Designing a Community for Transportation Demand Management: The Laguna West Pedestrian Pocket

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The field of transportation demand management has, until now, focused on reducing automobile use at suburban activity centers that are largely dependent on automobile access. Recent research has indicated that at sites where nonautomobile alternatives are inferior and parking is plentiful, mode choice for work, shopping, recreational, and linked trips can be influenced to a limited extent. In Sacramento County, California, a new mixed-use community currently under development may significantly affect the degree to which site design is used to influence mode choice. Known as the pedestrian pocket, new design elements and guidelines for site planning, density, and access are incorporated that may significantly affect lifestyles and travel mode choice for its inhabitants. Key design features include concentration of commercial, shopping, and office uses in a town center that is surrounded by high-density residential neighborhoods and large public spaces. The town center contains a transportation center, which acts as a focal and transfer point for transit services to internal and external points. Innovative roadway geometric designs, residential proximity to the town center, and landscaping are used to influence mode choice by encouraging nonvehicular travel and limiting automobile use for certain internal trip paths. Analyses of the potential for reduced automobile use indicate that project design alone may result in average daily vehicle-miles travelled reduction of 20 to 25 percent, and up to 15 percent in the peak hour alone. These reductions are based on travel patterns and mode splits typically associated with suburban activity centers of standard design.

A new type of mixed-use community is being developed in Sacramento County, California, that may have significant impacts on lifestyles and travel habits in future urban developments. Known commercially as Laguna West, this project is based on the pedestrian pocket concept, a unique approach to designing a planned unit development (PUD) developed by Calthorpe & Associates. This represents a new-generation PUD, whose design will preserve open space and minimize automobile use, and hence, average daily vehicle-miles of travel (VMT)—a key goal of any transportation demand management (TDM) or transportation system management (TSM) plan. The mixed-use site plan combines light industrial, office, commercial, recreational, and retail land uses with a large residential component.

The pedestrian pocket concept is unique in the way it redefines the spatial relationships among different activities within the community. A key design characteristic is higher development density, both within land use zones and between them. For example, residential densities close to the central commercial hub or town center will be 20 units per acre (R–20), and 14 per acre for the entire development. This is double the average for new suburban subdivisions in northern California. Residential density is reduced with distance from the town center to a low of R–7. The reduction of individual lot size is balanced by a presence of large, accessible public spaces and preserved open spaces nearby. As a consequence, overall residential densities are the same as for the standard subdivision in Sacramento County.

Many residential areas are located within walking distance of commercial and recreational facilities. Most of these would be located within or adjacent to the town center, a concentration of commercial, retail, and office uses, which will include a transportation center. At full buildout, the 1,000-acre Laguna West development will contain 3,400 residences of various size and density and up to 7,000 jobs. It will also include an elementary school, day care sites, offices, and sufficient convenience retail for the residents of the area. Approximately 35 percent of all residences lie within a ¼-mi radius of the town center, making it a popular, accessible destination.

The adopted street pattern is a radial hub and spoke system, providing direct links between all residential areas and the town center. Many residential streets are laid in a grid pattern, creating an interconnected, clear street system that provides multiple short, direct paths for both pedestrian and automobile circulation. Streets are narrow, in some cases 45 percent narrower than standards used for more typically designed subdivisions. Winding street patterns with dead ends and cul-de-sacs, typical in many suburban subdivisions, are avoided to prevent traffic concentration on major arterials and at key intersections, and longer travel distances for pedestrians and cyclists.

Capacity along arterial streets and thoroughfares adjacent to or outside of the pedestrian pocket must be sufficient to allow for the efficient movement of through-traffic. This procedure minimizes the amount of through-traffic attempting to pass through the development. These roads are typically located between the pocket and an outer, or secondary, area zoned for less-dense commercial or industrial development.

Finally, the emphasis and ultimately the acceptance of alternate modes of mobility, primarily walking and mass transit, are key to the potential success of this type of community.

