Effect of Neotraditional Neighborhood Design on Travel Characteristics

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Neotraditional neighborhood design (NTND) developments receive increasing attention as an alternative community design to standard suburban developments. By altering the spatial relationships through changes in zoning and transportation systems, automobile use is expected to be reduced. NTND requires the close proximity of residential and nonresidential uses connected with a straight, interconnecting street system and a network of bicycle paths and pedestrian walkways. Changes to the geometric design of streets reduce vehicular speeds. NTND has much in common with traditional developments. Because few NTNDs are built the authors researched trip files to see if residents of traditional (e.g., pre–World War II) and suburban (e.g., post–World War II) residential developments exhibit differing travel habits. The effects of traditional and standard suburban community design on household trip rates are evaluated. The analysis uses data from a 1980 regional travel survey of San Francisco Bay Area households. The findings indicate that households in newer suburban tract communities use vehicles more, whereas households in traditional communities rely more on alternative modes of transportation. When considering the results of the study for NTND design, remember that not all mode choice factors that exist in older traditional-design communities would be duplicated in a modern NTND. The findings show that community design and urban form have a significant influence on travel behavior. However, more research is needed to identify the relative influences of household income, automobile ownership, and other socioeconomic factors on trip generation and mode choice.

The 1980s witnessed extraordinary growth in traffic congestion in metropolitan regions throughout the United States. This phenomenon occurred not only in the nation's older metropolitan areas but also in suburban areas developed since World War II. That irony is not lost among city planners and transportation professionals who perceive increasing amounts of travel delay. For it was members of these professions who were largely responsible for the evolution of urban and suburban development patterns that are most common today.

Today's standard suburban development pattern commonly features segregation of land uses served by a strict hierarchy of roadways. Among other reasons this pattern evolved out of efforts to remove through traffic from residential streets to enhance safety and maximize capacity for vehicular traffic to enhance regional mobility. With a few exceptions, one could argue that before the 1980s these broad goals had been largely achieved and in fact will continue to be met in several parts of North America. However, continued growth in the suburban areas of larger urban areas, combined with the inherent difficulties faced by local and state officials responsible for providing sufficient regional transportation system capacity, will result in increasing amounts of congestion and delay.

This has led several urban planning and transportation professionals to revisit the fundamental assumptions that guide typical new development patterns. Many now believe that continued reliance on now-standard models for the development of large areas will have an increasingly negative impact on congestion, environmental quality, and in the long run, economic growth.

Two years ago the state of California enacted congestion management guidelines intended to control urban economic growth, congestion, and air quality by strengthening the connection between regional land-use planning and transportation capacity improvements. (California's Congestion Management Program was established as part of a statewide transportation funding measure approved by voters in 1990.) Administered at the county level, this process includes incentives for local jurisdictions to consider measures that not only facilitate traffic flow (i.e., capacity improvements) but also slow traffic growth attributable to new development (i.e. various transportation demand management measures).

Among those measures being considered in some California counties are alternative design models for new communities. These have been referred to as neotraditional neighborhood design, transit-oriented design, or the pedestrian pocket. A pedestrian pocket community known commercially as Laguna West is now under construction in Sacramento County. Several others of varying size have been proposed or designed. Neotraditional design features are typically reminiscent of pre–World War II small-town development patterns, which featured

- A neighborhood or town center district with considerable pedestrian access and consisting of mixed commercial and office uses;
- Connected grid street patterns that enhanced accessibility along alternate routes between the town center and adjacent residential neighborhoods;
- Close proximity between different land uses, which provided increased pedestrian access to local residents;
- Relatively narrow residential streets with on-street parking and tree canopies; and
- Small home lots with accessible public parks and recreational areas.

Neotraditional design proponents advance it as an alternative to standard suburban design on the basis of the claims that they help address regional congestion and broader goals such as air quality, energy conservation, and the preservation of open spaces. In effect they are seen as a potential way to manage travel demand through community design. To date little documented evidence exists to support claims of their effectiveness in reducing automobile trips and vehicle miles traveled (VMT). This is attributable to the lack of travel survey data available from modern, fully built neotraditional communities.

