Understanding the Transportation Performance of South Bay Study Areas

South Bay Transportation Performance Study

Technical Report 2

Marlon G. Boarnet

Prepared for the South Bay Cities Council of Governments
Funded by Los Angeles Metropolitan Transportation Authority

July 1, 2009

About the Author: Marlon G. Boarnet is Professor of Planning, Policy, and Design and Economics at the University of California, Irvine, where he has been on faculty since 1991. From 2003 through 2006, Boarnet was Chair of the Department of Planning, Policy, and Design at UC Irvine. Boarnet earned a Ph.D. from Princeton University in 1992. Boarnet's research focuses on land use and transportation, inter- and intra-metropolitan growth patterns, the links between transportation policy, land use, and economic development, and land use – travel behavior interactions. Boarnet's publications on these and other topics include over 40 refereed articles, book chapters, and reviewed reports. Boarnet is a co-author of *Travel by Design: The Influence of Urban Form on Travel*, a comprehensive study of the potential for linking land use and urban design to transportation policy published by Oxford University Press in 2001. Since 2002, Boarnet has served as managing Co-Editor of the *Journal of Regional Science*, a leading scholarly journal at the intersection of urban economics and quantitative geography. Boarnet is also an associate editor of the *Journal of the American Planning Association*, and he serves on the editorial boards of the *Journal of Planning Literature* and *Papers in Regional Science* and the *Journal of Transportation and Land Use*. Boarnet has received grants from or conducted contract research for the U.S. Environmental Protection Agency, the U.S. and California Departments of Transportation, the Robert Wood Johnson Foundation, the World Bank, the Bay Area Economic Forum, and the Orange County Business Council, among others. Boarnet has served has served as a consultant to Solimar Research and the South Bay Council of Governments, with responsibility for analyzing land use – travel behavior relationships as part of the South Bay Transportation Performance Study, since 2004.

Acknowledgements: This research was funded in several phases by the South Bay Cities Council of Governments (SBCCOG) through grants from Southern California Association of Governments (SCAG) and the Los Angeles Metropolitan Transportation Authority. The work described here was part of a larger study effort funded and directed by the SBCCOG. In early stages, Aaron Engstrom and Rocco Pendola assisted with data collection and data entry. Kenneth Joh provided excellent assistance with data analysis. In earlier phases of this work, Bill Fulton and Mai Nguyen provided valuable assistance and suggestions. Wally Siembab, in his role as project manager, provided suggestions and guidance throughout. Boarnet is responsible for the analyses and interpretations in this report.

I. Why Transportation Performance?

Neighborhood planners have long focused on the physical and functional characteristics of neighborhoods. That has included elements of urban design, fiscal impacts, land use compatibility, and economic performance. Transportation performance has more commonly been separated into two related realms. Regional transportation planners have focused on the infrastructure needs of metropolitan areas. Neighborhood transportation planning has until recently been concerned primarily with traffic flow, including fine-grained questions of level of service at specific intersections, ingress and egress to parking lots, traffic control, and safety. While those concerns remain, South Bay communities face pressing needs to consider transportation performance more holistically in their planning process.

As the largely already built-out South Bay region adds population, pressure to control traffic congestion will require careful integration of land use and transportation planning.[1] California Senate Bill 375 (SB 375) will raise the profile of land use – transportation planning, including requirements that transportation plans developed by the South Bay Cities Council of Governments be consistent with greenhouse gas emissions reduction targets set by California state law (e.g. Assembly Bill 32). More generally, concerns about neighborhood livability and quality of life have broadened the scope of neighborhood-level transportation planning beyond instrumental elements of traffic flow and control to the broader issue of how transportation is linked to quality of place. All of these developments will require that South Bay cities find ways to systematically assess the transportation performance of their neighborhoods. This report documents the results of a four-year study of transportation performance and the built environment in the South Bay, providing a basis for incorporating transportation into neighborhood plans in the South Bay's evolving context.[2]

II. Study Design

Study Areas

We studied eight neighborhoods in the South Bay, divided evenly among centers and corridors. Centers have an inwardly focused street geometry with a commercial core in the middle, while corridors have a linear commercial core along a major arterial with residential surrounding the commercial strip. Aerial photos and land use maps of a representative center and corridor are shown in Figures 1 – 4.

---

[1] The South Bay is expected to add 170,000 persons (on a base of approximately a million persons) by 2025 (projections by Southern California Association of Governments, as cited in Solimar Research, 2005).

[2] The first three years of research related to this project are documented in Phase I – III reports available at the South Bay Cities Council of Governments web site, http://www.southbaycities.org/.

Figure 1, Aerial Photo of Representative Center, Riviera Village

Figure 2, Land Use Map of Representative Center, Riviera Village

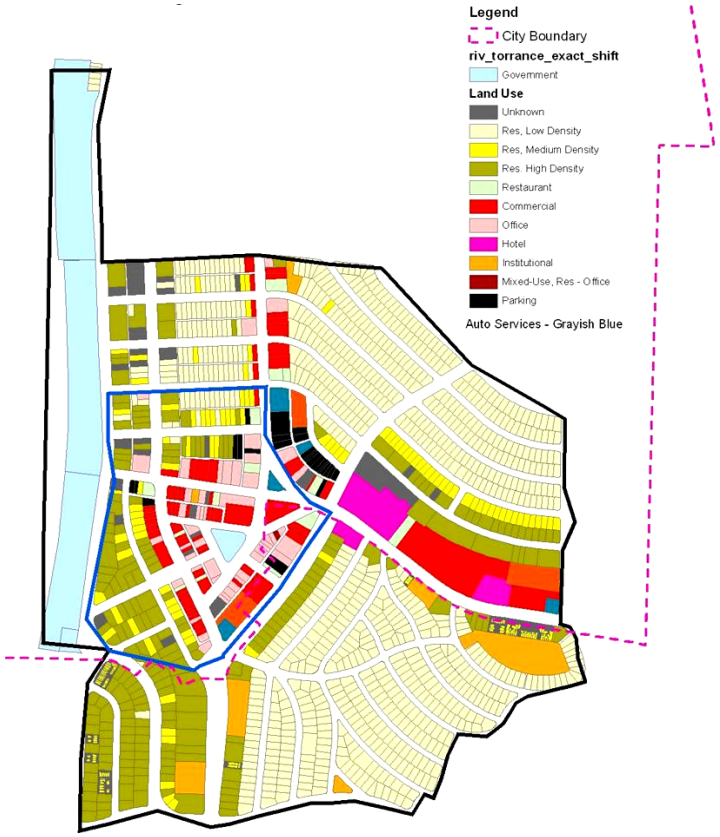
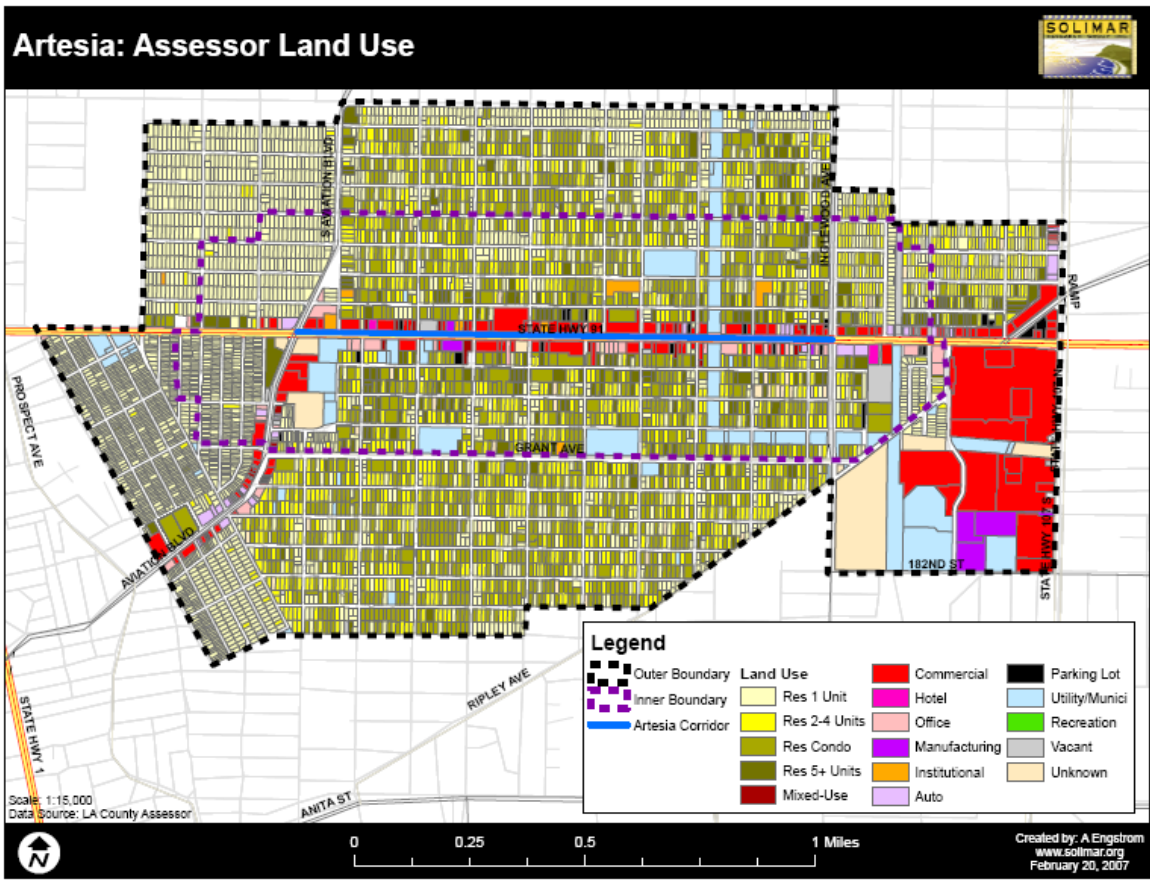


Figure 3, Aerial Photo of Representative Corridor, Artesia Boulevard

Figure 4, Land Use Map of Representative Corridor, Artesia Boulevard



Both centers and corridors contain a mix of residential and commercial land uses in close proximity. The centers are typically neighborhoods that date to before World War II,

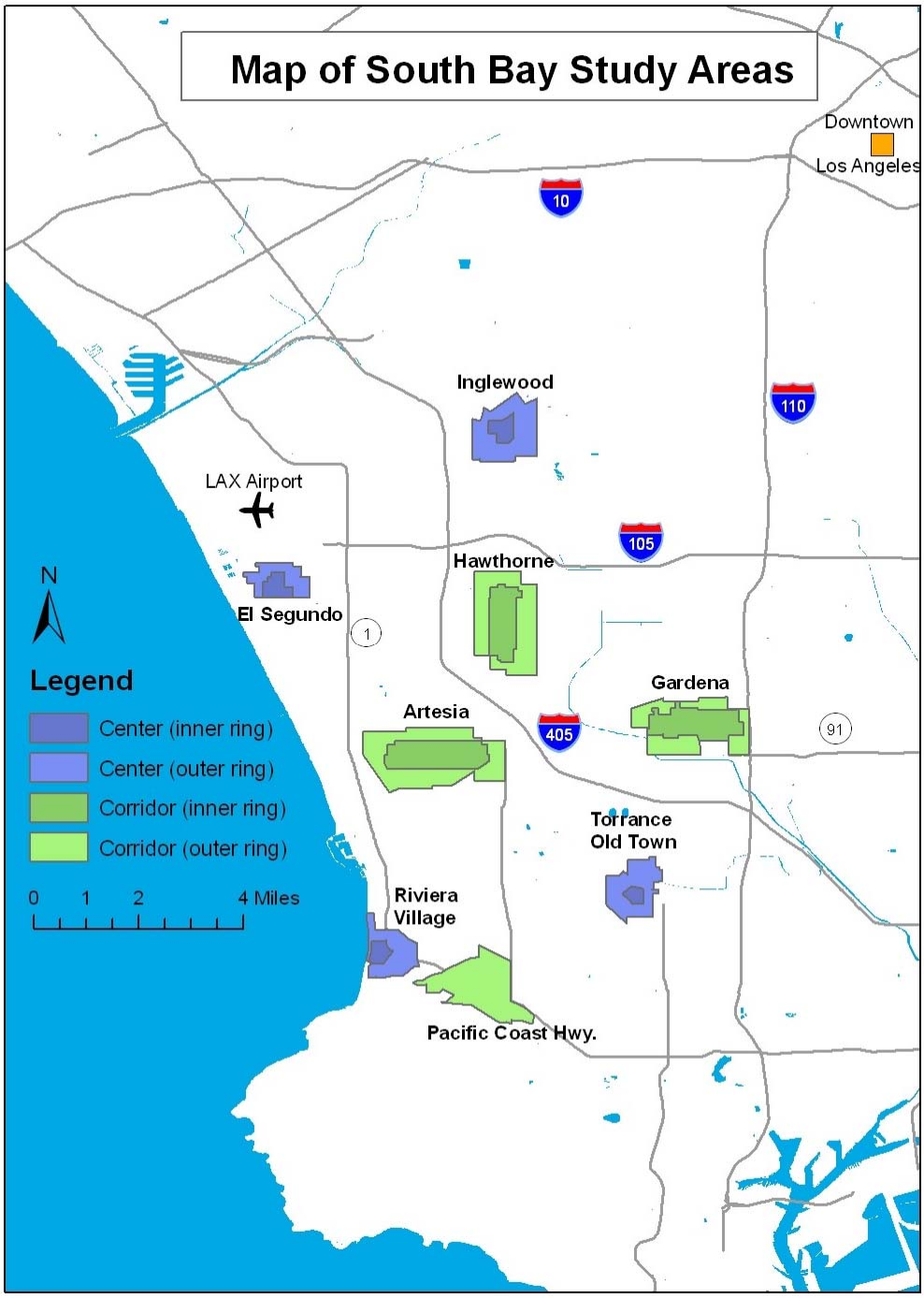
reflecting older pedestrian and transit oriented street geometries.[3] The corridors are arrayed along a regular grid of arterial streets that dominates much of the South Bay landscape. Hence centers and corridors compare, among other things, development patterns with similar mixes of residential and commercial but with physical development that has characteristics of communities from, respectively, the pre-automobile and post-automobile eras.

All but one of the study neighborhoods are divided into inner and outer rings. For centers, inner and outer boundaries were chosen to correspond to aggregations of census blocks based on an assessment of the physical integrity of the neighborhoods. Inner rings are approximately ¼ mile from center to edge and outer rings are approximately the next ¼ mile area. Corridors are arrayed around a linear arterial, typically one mile in length, with inner ring subjects chosen from among residents who live within ¼ mile from the corridor and outer ring subjects from the next larger ¼ mile area. The centers and corridors are listed below and are displayed in a map of the South Bay in Figure 5.

CENTERS	**Description**
Torrance Old Town	Centered on the historic civic center in downtown Torrance (Torrance Blvd. and Van Ness Ave.)
Inglewood	Centered on the civic center in downtown Inglewood (Manchester Blvd. and La Brea Ave.)
Riviera Village	Seaside neighborhood in Redondo Beach (Pacific Coast Highway and Palos Verdes Blvd.)
El Segundo	Centered on civic center in downtown El Segundo (Main St. and Grand Ave.)
CORRIDORS	**Description**
Pacific Coast Highway	Within City of Torrance, centered on commercial strip along Pacific Coast Hwy between Hawthorne Blvd and Calle Mayor
Hawthorne	Within City of Hawthorne, centered on commercial strip along Hawthorne Blvd between Rosecrans Ave. and El Segundo Blvd.
Artesia	Within City of Redondo Beach, centered on commercial strip along Artesia Blvd., between Aviation Blvd. and Inglewood Ave.
Gardena	Within City of Gardena, centered on commercial strip along Gardena Blvd., between Van Ness Ave. and Vermont Ave.

[3] For example, the Torrance Old Town study area was built around a Pacific Electric, or Red Car, trolley station in the early decades of the 20th century.

Figure 5: South Bay Study Areas



The travel behavior data for this study are from the South Bay Travel Survey (SBTS), which was funded by the South Bay Cities Council of Governments and the Southern California Association of Governments. The SBTS was a 155-question web-based and

mail survey that was conducted annually in three phases from 2005 to 2007.[4] Participants were asked to complete a one-day travel diary which included questions about trip purpose, mode choice, and trip distance. In addition, questions about attitudes regarding location choice were asked, as well as opinions about travel options, neighborhood amenities, schools, fear of crime, and a range of hypothetical policy changes.

For budget reasons, the SBTS was primarily web-based. Residents of the study areas were mailed letters that explained the purpose of the survey and asked them to complete a web-based version of the SBTS survey (the letter provided the web survey URL). Non-respondents received a follow up letter as a reminder. In the first phase of the study (which included the study areas in Inglewood, Riviera Village, Torrance Old Town, and Pacific Coast Highway), the resident samples were split, with some receiving paper surveys and others receiving invitations to participate in the web survey. Preliminary analysis showed that hypothesis tests about the influence of urban design on travel did not vary according to survey method used, and in later phases the web method was used exclusively. Response rates varied from 3.8 percent in Hawthorne to 11.9 percent in El Segundo. Comparison of respondents' characteristics with census data suggest that whites might have been over-represented, although the difference might have been due to the survey including a "decline to state" category for race/ethnicity, which in most study areas was comparable to the gap between census and survey proportions for whites. There were few other differences between census demographics and survey responses, but we caution that the South Bay study is inherently a case study, and the degree to which the South Bay results can be replicated in other locations or for other populations is a topic for future research.

Other data used in this study include data on all business establishments from the INFO-USA database (including NAICS code at the 6-digit level, employees, and sales) and 2000 U.S. Census data (e.g., population density). Built environment data such as street blocks and the percentage of four-way intersections were derived from mapping software and aerial photos.

Study Approach

The SBTS provides the basis for quantifying transportation performance, as discussed in the next section. The basic study approach includes the following elements:

- Quantify transportation performance, based on a comprehensive set of travel behavior variables drawn from the 2,125 survey responses to the SBTS.
- Compare transportation performance in centers and corridors, to assess differences between those two neighborhood types

[4] The 155 questions include multiple parts of the same question. The paper-based version of the survey organizes the same questions into 26 blocks, each a distinct question with multiple sections or responses, plus a travel diary.

- Use regression analysis to get insights into associations between neighborhood characteristics and transportation performance
- Use descriptive analysis for additional insights into transportation performance and neighborhood characteristics.

The data from the SBTS were compiled in three phases. In Phase I, residents of Riviera Village, Torrance Old Town, Inglewood, and Pacific Coast Highway were surveyed during the Spring of 2005. During that initial phase, Pacific Coast Highway (PCH) was considered a control group and PCH was compared to the other study areas. In Phase II, residents of El Segundo and Artesia were surveyed in the Spring of 2006. In Phase III, residents of Hawthorne and Gardena were surveyed in Spring of 2007. Initial analyses, including the Phase III final report, maintained the "experimental – control group" research design from Phase I. The Phase III final report used both PCH and Artesia as control groups. In this report, we compare all centers to all corridors, use regression analysis to illuminate associations between transportation performance and neighborhood characteristics, examine differences in transportation performance within corridors (to get insight into how corridors might be transformed to obtain transportation performance more typical of the well performing centers), and examine the data using descriptive statistics. We believe these analyses give more insight than the "experimental – control group" approach from earlier phases, but overall the results of this analysis reinforce, deepen, and extend, rather than contradict, results from the earlier phases.

