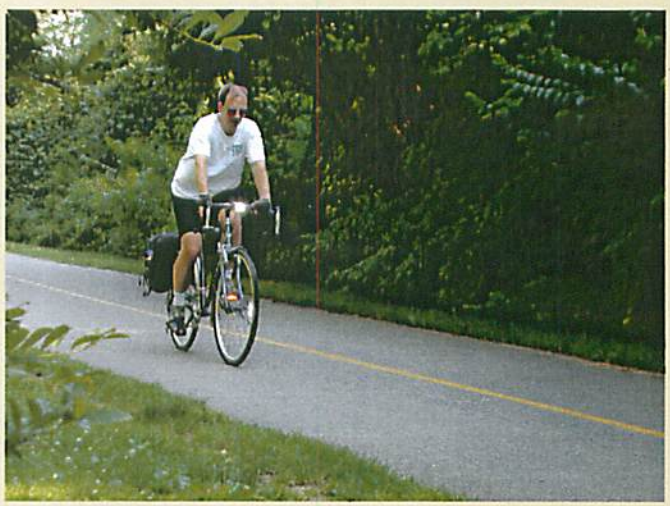
"When I commute by bike I save money,
get exercise, don't sit in traffic,
and don't pollute."

— Simon Walker, Bethesda, Maryland

Trails & Greenways:
Commute Rates from the 2000 Census



RAILS to TRAILS CONSERVANCY

Rails-to-Trails Conservancy

Commute Rates on Urban Trails: Indicators from the 2000 Census

Hugh Morris
Rails-to-Trails Conservancy
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Introduction

How many people bike to work each day? Does the creation of bicycle facilities, such as on-road signed routes or striped lanes or off-road paths help to induce more trips by that mode?

For nearly twelve years, the U.S. Department of Transportation has been investing an increasing amount of funds on such facilities, principally through the Transportation Enhancements program. Over one-half of these funds, now totaling approximately $650 million per year as shown in Figure 1, are spent on bicycle and pedestrian facilities and this amount accounts for over 75% of all federal funds spent on such facilities. Even with all this investment, the above questions are difficult to answer. There are several data sources that can shed some light on how many trips people make by bike each day but there are shortcomings with these datasets and, because cycling is such a geographically micro-level activity, corridor-specific, national-level statistics are at best not very useful and at worst are misleading when it comes to assessing the impact of facility development on user rates.

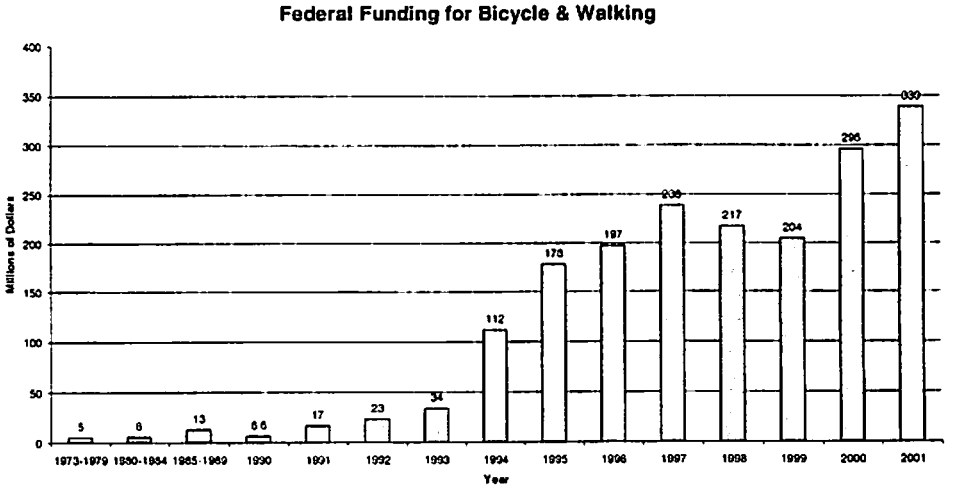

Figure 1: Federal Spending for Bicycling and Walking Facilities

The benefits of making trips by bicycle can be significant, both to the individual and to society as a whole, and thus encouraging trip making by bicycle is within the national interest and worthy of significant investment if such facilities are indeed used. Trip making by bicycle delivers such external benefits as reduced energy consumption, cleaner air, and a healthier population, all elements on which our government spends significant resources.

