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Bicycling in Davis and Five Other Small Cities

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Bicycling in Davis and Five Other Small Cities

1. Introduction

One hundred and forty years after its invention, the bicycle remains an important element of the transportation system. First, the bicycle is a low-cost, low-polluting alternative to driving that makes efficient use of limited roadway capacity. Second, for individuals who do not have the option of driving, the bicycle can be an effective means for getting places, particularly for trips that are too long for walking or are not served by transit (Murphy and Knoblauch 2004). Bicycling also plays a role in public health as a source of physical activity at a time when physical activity is declining and levels of obesity are reaching epidemic proportions (Killingsworth 2003). Bicycling, particularly bicycling for transportation, generates benefits to the bicyclist as well as to the community as a whole. Encouraging more bicycling, assuming this can be done safely and at reasonable expense, is thus a desirable societal goal.

At this point, the U.S. averages 0.39 bicycles per person, much lower than the 1.0 bicycles per person found in the Netherlands.[1] Bicycling accounts for less than 1 percent of all trips for all purposes in the U.S., according to the 2000 National Household Transportation Survey (Pucher and Renne 2003). Shares of trips by bicycle in European countries are anywhere from four times (in the U.K., France, and Italy) to 28 times (in the Netherlands) that of the U.S. (Pucher and Dijkstra 2003). Although bicycling is popular in some parts of the U.S., more than two-thirds of this bicycling is for recreation rather than transportation; the percentages of bicycling trips for work, school, and shopping in the Netherlands (60.0%) and in Germany (60.1%) are twice that in the US (30.5%) (Pucher and Dijkstra 2000).

These differences are not surprising, given differences in the physical and social environments in these countries compared with the U.S. (Pucher and Dijkstra 2000; Pucher and Buehler 2006; Pucher and Buehler 2008). This raises an important question for transportation planners in the U.S.: can they create conditions within the U.S., within the context of its physical and social environments, that will increase bicycle ownership and use, especially bicycling for transportation? In fact, some U.S. cities have substantial amounts of bicycling: the share of commuters usually bicycling to work, according to the 2000 U.S. Census, was 14.4% in Davis, CA, 6.9% in Boulder, CO, and 5.5% in Eugene, OR, compared to less than 1% for the U.S. overall. The extensive on-street and off-street bicycle networks in these towns undoubtedly helps to explain these relatively high levels of bicycling, but so might the strong bicycling culture in these communities (Buehler and Handy 2008). But the relative importance of these factors has not been rigorously assessed.

This study aims to fill that gap by examining factors influencing bicycle ownership, use and commuting in Davis, Boulder, Eugene, and three comparison cities. We use data collected through an on-line survey conducted in early fall 2006 to examine the relative influences of the physical and social environments, as well as individual factors, including socio-demographic

[1] http://www.worldwatch.org/node/4057. Accessed 20 October 2009.

characteristics and attitudes toward bicycling. The purpose of this study is to provide a stronger empirical basis for the development of strategies to promote bicycling by contributing to an improved understanding of factors influencing the decision to own and use a bicycle.

This report begins with a literature review on bicycle use and ownership, focusing on individual, physical-environmental and social-environmental factors. Next, we discuss our methodology including the survey and selection of cities. Results are presented in four sections: analysis of the three sets of factors on bicycling levels; analysis of bicycle commuting; analysis of respondents who recently moved; and analysis of respondents' biking behavior as children. For bicycling levels and bicycle commuting analyses, Davis is compared first to three other California cities and then to two other College Towns.

2. Literature Review

The term "bicycling" has multiple dimensions and, consequently, bicycling behavior can be measured in many different ways. In this study, we consider bicycling from two primary angles: bicycle use and bicycle ownership. Bicycle use can be measured as the frequency of biking in a given timeframe, the distance biked in a given timeframe, the amount one bikes to certain destinations, the last time one biked, and the share of bicycle commuting.

2.1 Conceptual basis

Bicycling is a physical activity as well as a means of travel to a destination (Handy 2005). Thus, rather than relying on travel behavior theories, we base our conceptual model on the ecological models widely used in physical activity research within the field of public health (Sallis and Owen, 2002). Based on these models, we hypothesize a multilevel array of factors that potentially influence bicycling. At the first level are individual factors including socio-demographics, attitudes, preferences, and beliefs, as well as comfort with bicycling (related to a concept called ''self-efficacy" in the field of public health). At the next level, physical-environment factors reflect land-use patterns, transportation infrastructure, and the natural environment. Finally, social-environment factors include the cultural norms of the community, as evidenced by the collective behaviors of its residents.

These three sets of factors are hypothesized to directly affect bicycling behavior (Figure 1). Individual factors contribute to the motivation to bicycle, while social and physical environment factors determine the quality of bicycling conditions and may enable and encourage bicycling, or hinder and discourage it (Handy 1996; Handy 2009). From the perspective of travel behavior theory, bicycle infrastructure influences the utility of bicycling for an individual, affecting travel time, safety, comfort, enjoyment, and other qualities of the bicycling experience that may be important to an individual when deciding whether or not to bicycle. Communities invest in bicycle infrastructure in order to increase the utility of bicycling and thus increase the likelihood that individuals choose bicycling over other options. Note that these factors may affect each other over time; a supportive social environment for bicycling, for example, may lead to community investments in bicycle infrastructure, while good infrastructure, in turn, may help to generate a supportive environment.

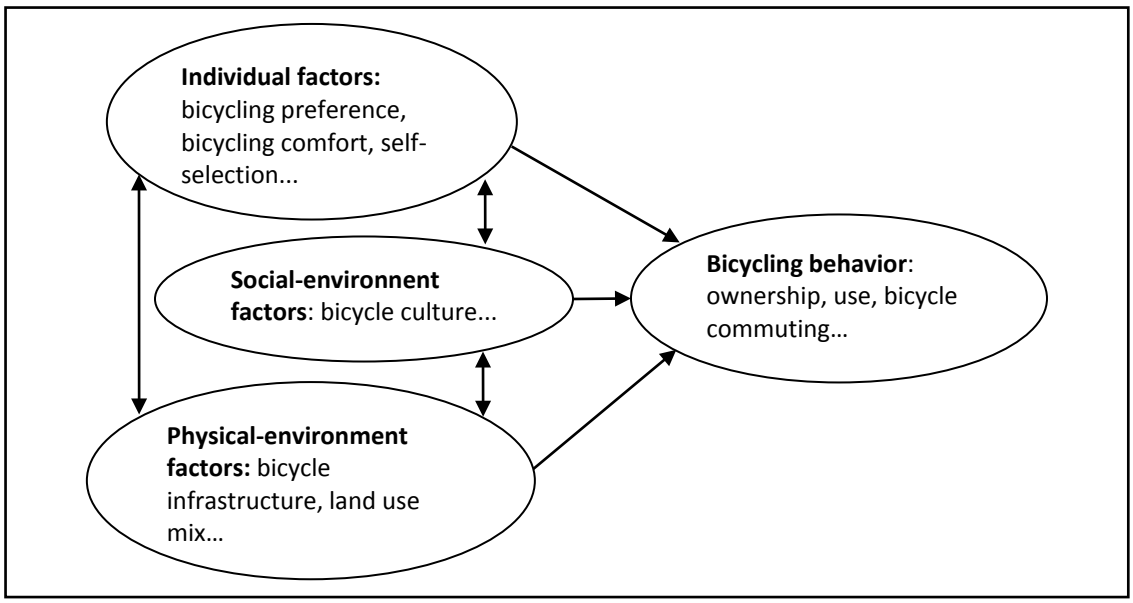

Figure 2-1. Conceptual Model

2.2. Literature review on bicycle ownership

Ownership is a natural precursor of bicycle use. In studies of travel mode choice, mode ownership or availability is always a key factor explaining mode use. For example, auto ownership is one of the principal explanatory factors of auto trip generation and frequency (e.g. Ortuzar and Willumsen 2001; Garling et al. 1998). Even so, a substantial share of trips made by households that do not own automobiles are, nevertheless, made by automobile, through getting rides with or borrowing cars from others (Lovejoy and Handy 2007). For bicycling, ownership is likely to be even more important in explaining use, as "getting a ride" is not possible (with the exception, perhaps, of tandem bicycles). Indeed, previous bicycling studies show that bike ownership is a vital and decisive component of biking behavior (e.g. Moudon et al. 2005). On the other hand, owning a bicycle does not guarantee use, as countless dusty bicycles hidden away in garages will attest.

It is plausible to assume that individual factors, social environment factors, and physical environment factors influence bicycle ownership. A previous review of 3000 Amsterdam inhabitants (Beck and Immers 1994) shows that the main reasons for not owning a bicycle are the availability of other means of transport (individual factors or physical environment factors), hazardous traffic conditions (an aspect of the physical environment), and bicycle theft (an aspect of the social environment).

Although few studies focus on bicycle ownership, research on other mode ownership gives strong evidence of an influence of environmental factors. For example, Tanner (1963) found that social background (income and social class) and physical environment (latitude and population density) have influences on the ownership of both cars and motorcycles. Hess and

Ong (2001) examined the role of land use patterns on auto ownership in Portland, Oregon and concluded that mixed-land use is negatively associated with auto ownership. Zegras (2007) found that the built environment – both micro-scale "household" and meso-scale "neighborhood" design characteristics – had an influence on motor vehicle ownership.

Until now, few cross-sectional studies have focused on factors influencing bicycle ownership. By assuming that individual factors, social environment factors, and physical environment factors influence bicycle ownership, this study aims to fill this gap and contribute to an improved understanding of factors associated with bicycle ownership.

2.3. Literature review on bicycle use

Prior research on bicycle commuting provides evidence of the importance of individual factors, including socio-economic and attitudinal factors, social-environment factors, and physical-environment factors in the choice to bicycle commute. Some studies on cycling employ descriptive analyses to report bicycle commuting characteristics (e.g. Dickinson et al. 2003; Gatersleben and Appleton 2007); most studies reviewed here examine factors influencing bicycling in explanatory analyses (e.g. Plaut 2005; Dill and Carr 2003). Among the explanatory analyses, some studies use aggregate data, at the level of cities or zones (e.g. Nelson and Allen 1997; Baltes 1996; Parkin et al. 2008); others use disaggregate data, at the level of the individual (e.g. Shafizadeh and Neimeier 1997; Geus et al. 2008). Two recent studies use original surveys to examine the effect of bicycle experience and infrastructure on frequency of bicycle commuting (Stinson and Bhat 2004) and the link between the built environment and bicycling (Moudon et al. 2005). However, the list of variables tested in previous studies is relatively limited (as presented in Table 2.1). Below, we review findings from previous studies and discuss our hypotheses about additional factors that may affect bicycle commuting, some based on previous studies of travel behavior (other than bicycle commuting) and some based on our own conjecture.

2.3.1. Individual Factors

Individual factors are commonly examined in bicycle commuting studies. Many previous studies provide evidence of the impacts on bicycle commuting of socio-economic factors such as gender, income, age, home ownership, and number of cars owned by a household. However, the influences of some socio-demographic characteristics on bicycling are still uncertain: age and income, for example, are negatively associated with bicycle commuting in some studies but have a positive or no impact in others (see Table 1). We expect socio-demographic characteristics to be associated with bicycle commuting and will control for them when testing a more comprehensive set of explanatory variables.

Table 2.1 Summary of Bicycling Studies

Category	Definition	Impact on bike commuting	References
Individual factors			
Socio-demographics	Female	- - - - -	Goldsmith 1992; Williams and Larson 1996; Stinson and Bhat 2004; Wardman et al. 2007; Parkin et al. 2008
	Age	- - - 0	Goldsmith 1992; Plaut 2005; Wardman et al. 2007; Stinson and Bhat 2004
	Income	- - - +00	Plaut 2005; Wardman et al. 2007; Parkin et al. 2008; Shafizadeh and Niemeier 1997; Goldsmith 1992; Stinson and Bhat 2004;
	Home ownership	-	Plaut 2005
	Not White (Race)	- -	Plaut 2005; Parkin et al. 2008
	Car ownership	- - -	Plaut 2005; Stinson and Bhat 2004; Parkin et al. 2008
	Education	+	Plaut 2005
	Higher professional	-	Parkin et al. 2008
	Percent of college students	+	Nelson and Allen 1997
Attitude factors	External self-efficacy	+	Geus et al. 2008
	Ecological-economic awareness	+	Geus et al. 2008
Physical environment: Built environment			
Transportation Infrastructure	Miles of bicycle pathways per 100,000 residents	+	Nelson and Allen 1997
	The number of Class I: separate bike path or Class II: on street bike lanes per square mile	+	Dill and Carr 2003
	Proportion of off-road route	+	Parkin et al. 2008
	Average score of 3 items: cycling lanes are present in the neighborhood and in good condition, etc.	0	Geus et al. 2008
	The presence of bike racks or lockers	+	Stinson and Bhat 2004
	Average score of 5 items about facilities for cyclists at the workplace	+	Geus et al. 2008
	the availability of cycle facilities at the workplace	+	Geus et al. 2008
Safety	Dangerous traffic conditions	-	Deakin 1985

Category	Definition	Impact on bike commuting	References
	Average score of 2 items: the speed of motorized vehicle is mostly slow and streetlights are present	0	Geus et al. 2008
	Average score of 3 items about risk of accident with a motorized vehicle, busy streets, etc.	0	Geus et al. 2008
	Average score of 3 items: fearing for crime makes cycling not possible, etc.	0	Geus et al. 2008
	Transport demand intensity (employees divided by road length)	-	Parkin et al. 2008
Land Use Pattern	Population density	+	Parkin et al. 2008
	Distance to work place	- -	Stinson and Bhat 2004; Parkin et al. 2008
	Estimated time to go to work place by bicycle	0	Geus et al. 2008
	Estimated time to go to bus, tram or metro stop	0	Geus et al. 2008
Neighborhood Type	Urban residence or suburban residence	+	Stinson and Bhat 2004
	Whether the work location is in an urban area	+	Stinson and Bhat 2004
Physical environment: Natural environment			
	Hilliness	-	Parkin et al. 2008
	Temperature	+	Parkin et al. 2008
	Rainfall	-	Parkin et al. 2008
	Number days of rain	-	Nelson and Allen 1997
Social environment factors			
	Relatives give social support through cycling together	+	Geus et al. 2008
	Encouraging cycling	0	Geus et al. 2008
	Social influence on cycling	0	Geus et al. 2008
	Social norms related to cycling	0	Geus et al. 2008

- negative relationship; + positive relationship; 0 not significant

Attitudes reflect an individual's specific opinions, intentions, affections, and beliefs about something. Given the importance of attitudes in explaining driving behavior (e.g., Ory 2007), it seems likely that attitudes of various sorts influence bicycle commuting. However, few studies have examined this possibility. One recent study of bicycling for transport among a working population found that people who have external self-efficacy (as indicated by the willingness to cycle even if the weather is bad) are more likely to bicycle for transport (Geus et al. 2008). Ecological-economic awareness (agreement that cycling is cheaper, better for the environment, etc.) also correlated closely with bicycle commuting in this study. Gatersleben and Appleton (2007), using stated preference methods, found that people who like bicycling would bicycle commute under most circumstances. We hypothesize that multiple attitudes will influence bicycling, such as confidence in one's ability to engage in bicycling, safety concerns when bicycling, affection for bicycling, attitudes toward other modes, and attitudes toward the environment and physical exercise.

Another set of potentially important individual factors are constraints. Factors that may constrain the ability of commuters to bicycle to work include some related to the person, others to the job. We hypothesize that physical ability and health condition may constrain bicycling, though previous bicycling studies have not examined these factors. Another potential constraint, so far unstudied for bicycling, is the need to run errands on the way to or from work (e.g. drop children off at school or daycare, go to the gym). Ye et al. (2006) show that the determination of the trip chaining pattern precedes mode choice for work tours; we expect this relationship to hold for bicycling as well. Potential job constraints include the need to use the worker's own car to travel to different sites during the work day, to carry things to or from work (e.g. a briefcase, or construction equipment), or to dress professionally (e.g. in a suit and tie). We test the effect of these constraints in our analysis as well.

Previous studies of bicycle commuting have not explored the possibility of "self-selection" (Cao et al. 2009), defined in this case as the possibility that residents of a city choose to live there in part because of the supportive bicycling environment. Although it is reasonable to assume based on prior studies that a pro-bicycle environment leads to more bicycling, it is also possible that an individual's preference for bicycling leads him to choose to live in a community like Davis. In this case, the path of causality runs directly from preferences to bicycling behavior but also indirectly from preferences through pro-bicycle environment to bicycling behavior. Although we do not test for the indirect effect in this study, we expect to find a direct association between a preference for living in a bicycling-oriented community and bicycle commuting.

2.3.2. Physical Environment

Previous studies have identified various characteristics of the physical environment, including built (man-made) and natural features, associated with bicycle commuting. Several studies show an association at the city level between bicycle commuting and bicycle infrastructure, including miles of bicycle pathways per 100,000 residents, number of bicycle lanes per square mile, and proportion of separated bicycle paths (e.g. Nelson and Allen 1997; Dill and Carr 2003;

Parkin et al. 2008). In addition, the availability of bicycle facilities at the workplace is associated with bicycling (Geus et al. 2008; Stinson and Bhat 2004). Findings for traffic conditions are not consistent: dangerous traffic conditions were one of the determinants of non-bicycle commuting in one study (Deakin 1985). Similarly, larger traffic volumes measured as employees divided by road length were negatively associated with bicycling in a second study (Parkin et al. 2008). However, the effect of traffic conditions on bicycle commuting was insignificant in a third (Geus et al. 2008).

Studies have also found that land use patterns, measured by population density and accessibility to the workplace or transit, are associated with bicycling to work (Parkin et al. 2008; Stinson and Bhat 2004). However, Geus et al. (2008) found an insignificant influence of estimated bicycling time to the workplace, perhaps because the study was restricted to workers living within 10 kilometers of their workplace. Stinson and Bhat (2004) found that urban location is positively related to bicycling to work. Natural features such as hilliness and weather have also been found to significantly correlate with bicycling. Although previous studies show the importance of the physical environment, especially the built environment, for bicycle commuting, one study showed that the built environment has a less significant influence than individual factors in determining the travel behavior of commuters (Susilo and Maat 2007).