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NEOTRADITIONAL TRANSPORTATION SYSTEM GOALS AND VMT REDUCTION

In the neotraditional community the automobile should be relied on less than in standard suburban development tracts. The overall transportation objectives are to reduce the number of vehicle trips and (VMT) by

- Limiting automobile use to the most appropriate or necessary purposes by minimizing automobile use for intracommunity travel and commutation;
- Maximizing the opportunities for and attractiveness of alternative modes, including walking, bicycling, and transit use; and
- Addressing public safety concerns through separation of pedestrians and cyclists from vehicular traffic and by slowing vehicular speeds through roadway design.

Ideally, the best way to measure the effectiveness in achieving these goals is to estimate the reduction in vehicle trips and VMT that is mostly attributable to the community and transportation system design. However, no completed neotraditional community exists.

Several recently published articles on neotraditional design recommended new design parameters and guidelines for planners and engineers. One recent paper estimated changes in travel patterns based on the potential reduction in trip generation rates as a function of lower automobile ownership rates among neotraditional community residents (*1*). Although this is a plausible assumption, the estimated reductions are based on conjecture.

This paper reviews statistics from the San Francisco Home Interview Surveys conducted in 1980. It focuses on trip generation reported by residents of pre–World War II and post–World War II residential developments and comments on the comparison of the results from these two subsets. Then criteria for each community type are described.

STUDY METHODOLOGY

By using data extracted from household travel surveys in the San Francisco Bay Area, estimates were made of the relative differences in trip rates among residents of communities designed as standard post–World War II suburbs and residents of older, more traditionally designed communities. The analysis involves a comparison of actual travel data collected from residents of several such communities in the San Francisco Bay Area (*2*).

Differences in trip rates attributable to community design are estimated by comparing the relative differences in actual travel behavior among residents of each type of community. These differences are evaluated by trip type, community design, and other factors.

Trip Types

The Bay Area Transportation Survey (BATS) obtained daily travel characteristics for various trip functions. Survey data were originally sorted into 10 trip categories and were aggregated into the following four categories for the purpose of this analysis.

1. Home-based work trips;
2. Home-based other trips: home/shop–home/change mode–home/person/social–home/education;
3. Work-based trips: work/shop–work/education–work/other–work/change mode; and
4. Non-home-based other trips.

Community Design

BATS coverage extended over the nine-county area shown in Figure 1. This nine-county area lies within MTC's jurisdiction (MTC is the regional transportation planning and project funding agency for the San Francisco Bay Area). This area was divided into the 34 superdistricts shown in Figure 2 and was further divided into 550 subzones (based on 1980 census tracts). The latter, more refined level of demarcation was used to identify survey zones. Communities in these zones were characterized as either standard suburban or traditional. For the purposes of this analysis, standard suburban refers to communities that

- Developed since the early 1950s with segregated land uses (i.e., minimal pedestrian access between residential and nonresidential uses),
- Have a well-defined hierarchy of roads,
- Concentrate site/area access at a few key points via major arterial roadways, and
- Have relatively little transit service.

We drew samples for the standard suburban statistics from various suburban communities located mostly in Contra Costa County (Concord, Pleasant Hill), Santa Clara County (Sunnyvale, Mountain View), and Alameda County (Fremont, Castro Valley).

Survey zones were labeled traditional communities if they

- Were mostly developed before World War II,
- Had a mixed-use downtown commercial district with significant on-street curbside parking, and
- Had an interconnecting street grid and residential neighborhoods in close proximity to nonresidential land uses.

The latter category included some residential neighborhoods within the cities of Oakland and Berkeley and some older, pre–World War II neighborhoods within suburban Bay Area communities. The analysis excluded any residential zones within the city of San Francisco because it contains little suburban-style development, has a high level of transit service and transit utilization, and a high jobs/housing ratio. It is unlikely that these characteristics could be recreated within a new town community to the extent that they exist in San Francisco or a similar large city.

The schematic drawings in Figure 3 illustrate the conceptual differences in community design and circulation patterns between the two land-use models. To simulate likely design conditions and demographics of neotraditional development, the extracted data sample excluded traditional communities in which local conditions were not likely to be replicated in a new development. For example, the analysis excluded residential areas that were adjacent to or within walking distance of urban downtown areas (i.e., downtown Oakland). Similarly, areas with newly developed exsuburban subdivisions that were relatively inaccessible to large employment concentrations at the time of the survey were also excluded.

