer (48%), and that driver behavior was safer and calmer with the cycle track (45%). Furthermore, motorists generally disagreed with the sentiment that the cycle track made driving less convenient or that it takes longer to drive this section of SW Broadway now. It is notable that motorists who never ride a bicycle (survey respondents stating that they "never" ride a bicycle) were somewhat more likely to be pessimistic about the cycle track than motorists who do ride a bicycle.

Motor vehicle delay is still low after removing one travel lane. An assessment of average motor vehicle control delay (for all vehicles) at signalized intersections on SW Broadway found an average delay per vehicle of two to seven seconds. This corresponds to a LOS A. In addition, PBOT has received few complaints about traffic on SW Broadway (only four traffic-related complaints in the comment log). No issues with parking were identified as a long-term problem.

Cyclists are using the cycle track rather than the motor vehicle lanes. Surveys indicated that 97% of cyclists always or usually ride in the cycle track when riding on this section of SW Broadway, which was confirmed in the video observation showing that 97% of cyclists rode in the cycle track. When comparing the prior bike lane configuration to the cycle track design, the percentage of cyclists riding in the motor vehicle lane decreased from 12% to 2% of riders.

Cyclist understanding of and compliance with the traffic signals on SW Broadway is poor. SW Broadway is a one-way street: with the exception of SW Jackson and the entrance to the PSU parking lot at SW College, right turns from SW Broadway are not allowed. The three intersections on the PSU campus (SW Mill, Montgomery, Harrison and Hall) are three-way ("T") intersections. The cycle track is on the far right, and the cross streets are on the left. Therefore, there is no motor vehicle traffic, only pedestrian traffic, crossing in front of bicycles stopped in the cycle track on a red signal indication. The signals are mounted over the motor vehicle lanes, but not the cycle track lane. Only 63% of cyclists surveyed indicated that they were required to stop when the signals on SW Broadway are red. Many cyclists expressed confusion about whether they needed to stop or stay stopped in the cycle track on a red signal indication. Consistent with the survey findings, only 56% of cyclists observed in the cycle track video review stopped during the red signal phase (though only 59% of observed cyclists stopped during the red signal before the cycle track was installed). Thus, it is likely that the lack of compliance is related to the lack of conflicting traffic rather than the cycle track design.

Cyclist use of the left-turn boxes could be improved. To facilitate left turns from the cycle track, the City installed small green boxes immediately to the left of the cycle track at the signalized intersections, in front of the parked cars. Cyclists are supposed to wait in the box until the pedestrian signal in the cross direction is green. This is sometimes described as a two-stage left turn. Alternatively, a cyclist could leave the cycle track a block ahead of a left turn, proceed across to the left-side traffic lane and turn left. While 76% of survey responses stated that cyclists SHOULD wait in the green box until the signal changes to make a left turn, only 54% stated that they actually turn left in that way. In the video data, 24 of the 407 cyclists made a left turn. Seven cyclists (29%) cycled into the green box and remained there until the signal changed; another seven cyclists (29%) turned from the cycle track once the signal changed but did not wait in the box – this number includes those that waited behind or next to the green box.

Cyclist and pedestrian conflicts are high. Although nearly 90% of pedestrians surveyed indicated they understood where they should wait for a "Walk" sign to cross SW Broadway (on the curb), a plurality (42%) expressed concern about the impact of the cycle track on crossing Broadway. Nearly a third of cyclists surveyed stated that they encounter pedestrians jaywalking across the cycle track 25% or more of the time. Combined with cyclists' low compliance in stopping at a red signal, there are many opportunities for collisions between cyclists and pedestrians. Over 40% of cyclists stated they had been involved in a near-collision with a pedestrian, while 12% of pedestrians stated they had been involved in a near-collision with a cyclist. One cyclist and two pedestrians surveyed stated that they have been involved in bicycle-pedestrian collisions on the cycle track. Video observation data confirms the risk – in situations where pedestrians were present while cyclists rode past on the cycle track, nearly one in 10 resulted in potentially unsafe interactions. These include instances of a cyclist or pedestrian having to stop or change direction as a precaution (3.5%) or an emergency (1%), or instances in which a cyclist rode within two to three feet of a pedestrian walking or standing on the street (4.5%).

A measurable change in cycle volumes was not detected. Cycle-track cyclist counts show a decrease in numbers, though our one-day comparisons are not of the same time period. The before video was taken during PSU's spring term, while the after video was taken over the summer break. Many survey respondents who currently cycle along the cycle track indicated that they previously cycled on SW Broadway less frequently (38%) and/or chose alternate routes (30%).

Loss of curb access presents a challenge to physically handicapped persons. Multiple comments received by the City of Portland indicated that the loss of the option to park and/or drop-off on the curb on SW Broadway is a problem for physically handicapped persons.

6 Buffered Bike Lanes

A copy of the survey instruments can be found in the Appendices. Expect where noted, the following conventions are used when summarizing data:

- Motorists who answered "Never" in response to "How often do you ride a bicycle?" were categorized as "Non-Cyclists."
- Motorists who answered 2) Less than one day a month; 3) 1-3 days a month; 4) 1-3 days a week; 5) 4 or more days a week in response to "How often do you ride a bicycle?" were categorized as "Cyclists."
- Respondents who selected "Strongly Agree" and "Somewhat Agree" were aggregated to "Agree."
- Respondents who selected "Strongly Disagree" and "Somewhat Disagree" were aggregated to "Disagree."

6.1 Buffered Bike Lanes - Cyclist Survey

The gender split of the buffered bike lane survey respondents was 72% male and 28% female (consistent with City counts of cyclists). Only 2% identified themselves as "Interested but concerned" cyclists, 78% as "enthusiastic and confident," 10% as "strong and fearless," and 11% as "other." As seen in Figure 13, the respondents represented an array of age groups, with the largest age groups being "35-44."

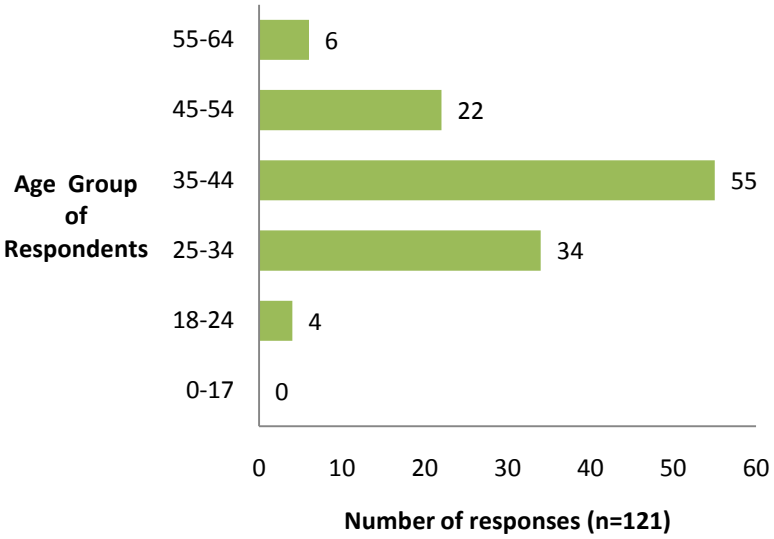


Figure 13. Respondent Age – Buffered Bike Lanes Cyclist Survey.

6.1.1 Choosing to Ride on SW Stark Street and SW Oak Street

As seen in Figure 14, respondents are riding on SW Stark and Oak streets more than they did previously. A third of the respondents indicated that they never rode on these streets prior to the installation of the buffered bike lanes, and over half of the respondents indicated that they rode on these streets less than three days a month. However, nearly two-thirds (63%) indicated that they now ride on the buffered bike lane streets four or more days a week, while 91% ride on the lanes at least once per week. Sixty-five percent of respondents agreed with the statement that they now

choose to cycle on SW Oak and Stark more often, while only 10% disagreed. See section 6.4.1 for information on observed counts.

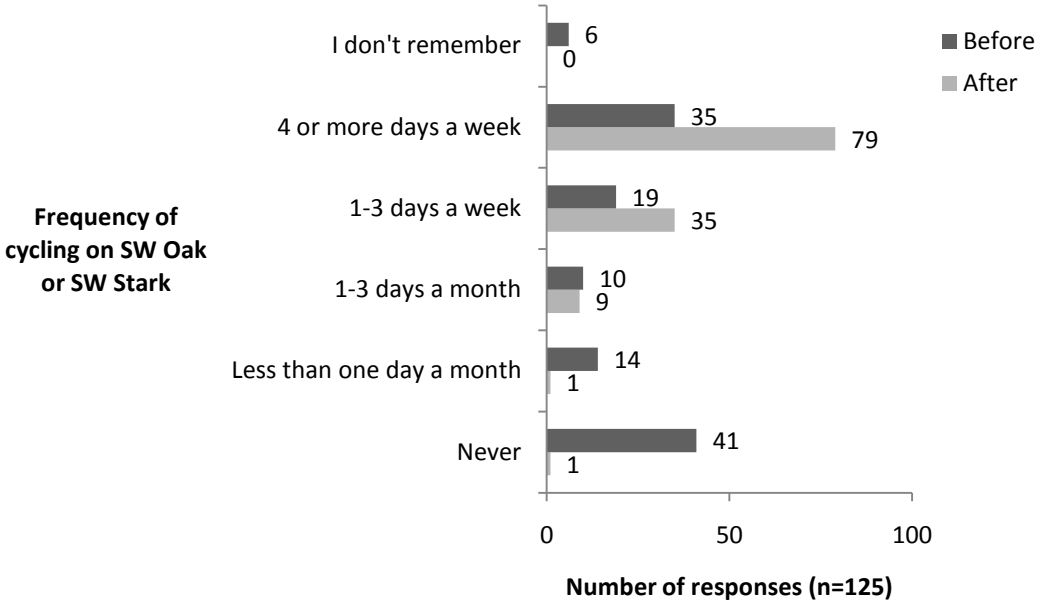


Figure 14. About How Often did you Ride your Bicycle on SW Oak (from Naito to 9th) or SW Stark (from 13th to Naito)?

Asked if they rode on a different street before the cycle track was implemented, 35% of respondents said they did. These respondents rode on a number of different streets, though the most commonly cited were NW Couch, SW Pine, Broadway and SW Main (with four mentions each), followed closely by NW Everett, NW Davis, SW Morrison, SW Madison and 6th Avenue (with three mentions each).

6.1.2 Cyclist Experience

Cyclists overwhelmingly expressed positive sentiments about the experience of riding a bicycle on the buffered bike lanes. Eight-nine percent expressed agreement that riding on SW Oak and SW Stark is safer for cyclists since the buffered bike lanes were installed, while 91% agreed that riding on these streets is now easier. Ninety-four percent of respondents felt that the buffered bike lanes make for a better environment for bicycling in Portland.

