Resident Perceptions of Bicycle Boulevards:

A Portland, Oregon Case Study

Mariah VanZerr, Transportation Planner
CH2M HILL
2020 SW Fourth Avenue, Suite 300
Portland, OR 97210
Work: 503.736.4348
Cel: 858.336.4396
Fax:503.736.2000
Email:Mariah.VanZerr@ch2m.com

This paper was written as part of the degree requirements for the
Masters of Urban and Regional Planning Degree at Portland State University.

Word Count: 3,686
Figure Count: 3,750
Total Words: 7,436

Submitted to the Transportation Research Board
For the 89th Annual Meeting
January 2009
Original Submission Date: July 31, 2009
Revisions Submitted: November, 15, 2009

Abstract

Bicycle boulevards are becoming increasingly popular as a means of encouraging alternate modes of transportation. However, little is known about the effects of bicycle boulevards on residential communities. For example, do bicycle boulevards have an impact on residential quality of life, safety for children, or sense of community? Do they encourage residents to bicycle more? How large a factor does the presence of a bicycle boulevard play into residents' decision to move to a neighborhood? To answer these questions, a survey of residents along a bicycle boulevard in Portland, Oregon was conducted, and a 29 percent population response rate was received. The majority of respondents felt that the SE Salmon Street bicycle boulevard has had a positive impact on home values, quality of life, sense of community, noise, air quality, and convenience for bicyclists; a negative impact on convenience for drivers; and no impact on safety for children, convenience for pedestrians, and the amount of traffic collisions. Additionally, 42 percent of respondents said living on a bicycle boulevard makes them more likely to bike, the majority of whom did not self-select to live on a bicycle boulevard. Additionally, survey respondents' comments revealed a split between positive and negative attitudes towards the bicycle boulevard. Key design and policy implications of these findings include the need to improve cyclist visibility at night, ensure adequate traffic diversion and traffic calming measures, and provide clearer communication about bicycle boulevard purpose, traffic laws, and expected courteous behaviors.

Word Count: 242

INTRODUCTION

Bicycle boulevards are becoming increasingly popular as a means of encouraging alternate modes of transportation. While bicycle infrastructure has been found to positively and significantly correlate with higher rates of bicycle commuting (1), little is known about the effects of bicycle boulevards on residential communities. For example, do bicycle boulevards have an impact on residential quality of life, safety for children, or sense of community? Do they encourage residents to bicycle more? How large a factor does the presence of a bicycle boulevard play into residents' decision to move to a neighborhood? A better understanding of the impacts of bicycle boulevards on existing residential communities will help transportation professionals design and implement more effective bicycle networks.

LITERATURE REVIEW

While other studies have addressed the role of bicycle infrastructure in influencing regional bicycling rates (1,6) and the role of self-selection and neighborhood amenities on influencing bicycle ownership (7,8), none have addressed the effects of bicycle boulevard designation on existing residents. By surveying residents of SE Salmon Street, a designated bicycle boulevard in Portland, Oregon, this study attempts to better understand how bicycle boulevards impact existing residents, their travel behavior, and the surrounding community. By soliciting feedback from residents that actually live on bicycle boulevards, transportation professionals can learn what works, what doesn't work, and whether specific policy or design-related improvements are indicated to improve the experience of residents.

BACKGROUND

Bicycle Boulevards

Bicycle boulevards are local roadways where bicycles and motor vehicles share the road, there are no marked bicycle lanes, and the through movement of bicycles is given priority over motor vehicle traffic (2). They are generally low-traffic neighborhood streets where stop signs are turned to keep cyclists moving, and traffic lights and curb extensions help cyclists cross busy streets (3). Street treatments such as traffic calming and traffic diversion devices are often used on bicycle boulevards to help slow down cars and discourage drivers from using them to bypass traffic (4). Some of the benefits of bicycle boulevards are generally thought to include cleaner air, and streets that are quieter, prettier, and safer for children and families (3).

SE Salmon Street

SE Salmon Street, in Portland, Oregon, is a well-used bicycle boulevard that runs east to west for 1.5 miles from SE 7th Avenue to SE 35th Avenue, (where it diverts one block north to SE Taylor as shown in Figure 1). SE Salmon Street parallels two major arterials (SE Hawthorne and SE Belmont) and connects directly to downtown Portland. The location of the SE Salmon Street bicycle boulevard makes it a practical corridor that connects bicyclists to high demand downtown destinations.