In our analysis, we examine the effect of distance to work, a function of land use patterns, as well as perceptions of the availability of safe routes to the work destination, which we expect to be a function of bicycle infrastructure and traffic conditions. We also expect the availability of bike racks and showers to influence bicycle commuting. In addition, we consider the impact of good transit service near the workplace, hypothesizing a possible synergistic effect between transit and bicycling. We also hypothesize that high parking cost near the workplace will encourage bicycle commuting.

2.3.3. Social Environment

Few studies have examined associations between the social environment and bicycle ownership and use, and the results have been mixed. Not surprisingly, bicycle theft is tied to bicycle ownership (Beck and Immers 1994), mostly likely through both the direct effect of having a bicycle stolen and the deterrent effect that theft has on purchasing another bicycle. Gues et al. (2007) examined the connection between attitudes and bicycle use, but found only one factor that seemed to matter: people with relatives who give social support through bicycling together were more likely to bicycle for transportation. Other aspects of the social environment, such as social support through encouraging cycling, social influence on cycling, and social norms related to transportation bicycling, tested in Geus et al. (2007), and social support for cycling in the neighborhood, as measured in Moudon et al. (2005), were not associated with regular bicycling. For bicycle commuting, we expect the social environment of the workplace to have an important influence. We define the social environment as including the attitudes and behaviors of co-workers at the workplace, specifically whether some co-workers bicycle to work, or whether co-workers are fitness-conscious. The attitudes of

employers towards bicycling may also contribute to the social environment. We examine whether these factors play an important role in explaining bicycling.

2.3.4. Endogeneities

The three categories of explanatory variables in the conceptual model are not necessarily independent. For example, social-environment and physical-environment factors may have a bi-directional link. A strong bicycling culture supports public investments in bicycling infrastructure; a high level of bicycling infrastructure attracts and encourages residents to bicycle, which in turn helps form the pattern of bicycling as a part of daily life in a community. While we recognize the importance of testing for these potential relationships, called endogeneities, the analysis presented below focuses on the direct relationships between the factors and bicycle commuting, rather that relationships between the factors. This analysis represents a first step towards more sophisticated modeling of the full conceptual model depicted in Figure 2-1.

2.4 Limitations

Although these studies provide important insights into factors influencing bicycle ownership and use, they have notable shortcomings. So far, studies have not fully examined the influences of the social environment on bicycling ownership and use. They have also not fully examined the role of individual attitudes and preferences. Of particular interest is the potential role of residential preferences: does a preference for bicycling lead individuals to choose a bicycling friendly community when deciding where to live? If so, then an observed association between the built environment and bicycling is driven at least in part by residential preferences rather than the environment itself. This possibility, called the "self-selection effect," has been documented in studies of walking as well as travel behavior more generally (Cao, et al. 2009). Furthermore, most studies have looked at bicycle ownership and/or bicycle use separately, without considering the possibility of a simultaneous or sequential ordering of decisions. To our knowledge, ours is the first empirical study to address each of these issues.

It is also important to note that because these studies use cross-sectional designs, they establish associations between these factors and bicycle ownership and use, but they do not on their own establish the existence of a causal relationship. For example, an association between bicycle infrastructure and share of bicycle commuters at the city level (Dill and Carr 2003) could mean that infrastructure encourages bicycling or that bicycling encourages investments in infrastructure or some combination of both. Establishing causality requires more sophisticated research designs, ideally quasi-experimental studies that evaluate changes in bicycle ownership and use from before to after the opening of a new bicycle facility or some other type of "intervention" designed to increase bicycling. Unfortunately, rigorous studies of bicycle interventions are rare (Pucher, et al. 2010), and they are difficult to carry out in practice (Krizek, et al. 2009). Cross-sectional studies provide important guidance as to the most promising factors to target in designing interventions: all else equal, changes in factors with strong

associations with bicycle use are more likely to lead to changes in bicycle use than are factors with weak associations with bicycle use (of course, other considerations also come into play, such as the cost and ease of changing the targeted factor). Cross-sectional studies, like ours, are thus an important step towards the design of effective strategies for increasing bicycling ownership and use.

3. Methodology

This study employs a cross-sectional research design to determine the relative influence of individual, physical-environment, and social-environment factors both on bicycle ownership and use and on bicycle commuting. The unit of analysis for the study is the individual. The sample is made up of residents of Davis, Boulder and Eugene, three relatively bike-friendly college towns, and three comparison communities that differ with respect to their physical and social environments. This approach enables an assessment of the direct relationships between these variables and bicycle ownership and use or bicycle commuting.

3.1 Selection of cities

Six communities were selected for the study based on several factors. Davis, CA, with a high bicycling level, was selected as a starting point. Davis has a fairly high level of bicycling infrastructure, a strong bicycling culture, and a public university. We then looked for comparison cities in California that were similar with respect to size, weather, topography, and presence of a college or university but differed with respect to bicycle infrastructure and culture. No communities perfectly fit our criteria. Chosen as comparison communities were Woodland, just 10 miles to the north of Davis, Chico, about two hours north of Davis, and Turlock, a few hours to the south. Woodland has a fairly high level of bicycling infrastructure, a weak bicycling culture and does not have a public university. Chico has a low level of bicycling infrastructure, a fairly strong bicycling culture and a large public university. Turlock has a low level of bicycling infrastructure, a weak bicycling culture and does not have a public university. In addition, we included Eugene, OR and Boulder, CO as comparison cities. Both cities have extensive bicycle infrastructure and enjoy reputations as bicycling communities nearly equal to Davis' reputation. This set of cities ensures reasonable comparability with respect to control variables but ample variation with respect to key explanatory variables. Individual-level variations will be accounted for in the analyses.

3.2 Survey

The survey was developed based on the conceptual framework, the literature review, prior surveys of travel behavior, focus groups with residents of Davis, and discussions among the research team. Several drafts of the survey were developed and tested with convenience samples. The survey included several different sections, including use of bicycles and other modes, perceptions of bicycle infrastructure, perceptions of bicycle culture, attitudes towards travel modes, bicycle commuting, bicycling in youth, and socio-demographics. The final survey was programmed in Survey Monkey, an on-line survey service. The survey instrument is included in Appendix B.

For each of the six communities, we purchased a random sample of 1500 residents from Martin Worldwide, a commercial provider; for Davis, we ordered an additional sample of 1000

residents who had relocated to Davis in the past year. Participants were recruited for the on-line survey by mail in June 2006, with two reminder postcards mailed in July and August. As an enticement for participation, respondents could choose to be entered into a drawing for one of three $100 prizes.

Of the original 10,000 addresses, over 2000 proved to be incorrect, as evidenced by the return of the letter to UC Davis. After accounting for these bad addresses, we achieved a response rate of over 10% in every city except Turlock, where the response rate was just 7.2%, with a high of 18.8 % in Davis. The overall response rate for the survey was 12.6 %, for a sample size of 965.

3.2.1 Respondent characteristics vs. Census data

The final survey database contained 965 respondents and 354 variables. The sample characteristics from the survey are shown in Table 3.1. The p-value in the table tells whether the percent or the mean of the characteristic is significantly different between the six cities at a 95% significance level.

Table 3.1 Characteristics of Cities- Results from Survey

Sample Characteristics	Davis	Chico	Woodland	Turlock	Eugene, OR	Boulder, CO	p-value
Number	354	135	125	92	130	129	
Percent female	46.6%	41.7%	43.2%	43.8%	43.3%	40.7%	0.880
Age:							0.287
20-34	21.6%	15.9%	12.6%	19.4%	22.2%	25.4%	
35-64	64.2%	61.9%	68.5%	67.0%	65.1%	60.7%	
65 years and over	15.2%	22.2%	18.9%	13.6%	12.7%	13.9%	
High school or greater education	99.4%	99.2%	98.2%	98.9%	99.2%	99.2%	0.919
BS/BA or greater education	88.6%	60.2%	53.6%	48.3%	56.3%	84.4%	0.000
Percent of HHs owning a car	96.9%	98.5%	95.9%	100.0%	93.8%	95.3%	0.117
Average HH size	2.5	2.3	2.3	2.7	2.3	2.4	0.071
Percent of HHs w/ kids (<18)	31.7%	23.0%	26.8%	36.4%	24.4%	23.0%	0.098
Percent home owners	74.9%	74.8%	84.1%	75.3%	66.9%	79.5%	0.057
Median HH income	$80,174	$59,412	$68,585	$65,116	$56,371	$80,342	0.000
Percent biking to work	25.8%	10.6%	5.7%	0.0%	14.8%	17.3%	0.000

Socio-demographic characteristics were obtained from the 2000 Census and are shown in Table 3.2.

Table 3.2 Characteristics of Cities- 2000 Census

	Davis	Chico	Woodland	Turlock	Eugene	Boulder
Population	60,341	59,444	49,132	55,488	137,999	94,510
Percent female	52.3%	50.9%	51.0%	51.9%	51.0%	48.4%
Age 20-34 years	51.5%	49.0%	31.5%	33.7%	36.8%	48.8%
Age 35-64 years	39.5%	37.3%	52.9%	48.6%	47.1%	41.2%
Age 65 years and over	9.1%	13.7%	15.6%	17.7%	16.1%	10.1%
High school or greater education	96.4%	87.3%	73.0%	70.4%	91.5%	94.7%
BS/BA or greater education	68.6%	33.6%	18.0%	19.1%	37.3%	66.9%
Percent of HHs owning a car	93.4%	97.8%	92.0%	98.9%	95.5%	96.8%
Average HH size	2.5	2.42	2.89	2.92	2.27	2.2
Percent of HHs w/ kids (<18)	27.5%	28.9%	44.2%	43.7%	27.5%	21.0%
Percent home owners	43.7%	39.6%	57.6%	54.7%	49.8%	48.4%
Median HH income	$42,454	$29,359	$44,449	$39,050	$35,850	$44,748
Percent biking to work	14.4%	5.2%	2.0%	1.1%	5.5%	6.9%

Source: 2000 U.S. Census

Survey respondent characteristics were then compared to the 2000 Census population data using a one-sided t-test (Table 3.3). The test shows a statistical difference between survey sample characteristics and 2000 Census population data for percent of home owners, median house hold income, education level and percent biking to work.

Table 3.3 One-sided t-test

	p-values					
	Davis	Chico	Woodland	Turlock	Eugene, OR	Boulder, CO
Percent female	0.04	0.04	0.11	0.13	0.08	0.08
High School or greater education	0	0	0	0	0	0
BS/BA or greater education	0	0	0	0	0	0
Percent of HHs owning a car	0	0.01	0		0.44	0.43
Average HH size	0.83	0.11	0	0.12	0.89	0.12
Percent of HHs w/ kids (<18)	0.11	0.12	0	0.16	0.42	0.61
Percent home owners	0	0	0	0	0	0
Median HH income	0	0	0	0	0	0
Percent biking to work	0	0.047	0.08		0.004	0.002

Although we designed the survey to be relevant to all individuals, not just bicyclists, it is possible that individuals who do not bicycle were less inclined to complete the survey. Because our survey had the added barrier of being online, non-response bias is a serious concern, although the overall response rate is not unusually low for general population self-administered paper surveys (Babbie 1998). In fact, the survey results show that 25.8% of Davis respondents usually commute to work by bicycle, in comparison to 14% in the 2000 Census; the survey share was higher than the census share for all cities except Turlock (Table 3.4). Response rates were the highest in Davis, with the highest bicycling level, and the lowest in Turlock, where bicycling rates were the lowest. The correlation between response rates and bicycling levels suggests that the nature of the non-response bias is similar across all cities. Further, because the focus of our study is on explaining bicycling behavior as a function of other variables rather than on describing the simple univariate distribution of bicycling per se, these differences are not expected to materially affect the results (Babbie 1998).

Table 3.4 Bicycling Levels: Census (2000) vs. Online Survey (2006)

	Davis	Chico	Woodland	Turlock	Eugene	Boulder
Census						
Share usually biking to work	14.4%	5.2%	2.0%	1.1%	5.5%	6.9%
Survey						
Share usually biking to work	25.8%	10.6%	5.7%	0.0%	14.8%	17.3%
Share bicycle ownership	78.0%	67.4%	55.3%	60.9%	72.3%	80.5%
Number of respondents	354	135	125	92	130	129
Response rate	18.8%	11.7%	10.2%	7.2%	12.1%	12.2%

To evaluate the non-response bias further, a short phone survey was conducted in May 2008 in Davis only (owing to budget limitations that prohibited a direct assessment of non-response bias across all the cities). Random-digit dialing was used to achieve a representative sample of 400 residents. Although the data collected from the phone survey, which can be viewed as a simple random sample of the population, show slightly lower bicycling levels (measured in various ways) than did the online survey conducted in the year 2006 (Table 3.5), the chi-square tests indicate that all the shares in Table 3.5 in the online survey are not significantly different from those in the phone survey at the 95% significance level (all the p-values are greater than 0.05), implying that the non-response bias of the data from the online survey is not as serious as Table 2 suggests. Note that the phone survey also measured significantly higher levels of bicycling to work than the 2000 Census. It seems unlikely that bicycle commuting has increased by 85% in the last eight years, but it is possible that the differences in the shares measured are partially attributable to differences in the wording of the question (e.g. usual mode of work "last week" as asked in the Census, versus "in a typical week with good weather" in the survey).

Table 3.5 Davis Bicycling Level: Phone Survey (2008) vs. Online Survey (2006)

	Phone Survey	Online Survey	Chi-Square Test p-values
Share bicycle ownership	76.3%	78.0%	0.576
Share biking in last 7 days	47.0%	53.0%	0.101
Share biking within last year	72.5%	74.1%	0.630
Share biking to work	26.6%	25.8%	0.785
Number of respondents	400	354	

3.2.2 Variables from survey

The survey variables can be categorized into four general groups; Appendix A describes the specific variables from each group.

1) Dependent variable—measurements of biking
This group includes various measures of bicycling, including bicycle ownership, the number of days biked in the previous week, how long ago the last bike ride was, miles biked in a typical week, bike to usual activity destinations, share of bicycling by purpose, and bicycle commuting.

2) Individual factors
The variables in this group include perceived comfort of bicycling on different types of facilities, perceived safety of biking to usual destinations, biking accident experiences, attitudes toward physical exercise, factors that affect mode choice, mode preferences, and socio-demographic variables such as income, education level, and gender.

3) Social environment factors
This group includes variables that reflect bicycle culture in the cities, including perceptions of other bicyclists and community attitudes towards bicyclists.

4) Physical environment factors
This category includes physical characteristics of the environment that can affect bicycling, including the distance from home to the usual activity destinations and perceptions of bicycling infrastructure.

4. Comparative Results

This section presents comparative results for bicycling and the individual, physical environment and social environment factors that may relate to bicycling. First, we compare Davis to the three other California cities: Turlock, Chico and Woodland. Second, we compare Davis to two other biking College Towns: Boulder, Colorado and Eugene, Oregon.

4.1 Davis vs. California Cities

An analysis of the survey variables from each of the four groups was performed for the four California cities: Davis, Chico, Woodland and Turlock. Davis was compared to the three other cities.

4.1.1 Bicycling levels, by city

Bicycling in Davis is significantly higher than Chico, Woodland and Turlock.

Table 4.1 Bicycling by City - California Cities

Bicycling Levels	Davis	Chico	Woodland	Turlock	p-value across all cities	p-value Davis vs. others
Percent biking in last 7 days	53.0%	37.3%	20.2%	12.0%	0.000	0.000
Average number of days biked	1.99	1.27	0.56	0.27	0.000	0.000
Percent biking within last year	72.6%	63.6%	41.9%	45.6%	0.000	0.000

4.1.2 Individual factors, by city

- *Bicycling comfort*

Table 4.2 shows respondents' level of comfort biking on different facility types across the four California cities. Respondents in each city have significantly different perceptions of comfort on all of the facilities except a four-lane street without bike lane. A significantly greater percent of respondents in Davis feel comfortable when biking on these same facilities compared to respondents in the other cities. This perception of comfort is significantly different between the cities of Davis, Chico, Woodland and Turlock.

Table 4.3 shows the bicycling safety concerns between the four cities. Bicycling safety concerns are significantly different between the cities. The higher percent of "being hit by another bike" in Davis may reflect more biking in this city than others. The lower percent of respondents being very concerned about "being hit by a car" in Davis is consistent with a better social

environment for bicyclists. The percent of respondents who are concerned about "being bitten by a dog," "being mugged or attacked," and "crashing because of road hazards" when bicycling is significantly greater in Turlock than in the other cities. This indicates that Turlock is not safe for biking and the street conditions are not good. With the exception of "being hit by another bike," the percent concerned about events happening when biking is smallest in Davis. This implies that Davis residents perceive a safer biking environment than the three other cities.

Table 4.2 Percent Comfortable Biking on Different Facility Types by City - California Cities

	Davis	Chico	Woodland	Turlock	p-value across all cities	p-value Davis vs. others
Off-street bicycle path	93.9%	80.9%	72.3%	72.2%	0.000	0.000
Quiet residential street	97.4%	90.7%	91.5%	87.9%	0.000	0.000
Two-lane local street with bike lane	89.8%	77.3%	74.4%	69.2%	0.003	0.000
Two-lane local street without bike lane	21.2%	15.3%	7.6%	6.7%	0.000	0.000
Four-lane street with bike lane	66.3%	61.1%	54.2%	52.7%	0.025	0.006
Four-lane street without bike lane	9.9%	8.4%	7.6%	10.0%	0.453	0.835

Table 4.3 Level of Concern About Events Happening by City - California Cities

	Davis	Chico	Woodland	Turlock	p-value across all cities	p-value Davis vs. others
Being hit by a car…					0.000	0.000
Not concerned	17.9%	9.2%	11.9%	8.9%		
Somewhat concerned	60.1%	48.5%	55.1%	44.4%		
Very concerned	22.0%	42.3%	33.1%	46.7%		
Being hit by another bike…					0.000	0.000
Not concerned	54.2%	64.9%	80.5%	82.2%		
Somewhat concerned	36.4%	28.2%	14.4%	14.4%		
Very concerned	9.3%	6.9%	5.1%	3.3%		
Being bitten by a dog…					0.000	0.000
Not concerned	71.4%	38.5%	44.9%	21.1%		
Somewhat concerned	24.3%	46.9%	46.6%	45.6%		
Very concerned	4.3%	14.6%	8.5%	33.3%		
Being mugged or attacked…					0.000	0.000
Not concerned	74.5%	55.4%	59.8%	47.8%		
Somewhat concerned	21.7%	34.6%	32.5%	35.6%		
Very concerned	3.8%	10.0%	7.7%	16.7%		
Crashing because of road hazards…					0.000	0.000
Not concerned	39.8%	35.9%	24.6%	21.1%		
Somewhat concerned	51.2%	45.8%	64.4%	52.2%		
Very concerned	9.0%	18.3%	11.0%	26.7%		

People in Davis have experienced more injuries and accidents while biking than the other cities (Table 4.4). This can not be explained by a more dangerous biking environment in Davis as our results above show that people in Davis are more comfortable on bicycle facilities and have a lower level of bicycling related safety concerns than those from the other cities. An alternative reason may be that the higher bicycling level leads to more injuries and accidents.