Compared to a standard bike lane, respondents prefer buffered bike lanes and indicated that they are willing to go out of their way to use them. Eighty-seven percent of respondents stated that they prefer a buffered bike lane over a standard bike lane, while 71% of respondents stated they would go out of their way (4.5 miles over four miles) to ride two miles on a buffered bike lane over two miles on a busy street with a standard bike lane. Asked if they think that the City of Portland should install buffered bike lanes at other locations, 77% of respondents responded affirmatively. The most

common suggested locations include more downtown streets (13 respondents), SW Broadway (seven respondents), NE Broadway (seven respondents), SE Hawthorne (six respondents), N Williams (five), N Vancouver (four), NE Sandy (four) and the East Side generally (six). Ten respondents supported adding buffered bike lanes wherever possible.

6.1.3 Cyclist Sense of Safety

In addition to respondents generally feeling that the buffered bike lanes make SW Oak and SW Stark safer, survey responses indicate that cyclists feel safer and more comfortable in their interactions with motorists. Over half of respondents (58%) feel that driver behavior on these sections of Oak and Stark is safer and calmer with the buffered bike lanes, while only 16% disagreed. Seventy-one percent of respondents disagreed with the statement that motor vehicles travel at faster speeds on these sections with the buffered bike lanes.

Asked if they have to pay a lot of attention to avoid being "doored" while riding in the buffered bike lanes, 12% indicated that they do have to pay a lot of attention, while over three-quarters (77%) indicated that they do not. Comparatively, nearly nine in 10 respondents (89%) felt that they have to pay a lot of attention to avoid being "doored" in a standard bike lane.

Cyclists were asked about their interactions with motor vehicles taking actions that require them to cross the buffered bike lane, which include parking in the lane to the right of the buffered bike lanes or making right turns. Responses indicated a relatively high-level of interactions, particularly between cyclists and right-turning vehicles. One respondent indicated they were involved in a collision with a vehicle making a parking maneuver - 11% of respondents have witnessed a near-miss between a cyclist and a parking vehicle, while 17% stated that they were involved in a near-miss with a parking vehicle. Four cyclists (3%) stated that they were involved in a collision with a right-turning vehicle on the buffered bike lanes - 30% of respondents have witnessed a near-miss between a cyclist and a right-turning vehicle, while 36% stated that they were involved in a near-miss with a right-turning vehicle.

6.1.4 Cyclist Perception of Motorist Actions

Respondents were asked about their understanding of rules affecting motor vehicles with regard to the buffered bike lanes, along with how often they see vehicles violating these rules. Cyclists indicated that they do not have a firm understanding of when cars are allowed to be in the buffered bike lanes. Asked, "When can cars be in the buffered bike lane?" over a third of respondents (36%) stated that they were unsure. Just over half (55%) thought motor vehicles could be in the lane when parking, while a similar number thought motor vehicles could be in the lane when preparing to make a right turn.

Asked if they feel motorists understand the rules pertaining to the buffered bike lanes, 52% of respondents stated that they do not, while only 8% stated that they feel motorists do understand the rules (the remainder were neutral). Table 11 shows responses to the frequency with which cyclists see cars and trucks driving in the buffered bike lane. Of the respondents, 48% reported seeing cars

driving in the buffered bike lanes at least once per week, while 22% of respondents reported seeing trucks driving in the buffered bike lanes at least once per week.

Table 11. How Often do you see the Following Vehicles Driving in the Buffered Bike Lane?

	Never	Less than one day a month	1-3 days a month	1-3 days a week	4 or more days a week	I don't remember	n
Cars	5	11	34	44	13	11	118
Trucks	17	19	32	17	8	22	115

6.1.5 Improving the Buffered Bike Lanes

Asked how to improve the buffered bike lanes, respondents indicated that clarifying the rules of the lanes is important. A total of 31 people cited educating users about the rules; 26 thought improved signage was needed; and 20 felt improved street markings were needed.

6.2 Buffered Bike Lanes - Motorist Survey

A total of 114 motorist surveys were collected along the buffered bike lanes. Survey respondents were 54% male and 45% female. Forty-three percent of respondents indicated that they never ride a bicycle, while an additional 24% ride less than one day a month and 17% ride one day or more per week. Figure 15 shows the age breakdown of motorist survey respondents.

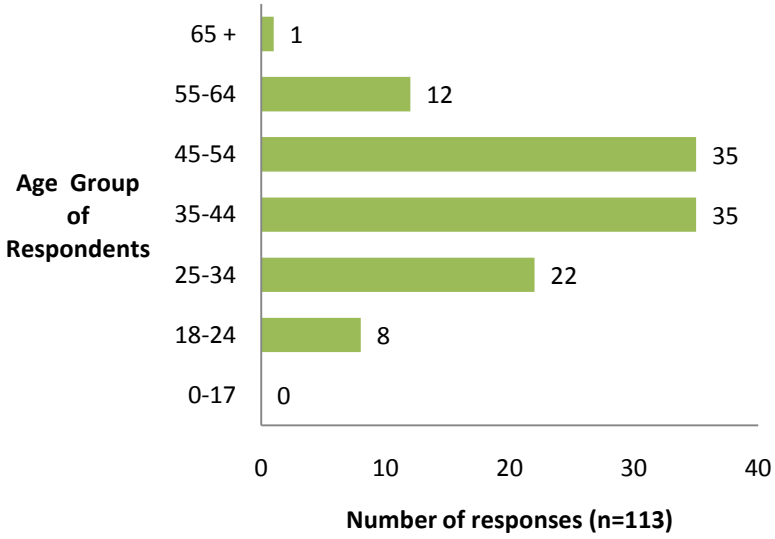


Figure 15. Respondent Age - Buffered Bike Lane Motorist Survey.

Respondents were asked how often they drive and park on the sections of SW Oak and Stark streets with the buffered bike lanes both before and after the new lanes were installed. As can be seen in Table 12, respondents generally indicated that their rates of driving and parking on Oak and Stark had not changed significantly since the buffered bike lanes were installed. A plurality of motorists who do not ever ride a bicycle (non-cyclists) – 39% - indicated that they now drive on these streets four or more days per week (compared to 19% for cyclists). However, respondents who cycle were more likely to drive on these streets one to three days a week (33%) or one to three days a month (29%) – compared to 15% and 20% of non-cyclists for the same figures. These rates were generally consistent before and after the buffered bike lanes.

Table 12. Frequency of driving and parking on SW Oak and Stark

	Never	Less than one day a month	1-3 days a month	1-3 days a week	4 or more days a week	n
Drive, Before	2%	14%	29%	25%	29%	102
Drive, Now	5%	19%	25%	25%	26%	102
Park, Before	34%	30%	23%	6%	7%	100
Park, Now	41%	30%	17%	7%	5%	100

6.2.1 Safety

While motorists indicated that they liked having bikes and cars more separated, there is not a sense that they have increased safety. Respondents agreed with the statement, "I like that bikes and cars

are more separated with the buffered bike lanes," though motorists who sometimes ride a bicycle (cyclists) were more likely to agree than non-cyclists. On two questions inquiring about the safety of driving and driver behavior, cyclists were split on the safety impact of buffered bike lanes while non-cyclists generally indicated that the buffered bikes lanes did not improve safety. See Table 13 for details.

Table 13. Motorist Agreement, Safety

	All		Motorists who are Non-Cyclists		Motorists who are Cyclists	
	Disagree	**Agree**	**Disagree**	**Agree**	**Disagree**	**Agree**
I like that bikes and cars are more separated with the buffered bike lanes	30%	64%	40%	54%	23%	72%
n	112		48		64	
The buffered bike lanes have made driving safer	48%	32%	64%	24%	35%	38%
n	111		45		66	
Driver behavior is safer and calmer with the buffered bike lanes	53%	32%	63%	21%	44%	42%
n	103		43		60	

6.2.2 Convenience

Several survey questions sought to get at the level of convenience, delay and stress experienced by motorists. The majority of respondents felt that the buffered bike lanes make driving less convenient (61%), feel that parking is more challenging and stressful (56%) and that they have changed how they drive with the buffered bike lanes (63%).

When asked about traffic delays and the amount of time required to drive these sections of SW Oak and Stark streets, motorists who never ride a bicycle expressed a negative opinion about the impact of the buffered bike lanes. They tended to agree with the statements that traffic had gotten worse and that it takes longer to drive these sections of road. However, respondents who sometimes ride a bicycle were generally split on both of these statements. See Table 14 for details on these safety-related questions.

Table 14. Motorist Agreement, Safety

		All		Motorists who are Non-Cyclists		Motorists who are Cyclists	
		Disagree	Agree	Disagree	Agree	Disagree	Agree
The buffered bike lanes have made driving less convenient		25%	61%	18%	69%	32%	53%
	n	110		45		65	
Parking on these sections of SW Oak and Stark is more stressful and challenging with the buffered bike lanes		27%	56%	23%	58%	32%	53%
	n	99		43		56	
I have changed how I drive on these sections of SW Oak and Stark because of the buffered bike lanes		19%	63%	13%	62%	24%	63%
	n	110		45		65	
Traffic has gotten worse since the buffered bike lanes were installed		26%	48%	14%	62%	35%	38%
	n	105		42		63	
It takes longer to drive these sections of SW Oak and Stark with the buffered bike lanes		25%	52%	14%	70%	34%	41%
	n	107		43		60	

6.2.3 Other Opinions

Asked if they would like to share anything else about the buffered bike lanes, 70 respondents wrote in a comment. Of those:

- Twenty expressed support for the buffered bike lanes and 15 expressed dislike for them.
- Twenty-four expressed confusion about how to use the buffered bike lanes, including what a car should do to turn right or park on the right side of the road, each of which require passing through the bike lane.

6.3 Buffered Bike Lanes - Business Survey

Businesses along SW Oak and Stark streets were surveyed to understand how or if the buffered bike lanes are impacting business. Thirty-five completed business surveys were received. Businesses have been operating at their current locations for an average of 21 years (median of 10 years). Fifteen of the businesses are restaurants or cafés, while nine are retail establishments. Twenty business owners and 10 business managers returned surveys (two respondents indicated "other" but did not elaborate). As seen in Table 15, respondent businesses represented a spectrum of sizes in terms of daily number of customers. In terms of the number of employees, respondent businesses were more likely to be under 10 employees, although there were a number of larger businesses represented as well.

Table 15. Respondent Business Size

Daily Customers		Employees	
Less than 25	7	Less than 5	19
25-49	7	5-9	4
50-99	4	10-14	2
100-199	8	15-19	0
200+	6	20-24	2
		25+	6

Asked to estimate what method of transportation both customers and employees took to get to work, Table 16 shows that respondents estimated that both groups drive about half the time. The major difference in estimates about how customers and employees get to the business was that businesses estimated nearly a third of customers get to the business by walking, whereas less than 5% of employees arrive on foot. Businesses also estimate employees are more likely to arrive by bicycle or transit than customers.

Table 16. Customer and Employee Travel Mode Estimates

	Based on your knowledge, estimate what % of your CUSTOMERS get to your business by…	Based on your knowledge, estimate what % of your EMPLOYEES commute to work at this location by…
Driving	46%	50%
Walking	29%	4%
Bike	7%	11%
Transit	12%	29%
Other	4%	0%
n	32	33

Respondents expressed concerns about the effect of the buffered bike lanes on business operations, including parking and deliveries. However, more businesses indicated support for the buffered bike lanes than not.