FIGURE 1 SE Salmon Street between SE 12th Ave and SE 35th Ave. (5)

Design Treatments

SE Salmon Street is a low traffic volume street, with traffic calming measures, way-finding signage, and few stop signs (which allows for continuous bicycle travel). The street is currently classified as both a central city bikeway and a local service street, which allows traffic calming measures to give priority to bicycles (2). SE Salmon Street was originally designated as a bikeway in the 1973 Portland Bicycle Master Plan, however, it wasn't until the 1980s that the first bicycle route signs were installed (Birk, M. "unpublished data"). Later that decade, SE Salmon Street became part of a traffic calming project that aimed to get traffic off nearby residential streets (including SE Salmon Street, SE Clinton Street, and SE Lincoln Street) and onto nearby major arterials (including SE Division Street, SE Hawthorne Boulevard, and SE Belmont Street). Specific traffic calming measures implemented included traffic circles (shown in Figure 2), and curb extensions at major intersections (as shown in Figure 3). The intersection at SE 30th Avenue also includes a flashing red warning signal to alert cyclists they are about to cross a heavy volume street (as shown in Figure 4 below).

Figure 2 Traffic calming devices such as this traffic circle at SE 27th Ave reduces traffic speeds on the SE Salmon Street bicycle boulevard.

Figure 3 Curb extensions help reduce cross-traffic speed on SE 30th Ave.

Figure 4 Flashing red light warns cyclists of high volume cross-traffic.

Pavement Markings (such as the bicycle symbol shown in Figure 5) and way-finding signage, (shown in Figure 6) were installed to help cyclists identify SE Salmon as a bicycle boulevard and navigate Portland's network of bicycle-friendly streets. While these design treatments may seem standard today, at the time, they were highly innovative.

Figure 5 Bicycle boulevard pavement markings on SE Salmon Street.

Figure 6 Way-finding signage at SE Salmon Street and SE 35th Ave.

METHODOLOGY

To gather data on resident perceptions of the impacts of the SE Salmon bicycle boulevard, a twenty question survey was developed. Key questions that framed the research include:

1) What are resident perceptions of the positive and negative impacts of living on a bicycle boulevard?
2) Does living on a bicycle boulevard encourage residents to cycle more?
3) To what extent does the presence of a bicycle boulevard factor into residents' location decision?

The survey was created online using SurveyMonkey©, a private online survey development company. Questions were designed using a combination of constrained and open-ended questions to provide a variety of categorical and continuous variables for analysis. Resident

perceptions of the impacts of bicycle boulevard designation were measured on a three-point Likert Scale.

The survey web address was printed on a flyer and then distributed to every residence facing SE Salmon Street between SE 12th Avenue and SE 35th Avenue. The web address was shortened to make it easier for residents to type the web address in manually from their browser at home. Surveys were distributed twice, once on Sunday, November 9th, 2008 from 12 to 2pm (to residences between SE12th Avenue and SE 30th Avenue) and again on Saturday, November 15th, 2008 from 2:15 – 3:15pm (to residences between SE 30th Avenue and SE 35th Avenue). Survey flyers were taped to the gates or front doors of all residences *facing* SE Salmon (i.e. homes on corners that were facing the cross-street did not receive a flyer). Homes with "no flyer" signs were skipped; however homes with "no solicitation/politics" signs did receive a flyer. Institutional facilities along the corridor, including a school and a senior center, did not receive a flyer. A total of 253 flyers were distributed, and 78 responses were received, resulting in a survey response rate of 31 percent. However, because some households in controlled-access multi-family complexes were inaccessible, not every household was able to receive a flyer. In these cases, a handful of survey flyers were taped near the apartment complex's mailboxes, (though it was not always clear how many units were in the building). In total, it is estimated that approximately 15 households may have been missed (including one home skipped out of respect for a "no flyer" sign). This means that the estimated total number of households along the study corridor is 268, resulting in a *population* response rate of 29 percent. This population response rate means we can be 95 percent confident (+/- 10 percent) that the survey results accurately represent the total population of SE Salmon households between SE 12th Avenue and SE 35th Avenue.