Table 4.4 Injuries and Accidents While Biking in City by City - California Cities

	Davis	Chico	Woodland	Turlock	p-value across all cities	p-value Davis vs. others
Ever injured while biking…					0.000	0.000
No	60.1%	70.5%	84.7%	72.5%		
Yes	39.9%	29.5%	15.3%	27.5%		
Ever been in collision with car while biking…					0.274	0.404
No	92.2%	90.9%	96.6%	94.4%		
Yes	7.8%	9.1%	3.4%	5.6%		

Table 4.5 shows that there are significantly different perceptions of comfort when biking to the selected usual destinations between the four cities. The perceived comfort levels in Davis are higher than those in the other cities across all selected destinations. This finding, while consistent with the higher level of comfort bicycling seen earlier, might also be an indicator of a safer bicycling environment in Davis.

Table 4.5 Level of Comfort Biking to Selected Destinations by City - California Cities

	Davis	Chico	Woodland	Turlock	p-value across all cities	p-value Davis vs. others
To usual grocery store…					0.000	0.000
Comfortable	76.1%	51.5%	45.8%	42.9%		
Not comfortable but would bike there anyway	8.9%	14.4%	14.4%	19.8%		
Not comfortable and would not bike there	15.0%	34.1%	39.8%	37.4%		
To nearest post office…					0.000	0.000
Comfortable	72.8%	48.5%	41.5%	42.9%		
Not comfortable but would bike there anyway	12.8%	19.7%	22.0%	19.8%		
Not comfortable and would not bike there	14.5%	31.8%	36.4%	37.4%		
To local elementary school…					0.000	0.000
Comfortable	89.2%	60.9%	69.8%	61.5%		
Not comfortable but would bike there anyway	4.4%	11.7%	12.9%	13.2%		
Not comfortable and would not bike there	6.4%	27.3%	17.2%	25.3%		

Table 4.5 Level of Comfort Biking to Selected Destinations by City - California Cities

	Davis	Chico	Woodland	Turlock	p-value across all cities	p-value Davis vs. others
To restaurant you like…					0.000	0.000
Comfortable	68.8%	46.6%	36.4%	38.5%		
Not comfortable but would bike there anyway	12.4%	17.6%	17.8%	16.5%		
Not comfortable and would not bike there	18.8%	35.9%	45.8%	45.1%		
To nearest bike shop…					0.000	0.000
Comfortable	73.0%	48.1%	44.8%	46.2%		
Not comfortable but would bike there anyway	13.7%	23.3%	15.5%	19.8%		
Not comfortable and would not bike there	13.4%	28.7%	39.7%	34.1%		

- *Bicycling and driving preferences*

Bicycling preferences are significantly different between these cities. The percent of respondents who agree or strongly agree with "like riding a bike" is significantly greater for Davis than the other cities. The percent of respondents who choose to live in a community because of good bike infrastructure is significantly higher in Davis than in the other cities. Consistently, the percent of respondents who like to drive in Davis is smaller than in the other cities, although the percent of respondents who try to limit driving is not statistically different between these cities.

Table 4.6 Bicycling and Driving Preferences by City - California Cities

	Davis	Chico	Woodland	Turlock	p-value across all cities	p-value Davis vs. others
Like riding a bike					0.005	0.003
Strongly disagree or disagree	9.2%	13.0%	20.5%	12.2%		
Neutral	13.8%	19.8%	14.5%	24.4%		
Agree or strongly agree	76.9%	67.2%	65.0%	63.3%		
Prefer to ride a bike rather than drive whenever possible					0.000	0.000
Strongly disagree or disagree	40.8%	58.0%	59.8%	67.8%		
Neutral	21.7%	25.2%	20.5%	21.1%		
Agree or strongly agree	37.6%	16.8%	19.7%	11.1%		
Like driving					0.001	0.000
Strongly disagree or disagree	18.5%	8.3%	8.8%	12.4%		
Neutral	24.6%	18.9%	14.0%	18.0%		
Agree or strongly agree	56.9%	72.7%	77.2%	69.7%		

Table 4.6 Bicycling and Driving Preferences by City - California Cities

	Davis	Chico	Woodland	Turlock	p-value across all cities	p-value Davis vs. others
Try to limit driving as much as possible					0.565	0.245
Strongly disagree or disagree	20.7%	26.5%	23.3%	29.2%		
Neutral	22.5%	22.7%	19.0%	18.0%		
Agree or strongly agree	56.8%	50.8%	57.8%	52.8%		
"Good for bicycling" is very important when choosing where to live	35.7%	20.2%	9.8%	6.8%	0.000	0.000

- *Environmental attitudes*

The percent of respondents who prefer stricter environmental laws and regulations is higher in Davis than in the other cities, as is the percent of respondents who limit driving to help improve air quality (Table 4.7). However, there is no significant difference in the share of respondents who say that considering environmental benefits is important when choosing transportation modes.

Table 4.7 Environmental Attitudes by City – California Cities

	Davis	Chico	Woodland	Turlock	p-value across all cities	p-value Davis vs. others
Prefer stricter environmental laws and regulations	85.0%	66.1%	66.4%	61.4%	0.000	0.000
Environmental benefit is an important or extremely important factor affecting mode choice	49.1%	44.3%	48.7%	48.9%	0.812	0.586
Limit driving to help improve air quality					0.061	0.018
Disagree or strongly disagree	19.5%	30.8%	23.1%	28.9%		
Neutral	26.7%	28.5%	25.6%	31.1%		
Agree or strongly agree	53.7%	40.8%	51.3%	40.0%		

- *Physical activity orientation*

Respondents in the four cities are equally likely to report that "it is important to get regular physical exercise," "I enjoy physical exercise," and that physical fitness is important when choosing modes (Table 4.8). The percent of respondents reporting good health is significantly higher in Davis than the other cities. One reason may be that the respondents are younger in Davis than other cities (Chico and Woodland). On the other hand, the mean age of respondents in Turlock is similar to that in Davis, yet the percent of respondents reporting good

health in Davis is significantly higher. Another possible reason for the difference in good health may be sampling bias: bicyclists are often in good health and may also be more likely to respond to a survey about bicycling.

Table 4.8 Physical Activity Orientation by City – California Cities

	Davis	Chico	Woodland	Turlock	p-value across all cities	p-value Davis vs. others
It is important to get regular physical exercise					0.131	0.256
Strongly disagree or disagree	4.0%	4.5%	1.7%	2.2%		
Neutral	1.7%	4.5%	0.8%	5.6%		
Agree or strongly agree	94.3%	90.9%	97.5%	92.2%		
Enjoy physical exercise					0.317	0.270
Strongly disagree or disagree	10.4%	9.1%	8.5%	7.8%		
Neutral	13.3%	20.5%	11.9%	20.0%		
Agree or strongly agree	76.4%	70.5%	79.7%	72.2%		
I am in good health					0.078	0.017
Strongly disagree or disagree	9.0%	12.1%	7.6%	8.9%		
Neutral	11.0%	15.2%	20.3%	21.1%		
Agree or strongly agree	80.0%	72.7%	72.0%	70.0%		
Physical fitness important when choosing modes	45.1%	50.8%	50.0%	43.3%	0.543	0.370

- *Socio-demographics*

Socio–demographic comparisons show that respondents in Davis and Turlock are significantly younger than those in the other two cities. Comparisons also show that education and income levels are different between these cities: respondents in Davis have much higher education and income levels.

Table 4.9 Socio-demographics by City – California Cities

	Davis	Chico	Woodland	Turlock	p-value across all cities	p-value Davis vs. others
Age (mean)	48.5	52.5	52.3	48.4	0.018	0.018
Gender (percent female)	46.6%	41.7%	43.2%	43.8%	0.790	0.186
BS/BA or greater education	88.6%	60.2%	53.6%	48.3%	0.000	0.000
Household size (mean)	2.5	2.3	2.3	2.7	0.048	0.384
Income (mean)	$80,174.1	$59,411.8	$68,584.9	$65,116.3	0.000	0.000
Physical/Mental Disability						
Limit drive	0.9%	1.6%	0.9%	3.4%	0.332	0.305
Limit bike	9.6%	13.4%	8.1%	15.7%	0.224	0.286

4.1.3 Physical environment factors, by city

- *Bicycle infrastructure*

Perceptions of bicycle infrastructure are significantly different between these cities, with Davis respondents reporting better infrastructure than in other cities (Table 4.10). Respondents in these cities equally disagree that "the area is too hilly for easy bicycling," not surprising given the flat terrain of the Central Valley where these cities are located.

Although Woodland has relatively high miles of bike lanes and paths per capita, the perception of the level of bicycle infrastructure in Woodland is not significantly higher than in Chico or Turlock. Woodland respondents are least likely to report that "the city has a network of off-street bike paths" and "bike lanes are free of obstacles."

Table 4.10 Bicycle Infrastructure by City – California Cities

Agree or Strongly Agree that…	Davis	Chico	Woodland	Turlock	p-value across all cities	p-value Davis vs. others
Major streets have bike lanes	90.6%	47.0%	49.6%	51.1%	0.000	0.000
Streets without bike lanes are wide enough to bike on	72.1%	38.9%	43.4%	44.2%	0.000	0.000
Stores and other destinations have bike racks	80.8%	56.6%	39.4%	30.9%	0.000	0.000
Streets and bike paths are well lit	67.5%	43.9%	39.3%	33.8%	0.000	0.000
Intersections have push-buttons or sensors for bicyclists or pedestrians	83.3%	76.9%	69.2%	69.8%	0.002	0.001
The city has a network of off-street bike paths	85.2%	57.4%	9.6%	14.9%	0.000	0.000
Bike lanes are free of obstacles	73.3%	68.7%	41.2%	47.9%	0.000	0.000
The bike route network has big gaps	17.5%	38.5%	65.3%	61.4%	0.000	0.000
The area is too hilly for easy bicycling	1.8%	1.6%	3.4%	2.4%	0.713	0.551

- *Destination distances*

Perceived distances to destinations, reflecting the land-use mix with each city, differs somewhat between the cities (Table 4.11). Significant differences were found for distances from home to the respondent's usual grocery store, nearest post office, and a bike repair shop; distances to a favorite restaurant and to the respondent's workplace did not differ. Davis respondents report being closer to their usual grocery store than respondents in other cities, but otherwise distances in Davis are similar to those in other cities.

Table 4.11 Distance to Destinations by City – California Cities

	Davis	Chico	Woodland	Turlock	p-value across all cities	p-value Davis vs. others
Distance from home to usual grocery store					0.000	0.001
Less than 2 miles	75.4%	55.6%	70.0%	65.9%		
More than 2 miles	24.6%	44.4%	30.0%	34.1%		
Distance from home to nearest post office					0.001	0.088
less than 2 miles	58.9%	38.5%	62.9%	52.8%		
More than 2 miles	39.1%	60.0%	36.3%	43.8%		
Don't know	2.0%	1.5%	0.8%	3.4%		
Distance from home to favorite restaurant					0.356	0.151
Less than 2 miles	52.7%	45.1%	49.2%	51.6%		
More than 2 miles	43.6%	52.6%	47.6%	48.4%		
Don't know	3.7%	2.3%	3.2%	0.0%		
Distance from home to a bike repair shop					0.003	0.001
Less than 2 miles	39.9%	30.4%	33.6%	41.6%		
More than 2 miles	44.8%	43.7%	39.3%	29.2%		
Don't know	15.3%	25.9%	27.0%	29.2%		
Distance from home to workplace					0.268	0.600
Less than 2 miles	24.1%	15.8%	28.1%	20.9%		
More than 2 miles	54.3%	55.6%	51.2%	57.1%		
Don't know	21.6%	28.6%	20.7%	22.0%		
Distance from home to the local elementary school					0.077	0.163
Less than 2 miles	53.8%	47.8%	46.3%	58.9%		
More than 2 miles	6.5%	10.4%	8.3%	13.3%		
Don't know	39.7%	41.8%	45.5%	27.8%		

4.1.4 Social environment factors, by city

Drivers' behaviors toward bicyclists, reflecting the social environment for bicycling, are more positive in Davis than in other cities (Table 4.12). Davis respondents are more likely to report that drive are not oblivious to bicyclists and that they yield to bicyclists and watch for them at intersections. Respondents in the four cities equally agree that "most people drive faster than the speed limit."

Perceptions of bicyclists are significantly different between the cities (Table 4.12). A higher percent of respondents in Davis think that bicycling is a normal mode of transportation, while a higher share of respondents in Turlock and Woodland perceive that it is rare for people to bike to get groceries. An especially high percent of respondents in Turlock think that bicyclists look like they are too poor to own a car. Davis residents are less likely to agree that bicyclists have a disregard for their personal safety.

Table 4.12 Drivers' Behaviors toward Bicyclists by City – California Cities

	Davis	Chico	Woodland	Turlock	p-value across all cities	p-value Davis vs. others
Most drivers seem oblivious to bicyclists					0.000	0.000
Strongly disagree or disagree	62.2%	40.3%	33.6%	23.1%		
Neutral	22.3%	32.8%	28.7%	29.7%		
Agree or strongly agree	15.5%	26.9%	37.7%	47.3%		
Most drivers yield to bicyclists					0.000	0.000
Strongly disagree or disagree	14.1%	24.1%	18.9%	43.2%		
Neutral	23.3%	26.3%	32.0%	21.6%		
Agree or strongly agree	62.6%	49.6%	49.2%	35.2%		
Most drivers watch for bicyclists at intersections					0.000	0.000
Strongly disagree or disagree	16.9%	23.9%	29.5%	47.8%		
Neutral	26.1%	30.6%	34.4%	23.3%		
Agree or strongly agree	57.0%	45.5%	36.1%	28.9%		
Most people drive faster than the speed limit					0.210	0.223
Strongly disagree or disagree	6.9%	3.7%	4.1%	9.9%		
Neutral	13.7%	10.4%	12.3%	6.6%		
Agree or strongly agree	79.4%	85.8%	83.6%	83.5%		

Table 4.13 Perceptions of Bicyclists by City – California Cities

	Davis	Chico	Woodland	Turlock	p-value across all cities	p-value Davis vs. others
Bicyclists spend a lot of money on their bikes					0.005	0.012
Strongly disagree or disagree	45.7%	36.3%	36.6%	29.7%		
Neutral	41.7%	43.0%	50.4%	60.4%		
Agree or strongly agree	12.6%	20.7%	13.0%	9.9%		
People rarely bike to groceries					0.000	0.000
Strongly disagree or disagree	36.2%	20.7%	9.8%	7.7%		
Neutral	16.4%	14.1%	10.7%	11.0%		
Agree or strongly agree	47.4%	65.2%	79.5%	81.3%		
Bicycling is a normal mode for adults in this community					0.000	0.000
Strongly disagree or disagree	27.8%	52.2%	83.6%	89.0%		
Neutral	20.1%	21.6%	9.0%	5.5%		
Agree or strongly agree	52.1%	26.1%	7.4%	5.5%		
Bicyclists are too poor to own a car					0.000	0.000
Strongly disagree or disagree	89.7%	74.1%	63.4%	40.7%		
Neutral	9.5%	22.2%	18.7%	26.4%		
Agree or strongly agree	0.9%	3.7%	17.9%	33.0%		
Kids often ride bikes for fun					0.735	0.745
Strongly disagree or disagree	19.0%	20.1%	17.9%	24.2%		
Neutral	18.7%	14.2%	17.1%	19.8%		
Agree or strongly agree	62.4%	65.7%	65.0%	56.0%		
Bicyclists have little regard for personal safety					0.001	0.000
Strongly disagree or disagree	47.0%	30.6%	37.4%	30.8%		
Neutral	25.2%	23.1%	22.8%	28.6%		
Agree or strongly agree	27.8%	46.3%	39.8%	40.7%		
Bicycle has ever been stolen					0.839	0.662
Not	73.6%	67.9%	75.5%	70.0%		
Once	17.1%	23.5%	18.4%	17.5%		
More than once	9.3%	8.6%	6.1%	12.5%		

4.2 Davis vs. Biking Cities

This section compares the city of Davis to two other similar cities in terms of bicycling infrastructure and culture: Eugene, Oregon and Boulder, Colorado. All three cities are home to major state universities and are widely considered to be "college towns."

4.2.1 Bicycling levels, by city

Levels of bicycling in Davis are significantly higher than in Eugene but comparable to those in Boulder (Table 4.14).

Table 4.14 Bicycling Level by City – Biking Cities

	Davis	Eugene	Boulder	p-value across all cities	p-value Davis vs. Eugene	p-value Davis vs. Boulder
Percent biking in last 7 days	53.0%	37.7%	50.0%	0.011	0.003	0.564
Average number of days biked	1.99	1.34	1.74	0.025	0.008	0.312
Percent biking within last year	72.6%	66.2%	69.3%	0.364	0.166	0.476

4.2.2 Individual factors, by city

- *Bicycling comfort*

Respondents' level of comfort bicycling on all facility types is not distinguishable across the three cities (Table 4.15). Levels of concern over potential events does differ, however (Table 4.16). The lower percent of respondents being somewhat or very concerned with "being hit by a car" in Davis suggests a better social environment for bicyclists. The higher percent of concern regarding "being hit by another bike" in Davis and Boulder may reflect the higher level of bicycling in these two cities. The lack of statistical difference in level of concern about crashing because of road hazards when bicycling in the three cities suggests that the street conditions are similar in these cities.