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TRANSPORTATION AND TRAFFIC GOALS

The term "pedestrian pocket" does not indicate that vehicular traffic is prohibited or unwelcome in this development. Rather, it describes an environment intended to be safe and inviting to pedestrian activity and interaction. In the pedestrian pocket, all modes of travel have a role. Thus, the transportation objectives are

1. To limit automobile use to the most appropriate or necessary purposes, e.g., by minimizing automobile use for intracommunity trips or errands, and commuting;
2. To maximize the opportunities for and attractiveness of alternative travel modes, particularly for pedestrians and cyclists;
3. To enhance public safety through designed separation of pedestrian and cyclist traffic from motor vehicles; and
4. To promote strategies to encourage mass transit use.

The combined, intended effects of these objectives are reduced dependence on automobiles for many routine trips, reduced average trip lengths, and hence, a reduction in community-wide VMT.

EVOLUTION IN LAND USE PLANNING

This section contains a brief discussion on the evolution of postwar land use planning methods, culminating in the pedestrian pocket concept. Each method of land use planning was shaped by the transportation facilities that serve them, from the postwar freeway-induced sprawl to mixed-use sites that deemphasize automobile use.

First Generation

Pre–World War II suburban development patterns were often constrained by the need for access to the commercial core of the central city, and by poorly developed networks of regional highways. Thus, commercial or residential subdivision development rarely took place far from existing major arterial roadways and public transportation facilities.

After the war, these constraints quickly disappeared with the rapid expansion of regional highway systems. Freeway expansion and the proliferation of inexpensive property and energy encouraged rapid suburban sprawl surrounding most large American cities. Often, the availability of highway access was the only guideline affecting location and density. Provision of nonautomobile travel alternatives was rarely a primary consideration.

Second Generation

The second generation of land use planning marked the introduction of specific plans and PUDs. These often consist of large tracts (3,000+ acres) zoned for a single (and more recently, multiple) use, and are designed to function independently of adjacent developments. Transportation access and distribution is designed for and dominated by the automobile for residential, business or professional, and commercial land uses. For example, many typical suburban business developments or business parks could be characterized as "islands in a sea of parking," often served by access systems segregated from local roadway networks. Interaction between buildings within a development is often automobile-dominated as well.

Roadway design commonly limits rather than promotes access within or between PUDs and adjacent areas. The hierarchy of roads, ranging from major arterial to minor street, is designed to limit exterior access to a few key points, exacerbating peak-hour traffic congestion. As with first-generation developments, little provision is made for alternative forms of access and circulation.

Third Generation

The third generation of planned development is characterized by the pedestrian pocket concept. In this case, the same large tract of property (3,000+ acres) is divided into smaller (1,000-acre) parcels, each developed as a mixed-use site. Each parcel contains a town center, with a mix of business, professional, and commercial development, surrounded by high-density residential areas. Outlying lower-density residential neighborhoods, though separated from the town center with large parks and public spaces, are connected by direct, radial arterial streets with clear view lines.

Most residential lots are smaller than in standard subdivisions. However, the absence of larger residential lots is balanced by the availability of numerous recreational amenities and large, nearby open spaces. These developments will have an average of 10,000 residents, considered by many to be an optimal size for community interaction within a village environment (e.g., such as Columbia, Maryland).

The pedestrian pocket transportation system incorporates walkways and bikeways that are physically separate from the street system. Mass transit services, including an internal circulation shuttle and services to exterior points, are easily accommodated. The latter may involve either bus or light rail service. The town center transportation center can be designed to accommodate either mode. However, achieving significant VMT reductions does not depend on heavily patronized transit service. Most VMT reductions would be attributable to the internalization of many routine trips and shorter average trip distances, which make nonvehicular travel alternatives more practical and attractive.

TRANSPORTATION SYSTEM DESIGN FOR THE PEDESTRIAN POCKET

Design Theory

The pedestrian pocket street network is designed to accommodate a balanced transportation system, where all travel modes promote pedestrian presence and activity. The design complements and reinforces increased community interaction in large public (as opposed to private) spaces. Public transportation is within walking distance of most residential areas. The town center is also accessible by foot or a short shuttle bus ride (35 percent of all residences are within ¼ mi).

Design standards were developed to match each street type to its respective role or function, in terms of speed limitations and circuitousness. These include residential streets, internal circulation streets, and major arterials that connect to regional roadways. The road network is designed to bring the key elements of the community together, while minimizing traffic within other areas. For example, major thoroughfares (primary residential boulevards) link the town center with key residential areas as well as commercial and industrial sites. At a lower level of performance, residential collectors and minor residential streets circulate among the various neighborhoods; minor residential streets provide access to individual homes at still lower performance levels.