III. Variables: Measuring Transportation Performance and Study Area Characteristics

A. Measuring Transportation Performance

Transportation performance is the aggregation of travel behavior. The South Bay study surveyed residents of the study areas (the SBTS), employees in the study areas, and visitors. Of those three surveys, the resident survey is the most reliable, and so we focus on that. Note, though, that insights about transportation performance from the resident survey provide only one window into the transportation performance of a neighborhood, and should ideally be combined with insights from an understanding of the travel behavior of employees who work (but do not live) in the neighborhood and visitors to the neighborhood.

Travel behavior, and hence transportation performance, can be divided into trip generation (the number of trips), trip distance, and mode. Requirements to reduce greenhouse gas emissions typically consider vehicle miles of travel (VMT), which is an amalgam of trip generation, mode, and distance. The SBTS allows measures of trip generation and mode, and somewhat rough measures of trip distances (in categories). The SBTS also includes measures of trip capture – the fraction of resident trips that are within their study area. It is not possible to construct reliable measures of VMT from the SBTS questions, as the distance categories are too broad. Emissions (whether of carbon equivalents or criteria pollutants) require characteristics of vehicles, which were not

surveyed in the SBTS. Hence we can characterize transportation but do not have direct measurements or estimates of associated emissions.

The transportation survey allows several measures of travel behavior, which can be grouped into two broad categories: (1) overall travel, not broken down by trip type, and (2) travel for seven specific trip purposes. Our measures of overall travel are shown in the column headers for Table 1 and listed below.

- Number of walking trips per person per day, from the travel diary survey (a measure of trip generation and mode choice)
- Number of driving trips, per person per day, from the travel diary survey (a measure of trip generation and mode choice)
- The respondent's assessment of what fraction of their travel is usually to their neighborhood center or corridor (a measure of neighborhood trip capture)[5]
- The respondent's assessment of their usual travel mode when going to their neighborhood center or corridor (a measure of mode choice).[6]

The above four variables are the transportation performance variables tied to overall travel, not broken down by trip type. For the travel diary questions, mode choices specified in the survey were: personal vehicle, single occupant; personal vehicle, multiple occupants; vanpool; bus (not a school bus); school bus; walk; bicycle; motorcycle/moped; taxi; and other. For the question about the usual mode of travel to centers or corridors, response categories are car, bus, walking, bicycling, or other. The survey revealed that personal vehicle and walking accounted for virtually all travel – other modes, including transit and bicycling, were rare responses. For that reason, we focus on walking and driving behavior.[7]

For travel by trip type (or trip purpose), we use the following measures of, in turn, trip generation, mode choice, and trip distance.

- number of trips in a typical week
- usual mode for a trip of that type
- usual distance for a trip of that type

The transportation performance measures by trip type are not drawn from the daily travel diary but from a separate section of the SBTS that queried respondents about their travel in a typical week. For travel by trip type, the responses, as indicated above, are a

---

[5] This is the response to the question "Think about all the trips you make during a typical week. About what percentage of all of your trips during a typical week are trips to your center or corridor? Circle one answer below." Response categories range from zero to 100 percent, in increments of ten percent.

[6] This is the response to the question: "When you go to your center or corridor, how do you usually get there?" Responses are car, bus, walking, bicycling, other.

[7] In an auto-oriented region like the South Bay, walking is interesting in and of itself and is also a possible gateway mode for future transit service. On the latter point see, e.g., Calthorpe (1993).

measure of the mode of the distribution (the usual trip frequency, travel mode, and distance for a trip of each type.)

B. Measuring Physical and Functional Characteristics of the Environment

A Starting Place: The 3 D's

Studies that have linked the built environment to travel behavior have typically focused on what are called the 3 D's – density, diversity, and design (per Cervero and Kockelman, 1997). Density has typically been measured as population density, diversity is land use mix (e.g. the mix of residential and commercial uses within a neighborhood), and design is the street pattern (typically distinctions between grid-oriented or curvilinear streets). More recently, analysts have added other variables, including destination accessibility, distance to transit, and (more often conceptually argued instead of empirically measured), parking supply and cost (see, e.g., Ewing et al., 2008, p. 67). For our purposes, the 3 D framework provides a starting point, but we also discuss how an analysis of the built environment could (and likely should) include characteristics that are somewhat broader.

We begin with the traditional 3 D characteristics. For each "D" characteristic, we list below variables that were used to measure that characteristic in the regression analysis that follows.

"3 D" Characteristic	Variables Tested
Density	Residential units per acre Employment plus population per acre
Diversity	Land use mix, not included in the regression analysis
Design	Block size (in acres) Percent of intersections that are 4-way (a measure of grid-orientedness)
Destination accessibility	A large number of employment and business variables were included, which proxy and extend this concept. See discussion below.
Distance to transit	Not included in regression analysis
Parking supply and cost	Not included in regression analysis

Of the standard 3 D variables, we excluded land use mix. All study areas have a mix of commercial and residential land uses. The distinction is not the mix per se but the geometric arrangement of the commercial, and whether the commercial concentration is in a central core or arrayed along an arterial boulevard. Comparisons of centers versus corridors can illuminate differences that may be linked to the geometric arrangement of the commercial concentration. Overall, our interest was not in the presence or absence of commercial proximate to residential, as all study areas have commercial and residential in close proximity, but in more detailed analyses of the character of the business

concentrations and the surrounding study areas. After experimenting with several density measures, we concluded that residential units per acre had the best predictive power (compared to, e.g., persons per acre), but in general residential density is not as strongly associated with transportation performance as are various measures of business establishment density (see the results section below.) The measures of the street grid – block size and percent of intersections that are four-way – are standard measures from the literature (Boarnet, Nesamani, and Smith, 2003; Frank, et al., 2006). Mean values for the base set of 3 D variables, by study area, are shown below. Table 1 includes mean values for the density of total business establishments and neighborhood businesses (defined later.) Those were among the two most important business density variables in the regression analysis, although a much larger set of variables were tested, and the results indicate that both density and the nature of business activities are linked to transportation performance.

Table 1: Mean Values for Neighborhood Land Use Characteristics.

Study Area	Housing units per acre	Total businesses per acre	Neigh. Businesses per acre	Average block size (in acres)	% of 4-way inter-sections
Centers					
Riviera Village, inner ring	12.25	6.44	3.50	5.10	33.30%
Riviera Village, outer ring	8.81	0.39	0.20	8.00	37.10%
Torrance Old Town, inner ring	13.16	6.26	2.50	5.40	56.00%
Torrance Old Town, outer ring	4.25	0.96	0.34	4.60	52.20%
El Segundo, inner ring	7.51	2.62	1.05	4.50	66.70%
El Segundo, outer ring	6.81	1.98	0.42	4.50	57.10%
Inglewood, inner ring	4.95	5.68	3.15	4.60	61.50%
Inglewood, outer ring	5.56	0.53	0.22	6.80	46.80%
Corridors					
Pacific Coast Highway	5.32	0.62	0.31	7.00	26.70%
Artesia Blvd., inner ring	10.27	1.05	0.38	5.00	84.90%
Artesia Blvd., outer ring	7.49	0.21	0.07	5.00	55.60%
Gardena Blvd., inner ring	6.36	1.03	0.47	5.50	37.80%
Gardena Blvd., outer ring	9.60	0.66	0.21	5.90	29.10%
Hawthorne Blvd., inner ring	8.94	1.39	0.66	9.70	53.80%
Hawthorne Blvd., outer ring	10.05	0.87	0.27	8.90	53.10%

Business Measures

In addition to the 3 D variables above, we included an extended set of business characteristics. These variables, listed below, are among the most important in the study. The regression results indicate that the character of the economic base of study areas is linked to transportation performance. Testing those links requires measures that go beyond simple counts of business destinations or the mix of commercial and residential (both common approaches in past research.) We list the extended business variables below, grouped by categories, and the variables used to measure those characteristics in the regression analysis.

Business Characteristic	Variables Tested
Density of Business Establishments	Business establishments per acre Neighborhood business establishments per acre (see Appendix A for definition) Retail Trade (NAICS 44-45) establishments per acre Other Services (NAICS 81) establishments per acre
Density of Economic Activity	Employees per acre Neighborhood business jobs per acre
Diversity of Business Functions	Herfindahl Index (defined below)
Concentration of Business Activity	Ratio of neighborhood businesses, defined as number of businesses in study area inner ring divided by number of businesses in study area outer ring Ratio of jobs in neighborhood businesses, ratio of inner to outer ring Ratio of total sales, inner ring value divided by outer ring value Ratio of retail sales (NAICS 44-45), inner ring value divided by outer ring value Ratio of sales in neighborhood businesses (per Appendix A), inner ring value divided by outer ring value

The business variables test the density of business activity, the concentration within the study area (measured as ratios of inner ring to outer ring values), and the composition of business activities. The diversity measure, a Herfindahl index, is defined based on two digit NAICS codes for each study area as shown below.

$$H = \sum_{i=1}^{n} share_i^2$$

where share = share of firms in the 2-digit NAICS code "i"
"i" indexes two-digit NAICS codes

Higher values of the Herfindahl index, H, indicate more concentration in a few 2-digit NAICS codes. (Hence, H measures concentration, or the inverse of diversity.) The maximum possible value for H is one, and based on the number of 2-digit NAICS codes the minimum possible value is 0.0476, which would correspond to business establishments within the study area being distributed evenly across all 21 2-digit NAICS codes. Note that H measures concentration or diversity among business types, not concentration of business activity in space. Concentration in space is measured by the ratio variables defined above.

Variables not Included in the Analysis

While the extensive set of business characteristics goes beyond existing land use – travel behavior studies, there are still many variables that could not be measured and included in the regression analysis. Some of those are more subjective in nature, and were assessed as part of the detailed case studies. Conceptually, several variables that were not measured might influence transportation performance. We include a brief list here, to emphasize that the variables tested above should not be considered an exhaustive list of neighborhood characteristics that may influence transportation performance, and to underscore how the case studies illuminate some factors that cannot be understood through the regression analysis alone. We list variables that are not in the regression analysis, but that might conceptually influence transportation performance, grouped into categories below.

Physical Characteristics of Land Use and Urban Design

Mix Type – The presence of adjacent shopping districts, or the character of the physical mix (e.g. the presence or absence of residential over retail) may affect transportation performance. Certainly the study areas are affected by larger surrounding areas. For example, the Riviera Village study area draws shoppers and visitors from the nearby Palos Verdes Peninsula, and the characteristics of the Palos Verdes resident base, it's proximity to Riviera Village, and the relative absence of other nearby shopping districts that are accessible to Palos Verdes and which may compete with Riviera Village influence the economic characteristics of Riviera Village and by extension that neighborhood's transportation performance. Such factors can be assessed using more descriptive, case study approaches, but variables outside of study areas and characteristics of the physical mix within study areas were not included in the regression analysis.

Pedestrian Amenities and Urban Design – The presence of sidewalks, absence of pedestrian barriers (e.g. large streets that cannot be easily crossed on foot), and the overall character of the pedestrian environment will affect transportation performance. More broadly, design characteristics that include street lighting, lines of sight, building facades and setbacks, gathering places, parks, and plazas, and the architectural characteristics of buildings and streetscapes will likely influence travel behavior and hence transportation performance. Those variables were not included in the regression analysis. Gathering data on design characteristics often requires direct observation of the built environment. See, e.g., Day et al. (2006) for an example of an observational instrument that has been developed to measure the pedestrian environment and urban design characteristics that may be linked to walking. Such characteristics, in this study, were not measured systematically and so were not included in the regression analysis.

Circulation

The measures of the street grid used in the regression analysis – block size and percent of intersections that are four-way – may miss several more fine-grained elements of

circulation that could be associated with transportation performance. The location of major arterials, which may form a barrier to walking and which might convey car traffic, were not measured. Whether arterials are on the fringe or in the middle of the study areas, and their relation to the commercial concentrations, could affect transportation performance. The comparison of centers and corridors, distinguished in part by arterial street patterns, provides some insight but detailed measurements that could go further were not included in the regression analysis. Parking availability and pricing, as mentioned earlier, is likely a key factor that was not quantified in the analysis. Bus transit service was also not included in the regression. While the survey respondents used personal vehicles for almost all of their travel, bus service varies across the study areas and more generally logic suggests that transit service would be linked to transportation performance.[8]

Resident and Workforce Population Characteristics

While a rich set of individual sociodemographic characteristics was included in the regression analysis, the study did not examine how the demographics of study areas (possibly through interactions with individual demographic characteristics) influence transportation performance. Similarly, the characteristics of the workforce population and visitors likely affect transportation performance.

Economics

Several characteristics of study area business concentrations might influence transportation performance. This would include the extent to which neighborhood commercial concentrations serve markets larger than the study areas, hence attracting a non-resident visitor population. Relatedly, the composition of the business base, including its specialization and diversity, may relate to visitor draw and hence transportation performance. The Herfindahl index begins to give insight into links between economic composition and transportation, but the Herfindahl does not capture all aspects of business composition. Descriptive analyses suggest that study areas may specialize in particular kinds of businesses, and an assessment of specialization and transportation performance is left to more exploratory, case study analyses.

IV. Overview of the Quantitative Analysis of Transportation Performance

The quantitative analysis proceeds in two steps. First, we examine differences in transportation performance between centers and corridors. That is a simple comparison of mean values across centers and corridors, and the result reveals that, in general, centers have more walking and higher trip capture rates. Second, we use regression analysis to examine neighborhood characteristics that are associated with differences in transportation performance. These two steps are sequential. First, do centers differ from corridors in terms of transportation performance, and after discovering that they do, why?

[8] Based on the travel diary results from the SBTS, 86 percent of trips made by survey respondents were by automobile.

The regression analysis, by revealing associations, can give insights into the question of why centers and corridors have, on average, different transportation performance.

Both steps involve comparisons of means. The first step is looking at uncontrolled means, while the second step looks at average (or mean) associations while controlling for the characteristics of both the survey respondent and the study area. The regression analysis, allowing one to control simultaneously for several variables, is a way to reveal associations that persist after possibly confounding variables are controlled. Yet in both cases, the results are statements of averages. Departures from the average (especially non-linearities or threshold effects), and associations that are based on variables that cannot be quantified or that were measured with weak proxies, would not be illuminated by the regression analysis.

Moving from associations to conclusions about causality requires some caution. The uncontrolled means, in particular, illuminate differences but give little information as to whether those differences or causal or why the differences occurred. The controlled means, from the regression analysis, can give more insight into causality. To some extent, the more control variables used in a regression the more confidence one can have that associations are not due to unmeasured confounding influences. This helps in attributing causality, but still a theoretical framework is necessary to conclude that an association shows a causal relationship.

In the travel behavior context, the question of whether neighborhood characteristics cause travel behavior involves the question of residential selection. Maybe persons move to neighborhoods that support their desired travel behavior, and if so it is not so much the neighborhood that caused the travel but rather the reverse – persons who wish to travel in a certain way move to a neighborhood that supports that travel behavior. Recent research suggests that a rich set of individual sociodemographic characteristics can help control for residential selection, and that remaining associations between neighborhood characteristics and travel behavior are likely causal (Cao et al., 2009). We use several individual characteristics – income, whether or not the survey respondent has children, age, employment status, race/ethnicity, length of residence in the neighborhood, and attitudes toward travel and neighborhood amenities – as control variables in the regressions. Also, analyses within corridors may abstract from location choice, as described below. Overall, we interpret associations to be causal using care and theoretical insights from the literature.

V. Results

A. Differences Between Centers and Corridors

Summaries of the overall measures of travel behavior, by study area, are shown in Table 2. The most notable difference is in the usual mode for travel to the commercial concentration in the middle of the respondent's center or corridor. Within centers, respondents' estimates of the percentage of their trips to the neighborhood center that were via walking ranged from 26.23% in Inglewood Outer Ring to 70.00% in Riviera

Village Inner Ring, while within corridors, the range was between 3.60% (Gardena Outer Ring) and 24.41% (Pacific Coast Highway).

Table 2: Travel Behavior, by Study Area

Study Area	Per person walking trips per day	Per person driving trips per day	% of All Trips that are to Center or Corridor	% of Survey Respondents who Usually Walk to Center or Corridor	Number of Survey Respondents
Centers					
Riviera Village, Inner Ring	0.383	2.333	46.1%	70.00%	81
Riviera Village, Outer Ring	0.222	2.12	46.0%	41.67%	158
Torrance Old Town, Inner Ring	0.278	2.333	47.2%	50.00%	54
Torrance Old Town, Outer Ring	0.202	2.427	45.5%	31.36%	124
El Segundo, Inner Ring	0.156	1.727	30.1%	69.23%	154
El Segundo, Outer Ring	0.112	1.9	25.0%	33.33%	170
Downtown Inglewood, Inner Ring	0.143	1.286	57.9%	42.86%	7
Downtown Inglewood, Outer Ring	0.077	1.246	33.2%	26.23%	65
Corridors					
Pacific Coast Highway	0.143	2.919	44.2%	24.41%	223
Artesia Blvd, Inner Ring	0.12	2.384	29.8%	12.55%	242
Artesia Blvd, Outer Ring	0.06	2.546	19.4%	4.44%	284
Gardena Blvd, Inner Ring	0.043	2.167	17.1%	14.88%	138
Gardena Blvd, Outer Ring	0.02	2.17	10.3%	3.60%	147
Hawthorne Blvd, Inner Ring	0.029	1.558	31.0%	18.00%	104
Hawthorne Blvd, Outer Ring	0.04	1.615	31.8%	8.64%	174

Table 3 shows the same travel behavior measures, averaged over all centers and corridors, with tests for statistically significant differences in means or proportions. Persons living in centers took, on average, 0.19 walking trips per day, more than double the 0.07 average daily walking trips for center residents. Similarly, center residents take an average of 2.00 daily driving trips, compared to 2.30 daily driving trips for corridor residents. When going to their center or corridor, 47 percent of center residents say they usually walk, while 12 percent of corridor residents say they usually walk to their neighborhood commercial concentration. Trip capture rates (measured by the self-assessed percentage of all trips to the commercial concentration in the center or corridor) are 37.7 percent for center residents and 27.0 percent for corridor residents. Overall, the comparison of means suggests that centers are places where persons walk more, drive less, and take more trips within the immediate study area.

Table 3:
Centers versus Corridors, Summary Travel Measures for Survey Respondents

	Per person walking trips per day	Per person driving trips per day	% of All Trips that are to Center or Corridor	% of Survey Respondents who Usually Walk to Center or Corridor
Centers	0.1907	2.0049	37.72%	47.32%
Corridors	0.0739	2.2957	27.00%	11.97%
t-statistic	**5.425**	**-3.1297**	**8.6192**	**19.1746**
p-value	**0.0000**	**0.0018**	**0.0000**	**0.0000**

Note: t-statistic for the two-sample test of the null hypothesis that the population means for centers and corridors are equal. t-statistics and p-values that reject the null of center and corridor equality are shown in bold.

We also ran regressions for each travel behavior in Table 3, controlling for the respondent's demographics and attitudes, and including a dummy variable equal to one if the respondent lived in a center. Regressions were run in three steps, first including only sociodemographic characteristics and then adding attitudes, first as the answers to nine questions and then with attitudes aggregated into three scales.[9] The sociodemographic variables are the same as in the regression analysis reported later in this paper. For daily walking trips, the percent of all trips that are to the resident's center or corridor, and the probability of traveling to the study center or corridor by walking, hypothesis tests from the regression results do not differ from the simple differences in means in Table 3. The regressions show no significant difference in daily driving trips across residents of centers or corridors after controlling for individual demographics and attitudes. Overall, the regressions confirm that persons living in centers walk more after controlling for their sociodemographic characteristics, but the regressions do not reveal less driving after controlling for sociodemographic characteristics.