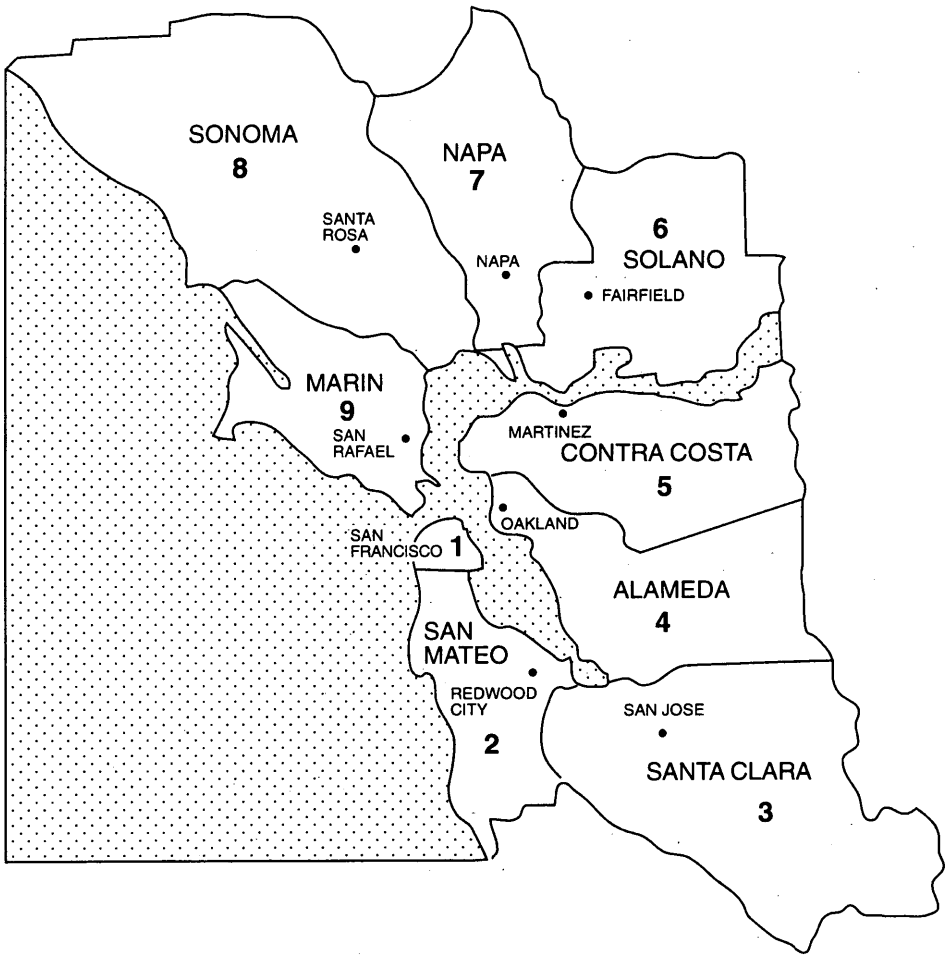

FIGURE 1 San Francisco Bay regional map: county names and codes.

Income Level

To replicate the conditions found in traditional neighborhoods, the Laguna West development in Sacramento County will include a variety of housing stock in price ranges that should attract an equally broad range of household income groups. Likewise, we included a broad range of income groups in the survey data profile. BATS grouped respondents into nine income categories, ranging from $0 to $100,000 in 1980 dollars. To reflect the likely target residential market, we included data on respondents in all but those in the lowest and highest income categories. This effectively eliminated households with incomes at the lowest income level (5 percent of all survey respondents) and the wealthiest 5 to 6 percent of all survey respondents. Thus, the data sample excludes those who would be most transit dependent and those who would be least inclined to consider alternate modes of travel. Approximately 18 percent of all survey respondents from both traditional and suburban areas did not respond to questions on household income. Their responses were also eliminated from the analysis.

Even with the high, low, and no response income categories removed, the mean household incomes in the suburban communities were on average 23 percent higher than the average household incomes in traditional communities. This analysis does not specifically address the potential effect of the income disparity on the study's findings. Recent research investigating the effect of household income on mode choice suggests that household income does positively correlate with automobile ownership and household trip rates. Subsequent research should therefore seek to equalize income levels within both survey populations to obtain more statistically reliable findings. However, the methodology of eliminating the highest and lowest income brackets employed in this study is seen as a reasonable first step to determine (a) if significant differences in travel characteristics between two community types do exist and (b) if there is a basis for performing more extensive, statistically significant analyses.