Design Application

Innovative design criteria have been developed for the project's transportation system. The goals are to modify driver behavior, enhance safety, and limit the dominance of motorized traffic. The design criteria are summarized in the following subsections.

Orientation to Town Center

The town center is served by a system of major streets that radiate symmetrically to the surrounding residential areas. Radial access provides excellent view corridors between these areas, which will encourage travel to and from the town center, particularly nonvehicular travel from close-in neighborhoods.

Grid Street Pattern

Many of the streets are laid out in a grid pattern, particularly within residential areas. This pattern results in multiple short routes between the town center and residential neighborhoods and external areas, and traffic is evenly dispersed onto parallel routes. This is a significant departure from circulation systems commonly found in northern California subdivisions characterized by circuitous collector streets, numerous cul-de-sacs and dead ends, and limited points of external access. The grid pattern also benefits pedestrians and cyclists by providing shorter and less congested paths to internal and external destinations. A graphic comparison of these two systems is shown in Figure 1.

Success of this plan depends on the provision of adequate

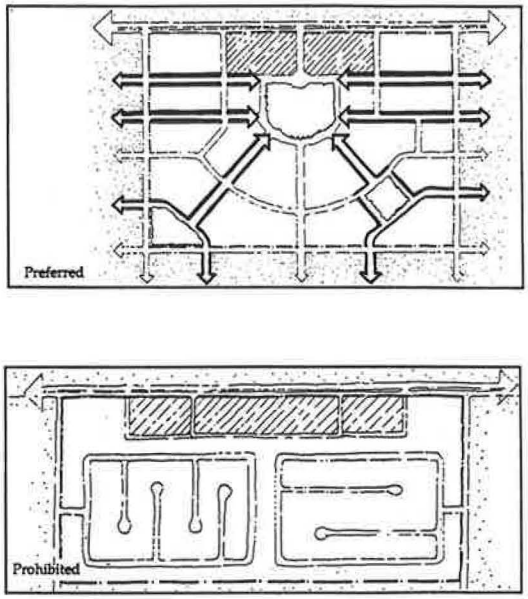


FIGURE 1 Street network comparison: pedestrian pocket (*top*) versus standard development design (*bottom*) (Calthorpe & Associates).

TABLE 1 LANE WIDTHS

Laguna Creek Lane Type	Total #Lanes	Lane Width	Parking Lane Width	1 Side/ Both Sides	County Standard Lane Width
Minor Residential (Lakeside)	2	11'/9' **	6'(+3' curb)	One (Next to 9' lane)	13'
Minor Residential (School/Park)	2	9'	6'(+3')	Both	13'
Minor Residential (Town Neighborhood)	2	9'	6'(+3')	Both	13'
Minor Residential (Neighborhoods)	2	7'	6'(+3')*	Both	13'
Minor Residential (Parkside Town Neighborhood)	1	11'	6'(+3')*	Both	N/A
Primary Residential (Boulevard)	2	16'	6'(+3')*	Both	18' (12'+6' Park)
Primary Residential (Boulevard-Lake)	2	16'	None	--	18' (12'+6' Park)
Major Residential (Neighborhoods)	2	11'	6'(+3')*	Both	13'
Residential Collector	2	11'	6'(+3')	Both	13'
Commercial (Town Center)	2	11' or 12'	6'(+3')	Both	13'
Commercial (Main Street)	2	10'	6'(+3')*	Both	13'

* Interspersed with tree boxes
** Wide lane on lakeside

arterial roadway capacity outside of the pocket to accommodate through traffic. Sufficient capacity on major streets and thoroughfares separating the pedestrian pocket from secondary areas or adjacent communities will minimize congestion within the pocket from through traffic seeking to divert from primary routes.

Roadway Design Elements

The goals of the roadway geometric design criteria are a departure from the automobile-oriented nature of standard tract development design in northern California. The following standards were selected to realize the goals of reduced automobile dependence and VMT.

