

**EVALUATING THE IMPACT OF NEIGHBORHOOD TRAIL DEVELOPMENT ON
ACTIVE TRAVEL BEHAVIOR AND OVERALL PHYSICAL ACTIVITY AMONG
SUBURBAN RESIDENTS**

Shaunna K. Burbidge, PhD
Brigham Young University
Department of Geography
690 Spencer W. Kimball Tower
Provo, UT 84602
Phone: 801-336-7991
Fax: 801-485-0638
E-mail: burbidge@byu.edu

Konstadinos G. Goulias, PhD
University of California Santa Barbara
Department of Geography and GeoTrans Lab
5706 Ellison Hall
Santa Barbara, CA 93106
Email: goulias@geog.ucsb.edu

Submitted July 7, 2008

Number of Words, Abstract = 235
Number of Words, Body = 4,672
Figures and Tables = 10 (x 250 = 2,500 words)
Total Words= 7,407

Paper submitted for presentation at the 88th annual Transportation Research Board Meeting
January 11-15, 2009, and subsequent publication in the Transportation Research Record: Journal
of the Transportation Research Board

ABSTRACT

Many studies have examined the impact that the built environment has on physical activity, and much of the existing research posits that if communities will provide and improve active infrastructure such as trails, sidewalks, and bike lanes, people will become more physically active. However, most of these studies have used cross-sectional methods which have allowed them to establish correlations but not behavioral causality. In this pilot project a longitudinal design is used to evaluate the impact neighborhood trail development to assess a trail construction impact on active travel behavior and overall physical activity among suburban residents. A sample of suburban residents in West Valley City, Utah was surveyed both before and after the construction of a class-one trail in their neighborhood using a preliminary household survey, individual activity diaries completed at three pre-assigned time points (before and twice after the trail's construction), new resident surveys, and a trail user's intercept survey. This intervention technique performs a more direct test of causality by looking at the same group of residents over time and analyzing if individual changes in behavior occur following the construction of the trail. In the paper we show that trail neighborhood residents did not use the facility after it was build, new residents did not move to the neighborhood because of the trail, and the users of the trail come from elsewhere. We also report trail amenities that appear to be more desirable.

INTRODUCTION

As overweight and obesity have become bigger issues in Americans' daily lives they have been widely attributed to the lack of physical activity in today's society. A new vigor of research interest in this arena has led many professionals to claim that current lifestyle patterns, such as the prolific reliance on personal vehicle use and a separation of land uses, have "engineered physical activity for non-exercise purposes out of many American's lives" (1).

Numerous studies regarding promotion of physical activity through active transportation have produced data focusing on key environmental variables and specific components of the built environment which act as promoters or deterrents to active travel (walking or bicycling). These have given researchers as well as planners and policy makers guidance when trying to incorporate more bicycle and pedestrian travel opportunities in their communities. Ultimately, much of the existing research posits that if communities will provide and improve active infrastructure such as trails, sidewalks, and bike lanes, people will become more physically active (2).

Although this assumption is made, very few studies have been able to successfully quantify the impact that the construction of new active infrastructure has on human behavior and physical activity levels, as they rely heavily on cross-sectional methodologies (3, 4, 5, 6, 7). Only two studies to date have attempted to identify behavioral change over time that can be attributed to the construction of active infrastructure (8, 9), but neither provides an analysis of behavioral change over time at the individual level, which would require using a disaggregate longitudinal design.

Additional recent research looks at behavioral causality from a different angle positing that individuals living in areas that support physical activity are more physically active than those living in areas that do not support physical activity. In an alternative hypothesis, individuals who are more physically active may prefer to live in areas that support physical activity, while individuals who have a low preference for physical activity may choose to live in areas which do not support physical activity (10). This is named self selection to indicate that analyses of travel behavior need to simultaneously model travel behavior and the choice of residential location and that the physical environment may simply reinforce a preferred behavior rather than be the cause of it. Several studies (11, 12, 13) provide strong evidence of self selection, although their cross-sectional nature allows for determination of correlation but not causality. Only one study (14) used quasi-longitudinal methods to control for the potential of self-selection.

Although cross-sectional data can tell us that there is a difference between behavior at two time points, it does not identify if individual changes have occurred, and if so why the changes occurred; nor can we reliably estimate how change may occur in the future (15). Kitamura stated that "behavioral relationships identified based on cross-sectional observations would not represent behavioral changes over time...longitudinal data and analysis are prerequisite for proper identification and prediction of behavior (16)". By establishing preliminary baseline data with regard to active travel behavior and physical activity, data can then be gathered over time to identify if changes in behavior have occurred because of changes in the built environment, rather than attempting to predict causality based on comparative data correlations. Additionally, using a longitudinal research design allows for a direct observation of residential choice by studying travel behavior in the same group of residents both before and after an infrastructure change takes place and surveying individuals who move to the area after the change has occurred.

This research design is the first of its kind to utilize a direct panel survey attached to an intervention to quantify the impact of the installation of a neighborhood trail. The key questions are:

- Does the installation of a neighborhood trail in an area not currently recognized for widespread physical activity trigger a change in the travel behavior and physical activity levels of neighborhood residents?
- Will changes in physical activity be maintained, increase, or decrease over time?
- Do residents living in closer proximity to the trail exhibit different behavioral patterns than those living further away?
- Are new residents to the neighborhood drawn to that specific area due to the presence of the trail?