SURVEY FINDINGS

The comparison of travel characteristics between the standard suburban and traditional communities is summarized in Table 1. This section discusses key observations and findings.

Comparison of Total Trips Per Household

A comparison of total daily trip generation rates shows that the standard suburban rate (11.03 trips/household) was 25 percent higher than the rate for traditional communities (8.83 trips/household). The automobile-driver mode was used for 64 percent of all trips in the

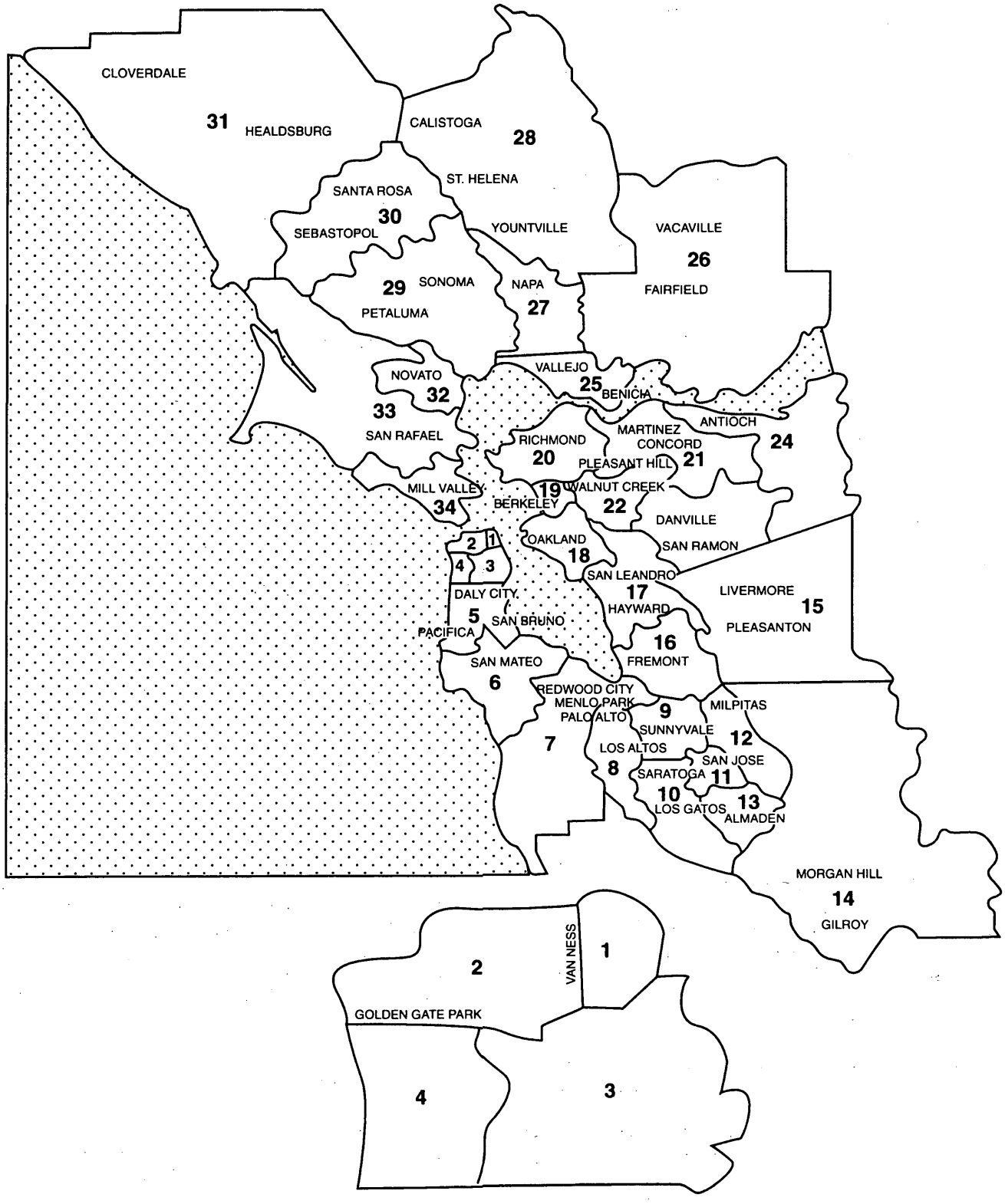

FIGURE 2 Thirty-four-superdistrict system based on 1980 census tracts and 550 travel analysis zones. (Source: MTC, October 1988.)