1. Narrow Street Widths. Streets within the pedestrian pocket are significantly narrower than Sacramento County standards applied to standard subdivisions. Street widths throughout the development are 15 to 45 percent lower than county standards for similar street classifications, and in some cases are as low as 7 ft on some residential blocks. Design widths for each street type and comparisons with Sacramento County standards are presented in Table 1.
2. Sidewalks or Pedestrian Walkways. These are installed on both sides of all streets. In the pedestrian pocket, most residential sidewalks are 4 ft wide, ranging up to 10 ft in densely developed areas. Three-foot curb widths separate sidewalks from streets.
3. Curb Radii. Intersection curb radii for all street types are lower than county standards. Radii reductions range from 17 percent for neighborhood collectors to 58 percent for minor residential streets. These reductions result in lower vehicular turning speeds, thus improving safety. These radii and comparisons to county standards are presented in Table 2.

For some primary residential boulevards, curb radius is narrowed with "necked" intersections, at which street widths are suddenly narrowed as intersections are approached. A typical necked intersection with 6-ft neck widths is shown in Figure 2. This configuration induces motorists to reduce speed as they approach intersections.

4. Parallel Parking. On-street parallel parking is encouraged in residential areas with 9-ft parking lanes (6-ft lanes with 3-ft curbs). Continuous on-street parking acts as a buffer between vehicular traffic and pedestrians, further enhancing safety.

TABLE 2 CURB RADII

Intersection Type	# Lanes	Curb Radius*	Necked	Neck Width	County Std. Radius*
Minor Residential	2	10'	No	--	24'
Commercial (Town Center & Main Street)	2	20'	No	--	24'
Primary Residential (Boulevards)	2	20'	Yes	6'	24'
Major Residential (Neighborhoods)	2	20'	No	---	--
Collectors (Neighborhood)	2	20'	No	--	24'

* Radius to raised curb edge (not including 3' curb)

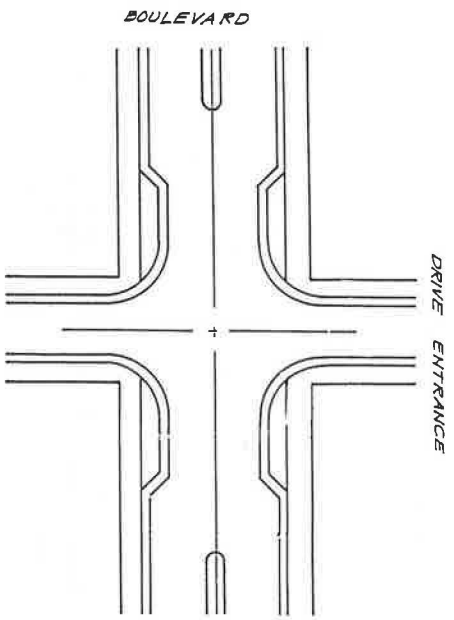


FIGURE 2 Typical necked intersection.

On streets shown as solid lines in Figure 3, tree planters are situated within the parking lanes at regular intervals. This strategy eliminates the use of parking lanes by through traffic. A typical design is shown in Figure 4. Potential safety impacts of trees in pavement were researched by contacting various local governments that had similar streets in their jurisdictions. Several municipalities (Sacramento, Larkspur, Mountain View, and Palo Alto) in northern Californian cities have adopted this measure in recent years, with no apparent detriment to safety.

5. Speed Control. Devices used to control vehicular speed are used on the long, straight primary residential boulevards. Stop signs are placed at key intersections along the boulevards to eliminate long high-speed stretches.

Residential Lot Configuration

Laguna West will contain 3,400 residential units. Approximately half of these will be multifamily housing, in densities of up to 20 units per acre. Of the outlying single-family home sites, lot configurations will be 40 percent smaller than those normally used in standard residential subdivisions. For example, 100-ft-wide × 80-ft-deep lots normally used for home sites in developments zoned R–5 will be reduced to 45 ft wide × 110 ft deep, producing R–7 lots. Street frontage per unit will be less than half of the standard design, although lots are 30 ft deeper. Building setbacks will be shallow, from 5 to 15 ft.