Table 4.15 Percent Comfortable Biking on Different Facility Types by City - Biking Cities

	Davis	Eugene	Boulder	p-value across all cities	p-value Davis vs. Eugene	p-value Davis vs. Boulder
Off-street bicycle path	93.9%	90.8%	94.5%	0.497	0.293	0.536
Quiet residential street	97.4%	96.9%	95.3%	0.337	0.167	0.440
Two-lane local street with bike lane	89.8%	83.8%	84.3%	0.142	0.109	0.066
Two-lane local street without bike lane	21.2%	19.4%	19.7%	0.834	0.906	0.528
Four-lane street with bike lane	66.3%	57.7%	53.2%	0.072	0.211	0.022
Four-lane street without bike lane	9.9%	7.7%	6.3%	0.196	0.430	0.064

Table 4.16 Level of Concern About Events Happening by City – Biking Cities

	Davis	Eugene	Boulder	p-value across all cities	p-value Davis vs. Eugene	p-value Davis vs. Boulder
Being hit by a car…				0.003	0.011	0.011
Not concerned	17.9%	6.9%	7.8%			
Somewhat concerned	60.1%	67.7%	61.7%			
Very concerned	22.0%	25.4%	30.5%			
Being hit by another bike…				0.047	0.013	0.761
Not concerned	54.2%	60.0%	57.0%			
Somewhat concerned	36.4%	38.5%	32.8%			
Very concerned	9.3%	1.5%	10.2%			
Being bitten by a dog…				0.049	0.216	0.129
Not concerned	71.4%	63.1%	79.7%			
Somewhat concerned	24.3%	31.5%	15.6%			
Very concerned	4.3%	5.4%	4.7%			
Being mugged or attacked…				0.000	0.007	0.017
Not concerned	74.5%	62.8%	86.7%			
Somewhat concerned	21.7%	27.1%	11.7%			
Very concerned	3.8%	10.1%	1.6%			
Crashing because of road hazards…				0.101	0.307	0.121
Not concerned	39.8%	35.4%	32.8%			
Somewhat concerned	51.2%	58.5%	52.3%			
Very concerned	9.0%	6.2%	14.8%			

The incidence of injuries and accidents differs, with a higher share of Davis residents reporting that they have been injured while biking at some time (Table 4.17). This may reflect the higher level of bicycling in Davis. On the other hand, the incidence of collisions with cars while bicycling does not differ across the three cities.

Table 4.17 Injuries and Accidents While Biking in City by City – Biking Cities

	Davis	Eugene	Boulder	p-value across all cities	p-value Davis vs. Eugene	p-value Davis vs. Boulder
Ever injured while biking…				0.002	0.005	0.005
No	60.1%	73.8%	74.0%			
Yes	39.9%	26.2%	26.0%			
Ever been in collision with car while biking…				0.623	0.813	0.395
No	92.2%	91.5%	94.5%			
Yes	7.8%	8.5%	5.5%			

Comfort biking to selected destinations differs across cities: Davis and Eugene respondents are similarly comfortable and, for the most part, more comfortable than Boulder respondents (Table 4.18).

Table 4.18 Level of Comfort Biking to Selected Destinations by City – Biking Cities

	Davis	Eugene	Boulder	p-value across all cities	p-value Davis vs. Eugene	p-value Davis vs. Boulder
To usual grocery store…				0.048	0.142	0.014
Comfortable	76.1%	68.2%	64.8%			
Not comfortable but would bike there anyway	8.9%	9.3%	8.6%			
Not comfortable and would not bike there	15.0%	22.5%	26.6%			
To nearest post office…				0.051	0.056	0.040
Comfortable	72.8%	61.5%	60.6%			
Not comfortable but would bike there anyway	12.8%	19.2%	18.1%			
Not comfortable and would not bike there	14.5%	19.2%	21.3%			
To local elementary school…				0.005	0.328	0.001
Comfortable	89.2%	84.3%	75.2%			
Not comfortable but would bike there anyway	4.4%	7.1%	8.3%			
Not comfortable and would not bike there	6.4%	8.7%	16.5%			
To restaurant you like…				0.001	0.037	0.021
Comfortable	68.8%	59.2%	66.7%			
Not comfortable but would bike there anyway	12.4%	21.5%	5.6%			
Not comfortable and would not bike there	18.8%	19.2%	27.8%			
To nearest bike shop…				0.024	0.166	0.011
Comfortable	73.0%	64.1%	61.6%			
Not comfortable but would bike there anyway	13.7%	18.8%	13.6%			
Not comfortable and would not bike there	13.4%	17.2%	24.8%			

- *Bicycling preference*

Bicycling preferences are mostly not significantly different between these cities (Table 4.19). However, a much greater percent of respondents in Davis agreed that finding a city "good for bicycling" was important to them when choosing where to live. This results suggests that high levels of bicycling in Davis stem in part from the "self-selection" of bicycling-oriented individuals to the bicycling-oriented environment of Davis.

Table 4.19 Bicycling Preference by City – Biking Cities

	Davis	Eugene	Boulder	p-value across all cities	p-value Davis vs. Eugene	p-value Davis vs. Boulder
Like riding a bike				0.138	0.081	0.742
Strongly disagree or disagree	9.2%	8.5%	11.1%			
Neutral	13.8%	22.3%	11.9%			
Agree or strongly agree	76.9%	69.2%	77.0%			
Prefer to ride a bike rather than drive whenever possible				0.658	0.302	0.874
Strongly disagree or disagree	40.8%	47.3%	43.3%			
Neutral	21.7%	22.5%	21.3%			
Agree or strongly agree	37.6%	30.2%	35.4%			
Like driving				0.139	0.053	0.923
Strongly disagree or disagree	18.5%	11.0%	20.0%			
Neutral	24.6%	20.5%	24.8%			
Agree or strongly agree	56.9%	68.5%	55.2%			
Try to limit driving as much as possible				0.286	0.503	0.245
Strongly disagree or disagree	20.7%	25.8%	18.1%			
Neutral	22.5%	21.1%	29.9%			
Agree or strongly agree	56.8%	53.1%	52.0%			
Good for bicycling is very Important when choosing living community	35.7%	16.9%	22.8%	0.000	0.000	0.009

- *Environmental attitudes*

Attitudes towards the environment are not significantly different between these cities (Table 4.20).

Table 4.20 Environmental Attitudes by City – Biking Cities

	Davis	Eugene	Boulder	p-value across all cities	p-value Davis vs. Eugene	p-value Davis vs. Boulder
Prefer stricter environmental laws and regulations	85.0%	80.6%	89.6%	0.134	0.245	0.206
Environmental benefit is an important or extremely important factor affecting mode choice	49.1%	47.7%	57.0%	0.240	0.776	0.127
Limit driving to help improve air quality				0.105	0.124	0.399
Disagree or strongly disagree	19.5%	27.7%	17.3%			
Neutral	26.7%	26.9%	22.0%			
Agree or strongly agree	53.7%	45.4%	60.6%			

- *Physical activity orientation*

Attitudes towards physical activity do not differ between these cities (Table 4.21).

Table 4.21 Physical Activity Orientation by City – Biking Cities

	Davis	Eugene	Boulder	p-value across all cities	p-value Davis vs. Eugene	p-value Davis vs. Boulder
It is important to get regular physical exercise				0.731	0.390	0.903
Strongly disagree or disagree	4.0%	6.2%	3.9%			
Neutral	1.7%	3.1%	2.4%			
Agree or strongly agree	94.3%	90.8%	93.7%			
Enjoy physical exercise				0.395	0.913	0.192
Strongly disagree or disagree	10.4%	11.5%	7.1%			
Neutral	13.3%	13.8%	8.7%			
Agree or strongly agree	76.4%	74.6%	84.1%			
I am in good health				0.369	0.190	0.860
Strongly disagree or disagree	9.0%	14.6%	8.6%			
Neutral	11.0%	11.5%	9.4%			
Agree or strongly agree	80.0%	73.8%	82.0%			
Physical fitness important when choosing modes	45.1%	50.8%	46.9%	0.541	0.268	0.729

- *Socio-demographics*

A comparison of socio-demographic variables shows Davis and Boulder to be quite similar (Table 4.22). Education and household income levels are significantly lower in Eugene than in Davis and Boulder.

Table 4.22 Socio-demographics by City – Biking Cities

	Davis	Eugene	Boulder	p-value across all cities	p-value Davis vs. Eugene	p-value Davis vs. Boulder
Age (mean)	48.5	47.9	47.7	0.865	0.741	0.618
Gender (percent female)	46.6%	43.3%	40.7%	0.500	0.530	0.259
BS/BA or greater education	88.6%	56.3%	84.4%	0.000	0.000	0.235
Household size (mean)	2.5	2.3	2.4	0.230	0.093	0.389
Income (mean)	$80,174.1	$56,371.0	$80,341.9	0.000	0.000	0.968
Physical/Mental Disability						
Limit drive	0.9%	3.9%	3.3%	0.071	0.026	0.071
Limit bike	9.6%	14.2%	10.7%	0.375	0.163	0.748

4.2.3 Physical environment factors, by city

- *Bicycle infrastructure*

Perceptions of bicycle infrastructure are similar in Davis and Eugene (Table 4.23). Davis respondents are more likely to perceive their city to have major streets with bike lanes and wider streets without bike lanes and less likely to perceive hilliness than Boulder respondents. However, Boulder respondents are more likely to perceive their city to have a good bicycle network and less likely to perceive obstacles in bike lanes than Davis respondents.

Table 4.23 Bicycle Infrastructure by City – Biking Cities

Agree or strongly agree that…	Davis	Eugene	Boulder	p-value across all cities	p-value Davis vs. Eugene	p-value Davis vs. Boulder
Major streets have bike lanes	90.6%	90.6%	76.2%	0.000	0.986	0.000
Streets without bike lanes are wide enough to bike on	72.1%	66.1%	56.5%	0.006	0.215	0.001
Stores and other destinations have bike racks	80.8%	82.0%	78.9%	0.822	0.777	0.646
Streets and bike paths are well lit	67.5%	65.3%	59.7%	0.308	0.661	0.125
Intersections have push-buttons or sensors for bicycles or pedestrians	83.3%	85.6%	83.2%	0.825	0.555	0.973
The city has a network of off-street bike paths	85.2%	92.0%	94.4%	0.010	0.055	0.008
Bike lanes are free of obstacles	73.3%	90.8%	88.7%	0.000	0.000	0.001
The bike route network has big gaps	17.5%	23.2%	19.8%	0.453	0.211	0.607
The area is too hilly for easy bicycling	1.8%	1.7%	8.1%	0.001	0.933	0.001

- *Destinations distance*

Perceived distances to destinations, reflecting the land-use mix with each city, differs somewhat between the cities (Table 4.24). Davis respondents are more likely to report being with 2 miles of their usual grocery store, as well as the nearest post office and local elmentary school. Otherwise, distances to destinations are similar, suggesting a similar land-use mix in each of these cities and thus comparable bicycling potential.

Table 4.24 Distance to Destinations by City - College Towns

	Davis	Eugene	Boulder	p-value across all cities	p-value Davis vs. Eugene	p-value Davis vs. Boulder
Distance from home to usual grocery store				0.002	0.017	0.001
Less than 2 miles	75.4%	64.3%	60.5%			
More than 2 miles	24.6%	35.7%	39.5%			
Distance from home to nearest post office				0.029	0.104	0.033
Less than 2 miles	58.9%	48.8%	49.6%			
More than 2 miles	39.1%	47.3%	50.4%			
Don't know	2.0%	3.9%	0.0%			
Distance from home to favorite restaurant				0.762	0.472	0.761
Less than 2 miles	52.7%	46.5%	49.6%			
More than 2 miles	43.6%	48.8%	47.3%			
Don't know	3.7%	4.7%	3.1%			
Distance from home to a bike repair shop				0.082	0.040	0.533
Less than 2 miles	39.9%	33.1%	44.5%			
More than 2 miles	44.8%	41.7%	39.1%			
Don't know	15.3%	25.2%	16.4%			
Distance from home to workplace				0.829	0.805	0.608
Less than 2 miles	24.1%	21.4%	21.9%			
More than 2 miles	54.3%	57.1%	52.3%			
Don't know	21.6%	21.4%	25.8%			
Distance from home to the local elementary school				0.001	0.104	0.000
Less than 2 miles	53.8%	50.0%	36.7%			
More than 2 miles	6.5%	12.5%	16.4%			
Don't know	39.7%	37.5%	46.9%			

4.2.4 Social environment factors, by city

Perceptions of drivers' behaviors toward bicyclists are not significantly different between Davis, Eugene and Boulder, implying a similar social environment for bicycling in each city (Table 4.25). However, perceptions of bicyclists differ in notable ways (Table 4.26). Bicyclists in Boulder are perceived to spend an especially high level of money on their bikes. A smaller percentage of respondents in Boulder think that "kids often ride bikes for fun" and a greater percentage of respondents in Boulder reported that their bicycle has never been stolen, compared to respondents in the other two cities.

Table 4.25 Drivers' Behaviors toward Bicyclists by City – College Towns

	Davis	Eugene	Boulder	p-value across all cities	p-value Davis vs. Eugene	p-value Davis vs. Boulder
Most drivers seem oblivious to bicyclists				0.128	0.252	0.124
Strongly disagree or disagree	62.2%	53.8%	62.0%			
Neutral	22.3%	27.7%	28.7%			
Agree or strongly agree	15.5%	18.5%	9.3%			
Most drivers yield to bicyclists				0.133	0.799	0.064
Strongly disagree or disagree	14.1%	13.1%	13.2%			
Neutral	23.3%	26.2%	14.0%			
Agree or strongly agree	62.6%	60.8%	72.9%			
Most drivers watch for bicyclists at intersections				0.072	0.386	0.078
Strongly disagree or disagree	16.9%	19.2%	20.2%			
Neutral	26.1%	30.8%	16.3%			
Agree or strongly agree	57.0%	50.0%	63.6%			
Most people drive faster than the speed limit				0.950	0.792	0.817
Strongly disagree or disagree	6.9%	8.5%	7.8%			
Neutral	13.7%	14.6%	15.5%			
Agree or strongly agree	79.4%	76.9%	76.7%			

Table 4.26 Perceptions of Bicyclists and Bicycling by City- College Towns

	Davis	Eugene	Boulder	p-value across all cities	p-value Davis vs. Eugene	p-value Davis vs. Boulder
Bicyclists spend a lot of money on their bikes				0.000	0.015	0.000
Strongly disagree or disagree	45.7%	32.3%	8.5%			
Neutral	41.7%	47.7%	31.0%			
Agree or strongly agree	12.6%	20.0%	60.5%			
People rarely bike to get groceries				0.306	0.731	0.194
Strongly disagree or disagree	36.2%	39.2%	27.3%			
Neutral	16.4%	13.8%	18.8%			
Agree or strongly agree	47.4%	46.9%	53.9%			
Bicycling is a normal mode for adults in this community				0.292	1.000	0.097
Strongly disagree or disagree	27.8%	27.7%	25.8%			
Neutral	20.1%	20.0%	12.5%			
Agree or strongly agree	52.1%	52.3%	61.7%			
Bicyclists are too poor to own a car				0.039	0.023	0.436
Strongly disagree or disagree	89.7%	82.2%	92.2%			
Neutral	9.5%	14.0%	6.2%			
Agree or strongly agree	0.9%	3.9%	1.6%			
Kids often ride bikes for fun				0.058	0.636	0.028
Strongly disagree or disagree	19.0%	21.5%	24.8%			
Neutral	18.7%	15.4%	26.4%			
Agree or strongly agree	62.4%	63.1%	48.8%			
Bicyclists have little regard for personal safety				0.762	0.932	0.409
Strongly disagree or disagree	47.0%	46.9%	51.2%			
Neutral	25.2%	23.8%	19.4%			
Agree or strongly agree	27.8%	29.2%	29.5%			
Bicycle has ever been stolen				0.032	0.867	0.010
Not	73.6%	70.7%	89.4%			
Once	17.1%	19.5%	7.1%			
More than once	9.3%	9.8%	3.5%			

5. Bike commuting

The purpose of this section is to identify factors that affect mode choice for commuting to work, especially biking to work. Potential factors include monthly parking cost, the need to run errands on the way to or from work, the social and physical work environments, and commute incentives. We limit the analysis to respondents for whom bicycling is theoretically a feasible mode choice, defined as those who both live and work in the six cities and who live less than 5 miles to work. It is important to note that the samples for Woodland and Turlock are especially small (Table 5.1). We first compare Davis to the other California cities then to the other biking cities.

Table 5.1 Number of Respondents from Each City

Workplace	Davis	Chico	Woodland	Turlock	Eugene	Boulder	Total
Number	152	48	17	28	42	50	337

5.1 Davis vs. California Cities

5.1.1 Comparison of mode choice to work

The percent of respondents bicycle commuting is significantly different across these cities, with a far higher share of Davis respondents biking from home to work as a primary mode (Table 5.2). Twenty respondents use bikes as a secondary transportation mode to work, with the car or carpool as the primary mode.

Table 5.2 Bike to Work by City – California Cities

	Davis	**Chico**	**Woodland**	**Turlock**	**p-value across all cities**	**p-value Davis vs. others**
Bike from home to work as primary mode	53.6%	25.0%	18.5%	0.0%	0.000	0.000
Bike from home to work as primary or secondary mode	55.6%	31.3%	22.2%	5.9%	0.000	0.000

5.1.2 Individual Commute Variables

- *Stops on the way to or from work*

The percent of respondents who stop for errands or entertainment on the way to or from work is significantly different between the cities (Table 5.3). In general, a smaller percentage of respondents working in Davis regularly stop for errands or entertainment compared to the

other cities. In contrast, a greater percentage of respondents working in Woodland and Turlock regularly stop for errands on the way to or from work than in the other cities. These stops do not necessarily preclude bicycle commuting, but some stops (dropping of children, grocery shopping), may make it more challenging.

Table 5.3 Stops on the Way to or from Work by City – California Cities

At least once per week…	Davis	Chico	Woodland	Turlock	p-value across all cities	p-value Davis vs. others
Drop off children on the way to work	21.5%	13.0%	23.1%	23.5%	0.600	0.512
Pick up children on the way home	19.3%	15.2%	15.4%	23.5%	0.838	0.638
Shop for groceries on the way home	43.0%	52.1%	66.7%	64.7%	0.060	0.018
Stop for other errands	42.6%	58.3%	76.9%	70.6%	0.002	0.000
Go out for dining/entertainment on the way home	13.3%	27.7%	33.3%	23.5%	0.027	0.004
Visit friends on the way home	8.7%	8.5%	25.9%	17.6%	0.050	0.113

5.1.3 Environmental Commute Variables

- *Monthly Cost of Parking*

The percentage of respondents having a monthly parking cost is significantly higher in Davis than the other three cities (Table 5.4). This result can be explained by the high share of Davis residents who work at UC Davis, where drivers must purchase a parking pass. Chico and Turlock are home to campuses of the California State University system, where parking fees also apply. Parking fees could be an incentive to bicycle commute.