6.3.1 Impact of Buffered Bike Lanes on Business Operations

Asked about the impact of buffered bike lanes on sales, 39% of businesses surveyed disagreed with the statement that the buffered bike lanes had a positive effect, while 15% expressed agreement (38% neither agreed nor disagreed). With regard to parking, 43% of respondents felt the buffered bike lanes made parking more difficult for customers, while 20% disagreed. Businesses were split on whether the lanes made parking more difficult for employees, with 33% agreeing and 33% disagreeing. Just over half of the businesses surveyed (51%) expressed agreement with the statement that the lanes make deliveries to their business more challenging; 20% disagreed. Eighteen percent of respondents felt the lanes increase bike and foot traffic to their business, while 42% disagreed. Table 17 shows the results for business operations-related questions.

Table 17. Business Agreement, Operations

The buffered bike lanes on SW Oak and SW Stark…	Strongly Disagree	Somewhat Disagree	Neither	Somewhat Agree	Strongly Agree	I Don't Know	Total	n
…have had a positive effect on my business sales	21%	18%	38%	6%	9%	9%	100%	34
…make parking more difficult for my customers	6%	14%	29%	20%	23%	9%	100%	35
…make parking more difficult for my employees	15%	18%	29%	18%	15%	6%	100%	34
…make deliveries to my business more challenging	6%	14%	26%	11%	40%	3%	100%	35
…increase bike and foot traffic to my business	21%	21%	29%	3%	15%	12%	100%	34

6.3.2 Transportation Options

Survey responses indicate that businesses value the transportation options provided by being downtown and support efforts to increase options. Businesses overwhelmingly agreed that downtown business owners should encourage their employees to get to work by means other than driving alone – 63% agreed and none disagreed. However, they were split on whether the buffered bike lanes increased transportation options. Slightly more businesses agreed than disagreed with the statement that the lanes "increase transportation options for employees and/or customers" (34% to 25%). Table 18 provided results for transportation options-related questions.

Table 18. Business Agreement, Transportation Options

	Strongly Disagree	Somewhat Disagree	Neither	Somewhat Agree	Strongly Agree	I Don't Know	Total	n
Downtown business owners should encourage their employees to get to work by means other than driving alone.	0%	0%	21%	24%	41%	15%	100%	34
The buffered bike lanes increase transportation options for employees and /or customers	11%	14%	26%	20%	14%	14%	100%	35

6.3.3 Businesses Support Portland's Bicycle Network

Despite the reservations expressed with regard to the impact of the lanes on parking, deliveries and sales, over half of the respondents (51%) agreed that the lanes are an important part of the

downtown Portland bicycle network - only 9% expressed disagreement on this statement. Asked about their support of the buffered bike lanes on each of the streets, 39% indicated support for the lane on SW Oak (24% indicated a lack of support), while 46% indicated support for the lane on SW Stark (28% indicated a lack of support). Respondents were split on whether they would support removing parking spaces for additional delivery loading zones. Table 19 shows the results for transportation options-related questions.

Table 19. Business Agreement, Bicycle Network and Lane Support

	Strongly Disagree	Somewhat Disagree	Neither	Somewhat Agree	Strongly Agree	I Don't Know	Total	n
The buffered bike lanes are an important part of downtown Portland's bicycle network	0%	9%	33%	21%	30%	6%	100%	33
I support the buffered bike lanes on SW Oak	18%	6%	26%	21%	18%	12%	100%	34
I support the buffered bike lanes on SW Stark	17%	11%	14%	29%	17%	11%	100%	35
I support removing some parking spaces to add additional loading zones for delivery vehicles.	29%	14%	14%	23%	11%	9%	100%	35

6.4 Buffered Bike Lanes – Video Observation

To assess cyclist and motorist actions and interactions at intersections along the buffered bike lanes, eight hours of video were reviewed. The particular intersections, dates and times are outlined below:

- SW Stark at 5th Avenue: 8/10/10
- SW Stark at 5th Avenue: 8/11/10
- SW Oak at 4th Avenue: 8/17/10
- SW Oak at 4th Avenue: 8/18/10

Additionally, certain hours of video from before the installation were reviewed in order to compare cyclist counts.

6.4.1 Cyclist Counts

Cyclist counts along the buffered bike lanes were conducted using video collected during peak bicycling hours (heading into downtown Portland in the morning on SW Oak and leaving downtown Portland in the evening on SW Stark). The counts, hourly totals of which are shown in Table 20, show significant increases in bicycle traffic on both Oak and Stark. Counts on Oak showed the number of cyclists increasing from 74 to 275 – an increase of 271%. The pre-installation counts were taken at SW 6th and Oak and the post-installation counts were taken at SW 4th and Oak. It is likely that some portion of the increase is due to the SW 4th and Oak location being downstream from the before location. On SW Stark, counts showed the number of cyclists increasing from 191 to 339 – an increase of 77%. However, in this instance, the post-installation counts (at SW 5th and Stark) were upstream of the pre-installation counts (at SW 3rd and Stark), suggesting that the observed increase on Stark may be understated. Taken together, these counts suggest that bicycle traffic has increased somewhere between 77% and 271%.

Table 20. Buffered Bike Lane - Cyclist Counts

	6th and Oak - 9/3/2009 (before)	*4th and Oak - 8/17/2010 (after)*		*3rd and Stark - 9/2/2009 (before)*	*5th and Stark - 8/10/2010 (after)*
Day	*Thurs*	*Tues*		*Weds*	*Tues*
7-8am	15	50	4-5pm	54	73
8-9am	37	157	5-6pm	92	174
9-10am	22	68	6-7pm	45	92
Totals	**74**	**275**	**Totals**	**191**	**339**
Percent Increase	**271%**		**Percent Increase**	**77%**	

6.4.2 Motorist Delay

Eight hours of video were reviewed to assess whether the buffered bike lanes were negatively impacting the travel time of motor vehicles or the motor vehicle LOS. For each 15-minute block of time during the PM rush period, the total number of motor vehicles were counted. For each car that came to a stop at the intersection, the length of the control delay was recorded (time departing the stop bar – time arriving at the stop bar or in queue). The average control delay per car was assessed by taking the total number of cars in each 15-minute segment and dividing that by the total delay during that segment of time. As seen in Table 21, the average delay per vehicle over the entire two-hour period ranged from 8.7 seconds per vehicle (LOS A) to 12.2 seconds per vehicle (LOS B). Along SW Oak Street, the highest delay per vehicle never rose above 17 seconds for any one 15-minute period (LOS B). Along SW Stark Street, the average delay per vehicle remained very low with the exception of the periods between 5 and 5:30 p.m. The average delay per vehicle on SW Stark from 5-5:15 was 34.8 seconds (LOS C – approaching D), while the average delay from 5:15-5:30 was 21 seconds (LOS C). The intersection of SW Stark and Fifth lacks a right-turn lane, which may contribute to additional delays for through vehicles.

For each 15-minute time period, a count of the number of cars driving in the buffered bike lane was made. The counts excluded cars that passed through the buffered bike lane for the purposes of parking or making a right turn.

Table 21. Motor Vehicle Delay on SW Oak and SW Stark during the PM Peak

SW Oak at 4th Avenue		4:00-4:15	4:15-4:30	4:30-4:45	4:45-5:00	5:00-5:15	5:15-5:30	5:30-5:45	5:45-6:00	Totals
8/17/10	Total Cars	54	36	59	51	48	48	53	31	380
	Cars in BBL	**4**	**4**	**5**	**5**	**4**	**6**	**8**	**1**	**37 (10%)**
	Total Delay	382	317	469	404	591	493	444	224	3324
	Delay per Car in seconds	**7.1**	**8.8**	**7.9**	**7.9**	**12.3**	**10.3**	**8.4**	**7.2**	**8.7**
8/18/10	Total Cars	44	36	44	33	61	48	41	39	346
	Cars in BBL	**6**	**3**	**3**	**5**	**3**	**3**	**4**	**5**	**32 (9%)**
	Total Delay	247	260	420	333	1038	339	464	234	3335
	Delay per Car in seconds	**5.6**	**7.2**	**9.5**	**10.1**	**17.0**	**7.1**	**11.3**	**6.0**	**9.6**
SW Stark at 5th Avenue		4:00-4:15	4:15-4:30	4:30-4:45	4:45-5:00	5:00-5:15	5:15-5:30	5:30-5:45	5:45-6:00	Totals
8/10/10	Total Cars	73	81	84	73	88	94	87	67	647
	Cars in BBL	**5**	**9**	**7**	**4**	**5**	**12**	**6**	**2**	**50 (8%)**
	Total Delay	546	276	873	184	3142	2301	446	149	7917
	Delay per Car in seconds	**7.5**	**3.4**	**10.4**	**2.5**	**35.7**	**24.5**	**5.1**	**2.2**	**12.2**
8/11/10	Total Cars	73	59	79	71	81	97	84	76	620
	Cars in BBL	**7**	**2**	**7**	**5**	**6**	**10**	**3**	**6**	**46 (7%)**
	Total Delay	348	196	710	274	2737	1705	206	462	6638
	Delay per Car in seconds	**4.8**	**3.3**	**9.0**	**3.9**	**33.8**	**17.6**	**2.5**	**6.1**	**10.7**

6.4.3 Motor Vehicles in the Buffered Bike Lanes

As shown in the rows "Cars in BBL" of Table 21, overall infraction rates were in the 9% to 10% range for SW Oak Street and in the 7% to 8% range for SW Stark Street. Interestingly, although one might expect instances of infractions to increase as delay per vehicle increased, this did not appear to occur – the two 15-minute blocks with the greatest delay per vehicle each had relatively few infractions.

6.4.4 Motorist Right-Turn Actions

In order to understand how motor vehicles are making right turns at intersections (without right-turn lanes) along the buffered bike lanes, all right turns made during the eight-hour sample were reviewed and coded. Fifty-seven percent of motorists turned from the motor vehicle (left) lane, while 37% moved into the buffered bike (right) lane and made the turn from there. Six percent of motorists turned from the parking lane, either passing through the buffered bike lane or commencing from a parked position.

Table 22. Motorist Right-Turn Actions

	Stark/5th 8/10/2010 4-6pm	Stark/5th 8/11/2010 4-6pm	Oak/4th 8/17/2010 4-6pm	Oak/4th 8/18/2010 4-6pm	Total
Right turn from the motor vehicle lane	35	30	49	52	**166**
Right turn from the buffered bike lane	37	27	21	22	**107**
Right turn from parking lane/area	3	4	8	3	**18**
Total	**75**	**61**	**78**	**77**	**291**

6.5 Buffered Bike Lanes – City of Portland Data

PBOT provided PSU with a log of comments and questions the City received pertaining to the cycle track.

Of 30 comments received regarding the buffered bike lanes, six were categorized as being supportive of the existing new facility, while 14 were categorized as pointing out problems with the existing buffered bike lanes. A number of users had questions about how the buffered bike lanes were meant to be used, including how cars were expected to park and make right turns. Some of the recurring comments included:

- Concerns about confusion regarding how motor vehicles should make right turns (seven comments).
- Concerns about motor vehicles driving in the buffered bicycle lane (five comments).
- Concerns about how motor vehicles should park in the parking strip to the right of the buffered bike lane (three comments).