Another departure from standard lot configuration will be garage location and layout. In many cases, garages will be detached and located behind each residence. They will not be visible from the street. Garages will be accessible by back alleyways that will run in between rows of houses. In addition, several garages will contain "granny flats," which are separate small dwellings located in the second level of garage structures. Partial occupancy of these flats will further increase

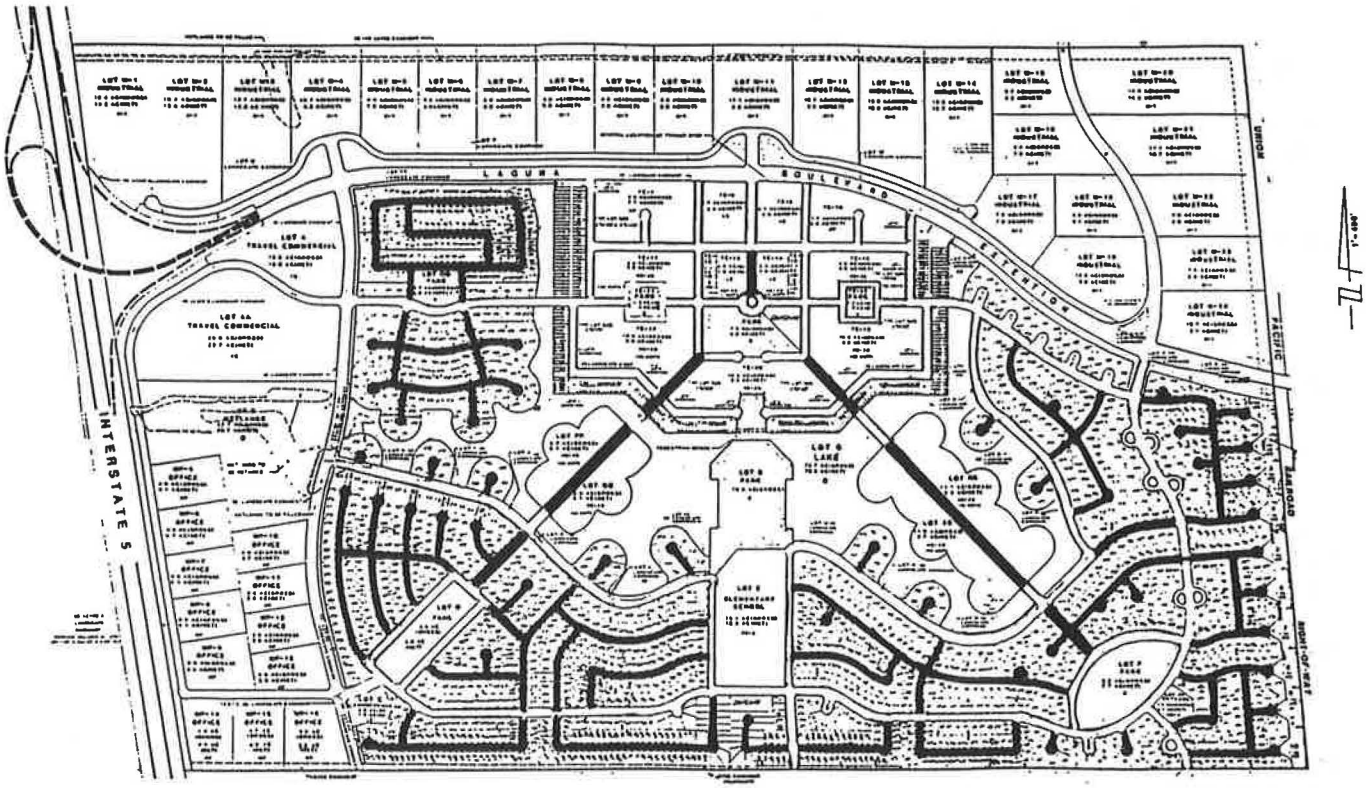


FIGURE 3 Streets with trees in the parking lane.

residential density. The intended effect of this configuration is to increase pedestrian activity on residential streets, thereby enhancing safety. Use of alleys for garage access and garbage collection will further enhance street safety. Schematic drawings of a typical residential site plan are shown in Figure 5.