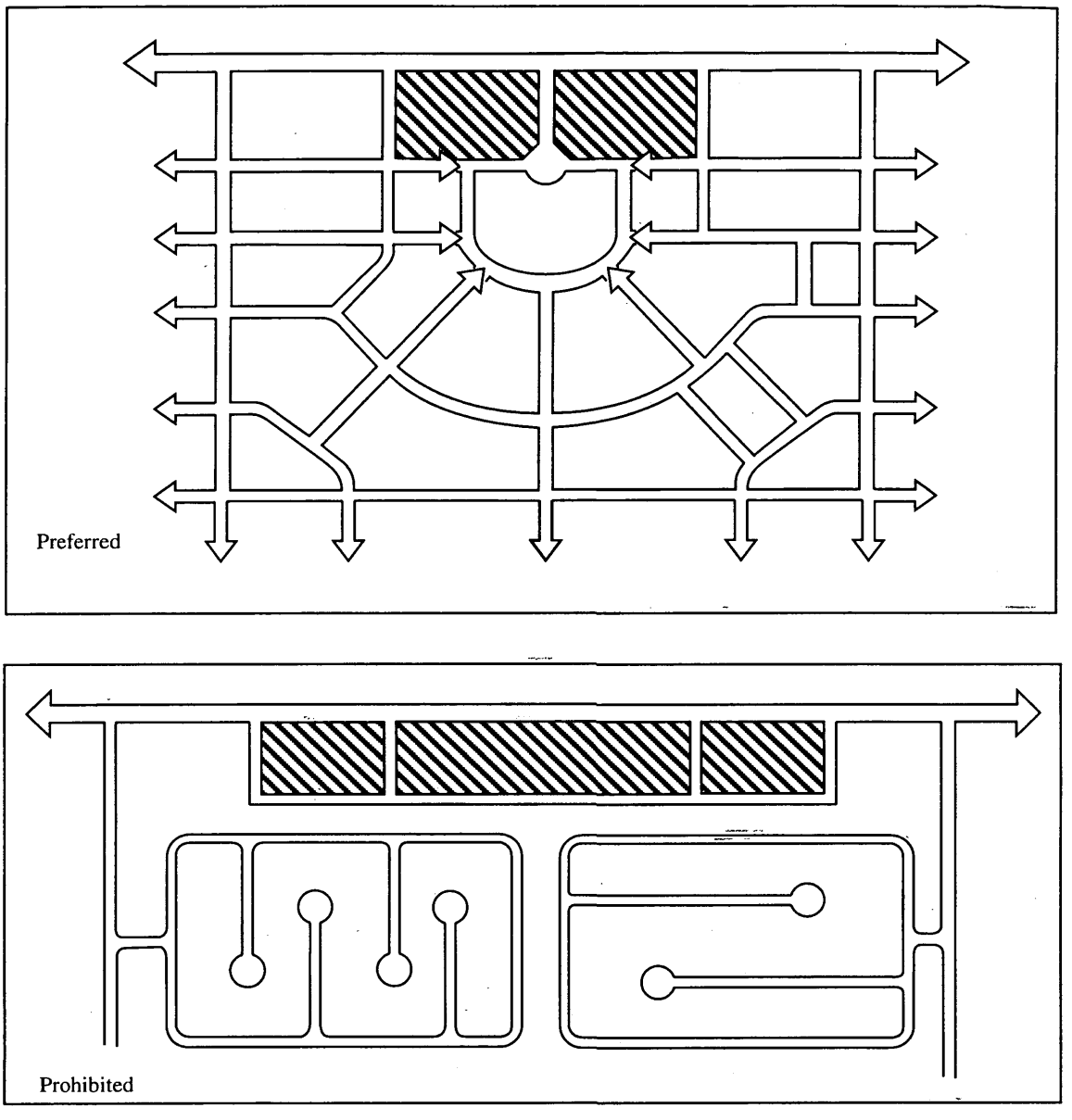

FIGURE 3 Street network comparison: pedestrian pocket versus standard development guide. (Source: Transit-Oriented Development Design Guidelines, Calthorpe & Associates, 1990.)

suburban areas but only 61 percent of all trips in the traditional areas. Automobile use for all trips was about 32 percent higher in the suburban areas (7.1 trips/day) than in the traditional areas (5.35 trips/day). Note that the total number of households surveyed was 7,091. The standard suburban subpopulation was 709 households, and the traditional households numbered 396. Once the high- and low-income groups were removed the final numbers of subpopulation households were 450 and 222, respectively.