Table 5.4 Monthly Cost of Parking by City – California Cities

	Davis	Chico	Woodland	Turlock	p-value across all cities	p-value Davis vs. others
There is monthly cost of parking at workplace	56.0%	13.3%	0.0%	17.6%	0.000	0.000

- *Physical environment of workplace*

Overall, the physical environment of workplaces as reported by respondents is significantly different across all cities (Table 5.5). Compared to other cities, Davis has a physical environment more conducive to bicycle commuting as measured by accessibility to a shower,

streets that are not dangerous for bicyclists, good transit service to the workplace, and ease of finding a secure bike rack.

Table 5.5 Physical Environment of Workplace by City - California Cities

	Davis	Chico	Woodland	Turlock	p-value across all cities	p-value Davis vs. others
Access to a shower near office (within a 5-minute walk)					0.115	0.017
Not true	62.7%	72.9%	88.9%	76.5%		
True	23.3%	20.8%	11.1%	17.6%		
Don't know	14.0%	6.3%	0.0%	5.9%		
Streets near workplace are dangerous for bicycling					0.000	0.000
Not true	91.3%	73.9%	70.4%	47.1%		
True	7.4%	23.9%	29.6%	47.1%		
Don't know	1.3%	2.2%	0.0%	5.9%		
There is good transit service to workplace					0.015	0.051
Not true	39.9%	47.9%	63.0%	52.9%		
True	52.0%	47.9%	22.2%	23.5%		
Don't know	8.1%	4.2%	14.8%	23.5%		
It is easy to find a secure rack/post to lock bikes at work place					0.000	0.000
Not true	12.9%	25.0%	55.6%	47.1%		
True	83.7%	68.8%	44.4%	47.1%		
Don't know	3.4%	6.3%	0.0%	5.9%		

- *Social environment of workplace for bicycling*

Overall, respondents in Davis report a more pro-bicycling social environment at their workplaces than those in the other cities (Table 5.6). Bicycling-favorable factors include the presence of co-workers who bike to work, employer incentives to carpool, bicycle or take transit to work, and the presence of other people in the workplace who are fitness-conscious. Factors unfavorable to bicycling include having to carry materials to or from work, supervisors who disapprove of commuting by bike, the need to dress professionally, and the need to use a vehicle during work; Davis is lower on all of these factors except having to carry materials.

Table 5.6 Social Environment of Work Place by City – California Cities

	Davis	Chico	Woodland	Turlock	p-value across all cities	p-value Davis vs. others
Some co-workers bike to work					0.000	0.000
Disagree	10.1%	31.3%	44.4%	64.7%		
Neutral	6.0%	8.3%	22.2%	17.6%		
Agree	83.9%	60.4%	33.3%	17.6%		
Employer offers incentives to carpool, bicycle or take transit to work					0.003	0.000
Disagree	57.4%	81.3%	74.1%	100.0%		
Neutral	24.3%	10.4%	18.5%	0.0%		
Agree	18.2%	8.3%	7.4%	0.0%		
People in workplace are fitness-conscious					0.011	0.072
Disagree	12.1%	22.9%	11.1%	41.2%		
Neutral	40.3%	43.8%	29.6%	41.2%		
Agree	47.7%	33.3%	59.3%	17.6%		
Need to carry materials to or from work					0.892	0.619
Disagree	45.6%	47.9%	51.9%	41.2%		
Neutral	10.2%	4.2%	7.4%	11.8%		
Agree	44.2%	47.9%	40.7%	47.1%		
Supervisors disapprove of commuting by bicycle					0.021	0.011
Disagree	89.3%	70.8%	81.5%	76.5%		
Neutral	10.1%	22.9%	18.5%	23.5%		
Agree	0.7%	6.3%	0.0%	0.0%		
People in workplace need to dress professionally					0.038	0.003
Disagree	47.0%	29.2%	25.9%	35.3%		
Neutral	24.2%	25.0%	18.5%	11.8%		
Agree	28.9%	45.8%	55.6%	52.9%		
Need to use own vehicle to travel to different sites during the day					0.038	0.060
Disagree	55.7%	45.8%	40.7%	23.5%		
Neutral	11.4%	22.9%	11.1%	11.8%		
Agree	32.9%	31.3%	48.1%	64.7%		

- *Incentives for bicycling*

Respondents from the four cities mostly do not differ in the degree to which they say various incentives would influence them to ride a bicycle more (Table 5.7). Turlock and Chico are more likely to say that they would be influenced by improvements to the bicycling route to their workplace. Davis respondents are less likely to say that having a shower available at the workplace would influence them. Overall, increases in gas prices and parking fees were the most likely to influence respondents to bicycle.

Table 5.7 Incentives for Biking by City – California Cities

Influence would be moderate or strong…	Davis	Chico	Woodland	Turlock	p-value across all cities	p-value Davis vs. others
Improvements to route for biking	28.6%	55.3%	37.0%	58.8%	0.002	0.001
Gift of $500 towards bike and accessories	49.3%	47.9%	50.0%	47.1%	0.996	0.884
An instructor shows the best route for biking	11.6%	21.7%	7.7%	17.6%	0.248	0.250
Increase of gas price to $4 per gallon	48.0%	61.7%	30.8%	58.8%	0.066	0.525
Increase of gas price to $6 per gallon	60.5%	76.1%	53.8%	58.8%	0.187	0.376
$20 per month increase in parking cost at work place	48.6%	47.8%	44.4%	47.1%	0.983	0.769
Bike Maintenance program to keep bikes in top running condition	43.9%	57.4%	34.6%	47.1%	0.251	0.456
Shower available at workplace	30.4%	50.0%	37.0%	41.2%	0.105	0.028

5.2 Davis vs. Biking Cities

5.2.1 Comparison of mode choice for work

Davis has significantly more use of bicycling as a primary mode to work than Eugene but not Boulder (Table 5.8).

Table 5.8 Bike Commuting by City – Biking Cities

	Davis	Eugene	Boulder	p-value across all cities	p-value Davis vs. Eugene	p-value Davis vs. Boulder
Bike from home to work as primary mode	53.6%	31.0%	44.0%	0.028	0.009	0.239
Bike from home to work as primary or secondary mode	55.6%	33.3%	50.0%	0.038	0.011	0.494

5.2.2. Individual Commute Factors

- *Stops on the way to or from work*

The percent of respondents who stop for errands or entertainment on the way to or from work is significantly different between the cities (Table 5.9). A smaller percent of Eugene respondents regularly drop off or pick up children on the way to work or home than of Davis respondents. Respondents working in Boulder stop for errands or go out for dining or entertainment on the way more often than in other cities. As noted above, these stops do not necessarily preclude bicycle commuting, but some stops (dropping of children, grocery shopping), may make it more challenging.

Table 5.9 Stops on Way to or from Work by City – Biking Cities

At least once per week…	Davis	Eugene	Boulder	p-value across all cities	p-value Davis vs. Eugene	p-value Davis vs. Boulder
Drop off children on the way to work	21.5%	7.3%	12.8%	0.069	0.038	0.187
Pick up children on the way home	19.3%	4.9%	8.5%	0.029	0.027	0.084
Shop for groceries on the way home	43.0%	38.1%	52.0%	0.375	0.573	0.266
Stop for other errands	42.6%	42.9%	62.0%	0.051	0.973	0.017
Go out for dining/entertainment on the way home	13.3%	26.2%	40.0%	0.000	0.045	0.000
Visit friends on the way home	8.7%	11.9%	10.0%	0.819	0.533	0.786

5.2.3. Environmental Commute Factors

- *Monthly Cost of Parking*

The monthly parking cost is significantly different between these cities (Table 5.10). The monthly parking fee in Davis is relatively higher than that in Eugene or Boulder.

Table 5.10 Monthly Cost of Parking by City – Bike Cities

	Davis	Eugene	Boulder	p-value across all cities	p-value Davis vs. Eugene	p-value Davis vs. Boulder
There is monthly cost of parking at workplace	56.0%	22.9%	14.7%	0.176	0.000	0.000

- *Physical environment of workplace*

The physical environments of workplaces are mostly not significantly different between these cities (5.11). Compared to Davis and Eugene, employees in Boulder have better access to showers near offices.

Table 5.11 Physical Environment of Workplace by City – Bike Cities

	Davis	Eugene	Boulder	p-value across all cities	p-value Davis vs. Eugene	p-value Davis vs. Boulder
Access to a shower near office (within a 5-minute walk)				0.000	0.163	0.000
Not true	62.7%	61.9%	30.0%			
True	23.3%	33.3%	62.0%			
Don't know	14.0%	4.8%	8.0%			
Streets near workplace are dangerous for bicycling				0.617	0.478	0.438
Not true	91.3%	87.8%	88.0%			
True	7.4%	12.2%	12.0%			
Don't know	1.3%	0.0%	0.0%			
There is good transit service to workplace				0.399	0.519	0.292
Not true	39.9%	31.0%	46.0%			
True	52.0%	61.9%	52.0%			
Don't know	8.1%	7.1%	2.0%			
It is easy to find a secure rack/post to lock bikes at work place				0.648	0.383	0.865
Not true	12.9%	21.4%	12.0%			
True	83.7%	76.2%	86.0%			
Don't know	3.4%	2.4%	2.0%			

- *Social environment of workplace for bicycling*

Davis, Eugene and Boulder have similar social environments for bicycling at workplaces (Table 5.12). People who work in Boulder are more likely to report fitness-consciousness in the workplace than in the other cities.

Table 5.12 Social Environment of Workplace by City – Bike Cities

	Davis	Eugene	Boulder	p-value across all cities	p-value Davis vs. Eugene	p-value Davis vs. Boulder
Some co-workers bike to work				0.356	0.193	0.505
Disagree	10.1%	19.5%	12.0%			
Neutral	6.0%	2.4%	2.0%			
Agree	83.9%	78.0%	86.0%			
Employer offers incentives to carpool, bicycle or take transit to work				0.313	0.523	0.106
Disagree	57.4%	52.4%	46.9%			
Neutral	24.3%	21.4%	20.4%			
Agree	18.2%	26.2%	32.7%			
People in workplace are fitness-conscious				0.005	0.348	0.001
Disagree	12.1%	11.9%	4.0%			
Neutral	40.3%	28.6%	18.0%			
Agree	47.7%	59.5%	78.0%			
Need to carry materials to or from work				0.650	0.774	0.315
Disagree	45.6%	50.0%	56.0%			
Neutral	10.2%	11.9%	12.0%			
Agree	44.2%	38.1%	32.0%			
Supervisors disapprove of commuting by bicycle				0.238	0.455	0.149
Disagree	89.3%	83.3%	95.9%			
Neutral	10.1%	14.3%	2.0%			
Agree	0.7%	2.4%	2.0%			
People in workplace need to dress professionally				0.060	0.063	0.433
Disagree	47.0%	31.0%	50.0%			
Neutral	24.2%	21.4%	30.0%			
Agree	28.9%	47.6%	20.0%			
Need to use own vehicle to travel to different sites during the day				0.651	0.517	0.478
Disagree	55.7%	61.9%	65.3%			
Neutral	11.4%	14.3%	10.2%			
Agree	32.9%	23.8%	24.5%			

- *Incentives for bicycling*

There are few significant differences between the three cities in the incentives that respondents say would influence them to bicycle more (Table 5.13). Eugene respondents are more likely than others to report that improvements in the biking route to the workplace would influence them to bicycle more. Respondents in all three cities report that an increase in gas prices and parking fees would influence them to bike more often.

Table 5.13 Incentives for Biking by City – Bike Cities

Influence would be moderate or strong…	Davis	Eugene	Boulder	p-value across all cities	p-value Davis vs. Eugene	p-value Davis vs. Boulder
Improvements of route for biking	28.6%	45.2%	36.0%	0.114	0.042	0.324
Gift of $500 bike and accessories	49.3%	59.5%	54.0%	0.483	0.243	0.568
A instructor shows the best route for biking	11.6%	14.6%	10.0%	0.786	0.596	0.762
Increase of gas price to $4 per gallon	48.0%	54.8%	42.0%	0.475	0.437	0.464
Increase of gas price to $6 per gallon	60.5%	71.4%	56.0%	0.295	0.198	0.572
$20 per month increase of parking cost at work place	48.6%	52.4%	41.7%	0.572	0.668	0.402
Bike Maintenance program to keep bikes in top running condition	43.9%	47.6%	40.0%	0.762	0.670	0.628
Shower available at workplace	30.4%	38.1%	22.0%	0.241	0.346	0.254

6. Recent Movers

In order to test the effect of a change in bicycling environment on bicycling, the survey included a section for respondents who moved to the city less than two years ago. Sixty-five respondents completed this section, with very small samples in all cities but Davis. We compare changes in bicycling for respondents who moved to each city, as well as differences in perceptions of changes in the respondents' environments.

6.1 Comparison of change of bicycling level

Comparisons between respondents' bicycling levels now and their bicycling levels in their previous communities are shown in Table 6.1. Across all cities, the change in bicycling levels is different. Respondents who recently moved to Davis and Boulder increased their bicycling behavior in their daily travel more than those who moved to the other cities. What is surprising here is that respondents who recently moved to Eugene decreased their bicycling level. This may be due to the small sample size of respondents moving to Eugene.

Table 6.1 Change in Bicycling Level for Recent Movers by City

Current Biking Level	Davis	Chico	Woodland	Turlock	Eugene	Boulder	p-value
Less	12.5%	25.0%	33.3%	66.7%	57.1%	22.2%	
N	4	1	2	2	4	2	
Same	15.6%	50.0%	33.3%	33.3%	28.6%	11.1%	.065
N	5	2	2	1	2	1	
More	71.9%	25.0%	33.3%	.0%	14.3%	66.7%	
N	23	1	2	0	1	6	

6.2 Comparison of environment change

Among recent movers to these cities, the perception of change in the physical bicycling environment is significantly different between these cities (Table 6.2). A higher percent of people who moved to Davis and Boulder felt that streets are wider, there are more bike racks, better lit bike paths, more push-buttons for bicycles, a greater off-street bike path network, fewer big gaps in the bike route network than where they previously lived.

Table 6.2 Change in Physical Environment for Recent Movers by City

	Davis	Chico	Woodland	Turlock	Eugene	Boulder	p-value
Streets without bike lanes are wide enough to bike on							.007
Worse	3.2%	50.0%	40.0%	33.3%	0.0%	0.0%	
Same	6.5%	25.0%	20.0%	33.3%	40.0%	37.5%	
Better	90.3%	25.0%	40.0%	33.3%	60.0%	62.5%	
Destinations have bike racks							.001
Worse	0.0%	0.0%	33.3%	33.3%	0.0%	0.0%	
Same	9.7%	66.7%	50.0%	33.3%	0.0%	14.3%	
Better	90.3%	33.3%	16.7%	33.3%	100.0%	85.7%	
Streets and bike paths are well lit							.026
Worse	7.1%	66.7%	14.3%	50.0%	0.0%	12.5%	
Same	17.9%	.0%	57.1%	50.0%	0.0%	50.0%	
Better	75.0%	33.3%	28.6%	0.0%	100.0%	37.5%	
Intersections have push-buttons or bike/ped sensors							.003
Worse	0.0%	25.0%	16.7%	50.0%	40.0%	0.0%	
Same	15.4%	50.0%	66.7%	50.0%	40.0%	57.1%	
Better	84.6%	25.0%	16.7%	0.0%	20.0%	42.9%	
City has a network or off-street bike paths							.000
Worse	3.4%	25.0%	50.0%	100.0%	0.0%	11.1%	
Same	.0%	0.0%	50.0%	0.0%	33.3%	11.1%	
Better	96.6%	75.0%	0.0%	0.0%	66.7%	77.8%	
Bike route network has big gaps							.021
Less gaps	69.6%	50.0%	0.0%	50.0%	0.0%	50.0%	
Same	17.4%	50.0%	0.0%	0.0%	50.0%	50.0%	
More gaps	13.0%	0.0%	100.0%	50.0%	50.0%	0.0%	
Biking is easier							.000
Disagree	0.0%	0.0%	28.6%	66.7%	28.6%	33.3%	
Neutral	0.0%	25.0%	42.9%	33.3%	28.6%	0.0%	
Agree	100.0%	75.0%	28.6%	0.0%	42.9%	66.7%	

Changes in the social environment for bicycling also differ significantly across the cities (Table 6.3). In general, respondents moving to Davis and Boulder are more likely to have more positive perceptions of the social environment now than where they lived previously.

Table 6.3 Change in Social Environment for Recent Movers by City

	Davis	Chico	Woodland	Turlock	Eugene	Boulder	p-value
Biking is a normal mode of transportation							.000
Agree less now	0.0%	0.0%	57.1%	0.0%	14.3%	11.1%	
Same	6.1%	25.0%	42.9%	100.0%	28.6%	22.2%	
Agree more now	93.9%	75.0%	.0%	0.0%	57.1%	66.7%	
Bicyclists are too poor to own a car							.028
Agree less now	39.4%	25.0%	28.6%	0.0%	28.6%	44.4%	
Same	48.5%	25.0%	28.6%	0.0%	57.1%	55.6%	
Agree more now	12.1%	50.0%	42.9%	100.0%	14.3%	0.0%	
It is rare for people to bike to the grocery store							.100
Agree less now	71.9%	25.0%	33.3%	66.7%	28.6%	55.6%	
Same	18.8%	75.0%	33.3%	0.0%	57.1%	44.4%	
Agree more now	9.4%	0.0%	33.3%	33.3%	14.3%	0.0%	

6.3 Analysis of recent movers excluding preference impacts

The comparisons of changes in the physical and social bicycling environments presented above show that recent movers to Davis and Boulder perceive a more positive change than movers to the other cities. Correspondingly, more movers to these two cities reported an increase in bicycling than movers to the other cities. However, we cannot conclude that there is a causal relationship between bicycling level and the environment based on this analysis alone.