Landscaping

Approximately 10,000 trees will be planted in Laguna West, nearly 3 trees for every residential unit. This is considered an important design element for both aesthetic reasons and to provide protection from the summer heat for pedestrians, cyclists, and parked cars. Shade trees will be planted along all streets. Trees placed in street planters will be no more than 30 ft apart, within a 6-ft-wide strip. Within 10 years of planting, most walkway areas and on-street parking spaces will be completely under shade. Trees planted in and along streets will also provide a buffer between pedestrians and cyclists, and automobiles. Separation of pedestrians and cyclists from busy streets is planned throughout the development.

MOBILITY ALTERNATIVES

Transit Center

A transit center is integrated into the town center. The transit center will be the focal point for all transit services provided within the project and to or from external points. It will be accessible to all residents and centers of employment within the project. One or more internal routes would link all project areas by circulating within the development along major boulevards and residential collectors. Routes to external points such as Sacramento will be provided as well. The nature of these services would be to respond to demand as the project matures. For example, vanpools or a limited subscription type of service may be provided during early construction phases, and evolve into regularly scheduled fixed routes, as warranted.

Potential Future Light Rail Service

Six acres have been set aside on the east side of the project, for a possible future extension of the Sacramento light-rail

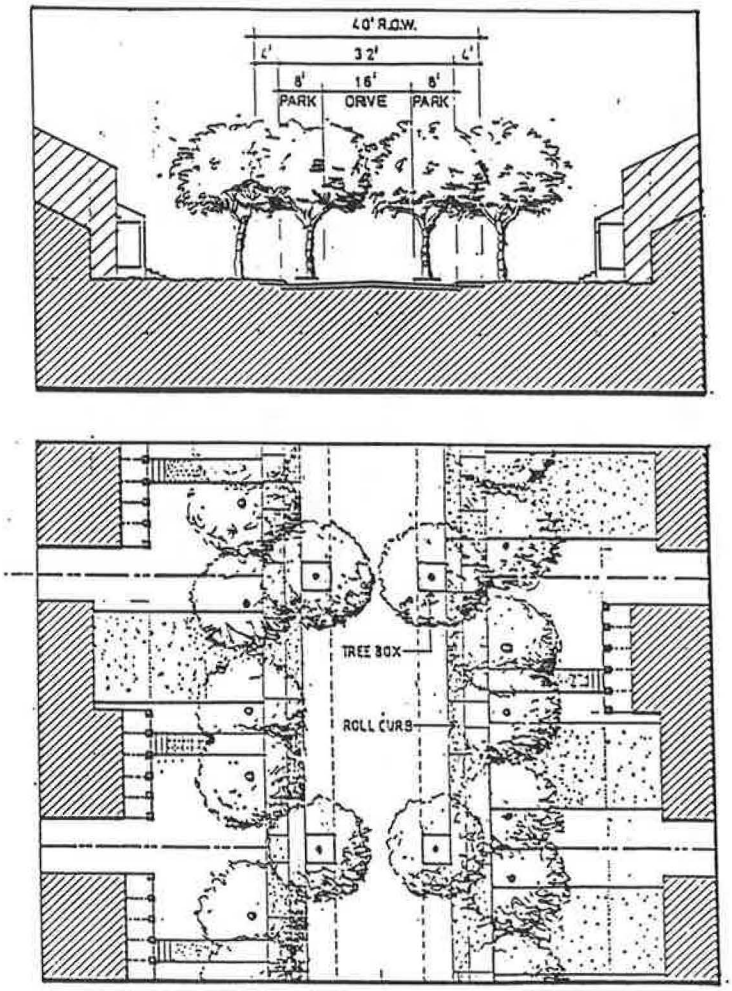


FIGURE 4 Use of tree boxes to widen street-sidewalk boundaries.

system. As Laguna West is fully built out and becomes a job magnet itself, the demand for transit service between Laguna West and the urbanized area to the north may justify an extension of the light-rail system to the project site. Thus, a sufficient land allotment for a rail station will be retained in the project, and the transit center will be modified as needed to provide shuttle services to the light-rail station.