Limitations of the study include a potential bias towards computer savvy residents with internet access, self-selection bias, and a potential bias towards homeowners. To help control for bias towards computer savvy residents, a phone number was provided on the survey to allow residents to respond by phone if they preferred; however, no surveys were successfully completed by phone. To help control for self-selection bias, the survey was left open long enough to acquire a sufficient response rate. However, residents with strong opinions about the bicycle boulevard (both positive and negative) may still have been more likely to fill out the survey. The bias towards homeowners may have occurred because some multi-unit apartment complexes had controlled access facilities, as described above. While efforts were made to control for this (by placing flyers near mailboxes), some rental units may nevertheless have been missed.

Survey results were collected online and the results were analyzed using Analysis of Variance (ANOVA), Chi Square, and proportional significance tests.

SURVEY RESULTS

Demographics

Survey respondents were asked how long they had lived on SE Salmon Street. Respondents ranged from having just moved to SE Salmon Street (less than ½ a year) to having lived on the

street for a total of 30 years (average = 8.5 years). Survey respondents reported an average of 3 people per household and 1.8 vehicles per household. The average age of respondents was 42 years old. In terms of annual household income, the majority of households (23.9 percent) made between $50,000 – $75,000 per year. Compared to the 1999 median family income of $33,070 for the surrounding area census tracts, survey respondents represented a higher than average income group.

Figure 7 below shows the percentage of respondents that considered themselves bicyclists, as well as respondents' gender and home ownership status. Most notably, 59 percent of respondents reported that they consider themselves cyclists, while only 41 percent said they consider themselves non-cyclists. Additionally, 57 percent of respondents were female and 59 percent were homeowners. This is higher than 2000 census data for the surrounding area census tracts, which reported 51 percent females and 25 percent owner occupied housing.

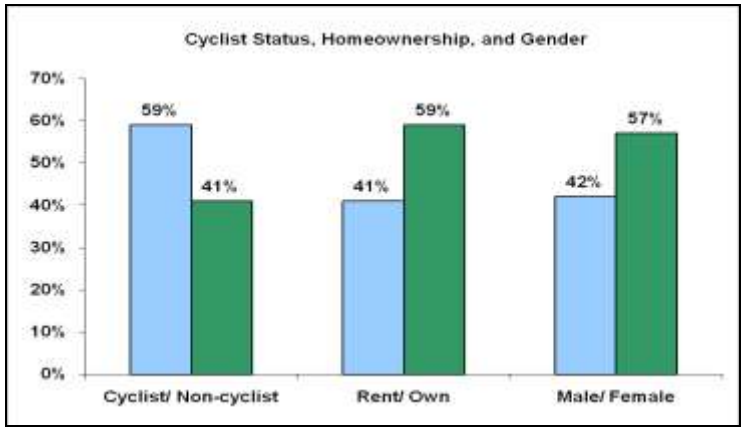

FIGURE 7 Reported cyclist status, homeownership, and gender.

Bicycling Behavior

When asked to select their primary mode of transportation, 46 percent said car/truck, 24 percent said bicycle, 10 percent said transit, and 5 percent said walking. Additionally, 5 of the 11 "other" responses reported splitting bicycling with another mode.

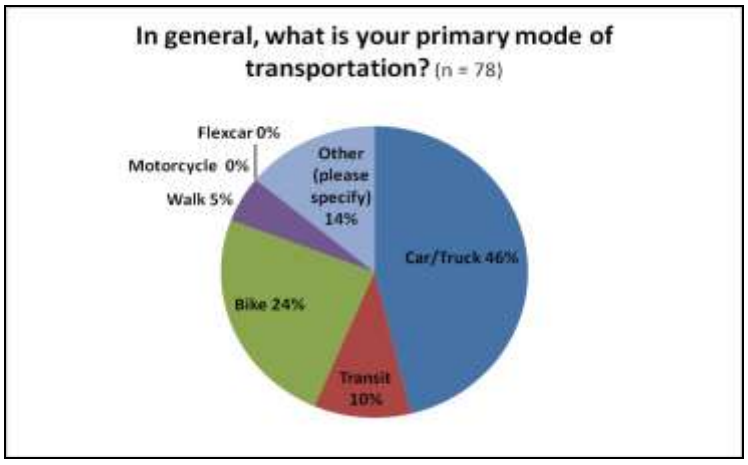

FIGURE 8 Primary mode of transportation.

When asked how many days per week they typically bike, 28 percent of respondents said never, 24.3 percent reported riding at least 5 days per week or more, and the remainder (47.4 percent) fell somewhere between less than one day per week and 4 days per week (see Figure 9 below).