6.6 Buffered Bike Lanes – Summary of Findings

More cyclists are choosing to ride on SW Oak and SW Stark. According to the survey data, the number of cyclists choosing to ride on these streets is significantly higher than before the buffered bike lanes were installed. Nearly 65% of the respondents indicated they choose to ride on the buffered bike lanes more often. Observation of the video counts found that the counts increased 77% on SW Stark and 271% on SW Oak. Because the locations of the before-and-after counts were not the same, the 77% increase is most likely understated.

Cyclists expressed support for the buffered bike lanes. Cyclists indicated that they are choosing to ride on SW Oak and Stark more often than before the buffered bike lanes were installed. They overwhelmingly agree that the streets are safer, easier and contribute to a better cycling environment in Portland. Cyclists indicated they feel lower risk of being "doored" in the buffered bike lanes and nearly nine in 10 cyclists preferred a buffered bike lane to a standard lane. Seven in 10 cyclists indicated they would go out of their way to ride on a buffered bike lane over a standard bike lane, while nearly eight in 10 cyclists felt that the City of Portland should install buffered bike lanes in other places.

Understanding of when motor vehicles can be in the buffered bike lane is poor. Both cyclists and motorists expressed confusion over when or if motor vehicles were allowed to be in the buffered bike lane. The most common sentiment voiced by motorists on the comment section of the survey was confusion about when a car can be in the buffered bike lane to carry out actions such as turning right and parking to the right of the bike lane. Asked when cars can be in the buffered bike lanes, over a third of cyclists indicated that they did not know the answer; over 50% stated that cars could be in the lane when making a right turn and a similar number felt they could do so when parking. Motor vehicles should only be in the buffered bike lane to park or to cross to get to the right-turn lane (if present).

Motorist actions when turning right without a right-turn lane are inconsistent. For intersections along the buffered bike lane without a right-turn lane, motorists' turning actions are inconsistent and present a danger both to cyclists and other motorists. Over a third of right-turning motorists moved into the buffered bike lane to make the turn, while just over half turned from the left motor vehicle lane. This perception was confirmed by the cyclist survey, which revealed that over a third of cyclists reported being involved in a near-collision with a right-turning vehicle and four respondents (3%) were involved in an actual collision with a right-turning vehicle in the buffered bike lane.

Motorists feel that the buffered bike lanes have made driving on SW Stark and SW Oak more challenging. Motorists indicated that driving on these streets is less convenient (61%), parking is more challenging (56%), and that traffic and travel times have increased with the buffered bike lanes (48-52%). Still, nearly two out of every three respondents indicated that they like the additional separation between cars and bicycles provided by the buffered bike lanes.

Motor vehicle delay has increased but it is still acceptable. Analysis of the video data found that the average control delay per vehicle increased with the addition of the buffered bike lane, but is still LOS A or B at all peak times, with the exception of 5-5:30 p.m. when delays reach 22-35 seconds per vehicle (LOS C– approaching D).

Businesses that responded to the survey support bicycle routes, but have concerns about loss of access. Businesses surveyed for the evaluation indicated that the buffered bike lanes present challenges to customers looking for parking and deliveries. However, businesses also indicated that the buffered bike lanes were an important part of Portland's downtown bicycle network. A plurality of businesses (42%) indicated that they support the buffered bike lanes (compared to 26% that indicated that they do not support the lanes).

7 Recommendations

7.1 Cycle Track

Overall, the results of the evaluation find that the SW Broadway cycle track is working well. The primary improvements that could be made relate to the cyclist-pedestrian interactions at the three-leg intersections. Because of its proximity to PSU, there are a large number of pedestrians that cross SW Broadway and the cycle track. In addition, cyclist compliance with the red signal indication was found to be poor. This lack of compliance increased the risk of pedestrian interactions, since pedestrians will be crossing the cycle track when SW Broadway traffic has the red indication.

These pedestrian-cycle interactions could be addressed by one or more of the following:

- Installation of a bicycle-specific traffic signal mounted in the pedestrian buffer and/or curb lane.
- The addition of a "Wait Here on Red" stencil in the cycle track.
- The addition of a clearly marked crosswalk across the cycle track with continental striping.
- Placement of a W11-2 sign on the cycle track in advance of the intersections.
- The addition of a stencil at the crosswalk landing pad that would indicate where pedestrians should wait.
- Installation of a sign assembly (W11-1 and R15-8) in the pedestrian buffer facing both ways that warns of bicycles and encourages pedestrians to watch for cyclists (similar to TriMet's light rail crossing warning sign).

W11-2

W11-1

R15-8

An alternative design would be to not require cyclists to stop at the T-intersections. To do this, a pedestrian island adjacent to parked cars would need to be constructed (preferably a raised concrete design). Pedestrians could then cross the cycle track and wait for the walk indication in the island. A crosswalk would be striped across the cycle track and the cyclist would be signed to "Yield to Peds" in the crosswalk. It is not clear if a change would be needed to ORS to allow through bicycle traffic when SW Broadway was stopped (since the cycle track is considered part of SW Broadway and controlled by those indications).

R9-6

The other operation that could be improved is the left-turn box. The use of these boxes could be improved by one or more of the following:

- Implement an ongoing education campaign about how to use the boxes. Implementation of similar boxes at other locations around the city will likely lead to an increase in the usage of the boxes as they become more familiar to cyclists.

- At some of the intersections on the PSU campus, there is no signal facing the left-turning cyclist. Thus, the cyclist must use the pedestrian signal to complete the left-turn. The addition of bicycle-specific traffic signal heads facing the cycle-track would make the movement clearer.
- Installation of channelization or a raised concrete island recommended in other improvements could be designed to incorporate the left-turn box.

Lastly, the issue of ADA curb access is a challenging design issue. One option would be the construction of a raised concrete curb (replacing the pedestrian buffer) on the street side (east side) of the cycle track. This will further separate motor vehicle traffic from the cycle track, prevent parking in the cycle track and provide a curb for motorists, buses and other users to use for disembarking, etc. It would need to be made wider in locations that were designed to be ADA loading areas (requiring an area five feet by eight feet long). In these locations, the entire cycle track could be raised to make a level surface.

7.2 Buffered Bike Lanes

Overall, the results of the evaluation indicate the buffered bike lanes are working well. There are two main areas where the operation of the buffered bike lanes could be improved.

One of the challenges with the buffered bike lane is that, while it is a bike lane, it looks very similar to a motor vehicle lane to motorists. Since this evaluation, PBOT has added additional cross hatching to the buffer to further delineate the bike lane, which should help improve the operations. Additional marking and signage could be considered such as overhead lane control signage on signal mast arms, lane control signs on the pole mounts at curbs, the addition of more bicycle stencils in the buffered bike lane, and possibly lane control arrows in the motor vehicle lane for cars at the beginning and midpoint of each block.

The second issue is the treatment of right turns for motor vehicles at the intersections without a right-turn lane. The video analysis and the survey indicate that this is a key conflict area. One alternative would be to add a right-turn lane by removing curb parking, shifting the bike lane, dropping the buffer, and adding a dotted line and green conflict marking such that cars could cross the buffered bike lane to enter the right-turn lane (as done at the intersections with right-turn lanes). This would provide motorists with a consistent manner in which to make right turns on the couplet. This would also have some delay benefits since it would remove right-turning vehicles delayed by pedestrians from limiting through vehicles. See Figure 16.

Figure 16. Sketch for addition of right-turn lane and offset Buffered Bike Lane.

8 List of Appendices

A. Cycle Track Surveys:
    1. Cyclist Survey Request Postcard
    2. Cyclist Survey
    3. Pedestrian Survey
    4. Motorist Survey
B. Buffered Bike Lane Surveys:
    1. Cyclist Survey Request Postcard
    2. Cyclist Survey
    3. Motorist Survey
    4. Business Survey

Appendix A - Cycle Track Surveys:

A1. Cycle Track: Cyclist Survey Request Postcard

A2. Cycle Track: Cyclist Survey

A3. Cycle Track: Pedestrian Survey

A4. Cycle Track: Motorist Survey

A1. Cycle Track: Cyclist Survey Request Postcard

Portland State UNIVERSITY

Dear Bicyclist,

Portland State University is conducting a study of the "cycle track" installed on SW Broadway in the City of Portland. You can participate in the study by completing an on-line survey. It will take about 10-15 minutes.

You can take the survey by going to the following website: www.its.pdx.edu/survey.htm

To take the survey, you will need to enter this number: «Code»

We are only asking a sample of bicyclists to complete this survey. Therefore, your participation is very important. In appreciation, everyone who completes the survey by 09/17/10 can enter a random drawing for four $25 Fred Meyer gift cards.

Your participation in the survey is voluntary. We will protect the confidentiality of your individual survey responses. The number above indicates to us where and when you received the postcard and helps prevent duplicate responses. It can not be used to identify you. If you have concerns or problems about your participation in this study or your rights as a research subject, please contact the Human Subjects Research Review Committee, Office of Research and Sponsored Projects, 600 Unitus Bldg., Portland State University, (503) 725-4288 / 1-877-480-4400. If you have any questions about the study, contact me at 503-725-9746 or monsere@pdx.edu If you are interested in learning more about me and the kind of research I do, please visit my web site at http://www.its.pdx.edu/.

Sincerely,

Christopher Monsere, Ph.D., P.E.
Assistant Professor
Civil and Environmental Engineering

A2. Cycle Track: Cyclist Survey

Block 1

Dear Bicyclist,

My name is Christopher Monsere and I am a faculty member at Portland State. I am conducting a study about the cycle track installed on SW Broadway between SW Clay and SW Jackson Streets. We hope that the results will help in future plans for improving bicycling in Portland and other cities.

Hearing from bicyclists like yourself is a very important part of this study. We have only invited a sample of bicyclists to participate in the study, by handing out postcards along the cycle track. Therefore, every response is very important and we hope you will participate. To do so, you need to complete a survey, starting on the next page. It should take about 10-15 minutes.

Your participation in the survey is voluntary. We will protect the confidentiality of your individual survey responses. The postcard that you received has a unique number that you will need to enter on the next page. That number only identifies where and when we handed you the postcard. We will use your individual responses only for the purposes of this study and they will not be linked to your name or other identifying information. You may also stop taking the survey at any time, with no consequences.

At the end of the survey, you will be directed to another webpage with an offer to submit your name into a drawing for four $25 gift certificates to Fred Meyer. That information will not be linked with your survey responses. The survey must be completed by 9/10/2010.

If you have concerns or problems about your participation in this study or your rights as a research subject, please contact the Human Subjects Research Review Committee, Office of Research and Sponsored Projects, 600 Unitus Bldg., Portland State University, (503) 725-4288 / 1-877-480-4400. If you have any questions about the study, contact me at 503-725-9746 or monsere@pdx.edu If you are interested in learning more about me and the kind of research I do, please visit my web site at http://www.its.pdx.edu/.

Sincerely,

Christopher Monsere, Ph.D., P.E.
Assistant Professor
Civil and Environmental Engineering

Do you agree to participate in this survey?