TDM Plan

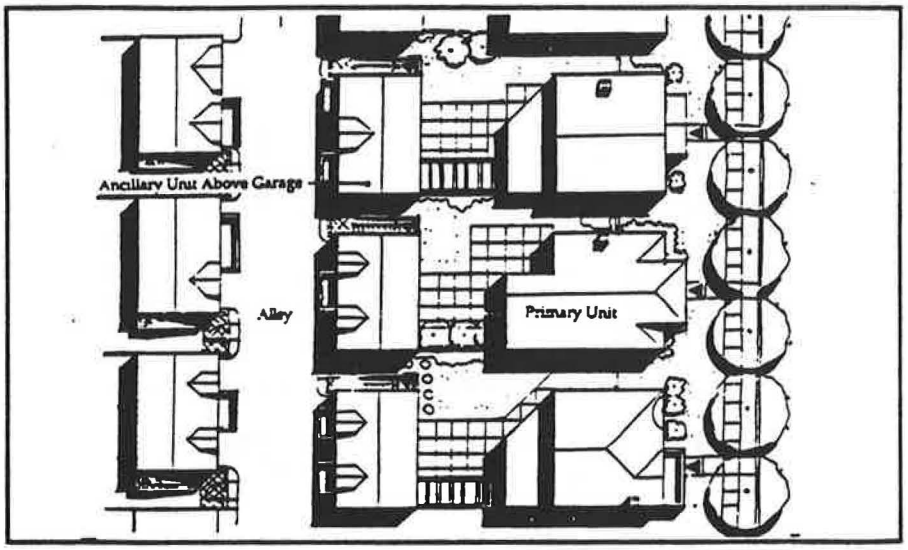
A comprehensive, appropriately phased TDM plan will be prepared for the project. This plan will go one step beyond the traditional TDM plans most frequently developed by new projects, because both employment and residential travel demand will be addressed. As the project is designed to mitigate automobile use, strategies with realistic automobile demand reduction goals will be adopted. TDM measures may include vanpool and carpool matching, subscription bus services, variable work hours (for on-site employers), and some of the transit services described earlier. A financing plan will also be adopted. Costs for these services would probably be largely borne by the developer during the early project phases. As the project matures, a gradually larger share of these services can be borne by on-site employers and residents.

Pedestrian Walkways and Bikeways

Many of the streets in Laguna West have lanes for bicyclists, and most have sidewalks for pedestrians. On streets that may have heavy bicycle and pedestrian use, there are separate paths for bicycles and pedestrians. The minimum sidewalk width is 4 ft, but many of the streets have sidewalk widths of up to 10 ft. The more spacious sidewalks are located on the boulevards where pedestrians are more likely to gravitate. Class 1 bikeways (no shared right-of-way with streets) are planned for selected collector streets and will converge on the town center. In these areas, bikeways will be separate from sidewalks. Bike routes on residential streets will consist of marked lanes or shared space with automobiles.

POTENTIAL VMT REDUCTION

Fehr & Peers Associates has analyzed the potential for VMT reduction attributable to the pedestrian pocket design. VMT reductions were calculated for key trip types, including home-work, home-shopping, and home–social or recreational activity (*1*). The results of this analysis were compared with research findings recently published by the National Re-



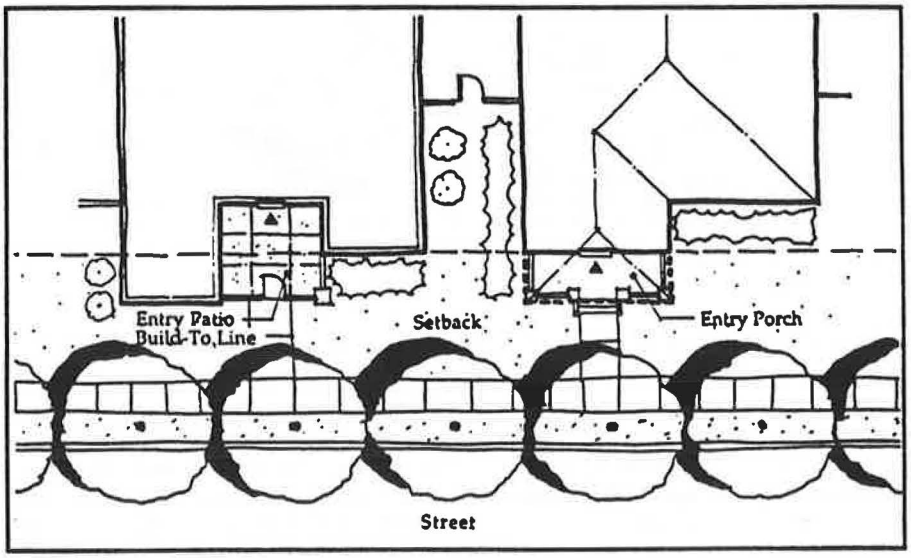


FIGURE 5 Typical residential site layout (Calthorpe & Associates).