STUDY DESIGN

This research highlights residents of the Academy Park Neighborhood in West Valley City, Utah; a suburban area within the Salt Lake City, Utah Metropolitan Region where similar to most suburban locations in the country, active modes are rarely chosen. This location is significant due to the existence of a 1 mile (1600 meter) section of an irrigation canal owned by the Salt Lake-Utah Canal Company which runs through the center of the study area.

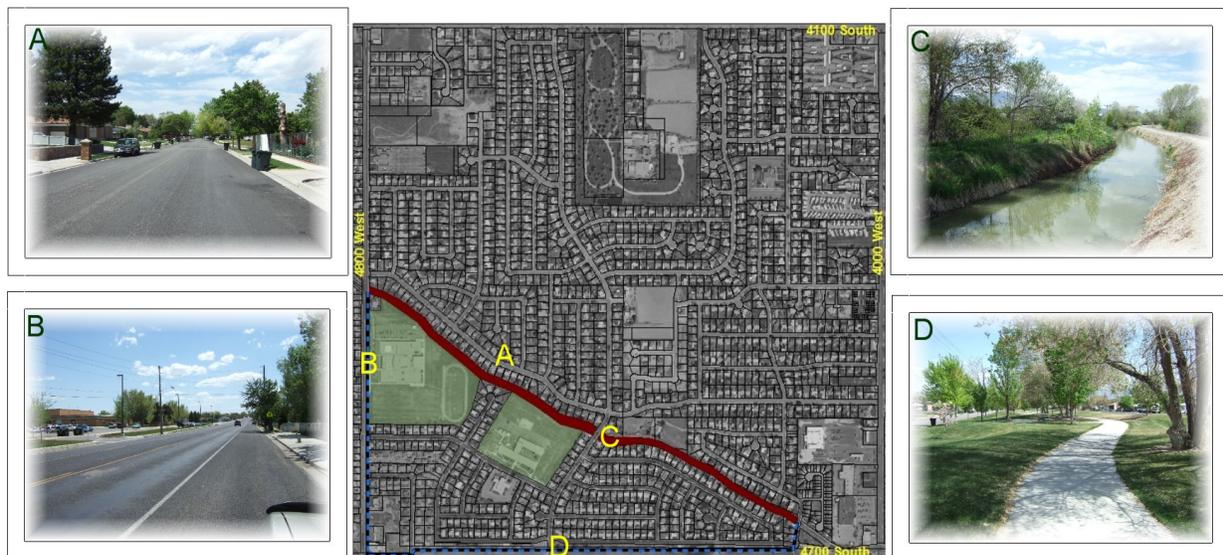


FIGURE 1 Canal Trail Right-of-Way* and Study Area.

*Canal right-of-way is identified in red, local schools in green, and existing connecting sidewalks in blue/black hash

The Salt Lake-Utah Canal Company collaborated with Salt Lake County and West Valley City to construct a “class one” trail (two way multi-use trail separated from existing roads and sidewalks) on the existing canal right-of-way. The trail serves the public as both a transportation and recreation facility (shown in Figure 1 above), and is adjacent to 2 major schools. Additionally, this trail created a 2.5 miles loop connecting two currently existing sidewalks (shown by a blue/black hash).

Data collection took place in four waves; a preliminary household questionnaire, and three activity diary data collection waves which measured individual behavior. The initial

questionnaire was conducted in October 2007 and contained questions regarding household demographics as well as lifestyle and travel preferences. Activity Diary 1 (AD1) was completed prior to the trail's construction (February 2007), Activity Diary 2 (AD2) was completed immediately following the trail's construction (within 1 month – October 2007), and Activity Diary 3 (AD3) was completed approximately 5 months after the trail's construction (February 2008). The Academy Park Activity Diary was loosely modeled after an extensively tested household activity diary (17) with modifications to fit the study here (e.g., a single day and children older than 5 years). The Academy Park Activity Diary provided specific data on activity type, begin and end time, activity duration, interpersonal interactions (did they participate in the activity with anyone), was travel part of the activity, and if so, distance traveled and mode used. Using an activity diary allowed for identification of physical activity accumulated through means other than transportation (i.e. exercise at home or elsewhere). In order to control for day to day variation, individuals were pre-assigned to a specific day of the week for all activity diary waves.

The preliminary household questionnaire was completed by 290 households consisting of 796 individuals (identified through a spatially stratified sample of neighborhood residents living within one mile of the proposed trail). Of those who participated in the questionnaire, 196 households agreed to participate in the activity diary portion of the data collection. Of those 196 households, 80 households (175 individuals) participated in Activity Diary 1 (40.8%), 56 households (144 individuals) participated in Activity Diary 2 (28.6%), and 41 households (107 individuals) participated in Activity Diary 3 (20.9%). Summary characteristics for respondents who participated in all activity diary waves are shown below in Table 1.

Concurrent to AD2 and AD3 a household questionnaire was sent to all new resident households which had moved to the area after the construction of the Academy Park Trail. The new resident questionnaire was identical to the initial household questionnaire completed by historic residents prior to the activity diaries, but also included questions regarding residential location decision making and specific characteristics which drew them to this specific neighborhood. Of the 206 new resident households contacted concurrent to AD2 and AD3, 32 households (117 individuals) completed “new resident” surveys (15.5%).