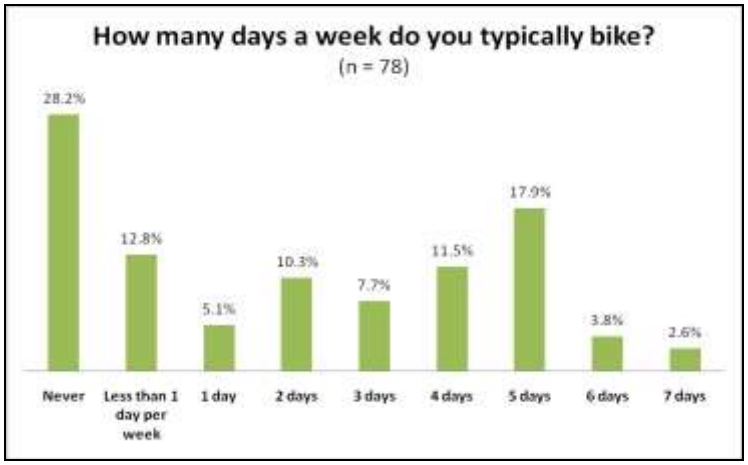

FIGURE 9 Weekly bicycling frequencies.

Respondents who reported riding at least "less than 1 day per week" or more (n=56), were asked to check all the destinations they typically bike to. Survey respondents reported typically biking to social/recreational destinations (82 percent), shopping/errands (61 percent), and to work (59 percent). Of the survey respondents over 16 who reported being employed out of the house (n=50), 50 percent reported typically biking to work. Compared to the City of Portland's 3.5 – 4.2 percent bicycle commute mode share (9), this is quite a bit larger. Of the workers over 16 who reported reported biking to work (n= 25), 60 percent reported typically biking 5 days per week or more.

Respondents who reported riding at least "less than 1 day per week" or more (n=56), were also asked what their primary reasons are for bicycling. Respondents said that the top two reasons they bike are to get exercise (92.9 percent) and because of environmental concerns (67.9 percent). Fifty percent of the "other" responses said that they bike because it's fun.

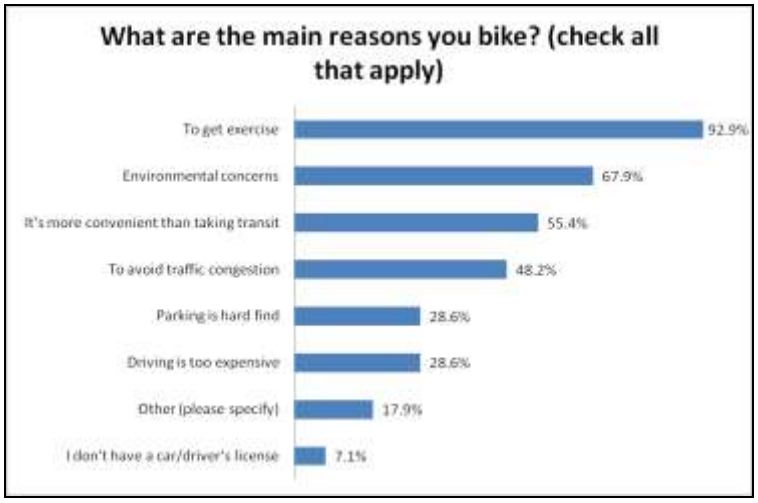

FIGURE 10 Reasons for bicycling.

Perceptions of the Bicycle Boulevard

When respondents were asked if they enjoy living on a bicycle boulevard, the overwhelming majority (68 percent) said "A lot", 16 percent said "A little", 11 percent said "Not at all", and 5 percent were indifferent.

When asked whether SE Salmon's bicycle boulevard designation factored into their decision to move to the street, 18.4 percent of respondents said the bicycle boulevard designation factored positively into their decision to move to SE Salmon, 19.7 percent said that it didn't factor into their decision either way, and nobody said the bicycle boulevard designation was a negative factor, (as shown in Figure 11 below). The remaining respondents either did not know that SE Salmon street was a bicycle boulevard when they moved to the street (28.9 percent), or they said they moved to the street before it became a bicycle boulevard (32.9 percent).