Indeed, it is possible that a preference for bicycling leads respondents to move to Davis or Boulder, which, consequently, results in higher bicycling levels in these two cities. For this reason, the following analysis is based on a sample that excludes people who move to a city because it is a good community for bicycling. This sub-sample has a total of 41 respondents, a small sample size for statistical testing, and most relationships tested were not statistically significant.

Table 6.4 shows cross-tabulations of changes in the environment with changes in bicycling for the four relationships that were most statistically significant. Worse bike racks are associated with a decrease in bicycling, but among respondents who report an improvement in bike racks

almost an equal share report a decrease in bicycling as report an increase. An improvement in signal push buttons for bicyclists has a clearer association with increases in bicycling. Moving to a flatter community is associated with an increase in bicycling. Finally, moving to an environment where bicycling is seen as more normal is associated with an increase in bicycling, while the reverse is also true – moving to an environment where bicycling is less seen normal is associated with a decrease in bicycling. Further studies using a larger sample and more sophisticated analysis methods are needed to more definitively test the hypothesis that a better bicycling environment can cause an increase in bicycling.

Table 6.4 Change of bicycling behavior and environment of people who recently moved to a city

				p-value
Destinations have bike racks	Better	Same	Worse	.046
Respondents who bike less now	41.7%	16.7%	100.0%	
Respondents who bike the same now	12.5%	66.7%	.0%	
Respondents who bike more now	45.8%	16.7%	.0%	
Intersections have push-buttons or sensors for bicycles	Better	Same	Worse	.024
Respondents who bike less now	14.3%	60.0%	40.0%	
Respondents who bike the same now	21.4%	20.0%	60.0%	
Respondents who bike more now	64.3%	20.0%	.0%	
Too hilly for easy biking	Hillier	Same	Flatter	.019
Respondents who bike less now	.0%	53.3%	11.8%	
Respondents who bike the same now	100.0%	13.3%	35.3%	
Respondents who bike more now	.0%	33.3%	52.9%	
Bicycling is a normal mode of transportation	More normal	Same	Less normal	.137
Respondents who bike less now	29.2%	40.0%	60.0%	
Respondents who bike the same now	20.8%	50.0%	20.0%	
Respondents who bike more now	50.0%	10.0%	20.0%	

7. Biking as Adolescents

The survey also included a section in which respondents were asked to recall their bicycling experience as adolescents, at ages 12 and 17.

7.1 Biking at age twelve

The vast majority of the overall sample – 96.6% - reported that they bike at age 12 (Table 7.1). Respondents reported biking to a variety of destinations at age twelve (Table 7.2). Biking to a friend's house and biking to roam or explore were the most common destinations. The share of respondents biking at age 12 did not differ between the cities (Table 7.3) and thus does not appear to help to explain the differences across cities in the percentage of adults bicycling.

Table 7.1 Biking rates at age twelve

Biked at age 12	Number of respondents	Percent
Biked	885	96.6
Did not	31	3.4
Total	**916**	**100.0**

Table 7.2 Percent of respondents who bike to certain destinations at age twelve

	Bike to School	Bike to Store	Bike to a Friend's	Bike to Roam/Explore	Bike to Library
Never (%)	44.5	31.4	8.6	5.5	47.3
Occasionally (%)	23.0	29.2	23.0	19.9	32.2
Once a week (%)	2.2	14.9	10.5	15.6	13.4
Several times a week (%)	12.6	20.1	39.8	40.8	5.5
Daily (%)	17.7	4.5	18.2	18.2	1.6

Table 7.3 Comparison of biking experience at age twelve between the cities

Biked at Age 12		Davis	Chico	Woodland	Turlock	Eugene	Boulder
Biked	Number	322	122	107	87	124	123
	Percent	95.0%	96.8%	96.4%	98.9%	96.9%	99.2%
Didn't Bike	Number	17	4	4	1	4	1
	Percent	5.0%	3.2%	3.6%	1.1%	3.1%	.8%
Total	Number	339	126	111	88	128	124

7.1.1. Reasons for not biking at age twelve

The small number of respondents who did not bike at age 12 reported a variety of reasons why (Table 7.4). The most common reason is that they did not have a bike at that time, and the second most common reasons was that they had not learned how to ride a bike. Busy (dangerous) streets were another main reason.

Table 7.4 Reasons for Not Biking at Age Twelve

Influence	Didn't want to	%	Never learned how	%	Neighborhood was hilly	%	Streets Busy	%
No	27	79.4	19	54.3	18	56.3	16	48.5
Weak	3	8.8	2	5.7	2	6.3	4	12.1
Moderate	3	8.8	2	5.7	6	18.8	4	12.1
Strong	1	2.9	12	34.3	6	18.8	9	27.3

Influence	Parents wouldn't let them	%	Never had a bike	%	No interesting places to bike to	%
No	23	69.7	12	34.3	27	79.4
Weak	1	3.0	6	17.1	3	8.8
Moderate	3	9.1	0		0	
Strong	6	18.2	17	48.6	4	11.8

7.1.2. Travel to school at age twelve

When the respondents were twelve, most of them walked or took school buses to school (Table 7.5). The percentage bicycling differed by community type, however (Table 7.6). Respondents who lived in cities or small towns biked significantly more than those living in suburban or rural areas. Those in cities and suburbs walked more than those in other community types. Respondents in rural areas drove to school significantly more than those in other areas. Distance to the school is also associated with mode to school, with those living within 1 mile most likely to walk, and bicycling more common for those living more than 1 mile from school compared to those living within 1 mile of school (Table 7.7).

Table 7.5 Mode to school at age twelve

Mode to School	Number	Percent
Car	203	23.1
Walk	338	38.4
Bike	91	10.3
School bus	231	26.3
Other	17	1.9
Total	**880**	**100.0**

Table 7.6 Comparison of common modes to school based on community type at age twelve

		Community Type				
Mode to School		**City**	**Small town**	**Suburb**	**Rural**	**Other**
Car	Number	15	87	22	73	5
	Percent	8.6%	24.9%	10.3%	58.9%	33.3%
Walk	Number	83	129	104	18	3
	Percent	47.7%	36.9%	48.8%	14.5%	20.0%
Bike	Number	23	41	13	12	1
	Percent	13.2%	11.7%	6.1%	9.7%	6.7%
School Bus	Number	44	89	72	20	5
	Percent	25.3%	25.4%	33.8%	16.1%	33.3%
Other	Number	9	4	2	1	1
	Percent	5.2%	1.1%	.9%	.8%	6.7%
Total		174	350	213	124	15

Table 7.7 Distance and mode to school at age twelve (p=.000)

		Distance To School	
Mode to School		**Less than a mile**	**More than a mile**
Car	Count	4	197
	%	1.2%	36.6%
Walk	Count	218	119
	%	65.1%	22.1%
Bike	Count	14	77
	%	4.2%	14.3%
School Bus	Count	96	133
	%	28.7%	24.7%
Other	Count	3	12
	%	.9%	2.2%
Total	Count	335	538

7.1.3. Traumatic experiences at age twelve

It is possible that traumatic experiences related to bicycling in adolescence affect bicycling as an adult. Respondents from the different cities were equally unlikely to report the experience of being hit by a car or of knowing a child who was killed or seriously injured when they were 12 (Tables 7.8 and 7.9).

Table 7.8 Comparison of experience of being hit by a car when biking at age twelve (p=.673)

Hit when biking	Davis	Chico	Woodland	Turlock	Eugene	Boulder
No	292	110	99	77	114	109
	91.8%	90.9%	93.4%	87.5%	92.7%	89.3%
Yes	26	11	7	11	9	13
	8.2%	9.1%	6.6%	12.5%	7.3%	10.7%
Total	318	121	106	88	123	122

Table 7.9 Comparison of experience of knowing a child who was killed or seriously injured by a car while bicycling or walking at age twelve (p=.190)

Knew a Child who had been Killed/Injured while Biking	Davis	Chico	Woodland	Turlock	Eugene	Boulder
No	277	96	90	76	103	111
	86.3%	79.3%	84.9%	86.4%	83.1%	91.0%
	44	25	16	12	21	11
Yes	13.7%	20.7%	15.1%	13.6%	16.9%	9.0%
Total	321	121	106	88	124	122

7.1.7. Bicycling environment at age twelve

Most of the respondents agreed that it was safe for them to ride a bike to stores, that streets were not dangerous to bike on, and that friends went to places by bike when they were twelve years old. However, many respondents reported that their parents did not bike on a regular basis.

Table 7.10 Bicycling environment at age twelve

Biking environment at age 12	Safe to bike to store	Streets are Dangerous	Parents Bike	Friends Bike
Disagree (%)	16.0	82.0	83.8	18.0
Neutral (%)	9.7	8.9	5.6	10.3
Agree (%)	74.3	9.1	10.6	71.8

7.2. Comparison of biking level between 17 and 12 year olds

Respondents were asked whether they bicycled more or less at age 17 than age 12 (Table 7.11). The percent who biked more or the same at 17 is significantly higher in Davis.

Table 7.11 Comparison of biking level at age seventeen between the cities (p=.005)

Biking Level at Age Seventeen	Davis	Chico	Woodland	Turlock	Eugene	Boulder
Less	236	108	88	70	100	99
	74.0%	90.8%	83.0%	79.5%	80.6%	81.1%
Same	34	6	4	9	8	15
	10.7%	5.0%	3.8%	10.2%	6.5%	12.3%
More	49	5	14	9	16	8
	15.4%	4.2%	13.2%	10.2%	12.9%	6.6%
Total	319	119	106	88	124	122

7.2.1. Reason for less biking

When asked why they bicycled less at 17, respondents most frequently indicated "Got a driver's license" as a reason (Table 7.12). About 60% of respondents got their driver's license at age 16 (Table 7.13). Another important reason for biking less was attending a new school, such as moving from middle school to high school. Friends stopping biking and losing interest in biking were also reasons for biking less.

Table 7.12 Comparison of reasons for less biking at age seventeen than at age twelve

	No influence	Weak influence	Moderate influence	Strong influence
Got Driver's License (%)	26.4	4.4	15.3	53.8
Bike was Vandalized (%)	88.0	5.1	4.1	2.9
New School (%)	57.7	7.0	14.2	21.1
I moved (%)	74.5	5.5	6.6	13.4
I crashed (%)	92.8	3.1	2.7	1.4
Lost Interest (%)	35.1	19.7	28.6	16.6
Friends Stopped (%)	42.1	16.0	24.1	17.8

Table 7.13 Age when respondents got driver's license

Age when got driver's license	Frequency	Percent (%)
15	56	6.4
16	516	58.6
17	135	15.3
18	75	8.5
19 and over	92	10.4
No license	7	0.8

8. Conclusions

This study provides new and potentially important insights into factors associated with bicycle commuting. The analysis provides empirical evidence of the influences of both physical and social environment factors on bicycle commuting, though it suggests that individual attitudes and constraints are the most important determinants of bicycle commuting, and the model identifies a significant "self-selection" effect in which residential preference for a good community for bicycling is positively associated with bicycle commuting. These results mean that planners must address all three types of factors in order to increase bicycle commuting. Indeed, in countries with much higher levels of bicycle commuting than the U.S., this is exactly what planners have done (Pucher and Buehler 2008).

The traditional focus on the physical environment at the workplace, such as bicycle parking and showers, seems to have only a marginal effect, at least directly. However, a policy of parking fees at or around the workplace may encourage bicycle commuting by discouraging driving, all else equal. More important, it seems, is the physical environment of the community, including distances between residences and workplaces and the quality of the bicycle facilities linking them; the latter factor may act in part indirectly through the perceptions of commuters of the safety of bicycling to their workplace. Changing these factors, however, can be much more challenging than providing facilities or implementing policies at the workplace.

The results suggest that changes to the physical environment alone are likely to have little impact. The social environment of the workplace is also important, though what matters is apparently not the incentives for bicycling commuting provided by the employer but rather the attitudes of supervisors towards bicycle commuting. Most important of all are the attitudes of the commuters themselves, particularly their comfort level with bicycling and how much they like bicycling. Changing attitudes, whether of commuters or their supervisors, has not traditionally fallen within the realm of transportation planners. However, changing the social culture of the workplace through promotional events such as "bike to work day" or through support such as guidance on bicycle commuting routes and training for bicyclists might help to improve attitudes toward bicycling. In addition, the application of social marketing strategies to travel behavior is increasing, and planners can also draw on the experiences of the public health community in bringing about behavior change. Although limited, the available evidence suggests that these "soft" strategies can have a measurable impact on bicycling (Pucher et al. 2010).

Even with changes in attitudes and favorable environments, however, some commuters face constraints that prevent them from bicycling, including the need to run errands on the way to or from work or to use a vehicle during the day for work purposes. Planners might consider strategies that would help to reduce these constraints, including policies that encourage mixed-use workplaces (e.g. having a gym, a bank, shops, and other services on-site), or a policy that encourages employers to provide vehicles (preferably alternative-fuel vehicles) for use by

commuters during the day. Such strategies could help to improve the feasibility of transit commuting as well as bicycle commuting.

The significance of the self-selection effect also suggests an indirect role for the physical environment. Communities that support bicycle commuting (through both the physical and social environments) may succeed in increasing bicycle commuting within the community more by attracting bicycle-oriented residents than by changing the behavior of existing residents. It is also possible that a supportive bicycling environment helps to change the attitudes of residents towards bicycling over time, increasing comfort levels and the degree to which residents like bicycling. The cross-sectional design of this study limits our ability to explore this possibility further.

In all, our results provide some direction for transportation planners in their efforts to increase bicycle commuting, but they also suggest a need to expand the realm of strategies planners consider and to partner with other agencies or organizations with experience in bringing about attitudinal changes. As planners implement their strategies, it is critical that they undertake rigorous evaluation studies of the effectiveness of their strategies. For example, employees should be surveyed before and after the implementation of new parking fees to measure changes in modes to work as well as their attitudes towards these modes. Although this study provides direction as to which factors are likely to make the most difference – which levers to pull, so to speak – planners can only be sure about the effectiveness of their strategies when they try them and evaluate them.

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APPENDIX A: Variables from Survey

Category	Concept	Variable	Range	Description
Dependent Variable	Bicycling	Have_Bike	[0, 1]	Own a bicycle or not; 1=own, 0=not own
		Bike_Not	[0, 1]	Biked or not within last week; 1=biked, 0=not
		Bike_Days	[0,7]	Days in last 7 days rode a bicycle; 0=0, 1=1,…,7=7 days
		BikeWithinYear	[0,1]	Time since last bicycle ride; 1=biked within last year, 0=biked beyond last year or not
		Bike_Work	[0,1]	Bicycle as usual mode to work place; 1=Yes, 0=No
		Bike_Grocery	[0,1]	Bicycle as usual mode to grocery; 1=Yes, 0=No
		BikeMiles	[0,410] Mean=16.61	Miles of bicycling in last seven days by purpose
Individual Factors	Bicycling comfort	Off-street bicycle path	[0,1]	Comfort level on an off-street bicycle path; 1=comfortable,0=not
		0uiet residential street	[0,1]	Comfort level on a quiet street; 1=comfortable,0=not
		Two-lane local street with bike lane	[0,1]	Comfort level on a 2 lane street with a bike lane; 1=comfortable,0=not
		Two-lane local street without bike lane	[0,1]	Comfort level on a 2 lane street without a bike lane; 1=comfortable,0=not

Category	Concept	Variable	Range	Description
		Four-lane street with bike lane	[0,1]	Comfort level on a 4 lane street with a bike lane; 1=comfortable,0=not
		Four-lane street without bike lane	[0,1]	Comfort level on a 4 lane street without a bike lane; 1=comfortable,0=not
		HitByCar	[1,3]	Concerns being hit by a car when biking; 1=not concern, 2=somewhat concern, 3=very concern
		HitByBike	[1,3]	Concerning being hit by bicyclists when biking;1=not concern, 2=somewhat concern, 3=very concern
		Crash	[1,3]	Concerning crashing because of road when biking; 1=not concern, 2=somewhat concern, 3=very concern
		Injured-Yes	[0,1]	Prior accidents and injuries while biking; 1=Yes, 0=No
		Safe_Grocery	[1,3]	Perceived safety biking to grocery store; 1=comfortable, 2=not comfortable but would bike to, 3=not comfortable and not bike to
		Safe_PO	[1,3]	Perceived safety biking to Postoffice;

Category	Concept	Variable	Range	Description
				1=comfortable, 2=not comfortable but would bike to, 3=not comfortable and not bike to
		Safe_Elem	[1,3]	Perceived safety biking to elementary school; 1=comfortable, 2=not comfortable but would bike to, 3=not comfortable and not bike to
	Bicycling preference	LikeBike	[1,3]	Like bike; 1=disagree, 2=neutral, 3=agree
		PreferBike	[1,3]	Preferences for bike; 1=disagree, 2=neutral, 3=agree
		LikeDrive	[1,3]	Like driving; 1=disagree, 2=neutral, 3=agree
		LimitDrive	[1,3]	Limit driving; 1=disagree, 2=neutral, 3=agree
		GoodBike (60)	[0,1]	Importance of bike infrastructure in choosing community; 1=important, 0=not important
	Environmental attitudes	EnvironPrefer (21)	[0,1]	Attitudes on transportation and environment: stricter environmental laws; 1=agree, 0=disagree
		LimitAir (19)	[1,3]	Concerns about environmental problems: limit driving to help air

Category	Concept	Variable	Range	Description
				quality; 1=disagree, 2=neutral, 3=agree
		EnvironBenefit	[0,1]	Concerns about environmental problems when choosing modes; 1=important, 0= not important
	Physical activity orientation	GetExe	[1,3]	Physical activity attitudes:important; 1=disagree, 2=neutral, 3=agree
		EnjoyExer	[1,3]	Physical activity attitudes:enjoy; 1=disagree, 2=neutral, 3=agree
		PhysicalFitness	[0,1]	Consider physical fitness when choosing modes; 1=important, 0=not important
		GoodHealth	[1,3]	Physical activity levels: health condition; 1=not good, 2=neutral, 3=good
	Socio-demographics	Age	[17,90] Mean=49.29	Age, gender, education, household structure, income, physical and/or mental limitations
		Gender	[0,1]	1=female, 0=male
		Education	[0,1]	1>=BS/BA, 0<BS/BA
		Householdsize	[1,6] Mean=2.4	
		Income	[5000,125000] Mean= 71042.6	
		Physical/Mental limit_drive	[0,1]	Physical/Mental limits driving; 1=Yes,