Though the comment is often made that the U.S. cannot achieve the bicycle trip rates seen in some other countries, an argument can also be made that it is not the lack of desire to make trips by bicycle but rather lack of opportunity. For example, a significant percentage of trips in the U.S. are quite short, as shown in Table 1, and thus are feasible on a bicycle, and, as this paper

will show, where investment in bicycle facilities has occurred, rates of trip making by bicycle are significantly higher than the national average. Simply put, the demand to make trips by bicycle is probably higher than what actually occurs and the expression of demand is being held back by lack of facilities.

Table 1: Percentage of Trips by Distance, Cumulative.

Trip Length	Urban Areas	All Areas
<= 1 mile	27.7%	22.2%
<= 2 miles	40.6%	38.2%
<=3 miles	50.1%	47.2%
<= 4 miles	56.5%	53.3%
<=5 miles	63.5%	60.3%
> 5 miles	36.5%	39.7%

Source: National Household Transportation Survey, 2001

This paper reviews existing literature on the subject of what we know about trip making by bicycle, looks at recent statistics from a variety of data sources, and concludes with a GIS-based micro-level analysis of bicycle commute rates of people who live in close proximity to urban trails. The hypothesis explored here is that the development of bicycle facilities matters and their creation does result in higher levels of bicycle trip making. Further, proximity to such facilities matters and those who live closer to such facilities tend to exhibit a greater propensity to bike to work.

Literature Review

A number of research papers have examined the level of bicycle trip making and the factors that may influence a person's choice to make a trip by bicycle. The four papers mentioned here each shed light on a different element of the extent of bicycle trip making.

- The Puget Sound Regional Council, the metropolitan planning organization for the Seattle, Washington area, conducts periodic surveys of trail users on the Burke-Gilman Trail which runs from the northern suburbs south into the city. The Trail opened for use in the late 1970s. In 1985, there were approximately 1,400 daily users of the trail, 6% of which were commuting. In 2000, daily use had grown to 1,750 and 32% were commuting.

- Also concerning the Burke-Gilman Trail, Shafizadeh and Niemeier (1997) studied trail-user survey data and found that 38% of commuters on the Burke-Gilman Trail live within one-half mile of the trail and 53% live within three-quarters of a mile of the trail.

- Nelson and Allen (1997) conducted a broader analysis of bicycle facilities and use rates. The study applies cross-sectional analysis to a dataset of eighteen U.S. cities in an effort to determine the impact of providing bicycle facilities on use rates while controlling for other factors. The authors found that even when controlling for such factors as weather,

terrain, and number of college students, a positive association exists between the miles of bicycle pathways per 100,000 residents and the percent of bike commuters.

- Troped et al (2001) surveyed residents living in proximity to the Minuteman Trail in the Boston area. Troped found that household use rates of the trail fell off the farther from the trail people lived. Other impediments to trail use included the existence of significant hills (going either to or from the trail), and the need to cross a busy street.

National Statistics

Three national-level data sources now exist on bicycling activity. Each of these shed light on the subject from a slightly different perspective.

First, the oldest data source, the U.S. Decennial Census, has been collecting journey-to-work data for several decades. However, it is only since 1980 that the mode of bicycle has been listed. Since then, bicycling to work rates, according to the Census data, have remained relatively flat, as detailed in Table 2.