Table 4, below, shows differences in travel by specific trip type across centers and corridors. These measures of travel behavior by trip type are from summary survey questions that queried respondents about travel in a typical week. Respondents were asked how many trips of each type they took in a typical week, the usual mode for a trip of that type, and the usual distance for a trip of that type. Responses, averaged across centers and corridors, are shown in Table 4.

[9] Attitudes were added in a separate step in case attitudes are endogenous to travel behavior. As with virtually all of the analyses associated with this research, we found that the hypothesis test on the "center" dummy variable hardly changed when attitudinal variables were added to the regression. The attitudinal questions asked about the respondent's assessment of the importance of walking to nearby stores and restaurants, living near work, school quality, neighborhood safety, nearby entertainment opportunities, transportation options, vibrant street life, and friendly neighbors, hence some of the questions queried attitudes that may be unrelated to travel behavior.

Table 4:
Centers versus Corridors: Travel by Trip Type

	Eat Meal trips	Grocery trips	Personal Services trips	Personal Shopping trips	School trips	Meeting trips	Enter-tainment trips
Usual # weekly trips							
Centers	2.8180	2.3128	1.6587	2.0531	0.9081	0.8764	2.0330
Corridors	2.7589	2.1344	1.5053	2.1265	1.0844	0.8101	1.8433
t-statistic	0.6424	**2.8509**	**2.4149**	-1.0756	-1.7839	1.1231	**2.3885**
p-value	0.5207	**0.0044**	**0.0158**	0.2822	0.0746	0.2615	**0.017**
% who usually walk							
Centers	20.66%	12.22%	19.78%	5.29%	5.32%	11.08%	15.88%
Corridors	4.43%	2.80%	5.16%	1.23%	5.04%	3.66%	3.60%
t-statistic	**10.9004**	**8.0947**	**9.2872**	**5.038**	0.1659	**4.5413**	**8.616**
p-value	**0.0000**	**0.0000**	**0.0000**	**0.0000**	0.8682	**0.0000**	**0.0000**
% who usually go < ¼ mi							
Centers	12.07%	18.32%	21.23%	10.96%	29.93%	22.58%	8.75%
Corridors	4.73%	8.75%	9.83%	5.10%	13.21%	7.46%	2.63%
t-statistic	**5.6112**	**6.0666**	**6.3692**	**4.5781**	**5.3814**	**6.7706**	**5.3579**
p-value	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

Note: t-statistic for the two-sample test of the null hypothesis that the population means for centers and corridors are equal. t-statistics and p-values that reject the null of center and corridor equality are shown in bold.

Centers shorten trips (relative to corridors) for all seven trip types. Those shorter trip distances lead to higher probabilities that center residents walk for all trip types except school trips. Yet trip generation rates (the usual number of trips per week) often do not differ between centers and corridors. There is some evidence that the shorter trip distances in centers induce more trip-making, as persons living in centers take more weekly trips for grocery shopping, personal services, and entertainment. This might explain why the regression analysis of overall travel showed that center residents walk more but do not drive less – in some cases, the shorter travel distances in centers induce both more walking and more total trips, a point illustrated theoretically by Crane (1996a and 1996b).

B. Regression Analysis – Some Insights that Help Explain the Differences

The general form for the regression model is shown below:

$$\text{Travel-Behavior-Variable} = \beta_0 + \text{Neighborhood-Characteristic-Variables}\beta_1 + \text{Individual-Sociodemographic-Variables}\beta_2 + \text{Individual-Attitudes}\ \beta_3 + u$$

Where Travel-Behavior-Variable = the dependent variables indicated in Section III, A

Neighborhood-Characteristic-Variables = a vector of built environment variables
Individual-Sociodemographic-Variables = a vector of individual characteristics
Individual-Attitudes = a vector of responses to attitudinal questions
the β terms are scalars or vectors of coefficients, to be estimated
u = the regression error term

There are seven dependent variables, which operationalize the transportation performance measures and are listed below:

1. walktrip = number of daily walking trips made by a survey respondent
2. drivetrip = number of daily driving trips made by a survey respondent
3. centerbycar = 1 if respondent stated that when they go to their neighborhood center or corridor they usually go by car, 0 otherwise
4. centerybywalk = 1 if respondent stated that when they go to their neighborhood center or corridor they usually go by walking, 0 otherwise
5. tripcapture30% = 1 if respondent stated that in a typical week at least 30% of their total trips are to their center or corridor, 0 otherwise
6. tripcapture40% = 1 if respondent stated that in a typical week at least 40% of their total trips are to their center or corridor, 0 otherwise
7. tripcapture50% = 1 if respondent stated that in a typical week at least 50% of their total trips are to their center or corridor, 0 otherwise

The neighborhood characteristic variables include three variables in all regressions, with several versions of a fourth variable also tested. The following neighborhood variables are included in all regressions:

1. housing units per acre
2. block size (in acres)
3. percent of intersections that are 4-way

The fourth variable tests, in turn, several versions of each study area's business base. The purpose is to examine, in detail, how employment and the economic base of study areas influence neighborhood transportation performance, while controlling for the other common "3 D" variables (density, block size, and street grid pattern.) Throughout this research, it was evident that the pattern of economic activity is more consistently associated with transportation performance than was the housing unit density, block size, or the grid pattern of the street system.

The business characteristics tested are listed in Section III, B under "Business Measures." All of the business and 3 D neighborhood characteristics are measured for each study area. Note that the data for the regressions are arrayed in a hierarchical fashion – we have survey data for individuals, and several individuals live within a study area. The neighborhood and business measures are for entire study areas. Throughout the regression analysis, we use clustered standard errors to adjust for the fact that the neighborhood and business measures do not vary for survey respondents within the same study area (see, e.g., Moulton, 1990 for a discussion).

Regression Control Variables – Individual Sociodemographics and Attitudes

We include a large number of individual characteristics and attitudes. Those variables are included in two steps. First, only the individual sociodemographic characteristics are included. Then, as a second step, each regression was rerun with attitudinal variables. We include the attitudinal variables as a second step in case some of the attitudes are endogenous to travel behavior. If persons adjust their attitudes toward neighborhoods to reflect their travel behavior (e.g. saying they do not wish to live in walking oriented places to justify their own auto-oriented travel behavior), that would create statistical difficulties that would confound making causal interpretations and would bias the regression coefficients. We find that, in general, the regression results hardly change whether or not attitudes are included in the regression, giving reassurance that, in fact, attitudes can be included in the regression. Yet still we felt it prudent to run each model with and without attitudes.

The individual socio-demographic variables are listed below.

Age less than 25, dummy = 1 or 0
Age 26 – 40, dummy = 1 or 0
Age 41 – 65, dummy = 1 or 0
Age > 65 years is the omitted (reference) category
Female = 1 if female
Hispanic = 1 if Hispanic
Black = 1 if African American
Asian = 1 if Asian
Other Race = 1 if other race
Employed = 1 if employed
Any Children = 1 if children in household
Child < 6 = 1 if one or more children in household less than 6 years of age
Car Availability = 1 if at least one car available to survey respondent
Cars > 2, dummy = 1 if more than two cars available in the household
Number of cars per licensed drivers in the household
Neighborhood residence, dummy variables indicating residences in the neighborhood for less than 1 year, 1-6 years 6-10 years, and more than 10 years. Entire life is reference category
Education: dummy variables indicating whether the individual only completed high school, had some college education (no bachelor's degree), completed a four-year college degree, or had more than a four-year college education. Less than high school education is reference category.
Income: dummy variables for annual income from $15,000 - $35,000, $35,000 - $55,000, $55,000 - $75,000, $75,000 - $100,000, and > $100,000. Less than $15,000 is reference category.

The attitudinal variables are drawn from answers to the below questions:

Attitudinal control variables: responses on scale from 1 to 5 gauging how important the following characteristics are when the individual chooses where to live, with 5 being most important
being able to walk to nearby stores and restaurants
being able to walk to work
living less than a ten minute drive to work
having good schools in the neighborhood
neighborhood safety
having nearby entertainment opportunities in the neighborhood
having transportation options in the neighborhood
living in a neighborhood with vibrant street life
living in a neighborhood where people are friendly

In the regressions for the number of daily walking and driving trips, only the attitudinal variable about the respondent's opinion of living near stores and restaurants was included, as including the full set of nine attitudinal variables in those regressions cause the maximum likelihood routine to not converge. In the other regressions, all nine attitudinal variables were included when attitudes were added to the model.

Regression Results

1. Associations Between Business Measures and Transportation Performance

The business variables were tested in turn, but always in regressions that included housing units per acre, block size, percent intersections four-way, and the full set of individual sociodemographic characteristics. There are seven dependent variables (measures of transportation performance), and for each dependent variable we ran two regressions, with and without the attitudinal variables. Thus each business variable is tested in 14 regressions. We list below the number of times that each business variable was statistically significant, at the 10 percent level, in those fourteen regressions.

density of establishments	# of times
Retail Trade Businesses per acre	12
Other Services Bus per acre	11
Businesses per acre	11
Neigh Bus per acre	11
density of economic activity	# of times
Employees per acre	11
Neigh jobs per acre	11
diversity of business functions	
Herfindahl index	8
(relationship is with increasing	
concentration in fewer functions)	

Concentration, inner versus outer	# of times
Neigh Biz ratio	2
Neigh jobs ratio	0
Sales ratio	0
Retail sales ratio	0
Neigh sales ratio	0
Scale	# of times
Total Sales	2
Retail Sales	0
Neigh Bus Sales	0
Hybrid Density Measure	# of times
(population + jobs) per acre	1

Measures of business density are most often significant. The number of retail trade establishments per acre is significant in 12 of 14 regressions, and the number of "other services" establishments per acre, the total number of business establishments per acre, and the number of neighborhood business establishments per acre are significant in 11 of 14 regressions. Measures of concentration (the ratio of activity in the inner versus outer ring) and measures of scale (e.g. total sales in a study area) are rarely significant. The measure of diversity of business functions is significant in 8 of 14 regressions.

In terms of signs of coefficients, the signs reveal associations between higher densities of business establishments and more walking (in most tests), less driving (an association that occurred fewer times than the association with more walking), and higher trip capture rates. The association between business diversity and transportation performance was largely an association between business functions concentrated in fewer 2-digit NAICS codes and more walking and higher trip capture rates. Regression results are in Appendix C.

In general, the business establishment density variables were significant more often than any of the more traditional 3 D variables. We illustrate this with two tables below. The first table shows the number of times that each 3 D variable was significant (out of 14 total tests) when the business measure was retail sales establishments per acre. The next table shows the same information when the business measure was retail sales. This compares two business measures at the far ends of the significance spectrum – retail establishments per acre was significant 12 out of 14 times, while retail sales was never significant.

3 D characteristic when business measure is Retail Business Establishments Per Acre

3 D Neighborhood Characteristic	Times Significant (out of 14 tests)
Residential Units Per Acre	4
Block Size	6
% Intersections 4-way	8

3 D characteristic when business measure is Retail Sales in Study Area

3 D Neighborhood Characteristic	Times Significant (out of 14 tests)
Residential Units Per Acre	4
Block Size	7
% Intersections 4-way	2

In general, none of the housing density or street grid variables are significant as often as the business establishment density measures. Furthermore, the sign of the association between the residential unit and block size variables is at times counter to expectations. When the business measure is retail establishments per acre, more housing units per acre is associated with more driving and less walking as the usual travel mode to the center or corridor – counter to simple expectations that residential density leads to less driving and more walking. When retail sales is the business measure, housing units per acre is associated with more walking trips and fewer driving trips per day – more in line with

expectations. When retail establishments per acre is the business measure, larger blocks and a larger percentage of 4-way intersections are associated with higher trip capture rates and fewer daily driving trips, while when retail sales is the business measure larger blocks are also associated with fewer daily walking trips, some of which is counter to expectations.

Overall, when controlling for business measures, housing units per acre performs especially poorly both in terms of statistical significance and associations that are often counter to Smart Growth theories. We conclude that business establishment density is a more effective predictor of walking-oriented travel and trip capture than is housing unit density. The street grid variables, especially the percentage of intersections that are 4-way, perform better than housing unit density but not as well as the business establishment density measures. On net, we conclude that the density of business establishments, and possibly the character of the economic base (measured by the Herfindahl index), are most strongly linked to study area transportation performance. To further explore the link between a neighborhood's economic base and transportation performance we examine the way that retail functions match to travel behaviors by trip type.

2. Associations Between Business Measures and Transportation Performance by Trip Type

To further explore the link between local shopping opportunities and travel behavior, we used the same regression to model travel by trip type. The dependent variable, for each trip type, is the probability that the respondent states that he/she usually walks for trips of that particular type. The regressions included the same sociodemographic and land use variables as before, except that for each trip type we included business variables that matched that trip type. For example, we include the number of "eating businesses" per acre in the regression for travel to eat meals, the number of "grocery businesses" per acre in the regression for grocery shopping travel, and so on. (See Appendix B for the definition of the business categories that match trip types.) This gives insight into how neighborhood travel behavior is influenced by the match of commercial opportunities and consumer demand, and reinforces that the business concentration measures reflect the role of economic destinations, rather than proxying for design or other related aspects of the built environment. The results are shown in Table 5.

Table 5: Regression Coefficient for Business Density by Trip Type in Regression for Probability of Walking for Same Trip Type

Dependent variable: Usual mode is walking for trips of this type →	Eat meals	Grocery shopping	Personal services	Personal shopping
Matching Business Variable ↓				
Eating businesses per acre	**1.86 (3.92)**			
Grocery jobs per acre		*0.26 (1.82)*		
Personal services businesses per acre			**0.85 (4.44)**	
Personal shopping businesses per acre				**2.03 (3.36)**

Note: t-statistic in parentheses below regression coefficient. Coefficient is from probit regression, with dependent variable = 1 if respondent said usual mode of travel for the trip type is walking. Independent variables are the full set of land use variables and individual sociodemographic characteristics. Only the coefficients on business variables are shown. Coefficients that are statistically significant at the 5 percent level (two-tailed test) are in bold, and coefficients that are statistically significant at the 10 percent level are in italics.

A higher density of businesses, measured by the density of establishments or employees in a particular function (eating businesses, groceries, or the like), is associated with more walking for trips of that same function. This reinforces the idea that a high density of business establishments, by creating many destinations for local shopping and services, attracts local trip making, where local trip making in the above regressions is proxied by the probability of walking as the usual mode for a trip.

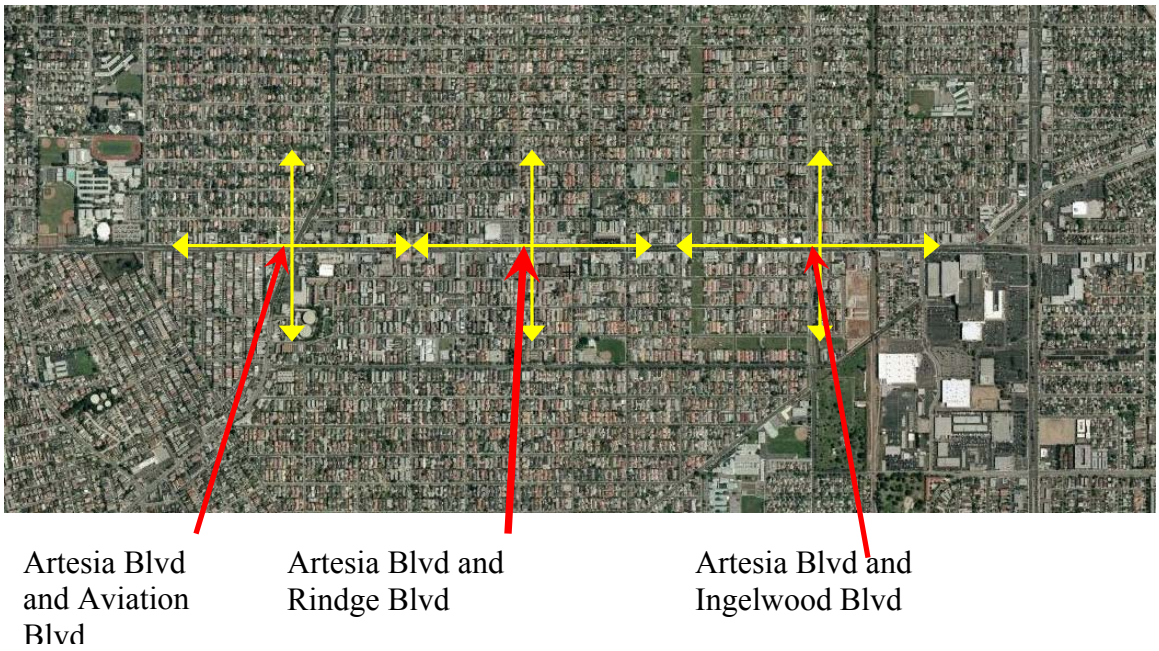
3. Residential Selection and Differences in Travel Behavior within Corridors

A common question in land use and travel behavior studies is residential selection. Does the built environment directly influence how people travel, or do persons with particular travel preferences choose to live in places that can support their desired travel pattern? We address that question by studying variation in travel behavior within a small study area – the Artesia corridor.

Three study areas, the Artesia, Hawthorne, and Gardena corridors, are mile-long commercial streets, demarcated by intersections with major arterial streets at each end point and intersected by a smaller arterial street roughly at the corridor mid-point. We focus on Artesia because businesses are not distributed smoothly along that commercial corridor, but instead are concentrated in the middle. We define dummy variables that indicate whether survey respondents live within ¼ mile of either corridor end-point (intersections with a major arterial) or within ¼ mile of the middle intersection with the minor arterial. These dummy variables are the basis for two-sample t-tests and regression

analyses of differences between each quarter-mile catchment area and the balance of the corridor. The three areas are shown graphically for the Artesia corridor in Figure 6.

Figure 6: Quarter-Mile Catchment Areas (approximately indicated by yellow arrows) Around Artesia Corridor end-point and mid-point intersections (indicated by red arrows)



The corridors are small and internally homogenous.[10] One implication is that persons might choose to live in the Artesia corridor study area, but conditional on that choice, the limited supply of houses available for sale or rent at any point in time might lead to particular housing choices within the study area that are close to random compared to the possibility of other location choices within the same neighborhood. To rephrase, persons can choose to live in a neighborhood of several blocks, but can persons really choose to live on a specific block? If residential location choice mostly determines the study area where persons live, but not where along the corridor residents live, then travel behavior differences within the corridors will be due to direct effects of differences in the built environment and business concentration, and not residential preferences.[11]

[10] We examined residents within a quarter-mile of Artesia and Rindge and residents in the balance of the Artesia corridor study area, and found no statistically significant differences in the probability that a survey respondent within or outside the ¼-mile around Artesia and Rindge had household income greater than $75,000 per year, income greater than $100,000 per year, income less than $15,000 per year, was female, Hispanic, Asian, or employed, had any children or children less than six years old, no statistically significant difference in the number of cars per licensed driver in the respondent's household, and no statistically significant difference in the probability that the respondent had a college degree, was a renter, or had lived in the neighborhood less than one year.

