Portland's Bicycle Corrals:

A Case Study of East 28th Avenue

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ABSTRACT

In 2009, the City of Portland installed 31 on-street bicycle-parking facilities, known as bicycle corrals, at locations around the city. In June and August of 2009, Portland installed five bicycle corrals on an eight-block stretch of East 28th Avenue between SE Pine and NE Glisan – an area with numerous bars, restaurants and shops. This paper examines how bicyclists visiting 28th Avenue are using and perceiving those corrals, using counts of parked bicycles and surveys of bicyclists. Findings indicate that cyclists will park in the corrals when they are not out of the way. Cyclists are less likely to go out of the way to use a corral in rainy weather, at night and on weekends. Survey results pointing to improved ability to find available racks corridor wide imply that the corrals have eased a bicycle parking dearth; however this is only a postulation that would need a "before" phase of the study to prove.

INTRODUCTION

In 2009, the City of Portland installed 31 on-street bicycle-parking facilities, known as bicycle corrals, at locations around the city. The corrals consist of a series of inverted U type bicycle racks with a painted or raised lip surrounding all racks. The corrals are intended to encourage bicycling and to re-direct bicycles that might otherwise have parked on sidewalks. Although Portland continues to expand its installation of the corrals, and many other cities have followed suit, there has been little research done as to whether corrals are achieving these intended goals.

Figure 1. Bicycle Corral at NE Glisan and NE 28th Avenue, installed June 26, 2009

In June and August of 2009, Portland installed five bicycle corrals on an eight block stretch of East 28th Avenue between SE Pine and NE Glisan – an area with numerous restaurants, bars and cafes, a theatre-pub, a Whole Foods grocery store, and several buildings devoted to manufacturing and offices. Figure 1 shows a corral installed at NE Glisan and 28th Avenue, in front of Pambiché restaurant.

This project sought to understand how bicyclists visiting 28th Avenue are using and perceiving those corrals. This was done using counts of parked bicycles along 28th avenue, both at corrals and at other locations along the stretch, and surveys of bicyclists. Results of the counts revealed that, while both bicycle racks in corrals and in non-corral locations were more heavily used in the evening and on weekends, corral racks received more usage relative to non-corral racks during weekdays and daytime counts. Counts also revealed that corrals received more usage relative to non-corral locations in dry weather, but that effect is lessened in rainy weather. Surveys showed most respondents had difficulty finding places to lock their bicycles prior to corral installation and found the corrals made visiting 28th Avenue more convenient. However, the corrals did not make respondents more likely to bicycle to the area, and most respondents would choose a rack over a corral if they rack were closer to their destination.

These results suggest that cyclists will park in the corrals when they are not out of the way. Cyclists are less likely to go out of the way to use a corral in rainy weather, at night and on weekends. Survey results pointing to improved ability to find available racks corridor wide suggest that the corrals have eased a bicycle parking dearth; however this is only a postulation that would need a "before" phase of the study to prove. Further directed research could directly target these questions and design controlled counts and pointed surveys to confirm or rebut the suggestions posited in this paper. This and ongoing research into bicycle parking is an important

component in understanding how end-of-trip facilities effect cyclists decisions and may inform future planning to target improvements that better meet cyclists need and improve business districts.

BACKGROUND

Portland installed its first bicycle rack in 2001 at the PGE Park stadium in order to accommodate visitors to the facility. The PGE corral, as shown in Figure 2, was eventually removed in 2005 during construction on a new condo high-rise – the Civic (S. Figliozzi, personal communication, November 18, 2009).

Figure 2. Bicycle Corral at PGE Park

A second corral was installed in 2004, in front of Fresh Pot Coffee House on North Albina Street. Four more corrals were added in 2006 and 2007 – two at North Mississippi street locations and two at SE Belmont Street locations. With these North Mississippi/Albina and SE Belmont installations, Portland Bureau of Transportation (PBOT) established the practice of partnering with local businesses that agree to provide basic upkeep on the facility. This practice would be used in the 2009 corral installations.

When PBOT installed the corrals on East 28th Avenue, it embarked on installing the densest collection of corrals in the city – previously, no more than two corrals had been installed in such a small area (the North Mississippi and Southeast Belmont locations, and at North Vancouver and Failing [installed June 2009]). Table 1 shows the East 28th Avenue corrals, with partnering business, nearest business, number of racks, and installation date. Corrals along the

stretch have a bicycle capacity of 102 bikes, while racks outside of corrals have a capacity of 79 bikes.

Table 1: Bicycle Corrals on East 28th Avenue

Intersection	Partnering Business	Nearest Business	Number of Racks	Installation Date
NE Glisan St & NE 28th Ave	Pambiché	Pambiché	12	6/26/09
NE 28th & Pine St	Ken's Pizza	Ken's Pizza	12	6/28/09
NE Ankeny St at NE 28th Ave	Crema Cafe	Crema Cafe	12	6/30/09
NE 28th Ave & NE Couch St	Beulahland	Fonda Rosa	9	8/21/09
NE 28th Ave & NE Davis	Tabla Bistro	Tabla Bistro	6	8/21/09

Of Note is that in the case of the corral at NE Couch Street, the partnering business was not the closest business to the corral, Fonda Rosa restaurant. Sarah Figliozzi of PBOT explained that although the "demand for this corral is clearly Beulahland," locating the corral at the bar's mid-block location would have meant "visibility of the corral itself [would be] lower, as well as visibility of cyclists entering and exciting the corral is lowered". Although initially hesitant, the owner of Fonda Rosa agreed to the corral "given that the corrals dramatically improve the visibility of shop fronts and improve outdoor seating environments" (S. Figliozzi, personal communication, November 18, 2009).