TABLE 1 Sample Characteristics for All Activity Diary Wave Respondents

Sample Characteristics	Study Sample (Standard Deviation)	Academy Park Neighborhood*
Number of persons in the sample (age 5+)	82	11,790
Number of households in the sample	32	3,500
Percent of males in the sample	45.1	48.5
Number of persons per household	3.51	3.36
Mean age of respondents	47.77	<i>Not Available</i>
% of persons age 5-12	12.5	17.8
% of persons age 13-15	1.3	
% of persons age 16-18	3.7	
% of persons age (18+)	82.5	
% of persons 65-85	27.5	5.0
% of persons 85+	1.3	0.4
Number of cars per household	2.21	2.66
Number of bikes per household	2.06	<i>Not Available</i>
% currently employed	47.6 62.5**	72.5
% possessing a driver's license	86.6	<i>Not Available</i>

Total Combined Household Income	≤\$40,000	37.8	41.2%
	\$40,001 to \$80,000	43.9	41.7%
	≥ \$80,001	18.3	17.1%

*U.S. Census Bureau (18)

**Rate for sample adults age 18-65

FINDINGS

The analysis here is a summary of the extensive analysis reported in Burbidge (26).

Behavioral Change Over Time

The central aspect of this research is the identification of the impact of the trail construction on total physical activity and active travel behavior. An analysis of trip-making behavior shows that individuals participated in the largest percentage of trips for work, followed by errands (and to return home from prior trips). Visiting, dining, and traveling to another mode resulted in the fewest number of trips. Table 2 shows that between Activity Diary 1 (AD1) and Activity Diary 2 (AD2) there was a slight decrease in the percentage of total trips related to work, school, and recreation, while there was a marked increase in the percentage of total trips related to errands, visiting, and traveling to another mode. From AD2 to AD3 there was an increase in work, shopping, escorting, appointment and recreation trips, and a decrease in trips for exercise, visiting, dining, religious services and returning home. There was very little change in trips for school or traveling to another mode.

TABLE 2 Mean Trip Making Behavior by Activity Type*

Activity Type	AD1	AD2	AD3
Work	18.3	12.3	14.5
Exercise	6.4	7.1	3.1
Errands	8.8	12.7	10.1
Visiting	2.4	5.6	2.3
Escorting	5.7	4.0	5.7
School	8.6	3.6	3.9
Shopping	7.3	3.8	5.2
Dining	3.7	3.3	2.3
Appointment	3.7	4.5	9.6
Traveling to Another Mode	0.7	1.4	1.6
Other Recreation	7.0	2.7	3.4
Religious Services	1.6	1.3	0.3
Returning Home	25.6	37.7	27.9
Mode Choice			
Automobile	81.4%	86.1%	87.3%
Transit	4.4%	2.2%	2.3%
Walk	13.7%	11.1%	9.9%
Bike	0.6%	0.7%	0.5%

*Numbers represent percentage of total trips by each trip type or transportation mode

This data shows the same pattern described above alluding to some level of seasonal variation. AD1 and AD3 show relatively similar patterns with regard to behavior, while AD2 shows an up or downturn in the number of trips taken for specific purposes. Trips for exercise are more frequent in the summer than in the winter, while work trips, escorting, and shopping trips are more prevalent in the winter. Table 2 also shows mode choice by wave with automobile at over 80% per wave. Between AD1 and AD2 and again between AD2 and AD3

automobile mode share increased, while walking decreased; transit and bicycle use remained nearly the same. This data clearly shows that active mode choice was on the decline in this sample as time passed.

The average duration for all trips was around 30 minutes for all waves (Table 3) confirming Janelle's assumptions regarding travel time thresholds (2004). Work trips were generally near the sample mean at about one half of an hour in length, comparable to trips for errands, visiting, and escorting someone. This time threshold was exceeded for traveling to other recreation (not considered exercise - with the exception of AD3), which would be expected because of the large recreational draw of the nearby Wasatch Mountains (skiing, mountain biking, hiking, fishing) which are located at approximately a 60 minute drive from the study area. For the first two activity diary waves, shopping trips, dining trips, and appointments also took a bit longer than average, but in AD3 these trips are cut relatively short, as were recreation trips. The shortest trips were for religious purposes and traveling to school. This is also expected because school districts are arranged geographically with students assigned to local schools (generally in close proximity to their home). Also, the majority of residents in this study area who attend religious services noted attending a local neighborhood community church.

TABLE 3 Mean Trip Duration by Activity Type*

Trip Type	AD1	AD2	AD3
Work	36.27 (40.11)	29.66 (26.78)	28.16 (25.61)
Exercise	54.86 (41.19)	41.28 (32.19)	57.08 (22.61)
Errands	26.44 (31.74)	29.07 (30.87)	37.54 (49.22)
Visiting	30.15 (29.37)	24.77 (32.21)	18.00 (9.91)
Escorting	38.52 (40.21)	35.59 (50.65)	27.55 (33.79)
School	16.22 (10.84)	17.40 (9.21)	13.87 (8.17)
Shopping	61.25 (66.37)	70.48 (88.33)	29.80 (24.30)
Dining	48.26 (16.77)	44.72 (29.83)	14.22 (7.45)
Appointment	40.10 (41.04)	35.80 (28.09)	18.24 (13.19)
Traveling to Another Mode	28.75 (6.29)	25.00 (13.36)	21.67 (14.72)
Other Recreation	93.55 (72.33)	102.67 (157.23)	23.08 (30.18)
Religious Services	6.88 (6.97)	7.86 (5.67)	5.00 (0.00)
Returning Home	23.66 (24.74)	23.14 (21.56)	29.52 (63.08)
All Trips	29.49 (37.04)	31.43 (42.90)	28.17 (35.37)