[11] This is similar in spirit to the recently popular use of regression discontinuity research designs in program evaluation (e.g. Imbens and Lemieux, 2008 and Cook, 2008). Those research designs examine differences in outcome variables for persons who are assigned to a program based on the value of an exogenous variable. Persons close to the threshold value for program assignment are analyzed, to obtain an estimate of the marginal rather than the average program or "treatment" effect. Here, the similarity is

The basic form of the analysis is outlined below:

1. Two-sample t-tests for differences between sample means or proportions for the three quarter-mile areas versus the balance of the corridor.
2. Regression analysis of travel behavior, with independent variables that include (a) a dummy variable indicating whether the individual lived within ¼ mile of either corridor end-point or the mid-point and variables that control for, in turn:
    a. the individual's sociodemographic characteristics, and
    b. the individual's sociodemographic characteristics and responses to attitudinal variables.[12]

Each analysis is done only within the corridor, with separate t-tests and regressions for each ¼-mile catchment area.[13] The travel behavior variables are the same as those defined at the beginning of this section. For the regression tests, we convert the regression coefficients into magnitudes to allow direct comparison with the magnitude of the difference in the two-sample t-test. Magnitudes are derived from negative binomial regression coefficients using the fact that the proportion change in the dependent variable is $[\exp(\beta) - 1]$, and for the probit regressions we obtained magnitudes from Stata's dprobit routine.

Overall, hypotheses tests hardly varied whether two-sample t-tests or regressions were used.[14] For the Artesia corridor, the only statistically significant differences were between persons living within a quarter-mile of the middle (intersection of Artesia and Rindge) and the balance of the study area; there were no statistically significant differences when comparing travel behavior for persons living within a quarter mile of either corridor endpoint and the balance of the study area, either from two-sample t-tests or from the regressions. Table 6 shows the magnitudes of differences for persons living within a quarter-mile of Artesia and Rindge and the balance of the study area, with blank cells indicating that there was no significant difference for that travel behavior. For each travel behavior variable in Table 6, first the magnitude of difference from the two-sample t-tests are shown, and then the rows below show the magnitude of difference from regressions with (1) demographic variables and (2) demographic and attitudinal variables.

---

looking at persons within the same corridor, using a threshold distance of ¼ mile and assuming that a survey respondent's location within the corridor is exogenous to travel behavior.

[12] See footnote 9 for a description of the attitudinal variables used.

[13] Note that in this part of the analysis survey respondents are compared only to respondents within the same corridor study area.

[14] This is consistent with the idea that travel differences within the Artesia corridor reflect the built environment and not residential selection. Recent studies have suggested that a rich set of individual demographic characteristics can control for residential selection in land use – travel behavior studies (e.g. Handy et al., 2006; Cao, et al., 2009; Brownstone, 2008). Following that logic, the fact that travel behavior differences within the corridor are remarkably similar whether or not we control for the respondent's sociodemographic characteristics and attitudes suggest that the effect is a direct effect of the built environment on travel.

Table 6: Magnitude of differences, Artesia and Ridge versus balance of Artesia corridor only statistically significant (95 percent level) differences are shown

Travel Behavior (from survey data)	Difference, ¼ mile of Rindge versus balance of corridor
Walk trips, avg per day per person	0.25
from regression with demographic variables	0.33
from regression with demo and attitude variables	0.34
driving trips, avg per day per person	-0.70
form regression with demographic variables	-0.76
from regression with demo and attitude variables	-0.75
fraction of persons who take **> 30% of trips to center**	15.18%
from regression with demographic variables	18.69%
from regression with demo and attitude variables	16.81%
fraction of persons who take **> 40% of trips to center**	10.52%
from regression with demographic variables	12.83%
from regression with demo and attitude variables	11.17%
fraction of persons who take **> 50% of trips to center**	4.78%
from regression with demographic variables	11.23%
from regression with demo and attitude variables	
fraction of persons who **usually walk to center**	19.40%
from regression with demographic variables	20.54%
from regression with demo and attitude variables	10.76%
fraction of persons who **usually drive to center**	-23.51%
from regression with demographic variables	-23.01%
from regression with demo and attitude variables	-12.94%

Note: Percentages indicate percentage point difference. Regressions were negative binomial for walking and driving trips, and probit for binary variables that indicate whether the individual reported taking more than 30%, 40%, or 50% of their trips to the corridor and for the regressions on the dummy variables indicating that the respondent usually walks or drives to the corridor. Magnitudes are derived from regression coefficients using the fact that $[\exp(\beta) - 1]$ is the proportion change in the dependent variable for negative binomial regression and using Stata's dprobit routine for probit regression. Magnitudes are only shown for differences that were statistically significant using 95 percent two-tailed tests; hence blank cells indicate no statistically significant difference between residents within ¼ mile of Artesia and Rindge and the balance of the study area for that travel behavior.

Persons who live within a quarter-mile of the mid-point of the Artesia corridor take more walking trips, fewer driving trips, have higher internal trip capture rates, and are more likely to walk when traveling to the corridor, as compared to other residents in the Artesia corridor study area. These differences are both statistically significant and meaningfully large in magnitude. For example, residents within a quarter-mile of the Artesia and Rindge intersection average approximately five times as many walking trips per day (0.3

versus 0.06 for the balance of the corridor) and approximately 25 percent fewer daily driving trips (1.8 compared to 2.6 in the balance of the corridor). As shown in Table 7, approximately half of the business activity along the study area's mile-long Artesia Boulevard corridor is concentrated within a quarter-mile of the Artesia and Rindge intersection, again suggesting an association between the concentration of local business activity and more walking-oriented travel behavior.

Table 7: Business Activity Concentration along Artesia Corridor, inner ring

Within ¼ mile of:	number of establishments	percent of inner ring	employees	percent of inner ring	sales ($1,000s)	Percent of inner ring
Artesia and Aviation	114	20.77%	586	33.72%	$108,338	28.17%
Artesia and Inglewood	150	27.32%	387	22.27%	$86,067	22.38%
Artesia and Rindge	285	51.91%	765	44.02%	$190,153	49.45%
Inner Ring Total	549	100.00%	1,738	100.00%	$384,558	100.00%

For comparison, we did the same analysis for the Hawthorne and Gardena corridors. Business activity is spread relatively smoothly along the Hawthorne corridor, with about a third of the establishments located at each location (the two end points and the middle). Consistent with our hypothesis that commercial concentration influences travel behavior, there were no statistically significant differences in walking or driving trip generation when comparing residents in the ¼ mile catchment areas to the balance of the Hawthorne study area. Along the Gardena corridor, persons who live near the eastern corridor end point (the intersection with Vermont) and within a ¼ mile of the corridor middle (the intersection with Normandie) are more likely to take 30 percent or more of their total trips to the corridor and are more likely to walk to the corridor. The eastern end of the Vermont corridor is home to a substantial concentration of local shopping businesses, which extend toward the middle intersection with Normandie, while the western end of the Gardena corridor has fewer local shopping destinations. Overall, the pattern of results suggests a recurring pattern – concentrations of neighborhood shopping destinations are associated with more pedestrian-oriented travel.

VI. Interpretation

On average, center residents have more daily walking trips, higher trip capture rates, and are more likely to walk when they travel to their neighborhood commercial concentration. The result that center residents take fewer daily driving trips did not persist in the full regression analysis when only center and corridor averages are compared. The regression results revealed that a key element of centers' walking-oriented transportation performance and higher trip capture rates is a high density of business establishments. That result is reinforced by all elements of the regression analysis. The density of business establishments was a better predictor of transportation performance than other business measures such as overall sales or the ratio of inner to outer ring values.

The implication is that transportation performance depends, in part, on concentrations of several business establishments. Taken literally, this implies that businesses on small parcels may contribute more to transportation performance than do larger establishments on larger parcels. Part of this may have to do with unmeasured design elements. Big boxes typically have large surface parking lots that break the pedestrian environment, leading to more auto-oriented urban form. Small parcels are more often consistent with narrow street setbacks and pedestrian orientation.

The density of business establishments also implies a robust concentration of commercial activities. The link to trip capture likely hinges on the robust concentration of shopping activities that is associated with high business establishment density. Study areas with good transportation performance are places where the local business base provides several destinations for local shopping. The match of local demand and local shopping opportunities influences transportation performance, as indicated by the regressions that show how residents are more likely to walk for specific trip types as their study area has more business establishments per acre for the same trip type.

The corridor analysis further reinforces the link between transportation performance and a concentration of commercial establishments. Residents within a quarter-mile of the Artesia and Rindge intersection took more walking walking trips, fewer daily driving trips, were more likely to walk and less likely to drive when traveling to their neighborhood commercial concentration, and had higher trip capture rates, all when compared with residents in the balance of the Artesia corridor study area. Approximately half of the businesses in the Artesia corridor inner ring are within a quarter-mile of the Artesia and Rindge intersection. The association between business establishment concentration and travel behavior within the relatively small Artesia study area reinforces the idea that transportation performance is improved when business activity is concentrated in a commercial core with a large number of establishments.

References

Boarnet, Marlon G., K. Nesamani, and C. Scott Smith. 2003. Comparing the Influence of Land Use on Nonwork Trip Generation and Vehicle Distance Traveled: An Analysis Using Travel Diary Data. Paper presented at 2004 meetings of the Transportation Research Board.

Brownstone, David. 2008. *Key Relationships Between the Built Environment and VMT*. Draft paper prepared for Transportation Research Board panel on "Relationships Among Development Patterns, Vehicle Miles Traveled, and Energy." October.

Calthorpe, Peter. 1993. *The Next American Metropolis: Ecology, Community, and the American Dream*. New York: Princeton Architectural Press.

Cao, Xinyu, Patricia Mokhtarian, and Susan L. Handy. 2009. Examining the impacts of residential self-selection on travel behavior: A focus on empirical findings. *Transport Reviews* (forthcoming).

Cervero, R., and K. Kockelman. 1997. Travel demand and the 3Ds: Density, diversity and design. *Transportation Research D* 2,3: 199-219.

Cook, Thomas D. 2008. "Waiting for Life to Arrive": A History of the Regression-Discontinuity Design in Psychology, Statistics, and Economics. *Journal of Econometrics* 142: 636-654.

Day, K., Boarnet, M.G., Alfonzo, M., & Forsyth, A. (2006). The Irvine Minnesota Inventory to measure built environments: Development, *American Journal of Preventive Medicine, 30*, 144–152.

Reid Ewing, Keith Bartholomew, Steve Winkelman, Jerry Walters, and Don Chen. 2008. *Growing Cooler: The Evidence on Urban Development and Climate Change*. Washington, D.C.: Urban Land Institute.

Frank, L. D., J. F. Sallis, T. L. Conway, J. E. Chapman, B. E. Saelens, and W. Backman. 2006. Many pathways to health: Associations between neighborhood walkability and active transportation, body mass index, and pollutant emissions. *Journal of the American Planning Association* 72 (1): 75-87.

Handy, Susan L, Xinyu Cao, and Patricia Mokhtarian. 2006**.** Self-Selection in the Relationship Between the Built Environment and Walking: Empirical Evidence from Northern California. *Journal of the American Planning Association* 72,1: 55-74.

Imbens, Guido W. and Thomas Lemieux. 2008. Regression Discontinuity Designs: A Guide to Practice. *Journal of Econometrics* 142: 615-635.

Solimar Research. 2005. *Mixed-Use Centers in the South Bay: How Do They Function and Do They Change Travel Demand?* Ventura, California: Solimar Research Group. http://www.southbaycities.org/node/255, accessed December, 2008.

Appendix A: Definition of Neighborhood Businesses By SIC Category

The following NAICS 6-digit categories were included in the definition of neighborhood businesses.

SIC CODE	Category Description
431101	POST OFFICES
481207	CELLULAR TELEPHONES (SERVICES)
525104	HARDWARE-RETAIL
526106	LANDSCAPING EQUIPMENT & SUPPLIES
531102	DEPARTMENT STORES
531104	DISCOUNT STORES
533101	VARIETY STORES
539901	GENERAL MERCHANDISE-RETAIL
541103	CONVENIENCE STORES
541105	GROCERS-RETAIL
542101	SEAFOOD-RETAIL
542107	MEAT-RETAIL
543104	JUICES-RETAIL
546102	BAKERS-RETAIL
546105	DOUGHNUTS
549901	HEALTH & DIET FOODS-RETAIL
549904	VITAMINS
549913	HERBS
549915	COFFEE & TEA
561101	MEN'S CLOTHING & FURNISHINGS-RETAIL
562101	WOMEN'S APPAREL-RETAIL
562103	MATERNITY APPAREL
562104	BRIDAL SHOPS
563206	HOSIERY-RETAIL
563207	HANDBAGS
563210	LINGERIE
564103	CHILDRENS & INFANTS WEAR-RETAIL
565101	CLOTHING-RETAIL
566101	SHOES-RETAIL
569904	DANCING SUPPLIES
569906	DRESSMAKERS
569909	WIGS TOUPEES & HAIRPIECES
569910	SHEEPSKIN SPECIALTIES
569913	SPORTSWEAR-RETAIL
569915	SWIMWEAR & ACCESSORIES-RETAIL
569917	T-SHIRTS-RETAIL
569919	TAILORS
569922	UNIFORMS
569927	HATS-RETAIL
569932	ALTERATIONS-CLOTHING
599401	NEWS DEALERS
599504	OPTICIANS
599902	CELLULAR TELEPHONES-EQUIPMENT & SUPLS
599905	WATER HEATERS-DEALERS
599909	TROPHIES AWARDS & MEDALS
599913	SURGICAL APPLIANCES
599921	RELIGIOUS GOODS
599922	ARTIFICIAL LIMBS
599927	PICTURE FRAMES-DEALERS
599931	FACTORY OUTLETS
599933	ORTHOPEDIC APPLIANCES
599934	MEXICAN GOODS
599940	WEDDING SUPPLIES & SERVICES
599948	AFRICAN GOODS-RETAIL
599949	COIN DEALERS SUPPLIES & ETC
599967	ARTIFICIAL FLOWERS & PLANTS & TREES
599969	ART GALLERIES & DEALERS
599974	HAWAIIAN GOODS
599992	COSMETICS & PERFUMES-RETAIL
602101	BANKS
603501	SAVINGS & LOAN ASSOCIATIONS
606101	CREDIT UNIONS
609902	MONEY ORDER SERVICE
609903	CHECK CASHING SERVICE
701101	HOTELS & MOTELS
721201	CLEANERS
721501	LAUNDRIES-SELF SERVICE
723101	SKIN TREATMENTS
723102	MANICURING
723105	BEAUTY SCHOOLS
723106	BEAUTY SALONS
723119	SPAS-BEAUTY & DAY
724101	BARBERS
725102	SHOE & BOOT REPAIRING
729901	HEALTH & FITNESS PROGRAM CONSULTANTS
729906	EXERCISE & PHYSICAL FITNESS PROGRAMS
729917	MASSAGE THERAPISTS
729944	TANNING SALONS
729963	MASSAGE
733403	COPYING & DUPLICATING SERVICE

SIC CODE	Category Description
569947	APPAREL & GARMENTS-RETAIL
571211	KITCHEN CABINETS & EQUIPMENT-HOUSEHOLD
571216	FURNITURE-DEALERS-RETAIL
571217	FURNITURE-DESIGNERS & CUSTOM BUILDERS
571219	HOUSE FURNISHINGS-RETAIL
571220	MATTRESSES
571305	CARPET & RUG DEALERS-NEW
571405	DRAPERY & CURTAIN FIXTURES
571407	DRAPERIES & CURTAINS-RETAIL/CUSTOM MADE
571916	WINDOW SHADES
571925	LINENS-RETAIL
572202	APPLIANCES-HOUSEHOLD-MAJOR-DEALERS
572218	SEWING MACHINES-HOUSEHOLD
573103	TELEVISION & RADIO-DEALERS
573105	STEREOPHONIC & HIGH FIDELITY EQUIP-DLRS
573113	AUDIO-VISUAL EQUIPMENT-DEALERS
573117	ELECTRONIC EQUIPMENT & SUPPLIES-RETAIL
573121	TELEVISION-GIANT SCREEN
573401	COMPUTER SOFTWARE
573402	COMPUTER PARTS & SUPPLIES
573403	PUBLISHING-DESKTOP
573407	COMPUTER & EQUIPMENT DEALERS
573416	MEDICAL SOFTWARE
573502	VIDEO TAPES DISCS & CASSETTES
573609	MUSIC DEALERS
581203	ICE CREAM PARLORS
581206	FOODS-CARRY OUT
581208	RESTAURANTS
581209	DELICATESSENS
581212	CATERERS
581213	CAFETERIAS
581214	CAFES
581222	PIZZA
581228	COFFEE SHOPS
581301	BARS
581303	COCKTAIL LOUNGES
591205	PHARMACIES
592102	LIQUORS-RETAIL
592103	WINES-RETAIL
593201	BOOK DEALERS-USED & RARE
593202	ANTIQUES-DEALERS
593222	THRIFT SHOPS

SIC CODE	Category Description
783201	THEATRES
784102	VIDEO TAPES & DISCS-RENTING & LEASING
791101	DANCING INSTRUCTION
792207	THEATRES-LIVE
799101	HEALTH CLUBS STUDIOS & GYMNASIUMS
799912	BILLIARD PARLORS
799936	GYMNASTIC INSTRUCTION
799945	MARTIAL ARTS INSTRUCTION
799951	PARKS
799973	TICKET SALES-ENTERTAINMENT SPORTS
801101	PHYSICIANS & SURGEONS
801104	CLINICS
802101	DENTISTS
804101	CHIROPRACTORS DC
804201	OPTOMETRISTS OD
804301	PODIATRISTS
804907	NURSES-PRACTITIONERS
804909	NUTRITIONISTS
804911	OCCUPATIONAL THERAPISTS
804913	ACUPUNCTURE
804918	PHYSICAL THERAPISTS
804922	PSYCHOLOGISTS
804924	PSYCHOTHERAPISTS
804925	SPEECH PATHOLOGISTS
804926	HOMEOPATHS
821101	RELIGIOUS SCHOOLS
821103	SCHOOLS
821107	SCHOOLS WITH SPECIAL ACADEMIC EDUCATION
822101	SCHOOLS-UNIVERSITIES & COLLEGES ACADEMIC
823106	LIBRARIES-PUBLIC
824301	COMPUTER TRAINING
824401	SCHOOLS-BUSINESS & VOCATIONAL
829901	SCHOOLS-GENERAL INTEREST
829909	TUTORING
829912	LANGUAGE SCHOOLS
829915	MUSIC INSTRUCTION-VOCAL
829916	MOTIVATIONAL & SELF IMPROVEMENT TRAINING
829918	MUSIC INSTRUCTION-INSTRUMENTAL
829972	EDUCATION CENTERS
832201	COUNSELING SERVICES
832210	DAY CARE CENTERS-ADULT
832215	MARRIAGE & FAMILY COUNSELORS