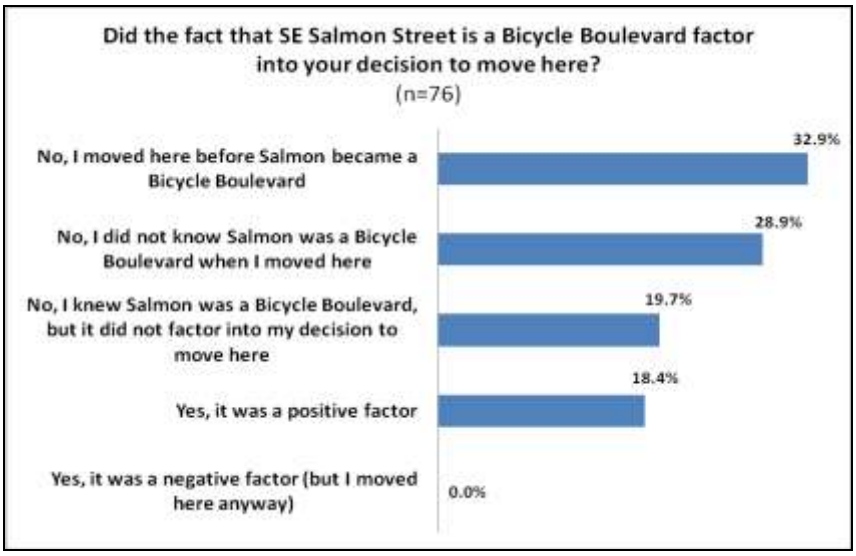

Figure 11 Influence on location decision.

When asked whether living on a bicycle boulevard influences whether or not they bike, 54 percent said that it does not influence whether or not they choose to bike, 42 percent said it makes them *more* likely to bike, and 4 percent said it makes them *less* likely to bike (as shown in Figure 12 below).

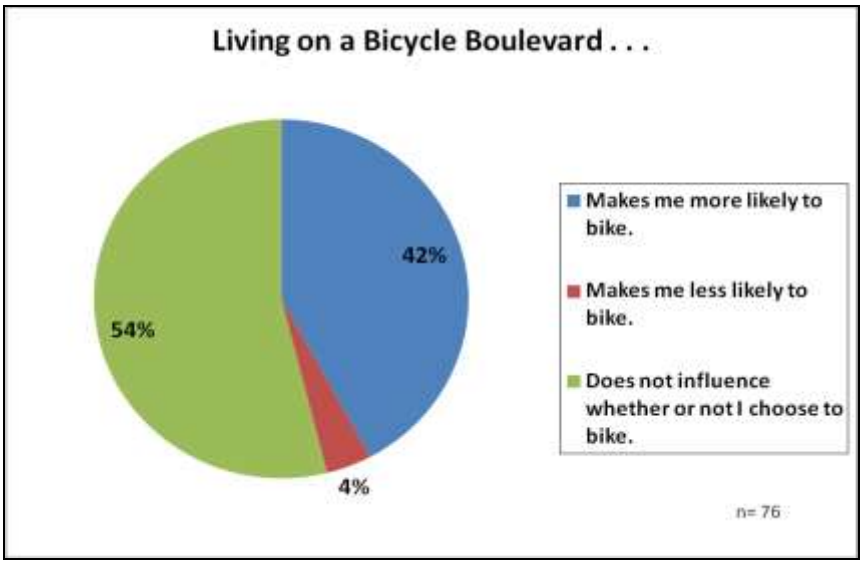

FIGURE 12 Influence of bicycle boulevard on cycling behavior.

Respondents were also asked to rate each of the categories in Table 1 according to whether or not they feel the bicycle boulevard designation has had a positive, negative, or neutral impact. A majority of respondents felt that the bicycle boulevard designation has had a positive impact on convenience for bicyclists, sense of community, quality of life, home values, air quality, and noise. Interestingly, the majority of respondents said the bicycle boulevard designation has had no impact on safety for children, convenience for pedestrians, or the number of traffic collisions on the street, although the responses for these categories had a greater variance. The only negative impact that respondents agreed on was convenience for drivers.