*Numbers represent mean trip length in minutes (standard deviation in parenthesis)

Next, a preliminary comparison of means was conducted to identify if any preliminary differences between before-trail total physical activity (total time and episodes) and active trips

(walking and bicycling) and after-trail behavior exist. Table 4 below shows that the t-test revealed no significant change between AD1 and AD2 at the 0.05 level. However, the analysis of means between AD1 and AD3 shows that there was a significant decrease in both the number of physical activity episodes as well as the total number of walking trips taken. This implies that the trail did not have a positive impact on active travel behavior. The change in behavior did not appear immediately (during AD2), but a significant decrease in total physical activity episodes and walking trips appeared 5 months after construction during AD3, which exactly the opposite outcome desired by the construction of a trail.

TABLE 4 Change in Active Trips and Physical Activity- Mean Test

	AD1	AD2	t-statistic	p-value
Total Physical Activity (Episodes)	0.86 (1.14)	0.74 (1.19)	-0.899	0.370
Total Physical Activity (Minutes)	29.75 (40.00)	35.70 (60.61)	0.944	0.347
Total Walking Trips	0.59 (0.99)	0.50 (1.16)	-0.763	0.447
Total Biking Trips	0.03 (0.26)	0.03 (0.22)	-0.000	1.000
	AD1	AD3	t-statistic	p-value
Total Physical Activity (Episodes)	0.90 (1.17)	0.65 (0.96)	-2.126	0.036
Total Physical Activity (Minutes)	32.48 (44.64)	30.65 (50.49)	-0.330	0.742
Total Walking Trips	0.64 (0.98)	0.38 (0.89)	-2.710	0.008
Total Biking Trips	0.00 (0.00)	0.01 (0.10)	1.00	0.320
<i>Number of Cases</i>	<i>AD1-AD2=144</i>		<i>AD1-AD3=98</i>	

To study more in depth the no effect of the trail before and immediately after and the decrease in physical activity while controlling for other exogenous factors a fixed-effects panel analysis regression was conducted on active trip making and physical activity covariates to incorporate the time effect (AD1, AD2, AD3) and the treatment effect (presence of the trail in AD2 and AD3) into analysis of individual behavior change.

The panel regression model is schematically $y_{it} = x_{it}\beta + c_i + u_{it}, (t = 1, \dots, T)$ where y is a behavior indicator, x represents covariate i at time t , β is the regression coefficient, c encompasses the time constant unobserved effect, and u includes the random error terms (19). The fixed effects estimator makes the longitudinal analysis more robust than the traditional means analysis/t-test, and allows for the identification of causality.

Table 5 is a summary of the different regression models estimated here and includes the amount of time per day per person interviewed and the number of episodes. This model is in essence a test of change in the dependent variable while at the same time accounting for other factors that may have changed between the two time points analyzed.

As shown in Table 5 below, the panel analysis also revealed that the installation of the trail had no significant impact on active travel behavior or physical activity in the sample in the short term (from AD1 to AD2), and between AD1 and AD3 there was a significant decrease in the total number of physical activity episodes as well as a significant reduction in the number of walking trips taken.

TABLE 5 Change in Active Trips and Physical Activity –Panel Analysis

AD1-AD2	Coefficients	t-value	p-value	R-square
Total Physical Activity (Episodes)	-0.052	-0.45	0.655	0.001
Total Physical Activity (Minutes)	8.806	1.53	0.129	0.008
Total Walking Trips	-0.059	-0.55	0.581	0.001
Total Biking Trips	-4.14 e-18	-0.00	1.000	0.000
AD1-AD3	Coefficients	t-value	p-value	R-square
Total Physical Activity (Episodes)	-0.245	-2.13	0.036	0.045
Total Physical Activity (Minutes)	-1.826	-0.33	0.742	0.001
Total Walking Trips	-0.265	-2.71	0.008	0.070
Total Biking Trips	0.010	1.00	0.320	0.010
<i>Number of Cases</i>	<i>AD1-AD2=144</i>		<i>AD1-AD3=98</i>	

By controlling for age, sex, household income, driver's license possession, number of children in the household, number of household cars, residential distance from the trail, employment status, and completion day within the model, this analysis determined that individuals between the ages of 18 and 64 significantly increased their total number of physical activity episodes between AD1 and AD3 ($B=0.56$, $p=0.024$). Since prior research has shown that the very young and the very old are the most likely to participate in physical activity (20) and active transportation (21, 22) this may be considered noteworthy.

Impact of Residential Proximity

Using a Poisson regression model the impact of residential proximity to the trail (in feet) on total physical activity episodes is also examined here. In AD3 (5 months following construction), proximity to the trail had no significant affect on total physical activity episodes. When taking into account the control variables, day of the week proved significant for all included days which suggests that the likelihood of participating in physical activity episodes is higher on Monday through Saturday than it is on Sunday (Table 6).