LITERATURE REVIEW

This review will first examine the literature on bicycle parking in general, then focus specifically on the information available on bicycle corrals, primarily from practice literature and public agency documents. Thorough research on the topic of on-street bicycle parking is quite limited and narrow, and the sub-topic of bicycle corrals has received even less study. Several evaluations have considered the impact of the presence of bicycle parking facilities in general,

although parking is usually a consideration in a larger study of bicycling facilities, rather than the main focus. Bicycle corrals have received some notice in professional and non-academic resources, which will be discussed below. Finally, methods used by previous studies, including research into bicycle survey and count best practices, will be reviewed to inform this evaluation.

Bicycle Parking

Several studies point to the importance of good bicycle parking facilities; however, as Pucher et al (2010) point out, the presumption of the importance of good parking facilities has resulted in a paucity of research on the relationship of parking facilities to increased levels of bicycling. They do point to several studies which have found such a relationship: Wardman et al (2007) analyzed National Transit Survey data in the UK and found that outdoor bicycle parking raised cycling levels by 0.5% (and indoor parking facilities raised levels about another 0.5%); Hunt and Abraham (2007) surveyed cyclists in Edmonton, Canada, and found that secure bicycle parking facilities made cycling significantly more attractive; and Martens (2007) found the secure parking facilities at transit locations significantly increased cycling and transit use. None of these studies took up the issue of on-street bicycle parking. In comparing differences in biking rates between American and Canadian cities, Pucher and Buehler (2006) note that Canadian cities have both substantially higher cycling rates and substantially more bicycle racks (bicycle racks are often prioritized in development code, in public rights of way, and at transit locations). At the same time, they also note that studies linking bike parking to cycling rates are lacking (and that most American cities know relatively little about existing bicycle parking, including the number of racks installed in the city).

There is a wider collection of non-academic writing on bicycle parking. This includes both policy and instructional documents from governments at various levels and from

professional organizations. The Bicycle Coalition of Greater Philadelphia released a report in 2008 entitled "Bicycle Parking: Key To A Green Philadelphia" arguing that "More bike parking is essential to encourage more people to use bikes for short trips to get to work and shopping, entertainment and cultural destinations", and the bicycle corrals should be part of that effort. The 2006 "San Francisco Bicycle Guide" is an information and educational document published by the San Francisco Municipal Transportation Agency. Chapter 11 covers bicycle parking and directs cyclists to newly installed on-street bicycle parking facilities. The 2008 Update of the Oregon Bicycle and Pedestrian Plan includes a chapter on bicycle parking, including a section discussing on-street bicycle parking: "Where there is insufficient room on the sidewalks to provide sufficient bicycle parking without cluttering the pedestrian zone, bicycle parking can be provided in the street. One parallel car parking spot can provide parking for up to 12 bicycles. It must be buffered by bollards, curb extensions or other forms of positive protection." The Association of Pedestrian and Bicycle Professionals (APBP) released a set of guidelines for bicycle parking stating that the "lack of a secure parking space keeps many people from using their bikes for basic transportation". The APBP guidelines provide recommendations for types of racks, sets of racks and rack areas; the guidelines do not specifically address on-street bicycle parking. There is a growing body of local government press releases announcing the installation of bicycle corrals and similar treatments. Such announcements were found for Baltimore, Seattle, Ann Arbor, and Bloomington (see Work Cited).

A 2008 student study on bicycle corrals and bicycle oases (a similar treatment to a bicycle corrals, except the racks are installed on a sidewalk - usually a curb extension – and are covered) found that the corrals had significantly higher average occupancy. Interviews with

cyclists suggested that convenience is more important than security or protection from weather (B. Haggerty, personal communication, November 19, 2009).

Bicycle Corrals in North America

As stated above, Portland introduced bicycle corrals at a few locations from 2001 to 2007; however, it was not until 2009 that corral installations became a regular sight around the city. Nabti and Ridgeway (2002) discuss on-street bicycle parking in section 7.3 of their 2002 report, citing existing bicycle corral type facilities in Berkeley, Chico and Palo Alto, California. The Berkeley installation, shown in Figure 3, included two wave racks surrounded by seven thick metal bollards, while the Chico racks, shown in Figure 4, included standard parking lot style curbs abutting the parking strip and approximately 3 inch in diameter plastic bollards facing the street. Nabti and Ridgeway knew of no evaluations of such on-street bicycle parking facilities. Montreal, Canada began installing seasonal on-street bicycle corrals at least as early as 2005[1], although they did not have bollards or curbs protecting them from travel lanes. San Francisco installed corrals as early as 2006.

Figure 3. On-street bicycle parking in Berkeley, California.

Following Portland's introduction of corrals to neighborhood centers on North Mississippi and East Belmont, a number of cities have installed such facilities, with many citing Portland's corrals. New York City took space from automobile parking and converted it to bicycle parking as early as June 2007 in Williamsburg, Brooklyn. That facility included a newly installed concrete raised curb upon which the bicycle racks were mounted. Victoria, BC

[1] For corral installation date, see: http://www.naparstek.com/2005/11/billyburg-bike-bandits-strike-again.php

installed a bicycle corral modeled after the Portland corrals in summer 2007. Seattle installed three corrals in February 2009. These were promptly followed by other cities, including Baltimore, Maryland (March 2009), Missoula, Montana (April 2009), Bloomington, Indiana (June 2009), Ann Arbor, Michigan (5 on-street bicycle racks purchased and installed in August 2009), and Key West, Florida[2]. None of the documentation identified on bicycle corrals suggests that evaluations are ongoing or planned. See **Appendix A** for further information about existing bicycle corrals and related on-street parking facilities.

Figure 4. On-street bicycle parking in Chico, California.