- No
- Yes

Are you 18 years or older?

- Yes
- No

If you are under the age of 18, does your parent or guardian give permission for you to participate in this survey?

- No
- Yes, my parent or guardian has reviewed the information above and given me permission to participate

Block 4

Thank you for taking the time to come to our survey. Unfortunately, based on your previous answers, you are unable to participate.

More information on transportation related research at Portland State University can be found at the Intelligent Transportation Systems Lab (http://its.pdx.edu).

Default Question Block

Please enter the unique ID number from the postcard you received about this survey.

When you received the postcard for this survey, where were you . . .

coming FROM on your bicycle?

- Work or school
- Shopping, errands, personal business (e.g. bank, doctor), eating out, visiting friends, etc.
- Home
- No particular destination, exercise
- I don't remember
- Other (please specify)

(Please provide the nearest intersection to the location you were coming FROM)

going TO on your bicycle?

- Work or school
- Shopping, errands, personal business (e.g. bank, doctor), eating out, visiting friends, etc.
- Home
- No particular destination, exercise
- I don't remember
- Other (please specify)

(Please provide the nearest intersection to the location you were going TO)

The City of Portland installed a “cycle track” on SW Broadway, between SW Clay and SW Jackson Streets, for bikes traveling south (see photo). Do you remember ever riding on the cycle track since it was installed?

- No
- Yes

Before the cycle track was installed, about how often did you ride your bicycle on this section of SW Broadway?

- Never
- Less than Once a Month
- 1-3 Times a Month
- 1-3 Days a Week
- 4 or more Days a Week
- I don't know

After the cycle track was installed, about how often do you ride your bicycle on this section of SW Broadway?

- Never
- Less than Once a Month
- 1-3 Times a Month
- 1-3 Days a Week
- 4 or more Days a Week
- I don't know

Before the cycle track was implemented, did you ride on a different street?

- No
- Yes (If yes, which one?)

When you ride your bicycle on this section of SW Broadway, in which location of the street do you ride?

- Always on the cycle track
- Usually on the cycle track, but sometimes in the traffic lanes
- Equally often on the cycle track and in the traffic lanes
- Usually in the traffic lanes, but sometimes on the cycle track
- Always in the traffic lanes
- Other (explain)

When you ride your bicycle on this section of SW Broadway, how often do you encounter a red light at one or more of the intersections?

- Never
- Rarely
- Often, but less than half the time
- About half the time
- More than half the time

When you are riding in the cycle track, are you required to stop when the traffic signal on SW Broadway is RED at the intersections that do not have a through-street to your right?

- Yes
- Yes, but you may proceed after coming to a complete stop (similar to a right turn on red)
- No
- I don't know

In your experience, how often do you encounter a pedestrian crossing or standing in the cycle track when you arrive at a RED light while cycling on this section of SW Broadway?

- Up to 25% of the time
- Between 25 and 50% of the time
- Between 50 and 75% of the time
- Greater than 75% of the time

I don't know

In your experience, how often do you encounter a pedestrian crossing or waiting in the cycle track when you arrive at a GREEN light while cycling on this section of SW Broadway?

- Up to 25% of the time
- Between 25 and 50% of the time
- Between 50 and 75% of the time
- Greater than 75% of the time
- I don't know

Do you agree or disagree with the following statements

	Strongly Disagree	Somewhat Disagree	Neither Agree nor Disagree	Somewhat Agree	Strongly Agree	I Don't Know
I understand how PEDESTRIANS are supposed to cross this section of SW Broadway, including where to wait and when to cross.						
MOST pedestrians understand how they are supposed to cross this section of SW Broadway, including where to wait and when to cross.						
Since the SW Broadway cycle track was installed, I choose to cycle on SW Broadway more often.						
The cycle track has made this section of SW Broadway SAFER for me as a cyclist.						
The cycle track has made this section of SW Broadway EASIER for me to use as a cyclist.						
The cycle track makes for a better cycling environment in Portland.						
Motor vehicle driver behavior on this section of SW Broadway is safer and calmer since the cycle track was installed.						
Motor vehicles travel at faster speeds on this section of SW Broadway since the cycle track was installed.						
While riding IN THE CYCLE TRACK,I have to pay a lot of attention to avoid being “doored” (e.g. having a car door open into the pathway of the bicycle)						

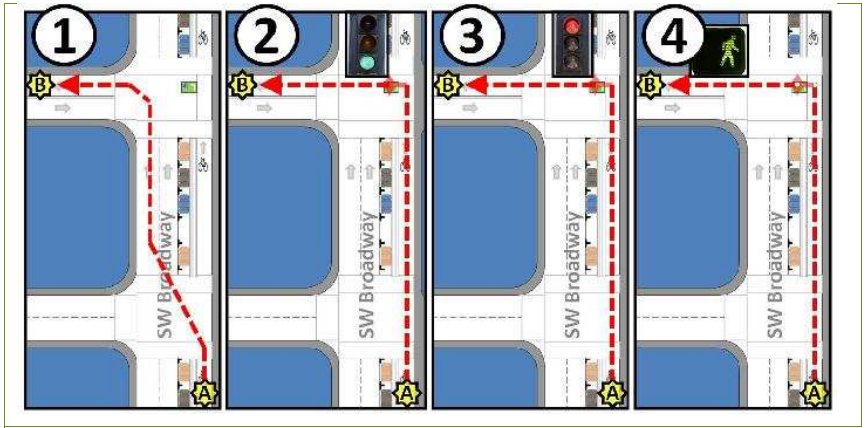
	Strongly Disagree	Somewhat Disagree	Neither Agree nor Disagree	Somewhat Agree	Strongly Agree	I Don't Know
while riding IN A STANDARD BIKE LANE next to parking, I have to pay a lot of attention to avoid being "doored".	○	○	○	○	○	○

If you answered that the cycle track has changed safety for cyclists on SW Broadway, please explain why.

If you answered that the cycle track has changed the ease or difficulty of cycling on SW Broadway, please explain why.

When you are in the cycle track and want to make a left-turn onto one of the eastbound streets (towards SW 6th AVE), how should cyclists make this maneuver?

For the next two questions, consider how to make left turns from the cycle track on this section of SW Broadway. Referring to the diagram below, assume that you are riding a bicycle and are at the point marked "A" and want to make a left turn to get to the point marked "B".



What sequence of actions SHOULD you take to complete this left-turn? (Refer to the path numbers in the above diagram)

- ○ Path 1: A block before the turn I would merge into the left traffic lane and then complete the left turn.
- ○ Path 2: I would wait in the green box until there is a gap in traffic on SW Broadway and then complete the left turn.
- ○ Path 3: I would wait in the green box until I see that traffic on SW Broadway has a red light, then complete the left turn.
- ○ Path 4: I would wait in the green box until I see the pedestrian signal to cross SW Broadway has turned green, then complete the left turn.
- ○ Other (please explain)

What sequence of actions do you ACTUALLY take most often?

- ○ Path 1: A block before the turn I would merge into the left traffic lane and then complete the left turn.
- ○ Path 2: I would wait in the green box until there is a gap in traffic on SW Broadway and then complete the left turn.
- ○ Path 3: I would wait in the green box until I see that traffic on SW Broadway has red light, then complete the left turn.
- ○ Path 4: I would wait in the green box until I see the pedestrian signal to cross SW Broadway has turned green, then complete the left turn.
- ○ Other (please explain)

Consider two scenarios: Imagine you are cycling from home to work.

- Under scenario A, the total trip requires 4 miles of cycling, including 2 miles on a busy street with a bike lane.
- Under scenario B, the total trip is 4.5 miles; however, 2 of those miles are on a cycle track.

Which scenario would you choose?

- ○ Scenario A
- ○ Scenario B
- ○ No difference

Have you been involved in a collision or near-miss with a pedestrian while riding a bicycle on the SW Broadway cycle track? (Select all that apply)

- ☐ No
- ☐ I have witnessed a collision between a cyclist and a pedestrian
- ☐ I have witnessed a near-miss between a cyclist and a pedestrian
- ☐ I have been involved in a collision with a pedestrian while riding my bike
- ☐ I have been involved in a near collision with a pedestrian while riding my bike
- ☐ Other, please explain:

Do you ever see the following vehicles parked in the cycle track? If so, how often?

	Never	Less than Once a Month	1-3 Times a Month	1-3 Days a Week	4 or more Days a Week
Passenger Cars, Pickups and SUVs	○	○	○	○	○
Buses	○	○	○	○	○
Commercial Vehicles (e.g. Delivery Trucks, etc.)	○	○	○	○	○

Do you think the City of Portland should install cycle tracks at other locations?

- ○ I don't know
- ○ No
- ○ Yes (if yes, where?)

What would you do to improve the cycle track?

What are the best or worst aspects of the cycle track?

Please describe, if applicable, if and how your travel behavior has changed since the cycle track was installed:

Do you have any other thoughts you would like to share about cycle tracks?

Block 2

Some Questions about You

We have a few questions about you so that we may understand the characteristics of our survey respondents. Please remember that we will keep this information confidential.

Please rate how comfortable you generally feel when bicycling in the following situations.

	Very Uncomfortable	Somewhat Uncomfortable	Neither	Somewhat Comfortable	Very Comfortable
On a street with heavy traffic and no bike lane	○	○	○	○	○
On a street with heavy traffic with a bike lane	○	○	○	○	○

	Very Uncomfortable	Somewhat Uncomfortable	Neither	Somewhat Comfortable	Very Comfortable
On a street with little traffic and no bike lane	○	○	○	○	○
On a street with little traffic with a bike lane	○	○	○	○	○
On a path or trail separate from the street	○	○	○	○	○

Which of the following best describes how you feel about bicycling on streets in the City of Portland?

- ○ I am not interested in any way and do not ride my bicycle on the streets
- ○ I am interested, but have concerns, so I never or rarely ride my bicycle on the streets
- ○ I am enthusiastic and confident while I ride by bicycle on the streets
- ○ I am strong and fearless while I ride my bicycle on the streets
- ○ Other

What is your gender?

- ○ Male
- ○ Female

What is your age?

- ○ 0-17
- ○ 18-24
- ○ 25-34
- ○ 35-44
- ○ 45-54
- ○ 55-64
- ○ 65 +

Is there anything else you would like to share with us?

Block 3

Those are all of the questions we have. Thank you very much for your time. Please click the "submit survey" button below.

If you would like to enter the random drawing for four $25 gift certificates to Fred Meyer, enter your information on the next page.

Thank you!

Christopher Monsere, Ph.D.
Portland State University
monsere@pdx.edu

A3. Cycle Track: Pedestrian Survey

PSU Cycle Track:
Pedestrian Survey

Hello,

My name is Christopher Monsere and I am a faculty member at Portland State University. I am conducting a study about the cycle track installed on SW Broadway between SW Clay and SW Jackson Streets. We hope that the results will help in future plans for improving bicycling in Portland and other cities.

Hearing from pedestrians like yourself is a very important part of this study. To participate, you need to complete this survey, which should take about 5 minutes.

Your participation in the survey is voluntary. We will protect the confidentiality of your individual survey responses. We will use your individual responses only for the purposes of this study and they will not be linked to your name or other identifying information. You may also stop taking the survey at any time, with no consequences.