TABLE 1 Resident Perceptions of the Impacts of Bicycle Boulevard Designation

Please mark whether you think the designation of Salmon Street as a bicycle boulevard has had an impact on the following elements of the neighborhood:			
Answer Options	**Positive Impact**	**Negative Impact**	**No Impact**
Convenience for Bicyclists	**97%**	0%	3%
Sense of Community	**74%**	4%	22%
Quality of Life	**72%**	11%	17%
Home Value	**57%**	8%	36%
Air Quality	**55%**	3%	42%
Noise	**50%**	18%	32%
Convenience for Drivers	13%	**66%**	21%
Number of Traffic Collisions	25%	28%	**47%**
Convenience for Pedestrians	29%	26%	**45%**
Safety for Children	37%	22%	**41%**

Suggestions for Improvement

Some of the primary recommendations for improvements that came out of the survey included adding signage/signals at problem intersections (51.3 percent), increasing the enforcement of traffic laws (39.5 percent), and separating bicycle and vehicle traffic (34.2 percent), as shown in Figure 13 below.

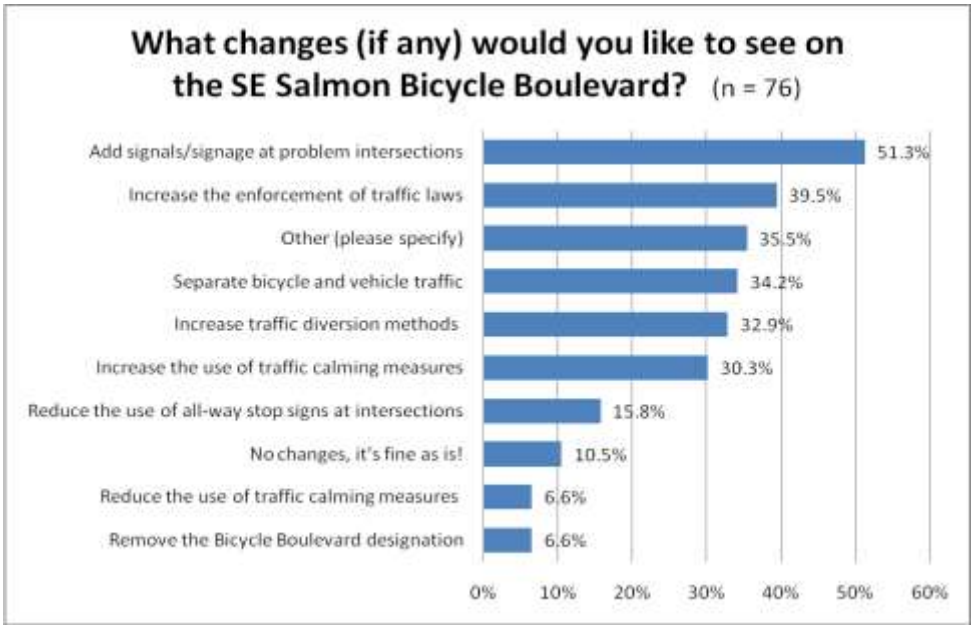

Figure 13: Suggestions for improvements to SE Salmon Street.

Many of the "other" comments addressed the problem of cars speeding on the bicycle boulevard and using the bicycle boulevard as a cut-through. Issues of pot-hole and traffic circle maintenance were common, as well as the need to address safety issues at key intersections (SE 20th, SE 23rd, SE 28th). Additionally, many residents remarked that the bicyclists provide the neighborhood with character and mentioned that they enjoy watching the bicyclists go by on their street.

Additionally, people included many comments when asked if they had any additional thoughts they would like to share (n=52). While the majority (48 percent) of comments could be categorized as positive towards the bicycle boulevard and bicyclists in general, another forty percent of the comments could be categorized as generally frustrated or openly hostile towards cyclists. Many of the comments surrounded the need for bicyclists to be better lit up at night, to stop more at stop signs, and to not speak loudly or use profanity when riding down the street at night. Additional comments surrounded the need to reduce automobile cut-through and speeding on the bicycle boulevard.

Of the respondents that expressed negative comments towards cyclists, 72 percent reported using a car or truck as their primary mode of transportation and 62 percent did not consider themselves bicyclists. Of the respondents that expressed positive comments, only 32 percent reported using a car or truck, and 68 percent considered themselves cyclists. This speaks to a general trend of misunderstanding between those who identify with different modes of transportation.