TABLE 6 Impact of Residential Proximity on PA Episodes in AD3

	AD3-Total Physical Activity (Episodes)		
	Coefficients	z-statistic	p-value
Proximity to Trail	0.000	1.15	0.251
Young (5-17)*	0.026	0.03	.0975
Middle (18-64)*	0.033	0.10	0.923
Male	0.144	0.46	0.646
# Children	-0.919	-0.75	0.454
HH Income	-0.016	-0.34	0.737
License*	-0.985	-1.10	0.272
1 Car*	0.946	0.77	0.443
2 Cars*	1.225	1.05	0.295
3+ cars*	1.25	1.09	0.275
Employment*	0.448	1.43	0.153
AD Monday*	14.310	16.08	0.000
AD Tuesday*	13.796	12.90	0.000
AD Wednesday*	14.002	14.24	0.000
AD Thursday*	14.356	16.38	0.000

AD Friday*	14.438	16.34	0.000
AD Saturday*	13.382	13.47	0.000
_Constant	-15.453	-8.22	0.000
<i>Number of Cases</i>	<i>107</i>	<i>Pseudo R²=0.076</i>	

*Variable = 1 if person fits in the category; 0 otherwise

**Age 65+, 0 cars, and completion on Sunday, used as reference categories

Additionally, a Poisson regression model was used to regress residential proximity (in feet) on total walking trips. Residential proximity was not significant in determining physical activity events.

TABLE 7 Impact of Residential Proximity on Walking Trips in AD3

	AD3-Total Walking Trips		
	Coefficients	z-statistic	p-value
Proximity to Trail	-4.14 e-07	-0.00	0.998
Young (5-17)*	-16.702	-0.00	0.996
Middle (18-64)*	-0.048	-0.09	0.929
Male*	-0.156	-0.45	0.650
# Children	-0.157	-0.98	0.327
HH Income	-0.088	-1.14	0.256
License*	-18.531	-0.01	0.996
1 Car*	-15.613	-0.00	0.998
2 Cars*	-.429	0.87	0.385
3+ cars*	-.163	0.38	0.705
Employment*	1.173	2.46	0.014
AD Monday*	-0.554	-0.51	0.612
AD Tuesday*	0.444	0.84	0.400
AD Wednesday*	1.014	2.12	0.034
AD Thursday*	0.680	1.13	0.260
AD Friday*	-17.016	-0.01	0.996
AD Saturday*	-17.413	-0.00	0.998
_Constant	16.781	0.00	0.996
<i>Number of Cases</i>	<i>107</i>	<i>R²=0.201</i>	

*Variable = 1 if person fits in the category; 0 otherwise

**Age 65+, 3+cars, and completion on Monday, used as reference categories

When controlling for distance, employment status and completion day were significant. Individuals who are currently employed and individuals who completed their diary on Thursday were more likely to participate in walking trips than the remainder of the sample. Also, only 2 bicycle trip observations in the sample prevented analysis of bicycle trips.

Additional regression models were run using categorical (dummy) variables for residential proximity potentially allowing for greater accuracy. These categories identify residential proximity as: less than ¼ mile (0-400 meters), between ¼ and ½ mile (401-800 meters), between ½ and ¾ miles (801-1,200 meters) and over ¾ mile (1,200+ meters). The only significant correlation revealed that households living one half to three quarters of a mile from the trail who participated in significantly fewer minutes of physical activity (nearly 45) than the remainder of the sample.

Several demographic variables proved to be significantly correlated to physical activity and total walking trips in AD3. Completion day was significantly correlated to total physical activity (episodes and time) and walking trips, with individuals who completed their diary on a weekday reporting more physical activity than those who completed their diary on a weekend

(especially Sunday). Individuals who are currently employed reported more physical activity episodes and walking trips than the remainder of the sample. When controlling for distance, young individuals (age 5-17), licensed drivers, and members of household with one or more vehicles, were significantly likely to participate in walking trips.

New Residents

When comparing new residents (those who moved to the area after the trail's construction) to historic resident households, it is immediately evident that they differ greatly. From the breakdown within each sample we see that the new residents are younger, and in larger, and middle income families. Nearly one in five new residents (18.8%) is under the age of 5, and nearly 35% are under age 12.

TABLE 8 Sample Characteristics of Historic versus New Residents

Sample Characteristics		Historic Residents	New Residents
Number of persons in the sample (age 5+)		181	117
Number of households in the sample		80	32
Number of persons per household		3.66	3.66
% of persons under age 5*		7.4	18.8
% of persons age 5-12*		13.0	15.4
% of persons age 13-15*		3.2	2.6
% of persons age 16-18*		2.3	4.3
% of persons age (18+)*		74.1	56.4
Number of cars per household		2.53	2.47
Number of bikes per household		2.01	1.65
Total Combined Household Income	<=\$40,000	28.1%	13.7%
	\$40,001 to \$80,000	41.7%	81.2%
	=> \$80,001	19.1%	5.1%
Mean length of tenure in current residence		12-15 years	6-9 months

A very small percentage of the new residents are teenagers (less than 10%) and barely over half of new residents are adults (Table 8). This is likely due to neighborhood turnover in which young families are moving into an area where a majority of historic residents have already raised their children to adulthood. This point is further proven by recognizing that the mean duration of tenure in current residence for historic residents is 12-15 years and only 6-9 months for new residents (by definition). Rates of ownership for vehicles per household were relatively comparable, and new resident households owned fewer bicycles. Differences and commonalities among new and historic residents are found also in motivating factors to choose this particular location for their residence. Table 9 shows that the major motivations for moving to the area were similar for the historic residents and new residents. Housing affordability, proximity to work, and proximity to friends and family were the top three contributors for both groups (in that order).