Everyone who completes the survey will be eligible to enter a random drawing for four $25 gift certificates to Fred Meyer. That information will not be linked with your survey responses.

If you have concerns or problems about your participation in this study or your rights as a research subject, please contact the Human Subjects Research Review Committee, Office of Research and Sponsored Projects, 600 Unitus Bldg., Portland State University, (503) 725-4288 / 1-877-480-4400. If you have any questions about the study, contact me at 503-725-9746 or monsere@pdx.edu. If you are interested in learning more about me and the kind of research I do, please visit my web site at http://www.its.pdx.edu/.

Sincerely,

Christopher Monsere, Ph.D., P.E.
Assistant Professor
Civil and Environmental Engineering

**** By completing this form you are agreeing that you are at least 18 years old and consenting to participate in this study ****

In August 2009, the City of Portland installed a "cycle track" on SW Broadway, between SW Clay and SW Jackson Streets, for bikes traveling south (a cycle track is a bike lane that is separated from traffic by a row of parked cars and a narrow median - SEE diagram and photo below).

1. **How frequently did (do) you walk through this area . . .**

BEFORE the Cycle Track was installed?

- ☐ Never
- ☐ Less than one day a month
- ☐ 1-3 days a month
- ☐ 1-3 days a week
- ☐ 4 or more days a week
- ☐ I don't remember

AFTER the cycle track was installed?

- ☐ Never
- ☐ Less than one day a month
- ☐ 1-3 days a month
- ☐ 1-3 days a week
- ☐ 4 or more days a week
- ☐ I don't remember

2. **When you have walked in the area near the cycle track, did you see any signs about the cycle track?**
   - ☐ Yes
   - ☐ No
   - ☐ I don't know

3. **What did the signs say?**

4. **Where should pedestrians wait to cross SW Broadway when the pedestrian crossing signal is red? (refer to the picture to the right)**
   - ☐ A: On the sidewalk/curb
   - ☐ B: Adjacent to the cycle track
   - ☐ C: Adjacent to the pedestrian median
   - ☐ D: Adjacent to the parking lane
   - ☐ Other _____

PLEASE TURN OVER

5. **Have you been in involved in or witnessed a collision or near-miss with a cyclist while trying to cross SW Broadway along the cycle track? (CHOOSE ALL THAT APPLY)**
   - ☐ I was involved in a collision with a cyclist while crossing SW Broadway on foot.
   - ☐ I was involved in a NEAR collision with a cyclist while crossing SW Broadway on foot.
   - ☐ I witnessed a cyclist/pedestrian collision on this section of SW Broadway
   - ☐ I witnessed a cyclist/pedestrian near miss on this section of SW Broadway

6. **Is there anything you think should be changed about the cycle track at this location?**
   - ☐ No
   - ☐ Yes
   - ☐ I don't know

7. **If YES, what should be changed about the cycle track?**

8. **Please indicate whether you agree or disagree with the following statements:**

   The cycle track makes for a better environment for pedestrians . . .

   . . . walking on the sidewalk next to the cycle track.
   - ☐ Strongly disagree
   - ☐ Somewhat disagree
   - ☐ Neither
   - ☐ Somewhat agree
   - ☐ Strongly Agree
   - ☐ I don't know

   . . . crossing SW Broadway.
   - ☐ Strongly disagree
   - ☐ Somewhat disagree
   - ☐ Neither
   - ☐ Somewhat agree
   - ☐ Strongly Agree
   - ☐ I don't know

9. **Do you have any other thoughts you would like to share about cycle tracks?**

Some Questions about You

We have a few questions about you so that we may understand the characteristics of our survey respondents. Please remember that we will keep this information confidential and is not linked to your name at any time.

10. **How often do you ride a bicycle?**
    - ☐ Never
    - ☐ Less than one day a month
    - ☐ 1-3 days a month
    - ☐ 1-3 days a week
    - ☐ 4 or more days a week
    - ☐ I don't remember

11. **Have you ridden a bicycle in the cycle track?**
    - ☐ No
    - ☐ Yes

12. **What is your gender?**
    - ☐ Male
    - ☐ Female

13. **What is your age?**
    - ☐ 0-17
    - ☐ 18-24
    - ☐ 25-34
    - ☐ 35-44
    - ☐ 45-54
    - ☐ 55-64
    - ☐ 65 +

Those are all of the questions we have. **Thank you very much for your time!** If you would like to be entered into a random drawing for one of four $25 gift certificates please provide your name and your preferred notification info (phone or email).

A4. Cycle Track: Motorist Survey

PSU Cycle Track - Driver Survey

Hello!

My name is Christopher Monsere and I am a faculty member at Portland State University. I am conducting a study on the cycle track on SW Broadway. As part of the study, we need to learn from the experiences of drivers on this section of SW Broadway. This research will be useful in helping design roads in the future.

Hearing from drivers like you is an important part of this study. You were invited to participate in this study because your vehicle was parked in one of the neighborhoods we are studying. Every response is very important and we hope you will participate. To do so, you need to complete a survey, which should take about 5 minutes.

Your participation in the survey is voluntary. We will protect the confidentiality of your individual survey responses. We will use your individual responses only for the purposes of this study and they will not be linked to your name or other identifying information.

Everyone who completes the survey will be eligible to enter a random drawing for four $25 gift certificates to Fred Meyer. Contact information for the drawing will be used to notify certificate recipients and will not be linked with your survey responses.

If you have concerns or problems about your participation in this study or your rights as a research subject, please contact the Human Subjects Research Review Committee, Office of Research and Sponsored Projects, 600 Unitus Bldg., Portland State University, (503) 725-4288 / 1-877-480-4400. If you have any questions about the study, contact me at 503-725-9746 or monsere@pdx.edu. If you are interested in learning more about me and the kind of research I do, please visit my web site at http://www.its.pdx.edu/.

Sincerely,

Christopher Monsere, Ph.D., P.E.
Assistant Professor
Civil and Environmental Engineering

**** By completing this form you are agreeing that you are at least 18 years old and consenting to participate in this study ****

In August 2009, the City of Portland installed a "cycle track" on SW Broadway, between SW Clay and SW Jackson Streets, for bikes traveling south (a cycle track is a bike lane that is separated from traffic by a row of parked cars and a narrow median - SEE diagram and photo below).

1) **How often did/do you drive or park a motor vehicle on SW Broadway between SW Clay and SW Jackson:**

BEFORE the Cycle Track was installed		SINCE the cycle track was installed	
Drive on Broadway	**Park on Broadway**	**Drive on Broadway**	**Park on Broadway**
☐ Never	☐ Never	☐ Never	☐ Never
☐ Less than one day a month	☐ Less than one day a month	☐ Less than one day a month	☐ Less than one day a month
☐ 1-3 days a month	☐ 1-3 days a month	☐ 1-3 days a month	☐ 1-3 days a month
☐ 1-3 days a week	☐ 1-3 days a week	☐ 1-3 days a week	☐ 1-3 days a week
☐ 4 or more days a week	☐ 4 or more days a week	☐ 4 or more days a week	☐ 4 or more days a week
☐ I don't remember	☐ I don't remember	☐ I don't remember	☐ I don't remember

Please indicate whether you agree or disagree with the following statements about the cycle track on SW Broadway between SW Clay and SW Jackson streets.

	Strongly Disagree	Somewhat Disagree	Neither Agree nor Disagree	Somewhat Agree	Strongly Agree	I Don't Know
2) **The cycle track has made driving safer**	☐	☐	☐	☐	☐	☐
3) **The cycle track has made driving less convenient**	☐	☐	☐	☐	☐	☐
4) **I like that bikes and cars are more separated with the cycle track**	☐	☐	☐	☐	☐	☐
5) **Parking on SW Broadway is more stressful and challenging with the cycle track**	☐	☐	☐	☐	☐	☐
6) **I have changed how I drive on SW Broadway because of the cycle track**	☐	☐	☐	☐	☐	☐
7) **Traffic has gotten worse since the cycle track**	☐	☐	☐	☐	☐	☐
8) **Driver behavior is safer and calmer with the cycle track**	☐	☐	☐	☐	☐	☐
9) **It takes longer to drive this section of SW Broadway with the cycle track**	☐	☐	☐	☐	☐	☐

Please Turn Over

10) Do you have any other thoughts you would like to share about the cycle track?

Some Questions about You

We have a few questions about you so that we may understand the characteristics of our survey respondents. Please remember that we will keep this information confidential and is not linked to your name at any time.

11) What type of vehicle do you drive most often on this section of SW Broadway?

Vehicle Type	**Vehicle Size**
☐ Passenger Car	☐ Compact
☐ Pickup Truck	☐ Midsize
☐ SUV/Van	☐ Large
☐ Delivery Vehicle	
☐ Motorcycle	

12) What is your gender?

☐ Male
☐ Female

13) How often do you ride a bicycle?

☐ Never
☐ Less than one day a month
☐ 1-3 days a month
☐ 1-3 days a week
☐ 4 or more days a week
☐ I don't remember

14) **What is your age?**

☐ 0-17	☐ 45-54
☐ 18-24	☐ 55-64
☐ 25-34	☐ 65 +
☐ 35-44	

Those are all of the questions we have. Thank you very much for your time! If you would like to be entered into a random drawing for one of four $25 gift certificates please provide your name and your preferred notification info (phone or email).

Thank you!

Chris Monsere, Ph.D.
Portland State University
monsere@pdx.edu

Appendix B - Buffered Bike Lane Surveys:

B1. Buffered Bike Lane: Cyclist Survey Request Postcard

B2. Buffered Bike Lane: Cyclist Survey

B3. Buffered Bike Lane: Motorist Survey

B4. Buffered Bike Lane: Business Survey

B1. Buffered Bike Lane: Cyclist Survey Request Postcard

Dear Bicyclist,

Portland State University is conducting a study of the **"buffered bike lanes"** installed on SW Oak and SW Stark. You can participate in the study by completing an on-line survey. It will take about 10-15 minutes.

You can take the survey by going to the following website: www.its.pdx.edu/survey.htm

To take the survey, you will need to enter this number: «Code»

We are only asking a sample of bicyclists to complete this survey. Therefore, your participation is very important. In appreciation, everyone who completes the survey by 09/30/10 can enter a random drawing for four $25 Fred Meyer gift cards.

Your participation in the survey is voluntary. We will protect the confidentiality of your individual survey responses. The number above indicates to us where and when you received the postcard and helps prevent duplicate responses. It can not be used to identify you. If you have concerns or problems about your participation in this study or your rights as a research subject, please contact the Human Subjects Research Review Committee, Office of Research and Sponsored Projects, 600 Unitus Bldg., Portland State University, (503) 725-4288 / 1-877-480-4400. If you have any questions about the study, contact me at 503-725-9746 or monsere@pdx.edu If you are interested in learning more about me and the kind of research I do, please visit my web site at http://www.its.pdx.edu/.