ANALYSIS

Perceptions

Chi Square tests were used to determine whether statistical differences exist between different groups of respondents and their perceptions on the impacts of bicycle boulevard designation. A test of two proportions was run for each significant pair to determine if the specific statistically significant relationship could be isolated. The following relationships were found to be statistically significant at the 95% confidence level:

- A significantly higher share of cyclists (84.4 percent) than non-cyclists (54.8 percent) considered the bicycle boulevard designation to be a positive impact on Quality of Life (P = .004)
- A significantly higher share of non-cyclists (80.6 percent) than cyclists (55.6 percent) felt that the bicycle boulevard designation has a negative impact on Convenience for Drivers. (P = .02)
- A significantly higher share of non-cyclists (67.7 percent) than cyclists (33.3 percent) felt that the bicycle boulevard designation has no impact on traffic collisions. (P = .004)
- A significantly higher share of renters (80 percent) than homeowners (56.5 percent) felt the bicycle boulevard designation has a negative impact on Convenience for Drivers. (P=.03)
- A significantly higher share of home owners (32.6 percent) than renters (6.7 percent) felt the bicycle boulevard designation has no impact on Sense of Community. (P=.008)
- A significantly higher share of home owners (45.7 percent) than renters (10 percent) felt the bicycle boulevard designation has no impact on Noise. (P=.001)

Another interesting finding is that no statistically significant difference could be found between any of the above groups concerning the perception that the bicycle boulevard has had a positive impact on home values. This means that the respondents who felt the bicycle boulevard has a positive impact on home values (57 percent) represented a broad range of residents, and not just cyclists.

Travel Behavior

In terms of travel behavior and location decision, survey respondents can be classified into four types of people living on the bicycle boulevard:

1) The Already Convinced (15 percent) - Residents who positively factored the bicycle boulevard into their location decision, and said living on a bicycle boulevard makes them more likely to bike.
2) The Easily Influenced (32 percent) - Residents who did not factor the bicycle boulevard into their location decision, but said living on a bicycle boulevard makes them more likely to bike.
3) The Cycling Supporters (4 percent) – Residents who positively factored the bicycle boulevard into their location decision, but said living on the bicycle boulevard does not influence whether or not they bike.
4) The Generally Uninterested (50 percent) – residents who did not factor the bicycle boulevard into their location decision, and said living on the bicycle boulevard does not influence whether or not they bike.

The average number of days per week reported bicycling was compared for residents in each category (as shown in Table 2). While the Type 1 residents reported riding the most often (3.59 days per week), it could be argued that these "Already Convinced" residents would likely be riding their bikes whether or not they lived on a bicycle boulevard, due to the self-selection effect (10). Type 1 and Type 3 residents can be considered "self-selectors" because they selected to move to SE Salmon in part because of the bicycle boulevard. Type 2 and Type 4 residents can be considered non "self-selectors" because they did not factor the bicycle boulevard into their decision to move to SE Salmon Street. However, 39 percent of these non self-selecting residents said living on a bicycle boulevard influenced them to bike more. Just how much more can be demonstrated by comparing the mean frequency of the days reported biking per week between Type 2 and Type 4 residents. All together, the Type 2 "Easily Influenced" residents reported riding their bicycles an average of 2.44 days per week, which is .52 days per week more than the Type 4 "Generally Uninterested" residents.

TABLE 2 Days per Week Reported Cycling by Resident Type

Type	Description	Percent (n=76)	Response	Days/Week Bicycle
1	Already Convinced	15%	Yes location, Yes behavior	3.59
2	Easily Influenced	32%	No location, Yes behavior	2.44
3	Cycling Supporters	4%	Yes location, No behavior	2.39
4	Generally Uninterested	50%	No location, No behavior	1.92

This reveals an important nuance to the self-selection debate in the literature (10). That is, while self-selectors (Type 1 respondents) may very well engage more in a desired activity than non-self-selectors (Type 2 and Type 4 respondents), it is the non-self selectors who represent the market segment most likely to make a change in their behavior, due to changes in the built environment. In this case, 39 percent of the non-self-selecting residents were influenced by the bicycle boulevard to bike an average of half a day per week more than the "Generally Uninterested" residents.

CONCLUSIONS

Key Findings and Recommendations for Further Research

The results of this survey indicate that residents generally agree with bicycle boulevard advocates that these low-traffic bikeways have a positive impact on quality of life, home values, sense of community, noise, air quality, and convenience for bicyclists. However, some of the more surprising results of this survey were that the majority of SE Salmon residents reported that the bicycle boulevard designation has had no impact on convenience for pedestrians, safety for children, or the number of traffic collisions. Since the traffic calming measures of bicycle boulevards are frequently touted as having positive impacts on all three of these categories, it is important to find out why SE Salmon residents disagree, and whether their opinions are shared by residents of other bicycle boulevards.