Comparison of Trip Percentages

Home-Based Work Trips

The automobile-driver (or drive-alone) rate for standard suburban communities (83 percent) was 14 percent higher than that for traditional communities (73 percent drive-alone rate). Carpooling was slightly higher in traditional communities (9 versus 7 percent), and use of alternative modes (transit, bicycle, pedestrian, other) was almost double—19 versus 10 percent for standard suburban communities. Transit use alone in the traditional community (11 percent) was nearly three times the rate for standard suburban communities (4 percent). The relative shares of pedestrian and walk travel were roughly equivalent—4 percent (traditional) versus 3 percent (standard suburban).

Home-Based Non-Work Trips

Although the differences in mode choice did not contrast as sharply in this trip category, the differences were still significant. The

TABLE 1 Trip Characteristics of Residents of Traditional Communities Versus Standard Suburban Subdivisions and Number of Daily Trips per Household

	Home-Based Work		Home-Based Nonwork		Work-Based Other		Nonhome-Based		All Trips Combined	
	Community									
	Traditional	Suburban	Traditional	Suburban	Traditional	Suburban	Traditional	Suburban	Traditional	Suburban
Mode of Travel										
Auto Driver	73%	83%	51%	60%	70%	77%	58%	66%	61%	68%
Auto Passenger	8%	7%	21%	23%	7%	11%	19%	25%	16%	18%
Transit	11%	4%	7%	3%	5%	2%	4%	1%	7%	3%
Bicycle	2%	2%	6%	3%	2%	1%	2%	1%	4%	2%
Walk	4%	3%	14%	10%	15%	8%	17%	8%	12%	8%
Other	2%	1%	1%	1%	1%	2%	0%	0%	1%	1%
Total	100%	100%	100%	100%	100%	101%	100%	101%	101%	100%

NUMBER OF DAILY TRIPS PER HOUSEHOLD

	Community	
Mode of Travel	Traditional	Suburban
Auto Driver	5.3	7.07
Auto Passenger	1.41	1.88
Transit	0.62	0.29
Bicycle	0.35	0.24
Walk	1.06	0.83
Other	0.09	0.72
Total	8.83	11.03

Compiled from data files from the Bay Area Transportation survey (BATS), 1980, Metropolitan Transportation Commission

automobile-driver rate in standard suburban communities was 15 percent higher than that in the traditional communities, and the combined automobile-driver/auto passenger rate was 14 percent higher. Combined use of alternate modes was 65 percent higher in traditional communities (28 percent) than in standard suburban communities (17 percent). Transit use was more than twice as high (7 versus 3 percent). Pedestrian travel was 40 percent higher (14 versus 10 percent). The largest proportion of walk trips in standard suburban communities was for home-school trips. Bicycle travel in traditional communities (6 percent) was twice the rate in suburban communities (3 percent).

Work-Based Other Trips

The mode choice patterns in this category reflect the mode choices for the home-to-work trip described earlier. Mode choice for trips from the workplace generally mirrored the mode used to commute to work. Combined automobile-driver/automobile-passenger rates were about 14 percent higher for the standard suburban areas (88 percent) than for the traditional areas (77 percent). Walk rates for the traditional community residents was 15 percent, versus 8 percent for suburban community residents.

All Trip Purposes Combined

The overall suburban area automobile-driver rate (68 percent) was about 11 percent higher than the rate for traditional areas (61 percent), and the combined automobile-driver/auto passenger rate for suburban areas was 12 percent higher than that for traditional areas. Overall transit use in the traditional areas (7 percent) was about more than double the rate in suburban areas (3 percent). Bicycle use in both areas was relatively low but was higher in traditional areas (4 percent) than in suburban areas (2 percent). Pedestrian activity in traditional communities (12 percent) was 50 percent higher than that in Suburban communities (8 percent).

Figure 4 compares trip percentages and trip rates graphically for all purposes combined.

CONCLUSIONS

The survey findings presented here illustrate significant differences in surveyed travel behavior between the residents of traditional communities and those of suburban communities. Of particular interest are the higher total household trip rates and automobile trip rates found among residents of communities with standard suburban design characteristics. The significant differences in urban design between the two sets of communities from which survey responses were tabulated may affect travel characteristics among respondents. In the traditional communities the relative proximity of housing to nonresidential, commercial land use and the availability and attractiveness of alternative travel modes may make automobile travel less needed and impractical for some trips.