Sincerely,

Christopher Monsere, Ph.D., P.E.
Assistant Professor
Civil and Environmental Engineering

B2. Buffered Bike Lane: Cyclist Survey

Block 3

Dear Bicyclist,

My name is Christopher Monsere and I am a faculty member at Portland State University. I am conducting a study about the buffered bike lanes installed on SW Oak and SW Stark in Portland. We hope that the results will help in future plans for improving bicycling in Portland and other cities.

Hearing from bicyclists like yourself is a very important part of this study. We have only invited a sample of bicyclists to participate in the study, by handing out postcards along the buffered bike lanes. Therefore, every response is very important and we hope you will participate. To do so, you need to complete a survey, starting on the next page. It should take about 10-15 minutes.

Your participation in the survey is voluntary. We will protect the confidentiality of your individual survey responses. The postcard that you received has a unique number that you will need to enter on the next page. That number only identifies where and when we handed you the postcard. We will use your individual responses only for the purposes of this study and they will not be linked to your name or other identifying information. You may also stop taking the survey at any time, with no consequences.

At the end of the survey, you will be directed to another webpage with an offer to submit your name into a drawing for four $25 gift certificates to Fred Meyer. That information will not be linked with your survey responses. The survey must be completed by 09/30/10.

If you have concerns or problems about your participation in this study or your rights as a research subject, please contact the Human Subjects Research Review Committee, Office of Research and Sponsored Projects, 600 Unitus Bldg., Portland State University, (503) 725-4288 / 1-877-480-4400. If you have any questions about the study, contact me at 503-725-9746 or monsere@pdx.edu If you are interested in learning more about me and the kind of research I do, please visit my web site at http://www.its.pdx.edu/.

Sincerely,

Christopher Monsere, Ph.D., P.E.
Assistant Professor
Civil and Environmental Engineering

Do you agree to participate in this survey?

- No
- Yes

Are you 18 years or older?

- Yes
- No

If you are under the age of 18, does your parent or guardian give permission for you to participate in this survey?

- No
- Yes, my parent or guardian has reviewed the information above and given me permission to participate

Block 4

Thank you for taking the time to come to our survey. Unfortunately, based on your previous answers, you are unable to participate.

Default Question Block

Please enter the unique ID number from the postcard you received about this survey.

When you received the postcard for this survey, where were you . . .

Coming FROM on your bicycle?

- Work or school
- Shopping, errands, personal business (e.g. bank, doctor), eating out, visiting friends, etc.
- Home
- No particular destination, exercise
- I don't remember
- Other (please specify)

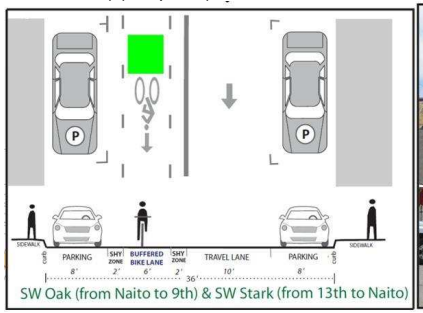
Please provide the nearest intersection to the location you were coming FROM

going TO on your bicycle?

- Work or school
- Shopping, errands, personal business (e.g. bank, doctor), eating out, visiting friends, etc.
- Home
- No particular destination, exercise
- I don't remember
- Other (please specify)

Please provide the nearest intersection to the location you were going TO

The City of Portland installed "buffered bike lanes" on SW Oak (from Naito to 9th) and SW Stark (from 13th to Naito) (see photo).



Do you remember ever riding in the buffered bike lanes since they were installed?

- No
- Yes

Before the buffered bike lanes were installed, about how often did you ride your bicycle on SW Oak (from Naito to 9th) or SW Stark (from 13th to Naito)?

- Never
- Less than one day a month
- 1-3 days a month
- 1-3 days a week
- 4 or more days a week
- I don't remember

Since the buffered bike lanes were installed, about how often do you ride your bicycle on SW Oak (from Naito to 9th) or SW Stark (from 13th to Naito)?

- Never
- Less than one day a month
- 1-3 days a month
- 1-3 days a week
- 4 or more days a week
- I don't know

Before the buffered bike lanes were installed, did you ride on a different street to make a similar trip as the one you were making when handed the survey card?

- No
- Yes (Which one?)

Please select your level of agreement or disagreement with the following statements.

Since the buffered bike lanes were installed on SW Oak and SW Stark....

	Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree	I Don't Know
I choose to cycle on SW Oak and SW Stark more often.						
Riding on SW Oak and SW Stark is SAFER for me as a cyclist.						
Riding on SW Oak and SW Stark is EASIER for me as a cyclist						

	Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree	I Don't Know
The buffered bike lanes make for a better environment for bicycling in Portland.	○	○	○	○	○	○
Motor vehicle driver behavior on these sections of SW Oak an SW Stark is safer and calmer.	○	○	○	○	○	○
Motor vehicles travel at faster speeds on these sections of SW Oak and SW Stark.	○	○	○	○	○	○

If you answered that the buffered bike lanes have changed safety for cyclists on SW Oak and SW Stark, please explain why.

If you answered that the buffered bike lanes have changed the ease or difficulty of cycling on SW Oak and SW Stark, please explain why.

Please select your level of agreement or disagreement with the following statements.

	Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree	I Don't Know
While riding in the BUFFERED BIKE LANES, I have to pay a lot of attention to avoid being "doored" (e.g. having a car door open into the pathway of the bicycle).	○	○	○	○	○	○
While riding in STANDARD BIKE LANES, I have to pay a lot of attention to avoid being "doored".	○	○	○	○	○	○
I prefer a BUFFERED BIKE LANE over a STANDARD BIKE LANE	○	○	○	○	○	○

When can cars be in the buffered bike lane? (check all that apply)

- ☐ Any time -- the lane is shared between cars and bicycles
- ☐ Never
- ☐

When parking

- ☐ When preparing to a make a right turn
- ☐ Not sure
- ☐ Other

Do you feel that motorists understand the rules pertaining to the buffered bike lanes?

- ○ No
- ○ Yes
- ○ I don't know
- ○ Other

For the next two questions consider: While riding a bicycle on the SW Oak or SW Stark buffered bike lanes, have you been involved in a collision or near-miss with a vehicle carrying out the following maneuvers?

A vehicle making a parking maneuver (Select all that apply)

- ☐ No
- ☐ I have witnessed a collision between a cyclist and a vehicle making a parking maneuver
- ☐ I have witnessed a near-miss between a cyclist and a vehicle making a parking maneuver
- ☐ I have been involved in a collision with a vehicle making a parking maneuver while riding my bike
- ☐ I have been involved in a near collision with a vehicle making a parking maneuver while riding my bike
- ☐ Other, please explain:

A vehicle making a right turning maneuver (Select all that apply)

- ☐ No
- ☐ I have witnessed a collision between a cyclist and a vehicle making a right-turning maneuver
- ☐ I have witnessed a near-miss between a cyclist and a vehicle making a right-turning maneuver
- ☐ I have been involved in a collision with a vehicle making a right-turning maneuver while riding my bike
- ☐ I have been involved in a near collision with a vehicle making a right-turning maneuver while riding my bike
- ☐ Other, please explain:

Consider two scenarios: Imagine you are cycling from home to work.

- Under scenario A, the trip requires 4 miles of cycling, including 2 miles on an arterial with a standard bike lane.
- Under scenario B, the trip is 4.5 miles; however, 2 of those miles are on a buffered bike lane.

Which scenario would you choose?

- Scenario A
- Scenario B
- No difference

How often do you see the following vehicles driving in the buffered bike lane?

	Never	Less than one day a month	1-3 days a month	1-3 days a week	4 or more days a week	I don't remember
Cars						
Trucks						

Do you think the City of Portland should install buffered bike lanes at other locations?

- I don't know
- No
- Yes (if yes, where?)

What would you do to improve the buffered bike lanes?

What are the best or worst aspects of the buffered bike lanes?

Please describe, if applicable, if and how your travel behavior has changed since the buffered bike lanes were installed:

Block 1

Some Questions about You

We have a few questions about you and where you live, so that we may understand the characteristics of our survey respondents. Please remember that we will keep this information confidential.

Please rate how comfortable you generally feel when bicycling in the following situations.

	Very Uncomfortable	Somewhat Uncomfortable	Neither	Somewhat Comfortable	Very Comfortable
On a street with heavy traffic and no bike lane					
On a street with heavy traffic with a bike lane					
On a street with little traffic and no bike lane					
On a street with little traffic with a bike lane					
On a path or trail separate from the street					

Which of the following best describes how you feel about bicycling on streets in the City of Portland?

- I am not interested in any way and do not ride my bicycle on the streets
- I am interested, but have concerns, so I never or rarely ride my bicycle on the streets
- I am enthusiastic and confident while I ride by bicycle on the streets
- I am strong and fearless while I ride my bicycle on the streets
- Other

What is your gender?

- Male
- Female

What is your age?

- 0-17
- 18-24
- 25-34
- 35-44
- 45-54
- 55-64
- 65+

Is there anything else you would like to share with us?

Block 2

Those are all of the questions we have. Thank you very much for your time. Please click the "submit survey" button below.

If you would like to enter the random drawing for four $25 gift certificates to Fred Meyer, you will be directed to a **separate independent survey** to enter your information on the next page.

Your responses collected so far will not in any way be linked to your information provided on the next page.

Thank you!

Christopher Monsere, Ph.D.
Portland State University
monsere@pdx.edu

B3. Buffered Bike Lane: Motorist Survey

Buffered Bike Lane - Driver Survey

Hello!

My name is Christopher Monsere, and I am a faculty member at Portland State University. I am conducting a study on the **buffered bike lanes** on SW Oak and SW Stark in Portland. As part of the study, we need to learn from the experiences of drivers on this section of SW Oak and SW Stark. This research will be useful in helping design roads in the future.

Hearing from drivers like yourself is a very important part of this study. You were invited to participate in this study because your vehicle was parked in one of the neighborhoods we are studying or you indicated that you drive one of these streets. Every response is very important and we hope you will participate. To do so, you need to complete a survey, starting on the next page. It should take about 5 minutes.

Your participation in the survey is voluntary. We will protect the confidentiality of your individual survey responses. We will use your individual responses only for the purposes of this study and they will not be linked to your name or other identifying information.

Everyone who completes the survey will be eligible to enter a random drawing for four $25 gift certificates to Fred Meyer. Contact information for the drawing will be used to notify certificate recipients and will not be linked with your survey responses.

If you have concerns or problems about your participation in this study or your rights as a research subject, please contact the Human Subjects Research Review Committee, Office of Research and Sponsored Projects, 600 Unitus Bldg., Portland State University, (503) 725-4288 / 1-877-480-4400. If you have any questions about the study, contact me at 503-725-9746 or monsere@pdx.edu. If you are interested in learning more about me and the kind of research I do, please visit my web site at http://www.its.pdx.edu/.