SIC CODE	Category Description
593226	SECOND HAND STORES
593229	PAWNBROKERS
593233	RECORDS-PHONOGRAPH-USED & RARE
593235	CLOTHING-COLLECTIBLE PERIOD & VINTAGE
594112	SURFBOARDS
594113	SPORTING GOODS-RETAIL
594130	GOLF EQUIPMENT & SUPPLIES-RETAIL
594137	DIVERS EQUIPMENT & SUPPLIES
594141	BICYCLES-DEALERS
594201	BOOK DEALERS-RETAIL
594205	COMIC BOOKS
594301	OFFICE SUPPLIES
594305	STATIONERS-RETAIL
594408	JEWELRY DESIGNERS
594409	JEWELERS-RETAIL
594501	CRAFT SUPPLIES
594503	WEAVING-LOOM
594505	MINIATURE ITEMS FOR COLLECTORS
594508	HOBBY & MODEL CONSTR SUPPLIES-RETAIL
594509	GAMES & GAME SUPPLIES
594514	CERAMIC PRODUCTS-DECORATIVE
594517	TOYS-RETAIL
594701	BALLOONS-NOVELTY & TOY
594705	COLLECTIBLES
594707	NOVELTIES-RETAIL
594709	INDIAN GOODS
594712	GIFT SHOPS
594713	GIFT BASKETS & PARCELS
594716	PARTY SUPPLIES
594801	LUGGAGE-RETAIL
594911	YARN-RETAIL
599201	FLORISTS-RETAIL
599206	WEDDING FLOWERS
599301	CIGAR CIGARETTE & TOBACCO DEALERS-RETAIL
832218	SOCIAL SERVICE & WELFARE ORGANIZATIONS
832221	SOCIAL WORKERS
832222	CHILDREN'S SVCS & ACTIVITIES INFORMATION
832235	HOUSING PROVIDERS
832252	
832256	PROBATION SERVICES
833102	REHABILITATION SERVICES
833104	MENTAL RETARDATION & DEV DISABLED SVCS
833106	CAREER & VOCATIONAL COUNSELING
833108	GOVERNMENT-JOB TRAINING/VOC REHAB SVCS
835101	CHILD CARE SERVICE
835102	SCHOOLS-NURSERY & KINDERGARTEN ACADEMIC
835104	CHILD CARE CENTERS-CONSULTANTS
839901	Social Services not otherwie classified
839902	Social Services not otherwie classified
839911	Social Services not otherwie classified
839919	Social Services not otherwie classified
839998	Social Services not otherwie classified
841201	MUSEUMS
864101	FRATERNAL ORGANIZATIONS
864102	VETERANS' & MILITARY ORGANIZATIONS
864121	
866104	CHURCH ORGANIZATIONS
866107	CHURCHES
866110	RELIGIOUS ORGANIZATIONS
866123	MEDITATION ORGANIZATIONS
869903	ORGANIZATIONS
869904	WOMEN'S ORGANIZATIONS & SERVICES
911103	COUNTY GOVERNMENT-EXECUTIVE OFFICES
911104	CITY GOVERNMENT-EXECUTIVE OFFICES
912102	GOVERNMENT OFFICES-STATE
912103	GOVERNMENT OFFICES-COUNTY
912104	GOVERNMENT OFFICES-CITY, VILLAGE & TWP

Appendix B: Definition of Business Establishments Matched to Trip Types

The following business definitions use the 2007 NAICS codes to construct business categories that match trip types. NAICS codes and descriptions are shown below, grouped by matching trip types. In each case below, the highest level NAICS code used for a category is shown.

Eat meal trips:

722	Food Services and Drinking Places

Grocery trips:

4451	Grocery Stores
4452	Specialty Food Stores
4453	Beer, Wine, and Liquor Stores
446191	Food (Health) Supplement Stores

Personal services trips

446	Health and Personal Care Stores
491	Postal Service
492	Couriers and Messengers
5221	Depository Credit Intermediation
5222	Nondepository Credit Intermediation
52231	Mortgage and Nonmortgage Loan Brokers
5231	Securities and Commodity Contracts Intermediation and Brokerage
5239	Other Financial Investment Activities
524	Insurance Carriers and Related Activities
5312	Offices of Real Estate Agents and Brokers
5313	Activities Related to Real Estate
5411	Legal Services
5412	Accounting, Tax Preparation, Bookkeeping, and Payroll Services
54192	Photographic Services
54194	Veterinary Services
5613	Employment Services
5615	Travel Arrangement and Reservation Services
561622	Locksmiths
56174	Carpet and Upholstery Cleaning Services
8111	Automotive Repair and Maintenance
8112	Electronic and Precision Equipment Repair and Maintenance
8113	Commercial and Industrial Machinery and Equipment (except Automotive and Electronic) Repair and Maintenance
8114	Personal and Household Goods Repair and Maintenance
8121	Personal Care Services
8123	Drycleaning and Laundry Services
81291	Pet Care (except Veterinary) Services
81292	Photofinishing
81299	All Other Personal Services

Personal shopping trips

447	Gasoline Stations
448	Clothing and Clothing Accessories Stores
451	Sporting Goods, Hobby, Book, and Music Stores
452	General Merchandise Stores
453	Miscellaneous Store Retailers
532	Rental and Leasing Services

Appendix C: Regression Results, Analysis of 3 D and Business Measures (coefficients on individual sociodemographic and attitude variables not reported.) Regressions are grouped according to business measure. Results from regressions without attitude variables are indicated by "w/o att" and results from regressions that include attitude variables are indicated by "w/ att." T-statistics are in parentheses below regression coefficients. Clustered standard errors were used throughout, with clustering on smallest definition of study area (inner or outer when such distinction was defined.)

1. Density of Establishments, business measure is:

Retail Trade Businesses per acre

	Walking trips		Driving trips		Center by car		Center by walking		Center trip capture greater than 30%		Center trip capture greater than 40%		Center trip capture greater than 50%	
	w/o att	w/ att	w/o att	w/ att	W/o att	w/ att	w/o att	w/ att	w/o att	w/ att	w/o att	w/ att	w/o att	w/ att
	-0.051	-0.013	0.020	0.019	0.235	0.241	-0.292	-0.300	-0.032	-0.024	-0.017	-0.009	-0.008	-0.001
Residential Units per acre	-(0.50)	-(0.13)	(1.12)	(1.13)	(3.10)	(3.63)	-(3.39)	-(4.03)	-(0.65)	-(0.44)	-(0.37)	-(0.17)	-(0.18)	-(0.02)
Retail Bus. per acre (NAICS 44-45, retail trade)	1.685	1.072	-0.026	0.000	-2.517	-2.340	2.866	2.699	1.383	1.186	1.179	1.003	0.947	0.804
	(2.33)	(1.48)	-(0.19)	(0.00)	-(3.67)	-(3.83)	(3.78)	(3.98)	(3.7)	(2.96)	(3.44)	(2.66)	(2.95)	(2.34)
	-0.099	-0.115	-0.068	-0.067	-0.031	-0.024	0.068	0.063	0.083	0.077	0.103	0.097	0.121	0.116
Block Size	-(0.65)	-(0.78)	-(4.24)	-(4.17)	-(0.46)	-(0.38)	(0.95)	(0.94)	(1.28)	(1.13)	(1.87)	(1.68)	(2.48)	(2.30)
	0.002	0.002	-0.003	-0.003	-0.010	-0.011	0.015	0.015	0.012	0.013	0.013	0.013	0.013	0.013
% intersections	(0.13)	(0.13)	-(2.14)	-(2.20)	-(1.17)	-(1.42)	(1.41)	(1.69)	(1.85)	(1.82)	(2.23)	(2.18)	(2.42)	(2.41)
Pseudo R-squared	0.0574	0.0731	0.0179	0.0183	0.1701	0.2368	0.1923	0.258	0.0837	0.1086	0.0914	0.1098	0.0914	0.1034
N	1282	1282	1282	1282	1279	1279	1279	1279	1280	1280	1280	1280	1280	1280

Other Services Businesses per acre

	Walking trips		Driving trips		Center by car		Center by walking		Center trip capture greater than 30%		Center trip capture greater than 40%		Center trip capture greater than 50%	
	w/o att	w/ att	w/o att	w/ att	w/o att	w/ att	w/o att	w/ att	w/o att	w/ att	w/o att	w/ att	w/o att	w/ att
	-0.031	-0.002	0.024	0.024	0.217	0.223	-0.273	-0.281	-0.011	-0.004	0.004	0.011	0.009	0.015
Residential Units per acre	-(0.35)	-(0.02)	(1.40)	(1.43)	(3.54)	(4.18)	-(4.27)	-(5.19)	-(0.26)	-(0.09)	(0.09)	(0.22)	(0.20)	(0.32)
Other Serv. Bus. per acre (NAICS	2.007	1.301	-0.118	-0.086	-3.185	-2.963	3.617	3.409	1.567	1.319	1.288	1.066	1.035	0.855
81, other svcs except pub adm)	(2.63)	(1.73)	-(0.74)	-(0.58)	-(4.54)	-(4.77)	(5.03)	(5.37)	(4.34)	(3.23)	(3.55)	(2.55)	(3.03)	(2.25)
	-0.108	-0.120	-0.071	-0.071	-0.029	-0.023	0.067	0.062	0.072	0.066	0.091	0.085	0.111	0.106
Block Size	-(.75)	-(.84)	-(4.71)	-(4.64)	-(.44)	-(.37)	(.99)	(.97)	(1.15)	(1.02)	(1.72)	(1.55)	(2.34)	(2.18)
	0.000	0.001	-0.004	-0.004	-0.009	-0.009	0.013	0.014	0.011	0.011	0.011	0.011	0.012	0.012
% intersections	(.01)	(.06)	-(2.38)	-(2.45)	-(1.14)	-(1.43)	(1.52)	(1.84)	(1.78)	(1.74)	(2.1)	(2.04)	(2.38)	(2.35)
Pseudo R-squared	0.0587	0.0738	0.018	0.0184	0.1928	0.2543	0.2187	0.2788	0.0854	0.109	0.091	0.1087	0.0909	0.1025
N	1282	1282	1282	1282	1279	1279	1279	1279	1280	1280	1280	1280	1280	1280

Business Establishments per acre

	walktrip		drivetrip		cenbycar		cenbywalk		cengt30pct		cengt40pct		cengt50pct	
	w/o q10	w/ q10	w/o q10	w/ q10	w/o q10	W/ q10	w/o q10	w/ q10	w/o q10	w/ q10	w/o q10	w/ q10	w/o q10	w/ q10
res_unit_pa	-0.013	0.016	0.028	0.028	0.213	0.220	-0.263	-0.272	-0.011	-0.004	0.008	0.015	0.012	0.018
	-(0.14)	-(0.18)	-(1.61)	(1.64)	(3.92)	(4.56)	-(4.52)	-(5.27)	-(0.25)	-(0.09)	(0.18)	(0.29)	(0.28)	(0.38)
comp_pa	0.268	0.162	-0.027	-0.022	-0.460	-0.429	0.515	0.486	0.229	0.193	0.180	0.148	0.145	0.120
	(2.38)	(1.48)	-(1.14)	-(1.01)	-(4.81)	-(5.04)	(5.16)	(5.45)	(4.04)	(3.12)	(3.22)	(2.4)	(2.78)	(2.14)
block_size	-0.106	-0.125	-0.076	-0.075	-0.054	-0.046	0.090	0.085	0.084	0.076	0.097	0.090	0.116	0.110
	-(0.71)	-(0.85)	-(5.35)	-(5.24)	-(0.82)	-(0.75)	(1.34)	(1.32)	(1.29)	(1.13)	(1.79)	(1.59)	(2.39)	(2.21)
pct_4way	-0.0009	-0.0004	-0.0038	-0.0038	-0.0081	-0.0087	0.0118	0.0125	0.0109	0.0112	0.0110	0.0111	0.0118	0.0119
	-(0.08)	-(0.03)	-(2.5)	-(2.56)	-(1.15)	-(1.42)	(1.46)	(1.75)	(1.7)	(1.68)	(1.93)	(1.91)	(2.22)	(2.23)
pseudo R-squared	0.0574	0.0729	0.0183	0.0186	0.1924	0.2542	0.2166	0.2772	0.0856	0.1092	0.0896	0.1077	0.0901	0.1019

Note: Survey variable q10, "Thinking about your neighborhood as a good place to live, how important is it to you that you can walk to work?" with responses from 1 "not at all important" to 5 "very important", was the only attitude variable in this regression.

Neighborhood Business establishments per acre

	walktrip		drivetrip		cenbycar		cenbywalk		cengt30pct		cengt40pct		cengt50pct	
	w/o q10	w/ q10	w/o q10	w/ q10	w/o q10	w/ q10	w/o q10	w/ q10	w/o q10	w/ q10	w/o q10	w/ q10	w/o q10	w/ q10
res_unit_pa	-0.046	-0.013	0.022	0.021	0.231	0.236	-0.287	-0.295	-0.024	-0.016	-0.010	-0.002	-0.002	0.005
	-(0.47)	-(0.13)	(1.25)	(1.26)	(3.36)	(3.98)	-(3.78)	(4.56)	-(0.5)	-(0.31)	-(0.23)	-(0.05)	-(0.05)	(0.1)
neigh_bus_pa	0.574	0.373	-0.019	-0.010	-0.876	-0.812	0.993	0.932	0.456	0.388	0.392	0.331	0.314	0.264
	(2.48)	(1.62)	-(0.41)	-(0.23)	-(3.98)	-(4.17)	(4.22)	(4.49)	(4.01)	(3.1)	(3.68)	(2.73)	(3.12)	(2.38)
block_size	-0.100	-0.114	-0.069	-0.069	-0.027	-0.020	0.063	0.057	0.078	0.071	0.099	0.092	0.117	0.112
	-(0.66)	-(0.77)	-(4.4)	-(4.34)	-(0.38)	-(0.3)	(0.85)	(0.81)	(1.15)	(1.03)	(1.74)	(1.58)	(2.34)	(2.19)
pct_4way	0.002	0.002	-0.003	-0.003	-0.011	-0.011	0.016	0.016	0.012	0.013	0.013	0.013	0.013	0.013
	(0.18)	(0.17)	-(2.19)	-(2.25)	-(1.3)	-(1.58)	(1.59)	(1.89)	(1.88)	(1.83)	(2.28)	(2.2)	(2.48)	(2.43)
pseudo R-squared	0.0580	0.0735	0.0179	0.0184	0.1796	0.2439	0.2034	0.2663	0.0843	0.1087	0.0921	0.1101	0.0916	0.1034

Note: Survey variable q10, "Thinking about your neighborhood as a good place to live, how important is it to you that you can walk to work?" with responses from 1 "not at all important" to 5 "very important", was the only attitude variable in this regression.

2. Density of Economic Activity, business measure is:

Employees per acre

	walktrip		drivetrip		cenbycar		cenbywalk		cengt30pct		cengt40pct		cengt50pct	
	w/o q10	w/ q10	w/o q10	w/ q10	w/o q10	w/ q10	w/o q10	w/ q10	w/o q10	w/ q10	w/o q10	w/ q10	w/o q10	w/ q10
res_unit_pa	0.050	0.055	0.019	0.019	0.102	0.118	-0.134	-0.153	0.038	0.037	0.043	0.043	0.041	0.041
	(0.67)	(0.77)	(1.38)	(1.49)	(1.91)	(2.56)	-(2.25)	-(2.97)	(0.93)	(0.85)	(1.13)	(1.02)	(1.13)	(1.04)
employ_pa	0.036	0.021	-0.001	0.000	-0.061	-0.057	0.068	0.064	0.032	0.026	0.028	0.023	0.023	0.019
	(1.91)	(1.21)	-(0.12)	(0.05)	-(3.44)	-(3.58)	(3.58)	(3.75)	(3.1)	(2.42)	(2.97)	(2.23)	(2.52)	(1.93)
block_size	-0.155	-0.157	-0.067	-0.067	0.022	0.024	0.001	0.001	0.053	0.050	0.079	0.075	0.102	0.098
	-(1.11)	-(1.16)	-(4.13)	-(4.12)	(0.35)	(0.42)	(0.02)	(0.02)	(0.86)	(0.79)	(1.52)	(1.41)	(2.16)	(2.06)
pct_4way	-0.002	-0.001	-0.003	-0.003	-0.008	-0.009	0.011	0.012	0.011	0.011	0.012	0.012	0.012	0.012
	-(0.14)	-(0.08)	-(2.04)	-(2.09)	-(1.04)	-(1.31)	(1.25)	(1.52)	(1.54)	(1.53)	(1.93)	(1.9)	(2.18)	(2.18)
pseudo R-squared	0.0553	0.072	0.0179	0.0183	0.163	0.2307	0.1815	0.2487	0.078	0.1038	0.0883	0.1071	0.0892	0.1015

Note: Survey variable q10, "Thinking about your neighborhood as a good place to live, how important is it to you that you can walk to work?" with responses from 1 "not at all important" to 5 "very important", was the only attitude variable in this regression.

Neighborhood Jobs per acre

	walktrip		drivetrip		cenbycar		cenbywalk		cengt30pct		cengt40pct		cengt50pct	
	w/o q10	w/ q10	w/o q10	w/ q10	w/o q10	w/ q10	w/o q10	w/ q10	w/o q10	w/ q10	w/o q10	w/ q10	w/o q10	w/ q10
res_unit_pa	-0.014	0.015	0.020	0.020	0.176	0.186	-0.222	-0.235	-0.011	-0.007	-0.001	0.004	0.005	0.010
	-(0.14)	(0.15)	(1.21)	(1.25)	(2.79)	(3.25)	-(2.97)	-(3.47)	-(0.23)	-(0.14)	-(0.02)	(0.07)	(0.13)	(0.21)
neigh_job_pa	0.089	0.053	-0.001	0.000	-0.127	-0.117	0.145	0.135	0.079	0.069	0.069	0.060	0.055	0.048
	(1.91)	(1.13)	-(0.21)	-(0.02)	-(3.4)	-(3.48)	(3.33)	(3.44)	(2.92)	(2.49)	(3.03)	(2.52)	(2.63)	(2.21)
block_size	-0.148	-0.151	-0.067	-0.067	0.050	0.052	-0.027	-0.028	0.046	0.045	0.072	0.070	0.096	0.095
	-(1.)	-(1.05)	-(4.3)	-(4.31)	(0.81)	(0.9)	-(0.41)	-(0.45)	(0.69)	(0.67)	(1.28)	(1.24)	(1.93)	(1.91)
pct_4way	0.002	0.001	-0.003	-0.003	-0.010	-0.010	0.014	0.014	0.013	0.013	0.014	0.014	0.014	0.014
	(0.13)	(0.09)	-(2.15)	-(2.2)	-(1.06)	-(1.27)	(1.23)	(1.45)	(1.71)	(1.72)	(2.1)	(2.12)	(2.27)	(2.3)
pseudo R-squared	0.056	0.072	0.018	0.018	0.148	0.219	0.166	0.236	0.082	0.108	0.091	0.110	0.091	0.104

Note: Survey variable q10, "Thinking about your neighborhood as a good place to live, how important is it to you that you can walk to work?" with responses from 1 "not at all important" to 5 "very important", was the only attitude variable in this regression.