Urban Design and Pedestrian Environment Aspects of Bicycle Corrals

The City of Portland Bureau of Transportation website states that corrals are not only good for increasing the attractiveness of bicycling, but also that they promote effective urban design, claiming that corrals improve sidewalk conditions "by removing locked bicycles from the sidewalk", "serve as de facto curb extensions", and "improve visibility at intersections by eliminating the opportunity for larger vehicles to park at street corners" (2009). As is evidenced by the lack of scholarly research on the topic, these claims have not been documented in an academic context; however, there is research on each of these urban design issues outside of the bicycle corral context that support these claims.

Supporting the claim that corrals improve sidewalk conditions, the 2008 Update of the Oregon Bicycle and Pedestrian Plan states that “curb extensions create good opportunities to provide bicycle parking out of the pedestrian zone, especially in areas where sidewalks are

[2] See Works Cited page for documents pertaining to the installation of corrals in these cities.

narrow. They also benefit from the proximity of a curb cut at the corners. The parking should be placed where it will not obscure visibility of pedestrians crossing the street, or motorists waiting to enter a street." According to the Oregon Department of Transportation Design Manual (2003), "curb extensions reduce the pedestrian crossing distance and improve the visibility of pedestrians for motorists on streets where parking is allowed." A 2005 study by Randal S. Johnson found a significant reduction in the average number of vehicles that pass a waiting pedestrian before yielding to the pedestrian with curb extensions installed. Regarding the claim that corrals remove the potential of sight-inhibiting parked cars or trucks near intersections and thereby improve visibility, a National Cooperative Highway Research Program (NCHRP) Report states that improved sight distance at an intersection permits "approaching drivers to anticipate and avoid collisions" (1996). When corrals are placed adjacent to intersections, they improve sight distance (assuming they are replacing parked cars or trucks) and, thus, may contribute to reducing collisions.

Methods in the Literature

This project will utilize bicycle counts and user surveys to assess the usage of bicycle corrals. Recent studies that touched on the issue of bicycle parking offer some insight into methods utilized to frame this study. Wardman et al (2007) used a national government-administered survey to assess how the availability of end-of-trip facilities, such as secure bicycle parking, influenced the attractiveness of bicycling to commuters; the researchers did not conduct additional surveys. Hunt & Abraham (2007) surveyed 1128 cyclists in Edmonton and asked respondents which of two hypothetical bicycle route scenarios were preferred - among alternatives, the presence or absence of secured parking at the end of the trip was stated. About 3500 surveys were distributed to cyclists or left attached to bicycles, for a response rate of

around 33%. Schneider et al (2006) caution about taking care in wording and distributing cyclist surveys, including being aware of potential differences between online and other types of surveys. Schneider et al (2005) seek to put together a methodological framework that can help researchers and evaluators to answer questions about walking and bicycling, including what effect facility construction has on levels of bicycling and walking.

Counts of parked bicycles can be used to predict bicycling rates as well as parking facility usage. The University of Washington conducts annual counts of bicycles on campus as a means of estimating bicycle trips to the campus. The survey is done on a similar day each year (described as a sunny Wednesday in May with temperatures in the 70s). In addition to interpolating cycling rates on the campus, the results of the count were used to identify underused and overused bicycle racks, and to shift placement of resources accordingly. In the UW study, a rack with greater than 80% utilization was identified as in need of additional racks, while utilization of less than 5% was identified as underutilized. No efforts to count or assess bicycle parking or corral usage were identified in the government and advocacy organization documents reviewed.

METHODOLOGY

A two-pronged approach was employed to understand how the bicycle corrals on East 28th Avenue are being used and perceived. To get concrete data on usage, a counting scheme was used to assess usage at various times of the day and week. To get data on perceptions, a short survey was administered to cyclists.

Counting

The UW study counted cyclists at midday under the assumption that time captured the highest utilization rate. Other counts, especially for active cyclists and pedestrians (i.e. not "parked" cycles) often employ afternoon rush hour counts, generally 4 to 6pm. An important difference between the East 28th Avenue bicycles corrals and campus counts or rush hour counts is that these corrals are in neighborhoods with different uses – different both from campus and downtown uses and different from each other (mixed uses within the street itself). Thus there is the possibility for non-traditional peak usage hours or even multiple peak hours throughout the day. One hypothesized outcome would be that corrals located near restaurants and bars would experience peak usage during evening dining hours – this peak would not have been identified under these prior-counting schemes. Hence, counts were conducted at varying times and days to assess usage.

Prior to conducting counts, an inventory of existing facilities was undertaken to note locations of the bicycle corrals and adjacent businesses. Additionally, other nearby bicycle infrastructure was noted, with a particular focus on other bicycle parking racks located along the same corridor. Using the inventory, a data collection sheet was put together to count the number of bicycles parked at each corrals and bike racks along the corridor. Additional information recorded included bicycles parked in other (non-corral and non-rack) locations and the number of motor vehicles parked on the block. See **Appendix B** for a copy of the corral/rack inventory and data collection form.

Data was collected during the week of October 27th to November 1st, which encompasses one weekend and one mid-week period. In order to capture a variety of days and

times, data was collected at eight times – on mid-week and weekend days, and at morning, afternoon, and evening hours. See Table 2 for a schedule of count times.

Table 2. Corral Count Days and Times

Day	*Times of Count*
October 27, 2009 (Tuesday)	8 to 9am; 12 to 1pm
October 28, 2009 (Wednesday)	5 to 6pm; 8 to 9pm
October 31, 2009 (Saturday)	2 to 3pm; 7 to 8pm; 10 to 11pm
November 1, 2009 (Sunday)	1030 to 1130am

Once collected and analyzed, the data should speak to the usage rates of the corrals and bicycle racks, peak hours, and potential saturation or under-utilization of corrals and racks. Useful information that could come of the count includes informing questions such as:

- Are the bike corrals being used and at what level? Are any corrals inadequate or under-utilized?
- Would the bicycle traffic have been accommodated with the existing (pre-corral) facilities?
- What are the peak hours and locations for corral usage?