Table 2: U.S. Census Bicycle Journey-to-Work Rates: 1980 to 2000

Year	Number	Percent
1980	468,348	0.5%
1990	466,856	0.4%
2000	488,497	0.4%

Source: U.S. Census

However, national-level statistics are misleading. For example, thirty-three states have bike-to-work rates lower than the national average and nineteen have rates above, with Alabama at the low end with 0.07% and Oregon at the high end with 1.07%. This range begs the question: why such variation? One answer may be the level of investment in bicycle facilities. Portland, Ore., long known for its bicycle friendliness, demonstrates the correlation, if not the causality, between investment in such facilities and levels of use. Over the past decade, the City of Portland has invested $12 million in bicycle and pedestrian improvements, much of this on four of the ten bridges spanning the Willamette River. Downtown is just on the west side of the river with the east side being principally residential with a few commercial corridors. These bridges act as chokepoints for anyone wanting to access downtown from the east side and allow for easy counting of bicycle traffic entering downtown. Prior to the bicycle facility investment, daily bike crossings on the four bridges totaled 3,015. Ten years and $12 million later, daily crossings are numbering 7,577 (Birk, 2003).

The value of the Census data is that it is national in scope and the resulting tabulations can be had at quite a small level of geographic detail.

The drawback of using the Census data stems from the way in which people were asked to respond to the journey-to-work question on the Census long form. The question reads: "How did this person usually get to work last week." There are two shortcomings with this structure. First,

the question is worded in such a way that if a person bikes to work two out of five days, the bicycle trips will not be recorded. Second, if the person used multiple modes to get to work, such as biking to a transit stop and then taking transit for a distance that was longer than the bike segment, only the transit trip would be recorded. Lastly, because the Census only records work trips in the last week of March, a significant portion of the country is usually still experiencing cold weather and thus seasonal variations are not accounted for. These shortcomings mean, however, that the number of bicycle trips is probably under reported. Bike connections to transit are growing in popularity as witnessed by Seattle's 40,000 bike boardings per month on its buses and the increasing number of Bike Stations being developed for bike connections to rail transit.

Second, the National Household Transportation Survey (NHTS), a detailed survey conducted approximately every five years, reveals other characteristics of trips made by bicycle. The NHTS tracks all trip purposes, not just work trips as the Census does. This broader scope results in a higher bike trip rate, 0.9% as compared with 0.4% from the Census for work trips. The drawback to this dataset is that it is not large enough to permit geographic disaggregation to the neighborhood level.

Third, the Bureau of Transportation Statistics, a unit of the U.S. Department of Transportation conducts a monthly survey on transportation issues. While this data source is not robust enough to present statistics for small geographic areas, it does address two of the shortcomings of the Census data, seasonality and trip purposes other than work. The survey asks about bicycle use in the prior month and statistics have been developed for a twelve-month period which reveals a lower number of bicycle trips in the colder months. In general, two percent of respondents indicated that they road a bike at least once in the past month for some trip purpose.

Thus, though the two national level travel-oriented surveys indicate higher rates of bicycle trip making, principally because these surveys look at all trip purposes, the hypothesis set forth here of proximity to a bicycle facility having an impact on use rates can only be investigated with the geographically disaggregated Census data and with the knowledge that the numbers reported here based on the Census data are, in all likelihood, underreporting actual level of bicycle trips.

Methodology

To explore the above hypothesis, thirteen urban trails, listed in Table 3, were selected for study. Each was open for use before the Census was conducted in April 2000. The selection was based on anecdotal knowledge that suggested that these trails are used for commuting.

Table 3: Study Trails

Trail	City	State	Length
Burke-Gilman Trail	Seattle	Washington	18
Pinellas Trail	St. Petersburg	Florida	47
Monon Trail	Indianapolis	Indiana	7.5
Capital Crescent-DC	Washington, D.C.		12
Capital Crescent-MD	Bethesda	Maryland	n/a
MoPac & Rock Island Trails	Lincoln	Nebraska	28 / 5
Eliza Furnace Trail	Pittsburgh	Pennsylvania	2.5