TABLE 9 Motivation for Choosing Residential Location

I Chose my Residence	Historic Residents	New Residents
Because it was affordable	82.7%	69.2%
To be close to work	34.6%	30.8%
To be close to friends or family	32.7%	28.2%
For the safe neighborhood	28.8%	13.7%
As a good environment for kids	25.0%	14.5%
Because I grew up in the area	21.2%	19.7%
To be close to shopping	17.3%	6.0%
For good access to transportation	5.8%	15.4%
To be closer to other amenities	5.8%	10.3%
For another reason	0.0%	1.7%

Some factors differ between historic and new residents. Perception of accessibility and amenities is more positive for the new residents than the historic, and perception of affordability is higher among the historic residents. New residents noted access to transportation as more important than proximity to shopping, finding a good environment for children, or neighborhood safety. This is rather ironic considering that new residents have younger households and more children than historic residents. Other amenities (i.e. trails, parks, and open space) were more important to new residents than historic residents as well. Over 80% of new resident households moved to this location from a prior residence located less than 5 miles away, and 30% relocated to the Academy Park Neighborhood from within West Valley City. This suggests that location familiarity may have been a big (although unrecognized) factor in choosing this new residential location.

When asked about walking behavior, nearly 2/3 of new resident households stated that the safety of their neighborhood impacts the amount of walking they do (compared to 1/4 of historic residents), and 40% of new residents claimed that they would walk more if they lived in a different neighborhood. This suggests that they do not feel that their current neighborhood promotes walking and they did not choose this location based on walking environments. As a reminder of context, this survey (of both new and historic residents) was conducted after the trail's construction was complete.

Trail Users

The lack of positive significance in the change of physical activity and trip making, in addition to the lack of evidence that new residents were drawn to the neighborhood because of the trail raises additional questions that were not originally expected at the design stage of this research. This lack of significance makes it highly important to identify any other exogenous factors that may inhibit local residents from utilizing the new trail. It was determined that the best way to acquire such information was to survey trail users directly. In order to gain information from trail users, an intercept survey was used. A convenience sample was employed for two separate four hour time spans per day, on two separate days of the week (Wednesday and Saturday) to intercept individuals using the trail and invite them to answer a small number of questions regarding demographics and information on their trail usage. The trail intercept survey yielded responses from 31 of the 43 total users (72.1%).

An analysis of trail users' survey responses shows that the majority of trail users were walkers (71%), followed by a minority of bicyclers (16.1%) and jogger/runners (12.9%). Of the individuals surveyed, the mean usage rate of the trail was 2.74 times per week. The mean residential distance from the trail for all trail users was 1.75 miles. Although this is within

walking/biking distance for many, it may not be considered as such for a large percentage of individuals. Trail users who participated in walking, lived closer, on average 1.22 miles, than those who biked (1.75 miles) or jogged/ran. Runners lived the furthest from the trail, on average of 4.62 miles, which suggests that they use the trail as just one portion of a much longer running route. Trail users were overwhelmingly accessing the trail using an active mode of transportation (93.5% walking/jogging or bicycling), and only a small percentage of users accessed the trail by automobile (6.5%). No users reported accessing the trail by transit.

A second key factor used to analyze trail users' responses, was whether or not they were actively engaged in their chosen activity prior to the construction of this trail; and if they did historically participate in this activity, where did they participate in the past? According to intercept survey responses, approximately 87% of trail users reported participating in the same type of activity prior to this trail's construction. The most frequent location for participation prior to the trail's construction was on local sidewalks (62.9%), followed by local streets (18.5%), or on another trail (18.5%). This confirms prior research which found that people are most likely to participate in physical activity on neighborhood streets, sidewalks, or trails (23). It also shows that this specific trail is merely a convenience for the majority of users, as only 13% of users reported not participating in this type of physical activity prior to the trail's construction.

Lastly, by asking trail users about their likes and dislikes regarding this specific trail, this study attempted to create a clearer picture of potential benefits or problems associated with the newly constructed trail, which may also shed some light on why additional residents have not chosen to utilize the trail for physical activity. A qualitative analysis of the pros and cons offered by trail users reveals that the most positive aspects of the trail include its newness or "novelty factor" (32.3%), cleanliness (26%), width (19.4%), proximity to residence (9.7%) and lack of crowds (9.7%). According to users, the most negative aspects of the trail included lack of amenities such as benches, lighting, and signage (32.2%), lack of distance or length ("too short"- 22.6%), and lack of connectivity to other destinations (9.7%). If this small sample of trail users reported these as weaknesses of the trail, it is highly likely that a larger number of local residents feel the same way. However, for the other non trail-using residents, these issues may be critical enough to completely discourage their use of the trail.

CONCLUSIONS

This analysis shows that in this case, the construction of a trail in a suburban neighborhood setting did not have a significant positive impact on the active travel behavior or physical activity levels of neighborhood residents in the short term. The mean test and panel analyses both show that construction of the trail was correlated to active transportation and physical activity but it was significantly the exact opposite of expectations.