3. Diversity of Business Functions, business measure is:

Herfindahl Index

	Walking trips		Driving trips		Center by car		Center by walking		Center trip capture greater than 30%		Center trip capture greater than 40%		Center trip capture greater than 50%	
	w/o att	w/ att	w/o att	w/ att	w/o att	w/ att	w/o att	w/ att	w/o att	w/ att	w/o att	w/ att	w/o att	w/ att
Residential Units per acre	0.080	0.048	0.018	0.019	0.027	0.051	-0.046	-0.074	0.069	0.062	0.072	0.065	0.063	0.057
	(1.46)	(1.19)	(1.42)	(1.67)	(0.36)	(0.71)	-(0.57)	-(0.94)	(1.25)	(1.19)	(1.46)	(1.40)	(1.47)	(1.42)
Herfindalh index	27.737	27.814	6.232	6.279	-10.050	-9.982	12.419	12.685	13.552	13.587	15.112	14.757	14.203	13.719
	(1.85)	(2.29)	(4.12)	(4.43)	-(0.91)	-(1.01)	(1.04)	(1.14)	(1.29)	(1.4)	(1.93)	(2.07)	(1.97)	(2.07)
Block Size	-0.298	-0.252	-0.071	-0.072	0.160	0.152	-0.160	-0.152	-0.004	0.000	0.026	0.030	0.059	0.062
	-(3.84)	-(3.02)	-(4.35)	-(4.77)	(2.05)	(2.27)	-(1.89)	-(2.06)	-(0.08)	(0.00)	(0.61)	(0.70)	(1.63)	(1.73)
% intersections	-0.001	0.004	-0.002	-0.002	0.002	0.000	-0.001	0.002	0.009	0.010	0.010	0.011	0.012	0.012
	-(0.11)	(0.42)	-(1.37)	-(1.51)	(0.25)	(0.02)	-(0.06)	(0.17)	(1.21)	(1.49)	(1.82)	(2.22)	(2.85)	(3.37)
Pseudo R-squared	0.0583	0.0783	0.0202	0.0207	0.0893	0.1733	0.0933	0.1782	0.0695	0.1013	0.0851	0.1084	0.09	0.1049
N	1282	1282	1282	1282	1279	1279	1279	1279	1280	1280	1280	1280	1280	1280

4. Concentration (inner versus outer), business measure is:

Neighborhood Jobs Ratio, inner vs. outer

	walktrip		drivetrip		cenbycar		cenbywalk		cengt30pct		cengt40pct		cengt50pct	
	w/o q10	w/ q10	w/o q10	w/ q10	w/o q10	w/ q10	w/o q10	w/ q10	w/o q10	w/ q10	w/o q10	w/ q10	w/o q10	w/ q10
res_unit_pa	0.132	0.107	0.018	0.020	0.021	0.043	-0.036	-0.062	0.075	0.068	0.081	0.074	0.071	0.066
	(1.76)	(1.7)	(1.61)	(1.78)	(0.21)	(0.47)	-(0.35)	-(0.63)	(1.15)	(1.13)	(1.39)	(1.38)	(1.34)	(1.36)
neigh_job_r	-0.705	-1.020	0.056	0.049	1.130	1.041	-1.040	-0.927	0.307	0.369	0.509	0.553	0.276	0.297
	-(0.39)	-(0.64)	(0.2)	(0.18)	(0.63)	(0.65)	-(0.55)	-(0.53)	(0.21)	(0.27)	(0.41)	(0.48)	(0.24)	(0.27)
block_size	-0.298	-0.265	-0.065	-0.066	0.178	0.168	-0.174	-0.162	0.009	0.015	0.040	0.045	0.069	0.072
	-(2.39)	-(2.31)	-(3.56)	-(3.76)	(1.73)	(1.91)	-(1.52)	-(1.62)	(0.15)	(0.25)	(0.78)	(0.92)	(1.49)	(1.64)
pct_4way	-0.013	-0.009	-0.003	-0.003	0.007	0.005	-0.006	-0.004	0.006	0.007	0.007	0.008	0.008	0.009
	-(0.9)	-(0.68)	-(2.59)	-(2.61)	(0.63)	(0.46)	-(0.5)	-(0.33)	(0.64)	(0.82)	(0.87)	(1.11)	(1.18)	(1.41)
pseudo R-squared	0.051	0.071	0.018	0.018	0.089	0.172	0.089	0.173	0.060	0.092	0.074	0.098	0.079	0.095

Note: Survey variable q10, "Thinking about your neighborhood as a good place to live, how important is it to you that you can walk to work?" with responses from 1 "not at all important" to 5 "very important", was the only attitude variable in this regression.

Total Sales Ratio, inner vs. outer

	walktrip		drivetrip		cenbycar		cenbywalk		cengt30pct		cengt40pct		cengt50pct	
	w/o q10	w/ q10	w/o q10	w/ q10	w/o q10	w/ q10	w/o q10	w/ q10	w/o q10	w/ q10	w/o q10	w/ q10	w/o q10	w/ q10
res_unit_pa	0.114	0.102	0.025	0.025	0.064	0.086	-0.080	-0.104	0.073	0.072	0.065	0.063	0.060	0.059
	(2.23)	(2.23)	(1.73)	(1.87)	(0.81)	(1.11)	-(0.93)	-(1.23)	(1.23)	(1.18)	(1.22)	(1.15)	(1.18)	(1.13)
sales_r	0.309	-0.101	-0.211	-0.192	-1.516	-1.446	1.523	1.453	0.024	-0.162	0.477	0.312	0.327	0.181
	(0.25)	-(0.1)	-(1.13)	-(1.1)	-(1.07)	-(1.1)	(1.04)	(1.06)	(0.03)	-(0.16)	(0.7)	(0.45)	(0.46)	(0.25)
block_size	-0.256	-0.224	-0.071	-0.071	0.112	0.105	-0.108	-0.100	0.005	0.006	0.042	0.043	0.071	0.071
	-(2.42)	-(2.19)	-(4.48)	-(4.61)	(1.29)	(1.38)	-(1.15)	-(1.19)	(0.08)	(0.11)	(0.9)	(0.95)	(1.64)	(1.71)
pct_4way	-0.012	-0.006	-0.003	-0.003	0.008	0.006	-0.007	-0.005	0.005	0.007	0.005	0.007	0.007	0.008
	-(1.06)	-(0.65)	-(2.25)	-(2.28)	(0.82)	(0.63)	-(0.66)	-(0.46)	(0.58)	(0.8)	(0.6)	(0.84)	(1.03)	(1.3)
pseudo R-squared	0.051	0.070	0.018	0.019	0.098	0.179	0.099	0.182	0.059	0.091	0.074	0.097	0.079	0.095

Note: Survey variable q10, "Thinking about your neighborhood as a good place to live, how important is it to you that you can walk to work?" with responses from 1 "not at all important" to 5 "very important", was the only attitude variable in this regression.

Retail Sales Ratio, inner versus outer

	walktrip		drivetrip		cenbycar		cenbywalk		cengt30pct		cengt40pct		cengt50pct	
	w/o q10	w/ q10	w/o q10	w/ q10	w/o q10	w/ q10	w/o q10	w/ q10	w/o q10	w/ q10	w/o q10	w/ q10	w/o q10	w/ q10
res_unit_pa	0.147	0.136	0.025	0.025	0.067	0.086	-0.086	-0.108	0.081	0.080	0.073	0.071	0.068	0.068
	(2.73)	(2.67)	(1.83)	(1.96)	(0.83)	(1.12)	-(0.98)	-(1.27)	(1.31)	(1.27)	(1.31)	(1.24)	(1.28)	(1.24)
retail_sales_r	-0.473	-0.889	-0.210	-0.193	-1.510	-1.364	1.599	1.459	-0.234	-0.434	0.250	0.069	0.059	-0.095
	-(0.45)	-(1.05)	-(0.91)	-(0.87)	-(1.07)	-(1.08)	(1.08)	(1.1)	-(0.25)	-(0.5)	(0.31)	(0.09)	(0.07)	-(0.13)
block_size	-0.295	-0.271	-0.072	-0.073	0.099	0.096	-0.093	-0.089	-0.002	-0.003	0.039	0.038	0.066	0.065
	-(3.35)	-(3.12)	-(4.34)	-(4.46)	(1.44)	(1.54)	-(1.28)	-(1.32)	-(0.05)	-(0.06)	(0.88)	(0.88)	(1.64)	(1.68)
pct_4way	-0.012	-0.006	-0.003	-0.003	0.006	0.004	-0.005	-0.003	0.006	0.007	0.006	0.007	0.008	0.009
	-(1.05)	-(0.65)	-(2.61)	-(2.62)	(0.64)	(0.44)	-(0.51)	-(0.3)	(0.63)	(0.83)	(0.74)	(0.96)	(1.16)	(1.42)
pseudo R-squared	0.051	0.071	0.018	0.019	0.098	0.179	0.101	0.183	0.060	0.092	0.073	0.097	0.079	0.095

Note: Survey variable q10, "Thinking about your neighborhood as a good place to live, how important is it to you that you can walk to work?" with responses from 1 "not at all important" to 5 "very important", was the only attitude variable in this regression.

Neighborhood Business Sales Ratio, inner versus outer

	walktrip		drivetrip		cenbycar		cenbywalk		cengt30pct		cengt40pct		cengt50pct	
	w/o q10	w/ q10	w/o q10	w/ q10	w/o q10	w/ q10	w/o q10	w/ q10	w/o q10	w/ q10	w/o q10	w/ q10	w/o q10	w/ q10
res_unit_pa	0.144	0.126	0.018	0.019	0.023	0.046	-0.041	-0.066	0.074	0.068	0.079	0.072	0.069	0.065
	(1.96)	(1.96)	(1.54)	(1.69)	(0.31)	(0.62)	-(0.5)	-(0.83)	(1.09)	(1.02)	(1.3)	(1.24)	(1.29)	(1.26)
neigh_sales_r	-0.719	-1.136	-0.017	-0.007	-0.305	-0.195	0.416	0.326	-0.073	-0.166	0.225	0.141	0.119	0.049
	-(0.69)	-(1.23)	-(0.12)	-(0.05)	-(0.31)	-(0.22)	(0.4)	(0.34)	-(0.09)	-(0.22)	(0.32)	(0.22)	(0.19)	(0.08)
block_size	-0.316	-0.296	-0.067	-0.067	0.139	0.136	-0.133	-0.127	0.002	0.005	0.037	0.039	0.067	0.068
	-(3.15)	-(3.14)	-(4.03)	-(4.23)	(1.82)	(2.02)	-(1.61)	-(1.72)	(0.04)	(0.09)	(0.74)	(0.8)	(1.51)	(1.6)
pct_4way	-0.013	-0.009	-0.003	-0.003	0.004	0.003	-0.004	-0.002	0.005	0.007	0.006	0.007	0.008	0.009
	-(1.05)	-(0.79)	-(2.68)	-(2.72)	(0.48)	(0.3)	-(0.34)	-(0.16)	(0.61)	(0.79)	(0.82)	(1.03)	(1.22)	(1.46)
pseudo R-squared	0.0509	0.0717	0.0179	0.0183	0.084	0.1682	0.0856	0.1705	0.0592	0.0915	0.0729	0.0967	0.0789	0.0946

Note: Survey variable q10, "Thinking about your neighborhood as a good place to live, how important is it to you that you can walk to work?" with responses from 1 "not at all important" to 5 "very important", was the only attitude variable in this regression.

5. Scale, business measure is:

Total Sales

	walktrip		drivetrip		cenbycar		cenbywalk		cengt30pct		cengt40pct		cengt50pct	
	w/o q10	w/ q10	w/o q10	w/ q10	w/o q10	w/ q10	w/o q10	w/ q10	w/o q10	w/ q10	w/o q10	w/ q10	w/o q10	w/ q10
res_unit_pa	0.126	0.095	0.015	0.016	-0.007	0.016	-0.006	-0.033	0.075	0.066	0.082	0.074	0.070	0.064
	(1.89)	(1.79)	(1.23)	(1.36)	-(0.1)	(0.23)	-(0.07)	-(0.41)	(1.06)	(0.96)	(1.26)	(1.18)	(1.22)	(1.17)
sales	-7.38E-08	-5.84E-07	-4.13E-07	-3.95E-07	-2.03E-06	-1.96E-06	2.11E-06	2.04E-06	1.17E-07	-8.87E-08	2.17E-07	3.58E-08	3.56E-08	-1.13E-07
	-(0.06)	-(0.6)	-(2.79)	-(2.8)	-(1.47)	-(1.56)	(1.47)	(1.55)	(0.16)	-(0.13)	(0.35)	(0.06)	(0.05)	-(0.18)
block_size	-0.266	-0.211	-0.051	-0.052	0.213	0.201	-0.211	-0.197	0.000	0.012	0.023	0.035	0.063	0.072
	-(2.23)	-(2.03)	-(3.24)	-(3.5)	(1.66)	(1.79)	-(1.56)	-(1.64)	(0.)	(0.15)	(0.31)	(0.5)	(0.92)	(1.14)
pct_4way	-0.012	-0.006	-0.003	-0.003	0.007	0.005	-0.007	-0.005	0.005	0.007	0.006	0.007	0.008	0.009
	-(1.02)	-(0.58)	-(2.7)	-(2.7)	(0.79)	(0.61)	-(0.65)	-(0.46)	(0.6)	(0.82)	(0.72)	(0.97)	(1.18)	(1.47)
pseudo R-squared	0.051	0.071	0.019	0.020	0.120	0.198	0.124	0.202	0.059	0.091	0.073	0.097	0.079	0.095

Note: Survey variable q10, "Thinking about your neighborhood as a good place to live, how important is it to you that you can walk to work?" with responses from 1 "not at all important" to 5 "very important", was the only attitude variable in this regression.

Retail Sales

	walktrip		drivetrip		cenbycar		cenbywalk		cengt30pct		cengt40pct		cengt50pct	
	w/o q10	w/ q10	w/o q10	w/ q10	w/o q10	w/ q10	w/o q10	w/ q10	w/o q10	w/ q10	w/o q10	w/ q10	w/o q10	w/ q10
res_unit_pa	0.163	0.148	0.021	0.022	0.043	0.065	-0.061	-0.087	0.083	0.079	0.076	0.072	0.070	0.068
	(2.63)	(2.57)	(1.74)	(1.88)	(0.58)	(0.92)	-(0.76)	-(1.1)	(1.25)	(1.19)	(1.31)	(1.23)	(1.27)	(1.22)
retail_sales	-2.29E-06	-3.08E-06	-3.25E-07	-3.05E-07	-2.16E-06	-2.04E-06	2.36E-06	2.27E-06	-9.24E-07	-1.21E-06	4.09E-07	1.45E-07	-3.40E-08	-2.68E-07
	-(1.03)	-(1.63)	-(0.68)	-(0.65)	-(0.72)	-(0.77)	(0.75)	(0.81)	-(0.39)	-(0.53)	(0.19)	(0.07)	-(0.02)	-(0.13)
block_size	-0.280	-0.236	-0.063	-0.064	0.164	0.156	-0.162	-0.153	0.013	0.021	0.028	0.034	0.065	0.070
	-(3.19)	-(2.96)	-(3.84)	-(3.93)	(1.69)	(1.82)	-(1.55)	-(1.64)	(0.15)	(0.26)	(0.38)	(0.51)	(0.95)	(1.12)
pct_4way	-0.011	-0.005	-0.003	-0.003	0.006	0.004	-0.005	-0.003	0.006	0.008	0.006	0.007	0.008	0.009
	-(0.96)	-(0.54)	-(2.55)	-(2.55)	(0.66)	(0.46)	-(0.52)	-(0.33)	(0.65)	(0.85)	(0.71)	(0.94)	(1.14)	(1.4)
pseudo R-squared	0.052	0.072	0.018	0.018	0.089	0.172	0.091	0.175	0.060	0.093	0.073	0.097	0.079	0.095

Note: Survey variable q10, "Thinking about your neighborhood as a good place to live, how important is it to you that you can walk to work?" with responses from 1 "not at all important" to 5 "very important", was the only attitude variable in this regression.

Sales in Neighborhood Businesses

	walktrip		drivetrip		cenbycar		cenbywalk		cengt30pct		cengt40pct		cengt50pct	
	w/o q10	w/ q10	w/o q10	w/ q10	w/o q10	w/ q10	w/o q10	w/ q10	w/o q10	w/ q10	w/o q10	w/ q10	w/o q10	w/ q10
res_unit_pa	0.152	0.128	0.016	0.017	0.012	0.037	-0.030	-0.058	0.076	0.068	0.077	0.070	0.068	0.063
	(1.72)	(1.75)	(1.26)	(1.44)	(0.14)	(0.45)	-(0.32)	-(0.66)	(1.1)	(1.05)	(1.32)	(1.27)	(1.32)	(1.3)
neigh_sales	-2.51E-06	-2.80E-06	7.37E-07	7.15E-07	1.42E-06	1.15E-06	-1.11E-06	-7.88E-07	-4.38E-07	-3.28E-07	9.06E-07	9.60E-07	6.45E-07	6.49E-07
	-(0.67)	-(0.85)	(1.13)	(1.14)	(0.34)	(0.32)	-(0.26)	-(0.21)	-(0.17)	-(0.14)	(0.43)	(0.48)	(0.33)	(0.35)
block_size	-0.270	-0.222	-0.074	-0.075	0.137	0.131	-0.137	-0.130	0.009	0.013	0.021	0.024	0.056	0.059
	-(2.61)	-(2.3)	-(3.91)	-(4.)	(1.24)	(1.35)	-(1.16)	-(1.24)	(0.11)	(0.16)	(0.28)	(0.35)	(0.82)	(0.94)
pct_4way	-0.012	-0.007	-0.004	-0.004	0.004	0.003	-0.004	-0.002	0.006	0.007	0.006	0.007	0.007	0.008
	-(1.)	-(0.65)	-(2.85)	-(3.02)	(0.4)	(0.25)	-(0.31)	-(0.16)	(0.63)	(0.82)	(0.76)	(1.)	(1.21)	(1.5)
pseudo R-squared	0.051	0.071	0.018	0.019	0.085	0.169	0.085	0.170	0.059	0.091	0.073	0.097	0.079	0.095

Note: Survey variable q10, “Thinking about your neighborhood as a good place to live, how important is it to you that you can walk to work?” with responses from 1 “not at all important” to 5 “very important”, was the only attitude variable in this regression.

6. Hybrid Density Measure, (employees + population) per acre, was also tested, in place of the housing unit and business density variables.

	Walking trips		Driving trips		Center by car		Center by walking		Center trip capture greater than 30%		Center trip capture greater than 40%		Center trip capture greater than 50%	
	w/o att	w/ att	w/o att	w/ att	w/o att	w/ att	w/o att	w/ att	w/o att	w/ att	w/o att	w/ att	w/o att	w/ att
	0.025	0.015	0.002	0.003	-0.023	-0.018	0.024	0.019	0.020	0.016	0.021	0.018	0.017	0.014
Employees + Pop. / acre	(1.91)	(1.35)	(0.73)	(0.93)	-(1.5)	-(1.29)	(1.5)	(1.28)	(1.41)	(1.18)	(1.79)	(1.56)	(1.47)	(1.28)
	-0.210	-0.176	-0.060	-0.061	0.181	0.179	-0.186	-0.184	0.014	0.020	0.042	0.047	0.075	0.080
Block Size	-(1.76)	-(1.55)	-(3.09)	-(3.18)	(1.99)	(2.28)	-(1.90)	-(2.13)	(0.22)	(0.32)	(0.80)	(0.92)	(1.45)	(1.58)
	-0.005	-0.002	-0.002	-0.002	0.003	0.002	-0.003	-0.002	0.009	0.010	0.010	0.011	0.011	0.012
% intersections 4-way	-(.51)	-(.22)	-(1.46)	-(1.49)	(.33)	(.25)	-(.25)	-(.18)	(1.43)	(1.61)	(1.97)	(2.19)	(2.32)	(2.54)
Pseudo R-squared	0.0507	0.0695	0.0177	0.0181	0.099	0.1748	0.1	0.1749	0.0635	0.0931	0.0777	0.0992	0.0807	0.0949
N	1282	1282	1282	1282	1279	1279	1279	1279	1280	1280	1280	1280	1280	1280

Appendix D: Regressions by trip type, matching trip type and number of business establishments (or for grocery, jobs) per acre as the business measure. Coefficients on individual sociodemographic and attitude variables not shown.