W&OD Trail	Arlington/Fairfax	Virginia	45
Custis trail	Arlington	Virginia	?
East Bay Bicycle Path	Providence	Rhode Island	14.5
Minuteman Commuter Bicycle Path	Boston/Arlington	Massachusetts	10.5
Iron Horse Trail	Concord/Pleasanton	California	17
Schuylkill River Trail	Philadelphia	Pennsylvania	22
Springwater Corridor	Portland	Oregon	16.5

Each trail was mapped in a geographic information system (GIS), along with the area street network and the Census block-group boundaries.[1] The GIS was used to create a half-mile buffer around each trail (see Figure 2). Previous research (Shafizadeh and Niemeir, 1997) noted above suggests that a significant portion, 38%, of trail commuters originate their trip within a half-mile of the trail. The block-group level journey-to-work from the 2000 Census was imported to the block-group boundary file for each county that contained a study trail.

The block groups in each county were divided into three categories: 1) those that fall completely or partially within the half-mile buffer, 2) those block groups that form a ring around those selected in part 1, and 3) the remaining block groups in the county, as depicted in Figure 3. The ring-grouping calculation was made to assess any falloff in the bike-to-work rate for households further from the trail. Figure 4 provides a visual representation of the bike-to-work rate of each block group in King County where the Burke-Gilman Trail is located. The figure contains a table in the upper left corner with the bike-to-work rates associated that trail. These data are the same as presented in Table 4, where bike-to-work rates are shown for each set of block groups indicated above for each of the thirteen trails.

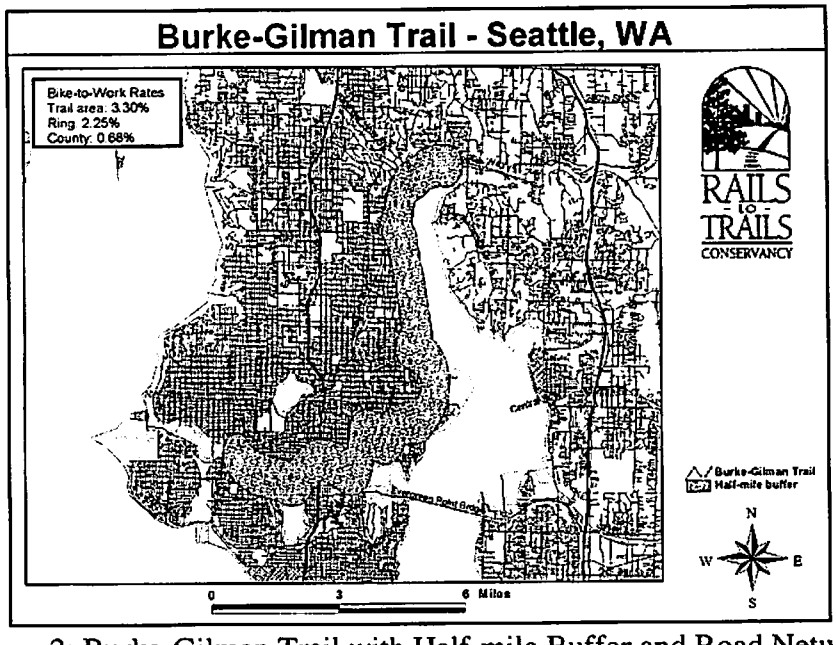

Figure 2: Burke-Gilman Trail with Half-mile Buffer and Road Network

[1] Census data is collected at the block level. Census blocks are bounded on all sides by visible features, such as streets, roads, and streams. The blocks are generally small in area and, in cities, are a true city block. Data from blocks are then aggregated into block groups. Block groups generally contain between 600 and 3,000 people, with an optimum size of 1,500 people. The Census does not report journey-to-work data at the block level.