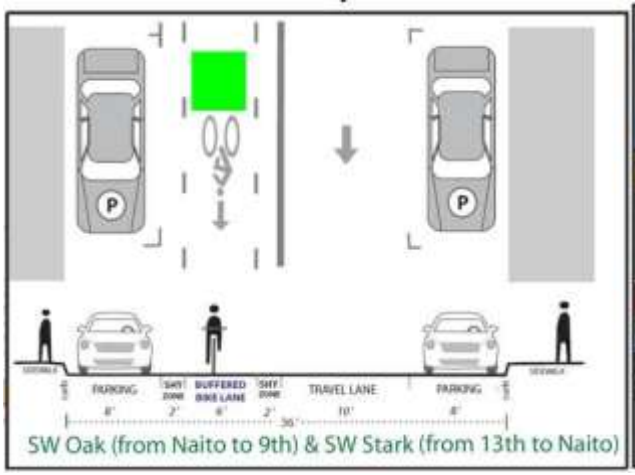
Sincerely,

Christopher Monsere, Ph.D., P.E.
Assistant Professor
Civil and Environmental Engineering

PLEASE TURN OVER

**** By completing this form you are agreeing that you are at least 18 years old and consenting to participate in this study ****

In the summer of 2009, the City of Portland installed **buffered bike lanes** on SW Oak (from Naito to 9th) and SW Stark (from 13th to Naito). (SEE diagram and photo of buffered bike lanes).



1) About how often did/do you drive or park a motor vehicle on SW Oak (from Naito to 9th) or SW Stark (from 13th to Naito):

BEFORE the buffered bike lanes were installed		**SINCE the buffered bike lanes were installed**	
Drive *on Oak or Stark*	***Park*** *on Oak or Stark*	***Drive*** *on Oak or Stark*	***Park*** *on Oak or Stark*
☐ *Never*	☐ *Never*	☐ *Never*	☐ *Never*
☐ *Less than 1 day a month*	☐ *Less than 1day a month*	☐ *Less than 1 day a month*	☐ *Less than 1 day a month*
☐ *1-3 days a month*	☐ *1-3 days a month*	☐ *1-3 days a month*	☐ *1-3 days a month*
☐ *1-3 days a week*	☐ *1-3 days a week*	☐ *1-3 days a week*	☐ *1-3 days a week*
☐ *4 or more days a week*	☐ *4 or more days a week*	☐ *4 or more days a week*	☐ *4 or more days a week*
☐ *I don't remember*	☐ *I don't remember*	☐ *I don't remember*	☐ *I don't remember*

Please indicate whether you agree or disagree with the following statements about the buffered bike lanes on SW Oak and SW Stark.

	Strongly Disagree	Somewhat Disagree	Neither Agree nor Disagree	Somewhat Agree	Strongly Agree	I Don't Know
2) The buffered bike lanes have made driving safer	☐	☐	☐	☐	☐	☐
3) The buffered bike lanes have made driving less convenient	☐	☐	☐	☐	☐	☐
4) I like that bikes and cars are more separated with the buffered bike lanes	☐	☐	☐	☐	☐	☐
5) Parking on these sections of SW Oak and Stark is more stressful and challenging with the buffered bike lanes	☐	☐	☐	☐	☐	☐
6) I have changed how I drive on these sections of SW Oak and Stark because of the buffered bike lanes	☐	☐	☐	☐	☐	☐
7) Traffic has gotten worse since the buffered bike lanes were installed	☐	☐	☐	☐	☐	☐
8) Driver behavior is safer and calmer with the buffered bike lanes	☐	☐	☐	☐	☐	☐
9) It takes longer to drive these sections of SW Oak and Stark with the buffered bike lanes	☐	☐	☐	☐	☐	☐

PLEASE TURN OVER

10) Do you have any other thoughts you would like to share about the buffered bike lanes?

Some Questions about You

We have a few questions about you so that we may understand the characteristics of our survey respondents. Please remember that we will keep this information confidential and is not linked to your name at any time.

11) What type and size of vehicle do you drive most often on this section of SW Broadway?

Vehicle Type	**Vehicle Size**
☐ Passenger Car	☐ Compact
☐ Pickup Truck	☐ Midsize
☐ SUV/Van	☐ Large
☐ Delivery Vehicle	
☐ Motorcycle	

12) What is your gender?

☐ Male
☐ Female

13) How often do you ride a bicycle?

☐ Never
☐ Less than one day a month
☐ 1-3 days a month
☐ 1-3 days a week
☐ 4 or more days a week
☐ I don't remember

14) **What is your age?**

☐ 0-17	☐ 45-54
☐ 18-24	☐ 55-64
☐ 25-34	☐ 65 +
☐ 35-44	

Those are all of the questions we have. Thank you very much for your time. If you would like to be entered into a random drawing for one of four $25 gift certificates please provide your name and your preferred notification info (phone or email).

Thank you!

Chris Monsere, Ph.D.
Portland State University
monsere@pdx.edu

B4. Buffered Bike Lane: Business Survey

Survey of SW Oak and SW Stark Businesses

Please return completed survey using the prepaid envelope provided
or call Nathan McNeil for survey pick-up 503-683-3437

Dear **BUSINESS OWNER OR MANAGER**:

My name is Christopher Monsere, and I am a faculty member at Portland State University. I am conducting a study on the buffered bike lanes on SW Oak and SW Stark in Portland for the City of Portland, Office of Transportation. As part of the study, we need to learn from the experiences of businesses on this section of SW Oak and SW Stark. Every response is very important and we hope you will participate. To do so, please complete a survey which should take about 5 minutes.

Your participation in the survey is voluntary, and we will protect the confidentiality of your individual survey responses. We will use your responses only for the purposes of this study and they will not be linked to your name, business or other identifying information.

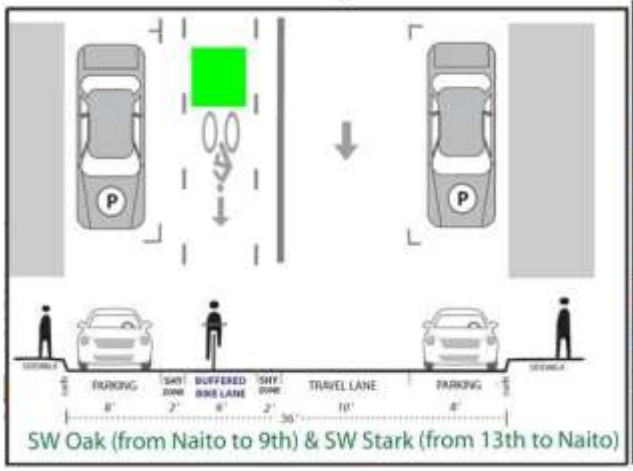
If you have concerns or problems about your participation in this study or your rights as a research subject, please contact the Human Subjects Research Review Committee, Office of Research and Sponsored Projects, 600 Unitus Bldg., Portland State University, (503) 725-4288 / 1-877-480-4400. If you have any questions about the study, contact me at 503-725-9746 or monsere@pdx.edu. If you are interested in learning more about me and the kind of research I do, please visit my web site at http://www.its.pdx.edu/.

Sincerely,

Christopher Monsere, Ph.D., P.E.
Assistant Professor
Civil and Environmental Engineering

BACKGROUND

In the summer of 2009, the City of Portland installed **buffered bike lanes** on SW Oak (from Naito to 9th) and SW Stark (from 13th to Naito). The design converted 1 motor vehicle lane to a bicycle-lane (SEE diagram and photo of buffered bike lanes).



**** This survey should be completed by the business owner or manager ****

1. **How many years have you been in business in this location?** ____ years

2. **What type of business do you operate at this location?**
   - ☐ Retail
   - ☐ Restaurant/Cafe
   - ☐ Bar/Entertainment Venue
   - ☐ Hotel
   - ☐ Professional Office
   - ☐ Gov't / Social Service Provision
   - ☐ Services
   - ☐ Bank
   - ☐ Other _____

3. **How many customers do you have visiting this location on an average day?**
   - ☐ Less than 25
   - ☐ 200+
   - ☐ 25-49
   - ☐ 50-99
   - ☐ Not applicable
   - ☐ 100-199
   - ☐ I prefer not to provide this information

4. **How many employees work at this location?**
   - ☐ Less than 5
   - ☐ 20-24
   - ☐ 5-9
   - ☐ 25+
   - ☐ 10-14
   - ☐ 15-19
   - ☐ I prefer not to provide this information

Please select your level of agreement or disagreement with the following statements.	Strongly Disagree	Somewhat Disagree	Neither Agree nor Disagree	Somewhat Agree	Strongly Agree	I Don't Know or NA
5. The buffered bike lanes on SW Oak and SW Stark…						
…have had a positive effect on my business sales	☐	☐	☐	☐	☐	☐
…make parking more difficult for my customers	☐	☐	☐	☐	☐	☐
…make parking more difficult for my employees	☐	☐	☐	☐	☐	☐
…increase transportation options for employees and /or customers	☐	☐	☐	☐	☐	☐
…make deliveries to my business more challenging	☐	☐	☐	☐	☐	☐
…are an important part of downtown Portland's bicycle network	☐	☐	☐	☐	☐	☐
…increase bike and foot traffic to my business	☐	☐	☐	☐	☐	☐
6. Downtown business owners should encourage their employees to get to work by means other than driving alone.	☐	☐	☐	☐	☐	☐
7. I support the buffered bike lanes on SW Oak	☐	☐	☐	☐	☐	☐
8. I support the buffered bike lanes on SW Stark	☐	☐	☐	☐	☐	☐
9. I support removing some parking spaces to add additional loading zones for delivery vehicles.	☐	☐	☐	☐	☐	☐

10. **Were you aware that the buffered were going to be installed on SW Oak and SW Stark before they were installed?**
    - ☐ Yes
    - ☐ No (please skip to Question 12)
    - ☐ Don't remember (please skip to Question 12)

	Strongly Disagree	Somewhat Disagree	Neither Agree nor Disagree	Somewhat Agree	Strongly Agree	I Don't Know or NA
11. Prior to installation, I supported the buffered bike lanes.	☐	☐	☐	☐	☐	☐
12. I am satisfied with the city's efforts to solicit input from businesses like mine for this project	☐	☐	☐	☐	☐	☐

13. **<u>Based on your knowledge, estimate</u> what % of your CUSTOMERS get to your business by…**
(The numbers you enter should total 100%)

Driving: _____% Walking_____% Bike_____% Transit_____% Other_____%

14. **<u>Based on your knowledge, estimate</u> what % of your EMPLOYEES commute to work at this location by…** (The numbers you enter should total 100%)

Driving: _____% Walking_____% Bike_____% Transit_____% Other_____%

15. **Do you have any thoughts or suggestions you would like to share about the buffered bike lanes?**

Some Questions about You

We have a few questions about you so that we may understand the characteristics of our survey respondents. Please remember that we will keep this information confidential and is not linked to your name at any time.

16. **What is your role in the business?**
☐ Business owner ☐ Manager ☐ Other _____

17. **What is your gender?**
☐ Male
☐ Female

18. **How often do you ride a bicycle?**
☐ Never
☐ Less than one day a month
☐ 1-3 days a month
☐ 1-3 days a week
☐ 4 or more days a week
☐ I don't remember

19. **Have you ridden a bicycle in the buffered bike lane?**
☐ Yes
☐ No

20. **What is your age?**
☐ 18-24 ☐ 45-54
☐ 25-34 ☐ 55-64
☐ 35-44 ☐ 65 +

Thank you very much for your time!