sources Defense Council (NRDC), which established a statistical correlation between urban density and automobile use (2). Comparison and correlation of the findings from the two studies indicate that daily VMT reductions of 20 to 25 percent may result from the innovative design of the pedestrian pocket. These reductions are taken from travel behavior normally associated with a typically designed suburban development (i.e., 80 percent automobile mode split)—not from an unlikely situation in which 100 percent of all trips are made by automobile. Thus, the impact on VMT may be significant.

Three factors contribute to VMT reduction: internalization of many routine trips, reduced automobile mode split, and a higher capture rate of internal jobs by residents.

1. Internalization of Trips. The dense development of commercial, retail, and other nonresidential land uses within the town center will exert a strong attraction on local residents. A substantially higher percentage of nonwork travel, particularly home-to-shopping trips, will remain within the development than would be the case in a standard-design development. The concentration of several desirable destinations within the town center will also increase the number of linked trips that occur there. Regardless of the effect on automobile mode split, the attraction of the town center on local residents will result in short trips and hence lower VMT.

2. Reduced Automobile Mode Split. The NRDC research found that proximity of a downtown or town center to local

residents, availability of good transit service, and a high proportion of non-work-linked trips will substantially reduce the automobile mode split for daily trips. A high correlation occurs between dense communities with centralized commercial activity centers and the availability of mass transit services. Automobile use and ownership are lower in dense, pedestrian, and transit-oriented areas.

3. High Job Capture Rate. Although no recent research is available, anecdotal evidence of trends in other planned, pedestrian-oriented communities indicates that a higher percentage of jobs located within the pedestrian pocket and secondary areas will be taken by development residents. Data provided by planners of Reston, Virginia, and Columbia, Maryland, indicate that 35 to 40 percent of all internal jobs are filled by local residents. This statistic compares favorably with an average of 15 to 20 percent of jobs in second-generation-type mixed-use developments captured by local residents. Therefore, fewer residents will make long commutes to external areas.

CONSEQUENCES AND CONCLUSIONS

Past application of transportation system design standards similar to those proposed for the Laguna West pedestrian pocket indicate that they can be effective in reducing automobile travel and VMT. Unlike most second-generation-type developments, they should provide a creative, safe environment for pedestrians and cyclists, as well as for motorists. Automobile travel will remain an essential component of the transportation system, but will not dominate internal circulation or render nonvehicular modes irrelevant.

Laguna West will be the first planned community of this type in the western United States. Its design is a significant departure from that of suburban and exurban planned development typical of northern California. The project incorporates a unique approach to the spatial relationships between major on-site activities, and is served with an innovative set of roadway geometrics and features.

The compatibility of the pedestrian pocket's site design, land use, and transportation system and its management has been described. Among the intended benefits of this approach is significant VMT reduction. A comparison of travel behavior documented at second-generation-type suburban activity centers (SACs) indicates the difficulty in altering travel behavior within existing or planned automobile-oriented developments. A recent NCHRP study on travel characteristics at suburban activity centers established relationships between building and site characteristics and travel behavior. The findings indicated that although there is often a great deal of interaction between buildings within large second-generation-type SACs, traffic congestion within the development and on access routes is perceived to be a significant problem by virtually all tenants and visitors. The reason is the near total reliance on the private automobile and lack of suitable travel alternatives. The study recommends three strategies for reducing the reliance on automobiles at existing or planned SACs:

- Cluster buildings to increase their proximity;
- Establish radial bus transit service, with a transit center (the practical limit on transit mode share is estimated at 6 percent (*3*)); and
- Establish continuous, direct pedestrian systems between buildings.

The costs of such retrofit programs can be high, with limited success. The pedestrian pocket incorporates all of these elements into its design and represents a promising solution to enhancing suburban mobility.

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