Category	Concept	Variable	Range	Description
				0=No
Social-Environment Factors	Bicycle culture	DriverObli	[1,3]	Perceptions of car drivers oblivious to bicyclists; 1=disagree, 2=neutral, 3=agree
		DriverYield	[1,3]	Perceptions of car drivers yielding to bicyclists; 1=disagree, 2=neutral, 3=agree
		DriverWatch	[1,3]	Perceptions of car drivers watching for bicyclists; 1=disagree, 2=neutral, 3=agree
		DriverSpeed	[1,3]	Perceptions of car drivers driving faster; 1=disagree, 2=neutral, 3=agree
		BikerSpend	[1,3]	Perceptions of bicyclists spending money on bikes; 1=disagree, 2=neutral, 3=agree
		RareBike	[1,3]	Perceptions of people rare biking to grocery; 1=disagree, 2=neutral, 3=agree
		BikeNormal	[1,3]	Perceptions of bike as a normal mode; 1=disagree, 2=neutral, 3=agree
		BikePoor	[1,3]	Perceptions of bicyclists are poor; 1=disagree, 2=neutral, 3=agree
		KidBike	[1,3]	Perceptions of kids often biking; 1=disagree, 2=neutral, 3=agree

Category	Concept	Variable	Range	Description
		LittleConcernSafety	[1,3]	Perceptions of bicyclists concern little about safety; 1=disagree, 2=neutral, 3=agree
		BikeStolen	[1,3]	Experience with stolen bicycles; 1=not stolen, 2=once, 3=more than twice
Physical-Environment Factors	Bicycle infrastructure	BikeLanes	[1,3]	Perceived bicycling conditions: major streets have bike lanes; 1=not true, 2=true, 3=don't know
		WideStreet	[1,3]	Perceived bicycling conditions: wide street without bike lanes; 1=not true, 2=true, 3=don't know
		BikeRacks	[1,3]	Perceived bicycling conditions: destinations have bike racks; 1=not true, 2=true, 3=don't know
		Pathlight	[1,3]	Perceived bicycling conditions: streets are well lighted; 1=not true, 2=true, 3=don't know
	Land-use mix	Dist_Grocery	[1,3]	Distance from home to nearest grocery; 1=less than 2 miles, 2=more than 2 miles, 3=don't know

Category	Concept	Variable	Range	Description
		Dist_PO	[1,3]	Distance from home to nearest Post office; 1=less than 2 miles, 2=more than 2 miles, 3=don't know
		Dist_Restaurant	[1,3]	Distance from home to nearest restaurant; 1=less than 2 miles, 2=more than 2 miles, 3=don't know
		Dist_Bikerepair	[1,3]	Distance from home to nearest bike repair store; 1=less than 2 miles, 2=more than 2 miles, 3=don't know
		Dist_Work	[1,3]	Distance from home to nearest work place; 1=less than 2 miles, 2=more than 2 miles, 3=don't know
		Dist_Elem	[1,3]	Distance from home to nearest elementary scholl; 1=less than 2 miles, 2=more than 2 miles, 3=don't know

APPENDIX B: Survey Instrument

UNIVERSITY OF CALIFORNIA, DAVIS

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INSTITUTE OF TRANSPORTATION STUDIES
(530) 752-6548 PHONE
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ONE SHIELDS AVENUE
DAVIS, CALIFORNIA 95616

UC Davis Travel Survey

Dear Davis Resident,

The University of California, Davis is conducting a study of the choices people make about their daily travel. By understanding how the characteristics of the cities we live in affect the transportation choices we make, policy-makers can better address our transportation problems.

The survey will take about 25 minutes to complete. Any adult household member can participate in the survey. While you may feel that some of the questions are not applicable to you, or that your particular travel preferences are not included in the multiple-choice questions, we hope you will answer them as best you can. Your opinions are important to us!

You will skip some sections based on your responses to questions. For instance, in Section 7 you are asked if you work outside the home. If your answer is "no", you will skip Section 8 and continue with Section 9. We've tried to make this as clear as possible, if you have any questions, feel free to call us for help.

Your participation in this survey is voluntary and your responses are completely confidential. We will use your individual responses only for the purpose of this study. We will use your respondent number only for keeping track of which households have responded.

If you have any questions, you can contact me directly at 530-752-5878 (call collect) or by email at slhandy@ucdavis.edu. You can also contact my assistant Ted Buehler at 530-848-3615 or email tjbuehler@ucdavis.edu .

And remember, only by completing the survey by Monday July 24, 2006, **you are eligible to win one of five $100 prizes!**

Thank you for your participation

Professor Susan Handy,
Principal Investigator

Section 2: Your daily travel

2. In five words or fewer, what do you think is the biggest transportation problem we face?

_____

3. Do you own or have regular access to a car?

□1 Yes □2 No

4. Do you own or have regular access to a bicycle (in working condition)?

□1 Yes □2 No

5. Is there bus or train service within a 5 minute walk of your home?

□1 Yes □2 No

6. During the last seven days, on how many days did you:

Drive or ride in a car?	0	1	2	3	4	5	6	7	days
Ride a bicycle?	0	1	2	3	4	5	6	7	days
Ride on a bus or train?	0	1	2	3	4	5	6	7	days
Walk outdoors for more than 10 minutes at a time?	0	1	2	3	4	5	6	7	days

7. Thinking of the longest portion of your trip in a typical week with good weather, how do you usually get to...

	Drive or ride in a car	*Ride a bike*	*Ride a bus or a train*	*Walk*	*Not applicable*
Your workplace or school	□1	□2	□3	□4	□5
Your usual grocery store	□1	□2	□3	□4	□5
The nearest post office	□1	□2	□3	□4	□5
A restaurant you like	□1	□2	□3	□4	□5
The local elementary school	□1	□2	□3	□4	□5

8. Approximately how many miles do you drive in a typical week (including weekends)? _____ miles

Continue to Section 3

Section 3: Your city, your neighborhood

These questions are about characteristics of your city and your neighborhood. By "neighborhood" we mean the area within a mile or two of your house -- including local shopping areas, schools, and major streets.

9. How far is it from your home to the following destinations?

	Less than a mile	*1-2 miles*	*2-4 miles*	*More than 4 miles*	*I don't know/Not applicable*
Your usual grocery store	☐1	☐2	☐3	☐4	☐5
The nearest post office	☐1	☐2	☐3	☐4	☐5
A restaurant you like	☐1	☐2	☐3	☐4	☐5
A bike repair shop	☐1	☐2	☐3	☐4	☐5
Your workplace	☐1	☐2	☐3	☐4	☐5
The local elementary school	☐1	☐2	☐3	☐4	☐5

10. How true are the following statements in describing your neighborhood? (We're interested in your assessment even if you don't regularly ride a bike).

	Not at all true	*Somewhat true*	*Mostly true*	*Entirely true*	*I don't know*
Major streets have bike lanes.	☐1	☐2	☐3	☐4	☐5
Streets without bike lanes are generally wide enough to bike on.	☐1	☐2	☐3	☐4	☐5
Stores and other destinations have bike racks.	☐1	☐2	☐3	☐4	☐5
Streets and bike paths are well lighted.	☐1	☐2	☐3	☐4	☐5
Intersections have push-buttons or sensors for bicycles or pedestrians.	☐1	☐2	☐3	☐4	☐5
The city has a network of off-street bike paths.	☐1	☐2	☐3	☐4	☐5
Bike lanes are free of obstacles.	☐1	☐2	☐3	☐4	☐5
The bike route network has big gaps.	☐1	☐2	☐3	☐4	☐5
The area is too hilly for easy bicycling.	☐1	☐2	☐3	☐4	☐5

Continue to Section 4

Section 4

These questions are about your observations of other people in your city.

11. Do you agree or disagree with the following statements about people that drive cars in your city?

	Strongly Disagree	*Disagree*	*Neutral*	*Agree*	*Strongly agree*
Most drivers seem oblivious to bicyclists.	☐1	☐2	☐3	☐4	☐5
Most drivers yield to bicyclists.	☐1	☐2	☐3	☐4	☐5
Most drivers watch for bicyclists at intersections.	☐1	☐2	☐3	☐4	☐5
Most people drive faster than the speed limit.	☐1	☐2	☐3	☐4	☐5

Section 4 (continued)

12. Do you agree or disagree with these statements about bicyclists in your city?

	Strongly Disagree	*Disagree*	*Neutral*	*Agree*	*Strongly agree*
Most bicyclists look like they spend a lot of money on their bikes.	□1	□2	□3	□4	□5
It is rare for people to shop for groceries on a bike.	□1	□2	□3	□4	□5
Bicycling is a normal mode of transportation for adults in this community.	□1	□2	□3	□4	□5
Most bicyclists look like they are too poor to own a car.	□1	□2	□3	□4	□5
Kids often ride their bikes around my neighborhood for fun.	□1	□2	□3	□4	□5
Many bicyclists appear to have little regard for their personal safety.	□1	□2	□3	□4	□5

Continue to Section 5

Section 5: Safety and Security

The following questions are about how safe you feel traveling around your community by bicycle.

We understand that many people don't bicycle regularly, but we're interested in your perceptions, too! Please answer the next set of questions whether you bike or not, according to how you feel about the following issues.

13. In general, how comfortable would you be riding a bicycle in the following kinds of streets in daylight and good weather?

	Comfortable	*Uncomfortable, but I'd ride there anyway*	*Uncomfortable, and I wouldn't ride on it*
An off-street bicycle path	□1	□2	□3
A quiet residential street	□1	□2	□3
A two-lane local street with a bicycle lane	□1	□2	□3
A narrow two-lane local street without a bicycle lane	□1	□2	□3
A four-lane street with a bicycle lane	□1	□2	□3
A four lane street without a bicycle lane	□1	□2	□3

14. How safe would you feel riding a bicycle to the following locations?

	Comfortable	*Uncomfortable, but I'd ride there anyway*	*Uncomfortable, and I wouldn't ride there*
Your usual grocery store	□1	□2	□3
The nearest post office	□1	□2	□3
The local elementary school	□1	□2	□3
A restaurant you like	□1	□2	□3
The nearest bike shop	□1	□2	□3

Section 5: Safety and Security (continued)

15. If or when bicycling, how concerned are you that the following events might happen?

	Not at all concerned	*Somewhat concerned*	*Very concerned*
Being hit by a car	□1	□2	□3
Being hit by another bicyclist while riding my bike	□1	□2	□3
Being bitten by a dog	□1	□2	□3
Being mugged or attacked	□1	□2	□3
Crashing because of road hazards (such as uneven pavement or debris on the road)	□1	□2	□3

16. Have you ever been injured riding a bike in Davis? (mark all that apply)

□1 No
□2 Yes, I hit or was hit by a car
□3 Yes, I hit or was hit by a bike
□4 Yes, I collided with a pedestrian
□5 Yes, but no other vehicles were involved (I crashed or 'wiped out').
□6 Other _____

17. Have you ever had a collision with a motor vehicle while riding your bike in Davis? (mark all that apply)

□1 No
□2 Yes, but I was not injured
□3 Yes, I was injured, but nothing serious
□4 Yes, I was injured and required medical attention

Continue to Section 6

Section 6: Travel preferences

We'd like to ask about your preferences with respect to travel and the environment. Please indicate your feelings about the following statements. There are no right or wrong answers; we want only your true opinions.

18. Do you agree or disagree with the following statements?

	Strongly Disagree	*Disagree*	*Neutral*	*Agree*	*Strongly agree*
It is important for me to get regular physical exercise.	□1	□2	□3	□4	□5
I enjoy physical exercise.	□1	□2	□3	□4	□5
I am in good health.	□1	□2	□3	□4	□5
The price of gasoline affects the choices I make about my daily travel.	□1	□2	□3	□4	□5
I try to limit my driving to help improve air quality.	□1	□2	□3	□4	□5
Travel time is generally wasted time.	□1	□2	□3	□4	□5
I like riding a bike	□1	□2	□3	□4	□5
I prefer to take transit rather than drive whenever possible	□1	□2	□3	□4	□5
I like taking transit	□1	□2	□3	□4	□5

Section 6: Travel preferences (continued)

18. (continued) Do you agree or disagree with the following statements?

	Strongly Disagree	*Disagree*	*Neutral*	*Agree*	*Strongly agree*
I need a car to do many of the things I like to do	□1	□2	□3	□4	□5
I like driving	□1	□2	□3	□4	□5
I prefer to ride a bike rather than drive whenever possible	□1	□2	□3	□4	□5
I like walking	□1	□2	□3	□4	□5
I try to limit my driving as much as possible	□1	□2	□3	□4	□5
I prefer to walk rather than drive whenever possible	□1	□2	□3	□4	□5

21. From the pair of statements below, please select the statement that most closely matches your opinion:

□1 Stricter environmental laws and regulations cost too many jobs and hurt the economy, or

□2 Stricter environmental laws and regulations are worth the cost

22. When you are choosing what form of travel (e.g. drive, walk, bike) to use for a trip, how important are the following factors in your decision?

	Not at all important	*Somewhat important*	*Important*	*Extremely important*
Physical fitness	□1	□2	□3	□4
Travel distance	□1	□2	□3	□4
Speed of travel	□1	□2	□3	□4
Convenience of travel	□1	□2	□3	□4
Cost of travel	□1	□2	□3	□4
Cost of parking	□1	□2	□3	□4
Enjoyment of travel	□1	□2	□3	□4
Environmental benefits	□1	□2	□3	□4
Traffic	□1	□2	□3	□4
Weather	□1	□2	□3	□4

Continue to Section 7

****

Section 7 Employment status

23. Are you currently employed?

□1 Yes, I work outside the house at least one day a week. (*Continue to Section 8*)

□2 Yes, I work at home. (***Skip** to **Section 9** on page 9*)

□3 No, but I volunteer outside the house at least one day a week. (*Continue to Section 8*)

□4 No. (***Skip** to **Section 9** on page 9*)

Section 8: Your commute

This section is about your daily commute. If you work full or part time, answer the questions for your place of work (If you don't work outside the house, skip to Section 9).

24. Where is your workplace located? (If you work at more than one location, use the most frequent location to which you report for work)

Street (or building) _____
nearest cross-street _____
City _____
About how many miles is it from home to work? ___ miles

25. In a typical week with good weather, how many days do you use each of the following forms of travel to and from work?

Fill in the *Primary* columns for the forms of travel you use for the longest distance of your trip.

Use the *Additional* columns if you use more than one form of travel (such as "drive and walk" or "bus and bicycle").

Only include walk in the *Additional* columns if you walk for more than 5 minutes from your parking place or transit stop.

	Primary (0 – 7 days)		*Additional (0 – 7days) (if applicable)*	
	home to work	work to home	home to work	work to home
Car/vanpool, with other household members				
Car/vanpool, with others				
Car, driving alone				
Walking				
Biking				
Bus or train				
Motorcycle or scooter				
Other _____				

26. What is the monthly cost of parking at your workplace?

□1 Don't know
□2 Not applicable
□3 No cost
□4 $1 - $10/month
□5 $11 - $20/month
□6 $21 - $30/month
□7 $31 - $40/month
□8 More than $40/month

27. How often do you run errands on your way to or from work?

	Never	*Less than once a week*	*One to four times a week*	*Daily*
Drop off children on way in to work?	□1	□2	□3	□4
Pick up children on the way home?	□1	□2	□3	□4
Shop for groceries on the way home?	□1	□2	□3	□4
Stop for other errands	□1	□2	□3	□4
Go out for dining/entertainment on the way home?	□1	□2	□3	□4
Visit friends on the way home?	□1	□2	□3	□4

Section 8: Your commute (continued)

28. Do you agree or disagree with the following statements about your work?

	No Influence	*Weak Influence*	*Moderate Influence*	*Strong Influence*
I often need to carry materials to or from work (more than a briefcase/backpack)	□1	□2	□3	□4
Some of my co-workers bike to work	□1	□2	□3	□4
My employer offers incentives to carpool, bicycle or take transit to work.	□1	□2	□3	□4
My supervisors disapprove of commuting by bicycle.	□1	□2	□3	□4
People in my workplace need to dress professionally.	□1	□2	□3	□4
People in my workplace are fitness-conscious.	□1	□2	□3	□4
I often need to use my own vehicle to travel to different sites during the day.	□1	□2	□3	□4

29. How true are the following statements about describing your workplace?

	Not at all true	*Somewhat true*	*Mostly true*	*Entirely true*	*I don't know*
I have access to a shower within a 5 minute walk of my office.	□1	□2	□3	□4	□5
The streets near my workplace are dangerous for bicycling.	□1	□2	□3	□4	□5
There is good transit service to my workplace.	□1	□2	□3	□4	□5
It is easy to find a secure rack/post to lock my bike to at work.	□1	□2	□3	□4	□5

30. How much would any of the following influence you to ride a bicycle more often?

	No Influence	*Weak Influence*	*Moderate Influence*	*Strong Influence*
Improvements made to the route from your home to workplace so that it was safe and comfortable for bicycling	□1	□2	□3	□4
Gift of $500 bike and accessories, of a style and size appropriate for you	□1	□2	□3	□4
A personal instructor to show you the best route and ride with you for the first week	□1	□2	□3	□4
Increase of gas price to $4 per gallon	□1	□2	□3	□4
Increase of gas price to $6 per gallon	□1	□2	□3	□4
$20 per month increase in parking fees at your workplace	□1	□2	□3	□4
Employer-sponsored maintenance program to keep your bike in top running condition (guaranteed flat repair, etc.)	□1	□2	□3	□4
Showers made available at my workplace	□1	□2	□3	□4

Section 8: Your commute (continued)

31. OPTIONAL: Do you have clarifications or other comments about your daily commute you'd like to make?

Continue to Section 9

Section 9: Most recent bike ride

For the next set of questions, think of the most recent time you went for a ride on a bicycle. It doesn't matter if it was last week or 30 years ago, we're interested in your trip!

32. When did you last go for a ride on a bicycle?

- □1 I have never ridden a bicycle
- □2 Over 10 years ago
- □3 Between 1 and 10 years ago
- □4 Between 1 month and 1 year ago
- □5 Between 1 week and 1 month ago
- □6 Within the last week

33. About how long and how far was this ride?
Even if you don't remember details, just answer as well as you can remember.