Survey

In addition to the count, a short survey was conducted to assess how cyclists perceive the corrals. The survey was administered during the counts described above, either given directly to cyclists or left attached to parked bicycles (with directions pointing them to an online survey). For postcards left on bicycles, instructions asked respondents to complete the survey within one week. The survey asked about usage of the corrals and asked respondents to comment on their perceptions of the ease of accessing destinations along the East 28th Avenue corridor, both before and after the installation of the corrals. The survey was brief so as not to discourage potential respondents – it consisted of ten (mostly multiple-choice) questions and was one page, front and back.

Schneider et al (2006) caution that all survey methods can influence results somewhat, and that online surveys are no exception. An online survey relies on the respondents having

enough interest in the topic to remember the survey and answer the questions at home. However, the online survey allows respondents to answer the questions on their own time and comfort. Some of the potential bias suggested by Schneider et al is somewhat balanced by the fact that all potential respondents are bicyclists to begin with, and are therefore already more likely than the average person to be interested in cycling issues (which is obviously an issue to be considered in and of itself, but it not significantly altered in this case by conducting the surveys either online or in person).

As mentioned above, data was collected during the week of October 27th to November 1st. Useful information to come from the surveys includes:

- Is bicycle parking easier to find since the installation of the bicycle corrals?
- Are corrals more attractive places to park than standard bike racks?
- Is it easier to visit the East 28th Avenue corridor since the installation of the corrals? Are respondents more likely to visit the corridor now?
- Does the presence of the corrals make people more likely to decide to use a bicycle for a trip to East 28th Avenue?

See **Appendix C** for a copy of the survey.

RESULTS

Bicycle Counts

A total of 223 bicycles were counted over eight count periods and over the nine-block corridor area. Table 3 shows average bicycle counts for each corral and a combined bicycle count for all racks on each block. The counts were somewhat low compared to capacity – bicycles in corrals were only at 14.2% of capacity while bicycles locked to non-corral racks along this stretch were at 14.6% of capacity. The counts showed that there is a clear desire on the part of cyclists to park between East Burnside and Northeast Davis (113 of the 223 bicycles counted on the nine block stretch were in these two blocks).

Table 3: Corral Bicycle Counts

			Bike Counts							
Block	Location	Racks	Total	Average	Weekday Average	Weekend Average	Day Average	Night Average	Dry Weather	Wet Weather
Glisan to Flanders	Pambiche Corral	12	24	3	2.5	3.5	2.75	2.5	3.33	2
	Non-Corral Racks	7	13	1.625	1.75	1.5	1.25	2.5	1.67	1.5
Flanders to Everett	Non-Corral Racks	10	9	1.125	1	1.25	0.5	2.25	1	1.5
Everett to Davis	Tabla Corral	6	2	0.25	0.5	0	0	0.5	0	1
	Non-Corral Racks	2	3	0.375	0.25	0.5	0.25	0.25	0.5	0
Davis to Couch	Beulahland Corral	9	59	7.375	7.25	7.5	6	10	8	5.5
	Non-Corral Racks	1	5	0.625	0.5	0.75	0.75	0.75	0.83	0
Couch to Burnside	Non-Corral Racks	14	49	6.125	6.25	6	5.75	7.75	5.67	7.5
Burnside to Ankeny	Non-Corral Racks	8	11	1.375	0.75	2	1.75	2.25	1.5	1
Ankeny to Ash	Crema Corral	12	24	3	3.75	2.25	4.5	0.75	3.17	2.5
	Non-Corral Racks	1	2	0.25	0.25	0.25	0.25	0	0.33	0
Ash to Pine	Other Bikes	n/a	0	0	0	0	0	0	0	0
Pine South	Ken's Pizza Corral	12	7	0.875	1.75	0	0.5	1.25	0.67	1.5
	Non-Corral Racks	n/a	0	0	0	0	0	0	0	0
Totals	Bikes in Corrals	51	116	14.5	15.75	13.25	13.75	15	15.17	12.5
	Percent of Capacity		14.2%	14.2%	15.4%	13.0%	13.5%	14.7%	14.9%	12.3%
	Bikes on Racks	43	92	11.5	10.75	12.25	10.5	15.75	11.5	11.5
	Rack Capacity		14.6%	14.6%	13.6%	15.5%	13.3%	19.9%	14.6%	14.6%
	Bikes Parked Elsewhere		15	1.875	1.5	2.25	2.25	1.75	2	1.5
	Parked Cars		523	65.375	60.25	70.5	57.75	69.25	68.67	55.5

On blocks where corrals were located, bicycles parked in corrals outnumbered bicycles parked on other racks by 116 to 23 (although the total capacity in corrals outnumbers the total non-corral rack capacity on these blocks by a similar margin 102 to 22). However, counts on blocks without corrals indicate that even though there was excess capacity in corrals 1-2 blocks away, cyclists did not go out of their way to park in the corrals.

Overall, the corrals had a higher average occupancy on weekdays (15.4%) than on weekends (13%), while non-corral racks showed the opposite trend. Corrals had a higher average occupancy at night (14.7%) than during the day (13.5%); however, a greater number of users parked bicycles at non-corral racks than in corrals during the evening (15.75 on average versus 15). Further, corrals were more heavily used in dry weather than in wet weather, while

non-corral locations received the same usage regardless of weather. Detailed counts are provided in **Appendix E**.