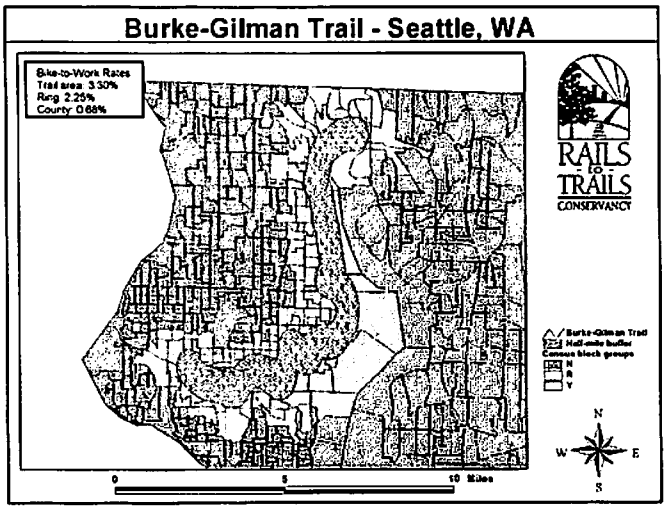

Figure 3: Burke-Gilman Trail with Census Block Groups.

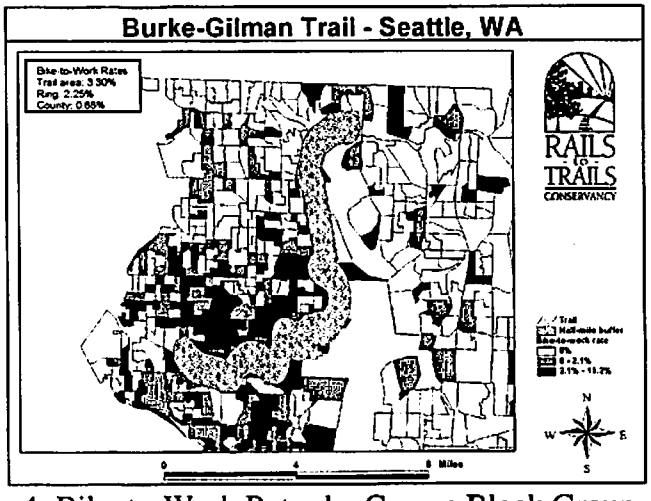

Figure 4: Bike-to-Work Rates by Census Block Group, 2000.

Findings

Tables 4 through 6 list the bike-to-work rates for each county where a study trail is located (note: the Capital Crescent Trail spans both Washington, D.C. and Maryland and the rates for each jurisdiction are listed), the bike-to-work rates for those block groups falling partially or fully within the half-mile buffer around the trail, and the bike-to-work rates for those block groups that form a ring around the first grouping, and finally the remainder of the county not included in either ring. Thus there are four bike-to-work rates listed for each study trail. In nine of the thirteen cases, those listed in Table 4, households closest to the trail have higher bike-to-work rates than those households in the outer ring, which in turn have higher rates than the county in which the trail is located (this progression does not completely hold up for the Pinellas Trail).

Table 4: Bicycle Commute Rates from the 2000 Census for Nine Urban Trails.

	County Total			Within 1/2 Mile of Trail			Secondary Ring			Rest of County		
Trail	All Modes	Bikers	% Bike	All Modes	Bikers	% Bike	All Modes	Bikers	% Bike	All Modes	Bikers	% Bike
Burke-Gilman Trail	769,739	7,037	0.91%	47,179	1,557	3.30%	34,122	769	2.25%	688,438	4,711	0.68%
Pinellas Trail	262,030	2,522	0.96%	58,687	749	1.28%	45,143	333	0.74%	158,200	1,440	0.91%
Monon Trail	379,858	811	0.21%	27,980	130	0.46%	24,363	101	0.41%	327,515	580	0.18%
Capital Crescent-DC	253,266	2,879	1.14%	7,361	125	1.70%	11,319	177	1.56%	234,586	2,577	1.10%
Capital Crescent-MD	399,515	1,103	0.28%	16,294	173	1.06%	18,220	97	0.53%	365,001	833	0.23%
MoPac & Rock Island	115,731	1,182	1.02%	45,708	666	1.46%	23,362	223	0.95%	46,661	293	0.63%
Eliza Furnace Trail	530,831	851	0.16%	13,949	128	0.92%	6,718	46	0.68%	510,164	677	0.13%
W&OD	649,973	1,455	0.22%	29,214	701	2.40%	94,958	262	0.28%	425,801	492	0.12%
Custis Trail	116,046	803	0.69%	38,707	371	0.96%	16,321	114	0.70%	61,018	318	0.52%
East Bay Bicycle Path	267,105	1,010	0.38%	24,972	212	0.85%	18,118	124	0.68%	224,015	674	0.30%
Aggregates	**3,744,094**	**19,653**	**0.52%**	**310,051**	**4,812**	**1.55%**	**292,644**	**2,246**	**0.77%**	**3,041,399**	**12,595**	**0.41%**