Eat Meal Trips, regression results

Independent Variable	eating trips per week		usual mode of eating trips by car		usual mode of eating trips by walking		usual distance for eating trips within quarter mile		usual mode of eating trips by walking w/ % who usually go < ¼ mi	
	w/o attitude	w/ attitude	w/o attitude	w/ attitude	w/o attitude	w/ attitude	w/o attitude	w/ attitude	w/o attitude	w/ attitude
% who usually go < ¼ mi									1.652746	1.682271
									(7.89)	(7.96)
residential units	-0.00039	-0.00051	0.072725	0.077071	-0.05715	-0.05431	-0.07386	-0.07289	-0.02666	-0.02214
per acre	-(0.03)	-(0.04)	(2.46)	(2.5)	-(1.91)	-(1.8)	-(2.89)	-(2.86)	-(0.78)	-(0.65)
eating businesses	-0.00587	0.011612	-2.30608	-1.97554	2.315088	1.914482	2.327059	2.147735	1.567638	1.070509
per acre	-(0.04)	(0.08)	-(4.21)	-(3.76)	(4.57)	(4.14)	(13.43)	(12.22)	(3.37)	(2.53)
Avg. block size	-0.01401	-0.01379	-0.00824	-0.00776	0.016002	0.010566	0.042137	0.039646	-0.01384	-0.02712
	-(0.8)	-(0.79)	-(0.13)	-(0.14)	(0.24)	(0.17)	(1.13)	(1.09)	-(0.2)	-(0.45)
% of 4-way	0.002057	0.002038	0.002178	0.001584	-0.00365	-0.00321	0.000123	0.000273	-0.00553	-0.00525
intersections	(2.58)	(2.55)	(0.45)	(0.33)	-(0.79)	-(0.71)	(0.07)	(0.16)	-(1.12)	-(1.06)
pseudo R-squared	0.019	0.0191	0.1267	0.1649	0.1349	0.1815	0.0843	0.0907	0.2774	0.3227

Notes: Cluster corrected z-statistics below coefficients in parentheses. Statistically significant coefficients, using 95% two-tailed test, are shown in bold. Coefficients on demographic variables and attitude variable not reported here.

Grocery Trips, regression results

Independent	grocery trips per week		usual mode of grocery trips by car		usual mode of grocery trips by walking		usual distance for grocery trips within quarter mile		usual mode of grocery trips by walking w/	
Variable									w/ % who usually go < ¼ mi	
	w/o attitude	w/ attitude	w/oattitude	w/ attitude	w/o attitude	w/ attitude	w/o attitude	w/ attitude	w/o attitude	w/ attitude
% who usually go < ¼ mi									1.631846	1.778081
									(8.41)	(10.27)
residential units	0.008197	0.008404	0.053627	0.0562498	-0.04349	-0.0430913	0.002355	0.00444	-0.03447	-0.0146437
per acre	(0.8)	(0.81)	(0.69)	(0.73)	-(0.5)	-(0.5)	(0.04)	(0.08)	-(0.46)	-(0.19)
grocery jobs	0.03773	0.031544	-0.31093	-0.2616362	0.310765	0.2598209	0.204251	0.191845	0.232563	-0.0420048
per acre	(2.12)	(1.75)	-(2.29)	-(1.89)	(2.2)	(1.82)	(2.86)	(2.93)	(1.88)	-(0.41)
average block size	-0.0262	-0.02652	-0.00877	-0.0047852	0.019859	0.0139964	0.040076	0.038362	-0.01847	-0.0420048
	-(1.34)	-(1.36)	-(0.1)	-(0.05)	(0.22)	(0.15)	(1.07)	(1.04)	-(0.19)	-(0.41)
% of 4-way	-0.00091	-0.00088	-0.00788	-0.0081266	0.007439	0.0079143	0.00452	0.004363	0.003132	0.0019854
intersections	-(0.57)	-(0.55)	-(0.89)	-(0.91)	(0.84)	(0.9)	(1.14)	(1.16)	(0.38)	(0.22)
pseudo R-squared	0.0188	0.0196	0.1877	0.2382	0.1836	0.2419	0.0703	0.0723	0.3566	0.421

Notes: Cluster corrected z-statistics below coefficients in parentheses. Statistically significant coefficients, using 95% two-tailed test, are shown in bold. Coefficients on demographic variables and attitude variable not reported here.

Personal Services Trips, regression results

Independent Variable	personal service trips per week		usual mode of personal service trips by car		usual mode of personal service trips by walking		usual distance for personal service trips within quarter mile		usual mode of personal service trips by walking w/ % who usually go < ¼ mi	
	w/o attitude	w/ attitude	w/o attitude	w/ attitude	w/o attitude	w/ attitude	w/o attitude	w/ attitude	w/o attitude	w/ attitude
% who usually go < ¼ mi									1.632112	1.643692
									(9.6)	(8.78)
residential units	-0.0112	-0.00957	0.183341	0.1744435	-0.19968	-0.1922909	-0.12649	-0.1218	-0.17056	-0.1580317
per acre	-(0.74)	-(0.6)	(2.82)	(3.19)	-(3.03)	-(3.28)	-(3.04)	(3.06)	-(3.06)	-(3.09)
personal service	0.094459	0.07205	-0.83519	-0.730906	0.947581	0.8454533	0.601948	0.564273	0.788601	0.6675419
businesses per acre	(1.58)	(1.16)	-(4.22)	-(4.49)	(4.55)	(4.58)	(3.63)	(3.41)	(4.71)	(4.05)
average block size	-0.01808	-0.01926	-0.07404	-0.0705152	0.103562	0.0990394	0.168526	0.165253	0.020203	0.0057317
	-(0.95)	-(1.05)	-(1.45)	-(1.44)	(1.67)	(1.58)	(3.73)	(3.72)	(0.33)	(0.09)
% of 4-way	0.001734	0.001741	-0.01459	-0.0142728	0.016789	0.0164988	0.010837	0.01061	0.01086	0.0103049
intersections	(1.54)	(1.53)	-(2.41)	-(2.88)	(2.31)	(2.55)	(2.07)	(2.12)	(1.89)	(1.95)
pseudo R-squared	0.0129	0.014	0.1425	0.1729	0.1584	0.1908	0.0627	0.0654	0.3318	0.3598

Notes: Cluster corrected z-statistics below coefficients in parentheses. Statistically significant coefficients, using 95% two-tailed test, are shown in bold. Coefficients on demographic variables and attitude variable not reported here.

Personal Shopping Trips, regression results

Independent Variable	personal shopping trips per week		usual mode of personal shopping trips by car		usual mode of personal shopping trips by walking		usual distance for personal shopping trips within quarter mile		usual mode of personal shopping trips by walking	
									w/ % who usually go < ¼ mi	
	w/o attitude	w/ attitude	w/o attitude	w/ attitude	w/o attitude	w/ attitude	w/o attitude	w/ attitude	w/o attitude	w/ attitude
% who usually go < ¼ mi									1.417298	1.459048
									(6.42)	(5.41)
residential units	0.010529	0.010461	0.124347	0.1169254	-0.13332	-0.1108148	-0.01604	-0.0124178	-0.09947	-0.0689784
per acre	(0.94)	(0.94)	(3.05)	(3.08)	-(3.81)	-(3.75)	-(0.42)	-(0.34)	-(2.59)	-(1.69)
personal shopping	-0.07465	-0.07706	-0.646	-0.5382555	0.70772	0.5649472	0.305541	0.2749122	0.581585	0.4324597
jobs per acre	-(2.56)	-(2.73)	-(7.13)	-(6.76)	(6.18)	(5.94)	(3.04)	(2.98)	(4.3)	(3.)
average block size	-0.03511	-0.03532	-0.09544	-0.0713379	0.128062	0.0907129	0.109815	0.1041169	0.085937	0.048811
	-(3.51)	-(3.56)	-(2.28)	-(1.75)	(3.42)	(2.69)	(2.36)	(2.28)	(1.96)	(1.06)
% of 4-way	-0.00165	-0.00162	-0.00551	-0.0052439	-0.00106	-0.0011638	0.014995	0.0148592	-0.00655	-0.0065539
Intersections	-(1.6)	-(1.61)	-(1.16)	-(1.13)	-(0.21)	-(0.25)	(3.06)	(3.13)	-(1.24)	-(1.28)
pseudo R-squared	0.0111	0.0112	0.2524	0.3043	0.26	0.3056	0.1041	0.1085	0.3554	0.3973

Notes: Cluster corrected z-statistics below coefficients in parentheses. Statistically significant coefficients, using 95% two-tailed test, are shown in bold. Coefficients on demographic variables and attitude variable not reported here.

Appendix E: Details of Corridor Analysis

Each of the three corridors, along Artesia, Gardena, and Hawthorne Boulevards, has a regular, grid-oriented geography. Each corridor is demarcated by two intersections with another major arterial, a mile apart, which establishes the study area. Mid-way between each corridor is an intersection with a "minor" arterial, although that street typically carries more traffic than residential roads. Hence, every mile there are intersections of two major arterials with a secondary arterial intersecting mid-way. The study area is composed of an inner ring, ¼ mile around the corridor, and an outer ring, from ¼ to ½ mile around the corridor. For our purposes, the intersections of the "major-major" and "major-minor" arterials are the fundamental focus of the study, and are listed below.

Artesia

Major-Major intersections: Artesia and Aviation, Artesia and Inglewood
Major-Minor intersection: Artesia and Rindge

Gardena

Major-Major intersections: Gardena and Western, Gardena and Vermont
Major-Minor intersection: Gardena and Normandie

Hawthorne

Major-Major intersection: Hawthorne and Rosecrans, Hawthorne and El Segundo
Major-Minor intersection: Hawthorne and El Segundo

Each corridor has commercial and business establishments along the corridor street itself (Artesia, Gardena, Hawthorne), with residential development along side streets that are laid out in highly regular grids. Hence each corridor study area has a mix of commercial and residential development and grid-oriented streets, but the linear lay-out of the commercial along the arterial is auto-oriented.

Transportation Performance Measures and Study Approach

Each corridor's transportation performance is measured using travel behavior data from the South Bay Travel Survey. The survey includes 523 respondents from the Artesia study area, 285 respondents in the Gardena corridor, and 278 respondents in the Hawthorne Boulevard corridor, providing sufficient respondents to allow comparisons of travel behavior within the corridors. The dependent variables (transportation performance measures), drawn from the survey data for individual respondents, are listed below.

1. Per person daily walking trip generation (number of walking trips per person per day)
2. Per person daily driving trip generation (number of driving trips per person per day)
3. The usual mode for trips to the center/corridor (whether that mode is by walking or car)

4. Center trip capture rate (whether persons take more than 30, 40, or 50 percent of their total trips to their center or corridor)
5. Travel by the following seven trip types: trips to go to school, eat meal, grocery shopping, personal shopping, personal services, entertainment/recreation, or attend meetings. For each of these trip types, information is available on:
    a. usual number of trips (of that type) per week
    b. usual mode for a trip of that type
    c. usual distance for a trip of that type

For each corridor, respondent's residences were geocoded, allowing respondents to be grouped according to whether or not they lived within ¼ mile of either major-major intersection of the major-minor intersection. For respondents within each of these quarter-mile catchment areas (around the two corridor endpoints and the corridor mid-point), the transportation performance variables listed above were summarized. After that, the study approach is straightforward – do respondents who live within any of the three catchment areas travel differently from the balance of the study area? Any such differences in travel behavior are then compared with differences in the study area's characteristics. This allows two results. First, locations along the corridors that display less auto-oriented travel patterns in terms of the performance measures outlined above can be identified. These places – possibly locations with more walking, less driving, higher trip capture, and a higher incidence of walking to the corridor – might be fruitful locations for future centered development that would seek to leverage the travel characteristics near that area. Second, by comparing differences in travel behavior within a corridor to differences in the built environment and business functionality along the corridor, we can gain insights into how to transform auto-oriented corridors into more pedestrian friendly centers.

Simple comparisons of sample averages, within and outside of the ¼ catchment areas in each corridor, are supplement by regression analysis. Two regression models are run for each of the first four performance measures listed above. In the first model, the dependent variable describing a survey respondent's travel behavior is regressed on that individual's sociodemographic characteristics, and in the second model individual attitudes, drawn from survey responses to attitudinal questions in the South Bay Travel Survey, are also included. The basic form of the analysis is outlined below:

3. T-tests for differences between sample means or proportions, ¼ areas versus balance of the corridor.
4. Regression analysis of travel behavior, with independent variables that include (a) a dummy variable indicating whether the individual lived within ¼ mile of either major-major or the major-minor intersection and:
    a. the individual's sociodemographic characteristics, and
    b. the individuals sociodemographic characteristics and responses to attitudinal variables.

Each analysis is done only within the corridor, so survey respondents are compared only to respondents within the same corridor study area, not across different corridors.

The travel behavior variables are:

1. Number of walking trips that the individual took in the one-day travel diary
2. Number of driving trips that the individual took in the one-day travel diary
3. A categorical variable that equals "1" if the individual reported that more than 30 percent of their trip-making was to their corridor of residence, "0" otherwise, as a measure of internal trip capture among corridor residents.[15]
4. A categorical variable equal to "1" if the respondent said that more than 40 percent of their trip-making was to their corridor, "0" otherwise.
5. A categorical variable equal to "1" if the respondent said that more than 50 percent of their trip-making was to their corridor, "0" otherwise.
6. A categorical variable equal to "1" if the survey respondent said that they usually walk when traveling to their local corridor, "0" otherwise.[16]
7. A categorical variable equal to "1" if the survey respondent said that they usually drive when traveling to their local corridor, "0" otherwise.

For each of those seven variables, three tests are performed: (1) t-tests for differences between sample averages within ¼ catchment areas and the balance of the study area, (2) tests for statistical significance of the dummy variable that defines residence within the ¼ mile catchment area from a regression that controls for individual demographic characteristics, and (3) tests for statistical significance of the dummy variable that defines residence within the ¼ mile catchment area from a regression that controls for individual demographic characteristics and attitudinal variables. The individual sociodemographic characteristics and the attitudinal variables are listed in the body of the report.

Artesia Corridor

Table 1 shows the results of tests of differences in travel behavior for the Artesia corridor. The tests or organized in three columns, first comparing travel behaviors for persons within ¼ mile of the intersection of Artesia and Aviation with persons who live in the balance of the study area, then (in the middle column) comparing travel differences for persons living within ¼ mile of the intersection of Artesia and Inglewood with persons living in the rest of the study area, and then in the last column comparing travel differences for persons living within ¼ mile of Artesia and Rindge with persons living in the balance of the study area. The right-most column, Artesia and Rindge, is the "major-minor" intersection at the corridor mid-point – a convention we follow in Tables 4 and 7 also.

---

[15] This is from the following survey question: Think about all the trips that you take in a typical week. About what percentage of all of your trips during a typical week are to your neighborhood center? Responses range from none to 100 percent in 10 percent increments, and each survey respondent was instructed that their local one-mile stretch of arterial corridor is the "neighborhood center" referred to in the question.

[16] This is the response to the following survey question: When you go to <insert corridor name here>, how do you usually get there? Responses are by car, bus, walking, bicycling, or other.

The rows are grouped for the dependent variables showing, in turn, respondents' average number of walking and driving trips on the travel diary day, the percent of respondents who stated that at least 30%, 40%, and 50% of their trips were to the corridor, and then the percent of respondents who stated that they usually walk to their corridor and the percent who usually drive to their corridor. For each of these variables, there are three rows. The first row shows the difference in the sample values within the ¼ mile catchment area and the balance of the corridor. That value does not control for individual respondent characteristics. Below that are two rows – the first reports regression coefficients for the same test, from a regression that controls for individual sociodemographics. This is the coefficient on the dummy variable that equals one if the respondent lives within the ¼ mile catchment area, and to reiterate each of the three columns corresponds to different ¼ mile areas. The second row gives the coefficient on the ¼ mile dummy variable from a regression that controls for both sociodemographics and attitudes. At the bottom of Table 1, we report the number of survey respondents within each ¼ mile catchment area and, for each ¼ mile area, the number who live in the balance of the corridor study area. The bottom row shows the number of observations for the regression analysis, which is typically lower than the total number of respondents due to missing data when some respondents did not answer all survey questions.

With only one exception, the hypothesis tests in Table 1 do not vary across the uncontrolled t-tests and the regression tests. Table 2 shows this same thing, and more. Table 2 gives the magnitude of the difference between the ¼ mile area and the balance of the study area. For the uncontrolled t-tests, the magnitude of the difference is simply the difference between the sample value for the two study areas, and can be read directly from Table 1. But for the regressions in Table 1 the coefficients do not give magnitudes. The regressions for Table 1 are either negative binomial regressions (for the number of walking and driving trips per day) or probit regressions (for the other dependent variables.) Both of those are nonlinear regression routines that require additional analysis to obtain magnitudes. (For OLS regressions, the magnitudes can be interpreted directly from coefficients, but that is not the case for nonlinear specifications such as negative binomial or probit routines.) The magnitudes implied by the regression coefficients are shown in Table 2. Table 2 only reports magnitudes for Artesia and Rindge, since that was the only intersection which showed statistically significant travel differences in Table 1. Table 2 only shows magnitudes for cases where the difference (between Artesia and Rindge and the balance of the corridor) was statistically significant at the 10 percent level or better. A blank cell in Table 2 indicates that the corresponding test was not statistically significant, and so properly interpreted there is no difference when there are blank cells.

The results in Table 2 show that magnitude of the travel differences between the Artesia-Rindge intersection and the rest of the corridor are remarkably stable, whether or not individual demographics and attitudes are controlled or not. Overall, survey respondents who live within ¼ mile of Artesia and Rindge travel take from 0.25 to 0.34 more walking trips per day and take from 0.7 to 0.75 fewer driving trips per day. Trip capture, when measured by the fraction of survey respondents who say that at least 30% of their trips are to the corridor, is from 15 to 17 percentage points higher within ¼ mile of Artesia and

Rindge, and those survey respondents are from 10 to 20 percentage points more likely to walk to the corridor and from 13 to 24 percentage points less likely to drive to the corridor.

Table 3 shows the functionality within ¼ mile of the intersections with Aviation, Inglewood, and Ridge. Table 3 shows the number of businesses, employees, and sales within each quarter-mile catchment area. The information for Artesia and Rindge is an approximation, derived by subtracting the values for the quarter-mile areas around Artesia and Aviation and Artesia and Inglewood from the total for the Artesia inner ring. This will overstate, likely to only a modest extent, the functionality near Artesia and Rindge.

Based on the information in Table 3, the Artesia corridor contains more businesses near the middle than at the endpoints. The data in Table 3 suggest that as much as half of the corridors businesses cluster near the intersection with Rindge. This more robust functionality might be related to the transportation performance differences reported in Tables 1 and 2, and both suggest that the Artesia and Rindge intersection is a likely candidate for conversion to a pedestrian oriented center.

The demographics of the Artesia and Rindge study area, compared with the demographics of the balance of the corridor, are shown in Appendix Table A-1. That table does not reveal substantial demographic differences near Artesia and Rindge, and regardless the regressions in Tables 1 and 2 control for individual demographics.