User Surveys

Although postcards were attached to each parked bike encountered during bicycle counts, and those encountered entering or exiting the corrals were directly asked to take the survey, the overall number of survey respondents was less than ideal – a total of 21 completed surveys were received. While the surveys can still be assessed to add some depth to our understanding of how cyclists are using and viewing the coro4rals, a larger sample size would be desirable to make strong conclusions based on their result. Nonetheless, the surveys showed most respondents had difficulty finding places to lock their bicycles prior to corral installation and found the corrals made visiting 28th Avenue more convenient. However, the corrals did not make respondents more likely to bicycle to the area, and most respondents would choose a rack over a corral if they rack were closer to their destination.

Few respondents visit the corridor everyday (10%) - most visit either several times a week (48%) or several times a month (33%). More than half of the respondents visit for the purpose of eating or drinking (52%), while the remained are split between shopping/errands, entertainment and other (the most common reason stated for other was "work"). The respondents, on average, get to the corridor using a bicycle 75 percent of the time, with walking or driving a car being the next most common responses (at 14.7% and 9.1%). The respondents, on average, lock their bicycles in the corrals for 59% of their visits to the area.

Question five asked "If your destination were not immediately in front of a corral (a block away, for example), where would you park your bicycle?" Few respondents stated that they would park in the nearest corral and walk to their destination if their destination were a

block away. 71% stated they would seek a bike rack directly in front of their destination, and only use a corral (a block away) if no nearer racks were available (and 24% would find something to lock up to at their destination regardless of rack availability). Question six asked, "Prior to the installation of the bicycle corrals, did you have difficulty finding a place to lock your bicycle?" No one felt it was impossible, however over 60% of respondents stated that they either could not find a bike rack (38%) or could not find one directly in front of their destination (24%). Only a quarter of respondents usually found a bike rack in front of their destination.

Eighty-six percent of respondents felt that bicycle corrals made visiting the corridor more convenient; however, only a third stated that the corrals made them more likely to visit the corridor – all other respondents stated that the corrals made no difference in their decision to visit. Similarly, a third of respondents stated that the corrals made them more likely to decide to ride a bicycle to the corridor (over another mode of transportation), while the remaining respondents stated that the corrals did not effect that decision. Aggregate survey response data are included as **Appendix F**.

DISCUSSION AND CONCLUSION

This study yields insight into the usage of bicycle corrals that could be used to inform more directed future studies. The counts indicate corrals are used by most visiting cyclists on the blocks where they are present; however, in most cases cyclists do not seem to be willing to go out of their way to park in a corral. That resistance to going out of their way may increase in the evening, on weekends, and in rainy weather – each of these possibilities merits further research.

The corral at NE 28th Avenue and Couch was by far the most heavily utilized corral, and still the block immediately to the south was the second most heavily utilized for bicycle parking

– this implies that those two blocks are where the most demand for bicycle parking exists. Corrals only a block or two further north received very few users, despite having plenty of available parking spaces. One solution to this problem would be for PBOT to add another corral between East Burnside and NE Couch (or perhaps move one of the existing corrals to this location). However, counts also revealed that the two blocks from East Burnside to NE Davis received the most parked cars, creating a potential point of conflict.

Survey results indicate that bicyclists like the corrals and will use them if they are near their desired destination. However, the corrals do not appear to be a destination in and of themselves, and are not attractive to cyclists if they are not very close to their intended destination. Combined with the count data showing that corrals are relatively less popular on evenings and weekends, these results may indicate that when cyclists are focused on a particular destination (perhaps because they are meeting friends at a bar or restaurant) they want a parking spot right in front of their destination, rather than a parking spot in the vicinity generally (for which a corral may be better suited).

Several limitations presented themselves while this study was being conducted. A main limitation is that there is no "before" component to this study, making it difficult to know the impact that the corrals have had. A future study could work with PBOT to conduct a count before a new installation, which would give a better picture of how cyclists were parking their bikes before and after the treatment. Further, the study was conducted in October and November, and on overcast or light rain conditions. Bicycling rates were likely substantially under summertime maximum levels, and corrals were significantly under capacity. Finally, the limited response to surveys makes drawing any significant conclusions from them difficult.

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Appendix A. Existing On-Street Bicycle Parking in Other North American Cities

Williamsburg, Brooklyn, New York. Installed June 2007. Removed parking spots and installed bike racks on a raised concrete platforms (essentially an extension of the sidewalk).

http://www.flickr.com/photos/38117599@N00/539921409

Williamsburg

http://www.flickr.com/photos/38117599@N00/824085092

Seattle, WA. Three bicycle corrals installed in February 2009.

http://www.worldchanging.com/local/seattle/archives/009386.html

Seattle, 12th Avenue

http://www.flickr.com/photos/81325557@N00/3274562573

Seattle, Broadway

http://www.flickr.com/photos/81325557@N00/3274565185

Seattle, Greenlake

http://www.flickr.com/photos/81325557@N00/3275391534

Berkeley, CA. Center Street at Oxford

Nabti Ridgeway

Chico, CA. Downtown.

Nabti Ridgeway

Ann Arbor, MI. 5 on street bicycle racks purchased and installed in August 2009.

http://www.a2dda.org/current_projects/onstreet_bicycle_racks/

Baltimore, MD. St. Paul Street, Charles Village. Installed March 2009.

http://www.flickr.com/photos/rllayman/3395430859

Missoula, MT. Installed April 2009.

http://missoulainmotion.ning.com/profiles/blogs/missoulas-first-onstreet-bike

Victoria, BC. Installed August 2007. Covered Bicycle Corral.

http://a123.g.akamai.net/f/123/12465/1d/media.canada.com/idl/vitc/20070902/207533-66040.jpg?size=620x400

San Francisco, CA. Installed 2009.

http://www.dbarchitect.com/article_slideshow/72.html#354

San Francisco

http://www.flickr.com/photos/sfbike/3932226563

Montreal, Quebec. Installed prior to November 2005. Seasonal, removed in winter.

http://www.naparstek.com/uploaded_images/montreal-709618.jpg

Bloomington, IN. Installed June 2009.