For these nine urban trails, the hypothesized pattern of people living near the trail having a greater rate of bicycling to work than other county residents holds true. In aggregate, the persons living in close proximity to these trails represent 4,812 bicycle commuters, fully 25% of all the bicycle commuters in the study counties. While these nine jurisdictions show a 0.52% bike-to-work rate, the Census block groups near the trail show a rate of 1.55%, three times greater.

Table 5 shows the same statistics for three other urban trails. With these trails, however, the bike-to-work rates for those persons living near the trail are actually lower than for the counties as a whole. This relationship seemed out of character and prompted a sub-area analysis. These trails share the characteristic of running from a fairy dense urban area type through suburban and even into rural areas where bike-to-work rates are inherently lower because of the distance one needs to traverse. For these three trails, bike-to-work rates for the entire trail as well as the urban portion were calculated. In each instance, the bike-to-work rate of the urban section exceeds that for the county as a whole.

Table 5: Sub-Area Analysis of Bike-to-Work Rates for Three Urban Trails.

	County Total			Within 1/2 Mile of Trail			Secondary Ring			Rest of County		
Trail	All Modes	Bikers	% Bike	All Modes	Bikers	% Bike	All Modes	Bikers	% Bike	All Modes	Bikers	% Bike
Minuteman--whole	698,183	4,984	0.71%	41,386	287	0.69%	21,903	276	1.26%	634,894	4,421	0.70%
Minuteman--Sub--2 miles				17,293	201	1.16%						
Iron Horse--whole	924,535	9,756	1.06%	78,742	603	0.77%	44,294	244	0.55%	801,499	8,909	1.11%
Iron Horse--sub--3 miles				12,953	138	1.07%						
Schuykill River Trail--whole	875,528	5,517	0.63%	50,814	315	0.62%						
Schuykill River Trail--sub—6 miles				18,152	198	1.09%						

Table 6 presents data for the Springwater Corridor in Portland, Oregon. Bike-to-work rates for residents in close proximity of this trail are less than for the county as a whole, similar to those in Table 5, above. The reason for this relationship with this trail may, however, be different than for the three trails listed in Table 5. As noted above, Portland Ore., has invested substantially in a wide variety of bicycle infrastructure, on road and off road. This may mean that the bicycle facilities, on-road as well as off-road may be ubiquitous and thus the trail may provide little

marginal benefit to bike commuters and thus such trails may not draw as many users. Second, there may be a substantial bike commute attractor, such as a college, elsewhere in the county that drives up the overall bike commute rate for that county, thus providing a higher threshold for the trail to be compared with.

Table 6: Impact of Ubiquitous Bicycle Facilities on Facility-Specific Use Rates.

	County Total			Within 1/2 Mile of Trail			Secondary Ring			Rest of County		
Trail	All Modes	Bikers	% Bike	All Modes	Bikers	% Bike	All Modes	Bikers	% Bike	All Modes	Bikers	% Bike
Springwater—whole	397,969	4,851	1.22%	38,575	231	0.60%	28,101	194	0.69%	331,293	4,426	1.34%

Characteristics of Successful Commuting Trails

Just as demand for road use is based on a variety of factors, so too is the level of use and purpose of use of a trail determined by many of the same factors:

- **Number of competing facilities in the region:** If multiple facilities exist in relative close proximity one another and connect the same origins and destinations then these facilities may compete for the given quantity of users in the area. If users perceive one facility to be more crowed than another, they may switch to using the other.
- **Number of people living/working within proximate distance of the facility:** As noted in the literature review, people are more likely to use a trail or greenway if the facility is within a mile or so of their residence, this is particularly true for commute trips.
- **Mix of land uses around the facility:** If a trail is surrounded by only one land-use type, such as residential, trail users can only use the trail for the trip purpose of visiting a friend. However, if the trail also connects to employment centers, schools, libraries, and shopping areas, then trip makers can use the trail for accessing those land-use types as well.
- **Number of access points to the facility:** If a trail were designed so that it connected a variety of land-use types but the only access points to the trail were at the end points and not along the way then only those land uses at the end points would be viable destinations. Trails such as the Custis Trail in suburban Washington, D.C. have access points into the surrounding neighborhood roughly every 100 yards.
- **Length of the facility:** The longer a trail is, the more community resources it can connect.
- **Trail system/network vs. single facility:** A network of interconnecting trails is substantially more useful for trip making because it has the ability to connect people to more places.
- **Trail surface, signs, site lines, and maintenance:** Design characteristics of the trail itself are important. Bike commuters like to go fast and that is best achieved on an asphalt trail with minimal grade and gentle curves.
- **Facilities at destination to secure bike and change attire:** A chain is only as strong as its weakest link and the use of a trail for trip making is no exception. If there is no place to safely park one's bike at the end of the trip then the trip won't be made. Also important is a place for the commuter to wash and change.

Conclusions

This preliminary analysis of the 2000 Census journey-to-work data suggests that trails in urban areas may induce bike commuting by people who live in close proximity to the trail. Further research needs to be conducted to determine statistical significance of difference in these rates and whether or not causality is involved. Does close proximity to a trail encourage people to dust off their bike and start riding? Or did people who already have a propensity to bike to work move their residence to a location near a trail in order that they could bike to work? Or, because there was not a random selection of urban trails for this study, did the analysis get lucky?

Though the Census journey-to-work data does not lend itself to non-work trips, it would be useful for future research to explore such trips as they are the majority of trips we make, 75%, and tend to be shorter, average of approximately 7 miles for shopping and dining trips, compared with commute trips which average 13 miles, and thus more readily lend themselves to non-motorized modes of travel if facilities exist for people to safely use a non-motorized mode (NHTS). Too, there are seasonal variations in non-motorized trip making that the Census data cannot address. Combined, these impediments suggest that trip making by bicycle may be greater than the responses to the 2000 Census suggest.

References

Birk, M. 2003. "A Tale of Portland Bridges" Unpublished. Available at www.altaplanning.com

BTS, 2002. "OmniStats—Bicycle Use Among Adult US Residents." Vol. 2, Issue 6. December 2002. Bureau of Transportation Statistics, U.S. Department of Transportation.

Nelson, C. and D. Allen, 1997. "If You Build Them, Commuters Will Use Them: Cross-sectional analysis of commuters and bicycle facilities." Transportation Research Board Annual Meeting, January 1997, Paper # 97-0132.

PSRC, 2000. "Burke-Gilman/Lake Sammamish Trail Use." Puget Sound Trends, No. T14, November 2000. Puget Sound Regional Council, Seattle Washington.

Shafizadeh, K. and D. Niemeir, 1997. "Bicycle Journey-to-Work: Travel Behavior Characteristics and Spatial Attributes." Transportation Research Board Annual Meeting, January 1997, Paper # 97-0900.

STPP, 2002. "Census Journey-to-Work: What do we know about how Americans Travel?." Decoding Transportation Policy & Practice #4. Surface Transportation Policy Project. Washington, D.C.

Troped, P. et al. 2001. "Associations between Self-Reported and Objective Physical Environmental Factors and Use of a Community Rail-Trail." Journal of Preventive Medicine. Vol. 32, pp 191-200. Available at www.idealibrary.com