However, these findings are preliminary, should not be considered conclusive, and raise questions that indicate the need for more research. For example, what causes the difference in household trip generation rates between the survey populations? This may be

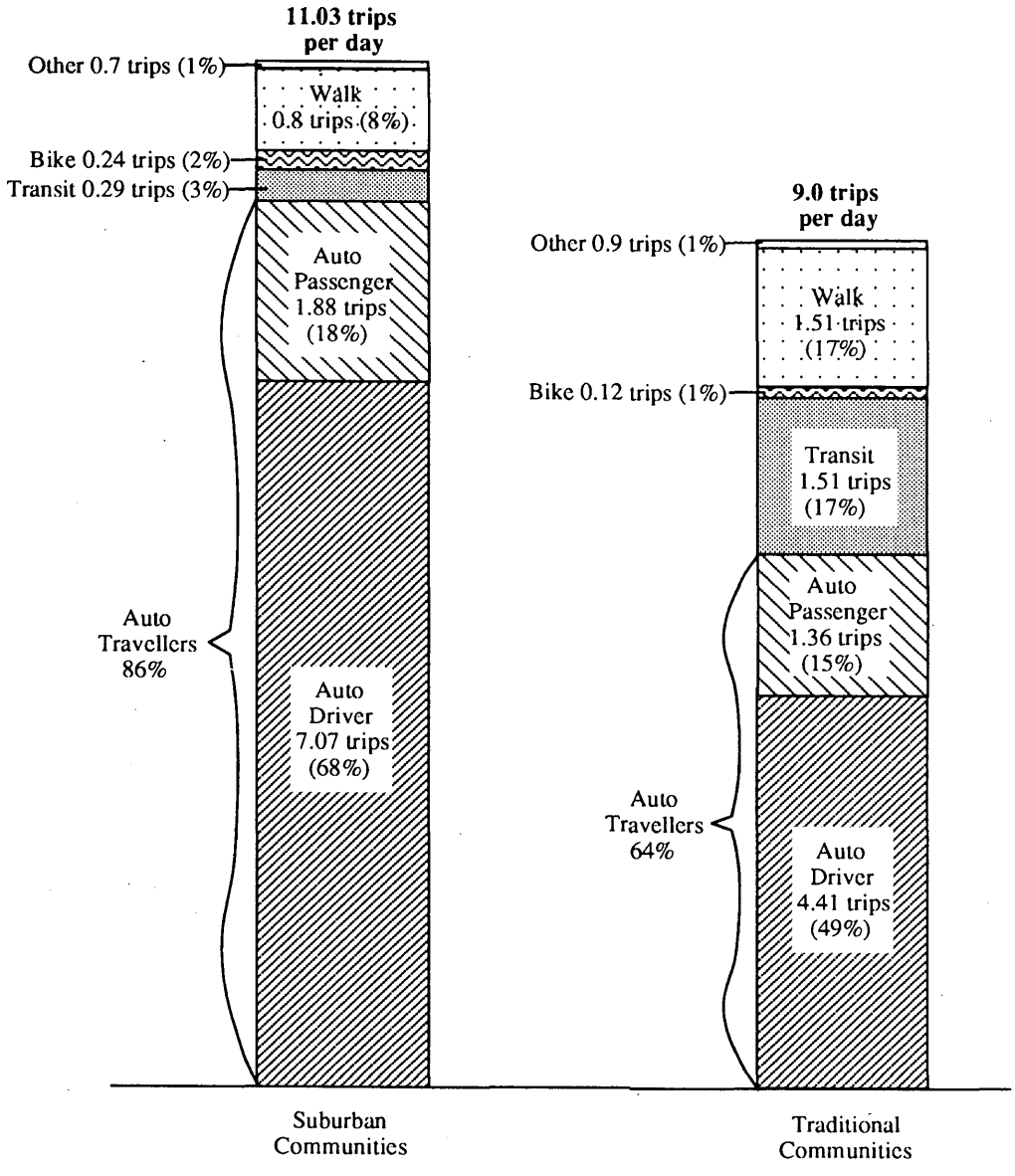

FIGURE 4 Mode choice comparison for all trip types in San Francisco Bay Area: representative samples for suburban communities and traditional communities.

explained by the 23 percent income disparity between the two study groups. Other demographic factors such as household size may also be significant. Follow-on research is needed to isolate and determine the relative impacts of these variables on trip generation and mode choice. Still, the significant degree of variation in travel behavior identified in this comparison indicates that urban form may exert some influence on travel behavior.