http://mitchrice.us/bike/2009/07/04/new-bike-racks-in-bloomington

Bloomington

http://mitchrice.us/bike/2009/07/04/new-bike-racks-in-bloomington

Key West, FL.

http://www.transitmiami.com/2009/09/21/key-west-bicycle-parking

Appendix B. Count Form

		Side of Street	On Street	Cross Street	Racks	Nearest Business	Bike Count Day/Time
Glisan to Flanders	Corral	NE Corner	NE Glisan	NE 28th Avenue	12	Pambiche	
	Staple	SE Corner	NE Glisan	NE 28th Avenue	2	Lucky's Bar	
	Staple	NW Corner	NE Glisan	NE 28th Avenue	3	K & J Market	
	Staple	SE Corner	NE 28th Avenue	NE Glisan	1	Lucky's Bar	
	Staple	NE Corner	NE Flanders	NE 28th Avenue	1	House	
						Other Bikes	
						# of Cars parked	
Flanders to Everett	Wave	SE Corner	NE Flanders	NE 28th Avenue	8 bar wave	bar	
	Rack	SE Corner	NE 28th Avenue	NE Flanders	1	bar	
	Rack	East Side	NE 28th Avenue	NE Everett/Flanders	1	Circle Healthcare	
						Other Bikes	
						# of Cars parked	
Everett to Davis	Rack	SE Corner	NE 28th Avenue	NE Everett	1	Staccato Gelato	
	Rack	SE Corner	NE Everett	NE 28th Avenue	1	Staccato Gelato	
	Corral	NE Corner	NE 28th Avenue	NE Davis	6	Tabla	
						Other Bikes	
						# of Cars parked	
Davis to Couch	Rack	SW Corner	NE 28th Avenue	NE Davis	1	Alma Chocolate	
	Corral	NE Corner	NE 28th Avenue	NE Couch	9	Fonda Rosa	
						Other Bikes	
						# of Cars parked	
Couch to Burnside	Rack	SE Corner	NE Couch	NE 28th Avenue	1	La Buca	
	Rack	East Side	NE 28th Avenue	NE Couch	1	La Buca	
	Rack	East Side	NE 28th Avenue	Couch/Burnside	2	Chin Yen Lounge / Rest.	
	Rack	NE Corner	NE 28th Avenue	E Burnside	2	Starbucks	
	Rack	North Side	E Burnside	SE 28th Avenue	1	Whole Foods	
	Rack	NW Corner	NE 28th Avenue	E Burnside	2	Laurelhurst Cinema	
	Rack	NW Corner	E Burnside	NE 28th Avenue	5	Laurelhurst Cinema	
						Other Bikes	
						# of Cars parked	
Burnside to Ankeny	Rack	SW Corner	E Burnside	NE 28th Avenue	2	Radsummer	
	Rack	SW Corner	SE 28th Avenue	E Burnside	1	Radsummer	
	Rack	West Side	SE 28th Avenue	Ankeny/Burnside	2	Holmans	
	Rack	East Side	SE 28th Avenue	Ankeny/Burnside	1	New Apt Bldg	
	Rack	South Side	E Burnside	SE 28th Avenue	1	New Apt Bldg	
	Rack	NW Corner	SE 28th Avenue	SE Ankeny	1	Esparzas	
						Other Bikes	
						# of Cars parked	

Ankeny to Ash	Rack	SW Corner	SE Ankeny	SE 28th Avenue	1	Crema	
	Corral	SW Corner	SE 28th Avenue	SE Ankeny	12	Crema	
						Other Bikes	
						# of Cars parked	
Ash to Pine						**Other Bikes**	
						# of Cars parked	
Pine South	Corral	SE Corner	SE 28th Avenue	SE Pine	12	Ken's Pizza	
						Other Bikes	
						# of Cars parked	
						Weather:	

Appendix C. Survey Questions

On average, how often do you visit the section of East 28th Avenue between SE Pine and NE Glisan (e.g. a couple blocks on either side of Burnside)?

- ☐ Every day
- ☐ Several times a week
- ☐ Several times a month
- ☐ Once a month or less
- ☐ First time here

What is the most common reason you visit this section of East 28th Avenue?

- ☐ Eating/Drinking
- ☐ Shopping/Errands
- ☐ Entertainment
- ☐ Other (explain)

When you visit this section of NE 28th Avenue, how do you get there? Provide a percentage (%) for each type:

- Walk ____ % of the time
- Transit ____ % of the time
- Bicycle ____ % of the time
- Car ____ % of the time
- Other ____ % of the time
  - If other, please explain: _____

The City of Portland recently installed "bicycle corrals" at select locations along 28th Avenue where multiple bicycles can park in one place (see picture). when you visit this neighborhood by bike, what percentage of the time do you lock your bike in the corral?

☐ _____%

If your destination were not immediately in front of a corral (a block away, for example), where would you park your bicycle?

- ☐ In the nearest corral and walk to my destination.
- ☐ Directly in front of my destination, but only if a bike rack is available, otherwise in the nearest corral.
- ☐ Directly in front of my destination – I'll find something to lock up to.

Prior to the installation of the bicycle corrals, did you have difficulty finding a place to lock your bicycle?

- ☐ It was impossible.
- ☐ I usually found something to lock to, but not a bike rack.
- ☐ I usually found a bike rack, but not directly in front of my destination.
- ☐ I usually found a bike rack right in front of my destination.
- ☐ I don't remember

Do the bicycle corrals make visiting East 28th Avenue more or less convenient?

- ☐ More convenient
- ☐ No difference
- ☐ Less convenient

Do the bicycle corrals make you more or less likely to visit East 28th Avenue?