Additional key results include the finding that 39 percent of the residents that did not "self-select" to move to the bicycle boulevard reported that living on a bicycle boulevard makes them more likely to bike. These residents reported biking .52 days per week more on average than the

non "self-selecting" residents who said they were not influenced to bike. This finding indicates that designating bicycle boulevards in existing residential neighborhoods may have the ability to encourage some of the existing residents to bicycle more, as opposed to only those new residents that "self-select" to move into the community.

Further study, comparing these results to residents of other bicycle boulevards, as well as residents of similar residential streets that are not designated bicycle boulevards (as a control), is recommended.

Design and Policy Implications

Bicycle boulevard design and policy issues were found to be at the heart of many of the frustrated comments expressed in the additional comments section of the survey. Comments regarding problems with poor cyclist visibility, cyclist adherence to bicycle traffic laws, and cyclist courtesy can be addressed by transportation professionals by keeping the following lessons in mind:

- Ensure that bicycle boulevards are designed with cyclist visibility in mind. Additional street lights on bicycle boulevards for nighttime, or strategically placed mirrors near driveways at blind intersections, may help alleviate driver/cyclist tensions.
- Ensure that cyclists are educated on the rules of the road, and that cycling violations are enforced.
- Ensure that the use of stop signs on bicycle boulevards is minimal, especially on hills. It is harder for cyclists to stop and start, and when stop signs appear arbitrary, cyclists are more likely to ignore them, enhancing driver/cyclists tensions.

Additionally, comments regarding problems with automobile cut-through and speeding on bicycle boulevards can be addressed by:

- Ensuring that traffic diversion devices are frequent enough to deter non-local traffic.
- Ensuring that traffic calming devices are frequent enough to deter vehicle speeding.
- Ensuring that the bicyclist priority on the street is clearly displayed through signage, and reinforced through community education and outreach programs.

REFERENCES

1. Dill, J., and T. Carr. Bicycle Commuting and Facilities in Major U.S. Cities. In *Transportation Research Record: Journal of the Transportation Research Board*, No. 1828, Transportation Research board of the National Academies, Washington, D.C., 2003, pp. 116-123.

2. City of Portland Office of Transportation. *Bicycle Master Plan*, May 1996, Updated July 1998. http://www.portlandonline.com/shared/cfm/image.cfm?id=40414. Accessed December 5, 2008

3. Bicycle Transportation Alliance. *Why Bike Boulevards?* http://www.bta4bikes.org/at_work/bikeboulevards.php. Accessed December 5, 2008.

4. Eckerson, Clarence Jr. *Portland, Ore. - Bicycle Boulevards*. January 29, 2007. StreetFilms, Livable Streets Initiative. http://www.streetfilms.org/archives/portland-or-bicycle-boulevards/. Accessed December 7, 2008.

5. City of Portland Office of Transportation. *Neighborhood Bikeway Map: Southeast*, http://www.portlandonline.com/transportation/index.cfm?c=34809&a=181708. Accessed December 7, 2008.

6. Krizek, K. J., and G. Barnes, K. Thompson. Analyzing the Effect of Bicycle Facilities on Commute Mode Share over Time. *Journal of Urban Planning and Development*. Vol 135, no. 2, 2009.

7. Pinjari, A. R., and N. Eluru, C. R. Bhat, R. M. Pendyala, E. Spissu. A Joint Model of Residential Neighborhood Type Choice and Bicycle Ownership: Accounting for Self-Selection and Unobserved Heterogeneity. *Transportation Research Board 87th Annual Meeting* (08-2495). Transportation Research board of the National Academies, Washington, D.C., 2008.

8. Pinjari, A. R., and R. M. Pendyala, C. R. Bhat, P. Waddell. Modeling the Choice Continuum: Integrated Model of Residential Location, Automobile Ownership, Bicycle Ownership, and Commute Tour Mode Choice Decisions. *Transportation Research Board 87th Annual Meeting* (08-2647). Transportation Research board of the National Academies, Washington, D.C., 2008.

9. U.S. Census Bureau, American Community Survey, Means of Transportation to Work – Universe: Workers 16 years and over, 2005-2007.

10. Handy, S. Questioning Assumptions: Do New Urbanists Walk More? *Planning*, Vol. 72 Issue 1, January 2006, pp. 36-37.