_____ miles _____ minutes

34. What the primary purpose for taking this ride?

- □1 Transportation to or from work or school
- □2 Transportation to a friend's house, a store, or another destination
- □3 Recreational--for pleasure or exercise

35. How much influence did the following factors have on your choice of a bicycle on this trip?

	No Influence	*Weak Influence*	*Moderate Influence*	*Strong Influence*
Bicycling was less expensive than driving	□1	□2	□3	□4
Bicycling was a fast way to get to my destination	□1	□2	□3	□4
Bicycling provided me with exercise, health, or pleasure	□1	□2	□3	□4
I did not have a drivers' license	□1	□2	□3	□4
I did not have access to a car	□1	□2	□3	□4
There was limited parking at my destination	□1	□2	□3	□4
Bicycling was better for the environment	□1	□2	□3	□4
Bicycling enabled me to enjoy good weather	□1	□2	□3	□4

If your "most recent ride" was one year ago or less, Continue to Section 10
*If your "most recent ride" was over one year ago, **Skip** ahead to **Section 11** (on page 11)*

Section 10: Bicycling in your city

The next set of questions is about your bicycling habits and experiences (for people who have ridden a bicycle in the last year – otherwise skip to Section 11).

36. What type of bike do you ride?

	Primary bike	Additional bike (if any)
Bike type	□1 Mountain bike □2 "10-Speed" or racing bike □3 "Hybrid" or city bike □4 Cruiser □5 I don't know □6 Other	□1 Mountain bike □2 "10-Speed" or racing bike □3 "Hybrid" or city bike □4 Cruiser □5 I don't know □6 Other
Where did you buy this bike?	□1 New, from a bike shop near your home □2 New, from a bike shop elsewhere □3 New, from a store like Walmart, Target, etc. □4 Used, from a friend □5 Used, from someone you didn't know □6 It was a gift	□1 New, from a bike shop near your home □2 New, from a bike shop elsewhere □3 New, from a store like Walmart, Target, etc. □4 Used, from a friend □5 Used, from someone you didn't know □6 It was a gift
Is this bike in working condition today?	□1 Yes □2 No, it needs minor repairs (less than $50) □3 No, it needs major repairs (more than $50)	□1 Yes □2 No, it needs minor repairs (less than $50) □3 No, it needs major repairs (more than $50)

37. In an average week, how many miles do you ride on your bike? _____ miles

38. What portion of your bike rides are for transportation (commuting, shopping, visiting people) and what portion are for recreation (exercise, pleasure rides, adventure)?
By "bike ride" we mean a time you ride a bicycle for five minutes or more.

□1 All bike rides for transportation
□2 Most bike rides for transportation
□3 About half and half for each
□4 Most bike rides for recreation
□5 All bike rides for recreation

39. Do you consider yourself able to do the following bicycle maintenance tasks?

	Yes	*No*	*Maybe*
Fix a flat tire	□1	□2	□3
Pump air into a tire	□1	□2	□3
Adjust the seat height	□1	□2	□3
Adjust the brakes	□1	□2	□3
Oil the chain	□1	□2	□3
I can fix any problem I have with my bicycle	□1	□2	□3

40. How well do you maintain your bicycle (or the bicycle you most frequently use)?

□1 My bike is always in top running condition
□2 I try to keep ahead of problems, but not always
□3 My bike usually has a few problems, but I ride it anyway
□4 My bike usually has serious mechanical problems

Section 10: Bicycling in your city (continued)

41. The last time that your bike needed major repairs (more than $50), how long did it take you to get it repaired?

- □1 Less than one day
- □2 One day to one week
- □3 One week to one month
- □4 More than one month
- □5 My bike has never needed major repairs

42. Has your bicycle ever been stolen in Davis?

- □1 No
- □2 Yes, once
- □3 Yes, twice
- □4 Yes, three or four times
- □5 Yes, five times or more

43. OPTIONAL: Do you have any other comments you'd like to share with us about bicycling you'd like to share with us?

Skip** to **Section 12

****

Section 11: Special questions for nonbicyclists

44. In five words or fewer, why did you stop riding after your most recent ride?

_____

45. In five words or fewer, why don't you ride a bike now?

_____

Continue to Section 12

Section 12: Bicycling as a child

46. Did you ever ride a bicycle when you were about 12 years old?

- □1 Yes – ***Skip*** *to* ***Section 14*** *(in the middle of this page)*
- □2 No -- *Continue to Section 13*

Section 13: People who didn't bicycle as children

47. How much did the following factors influence you not to bike as a child?

	No Influence	*Weak Influence*	*Moderate Influence*	*Strong Influence*
I didn't want to ride a bike	□1	□2	□3	□4
I never learned to ride a bike	□1	□2	□3	□4
My neighborhood was too hilly	□1	□2	□3	□4
The streets in my neighborhood were too busy	□1	□2	□3	□4
The streets in my neighborhood were too busy	□1	□2	□3	□4
My parents wouldn't let me	□1	□2	□3	□4
I never had a bike	□1	□2	□3	□4
There were no interesting places to bike to	□1	□2	□3	□4

Skip *to* ***Section 15*** *(on page 15)*

****

Section 14: People who bicycled as children

This section is about how much you bicycled as a child. For the next set of questions, answer for a time in your childhood when you were about 12 years old.

48. Which of the following best describes the neighborhood you lived in at this time?

- □1 Rural area
- □2 Suburban neighborhood
- □3 Small town
- □4 City neighborhood
- □5 Other _____

49. What was your most common form of travel to school during this time? (in good weather)

- □1 Ride in a car
- □2 Walk
- □3 Schoolbus
- □4 Bike
- □5 Other (please specify)

50. About how far was it from your home to school?

- □1 A couple blocks or less
- □2 Between a couple blocks and a mile
- □3 One to three miles
- □4 More than three miles

(Continue to the next page)

Section 14: Bicycling in your youth (continued)

51. How often did you bike to the following places?

	Never	*Occasionally*	*About once a week*	*Several times a weak*	*Daily*
School	□1	□2	□3	□4	□5
Convenience store (ex. 7-11)	□1	□2	□3	□4	□5
Friends' houses	□1	□2	□3	□4	□5
Roaming/exploring	□1	□2	□3	□4	□5
Library	□1	□2	□3	□4	□5

52. Were you ever hit by a car while bicycling as a youth? (Answer all that apply)

□1 No
□2 No, but I came very close to being hit
□3 Yes, but not injured
□4 Yes, scrapes an bruises
□5 Yes, required medical attention
□6 Yes, seriously injured
□7 Yes, I was lucky I wasn't killed in this accident (regardless of injury)

53. During this time, were any children from your school or neighborhood killed or seriously injured by a car while bicycling or walking?

□1 Yes
□2 No
□3 I don't remember

54. Do agree or disagree with the following statements about your life at this time?

	Strongly Disagree	*Disagree*	*Neutral*	*Agree*	*Strongly agree*
It was safe for me to ride a bike to the nearest store.	□1	□2	□3	□4	□5
Streets around my house were too dangerous for me to ride a bike.	□1	□2	□3	□4	□5
At least one of my parents/guardians rode a bike on a regular basis.	□1	□2	□3	□4	□5
My friends and I would frequently go places by bike	□1	□2	□3	□4	□5

(Continue to the next page)

Section 14: Bicycling in your youth (continued)

55. Did you bike more or less when you were 17 compared to when you were 12?

- □1 Less when I was 17
- □2 About the same
- □3 More when I was 17

56. If you bicycled less when you were 17 than when you were 12, how much did the following events influence you to bicycle less?

	No Influence	*Weak Influence*	*Moderate Influence*	*Strong Influence*
I started attending a new school	□1	□2	□3	□4
I never learned to ride a bike	□1	□2	□3	□4
My bike was vandalized or stolen	□1	□2	□3	□4
My friends stopped doing it	□1	□2	□3	□4
I lost interest	□1	□2	□3	□4
I crashed on my bike	□1	□2	□3	□4
I got a drivers' license	□1	□2	□3	□4
There were no interesting places to bike to	□1	□2	□3	□4

57. How old were you when you got your drivers' license?

- □1 15 or younger
- □2 16
- □3 17
- □4 18
- □5 19 or older
- □6 I have never had a drivers' license

58. OPTIONAL: Would you like to share any other comments about bicycling and your childhood with us?

****

Continue to Section 15

Section 15: When did you move to Davis?

59. How long have you lived in Davis?

- □1 Less than two years
- □2 2 to 5 years
- □3 6 to 10 years
- □4 11 to 20 years
- □5 21 to 30 years
- □6 More than 30 years

60. How important were the following in your choice to live in Davis?

	Not at all important	*Somewhat important*	*Important*	*Extremely important*
Good investment potential of a home	□1	□2	□3	□4
High quality K-12 schools	□1	□2	□3	□4
A good community for bicycling	□1	□2	□3	□4
Close to where I work	□1	□2	□3	□4
Safe neighborhood for kids to play outdoors	□1	□2	□3	□4

*If you have lived in Davis for **2 years or less**, continue to Section 16*
*If you have lived in Davis for over **2 years**, **skip** to **Section 18** (on page 18)*

****

Section 16: Davis and your previous community

The following questions are about how Davis differs from your previous community.

61. When did you move to Davis?

Year _____
Month _____

62. Where did you move from?

State or country _____
City/locale _____
Street _____
At nearest cross street _____

63. Which best describes the neighborhood you previously lived in?

- □1 Rural area
- □2 Suburban neighborhood
- □3 Small town
- □4 City neighborhood
- □5 Other _____

(Continue to the next page)

Section 16: Davis and your previous community (continued)

64. Before you moved to Davis, how did you usually get to work/school?
(Think of a month with good weather, sometime in the year before you moved)

- □1 I did not commute to work at that time
- □2 Drive alone
- □3 Walk
- □4 Carpool
- □5 Telecommute
- □6 Transit (bus or rail)
- □7 Bicycle
- □8 Other _____

65. How far was it from your home to the following destinations?

	Less than a mile	*1-2 miles*	*2-4 miles*	*More than 4 miles*	*I don't know/Not applicable*
Your usual grocery store	□1	□2	□3	□4	□5
The nearest post office	□1	□2	□3	□4	□5
Your workplace	□1	□2	□3	□4	□5
A bike repair shop	□1	□2	□3	□4	□5
A restaurant you liked	□1	□2	□3	□4	□5
The local elementary school	□1	□2	□3	□4	□5

66. How true are the following statements in describing your previous neighborhood?

	Not at all true	*Somewhat true*	*Mostly true*	*Entirely true*	*I don't know*
Major streets had bike lanes	□1	□2	□3	□4	□5
Streets without bike lanes were generally wide enough to bike on	□1	□2	□3	□4	□5
Stores and other destinations had bike racks	□1	□2	□3	□4	□5
Streets and bike paths were well lighted	□1	□2	□3	□4	□5
Intersections had push-buttons or sensors for bicycles	□1	□2	□3	□4	□5
The city had a network of off-street bike paths	□1	□2	□3	□4	□5
The bike route network had big gaps	□1	□2	□3	□4	□5
The area was too hilly for easy bicycling	□1	□2	□3	□4	□5

(continue to the next page)

Section 16: Davis and your previous community (continued)

67. Do you agree or disagree with the following statements about bicyclists in your previous community?

	Strongly Disagree	*Disagree*	*Neutral*	*Agree*	*Strongly agree*
Most bicyclists looked like they spend a lot of money on their bikes.	☐1	☐2	☐3	☐4	☐5
It was rare for people to shop for groceries on a bike	☐1	☐2	☐3	☐4	☐5
Bicycling was a normal mode of transportation for adults in the community	☐1	☐2	☐3	☐4	☐5
Most bicyclists looked like they are too poor to own a car.	☐1	☐2	☐3	☐4	☐5
Kids often rode their bikes around my neighborhood for fun	☐1	☐2	☐3	☐4	☐5
Many bicyclists appeared to have little regard for their personal safety	☐1	☐2	☐3	☐4	☐5

68. Think about your current daily travel now and your daily travel before you moved to Davis. We would like to know how this has changed, for whatever reason. Answer for your own travel only.

	A lot less now	*A little less now*	*About the same*	*A little more now*	*A lot more now*
How much do you **drive** now, compared to your previous city?	☐1	☐2	☐3	☐4	☐5
How much do you **use public transit** now, compared to your previous city?	☐1	☐2	☐3	☐4	☐5
How much do you **walk in your neighborhood** now compared to your previous city?	☐1	☐2	☐3	☐4	☐5
How much do you **ride your bike** now, compared to your previous city?	☐1	☐2	☐3	☐4	☐5

69. Do you agree or disagree with the following statements in describing the differences between Davis and your previous city of residence?

	Strongly Disagree	*Disagree*	*Neutral*	*Agree*	*Strongly agree*
It's easier to get around on transit in Davis than in my previous city.	☐1	☐2	☐3	☐4	☐5
It's easier to get around on a bike in Davis than in my previous city.	☐1	☐2	☐3	☐4	☐5
When I drive, I'm more cautious of people on bikes than I was in my previous city.	☐1	☐2	☐3	☐4	☐5
The availability of non-car options for travel was a consideration in my decision to move to Davis.	☐1	☐2	☐3	☐4	☐5

***Skip** to **Section 19** (in the middle of the next page)*

Section 18: Changes in your travel

(This section is for people who have lived in Davis for over two years – others skip to Section 19)

70. Think about your daily travel now and your daily travel about a year ago. We would like to know how this has changed, for whatever reason. Answer for your own travel only.

	A lot less now	*A little less now*	*About the same*	*A little more now*	*A lot more now*
How much do you **drive** now, compared to a year ago?	□1	□2	□3	□4	□5
How much do you **use public transit** now, compared to a year ago?	□1	□2	□3	□4	□5
How much do you **walk in your neighborhood** now compared to a year ago?	□1	□2	□3	□4	□5
How much do you **ride your bike** now, compared to a year ago?	□1	□2	□3	□4	□5

Continue to Section 19

Section 19: Are you a student?

71. Were you a college or university student sometime in the last year?

□1 Yes, full time (*if yes, continue to section 20*)
□2 Yes, part time (*if yes, continue to section 20*)
□3 No (*if no, **Skip** to **Section 21** on the next page*)

Section 20: Travel to Campus

72. What college/university do you attend?

Name _____
Location (city) _____
About how many miles is it from home to campus? ___ miles

73. In a typical week with good weather, how many days do you use each of the following forms of travel to and from school?

Fill in the *Primary* columns for the forms of travel you use for the longest distance of your trip.

Use the *Additional* columns if you use more than one form of travel (such as drive and walk or bus and bicycle).

Only include walk in the *Additional* columns if you walk for more than 5 minutes from your parking place or transit stop.

	Primary (0 – 7 days)		*Additional (0 – 7days) (if applicable)*	
	home to school	school to home	home to school	school to home
Car/vanpool, with other household members				
Car/vanpool, with others				
Car, driving alone				
Walking				
Biking				
Bus or train				
Motorcycle or scooter				
Other _____				

Continue to Section 21 (next page)

Section 21: You and your household

The questions in this section ask a few things about you and the members of your household. These characteristics are important for understanding your choices about daily travel. We guarantee the confidentiality of this information and assure you that we will use this information only for analysis purposes.

74. What is your gender? □1 Female □2 Male

75. What is your age? ___

76. Please tell us about yourself and the members of your current household.

	Household member				
	Person 2	Person 3	Person 4	Person 5	Person 6
a. Age in years?					
b. Related to you?	□1 Yes □2 No	□1 Yes □2 No	□1 Yes □2 No	□1 Yes □2 No	□1 Yes □2 No
c. Employed now?	□1 Full-time □2 Part-Time □3 No	□1 Full-time □2 Part-Time □3 No	□1 Full-time □2 Part-Time □3 No	□1 Full-time □2 Part-Time □3 No	□1 Full-time □2 Part-Time □3 No
c. Ride a bike?	□1 Never □2 Once a month or less □3 Several times a month □4 Once a week or more □5 Daily	□1 Never □2 Once a month or less □3 Several times a month □4 Once a week or more □5 Daily	□1 Never □2 Once a month or less □3 Several times a month □4 Once a week or more □5 Daily	□1 Never □2 Once a month or less □3 Several times a month □4 Once a week or more □5 Daily	□1 Never □2 Once a month or less □3 Several times a month □4 Once a week or more □5 Daily

77. Do you have a driver's license? □1 No □2 Yes

78. Do you have any physical or mental conditions that seriously limit or prevent you from doing any of the following?

Driving a vehicle	□1 No	□2 Yes
Driving a vehicle on the freeway	□1 No	□2 Yes
Walking outside the home	□1 No	□2 Yes
Riding a bicycle	□1 No	□2 Yes
Using public transit	□1 No	□2 Yes

80. What is your highest level of education?

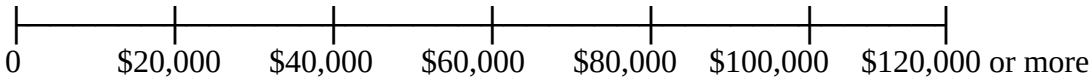
□1 Some grade school or high school
□2 High school diploma
□3 Some college or technical school
□4 Four-year college degree or technical school degree/certificate
□5 Some graduate school
□6 Completed graduate degree(s)

Continue to the last page!

79. Is there anyone in your household that needs assistance to travel outside of the home?

A child/children	□1 No	□2 Yes
An elder/elders	□1 No	□2 Yes
Other	□1 No	□2 Yes

81. To understand travel choices, and for statistical purposes, we need an idea of your total household income. Please indicate the approximate total annual combined income of all the working adults in your household.



82. Do you rent or own your current residence? □1 Rent □2 Own

83. Please mark the one race or ethnicity that best applies to you

□1 American Indian/Alaskan Native
□2 Asian/Pacific Islander
□3 Black/African American
□4 Hispanic/Latino
□5 White, Not of Hispanic Origin
□6 I would rather not answer
□7 Other (please specify) _____

84. Which one of the following statements best describes your current relationship status?

□1 Married or in a steady relationship
□2 Single and dating
□3 Single and not currently dating
□4 I would rather not answer

86. Is it OK for us to contact you if we have questions about your survey? If so, please provide the following contact information. Providing this information is entirely optional.

Daytime phone number, __ __ __ - __ __ __ - __ __ __ __
and / or
E-mail address _____
Confirm your email address _____

87. OPTIONAL: Is there anything else you'd like to tell us regarding transportation in your city, or thoughts about the survey?

Thank you for your participation!