- ☐ More likely
- ☐ No difference
- ☐ Less likely

Assume that you had decided to visit East 28th Avenue. **Do the bicycle corrals make you more likely to choose to ride a bicycle there, rather than to drive, walk, take transit, etc?**

- ☐ More likely
- ☐ No difference
- ☐ Less likely

What is the street intersection nearest to your home?_____

You are done – Thanks!

Appendix D. Bicycle Corrals Installed in Portland[3]

Intersection	Partnering Business	Business District	Installation Date
PGE Park	PGE Park	Downtown/Goose Hollow	2001 (removed May 2005)
N Mississippi & Shaver	Fresh Pot Coffee House	N Mississippi Ave/Albina	9/20/04
N Mississippi & N Beech	Amnesia Brewing	N Mississippi Ave/Albina	11/21/06
SE Belmont & SE 34th Ave	Stumptown Coffee Roasters	SE Belmont	6/30/07
SE Belmont & SE 33rd Ave	Saint Cupcake	SE Belmont	6/30/07
N Mississippi & Fremont	Por Que Non Mississippi	N Mississippi Ave/Albina	9/30/07
NW 13th at NW Johnson	Pacific Northwest College of Art	NW Pearl District	3/27/09
NE Alberta St & NE 31st Ave	Vita Café/People's Yoga	NE Alberta	5/7/09
N Lombard St & N Alta Ave	St John's Theater	N Lombard - St Johns	5/7/09
NW Thurman & 24th Ave	Dragonfly Coffee House	NW District Association	5/7/09
Se Hawthorne & 46th	Por Que Non Hawthorne	SE Hawthorne	5/27/09
N Williams & N Failing	Pix Patisserie	N Williams/Vancouver	6/25/09
N Williams & N Failing	Lincoln Restaurant	N Williams/Vancouver	6/25/09
NE Glisan St & NE 28th Ave	Pambiche	NE 28th Ave	6/26/09
NE 28th & Pine St	Kens Artisan Pizza	NE 28th Ave	6/28/09
NE Ankeny St at NE 28th Ave	Crema Cafe	NE 28th Ave	6/30/09
NE 28th Ave & NE Couch St	Beulahland	NE 28th Ave	8/21/09
NE 28th Ave & NE Davis	Tabla Mediterranean Bistro	NE 28th Ave	8/21/09
N Russell St & N Interstate Ave	Widmer Brothers Brewing Co.	ICURAC	8/28/09
SW Broadway & Morrison	Abercrombie & Fitch	SW Downtown	9/17/09
NE Alberta & 12th	Black Cat Café	NE Alberta	9/17/09
NE Alberta & 17th	Community Cycling Center	NE Alberta	9/17/09
NE Alberta & 18th	Nest Bar	NE Alberta	9/17/09
NE Alberta & 22nd	Pine Street Biscuits	NE Alberta	9/17/09
NE Alberta & 24th	Alleyway Cafe	NE Alberta	9/17/09
NE Alberta & 29th	Pie Footwear	NE Alberta	9/17/09
SW Salmon & SW Park	South Park Seafood Grill & Wine Bar	SW Downtown	9/18/09
NW 11th Ave & NW Couch	Powell's Books	SW Downtown	9/18/09
SW 3rd Ave & SW Pine St	Bijou Café	SW Downtown	9/18/09
SW Stark St and SW 10th Ave	Ace Hotel	SW Downtown	9/18/09
N Killingsworth & N Williams	Ethos Music Center	N Killingworth	9/25/09
SE 22nd Ave & SE Division St	Bar Avignon	SE Clinton/Division	9/29/09
SE 26th Ave & SE Division St	Little T / The Clinton	SE Clinton/Division	9/29/09
NE Russell & NE Rodney	Toro Bravo/Wonder Ballroom	Russell Street	9/29/09
SW Broadway & Pine St	Saucebox	SW Downtown	11/8/09
SE 50th Ave & SE Division St	North Bar, Lucky 13 Bicycles, Blue Pig Café	SE Clinton/Division	11/16/09
SE 9th Ave at SE Ash St	Biwa Restaurant	Inner SE	11/16/09

[3] Provided by Sarah Figliozzi, Portland Bureau of Transportation.