Hawthorne Corridor

Tables 4 and 5 show, respectively, the results of the hypothesis tests for differences along the Hawthorne Boulevard corridor and the magnitudes of the statistically significant effects. The format of Table 4 follows Table 1, and similarly Table 5 has the same format as Table 4. There are fewer differences along Hawthorne than there were along Artesia.

The intersection at Hawthorne and Rosecrans shows evidence of larger trip capture than the balance of the study area. In terms of magnitudes, survey respondents within ¼ mile of Hawthorne and Rosecrans are from 20 percent to 26 percent more likely to travel to the Hawthorne corridor, depending on whether the trip capture threshold is, respectively, 40 percent or 50 percent of all trips. Again, the magnitudes and hypothesis tests are remarkably similar regardless of whether we control for respondents' sociodemographic characteristics and attitudes. The intersection at 135th shows evidence of negative trip capture – respondents living near that intersection visit the Hawthorne corridor less often, as a percentage of total trip making, than do residents in the balance of the corridor. Persons living within ¼ mile of 135th Street are more likely to walk when traveling to the corridor, but that effect is not significant after controlling for demographics and attitudes.

The functionality for the Hawthorne corridor is summarized in Table 6. As in Table 4, the values for the mid-point, at 135th Street, are the difference between the inner ring

values and the two ¼ mile areas at the corridor end. As such, this is an approximation that will overstate functionality at the mid-point of the corridor.

The differences across the quarter-mile catchment areas are not as dramatic as for the Artesia corridor, but the intersection with Rosecrans shows more activity by two measures – establishments and sales. Note that the more smooth distribution of functionality along the corridor is consistent with the relatively smaller number of travel behavior difference along the corridor, as compared with Artesia.

Gardena Corridor

The travel behavior analysis for the Gardena corridor is shown in Tables 7 and 8. The tables show substantial differences near the intersections with Vermont and Normandie, suggestive of improved transportation performance at those intersections. Functionality data for the Gardena corridor is not currently available.

Table 1: Transportation Performance at Corridor Ends and Midpoint, Artesia (bold indicates statistically significant at 5% level, bold italic at 10% level)

Center -->	Artesia left (Aviation)				Artesia right (Inglewood)				Artesia middle (Rindge)			
Performance Indicator	within 1/4 mile	balance of corridor	Difference (or for regression coeff)	t-stat, difference in means (or t-stat for reg coeff)	within 1/4 mile	balance of corridor	Difference (or for regression coeff)	t-stat, difference in means (or t-stat for reg coeff)	within 1/4 mile	balance of corridor	Difference (or for regression coeff)	t-stat, difference in means (or t-stat for reg coeff)
walk trips, avg per day per person	0.0232	0.0931	-0.0699	-0.95	0.2121	0.0791	0.1330	1.60	**0.3051**	**0.0600**	**0.2451**	**3.89**
regression with demographic variables			-1.2748	-0.97			0.9388	1.13			**1.8611**	**2.70**
regression with demo and attitude variables			-1.0863	-0.83			1.3365	1.59			**1.9085**	**2.75**
driving trips, avg per day per person	2.3260	2.4850	-0.1590	-0.48	2.6670	2.4580	0.2090	0.55	**1.8470**	**2.5500**	**-0.7030**	**-2.43**
regression with demographic variables			-0.0570	-0.46			0.1807	1.32			**-0.3524**	**-3.01**
regression with demo and attitude variables			-0.0211	-0.17			0.1468	1.08			**-0.3469**	**-2.96**

Center -->	Artesia left (Aviation)				Artesia right (Inglewood)				Artesia middle (Rindge)			
fraction of persons who take **> 30% of trips to center**	39.02%	31.30%	7.72%	1.02	40.63%	31.34%	9.29%	1.09	**45.45%**	**30.27%**	**15.18%**	**2.29**
regression with demo variables			0.22	0.98			0.29	1.09			**0.50**	**2.51**
regression with demo and attitude variables			0.23	0.98			0.34	1.24			**0.45**	**2.23**
fraction of persons who **take > 40% of trips to center**	31.71%	22.61%	9.10%	1.32	28.13%	23.03%	5.10%	0.66	***32.72%***	***22.20%***	***10.52%***	***1.74***
regression with demo variables			0.30	1.26			0.17	0.61			***0.39***	***1.88***
regression with demo and attitude variables			0.30	1.23			0.21	0.73			***0.35***	***1.65***
fraction of persons who take **> 50% of trips to center**	26.83%	18.26%	8.57%	1.34	25%	18.55%	6.45%	0.90	***22.72%***	***17.94%***	***4.78%***	***1.67***
regression with demo variables			0.22	0.90			0.19	0.66			***0.38***	***1.79***
regression with demo and attitude variables			0.21	0.82			0.25	0.83			0.33	1.52

Center -->	Artesia left (Aviation)				Artesia right (Inglewood)				Artesia middle (Rindge)			
fraction of persons who usually **walk to center**	7.32%	8.26%	-0.94%	-0.21	12.50%	7.89%	4.61%	0.92	**25.45%**	**6.05%**	**19.40%**	**5.07**
regression with demographic variables			-0.12	-0.32			-0.28	-0.61			**1.01**	**4.09**
regression with demo and attitude variables			-0.28	-0.63			-0.24	-0.45			**1.02**	**3.61**
fraction of persons who usually **drive to center**	87.80%	90.22%	-2.42%	0.49	84.38%	90.41%	-6.03%	1.10	**69.09%**	**92.60%**	**-23.51%**	**5.65**
regression with demographic variables			-0.15	-0.49			0.09	0.21			**-1.03**	**-4.36**
regression with demo and attitude variables			0.08	0.21			-0.10	-0.21			**-1.03**	**-3.79**
number of observations	41	460			32	469			55	446		
total in Artesia	501											
N for regressions	448											

Table 2: Magnitude of differences, Artesia and Ridge versus balance of Artesia corridor
(only statistically significant differences shown)

Performance Indicator (from survey data)	Difference, ¼ mile of Rindge versus balance of corridor
walk trips, avg per day per person	0.25
from regression with demographic variables	0.33
from regression with demo and attitude variables	0.34
driving trips, avg per day per person	-0.70
form regression with demographic variables	-0.76
from regression with demo and attitude variables	-0.75
fraction of persons who take **> 30% of trips to center**	15.18%
from regression with demographic variables	18.69%
from regression with demo and attitude variables	16.81%
fraction of persons who take **> 40% of trips to center**	10.52%
from regression with demographic variables	12.83%
from regression with demo and attitude variables	11.17%
fraction of persons who take **> 50% of trips to center**	4.78%
from regression with demographic variables	11.23%
from regression with demo and attitude variables	
fraction of persons who **usually walk to center**	19.40%
from regression with demographic variables	20.54%
from regression with demo and attitude variables	10.76%
fraction of persons who **usually drive to center**	-23.51%
from regression with demographic variables	-23.01%
from regression with demo and attitude variables	-12.94%

Note: Percentages indicate percentage point difference.

Table 3: Business Functionality along Artesia Corridor, inner ring

Within 1/4 mile of:	number of establishments	percent of inner ring	employees	percent of inner ring	sales ($1,000s)	percent of inner ring
Artesia and Aviation	114	20.77%	586	33.72%	$108,338	28.17%
Artesia and Inglewood	150	27.32%	387	22.27%	$86,067	22.38%
Artesia and Rindge (a)	285	51.91%	765	44.02%	$190,153	49.45%
Inner Ring Total	549	100.00%	1,738	100.00%	$384,558	100.00%

(a) approximated as the difference between inner ring and endpoint 1/4 mile totals

Table 4: Transportation Performance at Corridor Ends and Midpoint, Hawthorne (bold indicates statistically significant at 5% level, bold italic at 10% level)

Center -->	Hawthorne left (Rosecrans)				Hawthorne right (El Segundo)				Hawthorne middle (135th)			
Performance Indicator	within 1/4 mile	balance of corridor	Difference	t-stat, difference in means	within 1/4 mile	balance of corridor	Difference	t-stat, difference in means	within 1/4 mile	balance of corridor	Difference	t-stat, difference in means
walk trips, avg per day per person	0.0645	0.0324	0.0321	0.90	0	0.0382	-0.0382	-0.79	0.0294	0.0369	-0.0075	-0.22
regression with demographic variables (a)			-34.3402	0.00			-8.5184	0.00			30.5796	0.00
regression with demo and attitude variables (a)			-9.5198	0.00			-8.2190	0.00			7.2796	0.00
driving trips, avg per day per person	1.613	1.591	0.0220	0.08	1.0625	1.626	-0.5635	-1.51	1.706	1.578	0.1280	0.48
regression with demographic variables			0.0587	0.35			-0.3464	-1.28			0.1572	1.00
regression with demo and attitude variables			0.0343	0.20			-0.3532	-1.26			0.1620	0.97

Center -->	Hawthorne left (Rosecrans)				Hawthorne right (El Segundo)				Hawthorne middle (135th)			
fraction of persons who take **> 30% of trips to center**	55.17%	42.86%	12.31%	1.26	46.67%	44.01%	2.66%	-0.19	33.33%	45.81%	-12.48%	-1.35
regression with demo variables			0.29	0.88			-0.25	-0.61			-0.23	-0.74
regression with demo and attitude variables			0.19	0.53			-0.39	-0.88			-0.35	-1.05
fraction of persons who take **> 40% of trips to center**	**55.17%**	**34.20%**	**20.97%**	**2.22**	33.33%	36.73%	-3.40%	-0.26	**21.21%**	**38.77%**	**-17.56%**	**-1.96**
regression with demo variables			***0.55***	***1.67***			-0.23	-0.54			***-0.64***	***-1.93***
regression with demo and attitude variables			0.52	1.46			-0.30	-0.69			**-0.72**	**-2.05**
fraction of persons who take **> 50% of trips to center**	**55.17%**	**28.57%**	**26.60%**	**2.94**	20.00%	32.24%	-12.24%	0.99	21.21%	33.03%	-11.82%	-1.37
regression with demo variables			**0.70**	**2.09**			-0.55	-1.15			-0.38	-1.16
regression with demo and attitude variables			***0.73***	***1.99***			-0.42	-0.83			-0.33	-0.92

Center -->	Hawthorne left (Rosecrans)				Hawthorne right (El Segundo)				Hawthorne middle (135th)			
fraction of persons who usually **walk to center**	17.24%	11.59%	5.65%	0.87	20.00%	11.74%	8.26%	0.95	***21.21%***	***10.92%***	***10.29%***	***1.69***
regression with demographic variables			0.52	1.14			0.82	1.30			0.50	1.16
regression with demo and attitude variables			0.4291789	0.77			1.33	1.59			0.57	1.14
fraction of persons who usually **drive to center**	75.86%	86.69%	-10.83%	1.56	80.00%	85.83%	-5.83%	0.62	78.79%	86.46%	-7.67%	1.17
regression with demographic variables			-0.47	-1.09			-0.40	-0.68			-0.37	-0.91
regression with demo and attitude variables			-0.38	-0.70			-0.82	-1.12			-0.33	-0.69
number of observations	29	233			15	247			33	229		
total in Hawthorne	262											
total for regressoins	211											

Notes: (a) Likelihood function for negative binomial regression was not concave. Regression using OLS gives same result for hypothesis test (insigificant).

Table 5: Magnitude of differences, Hawthorne and Rosecrans versus balance of Hawthorne corridor and Hawthorne and 135th versus balance of corridor (only statistically significant differences shown)

Performance Indicator (from survey data)	Difference, 1/4 mile from Rosecrans vs. balance of corridor	Difference, 1/4 mile from 135th vs. balance of corridor
walk trips, avg per day per person		
from regression with demographic variables		
from regression with demo and attitude variables		
driving trips, avg per day per person		
form regression with demographic variables		
from regression with demo and attitude variables		
fraction of persons who take **> 30% of trips to center**		
from regression with demographic variables		
from regression with demo and attitude variables		
fraction of persons who take **> 40% of trips to center**	20.97%	-17.56%
from regression with demographic variables	20.99%	-19.81%
from regression with demo and attitude variables		-21.23%
fraction of persons who take **> 50% of trips to center**	26.60%	
from regression with demographic variables	26.05%	
from regression with demo and attitude variables	26.37%	
fraction of persons who **usually walk to center**		10.29%
from regression with demographic variables		
from regression with demo and attitude variables		
fraction of persons who **usually drive to center**		
from regression with demographic variables		
from regression with demo and attitude variables		

Note: Percentages indicate percentage point difference.

Table 6: Business Functionality along Hawthorne Corridor, Inner Ring

Within 1/4 mile of:	number of establishments	percent of inner ring	employees	percent of inner ring	sales ($1,000s)	percent of inner ring
Hawthorne and Rosecrans	201	36.61%	1,024	27.23%	$247,943	41.59%
Hawthorne and El Segundo	160	29.14%	1,718	45.68%	$145,200	24.36%
Hawthorne and 135th (a)	188	34.24%	1,019	27.09%	$203,025	34.05%
Inner Ring Total	549	100.00%	3,761	100.00%	$596,168	100.00%

(a) approximated as the difference between inner ring and endpoint 1/4 mile totals

Table 7: Transportation Performance at Corridor Ends and Midpoint, Gardena (bold indicates statistically significant at 5% level, bold italic at 10% level)

Center -->	Gardena left (Western)				Gardena right (Vermont)				Gardena middle (Normandie)			
Performance Indicator	within 1/4 mile	balance of corridor	Difference (or for regression coeff)	t-stat, difference in means (or t-stat for reg coeff)	within 1/4 mile	balance of corridor	Difference (or for regression coeff)	t-stat, difference in means (or t-stat for reg coeff)	within 1/4 mile	balance of corridor	Difference (or for regression coeff)	t-stat, difference in means (or t-stat for reg coeff)
walk trips, avg per day per person	0.087	0.0267	0.0603	1.43	0.0833	0.0268	0.0565	1.37	0.0286	0.0125	0.0161	0.10
regression with demographic variables (a)			0.9815	0.68			89.0172	0.05			-497.7159	-0.46
regression with demo and attitude variables (a)			21.7609	0.00			25.5380	0.01			-18.9902	-0.01
driving trips, avg per day per person	**3.1304**	**2.084**	**1.0464**	**2.37**	1.7917	2.2031	-0.4114	-0.94	2.3143	2.148	0.1663	0.45
regression with demographic variables			0.1988	1.18			-0.2767	-1.36			0.2253	1.50
regression with demo and attitude variables			0.1644	0.99			-0.2016	-0.98			0.2280	1.52

Center -->	Gardena left (Western)				Gardena right (Vermont)				Gardena middle (Normandie)			
fraction of persons who take **> 30% of trips to center**	4.54%	17.22%	-12.68%	1.55	**42.86%**	**13.81%**	**29.05%**	**3.54**	**35.48%**	**13.54%**	**21.94%**	**3.16**
regression with demographic variables (b)		n/a	n/a				**1.08**	**2.58**			**1.11**	**3.23**
regression with demo and attitude variables (b)		n/a	n/a				**1.46**	**2.96**			**1.33**	**3.36**
fraction of persons who take **> 40% of trips to center**	0.00%	10.50%	-10.50%	-1.60	**23.81%**	**8.37%**	**15.44%**	**2.32**	***19.35%***	***8.30%***	***11.05%***	***1.97***
regression with demographic variables (c)		n/a	n/a				0.72	1.18			0.67	1.58
regression with demo and attitude variables (c)		n/a	n/a				***1.60***	***1.92***			***1.05***	***1.82***
fraction of persons who take **> 50% of trips to center**	0.00%	8.82%	-8.82%	1.45	***19.05%***	***7.11%***	***11.94%***	***1.93***	***16.13%***	***6.99%***	***9.14%***	***1.76***
regression with demographic variables (d)		n/a	n/a				0.65	1.04			0.59	1.33
regression with demo and attitude variables (d)		n/a	n/a				***2.02***	***1.73***			**1.88**	**2.17**

Center -->	Gardena left (Western)				Gardena right (Vermont)				Gardena middle (Normandie)			
fraction of persons who usually **walk to center**	9.09%	8.83%	0.26%	0.04	**23.81%**	**7.53%**	**16.28%**	**2.54**	**29.03%**	**6.11%**	**22.92%**	**4.35**
regression with demographic variables			0.17	0.35			**1.04**	**1.98**			**1.01**	**2.69**
regression with demo and attitude variables			0.42	0.76			***1.01***	***1.80***			**1.22**	**2.74**
fraction of persons who usually **drive to center**	86.36%	88.66%	-2.30%	-0.32	**71.43%**	**89.96%**	**-18.53%**	**-2.57**	**70.97%**	**90.83%**	**-19.86%**	**-3.30**
regression with demographic variables			-0.21	-0.48			-0.67	-1.49			**-0.73**	**-2.18**
regression with demo and attitude variables			-0.64	-1.27			-0.46	-0.94			**-1.06**	**-2.52**
number of observations	22	238			21	239			31	229		
total in Gardena	260											
total for regressions	223											

Notes: (a) Likelihood function for negative binomial regression was not concave. Regression using OLS gives same result for hypothesis test (insigificant). (b) n/a indicates Gard_Western dummy dropped from regression due to colinearity (and due to missing variables for some respondents.) When OLS is used, coefficient is -0.17728 (t-stat = -2.06) with only soc-demo variables and coefficient = -0.1561 (t-stat = -1.82) when attitudinal variables are added. (c) n/a indicates Gard_Western dummy dropped from regression due to colinearity (and due to missing variables for some respondents.) With OLS, coefficient is -0.0792 (t-stat = -1.14) with only soc-demo variables and coefficient = -0.0546 (t-stat = -0.79) when attitudinal variables are added. (d) n/a indicates Gard_Western dummy dropped from regression due to colinearity (and due to missing variables for some respondents.) With OLS, coefficient is -0.0718 (t-stat = -1.12) with only soc-demo variables and coefficient = -0.0472 (t-stat = -0.74) when attitudinal variables are added.

Table 8: Magnitude of differences, Gardena intersections versus balance of corridor
(only statistically significant differences shown)

Performance Indicator (from survey data)	Difference, 1/4 mile of Western versus balance of corridor	Difference, 1/4 mile of Vermont versus balance of corridor	Difference, 1/4 mile of Normandie versus balance of corridor
walk trips, avg per day per person			
from regression with demographic variables			
from regression with demo and attitude variables			
driving trips, avg per day per person	1.05		
form regression with demographic variables			
from regression with demo and attitude variables			
fraction of persons who take **> 30% of trips to center**		29.05%	21.94%
from regression with demographic variables		28.37%	26.68%
from regression with demo and attitude variables		32.99%	26.94%
fraction of persons who take **> 40% of trips to center**		15.44%	11.05%
from regression with demographic variables			
from regression with demo and attitude variables		4.22%	1.11%
fraction of persons who take **> 50% of trips to center**		11.94%	9.14%
from regression with demographic variables			
from regression with demo and attitude variables		0.18%	0.000371%
fraction of persons who **usually walk to center**		16.28%	22.92%
from regression with demographic variables		15.79%	12.83%
from regression with demo and attitude variables		12.73%	13.48%
fraction of persons who **usually drive to center**		-18.53%	-19.86%
from regression with demographic variables			-15.72%
from regression with demo and attitude variables			-17.63%

Note: Percentages indicate percentage point difference.