In addition, residential proximity to the local trail had rather limited significant correlation to total physical activity and active travel behavior. There was no significance in a continuous distance variable analysis, and a categorical analysis revealed that only households living one half to three quarters of a mile from the trail participated in significantly fewer minutes of physical activity (nearly 45) than the remainder of the sample.

Several demographic variables proved to be significantly correlated to physical activity and total walking trips after the trail's construction, including day of the week, employment, age, possession of a drivers' license, and number of household vehicles. Additionally, adults age 18-64 did show a significant increase in physical activity episodes over the measured time period.

This suggests that perhaps building the trail did not impact those who were already predisposed to participate in physical activity (the very young or very old), but may have impacted individuals who were likely to participate in physical activity and active travel behaviors to begin with.

It is highly unlikely that new residents were drawn to this specific neighborhood by the new walking/biking trail. The new residents are in large, young, middle income families, who moved to this location for much the same reasons as their historic counterparts - primarily housing affordability, and proximity to employment or friends/family. They did report the importance of access to transportation and other amenities (i.e. trails, parks, and open space) at a higher rate than historic residents, but also view their neighborhood as less safe than historic residents and report that they would be more likely to walk if they lived in a different neighborhood.

The trail intercept survey revealed that although the mean residential distance from the trail for all trail users was within walking/biking distance for many (1.75 miles), it may not be considered as such for a large percentage of individuals. This also suggests that future studies should include a larger geographic catchment area when conducting intervention analyses of this type. The follow-up with trail users suggests that the trail did not cause an increase in physical activity participation for the majority of them; it simply changed the location where they were participating in physical activity. This also confirmed the data analysis set forth in the prior section of this document which found that the trail's construction did not produce a significant increase in active travel behavior or physical activity and in fact the contrary was established.

Although approximately 63.1% of this sample's respondents stated that "an increase in neighborhood trails would be a positive thing", these results suggest that this specific trail must not have possessed all the necessary characteristics to induce a behavioral change (as suggested by the trail users intercept survey). A lack of information may also be impacting the trail's usage. There is a 2.5 mile loop crated by the trail and adjoining sidewalks (shown in Figure 1), but a lack of adequate signage delineating the existence of this loop may be limiting the trail's effectiveness. Also, this trail segment, although part of a large network of infrastructure, was only 1 mile long. Perhaps a longer segment would be necessary in order to directly impact physical activity or create a larger behavioral change. In addition to being a concern raised by trail users, many prior studies have expressed the necessity of "destinations" to promote active transportation (24, 25). This location may not be close enough in proximity to adequate destinations (i.e. shopping, parks, etc.) to promote physically active transportation.

Although some of the findings of this research run counter to the original hypotheses that in turn were based on the literature, a trail does indeed have a place as a part of the overall urban structure. This research simply shows that trails should not be constructed merely to provide the supply needed by an imagined demand for physical activity, but rather should be incorporated into the overall design of a community as one component of a multi-modal transportation and recreation system. Trails can be a strong asset to a community but care should be taken to design the trail including appropriate characteristics (as discussed above) and according to current urban design best practices that should account for the activity and travel needs of the residents. Simply installing a paved path (such as this trail) where there was not one before is obviously not enough to induce demand for physical activity when that physical activity does not fit the lifestyle and the every day life of people.

ACKNOWLEDGEMENT

The authors acknowledge the generous support of the following organizations in providing both funding as well as outside assistance in data collection and analysis throughout this project: The National Highway Institute of the Federal Highway Administration through the Dwight David Eisenhower Graduate Transportation Fellowship, the University of California Transportation Center through the UCTC Doctoral Dissertation Research Grant, the Department of Geography at the University of California-Santa Barbara, the Wasatch Front Regional Council, the Utah Department of Health - Heart Disease and Stroke Prevention Division, West Valley City Corporation, and the Salt Lake County Department of Parks and Recreation. Valuable input in this research was also provided by Susan Handy from UC Davis, Helen Couclelis, Rick Church, and Bree Jones from UCSB, and Mark Bradley.