Appendix E: Count results

	Racks	Nearest Business	Tue. 10/27 8-9am	Tue. 10/27 12-1pm	Wed. 10/28 5-6pm	Wed. 10/28 8-9pm	Sat. 10/31 2-3pm	Sat. 10/31 7-8pm	Sat. 10/31 10-11pm	Sun. 11/1 1030-11am	Total	Average
Glisan to Flanders	*12*	*Pambiche Corral*	*2*	*4*	*2*	*2*	*2*	*3*	*3*	*6*	*24*	*3*
	2	Lucky's Bar	0	0	0	0	0	0	0	0	0	0
	3	K & J Market	0	2	1	3	0	2	2	0	10	1.25
	1	Lucky's Bar	0	0	1	0	1	1	0	0	3	0.375
	1	House	0	0	0	0	0	0	0	0	0	0
		Other Bikes	0	0	0	0	0	0	0	0	0	0
		# of Cars parked on block	2	8	5	5	3	6	5	4	38	4.75
Flanders to Everett	8 bar wave	Bar	0	0	0	1	0	1	1	0	3	0.375
	1	Bar	0	0	1	1	0	2	1	0	5	0.625
	1	Circle Healthcare	0	0	0	1	0	0	0	0	1	0.125
		Other Bikes	1	0	0	0	0	0	0	0	1	0.125
		# of Cars parked on block	2	8	5	4	3	2	3	4	31	3.875
Everett to Davis	1	Staccato Gelato	0	1	0	0	0	1	0	1	3	0.375
	1	Staccato Gelato	0	0	0	0	0	0	0	0	0	0
	6	*Tabla Corral*	*0*	*0*	*0*	*2*	*0*	*0*	*0*	*0*	*2*	*0.25*
		Other Bikes	0	0	0	0	0	0	0	0	0	0
		# of Cars parked on block	2	7	8	8	4	6	7	7	49	6.125
Davis to Couch	1	Alma Chocolate	0	1	1	0	1	1	1	0	5	0.625
	9	*Beulahland Corral*	*2*	*5*	*13*	*9*	*6*	*7*	*11*	*6*	*59*	*7.375*
		Other Bikes	0	0	0	1	0	1	3	2	7	0.875
		# of Cars parked on block	10	12	10	16	11	16	11	14	100	12.5
Couch to Burnside	1	La Buca	0	0	1	1	0	0	0	0	2	0.25
	1	La Buca	0	0	0	0	0	1	0	0	1	0.125
	2	Chin Yen Lounge	3	3	2	3	1	1	1	1	15	1.875
	2	Starbucks	1	2	2	3	2	2	1	1	14	1.75
	1	Whole Foods	0	0	0	0	2	2	0	1	5	0.625
	2	Laurelhurst Cinema	0	0	0	2	0	0	1	0	3	0.375
	5	Laurelhurst Cinema	0	0	0	2	1	1	5	0	9	1.125
		Other Bikes	1	0	0	1	0	0	0	2	4	0.5
		# of Cars parked on block	8	9	6	9	8	11	11	9	71	8.875
Burnside to Ankeny	2	Radsummer	0	0	0	0	0	0	0	0	0	0
	1	Radsummer	0	0	0	0	0	0	0	0	0	0
	2	Holmans	0	0	1	1	1	0	5	0	8	1
	1	New Apt Bldg	0	0	0	0	0	0	0	0	0	0
	1	New Apt Bldg	0	0	0	0	0	0	0	0	0	0
	1	Esparzas	0	0	0	1	0	0	1	1	3	0.375
		Other Bikes	0	1	0	0	0	1	0	0	2	0.25
		# of Cars parked on block	3	5	6	7	14	5	8	15	63	7.875
Ankeny to Ash	1	Crema	0	1	0	0	0	0	0	1	2	0.25
	12	*Crema Corral*	*5*	*8*	*2*	*0*	*5*	*1*	*0*	*3*	*24*	*3*
		Other Bikes	1	1	1	0	2	0	0	0	5	0.625
		# of Cars parked on block	3	8	6	3	9	2	0	12	43	5.375
Ash to Pine		Other Bikes	0	0	0	0	0	0	0	0	0	0
		# of Cars parked on block	0	4	7	10	5	15	8	8	57	7.125
Pine South	*12*	*Ken's Pizza Corral*	*0*	*2*	*2*	*3*	*0*	*0*	*0*	*0*	*7*	*0.875*
		Other Bikes	0	0	0	0	0	0	0	0	0	0
		# of Cars parked on block	6	7	9	13	6	13	11	6	71	8.875
		Weather	drizzle	overcast	overcast	drizzle	overcast	overcast	overcast	overcast		
		Bikes in Corrals	9	19	19	16	13	11	14	15	116	14.5
		Corral Capacity	102	102	102	102	102	102	102	102	816	102
		Bikes on Racks	4	10	10	19	9	15	19	6	92	11.5
		Rack Capacity	79	79	79	79	79	79	79	79	632	79
		Bikes Elsewhere	2	2	1	1	2	2	3	2	15	1.875
		Parked Cars	36	68	62	75	63	76	64	79	523	65.375

Appendix F. Aggregate Survey Responses.

On average, how often do you visit the section of East 28th Avenue between SE Pine and NE Glisan (e.g. a couple blocks on either side of Burnside)?

☐ Every day	2	10%
☐ Several times a week	10	48%
☐ Several times a month	7	33%
☐ Once a month or less	2	10%
☐ First time here	0	0%

What is the most common reason you visit this section of East 28th Avenue?

☐ Eating/Drinking	11	52%
☐ Shopping/Errands	3	14%
☐ Entertainment	3	14%
☐ Other (explain)	4	19%

When you visit this section of NE 28th Avenue, how do you get there? Provide a percentage (%) for each type:

Walk ____ % of the time	14.69
Transit ____ % of the time	0.38
Bicycle ____ % of the time	75.81
Car ____ % of the time	9.10
Other ____ % of the time	0.00

The City of Portland recently installed "bicycle corrals" at select locations along 28th Avenue where multiple bicycles can park in one place (see picture). **When you visit this neighborhood by bike, what percentage of the time do you lock your bike in the corral?**

☐ _____% 59.33

If your destination were not immediately in front of a corral (a block away, for example), where would you park your bicycle?

☐ In the nearest corral and walk to my destination.	1	5%
☐ Directly in front of my destination, but only if a bike rack is available, otherwise in the nearest corral.	15	71%
☐ Directly in front of my destination – I'll find something to lock up to.	5	24%

Prior to the installation of the bicycle corrals, did you have difficulty finding a place to lock your bicycle?

☐ It was impossible.	0	0%
☐ I usually found something to lock to, but not a bike rack.	8	38%
☐ I usually found a bike rack, but not directly in front of my destination.	5	24%
☐ I usually found a bike rack right in front of my destination.	5	24%
☐ I don't remember	3	14%

Do the bicycle corrals make visiting East 28th Avenue more or less convenient?

☐ More convenient	18	86%
☐ No difference	3	14%
☐ Less convenient	0	0%

Do the bicycle corrals make you more or less likely to visit East 28th Avenue?

☐ More likely	7	33%
☐ No difference	14	67%
☐ Less likely	0	0%

Assume that you had decided to visit East 28th Avenue. **Do the bicycle corrals make you more likely to choose to ride a bicycle there, rather than to drive, walk, take transit, etc?**

☐ More likely	7	33%
☐ No difference	14	67%
☐ Less likely	0	0%