Practitioners hoping to use these findings for future applications should not draw direct parallels to expected travel behavior within a neotraditional setting. Several factors prevent such direct comparisons. The traditional communities included in this study have evolved over periods of six or more decades in settings that became increasingly urban over time. Their development was facilitated with the type of infrastructure that is not likely to be duplicated in new nonurban or small urban settings. Specifically, these factors include

- Access to extensive public transportation networks,
- Close proximity to large employment concentrations that are well served by extensive local and regional transit systems, and
- Lack of secure off-street parking.

It could take years, perhaps decades, for one or more neotraditional communities to evolve to the extent that travel patterns would closely match those of older traditional urban communities. One must also consider the larger geographic context in which a neotraditional community is developed. For example, if a neotraditional community is built as an "island" surrounded by standard suburban subdivisions (as in the case of Laguna West), aggregate changes in overall travel behavior could be limited.

However, these findings do indicate the type of shift or changes in travel behavior that could transpire as neotraditional developments mature. The data contained in Table 1 show that traditional

households generate 25 percent fewer daily trips by all modes than suburban households and 32 percent fewer automobile-driver trips. These reductions probably represent an upper limit to what one could expect among neotraditional community residents. Actual results will depend on a number of factors, including

- Proximity and access to large employment concentrations, such as the downtown central business district of a large city;
- Socioeconomic cross section within a neotraditional community;
- Internal jobs-housing balance;
- Individual neotraditional design characteristics, that is, average distances between residential and nonresidential land uses, and the quality and convenience of facilities to accommodate alternate modes of travel such as bicycle paths and walkways;
- Availability of (free) parking near nonresidential land uses; and
- Quality of transit service to internal and external points.

The manner in which these findings should differ from actual future results is in (a) the percentage distribution of travel among the alternative mode choices and (b) the degree of reduction one could expect for automobile trips. These differences are discussed further in the following sections.

Potential Shifts to Alternative Modes

Transit use is higher in the traditional communities, in part because of the availability of bus and rail networks and good levels of service. Given the service-dependent nature of transit patronage, replicating these mode shares within a neotraditional community is not likely to occur in a development's first 10 to 15 years of existence. This would only occur if the development is a large infill project located within a dense urban redevelopment environment with an existing transit infrastructure or if the project is located near a large, diverse employment concentration and is provided with excellent transit service. The proposed Mission Bay development in San Francisco is an example. In lieu of these factors transit use may be only marginally higher than that in a standard suburban environment.

The survey indicated that bicycle use in traditional communities is low, albeit higher than that in standard suburban communities. Some of the planned neotraditional communities such as Laguna West have taken significant steps to encourage bicycle use through bicycle path facility design and the provision of bicycle parking facilities in nonresidential areas. Similarly, plans for other neotraditional communities include extensive pedestrian walkway facilities linking residential and nonresidential areas. Such user-friendly designs and the availability of these facilities could result in higher pedestrian and bicycle mode shares than in standard suburban communities.

Potential Reductions in Automobile Trips

Use of these findings to estimate trip reductions attributable to neotraditional design is complicated by the need for additional research and inherent differences between existing traditional and new, neotraditional communities described previously. This study does not conclusively determine that urban design alone results in lower household trip rates when all socioeconomic variables are held equal, although the degree of difference found indicates that urban design may be a contributing factor. The availability of a mixed-use commercial core accessible to cyclists and pedestrians could theoretically result in some reduction in daily household trip rates. However, more research is needed to confirm this particular hypothesis and to distinguish the relative influence of urban design on travel behavior.

Finally, the extent to which neotraditional communities can replicate traditional communities, thus causing significant modal shifts, will depend on the degree to which the factors discussed in this paper will exist. If elements of these factors can be incorporated, significant mode shifts could occur voluntarily (i.e., without road or parking pricing measures). It seems that well-located neotraditional communities forming the majority of future development within a defined region could have significant benefits in addressing the regional congestion relief and air quality goals.

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Publication of this paper sponsored by Committee on Transportation and Land Development.