REFERENCES

- 1 Sallis, J.F., L.D. Frank, B.E. Saelens, and M.K. Kraft. Active Transportation and Physical Activity: Opportunities for collaboration on transportation and public health research. *Transportation Research Part A*, Vol. 38, 2004, pp. 249-268.
- 2 Task Force on Community Preventive Services. Recommendations to Increase Physical Activity in Communities. *American Journal of Preventative Medicine*, Vol. 22, No. 4S, 2002, pp. 67-72.
- 3 Brownson, R.C., R.A. Housemann, D.R. Brown, J. Jackson-Thompson, A.C. King, B.R. Malone, and J.F. Sallis. Promoting Physical Activity in Rural Communities: Walking Trail Access, Use, and Effects. *American Journal of Preventative Medicine*, Vol. 18, No. 3, 2000, pp. 235-241.
- 4 Brownson, R.C., E.A. Baker, R.L. Boyd, N.M. Caito, K. Duggan, R.A. Housemann, M.W. Kreuter, T. Mitchell, F.Motton, C.Pulley, T.L. Schnid, and D. Walton. A Community-Based Approach to Promoting Walking in Rural Areas. *American Journal of Preventative Medicine*, Vol. 27, No. 1, 2004, pp. 28-34.
- 5 Brownson, R.C., L. Hagood, S.L. Lovegreen, B. Britton, N.M. Caito, M.B. Elliott, J. Emery, D. Haire-Joshu, D. Hicks, B. Johnson, J.B. McGill, S. Morton, G. Rhodes, T. Thurman, and D. Tune. A Multi-Level Ecological Approach to Promoting Walking in Rural Communities. *Preventative Medicine*, Vol. 41, No. 5-6, 2005, pp. 837-842.
- 6 Giles-Corti, B., and R.J. Donovan. The relative influence of individual, social and physical environment determinants of physical activity. *Social Science & Medicine*, Vol. 54, 2002, pp. 1793-1812.
- 7 Troped, P.J., R.P. Saunders, R.R. Pate, B. Reininger, J.R. Ureda, and S.J. Thompson. Associations between Self-Reported and Objective Physical Environmental Factors and Use of a Community Rail-Trail. *Preventative Medicine*, Vol. 32, 2001, pp. 191-200.
- 8 Evenson, K.R., A.H. Herring, and S.L. Huston. Evaluating Change in Physical Activity with the Building of a Multi-Use Trail. *American Journal of Preventative Medicine*, Vol. 28, 2005, pp. 177-185.
- 9 Barnes, G., K. Thompson, and K.Krizek. *A Longitudinal Analysis of the Effect of Bicycle Facilities on Commute Mode Share*. Presented at the 85th Annual Meeting of the Transportation Research Board, Washington, D.C., 2006.
- 10 Handy, S.L. *Critical Assessment of the Literature on the Relationships Among Transportation, Land-Use, and Physical Activity*. Special Report Number 282. Transportation Research Board and the Institute of Medicine of the National Academies, Committee on Physical Activity, Health, Transportation, and Land Use, 2005.

- 11 Handy, S.L., and K.J. Clifton. Local Shopping as a Strategy for Reducing Automobile Travel. *Transportation*, Vol. 28, 2001, pp. 317-346.
- 12 Bagley, M.N., P.L. Mokhtarian, et al. A Methodology for the Disaggregate, Multi-Dimensional Measurement of Neighborhood Type. *Urban Studies*, Vol. 39, No. 4, 2002, 689-704.
- 13 Greenwald, M.J., and M.G. Boarnet. Built Environment as a Determinant of Walking Behavior: Analyzing Nonwork Pedestrian Travel in Portland, Oregon. *Transportation Research Record: Journal of the Transportation Research Board*, No. 1780, Transportation Research Board of the National Academies, Washington, D.C., 2001, pp. 33-42.
- 14 Handy, S.L., X. Cao, and P. Mokhtarian. Self-Selection in the Relationship between the Built Environment and Walking. *Journal of the American Planning Association*, Vol. 72, No. 1, 2006, pp. 55-74.
- 15 Miller, E.J. Panels and Other Survey Extensions to the Transportation Tomorrow Survey. Data Management Group, Joint Program in Transportation, University of Toronto, 1999.
- 16 Kitamura, R. Panel Analysis in Transportation Planning: An Overview. *Transportation Research*, Vol. 24A, No. 6, 1990, pp. 401-415.
- 17 Patten, M.L., and K.G. Goulias. Integrated Survey Design for a Household Activity-Travel Survey in Centre County, Pennsylvania. Presented at the 83rd Annual Meeting of the Transportation Research Board, Washington, D.C., 2004.
- 18 *Profile of General Demographic Characteristics-Year 2000*. U.S. Census Bureau. <http://www.factfinder.census.gov>. Accessed October 31, 2005.
- 19 Wooldridge, J. M. *Econometric Analysis of Cross Section and Panel Data*. Massachusetts Institute of Technology, Boston, 2002.
- 20 Ewing, R., T. Schmid, R. Killingsworth, A. Zlot, and S. Raudenbush. Relationship Between Urban Sprawl and Physical Activity, Obesity, and Morbidity. *American Journal of Health Promotion*, Vol. 18, No. 1, 2003, pp. 47-57.
- 21 Burbidge, S.K., K.G. Goulias, and T.G. Kim. *Travel Behavior Comparisons of Active Living and Inactive Living Lifestyles*. Presented at the 85th Annual Meeting of the Transportation Research Board, Washington, D.C., 2006.
- 22 Pucher, J., and J.L. Renne. Socioeconomics of Urban Travel: Evidence from the 2001 NHTS. *Transportation Quarterly*, Vol. 57, No. 3, 2003, pp. 49-77.
- 23 Brownson, R.C., E.A. Baker, R.A. Housemann, L.K. Brennan, and S.J. Bacak. Environmental and Policy Determinants of Physical Activity in the United States. *American Journal of Public Health*, Vol. 91, No. 12, 2001, pp. 1995-2003.

- 24 Burden, D. *Ten Keys to Walkable/Liveable Communities*: Local Government Commission, <http://www.lgc.org>. Accessed September 2004.
- 25 Handy, S.L. *Community Design and Physical Activity: What Do We Know and What Don't We Know?* Presented at the Obesity and the Built Environment: Improving Public Health through Community Design, Washington, D.C., 2004.
- 26 Burbidge, S.K. *Evaluating the Impact of Neighborhood Trail Development on Active Travel Behavior and Overall Physical Activity*. A dissertation completed in partial satisfaction of the requirements of Doctor of Philosophy, University of California Santa Barbara, 2008.